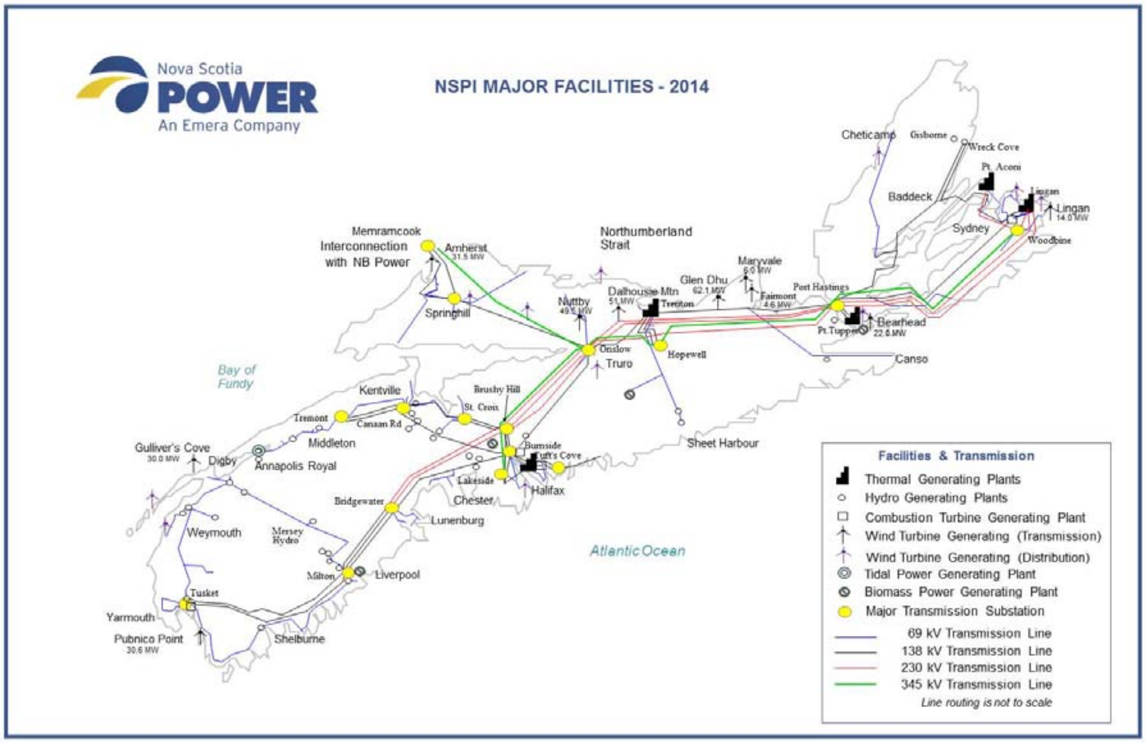
Nova Scotia Power
2015 Annual Capital Expenditure Plan



Date Filed: November 6, 2014

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Executive Summary

Throughout recent regulatory proceedings, including prior General Rate Application (GRA) and Annual Capital Expenditure (ACE) Plan proceedings, and in direct conversations with customers, there has been a consistent message from customers and stakeholders that Nova Scotia Power (NS Power, the Company) must make every effort to reduce upward pressure on future electricity rates, while providing safe, reliable service and abiding by all environmental and regulatory obligations.

The 2015 ACE Plan filing is an important part of NS Power's capital program, providing the Nova Scotia Utility and Review Board (Board, UARB), stakeholders and NS Power's customers with our outlook on capital spending for the year ahead. The 2015 ACE Plan, like 2013 and 2014 before it, is focused on affordability, while maintaining a safe and reliable power system.

The overall 2015 capital budget is $273.0 million, of which NS Power seeks approval of 84 capital work orders plus the capital routine program. Proposed capital expenditures for 2015 are compared to prior years in the table below.

Year	2010 Actual	2011 Actual	2012 Actual	2013 Actual	2014 ACE Plan	2014 Q3 F[1]	2015 ACE Plan
Generation	$129.0	$85.4	$88.7	$68.4	$58.8	$61.8	$99.8
New Renewables	256.0	66.2	53.2	15.2	30.9	89.5	12.1
Transmission	45.1	58.4	45.4	31.0	51.8	53.7	68.0
Distribution	59.6	62.4	68.7	62.9	59.0	53.5	64.1
General Plant	54.0	42.5	28.5	29.9	27.5	26.2	29.0
Total	**$543.7**	**$315.0**	**$284.5**	**$207.5**	**$228.0**	**$284.8**	**$273.0**

NS Power's 2015 capital expenditure program balances spending restraint with the investment necessary to sustain NS Power's capital assets and provide reliable service.

[1] The variance from the 2014 ACE Plan is primarily due to the acceleration of South Canoe Wind Farm.

The majority of capital work orders submitted for approval are less than $1 million each: 32 projects are forecast between $250,000 and $500,000; 37 are forecast between $500,000 and $1 million, and 15 exceed $1 million. Most of these work orders reflect sustaining and compliance capital work on our system. Representative projects include rebuilding or refurbishing aging and deteriorated plant and equipment, or investment in our assets in order to comply with regulations, as can be seen in the examples provided below.

Generation	Transmission & Distribution
44267 Trenton Ash Lagoon Site Closure This project is to decommission and close the original Trenton Ash Management Site as per the Trenton Operating Approval.	46339 120H Brushy Hill SVC Controls Replacement This project is for the replacement of the Static Var Compensator (SVC) controls at the 120H - Brushy Hill Substation.
43094 – LIN3 High Temperature Fastener Replacement This project is to replace steam turbine high temperature fasteners (bolts and studs) to ensure the integrity of the steam turbine at Lingan Unit #3	46513 3C Port Hastings BPS Upgrades This project is to upgrade the protection system at 3C-Port Hastings (230kV) to comply with Northeast Power Coordinating Council (NPCC) bulk power system protection risk reduction plan.
41139 Annapolis Sluiceway Superstructure Refurbishment This project is to refurbish the steel superstructure, steel sluice gates, embedded steel for the gate guides and stoplog checks.	46292 2015 Padmount Transformer Replacements This project is for the replacement of 80 padmount transformers identified through the padmount inspection program.

In 2013, NS Power engaged with Board staff and consultants for the Small Business Advocate and Consumer Advocate on the process to revise NS Power's Capital Expenditure Justification Criteria (CEJC). Many enhancements to the CEJC, including revisions to NS Power's Economic Analysis Model, were adopted with support from those parties. The UARB approved the new Summary CEJC and accepted the new Detailed CEJC on September 18, 2013.

In 2014, NS Power again engaged with Board staff, stakeholders including the Industrial Group, Small Business Advocate, and Consumer Advocate, as well as their consultants, on the following topics such as the capitalization of routines, affordability, and improvements to the ACE Plan and capital processes.

The 2015 ACE Plan is an important part of reducing upward pressure on rates while focusing on strengthening reliability and safety as well as minimizing the need for future large investment.

NS Power respectfully requests Board approval of the following:

- 84 Capital Items with 2015 budget spending of $65,638,037 and total project spending of $83,627,912. (Please refer to Section 2.2.)

- Capital routine programs with 2015 budget spending of $73,097,621. (Please refer to Section 7.1.)

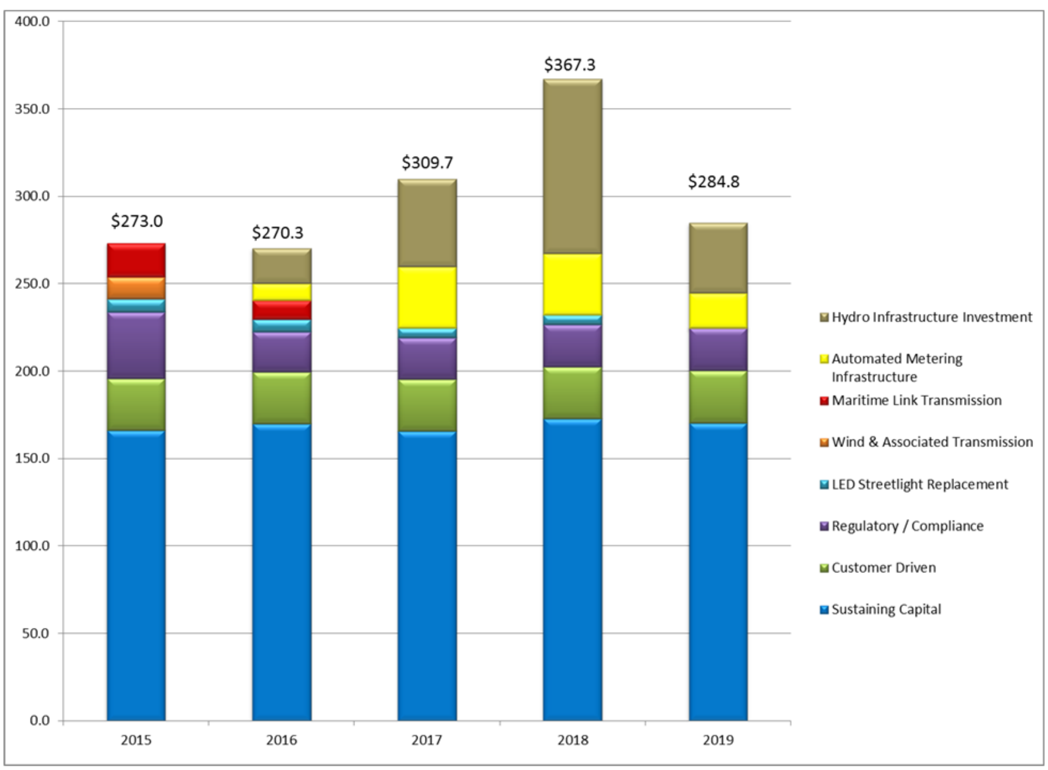
- 2015 AFUDC Rate of 7.23%.

1 Introduction

1.1 Sustaining Capital Program

The 2015 ACE Plan has been developed to meet our customers' expectations regarding a safe, well-maintained system, reliable service, and less reliance on fossil fuel generation. It is a largely sustaining capital program representing cost-effective investments to ensure safe, reliable electrical service for our customers. There is an emphasis on making the best use of our existing assets and maintaining them. In this way, NS Power is addressing the affordability of investments and reducing upward pressure on rates.

As can be seen in the figure below, the investments on sustaining our assets, customer driven investments, and investments required by regulatory or environmental standards are reasonably stable. Strategic capital investments, such as fast acting generation, hydro infrastructure re-investment, and Automated Metering Infrastructure may create larger capital investments in future years.



Investment Type	2015	2016	2017	2018	2019
Sustaining Capital	166.3	169.8	165.8	172.7	170.4
Customer Growth	29.6	29.7	29.8	29.9	30.0
Regulatory / Compliance	38.1	23.0	23.5	23.9	24.4
LED Streetlight Replacement	7.3	7.3	5.7	5.7	0.0
Wind & Associated Transmission	12.8	0.0	0.0	0.0	0.0
Maritime Link Transmission	19.0	10.5	0.0	0.0	0.0
Automated Metering Infrastructure	0.0	10.0	35.0	35.0	20.0
Hydro Infrastructure Investment	0.0	20.0	50.0	100.0	40.0
	273.0	**270.3**	**309.7**	**367.3**	**284.8**

*Totals may be off slightly due to rounding. Figures are noted in $millions.

The Sustaining, Customer Driven, and Regulatory/Compliance Capital portion of the annual forecast is more certain than the large scale strategic capital profile. The Sustaining Capital estimates are built up from well-established asset management and replacement programs while Strategic Capital reflects projections of spending that are expected or are anticipated to be necessary to meet system requirements related to legislation or, as in the case of the fast acting generation, may be made necessary by the transition of NS Power's power system to renewable sources of generation. Specifically, integrating the significant wind generation in place and under development may require new fast-acting generation to provide additional load following and regulation capability. Accordingly, the identified expenditures for Fast-Acting Generation profiled in 2017 and 2018 are at this time forecasts and not firm plans. These may be shifted further into the future or cancelled if determined to be avoidable through operating experience.

1.2 Integrated Resource Plan

The 2014 Integrated Resource Plan (IRP) process was conducted throughout 2014 and reached a recent milestone with the filing of NS Power's final report on October 15. Capital spending described in this ACE Plan is consistent with the assumptions in the IRP.

The 2015 ACE Plan is a largely sustaining capital program representing cost-effective investments to ensure safe, reliable electrical service for our customers. The ACE Plan emphasizes making the best use of and maintaining our existing assets. In this way, NS Power is addressing the affordability of investments while managing upward pressure on rates.

The capital expenditures noted in the 2015 ACE Plan are also consistent with the assumptions and conclusions found in NS Power's 10 Year System Outlook report provided to the UARB on June 27, 2014.

1.3 Stakeholder Engagement – Affordability

NS Power has continued to work with stakeholders and their consultants on the issue of affordability. In the UARB's 2013 ACE Plan Decision, the Board provided the following directives:

> …The impact of capital expenditures on future customer rates should be an integral part of the 2014 ACE Plan project selection.[2]
>
> The Board directs that the parties discuss the issue of affordability and whether it can be incorporated into the ranking or justification criteria in the CEJC discussions.[3]
>
> The Board directs NSPI to continue to report in future ACE Plan applications on how it addresses affordability, in greater detail where practicable.[4]

Stakeholder discussions on these items occurred throughout 2013. It was determined that rate impacts, revenue requirement, and affordability were best examined as part of NS Power's ongoing efforts to reduce overall capital expenditures. NS Power's approach aims to pursue economically justified projects, and to select, defer or cancel eligible projects which are brought forward internally for evaluation per the criteria found in the CEJC.

As part of that engagement, NS Power also revised its Economic Analysis Model (EAM) by adopting a revenue requirement model. Barring other mitigating circumstances, the project alternative with the lowest revenue requirement will be the preferred option. Moreover, various sensitivity analyses were added to test for variations in capital investment, avoided costs and timing of the projects.

This approach to both affordability and the EAMs was incorporated into the 2014 ACE Plan. As

[2] NS Power 2013 ACE Plan, UARB Order, NSUARB - P-128.13, June 4, 2013, page 2.
[3] Ibid.
[4] Ibid.

per the 2014 ACE Plan Terms of Consensus[5] reached between the parties, it was agreed that the issue of affordability would be discussed with stakeholders subsequent to the ACE Plan proceeding, so that NS Power can receive further input for consideration in future ACE Plans.

NS Power discussed affordability with stakeholders and their consultants in 2014. NS Power agreed to provide additional information in Section 8.1.1 Impact of 2015 ACE Plan on Revenue Requirement and Affordability, the directive providing the ACE Plan's revenue requirement impact and revenue requirement impact forecast for future years. In particular, NS Power has provided a table in Section 8.1.1 breaking out the revenue requirement of its Current Asset Base capital investments (Sustaining Capital, Regulatory/Compliance, LED Streetlight Replacement).

In addition to the new table for revenue requirement for Current Asset Base, NS Power continues to provide other detailed information regarding the revenue requirement impact of certain classes of expenditures. For example, Section 8.1.1 also provides the revenue requirement impact of economically justified and work support facility projects. Moreover, Section 8.1.3 Directive 11 – Annual Ranking/Prioritization of Capital Projects provides NS Power's rationale and rankings of projects that have made their way into the 2015 ACE Plan for stakeholder review and approval.

Finally, as a result of feedback from and discussions with the consultant for the Small Business Advocate, NS Power has restructured Section 8.1.1 to provide a narrative in an effort to clarify the nature of NS Power's different capital investments and their impact on revenue requirement.

The capital program presented in the 2015 ACE Plan represents the best interests of customers while maintaining the reliability and performance of NS Power's Generation, Transmission and Distribution assets.

1.4 Stakeholder Engagement – Capitalization versus Expensing of Routines

In the spirit of better understanding affordability and determining best value for NS Power customers, NS Power agreed, per the 2014 ACE Plan Terms of Consensus, to discuss the issue of

[5] NSPI 2014 ACE Plan – Agreement – M05998/P-128.14 - March 19, 2014.

capitalizing versus expensing routines subsequent to the ACE Plan proceeding. In its 2014 ACE Plan Decision, the Board directed NS Power to provide a report on this stakeholder consultation no later than July 31, 2014.

NS Power's discussions with Board staff and stakeholders explored whether the capitalization of routines was in the best interest of customers, providing the least cost option, as compared to expensing them. It was concluded that the continued capitalization of routines, in compliance with NS Power's accounting policies and procedures, is the best value and least cost option.

The conclusion of NS Power's report of July 31, 2014 stated:

> NS Power submits that when the treatment and costs of routines are examined on a net present value basis and reconciled to intergenerational equity and useful life, that capitalization of routines emerges as the best value and least cost option for NS Power customers assuming NS Power's lower cost of capital.
>
> The application of accounting principles requires professional judgment and thus "grey" areas may occur. NS Power is focused on providing best value for customers and ensuring intergenerational equity and thus commits to continuing to closely examine capital routines and the expenditures that make their way into them, measured against NS Power's Accounting Policy and Procedures to appropriately classify expenditures as either capital or expense.

The Board, by letter of September 19, 2014, requested additional comments from stakeholders by October 2. The Consumer Advocate and the Small Business Advocate made submissions.

The Consumer Advocate stated:

> The Consumer Advocate is in general agreement with the progress referenced by NSPI.

The Small Business Advocate stated:

> The SBA in its participation supported the NSPI filing and appreciated the ability to review and provide input to NSPI prior to the filing.

The UARB issued its comments by letter dated October 10, 2014. The Board stated:

> The Board appreciates the efforts of all who participated in this process and accepts the recommendations and assurance from NSPI that it will closely examine transactions to ensure appropriate classification. The Board will monitor future ACE Plan budgets and actual results for compliance with the revised accounting policy and representations made in this process.
>
> In its submission, NSPI acknowledges that timing differences related to tax deductions can have a cost impact to customers. The Board anticipates further scrutiny related to the timing differences and associated impact on customer rates in future proceedings.

1.5 Stakeholder Engagement – ACE Plan and Capital Process Improvements

In addition to the matters noted above, the Board, in its 2014 ACE Plan Decision, stated:

> …the Board continues to seek improvement in a number of areas. These were canvassed with the NSPI panel during the hearing, and include: frequency and characterization of U & U (Unforeseen and Unbudgeted) submissions; difficulty in reconciling information respecting the status of projects in the ACE Plans of prior years, particularly "deferred", "pending submission", and "cancelled" projects; and, the increased number of requests for approval of capital items "outside the quarter''. The Board also notes that the ACE Plans include a growing number of projects, especially some having large expenditures, which are to be submitted for subsequent approval.

Accordingly, the Board provided the following directive in its 2014 ACE Plan Decision:

> The Board directs that NSPI undertake a consultation with stakeholders, and as appropriate, Board staff and counsel, to address how the process, contents, and timetable for future ACE Plan applications and individual work order applications might be improved. NSPI is directed to report on the results of such consultation no later than the filing of the next ACE Plan application.

NS Power provided its update on this matter by letter dated November 4, 2014. As per NS Power's update, the following issues were discussed with Board staff, Board counsel, stakeholders and their consultants, and the corresponding improvements were incorporated in the 2015 ACE Plan and general capital process.

ACE Plan – Subsequent Submittal List and Capital Items Submitted for Approval

An increase in the number of capital items listed for subsequent submission and not included in the ACE Plan for review and approval has been noted by the Board and stakeholders.

Capital items that appear on the Subsequent Submission list are typically in early stages of the development process. As such, they have not been thoroughly scoped, and may not have fully developed budgets. Cost and technical supporting documentation at this stage may not be available. Therefore, they are withheld from submission at the time the ACE Plan is submitted until such a time that budgeting, scoping, and supporting documentation can be completed.

In order to reduce the number of capital items found on the Subsequent Submittal list, NS Power proposed that more capital items be submitted in the ACE Plan for review and approval, with the caveat that a number of these capital items may not be fully scoped or have detailed supporting documentation.

Although this will potentially increase the likelihood of variances from budget to actual costs, there are risk control and mitigating processes in place.

- Projects submitted for approval remain subject to internal vetting with respect to the accuracy of budgeting – only those projects with reasonable cost certainty will be submitted for review and approval, and those that do not will remain on the Subsequent Submission list (Section 2.3).

- The Board may, at its discretion, set aside for individual review any capital work order it deems, as it has in prior years.

- Pursuant to the Board approved Capital Expenditure Justification Criteria (CEJC), NS Power is required to submit for the Board's review and approval a Final Cost (FIN) capital work order for projects that have realized a scope change or have final costs with a variance of more than the greater of +/- 5 percent or +/- $250,000. NS Power may also submit for the Board's review and approval an Authorization to Overspend (ATO) capital work order prior to final costing where overspend or a scope change has occurred.

Stakeholders and their consultants are supportive of this approach, which has been implemented in the 2015 ACE Plan.

In comparison to the 43 capital work orders submitted for approval in the 2014 ACE Plan, the 2015 ACE Plan has 84 capital work orders submitted for approval. In comparison to the 43 capital work orders pending submission in the 2014 ACE Plan, the 2015 ACE Plan Subsequent Submission list has 46 capital work orders listed.

Lastly, NS Power proposed combining the Capital Items Pending Submission and the ACE Plan Capital Items Forecast for Subsequent Approval lists for increased clarity: the new combined list is titled Capital Items for Subsequent Submission. Stakeholders and their consultants have also accepted this new approach. The Capital Items for Subsequent Submission list includes projects with forecasted 2015 spend that will be submitted after the submission of the 2015 ACE Plan. It can be found in section 2.3.

ACE Plan – Revised Deferred/Cancelled List

Improving the ability to track deferred and cancelled items found in the ACE Capital Items Deferred/Cancelled list was requested by the UARB and stakeholders. NS Power proposed that additional columns in the list be added:

- Deferred To – This column identifies which year the project has been deferred to.
- Previously Approved – This column identifies whether the project has been previously approved by the UARB.
- Prior ACE Plan Reference – This column identifies in which ACE Plan the project was originally referenced.
- Current ACE Plan Reference – This column identifies where in the current ACE Plan the project can be found.

Stakeholders and their consultants accepted this approach. The revised ACE Plan Capital Items Deferred/Cancelled list can be found in Section 1.7.

ACE Plan – Carry-Over Spending Clarification

Some projects listed in the various Carry-Over Spending lists broken out by capital function (i.e. Generation, Transmission, Distribution and General Plant) were noted by the UARB and stakeholders as having yet to be approved by the UARB.

NS Power advised that the Carry-Over Spending lists only include those projects that have been previously submitted to and approved by the UARB, or have been submitted but have not yet received approval.

For additional clarity, NS Power proposed identifying with an asterisk and corresponding note those projects that have been submitted to the UARB but have yet to receive approval. The Carry-Over Spending lists with this new feature can be found in sections 3.2, 4.2, 5.2, and 6.2.

Stakeholders and their consultants accepted this approach.

ACE Plan – Timetable

Submission of the ACE Plan in the first week of November allows for the completion of an IR process in the month of December. This, in turn, allows for the timely completion of a hearing process in the new-year.

Going forward, NS Power will continue to endeavour to submit the ACE Plan by the first week of November at the latest.

Stakeholders and their consultants accepted this approach.

Capital Process – Revised Definition of Unforeseen & Unbudgeted (U&U)

The frequency and characterization of capital work orders deemed Unforeseen & Unbudgeted (U&U) was noted by the UARB and stakeholders. The current definition of U&U in the Capital Expenditure Justification Criteria (CEJC) is:

> *Unforeseen and Unbudgeted (U&U)*: An unforeseen and unbudgeted project that develops throughout the year and was not included in the current ACE Plan. A U&U represents items that cannot wait until the next ACE Plan for approval.

Under this definition, some capital work orders, notwithstanding the fact that they were foreseen and budgeted, were classified as U&Us when submitted to the UARB.

For example, if a capital item originally referenced in the 2013 ACE Plan for Subsequent Submission was not submitted until sometime in 2014, then under the current definition that project would be labelled a U&U because it would not be a current ACE Plan item.

This application of the designation of U&U to similar capital work orders has led to some confusion. As such, NS Power proposed a revision to the definition of U&U, and, with the feedback of Board staff, counsel, stakeholders and their consultants, settled on the following revised definition:

> *Unforeseen and Unbudgeted (U&U)*: An unforeseen and unbudgeted project that develops throughout the year, typically in response to discoveries made through routine inspections, maintenance, and/or unplanned failures, and was not included in prior ACE Plans or the current ACE Plan. Projects foreseen and budgeted for future years, but pulled ahead for commencement and/or completion in the current year, are not U&Us regardless of whether they are referenced in prior ACE Plans. A U&U ~~represents items that~~ is submitted because it cannot wait until the next ACE Plan for approval.

Under this definition, capital items that are foreseen and budgeted will not be labelled as U&Us. Rather, when capital work orders that do not appear in the current ACE Plan are submitted to the UARB for review and approval, they will clearly identify in which ACE Plan they were originally referenced. Projects pulled forward from future years for completion in the current year will be identified as “Planned & Advanced (P&A)” with reasons.

Stakeholders and their consultants accepted this approach.

NS Power submitted the revised U&U definition in the CEJC to the UARB on November 4, 2014.

Capital Process – Revised Quarterly Capital Report

In order to provide additional clarity on the status and tracking of all capital items found in the ACE Plan and filed throughout the year, NS Power also suggested significant revisions to the Quarterly Capital Reports filed with the UARB.

The first revised Quarterly Capital Report was filed on October 31, 2014 along with the Q3 capital work order package.

The revised Quarterly Capital Report retains the format of the first report which provides an overview of capital expenditures broken out by the four main functional classes: Generation, Transmission, Distribution, and General Plant.

However, the two following reports, NS Power 2014 Capital Item Submissions to UARB and Capital Item Activation Schedule for 2014 (as per ACE) have been replaced by a new report consolidating all of the information into one table. This table provides an ongoing list of all active projects referenced in an ACE Plan or submitted to the UARB, from initial reference or submission, all the way to Final Costing at which point the project is then dropped from the list. This format provides the Board and stakeholder a comprehensive listing of all projects updated on a quarterly basis, consolidated into one clear and transparent format.

Stakeholders and their consultants accepted this approach.

1.6 2015 AFUDC Rate

In the Board's 2013 ACE Plan Decision, the UARB provided the following directive:

> The Board directs NSPI to adjust the rate used for AFUDC purposes to match that approved in the most recent GRA.

Per the Board's direction, NS Power used the 2013 General Rate Application approved 2014 AFUDC rate of 7.78 percent as noted in the 2014 ACE Plan.

For 2015, there is no prior Board approved AFUDC rate. Therefore, NS Power respectfully requests Board approval of the 2015 AFUDC rate at 7.23 percent, as supported by the following table.

Nova Scotia Power Inc.
<u>Estimated Average Capital and Cost of Capital</u>
Year Ended December 31st 2015
Millions of Dollars

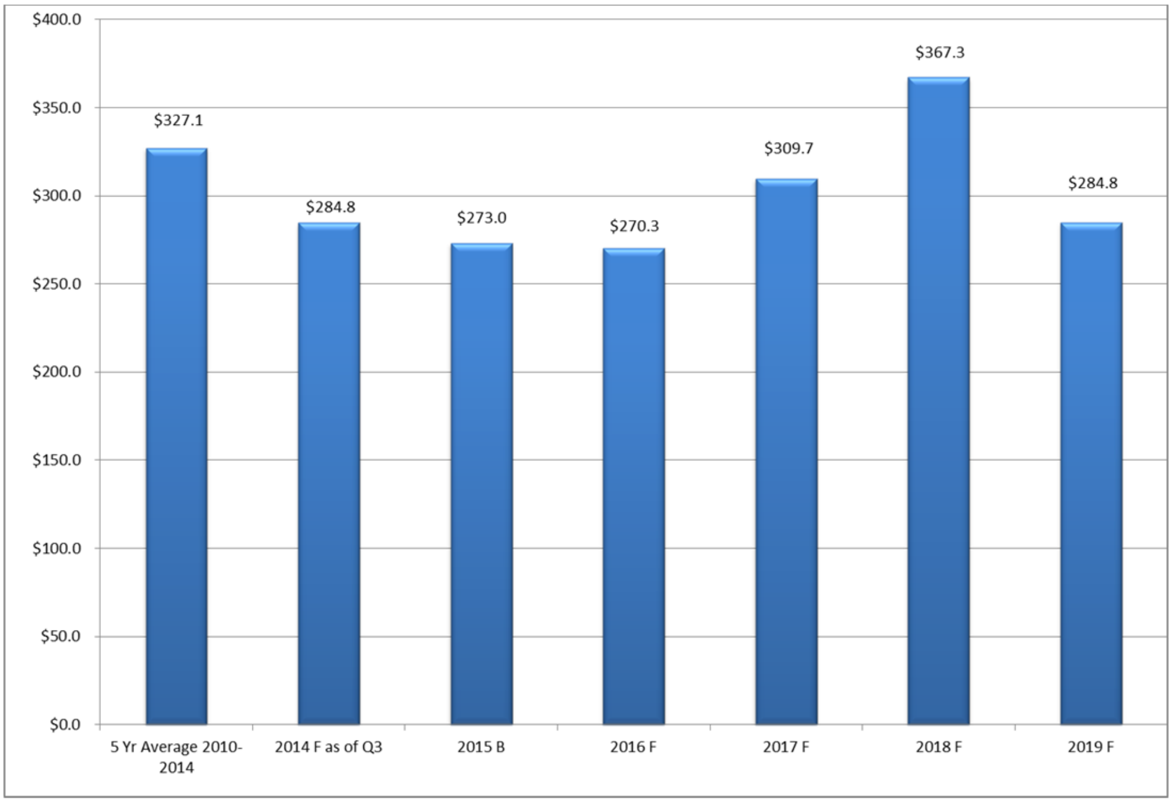
	Opening	Closing	Average Capital	Capital Ratio	Cost Pre-tax Factor	Cost After-tax Factor	Weighted Pre-tax Cost	Weighted After-tax Cost
Estimated Cost of Capital								
Short-term debt	$284.8	$232.8	$258.8	6.7%	2.36%	1.63%	0.16%	0.11%
Long-term debt	1,956.5	2,185.6	2,071.0	54.0%	6.52%	4.53%	3.52%	2.44%
Total debt	$2,241.3	$2,418.4	$2,329.9	60.7%	8.88%	6.16%	3.68%	2.55%
Preferred shares	132.2	0.0	66.1	1.7%	10.04%	9.70%	0.17%	0.17%
Common equity	1,422.1	1,458.5	1,440.3	37.5%	9.00%	9.00%	3.38%	3.38%
Total	**$3,795.6**	**$3,876.9**	**$3,836.3**	**100.0%**			**7.23%**	**6.10%**

Notes:
1) Figures presented may include $0.1M in rounding differences on some line items.
2) Pre-tax equity cost excludes the income tax gross-up factor.
3) Calculations based on 2015 internal NSPI Budget.
4) Average capital reflects average of year-end balances.

The AFUDC rate applied to 2015 ACE Plan projects is 7.22 percent. The difference between this 7.22 percent and the request for approval of 7.23 percent is due to timing: ACE Plan budgeting and completion of capital items occurred prior to the completion of the AFUDC calculation that will be used across all of NS Power's functions. The difference of 0.01 percent represents a difference of approximately $7,000 on the total 2015 ACE Plan forecast of $273.0 million. AFUDC on the 2015 ACE Plan items will be calculated at the 7.23 percent provided this rate is approved by the UARB. No change to the budget amount of projects is required.

1.7 Capital Spending History and Forecast Overview

Historical, Budget and Forecast
(Millions of Dollars)



F = Forecast, B=Budget in above figure

Total Annual Capital Expenditures by Function
(Millions of Dollar)

	Actuals						ACE Plan	Forecast			
Year	**2010**	**2011**	**2012**	**2013**	**2014 Q3 F**	**2014 ACE Plan Budget**	**2015**	**2016**	**2017**	**2018**	**2019**
Generation	$129.0	$85.4	$88.7	$68.4	$61.8	$58.8	$99.8	$104.7	$129.8	$175.7	$119.1
New Renewables	256.0	66.2	53.2	15.2	89.5	30.9	$12.1	-	-	-	-
Transmission	45.1	58.4	45.4	31.0	53.7	51.8	$68.0	63.1	48.9	50.0	51.0
Distribution	59.6	62.4	68.7	62.9	53.5	59.0	$64.1	75.2	99.8	101.0	81.5
General Plant	54.0	42.5	28.5	29.9	26.2	27.5	$29.0	27.3	31.3	40.5	33.2
Total	**$543.7**	**$315.0**	**$284.5**	**$207.5**	**$284.8**	**$228.0**	**$273.0**	**$270.3**	**$309.7**	**$367.3**	**$284.8**

NOTE: Figures presented may include $0.1M in rounding differences on some line items. Increase in New Renewables from 2014 ACE Budget to 2014 Q3 Forecast is due to the re-timing of work at the South Canoe Wind Farm.

1.8 2014 ACE Capital Items Deferred/Cancelled

NS Power's list of deferred and cancelled capital work orders relative to the 2014 ACE Plan are noted in the following table.

This list reflects NS Power's efforts to manage capital expenditures in order to reduce upward pressure on rates. Continued diligence in the form of inspections, operational observations and risk assessments allows projects to be re-validated and re-prioritized over the course of the year.

Of the 39 projects listed, one project was included in the 2014 ACE Plan for approval. 12 of these projects were listed in the 2014 ACE Plan to be filed separately as individual capital items. The remaining 26 projects were listed in the 2014 ACE Plan as projects under $250,000.

These 39 projects were originally included in the 2014 ACE Plan with a forecasted spend of $23.2 million in 2014.

2014 ACE Items – Deferred or Cancelled

CI	Project Title	2014 ACE Project Total	Cancelled/ Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2015 ACE Plan Reference
Generation							
41142	HYD - St. Margaret's Fish Passage *In-stream improvements required prior to construction were completed in 2014, which pushed the project start into 2015.*	3,163,840	Deferred	2015		Subsequent Approval	Subsequent Approval
45116	BGT1 GG4C-1D Engine Refurbishment *Project was deferred due to a re-prioritization of efforts focusing on Burnside 3.*	1,152,807	Deferred	2015	ACE 2014	Request Approval	Request Approval
44978	HYD-Wreck Cove Automation *Originally forecasted to be done in 2014-2015, design will not be completed until late 2014. This is now an ACE 2015 subsequent approval project.*	805,604	Deferred	2015		Subsequent Approval	Subsequent Approval
44730	TRE5 Turbine Main and Control Valves Refurbishments *This project was originally intended to procure materials in 2014 and execute construction in 2015. Long lead time of materials pushed the receipt of these into 2015, leading to the full project being proposed for 2015.*	731,359	Deferred	2015		Subsequent Approval	Request Approval
29065	CTS BGT Replace Halon Fire Protection System *Original plan was to complete in late 2014. Current outage schedule aligned with a 2015 completion.*	356,702	Deferred	2015		Subsequent Approval	Subsequent Approval
45180	ICP - Rail Line Bridge Work *Inspections have shown that this investment is not necessary at this time.*	308,108	Cancelled			Subsequent Approval	

2014 ACE Items – Deferred or Cancelled

CI	Project Title	2014 ACE Project Total	Cancelled/ Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2015 ACE Plan Reference
43155	CT - BGT2 Air Intake Structure Refurbishment *Temporary repairs were completed on this structure, which allowed the work to be pushed to a later date.*	306,586	Deferred	2016		Subsequent Approval	
43027	POT - Refurbish Dust Collection Area Explosion System *Deferred - Modifications require outage of at least 3 weeks – deferred to 2015 for longer outage availability.*	240,050	Deferred	2015		Less Than 250K	Less than 250K
43407	TRE5 Cable Rooms Fire Protection *This project is being re-assessed as part of the fire protection strategy, and is not necessary at this time.*	233,634	Cancelled			Less Than 250K	
41664	TRE5 Precip Refurbishment *Further inspection showed the condition has not deteriorated to the extent anticipated from previous inspections and the work is not needed at this time.*	231,670	Deferred	2016		Less Than 250K	
42973	TUC - #1, 2 and 4 WTP DCS upgrade *Deferred - At this time, an alternate solution is being investigated. Once design is finalized, the project will be completed in 2015.*	227,093	Deferred	2015		Less Than 250K	Less than 250K
44716	TUC2 - North Boiler Feed Pump Refurbishment *Deferred - The Boiler feed pump is performing at a level where this project can be safely deferred until 2015.*	190,110	Deferred	2015		Less Than 250K	Less than 250K

2014 ACE Items – Deferred or Cancelled

CI	Project Title	2014 ACE Project Total	Cancelled/ Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2015 ACE Plan Reference
44627	TUC - No. 3 Elevator Control System Replacement *This project is no longer necessary as maintenance has mitigated the need for this work to be completed.*	180,292	Cancelled			Less Than 250K	
43429	TRE5 Lube Oil Cooler Retube *The risk associated with this project is being mitigated with more frequent inspections and eddy-current testing. This allows this project to be deferred into 2016.*	178,095	Deferred	2016		Less Than 250K	
42937	TUC-LMs East Gas Compressor Overhaul *Deferred - Further inspection is required in 2014 to finalize the design of this project. Will be completed in 2015.*	154,583	Deferred	2015		Less Than 250K	Less than 250K
44721	TRE Ash Site Covering (2014) *Due to the transition from Phase One to Phase Two last year, there was minimal ash at final grade in 2013; therefore the scope of the 2013 project (CI 43409) will cover the work required in 2014.*	150,814	Cancelled			Less Than 250K	
44740	TUC3 - Precip field power supply *Further investigation is required in 2014 to finalize the design of this project.*	143,371	Deferred	2016		Less Than 250K	
44587	POT - Selective Ash Site Capping 2014 *2013 ash site capping project carried over to 2014 resulting in deferral of 2014 project to 2015.*	142,076	Deferred	2015		Less Than 250K	Less than 250K

2014 ACE Items – Deferred or Cancelled

CI	Project Title	2014 ACE Project Total	Cancelled/ Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2015 ACE Plan Reference
44734	TRE6 High Energy Piping Snubbers *The scope of this project will be completed over future years under the Routine Equipment Replacement project.*	138,332	Cancelled			Less Than 250K	
22426	TRE 5-1 Air Heater Outlet Expansion Joint Replacement *Deferred - Recent observation of the condition of the expansion joint was favourable, allowing this work to be deferred. Project will be revisited in 2016.*	129,569	Deferred	2016		Less Than 250K	
44787	CT - DC Battery Bank Replacement *In order to complete this work, the units must be taken offline. Scheduling did not allow for the work to be completed in 2014.*	118,936	Deferred	2015		Less Than 250K	Less than 250K
45330	HYD-WRC C3 Culvert Replacement *Access to work is interrupted due to the refurbishment work at Cheticamp D-1. Planned to be completed after D-1 construction is complete.*	116,396	Deferred	2016		Less Than 250K	
45181	ICP - Rail Line Road Crossing Upgrades *Further assessment showed the condition of the road crossing allowed for the work to be completed at a later date.*	116,267	Deferred	2016		Less Than 250K	
42050	CT- Tusket Air Dryer Upgrade *Investigation into alternative methods to needing an air dryer are currently being undertaken.*	103,428	Deferred	2016		Less Than 250K	

2014 ACE Items – Deferred or Cancelled

CI	Project Title	2014 ACE Project Total	Cancelled/ Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2015 ACE Plan Reference
45246	LIN - CW MCC Refurbishment *Full scope of the project wasn't determined until late 2014, pushing construction to 2015.*	101,682	Deferred	2015		Less Than 250K	Request Approval
37544	TRE5 - Coal MCC Transformer Replacement *Originally included as a Trenton capital project. Will now be completed under a distribution deteriorated plant replacement routine.*	90,927	Cancelled			Less Than 250K	
37982	CT - BGT3 AVR Replacement *The availability of vendor support on this item did not allow this work to be completed. Procurement through another vendor would be a much more expensive option.*	75,141	Deferred	2016		Less Than 250K	
44768	TRE 4kV Breakers 2014 *This 2013 4kV Breaker project completed sufficient work to eliminate the need for this project.*	73,493	Cancelled			Less Than 250K	
42971	TUC2 - DCS Upgrade *Further investigation revealed there was minimal operational risk in deferring this project to 2015.*	56,631	Deferred	2015		Less Than 250K	Less than 250K
45174	PHB - Fire System Upgrades *This project no longer meets the $25,000 materiality limit set out in NS Power's accounting policies. Work will be expensed.*	26,820	Cancelled			Less Than 250K	
45172	PHB - Dust Mitigation in Electrical Rooms *This project no longer meets the $25,000 materiality limit set out in NS Power's accounting policies. Work will be expensed.*	26,626	Cancelled			Less Than 250K	

2014 ACE Items – Deferred or Cancelled

CI	Project Title	2014 ACE Project Total	Cancelled/ Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2015 ACE Plan Reference
44786	BGT1 - Oil Filter Upgrade *The solution to this project has yet to be finalized. Further assessment is required to finalize the scope of this project.*	24,944	Deferred	2016		Less Than 250K	
Transmission							
43324	L6513 Rebuild / Upgrade Line Terminals *Project timelines to be finalized. Project will be started in 2015.*	16,141,774	Deferred	2015		Subsequent Approval	Subsequent Approval
43678	Separate L8004/L7005 on Canso Crossing Double Circuit Tower *Project timelines to be finalized. Project will be started in 2015.*	10,818,967	Deferred	2015		Subsequent Approval	Subsequent Approval
45066	Upgrade L6511 and L7019 Thermal Rating *Project timelines to be finalized. Project will be started in 2015.*	7,707,849	Deferred	2015		Subsequent Approval	Subsequent Approval
45306	George Street Substation Addition *Project was forecasted to start in late 2014. Engineering / scoping is now being completed in order to begin construction in 2015.*	3,771,492	Deferred	2015		Subsequent Approval	Subsequent Approval
General Plant							
44671	IT-Oracle Financials Upgrade *NS Power is currently exploring alternatives which may not require this capital investment*	6,633,731	Cancelled			Subsequent Approval	

2014 ACE Items – Deferred or Cancelled

CI	Project Title	2014 ACE Project Total	Cancelled/ Deferred	Deferred To	Prior Approval	Prior ACE Plan Reference	2015 ACE Plan Reference
44713	IT - Safety Health and Wellness Tracking System *Project is no longer necessary as the current system's life is being extended through a hardware replacement.*	358,924	Cancelled			Subsequent Approval	
41442	IT - Advanced Laptop Security *Deferred - NS Power is evaluating the product selection related to desktop encryption. This project will now be completed in 2015.*	84,464	Deferred	2015		Less Than 250K	Less than 250K

2 2015 Annual Capital Expenditure Plan

2.1 Summary of Expenditures

The following table provides the proposed 2015 capital investment by approval category for NS Power's ACE Plan filing. This Application seeks UARB approval of the 2015 routine capital and other 2015 projects, which total $139.5 million of forecast spending in 2015. Certain items do not require UARB approval, but are included in the Company's annual capital plan for transparency and stakeholders' information. The 2015 ACE Plan budget also includes spending on multi-year projects that were previously approved by the UARB.

2015 ACE Plan Spend	2015 UARB Approval Request ($M)	UARB Approval Not Required ($M)	Capital Items Forecast for Later Filing & Approval in 2014/2015 ($M)	Previously Approved Capital Projects with 2015 Carryover ($M)	2015 ACE Plan ($M)
Capital Item Approval Sought through the 2015 ACE Process (Including Routine Capital Projects*)	138.7				**138.7**
Capital Items Submitted for Later Approval in 2015			63.9		**63.9**
2015 Carryover Projects				47.9	**47.9**
Capital Items Less Than $250K		12.3			**12.3**
Point Aconi Capital Spend		10.3			**10.3**
2015 ACE Plan	**138.7**	**22.5**	**63.9**	**47.9**	**273.0**

**Routine Capital spending represents $73.4 million of total spending in 2015. Excluding the costs of $0.4 million associated with Point Aconi Routines, NS Power is seeking approval of $73.1 million of Routine spending in 2015.*
NOTE: Figures presented in the ACE Plan document reflect rounding which may cause $0.1 million in rounding differences on some line items.

Capital item justifications are based on the Capital Expenditure Justification Criteria as approved by the Board in 2013.

2.2 2015 ACE Plan Capital Items Submitted for Approval

This table provides the list of Capital Items for which NS Power seeks UARB approval by this Application, totaling $65.6 million of spending in 2015, with a total forecast spending of $83.6 million.

Tab #	CI#	Project Title	2015 Budget ($)	Project Total ($)
Hydro				
G01	41139	HYD - Annapolis Sluiceway Superstructure Refurbishment	1,615,767	3,410,322
G02	43066	HYD - Little Indian Dam / Mill Lake Upgrade	1,188,480	1,409,587
G03	43607	HYD - Malay Falls #5 Unit Overhaul	780,932	1,077,255
G04	46594	HYD Sissiboo Falls Overhaul	817,153	817,153
G05	45370	HYD - WRC Unit 1 Excitation System	578,113	578,113
G06	44667	HYD Upper Lake Falls Unit #1 Overhaul	477,533	477,533
Total New Hydro Spending			**$5,457,978**	**$7,769,963**
Steam				
Ash Site Investment				
G07	44267	TRE Ash Lagoon Site Closure	4,571,161	7,994,849
G08	44188	TRE Ash Site Phase 1 Capping	2,093,285	4,538,289
Boiler				
G09	46299	TRE6 Boiler Refurbishments	873,652	873,652
G10	46256	POT - Boiler Refurbishment 2015	780,097	780,097
G11	46451	PHB Boiler Refurbishment 2015	673,602	673,602
G12	46302	TRE5 Boiler Refurbishments	647,845	647,845
G13	46467	LIN3 - Division Wall Replacement	635,747	635,747
G14	46352	TRE5 Air Heater Refurbishments	527,994	527,994
G15	46469	LIN4 - Boiler Refurbishment 2015	501,938	501,938
G16	46470	LIN1 - Boiler Refurbishment 2015	496,369	496,369
G17	46463	LIN3 - Air Heater Refurbishment	477,566	477,566
G18	44191	POT Coal Nozzle and Bucket Replacement	409,515	570,309
G19	46472	LIN3 - Boiler Chemical Treatment	387,649	387,649
G20	46394	POT - Air Heater Steam Coil Replacement -North Side	361,514	361,514
G21	46482	LIN3 Burner Front Refurbishment	299,261	299,261
G22	46508	LIN2 Boiler Refurbishment	289,345	289,345
G23	41645	TRE6 Bottom Ash Seal Replacement	214,383	307,499
Turbine				
G24	42806	LIN3 L-0 Turbine Blade Replacements	3,881,826	4,157,741
G25	43094	LIN3 HT Fastener Replacement	868,348	868,348

Tab #	CI#	Project Title	2015 Budget ($)	Project Total ($)
G26	44730	TRE5 Turbine Valves Refurbishment	752,160	752,160
G27	46336	POT Turbine Valve Refurbishment	616,865	616,865
G28	46473	TUC3 - Turbine Valve Refurbishment	609,870	609,870
G29	46464	TUC1 - Turbine Valve Refurbishment	541,162	541,162
Generator				
G30	43088	LIN3 Generator Rotor Rewind	1,901,480	1,901,480
G31	40363	LIN3 High Voltage Bushing Refurbishment	628,531	628,531
Chemical				
G32	46484	TUC - Unit 1&2 Analytical Panel Replacement	386,607	386,607
G33	46496	LIN3 Analytical Panel Replacement	276,756	276,756
Balance of Plant				
G34	41227	LIN3 Condenser Large Bore Pipe and Valve Refurbishment	1,299,329	1,299,329
G35	28288	POT Turbine Supervisory Equipment Upgrade	822,535	822,535
G36	43031	POT - #5 HP Feedwater Heater Replacement	811,277	812,644
G37	46055	LIN - Coal Mill Refurbishment 2015	736,546	736,546
G38	46301	TRE6 6A 6B Mills Refurbishment	665,045	665,045
G39	46392	POT - Plant Siding Replacement	547,659	547,659
G40	46058	LIN Coal Plant Structural Refurbishment - Phase 1	516,818	516,818
G41	46395	TRE5 Baghouse Filter Replacements 2015	489,517	489,517
G42	46070	LIN3 Bottom Ash Replacement	475,908	475,908
G43	46372	POT - Coal Mill Overhauls	418,292	418,292
G44	45851	POT - Stack Repairs	349,165	381,316
G45	45246	LIN Cooling Water MCC Refurbishment	295,667	327,633
G46	46057	LIN - CW Screen Refurbishment 2015	292,634	292,634
G47	46293	LIN Coal Bunker Chute Refurbishment	291,730	291,730
Total New Steam Spending			**$32,716,653**	**$39,180,653**
Gas Turbine				
G48	45116	CT - BGT1 GG4C-1D Engine Refurbishment	1,168,167	1,168,167
G49	20511	CT - Victoria Junction Replace Halon Fire Protection System	268,467	268,467
Total New Gas Turbine Spending			**$1,436,634**	**$1,436,634**
Total New Generation Spending			**$39,611,265**	**$48,387,251**
Transmission				
T01	46339	120H Brushy Hill - SVC Controls Replacement	3,689,176	9,959,330
T02	46513	3C Port Hastings BPS Upgrade	2,795,730	3,684,823

Tab #	CI#	Project Title	2015 Budget ($)	Project Total ($)
T03	46340	2015 Transmission Switch & Breaker Replacements	1,581,599	1,581,599
T04	43490	2015 Steel Tower Life Extension	641,709	1,441,709
T05	43267	13V Gulch Hydro Replace 13V-GT1 and 13V-VR1	1,061,902	1,061,902
T06	44976	10H 25kV Breaker Replacement	953,521	953,521
T07	46583	L6511 Replacements	905,745	905,745
T08	46331	L7001 Replacements - Phase 2	888,192	888,192
T09	46335	L5511 Replacements	722,934	722,934
T10	44979	L5527 Structure Replacements	721,068	721,068
T11	46362	L5560 Transmission Line Reconductor	626,895	626,895
T12	46353	2015 Substation Recloser Replacements	596,893	596,893
T13	43261	6V-GT1 Hollow Bridge Hydro Transformer Replacement	550,938	550,938
T14	46337	L6535/L6551 Insulator Replacements	459,422	459,422
T15	46354	2015 Reactor Breaker Replacements	460,691	460,691
T16	46582	L5569 Upgrade	369,032	369,032
T17	46356	2015 Sacrificial Anode Installation Program	304,612	304,612
Total New Transmission Spending			**$17,330,057**	**$25,289,305**
Distribution				
D01	46292	2015 Padmount Transformer Replacement Program	1,536,110	1,536,110
D02	46458	16N-302 Stewiacke Reconductor	592,084	965,830
D03	43234	104S-313 Baddeck Rebuild	778,470	778,470
D04	46576	2015 PCB Phase-out for Pole Top Transformers	733,503	733,503
D05	45031	3N Oxford Conversion Phase 1	716,167	716,167
D06	46457	79V-401 Cameron Lake Voltage Conversion	282,166	637,939
D07	46456	11W Yarmouth 4kV Conversion	295,167	545,514
D08	46304	20W-311 Argyle Sound Reconductor	430,435	430,435
D09	46251	36V-303 Saxon Double Circuit	425,838	425,838
D10	43203	58C-405 / 11C Belle Cote Phase 1	339,419	339,419
D11	45003	2015 Hydraulic Recloser Replacements	260,524	260,524
Total New Distribution Spending			**$6,389,884**	**$7,369,750**
General Plant				
Telecommunications				
GP01	46307	2015 Multiplexer Network Upgrades	446,538	446,538
GP02	46308	2015 Microwave System Capacity Upgrade	316,142	316,142
GP03	46306	2015 Telecom Building Replacement	251,727	251,727
Total New Telecommunications Spending			**1,014,407**	**1,014,407**

Tab #	CI#	Project Title	2015 Budget ($)	Project Total ($)
Computers				
GP04	46365	Maximo Enhancements for Substation Field Mobility	315,242	315,242
GP05	46364	Maximo Enhancements for Telecom & Relays	170,598	272,539
Total New Computer Spending			**485,840**	**587,781**
Other General Plant				
GP06	46050	Operator Training Simulator	358,284	531,119
GP07	46657	Wire Inspection Services - Analyzer Replacement	448,300	448,300
Total New Other General Plant Spending			**806,584**	**979,419**
Total New General Plant Spending			**2,306,831**	**2,581,607**
Total New Capital Spending			**$65,638,037**	**$83,627,912**
Total Routine Capital Spending			**$73,097,621**	**$73,097,621**
Total Capital Items for which Approval is Sought			**$138,735,658**	**$156,725,533**

2.3 2015 ACE Plan Capital Items Forecast for Subsequent Approval

The following table identifies 2015 projects that are not yet ready for submission to the UARB, and that NS Power anticipates will be filed for approval throughout 2015. NS Power estimates $63.9 million of spending in 2015 on these projects, which are currently estimated for total spending of $173.9 million. The budget numbers indicated below are estimates as NS Power needs additional time to refine the specific project budget proposals. This section of the Company's filing is designed to provide an indication of these anticipated 2015 projects, as requested by the Board.

CI#	Project Title	2015 Budget ($)	Project Total ($)
Hydro			
41142	HYD - St. Margaret's Fish Passage *This project is to construct a new fish ladder adjacent to main dam on the Saint Margaret's Bay Hydro system.*	2,900,021	3,433,314
44978	HYD-Wreck Cove Automation *This project is to modernize and automate the Wreck Cove facility for more efficient trouble-shooting and unit monitoring.*	874,891	2,379,999

CI#	Project Title	2015 Budget ($)	Project Total ($)
40283	HYD - Wrights Lake Dam Refurbishment *This project includes the refurbishment of the Wright's Lake Dam on the St. Margaret's Bay Hydro System in order to meet Canadian Dam Safety Guidelines.*	1,967,723	2,242,751
41130	HYD - Avon #2 Generator Stator Rewind *This project includes the rewind of the Avon #2 generator stator on the Avon Hydro System.*	620,353	694,096
45171	HYD-Avon 1 Pipeline Replacement *The project includes the replacement of the existing wood stave pipeline on the Avon River System, with a modern concrete and fiberglass composite pipe.*	467,755	547,780
46232	HYD - WHR Pipeline Replacement *The project includes the replacement of the existing wood stave pipeline for the White Rock generating station on the Black River System, with a modern concrete and fiberglass composite pipe.*	458,493	538,454
	Total New Hydro Spending for Subsequent Approval	**7,289,236**	**9,836,394**
Gas Turbine			
33142	CT- Burnside #4 Unit Restoration *This project provides for work required to bring the Burnside Unit 4 back in service.*	3,094,420	3,469,160
44775	CT - TUC#4 LM6000 Generator Rotor Re-wedge *This project is for the disassembly, rotor re-wedge and re-assembly of the Tuft's Cove #4 LM6000 generator rotor.*	691,046	803,594
46506	LM6000 - Noise Mitigation *This project includes activities designed to reduce the noise levels of the LM6000s to neighbouring properties.*	707,491	707,491
46483	CT - Tusket Control System Upgrade *This project includes the upgrade to the PLC (Programmable Logic Controller) at the Tusket CT.*	441,816	441,816
44752	BGT1 - Generator Rotor Retaining Ring Replacement *This project includes the replacement of the rotor retaining ring with new allow retaining rings*	357,869	357,869
29065	CT - BGT Replace Halon Fire Protection System *This project is to replace the current Halon fire protection system with an environmentally friendly one at Burnside Combustion Turbine facility.*	234,780	356,682
46507	LM6000 - Fuel Nozzle Rotable Kit *This project includes the purchase of a Fuel Nozzle rotable kit to be used in future planned outages on the Combustion Turbine fleet.*	295,772	295,772
45117	BGT1 - PLC and Field Device Control Upgrade *This project includes the upgrade to the PLC (Programmable Logic Controller) at the Burnside Unit #1 CT.*	253,768	253,768
	Total New Gas Turbine Spending for Subsequent Approval	**6,076,961**	**$6,686,152**
Steam			
46068	LIN CW Debris Removal System *This project includes the installation of a cooling water debris removal system on Lingan Units 3 & 4 which will remove debris prior to entering and damaging the cooling water screens and the cooling water pumps.*	1,575,866	1,575,866

CI#	Project Title	2015 Budget ($)	Project Total ($)
46300	TRE6 – Air Heater Refurbishment *This project includes the replacement of cold end baskets, cold end basket grids and sector plates related to the Trenton 6 air heater.*	752,215	752,215
44536	LIN3 HP Rows 1&2 Replacement *This project includes the removal and re-installation of Turbine High Pressure (HP) Rows 1&2 on Lingan Unit #3.*	706,791	706,791
46466	TUC2 - Rotary Airheater Refurbishment *This project includes the refurbishment or replacement of seals, baskets, rotary gearbox and drive and structural repairs on the Tuft's Cove Unit #2 Rotary Air Heater.*	439,946	439,946
46655	ICP Mile 10.1 Bridge Repairs *This project includes the encasement of bridge abutments in order to maintain the structural integrity of the bridge*	377,279	377,279
	Total New Steam Spending for Subsequent Approval	**3,852,096**	**$3,852,096**
	Total New Generation Spending for Subsequent Approval	**$17,218,294**	**$20,374,642**
Transmission			
46591	88S Lingan Replace 230kV GIS *This project includes the replacement of the existing 230kV Westinghouse Gas Insulated Switchgear at 88S Lingan. This project will be completed over a five year period.*	3,274,637	23,510,262
43324	L6513 Rebuild/upgrade line terminals *This is a network upgrade project required to support the Maritime Link Investment.*	12,735,850	23,429,902
43678	Separate L8004/L7005 on Canso Crossing Double Circuit Tower(DCT) *This is a network upgrade project required to support the Maritime Link Investment.*	1,367,669	10,797,354
41519	Harbour East 138 kV Transmission Line *This project includes the design and construction of a new 138kV transmission line from the existing Dartmouth East (113h) substation to a new substation required in the Eastern Passage area.*	497,838	8,793,272
44987	L7003 Lidar Upgrades *This project provides for the increase of clearances on L-7003 in order to meet Canadian Standards Association requirements.*	2,871,847	6,885,817
45053	69Kv Structure Replacements West *This project includes structural replacements on lines: L5531, L5535, L5532 and L5541.*	290,836	4,495,729
45306	George Street Substation Addition *This project provides for the addition of a new substation on George Street in Sydney.*	2,431,743	4,300,627
45066	Upgrade L6511 and L7019 Thermal Rating *This is a network upgrade project required to support the Maritime Link Investment.*	3,219,774	3,693,033
46587	Metro Voltage Support Add Capacitor *This project provides for the installation of a capacitor bank in the Metro area. This will provide additional flexibility in the dispatch of the generation fleet as it will increase the limit on the Onslow South (ONS) corridor.*	1,499,915	2,522,277

CI#	Project Title	2015 Budget ($)	Project Total ($)
46586	2015 PCB Removal - Substation *This project includes PCB sampling of all substation oil-filled equipment (250 items in 2015) and the removal of substation devices with 500 mg/kg, or more of PCBs, to be in compliance with 2008 Federal Environmental PCB Regulations.*	1,262,087	1,262,087
46333	L6538 Replacements *L6538 is a 138kV transmission line that connects 5S Glentosh to 3S Gannon Road substations. This project includes the replacement of 10 poles, 59 cross arms and 169 insulators.*	500,375	1,019,443
45795	L6503 Upgrade *L6503 is a 138kV transmission line that connects 1N Onslow to 50N Trenton substations. This project includes the replacement of 57 poles and reframing of 22 structures.*	780,641	780,641
46332	L6539 Replacements *L6539 is a 138kV transmission line that connects 2S Victoria Junction to 3S Gannon Road substations. This project includes the replacement of 24 poles, 29 cross arms and 87 insulators.*	736,393	736,393
41438	85S Cable Termination Replacement Wreck Cove *This project includes the retirement and replacement of the existing six 144kV cable terminations in the 85S - Wreck Cove substation.*	616,959	616,959
	Total New Transmission Spending for Subsequent Approval	**32,086,563**	**$92,843,795**
Distribution			
40320	LED Street Light Conversion *LED Street Light Deployment program.*	7,280,062	40,609,354
44749	Tiverton Tower Refurbishment *This project includes the replacement of the steel tower located at the edge of the Petit Passage water crossing near Tiverton, NS, which holds feeder 509V-301.*	935,802	1,281,771
44836	Halifax 4kV Conversion Part 2 *This project will convert two parts of the 9H-224 feeder in Halifax from 4kV to 25kV. Part 1 includes two Northwood Terrace vaults and Part 2 includes 1.6 km of overhead line on Agricola St.*	581,405	842,670
46651	23H-303G Rockingham Conversion Part 1 *This project is required to reduce the 12kV loading at 23H-Rockingham, through initial conversions to 25kV. These initial conversions will create a new feeder tie between Dutch Village Road and Northwest Arm Drive*	266,008	572,750
46398	20H Spryfield Voltage Conversion *The project includes the conversion of two parts of feeders 20H-302 and 20H-306 from 12kV to 25kV. This will allow to switch the converted feeder sections to other substations such as Armdale and Lakeside and offload the Spryfield substation.*	329,169	444,970
43218	88W-323HA Tusket Islands Phase 3 *This is a continuation of project developed to replace deteriorated poles on the Tusket Islands feeder, 88W-323HA. For 2015, Calf Island has been selected for replacement of deteriorated plant.*	286,911	286,911
	Total New Distribution Plant Spending for Subsequent Approval	**9,679,358**	**44,038,425**

CI#	Project Title	2015 Budget ($)	Project Total ($)
General Plant			
46552	Backbone Communications System Upgrade *This project will cover the upgrades and additions required to NSPI's Backbone communications system to support current and future communications needs.*	1,189,999	12,525,792
46075	IT – Maximo Upgrade *This project will upgrade the current version of the Maximo application to a supported version. The current version has reached the end of its expected life and is no longer supported by the vendor.*	1,198,973	1,198,973
46739	IT - Outage Map Technology Upgrades *This project includes upgrades to the functionality of NS Power's online Outage Map.*	982,880	1,023,269
41425	IT – Cognos Upgrade *This project includes the upgrade of the existing Cognos platform, used for large portions of NS Power's financial reporting activities, from Version 7.4 to Version 10.*	323,498	526,740
46411	AMO Hydro Asset Management PE *This project is to implement similar asset management practices in Hydro as have been implemented in NS Power's thermal plants. It will implement mobile technology, risk profiling, PdP and PdM program development.*	205,643	376,637
46073	IT – Lotus Notes Applications Replacement *This project is to replace the current versions of Lotus notes and the hardware it is running on with hardware and software applications that are supported.*	308,782	308,782
46671	CIP v5 Cyber System Systems *This project is required to meet new NERC standards around cyber security. It includes the adoption of the new version (v5) which includes the implementation of security measures for cyber systems based on the impact rating (high, medium, low) of the Bulk Power System elements they support.*	730,200	730,200
	Total New General Plant Spending for Subsequent Approval	**$4,939,974**	**$16,690,391**
	Total Capital Items for Subsequent Approval	**$63,924,189**	**$173,947,254**

2.4 2015 ACE Plan Capital Items with Estimated Total Project Cost of Less Than $250,000

This table includes capital items with a total project cost of less than $250,000. In accordance with Section 35 of the Public Utilities Act, these projects do not require UARB approval but are provided for transparency and stakeholder information.

CI#	Project Title	2015 Budget ($)	Project Total ($)
Hydro			
45892	HYD - ANN Sluiceway Stop Log Repair	227,518	227,518
46252	HYD - Dobble Set Procurement	71,684	71,684
	Total Hydro Items Less Than $250,000	**$299,202**	**$299,202**
Steam			
46673	LIN - Plant Noise Mitigation	247,024	247,024
38108	POT - AVR Replacement	245,617	245,617
43389	LIN3 Bentley Nevada Upgrade - System 1	242,907	242,907
46532	LIN 3 Condenser Tube Protective Coating	241,868	241,868
43027	POT - Refurbish Dust Collection Area Explosion System	239,355	239,355
46434	TRE6 Coal Pile Reclaim Markers	234,372	234,372
46417	POT - Asbestos Management 2015	233,769	233,769
46422	POT - Automatic Trash Rack Cleaning System	233,741	233,741
45176	ICP - Pier Belting	231,227	231,227
45801	TRE5 Coal Pile Reclaim Markers	218,169	230,773
46653	ICP Chute Gate #1 Conveyor Replacement	230,547	230,547
42973	TUC - #1, 2 and 4 WTP DCS upgrade	225,579	225,579
46654	ICP Conveyor Belt Replacement	219,839	219,839
46423	POT - Building Ventilation Fan Refurbishment	216,683	216,683
46418	POT - Fire System Upgrades	204,813	204,813

CI#	Project Title	2015 Budget ($)	Project Total ($)
46486	TUC - Asbestos Abatement 2015	197,236	197,236
46452	PHB Fuel System Refurbishment 2015	195,449	195,449
46481	LIN3 Turbine Valve Refurbishment	194,647	194,647
46487	TUC - 4160V & 600V Breaker Replacement 2015	192,003	192,003
46485	TUC - Gas Block Valves	191,971	191,971
44716	TUC2 - North Boiler Feed Pump Refurbishment	191,007	191,007
46377	TRE5 5-1 CW Screens Refurbishment	177,928	177,928
42937	TUC-LMs East Gas Compressor Overhaul	154,319	154,319
46378	TRE Asbestos Abatement 2015	151,688	151,688
46379	TRE Ash Site Management 2015	150,853	150,853
46396	TRE5 Battery Bank Replacements	146,636	146,636
43213	LIN3 Battery Replacement	145,521	145,521
44587	POT - Selective Ash Site Capping	141,282	141,282
40297	TRE5 - Boiler House Tundish Drains Replacement	138,177	138,177
44354	LIN 4160 Motor Refurbishment	135,699	135,699
46492	TUC1 - Polisher Upgrade	130,917	130,917
46553	LIN - Dissolved O2 Analyzer Replacement	128,729	128,729
28249	POT Structural Steel Refurbishment	123,921	123,921
46063	LIN Coal System Guard Upgrade	123,691	123,691
22614	POT Flame Scanner Replacement	120,578	120,578
46531	TRE WWTP Discharge Pump Replacement	119,610	119,610
46493	TUC2 - Polisher Upgrade	114,885	114,885
46672	LIN - Boiler Nitrogen Generator	113,405	113,405
46271	LIN3 Ash Incline Structural Steel Refurbishment	106,631	106,631
46460	TRE5 Blowdown Tank Header Replacements	79,082	104,568
46622	POT - Replace Heavy Fuel Oil Pumps	102,597	102,597
46059	LIN - 4KV and 600V Breaker Refurbishment 2015	100,138	100,138
46494	TUC3 - Chimney Refurbishment	99,172	99,172
46433	TRE6 ID Fan Motor Coolers	96,744	96,744

CI#	Project Title	2015 Budget ($)	Project Total ($)
45994	POT - O2 Analyzer Upgrade	95,548	95,548
46495	TUC3 - DCS Upgrade	95,475	95,475
42944	TUC3 - Boiler Drum North PSV Replacement	70,524	70,524
46497	TUC - WTP Resin Replacement	69,415	69,415
42971	TUC2 - DCS Upgrade	56,468	56,468
46424	TRE Turbine Dehumidifier	54,403	54,403
46375	POT - Condenser Level Control Upgrade	52,852	52,852
46596	POT - Precipitator Refurbishment	51,935	51,935
46577	TRE6 High Energy Piping Upgrades	51,210	51,210
46498	TUC - Unit 2&3 LP Spindle HCF Assessments	50,000	50,000
46427	TRE Acid/Caustic Pump Replacement	49,790	49,790
46428	TRE6 Polisher Resin Replacements	48,636	48,636
46430	TRE6 Demin Silica Monitor	31,238	31,238
46429	TRE5 Demin Silica Monitor	31,238	31,238
46502	TUC - Silica Analyzer	25,000	25,000
	Total Steam Items Less Than $250,000	**$8,363,758**	**$8,401,847**
Gas Turbine			
43159	CT - BGT Annunciation Units Upgrade to DAS	148,143	148,143
43420	CT's - BGT Air Dryer System Upgrade	125,947	125,947
44787	CT - DC Battery Bank Replacement	121,538	121,538
45118	BGT1 - Addition of Flux Probe & Partial Discharge	65,650	65,650
43146	CT's - VJ Air Dryer System Upgrade	64,441	64,441
45122	BGT3 - Clutch Switch Improvement	28,981	28,981
45121	BGT2 - Clutch Switch improvement	28,637	28,637

CI#	Project Title	2015 Budget ($)	Project Total ($)
	Total Gas Turbine Items Less Than $250,000	**$583,336**	**$583,336**
	Total Generation Items Less Than $250,000	**$9,246,296**	**$9,284,386**
Transmission			
46360	L5545B Reconductor	222,827	222,827
46588	L5027 Upgrade Line Switches	197,609	197,609
46366	65V Middleton Substation RTU Addition	196,655	196,655
46397	Substation Telemetry	158,916	158,916
	Total Transmission Items Less Than $250,000	**$776,006**	**$776,006**
Distribution			
46593	70V Bridgetown Voltage Conversion	237,679	237,679
46579	48W-204 Wolfe Street Voltage Conversion	228,183	228,183
46623	Rights for Existing Facilities on Railway Lands	187,067	187,067
46581	500N-301 Caribou Island Overload	168,922	168,922
	Total Distribution Items Less Than $250,000	**$821,851**	**$821,851**
General Plant			
46585	Upgrade Planner Tools	248,678	248,678
46590	T&D Asset Management Project	243,013	243,013
46078	IT - SharePoint Upgrade	227,585	227,585
46573	CADD Document Management System	222,730	222,730
46310	2015 Telecom 48VDC Battery & Charger Replacements	154,168	154,168
46357	TD PI Server Replacement	148,033	148,033

CI#	Project Title	2015 Budget ($)	Project Total ($)
41442	IT - Advanced Laptop Security	85,056	85,056
46634	IT - SharePoint Expanded Functionality	76,674	76,674
	Total General Plant Items Less Than $250,000	**$1,405,937**	**$1,405,937**
	Total Capital Items Less Than $250,000	**$12,250,090**	**$12,288,180**

2.5 2015 ACE Plan Capital Items – Point Aconi Generating Station

This table provides the Point Aconi capital projects for 2015. These projects do not require UARB Approval.

CI#	Project Title	2015 Budget ($)	Project Total ($)
46461	POA - Ash Cell Capping 2015	4,117,108	4,117,108
45029	POA - Auxiliary Boiler Replacement	809,993	809,993
43266	89S-ST2 Point Aconi Replace Station Service Transformer	767,206	767,206
46462	POA - Boiler Refractory Replacement 2015	662,485	662,485
46674	POA - SH3 Tube Replacement	483,415	483,415
43110	POA - Structural Steel Refurbishment Program	397,560	397,560
46511	POA Boiler Refurbishment 2015	250,624	250,624
43257	POA - Main Oil Tank Refurbishment	202,778	202,778
43114	POA - Screw Cooler Trough Replacement	68,935	211,658
46509	POA Arrowhead Replacement	192,883	192,883
46061	POA CW Valve Replacement	364,555	364,555
43244	POA - Stack Lighting	165,931	165,931
43120	POA - UPS Chargers Replacement	156,204	156,204
46069	POA Limestone Mill Refurbishment	142,457	142,457
44651	POA - PLC Migration Program 2014	117,458	117,458
46064	POA Coal System Guard Upgrade	109,694	109,694

CI#	Project Title	2015 Budget ($)	Project Total ($)
43240	POA - HVAC Equipment Replacement	105,404	105,404
43141	POA - Circulating Water (CW) Screen Refurbishment	97,311	97,311
46062	POA Valve Component Replacement 2015	85,156	85,156
43245	POA - Plant Communication (PA & Radio)	85,045	85,045
43243	POA - Wellfield Communication	81,785	81,785
46510	POA Expansion Joint Replacement	71,752	71,752
46060	POA - 4KV 600V Breaker Refurbishment 2015	64,712	64,712
43118	POA - Plant Heating Upgrade	56,926	56,926
	Total Point Aconi New Spending	**$9,657,378**	**$9,800,101**
	Point Aconi Carryover Spending	**$148,204**	**$363,506**
	Point Aconi Routine Spending		
25647	POA DCMS Equipment Replacement	20,000	20,000
21485	POA - Kelly Rock Limestone Quarry	19,775	19,775
21484	POA Plant Tools & Equipment	52,530	52,530
10718	POA - Routine Equipment Replacement	215,000	215,000
27858	POA Roofing Routine	99,986	99,986
33865	POA Heat Rate Routine	40,000	40,000
	Point Aconi Routine Spending	**$447,291**	**$447,291**
	Total Point Aconi Capital Spending	**$10,252,873**	**$10,610,898**

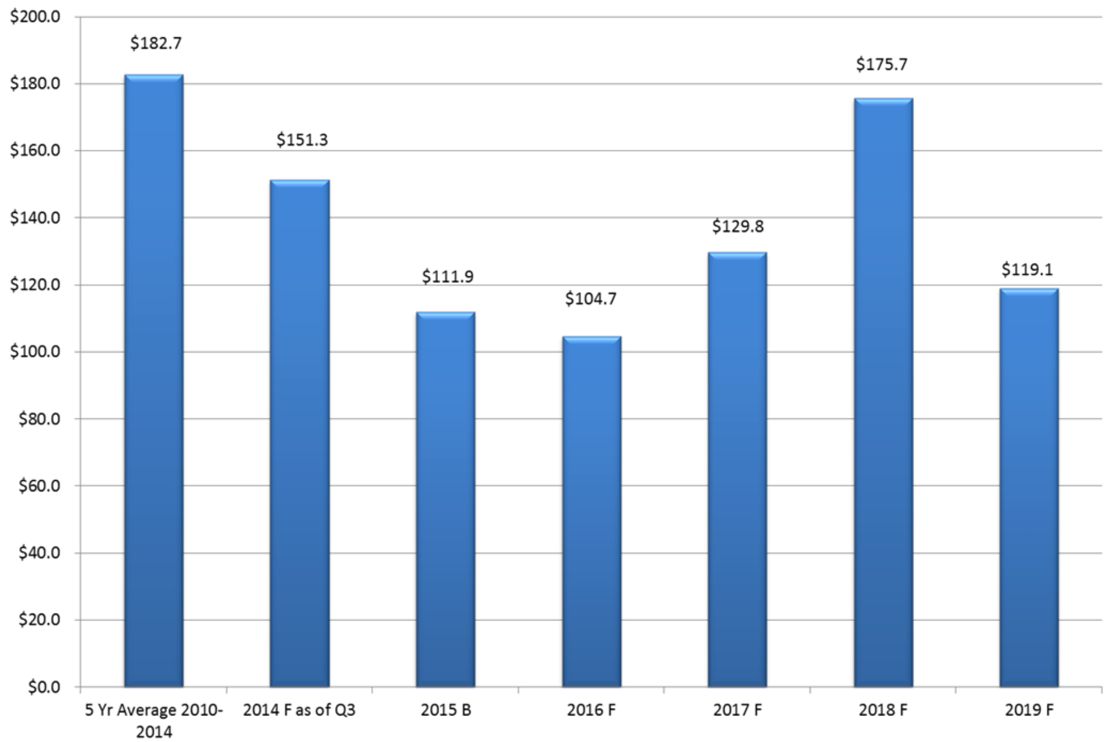
Note: $92,305 of the above is General Plant spend (CI 25647, 21485, and 21484) included in table 6.1 and excluded from table 3.1.

Note: $767,206 of the above is Transmission spend (CI 43266) included in table 4.1 and excluded from table 3.1.

3 Generation

Generation includes all items for NS Power's generation facilities. This includes replacements and additions to Thermal, Hydro, Wind, Tidal, Gas Turbine and Biomass plants.

(Millions of Dollars)



F = Forecast, B=Budget in above figure

3.1 Generation – Highlights

The focus for Generation capital investments in 2015 is the continued investment in hydro infrastructure renewal and sustaining the current thermal asset base. The $112 million Generation capital investment plan for 2015 is comprised of the following:

i	New 2015 capital spending for projects with total estimated project spend greater than $250,000 and for which approval is sought. (As provided in Section 2.2)	$39.6
ii	2015 capital spending for projects with total estimated project spend greater than $250,000 for which approval will be sought subsequent to the filing of ACE 2015. (As provided in Section 2.3)	17.2
iii	New capital spending for projects with total estimated spend less than $250,000 for which approval is not sought. (As provided in Section 2.4)	9.2
iv	Point Aconi Generating Station Capital Spending. (As provided in Section 2.5)	9.4
v	Carry-over capital spending. (As provided in Section 3.2)	32.6
vi	Routine capital Spending. (As provided in Section 7)	3.9
	Total 2015 Generation Capital Investment Plan	$111.9 M
	Request for ACE Approval (Items i + vi)	$44.2M

3.2 Generation – Carry-over Capital Spending Summary

Project Number	CI#	Project Title	Start Date	Final Date	Previous Expenditure ($)	2015 Budget ($)	Subsequent Spending ($)	Total Estimate ($)
Hydro Generation Plant								
H517	16374	HYD Gaspereau Dam Safety Remedial Works	2007/04	2015/12	5,485,978	7,109,464	-	12,595,442
H659	43067	HYD - Cheticamp Dam D-1 Refurbishment	2012/08	2015/12	927,617	4,791,877	-	5,719,494
H650	20758	HYD - U&U Nictaux Pipeline Replacement & Intake Refurbishment	2012/01	2016/12	2,104,327	2,360,169	-	4,464,496
H660	17581	HYD - Weymouth Electrical Replacement	2012/07	2016/10	332,642	409,979	378,059	1,120,679
H638	23125	HYD - Sissiboo Falls - Electrical Equipment Replacement	2011/12	2015/09	196,016	396,528	-	592,544
H653	41145	HYD - Mersey - Upper Lake Falls Rip Rap Replacement	2012/05	2016/10	302,122	278,114	-	580,236
H694	44887	HYD - Sissiboo Pipeline Replacement	2013/07	2015/08	250,545	233,118	-	483,664
H688	20571	HYD - Weymouth Falls Tailrace Deck Refurbishment	2013/03	2015/12	43,299	325,097	-	368,396
H648	42709	HYD - U&U PLC Upgrades	2012/04	2015/05	126,227	79,223	-	205,450
	Total Hydro Generation Plant				**$9,768,774**	**$15,983,569**	**$378,059**	**$26,130,402**
Steam Generation Plant								
S613	30954	LIN3-ESP Gas Flow Modification	2010/01	2016/12	210,715	15,486	1,222,181	1,448,382
S901	35083	LIN 2011 Ash Site Sealing and Capping	2011/11	2015/06	399,755	824,837	-	1,224,592
S925	37611	LIN3 - Generator Excitation & AVR System Replacement	2012/02	2015/08	52,804	687,693	-	740,497
SB59	41233	LIN3 Boiler Refurbishment	2013/04	2015/12	309,917	516,216	-	826,133
SB35	43006	TRE6 PLC Upgrades	2013/01	2015/11	353,857	313,499	-	667,356
SB92	36603	LIN3-DAS Upgrades	2013/08	2015/09	-	562,180	-	562,180
SC39	43168	LIN CW Pump Refurbish and Upgrade	2014/06	2015/12	22,940	428,138	-	451,078
S795	28645	TRE6 - Turbine Controls Power Supplies Replacement	2012/03	2015/11	241,310	200,458	-	441,767
SC57	42939	TUC2 - South Circulating Water Pump Refurbishment	2014/05	2015/07	203,269	231,997	-	435,266
SB05	41226	LIN - Boiler Feed Pump Proportional Valve Replacements - Unit #1	2012/09	2015/12	-	238,072	-	238,072
S654	22410	TRE5 5-1 Condensate Extraction Pump Refurbishment	2014/10	2015/12	-	201,537	-	201,537

Project Number	CI#	Project Title	Start Date	Final Date	Previous Expenditure ($)	2015 Budget ($)	Subsequent Spending ($)	Total Estimate ($)
SD12	44589	POT - Replace Overhead Door at A-Mill	2014/10	2016/12	-	134,749	38,727	173,476
SD39	43050	POT - Replace Drum Dose Skids	2014/08	2015/10	146,779	19,085	-	165,864
SD31	43038	POT - FeS04 Dosing Control System	2014/09	2015/12	93,572	44,417	-	137,988
SD11	44722	TRE5 Low Load Valve Replacement	2014/06	2015/11	45,860	72,693	-	118,553
	Total Steam Generation Plant				**$2,080,777**	**$4,491,056**	**$1,260,908**	**$7,832,740**
Wind Generation Plant								
W117	42127	South Canoe Wind Project	2012/01	2015/12	86,889,286	12,091,804	-	98,981,090
W116	40785	Sable Wind	2011/01	2015/02	13,108,719	46,735	-	13,155,454
	Total Wind Turbine Generation Plant				**$99,998,005**	**$12,138,539**	**$0**	**$112,136,544**
Total Generation Carry Over Spending					**$111,847,555**	**$32,613,164**	**$1,638,967**	**$146,099,686**

3.3 Generation – New 2015 Capital Items for ACE Plan Approval

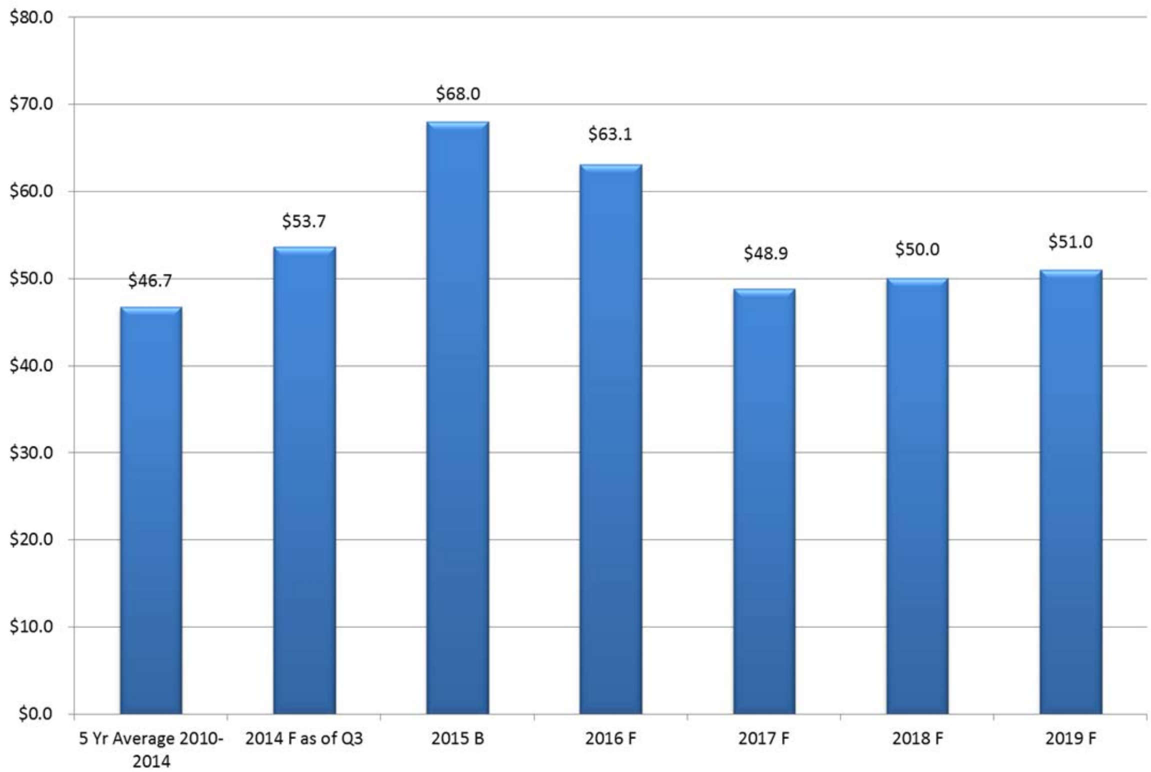
Tab #	CI#	Project Title	2015 Budget	Project Total
	Hydro Generation Plant			
G01	41139	HYD - Annapolis Sluiceway Superstructure Refurbishment	1,615,767	3,410,322
G02	43066	HYD - Little Indian Dam / Mill Lake Upgrade	1,188,480	1,409,587
G03	43607	HYD - Malay Falls #5 Unit Overhaul	780,932	1,077,255
G04	46594	HYD Sissiboo Falls Overhaul	817,153	817,153
G05	45370	HYD - WRC Unit 1 Excitation System	578,113	578,113
G06	44667	HYD Upper Lake Falls Unit #1 Overhaul	477,533	477,533
		Total Hydro Generation Plant	**$5,457,978**	**$7,769,963**
	Steam Generation Plant			
Ash Site Investment				
G07	44267	TRE Ash Lagoon Site Closure	4,571,161	7,994,849
G08	44188	TRE Ash Site Phase 1 Capping	2,093,285	4,538,289
Boiler				
G09	46299	TRE6 Boiler Refurbishments	873,652	873,652
G10	46256	POT - Boiler Refurbishment 2015	780,097	780,097
G11	46451	PHB Boiler Refurbishment 2015	673,602	673,602
G12	46302	TRE5 Boiler Refurbishments	647,845	647,845
G13	46467	LIN3 - Division Wall Replacement	635,747	635,747
G14	46352	TRE5 Air Heater Refurbishments	527,994	527,994
G15	46469	LIN4 - Boiler Refurbishment 2015	501,938	501,938
G16	46470	LIN1 - Boiler Refurbishment 2015	496,369	496,369
G17	46463	LIN3 - Air Heater Refurbishment	477,566	477,566
G18	44191	POT Coal Nozzle and Bucket Replacement	409,515	570,309

Tab #	CI#	Project Title	2015 Budget	Project Total
G19	46472	LIN3 - Boiler Chemical Treatment	387,649	387,649
G20	46394	POT - Air Heater Steam Coil Replacement -North Side	361,514	361,514
G21	46482	LIN3 Burner Front Refurbishment	299,261	299,261
G22	46508	LIN2 Boiler Refurbishment	289,345	289,345
G23	41645	TRE6 Bottom Ash Seal Replacement	214,383	307,499
Turbine				
G24	42806	LIN3 L-0 Turbine Blade Replacements	3,881,826	4,157,741
G25	43094	LIN3 HT Fastener Replacement	868,348	868,348
G26	44730	TRE5 Turbine Valves Refurbishment	752,160	752,160
G27	46336	POT Turbine Valve Refurbishment	616,865	616,865
G28	46473	TUC3 - Turbine Valve Refurbishment	609,870	609,870
G29	46464	TUC1 - Turbine Valve Refurbishment	541,162	541,162
Generator				
G30	43088	LIN3 Generator Rotor Rewind	1,901,480	1,901,480
G31	40363	LIN3 High Voltage Bushing Refurbishment	628,531	628,531
Chemical				
G32	46484	TUC - Unit 1&2 Analytical Panel Replacement	386,607	386,607
G33	46496	LIN3 Analytical Panel Replacement	276,756	276,756
Balance of Plant				
G34	41227	LIN3 Condenser Large Bore Pipe and Valve Refurbishment	1,299,329	1,299,329
G35	28288	POT Turbine Supervisory Equipment Upgrade	822,535	822,535
G36	43031	POT - #5 HP Feedwater Heater Replacement	811,277	812,644
G37	46055	LIN - Coal Mill Refurbishment 2015	736,546	736,546
G38	46301	TRE6 6A 6B Mills Refurbishment	665,045	665,045
G39	46392	POT - Plant Siding Replacement	547,659	547,659
G40	46058	LIN Coal Plant Structural Refurbishment - Phase 1	516,818	516,818
G41	46395	TRE5 Baghouse Filter Replacements 2015	489,517	489,517
G42	46070	LIN3 Bottom Ash Replacement	475,908	475,908
G43	46372	POT - Coal Mill Overhauls	418,292	418,292
G44	45851	POT - Stack Repairs	349,165	381,316
G45	45246	LIN Cooling Water MCC Refurbishment	295,667	327,633
G46	46057	LIN - CW Screen Refurbishment 2015	292,634	292,634
G47	46293	LIN Coal Bunker Chute Refurbishment	291,730	291,730
		Total Steam Generation Plant	**$32,716,653**	**$39,180,653**
	Gas Turbine Generation Plant			
G48	45116	CT - BGT1 GG4C-1D Engine Refurbishment	1,168,167	1,168,167
G49	20511	CT - Victoria Junction Replace Halon Fire Protection System	268,467	268,467
		Total Gas Turbine Generation Plant	**$1,436,634**	**$1,436,634**
	Total Generation New Spending		**$39,611,265**	**$48,387,251**

4 Transmission

Transmission includes items for replacement, reinforcement or expansion of the transmission system, which transmits electrical energy from the generation plants, the NB/NS Power interconnection and throughout the province. Transmission includes energy transmitted at 69 kV level or higher.

(Millions of Dollars)



F = Forecast, B=Budget in above figure

4.1 Transmission – Highlights

The focus for Transmission capital investments in 2015 continues to reflect localized customer load growth and system reliability, as well as transmission required to integrate renewable projects. The $68 million Transmission capital investment plan for 2015 is comprised of the following:

i	New 2015 capital spending for projects with total estimated project spend greater than $250,000 and for which approval is sought. (As provided in Section 2.2)	$17.3
ii	2015 capital spending for projects with total estimated project spend greater than $250,000 for which approval will be sought subsequent to the filing of ACE 2015. (As provided in Section 2.3)	32.1
iii	New capital spending for projects with total estimated spend less than $250,000 for which approval is not sought. (As provided in Section 2.4)	0.8
iv	Point Aconi Generating Station Capital Spending. (As provided in Section 2.5)	0.8
v	Carry-over capital spending. (As provided in Section 4.2)	8.2
vi	Routine capital Spending. (As provided in Section 7)	8.8
	Total 2015 Transmission Capital Investment Plan	$68.0 M
	Request for ACE Approval (Items i + vi)	$26.1M

4.2 Transmission – Carry-over Capital Spending Summary

Project Number	CI#	Project Title	Start Date	Final Date	Previous Expenditure	2015 Budget	Subsequent Spending	Total Estimate
Transmission Plant								
T790	43684	Interconnection Substation South Canoe Wind Project	2013/12	2015/04	7,950,019	16,901	-	7,966,921
T789	43683	South Canoe Wind Project (SCWP) Transmission Line	2013/11	2015/01	4,948,900	271,395	-	5,220,295
T788	43681	South Canoe Wind Project Substation Network Upgrades	2013/12	2015/03	3,306,984	339,896	-	3,646,880
T808	43205	L5510 Insulator Replacements	2014/03	2017/12	645,138	848,514	1,660,656	3,154,308
T801	45067	67N Onslow 345 KV Node Swap	2014/03	2015/12	1,560,621	1,721,590	524,410	3,806,621
T786	43291	Protection Risk Reduction 67N-Onslow 230KV	2013/01	2015/12	2,179,107	689,629	-	2,868,737
T768	43786	2013 L8002 Tower Refurbishment	2013/03	2015/05	1,326,464	837,424	-	2,163,888
T819	45882	103H-T63 Transformer Replacement	2014/12	2015/12	243,057	1,815,298	-	2,058,354
T754	43292	Protection Risk Reduction 120H-Brushy Hill 230KV	2012/01	2015/06	1,555,617	190,745	-	1,746,362
T745	41535	2012 Steel Tower Painting	2012/05	2015/12	937,435	517,857	-	1,455,292
T778	43726	Replace 3N-T51 Transformer	2013/06	2015/04	462,495	344,817	-	807,312
T809	44983	Reactor Bank Breaker Replacements	2014/05	2015/06	214,632	221,899	-	436,531
T813	44977	3W Breaker, Switch & Cable Replacements	2014/06	2015/12	196,594	214,535	-	411,129
T797	44982	New Spare Transformer to Replace 20W-T51	2014/03	2015/03	200,007	198,311	-	398,318
	Total Transmission Plant				**$25,727,070**	**$8,228,812**	**$2,185,066**	**$36,140,949**
Total Transmission Carry Over Spending					**$25,727,070**	**$8,228,812**	**$2,185,066**	**$36,140,949**

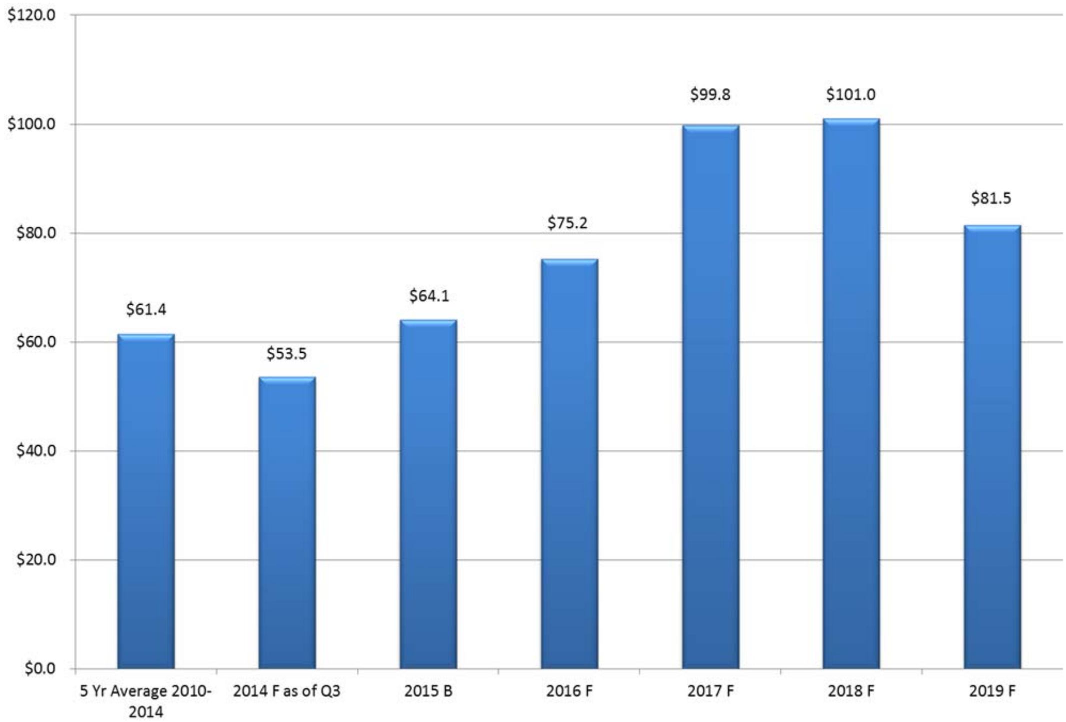
4.3 Transmission – New 2015 Capital items for ACE Plan Approval

Tab #	CI#	Project Title	2015 Budget	Project Total
	Transmission Plant			
T01	46339	120H Brushy Hill - SVC Controls Replacement	3,689,176	9,959,330
T02	46513	3C Port Hastings BPS Upgrade	2,795,730	3,684,823
T03	46340	2015 Transmission Switch & Breaker Replacements	1,581,599	1,581,599
T04	43490	2015 Steel Tower Life Extension	641,709	1,441,709
T05	43267	13V Gulch Hydro Replace 13V-GT1 and 13V-VR1	1,061,902	1,061,902
T06	44976	10H 25kV Breaker Replacement	953,521	953,521
T07	46583	L6511 Replacements	905,745	905,745
T08	46331	L7001 Replacements - Phase 2	888,192	888,192
T09	46335	L5511 Replacements	722,934	722,934
T10	44979	L5527 Structure Replacements	721,068	721,068
T11	46362	L5560 Transmission Line Reconductor	626,895	626,895
T12	46353	2015 Substation Recloser Replacements	596,893	596,893
T13	43261	6V-GT1 Hollow Bridge Hydro Transformer Replacement	550,938	550,938
T14	46337	L6535/L6551 Insulator Replacements	459,422	459,422
T15	46354	2015 Reactor Breaker Replacements	460,691	460,691
T16	46582	L5569 Upgrade	369,032	369,032
T17	46356	2015 Sacrificial Anode Installation Program	304,612	304,612
		Total Transmission Plant	**$17,330,057**	**$25,289,305**
	Total Transmission New Spending		**$17,330,057**	**$25,289,305**

5 Distribution

Distribution includes replacement of and additions to equipment for delivering electric energy from points on the transmission system to customers served at voltages below 69 kV.

(Millions of Dollars)



F = Forecast, B=Budget in above figure

5.1 Distribution – Highlights

The focus for Distribution capital investments in 2015 continues to reflect localized customer load growth and customer reliability. The $64.1 million Distribution capital investment plan for 2015 is comprised of the following:

i	New 2015 capital spending for projects with total estimated project spend greater than $250,000 and for which approval is sought. (As provided in Section 2.2)	$6.4
ii	2015 capital spending for projects with total estimated project spend greater than $250,000 for which approval will be sought subsequent to the filing of ACE 2015. (As provided in Section 2.3)	9.7
iii	New capital spending for projects with total estimated spend less than $250,000 for which approval is not sought. (As provided in Section 2.4)	0.8
iv	Carry-over capital spending. (As provided in Section 5.2)	1.6
v	Routine capital Spending. (As provided in Section 7)	45.6
	Total 2015 Distribution Capital Investment Plan	$64.1M
	Request for ACE Approval (Items i + v)	$52.0M

5.2 Distribution – Carry-over Capital Spending Summary

Project Number	CI#	Project Title	Start Date	Final Date	Previous Expenditure	2015 Budget	Subsequent Spending	Total Estimate
Distribution Plant								
D562	44826	2014 Build-to-Roadside	2014/03	2015/12	122,863	730,641	-	853,504
D418	41383	2012 Halifax Underground Feeder Replacement	2012/03	2015/06	532,136	127,358	-	659,493
D497	43282	2013 Distribution Feeder Ties	2013/03	2015/09	289,159	145,774	-	434,934
D570	43177	103W-311 Gold River Reconductor Phase 3	2014/03	2015/04	355,991	44,200	-	400,190
D580	44833	99V-312 - Highbury New Feeder	2014/06	2015/12	227	322,749	-	322,976
D427	41341	1H-Water Street New Feeder	2012/03	2015/05	191,944	92,267	-	284,211
D476	43195	2013 Remote Communication on Reclosers	2013/03	2015/10	207	183,199	-	183,406
	Total Distribution Plant				**$1,492,527**	**$1,646,188**	**$0**	**$3,138,715**
Total Distribution Carry Over Spending					**$1,492,527**	**$1,646,188**	**$0**	**$3,138,715**

5.3 Distribution – New 2015 Capital Items for ACE Plan Approval

Tab #	CI#	Project Title	2015 Budget	Project Total
	Distribution Plant			
D01	46292	2015 Padmount Transformer Replacement Program	1,536,110	1,536,110
D02	46458	16N-302 Stewiacke Reconductor	592,084	965,830
D03	43234	104S-313 Baddeck Rebuild	778,470	778,470
D04	46576	2015 PCB Phase-out for Pole Top Transformers	733,503	733,503
D05	45031	3N Oxford Conversion Phase 1	716,167	716,167
D06	46457	79V-401 Cameron Lake Voltage Conversion	282,166	637,939
D07	46456	11W Yarmouth 4kV Conversion	295,167	545,514
D08	46304	20W-311 Argyle Sound Reconductor	430,435	430,435
D09	46251	36V-303 Saxon Double Circuit	425,838	425,838
D10	43203	58C-405 / 11C Belle Cote Phase 1	339,419	339,419
D11	45003	2015 Hydraulic Recloser Replacements	260,524	260,524
		Total Distribution Plant	**$6,389,884**	**$7,369,750**
	Total Distribution New Spending		**$6,389,884**	**$7,369,750**

6 General Plant

General Plant includes computer infrastructure and communication equipment, which comprise the majority of capital expenditures incurred under this function. Other items such as furniture, office equipment and capital tools are also included under this function.

The General Plant function also includes vehicles. That is, replacement and additions to transportation and work vehicles, and construction equipment.

The General Plant function also includes all buildings except generating and substation facilities. It primarily pertains to customer service, work depot and head office facilities.

(Millions of Dollars)

F = Forecast, B=Budget in above figure

6.1 General Plant – Highlights

General Plant capital investment in 2015 focuses primarily on Information Technology and control system related projects and vehicle purchases. The $29.0 million General Plant capital investment plan for 2015 is comprised of the following:

i	New 2015 capital spending for projects with total estimated project spend greater than $250,000 and for which approval is sought. (As provided in Section 2.2)	$2.3
ii	2015 capital spending for projects with total estimated project spend greater than $250,000 for which approval will be sought subsequent to the filing of ACE 2015. (As provided in Section 2.3)	4.9
iii	New capital spending for projects with total estimated spend less than $250,000 for which approval is not sought. (As provided in Section 2.4)	1.4
iv	Point Aconi Generating Station Capital Spending. (As provided in Section 2.5)	0.1
v	Carry-over capital spending. (As provided in Section 6.2)	5.4
vi	Routine capital Spending. (As provided in Section 7)	14.9
	Total 2015 General Plant Capital Investment Plan	$29.0M
	Request for ACE Approval (Items i + vi)	$17.2M

6.2 General Plant – Carry-over Capital Spending Summary

Project Number	CI#	Project Title	Start Date	Final Date	Previous Expenditure	2015 Budget	Subsequent Spending	Total Estimate
Telecommunications								
P931	44967	2014 Multiplexer Network Upgrades	2014/02	2015/05	606,980	46,792	-	653,772
P930	44966	2014 Microwave System Capacity Upgrade	2014/02	2015/06	341,069	59,438	-	400,507
P888	41420	Upgrade Multiplexer Network Manager	2012/03	2015/06	244,893	60,868	-	305,762
P885	41404	Multiplexer Group Replacement	2012/03	2015/03	127,949	28,183	-	156,132
P929	44969	Replace Multiplexer and Teleprotection Equipment 2014	2014/10	2016/06	-	74,460	75,056	149,516
P913	43173	2013 Upgrade Multiplexer Group	2013/07	2015/05	40,426	103,648	-	144,075
	Total Telecommunications				**$1,361,318**	**$373,389**	**$75,056**	**$1,809,763**
Computers								
P855	40278	OMS Replacement	2011/04	2015/05	3,971,036	659,654	-	4,630,690
P901	40648	IT - Field Mobility System	2012/01	2015/12	2,034,588	1,288,648	-	3,323,236
P934	45881	IT - Windows Server 2003 Upgrade U&U	2014/04	2015/09	892,182	1,409,487	-	2,301,669
P845	40743	IT - NSPI Intranet	2011/03	2015/02	695,891	42,500	-	738,391
P941	45873	IT-U&U CIS Customer Self Service	2014/03	2015/01	249,721	113,521	-	363,242
P899	41403	GIS Enterprise License Agreement	2012/01	2016/12	257,500	100,000	-	357,500
	45036	ArcFM Designer Software	2014/02	2015/07	166,410	175,949	-	342,359
	Total Computers				**$8,267,329**	**$3,789,759**	**$0**	**$12,057,087**
Outage Performance								
P897	41433	2012 New RTU Deployment	2012/06	2015/05	889,749	91,002	-	980,751
P943	43227	2014 RTU Replacements	2014/06	2015/07	251,292	444,630	-	695,922
P910	43221	2013 New RTU Deployment	2013/06	2015/06	292,384	248,276	-	540,660
	Total Equipment Replacement				**$1,433,425**	**$783,909**	**$0**	**$2,217,334**
Other General Property								
P834	40103	U&U Load Control Demonstration	2010/10	2015/03	3,867,536	450,000	-	4,317,536
	Total Other General Property				**$3,867,536**	**$450,000**	**$0**	**$4,317,536**
Total General Plant Carry Over Spending					**$14,929,608**	**$5,397,056**	**$75,056**	**$20,401,721**

6.3 General Plant – New 2015 Capital Items for ACE Plan Approval

Tab #	CI#	Project Title	2015 Budget	Project Total
Telecommunications				
GP01	46307	2015 Multiplexer Network Upgrades	446,538	446,538
GP02	46308	2015 Microwave System Capacity Upgrade	316,142	316,142
GP03	46306	2015 Telecom Building Replacement	251,727	251,727
Total New Telecommunication Spending			**$1,014,407**	**$1,014,407**
Computers				
GP04	46365	Maximo Enhancements for Substation Field Mobility	315,242	315,242
GP05	46364	Maximo Enhancements for Telecom & Relays	170,598	272,539
Total New Computer Spending			**$485,840**	**$587,781**
Other General Plant				
GP06	46050	Operator Training Simulator	358,284	531,119
GP07	46657	Wire Inspection Services - Analyzer Replacement	448,300	448,300
Total Other General Plan Spending			**$806,584**	**$979,419**
Total New General Plant Spending			**$2,306,831**	**$2,581,607**

7 Routine Capital Program

This category includes recurring annual expenditures as described in the CEJC for replacement of equipment (like-for-like replacement), additions to existing equipment base resulting from system growth and addition of customers to the system.

7.1 Routine Capital Spending by Function Yr/Yr

	2013 Actual	2014 Budget	2014 Forecast	2015 ACE Plan
Generation				
Generation Equipment Replacements	$3,096,991	$3,097,805	$2,829,826	$3,141,233
Generation Other Hydro	414,296	385,649	396,175	401,450
Generation Other Thermal	130,945	241,346	194,828	318,805
	3,642,232	3,724,800	3,420,830	3,861,488
Transmission				
Transmission Substation Replacement, Add'ns/Mod'ns	2,803,215	2,864,329	2,861,976	2,885,587
Primary Equipment Spares	150,142	215,000	215,000	215,000
Protection Modification & Replacement	409,021	418,163	418,063	427,653
Transmission Line Replacement, Add'ns/Mod'ns	5,483,209	4,677,539	5,546,510	4,688,380
Transmission Right-of-Way Widening	133,575	117,230	115,474	600,000
	8,979,162	8,292,260	9,157,023	8,816,620
Distribution				
Meters	2,049,594	2,476,304	2,380,606	2,972,781
Distribution Upgrades and Replacement	16,560,618	19,858,097	24,213,625	19,792,780
New Customers	20,610,493	21,541,437	21,643,510	21,532,153
Joint Use	504,880	670,157	676,206	665,536
Distribution Right-of-Way Widening	2,073,221	746,227	746,227	600,000
	41,798,805	45,292,221	49,660,173	45,563,251
General Plant				
Work Vehicles	2,743,843	5,587,552	3,421,544	5,628,171
Tools and Test Equipment	1,329,417	1,376,639	1,383,911	1,390,939
Telecommunications	744,581	933,819	932,278	844,326
Computing Asset Management	3,252,473	3,282,870	2,601,768	2,680,249

	2013 Actual	2014 Budget	2014 Forecast	2015 ACE Plan
Property Improvements and Furniture	2,963,816	2,280,000	2,280,000	3.105,000
Other	1,363,283	1,505,404	1,056,417	1,207,577
	12,397,413	14,966,284	11,675,918	14,856,262
Total Routine Capital Spending	**$66,817,612**	**$72,275,566**	**$73,913,943**	**$73,097,621**

Note 1: The entire Routine program totals $73.4 million including Pt. Aconi routines. The totals presented above and in the following information do not include Point Aconi routines.

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7.2 Routine Capital Spending Project Breakdown Yr/Yr

Project #	CI #	Project Title	2013 Actual	2014 Budget	2014 Forecast	2015 ACE Plan
G001	10634	CT - Routine Equipment Replacements	$217,544	$122,945	$140,774	144,000
H001	11622	HYD - Routine Equipment Replacement	664,598	509,052	509,663	701,531
H004	27867	HYD - Roofing Routine	56,037	167,948	168,486	169,480
S001	23428	GS - Routine Capital	108,611	135,000	72,898	132,000
	10645	POT - Routine Equipment Replacement	207,088	219,626	245,535	233,252
	10673	TRE - Routine Equipment Replacement	313,043	299,049	303,881	351,760
	43646	PHB - Routine Equipment Replacement	422,955	357,321	377,404	128,030
	10621	TUC - Routine Equipment Replacement	375,078	337,878	308,868	255,032
	10626	LIN - Routine Equipment Replacement	443,636	375,982	387,269	384,155
S004	27856	TRE - Roofing Routine	167,120	88,862	73,898	47,688
	27855	POT - Roofing Routine	0	197,575	31,058	268,242
	27854	TUC - Roofing Routine	243	143,166	70,684	200,000
	27857	LIN - Roofing Routine	162	11,070	221	0
G008	38899	CT'S Tooling Routine	19,706	20,000	27,052	28,000
W001	41830	Wind - Routine Equipment Replacement	101,170	112,332	112,135	98,064
		Generation Equipment Replacements Total	**$3,096,991**	**$3,097,805**	**$2,829,826**	**$3,141,233**
H005	35583	HYD - Oil Release Risk Assessment	177,131	207,592	217,873	217,019
H006	35584	HYD - Gate Refurbishment	237,165	178,057	178,303	184,430
		Generation Hydro Total	**$414,296**	**$385,649**	**$396,175**	**$401,450**
S005	33871	TUC - Heat Rate Routine	5,535	48,801	35,808	80,000

Project #	CI #	Project Title	2013 Actual	2014 Budget	2014 Forecast	2015 ACE Plan
	33867	POT - Heat Rate Routine	59,908	47,149	55,694	77,451
	33869	TRE - Heat Rate Routine	0	73,397	30,582	81,354
	33863	LIN - Heat Rate Routine	65,502	72,000	72,744	80,000
		Generation Thermal Total	**$130,945**	**$241,346**	**$194,828**	**$318,805**
T003	23120	Provincial - Trans Substation Primary	2,184,237	2,017,875	2,016,379	2,050,586
T004	23121	Provincial - Substation Additions & Replacements	618,978	846,454	845,597	835,001
		Transmission Subs Replace, Adds/Mods Total	**$2,803,215**	**$2,864,329**	**$2,861,976**	**$2,885,587**
T018	14973	Primary Equipment Spares	150,142	215,000	215,000	215,000
		Primary Equipment Spares Total	**$150,142**	**$215,000**	**$215,000**	**$215,000**
T016	14841	Protection Modification & Replacement	409,021	418,163	418,063	427,653
		Protection Modification & Replacement Total	**$409,021**	**$418,163**	**$418,063**	**$427,653**
T001	23115	Provincial Transmission Line Replace	1,630,646	844,924	1,809,346	857,506
T011	23118	Provincial - Planned Trans Line Replacement	3,852,564	3,832,614	3,737,164	3,830,874
		Transmission Line Replacements Total	**$5,483,209**	**$4,677,539**	**$5,546,510**	**$4,688,380**
T010	43827	Transmission Right-of-Way Widening	133,575	117,230	115,474	600,000
		Transmission Right-of-Way Widening Total	**$133,575**	**$117,230**	**$115,474**	**$600,000**
D009	26496	Meter Routine	2,049,594	2,476,304	2,380,606	2,972,781
		Meters Total	**$2,049,594**	**$2,476,304**	**$2,380,606**	**$2,972,781**
D005	23158	Unplanned Replace Deteriorated	7,701,548	9,232,511	9,134,361	9,234,125
D006	23135	Regulatory Replacements - Province	1,356,073	951,526	931,524	941,562
D008	23361	Provincial Storm	1,470,563	2,482,675	6,720,800	2,463,027
D051	29038	System Performance Improvement Routine	89,920	307,387	306,381	303,860
D055	23137	Planned Replacement Of Distr	5,942,514	6,883,997	7,120,558	6,850,206
		Distribution Upgrades and Replacement Total	**$16,560,618**	**$19,858,097**	**$24,213,625**	**$19,792,780**
D004	26716	New Customer Upgrades	6,985,120	7,385,274	7,866,512	7,382,233
D018	23511	Primary Equipment Spares - Distribution	0	150,000	150,000	150,000

Project #	CI #	Project Title	2013 Actual	2014 Budget	2014 Forecast	2015 ACE Plan
D061	39766	New Customers - Residential	7,883,373	8,442,778	8,642,529	8,437,808
D062	39770	New Customers - Commercial	5,742,000	5,563,386	4,984,469	5,562,112
		New Customers Total	**$20,610,493**	**$21,541,437**	**$21,643,510**	**$21,532,153**
D007	23136	Contractual Replacements (Joint Use)	504,880	670,157	676,206	665,536
		Joint Use Total	**$504,880**	**$670,157**	**$676,206**	**$665,536**
D010	23127	Provincially Widening	2,073,221	746,227	746,227	600,000
		Right of Way Widening Total	**$2,073,221**	**$746,227**	**$746,227**	**$600,000**
P006	20945	Replacement and Additional Work Vehicles	125,942	192,500	192,500	192,500
P009	16192	Mobile Transformer & Track Routine	35,941	71,052	71,052	70,671
P063	39304	Class 3 Work Vehicle Replacements	-2,495	280,000	277,186	280,000
P062	39305	Work Vehicle Replacements	2,192,875	3,334,000	1,170,806	3,375,000
P061	40236	Transportation Vehicle Replacements	391,580	1,710,000	1,710,000	1,710,000
		Work Vehicles Total	**$2,743,843**	**$5,587,552**	**$3,421,544**	**$5,628,171**
P002/P016		Tools and Equipment	1,263,507	1,299,639	1,293,078	1,300,939
P015	11611	Hydro Production Tools, Test Equipment	65,910	77,000	90,833	90,000
		Tools and Test Equipment Total	**$1,329,417**	**$1,376,639**	**$1,383,911**	**$1,390,939**
P025	16365	Mobile Radio Routine	52,548	87,362	86,951	58,578
P027	16551	Telecommunication Radio and Fibre Optics	142,019	157,912	157,912	148,180
P028	16550	Telecommunication Systems Replace & Modifications	375,871	508,645	507,514	506,049
P814	38243	Telecommunications Spares	174,143	179,900	179,900	131,520
		Telecommunications Total	**$744,581**	**$933,819**	**$932,278**	**$844,326**
P010	16073	SCADA Improvements Routine	97,548	155,128	146,545	154,092
P031	29114	NSPI Non-CGI Infrastructure	3,019,275	2,925,230	2,240,091	2,330,876
P040	28522	CT'S Dcms Routine	12,066	20,000	42,792	20,000
	25667	POT - DCMS Equipment Replacement Routine	29,234	32,000	32,621	25,500
	25626	TRE - DCMS Equipment Replacement Routine	5,256	39,513	40,509	45,301
	25646	TUC - DCMS Equipment Replacement Routine	43,686	76,200	61,675	50,000
	25668	LIN - DCMS Equipment Replacement Routine	45,409	34,800	37,536	54,480
		Computing Asset Management Total	**$3,252,473**	**$3,282,870**	**$2,601,768**	**$2,680,249**

Project #	CI #	Project Title	2013 Actual	2014 Budget	2014 Forecast	2015 ACE Plan
P001/P030		Property Improvement and Furniture	2,963,816	2,280,000	2,280,000	3,105,000
		Property Improvement and Furniture Total	**$2,963,816**	**$2,280,000**	**$2,280,000**	**$3,105,000**
P012/P041		Other (HYD - Security Improvement & FAC - Land Acquisition)	868,237	864,655	587,690	639,577
P816	38897	FAC Enviro Property Remed Routine	212,215	208,000	207,997	222,500
P815	38896	FAC Environment Site Assess Routine	84,290	132,749	132,748	145,500
P032	38848	Purchasing Equip & Warehouse Routine	198,540	300,000	127,982	200,000
		Other Total	**$1,363,283**	**$1,505,404**	**$1,056,417**	**$1,207,577**
Routine Capital Spending			**$66,817,612**	**$72,275,566**	**$73,913,943**	**$73,097,621**

*POA amounts have been removed to represent the spend amount that requires UARB approval.

*POA amounts related to routines can be found in Section 2.5.

7.3 2015 Routine Capital Spending Project Details

Transmission Substation Replacements, Additions and Modifications

T003 Provincial: Transmission Substation Primary Equipment	2015 ACE Plan ($)
Unplanned failures	1,152,086
87S-Generator Transformer Coolers	150,000
90H Sackville - Replace breaker 502	110,000
96H Ruth Falls - Repair retaining wall	100,000
Re-gasket 1C GT1 and UT1	78,000
2 transformer surface refurbishments (103H, 99W)	70,000
3C Port Hastings - Refurbish bearings on 230kV switches	48,000
16V Weymouth - Replace T51 Rads	47,000
102S-T51 - Replace Bushings	45,000
88S Lingan - SF6 bus repairs	30,000
Replace oil containment pits at 45V	35,000
Re-gasket 87W-T62 transformer	14,000
91H Tuft's Cove - Transformer tank refurb	20,000
104H Kempt Rd - 449 capacitor breaker installation	20,000
2S Victoria Junction - Replace insulators on 2S-532	7,500
2S Victoria Junction - Replace air control valves on breakers 572, 573	5,000
15S New Waterford - Replace whips on 501A switch	20,000
3S Gannon Rd. - Replace 125V Batteries	25,000
58H-503A Switch	15,000
6V-501 Switch - Replace MOD	15,000
Spare 125VDC Battery Charger	10,000
100C - Replace AC Panel	10,000
57S - Replace AC Panel	10,000
Transformer gas detector relay refurb. 87S GT1, 3 and 4	7,000
84S VJ Distribution - Replace 303B & 304B switches	7,000
Total T003 Provincial: Transmission Substation Primary Equipment	**$2,050,586**

T004 Provincial- Substation Additions & Replacements	
Unknown Additions	374,001
Substation On-line monitoring project	170,000
Substation Recloser: add Fibre Communications	127,000
99W-603 - Upgrade In-line switch to structure mounted switch	55,000
New 69 kV switch on source side of 81W - Lunenburg	40,000
Install On-line Oil Filtration units	38,000
45V Transformer and Breaker Meter	11,000
85S MS Calisto 2s SCADA Connection	10,000

2C - Install Section of Wooden Fence	5,000
Add bypass fuse to 77V-401	5,000
Total T004 Provincial - Substation Additions & Replacements	**$835,001**
Total Transmission Substation Replacements, Additions and Modifications	**$2,885,587**

Transmission Line Replacement, Additions/Modifications

Primary Equipment Spares

T018 Primary Equipment Spares	**2015 ACE Plan ($)**
Spare 138kV Breaker	136,341
Spare 69kV Breaker	78,659
Total Primary Equipment Spares	**$215,000**

Protection Modification & Replacement

T016 Protection Modification & Replacement	**2015 ACE Plan Forecast**
L-6020 & L-6021 Add Perm & TT	$14,092
43V Replace Protection on L-5017	16,076
43V Replace Protection on L-5022	16,076
Replace 345 kV B SPS at 2C Port Hastings	57,811
Replace 345 kV B SPS at 79N Hopewell	60,144
Unplanned Relay Replacement	77,923
Replace 345 kV B SPS at 88S Lingan	60,144
BPS Mitigation of Cross Tripping	31,110
Replace B81 bus Protection at 67N	76,761
Add satellite clocks to 89S, 91H, 1N	17,517
Total Protection Modification & Replacement	**$427,653**

Transmission Line Replacement, Additions / Modifications

T001 Provincial Transmission Line Replacement (Unplanned)	**2015 ACE Plan Forecast**
This routine has budgeted a 1% increase from 2014 Approved ACE Plan amounts.	857,506

T011 Provincial- Planned Transmission Line Replacement

LINE #	Description	2015 ACE Plan ($)
L5015	Avon to Three Mile Plains	76,734
L5016	17V St. Croix to 20V Five Points	133,528
L5027A	9W, 20W and 22w	99,858
L5028	1N Onslow to 11N Lafarge	528,617
L5030	10N to 6N	55,860
L5057	74V tap off L5026	10,457
L5536A	9W Tusket to 88W Pleasant Street	305,212
L5536B	88W Pleasant St to 16W Hebron	24,850
L5548	30N Maccan to 17N Brownell	202,664
L5551	79w Lunenburg to 80w Indian Path	97,629
L5032	23H Rockingham Tap	18,904
L5563	2S VJ to 4S Townsend St	171,262
L6004	90H Sackville to 43V Cannan Rd	56,657
L6012	17V St. Croix to 43V Cannan Rd	77,979
L5521	1N Onslow to 15N Willow Lane	134,541
L6008	90H Sackville to 103H Lakeside	373,255
L6518	2C to 47C Stora	236,339
L6543	2C to 3C EHV	21,419
L6548	2C to 3C	28,946
L5506	Pictou to Ambercrombie	288,866
L5544	3w Big Falls to 1W Upper Lake	81,184
L5547	Westhavers elbow to National Sea	46,429
L7005	Onslow to PH	210,359
L5500	Trenton 50N to Stellarton 62N	273,974
Various	1-6 Month Inspection Driven Work	275,353
T011 Provincial- Planned Transmission Line Replacement		**$3,830,874**
Transmission Line Replacement Total		**$4,688,380**

T010 Provincial Transmission Right of Way Widening

This forecast is developed based on the known level of widening in the current year.

Line	Current Line Height	Dominant Tree Height	Tree Density	Slope	Current Clear Width	Increased Width	Line Security Improvement	Spans	Distribution Substations	Avg Customer Impact	Tree Contact Duration (hrs)	Interruption Frequency	ACHI	2015 ACE Plan
L-5535	10.00	15.00	1,422.00	-	8.00	2.00	66.00	168.00	15V,9W	850.00	6.58	0.25	922.85	386,811.00
L-5531	7.30	19.80	1,567.00	-	11.00	5.00	90.00	93.00	77V, 13V	4,152.00	5.32	0.33	2,952.15	213,189.00
												Total	**3,875**	**$ 600,000**

Overall $/ACHI	**$ 154.84**

Transmission Total **$8,816,620**

Meters – D009 Meter Routine

Item#	Prg#	Meter Type	Meter Style	Description	2015 Forecast	Current Unit Cost	Capital for meters
1.0 Element, 120-240 volt							
1	294	I-210+	GE	240V, 10A, 2W, 4 Jaw, 4 dial	200	80.68	$16,136.00
2	220	kV2c	GE	T/R, 2W, 4Jaw, TOU (KWH) c/w L.C. (ETS)	60	173.25	$10,395.00
3	230	I-210+c	GE	T/R, 2W, 4Jaw, KW/KVA dmd	140	127.00	$17,780.00
6	296	KV2C	GE	T/R, 2W, 4jaw, BID, TOU LC(ETS)	20	348.25	$6,965.00

1.5 Element, 120-240 volt							
6	*N/A*	C1S	Centron	240V, 200A, 3W,4 Jaw, 5 dial	20000	26.50	$530,000.00
7	219	SS1S1T	Sentinel	S/C, 3W, 4Jaw, TOU(KWH) c/w L.C. (ETS)	700	155.25	$108,675.00
8	231	SS1S2D	Sentinel	S/C, 3W, 4Jaw, KW/KVA dmd	700	143.75	$100,625.00
10	236	SS1S1L	Sentinel	S/C, 3W, 4Jaw, (KWH) c/w modem & L.P.	10	373.75	$3,737.50
12	266			S/C, 3W, 4Jaw, (kWh), BID	20	135.00	$2,700.00
13	291			SC, 3W, 4Jaw, (kWh) TOU, BID, LC (ETS)	12	175.00	$2,100.00
14	292			S/C, 3W, 4Jaw, kWh/kW, BID	8	135.00	$1,080.00

2.0 Element, 120-480 volt							
11	N/A	CN1S	Centron	120V,200A,3W,5Jaw(9o,clock pos:), 5 dial	1100	83.00	$91,300.00
12	226	SS2S2D	Sentinel	S/C, 3W, 5Jaw(9 o,clock pos:) KW/KVA dmd,(Mult: 25)	60	143.75	$8,625.00
14	233	SS2S1T	Sentinel	S/C, 3W, 5Jaw(9 o,clock pos:)TOU(KWH) c/w L.C.(ETS)	60	155.25	$9,315.00
15	235	SS3S3L	Sentinel	T/R, 3W, 8Jaw, KW/KVA dmd, c/w modem, L.P.	4	373.75	$1,495.00
16	246			T/R, 3W, 8Jaw, KW/KVA dmd, c/w modem,L.P, KYZ	4	360.00	$1,440.00
17	254			S/C,3W, 5jaw(9 o,clock pos:)KW/KVA dmd, modem,LP,(Mult 25)	4	325.00	$1,300.00
18	271			T/R, 3W, 8 Jaw, kW/kVA dmd, Modem, LP (5-min int)	4	300.00	$1,200.00
20	297	SS3S2D	Sentinel	T/R, 3W, 8Jaw, KW/KVA dmd	150	143.75	$21,562.50

2.5 Element, 120-347 volt							
18	281	SS5S0	Sentinel	T/R,4W, 13Jaw, 120-480V, 0.1-10A (KWH)	40	121.00	$4,840.00
19	228	SS2S2D	Sentinel	T/R, 4W, 13Jaw, KW/KVA dmd	200	121.00	$24,200.00

Item#	Prg#	Meter Type	Meter Style	Description	2015 Forecast	Current Unit Cost	Capital for meters
21	234	SS5S3L	Sentinel	T/R,4W, 13Jaw, KW/KVA dmd c/w modem, L.P.	40	373.75	$14,950.00
24	288			T/R, W, 13 Jaw, kW BID	8	135.00	$1,080.00
3.0 Element, 120-347 volt							
24	247	SS4S0D	Sentinel	S/C, 4 W, 7Jaw, (KWH)	300	121.00	$36,300.00
26	218	SS4S3L	Sentinel	T/R, 4W, 13Jaw, KW/KVA dmd, c/w modem, L.P.	20	373.75	$7,475.00
27	222	SS4S2D	Sentinel	S/C, 4W, 7Jaw, KW/KVA dmd, (Mult 25)	900	121.00	$108,900.00
28	223	SS4S2D	Sentinel	T/R, 4W, 13Jaw, KW/KVA dmd	300	121.00	$36,300.00
30	243	SS4S3L	Sentinel	T/R, 4W, 13Jaw, KW/KVA, dmd, c/w modem, L.P, KYZ	20	414.00	$8,280.00
31	275	SS4S3L	Sentinel	T/R, 4W, 13 Jaw, kW/kVA dmd, modem, LP (5 min int)	4	373.75	$1,495.00
33	283			T/R, 4W, 13 Jak, kWh/kW, BID	20	135.00	$2,700.00
34	295			S/C, 4W, 7Jaw, kWh/kW, BID	20	135.00	$2,700.00
35	211			T/R, 4W, 13 Jaw, TOU, kWh	4	135.00	$540.00

Total Meters	**25132**		**$1,186,191.00**
Misc Meters "ION"	4	5,000.00	**20,000**
CT and PT requirements			**150,000**
Wire Adapters and switches			**90,000**
Total Materials			**1,446,191**
Applied Overhead			**876,590**
Labour			**650,000**
D009 Meters Total			**$2,972,781**

Distribution Upgrades and Replacement

	2015 ACE Plan ($)
D005 Unplanned Replacement Deteriorated Equipment	
The forecast was developed based on an estimated 3,597 person-days of work at a unit cost of $2,567/man-day	**$9,234,125**
D006 Regulatory Replacements	
The forecast is developed based on experience or information from various government agencies. This amount could vary based on current year decisions by these agencies.	**$941,562**
D008 Provincial Storm	
This forecast is developed based on past experience. There can be significant variation in this amount based on yearly storm activity.	**$2,463,027**
D051 System Performance Improvement	
Add single phase regulator North River Road	22,500
Barrington Reinsulate Causeway to Cape Sable Island	52,500
Longspell Rd - Add Two Phases	63,860
99V-313 Add 2nd phase Olympic Avenue	30,000
Recloser Upgrades	60,000
1N-404/81N-411 Feeder Tie - Conductor Upgrade	75,000
Total D051 System Performance Improvement	**$303,860**
D055 Planned Replacement of Distribution Equipment	
Bin Work (Work resulting from NSPI's distribution line inspection program that has been identified as requiring follow up within one year.)	1,842,606
Streetlight/service removal (This funding is to support system upgrades required for street light installations. This includes transformer installs, service upgrades and/or new pole installations.)	300,000
Field Driven Work	600,000
Rebuild double circuit pole line Gannon Road to RR tracks, North Sydney,	92,144
Reconductor 103C-311 feeder section between substation and Cabot Trail	261,404
North Range Cross Rd - Re-pole	60,000
Mount Hanley Road Rebuild	135,000
1N-403/405 - Deteriorated plant	45,000
Reconductor Arichat to Legion	328,401
Remove Abandoned line to Lighthouse, Moques Pt, Main A Dieu	50,000
New Edinburgh Extend 1 Phase	75,000
Back Cornwall	112,835
Tancook - bank erosion; deteriorated plant on islands	300,000
Linden road - Reconductor	221,247
Vault Upgrade	95,000
Rodney Road - Reconductor	101,697
Windsor phase 2 - Deteriorated poles	187,500
Amherst Point Road - Reconductor	221,380
Voltage Regulator Replacement - 2015	65,000

Big Brook: Rail Crossing	100,000
Orion Wharf Newellton Reconductor	75,434
East Sable Road	120,000
65V-302 Bloomington Road Reconductor	135,000
Rhodes Corner Rebuild	180,000
Rodney Road Reconductor	180,000
22W-311 - Daniel Head	270,000
Castle Frederick Road - Rebuild	216,007
87W-311 - Mill Lake phase 2 (plus see Aliant request)	362,755
Beaton Road, Port Hood, 2C-402G	44,000
77V-303 Replace Deteriorated Conductor Victoria Street	72,795
Total D055 Planned Replacement of Distribution Equipment	**$6,850,206**
Distribution Upgrades and Replacement Total	**$19,792,780**

New Customers

	2015 ACE Plan ($)
D004 New Customer Upgrades	
This forecast developed as a % of D061 and D062 net of capital contributions. In 2015 this is estimated to be 52%.	**$7,382,233**
D018 Primary Equipment Spares Distribution	
This forecast is developed based on the probable amount of distribution spare equipment required during the year.	**$150,000**
D061 New Customers- Residential	
This forecast is for the costs associated with new residential customers net of capital contributions. Costs include metered services, unmetered services, line extensions and underground services.	**$8,437,808**
D062 New Customers- Commercial	
This forecast is for the costs associated with new commercial customers net of capital contributions. Costs include metered services, unmetered services, line extensions and underground services.	**$5,562,112**
Total New Customers	**$21,532,153**
Joint Use Total	
This forecast is developed based on prior spending levels for both Joint Use requests from Nova Scotia Power's Joint Use Partner, Bell Aliant and communication utility requests.	**$665,536**
Right of Way Widening Total	
This forecast is developed based on the known level of widening in the current year.	**$600,000**
Distribution Total	**$45,563,251**

Right-of-Way Widening Total

This forecast is developed based on an identified level of widening in the current year. The spend in this Routine reflects the work that will be required to widen the following rights-of-way to standard.

Line	General Location	Region	Line Height	Dominant Tree Height	Density	Slope	Clear Width	Increased Width	LineSecurity	Average Storm Tree Contacts CHI	ACHI	Spans	Cost/Span ($)	Estimate (AO included) ($)	$/ACHI ($)
13V-303	*North Range Cross Road area*	*West*	12.5	17	1050	1.5	3	3.09	52	4,394	2,285	60	1,000	74,268	32.5
13V-303	*Sissiboo Rd area, Digby*	*West*	11	15.3	1000	0	0.16	5.93	80	4,394	3,515	105	1,000	129,969	37.0
1V-443	*Vaughn to New Ross*	*Central*	11	18	889	3	3	3	47	14,384	6,760	160	800	158,438	23.4
13V-303	*Purdy Road area, Digby*	*West*	12.25	185	775	0	3	3.09	45	4,394	1,977	95	800	94,073	47.6
1V-443G	*Hwy 12 - south of New Ross*	*Central*	10..18	12.56	1216	0	0.5	5.59	88	13,847	12,185	145	800	143,252	11.8
									Totals	**41,412**	**26,722**	**565**		**600,000**	**22.5**

Work Vehicles

P006 Replacement and Additional Work Vehicles	Quantity	Unit Price	2015 ACE Plan ($)
Reel and Pole Trailers	7.00	$27,500	$192,500
Total P006 Replacement and Additional Work Vehicles			**$192,500**
P009 Mobile Transformer & Track			
This forecast is developed based on estimated repairs or modifications to track machines or the mobile transformers.			**$70,671**
P061 Transportation Vehicle Replacements	60.00	$29,750	$1,785,000
		Salvage	-$75,000
			$1,710,000
P062 Work Vehicle Replacements	14.00	$250,000	$3,500,000
		Salvage	-$125,000
			$3,375,000
P063 Class 3 Work Vehicle Replacements	3.00	$100,000	$300,000
		Salvage	-$20,000
			$280,000
	Total Work Vehicles		**$5,628,171**

Tools and Equipment

Description	Quantity	Estimated Unit Cost	2015 ACE Plan ($)
Meter Shop Tools and Equipment			**50,000**
Provincial Line Tools & Equipment			
Western Territory			
6 ton presses	6	1,600	9,600
Gator Tail rope and reel	6	3,900	23,400
Hydraulic (gas) saws	4	1,900	7,600
Y45 Press	1	4,000	4,000
Power Quality equipment	1	6,000	6,000
Battery cutters	4	3,800	15,200
10 Kv Megger	1	3,500	3,500
Under Water cable Locator	1	6,000	6,000
Western Territory Total			**75,300**

Eastern Territory			
Huskie IL-ND MD 6 Press	4	2,189	8,756
Y-35 Press Battery operated	3	3,978	11,934
Huskie Battery Operated Cutters REC-Y33	4	2,986	11,944
Yellow Grounding Kit with light pole Band	3	1,300	3,900
Busk Barrels	2	1,206	2,412
Hot line Wire Running Kit (80 blocks and 12 Arm extension	2	24,695	49,390
Gas Powered stick Saw	2	1,100	2,200
Meter Base Recorder	1	3,215	3,215
Eastern Territory Total			**93,751**
Central Territory			
Hydraulic drill	4	1,300	5,200
6 ton press	5	2,500	12,500
12 ton press	3	4,000	12,000
Husky 6 ton and 12 ton die kits	5	1,500	7,500
3 phase patten jumper sets - 15' - 2/0	8	2,200	17,600
Hydraulic Chain saw	4	1,500	6,000
Dewalt battery powered tools (9 piece set)	3	1,200	3,600
cable locator kit	1	8,500	8,500
live line phasing sticks	2	2,000	4,000
Box locator	2	2,000	4,000
Hydraulic Cutters REC Y33	6	3,000	18,000
Tension stringing kit	1	32,000	32,000
Man hole Retractor and Tripod	1	5,000	5,000
Inverter	2	1,200	2,400
Set of 3 DRA's for engineering	2	6,000	12,000
Air Monitors	2	1,200	2,400
Hubbell U/G Pulling Kit	2	1,300	2,600
HUSKIE REMOTE U/G DIE KIT	6	4,600	27,600
LOAD LOOKER AMMETER PART #MEAMP32RN	2	1,800	3,600
Huskie Hydraulic Pump R-14EF	1	2,300	2,300
Underground DRA's	2	7,500	15,000
Central Territory Total			**203,800**
T&D Asset			
Breakdown Allowance	1	50,726	50,726
Portable Ground Sets	100	1,300	130,000
Rope Tester	4	2,918	11,672
Dielectric Rope	4	2,200	8,800
6 ton Presses for Rotational Spares	18	2,189	39,402
12 ton Presses for Rotational Spares	12	4,189	50,268
Hydraulic Drills for Rotational Spares	10	1,585	15,850
Stick Cleaner for PETC	1	15,000	15,000

	Bucket Hoist for - PETC	1	25,000	25,000
	T&D Asset Total			**346,718**
	Fleet			
	Variable Load Carbon Pile Battery Tester	1	2,270	2,270
	Total Fleet			**2,270**
	System Maintenance			
	Stabilizing Binoculars	3	1,500	4,500
	Battery load test set	1	2,800	2,800
	FLIR cameras	3	4,600	13,800
	Portable SF6 DILO gas carts	2	25,000	50,000
	10kv meggars	3	6,000	18,000
	50kV AC hipot set	1	10,000	10,000
	Oil breakdown test sets	2	5,000	10,000
	U/G cable locator	1	8,000	8,000
	Vanguard CT test set	1	20,000	20,000
	138kv phasing sticks	2	2,200	4,400
	Y35 battery presses	4	3,900	15,600
	High current injection sets	3	7,000	21,000
	Winding resistance set	1	15,000	15,000
	3phase power quality meter	2	12,000	24,000
	Hand held TTR	2	2,000	4,000
	Digital hydrometer	1	7,500	7,500
	Battery operated cable cutter	4	1,800	7,200
	ABB test plugs	5	3,800	19,000
	System Maintenance Total			**254,800**
	P002 Tools and Equipment Total			**1,026,639**
P015 Hydro Production Tools & Test Equipment				**$90,000**
P016 Thermal Production Tools & Test Equipment				
	POT Tools & Equipment			$66,300
	TUC Tools & Equipment			53,000
	TRE Tools & Equipment			80,000
	LIN Tools & Equipment			75,000
	P016 Thermal Production Tools & Test Equipment Total			**$274,300**
	Tools and Test Equipment Total			**$1,390,939**

Telecommunications

P025 Mobile Radio	ACE 2015 Plan ($)
Replacement Radio Equipment Hardware and Upgrades	13,294
Equipment repairs - Nova Standing PO	12,378
Miscellaneous Support for existing system	32,906
P025 Mobile Radio Total	**58,578**
P027 Telecommunication Radio & Fibre Ops	
Generator Upgrades - 3 sites	104,767
Radio Site repairs - Misc.	22,346
Reconfigure Generator Alarms at Sites (ongoing)	6,109
Misc. repairs	14,958
P027 Telecommunication Radio & Fibre Ops Total	**148,180**
P028 Telecommunication Systems Replace & Modifications	
Replace Baily & Marconi Multiplex Equipment	32,114
Upgrade site access equipment	26,640
Install Newbridge Shelves @ RAL and Move Circuits	35,054
Remove old Baily Mux Equipment	13,609
Backup Control Center Circuits	17,224
Backup Time Synch for BCC	13,260
Batteries	15,815
Misc. Power Supplies	5,000
UPS Repairs/Replacements	5,000
Replace Ethernet Spread Spectrum Radios	28,139
Newbridge CPSS Work	1,647
ALU Network Sync Project	1,630
ALU Path Diversity Project	16,470
Misc. Alcatel Equipment	16,000
Misc. Telecom Equipment	7,500
Misc. Telecom Equipment	5,000
Cable & Entrance Protection	15,000
Switched Communications (SOPS, etc.)	5,000
Misc. Fibre Optics (Replace NEC/ADC eqpt.)	60,428
Fibre Link (Substation to Radio Site)	17,706
Network Monitoring - upgrade TMON alarming system	26,150
TMON Installation and Alarm Commissioning	8,235
Cancel PBX Voice Trunks and Circuit Designs (TUC, TRE, LAK, RAL, SYD)	815
Review and Update System Drawings	41,209
Replace Cable List Program	54,799
LED Tower Lighting Upgrades	36,605
P028 Telecommunication Systems Replace & Modifications Total	**506,049**

P814 Telecommunications Spares	
Alcatel-Lucent MDR8000 Microwave Radio	25,815
Net Guardian Alarm Monitoring Equipment	25,815
Ethernet Spares	10,815
MDS SD9, Transnet, INet	10,815
SEL 2505, 2506 Spares	10,815
RFL IMUX and 9745 Spares	25,815
Battery Charger Spare	10,815
Misc. spares	10,815
P814 Telecommunications Spares Total	**131,520**
Telecommunications Total	**844,326**

Computing and Asset Management

P010 SCADA Improvements		**2015 ACE Plan ($)**
	This forecast is developed based on anticipated SCADA equipment/operator interfaces failures or modifications	
P010 SCADA Improvements Total		**$154,092**

P031 NSPI IT Infrastructure

Infrastructure Component	Asset Management Plan	Volume to be Refreshed	2015 ACE Plan ($)
Voice and Data Network	Network Infrastructure & Equipment		$1,333,560
Servers	Servers Refresh, Licenses, & Storage		792,928
Laptop and Desktop Computers	New laptop or desktop computers	18	88,276
Laptop and Desktop Computers	Laptop/Desktop Mgmt Tool-capacity upgrade		60,070
Laptop and Desktop Computers	New software licenses		12,014
Power Supplies	Replaced after 10 years		24,028
Accessories	Accessories		20,000
P031 NSPI IT Infrastructure Total			**$2,330,876**

P040 DCMS Equipment Replacement		
	CT's DCMS Equipment Replacement	$20,000
	LIN DCMS Equipment Replacement	54,480
	POT DCMS Equipment Replacement	25,500

	TRE DCMS Equipment Replacement	45,301
	TUC DCMS Equipment Replacement	50,000
		$195,281
	Computing and Asset Management Total	**$2,680,249**
Property Improvement and Furniture		
P001	FAC - Property Improvements	$3,005,000
P030	FAC - Lower Water Street	100,000
	Property Improvement and Furniture Total	**$3,105,000**
Other		
P012	HYD - Security Improvement	$539,577
P041	FAC - Land Acquisition Routine	100,000
P816	FAC - Environment Property Remediation	222,500
P815	FAC - Environment Site Assessment	145,500
P032	FAC - Equipment & Warehouse	200,000
	Other Total	**$1,207,577**
	General Plant Total	**$14,856,262**

8 Appendix

8.1 UARB ACE Plan Directives

NS Power has received a number of Directives from prior ACE Plan Decisions. Responses to the Board's Directives are provided below.

8.1.1 Impact of 2015 ACE Plan on Revenue Requirement and Affordability

Introduction

Revenue requirement and its effect on rates are well understood: increases in revenue requirement create upward pressure on rates. In turn, rate increases may occur. NS Power recognizes that rate increases are of particular concern for our customers and stakeholders which, through ongoing engagements with them, is frequently expressed in terms of affordability.

As such, over the years the UARB has directed NS Power to provide information regarding the ACE Plan's revenue requirement impact. Directive 7 of the 2011 ACE Plan Decision and Directive 12 of the 2012 ACE Plan Decision direct NS Power to provide the estimated effect the ACE Plan may have on revenue requirement over the next five years. This is provided in the tables that follow.

This information has been provided in the ACE Plan for several years and, through discussion and agreement with stakeholders as well as further direction from the UARB, has grown to include tables breaking out the revenue requirement impact of:

- Economically Justified capital investments (2013 CEJC stakeholder engagement),
- Current Asset capital investments (2014 stakeholder engagement), and
- Work Support Facilities capital investments (UARB 2013 ACE Plan Decision Directive 13)

Considered as a whole, this information provides the UARB and stakeholders an impression of the impact NS Power's capital program is expected to have on revenue requirement and helps inform discussions on affordability. NS Power submits that the 2015 ACE Plan, designed largely as a sustainable capital program, is investing where required to best maintain the performance and reliability of our assets, while lessening upward pressure on rates.

This may not be apparent when examining the overall revenue requirement table alone. The overall revenue requirement table, “Long-Term Capital Planning & Revenue Requirement”, shows that NS Power’s capital expenditures have a decreasing effect on NS Power’s revenue requirement over the next five years when one considers the contribution to fixed costs provided by new customer additions.

Overall Capital Revenue Requirement

The overall revenue requirement calculation that follows shows the effect on rate base and the effect on revenue requirement. To the extent capital expenditures equal depreciation expense in a given year, there is no incremental effect on rate base or associated revenue requirement and therefore it is not included in the calculation.

The revenue requirement assessment incorporates the following inputs:

- Incremental capital expenditures compared to forecasted depreciation expense.
- Administrative overhead credit based on the prorated incremental capital to total capital expenditures.
- Depreciation expense based on prorated incremental capital expenditures.
- Incremental interest based on the cost of debt multiplied by the portion of debt to total capital of the incremental outstanding rate base.
- AFUDC based on a proration of incremental capital to total capital expenditures.
- Income taxes based on the resultant effects and prorated Capital Cost Allowance for tax purposes.
- Net earnings based on the rate of return multiplied by the portion of equity to total capital of the incremental outstanding rate base.
- Additional fixed cost recovery received from customer growth achieved through capital investment to serve these customers.

This method does not address the revenue requirement effect should the capital projects not be completed. Costs resulting from not completing certain projects include items such as increased operating costs, increased fuel costs, increased repair and maintenance expenses, and other risks or implications. The Economic Analysis Model used to decide whether an economically justified capital project is the best option for customers includes estimates of the avoided expenses; these avoided cost benefits are not included in this revenue requirement calculation. The effect of economic projects and their savings is broken out separately in the subsequent section.

LONG-TERM CAPITAL PLANNING & REVENUE REQUIREMENT

NOVA SCOTIA POWER ($M)	2015 ACE	2016	2017	2018	2019
Capital Expenditures	$273.0	$270.3	$309.7	$367.3	$284.8
Less: Depreciation of all assets	188.8	195.8	201.4	207.9	214.1
Incremental Spend over Depreciation	84.3	74.5	108.3	159.4	70.7
Incremental Spend as a portion of Total Spend	30.9%	27.6%	35.0%	43.4%	24.8%
Annual incremental revenue requirement	($13.3)	$2.9	$1.3	$4.1	$14.1
Cumulative incremental revenue requirement compared to 2014	($13.3)	($10.4)	($9.0)	($4.9)	$9.2
Rate impact compared to 2014	-1.0%	-0.8%	-0.7%	-0.4%	0.7%
Expenses					
Fuel	-	-	-	-	-
OM&G	(4.2)	(8.3)	(12.5)	(16.6)	(20.8)
Administrative Overhead	(11.0)	(9.5)	(14.0)	(18.9)	(8.8)
Depreciation	1.4	3.2	6.0	10.2	7.4
Interest	1.4	3.9	6.8	11.5	15.5
AFUDC	(1.5)	(1.1)	(1.5)	(2.4)	(1.0)
Earnings before tax	0.7	1.4	6.0	11.2	16.8
Income Tax	(0.5)	(1.9)	0.1	1.2	3.2
Net Earnings	$1.2	$3.4	$6.0	$10.1	$13.6
Average incremental Net Book Value of projects in 5-year plan	41.5	118.6	205.4	331.1	437.3

The overall capital revenue requirement shown above, in the line item "Cumulative incremental revenue requirement", shows a decreasing revenue requirement over a five year period. Years 2015 to 2018 show a decrease in capital revenue requirement compared to 2014. This is due to additional fixed cost recovery received from customer growth achieved through capital investment to serve these customers, Administrative Overhead and AFUDC credits related to construction of capital assets, and tax treatment of the South Canoe Wind Farm.

Year 2019 is forecasted to have an increase in revenue requirement compared to 2014. However, the cumulative effect of all years 2015 to 2019 is a decrease in revenue requirement, resulting in a lessening of upward pressure on rates.

Categories of Capital Expenditures and Revenue Requirement

Not unlike the functional classes of capital expenditures noted throughout the ACE Plan, overall revenue requirement can be broken down into different subcategories. A table breaking out "Current Asset Investment" is provided in the following table.

Current Asset Investment is made up of all capital investment on our current asset base which includes both compliance and sustaining capital projects. (It does not include investment that creates new assets (e.g. customer growth and wind farms) or substantially alters current assets (e.g. transmission upgrades for Wind / Maritime Link)).

CURRENT ASSET INVESTMENT – REVENUE REQUIREMENT

NOVA SCOTIA POWER ($M)	2015 ACE	2016	2017	2018	2019
Capital Expenditures	$211.5	$200.1	$194.9	$202.4	$194.8
Less: Depreciation of all assets	188.8	192.7	196.6	200.6	204.6
Incremental Spend over Depreciation	22.8	7.4	(1.7)	1.7	(9.8)
Annual incremental revenue requirement	($1.5)	$3.1	$1.1	($0.3)	$0.6
Cumulative incremental revenue requirement compared to 2014	($1.5)	$1.6	$2.7	$2.4	$3.0
Rate impact compared to 2014	-0.12%	0.12%	0.21%	0.18%	0.23%
Expenses					
Fuel	-	-	-	-	-
OM&G	-	-	-	-	-
Administrative Overhead	(2.9)	(0.9)	0.2	(0.2)	1.1
Depreciation	0.2	0.2	(0.1)	0.1	(0.9)
Interest	0.4	1.0	1.1	1.1	1.0
AFUDC	(0.3)	(0.1)	0.0	(0.0)	0.1
Earnings before tax	1.1	1.3	1.4	1.4	1.6
Income Tax	0.7	0.4	0.5	0.4	0.8
Net Earnings	$0.4	$0.9	$1.0	$1.0	$0.9
Average incremental Net Book Value of projects in 5-year plan	11.3	26.2	28.9	28.9	25.3

Compliance investment is required to meet a variety of regulatory requirements.

Sustaining investment includes projects in Transmission & Distribution (T&D), Work Support Facilities, and Generation necessary to sustain those assets:

- Sustaining investment in T&D is developed through inspection programs and is well aligned with the quantity of assets/expected useful life of the assets currently in-service.

- Sustaining investment in Work Support Facilities is based on technical, economic or regulatory requirements of the assets.

- Sustaining investment in our generation assets is done through our asset management program and developed through ongoing inspection programs and based on condition and criticality of the asset. Sustaining investments in generation are backed up with economic analysis stating it is more economical to complete this project compared to a "do nothing" option.

Current Asset Investments represent those projects that NS Power is either required to complete or makes best efforts to minimize in an effort to reduce upward pressure on rates, while maintaining system reliability and performance.

Further reductions in NS Power's current asset investment in T&D assets could lead to a decrease in reliability. Likewise, further reductions in current asset investment in generation assets, and corresponding economically justified projects, could lead to reduced generation performance and outages resulting in an increase in revenue requirement due to incurring expenses that would otherwise be avoided.

<u>Effect of Economically Justified Projects</u>

NS Power's overall revenue requirement impact, of which NS Power's capital revenue requirement is a part, is influenced by economically justified projects.

Economically justified projects contribute to lessening upward pressure on rates by keeping NS Power's overall revenue requirement lower than it otherwise would be.

The table below includes the effect of all new economically justified projects in the 2015 ACE Plan.

REVENUE REQUIREMENT OF ECONOMICALLY JUSTIFIED PROJECTS

NOVA SCOTIA POWER ($M)	2015	2016	2017	2018	2019
Capital Expenditures (Spend)	$25.2	$0.0	$0.0	$0.0	$0.0
Electric Revenue	($9.1)	($9.4)	($11.8)	($12.0)	($13.9)
Operating Expense	(1.6)	-	-	-	-
Avoided Expenses	(8.0)	(11.6)	(14.1)	(14.4)	(16.3)
Depreciation Expense	0.4	0.7	0.7	0.7	0.7
Interest	0.5	1.0	1.0	0.9	0.9
AFUDC	(0.2)	-	-	-	-
Earnings before taxes	(0.3)	0.6	0.7	0.7	0.8
Income taxes	(0.7)	(0.3)	(0.2)	(0.1)	0.0
Net Earnings	$0.5	$0.8	$0.8	$0.8	$0.8
Revenue Requirement of Capital Investment	($1.1)	$2.2	$2.3	$2.3	$2.3
Total Revenue Requirement	($9.1)	($9.4)	($11.8)	($12.0)	($13.9)

The "Incremental Revenue Requirement" line shows that NS Power's overall revenue requirement by completing these projects is less than the overall revenue requirement if these projects were not completed. In other words, NS Power's revenue requirement in 2015, if NS Power did not pursue its economically justified capital projects, would be $9.4 million higher.

As can be seen in the table, the avoided $9.4 million in Revenue Requirement is composed mostly of avoided expenses. These avoided expenses do not represent a reduction in NS Power's capital revenue requirement. Rather, they are primarily avoided replacement energy costs, as shown in each economically justified project's Economic Analysis Model.

Upward pressure on rates caused by NS Power's overall revenue requirement is lessened when economically justified projects are completed as compared to not completing them. The benefit of completing these projects is seen immediately in the first year.

Conclusion

NS Power's capital revenue requirement shows a decrease in 2015 to 2018 compared to 2014. Year 2019 is forecasted to have an increase in revenue requirement compared to 2014. However, the cumulative effect of all years 2015 to 2019 is a decrease in revenue requirement, resulting in a lessening of upward pressure on rates.

Investment in the Current Asset Base has a small impact on revenue requirement while maintaining reliability and performance of assets, and are justified based on their need and/or economics per the requirements of the CEJC.

Investment in economically justified projects lessens upward pressure on overall revenue requirement and rates by avoiding considerable expenses primarily in replacement energy that would otherwise be incurred.

NS Power recognizes that this describes the influence of our capital program only. NS Power also recognizes that all aspects of our business contribute to the complete picture of our revenue requirement in any given year. Those other aspects include, broadly, fuel costs and operating, maintenance, and general (OM&G) costs, and past investments. While there is value in understanding all influences on revenue requirement, NS Power submits that a General Rate Application proceeding is best suited to address influences outside of capital expenditures.

Examined on its own, the 2015 ACE Plan emphasizes affordability for customers by minimizing capital expenditures while maintaining NS Power's Generation, Transmission and Distribution systems. This sustaining capital investment plan provides a stable year over year investment plan in order to properly replace and refurbish our existing assets.

Addendum: Work Support Facilities

NS Power has broken out the revenue requirement effect of Work Support Facilities projects. Work Support Facilities projects, according to the CEJC, are those typically associated with building facilities replacement and modifications, telecontrol and telecommunications, and information technology.

Work Support Facilities projects that NS Power submits for approval provide a clear benefit or are considered necessary. For example, Information Technology related capital projects are frequently necessary due to a number of factors including obsolescence of previous technology, manufacturer support expiring, or improving work practices in line with industry trends. Work Support Facilities capital work orders will be assessed and submitted per the criteria found in the CEJC, and, Pursuant to the 2014 ACE Plan Terms of Consensus, will describe the corresponding justification for the project, be it technical or economic.

LONG-TERM CAPITAL PLANNING & REVENUE REQUIREMENT OF WORK SUPPORT FACILITIES*

NOVA SCOTIA POWER ($MM)	**2015 ACE**	**2016**	**2017**	**2018**	**2019**
Capital Expenditures	$26.9	$27.4	$28.0	$28.6	$29.1
Less: Depreciation of assets	18.6	19.9	18.2	16.2	21.9
Incremental Spend over Depreciation	8.3	7.6	9.8	12.4	7.2
Incremental Spend as a portion of Total Spend	30.9%	27.6%	35.0%	43.4%	24.8%
Annual incremental revenue requirement	($0.2)	$0.9	$0.8	$1.1	$1.0
Cumulative incremental revenue requirement compared to 2014	($0.2)	$0.6	$1.4	$2.5	$3.5
Expenses					
Fuel	-	-	-	-	-
OM&G	-	-	-	-	-
Administrative Overhead	(0.7)	(0.7)	(0.9)	(1.1)	(0.6)
Depreciation	0.1	0.4	0.8	1.4	1.0
Interest	0.2	0.5	0.8	1.2	1.5
AFUDC	(0.1)	(0.1)	(0.1)	(0.2)	(0.1)`
Earnings before tax	0.3	0.6	0.9	1.3	1.7
Income Tax	0.2	0.2	0.2	0.3	0.4
Net Earnings	$0.1	$0.4	$0.7	$1.0	$1.3
Average incremental Net Book Value of projects in 5-year plan	4.1	11.8	19.9	29.9	38.5

*As NS Power has not determined the future planned investments in Work Support Facilities beyond 2015, the analysis assumes that the level of investment would increase by an inflation rate of 2 percent annually. The revenue requirement effect includes the same factors as those used in the Long-Term Capital Planning & Revenue Requirement table.

8.1.2 Summary of 2015 ACE Plan Capital Items Related to NERC and/or NPCC Standards

The table below is provided pursuant to the UARB's 2011 ACE Plan Decision Directive 9.

CI#	Project Title	2015 ACE Plan	Total Estimate	2015 ACE Category
46513	3C Port Hastings BPS Upgrade	$2,795,730	$3,684,823	Request Approval
43291	Protection Risk Reduction 67N-Onslow 230KV	689,629	2,868,737	Carryover
43292	Protection Risk Reduction 120H-Brushy Hill 230KV	190,745	1,746,362	Carryover
46671	CIP v5 Cyber System Systems	730,200	730,200	Subsequent Approval
46050	Operator Training Simulator	358,284	531,119	Request Approval
NERC and/or NPCC Compliance Total		**$4,764,587**	**$9,561,241**	

** The primary justification for the projects listed is compliance with NERC Standards and/or NPCC Criteria. Other capital projects (e.g. generation projects that preserve reserve margins or maintain Black-Start Capability) provide important compliance benefits but these are secondary to the project primary justification.*

8.1.3 Annual Ranking/Prioritization of Capital Projects

Per 2011 ACE Plan directive 11 and 2013 ACE Plan directive 7, below is NS Power's capital project ranking criteria.

NS Power capital projects are ranked according to the following criteria:

- Health and Safety: Operating Permits, Personnel Safety
- Regulatory Compliance: Renewable Electricity Standards, GHG Regulations, Air, Emission Regulations, NERC/NPCC Requirements, Generating Unit Operating Approvals issued by NSE
- Requirement to Serve
- Customer Reliability: SAIDI, SAIFI, CAIDI
- Economics: Based on Net Present Value of the Project, Levelized Cost Analysis, $/Avoided Customer Hours of Interruption (ACHI)

Each year, the capital program includes those projects which are essential for health and safety objectives, regulatory compliance, and those which are required to provide service to an area.

Projects which serve to address customer reliability are evaluated based on factors related to performance targets (System Average Interruption Duration Index (SAIDI), System Average Interruption Frequency Index (SAIFI), Customer Average Interruption Duration Index (CAIDI), etc.). Business sustainability initiatives are evaluated based on their economic ranking.

The tables that follow identify the projects included in the 2015 ACE Plan, their ranking category and ranking value where applicable.

Generation

NS Power has begun to use a ranking method that is different than previous years. As opposed to the rating scale from 1-9, a two axis method has been deployed for all Hydro, Steam and Combustion Turbine assets which results in a final ranking of 1-25. Ranking (now called risk) is developed by determining the “Criticality” (ranked 1-5) and “Condition” (ranked 1-5) of each asset and multiplying the two to determine the overall risk.

This exercise is conducted for all equipment within like asset classes such that the risk profile for the entire asset class can be calculated. For complex asset classes (Turbines and Generators) many elements are risk profiled such that an analysis of many aspects of the asset can be conducted to determine which projects are to be brought forward. This approach represents best in industry practice as it is related to determination of risk and mitigating measures.

Hydro – 2015 ACE Plan Capital Item Rankings

CI	Project Title	2015 ACE Budget	Project Type	Ranking Category	Criticality	Condition	Ranking
41142	HYD - St. Margaret's Fish Passage	2,900,021	New	Environment	5.00	3.00	15.00
41139	HYD - Annapolis Sluiceway Superstructure Refurbishment	1,615,767	New	Business Sustainability	5.00	4.00	20.00
40283	HYD - Wrights Lake Dam Refurbishment	1,967,723	New	Safety	5.00	4.00	20.00
44978	HYD-Wreck Cove Automation	874,891	New	Business Sustainability	4.00	4.00	16.00
43066	HYD - Little Indian Dam / Mill Lake Upgrade	1,188,480	New	Safety	5.00	4.00	20.00
43607	HYD - Malay Falls #5 Unit Overhaul	780,932	New	Business Sustainability	4.00	4.00	16.00
46594	HYD Sissiboo Falls Overhaul	817,153	New	Business Sustainability	4.00	4.00	16.00
41130	HYD - Avon #2 Generator Stator Rewind	620,353	New	Business Sustainability	4.00	5.00	20.00

CI	Project Title	2015 ACE Budget	Project Type	Ranking Category	Criticality	Condition	Ranking
45370	HYD - WRC Unit 1 Excitation System	578,113	New	Business Sustainability	4.00	4.00	16.00
45171	HYD-Avon 1 Pipeline Replacement	467,755	New	Business Sustainability	4.00	5.00	20.00
46232	HYD - WHR Pipeline Replacement	458,493	New	Business Sustainability	4.00	5.00	20.00
44667	HYD Upper Lake Falls Unit #1 Overhaul	477,533	New	Business Sustainability	4.00	4.00	16.00
45892	HYD - ANN Sluiceway Stop Log Repair	227,518	New	Business Sustainability	3.00	5.00	15.00
46252	HYD - Dobble Set Procurement	71,684	New	Business Sustainability	3.00	5.00	15.00
35584	HYD - Gate Refurbishment Routine	184,430	New	Routine	3.00	5.00	15.00
27867	HYD - Roofing Routine	169,480	New	Routine	3.00	5.00	15.00
11622	HYD - Routine Equipment Replacements	701,531	New	Routine	3.00	5.00	15.00
35583	HYD Oil Release Risk Assessment Remediation Routine	217,019	New	Routine	3.00	5.00	15.00

Steam – 2015 ACE Plan Capital Item Rankings

CI	Project Title	2015 ACE Budget	Project Type	Ranking Category	Criticality	Condition	Ranking
44267	TRE Ash Lagoon Site Closure	4,571,161	New	Environment	4.00	5.00	20.00
44188	TRE Ash Site Phase 1 Capping	2,093,285	New	Environment	4.00	5.00	20.00
42806	LIN3 L-0 Turbine Blade Replacements	3,881,826	New	Business Sustainability	5.00	5.00	25.00
43088	LIN3 Generator Rotor Rewind	1,901,480	New	Business Sustainability	5.00	4.00	20.00
46068	LIN CW Debris Removal System	1,575,866	New	Business Sustainability	3.00	5.00	15.00
41227	LIN3 Condenser Large Bore Pipe and Valve Refurbishment	1,299,329	New	Business Sustainability	4.00	4.00	16.00
46299	TRE6 Boiler Refurbishments	873,652	New	Business Sustainability	4.00	5.00	20.00
43094	LIN3 HT Fastener Replacement	868,348	New	Business Sustainability	3.00	5.00	15.00
28288	POT Turbine Supervisory Equipment Upgrade	822,535	New	Business Sustainability	4.00	5.00	20.00
43031	POT - #5 HP Feedwater Heater Replacement	811,277	New	Business Sustainability	4.00	4.00	16.00
46256	POT - Boiler Refurbishment 2015	780,097	New	Business Sustainability	4.00	5.00	20.00
46300	TRE6 Air Heater Refurbishment	752,215	New	Business Sustainability	4.00	4.00	16.00
44730	TRE5 Turbine Valves Refurbishment	752,160	New	Business Sustainability	4.00	4.00	16.00
46055	LIN - Coal Mill Refurbishment 2015	736,546	New	Business Sustainability	3.00	5.00	15.00
44536	LIN3 HP Rows 1&2 Replacement	706,791	New	Business Sustainability	5.00	5.00	25.00
46451	PHB Boiler Refurbishment 2015	673,602	New	Business Sustainability	4.00	4.00	16.00
46301	TRE6 6A 6B Mills Refurbishment	665,045	New	Business Sustainability	3.00	5.00	15.00
46302	TRE5 Boiler Refurbishments	647,845	New	Business Sustainability	4.00	5.00	20.00
46467	LIN3 - Division Wall Replacement	635,747	New	Business Sustainability	4.00	5.00	20.00
40363	LIN3 High Voltage Bushing Refurbishment	628,531	New	Business Sustainability	4.00	4.00	16.00
46336	POT Turbine Valve Refurbishment	616,865	New	Business Sustainability	4.00	4.00	16.00
46473	TUC3 - Turbine Valve Refurbishment	609,870	New	Business Sustainability	4.00	4.00	16.00

CI	Project Title	2015 ACE Budget	Project Type	Ranking Category	Criticality	Condition	Ranking
44191	POT Coal Nozzle and Bucket Replacement	409,515	New	Business Sustainability	4.00	4.00	16.00
46392	POT - Plant Siding Replacement	547,659	New	Safety	5.00	3.00	15.00
46464	TUC1 - Turbine Valve Refurbishment	541,162	New	Business Sustainability	4.00	4.00	16.00
46352	TRE5 Air Heater Refurbishments	527,994	New	Business Sustainability	4.00	4.00	16.00
46058	LIN Coal Plant Structural Refurbishment - Phase 1	516,818	New	Safety	4.00	4.00	16.00
46469	LIN4 - Boiler Refurbishment 2015	501,938	New	Business Sustainability	4.00	5.00	20.00
46470	LIN1 - Boiler Refurbishment 2015	496,369	New	Business Sustainability	4.00	5.00	20.00
46395	TRE5 Baghouse Filter Replacements 2015	489,517	New	Environment	4.00	4.00	16.00
46463	LIN3 - Air Heater Refurbishment	477,566	New	Business Sustainability	3.00	5.00	15.00
46070	LIN3 Bottom Ash Replacement	475,908	New	Business Sustainability	3.00	5.00	15.00
46466	TUC2 - Rotary Airheater Refurbishment	439,946	New	Business Sustainability	4.00	4.00	16.00
46372	POT - Coal Mill Overhauls	418,292	New	Business Sustainability	3.00	5.00	15.00
46472	LIN3 - Boiler Chemical Treatment	387,649	New	Business Sustainability	4.00	4.00	16.00
46484	TUC - Unit 1&2 Analytical Panel Replacement	386,607	New	Business Sustainability	3.00	5.00	15.00
45851	POT - Stack Repairs	349,165	New	Safety	4.00	4.00	16.00
46655	ICP Mile 10.1 Bridge Repairs	377,279	New	Business Sustainability	5.00	4.00	20.00
46394	POT - Air Heater Steam Coil Replacement - North Side	361,514	New	Business Sustainability	3.00	5.00	15.00
45246	LIN Cooling Water MCC Refurbishment	295,667	New	Safety	5.00	4.00	20.00
41645	TRE6 Bottom Ash Seal Replacement	214,383	New	Business Sustainability	4.00	4.00	16.00
46482	LIN3 Burner Front Refurbishment	299,261	New	Business Sustainability	4.00	4.00	16.00
46057	LIN - CW Screen Refurbishment 2015	292,634	New	Business Sustainability	3.00	5.00	15.00
46293	LIN Coal Bunker Chute Refurbishment	291,730	New	Safety	3.00	5.00	15.00
46508	LIN2 Boiler Refurbishment	289,345	New	Business Sustainability	3.00	5.00	15.00
46496	LIN3 Analytical Panel Replacement	276,756	New	Business Sustainability	5.00	4.00	20.00

CI	Project Title	2015 ACE Budget	Project Type	Ranking Category	Criticality	Condition	Ranking
46673	LIN - Plant Noise Mitigation	247,024	New	Safety	4.00	5.00	20.00
38108	POT - AVR Replacement	245,617	New	Business Sustainability	4.00	4.00	16.00
43389	LIN3 Bentley Nevada Upgrade - System 1	242,907	New	Business Sustainability	3.00	5.00	15.00
46532	LIN 3 Condenser Tube Protective Coating	241,868	New	Business Sustainability	3.00	5.00	15.00
43027	POT - Refurbish Dust Collection Area Explosion System	239,355	New	Safety	5.00	4.00	20.00
46434	TRE6 Coal Pile Reclaim Markers	234,372	New	Safety	4.00	5.00	20.00
46417	POT - Asbestos Management 2015	233,769	New	Safety	5.00	3.00	15.00
46422	POT - Automatic Trash Rack Cleaning System	233,741	New	Business Sustainability	3.00	5.00	15.00
45176	ICP - Pier Belting	231,227	New	Business Sustainability	3.00	5.00	15.00
45801	TRE5 Coal Pile Reclaim Markers	218,169	New	Safety	4.00	5.00	20.00
46653	ICP Chute Gate #1 Conveyor Replacement	230,547	New	Business Sustainability	3.00	5.00	15.00
42973	TUC - #1, 2 and 4 WTP DCS upgrade	225,579	New	Business Sustainability	4.00	4.00	16.00
46654	ICP Conveyor Belt Replacement	219,839	New	Business Sustainability	3.00	5.00	15.00
46423	POT - Building Ventilation Fan Refurbishment	216,683	New	Safety	5.00	4.00	20.00
46418	POT - Fire System Upgrades	204,813	New	Safety	5.00	4.00	20.00
46486	TUC - Asbestos Abatement 2015	197,236	New	Safety	5.00	3.00	15.00
46452	PHB Fuel System Refurbishment 2015	195,449	New	Business Sustainability	4.00	4.00	16.00
46481	LIN3 Turbine Valve Refurbishment	194,647	New	Business Sustainability	4.00	4.00	16.00
46487	TUC - 4160V & 600V Breaker Replacement 2015	192,003	New	Business Sustainability	4.00	5.00	20.00
46485	TUC - Gas Block Valves	191,971	New	Business Sustainability	3.00	5.00	15.00
44716	TUC2 - North Boiler Feed Pump Refurbishment	191,007	New	Business Sustainability	3.00	5.00	15.00
46377	TRE5 5-1 CW Screens Refurbishment	177,928	New	Business Sustainability	3.00	5.00	15.00
42937	TUC-LMs East Gas Compressor Overhaul	154,319	New	Business Sustainability	4.00	4.00	16.00
46378	TRE Asbestos Abatement 2015	151,688	New	Safety	5.00	3.00	15.00
46379	TRE Ash Site Management 2015	150,853	New	Environment	4.00	5.00	20.00

CI	Project Title	2015 ACE Budget	Project Type	Ranking Category	Criticality	Condition	Ranking
46396	TRE5 Battery Bank Replacements	146,636	New	Business Sustainability	5.00	4.00	20.00
43213	LIN3 Battery Replacement	145,521	New	Business Sustainability	4.00	4.00	16.00
44587	POT - Selective Ash Site Capping	141,282	New	Environment	4.00	5.00	20.00
40297	TRE5 - Boiler House Tundish Drains Replacement	138,177	New	Business Sustainability	5.00	4.00	20.00
44354	LIN 4160 Motor Refurbishment	135,699	New	Business Sustainability	4.00	4.00	16.00
46492	TUC1 - Polisher Upgrade	130,917	New	Business Sustainability	4.00	5.00	20.00
46553	LIN - Dissolved O2 Analyzer Replacement	128,729	New	Business Sustainability	4.00	4.00	16.00
28249	POT Structural Steel Refurbishment	123,921	New	Business Sustainability	3.00	5.00	15.00
46063	LIN Coal System Guard Upgrade	123,691	New	Safety	5.00	4.00	20.00
22614	POT Flame Scanner Replacement	120,578	New	Safety	4.00	4.00	16.00
46531	TRE WWTP Discharge Pump Replacement	119,610	New	Business Sustainability	4.00	4.00	16.00
46493	TUC2 - Polisher Upgrade	114,885	New	Business Sustainability	5.00	5.00	25.00
46672	LIN - Boiler Nitrogen Generator	113,405	New	Business Sustainability	4.00	4.00	16.00
46271	LIN3 Ash Incline Structural Steel Refurbishment	106,631	New	Business Sustainability	3.00	5.00	15.00
46460	TRE5 Blowdown Tank Header Replacements	79,082	New	Business Sustainability	4.00	5.00	20.00
46622	POT - Replace Heavy Fuel Oil Pumps	102,597	New	Business Sustainability	3.00	5.00	15.00
46059	LIN - 4KV and 600V Breaker Refurbishment 2015	100,138	New	Business Sustainability	3.00	5.00	15.00
46494	TUC3 - Chimney Refurbishment	99,172	New	Business Sustainability	4.00	4.00	16.00
46433	TRE6 ID Fan Motor Coolers	96,744	New	Business Sustainability	4.00	4.00	16.00
45994	POT - O2 Analyzer Upgrade	95,548	New	Business Sustainability	4.00	4.00	16.00
46495	TUC3 - DCS Upgrade	95,475	New	Business Sustainability	4.00	4.00	16.00
42944	TUC3 - Boiler Drum North PSV Replacement	70,524	New	Business Sustainability	5.00	4.00	20.00
46497	TUC - WTP Resin Replacement	69,415	New	Business Sustainability	5.00	4.00	20.00
42971	TUC2 - DCS Upgrade	56,468	New	Business Sustainability	4.00	4.00	16.00

CI	Project Title	2015 ACE Budget	Project Type	Ranking Category	Criticality	Condition	Ranking
46424	TRE Turbine Dehumidifier	54,403	New	Business Sustainability	3.00	5.00	15.00
46375	POT - Condenser Level Control Upgrade	52,852	New	Business Sustainability	4.00	4.00	16.00
46596	POT - Precipitator Refurbishment	51,935	New	Environment	4.00	4.00	16.00
46577	TRE6 High Energy Piping Upgrades	51,210	New	Business Sustainability	4.00	4.00	16.00
46498	TUC - Unit 2&3 LP Spindle HCF Assessments	50,000	New	Business Sustainability	5.00	3.00	15.00
46427	TRE Acid/Caustic Pump Replacement	49,790	New	Business Sustainability	5.00	3.00	15.00
46428	TRE6 Polisher Resin Replacements	48,636	New	Business Sustainability	3.00	5.00	15.00
46430	TRE6 Demin Silica Monitor	31,238	New	Business Sustainability	5.00	3.00	15.00
46429	TRE5 Demin Silica Monitor	31,238	New	Business Sustainability	5.00	3.00	15.00
46502	TUC - Silica Analyzer	25,000	New	Business Sustainability	4.00	5.00	20.00
10626	LIN - Routine Equipment Replacements	384,155	New	Routine	3.00	5.00	15.00
10621	TUC - Routine Equipment Replacements	255,032	New	Routine	3.00	5.00	15.00
10645	POT - Routine Equipment Replacements	233,252	New	Routine	3.00	5.00	15.00
10673	TRE - Routine Equipment Replacements	351,760	New	Routine	3.00	5.00	15.00
43646	PHB - Routine Equipment Replacements	128,030	New	Routine	3.00	5.00	15.00
27856	TRE-ROOFING ROUTINE	47,688	New	Routine	3.00	5.00	15.00
27854	TUC-ROOFING ROUTINE	200,000	New	Routine	3.00	5.00	15.00
27855	POT-ROOFING ROUTINE	268,242	New	Routine	3.00	5.00	15.00
23428	GS - Routine Capital	132,000	New	Routine	3.00	5.00	15.00
33863	LIN - Heat Rate Routine	80,000	New	Routine	3.00	5.00	15.00
33867	POT - Heat Rate Routine	77,451	New	Routine	3.00	5.00	15.00
33869	TRE - Heat Rate Routine	81,354	New	Routine	3.00	5.00	15.00
33871	TUC - Heat Rate Routine	80,000	New	Routine	3.00	5.00	15.00

Combustion Turbine – 2015 ACE Plan Capital Item Rankings

CI	Project Title	2015 ACE Budget	Project Type	Ranking Category	Criticality	Condition	Ranking
33142	CT- Burnside #4 Unit Restoration	3,094,420	New	Business Sustainability	4.00	5.00	20.00
45116	CT - BGT1 GG4C-1D Engine Refurbishment	1,168,167	New	Business Sustainability	4.00	4.00	16.00
44775	CT - TUC#4 LM6000 Generator Rotor Re-wedge	691,046	New	Business Sustainability	5.00	4.00	20.00
46506	LM6000 - Noise Mitigation	707,491	New	Environment	4.00	4.00	16.00
46483	CT - Tusket Control System Upgrade	441,816	New	Business Sustainability	3.00	5.00	15.00
44752	BGT1 - Generator Rotor Retaining Ring Replacement	357,869	New	Business Sustainability	5.00	4.00	20.00
29065	CT - BGT Replace Halon Fire Protection System	234,780	New	Safety	5.00	4.00	20.00
46507	LM6000 - Fuel Nozzle Rotable Kit	295,772	New	Business Sustainability	3.00	5.00	15.00
20511	CT - Victoria Junction Replace Halon Fire Protection System	268,467	New	Safety	4.00	5.00	20.00
45117	BGT1 - PLC and Field Device Control Upgrade	253,768	New	Business Sustainability	3.00	5.00	15.00
43159	CT - BGT Annunciation Units Upgrade to DAS	148,143	New	Business Sustainability	3.00	5.00	15.00
43420	CT's - BGT Air Dryer System Upgrade	125,947	New	Business Sustainability	3.00	5.00	15.00
44787	CT - DC Battery Bank Replacement	121,538	New	Business Sustainability	4.00	5.00	20.00
45118	BGT1 - Addition of Flux Probe & Partial Discharge	65,650	New	Business Sustainability	4.00	5.00	20.00
43146	CT's - VJ Air Dryer System Upgrade	64,441	New	Business Sustainability	3.00	5.00	15.00
45122	BGT3 - Clutch Switch Improvement	28,981	New	Business Sustainability	4.00	4.00	16.00
45121	BGT2 - Clutch Switch improvement	28,637	New	Business Sustainability	4.00	4.00	16.00
10634	CT - Routine Equipment Replacements	144,000	New	Routine	3.00	5.00	15.00
38899	CT'S Tooling Routine	28,000	New	Routine	3.00	5.00	15.00

Transmission & Distribution

Customer Operations (Transmission & Distribution) ranks capital projects according to three categories. The first is “Criteria”. The Criteria category consists of Regulatory, Deteriorated Plant, System Reliability, Load Growth, Overloaded Equipment, Load Balancing and Customer Reliability. Each of these is assigned a ranking between 1.0 and 3.0.

The second is “Business Driver”. The Business Driver category consists of Planning Study, Safety, Environment, Renewable Electricity Standard, Existing Issue, Pending Issue, and Regulatory Requirement. Each of these is assigned a ranking between 1.0 and 3.0.

The third is “Risk”. The Risk category consists of low, medium and high. Each of these is assigned a ranking between 1.0 and 3.0. Each project is assigned a measure from each of the three categories and the sum of these rankings makes up the overall project ranking.

Each of the three categories has a top scale of 3.0 for a maximum project ranking of 9.0. All rankings are reviewed by a review team to ensure the projects are justified and appropriate for inclusion in the ACE Plan. The lower ranking suggests a lower priority than a higher ranking.

Transmission and Distribution – 2015 ACE Plan Capital Item Rankings

FP / CI Number	Project Title	2015 ACE Budget ($)	Project Type	Ranking Category	Project Ranking
Transmission Capital Items Included in 2015 ACE Plan					
46591	88S Lingan Replace 230kV GIS	3,274,637	New	System Reliability	8.0
43324	L6513 Rebuild/upgrade line terminals	12,735,850	New	Requirement to Serve	9.0
43678	Separate L8004/L7005 on Canso Crossing Double Circuit Tower(DCT)	1,367,669	New	Requirement to Serve	9.0
46339	120H Brushy Hill - SVC Controls Replacement	3,689,176	New	System Reliability	8.0
41519	Harbour East 138 kV Transmission Line	497,838	New	Load Growth	8.0
45053	69Kv Structure Replacements West	290,836	New	Regulatory	8.0
45306	George Street Substation Addition	2,431,743	New	Load Growth	8.5
45066	Upgrade L6511 and L7019 Thermal Rating	3,219,774	New	Requirement to Serve	9.0
46513	3C Port Hastings BPS Upgrade	2,795,730	New	Regulatory	9.0
46587	Metro Voltage Support Add Capacitor	1,499,915	New	Load Balancing	8.0
46340	2015 Transmission Switch & Breaker Replacements	1,581,599	New	System Reliability	8.5
43490	2015 Steel Tower Life Extension	641,709	New	System Reliability	8.0
46586	2015 PCB Removal - Substation	1,262,087	New	Regulatory	9.0
43267	13V Gulch Hydro Replace 13V-GT1 and 13V-VR1	1,061,902	New	System Reliability	8.0

FP / CI Number	Project Title	2015 ACE Budget ($)	Project Type	Ranking Category	Project Ranking
46333	L6538 Replacements	500,375	New	System Reliability	6.5
44976	10H 25kV Breaker Replacement	953,521	New	System Reliability	7.5
46583	L6511 Replacements	905,745	New	System Reliability	8.0
46331	L7001 Replacements - Phase 2	888,192	New	System Reliability	8.5
45795	L6503 Upgrade	780,641	New	Sustaining	8.5
46332	L6539 Replacements	736,393	New	System Reliability	6.5
46335	L5511 Replacements	722,934	New	System Reliability	8.5
44979	L5527 Structure Replacements	721,068	New	System Reliability	7.5
46362	L5560 Transmission Line Reconductor	626,895	New	System Reliability	8.0
41438	85S Cable Termination Replacement Wreck Cove	616,959	New	System Reliability	7.5
46353	2015 Substation Recloser Replacements	596,893	New	System Reliability	8.0
43261	6V-GT1 Hollow Bridge Hydro Transformer Replacement	550,938	New	System Reliability	7.5
46354	2015 Reactor Breaker Replacements	460,691	New	System Reliability	8.5
46337	L6535/L6551 Insulator Replacements	459,422	New	System Reliability	8.0
46582	L5569 Upgrade	369,032	New	System Reliability	7.5
46356	2015 Sacrificial Anode Installation Program	304,612	New	System Reliability	8.5
46360	L5545B Reconductor	222,827	New	System Reliability	7.5
46588	L5027 Upgrade Line Switches	197,609	New	System Reliability	7.5
46366	65V Middleton Substation RTU Addition	196,655	New	Customer Reliability	7.5
46397	Substation Telemetry	158,916	New	System Reliability	8.0
Distribution Capital Items Included in 2015 ACE Plan					
46292	2015 Padmount Transformer Replacement Program	1,536,110	New	System Reliability	8.5
44749	Tiverton Tower Refurbishment	935,802	New	Regulatory	9.0
46458	16N-302 Stewiacke Reconductor	592,084	New	System Reliability	7.0
44836	Halifax 4kV Conversion Part 2	581,405	New	System Reliability	8.0
43234	104S-313 Baddeck Rebuild	778,470	New	System Reliability	8.0
46576	2015 PCB Phase-out for Pole Top Transformers	733,503	New	Regulatory	8.5
45031	3N Oxford Conversion Phase 1	716,167	New	Overloaded Equipment	9.0
46457	79V-401 Cameron Lake Voltage Conversion	282,166	New	Load Growth	7.0
46651	23H-303G Rockingham Conversion Part 1	266,008	New	Sustaining	8.0
46456	11W Yarmouth 4kV Conversion	295,167	New	System Reliability	8.0
46398	20H Spryfield Voltage Conversion	329,169	New	Load Growth	8.0
46304	20W-311 Argyle Sound Reconductor	430,435	New	System Reliability	8.0
46251	36V-303 Saxon Double Circuit	425,838	New	Overloaded Equipment	8.5
43203	58C-405 / 11C Belle Cote Phase 1	339,419	New	System Reliability	8.0
43218	88W-323HA Tusket Islands Phase 3	286,911	New	Load Growth	8.0
45003	2015 Hydraulic Recloser Replacements	260,524	New	System Reliability	8.0
46593	70V Bridgetown Voltage Conversion	237,679	New	Overloaded Equipment	9.0
46579	48W-204 Wolfe Street Voltage Conversion	228,183	New	Regulatory	9.0

FP / CI Number	Project Title	2015 ACE Budget ($)	Project Type	Ranking Category	Project Ranking
46623	Rights for Existing Facilities on Railway Lands	187,067	New	Sustaining	9.0
46581	500N-301 Caribou Island Overload	168,922	New	Load Growth	8.0
Routine Capital Items Included in 2015 ACE Plan					
23118	Provincial - Planned Trans Line Replacement	3,830,874	Routine	Transmission	9.0
23120	Provincial-Trans Substation Primary	2,050,586	Routine	Transmission	9.0
23115	Provincial Transmission Line Replace	857,506	Routine	Transmission	9.0
23121	Provincial - Substation Additions & Replacements	835,001	Routine	Transmission	9.0
14841	Protection Modification & Replacement	427,653	Routine	Transmission	9.0
14973	Primary Equipment Spares	215,000	Routine	Transmission	9.0
23137	Planned Replacement Of Distr	6,850,206	Routine	Distribution	9.0
26496	Meter Routine	2,972,781	Routine	Distribution	9.0
23158	Unplanned Replace Deteriorated	9,234,125	Routine	Distribution	9.0
39766	New Customers - Residential	8,437,808	Routine	Distribution	9.0
26716	New Customer Upgrades	7,382,233	Routine	Distribution	9.0
23361	Provincial Storm	2,463,027	Routine	Distribution	9.0
39770	New Customers - Commercial	5,562,112	Routine	Distribution	9.0
23127	Provincially Widening	600,000	Routine	Distribution	9.0
29038	System Performance Improvement Routine	303,860	Routine	Distribution	9.0
23135	Regulatory Replacements - Province	941,562	Routine	Distribution	9.0
23136	Contractual Replacements (Joint Use)	665,536	Routine	Distribution	9.0
23511	Primary Equipment Spares - Distribution	150,000	Routine	Distribution	9.0

General Plant – Capital Item Rankings

The projects brought forward under General Plant primarily involve information technology, telecommunications, facilities initiatives, and vehicles. These areas are too diverse to develop a comparable and useful ranking system across the groups, and therefore the determination of whether a project will proceed is based upon lifecycle or economic benefit.

8.1.4 2015 to 2019 Forecasted ACE Plan Expenditures by Functional Class and Spending Program

Pursuant to 2011 ACE Plan Directive 12, NS Power provides its forecasted spend by functional class and spending program. NS Power does not anticipate a significant change in the investment level for projects under $250,000 or the Routine program from 2015 to 2019. Justifications for projects determined as capital investments are scoped on an annual basis. Capital investment on the basis of health and safety, environmental compliance and requirement to serve remains non-discretionary. The following table identifies anticipated sustaining capital by function and specific notable investments included in this ACE Plan. Investment levels from 2015-2019 are subject to change based on operating conditions, updated asset assessments, regulatory directives, or legislation.

Sustaining capital funding levels represent typical annual investment by function in a given year to sustain the integrity of existing assets. Notable capital projections reflect specific projects. Included in these specific projects are strategic multi-year program investments and asset growth.

	2015 ACE	2016	2017	2018	2019
Base Capital Investment ($M)					
Thermal Generation	34.7	42.8	52.0	47.6	50.5
Combustion Turbines	8.3	5.5	5.5	5.5	5.5
Hydro Generation	30.3	21.7	22.1	22.6	23.0
Wind Generation	0.1	0.1	0.1	0.1	0.1
Transmission	45.1	48.6	44.6	45.5	46.4
Distribution	56.8	58.0	59.1	60.3	61.5
General Plant	29.0	23.1	24.3	27.8	24.2
Total Base Capital Expenditure ($M)	**204.2**	**199.7**	**207.8**	**209.3**	**211.2**
Notable Capital Investment ($M)					
Thermal:					
Ash Site Investment	11.9				
Lingan Unit #3 Major Outage	14.6				
Lingan Unit #4 Major Outage		14.6			
General Plant:					
IT - CIS Replacement	0.0	0.3	3.0	9.0	9.0
Replace Mobile Radio System	0.0	4.0	4.0	3.7	
Wind (& Associated Transmission):					
South Canoe Wind Farm	12.1				
Associated Transmission	0.6				
Sable Wind Farm	0.0				
Associated Transmission	0.0				
Distribution:					
Automated Metering Infrastructure		10.0	35.0	35.0	20.0
LED Streetlights	7.3	7.3	5.7	5.7	
Transmission:					
Maritime Link Transmission	19.0	10.5			
Lingan GIS Replacement	3.3	4.0	4.3	4.6	4.6
Hydro:					

	2015 ACE	2016	2017	2018	2019
Hydro Infrastructural Renewal					
Wreck Cove Overhaul				60.0	
Mersey Re-Development		20.0	50.0	40.0	40.0
Total Notable Capital ($M)	**68.8**	**70.6**	**102.0**	**158.0**	**73.6**
Total Annual Capital Investment ($M)	**273.0**	**270.3**	**309.7**	**367.3**	**284.8**

8.1.5 Routine Expenditures

In the UARB's 2013 ACE Plan Decision, pursuant to Directive 2, NS Power was directed "to analyze the routine expenditures to determine what are the "like-for-like" totals", and "explain why those totals, if they are similar in magnitude to the Board's analysis, are growing at an annual rate in excess of inflation."

A summary of NS Power's total routine and like-for-like routine spending is provided below:

ANNUAL COST OF LIKE-FOR-LIKE ROUTINE REPLACEMENTS

NOVA SCOTIA POWER ($M)	2011 Actual	2012 Actual	2013 Actuals	2014 Forecast	2015 ACE Plan
Total Routine Spending	$78.4	$74.9	$66.8	$73.9	$73.1
Less:					
New Customers	22.2	24.2	20.6	21.6	21.5
System Growth and Performance	2.8	3.0	3.0	2.2	2.7
Other	1.4	1.3	1.3	1.1	1.2
Like-for-Like	52.0	46.4	41.8	48.9	47.7
Work Vehicles (Like-for-like)	6.5	5.6	2.7	3.4	5.6
Net (Like-for-like)	45.5	40.8	39.1	45.5	42.1

*Point Aconi amounts have been removed in order to reflect the spend totals that require UARB approval.

As can be seen in the table above, routine spending and like-for-like spending has remained relatively stable over the last several years. NS Power's forecast for 2015 is also consistent with this routine spending trend.

Routine classifications are determined by the primary classification of each routine project. If the majority of the work completed under the routine is like-for-like replacements, the routine was classified as like-for-like. New Customer routines, System Growth and Performance routines (such as heat rate, system improvement and right-of-way widening routines) and other routines (such as joint use and environmental assessment routines) were not included in the like-for-like totals.

NS Power addresses reactive items within routines by using the professional judgment of its engineers to assess the urgency of each job. At an overall routine level, NS Power actively evaluates and prioritizes work in order to manage costs within budget. Each month, NS Power monitors the activities within the routines to evaluate whether the work is necessary.

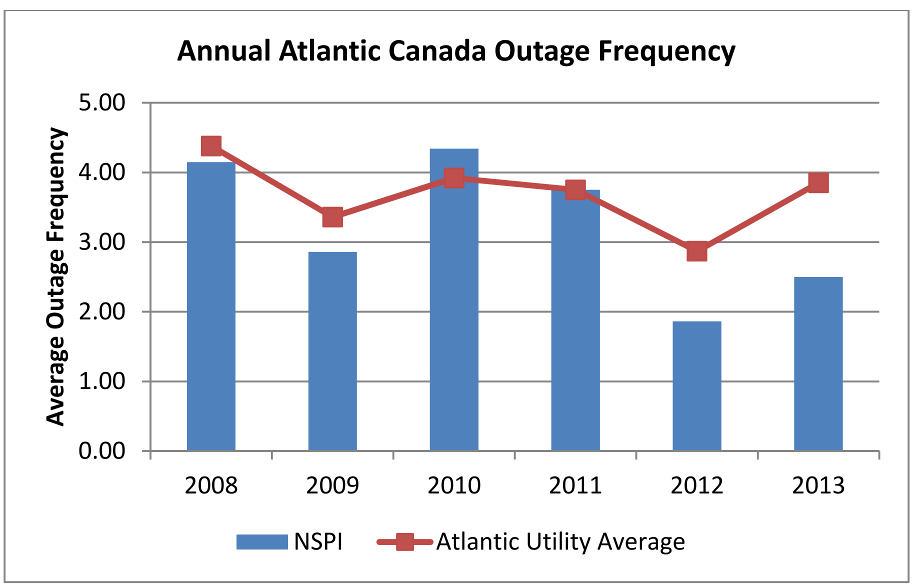
8.1.6 Impact of Reliability Projects

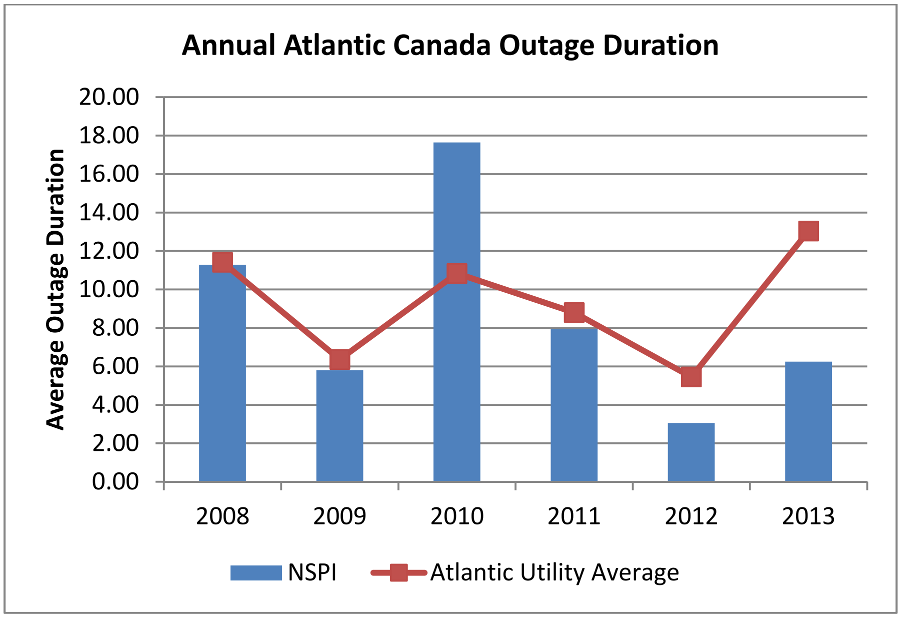
The UARB's 2013 ACE Plan decision Directive 14 stated:

> …the Board expects NSPI to monitor the impact of the deferral of reliability projects in the original 2013 ACE Plan closely and to provide a report on the results in the next ACE Plan.

Due to the events of Post Tropical Storm Arthur (Arthur) in early July 2014 and following discussion with Board staff, it was considered appropriate to provide this directive in the 2015 ACE Plan. This year's directive includes commentary on the impact of Arthur on year-to-date 2014 reliability statistics.

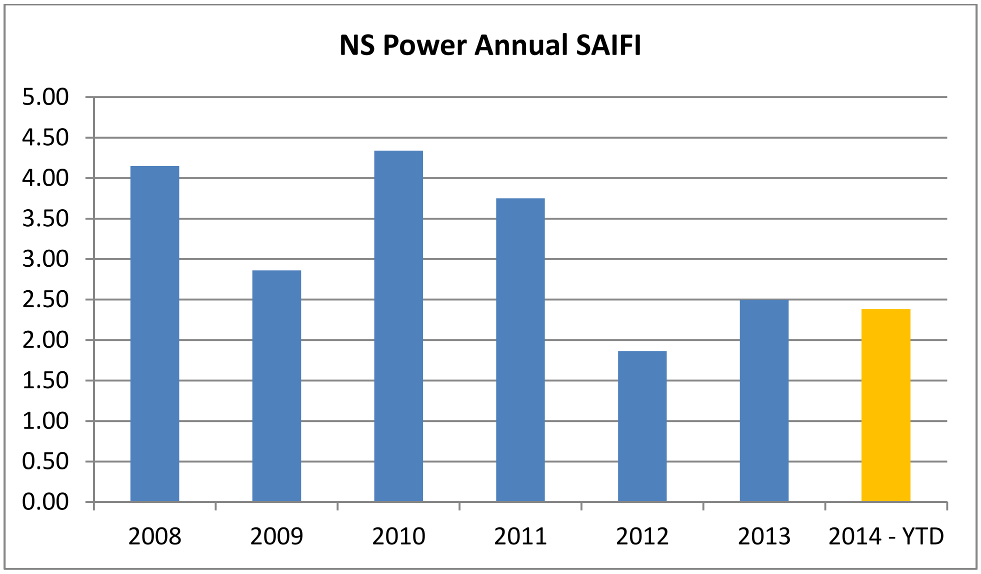
In 2012 and 2013 NS Power experienced its best reliability results in recent years. As shown in the charts below, NS Power's annual outage frequency and duration continues to be well below the average of Atlantic Canada utilities.

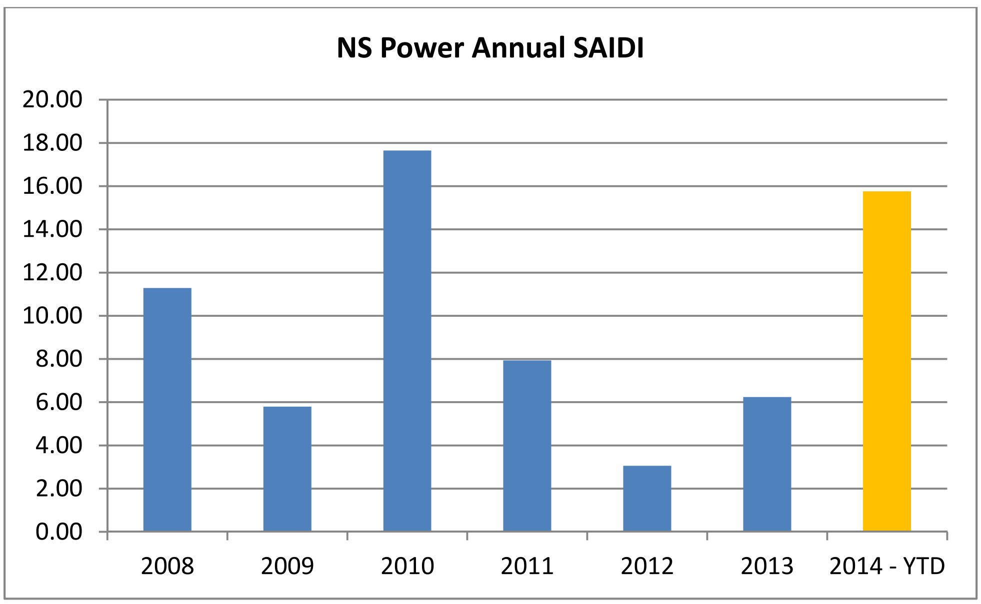




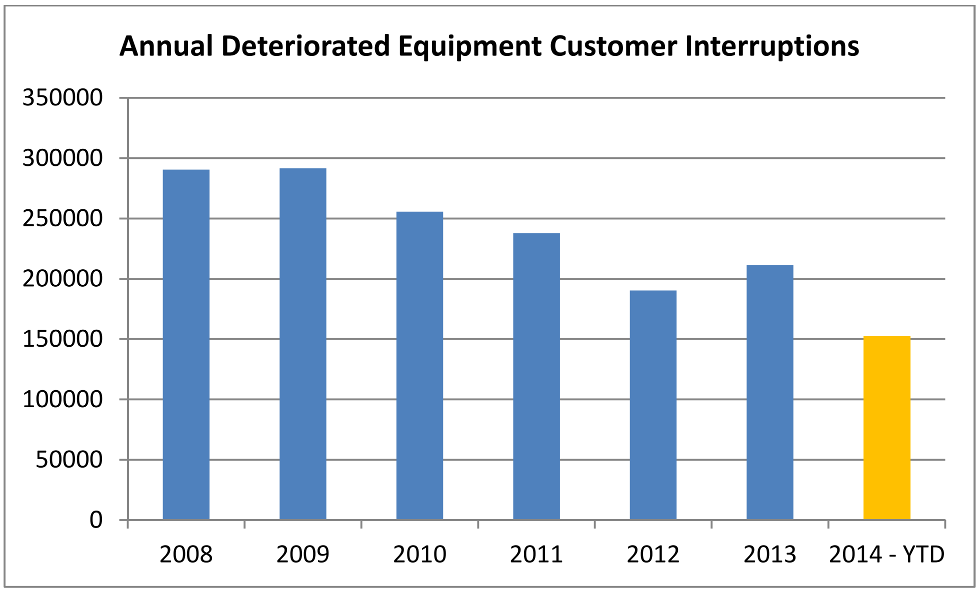
Given these reliability results, NS Power has moderated its expenditures in reliability beginning with the 2014 ACE Plan and continuing with the 2015 ACE Plan. The majority of spend related to NS Power's reliability program has been completed. The remaining spend has been spread out among 2013, 2014 and 2015, in subsequent capital items.

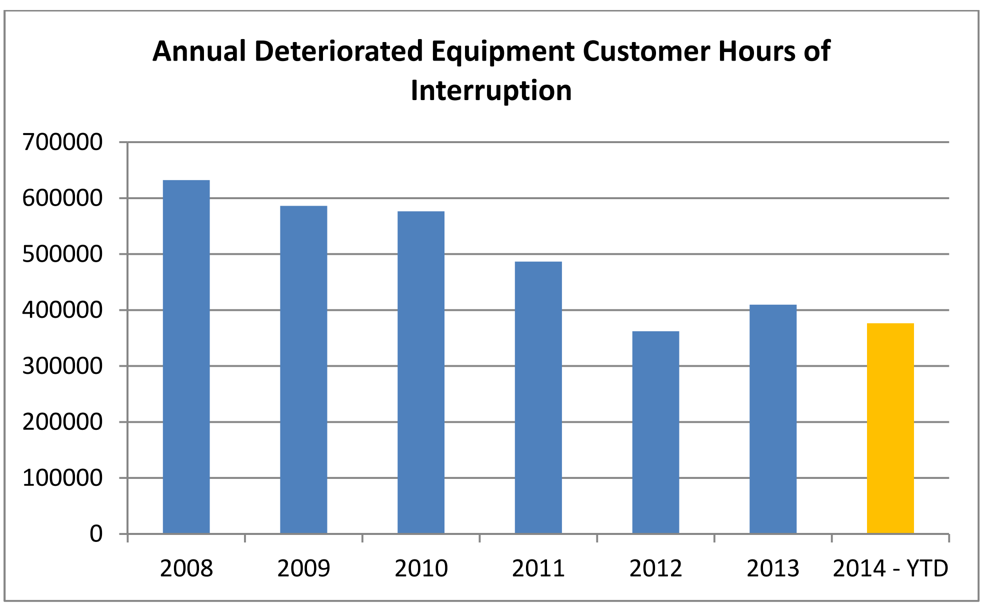
As can be seen in the "NS Power Annual SAIFI" and "NS Power Annual SAIDI" charts below, customers are experiencing fewer interruptions and shorter total duration of outages. However, 2014 year-to-date statistics are trending significantly higher than the best ever results of the last two years due to the effects of Arthur in early July.


NS Power Annual SAIFI
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
2008
2009
2010
2011
2012
2013
2014 - YTD

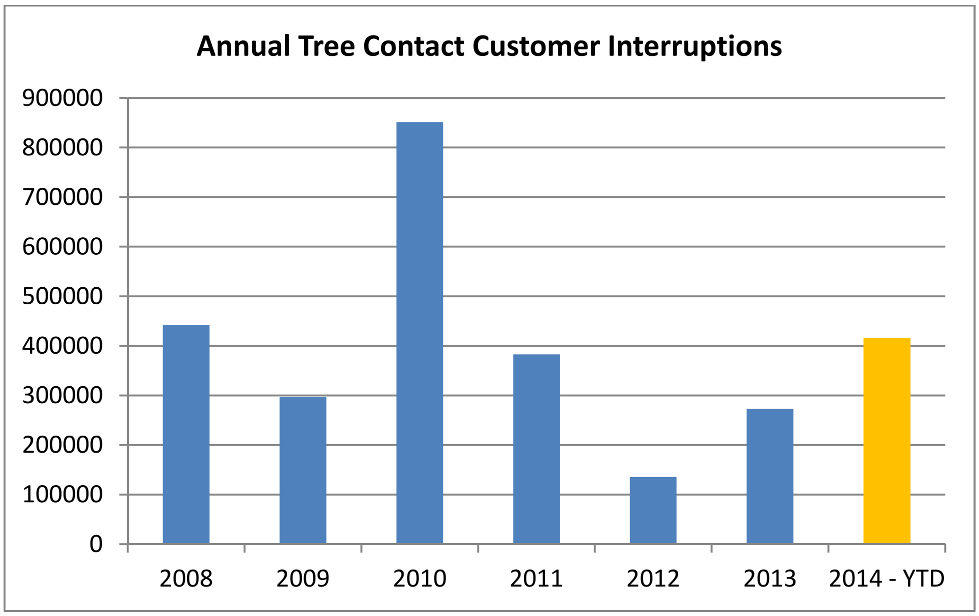

NS Power Annual SAIDI
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2008
2009
2010
2011
2012
2013
2014 - YTD

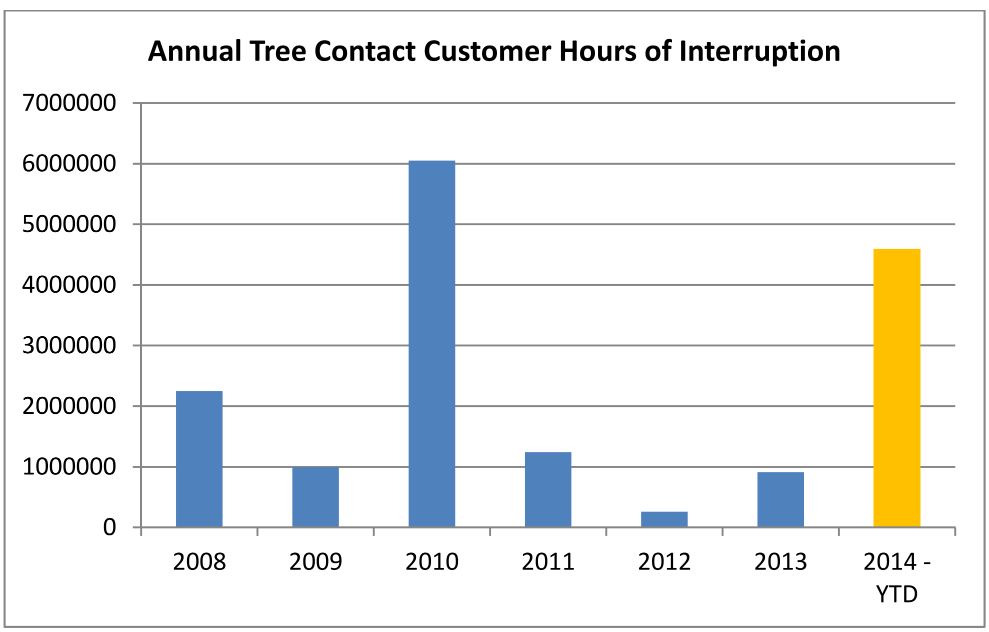
The following two charts demonstrate reliability gains realized through upgrades and replacements of targeted distribution equipment. There has been a steady improvement in both customer interruptions and customer hours of interruption due to deteriorated equipment. These too are unaffected by Arthur whereas the effects of Arthur were mainly the result of high winds and vegetation contact with NS Power's transmission and distribution systems, independent of the state of deteriorated equipment.





The following two charts demonstrate both customer interruptions and customer hours of interruptions due to tree contacts are trending towards improved customer reliability. As can be seen in these charts, Arthur has had the greatest effect on tree contact caused interruptions. When Arthur arrived in Nova Scotia, trees were full of leaves and the ground was still relatively moist, resulting in trees susceptible to capturing the wind and easier to uproot. Falling trees and branches caused the majority of power outages related to Arthur.





Notwithstanding the effects of Arthur in early July, the multi-year Reliability Investment Strategy has resulted in a step-change towards improved reliability for NS Power customers. System reliability has been improved to a level where reductions and deferrals of reliability investments can be made for customer affordability, while sustaining similar overall reliability.

The first stage of the Arthur proceeding recently concluded with the UARB's Decision issued on October 6, 2014. Notwithstanding Liberty's recommendations related to distribution cutouts and transmission storm hardening, and NS Power's agreement to address those recommendations, the Board's Decision made no conclusions with respect to NS Power's capital program as it relates to capital investments in reliability and NS Power's overall reliability investment program. Additional capital expenditures as a result of Arthur, beyond what is currently forecasted and provided in the 2015 ACE Plan, are currently under evaluation. CI 46739 - IT Outage Map Technology Upgrades is the only Arthur related capital item planned for subsequent submittal at this time.

NS Power continually monitors outages and performance of transmission, substation and distribution assets, and future investments will continue at an appropriate level to ensure affordable and reliable service.

8.1.7 Interruptible Customers

The UARB's 2013 ACE Plan Decision Directive 15 stated:

> …an annual report, as part of the ACE Plan filing, tracking interruptions to interruptible customers is useful and reasonable. The Board directs NSPI to provide this information in future ACE Plans.

The North American Electric Reliability Corporation (NERC) requires NS Power to maintain defined levels of Operating Reserve capacity (capacity or load that can be activated/reduced within ten minutes). While NS Power begins each day with a generation plan designed to serve customers and to maintain the required Operating Reserves, circumstances do arise where this reserve requirement cannot be met with available resources. In these situations, interruptible customers are called upon to temporarily cease their electricity consumption to protect service to firm customers and maintain Operating Reserves.

NS Power offers four tariffs that require customers to reduce their loads within 10 minutes when instructed to do so. The four tariffs are:

1) The Large Industrial Interruptible Rider (LIIR) Tariff
2) The Port Hawkesbury Paper Load Retention Mechanism (PHP LRM) Tariff
3) The Generation Replacement and Load Following (GR&LF) Rate
4) The Shore Power Tariff

The process for interruption of loads for each group is essentially the same: telephone notification with the requirement to reduce load within 10 minutes. Some customers can be controlled with remote switching, but are notified by phone as well.

In exchange for allowing their load to be interrupted, interruptible customers receive a discount based on the avoided capital costs associated with peaking units that would otherwise have been required to serve a larger firm peak load. If an interruptible customer is unable to comply with the provisions of their tariff, a penalty is applied.

The LIIR class was historically interrupted once or twice per year and would experience periods where they were not called at all for several years. Comparatively, the last several years have seen more frequent interruptions. The largest change in conditions leading to these interruptions is the absence of the priority interruption provided by the customers subscribed to the Extra Large Industrial tariff (paper mills). Increased difficulty in securing imports due to transmission constraints outside of the Nova Scotia system has also contributed. Studies have indicated that more interruptions can be expected as more variable generation from renewable sources such as wind is added to the power system.

Amendments were made to the LIIR and the PHP LRT regarding the use of technology to enable NS Power to determine the exact demand at some customer's sites in real time and to be able to disconnect those loads directly from the NS Power Control Centre. Customers wishing to be in this position were required to install the necessary equipment at their own cost. In the case of the PHP mill, the equipment was already in place as it was installed during construction of the supply infrastructure. Customers who have provided direct load control to NS Power provide 10-minute reserve without having to interrupt to free up generation. The aim of the changes made was to reduce the number of interruptions required as reserves are increased by the amount of load from this class of customer. Below is a table summarizing interruptions in the LIIR customer class from 2009 to the present.

Year	LIIR Customers			
	Date	**Number of LIIR customers interrupted**	**Estimated load interrupted (MW)**	**Estimated average duration**
2009	January 26 April 9 December 1 December 17	26 25 7 25	80 67 30 82	2 hours 1.5 hours 1.2 hours 1.5 hours
2010	February 1	8	25	40 minutes
2011	January 23	25	74	45 minutes
2012	N/A	0	0	
2013 (to end of October)	January 2 January 3 January 16 February 8	8 2 22 10	26 16 69 34	55 minutes 1 hour 40 minutes 2 hours
2014	April 25	6	28	4 hours

In 2014, the UARB approved a pilot program to amend interruption provisions of the LIIR and LRT tariffs. The project aims to have NS Power control participating customers' load, which will enable this load to be counted as 10 minute reserve under NERC requirements, which should reduce the number and duration of customer interruptions.

Below are tables summarizing recent interruptions to PHP LRT and the GR&LF customers.

PHP LRT Interruptions*		
Date	**Load Interrupted (MW)**	**Estimated Average Duration**
Jan 2, 2013	15	1.5 hours
Jan 3, 2013	11	50 minutes
Jan 16, 2013	37	1.75 hours
Feb 8, 2013	41	2.67 hours

*PHP LRT came into effect September 27, 2012.

*As PHP is counted as 10-minute reserve and the LIIR interruptions called in April 2014 were intended to restore reserves to 171 MW, no interruption was called for PHP.

GR&LF Interruptions*	
Date	**Estimated Average Duration**
Sept 6, 2012	1.5 hours
Dec 1, 2012	1.75 hours
Jan 2, 2013	1.58 hours
Jan 3, 2013	1 hour
Jan 6, 2013	1.25 hours
Jan 16, 2013	1.75 hours
Feb 8, 2013	2.75 hours
April 25, 2014	3 hours

*There is no significant load relief associated with GR&LF interruptions.

All interruptions to these classes of customers were required to maintain the system operator's 10-minute reserve requirements and were executed in accordance with the applicable tariff.

8.2 2015 Capital Spending by Justification Criteria

Items in the 2015 ACE Plan have been developed using the 2013 CEJC. Definitions of the various criteria referenced in the following table are included in the CEJC.

(Millions of Dollars)

Justification Criteria	2015 Budget	Projects included for Approval	Routine Spend	Less than $250K	Items for Later Filing 2015	Carryover	Pt. Aconi
Distribution System*	$60.6	$5.7	$42.6	$1.0	$9.7	$1.6	$0.0
Thermal	51.1	25.5	2.6	6.4	8.2	3.5	4.8
Work Support*	26.9	2.3	13.7	1.2	4.7	4.9	0.0
Hydro	17.8	2.7	1.8	0.3	2.6	10.5	0.0
Health and Safety	16.2	5.1	0.0	2.2	2.7	5.7	0.5
Transmission Plant	66.5	17.3	8.8	0.6	30.8	8.2	0.8
Environmental	30.2	7.9	0.5	0.3	4.4	13.0	4.1
Metering Equipment	3.4	0.0	3.0	0.0	0.0	0.5	0.0
System Design	0.2	0.0	0.0	0.2	0.0	0.0	0.0
Facilities/Land and Right-of-Way	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Total	**$273.0**	**$66.4**	**$73.1**	**$12.3**	**$63.2**	**$47.9**	**$10.3**

*Details of justification sub-criteria are provided on the following section.

8.3 2015 Capital Spending by Justification Sub-Criteria

(Millions of Dollars)

Justification Sub-Criteria	2015 Budget	Projects included for Approval	Routine Spend	Less than $250K	Items for Subsequent Submission	Carryover
Distribution System						
Requirement to Serve	$34.9	$0.0	$34.5	$0.2	$0.3	$0.0
Pole Strength	6.9	0.0	6.9	0.0	0.0	0.0
Joint Use Agreement	0.7	0.0	0.7	0.0	0.0	0.0
Deteriorated Conductor	2.3	2.1	0.0	0.0	0.0	0.2
Equipment Replacement	10.3	2.1	0.0	0.0	8.2	0.0
Outage Performance	1.9	0.0	0.6	0.2	0.0	1.1
Overloaded Equipment	0.3	0.0	0.0	0.2	0.0	0.1
Service Voltage	0.2	0.0	0.0	0.2	0.0	0.0
Other Distribution System	3.2	1.4	0.0	0.2	1.2	0.3
Total	**$60.6**	**$5.7**	**$42.6**	**$1.0**	**$9.7**	**$1.6**
Work Support Facilities						
Buildings	$3.6	$0.3	$3.3	$0.0	$0.0	$0.0
Furniture & Fixtures	0.0	0.0	0.0	0.0	0.0	0.0
Telecommunications	5.3	0.8	0.8	0.2	1.2	2.3
Computers / IT	10.3	1.3	2.6	1.0	3.5	1.8
Tools & Equipment	1.4	0.0	1.4	0.0	0.0	0.0
Vehicles	5.6	0.0	5.6	0.0	0.0	0.0
Equipment Replacement	0.8	0.0	0.0	0.0	0.0	0.8
Other	0.0	0.0	0.0	0.0	0.0	0.0
Total	**$26.9**	**$2.3**	**$13.7**	**$1.2**	**$4.7**	**$4.9**

8.4 Quick Reference Sheet

2015 AFUDC Rate 7.23%

Please refer to section 1.6 regarding NS Power's application for approval of the 2015 AFUDC rate.

2015 O/H Rates

Generation		**Customer Operations**		**Shared Services**	
PP Regular	20.04%	Regular	81.82%	IT	54.45%
Hydro	26.97%	Contract	23.78%	Proj. Support*	59.40%
Contractor	8.96%	Vehicle	53.04%		

*Formerly T&CS Labour AO includes engineering and environmental support of capital projects.

8.5 2015 Depreciation Rates

	2015
Steam Production Plant	
Lingan	
Lingan 1-2	4.12%
Lingan 3-4	2.28%
Lingan - Common	4.48%
Total Lingan	3.35%
Point Aconi 1	2.27%
Point Tupper	
Point Tupper 1 (Common)	3.97%
Point Tupper 2	2.82%
Total Point Tupper	2.89%
Trenton	
Trenton 5	3.10%
Trenton 6	2.34%
Trenton - Common	0.47%
Total Trenton	2.47%
Tufts Cove	
Tufts Cove 1	4.24%
Tufts Cove 2	3.68%
Tufts Cove 3	2.33%
Tufts Cove - Common	3.44%
Total Tufts Cove	3.27%
Port Hawkesbury Biomass	2.50%
Point Tupper Marine Terminal	4.06%
International Coal Pier	2.60%
General	2.82%
Total Steam Production Plant	**2.82%**

	2015
Hydro Production Plant	
Avon	3.02%
Bear River	1.80%
Black River	2.04%
Dickie Brook	3.16%
Fall River	1.82%
Harmony	4.55%
Lequille System	2.33%
Roseway	2.29%
Mersey	2.00%
St. Margaret's	2.85%
Sheet Harbour	3.38%
Tusket	2.64%
Wreck Cove System	1.67%
Annapolis Tidal	2.32%
General	2.10%
Total Hydro Production	**2.10%**

	2015
Other Production - Gas Turbines	
Burnside	2.40%
Tusket	6.42%
Victoria Junction	3.17%
Tufts Cove Unit 4	2.55%
Tufts Cove Unit 5	2.77%
Tufts Cove Unit 6	3.03%
Wind Turbines	
Pre 2009 Wind	5.52%
Post 2009 Wind	4.0%
Transmission Plant	
Land Rights - Easements	1.26%
Station Equipment	2.14%
Towers & Fixtures	1.26%
Poles & Fixtures	4.32%
Overhead Conductors & Devices	1.96%
Underground Conduit	1.53%
Underground Conductors & Devices	2.61%
Roads, Trails & Bridges	1.74%
Total Transmission Plant	**2.35%**

	2015
Distribution Plant	
Land Rights - Easements, Surveys & Clearing	1.56%
Structures & Improvements	5.31%
Station Equipment	1.28%
SCADA Equipment	9.68%
Remote Monitoring Equipment	10.32%
Station Equipment - Miscellaneous	12.49%
Poles, Towers & Fixtures	3.79%
Overhead Conductors & Devices	3.33%
Underground Conduit	1.51%
Underground Conductors & Devices	3.17%
Line Transformers	4.09%
Services	5.33%
Meters	6.87%
Street Lighting & Signal Systems	5.33%
Total Distribution Plant	**3.89%**

	2015
General Plant	
Land Rights - General Plant	1.93%
Structures & improvements	2.85%
Office Furniture & Equipment	9.26%
Office Furniture & Equip - Comp Hardware	20.00%
Office Furniture & Equip - Comp Software	10.00%
Transportation Equipment	9.55%
Stores Equipment	14.97%
Communication Equipment	4.38%
Communication Equipment - SCADA Eq	1.33%
Remote Monitoring Equipment	10.27%
Miscellaneous Equipment	5.02%
Roads, Bridges & Traps (Kelly Rock)	2.58%
Mining Equipment (Kelly Rock)	2.92%
Total General Plant	**8.16%**

8.6 Summary of Economically Justified Projects

Revenue Requirement Summary							Change in Revenue Requirement due to:			PV of Revenue Requirement by Year							
CI	Project	Alternative	Rank as Filed	As Filed	Capital Spend Increased 10%	Avoided Expenses Reduced 10%	Deferral of 1 year	Deferral of 2 years	Deferral of 3 years	Year 0 / 2014	Year 1 / 2015	Year 2 / 2016	Year 3 / 2017	Year 4 / 2018	Year 5 / 2019	Years 6 to end of life / 2020+	Total
28288	POT Turbine Supervisory Equipment Upgrade	Upgrade Turbine Supervisory Equipment vs. Avoided Repair and Replacement Energy Costs	1	(9,435,037)	(9,354,320)	(8,410,816)	808,241	1,521,318	2,185,975	-	(804,241)	(672,560)	(649,882)	(627,934)	(606,676)	(6,073,745)	(9,435,037)
40363	LIN3 HVB Replacement	Refurbish HVB vs. Avoided Repair and Replacement Energy Costs	1	(2,617,873)	(2,561,191)	(2,299,404)	280,392	513,193	798,466	-	(318,102)	(205,361)	(277,109)	(265,400)	(327,488)	(1,224,412)	(2,617,873)
41227	LIN3 Condenser Large Bore Piping and Valve Refurbishment	Replace Piping and Valve Refurb vs. Avoided Repair and Replacement Energy Costs	1	(4,746,934)	(4,616,558)	(4,141,864)	126,075	228,358	380,570	(49,855)	(62,050)	(86,891)	(135,804)	(156,758)	(245,680)	(4,009,895)	(4,746,934)
41645	TRE6 Bottom Ash Seal Replacement	Seal Replacement vs Avoided Repair and Replacement Energy Costs	1	(1,609,824)	(1,582,564)	(1,421,581)	174,894	413,021	735,438	-	(201,416)	(224,251)	(318,054)	(469,913)	(610,118)	213,928	(1,609,824)
42806	LIN3 L-0 Blade Replacement	Replace Blades vs Avoided Repair and Replacement Energy Costs	1	(6,675,911)	(6,296,051)	(5,628,459)	643,363	1,153,197	1,571,058	-	(802,216)	(330,057)	(364,319)	(395,086)	(422,501)	(4,361,731)	(6,675,911)
43031	POT #5 HP Heater Replacement	Refurbish Heater vs Avoided Repair and Replacement Energy Costs	1	(3,662,672)	(3,584,943)	(3,218,676)	166,263	316,507	461,568	-	(183,013)	(109,915)	(130,157)	(148,613)	(165,381)	(2,925,593)	(3,662,672)
43031	POT #5 HP Heater Replacement	Retube vs Avoided Repair and Replacement Energy Costs	2	(1,871,136)	(1,831,392)	(1,644,279)	41,957	86,909	136,534	-	(53,514)	(23,952)	(41,735)	(57,787)	(72,223)	(1,621,925)	(1,871,136)
43088	LIN3 Rotor Rewind	Rotor Rewind vs. Avoided Repair and Replacement Energy Costs	1	(3,857,926)	(3,680,356)	(3,294,564)	257,919	513,009	777,795	-	(303,062)	(173,217)	(241,064)	(231,149)	(221,869)	(2,687,564)	(3,857,926)
43094	LIN3 High Temperature Fastener Replacement	Replace Fasteners vs Avoided Repair and Replacement Energy Costs	1	(3,537,437)	(3,456,883)	(3,103,140)	230,820	457,443	691,342	-	(257,354)	(189,156)	(222,999)	(253,853)	(281,890)	(2,332,185)	(3,537,437)
43607	HYD Malay Falls Unit#5 Overhaul	Repair Runner vs. Avoided Repair and Replacement Energy Costs	2	(3,635,418)	(3,532,848)	(3,169,306)	264,335	488,853	680,228	-	(297,849)	(179,283)	(171,611)	(164,526)	(157,906)	(2,664,242)	(3,635,418)
43607	HYD Malay Falls Unit#5 Overhaul	Replace Runner	1	(3,812,128)	(3,727,229)	(3,346,016)	264,335	481,087	658,228	-	(403,509)	(273,016)	(193,020)	(154,754)	(135,821)	(2,652,009)	(3,812,128)
44191	POT Coal Nozzle and Bucket Replacement	Coal Nozzle and Bucket Replacement vs Avoided Repair and Replacement Energy Costs	1	(3,950,044)	(3,893,155)	(3,498,150)	510,540	968,624	1,392,174	-	(513,232)	(428,844)	(413,234)	(398,285)	(383,951)	(1,812,498)	(3,950,044)
44667	HYD Upper Lake Falls Unit#5 Overhaul	Overhaul Unit vs Avoided Repair and Replacement Energy Costs	1	(7,752,845)	(7,714,897)	(6,939,612)	228,762	452,873	674,240	-	(313,867)	(203,235)	(215,260)	(225,697)	(234,662)	(6,560,124)	(7,752,845)
44730	TRE5 Turbine Valve Refurbishment	Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs.	1	(2,299,917)	(2,224,834)	(1,994,843)	196,967	358,379	503,358	-	(200,368)	(120,258)	(128,994)	(136,968)	(144,210)	(1,569,120)	(2,299,917)
45370	HYD – Wreck Cove Unit#1 Excitation System	Replace Exciter vs. Avoided Repair and Replacement Energy Costs	1	(38,613,996)	(38,565,978)	(34,704,579)	-	849,064	1,805,706	-	(59,144)	(827,669)	(952,553)	(1,063,409)	(1,161,289)	(34,549,932)	(38,613,996)
46055	LIN - Mill Refurbishment 2015	Mill Refurbishment vs. Avoided Repair and Replacement Energy Costs	1	(453,968)	(383,955)	(338,558)	112,780	273,560	455,761	-	(150,763)	(112,064)	(157,808)	(223,945)	(292,426)	483,037	(453,968)
46057	LIN CW Screen Refurbishment	CW Screen Refurbish vs. Avoided Repair and Replacement Energy Costs	1	(770,494)	(745,849)	(668,800)	69,322	190,723	320,684	-	(105,338)	(109,174)	(126,747)	(142,972)	(157,916)	(128,346)	(770,494)
46070	LIN3 Bottom Ash Refurbishment	Bottom Ash Refurbish vs. Avoided Repair and Replacement Energy Costs	1	(1,687,692)	(1,644,779)	(1,476,010)	50,099	103,356	162,864	-	(77,783)	(32,515)	(53,333)	(72,329)	(208,392)	(1,243,341)	(1,687,692)
46256	POT - Boiler Refurbishment	Refurbish Boiler vs. Avoided Repair and Replacement Energy Costs	1	(2,097,532)	(2,021,738)	(1,811,985)	277,281	636,314	1,080,883	-	(319,195)	(318,077)	(429,996)	(532,373)	(512,506)	14,614	(2,097,532)
46299	TRE6 Boiler Refurbishments	Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs	1	(1,834,328)	(1,754,860)	(1,571,427)	300,612	572,045	805,992	-	(353,689)	(232,486)	(222,005)	(347,260)	(331,340)	(347,548)	(1,834,328)
46301	TRE6 6A 6B Mill Refurbishment	Mill Refurbishment vs Avoided Repair and Replacement Energy Costs	1	(2,810,767)	(2,747,279)	(2,466,202)	440,435	1,739,777	3,383,210	-	(471,854)	(1,268,551)	(1,634,481)	46,200	43,097	474,823	(2,810,767)
46302	TRE5 Boiler Refurbishments	Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs	1	(3,750,450)	(3,690,491)	(3,315,446)	147,616	379,953	583,172	-	(188,519)	(197,452)	(188,925)	(295,080)	(281,837)	(2,598,639)	(3,750,450)
46336	POT Turbine Valve Refurbishment	Refurbish Valves vs. Avoided Repair and Replacement Energy Costs	1	(1,529,333)	(1,466,242)	(1,313,309)	304,911	585,521	854,199	-	(303,861)	(248,781)	(257,672)	(265,474)	(272,251)	(181,294)	(1,529,333)

Revenue Requirement Summary							Change in Revenue Requirement due to:			PV of Revenue Requirement by Year							
CI	Project	Alternative	Rank as Filed	As Filed	Capital Spend Increased 10%	Avoided Expenses Reduced 10%	Deferral of 1 year	Deferral of 2 years	Deferral of 3 years	Year 0 / 2014	Year 1 / 2015	Year 2 / 2016	Year 3 / 2017	Year 4 / 2018	Year 5 / 2019	Years 6 to end of life / 2020+	Total
46352	TRE5 – Air Heater Refurbishment	Air Heater Refurbishment vs Avoided Repair and Replacement Energy Costs	1	(1,465,282)	(1,416,826)	(1,270,298)	113,404	214,492	314,742	-	(153,027)	(72,508)	(88,508)	(102,844)	(115,624)	(932,770)	(1,465,282)
46372	POT - Coal Mill Overhaul	Mill Overhaul vs Avoided Repair and Replacement Energy Costs	1	(1,656,215)	(1,615,078)	(1,449,456)	235,538	549,839	944,412	-	(244,551)	(292,690)	(386,865)	(473,096)	(551,884)	292,873	(1,656,215)
46394	POT – Air Heater Steam Coil Replacement – North Side	Replace Steam Coils vs Avoided Repair and Replacement Energy Costs	1	(3,436,824)	(3,402,371)	(3,058,689)	310,819	584,021	835,427	-	(317,834)	(255,301)	(244,766)	(234,728)	(225,153)	(2,159,041)	(3,436,824)
46463	LIN3 Air Heater Refurbishment	Air Heater Refurbishment vs. Avoided Repair and Replacement Energy Costs	1	(779,426)	(734,244)	(656,301)	81,458	159,443	238,785	-	(85,111)	(57,589)	(73,503)	(88,038)	(101,271)	(373,914)	(779,426)
46464	TUC1 Turbine Valve Refurbishments	Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs	1	(689,240)	(637,246)	(568,322)	115,410	216,501	307,366	-	(124,324)	(65,124)	(72,461)	(79,252)	(85,513)	(262,566)	(689,240)
46467	LIN3 Division Wall Replacement	Division Wall Replacement vs. Avoided Repair and Replacement Energy Costs	1	(1,829,580)	(1,771,595)	(1,588,637)	44,869	129,969	275,221	-	(75,576)	(57,473)	(137,105)	(269,048)	(260,170)	(1,030,208)	(1,829,580)
46469	LIN4 Boiler Refurbishment	Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs	1	(1,080,330)	(1,035,180)	(927,147)	108,648	300,655	471,765	-	(141,048)	(170,033)	(164,563)	(255,534)	(339,575)	(9,577)	(1,080,330)
46470	LIN1 Boiler Refurbishment	Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs	1	(667,023)	(620,394)	(553,692)	100,852	268,803	505,880	-	(128,588)	(135,191)	(220,612)	(214,579)	(290,857)	322,804	(667,023)
46472	LIN3 Boiler Chemical Treatment	Chemical Treatment vs. Avoided Repair and Replacement Energy Costs	1	(2,614,995)	(2,580,386)	(2,318,887)	112,173	309,747	590,205	-	(139,470)	(180,574)	(275,357)	(265,772)	(350,054)	(1,403,767)	(2,614,995)
46473	TUC3 Turbine Valve Refurbishments	Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs	1	(591,549)	(533,875)	(474,720)	121,620	215,043	295,979	-	(123,359)	(67,162)	(73,153)	(78,768)	(84,007)	(165,099)	(591,549)
46482	LIN3 Burner Front Refurbishment	Refurbish Burner Front vs Avoided Repair and Replacement Energy Costs	1	(618,684)	(590,395)	(528,527)	86,306	236,439	372,410	-	(89,442)	(137,325)	(132,304)	(201,012)	(264,116)	205,515	(618,684)
46508	LIN2 Boiler Refurbishment 2015	Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs	1	(496,109)	(468,974)	(419,363)	81,507	231,510	445,526	-	(98,198)	(130,898)	(204,411)	(272,809)	22,002	188,205	(496,109)
46594	HYD Sissiboo Falls Overhaul	Rotor rewind / Wicket Gate refurb vs Avoided Repair and Replacement Energy Costs	1	(7,173,779)	(7,106,145)	(6,388,767)	268,961	510,757	730,269	-	(368,639)	(209,893)	(212,451)	(214,390)	(215,741)	(5,952,666)	(7,173,779)
	Summary of all Economically Justified Projects		**1**	**(130,606,143)**	**(128,226,859)**	**(115,166,245)**	**7,373,193**	**16,634,545**	**26,610,669**	**(49,855)**	**(8,481,743)**	**(8,195,293)**	**(9,599,473)**	**(9,110,922)**	**(9,817,072)**	**(85,351,786)**	**(130,606,143)**

Generation

Generation Asset Management

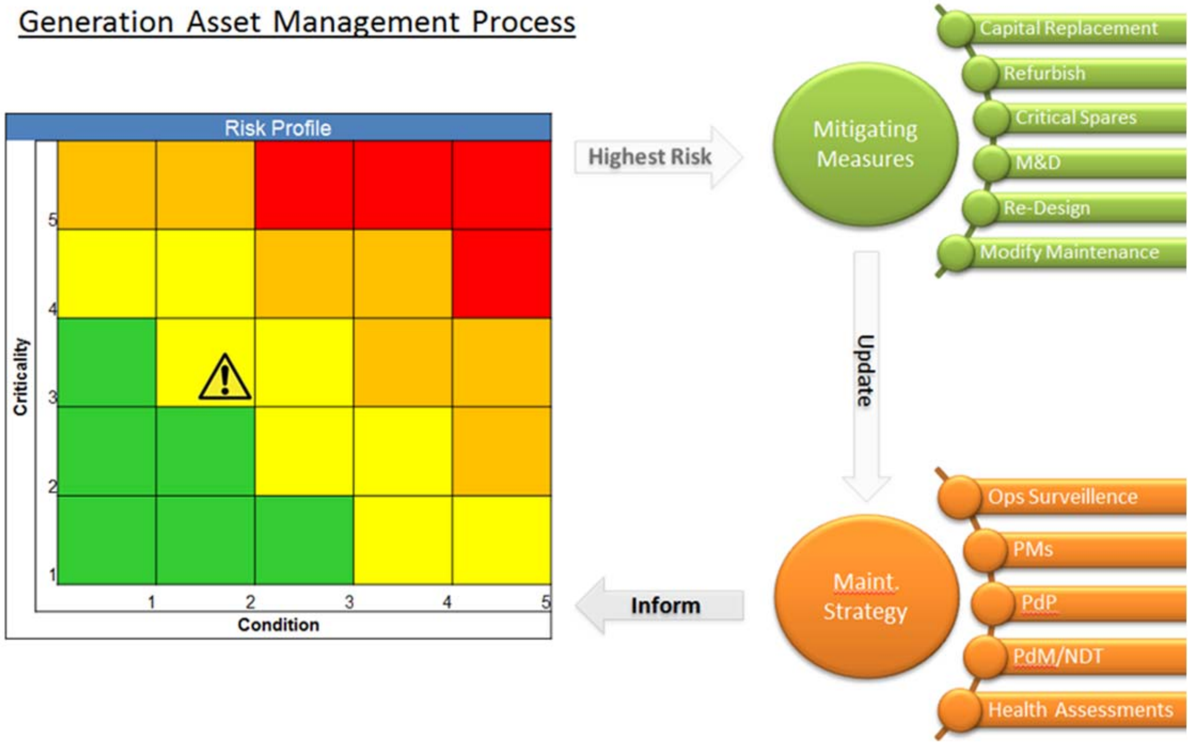
As part of NS Power's Generation Asset Management Approach, risk profiles are developed for key asset classes. These risk profiles are essential to developing asset plans including: Maintenance Strategy, Refurbishment Scope and Timing, Outage Requirements and Capital Investment Plans.

A risk profile is developed for each major asset class. The risk profile considers the criticality of the equipment to unit availability and its condition, each across a range of 1-5, resulting in a ranking on a 25 point scale. NS Power has developed comprehensive approaches to establish equipment condition. Regular maintenance activities, operator surveillance, testing, real time analysis and industry experts are employed to develop and maintain a view of equipment health (condition).

The degree and nature of the effort to assess equipment health is a function of the complexity of the asset class. To this end, NS Power categorizes its various asset classes in several different ways: Simple Asset Classes (Motors, Pumps, Fans, Compressors, Rotating Equipment, etc), Complex Asset Classes (Turbines, Generators, Boilers, CTs) and Systems Asset Classes (Chemical Systems, Control Systems, Mercury (Hg) Systems, etc).

The following graphic illustrates this approach and is central to NS Power's Asset Management thinking. Risk Profiles result in the selection of Mitigating Measures and Maintenance Strategies. Capital investment is one of numerous Mitigation Measures to address asset risks. Selection of mitigating strategy also considers how the unit is currently planned to be utilized.

<u>Generation Asset Management Process</u>



Hydro

Hydro Generation

NS Power's Hydro generation fleet is made up of 17 rivers systems, with 33 powerhouses, 54 generating units and 153 main dams, ranging in age from 29 to 92 years old.

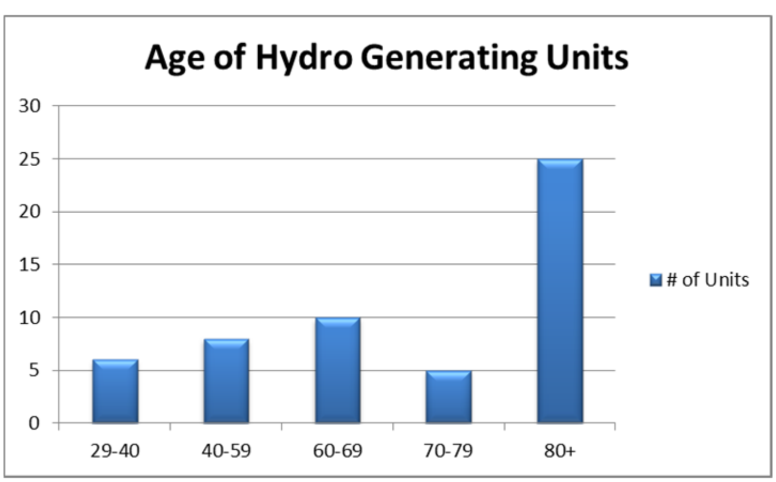
Asset classes in Hydro generation that typically require an ongoing investment plan include Dams, Pipelines, Generators, Turbines, Gates and Water Control Structures, and other associated (Balance of Plant) equipment.

Dams represent the single largest investment requirement. NS Power maintains a comprehensive program to assess Dam Safety and plan investment on a prioritized risk basis. Similar to other Power Production asset classes Criticality (consequence) and Condition are considered when calculating risk.

Pipelines also represent a significant investment. Hydro has been engaged in a program of Pipeline replacements which has seen the move from original wood stave technology to a more robust and environmentally friendly product such as High Density Polyethylene. These original woodstave pipelines are not serviceable to end of the generation unit's life and therefore an active program to replace these pipelines, based on their condition has been ongoing.

As Hydro has some 54 generating units, multiple major overhauls are required annually in order to sustain generation. Major overhauls typically include work on the Generators, Turbines and water control structures. These major outages are also determined on a condition basis and could include the replacement of Turbine Runners, refurbishment of Wicket Gates and Generator rewinds

Balance of Plant equipment, such as Electrics and Controls, is typically replaced as a function of serviceability (obsolescence).



CI Number: 41139

Title: HYD – Annapolis Sluiceway Superstructure Refurbishment

Start Date:	2015/01
In-Service Date:	2016/07
Final Cost Date:	2016/12
Function:	Hydro
Forecast Amount:	$3,410,322

DESCRIPTION:

This project includes the refurbishment of the steel superstructure, steel sluice gates and embedded steel for the gate guides and stoplog checks. Replacement of the controls and monitoring system for the sluiceway will also occur.

The sluiceway and adjacent Annapolis River causeway were originally constructed by the Nova Scotia Government in the 1950s at Annapolis Royal as a means of reducing flooding of farmland along the Annapolis River caused by high tides in the Bay of Fundy. In the 1980s, the Annapolis Tidal Plant was constructed at the causeway location, and modifications were made to the sluice gates to allow for flow in both directions as part of the Annapolis Tidal Plant's operating regime. No significant upgrades to the sluiceway superstructure, sluice gates, or controls have been undertaken since that time.

The sluiceway superstructure and sluice gates are constructed of steel, and are operating in a corrosive salt water environment. Consequently, the steel superstructure, steel sluice gates, and embedded steel for the gate guides and stoplog checks are corroded and need to be refurbished. In addition, the controls and monitoring system for the sluiceway have reached the end of their useful life, are obsolete, and are difficult for which to source spare parts.

The two sluice gates are a significant size (30 feet x 24 feet), and are operated twice daily on rising tides under normal operating conditions to support Tidal Generating Unit operation. Under heavy storm run-in conditions, the sluice gates are operated on ebb tides to facilitate the movement of Annapolis River flow through the causeway and to the Bay of Fundy.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

Depreciation Class: Annapolis Hydro System

Estimated Useful Life: 25 years

JUSTIFICATION:

Justification Criteria: Health & Safety

Sub Criteria: Maintenance

Why do this project?

The superstructure steel exists in a corrosive marine environment where structural steel must maintain an effective protective coating or will be subjected to accelerated corrosive deterioration associated with chloride exposure and oxidation. The existing protective coating has deteriorated and is no longer able to effectively protect the support superstructure and its elements. Sluice gate hoisting equipment also requires replacement due to age and condition. If the gates become inoperable due to failures of components in the superstructure, operation of the tidal generating unit will be interrupted and private properties upstream of the Annapolis Causeway would flood under storm conditions. Under heavy storm run in conditions the entire causeway and the powerhouse located therein could be endangered.

Why do this project now?

Protective coatings previously applied to the Annapolis Sluice Gates steel superstructure have deteriorated and no longer form a protective barrier between unprotected steel and corrosive chlorides and oxygen found in abundance in this environment. At present, the bulk of the superstructure can be rehabilitated and recoated to remain in service.

In some areas, the base metal is exposed to the elements and is corroding at an accelerated rate. If the superstructure is not refurbished in a timely manner, the base metal loss will be such that major structural repairs (or complete replacement) will be required in addition to the currently envisioned scope of refurbishment.

As of 2015, generation from NS Power's legacy hydro facilities will qualify under the provisions of the Nova Scotia Renewable Electricity Regulations. Generation from hydro facilities is an important part of NS Powers compliance plan to serve 25 percent of sales from qualifying renewable generation sources.

Why do this project this way?

Refurbishment and re-application of protective coatings is industry standard for structural steel installations in a marine environment. Refurbishment will ensure that the Annapolis River sluice gates can remain in service. Replacement of the hoist equipment was chosen as these hoists are approximately 50 years old. The configuration of the sheaves causes extra wear on the hoist ropes and has a height restriction which does not allow the gates to be lifted clear of the checks with the current configuration. Replacement of the hoist equipment is the only way to eliminate these issues.

CI Number : 41139-H655 - HYD - Annapolis Sluiceway Superstructure Refurbishment **Project Number** H655

Parent CI Number : -

Cost Centre : 435 - 435-Annapolis Tidal Power **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		171,434	0	171,434
095		095-Hydro Overtime Labour AO		584	0	584
095		095-Thermal & Hydro Contracts AO		111,684	0	111,684
095		095 - Proj Supp Regular Labour AO		1,059	0	1,059
095		095-Hydro Regular Labour AO		21,082	0	21,082
001	028	001 - Regular Labour (No AO)	028 - HGP - Dams & Spillways	7,139	0	7,139
001	028	001 - HYDRO Regular Labour	028 - HGP - Dams & Spillways	79,559	0	79,559
001	028	001 - Proj Supp Regular Labour	028 - HGP - Dams & Spillways	4,050	0	4,050
002	028	002 - HYDRO Overtime Labour	028 - HGP - Dams & Spillways	5,030	0	5,030
002	028	002 - Overtime Labour (No AO)	028 - HGP - Dams & Spillways	2,193	0	2,193
011	028	011 - Travel Expense	028 - HGP - Dams & Spillways	6,172	0	6,172
012	028	012 - Materials	028 - HGP - Dams & Spillways	1,650,989	0	1,650,989
013	028	013 - POWER PRODUCTION Contracts	028 - HGP - Dams & Spillways	1,226,642	0	1,226,642
028	028	028 - Consulting	028 - HGP - Dams & Spillways	119,880	0	119,880
041	028	041 - Meals & Entertainment	028 - HGP - Dams & Spillways	2,824	0	2,824
			Total Cost:	3,410,322	0	3,410,322
			Original Cost:	761,184		

Capital Project Detailed Estimate

Location: Hydro
CI# / FP#: 41139
Title: HYD - Annapolis Sluiceway Superstructure Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Engineering	PD	104	$ 391.49	$ 40,714.56		
Hydro River Staff	PD	142	$ 352.35	$ 50,033.53		
	PD			$ -		
			Sub-Total	$ 90,748.09		
002 OT Labour						
Hydro River Staff	PD	10.25	$ 704.70	$ 7,223.15		
				$ -		
				$ -		
				$ -		
			Sub-Total	$ 7,223.15		
011 Travel Expense						
Engineering Site Visits				$ 1,372.21		
Travel to Site during Construction				$ 4,800.00		
			Sub-Total	$ 6,172.21		
012 Materials						
Structural - Hoist Superstructure		1	$ 125,500.00	$ 125,500.00	Cost Support Item 1 - Material portion of $420,000	
Structural - Spillway Gates		1	$ 113,500.00	$ 113,500.00	Cost Support Item 1 - Material portion of $380,000	
Structural - Spillway Gate Guides		1	$ 30,000.00	$ 30,000.00	Cost Support Item 1 - Material portion of $100,000	
New Hoist Equipment		1	$ 1,230,000.00	$ 1,230,000.00	Cost Support Item 1 - Material portion of $1,630,000	
Electrical - Power Upgrades		1	$ 110,000.00	$ 110,000.00	Cost Support Item 1 - Material portion of $250,000	
Electrical - Lighting Upgrades		1	$ 28,000.00	$ 28,000.00	Cost Support Item 1 - Material portion of $70,000	
Project Development cost		1	$ 13,988.54	$ 13,988.54		
				$ -		
				$ -		
			Sub-Total	$ 1,650,988.54		
013 Contracts						
Structural - Hoist Superstructure		1	$ 294,500.00	$ 294,500.00	Cost Support Item 1 - Contract portion of $420,000	
Structural - Spillway Gates		1	$ 266,500.00	$ 266,500.00	Cost Support Item 1 - Contract portion of $380,000	
Structural - Spillway Gate Guides		1	$ 70,000.00	$ 70,000.00	Cost Support Item 1 - Contract portion of $100,000	
Install Hoist Equipment		1	$ 400,000.00	$ 400,000.00	Cost Support Item 1 - Contract portion of $1,630,000	
Electrical - Power Upgrades		1	$ 140,000.00	$ 140,000.00	Cost Support Item 1 - Contract portion of $250,000	
Electrical - Lighting Upgrades		1	$ 42,000.00	$ 42,000.00	Cost Support Item 1 - Contract portion of $70,000	
Project Development cost		1	$ 13,642.46	$ 13,642.46		
				$ -		
				$ -		
			Sub-Total	$ 1,226,642.46		
028 Consulting						
Engineering / Design		1	$ 101,880.00	$ 101,880.00		
QA / QC		1	$ 18,000.00	$ 18,000.00		
				$ -		
			Sub-Total	$ 119,880.00		
041 Meals & Entertainment						
Meals during Developmental Trips				$ 424.40		
Meals during Construction				$ 2,400.00		
			Sub-Total	$ 2,824.40		
094 Interest Capitalized						
AFUDC				$ 171,434.25		
				$ -		
			Sub-Total	$ 171,434.25		
095 Administrative Overhead						
Hydro Reg. Labour AO				$ 21,081.52		
Project Support Labour AO				$ 1,059.37		
Hydro OT Labour AO				$ 584.02		
Thermal / Hydro Contracts AO				$ 111,684.46		
			Sub-Total	$ 134,409.37		
			SUB-TOTAL (no AO, AFUDC)	$ 3,104,478.85		
			TOTAL (AO, AFUDC included)	$ 3,410,322.47		
Original Cost				$761,184.27		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

3.0 SUMMARY

The following is a summary of the remedial measures for each discipline along with a total estimated project capital cost for the work in 2013 dollars. These costs are preliminary (+/- 30%) and include assumptions for engineering fees and contingency to coincide with the concept level of the designs recommended. The values do not include taxes, NSPI administration costs, or other indirect project costs.

TABLE 4
SUMMARY OF PRELIMINARY TOTAL ESTIMATED PROJECT COSTS

Option	Discipline	Item	Estimated Costs (Preliminary)
Option 1	Structural	Hoist Superstructure	$420,000
		Spillway Gates	$380,000
		Spillway Gate Guides	$100,000
	Mechanical	Install New Hoist Equipment	$1,630,000
	Electrical	Power Upgrades	$250,000
		Lighting Upgrades	$70,000
Option 1 – Total Remedial Costs			**$2,850,000**
Option 2	Structural	Hoist Superstructure	$420,000
		Spillway Gates	$380,000
		Spillway Gate Guides	$100,000
	Mechanical	Hoist Modifications / Upgrades	$820,000
	Electrical	Power Upgrades	$250,000
		Lighting Upgrades	$70,000
Option 2 – Total Remedial Costs			**$2,040,000**

Nova Scotia POWER
An Emera Company

Annapolis Sluiceway Conceptual Design

FINAL REPORT
October 2013
KGS Group 13-2242-001

Prepared By

Shaun Beatty, P.Eng.
Senior Structural Engineer

Approved By

Gordon McPhail, P.Eng.
Manager, Hydrotechnical Services

KGS GROUP CONSULTING ENGINEERS

Stantec

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EXECUTIVE SUMMARY

The objective of this study is to conduct a site investigation and undertake the conceptual design and capital cost estimate of alternatives to address our inspection results along with the findings in the 2009 condition assessment and design adequacy study of the sluice gate facility. Our assessment covers structural, mechanical and electrical aspects relating to the sluice gate equipment. Aspects relating to the concrete structures are not part of this assessment.

KGS Group reviewed the findings of previous assessments and incorporated those findings with our observations in determining a set of recommended rehabilitation and upgrade measures at the site. Conceptual designs for the recommended measures are presented along with capital costs estimates. A proposed work staging plan and schedule is also provided.

Rehabilitation work recommended in this report addresses issues with the sluice gate guides, minor structural deficiencies with the gate hoist support structure, fall-protection for maintenance personnel, mechanical hoist deficiencies, and electrical deficiencies with power, cabling, controls and lighting. Two options are presented for addressing the mechanical deficiencies with the hoists. The total estimated capital construction cost for the proposed (Option 1) rehabilitation concepts (direct expenses only) is approximately $2.85 million, not including taxes. The construction is proposed to be phased over a two year period with one gate / sluice bay rehabilitated in each year.

1.0 INTRODUCTION

1.1 STUDY OBJECTIVES

Nova Scotia Power Inc. (NSPI) owns and operates the Annapolis Hydro System which is located in the south end of Nova Scotia, approximately 150 km west of Halifax near the town of Annapolis Royal. The Annapolis Hydro Station is comprised of one horizontal bulb type tidal unit capable of producing 17MW that was commissioned in 1984. The upstream estuarial section of the Annapolis River serves as the headpond for the plant with water controlled via the sluice gates to recharge the headpond or to release water as may be required for the plant operation.

Figure 1 – Site Location

The sluiceway pre-dates the generating station by several decades. In the 1950's the original 700 metre (2300 feet) long porous rock-fill Annapolis River Causeway (barrage) was constructed as a means for controlling the upstream and downstream flows of the Annapolis River and to thereby offer some protection from flooding of farmland. As a secondary benefit a roadway across the causeway provided a permanent link between the town of Annapolis Royal and Granville Ferry, replacing an old bridge structure (Refer to Photo 1 below). The causeway utilized two 30 ft. wide X 24 ft. high vertical steel roller gates (Refer to Photo 2 below) to control the main river flows through the causeway. The sluiceway incorporated an integral fish passage to permit migrating species passage to and from the river estuary. The sluiceway underwent modifications and refurbishment when the tidal plant was constructed in the 1980's.

Photo 1 – Arial View of Annapolis Causeway

Photo 2 – Annapolis Sluiceway Gates and Superstructure

A condition assessment and design adequacy study was conducted in 2009 and it was determined that the superstructure and controls at the sluiceway gates were in need of refurbishment and upgrade.

The objective of this study is to conduct site investigations and undertake the conceptual design and capital cost estimate of alternatives to address the inspection results and the findings in the 2009 condition assessment and design adequacy study of the sluice gate facility. The project tasks are as follows:

- Site assessment of the structural, mechanical and electrical components of the Annapolis Sluiceway
- Conceptual design of recommended structural modifications to the steel superstructure, and embedded parts for the sluice gates and stoplogs
- Conceptual design of modifications to the sluice gates (excluding stoplogs)

- Conceptual design of an emergency power supply for the sluice gates
- Conceptual design of a mechanical back-up operator for the sluice gates (in the event of hoist failure)
- Conceptual design of lighting and service receptacle upgrades to the sluice gate superstructure
- Conceptual design of new control and monitoring system to the sluices
- Review of the existing power supply and conceptual design of a recommended new power supply, including redundancy to the sluice structure (MCC's, distribution panels, transfer switches, etc.)
- Conceptual design of recommended modifications to the hoists, hoist controls, and hoist braking system
- Development of a staged implementation strategy for the refurbishment program
- Development of a capital cost estimate (+/- 30%) and schedule for a staged refurbishment program

1.2 BACKGROUND INFORMATION

NSPI provided drawings, past study results, and other background information for the Annapolis Sluiceway. Selected information is summarized below.

1.2.1 Condition and Design Adequacy Assessment (Hatch, 2010)

Hatch conducted site investigations in June 2009, and finalized their assessment report in August 2010. Recommendations included:

General

1. Evaluate and develop critical spare parts list for items that must be stocked on site.
2. Bring drawings for the facility to an as-built status.
3. Investigate the addition of a power take-off arrangement as an alternative drive and emergency power source.
4. Investigate the feasibility of installing a third sluice gate.

Electrical

1. Replace cable tray along roadway.
2. Service and/or replace exterior light fixtures.
3. Install exterior receptacles for tools and portable pump(s).
4. Replace obsolete PLC and remote I/O.
5. Upgrade the control and monitoring platform at the generating plant to eliminate all DOS based software.
6. Replace gate raise/lower reversing starters in MCC.
7. Complete IR scan of MCC and power distribution equipment (Test must be completed while equipment is under load).
8. Reroute and secure cables at top of superstructure.
9. Repair cables that are pulled from junction boxes. (rotary limit on Gate #1).
10. Install accurate labels on equipment and power distribution equipment.
11. Develop multiyear plan to replace MCC's, distribution panels and Robonic transfer switch.

Mechanical

1. Hoist brake upgrade per Geocon (if not done).
2. Clean and repaint gates.
3. Replace lost/eroded anodes.
4. Repair cracked welds on gates.
5. Extend skinplate at bottom seal to tidal side flange of bottom horizontal girder.
6. Replace gate seals.
7. Replace hoist ropes if > 2 years old.
8. Investigate addition of fan brake to hoist drive train.
9. Investigate new side rollers – low friction, spring loaded.
10. Install a jib crane on the top of the superstructure for parts handling.
11. Install load cell for hoist load monitoring.
12. Investigate addition of auto gate position measurement.
13. Investigate addition of inclinometer for rope balancing.

14. Investigate design of gate wheels and roller path regarding wear and tracking.

Civil/Structural – Steel Hoist Tower

1. Installed engineered attachment points for fall arrest at the top and intermediate platforms.
2. Cleaning, priming and painting of the entire structure.
3. Repair corroded portions of stiffener plates and base plates as required.
4. Add additional drain holes in the platform steel inside the containment around the wire rope drums.
5. Replace corroded stiffener plates with new plates at the wire rope drum supports.
6. Drill holes to drain condensate from the box beams supporting the underslung sheaves.
7. Add stainless steel nuts and bolts at the supports for the end ladders and gate guide supports.
8. Repair safety cage hoops and add one safety landing at the center ladder.

Civil/Structural – Concrete Sluice Gate Facility

1. Clean exposed corroded reinforcing steel and chip & repair concrete that is spalling on the underside of the concrete walkway beam at sluice #1.
2. Drill drain holes as required, clean corroded areas and paint the entire pipe handrail around the sluice walkway with zinc-rich paint.
3. Drill drain holes as required, blast clean, prime and paint the HSS handrails/barriers at the ends of the walkways on the sluice abutments.
4. Repair cracked concrete posts with epoxy or drilled and grouted dowels on the roadway handrail adjacent to the steel hoist tower.
5. Repair as required and paint the embedded steel gains for the gate guides and the stop logs.
6. Remove standing water from the gains heater holes and fill with grout.
7. Tremie concrete repairs to fill scour holes under aprons in sluices #1 and #2.

1.2.2 Various Inspection Reports (Geocon Atlantic, 2008 & 2009)

In 2008 and 2009 Geocon inspected the sluice support structure, the gates, and the hoist equipment. As stated in the reports, recommendations included:

July 2008

- Align / adjust the hoist brake on Gate #1 and remove glaze to increase braking efficiency. Investigate a brake with a higher torque rating or governor brake for each hoist motor.
- Tighten loose bolts on all guide roller plates. Replace bent or missing bolts.
- Investigate movement of the gate support structure. Replace corroded bolts on the support structure and monitor members for corrosion.
- Replace missing or eroded anodes to maintain protection.
- Remove marine growth occasionally. Investigate the possibility of using antifouling paint the next time the gates are painted.

August 2008

- Gate and support structure require protective coating touch-up and renewal in a couple of years.
- Refurbish the gate winch bearing supports
- Tighten/replace miscellaneous bolts
- Repair gate guide channel plates
- Maintenance of anodes.

July 2009

- Repair significant structural cracking observed at welded connections to the main supporting horizontal beams/stringers of each gate.
- Replace/tighten miscellaneous bolts on the gates.

1.2.3 Reference Drawings

Reference drawings including some original construction drawings are provided in Appendix B.

2.0 CONDITION AND OPERATION ASSESSMENT

2.1 SITE INSPECTIONS

KGS Group and Stantec completed the initial site visit to the Annapolis Sluiceway on January 29th and 30th, 2013. The conditions ranged from partly cloudy on the 29th to snow and freezing rain on the 30th. A limited visual inspection was performed which covered the structural steel, mechanical and electrical equipment on the sluiceway. The findings of this inspection are discussed in the following sections.

2.2 STRUCTURAL ASSESSMENT

2.2.1 Concrete Structures

Assessment of the concrete structures was not part of the scope of work for this study. However, during our site inspection we did observe some minor condition issues with the concrete, in particular, light to moderate spalling adjacent to the embedded steel gate guide components. The spalling ranged in size from ½" to 4" deep in the upper visible portions of the gate guides, primarily adjacent to the embedded side guide roller path, as could be observed from the spillway deck level (Refer to Photo 3 below).

A review of underwater inspection video provided to KGS Group (dated around 2009 according to NSPI) did not reveal any additional deficiencies with the concrete. However, this video did not cover both water passages in their entirety. The video did show a fair amount of steel debris on the surface of the concrete rollway/apron slab that included old materials that were removed or had fallen off of the spillway gate such as an original side roller assembly and remnants of cathodic protection anodes.

Photo 3 – Gate Guide Side Roller Path

Recommendations

- Plan to conduct repairs to the spalled concrete adjacent to the embedded steel gate guide components in the medium term (5 years) to help ensure the long-term performance of the embedded parts.
- Remove steel debris on apron slab that could migrate under the spillway gate and prevent proper closure.

2.2.2 Superstructure

Description

The spillway gate hoist superstructure consists of a steel bridge spanning two water passages and supported on braced steel towers (Refer to Photo 1). The hoist equipment is supported on the bridge and covered with small removable enclosures. The hoist bridge is accessed by vertical ladder at the center tower which is equipped with a recently-installed vertical fall-arrest lifeline. The original cage for the ladder was removed. Each end tower has a vertical ladder to access a maintenance platform where the upper sheaves of the spillway gate are accessed when in the raised position. These ladders are also equipped with vertical lifelines for fall protection. The top of the bridge is 10 meters (33 feet) above the concrete deck level.

The steel superstructure has undergone some modifications over the last decade including reinforced (enlarged) tower base plates and additional galvanized anchors, repairs/changes to wire-rope drum-supporting box beams on the bridge, stiffening of some drum support stiffeners, changes to the upper sheave block support arrangement (now suspended beneath the bridge girders), and changes to the ladders as already described.

Inspection and Assessment Findings

KGS Group visually assessed the condition of the steel superstructure and identified several aspects that warrant attention as outlined below. A structural assessment of the steel superstructure was not performed by KGS Group as this was not part of the scope of work. A structural assessment was performed in 2010 by Hatch, of which the findings were outlined in Section 1.2.1.

The tower base plates and visible portions of the anchor bolts were found to be in relatively good condition with minor corrosion along the edges of some stiffeners. The original anchor bolts were covered in heavy layers of paint. Sample chipping and scraping indicated minimal corrosion of these anchors. There is a substantial amount of corrosion staining on the base plates and lower parts of the tower steel, typically running down from above. The existing epoxy coating is in need of full replacement and a detailed inspection of the anchors and towers should be performed after sand-blasting to verify the condition.

The remainder of the coating on the towers and bridge had distributed defects ranging from minor to severe. It is reported that protective coating applications in the past were not done under proper conditions. The steel exhibited minor surface corrosion along edges of bracing members, stiffeners and around the suspended upper sheave structure. Based on the extent and distribution of the coating issues and corrosion, a full protective coating replacement appears appropriate. Many of the connection bolts exhibit minor to moderate surface corrosion and a substantial amount of corrosion staining indicates that the inside surfaces of the bolt holes are corroding as well. Bolts should be replaced with galvanized bolts when the tower is re-coated and the bolt holes should be cleaned and painted at the same time.

The L-shaped ladder-support brackets on each end tower are severely corroded and in need of full or partial replacement (see Photo 4 below). Replacement with new galvanized components is likely more economical than salvaging and painting the existing components. These are bolted to the tower columns and will be relatively easy to replace.

Photo 4 – L-Shaped End Tower Ladder Support Brackets

Two out of the eight drum-support box beams that span between the main bridge girders beneath the floor plate have been replaced in recent years with wide-flange beams and channels. This is reportedly because of damage due to infiltration and freezing of water and condensation. Our visual inspection indicated that the remaining box beams appear to be in good condition. The box beam shape is preferable due to ease of painting, continuous sealed welds, and lack of pockets or ledges for dirt and salt water to collect. However, keeping the box beams watertight will be essential to maintaining their condition. Upon cleaning and sand-blasting of the bridge floor plate, a detailed inspection for potential points of water penetration should be conducted and any openings sealed with weld. Drilling drain holes in the underside of the box beams could be considered, but this can expose the interior of the beams to the elements and internal condition inspection will be difficult and have limitations.

The drum supports (structural stands above the floor) have stiffener plates (refer to Photo 5 below). Several of the stiffeners directly below the center of the drum have been reinforced in the past with additional plates. There did not appear to be evidence of prior damage or corrosion and not all center stiffeners have been reinforced, so it is not clear why this was done. One of the drum supports has received new HSS stiffeners and this was clearly done to accommodate the new wide flange support beam beneath which was installed to replace the damaged box beam. The condition of the stiffeners appears to be good, but the floor plate around the base is corroded in places and the welds may require repair. The extent of such repair would need to be confirmed after sand-blasting during the coating replacement.

Photo 5 – Reinforced Rope Drum Support Stiffeners

The checkered floor plate on the bridge is generally in good condition with the exception of the areas inside the wire-rope drum covers. There is a substantial amount of dirt, grease and debris on the floor, several holes cut through the floor and evidence of moderate to severe corrosion in localized areas around the openings and around the stiffened drum supports/stands. It would appear that the wire rope drips salt water into this area when it is wrapped on the drum (gate raised) and this water does not properly drain out (flat floor). Much of this problem could be corrected by adding a stainless steel sloped drip pan under the drum that drains the water back out through the existing rope slot in the floor.

A review of the access requirements for maintenance personnel indicated that the existing ladders with the vertical lifelines are adequate. It is understood that the top platform within the center tower (below the bridge) is accessed fairly routinely to perform maintenance at the top of a raised spillway gate (such as replacing a wire rope). Access onto this platform from the vertical ladder was awkward and there were no proper fall-arrest connections for workers on this platform. Therefore a modification to improve work safety on this platform is proposed.

Recommendations

- Clean, blast and apply complete new protective coating on the bridge, towers, and hoist covers. Heat and hoard around the tower for one spillway gate at a time. The hoist covers should be removed and could be painted under hoarding at deck level or taken to a shop. Replace corroded bolts with galvanized bolts throughout and in the process, clean and recoat the bolt holes. A detailed inspection of the structure should be conducted throughout with particular attention around the tower anchors and the floor plate around the wire-rope drums to confirm if any repairs to welds or leaks (into the box beams) are required.

- Evaluate the drum support stands and confirm if the existing stiffeners are adequate for the applied design loads from the drum. Re-inspect welds to the floor plate after cleaning and sand-blasting including performing NDE inspection.

- Inspect floor plate and box-beams for leaks after cleaning and sandblasting and seal any leaks with weld prior to re-coating.

- Replace all L-shaped ladder support brackets on the end towers with new galvanized parts. The design of the parts should be verified as well to ensure they are code compliant. It is anticipated that this would be more economical than salvaging and repainting the existing brackets, while limiting the amount of time the ladders would be out of service.

- Install a horizontal fall-arrest lifeline overhead of the top maintenance platform on the center tower. This lifeline would be designed with two attachment points so two workers can access the platform at one time. The attachment points can move along the lifeline providing mobility, and can be moved near the ladder for safe and easy access to and from the vertical ladder. Refer to Figure 2 for a sketch of the proposed arrangement.

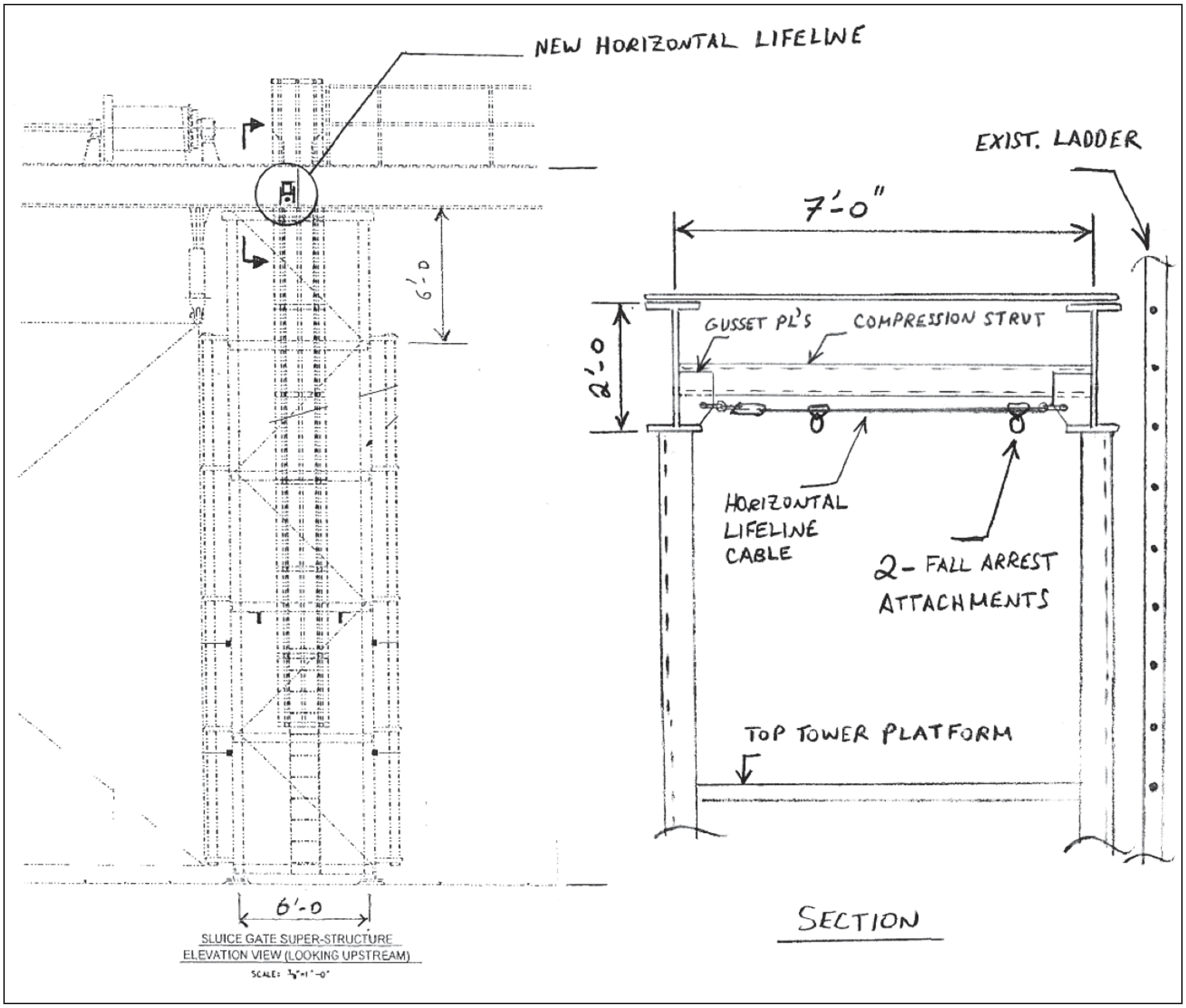


Figure 2 – Proposed Fall Protection Upgrade

2.2.3 Sluice Gates

Description

There are two identical vertical-lift spillway gates that consist of rigid structural steel frames with a skin plate on the reservoir side and two lift points, one above each end girder. The gates are 7.47 m (24.5 ft) high by approximately 9.75 m (32 ft) wide. Each gate has a total of ten cast-iron main rollers that have been refurbished in the last decade. The upstream and downstream faces of the gates have sacrificial zinc anodes attached that continue to be replaced on a regular basis by NSPI maintenance personnel. There are also 'mushroom' shaped sacrificial zinc anodes placed inside the gate end girders (wheel boxes).

The original gates had small side rollers positioned at the top and bottom corners of the gate body, but these rollers were replaced with bumpers in the 1980s. The gates have undergone other modifications over the years including refurbishment of the main roller assemblies, end girder stiffening and replacement of the gate seals. The current seals consist of double-bulb rubber side seals and lintel seal attached to the skin plate on the reservoir side of the gate. A rectangular rubber seal runs along the bottom of the gate body.

The gates have reportedly undergone severe impacts with the sill beam in the past due to closing at a high rate of speed (due to rope break or solenoid brake release). Cracked welds along several lower structural members were identified in previous inspections and these welds have reportedly been repaired.

Inspection and Assessment Findings

The gate body appears to be in good condition with no significant signs of corrosion indicating that the cathodic protection system is functioning well. The surface of the gate was coated in a thin film of dirt and organic material (see Photo 6 below). The protective coating on the gate appears to be in need of replacement in the short to medium term.

Photo 6 – Spillway Gate #2 Lintel Seal

KGS Group has not been able to confirm if the cracked welds on the lower gate structure have been repaired, but in the absence of confirmation with a non-destructive inspection report this can only be properly verified by an inspection after sand-blasting and prior to re-application of the protective coating.

The hardness of the main rollers was tested and found to be around 350 BHN (nominal) which is adequate and there were no visible signs of distress or wear.

The side bumpers were in good shape. The embedded steel contact plate/channel in the guides is heavily pitted and has a rough surface. There is a concern that the friction between the bumpers and this embedded plate could be high when there is contact during gate operation. Side rollers would reduce this friction considerably and reduce the risk of the gate binding in the guides. Refacing the bumpers with ultra-high molecular weight (UHMW) plastic to reduce friction is anticipated to be less effective than new side rollers due to the depth and extent of pitting on the embedded guide surface.

The lintel seal across the top of Sluice Gate #2 (south) is in very poor shape and is partially torn off of the gate (see Photo 6). It appears that the double-bulb seal has folded over due to high interference contact with the embedded steel lintel plate. Also, the double-bulb design does not have adequate rigidity to prevent this type of problem. A double stem clamped bulb (as shown in Figure 3) is typically used for this type of seal to overcome this inherent concern. The condition of the lintel seal on Gate #1 is considerably better, but it has been replaced recently. The drawings from the 1980's indicate that PTFE was specified to improve durability and reduce friction, but the current seals do not have PTFE cladding. The higher friction value will further contribute to the fold-over problem exhibited. Any replacement seal should be clad with PTFE or polyurethane. Brass cladding is also an option.

The gates exhibit difficulty in closing over the last 6 to 12 inches of travel as will be discussed in the mechanical section of this report. As a result, NSPI operators typically do not fully close the gates. The problems with the lintel seal could potentially be causing these operational issues. Since no other causes have been identified at this point, this appears to be the likely problem. A tight interference fit between the lintel seal and embedded lintel seal plate could also contribute to this problem. Since the gate could not be dewatered to access this area during this inspection, these tolerances and surface condition could not be confirmed, but it is recommended to confirm this prior to final design of proposed modifications.

KGS Group reviewed the potential for downpull forces on the spillway gate during operation. Downpull forces will act on the gate when there is flow under the gate with resulting reduced pressures combined with water within the open gate body. Downpull forces would be greater when there is a combination of high tides and low reservoir levels. The Hatch 2009 report identified an unusual condition during functional testing with a reported tide at 1.5 m (5 ft) higher than the reservoir side. The normal condition during operation is when both the water levels are nearly balanced. Under further review, KGS Group determined that another likely scenario would be the requirement to open the gates to spill during a high reservoir level combined with a low tide. Based on our estimates using a typical daily tidal variation of approximately 8.1 metres, the maximum normal hoist load would result from this scenario. This governing scenario would have negligible downpull forces on the gate. A scenario with downpull forces resulting from a high tide during gate operation (1.5 m differential assumed) would not govern according to our estimates. As a result, it is our opinion that there would be no real advantage to changing the gate body to reduce downpull forces and the addition of a downstream skin plate will have minimal influence on the magnitude of downpull force.

Recommendations

- Replace the gate side bumpers with new side rollers to reduce friction during contact with the side guides. Refer to Figure 3 for a sketch of the proposed change. Essentially, the rollers assembly would be similar to the original equipment. Due to changes with the bottom seals on the gates, the bottom side rollers assemblies would need to be relocated, likely pocketed into the side of the end girder. The geometry should be evaluated in more detail during detailed design to maximize the roller diameter.
- Replace the lintel seals on the spillway gates with a re-designed seal consisting of a double-stem center bulb seal as shown in the sketch on Figure 4. Reduce the seal interference from 8 mm shown on the original drawing to 5 mm and provide PTFE cladding on the bulb to improve durability and reduce friction forces. The double clamped seal and reduced interference will prevent the problem of seal fold-over currently being experienced. The clearance between the gate skin plate and the embedded lintel seal plate must be confirmed prior to final design.
- Replace the protective coating on the gate and perform detailed NDE inspection of all gate welds after sand-blasting to confirm there are no new or remaining cracked welds.

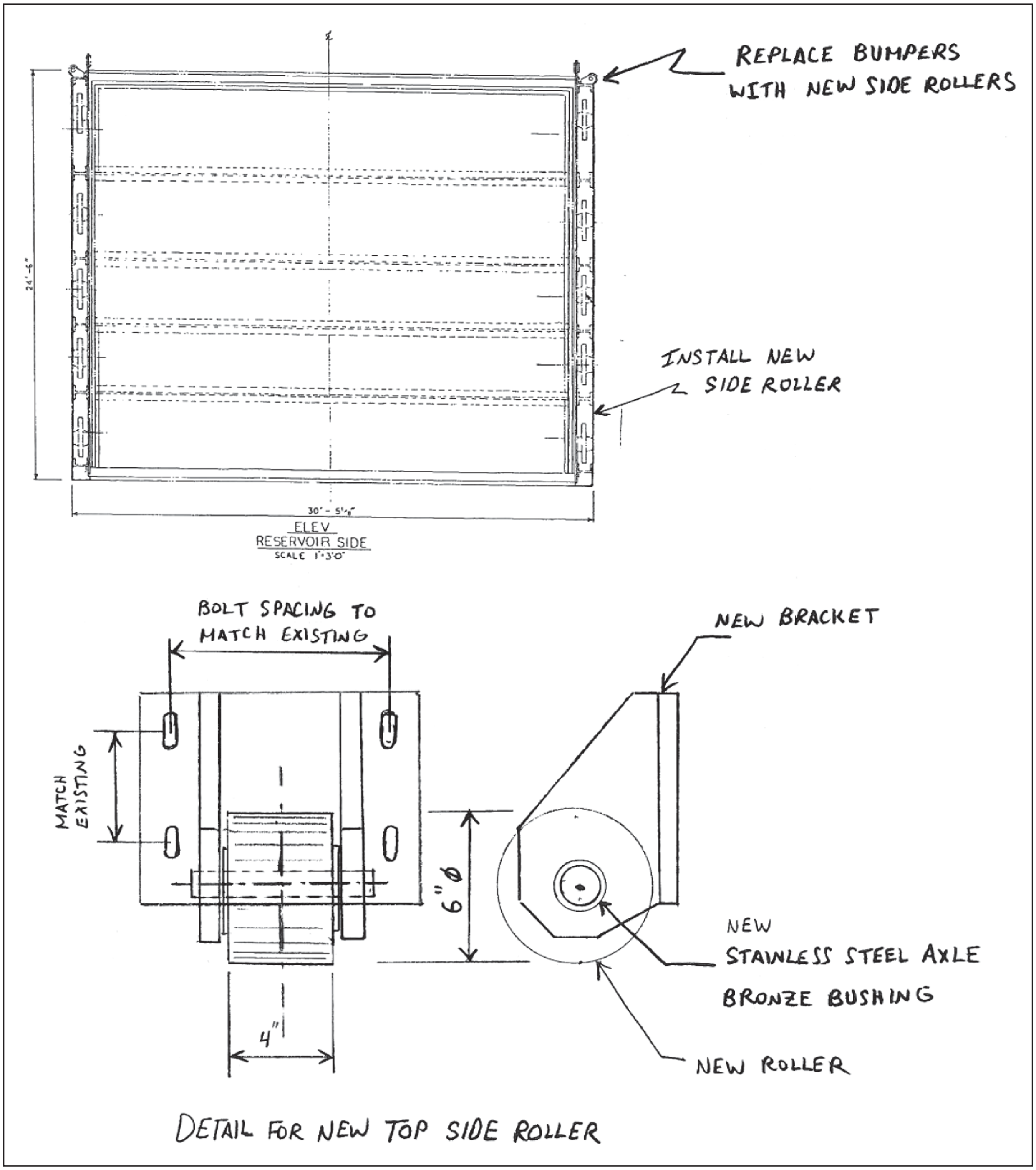


Figure 3 – Proposed New Gate Side Rollers

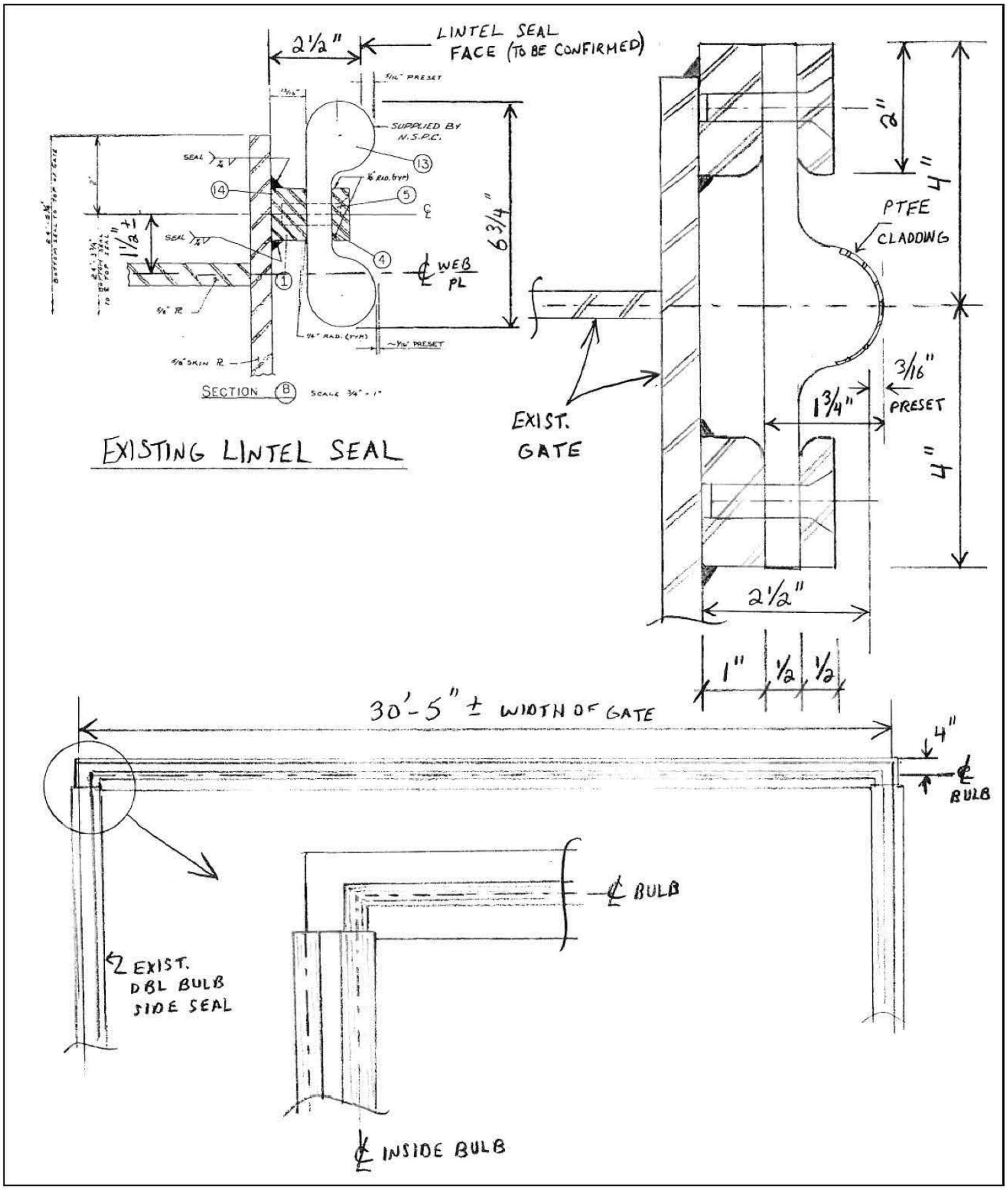


Figure 4 – Proposed Gate Seal Upgrade

2.2.4 Gate Guides and Stoplog Guides

Description

The spillway gate guides include vertical embedded steel components in the concrete piers with guide extensions attached to the steel hoist superstructure towers. There is an embedded lintel seal plate across the top of the reservoir side of the gate and a sill beam embedded in the horizontal concrete base slab of the water passage. The embedded portion of the guides is approximately 13.4 m (44 ft) in total height and the water passage width is about 9.2 metres (30 feet).

Each side of the lower portion of the embedded vertical guides, extending up from the sill to approximately 0.5 metres above the lintel, consists of a 32 mm thick x 180 mm wide (1.25" x 7") hardened carbon steel roller path and embedded wide flange beam. The upper guide above the lintel consists of an embedded channel with stiffener and a 6 mm (1/4") x 180 mm mild carbon steel overlay roller path plate. There are identical roller paths on both the upstream and downstream faces of the guides to accommodate both directions of loading depending on the tidal and reservoir water levels. The roller path plates were replaced within the last decade to accommodate the machined, refurbished gate rollers. Thicker plates were installed to make up the difference for the reduced roller diameter.

There are a set of stoplog guides on the upstream and downstream side of the spillway gate for each water passage. The upstream stoplog guides are accessed through openings in the deck of the road bridge which are normally covered by steel grating. The guides consist of steel channels embedded in the pier concrete.

Inspection and Assessment Findings

During this site visit, the stoplogs were stored off-site and the waterpassages could not be dewatered. Therefore, the gate guides were not accessible for close inspection and as a result, the findings are limited to above-water visual observations from the spillway walkway above the piers. In general, light to moderate surface corrosion was evident on the embedded steel components, with more severe corrosion and pitting near the top, particularly for the side guide roller path. There are sacrificial galvanic anodes installed up the inner corners of the gate guide checks that appear to be helping to minimize corrosion, particularly the lower portions of the guides. Not all anodes were visible but it appears that some anodes are in need of replacement. Based on our limited visual examination of the exposed embedded parts, there does not appear to be a need for major guide repairs in the short term with the exception of the upper roller paths as discussed below. The tops of the embedded side guide roller paths are deteriorated and do not have a proper taper to prevent a gate component from catching on the top edge (refer to Photo 7 below).

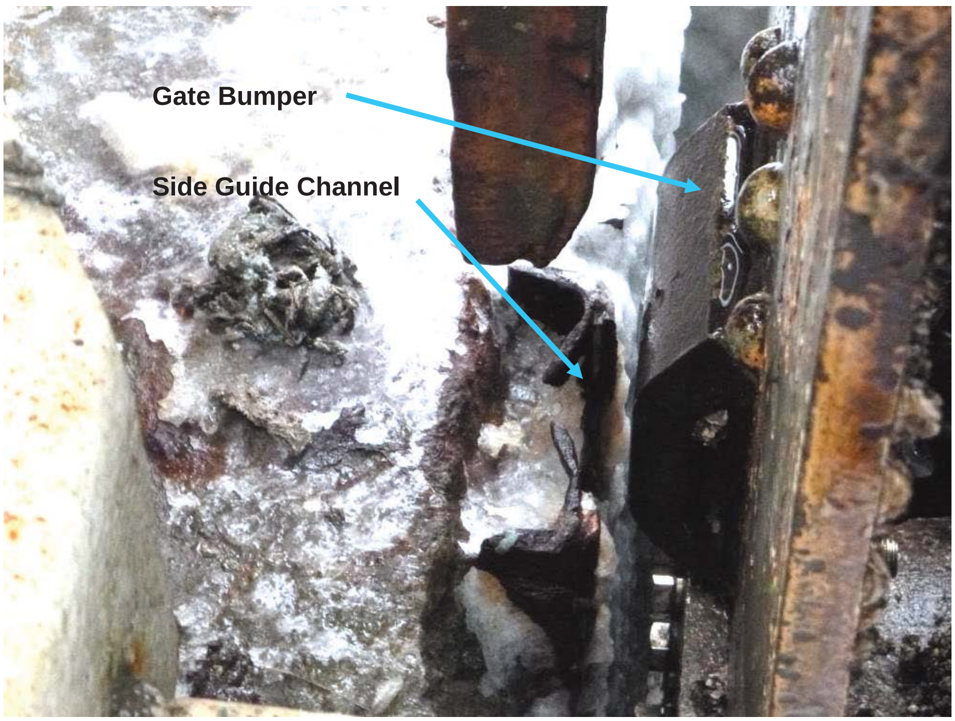


Photo 7 – Deterioration of Embedded Side Guide Roller Path Channel

Light to moderate spalling of the concrete adjacent to the embedded steel up the face of the water passage pier faces was evident along with the upper portions of the embedded side roller paths (as described previously in Section 3.2.1).

The 6 mm (¼") thick overlay plates on the upper embedded guides all exhibit plastic deformation from high roller loads on approximately the lower 1.8 m (6 ft) directly above the transition from the thick, hardened roller path to mild steel plate (refer to Photo 8). The amount of deformation into the plate is somewhat surprising as the semi-rigid gate body would not be expected to deflect enough at the top to allow such deformation. The water loads on the gate body should maintain vertical alignment of the gate body and the roller loads should be smaller at the top. It is suspected that the face of the 6 mm (¼") plate is not quite flush with the plate below and/or there may be misalignment of some rollers on the lower roller path or a combination of both causing the gate body to pivot slightly as the gate is raised which places higher loads on the top gate rollers. The mild carbon steel plates have not been able to withstand these significant roller loads without deformation.

Photo 8 – Deformation of ¼" Roller Path above Lintel (Tidal Side)

Upper portions of the 6 mm overlay plate exhibited locations with fractured or incomplete fillet welds parallel to the inner plate edge.

The roller paths were not accessible for close inspection but there were left-over sections of 1.25" x 7" hardened roller path plate in NSPI's yard which KGS Group was able to take hardness readings from. The recorded hardness of the roller path plate was approximately 375 BHN nominal which is suitable for typical design, and is compatible with the measured roller hardness. Only the upper portion of these plates was visible during our inspection, but the portion that was visible did not exhibit any signs of deformation from roller loads.

During this site visit, only limited portions of the stoplog guides were visible for inspection. Based on observations of visible portions above the waterline, the condition of the embedded steel appears fair to good with light to moderate surface corrosion evident. The condition of the concrete around the guides also appears to be in good shape. An underwater inspection video (from around 2009) provided by NSPI shows portions of the stoplog guides below the waterline. There are deposits of dirt and organic matter coating the surfaces of the guides and concrete, so the condition is not evident. However, there were no clear signs of any structural condition issues or significant spalling on the video. There is a fair amount of mussel growth on the guides that would need to be removed prior to future inspections or stoplog installation.

Recommendations

- Replace the bottom 1.8 m (6 ft) to 2.4 m (8 ft) of the 6 mm (¼") roller path plate above the lintel with 6 mm x 180 mm (¼" x 7") hardened steel plate (700QT). This should be replaced for all eight (8) locations. Refer to Figure 5 for a sketch of the proposed repair.
- Repair any broken or incomplete fillet welds on the upper portions of the 6 mm (¼") roller path plate that remain.
- Perform detailed inspection of gate guides under fully-dewatered conditions and survey the roller paths for plumb, alignment and straightness.
- Replace galvanic anodes up the gate guide checks.
- Repair the tops of the side guide roller path channels (at the top of the piers) to provide a taper to prevent any parts of the gate from catching on the edge.
- Clean off the mussel growth and organic matter on the stoplog guides to allow proper stoplog installation and in the short term, plan an inspection of the stoplog guides above and below the waterline.

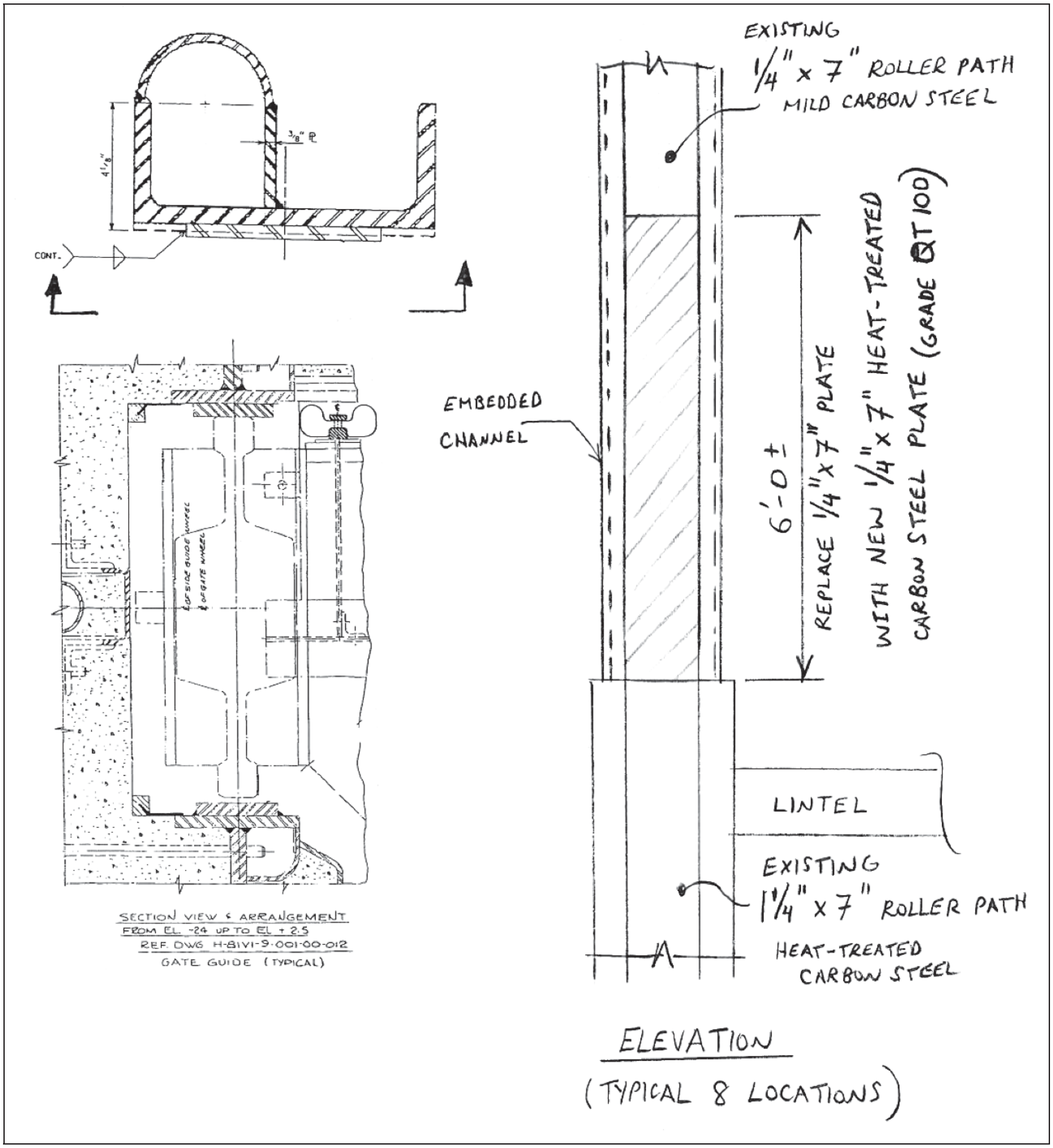


Figure 5 – Proposed Gate Guide Repairs

2.2.5 Structural Assessment Estimated Probable Capital Costs for Repairs

The estimated costs provided below are preliminary (+/- 30%) and include assumptions for engineering fees and contingency. A contingency of approximately 25% has been assumed for the structural work items to account for the fact that these are concepts, the guides have not received a full detailed examination, and to provide an allowance for unidentified unknowns. The values in the table do not include taxes, NSPI administration costs, or other indirect project costs. Refer to Appendix H for the estimated cost breakdown for material and equipment, labour and engineering to address each deficiency.

TABLE 1
SUMMARY OF CIVIL / STRUCTURAL DEFICIENCIES AND PRELIMINARY ESTIMATED COSTS FOR REPAIRS

Deficiency	Description	Proposed Remedial Measure	Estimated Cost (Preliminary)
Superstructure protective coating	Entire hoist superstructure requires new coating, replace corroded bolts	Heat, hoard, clean, sand-blast, repaint entire structure (one water passage at a time.	$360,000
Corroded welds, floor plate on hoist bridge	Floor plate around rope drum supports is corroded. Extent to be confirmed.	Assume allowance for repairing a portion of the welds and sealing any holes in floor.	$23,000
Corroded L-shaped ladder brackets	Brackets supporting vertical ladders on end towers are severely corroded.	Replace 8 brackets with new galvanized components	$15,000
Lack of fall protection on upper platform of center tower	No safe fall-arrest device for accessing platform from ladder or work working on platform	Install overhead horizontal lifeline with two attachments to accommodate two workers on platform	$20,000
Gate side bumper friction	Corroded side roller path is corroded leading to high friction contact with bumpers	Replace bumpers / install new side rollers on both gates (8 assemblies required)	$40,000
Gate side guide roller path	Top edge at top of pier is deteriorated and lacks a tapered edge.	Repair the top edges of the side guide roller paths.	$12,000

Deficiency	Description	Proposed Remedial Measure	Estimated Cost (Preliminary)
Gate lintel seal damage	Double-bulb lintel seal is prone to roll-over and binding	Redesign and replace lintel seal on both gates to be double-stem (center bulb).	$90,000
Gate protective coating	Protective coating on both gates requires complete replacement	Heat, hoard, clean, sand-blast, repaint entire gate (x2).	$255,000 (Hoarding costs included with superstructure painting above)
Deformed ¼" upper roller path overlay	¼" x 7" x 6 feet sections are deformed and other locations have fractured welds. Same for 8 guide locations	Replace deformed sections of plate and repair welds on remaining length (8 locations typical).	$85,000
Sub-total for Structural			**$900,000**

2.3 MECHANICAL ASSESSMENT

On-site evaluation of the Annapolis Sluiceway Gate Hoists has revealed a variety of problems with the arrangement of the current hoist equipment. Due to prior modifications to the upper sheaves, both gates can no longer be fully raised to the maintenance position. This prevents sufficient access to the lower edges of the gates for maintenance of the sill seals. Furthermore, there are currently no fan brakes installed on the drive assembly and there is reported corrosion within the main drum brakes. Lastly, an analysis of the loads on the gearboxes has determined that they are undersized for the application at hand.

The following mechanical assessment addresses each of these mechanical deficiencies or limitations individually. The last sections of this mechanical assessment present the repair or replacement options available to Nova Scotia Power.

The sluiceway gate hoists are double-drum, wire rope hoists that are comprised of 250 lb-ft Witton Kramer Perigrip Brakes connected to 20 HP, 1150 rpm Brook-Crompton-Parkinson electric motors. The electric motor is coupled to a Falk Ultramax concentric gear drive with a ratio of 1:31.08. The gear drive output shaft is equipped with a 16 tooth pinion driving a 46 tooth gear located on the main drum drive shaft. The main drum drive shaft rotates 18 tooth drum pinions on either side of the drive unit, which in turn drives the 69 tooth drum gears to rotate the Ø26" drums to raise/lower the gate hoists.

The facility has experienced hoist wire rope failures in the past and a rope replacement program with a 2 year interval has been implemented. Furthermore, due to mechanical failures over the years, much of the sluiceway gate hoist assemblies have been modified from the original design with little documentation. The gearboxes, hoist drums, hoist sheaves and rope sizes have been changed. It is assumed that at least one of the brake assemblies has been changed as the brake arrangement is not the same on both hoists.

2.3.1 Hoist Fan Brake Assessment

Description

Best modern practice for vertical lift gate hoists is for the assembly to be equipped with a fan brake (otherwise known as a power absorption fan). In the event of a mechanical/electrical failure, the fan brake regulates the rate of descent of a load (sluiceway gate) by using air to absorb the power of the descending load.

Inspection and Assessment Findings

The existing sluiceway gate hoist assemblies currently do not have fan brakes connected to the hoist drive train, although site inspection evidence and anecdotal accounts indicate that fan brakes were installed at one time (Refer to Photos 9 & 10 below). Therefore, the gates cannot be safely lowered under emergency conditions with loss of power.

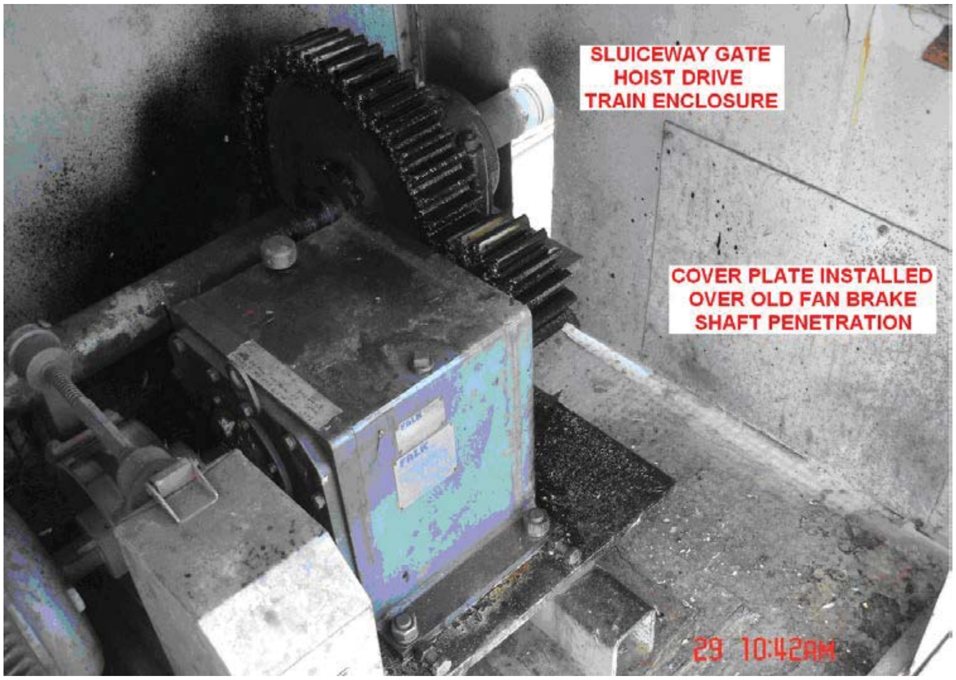


Photo 9 – Interior of Sluiceway Gate Hoist Drive Train Enclosure

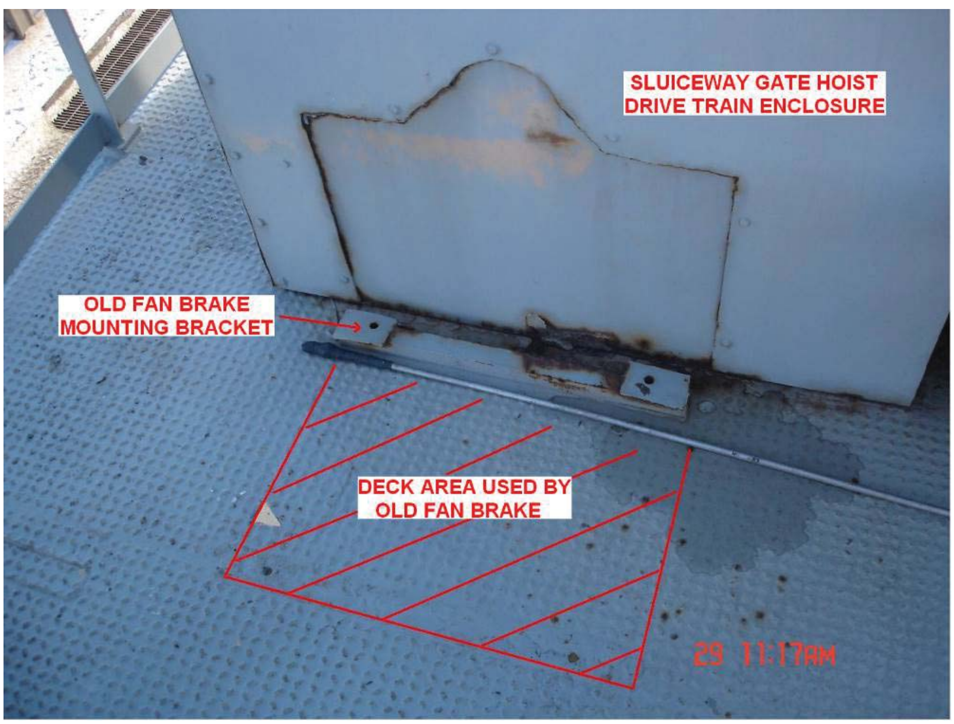


Photo 10 – Exterior of Sluiceway Gate Hoist Drive Train Enclosure

Recommendations

- Add fan brakes to the two sluiceway gate hoist drive trains. In order for the fan brakes to operate effectively, they have to be driven at speeds that are on the order of the motor RPM. Based on the current arrangement of the equipment, this would require the fan brakes to be connected to the back of the hoist motors. All other possible connection points on the drive train are too slow.

2.3.2 Hoist Gear Box Assessment

Description

Based on the OEM nameplates on both hoist gear boxes, the gear boxes are Model 2070FC2A-31.08 Falk Ultramax gear drives which were manufactured in 1997 and 1999. Anecdotal accounts by Nova Scotia Power staff indicate that at one time, both wire ropes on one gate hoist failed, and in the process, destroyed the gear box.

Inspection and Assessment Findings

The gear boxes are configured with the input (high speed) shaft and the output (low speed) shaft in a concentric arrangement with a ratio of 1:31.08. Further review of the selection information indicates that the power ratings of the gear boxes are suitable for the application due to the short intermittent use. However, review of the Overhung Load (OHL) calculations for this application has revealed a deficiency. The allowable overhung load for the model 2070 gear drives is 8,500 lbs. Based on the motor horsepower, load connection factor, load location factor, pitch diameter of the low speed side pinion and output shaft RPM, the current process creates an OHL value of 11,124 lbs which is 23.6% over the 8,500 lbs rating. Please refer to the Appendix C for detailed calculations of the OHL that were carried out in accordance with the typical manufacturer's published literature. This information was communicated with the gear box manufacturer and confirmed to be deficient. Based on this information, the OEM supplier has recommended increasing the size of the gear boxes to a larger capacity model (Model 2080FC2A-31.08). Keeping all other variables the same, a Model 2080FC2A-31.08 gear box would have an OHL value within the manufacturer's recommendations.

Recommendations

- Replace the model 2070FC2A-31.08 Falk Ultramax gear boxes with model 2080FC2A-31.08 Falk Ultramax gear boxes.

2.3.3 Hoist Motor Brake Assessment

Description

Based on the OEM nameplates, the motor brakes are Perigrip Magnetic Drum Brakes, type ACP 10, calibrated for 250 lb-ft of torque braking force and rated for continuous operation (90°C). One is manufactured by Witton Kramer while the other is manufactured by Associated Electrical Industries Canada Ltd.

Inspection and Assessment Findings

One of the two Perigrip brakes for the sluiceway gate hoist assemblies is located between the electric motor and the gear box, while the other hoist has the brake mounted to the back side of the electric motor (Refer to Photos 11 & 12 below) and there is a flex coupling between the motor and gear box.

Photo 11 – Perigrip Brake on the Front Side of the Hoist Motor

Photo 12 – Perigrip Brake on the Back Side of the Hoist Motor

As per CMAA 70, hoist holding brakes shall have a minimum torque rating of 125% when used with a control braking means other than mechanical (Normal controlled braking is through the electric motor as regenerative braking). The rated hoisting load torque at the motor shaft/perigrip brake is calculated to be 54.9 lb-ft. Please refer to Appendix D for detailed calculations of the hoisting load torque. In accordance with CMAA 70 section 4.9.1.2., 125% of a 54.9 lb-ft torque load is 68.63 lb-ft. Thus the capacity of the Perigrip brake is adequate.

However, information from the Geocon Atlantic report of 2008 (ANN-SG-G-RP-2008-35, July 3, 2008) indicates that the Perigrip brake on gate #1 was very close to slipping, that the drum is glazed and one of the shoes are not adjusted properly. Furthermore, information from the Hatch report of 2010 (H333026, Rev. 0, August 26, 2010) indicates that the internals of the #1 hoist brake show significant corrosion due to moisture ingression and condensation.

Based on the information presented above, the existing Perigrip brakes are deemed to have adequate capacity. However, due to the condition of the brakes (as brought up in the 2008 Geocon Atlantic and 2010 Hatch reports) the Perigrip brakes require servicing and/or replacement depending on the extent of the internal corrosion. This work should be done as soon as possible.

Recommendations

- Service and/or replace the Perigrip Brakes (depending on the extent of the internal corrosion) as soon as possible.

2.3.4 Wire Rope Assessment

Description

Hoist rope failure has been a problem at this site in the past and anecdotal information is that the facility has instituted a rope replacement program with a 2 year interval. Information from a copy of a purchase order to a local wire rope supplier in Nova Scotia indicates that the wire rope recently purchased is Ø1" 6x26WS galvanized EIPS, IWRC, RRL wire rope with a minimum breaking force of 103,500 lbs.

Inspection and Assessment Findings

Communication with the wire rope supplier has indicated that this is a general purpose rope and while it meets the load capacity requirements of the application (as shown in Appendix E below), it would be possible to replace this rope with a more suitable “crane grade” rope that would provide improved service life. Furthermore, the rope supplier stated that although the 6x26 wire rope has good resistance to wear, a 6x36 wire rope might be the better selection due to the 6x36’s improved flexibility characteristics.

It must be further noted that pictures from the recent site visit indicate that the current wire ropes installed on the hoist are Ø1” 6x36 based on views their cross-section construction.

CMAA 70 indicates that for hoisting ropes, the rated capacity load plus the load block weight divided by the number of parts of rope shall not exceed 20% of the published breaking strength (PBS) of the rope. Please refer to Appendix E for detailed calculations of the rated capacity of the ropes. Therefore as illustrated by the calculations, the Ø1” 6x26WS galvanized EIPS, IWRC, RRL general purpose wire rope is within the design criteria for the application.

A second aspect that was investigated that influences the service life of wire ropes is the Rope Fleet Angle. CMAA 70 states that the rope fleet angle for machined steel drums should be limited to 1 in 14 slope (4°), and the rope fleet angle for sheaves should be limited to 1 in 12 slope (4°45’ or 4.75°). See Figures 6 & 7 below.

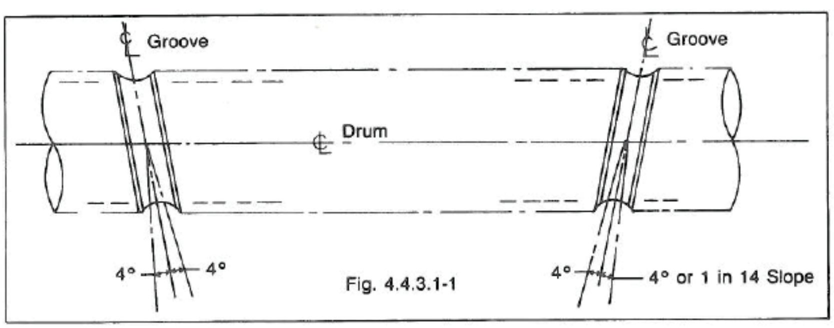


Figure 6 – Machined Drum Fleet Angle

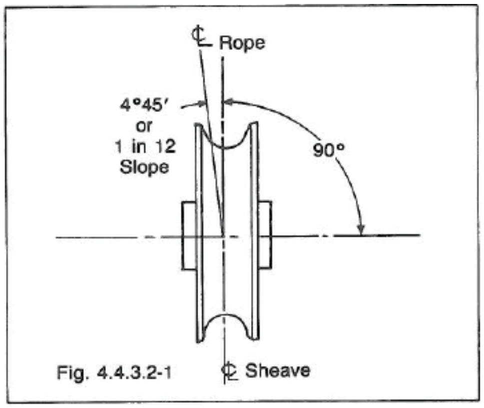


Figure 7 – Sheave Fleet Angle

Contrary to CMAA 70 above, information published by some wire rope manufacturers states that fleet angles should not exceed 1.5° for smooth drums or 2° for grooved drums to prevent wire rope scuffing.

Based on dimensional information and elevations requested from, and provided by Nova Scotia Power staff, the calculated fleet angle of the wire ropes between the drums and the lead sheaves connected to the top of the sluiceway gates is 2.47°.

Thus, the fleet angle on the wire ropes due to the current configuration is marginally greater than what is recommended by wire rope manufacturer's, but is well within the limits as specified by CMAA 70, and is therefore acceptable although it may be influencing the service life of the wire ropes.

Further to the issues discussed above, a third aspect that could have a serious effect on the service life of the wire ropes is racking of the gates. The current dual rope arrangement has no equalizer sheave between the two lifting points to balance the load between the two ropes. If the ropes are misadjusted, more load is being transferred to one rope than other, thereby increasing the stress on that rope. This unequal lifting force could lead to racking the gate within its guides (further increasing the load) and this could accelerate wear and eventual breaking of the ropes.

To assist with the proper adjustment of the two wire ropes to even the distribution of the gate load, it is recommended that load cells be installed to measure the tension on the wire ropes.

The load cells would be connected to digital displays to feed live load information to the Nova Scotia Power maintenance staff, enabling them to confirm the proper distribution of the gate loads over both ropes. The readings could then be periodically verified to confirm the load is shared equally by both ropes. This would also provide early indication of impending rope problems.

Further to the load cells, the installation of auto gate position measurement equipment was requested by NSPI to monitor and relay the positions of the gates to the NSPI staff. This would be accomplished with the installation of an absolute rotary encoder on one drum shaft per hoist. The readings could be read locally or relayed back to a remote monitoring point.

Recommendations

- Maintain current practice of regular rope replacement.
- Replace the existing wire rope with new Ø1" 6x36WS galvanized EIPS, IWRC, RRL wire rope or an equivalent diameter "crane grade" wire rope at the next wire rope replacement interval.
- Install load cells on the wire ropes to confirm even distribution of the gate loads.
- Install automatic gate position measurement equipment on each hoist assembly to monitor and measure the position of the gates.

2.3.5 Wire Rope Lubrication Assessment

Description

Wire rope dressing is applied to wire ropes to provide lubrication (to reduce friction as the individual wires move over each other) and to provide corrosion and wear protection.

Inspection and Assessment Findings

On site observation and information from Nova Scotia Power staff indicates that the wire ropes are currently lubricated/dressed with Dynagard Blue environmental wire rope lubricant manufactured by The Kirkpatrick Group as shown in Photo 13 below.

Photo 13 – Dynagard Blue on Hoist Wire Rope

According to the manufacturer's literature, Dynagard Blue is an extreme pressure unleaded environmental wire rope lubricant blended for excellent resistance to softening under severe working conditions and water resistance in marine applications.

Communication with the manufacturer (The Kirkpatrick Group) on this application has indicated that Dynagard Blue is an appropriate lubricant for the sluiceway gate hoists. However, they also indicated that applying the lubrication with a pressurized lubrication system would improve the service life of the wire ropes due to the lubrication of the independent wire rope core. Lubrication of the rope core cannot be guaranteed when applied manually by hand. The lubrication system utilizes a pressurized cone with which the full length of wire rope is manually fed through to apply the lubricant. Once the entire length of wire rope has been lubricated, the pressurized cone is removed and the wire rope is re-fed onto its drum and sheaves for operation. The pressurized cone is then used to lubricate additional ropes on the system.

Recommendations

- Procure a pressurized lubricant system to be used to apply the rope dressing.

2.3.6 Sheave and Drum Diameter Assessment

Description

Anecdotal information from Nova Scotia Power staff indicates that the upper sheaves were at one time located on the drum shafts, but that they have since been lowered to beneath the deck of the hoist structure. In doing so, the gates can no longer be fully raised to their maintenance positions. Without significant modification to the hoist system to raise the upper sheaves, there is no current solution to raising the gates high enough to service the lower gate sections and seals.

Inspection and Assessment Findings

Drawings provided by the Nova Scotia Power staff illustrate that the current sluiceway gate hoist upper and lower sheaves have pitch diameters of Ø20" and Ø19.5", and the hoist drums have a pitch diameter of Ø26". As the sluiceway gate hoists operate at near the rated capacity, and due to the frequency of the operation; these two systems are classified under CMAA 70 as Class D (Heavy Service) cranes.

Based on CMAA 70 Table 4.5.2-1 (Guide for minimum pitch diameter of running sheaves) (Refer to Appendix F) and a Ø1" 6x36 (6x37 class) wire rope, the minimum pitch diameter should be Ø20" (20 x d where d = rope diameter). Therefore the pitch diameter of the sheaves just meets the CMAA 70 minimum pitch diameter of Ø20" (20 x d). However, it should be noted that these sheaves would be undersized if the wire rope was Ø1" 6x26 (6x19 class). This rope requires sheaves with a minimum pitch diameter of Ø24" (24 x d).

In accordance with CMAA 70 Table 4.6.4-1 (Guide for minimum pitch diameter of drums) (Refer to Appendix F) and a Ø1" 6x36 (6x37 class) wire rope, the minimum pitch diameter of the drums should be Ø20" (20 x d where d = rope diameter). Therefore the pitch diameter of the drums of

Ø26" is acceptable. These drums are also sized appropriately for use with Ø1" 6x26 (6x19 class) wire rope. KGS Group has confirmed that the machined grooves on the drums meet CMAA 70 requirements for groove depth and pitch.

Lastly, it should be noted that while the sheaves and drums mentioned above meet the minimum requirements of CMAA 70 for the type and size of wire rope, most wire rope manufacturers often recommend sheave and drum diameters that exceed the CMAA 70 requirements. Based on the information above, the existing upper and lower sheaves and drums are within the requirements of CMAA 70 when using a Ø1" 6x36 rope and are thus acceptable.

Recommendations

- No work required at this time on this aspect.

2.3.7 Machine Guarding Assessment

Description

Mechanical hazards is a general designation for all physical factors that can give rise to injury deriving from the mechanical action of a machine, machine parts, tools, workplaces, and loads, or from projected solid or fluid materials.

Inspection and Assessment Findings

On-site evaluation of the sluiceway gate hoist assemblies indicates that while the assemblies are shielded from the elements by large steel enclosures (Refer to Photo 14 below), the internal rotating components (shafts and gears) are not guarded within the enclosures to protect the maintenance/inspection personnel when servicing the hoist assemblies (Refer to Photos 15 & 16 below).

Photo 14 – Hoist Assembly Enclosures

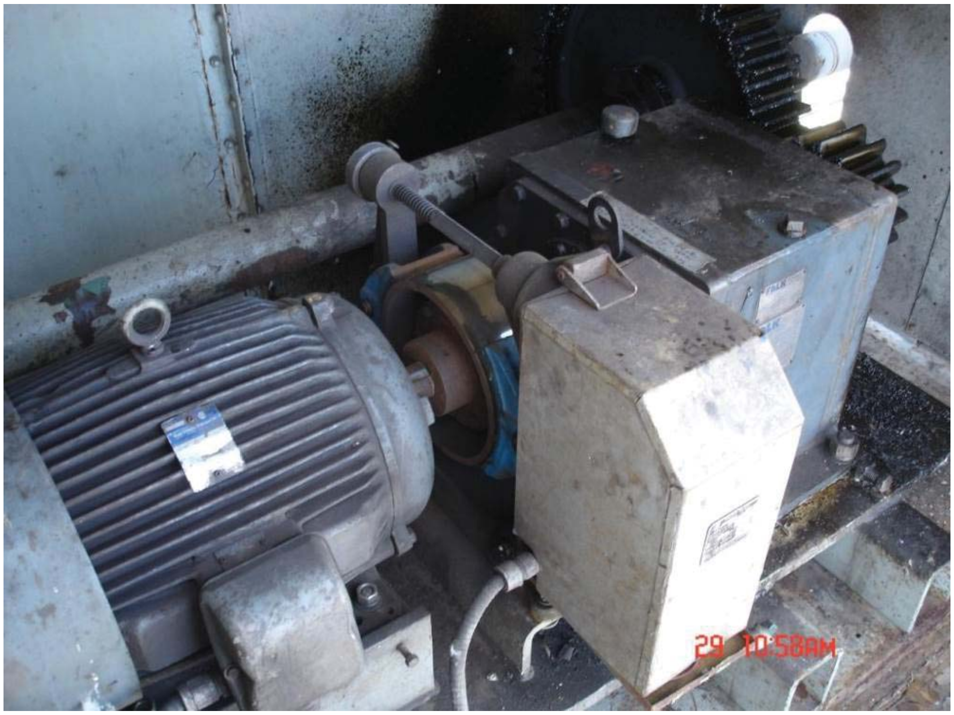


Photo 15 – Unguarded Rotating Hoist Assembly Components

Photo 16 – Unguarded Rotating Drum Components

Referring to CSA standard Z432-04 Safeguarding of Machinery, there are several mechanical hazards present in the current configuration of the sluiceway gate hoist assemblies. The following mechanical hazards are present at this site:

- Entanglement Hazards – occurs as a result of bodily contact with rotating and moving parts and counter-rotating parts. The sluiceway gate hoist motor shaft, drive gears, drum shafts and driven drum gears present entanglement hazards.
- Crushing Hazards – occurs as a result of bodily contact between one part of machinery moving against another part. The sluiceway gate hoist drive and driven gears present crushing hazards.
- Drawing-in/Trapping Hazard – occurs as a result of bodily contact between two counter-rotating parts. The sluiceway gate hoist drive and driven gears present drawn-in/trapping hazards.

These hazards are made much more significant at this site due to the frequent equipment starts and stops that occur without prior indication or warning. Furthermore, in the event of an incident or accident, there is no means of shutting down the system from the top of the hoist structure.

Recommendations

- Add machine guarding around the hazards listed above. Machine guarding may be in the form of sheet metal or expanded metal mesh enclosures fabricated and installed over the rotating shafts and gears.

2.3.8 Weatherproofing Assessment

Description

Weatherproofing entails the protection of the mechanical equipment from the elements. Both gate hoist drive systems and wire rope drum assemblies are currently covered by either steel or fiberglass removable enclosures.

Inspection and Assessment Findings

On site evaluation of the sluiceway gate hoist assemblies indicates that while the assemblies are shielded from the elements by large steel or fiberglass enclosures, there are several penetrations in the enclosures which let water in. This standing water then leads to accelerated corrosion of the steel hoist decking and supports (Refer to Photos 17 through 24 below).

In addition to rain and snow, salt water (transported by the wire ropes) is entering the hoist drum enclosures and dripping down onto the hoist structure floor causing accelerated corrosion.

Photo 17 – Drive Shaft Enclosure

Photo 18 – Drive Shaft Enclosure Penetration

Photo 19 – Drive Shaft Enclosure Penetration Corrosion

Photo 20 – Electrical Conduit Penetration

Photo 21 – Drum Enclosure Internal Corrosion

Photo 22 – Drum Enclosure Severe Deck Corrosion

Photo 23 – Drum Enclosure Severe Deck Corrosion

Photo 24 – Drum Enclosure Deck Penetration

Recommendations

- Install angled stainless steel drip trays under each hoist drum to catch the dripping salt water and drain it out through the hole in the deck for the wire rope. To prevent galvanic corrosion, the stainless steel would have to be isolated from the carbon steel components by gasketing. Refer to Figure 8 below for a conceptual sketch of the drip trays.
- Install rain/snow guards over the drum drive shaft penetrations to deflect the rain/snow from entering the enclosures.
- Install two rubber sheets butted up against each other onto the enclosures below the drum drive shafts to block the rain/snow from entering the enclosures while allowing the drum drive shafts to pass through the rubber when the enclosures are lifted up out of the way.

- Seal the curb and electrical penetrations around the base of the enclosures.

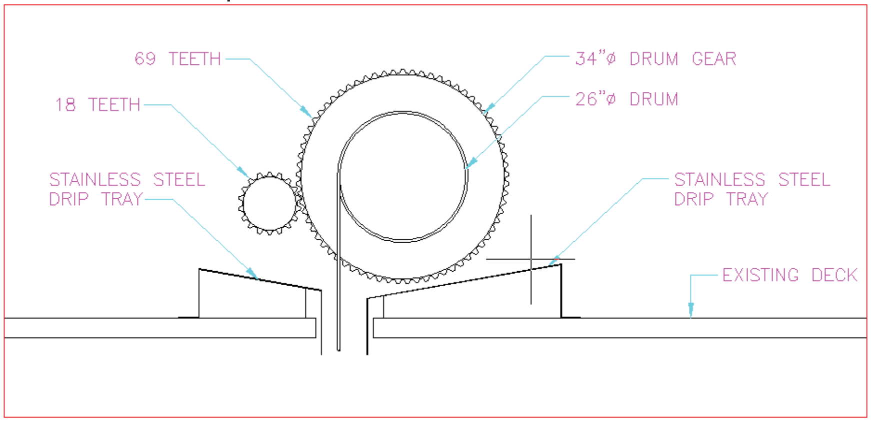


Figure 8 – Elevation View of Drip Trays

2.3.9 Mechanical Raise / Lower Back-Up for Sluice Gates

Description

The sluiceway gates are currently raised and lowered at each tide (twice per day) to charge the upstream estuarial section of the Annapolis river with headwater for the Annapolis Tidal Generating Station. The existing sluiceway gate hoist assemblies currently do not have a means of back-up mechanical operation. In the event of an electrical failure of a component of the sluiceway gate hoist assemblies, there is no way to raise and lower the gates to regulate the water level within the estuary. Nova Scotia Power staff has requested that KGS Group prepare a concept for the provision of a mechanical backup system.

Design Configurations

The following information presents two proposed design configurations for providing back-up mechanical gate operation. The first utilizes a diesel or gas engine mounted to a skid at ground level which will be used to power a hydraulic pump. The motor skid and hydraulic pump would be located within a small structure (shed) to provide security and protection from the elements. The hydraulic pump would then power hydraulic motors located within the two hoist drive enclosures located at the top of the hoist structure. The hydraulic motors in turn would feed through small gearboxes and hydraulic clutches to a chain drive sprocket. The chain would then be connected to another sprocket on the electric motor drive shaft as shown in Figure 9 to power the gates in the event of an unplanned event. KGS Group has successfully implemented a similar arrangement in the past. Due to the higher cost and the level of complexity, as well as using hydraulic oil over water, this is not the preferred solution.

The second design configuration utilizes a portable electric drill mounted to a tripod outside of the hoist drive enclosure. The drill attaches to a drive shaft with a coupling through a hole in the enclosure which in turn connects to a small gear box and clutch assembly to a chain drive sprocket. The chain would then be connected to another sprocket on the electric motor drive shaft as shown in Figure 10 to power the gates.

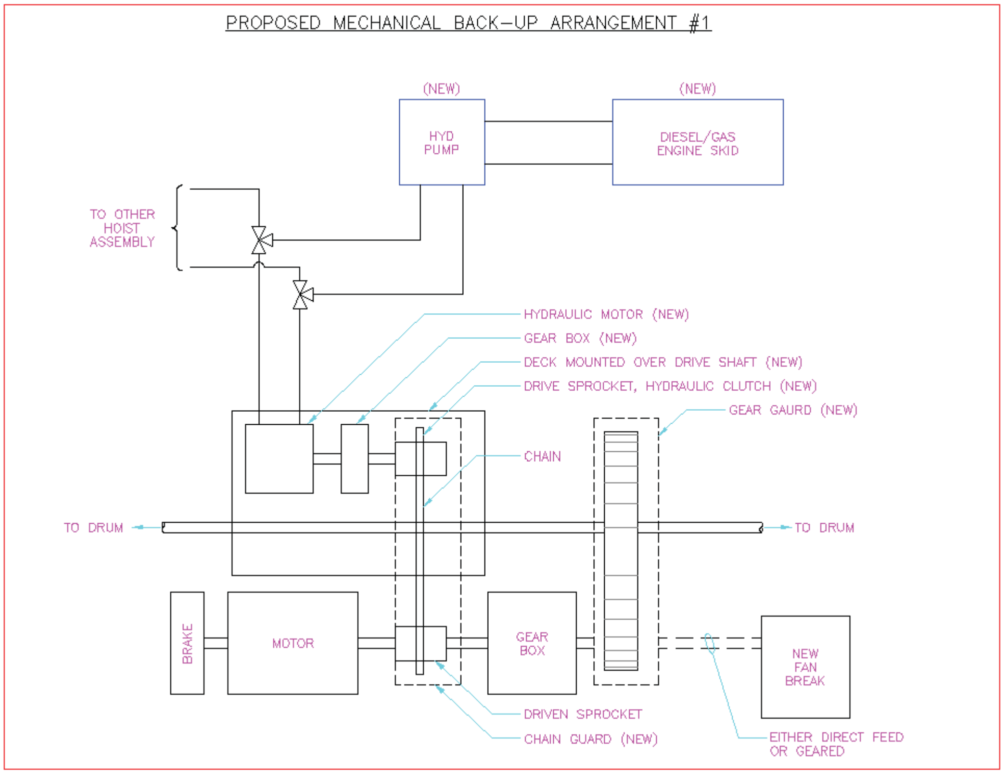


Figure 9 – Proposed Diesel / Gas Hydraulic Mechanical Back-up Arrangement

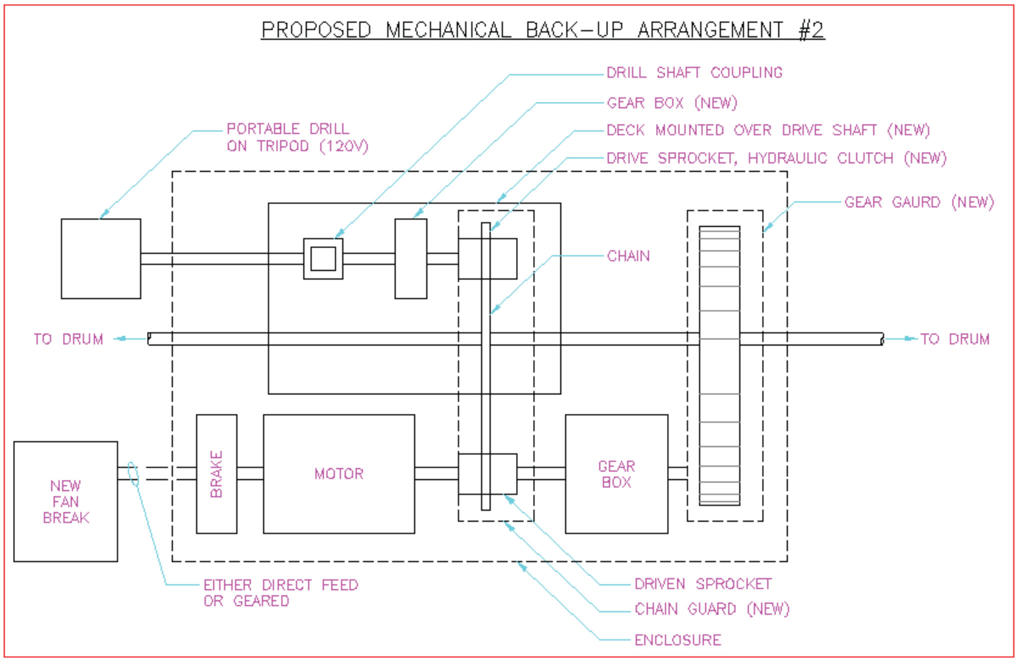


Figure 10 – Proposed Drill Mechanical Back-up Arrangement

Recommendations

- Install the second design configuration utilizing a portable drill as the power unit for providing emergency mechanical motion of the gates.

2.3.10 Mechanical Summary

The detailed inspection and assessment of the Annapolis sluiceway gate hoist mechanical systems has highlighted several issues and deficiencies with the existing arrangement.

- The fan brakes have been removed and the gear boxes are overloaded.
- The motor brakes require service and/or replacement.
- The current hoisting arrangement which could be racking the gates produces accelerated wear on the wire ropes leading to premature failure.
- The wire rope lubrication may not be providing sufficient protection to the wire ropes from damage and the environment.
- There is insufficient mechanical guarding to safely protect maintenance/inspection personnel from entanglement and crushing hazards and the existing equipment enclosures have penetrations which let standing water accelerate corrosion of the steel components.

- There is currently no means of measuring the loads on the gate wire ropes or measuring the locations of the gates.
- Lastly, there is no means of mechanical raising/lowering the gates in the event of an electrical failure.

KGS has reviewed the available information and has prepared two options for Nova Scotia Power. The first option which is recommended by KGS is to replace the gate hoists completely with new ones designed to modern standards. A budgetary estimate has been provided by COH Inc. for $1,630,000 to completely modernize the two Annapolis sluiceway gate hoist systems. This preliminary estimate (+/- 30%) includes costs for engineering and assumed contingencies, but does not include taxes, or indirect costs such as NSPI administration costs.

The second option would be to repair the existing hoists and bring them up to current standards by replacing and/or servicing the existing equipment as illustrated in the sections above. Cost estimates of the individual components required to modernize the Annapolis sluiceway gate hoists total up to a combined repair estimate of $820,000. This cost estimate is based on separate mobilization/demobilization costs for each individual repair/modification, and excludes taxes and indirects. If all of the recommendations where instituted at one time, the cost estimate would be reduced. It should also be noted that addressing the individual deficiencies of the hoists is still considerably less expensive than the complete hoist replacement option. However, simply addressing the individual deficiencies listed would keep many of the aging components and does not address the issue of not being able to raise the gate to the maintenance position.

2.3.11 Estimated Capital Costs For Mechanical Repairs

The estimated costs provided below are preliminary (+/- 30%) and include assumptions for engineering fees and contingency. A contingency of 10% is assumed for the mechanical work items as there is less potential for unidentified unknowns. The values do not include taxes, NSPI administration costs, or other indirect project costs. Refer to Appendix H for the estimated cost breakdown for material and equipment, labour and engineering to address each deficiency.

TABLE 2
SUMMARY OF MECHANICAL DEFICIENCIES AND PRELIMINARY ESTIMATED COSTS FOR REPAIRS

Option	Deficiency	Description	Proposed Remedial Measure	Estimated Cost (Prelim.)
1	Multiple un-documented modifications to both hoists.	- Fan brakes are missing. - Hoist gear boxes are undersized. - No mechanical back-up for raising/lowering the gates. - Sheaves are improperly located for gate motion. - Motor brakes require service. - Wire ropes keep breaking. - No mechanical guarding. - Lack of weatherproofing has led to structural corrosion.	Replace existing hoists with new hoists.	$1,630,000
2	Missing fan brakes on both hoists.	Fan brakes regulate the rate of descent of a load (sluiceway gates) in the event of a failure by using air to absorb the power of the descending load.	Replace missing fan brakes on both hoists.	$190,000
	Gear boxes on both hoists are overloaded.	Model 2070FC2A-31.08 Falk Ultramax gear drives are not suitable and overloaded. OEM manufacturer recommends upgrading to model 2080FC2A-31.08 gear drives.	Replace deficient gear boxes on both hoists.	$170,000
	Corrosion and mis-adjustment of hoist motor brakes.	Previous reports indicate that the brakes are misaligned and show significant corrosion due to moisture ingression/condensation.	Immediately service or replace motor brakes.	$30,000
	Breaking wire ropes.	The existing Ø1" 6x26 wire rope is a general purpose rope that meets the load capacity requirements of the application. However, it would be possible to replace this with a Ø1" 6x36WS galvanized EIPS, IWRC, RRL wire rope or "crane grade" quality rope which exhibits improved wear and flexibility characteristics.	Replace the existing wire rope at the next wire rope replacement interval.	$10,000

Option	Deficiency	Description	Proposed Remedial Measure	Estimated Cost (Prelim.)
2	Wire rope lubrication	Wire rope dressing is manually applied. Lubricant OEM recommends a pressurized lubrication system which would improve service life due to the lubrication of the independent wire rope core.	Procure a pressurized lubricant system for applying the rope dressing.	$6,000
	Machine Guarding	Sluiceway gate hoist assemblies are shielded from the elements by large enclosures. However, the internal rotating components (shafts and gears) are not guarded within the enclosures to protect the maintenance/inspection personnel when servicing the hoists.	Add machine guarding around the rotating hazards.	$15,000
	Auto Gate Position Measurement	There is currently no means of monitoring the position of the gate.	Install an absolute rotary encoder system on each hoist drum to measure and indicate position.	$80,000
	Load Cells for Hoist Load Monitoring	There is currently no means of monitoring the load the gate is placing on the two wire ropes.	Install load cells on each wire rope with digital displays.	$170,000
	Weather-proofing	The large enclosures protecting the mechanical equipment from the elements have several penetrations which let water in. This standing water then leads to accelerated corrosion of the steel decking, supports and equipment.	Install SS drip trays. Install rain/snow guards over shafts. Seal curb and electrical penetrations.	$10,000
	Mechanical Raise/Lower Back-up Operation of Gates.	The existing sluiceway gate hoist assemblies do not have a means of back-up mechanical operation in the event of an electrical failure.	Install the portable drill design as the mechanical back-up configuration.	$150,000
Mechanical Option 2 Sub-total				**$831,000**

2.4 ELECTRICAL ASSESSMENT

2.4.1 Building and Sluice Electrical Services

Inspection and Assessment Findings

The MCC building services panel and step down transformer reside within the MCC (see Photo 25). This arrangement is not common practice and is generally discouraged due to the heat generated by the transformer. As well, the remote I/O rack is obsolete.

Photo 25 – Existing MCC Transformer, Panel and Transfer Switch

Gate #1 is currently having motor starter issues, which could be due to the fact that the motor control center (MCC) has surpassed its service life and new replacement parts are very hard to come by.

Cabling along the top of the sluiceway gate structure is not properly secured to the structure (see Photo 26 below). The gate structure is not equipped with welding outlets or 120V general convenience receptacles to support maintenance activities.

Photo 26 – Gate Structure Cabling

Recommendations

The existing building services distribution panel and step down transformer in the MCC building are recommended to be replaced with a new wall mounted panel and floor mounted transformer. By keeping these two pieces of equipment remote from the MCC it will reduce unnecessary heat generation. It is also recommended that maintenance receptacles for welding and general purpose be added to the MCC building to allow for ease of maintenance.

Electrical cabling at the top of the sluiceway structure should be properly secured to the structure. For the most part cables are hanging freely. We recommend that a cable tray be installed on the structure to properly support these cables.

The new remote I/O rack will also be wall mounted in the MCC building and fed from the new service panel. In order for this transition to take place without having major disruptions to sluiceway operations, the existing MCC will need to be removed in phases. The phases are as follows:

Phase 1:

- Install the new MCC; two 100A, 600V fused disconnect switches (normal and backup); one 100A, 600V, 2pole transfer switch; 15kVA floor mounted epoxy potted transformer; one 100A, 120/208V service panel; and maintenance receptacles c/w cabling as shown on conceptual sketches B-5701 and B-5702 provided in Appendix G.
- Relocate the existing meter to location shown on sketch B-5702.
- Connect the meter to the street level power distribution system.
- Connect the existing meter to the new MCC through the new 100A "backup" fused disconnect and transfer switch, as shown on sketch B-5701.
- Power up new service panel, transformer, and remote I/O rack.

Phase 2:

- Transfer the existing building services loads over to the new electrical panel from the existing panel.
- Once all of the loads are transferred over the existing MCC section can be removed including the automatic transfer switch section.
- Once this section is removed from the existing MCC the new remote I/O rack can be installed in its place, which will be powered from the new service panel.

Phase 3:

- Transfer the gate power supply and controls from the existing MCC to the new MCC one gate at time, this will ensure one gate remains in service.
- Prior to swapping over the motor feed it is critical to have the PLC programming complete, and the control wiring already in place between the new MCC and PLC.
- Once the other gate is not operating follow the identical process to swap it over to the new MCC.
- The existing cable tray can be reworked as required once all of the cabling is pulled back and connected to the new MCC.

Phase 4:

- Remove the remaining MCC sections and finish connecting the power supply from the powerhouse to the transfer switch through the new 100A "normal" fused disconnect. Refer to sketch B-5701.

Note that the 120V convenience receptacles, welding outlet and generator outlet can be installed at any time and wired up to the new MCC once it is installed. Also, note that Sketch B-

5701 in Appendix G shows a kirk-key interlock system between the MCC main breaker and the generator breaker to ensure there is no back feeding in the system. The generator outlet plug is intended to provide the capability of powering the gates in the event of multiple power failures.

2.4.2 Control Cabling

Inspection and Assessment Findings

Over hoist limit switches are not directly wired to the gate motors. This increases the probability of having the motor not stopping when the limit is reached, which could result in equipment damage. The head pond level indicator cabling is not adequately protected from mechanical damage (it is laying across the floor) (see Photo 27).

Photo 27 – Head Pond Level Transmitter

The powerhouse PLC is mounted on a plywood back board, which is not common practice and is not suitable for this application (see Photo 28). The PLC should be mounted in a cabinet.

Also, the PLC has a 120V power supply; many terminals are not finger safe which presents a shock hazard. All 120V circuits should not be exposed (they should be in an enclosure).

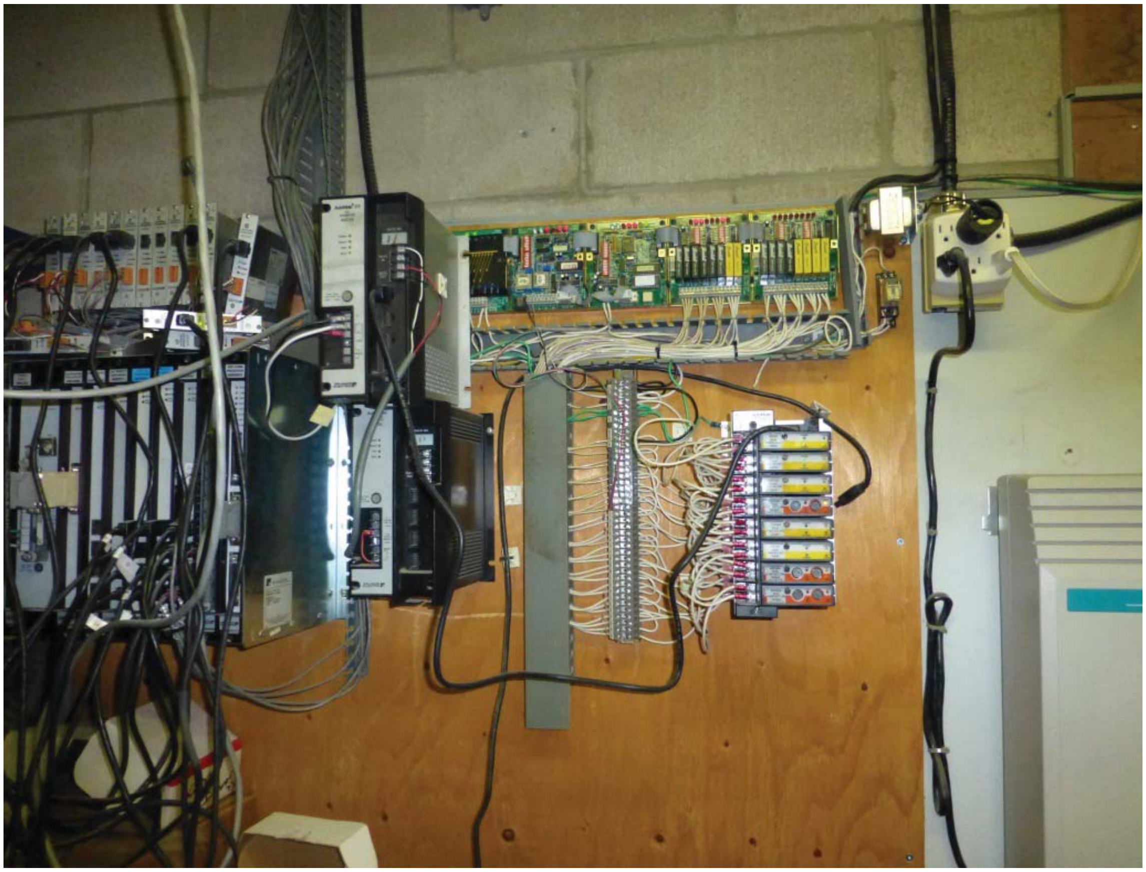


Photo 28 – Powerhouse PLC

Photo 29: Sluiceway Remote PLC in MCC

Recommendations

Existing gate control cables are to be removed from the existing MCC and transferred over to the new MCC and PLC. This work should be completed during Phase 3 of the electrical services upgrade.

The existing over hoist limit switches are not wired directly into their corresponding motor starters. It is recommended that the limit switches be wired directly to the starter such that when they are activated the starter coil “pulls out”. This reconfiguration it will eliminate the possibility of the structure or gate motor being damaged in the event the PLC fails.

The Head pond level indicator cable shall be reworked and proper mechanical protection shall be provided. It is recommended that the cable be re-routed and installed in conduit.

It is recommended that the powerhouse gate control PLC be replaced with a new wall mounted cabinet and PLC.

2.4.3 Building Heating

Currently, heating within the MCC building is provided by baseboard electric heaters. These need to be removed to make room for the new MCC sections. We recommend that the baseboard heaters be replaced by a new 3 kilowatt unit heater (complete with an integral thermostat) be mounted to the ceiling. This arrangement will facilitate the recommended equipment installations and make better use of the electrical room wall space.

2.4.4 Exterior Lighting

The existing lighting system does not provide adequate lighting to gate structures and walkways (see Photo 30). It is recommended that the existing cobra head light fixtures mounted on gates 1 and 2 be removed and replaced with several strategically placed wall packs and flood lights. Existing cabling and controls shall be removed and replaced with new equipment complete with "on/off" switching for troubleshooting. The new lighting will provide better conditions for traveling vehicles and allow for maintenance activities to take place after hours with minimal construction lighting required.

Photo 30 – Structure Lighting

2.4.5 Estimated Capital Costs for Electrical Upgrades

The estimated costs provided below are preliminary (+/- 30%) and include assumptions for engineering fees and contingency. A contingency of approximately 25% has been assumed for the electrical work items to account for the fact that these are concepts, and to provide an allowance for unidentified unknowns. The values in the table do not include taxes, NSPI administration costs, or other indirect project costs. Refer to Appendix H for the estimated cost breakdown for material and equipment, labour and engineering to address each deficiency.

TABLE 3
SUMMARY OF ELECTRICAL DEFICIENCIES AND PRELIMINARY ESTIMATED COSTS FOR REPAIRS

Deficiency	Description	Proposed Remedial Measure	Estimated Cost (Prelim.)
Power and Controls – Miscellaneous	- MCC building services panel & step-down transformer located inside the MCC – heat issue. - The remote I/O is obsolete. - Cabling along gate structure is not secure. - No welding outlets or 120V general convenience receptacles. - Overhoist limit switches are not wired directly to the hoist motor starters. - Head pond level indicator cabling is not adequately protected. - Powerhouse PLC is mounted on plywood backboard and terminals have shock hazard. - Existing baseboard heaters interfere with proposed new MCC installation.	- Replace with new wall-mounted MCC and floor-mounted transformer. - Provide new remote I/O rack. - Install cable tray along gate structure. - Add receptacles. - Wire the limit switches directly to the hoist motor starters. - Rework cabling with proper mechanical protection. - Replace with new wall-mounted PLC in a cabinet, place the 120V circuits in an enclosure. - Replace baseboard heaters with new 3 kw unit heater.	$250,000
Exterior Lighting	Inadequate lighting to gate structures and walkways for operation and maintenance work.	Install new upgraded lighting, cabling and controls.	$70,000
Subtotal for Electrical			**$320,000**

3.0 SUMMARY

The following is a summary of the remedial measures for each discipline along with a total estimated project capital cost for the work in 2013 dollars. These costs are preliminary (+/- 30%) and include assumptions for engineering fees and contingency to coincide with the concept level of the designs recommended. The values do not include taxes, NSPI administration costs, or other indirect project costs.

TABLE 4
SUMMARY OF PRELIMINARY TOTAL ESTIMATED PROJECT COSTS

Option	Discipline	Item	Estimated Costs (Preliminary)
Option 1	Structural	Hoist Superstructure	$420,000
		Spillway Gates	$380,000
		Spillway Gate Guides	$100,000
	Mechanical	Install New Hoist Equipment	$1,630,000
	Electrical	Power Upgrades	$250,000
		Lighting Upgrades	$70,000
Option 1 – Total Remedial Costs			**$2,850,000**
Option 2	Structural	Hoist Superstructure	$420,000
		Spillway Gates	$380,000
		Spillway Gate Guides	$100,000
	Mechanical	Hoist Modifications / Upgrades	$820,000
	Electrical	Power Upgrades	$250,000
		Lighting Upgrades	$70,000
Option 2 – Total Remedial Costs			**$2,040,000**

4.0 WORK STAGING PLAN

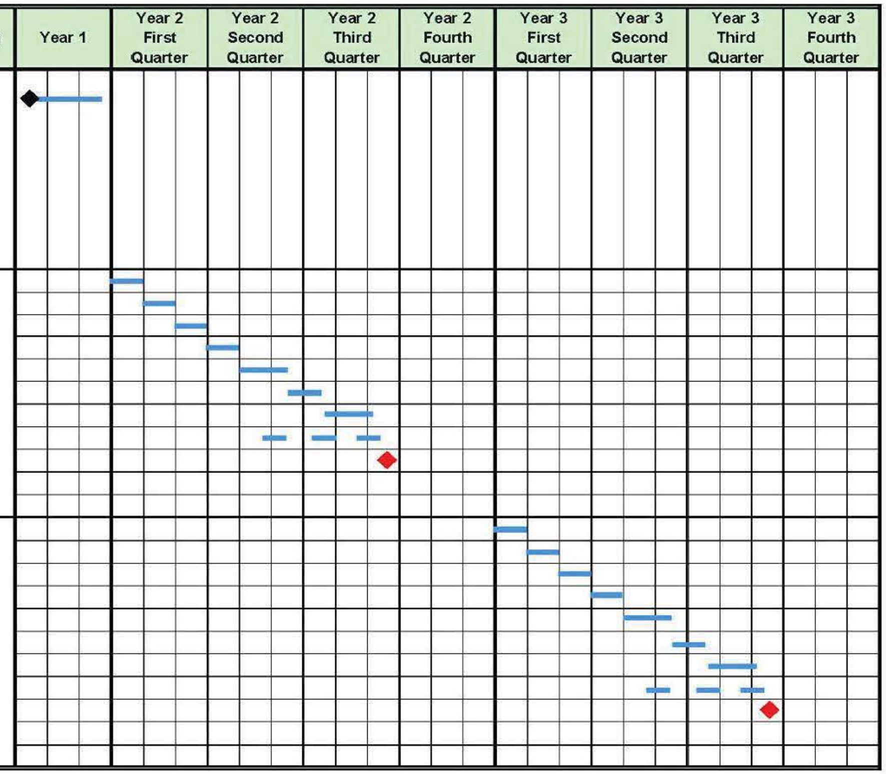
The proposed staging of the rehabilitation work is spread out over a two year period, with one sluiceway bay completed in each year. Table 5 provides a breakdown of the work tasks along with an estimated duration. Refer also to the work schedule provided in Figure 11.

TABLE 5
WORK STAGING PLAN

Task	Description	Year	Estimated Duration	Comments
1	Detailed Design, Dewatered gate guide inspections, Tender (Bay 1 and Bay 2)	Year 1	8 -10 months	Perform inspection in spring/summer to verify extent of guide repair work
2	Gate Guide Repairs - Bay 1	Year 2	3 weeks**	Gate dogged, dewatered with stoplogs, duration depends on final scope
3	Hoist superstructure modifications - Bay 1	Year 2	3 weeks	Dewater and perform modifications 1 bay at a time. (Structural mods & basic mechanical supports, remove electrical to be replaced)
4	Sluice Gate #1 modifications (side rollers, seals)	Year 2	4 weeks	Gate raised above deck. Gate mods can be performed simultaneously with hoist mods
5	Disconnect gate, dissassemble hoist, prepare for coating work including hoarding - Bay 1	Year 2	3 weeks	Install hoarding on one half of the structure
6	Hoist Superstructure Coatings - Bay 1	Year 2	6 weeks	Work includes replacement of corroded bolts
7	Sluice Gate Coatings - Bay 1	Year 2	4 weeks	Attach gate and raise up inside superstructure hoarding
8	Install Hoist Mechanical Equipment - Bay 1	Year 2	6 weeks	Performed concurrently with electrical upgrades
9	Install Electrical Upgrades - Bay 1	Year 2	7 weeks	Installation to be conducted in phases.
10	Gate Guide Repairs - Bay 2	Year 3	3 weeks**	Same comment as above for Bay 1.
11	Hoist superstructure modifications - Bay 2	Year 3	3 weeks	Same comment as above for Bay 1.
12	Sluice Gate #2 modifications (side rollers, seals)	Year 3	4 weeks	Same comment as above for Bay 1.
13	Disconnect gate, dissassemble hoist, prepare for coating work - Bay 2	Year 3	3 weeks	Same comment as above for Bay 1.
14	Hoist Superstructure Coatings - Bay 2	Year 3	6 weeks	Same comment as above for Bay 1.
15	Sluice Gate Coatings - Bay 2	Year 3	4 weeks	Same comment as above for Bay 1.
16	Install Hoist Mechanical Equipment - Bay 2	Year 3	6 weeks	Same comment as above for Bay 1.
17	Install Electrical Upgrades - Bay 2	Year 3	7 weeks	Same comment as above for Bay 1.

*** Depends on results of full gate guide inspection.*

Annapolis Royal Tidal Plant Sluiceway Rehabilitation	Duration
1 Detailed Design / Tender the Work	10 months
- Performance specification for hoist work	
- Detailed design of modifications	
- Engineering Drawings and Specifications	
- Dewatered Gate Guide Inspections	
- Tender the Work	
Sluiceway Bay 1	
2 Gate Guide Repairs	3 weeks
3 Hoist Superstructure Modifications	3 weeks
4 Sluice Gate #1 Modifications (Side rollers & seals)	4 weeks
5 Disconnect Gate, dissassemble hoist, prepare for coating work	3 weeks
6 Hoist Superstructure Coatings	6 weeks
7 Sluice Gate Coatings	4 weeks
8 Install Hoist Mechanical Equipment	6 weeks
9 Install Electrical Upgrades	7 weeks
10 Commission Gate #1	1 week
Sluiceway Bay 2	
11 Gate Guide Repairs	3 weeks
12 Hoist Superstructure Modifications	3 weeks
13 Sluice Gate #2 Modifications (Side rollers & seals)	4 weeks
14 Disconnect Gate, dissassemble hoist, prepare for coating work	3 weeks
15 Hoist Superstructure Coatings	6 weeks
16 Sluice Gate Coatings	4 weeks
17 Install Hoist Mechanical Equipment	6 weeks
18 Install Electrical Upgrades	7 weeks
19 Commission Gate #2	1 week



Legend

- Milestones
- Ongoing task

Figue 11 – Work Staging Plan Schedule

5.0 STATEMENT OF LIMITATIONS AND CONDITIONS

5.1 THIRD PARTY USE OF REPORT

This report has been prepared for Nova Scotia Power Incorporated to whom this report has been addressed and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions undertaken based on this report.

5.2 CAPITAL COST ESTIMATE STATEMENT OF LIMITATIONS

The cost estimates included with this report have been prepared by KGS Group using its professional judgment and exercising due care consistent with the level of detail required for the stage of the project for which the estimate has been developed. These estimates represent KGS Group’s opinion of the probable costs and are based on factors over which KGS has no control. These factors include, without limitation, site conditions, availability of qualified labour and materials, present workload of the Bidders at the time of tendering and overall market conditions. KGS does not assume any responsibility to the Client, in contract, tort or otherwise in connection with such estimates and shall not be liable to the Client if such estimates prove to be inaccurate or incorrect.

6.0 REFERENCES

1. Hatch (2010), "Annapolis Tidal Plant Sluice Facility Condition and Design Adequacy Assessment", Final Report, ANN-SG-G-RP-2010-49, August 26, 2010.

2. Geocon Atlantic (2008), "Preliminary Report on Sluice Gate Cranes, Annapolis Tidal Power Plant", ANN-SG-G-RP-2008-35, July 3, 2008.

3. Geocon Atlantic (2008, Inspection Report (Sluice gates and supporting structure and equipment), ANN-SG-G-RP-2008-36, August 12, 2008.

4. Geocon Altantic (2009), Inspection Report (Examination for cracks/damage), ANN-SG-G-RP-2009-41, July 21, 2009.

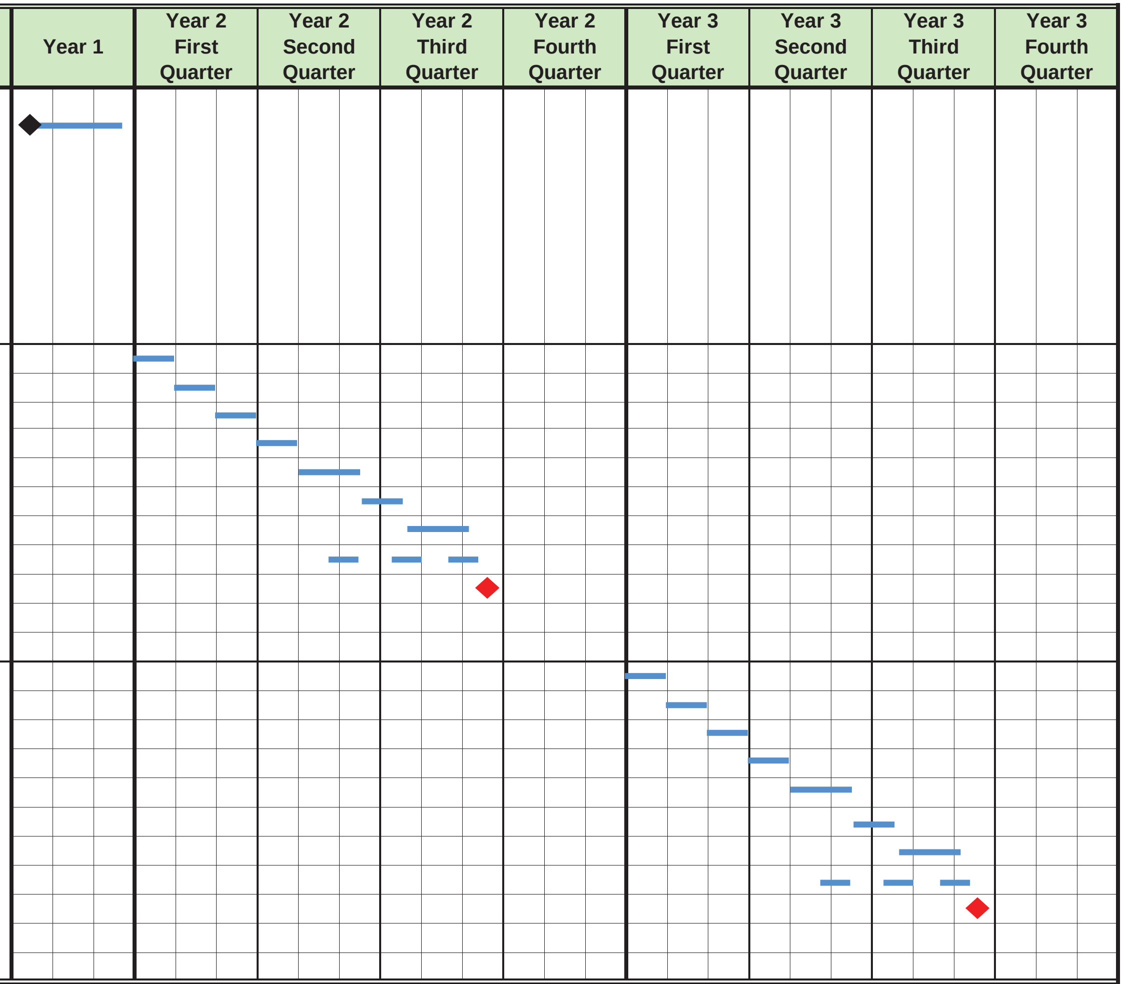
5. NSPI (2008), "Annapolis Tidal Plant Sluice Gate No. 1 Gate Checks Inspection", ANN-SG-G-RP-2008-34, September 12, 2008.

FIGURES

Figure 11: Work Staging Plan Schedule

Annapolis Royal Tidal Plant - Sluiceway Rehabilitation

Annapolis Royal Tidal Plant Sluiceway Rehabilitation	Duration
1 Detailed Design / Tender the Work	10 months
- Performance specification for hoist work	
- Detailed design of modifications	
- Engineering Drawings and Specifications	
- Dewatered Gate Guide Inspections	
- Tender the Work	
Sluiceway Bay 1	
2 Gate Guide Repairs	3 weeks
3 Hoist Superstructure Modifications	3 weeks
4 Sluice Gate #1 Modifications (Side rollers & seals)	4 weeks
5 Disconnect Gate, dissassemble hoist, prepare for coating work	3 weeks
6 Hoist Superstructure Coatings	6 weeks
7 Sluice Gate Coatings	4 weeks
8 Install Hoist Mechanical Equipment	6 weeks
9 Install Electrical Upgrades	7 weeks
10 Commission Gate #1	1 week
Sluiceway Bay 2	
11 Gate Guide Repairs	3 weeks
12 Hoist Superstructure Modifications	3 weeks
13 Sluice Gate #2 Modifications (Side rollers & seals)	4 weeks
14 Disconnect Gate, dissassemble hoist, prepare for coating work	3 weeks
15 Hoist Superstructure Coatings	6 weeks
16 Sluice Gate Coatings	4 weeks
17 Install Hoist Mechanical Equipment	6 weeks
18 Install Electrical Upgrades	7 weeks
19 Commission Gate #2	1 week



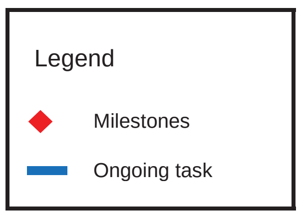


Figure 11: Work Staging Plan Schedule
Annapolis Royal Titdal Plant – Sluiceway Rehabilitation
KGS Project No: 13-2242-001 June 2013

P:\Projects\2013\13-2242-001\Doc.Control\Issued\SOURCE\Docs\RPT_Annapolis Sluiceway Eval\DRAFT\Figure 11 - Work Staging Plan Schedule.xls

APPENDICES

APPENDIX A

ADDITIONAL INSPECTION PHOTOGRAPHS

Photo 1 – Typical Tower Base Plates

Photo 2 – Typical Surface Corrosion and Staining on Lower Portions of Towers

Photo 3 – End Ladder Support L-Bracket Severe Corrosion

Photo 4 – Box Beam Replaced with S-beam and Channel – Bolted Connections

Photo 5 – Upper Sheave Support Suspended Structure

Photo 6 – Stoplog Guides (Tidal Side)

Photo 7 – Gate Side Guide (Top), Corrosion, Concrete Spalling

Photo 8 – ¼" Roller Path Overlay Plate Separation

Photo 9 – Damaged Lintel Seal on Spillway Gate #2

Photo 10 – Partially Twisted Lower Gate Seal and Bent Zinc Anode Adjacent

Photo 11 – Deformed ¼" Overlay Plate (Reservoir Side)

Photo 12 – Back (Tidal side) of Spillway Gate - Typical

Photo 13 – Surface Corrosion on Connection Bolts for Recent Installation of Beams to Replace Box Beam

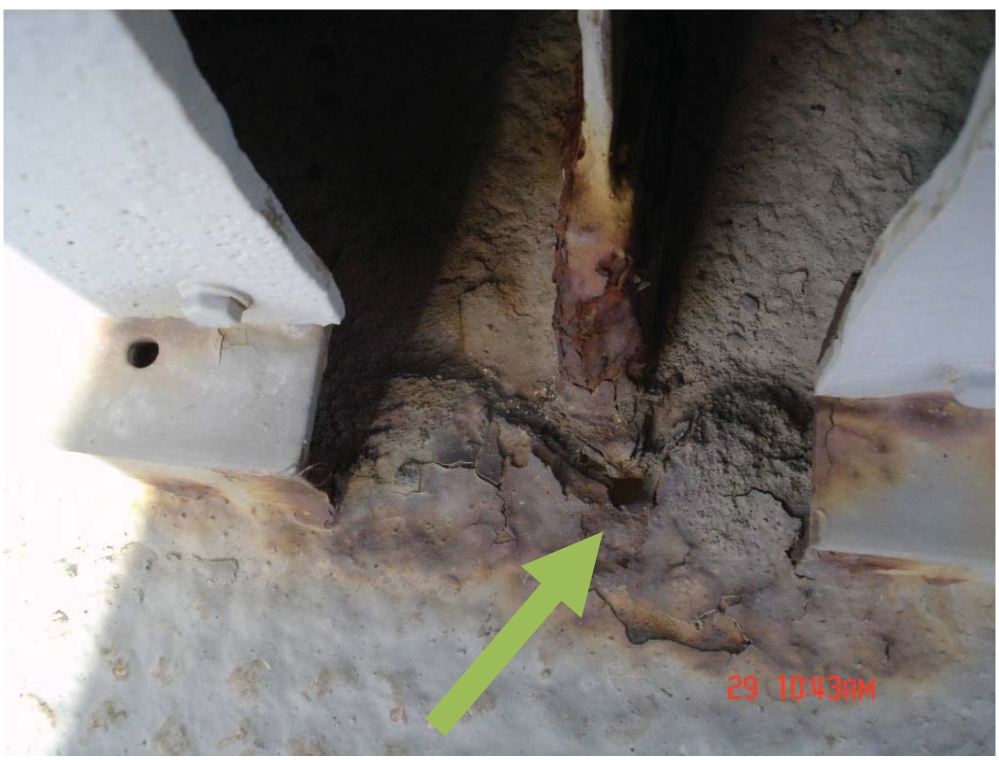


Photo 14 – Floor Plate Corrosion around Drum Support Bearing Stiffener Hole

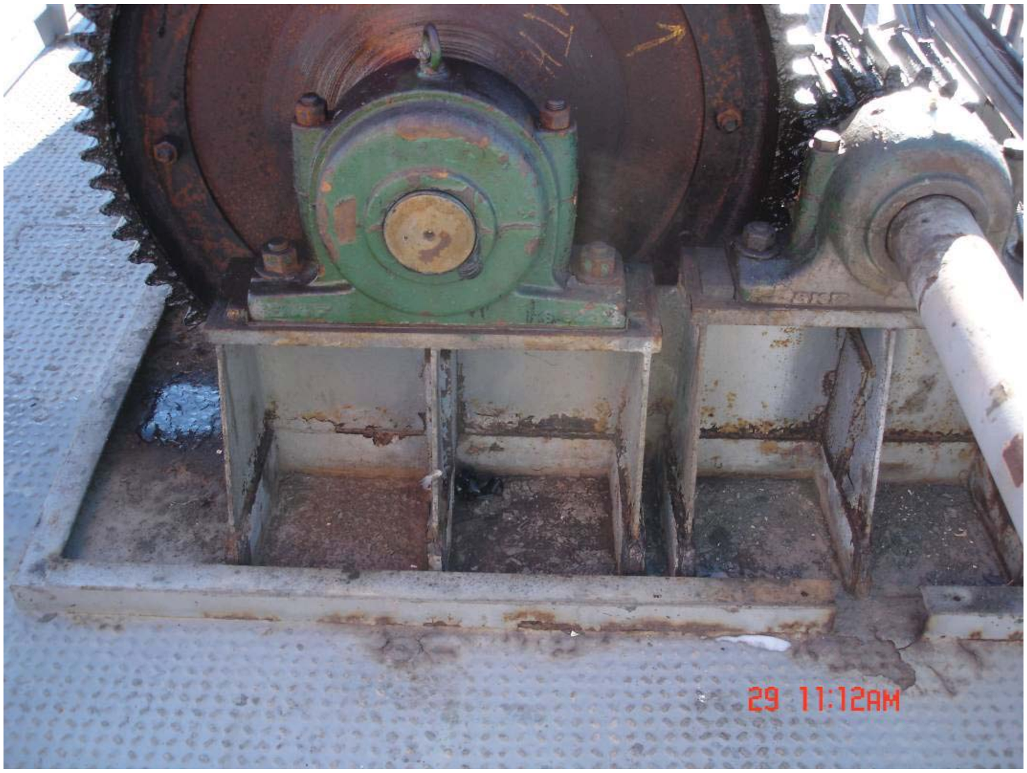


Photo 15 – Reinforcement Plates on Center Stiffeners

Photo 16 – Floor Plate Corrosion under Drum

Photo 17 – Hardness Testing of Spare Roller Path Plate (32 mm)

Photo 18 – End Tower Base Plate Surface Corrosion

Photo 19 – Hoist Superstructure Typical Localized Surface Corrosion and Staining

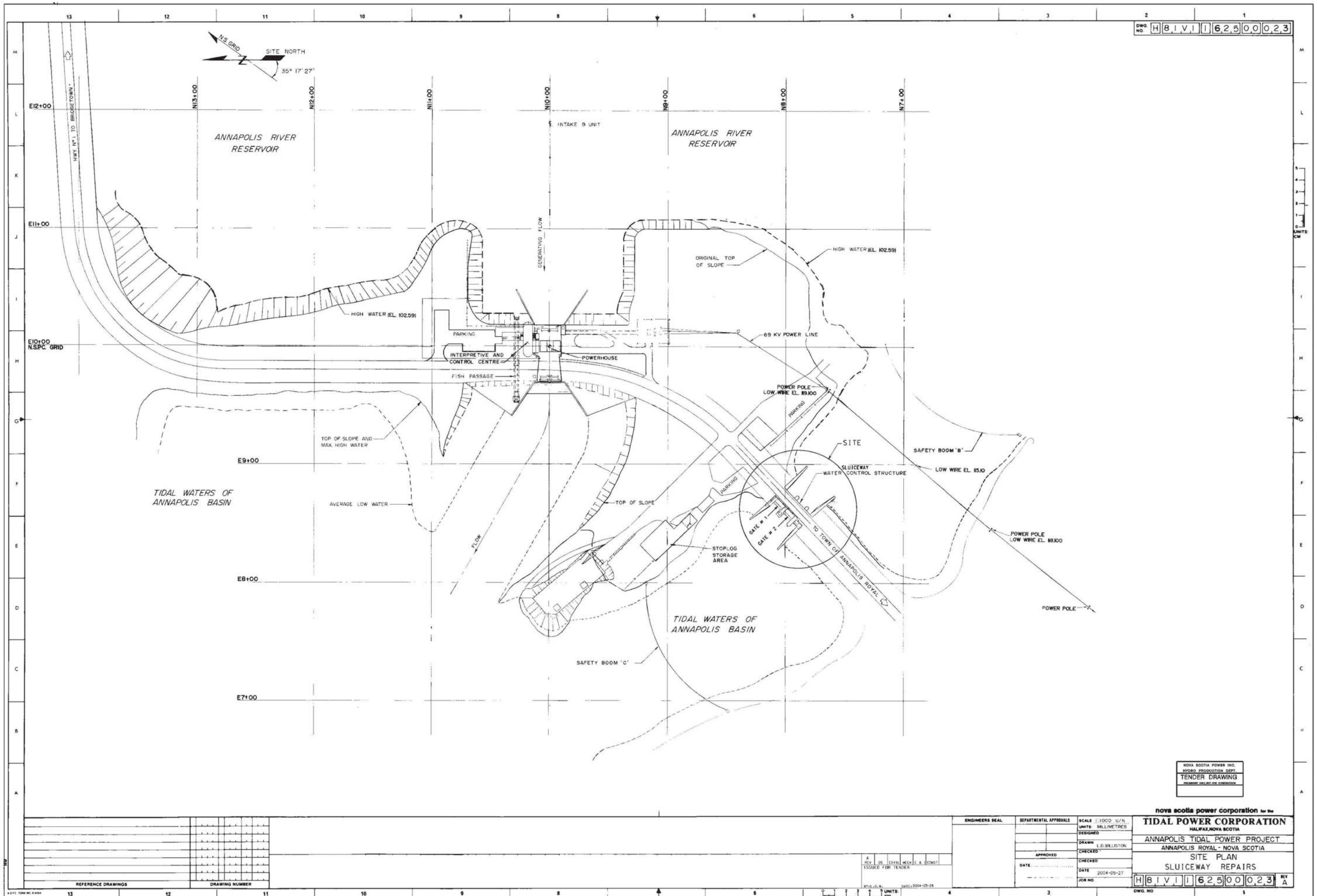
Photo 20 – Structural Bolt Corrosion

Photo 21 – Corrosion of Hanger Connection for Upper Sheave Support Structure

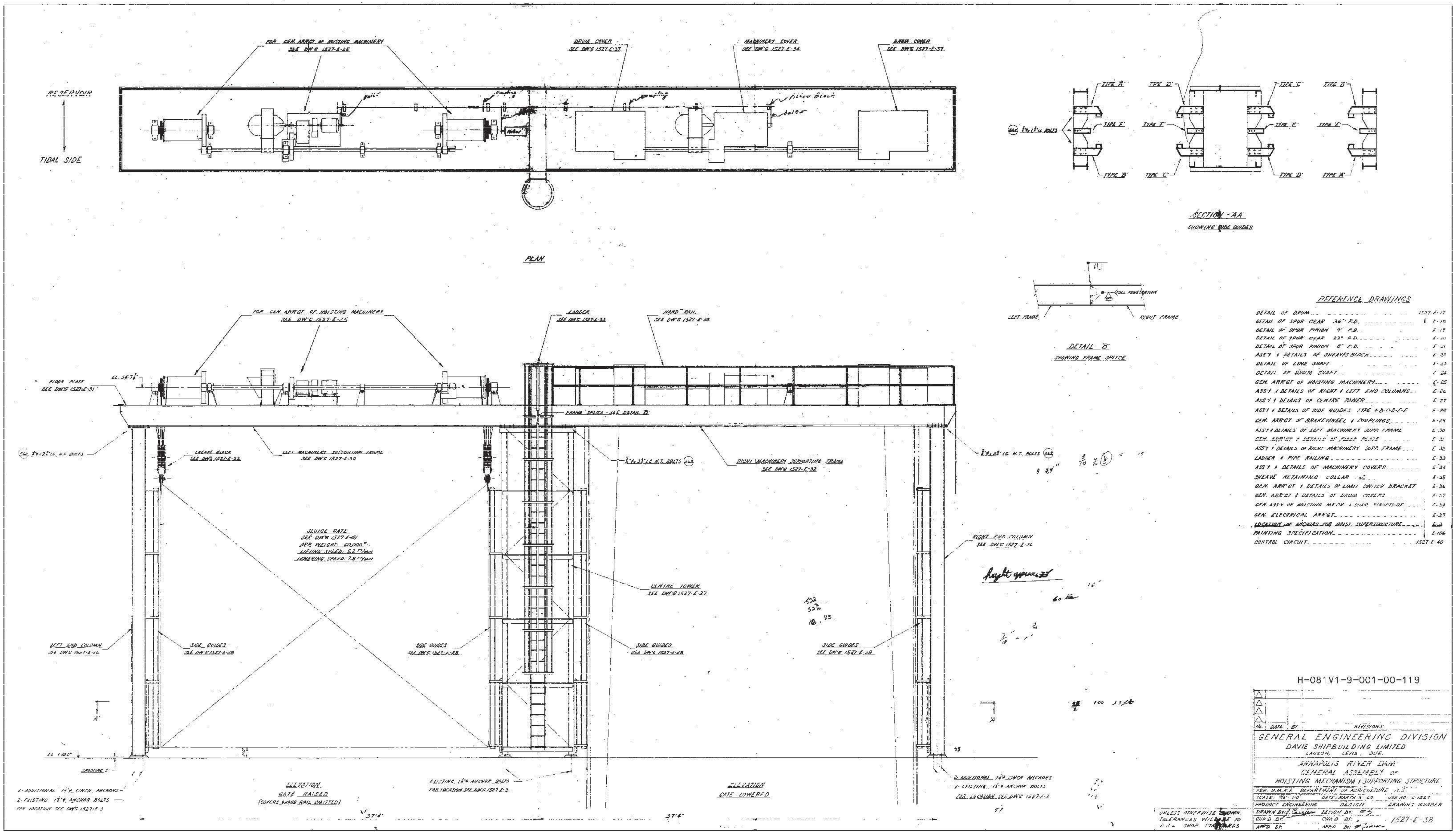
Photo 22 – Ice Collected in Back of Spillway Gate When Opened

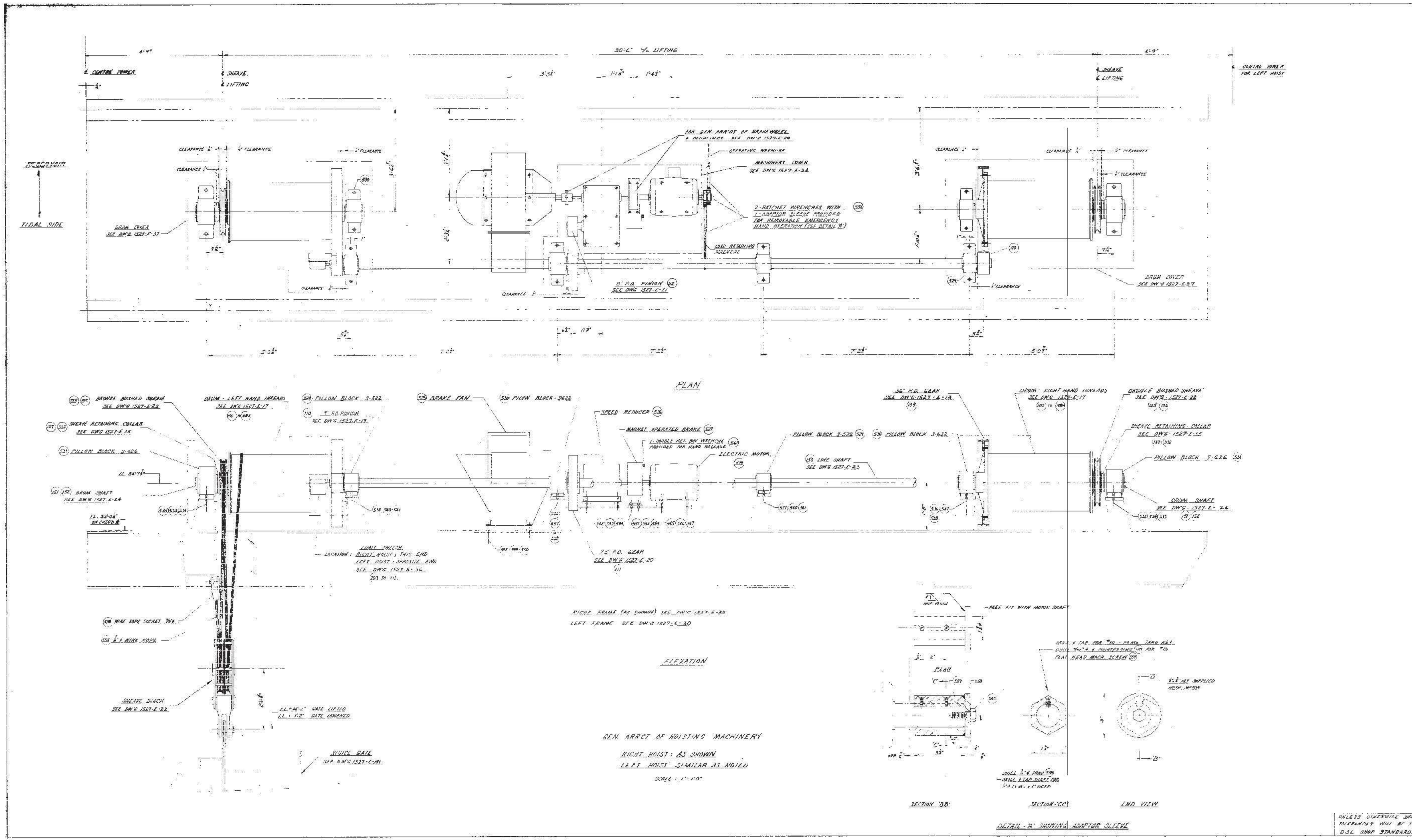
APPENDIX B

REFERENCE MATERIAL



SITE NORTH
N.S. GRID
35° 17' 27"
ANNAPOLIS RIVER RESERVOIR
TIDAL WATERS OF ANNAPOLIS BASIN
HIGH WATER (EL. 102.59)
PARKING
INTERPRETIVE AND CONTROL CENTRE
FISH PASSAGE
POWERHOUSE
69 KV POWER LINE
POWER POLE LOW WIRE EL. 89.100
SITE
SLUICEWAY WATER CONTROL STRUCTURE
SAFETY BOOM 'B'
LOW WIRE EL. 85.10
POWER POLE LOW WIRE EL. 88.100
POWER POLE
TOP OF SLOPE AND MAX. HIGH WATER
AVERAGE LOW WATER
TOP OF SLOPE
STOPLOG STORAGE AREA
SAFETY BOOM 'C'
TO TOWN OF ANNAPOLIS ROYAL
ORIGINAL TOP OF SLOPE
GENERATING FLOW
FLOW
HWY. N°1 TO BRIDGETOWN
TENDER DRAWING
NOVA SCOTIA POWER INC. HYDRO PRODUCTION DEPT.
nova scotia power corporation for the
TIDAL POWER CORPORATION
HALIFAX, NOVA SCOTIA
ANNAPOLIS TIDAL POWER PROJECT
ANNAPOLIS ROYAL - NOVA SCOTIA
SITE PLAN
SLUICEWAY REPAIRS
SCALE 1:1000 U/N
UNITS: MILLIMETRES
DRAWN L.D. WILLISTON
DATE 2004-05-27
DWG. NO. H81VI1 6250023
REV A
ISSUED FOR TENDER
REFERENCE DRAWINGS
DRAWING NUMBER


RESERVOIR
TIDAL SIDE
PLAN
SECTION "AA"
SHOWING SIDE GUIDES
DETAIL "B"
SHOWING FRAME SPLICE
SLUICE GATE
SEE DW'G 1527-E-181
APP. WEIGHT: 60,000#
LIFTING SPEED: 5.2"/min
LOWERING SPEED: 7.8"/min
CENTRE TOWER
SEE DW'G 1527-E-27
RIGHT END COLUMN
SEE DW'G 1527-E-26
LEFT END COLUMN
SIDE GUIDES
ELEVATION
GATE RAISED
(COVERS & HAND RAIL OMITTED)
ELEVATION
GATE LOWERED
REFERENCE DRAWINGS
DETAIL OF DRUM 1527-E-17
DETAIL OF SPUR GEAR 36" P.D. E-18
DETAIL OF SPUR PINION 9" P.D. E-19
DETAIL OF SPUR GEAR 23" P.D. E-20
DETAIL OF SPUR PINION 8" P.D. E-21
ASS'Y & DETAILS OF SHEAVES BLOCK E-22
DETAIL OF LINE SHAFT E-23
DETAIL OF DRUM SHAFT E-24
GEN. ARR'GT OF HOISTING MACHINERY E-25
ASS'Y & DETAILS OF RIGHT & LEFT END COLUMNS E-26
ASS'Y & DETAILS OF CENTRE TOWER E-27
ASS'Y & DETAILS OF SIDE GUIDES TYPE A-B-C-D-E-F E-28
GEN. ARR'GT OF BRAKEWHEEL & COUPLINGS E-29
ASS'Y & DETAILS OF LEFT MACHINERY SUPP. FRAME E-30
GEN. ARR'GT & DETAILS OF FLOOR PLATE E-31
ASS'Y & DETAILS OF RIGHT MACHINERY SUPP. FRAME E-32
LADDER & PIPE RAILING E-33
ASS'Y & DETAILS OF MACHINERY COVERS E-34
SHEAVE RETAINING COLLAR E-35
GEN. ARR'GT & DETAILS OF LIMIT SWITCH BRACKET E-36
GEN. ARR'GT & DETAILS OF DRUM COVERS E-37
GEN. ASS'Y OF HOISTING MECH. & SUPP. STRUCTURE E-38
GEN. ELECTRICAL ARR'GT E-39
LOCATION OF ANCHORS FOR HOIST SUPERSTRUCTURE E-3
PAINTING SPECIFICATION E-106
CONTROL CIRCUIT 1527-E-40
H-081V1-9-001-00-119
No. DATE BY REVISIONS
GENERAL ENGINEERING DIVISION
DAVIE SHIPBUILDING LIMITED
LAUZON, LEVIS, QUE.
ANNAPOLIS RIVER DAM
GENERAL ASSEMBLY OF
HOISTING MECHANISM & SUPPORTING STRUCTURE
FOR: M.M.R.A. DEPARTMENT OF AGRICULTURE N.S.
DATE: MARCH 8 60
JOB NO: C-1527
PRODUCT ENGINEERING
DESIGN
DRAWING NUMBER
DRAWN BY:
DESIGN BY:
CHK'D BY:
APP'D BY:
1527-E-38



BILL OF MATERIAL

PART No	MATERIAL	SPECIFICATION	DIMENSIONS OR SIZE	WIDTH	LENGTH	QTY
525	BRAKE FAN	BUFFALO FORGE	#345 CCW		BL	2
526	SPEED REDUCER	FORANO	[illegible]	[illegible]	[illegible]	2
527	MAGNET OPER. SHOE TYPE	[illegible]	[illegible]	[illegible]		[illegible]
528	ELECTRIC MOTOR	B.T.H.	[illegible]	[illegible]	[illegible]	[illegible]
529	PILLOW BLOCK	S.K.F.	[illegible]	[illegible]	[illegible]	[illegible]
530	— // —	— // —	S-22622	FOR 3 [illegible] SHAFT		6
531	— // —	— // —	S-22626	FOR 4½" SHAFT		4
532	HEX. SOCKET CUT POINT SET SCREW		⅜"φ		1"LG	16
533	HEX. HEAD BOLT	A-307	1⅛"φ		4½"	8
534	HEAVY SEMI FIN. HEX NUT	A-307	1⅛"φ			8
535	HEAVY PLAIN WASHER	STEEL	1⅛"φ			16
536	HEX. HEAD BOLT	A-307	1"φ		4"	12
537	HEAVY SEMI FIN. HEX. NUT	A-307	1"φ			12
538	HEAVY PLAIN WASHER	STEEL	1"φ			24
539	HEX. HD. BOLT	A-307	⅞"φ		4"	12
540	HEAVY SEMI FIN. HEX NUT	A-307	⅞"φ			12
541	HEAVY PLAIN WASHER	STEEL	⅞"φ			24
542	HEX. HD. BOLT	A-307	¾"φ		6"	12
543	HEAVY SEMI FIN. HEX. NUT	A-307	¾"φ			12
544	HEAVY PLAIN WASHER		¾"φ			24
545	HEX. HD. BOLT	A-307	⅝"φ		4½"	8
546	HEAVY SEMI FIN. HEX NUT	A-307	⅝"φ			8
547	HEAVY PLAIN WASHER	STEEL	⅝"φ			16
548	HEX. HEAD BOLT	A-307	½"φ		4"	12
549	HEAVY SEMI FIN. HEX NUT	A-307	½"φ			12
550	HEAVY PLAIN WASHER	STEEL	½"φ			24
551	HEX. HD. BOLT	A-307	⅜"φ		2½"	8
552	HEAVY SEMI FIN. HEX. NUT	A-307	⅜"φ			8
553	HEAVY PLAIN WASHER	STEEL	⅜"φ			16
554	WIRE ROPE SOCKET	FORGED STEEL	⅞"φ	OPEN	TYPE	4
555	WIRE ROPE	GALV. STEEL	⅞"φ	6×37	250'	4
556	LOWELL REVERSIBLE RATCHET WRENCHE		N° 44 WITH 2⅝" HEX. OPEN			2
557	HEX. BAR	STEEL	2⅝" HEX.		4"	1
558	PLATE	A-7	⅜"	3½"	3½"	1
559	FLAT HD. MACH. SCREW	STEEL	#10 - 24 NC.		½"	2
560	HEX. HD. MACH. SCREW	"	½"φ		1"	1
561	ARMSTRONG DOUBLE HEX. BOX WRENCHE		№ 1806 B (1" HEX. OPEN)			1

GENERAL NOTES

1) TO ALIGN GATE WITH EMBEDDED PARTS AND PERMIT EQUAL LIFTING AT BOTH ENDS OF GATE, CABLES MUST BE ATTACHED TO BOTH DRUMS AND FINAL ADJUSMENT OBTAINED WITH DRUM PINION AT ONE END ONLY

2) BILL OF MATERIAL MADE FOR 2 HOISTS AS REQ'D

H-081V1-9-001-00-101

No	DATE	BY	REVISIONS
1	MAR. 3-60	J.P.	DETAIL OF HAND OPERATION ADD'D - PART 552 TO 561 ADDED

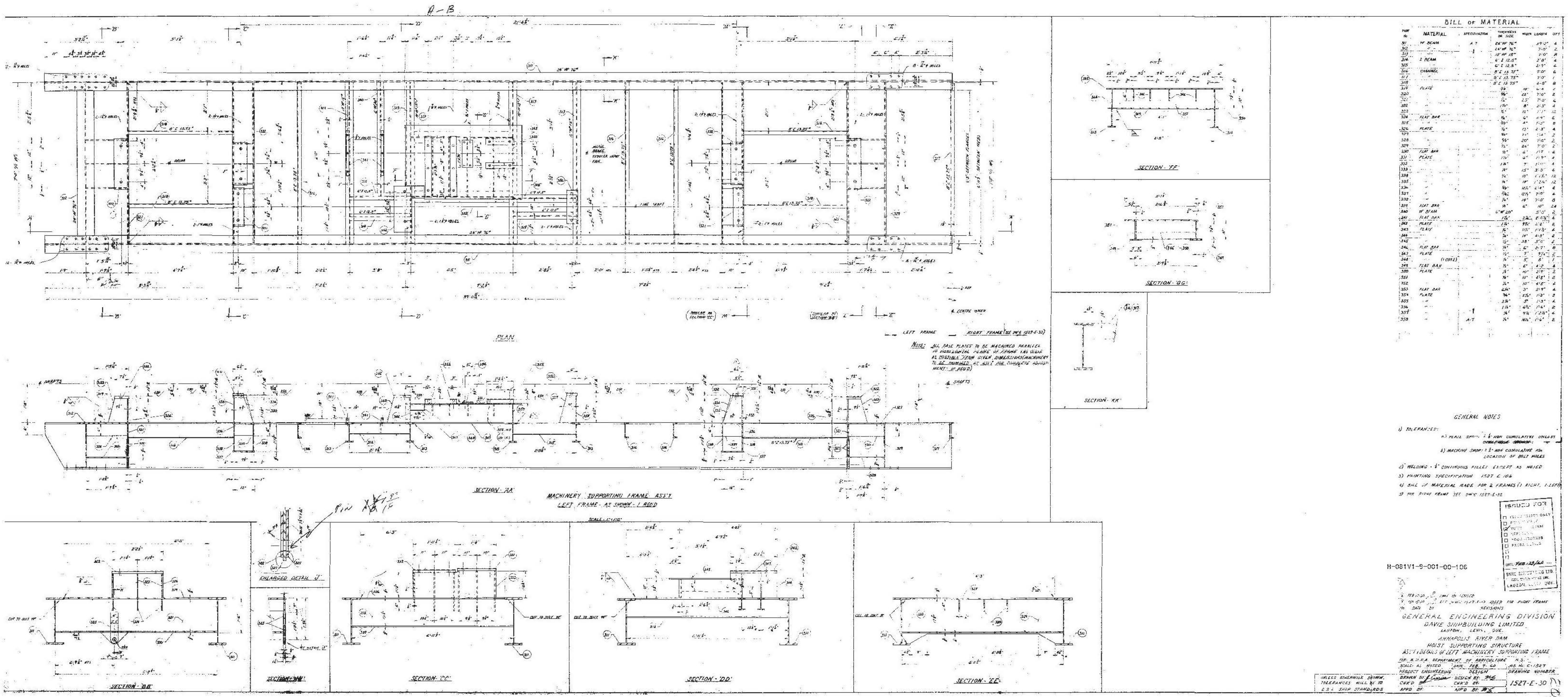
GENERAL ENGINEERING DIVISION
DAVIE SHIPBUILDING LIMITED
LAUZON, LEVIS, QUE.

ANNAPOLIS RIVER DAM
HOISTING MECHANISM
GEN. ARR'GT OF HOISTING MACHINERY

FOR: M.M.R.A. DEPARTMENT OF AGRICULTURE N.S.
SCALE: AS NOTED | DATE: MARCH 1 - 60 | JOB No: C-1527

UNLESS OTHERWISE SHOWN, TOLERANCES WILL BE TO DSL SHOP STANDARDS

PRODUCT ENGINEERING: DRAWN BY: J. [illegible] / CHK'D BY: [illegible] / APP'D BY:
DESIGN: DESIGN BY: M.S. / CHK'D BY: / APP'D BY: M.S.
DRAWING NUMBER: 1527-E-25


PLAN
SECTION 'AA'
MACHINERY SUPPORTING FRAME ASS'Y
LEFT FRAME - AS SHOWN - 1 REQ'D
SECTION 'FF'
SECTION 'GG'
SECTION 'KK'
SECTION 'BB'
ENLARGED DETAIL 'J'
SECTION 'CC'
SECTION 'DD'
SECTION 'EE'
BILL OF MATERIAL
GENERAL NOTES
5) FOR RIGHT FRAME SEE DWG 1527-E-32
ISSUED FOR
H-081V1-9-001-00-106
REVISIONS
GENERAL ENGINEERING DIVISION
DAVIE SHIPBUILDING LIMITED
LAUZON, LEVIS, QUE.
ANNAPOLIS RIVER DAM
HOIST SUPPORTING STRUCTURE
ASS'Y & DETAILS OF LEFT MACHINERY SUPPORTING FRAME
FOR: M.M.R.A. DEPARTMENT OF AGRICULTURE N.S.
SCALE: AS NOTED
DATE: FEB. 9-60
JOB No: E-1527
PRODUCT ENGINEERING
DESIGN
DRAWING NUMBER
DRAWN BY:
DESIGN BY:
CHK'D BY:
APP'D BY:
1527-E-30

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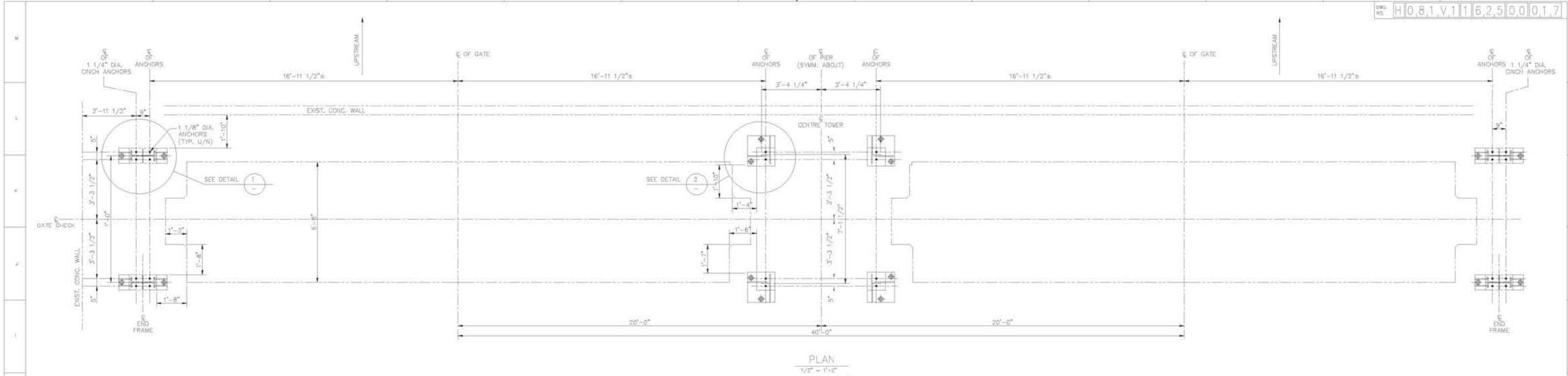
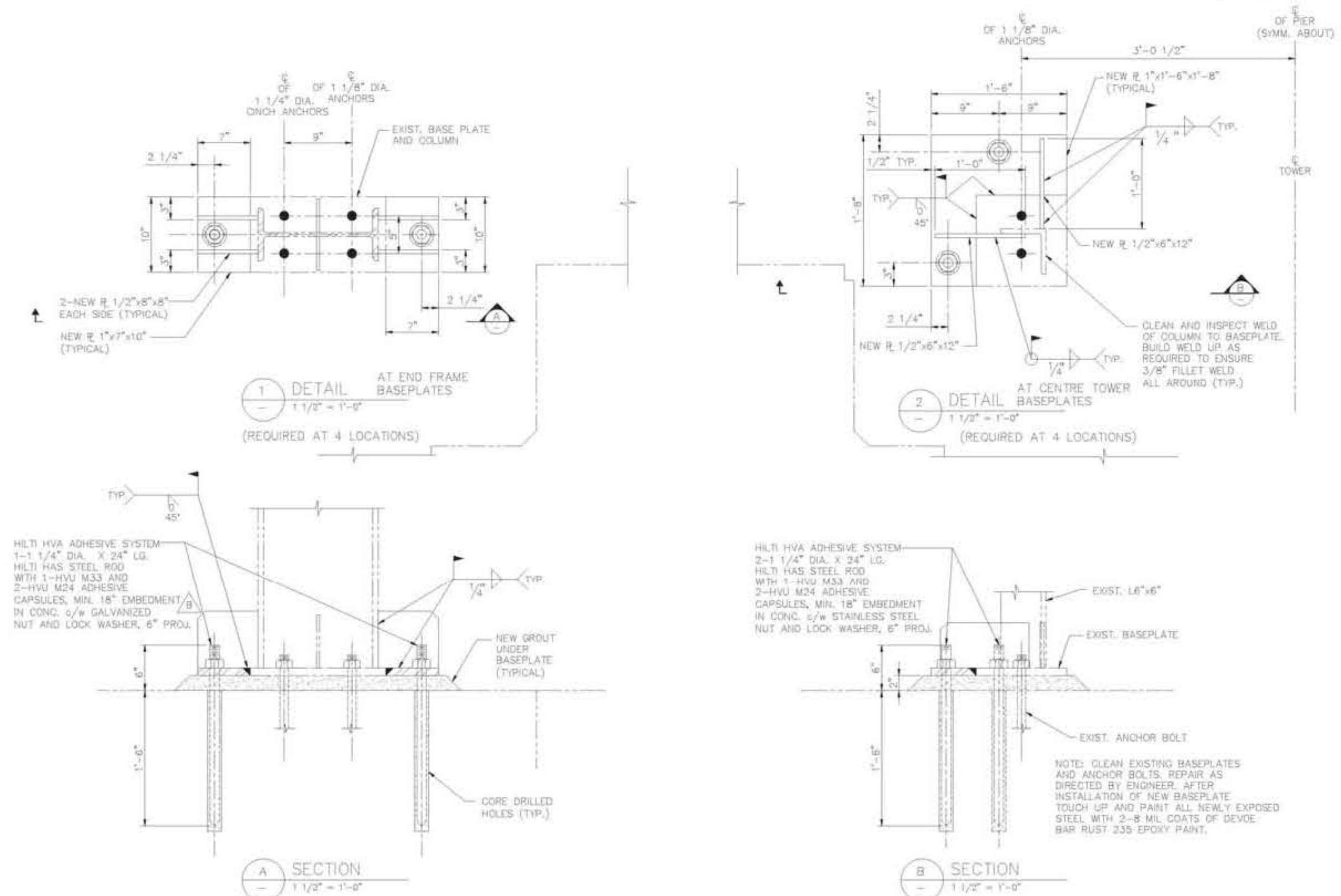
DWG. NO. H081V1 1 625 00 017





MAXIMUM BASEPLATE REACTIONS SUMMARY TABLE						
LOCATION	UNFACTORED LOAD (kN)			FACTORED LOAD (kN)		
	SHEAR	TENSION (UPLIFT)	COMPRESSION	SHEAR	TENSION (UPLIFT)	COMPRESSION
END FRAMES	71	264	477	121	417	678
CENTRE TOWER	100	287	486	159	451	701

GENERAL NOTES:

1. STRUCTURAL STEEL SHALL CONFORM TO CAN/CSA-G40.20/G40.21 GRADE 300W.
2. STRUCTURAL STEEL SHALL BE FABRICATED AND ERECTED IN ACCORDANCE WITH CAN/CSA-S16.1-M94.
3. NEW STEEL SHALL BE BLAST CLEANED IN ACCORDANCE WITH SSPC SP6, COMMERCIAL BLAST CLEANING. EXISTING STEEL SHALL BE CLEANED IN ACCORDANCE WITH SSPC-SP3, POWER TOOL CLEANING.
4. PAINT SHALL BE DEVOE BAR-RUST 235 EPOXY. USE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
5. ALL WELDING SHALL UTILIZE E480 XX ELECTRODES AND SHALL MEET THE LATEST REQUIREMENTS OF CSA W59 AND W47.1.
6. GROUT SHALL BE M-BED STANDARD AS MANUFACTURED BY STERNSON OR APPROVED EQUAL.
7. THE HILTI HVA ADHESIVE ANCHORING SYSTEM SHALL CONSIST OF THE FOLLOWING:
   a) HVU ADHESIVE CAPSULES
   b) HAS THREADED ANCHOR RODS (HOT-DIPPED GALVANIZED) GRADE B7
      MINIMUM TENSILE STRENGTH = 860 MPa
      MINIMUM YIELD STRENGTH = 720 MPa

ALL ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS AND RECOMMENDATIONS. SPECIAL ATTENTION SHALL BE NOTED WITH REGARDS TO THE TIME AND TEMPERATURE CONSIDERATIONS FOR MIXING AND CURING OF THE ADHESIVE CAPSULES. NO MATERIALS SHALL BE USED THAT ARE PAST THEIR EXPIRATION DATE.

APPROVED FOR CONSTRUCTION

YMCL Engineering Limited

REFERENCE DRAWINGS	DWG.NO.
LOCATION OF ANCHORS FOR HOISTS SUPERSTRUCTURE	H081V1 9 001 00 89
GENERAL ASSEMBLY	H081V1 9 001 00 118

REV	DATE/BY	DESCRIPTION
B	BY: S.W.P. DATE: 2000-11-08	REVISED SECTION "A" NOTE
A	BY: S.W.P. DATE: 1999-12-17	ISSUED FOR CONSTRUCTION

SEAL: ORIGINAL ISSUE APPROVED FOR CONSTRUCTION BY: P.A. PEACH DATED: DEC. 23, 1999 REGISTRATION No.: 4597 REGISTERED PROFESSIONAL ENGINEER PROVINCE OF NOVA SCOTIA

DEPARTMENTAL APPROVALS: CIVIL / E & I / MECH / CONST — APPROVED — DATE

SCALE 1/2" = 1'-0"
UNITS IMPERIAL
DESIGNED P.A.P.
DRAWN S.W.P.
CHECKED T.A.M.
CHECKED
DATE DECEMBER 1999
W.O. –

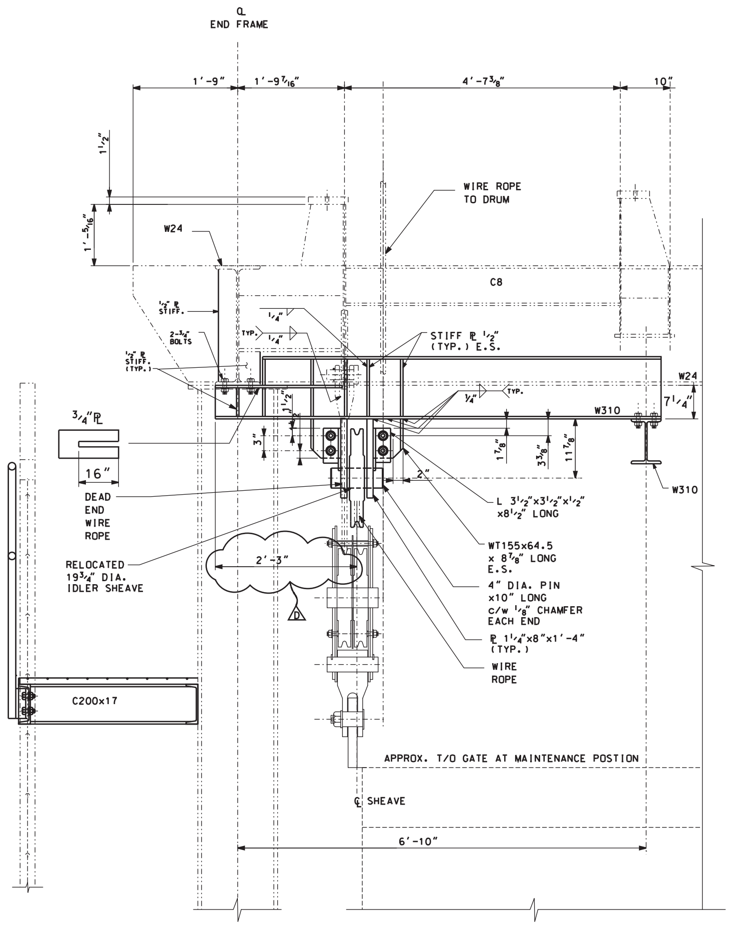
Nova Scotia Power Inc.
Halifax, Nova Scotia, Canada

ANNAPOLIS TIDAL GENERATING STATION
ANNAPOLIS RIVER SLUICE GATE STRUCTURE
SUPERSTRUCTURE ANCHORAGE MODIFICATIONS

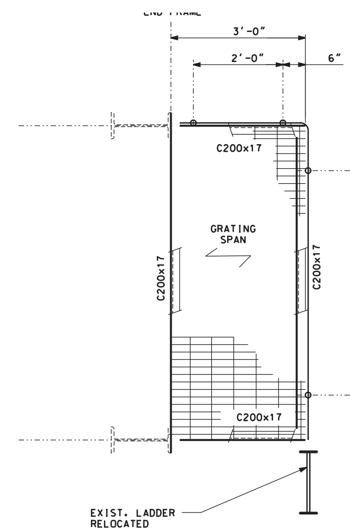
DWG.NO. H081V1 1 625 00 017 REV. B

M:\GE\HYDRO\Annapolis\Unit 1\Civil\62500032.dgn

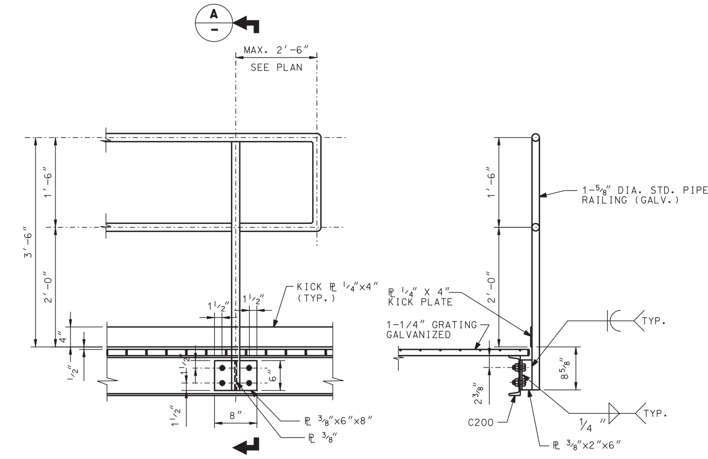
H 0 8 1 V 2 1 6 2 5 0 0 0 3 2



SECTION A/031
SCALE 1" = 1'-0"



ACCESS PLATFORM
SCALE 3/4" = 1'-0"



END POST DETAIL
SCALE 1" = 1'-0"

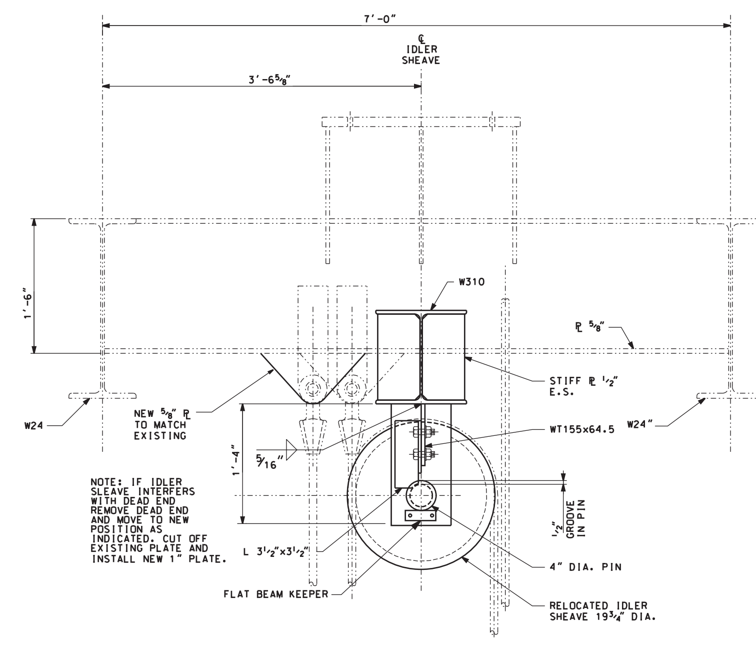
SECTION A/–
SCALE 1" = 1'-0"

NOTES

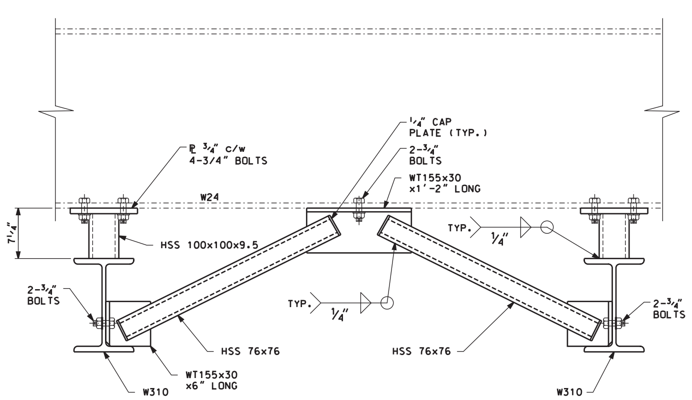
1. ALL DIMENSIONS IN FEET AND INCHES UNLESS NOTED.
2. DESIGN IN ACCORDANCE WITH THE NATIONAL BUILDING CODE OF CANADA - 1995.
3. CONFIRM ALL DIMENSIONS TO EXISTING ON SITE. REPORT ANY DISCREPANCIES TO THE ENGINEER PRIOR TO PROCEEDING WITH WORK.
4. PROVIDE PROTECTION TO ALL EXISTING SURFACES THAT ARE TO REMAIN AS PART OF THE FINISHED WORK TO THE SATISFACTION OF THE ENGINEER. DO NOT FIELD WELD TO EXISTING STEEL.
5. DESIGN SUPERIMPOSED LOADS: EQUIPMENT LOAD OF WIRE ROPE. APPROXIMATELY 80,000 LBS.

STRUCTURAL STEEL:

1. ALL STRUCTURAL STEEL SHALL CONFORM TO AN/CSA-G40.20/G40.21 GRADE 350W. GRADE 300W FOR ANGLES AND PLATES
2. STRUCTURAL STEEL SHALL BE FABRICATED AND ERECTED IN ACCORDANCE WITH CAN/CSA-S16.1-M94.
3. ALL STRUCTURAL STEEL SHALL BE CLEANED TO SSPC-SP10 AND APPLY AMERLOCK 400 COATING SYSTEM:
   .1 FIRST COAT 4-8 MIL (DFT).
   .2 INTERMEDIATE STRIPE COAT.
   .3 TOP COAT 4-8 MILS (DFT).
   .4 COLOR SHALL MATCH EXISTING STEEL FRAMING.
4. SUBMIT SHOP DRAWINGS FOR REVIEW PRIOR TO FABRICATION AND IN ACCORDANCE WITH CAN/CSA-S16.1-M94.
5. ALL WELDING SHALL UTILIZE E480XX ELECTRODES AND SHALL MEET THE LATEST REQUIREMENTS OF W47.1. DO WELDING IN ACCORDANCE WITH CSA W59.
6. BOLTS: ALL BOLTS SHALL BE M20 (METRIC DESIGNATION) ASTM A325-94 BOLTS UNLESS INDICATED OTHERWISE.
7. GRATING: TYPE W/F BEARING BARS 1 1/4" x 3/16" @ 1 3/16" C/C. BANDED AND GALVANIZED AS MANUFACTURED BY IKG INDUSTRIES.



SECTION B/031
SCALE 1 1/2" = 1'-0"



SECTION (TYP. 4 LOCATIONS) C/031
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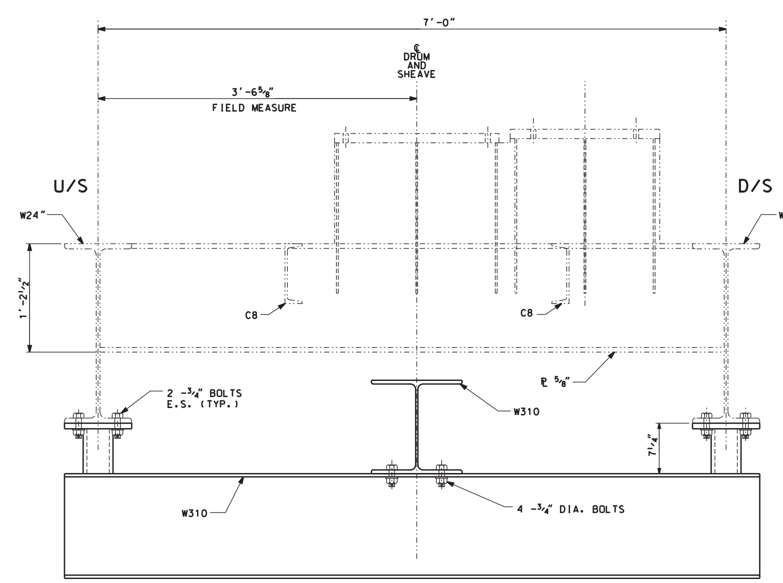


SECTION D/031
SCALE 1 1/2" = 1'-0"

AS BUILT

YMCL Engineering Limited
Suite 1404, CIBC Building, 1809 Barrington St., Hfx, N.S. B3J 3K8
Tel: (902)-429-3514 Fax: (902)-431-9622

REV	DS	CIVIL	MECH	E & I	CONST	DESCRIPTION	BY	DATE
D						REVISED AS BUILT		2005-10-31
C						ISSUED FOR TENDER GATE No.1 ONLY		2005-06-23
B						REVISED AS BUILT DRAWING RENUMBERED FORMELY DWG. No. 62500022		2005-06-14
A						ISSUED FOR TENDER GATE NO.2 ONLY	RJL	2004-09-03
0						ISSUED FOR INFORMATION ONLY	SWP	2003-07-09

AS SHOWN
IMPERIAL
TAM
SWP/RJL
TAM
JULY 2003

ANNAPOLIS TIDAL GENERATING STATION
ANNAPOLIS SLUICE GATE STRUCTURE
IDLER SHEAVE SUPPORT FRAME
STRUCTURAL STEEL
SECTIONS

H 0 8 1 V 1 1 6 2 5 0 0 0 3 2 D

$$$$$$$SYTIME$$$$$$$
DGN$SPECIFICATION********
USER$NAME

$$REF01$$
$$REF02$$
$$REF03$$
$$REF04$$
$$REF05$$
$$REF06$$

NOVA SCOTIA POWER INC.
HYDRO PRODUCTION DEPT.
TENDER DRAWING
PRELIMINARY ONLY, NOT FOR CONSTRUCTION

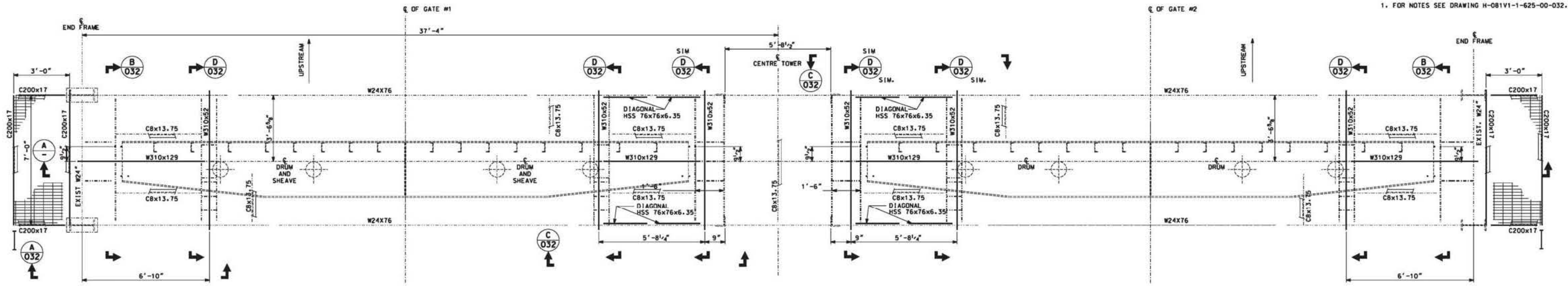
2 of 2

M:\GE\HYDRO\Annapolis\Unit 1\Civil\62500031.dgn

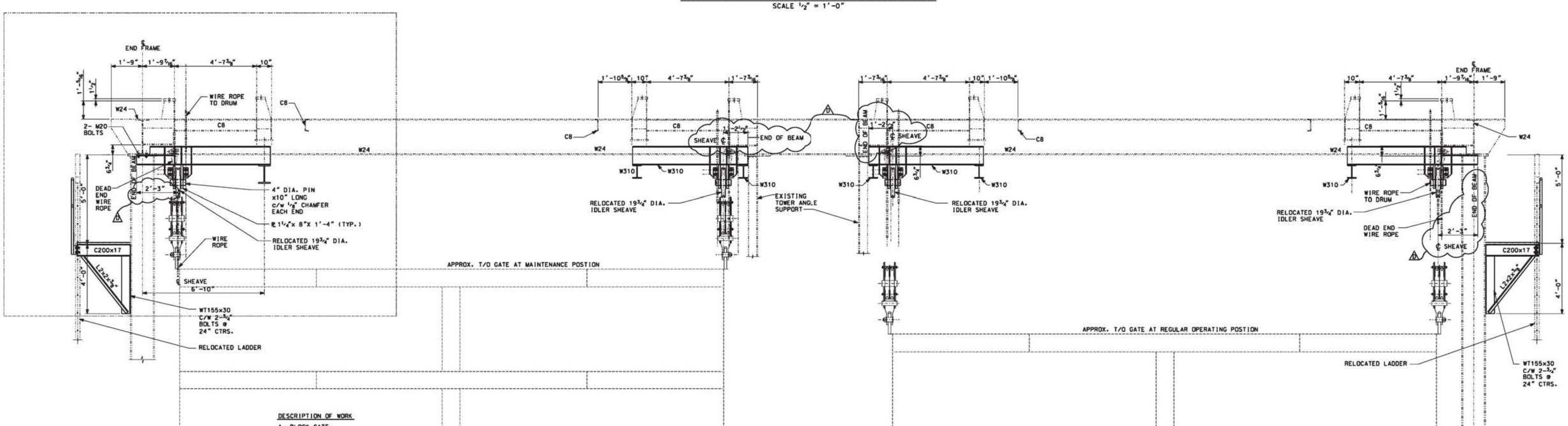
H 0 8 1 V 2 1 6 2 5 0 0 0 3 1

NOTES

1. FOR NOTES SEE DRAWING H-081V1-1-625-00-032.



PLAN OF SLUICE GATE HOIST STRUCTURE
SCALE ½" = 1'-0"



DESCRIPTION OF WORK

1. BLOCK GATE.
2. REMOVE IDLER SLEAVE AND WIRE ROPE AS REQUIRED. INSTALL "DUMMY" DISK IDLER ON HOIST MAIN SHAFTS.
3. INSTALL NEW STEEL FRAME AND REINSTALL IDLER SLEAVE IN NEW LOCATION AS INDICATED.
4. REMOVE EXISTING LADDER. INSTALL NEW ACCESS PLATFORM

SECTION (A/–) VIEW OF GATE STRUCTURE LOOKING UPSTREAM
SCALE 1½" = 1'-0"

AS BUILT

YMCL Engineering Limited

ASSEMBLY AND DETAILS OF RIGHT SUPPORTING FRAME	H 8 1 V 1 9 0 0 1 0 0 1 0 8
ASSEMBLE AND DETAILS OF RIGHT AND LEFT END COLUMNS	H 8 1 V 1 9 0 0 1 0 0 1 0 2
ASSEMBLY AND DETAILS OF GATE SHEAVE BLOCK	H 8 1 V 1 9 0 0 1 0 0 0 9 8

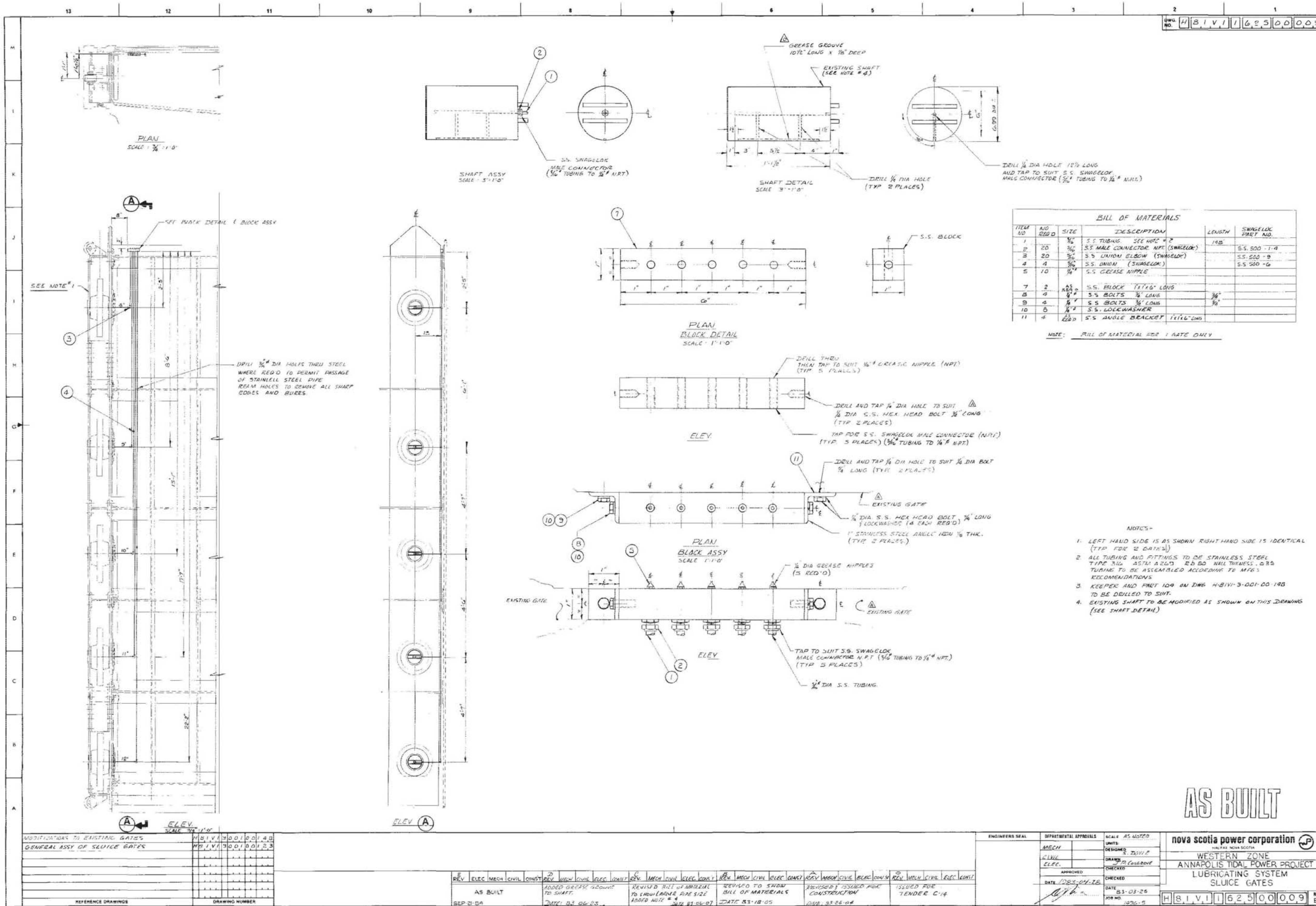
REV	DESCRIPTION	DATE
D	REVISED AS NOTED AS BUILT	2005-10-31
C	ISSUED FOR TENDER GATE No.1 ONLY	2005-06-23
B	REVISED AS BUILT DRAWING RENUMBERED FORMELY DWG. NO. 62500021	2005-06-14
A	ISSUED FOR TENDER GATE No.2 ONLY (BY: RJL)	2004-09-03
0	ISSUED FOR INFORMATION ONLY (BY: SWP)	2003-07-09

AS SHOWN
IMPERIAL
LHM/TAM
SWP/RJL
TAM
JULY 2003

ANNAPOLIS TIDAL GENERATING STATION
ANNAPOLIS SLUICE GATE STRUCTURE
IDLER SHEAVE SUPPORT FRAME
STRUCTURAL STEEL
PLAN AND SECTIONS

H 0 8 1 V 1 1 6 2 5 0 0 0 3 1 D

2 of 2



BILL OF MATERIALS

ITEM NO	NO REQ'D	SIZE	DESCRIPTION	LENGTH	SWAGELOK PART NO.
1		5/16"	S.S. TUBING SEE NOTE # 2	148'	
2	20	5/16"	S.S. MALE CONNECTOR NPT (SWAGELOK)		S.S. 500 - 1 - 4
3	20	5/16"	S.S. UNION ELBOW (SWAGELOK)		S.S. 500 - 9
4	4	5/16"	S.S. UNION (SWAGELOK)		S.S. 500 - 6
5	10	¼"Ø	S.S. GREASE NIPPLE		
7	2	AS REQ'D	S.S. BLOCK 1"x1"x6" LONG		
8	4	¼"Ø	S.S. BOLTS ¾" LONG	¾"	
9	4	¼"Ø	S.S. BOLTS ¾" LONG	¾"	
10	8	¼"Ø	S.S. LOCKWASHER		
11	4	AS REQ'D	S.S. ANGLE BRACKET 1"x1"x6" LONG		

NOTE: BILL OF MATERIAL FOR 1 GATE ONLY

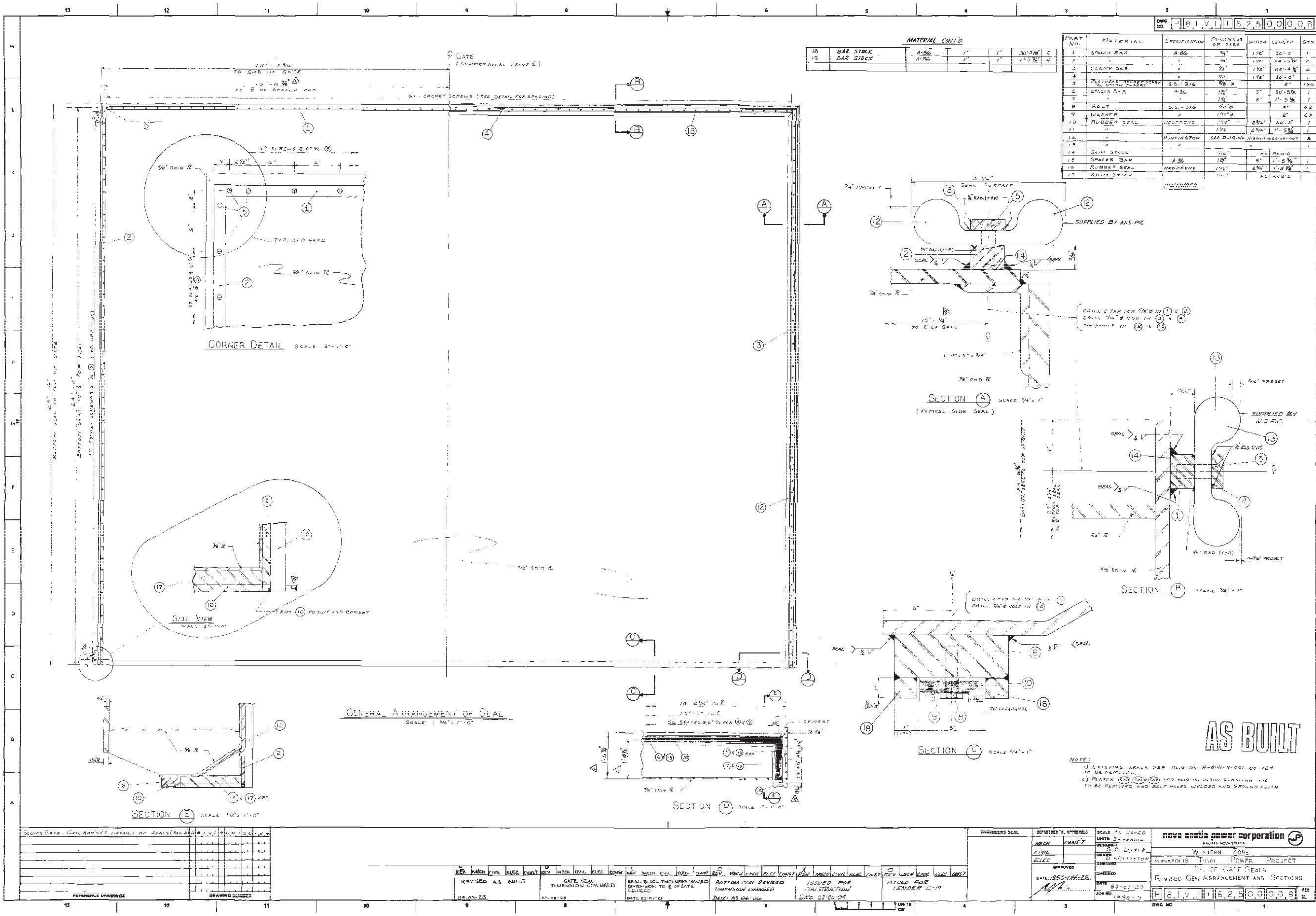
NOTES:-

1. LEFT HAND SIDE IS AS SHOWN RIGHT HAND SIDE IS IDENTICAL (TYP FOR 2 GATES)
2. ALL TUBING AND FITTINGS TO BE STAINLESS STEEL TYPE 316 ASTM A269 Rb 80 WALL THKNESS .035 TUBING TO BE ASSEMBLED ACCORDING TO MFGS RECOMENDATIONS
3. KEEPER AND PART 109 ON DWG H-81VI-3-001-00-148 TO BE DRILLED TO SUIT.
4. EXISTING SHAFT TO BE MODIFIED AS SHOWN ON THIS DRAWING (SEE SHAFT DETAIL)

AS BUILT

nova scotia power corporation
HALIFAX NOVA SCOTIA
WESTERN ZONE
ANNAPOLIS TIDAL POWER PROJECT
LUBRICATING SYSTEM
SLUICE GATES

SCALE: AS NOTED
DESIGNED: R. DOYLE
DRAWN: J.P. Cosgrove
DATE: 83-03-26
JOB NO. 1936-5
APPROVED DATE: 1983-04-28
DWG. NO. H 8 1 V 1 1 6 2 5 0 0 0 0 9 REV E



MATERIAL CONT'D

18	BAR STOCK	A-36	1"	1"	30'-5⅝"	2
19	BAR STOCK	A-36	1"	1"	1'-5⅝"	4

PART No.	MATERIAL	SPECIFICATION	THICKNESS OR SIZE	WIDTH	LENGTH	QTY.
1	SPACER BAR	A-36	¾"	1½"	30'-0"	1
2	"	"	¾"	1½"	24'-5⅝"	2
3	CLAMP BAR	"	½"	1½"	24'-4⅞"	2
4	"	"	½"	1½"	30'-0"	1
5	FLATHEAD SOCKET SCREW W/ NYLON INSERT	S.S.-316	⅝" ϕ		2"	190
6	SPACER BAR	A-36	1½"	5"	30'-5⅝"	1
7	"	"	1½"	5"	1'-5⅝"	1
8	BOLT	S.S.-316	½" ϕ		2"	62
9	WASHER	"	1½" ϕ		2"	62
10	RUBBER SEAL	NEOPRENE	1¼"	2¾"	30'-3"	1
11	"	"	1¼"	2¾"	1'-5⅝"	1
12	"	HUNTINGTON	SEE DWG. No. H-81V1-1-625-00-007			2
13	"	"	"			1
14	SHIM STOCK		1/16"	AS	REQ'D	
15	SPACER BAR	A-36	1½"	5"	1'-5⅝"	1
16	RUBBER SEAL	NEOPRENE	1¼"	2¾"	1'-5⅝"	1
17	SHIM STOCK		1/16"	AS	REQ'D	

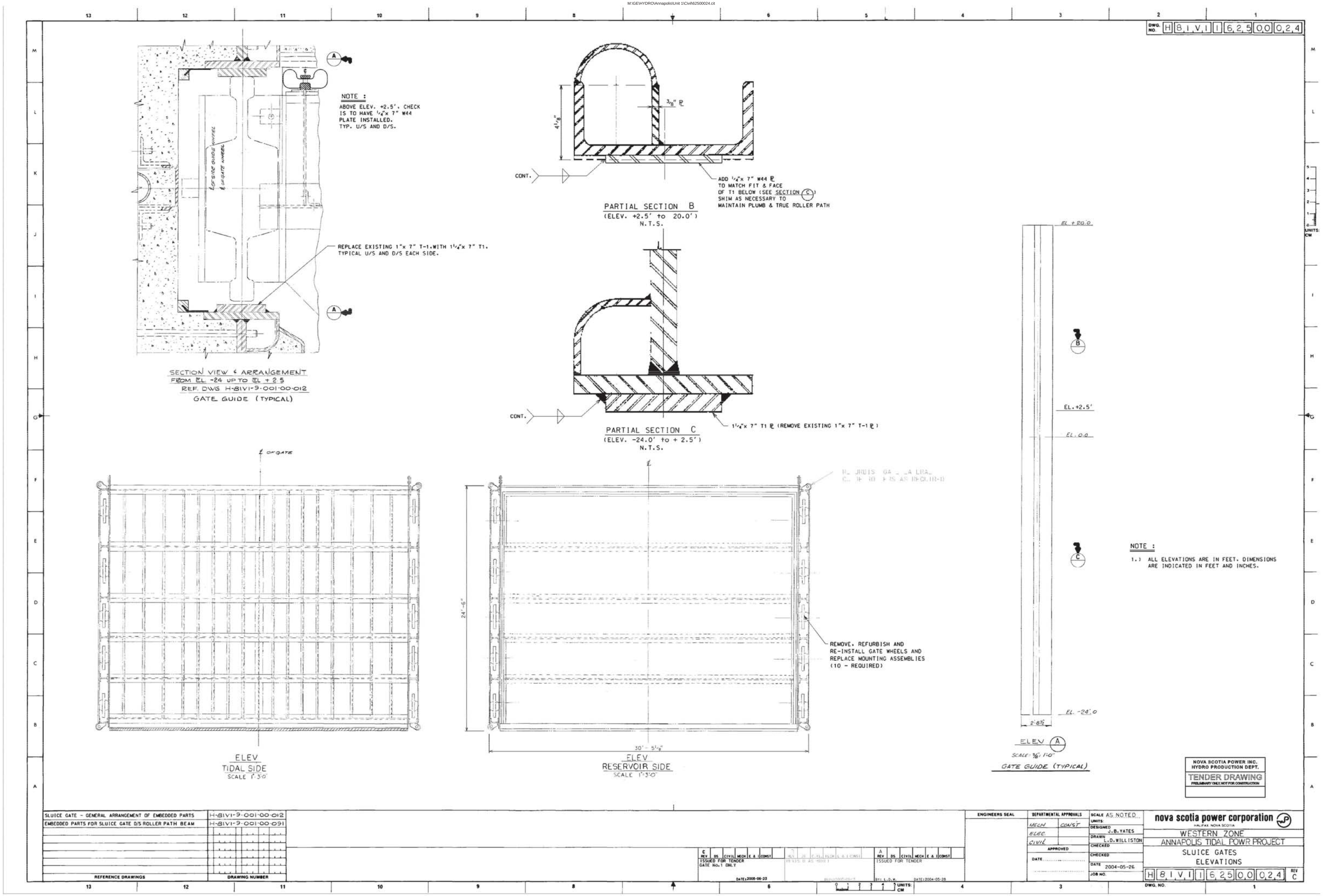
CONTINUED

NOTE:
1) EXISTING SEALS PER DWG. No. H-81V1-9-001-00-124 TO BE REMOVED.
2) PLATES (500), (501) & (502) PER DWG No. H-81V1-9-001-00-124 TO BE REMOVED AND BOLT HOLES WELDED AND GROUND FLUSH

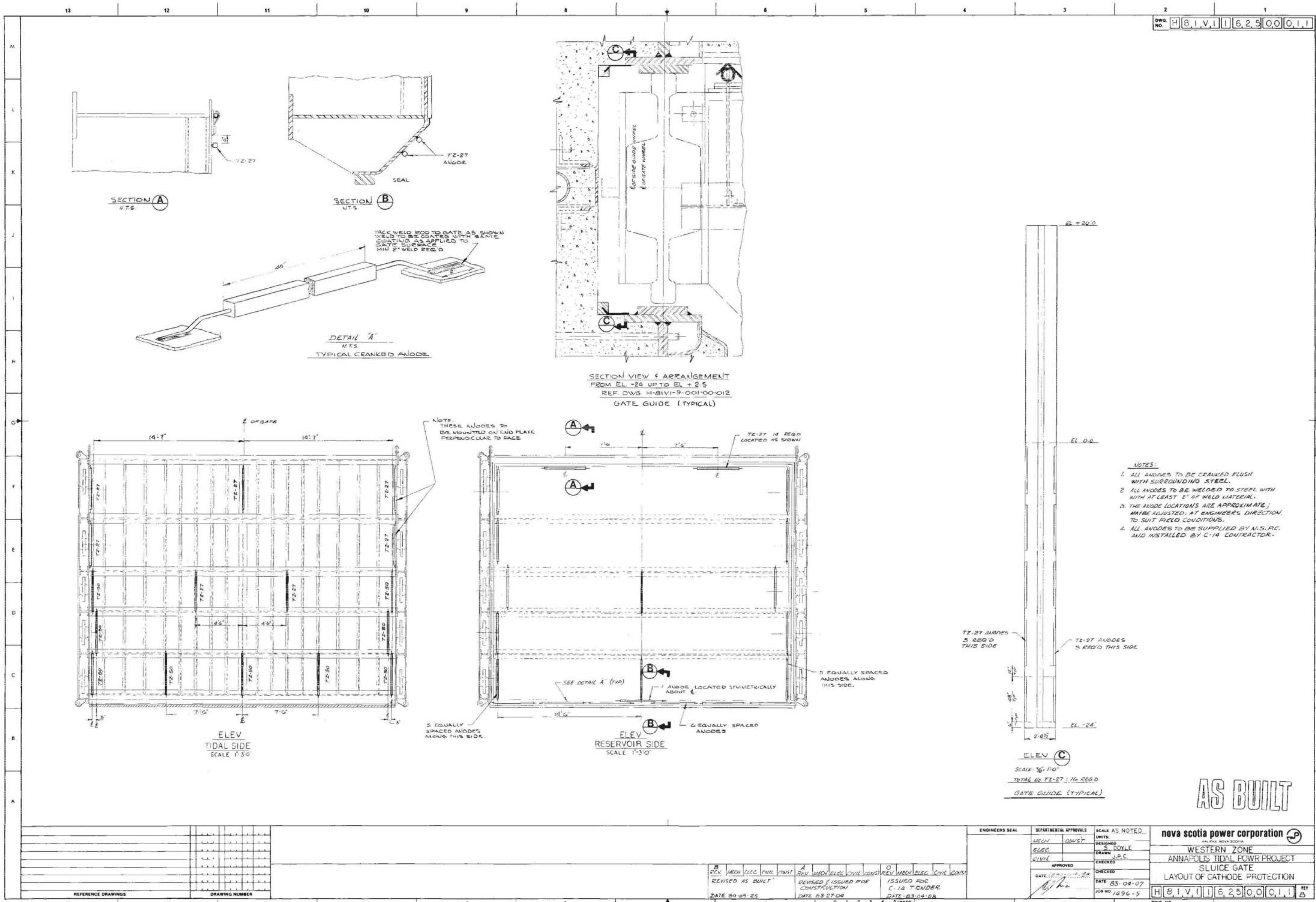
REV.	DESCRIPTION	DATE
	REVISED AS BUILT	84-04-28
	GATE SEAL DIMENSION CHANGED	83-08-24
	SEAL BLOCK THICKNESS CHANGED DIMENSION TO ℄ OF GATE CHANGED	83-07-21
	BOTTOM SEAL REVISED DIMENSION CHANGED	83-04-06
	ISSUED FOR CONSTRUCTION	83-02-04
	ISSUED FOR TENDER	83-1-18

SCALE: AS NOTED
UNITS: IMPERIAL
DESIGNED: S.C. DOYLE
DRAWN: D. WILLISTON
DATE: 83-01-27
JOB NO. 1496-0
APPROVED DATE: 1983-04-28

nova scotia power corporation
HALIFAX NOVA SCOTIA
WESTERN ZONE
ANNAPOLIS TIDAL POWER PROJECT
SLUICE GATE SEALS
REVISED GEN. ARRANGEMENT AND SECTIONS
DWG. NO. H 8 1 V 1 1 6 2 5 0 0 0 0 8



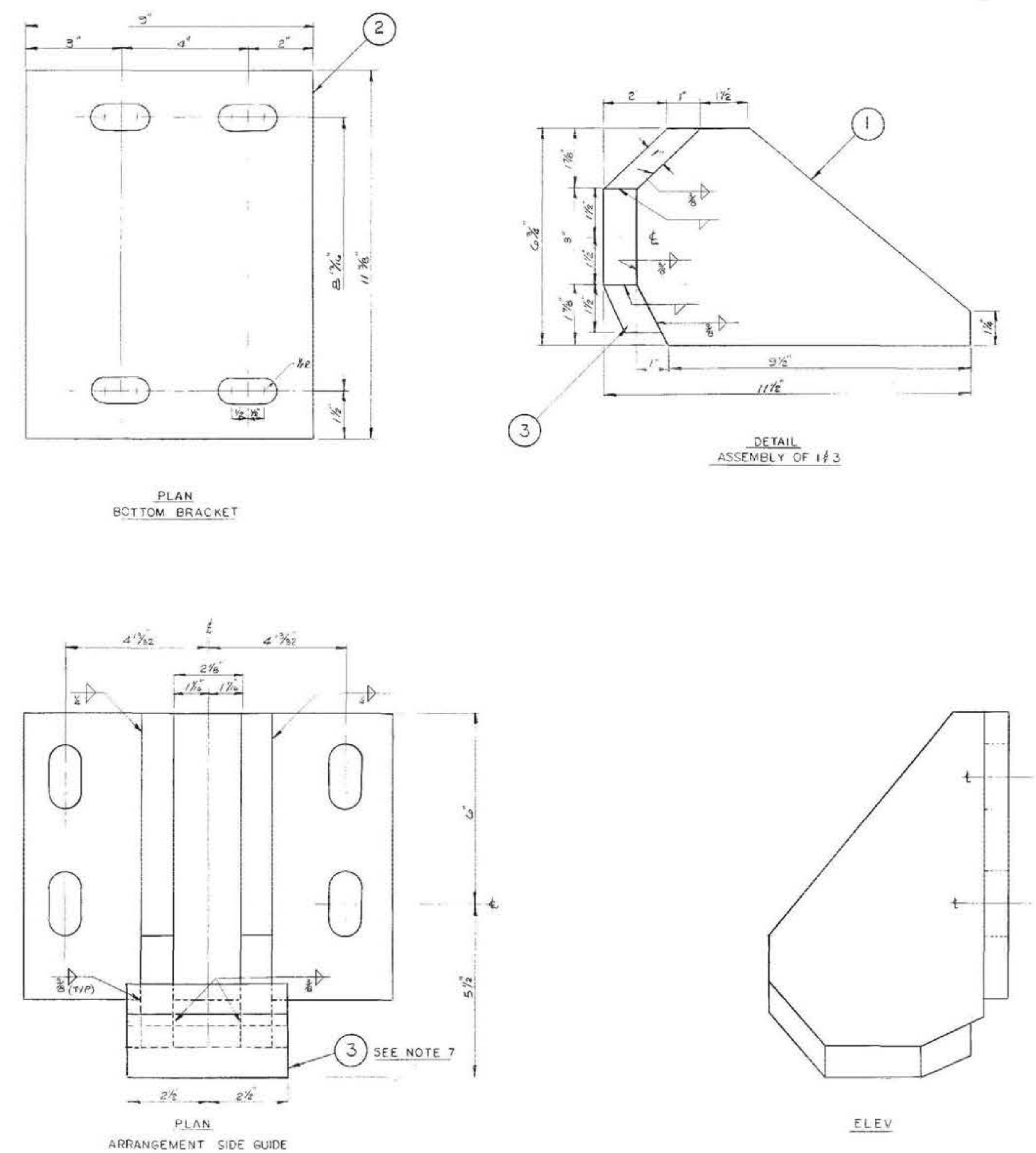
NOTE :
ABOVE ELEV. +2.5', CHECK IS TO HAVE 1/4"x 7" W44 PLATE INSTALLED. TYP. U/S AND D/S.
REPLACE EXISTING 1"x 7" T-1, WITH 1 1/4"x 7" T1. TYPICAL U/S AND D/S EACH SIDE.
SECTION VIEW & ARRANGEMENT FROM EL -24 UP TO EL +2.5
REF. DWG H-81V1-9-001-00-012
GATE GUIDE (TYPICAL)
CONT.
ADD 1/4"x 7" W44 PL TO MATCH FIT & FACE OF T1 BELOW (SEE SECTION C) SHIM AS NECESSARY TO MAINTAIN PLUMB & TRUE ROLLER PATH
PARTIAL SECTION B
(ELEV. +2.5' to 20.0')
N.T.S.
1 1/4"x 7" T1 PL (REMOVE EXISTING 1"x 7" T-1 PL)
PARTIAL SECTION C
(ELEV. -24.0' to + 2.5')
N.T.S.
EL +20.0
EL.+2.5'
EL.0.0
EL. -24'.0
ELEV A
SCALE: 3/8": 1'-0"
GATE GUIDE (TYPICAL)
ELEV
TIDAL SIDE
SCALE 1":3'-0"
24'-6"
30'-5 1/8"
ELEV
RESERVOIR SIDE
SCALE 1":3'-0"
REMOVE, REFURBISH AND RE-INSTALL GATE WHEELS AND REPLACE MOUNTING ASSEMBLIES (10 - REQUIRED)
NOTE :
1.) ALL ELEVATIONS ARE IN FEET, DIMENSIONS ARE INDICATED IN FEET AND INCHES.
NOVA SCOTIA POWER INC.
HYDRO PRODUCTION DEPT.
TENDER DRAWING
PRELIMINARY ONLY, NOT FOR CONSTRUCTION
SLUICE GATE - GENERAL ARRANGEMENT OF EMBEDDED PARTS H-81V1-9-001-00-012
EMBEDDED PARTS FOR SLUICE GATE D/S ROLLER PATH BEAM H-81V1-9-001-00-091
REFERENCE DRAWINGS
DRAWING NUMBER
ISSUED FOR TENDER GATE No.1 ONLY
ISSUED FOR TENDER
ENGINEERS SEAL
DEPARTMENTAL APPROVALS
MECH
CONST
ELEC.
CIVIL
APPROVED
DATE
SCALE AS NOTED
UNITS:
DESIGNED J.B.YATES
DRAWN L.D.WILLISTON
CHECKED
CHECKED
DATE 2004-05-26
JOB NO.
nova scotia power corporation
HALIFAX NOVA SCOTIA
WESTERN ZONE
ANNAPOLIS TIDAL POWR PROJECT
SLUICE GATES
ELEVATIONS
H 8 1 V 1 1 6 2 5 0 0 0 2 4
REV C
DWG. NO.


SECTION A
N.T.S.
SECTION B
N.T.S.
TZ-27 ANODE
SEAL
DETAIL "A"
N.T.S.
TYPICAL CRANKED ANODE
SECTION VIEW & ARRANGEMENT
FROM EL -24 UP TO EL +2.5
REF. DWG H-81VI-9-001-00-012
GATE GUIDE (TYPICAL)
ELEV
TIDAL SIDE
SCALE 1":3'0"
ELEV
RESERVOIR SIDE
SCALE 1":3'0"
ELEV C
SCALE 3/8":1'-0"
TOTAL No TZ-27 : 16 REQ'D
GATE GUIDE (TYPICAL)
NOTES:
1. ALL ANODES TO BE CRANKED FLUSH WITH SURROUNDING STEEL.
2. ALL ANODES TO BE WELDED TO STEEL WITH WITH AT LEAST 2" OF WELD MATERIAL.
3. THE ANODE LOCATIONS ARE APPROXIMATE; MAYBE ADJUSTED. AT ENGINEERS DIRECTION TO SUIT FIELD CONDITIONS.
4. ALL ANODES TO BE SUPPLIED BY N.S.P.C. AND INSTALLED BY C-14 CONTRACTOR.
AS BUILT
SCALE AS NOTED
DESIGNED S. DOYLE
DRAWN J.P.C.
DATE 83-04-07
JOB NO. 1496-5
nova scotia power corporation
HALIFAX NOVA SCOTIA
WESTERN ZONE
ANNAPOLIS TIDAL POWR PROJECT
SLUICE GATE
LAYOUT OF CATHODE PROTECTION
DWG. NO. H 81VI 1 625 00 011
REV B

DWG. NO. H 8,1,V,1 1 6,2,5 0,0 0,1,0

BILL OF MATERIALS

ITEM NO	SIZE	QTY	DESCRIPTION	REMARKS
1	1" PL	16	SIDE BRACKET	
2	¾" PL	8	BOTTOM BRACKET	
3	1" PL	8	GUIDE BAR	



GENERAL NOTES

1. ± ⅛" NON CUMULATIVE TOLERANCE UNLESS OTHERWISE SHOWN
2. ALL STEEL TO BE C.S.A. G40.21 300 W & NEW STOCK
3. ALL WELDING TO MEET REQUIREMENTS OF C.S.A. S16 W47.1-1973 & W59-1977
4. ALL PAINTING AS PER SPECIFICATION
5. ATTACHING BOLTS TO BE SUPPLIED BY INSTALLING CONTRACTOR: ¾"ø A325 HIGH STRENTH GALVANIZED WITH PLAIN & LOCK WASHERS. BOLTS TO BE 2½" LONG. (4 PER ASSY)
6. 8 ASSEMBLIES REQ'D
7. ITEM NO 3 TO BE TAILORED TO SUIT ITEM NO.1
8. ASSEMBLY SHALL BE INSTALLED SUCH THAT CLEARANCE TO SIDE ROLLER GUIDE FROM FACE OF THIS ASSEMBLY IS ¼" EACH SIDE OR ½" TOTAL

AS BUILT

REV	MECH	CIVIL	ELEC	CONST	DESCRIPTION
C					AS BUILT SEP 21-84
B					ISSUED FOR CONSTRUCTION DATE 83-26-04
A					DIMENSIONS CHANGED ISSUED FOR SUPPLY ONLY
0					ISSUED FOR INFORMATION ONLY TENDER C-14

REFERENCE DRAWINGS | DRAWING NUMBER

ENGINEERS SEAL

DEPARTMENTAL APPROVALS: MECH | CONST | ELEC | CIVIL

APPROVED DATE 83-04-13

SCALE ½" = 1'-0"
UNITS:
DESIGNED S. DOYLE
DRAWN J. P. COSGROVE
CHECKED
CHECKED
DATE 83-28-03
JOB NO. 1456-5

nova scotia power corporation
HALIFAX, NOVA SCOTIA

WESTERN ZONE
ANNAPOLIS TIDAL POWER PROJECT
SLUICE GATE
ASSY & DETAIL OF SIDE GUIDE BAR ASS'Y

DWG. NO. H 8,1,V,1 1 6,2,5 0,0 0,1,0 REV C

APPENDIX C

HOIST GEAR BOX ASSESSMENT AND

OVERHUNG LOAD CALCULATIONS

HOIST GEAR BOX ASSESSMENT CALCULATIONS

OVERHUNG LOAD = (126,000 X HP X F_C X L_F)/(PITCH Ø X RPM)
= (126,000 X 20 X 1.25 X 0.98)/(7.5 X 37)
= 3,087,000/277.5
= 11,124.3 LBS

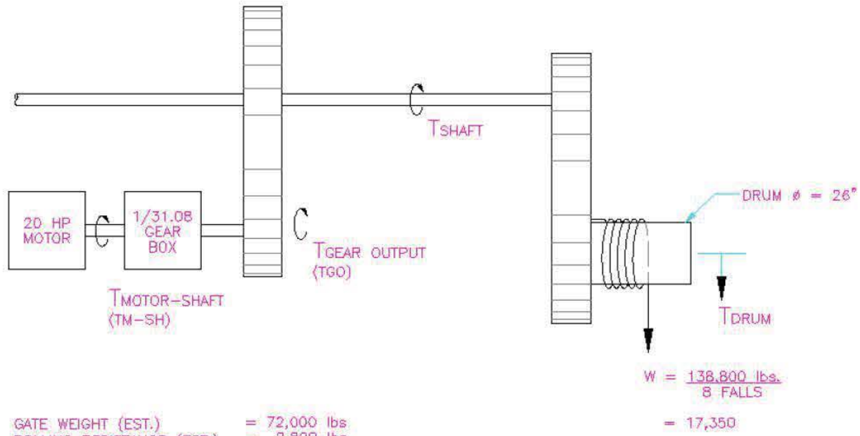
WHERE:

F_C = LOAD CONNECTION FACTOR = 1.25 FOR MACHINED PINION & GEAR.
L_F = LOAD LOCATION FACTOR FOR LOW SPEED SHAFTS = 0.98 BASED ON THE 3" DISTANCE FROM THE CENTER LINE OF THE PINION LOAD TO THE REDUCER SEAL CAGE.
PITCH Ø = 7.5"
RPM = 37

APPENDIX D

HOIST MOTOR BRAKE ASSESSMENT AND

HOISTING LOAD TORQUE CALCULATIONS



GATE WEIGHT (EST.)	= 72,000 lbs
ROLLING RESISTANCE (EST.)	= 2,800 lbs
BEARING FRICTION (EST.)	= 43,000 lbs
SEAL FRICTION (EST.)	= 14,000 lbs
ICE LOAD (EST.)	= 7,000 lbs
	138,800 lbs

T_{DRUM} = 17,350lbs x 13" R = 225,550 lb . in

T_{SHAFT} = T_{DRUM} x 18/69 = 50,839 lb . IN

T_{GO} = T_{SHAFT} x 16/46 = 20,466 lb . IN

T_{M-SH} = T_{GO} x 1/31.08 = 658.5 lb . IN / 12" = 54.9 lb . FT

APPENDIX E

WIRE ROPE ASSESSMENT AND

RATED CAPACITY CALCULATIONS

RATED CAPACITY OF LOAD INCLUDING LOAD BLOCK WEIGHT SHALL NOT EXCEED 20% OF THE PUBLISHED BREAKING STRENGTH. PUBLISHED BREAKING STRENGTH OF THE ROPE INFORMATION PROVIDED (PBS) = 103,500 LBS.

THEREFORE 20% OF PBS = 20,700 LBS.

RATED CAPACITY OF LOAD INCLUDING LOAD BLOCK WEIGHT (EST.):		123,724 LBS
DIVIDED BY THE NUMBER OF PARTS OF ROPE:	8	
EQUALS:	= 15,466 LBS	

THEREFORE, AS 15,466 LBS < 20,700 LBS, THE WIRE ROPE IS WITHIN THE DESIGN CRITERIA.

APPENDIX F

REFERENCE TABLES FROM CMAA 70

TABLES 4.5.2-1 AND 4.6.4-1

TABLE 4.5.2-1
GUIDE FOR MINIMUM PITCH DIAMETER OF RUNNING SHEAVES

CMAA Class	6 × 37 Class Rope	6 × 19 Class Rope
A & B	16	20
C	18	24
D	20	24
E	24	30
F	30	30

(all values × d)

d = rope diameter

TABLE 4.6.4-1

GUIDE FOR MINIMUM PITCH DIAMETER OF DRUMS

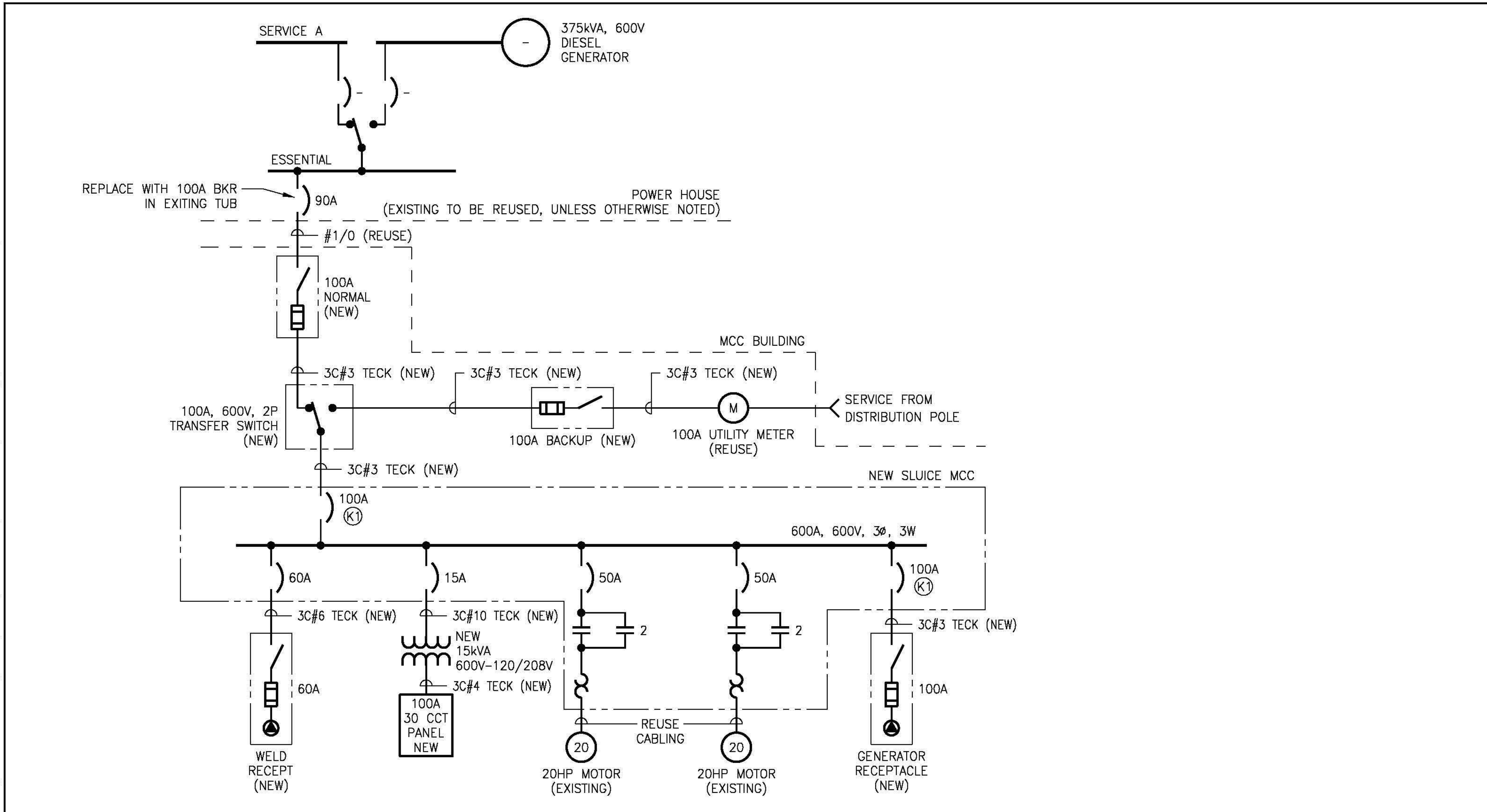
CMAA Class	6 × 37 Class Rope	6 × 19 Class Rope
A & B	16	20
C	18	24
D	20	24
E	24	30
F	30	30

(all values × d)

d = rope diameter

APPENDIX G

ELECTRICAL UPGRADE SKETCHES



A	MARCH 18, 2013 CLIENT	INFORMATION						
REV.	ISSUED TO	ISSUED FOR	REV.	DATE	BY	REVISIONS	DES	DFTG

Stantec

DESIGN CHK	DFTG CHK	DES	DFTG	SCALE
		MAK	MTC	NTS
APPROVED	SPEC.	P.M. MDV	P.T.	DATE MAR. 4, 2013

ANNAPOLIS ROYAL SLUICEWAY CONCEPTUAL DESIGN

CONCEPTUAL ELECTRICAL POWER RISER DIAGRAM

JOB No.	DWG. No.	SHEET	REV
133545764	B-5701	– of –	A

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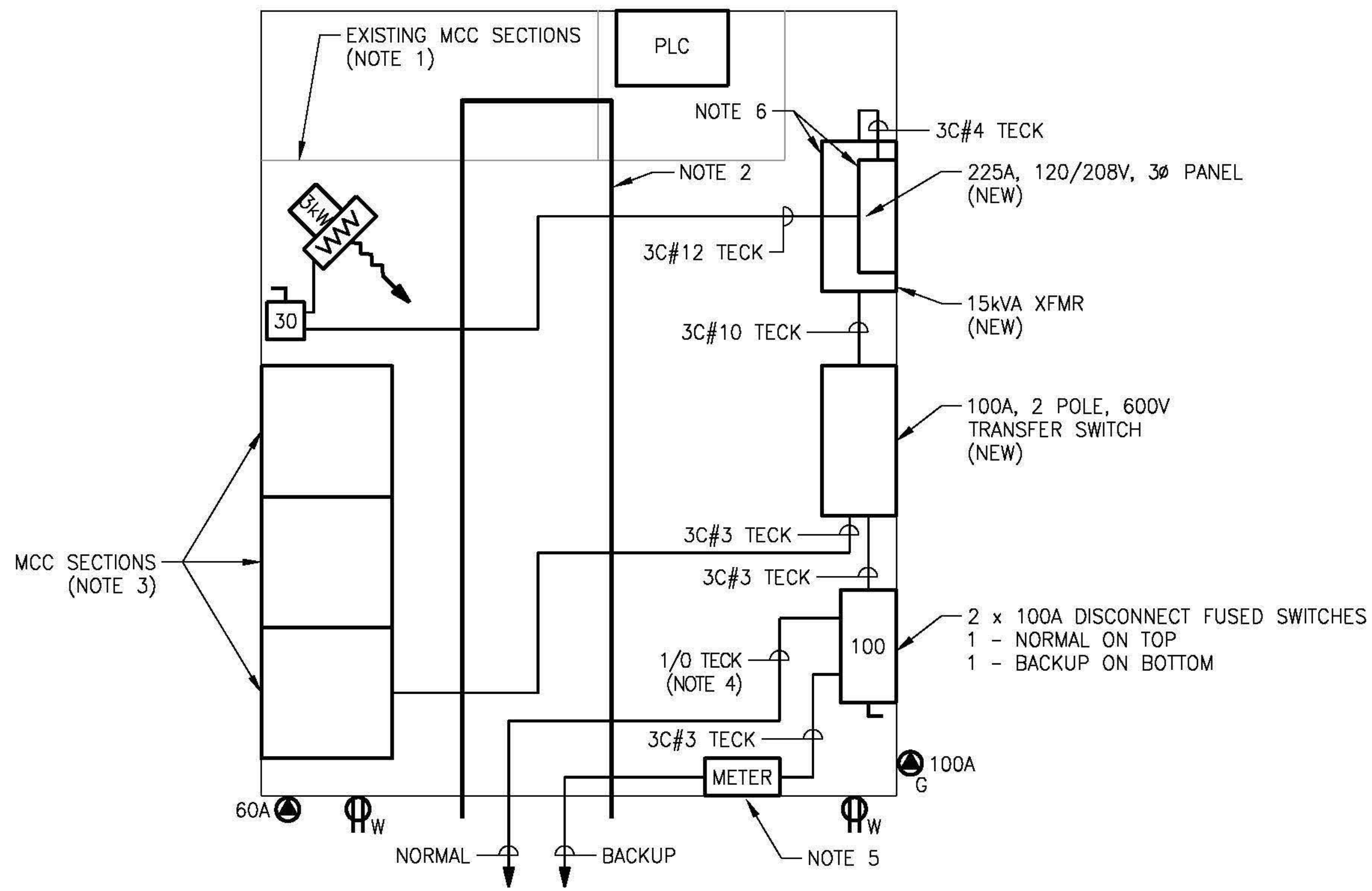


MCC ELECTRICAL ROOM

SCALE: ½"=1'-0"

NOTES:

1. EXISTING MCC SECTIONS TO BE REMOVED IN PHASES.
2. REWORK EXISTING CABLE TRAY AS REQUIRED. EXISTING MOTOR FEEDER CABLES TO BE PULLED BACK AND CONNECTED TO NEW MCC.
3. INSTALL NEW MCC SECTIONS AND POWER UP EQUIPMENT IN PHASE WITH REMOVAL OF EXISTING MCC SECTIONS.
4. REUSE EXISTING #1/0 TO FEED NORMAL POWER DISCONNECT.
5. REUSE EXISTING METER, CONTRACTOR TO RELOCATE AS REQUIRED.
6. NEW 15kVA TRANSFORMER MOUNTED ON FLOOR TO FEED NEW 225A, 120/208V PANEL MOUNTED ABOVE TRANSFORMER.

LEGEND:

W	15A-1P, 120V "U" GROUND DUPLEX RECEPTACLE 'W' INDICATES WEATHER PROOF
60A	60A-3P, 600V WELDING OUTLET
100A G	100A-3P, 600V BACKUP GENERATOR OUTLET
30	600V, 3Ø FUSED DISCONNECT SWITCH '30' INDICATES AMPERE RATING
3kW	3kW, 3Ø, 208V INDUSTRIAL UNIT HEATER C/W BUILT IN THERMOSTAT
PLC	NEW PLC CABINET
METER	EXISTING UTILITY POWER METER
K1	KIRK KEY INTERLOCK

V:\1335\active\133545764\3_electrical\3_drawing\133545764B5702.dwg mchalupowski Mar 15, 2013 3:17pm

REV.	ISSUED TO	ISSUED FOR
A	MARCH 18, 2013 CLIENT	INFORMATION

REV.	DATE	BY	REVISIONS	DES	DFTG

Stantec

DESIGN CHK	DFTG CHK	DES	DFTG	SCALE
		MAK	MTC	1/2"=1'-0"
APPROVED	SPEC.	P.M.	P.T.	DATE
		MDV		MAR. 4, 2013

ANNAPOLIS ROYAL SLUICEWAY CONCEPTUAL DESIGN

CONCEPTUAL ELECTRICAL
MCC BUILDING LAYOUT

JOB No.	DWG. No.	SHEET	REV
133545764	B-5702	– of –	A

APPENDIX H

BREAKDOWN OF COST ESTIMATES

APPENDIX H
BREAKDOWN OF PRELIMINARY CONSTRUCTION COSTS
KGS GROUP PROJECT NO: 13-2242-001

Civil / Structural Work

Deficiency	Proposed Remedial Measure	Material and Equipment Cost	Labour Costs	Engineering Fee	Total Cost
Superstructure Protective Coating	Heat, hoard, clean, sand-blast, repaint entire structure (one water passage at a time).	$145,000	$210,000	$5,000	**$360,000**
Corroded welds and floor plate on hoist bridge	Assume allowance for repairing a portion of the welds and sealing any holes in floor.	$1,500	$11,500	$10,000	**$23,000**
Corroded L-shaped ladder brackets	Replace 8 brackets with new galvanized components	$5,500	$6,000	$3,500	**$15,000**
Lack of fall protection on upper platform of center tower	Install overhead horizontal lifeline with two attachments to accommodate two workers on platform	$3,500	$6,500	$10,000	**$20,000**
Gate side bumper friction	Replace bumpers / install new side rollers on both gates (8 assemblies required)	$6,000	$14,000	$20,000	**$40,000**
Gate side guide roller path	Repair the top edges of the side guide roller paths.	$2,500	$6,500	$3,000	**$12,000**
Gate lintel seal damage	Redesign and replace lintel seal on both gates to be double-stem (center bulb).	$15,000	$55,000	$20,000	**$90,000**
Gate protective coating	Heat, hoard, clean, sand-blast, repaint entire gate (x2).	$80,000	$170,000	$5,000	**$255,000**
Deformed ¼” upper roller path overlay	Replace deformed sections of plate and repair welds on remaining length (8 locations typical).	$10,000	$65,000	$10,000	**$85,000**
		$269,000	**$544,500**	**$86,500**	**$900,000**

APPENDIX H
BREAKDOWN OF PRELIMINARY CONSTRUCTION COSTS
KGS GROUP PROJECT NO: 13-2242-001

Mechanical Work

Option	Deficiency	Proposed Remedial Measure	Material and Equipment Cost	Labour Costs	Engineering Fee	Total Cost
1	Multiple un-documented modifications to both hoists.	Replace existing hoists with new hoists. Quote obtained from COH Inc.				$1,630,000
						$1,630,000
2	Missing fan brakes on both hoists.	Replace missing fan brakes on both hoists.	$66,150	$86,850	$37,000	$190,000
	Gear boxes on both hoists are overloaded.	Replace deficient gear boxes on both hoists.	$32,900	$103,800	$33,300	$170,000
	Corrosion and mis-adjustment of hoist motor brakes.	Immediately service or replace motor brakes.	$15,000	$12,000	$3,000	$30,000
	Breaking wire ropes.	Replace the existing wire rope at the next wire rope replacement interval.	$4,000	$5,000	$1,000	$10,000
	Wire rope lubrication	Procure a pressurized lubricant system for applying the rope dressing.	$6,000			$6,000
	Machine Guarding	Add machine guarding around the rotating hazards.	$5,000	$8,500	$1,500	$15,000
	Auto Gate Position Measurement	Install an absolute rotary encoder system on each hoist drum to measure and indicate position.	$6,050	$44,450	$29,500	$80,000
	Load Cells for Hoist Load Monitoring	Install load cells on each wire rope with digital displays.	$36,600	$100,100	$33,300	$170,000
	Weather-proofing	Install SS drip trays. Install rain/snow guards over shafts. Seal curb and electrical penetrations.	$4,000	$5,000	$1,000	$10,000
	Mechanical Raise/Lower Back-up Operation of Gates.	Install the portable drill design as the mechanical back-up configuration.	$31,250	$74,650	$44,100	$150,000
			$206,950	**$440,350**	**$183,700**	**$831,000**

APPENDIX H
BREAKDOWN OF PRELIMINARY CONSTRUCTION COSTS
KGS GROUP PROJECT NO: 13-2242-001

Electrical Work

Deficiency	Proposed Remedial Measure	Material and Equipment Cost	Labour Costs	Engineering Fee	Total Cost
Power and Controls - Miscellaneous Items	- Replace with new wall-mounted MCC and floor-mounted transformer. - Provide new remote I/O rack. - Install cable tray along gate structure. - Add receptacles. - Wire the limit switches directly to the hoist motor starters. - Rework cabling with proper mechanical protection. - Replace with new wall-mounted PLC in a cabinet, place the 120V circuits in an enclosure. - Replace baseboard heaters with new 3 kw unit heater.	$110,000	$65,000	$75,000	**$250,000**
Exterior Lighting and Fixtures	Install new upgraded lighting, cabling and controls.	$28,000	$27,000	$15,000	**$70,000**
		$138,000	**$92,000**	**$90,000**	**$320,000**

CI Number: 43066

Title: HYD – Little Indian Dam / Mill Lake Upgrades

Start Date: 2012/07
In-Service Date: 2015/09
Final Cost Date: 2016/03
Function: Hydro
Forecast Amount: $1,409,587

DESCRIPTION:

This item covers the upgrades to the dams and diversions structure at Little Indian Lake, and the spillway structure at Mill Lake to meet the requirements of the Canadian Dam Safety guidelines.

Summary of Related CIs (+/- 2 years):
2015 CI 40283 HYD Wright's Lake Dam Refurbishment $2,891,503

JUSTIFICATION:

Justification Criteria: Health & Safety

Sub Criteria: Maintenance

Depreciation Class: St. Margaret's Bay Hydro System

Estimated Useful Life: 70 years

Why do this project?

In 2009, Nova Scotia Power carried out a flood study and dam safety review of its St. Margaret's Bay Hydro system in accordance with the Canadian Dam Safety (CDA) guidelines. The dam safety review of Little Indian Lake concluded that at present the dams/concrete diversion structures, and gates/gate operators are in need of refurbishment, and thus cannot be considered fully reliable to divert waters from Mill Lake during periods of high flows. In addition, the earth embankment top elevation is too low and does not meet present day design criteria.

The dam safety review of Mill Lake concluded that the present minimum freeboard is less than the required minimum freeboard and thus not meeting the current CDA guidelines.

Why do this project now?

Since 1986, NS Power has carried out dam safety related work on a priority basis based on public risk. The work at Little Indian Lake and Mill Lake is scheduled for 2015, based on the downstream consequences if the dam should breach or overtop. This work was originally scheduled for 2016. However, due to other capital investment at the St. Margaret's Bay Hydro system in 2015, completing this work while the river system is not operating will avoid a similar 4 month period of lost generation in 2016

As of 2015, generation from NS Power's legacy hydro facilities will qualify under the provisions of the Nova Scotia Renewable Electricity Regulations. Generation from hydro facilities is an important part of NS Powers compliance plan to serve 25 percent of sales from qualifying renewable generation sources.

Why do this project this way?

The Little Indian Lake concrete diversion structure needs to be refurbished in order to reliably control the discharge between Little Indian Lake and Mill Lake. The refurbishment planned for this diversion structure is the only feasible option. The dams must be refurbished to meet the Canadian Dam Safety guidelines for freeboard (the space between the crest of the dam and high water level). At Mill Lake, the discharge capacity of the spillway structures must be increased so the Mill Lake dams meet the Canadian Dam Safety guidelines for minimum freeboard. Alternatives to this work would be to decommission this dam, which comes at a high cost and leads to significant lost generation, increase the size of the existing gates which is a more costly option with additional benefit, and extend the overflow spillway but earth conditions led to this being much more costly.

CI Number : 43066-H661 - HYD - Little Indian Dam / Mill Lake Upgrade **Project Number** H661

Parent CI Number : -

Cost Centre : 440 - 440-St.Margaret's Hydro System **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		32,302	0	32,302
095		095 - Proj Supp Regular Labour AO		17,612	0	17,612
095		095-Thermal & Hydro Contracts AO		21,690	0	21,690
095		095-Hydro Regular Labour AO		1,274	0	1,274
001	007	001 - HYDRO Regular Labour	007 - HGP - Environmental	4,933	0	4,933
011	007	011 - Travel Expense	007 - HGP - Environmental	1,000	0	1,000
028	007	028 - Consulting	007 - HGP - Environmental	9,300	0	9,300
001	028	001 - Proj Supp Regular Labour	028 - HGP - Dams & Spillways	33,276	0	33,276
011	028	011 - Travel Expense	028 - HGP - Dams & Spillways	2,350	0	2,350
012	028	012 - Materials	028 - HGP - Dams & Spillways	[redacted]	0	[redacted]
013	028	013 - POWER PRODUCTION Contracts	028 - HGP - Dams & Spillways	[redacted]	0	[redacted]
028	028	028 - Consulting	028 - HGP - Dams & Spillways	245,000	0	245,000
066	028	066 - Other Goods & Services	028 - HGP - Dams & Spillways	[redacted]	0	[redacted]
028	087	028 - Consulting	087 Field Super.& Ops.	45,000	0	45,000
			Total Cost:	1,409,587	0	1,409,587
			Original Cost:	697,967		

Capital Project Detailed Estimate

Location: Hydro
CI# / FP#: 43066
Title: HYD – Little Indian Dam / Mill Lake Upgrades
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Engineering - Design / PM	PD	85.00	$ 391	$ 33,276.33		
Hydro River Staff	PD	14	$ 352	$ 4,932.88		
			Sub-Total	$ 38,209.21		
011 Travel Expense						
Travel to site	lot	1.00	$ 3,350.00	$ 3,350.00		
				$ -		
			Sub-Total	$ 3,350.00		
012 Materials						
Misc. Materials	lot	1.00	[redacted]		Cost Suport Item #1 - Lines 3.3-3.5,4.2-4.5 & 5.1-5.4	
				$ -		
			Sub-Total	[redacted]		
013 Contracts						
Dam Refurbishment	lot	1.00	[redacted]		Cost Suport Item #1 - All remaining lines.	
				$ -		
			Sub-Total	[redacted]		
028 Consulting						
Environmental	lot	1	$ 9,300.00	$ 9,300.00		
Dam Design	lot	1	$ 185,000.00	$ 185,000.00		
Consulting during Construction	mths	6	$ 10,000	$ 60,000.00		
Site Supervision	mths	4.5	$ 10,000	$ 45,000.00		
			Sub-Total	$ 299,300.00		
066 Other Goods & Services						
Contingency	%	[redacted]				
				$ -		
			Sub-Total	[redacted]		
094 Interest Capitalized						
				$32,301.93		
				$ -		
			Sub-Total	$ 32,301.93		
095 Administrative Overhead						
Hydro Reg. Labour AO				$ 1,274.15		
Project Support Labour AO				$ 17,611.71		
Thermal / Hydro Contracts AO				$ 21,690.20		
			Sub-Total	$ 40,576.06		
			SUB-TOTAL (no AO, AFUDC)	$ 1,336,709.21		
			TOTAL (AO, AFUDC included)	$ 1,409,587.20		
Original Cost				$697,967.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

HATCH™

Construction Cost Estimate

Client: Nova Scotia Power Inc.
Date: Aug 31, 2014
Project Name: Little Indian Lake Diversion & Mill Lake Refurbishment
Prepared by:
Project Number: H-341943
Reviewed by:

Description: Construction cost estimate for refurbishment of dam/spillway/sluiceway to be used for budgetary purposes. Accuracy = +/-30%

Item	Description	Estim. Quantity	Unit	Unit Price	Amount
1	**Contractor's Construction Indirects**				
1.1	Mobilization & Demobilization	1	LS	[redacted]	[redacted]
1.2	Construction Facilities (office, site trailers, site services)	1	LS	[redacted]	[redacted]
1.3	Site Supervision & Site Safety/Admininstration	1	LS	[redacted]	[redacted]
1.4	Site Surveys & Quality Control	1	LS	[redacted]	[redacted]
	Subtotal				[redacted]
2	**General Items**				
2.1	Access Road Upgrading and Maintenance (Crossover Structure)	1	LS	[redacted]	[redacted]
2.2	Site Access (Mill Lake Spillway)	1	LS	[redacted]	[redacted]
2.3	Environmental Protection	1	LS	[redacted]	[redacted]
2.4	Water Control	1	LS	[redacted]	[redacted]
	Subtotal				[redacted]
3	**Earthworks**				
3.1	Clearing, Grubbing, and Stripping	1	LS	[redacted]	[redacted]
3.2	Class A Excavation	500	yd^3	[redacted]	[redacted]
3.3	Zone 1 - Granular Fill - Crossover Embankment	750	yd^3	[redacted]	[redacted]
3.4	Zone 4 - Bedding - Crossover Embankment	125	yd^3	[redacted]	[redacted]
3.5	Zone 8 - Riprap - Crossover Embankment	250	yd^3	[redacted]	[redacted]
	Subtotal				[redacted]
4	**Concrete Works**				
4.1	Demolition - Crossover and Mill Lake Dam	1	LS	[redacted]	[redacted]
4.2	Concrete - New Crossover Sluiceway	100	yd^3	[redacted]	[redacted]
4.3	Concrete - Crossover Core Wall	90	yd^3	[redacted]	[redacted]
4.4	Concrete - Mill Lake Dam	30	yd^3	[redacted]	[redacted]
4.5	Passive Anchors - Crossover	6	ea	[redacted]	[redacted]
	Subtotal				[redacted]
5	**Metals and Gates**				
5.1	Chainlink Fence/Gates	1	LS	[redacted]	[redacted]
5.2	Sluice Gate Systems	2	LS	[redacted]	[redacted]
5.3	Overshot Gate	1	LS	[redacted]	[redacted]
5.4	Miscellaneous Steel	1	LS	[redacted]	[redacted]
	Subtotal				[redacted]
Total Estimated Construction Cost without Contingency					[redacted]
Contingency (20%)					[redacted]
Total Estimated Construction Cost					[redacted]

Project Features:

- Overshot gate installed at Mill Lake Dam
- Section of Mill Lake Dam Spillway removed for installation of overshot gate

CI Number: 43607

Title: HYD – Malay Falls #5 Unit Overhaul

Start Date: 2014/10
In-Service Date: 2015/04
Final Cost Date: 2015/10
Function: Hydro
Forecast Amount: $1,077,255

DESCRIPTION:

Sheet Harbour Hydro is comprised of two generating stations located at Malay falls and Ruth Falls. The System is rated at 3.6 MW and produces 14 GWh annually. This project includes the replacements of the Malay Falls #5 turbine runner and wicket gates, as well as refurbishment of the lower seal ring, shaft, and headcover. Malay Falls #5 is one of six hydro electric generators located on the East River Sheet Harbour. The unit was originally installed in 1972 and has seen routine overhauls as necessary to maintain it in good working order. The work will focus on the replacement of the hydro turbine runner, a Francis wheel, and refurbishment of the other turbine components.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

Depreciation Class: Sheet Harbour Hydro System

Estimated Useful Life: 40 Years

JUSTIFICATION:

Justification Criteria: Hydro

Sub Criteria: Maintenance

Why do this project?

Malay Falls Unit #5 is a 1.1MW hydro generating unit on the Sheet Harbour Hydro System. Similar work on Malay Falls Unit #6 led to an increased capacity of approximately 0.1MW. This unit is currently in a deteriorated condition and cannot be returned to service until this overhaul is complete.

Why do this project now?

This project is intended to be completed in 2015 as part of Hydro's unit overhaul prioritization plan. Unit overhauls are prioritized based on ensuring a unit's availability and avoiding lost generation and associated replacement energy costs. Completing this overhaul after runner replacements were recently completed at Ruth Falls is the most economic option as the capacity of the Malay Falls units was limited during the work at Ruth Falls.

As of 2015 the generation from NS Power's legacy hydro facilities will qualify under the provisions of the Nova Scotia Renewable Electricity Regulations. Generation from hydro facilities is an important part of NS Power's compliance plan to serve 25 percent of sales from qualifying renewable generation sources.

Why do this project this way?

Replacing the runner is a more economic option compared to refurbishment, as shown in the attached Economic Analysis Model (EAM). Additional equipment is being refurbished as their condition is such that refurbishment will return them to good condition, and is much less costly than replacement.

CI Number : 43607-H670 - HYD - Malay Falls #5 Unit Overhaul **Project Number** H670

Parent CI Number : -

Cost Centre : 450 - 450-Sheet Harbour Hydro System **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		22,292	0	22,292
095		095-Hydro Term Labour AO		15,363	0	15,363
095		095-Thermal & Hydro Contracts AO		8,533	0	8,533
095		095-Hydro Regular Labour AO		43,916	0	43,916
095		095-Hydro Overtime Labour AO		61	0	61
001	024	001 - HYDRO Regular Labour	024 - HGP - Turbine (Hydro)	166,190	0	166,190
002	024	002 - HYDRO Overtime Labour	024 - HGP - Turbine (Hydro)	627	0	627
004	024	004 - HYDRO Term Labour	024 - HGP - Turbine (Hydro)	57,081	0	57,081
011	024	011 - Travel Expense	024 - HGP - Turbine (Hydro)	10,701	0	10,701
012	024	012 - Materials	024 - HGP - Turbine (Hydro)	570,228	0	570,228
013	024	013 - POWER PRODUCTION Contracts	024 - HGP - Turbine (Hydro)	94,575	0	94,575
028	024	028 - Consulting	024 - HGP - Turbine (Hydro)	84,545	0	84,545
041	024	041 - Meals & Entertainment	024 - HGP - Turbine (Hydro)	2,663	0	2,663
066	024	066 - Other Goods & Services	024 - HGP - Turbine (Hydro)	481	0	481
			Total Cost:	1,077,255	0	1,077,255
			Original Cost:	65,473		

Capital Project Detailed Estimate

Location: Hydro
CI# / FP#: 43607
Title: HYD - Malay Falls #5 Unit Overhaul
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Engineering	PD	87.00	$ 391.49	$ 34,059.30		
Hydro River Staff	PD	375.00	$ 352.35	$ 132,130.80		
	PD					
			Sub-Total	$ 166,190.10		
002 OT Labour						
Hydro River Staff				$ 627.00		
				$ -		
			Sub-Total	$ 627.00		
004 Term Labour						
		162.00	$ 352.35	$ 57,080.51		
				$ -		
			Sub-Total	$ 57,080.51		
011 Travel Expense						
Travel / Lodging				$ 10,700.94		
				$ -		
			Sub-Total	$ 10,700.94		
012 Materials						
New Wicket Gates (4)	ea	4	[redacted]		Cost Support Item 3 - Line 030	
Stay rods, bushings etc…	Lot	1	$ 50,594.00	$ 50,594.00		
New Runner	Lot	1	[redacted]		Cost Support Item 2	
Field breaker	Lot	1	$ 26,805.53	$ 26,805.53		
				$ -		
			Sub-Total	$ 570,227.53		
013 Contracts						
Lower Seal Ring Machining	Lot	1	[redacted]		Cost Support Item 4	
Shaft Machining	Lot	1			Cost Support Item 1 - Line 030	
Headcover Repairs	Lot	1			Cost Support Item 3 - Line 020	
Misc	Lot	1	$ 15,800.00	$ 15,800.00		
				$ -		
			Sub-Total	$ 94,575.00		
028 Consulting						
Unit Condition Assessment	Lot	1	$ 84,545.40	$ 84,545.40		
				$ -		
				$ -		
			Sub-Total	$ 84,545.40		
041 Meals & Entertainment						
Meals during travel		1	$ 2,663.14	$ 2,663.14		
				$ -		
			Sub-Total	$ 2,663.14		
066 Other Goods & Services						
Misc.				$ 481.21		
				$ -		
			Sub-Total	$ 481.21		
094 Interest Capitalized						
AFUDC				$ 22,291.54		
				$ -		
			Sub-Total	$ 22,291.54		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 43,916.17		
Hydro OT Labour AO				$ 60.69		
Hydro Term Labour AO				$ 15,363.00		
Thermal / Hydro Contracts AO				$ 8,532.89		
			Sub-Total	$ 67,872.75		
			SUB-TOTAL (no AO, AFUDC)	$ 987,090.83		
			TOTAL (AO, AFUDC included)	$ 1,077,255.12		
Original Cost				$ 65,473.32		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

HYD Malay Falls Unit#5 Overhaul
Summary of Alternatives

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Hydro & Wind	**CI Number:**	
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Repair Runner vs. Avoided Repair and	6.19%	-3,635,418	2,878,174	2	39.79%	3.6 years
B	Replace Runner	6.19%	-3,812,128	3,023,639	1	34.89%	3.8 years
C	Test 3	6.19%	0	0	3	#NUM!	0.0 years
D	Test 4	6.19%	0	0	3	#NUM!	0.0 years

Recommendation :

Replacing the runner is the recommended option in this case due to the lower revenue requirement. Also considered is the benefit of getting a new runner, which comes with improved generating efficiencies, as opposed to refurbishing the current runner.

Notes/Comments :

Repair Runner vs. Avoided Repair and Replacement Energy Costs

Repair runner and reinstall in unit with refurbishment of required refurbished parts.

Replace Runner

Replace runner with new improving efficiency and reassemeble with required refubished parts.

Test 3

Test 4

HYD Malay Falls Unit#5 Overhaul
Summary of Sensitivities

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Hydro & Wind	**CI Number:**	
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Repair Runner vs. Avoided Repair and Replacem	6.19%	-3,635,418	2,878,174	2	39.79%	3.6 years
B	Replace Runner	6.19%	-3,812,128	3,023,639	1	34.89%	3.8 years
C	Test 3	6.19%	0	0	3	#NUM!	0.0 years
D	Test 4	6.19%	0	0	3	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Repair Runner vs. Avoided Repair and Replacem	10%	-3,532,848	2,795,008	2	35.30%	4.0 years
B	Replace Runner	10%	-3,727,229	2,955,020	1	31.33%	4.3 years
C	Test 3	10%	0	0	3	#NUM!	0.0 years
D	Test 4	10%	0	0	3	#NUM!	0.0 years

Change:						
	A	102,570	-83,166	0	-4.49%	0.4 years
	B	84,899	-68,619	0	-3.57%	0.4 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Repair Runner vs. Avoided Repair and Replacem	-10%	-3,169,306	2,507,191	2	34.86%	4.1 years
B	Replace Runner	-10%	-3,346,016	2,652,656	1	30.98%	4.3 years
C	Test 3	-10%	0	0	3	#NUM!	0.0 years
D	Test 4	-10%	0	0	3	#NUM!	0.0 years

Change:						
	A	466,112	-370,983	0	-4.93%	0.4 years
	B	466,112	-370,983	0	-3.92%	0.5 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	264,335	488,853	680,228	No
	B	264,335	481,087	658,228	No
	C	0	0	0	No
	D	0	0	0	No

HYD Malay Falls Unit#5 Overhaul
Avoided Cost Calculations

Division :	Power Production	Date :	29-Oct-14
Department :	Hydro & Wind	CI Number:	
Originator :		Project No. :	

Repair Runner vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	1	1				
Duration (Hours)	5256	5256				
Totals	$283,420	$287,069	$0	$0	$283,420	$287,069

Total Capital Cost of Alternative	$1,717,555

Replace Runner

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	1	1				
Duration (Hours)	5256	5256				
Totals	$283,420	$287,069	$0	$0	$283,420	$287,069

Total Capital Cost of Alternative	$1,077,255

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative	$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0

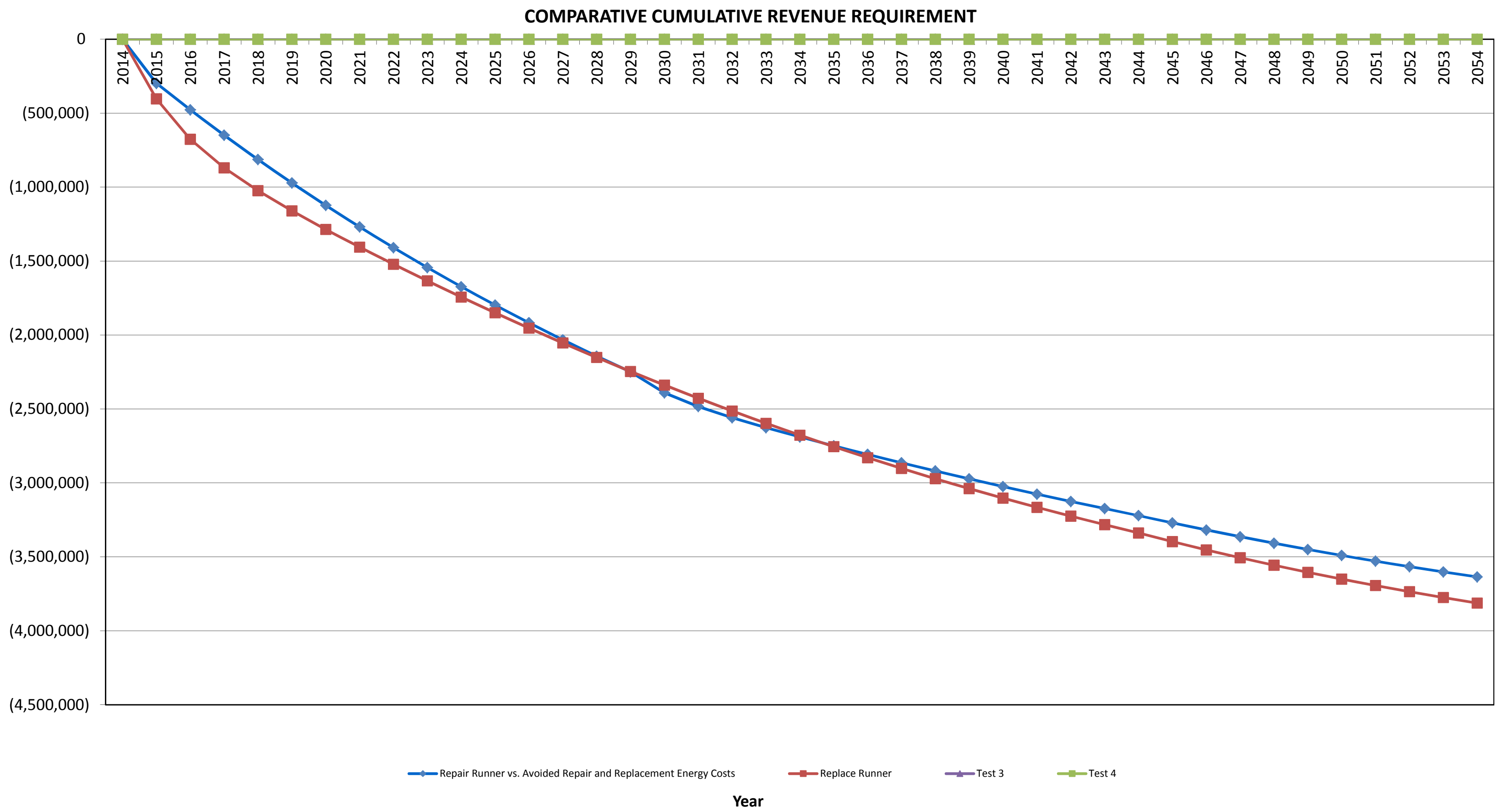
Total Capital Cost of Alternative	$0

HYD Malay Falls Unit#5 Overhaul
Repair Runner vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	283,420.3	(762,456.2)	30,326.3	740,501.3	(479,035.9)	(78,459.1)	(557,495.0)	(524,997.7)	0.94	(524,997.7)
2016	-	-	287,069.2	-	58,226.5	672,761.5	287,069.2	(70,941.2)	216,127.9	191,665.4	0.89	(333,332.3)
2017	-	-	292,810.5	-	53,568.4	612,603.1	292,810.5	(74,165.1)	218,645.5	182,595.3	0.84	(150,737.0)
2018	-	-	298,666.7	-	49,282.9	558,755.1	298,666.7	(77,309.0)	221,357.8	174,084.6	0.79	23,347.6
2019	-	-	304,640.1	-	45,340.3	510,252.6	304,640.1	(80,382.9)	224,257.2	166,084.2	0.74	189,431.8
2020	-	-	310,732.9	-	41,713.1	466,348.9	310,732.9	(83,396.1)	227,336.7	158,550.6	0.70	347,982.4
2021	-	-	316,947.5	-	38,376.0	426,455.5	316,947.5	(86,357.2)	230,590.4	151,445.3	0.66	499,427.7
2022	-	-	323,286.5	-	35,306.0	390,098.3	323,286.5	(89,274.0)	234,012.5	144,733.9	0.62	644,161.5
2023	-	-	329,752.2	-	32,481.5	356,888.7	329,752.2	(92,153.9)	237,598.3	138,385.5	0.58	782,547.1
2024	-	-	336,347.3	-	29,883.0	326,501.3	336,347.3	(95,003.9)	241,343.3	132,372.9	0.55	914,920.0
2025	-	-	343,074.2	-	27,492.3	298,659.6	343,074.2	(97,830.4)	245,243.8	126,671.3	0.52	1,041,591.3
2026	-	-	349,935.7	-	25,292.9	273,124.6	349,935.7	(100,639.3)	249,296.4	121,258.6	0.49	1,162,849.9
2027	-	-	356,934.4	-	23,269.5	249,687.5	356,934.4	(103,436.1)	253,498.3	116,114.9	0.46	1,278,964.8
2028	-	-	364,073.1	-	21,407.9	228,163.4	364,073.1	(106,226.2)	257,846.9	111,222.1	0.43	1,390,187.0
2029	-	-	371,354.6	-	19,695.3	208,387.6	371,354.6	(109,014.4)	262,340.2	106,564.0	0.41	1,496,751.0
2030	-	-	378,781.7	(894,133.4)	465,186.4	637,278.9	(515,351.8)	26,785.5	(488,566.3)	(186,889.8)	0.38	1,309,861.2
2031	-	-	386,357.3	-	240,203.5	397,036.8	386,357.3	(45,307.7)	341,049.6	122,855.9	0.36	1,432,717.1
2032	-	-	394,084.4	-	127,103.2	269,906.9	394,084.4	(82,764.2)	311,320.2	105,609.3	0.34	1,538,326.4
2033	-	-	401,966.1	-	69,992.9	199,895.5	401,966.1	(102,911.7)	299,054.4	95,534.8	0.32	1,633,861.1
2034	-	-	410,005.4	-	40,922.5	158,960.2	410,005.4	(114,415.7)	295,589.7	88,923.6	0.30	1,722,784.7
2035	-	-	418,205.5	-	25,913.2	133,038.1	418,205.5	(121,610.6)	296,594.9	84,024.8	0.28	1,806,809.5
2036	-	-	426,569.7	-	17,972.4	115,059.6	426,569.7	(126,665.2)	299,904.5	80,009.8	0.27	1,886,819.4
2037	-	-	435,101.1	-	13,600.7	101,454.6	435,101.1	(130,665.1)	304,435.9	76,484.4	0.25	1,963,303.7
2038	-	-	443,803.1	-	11,045.7	90,405.9	443,803.1	(134,154.8)	309,648.3	73,259.1	0.24	2,036,562.9
2039	-	-	452,679.1	-	9,428.6	80,975.3	452,679.1	(137,407.7)	315,271.5	70,241.6	0.22	2,106,804.4
2040	-	-	461,732.7	-	8,307.6	72,666.3	461,732.7	(140,561.8)	321,170.9	67,384.8	0.21	2,174,189.2
2041	-	-	470,967.4	-	7,459.6	65,205.7	470,967.4	(143,687.4)	327,280.0	64,663.9	0.20	2,238,853.1
2042	-	-	480,386.7	-	6,771.1	58,433.9	480,386.7	(146,820.8)	333,565.9	62,064.1	0.19	2,300,917.2
2043	-	-	489,994.5	-	6,183.6	52,249.8	489,994.5	(149,981.4)	340,013.1	59,575.9	0.18	2,360,493.1
2044	-	-	499,794.3	-	5,666.0	46,583.5	499,794.3	(153,179.8)	346,614.6	57,192.4	0.17	2,417,685.5
2045	-	-	509,790.2	-	5,201.3	41,382.0	509,790.2	(156,422.6)	353,367.7	54,907.9	0.16	2,472,593.3
2046	-	-	519,986.0	-	4,779.4	36,602.4	519,986.0	(159,714.0)	360,272.0	52,717.5	0.15	2,525,310.8
2047	-	-	530,385.8	-	4,394.2	32,208.1	530,385.8	(163,057.4)	367,328.4	50,616.8	0.14	2,575,927.6
2048	-	-	540,993.5	-	4,041.2	28,166.8	540,993.5	(166,455.2)	374,538.3	48,601.9	0.13	2,624,529.5
2049	-	-	551,813.3	-	3,717.2	24,449.5	551,813.3	(169,909.8)	381,903.5	46,668.8	0.12	2,671,198.4
2050	-	-	562,849.6	-	3,419.5	21,030.0	562,849.6	(173,423.3)	389,426.3	44,814.1	0.12	2,716,012.5
2051	-	-	574,106.6	-	3,145.8	17,884.2	574,106.6	(176,997.9)	397,108.7	43,034.4	0.11	2,759,046.9
2052	-	-	585,588.7	-	2,894.0	14,990.2	585,588.7	(180,635.4)	404,953.4	41,326.4	0.10	2,800,373.2
2053	-	-	597,300.5	-	2,662.4	12,327.7	597,300.5	(184,337.8)	412,962.7	39,687.1	0.10	2,840,060.4
2054	-	-	609,246.5	-	2,449.4	9,878.3	609,246.5	(188,107.1)	421,139.4	38,113.7	0.09	2,878,174.1
Total	**-**	**-**	**17,001,535.0**	**(1,656,589.6)**	**1,624,123.4**		**15,344,945.4**	**(4,766,997.6)**	**10,577,947.8**	**2,878,174.1**		

HYD Malay Falls Unit#5 Overhaul
Replace Runner

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	283,420.3	(1,009,382.5)	246,772.8	1,002,362.4	(725,962.2)	(11,360.7)	(737,323.0)	(694,343.1)	0.94	(694,343.1)
2016	-	-	287,069.2	-	370,159.1	365,068.7	287,069.2	25,757.9	312,827.0	277,419.5	0.89	(416,923.6)
2017	-	-	292,810.5	-	185,079.6	172,353.4	292,810.5	(33,396.6)	259,413.9	216,641.9	0.84	(200,281.7)
2018	-	-	298,666.7	-	92,539.8	75,995.8	298,666.7	(63,899.4)	234,767.4	184,630.4	0.79	(15,651.3)
2019	-	-	304,640.1	-	46,269.9	27,817.0	304,640.1	(80,094.8)	224,545.3	166,297.6	0.74	150,646.3
2020	-	-	310,732.9	-	23,134.9	3,727.6	310,732.9	(89,155.4)	221,577.5	154,534.0	0.70	305,180.3
2021	-	-	316,947.5	-	11,567.5	(8,317.1)	316,947.5	(94,667.8)	222,279.7	145,987.1	0.66	451,167.4
2022	-	-	323,286.5	-	5,783.7	(14,339.5)	323,286.5	(98,425.9)	224,860.6	139,073.5	0.62	590,240.9
2023	-	-	329,752.2	-	2,891.9	(17,350.6)	329,752.2	(101,326.7)	228,425.5	133,043.0	0.58	723,283.9
2024	-	-	336,347.3	-	1,445.9	(18,856.2)	336,347.3	(103,819.4)	232,527.9	127,537.8	0.55	850,821.7
2025	-	-	343,074.2	-	723.0	(19,609.0)	343,074.2	(106,128.9)	236,945.3	122,385.0	0.52	973,206.7
2026	-	-	349,935.7	-	361.5	(19,985.4)	349,935.7	(108,368.0)	241,567.7	117,499.3	0.49	1,090,706.0
2027	-	-	356,934.4	-	180.7	(20,173.6)	356,934.4	(110,593.6)	246,340.8	112,836.4	0.46	1,203,542.4
2028	-	-	364,073.1	-	90.4	(20,267.7)	364,073.1	(112,834.6)	251,238.5	108,371.6	0.43	1,311,914.0
2029	-	-	371,354.6	-	45.2	(20,314.8)	371,354.6	(115,105.9)	256,248.7	104,089.6	0.41	1,416,003.6
2030	-	-	378,781.7	-	22.6	(20,338.3)	378,781.7	(117,415.3)	261,366.3	99,979.7	0.38	1,515,983.3
2031	-	-	386,357.3	-	11.3	(20,350.1)	386,357.3	(119,767.3)	266,590.0	96,033.4	0.36	1,612,016.7
2032	-	-	394,084.4	-	5.6	(20,355.9)	394,084.4	(122,164.4)	271,920.0	92,243.5	0.34	1,704,260.2
2033	-	-	401,966.1	-	2.8	(20,358.9)	401,966.1	(124,608.6)	277,357.5	88,603.5	0.32	1,792,863.8
2034	-	-	410,005.4	-	1.4	(20,360.4)	410,005.4	(127,101.2)	282,904.2	85,107.3	0.30	1,877,971.1
2035	-	-	418,205.5	-	0.7	(20,361.1)	418,205.5	(129,643.5)	288,562.0	81,749.1	0.28	1,959,720.3
2036	-	-	426,569.7	-	0.4	(20,361.5)	426,569.7	(132,236.5)	294,333.2	78,523.5	0.27	2,038,243.7
2037	-	-	435,101.1	-	0.2	(20,361.6)	435,101.1	(134,881.3)	300,219.8	75,425.1	0.25	2,113,668.9
2038	-	-	443,803.1	-	0.1	(20,361.7)	443,803.1	(137,578.9)	306,224.1	72,449.0	0.24	2,186,117.9
2039	-	-	452,679.1	-	0.0	(20,361.8)	452,679.1	(140,330.5)	312,348.6	69,590.4	0.22	2,255,708.2
2040	-	-	461,732.7	-	0.0	(20,361.8)	461,732.7	(143,137.1)	318,595.6	66,844.5	0.21	2,322,552.7
2041	-	-	470,967.4	-	0.0	(20,361.8)	470,967.4	(145,999.9)	324,967.5	64,207.0	0.20	2,386,759.7
2042	-	-	480,386.7	-	0.0	(20,361.8)	480,386.7	(148,919.9)	331,466.8	61,673.5	0.19	2,448,433.2
2043	-	-	489,994.5	-	0.0	(20,361.8)	489,994.5	(151,898.3)	338,096.2	59,240.0	0.18	2,507,673.2
2044	-	-	499,794.3	-	0.0	(20,361.8)	499,794.3	(154,936.2)	344,858.1	56,902.6	0.17	2,564,575.8
2045	-	-	509,790.2	-	0.0	(20,361.8)	509,790.2	(158,035.0)	351,755.3	54,657.3	0.16	2,619,233.1
2046	-	-	519,986.0	-	0.0	(20,361.8)	519,986.0	(161,195.7)	358,790.4	52,500.7	0.15	2,671,733.8
2047	-	-	530,385.8	-	0.0	(20,361.8)	530,385.8	(164,419.6)	365,966.2	50,429.1	0.14	2,722,162.9
2048	-	-	540,993.5	-	0.0	(20,361.8)	540,993.5	(167,708.0)	373,285.5	48,439.3	0.13	2,770,602.2
2049	-	-	551,813.3	-	0.0	(20,361.8)	551,813.3	(171,062.1)	380,751.2	46,528.0	0.12	2,817,130.3
2050	-	-	562,849.6	-	0.0	(20,361.8)	562,849.6	(174,483.4)	388,366.2	44,692.1	0.12	2,861,822.4
2051	-	-	574,106.6	-	0.0	(20,361.8)	574,106.6	(177,973.0)	396,133.6	42,928.7	0.11	2,904,751.1
2052	-	-	585,588.7	-	0.0	(20,361.8)	585,588.7	(181,532.5)	404,056.2	41,234.8	0.10	2,945,985.9
2053	-	-	597,300.5	-	0.0	(20,361.8)	597,300.5	(185,163.2)	412,137.3	39,607.8	0.10	2,985,593.7
2054	-	-	609,246.5	-	0.0	(20,361.8)	609,246.5	(188,866.4)	420,380.1	38,045.0	0.09	3,023,638.7
	-	**-**	**17,001,535.0**	**(1,009,382.5)**	**987,091.0**		**15,992,152.5**	**(4,964,477.6)**	**11,027,674.8**	**3,023,638.7**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(500,000)
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Repair Runner vs. Avoided Repair and Replacement Energy Costs
Replace Runner
Test 3
Test 4
Year

WEIR
SECTEUR INDUSTRIEL ET PRODUCTION D'ÉNERGIE

QUOTATION / ESTIMATE
SOUMISSION / ESTIMATION

FACILITY-INSTALLATION	QUOTATION No. SOUMISSION
K25	**7093151-R1**
PAGE	DATE
1 / 4	2009/11/23

To-À: **01894042**
NOVA SCOTIA POWER CORP
EASTERN SHORE HYDRO
293 MALAY FALLS RD. HWY 374
SHEET HARBOOUR NS B0J 3B0
CANADA

Attention: JAMIE YATES
Ref./Réf:
T:
F:
Email/Courriel:

From-De: RADISA TOMOVIC
8600, RUE ST-PATRICK
LASALLE, QUEBEC H8N 1V1
CANADA

T:
F:
Email/Courriel:
Sales Rep/ Représentant: SCOTT PARSONS

We appreciate the opportunity to provide you with this quote and look forward to a positive response.
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LINE LIGNE	DESCRIPTION	QTY. QTÉ	UNIT PRICE PRIX UNITAIRE	AMOUNT MONTANT
010	RUNNER & SHAFT - EVALUATION OF REPAIR	1	[redacted]	[redacted]

Weir Reference no.: / No référence Weir : **6106116**

RECEIVING/HANDLING
DISMANTLE SHAFT FROM THE RUNNER
BLAST TO SSPC-SP 10 NEAR WHITE

RUNNER:
ANALYSE MATERIAL
MPI (LPI) TO DISCOVER ALL THE CRACKS
DIMENSIONAL INSPECTION, DIA'S, LENGTH AND TAPERED BORE

SHAFT:
ANALYSE MATERIAL
MPI
SET ON THE LATHE, INSPECT FOR RUNOUTS
RECORD DIA'S AND TAPERED END
PREPARE REPORTS

Terms and Conditions
Termes et conditions

FOB - FAB: MONTREAL SERVICE CENTRE
Validity - Validité: 2009/12/31
Taxes: EXTRA, IF APPLICABLE - SI APPLICABLE
Currency - Devise: CANADIAN
Payment Terms - Conditions de paiement: NET 30 DAYS
Delivery Terms - Conditions de livraison: **TO BE DISCUSSED**

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LINE LIGNE	DESCRIPTION	QTY. QTÉ	UNIT PRICE PRIX UNITAIRE	AMOUNT MONTANT
020	(1)TURBINE RUNNER (FRANCIS)	1	[redacted]	[redacted]

Weir Reference no.: **6106117**
No référence Weir :

SCOPE OF WORK:

FOLLOWING INITIAL CLEANNING AND ASSESMENT
PREMACHINE RUNNER CROWN DIA. FOR WELD OVERLAY
PREPARE WELDING PROCEDURE
ARC-AIR ALL THE CRACKS FOUND (NDE 9-124)
CLEAN BY GRINDING GOUGED SURFACES
MAGNETIC PARTICLE INSPECTION (LPI IF REQUIRED)
WELD EXCAVATED AREA
GRIND SMOOTH WELDED SURFACES AND RADII
STRESS RELIEVE
MAGNETIC PARTICLE INSPECTION
PREMACHINE RUNNER BAND (WEARING RING SEAT)
METALIZE WEARING RING "SEAT" (FILL UP CAVITIES)
MACHINE METALIZED DIAMETER TO THE ORIGINAL DIMENSION
FABRICATE AND SHRINK FIT NEW WEARING RING
MACHINE WEARING RING AND CROWN DIA'S AS PER DRAWING
MIN. CLEAN TAPERED BORE AND TWO FACES (CROWN)

Terms and Conditions
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LINE LIGNE	DESCRIPTION	QTY. QTÉ	UNIT PRICE PRIX UNITAIRE	AMOUNT MONTANT
	INSPECT AND RECORD *APPLY CORROSION RESISTANT COATING ON ALL NON-MACHINED SURFACES (WEARGUARD EPOXY)* *SUPPLY MATERIAL AND FABRICATE BALANCING MANDREL* *BALANCE TO REQ. SPEC'S* *PREPARE FINAL INSPECTION REPORT* *PREPARE FOR THE ASSY WITH THE SHAFT* *NOTE: DYNAMIC BALANCING IS NOT INCLUDED IN OUR PRICE - TIME CAN'T BE ACURATELY ESTIMATED.* *BALANCING IS DONE AT HOURLY RATE OF $108.00*			
030	(1) TURBINE SHAFT Weir Reference no.: / No référence Weir : **6106373** *SCOPE OF WORK: REV.-1* *REMOVE KEY* *VERIFY TAPER FIT WITH THE RUNNER (PRUSSIAN BLUE)* *WELD OVERLAY TAPER - CARBON STEEL* **** MACHINE SS SLEEVE - NS POWER TO SUPPLY NEW DIAMETER **** *MACHINE 2" BAND FOR ALIGNMENT PURPOSES*	1	[redacted]	[redacted]

Terms and Conditions
Termes et conditions

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WEIR
SECTEUR INDUSTRIEL ET PRODUCTION D'ÉNERGIE

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LINE LIGNE	DESCRIPTION	QTY. QTÉ	UNIT PRICE PRIX UNITAIRE	AMOUNT MONTANT
	MIN. MACHINE LOCKIN PLATE GROOVE			
	ESTABLISH TAPER END DIMESIONS TO KEEP THE RUNNER IN ITS ORIGINAL POSITION			
	MACHINE TAPERED END			
	DRILL AND TAP ONE HOLE FOR ASSY WITH THE RUNNER			
	CLEAN KEYWAY, ASSY KEY			
	FABRICATE NEW LOCKING PLATES			
	INSPECT AND RECORD			
	APPLY CORROSION RESISTANT COATING ON NON-MACHINED DIA'S			
	ASSEMBLE SHAFT AND RUNNER			
	PREPARE FOR SHIPMENT			

QuotationTotal
Total de la soumission [redacted]

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RADISA TOMOVIC

REVIEWED BY / RÉVISÉ PAR

COS184-B

Weir American Hydro

201 Brownlow Ave, Suite 44
Dartmouth, Nova Scotia
B3B 1W2

Tel:
Cell:
Fax:
E-mail :

May 30, 2014

Ms. Andrea MacKay
Nova Scotia Power Inc.
P. O. Box 910
Halifax, NS B3J 2W5
Canada

SUBJECT: Malay Falls #5 Replacement Runner
American Hydro Corporation Proposal Number 3407 Rev 1

Dear Ms. MacKay:

Weir American Hydro is pleased to provide this revised quotation for a new runner to be custom designed and manufactured for your Malay Falls Unit 5 hydro turbine. Our quotation is presented in accordance with the terms and conditions of the new runner purchase agreement between American Hydro Corporation and Nova Scotia Power.

The pricing for the runner is based on the formula included in the new runner purchase agreement, effective February 20, 2012 and escalated to reflect a 3 year increase since the formula was last changed. This old pricing formula applied to runners ordered through 2012. We are prepared to discuss this increase with you in order to assure you that you are receiving a competitive market pricing level.

We are providing pricing for two delivery options. The base price is for our standard delivery and the optional price is for an expedited delivery. The expedited delivery is being presented, as it is our understanding that there may be additional value to NSP for receiving the runner prior to the end of 2014.

The prices are:

<u>Base Price</u>
$[redacted] CDN per runner with a delivery of 8-9 months after receipt of order and agreement on hydraulic performance goals.

<u>Optional Price</u>
$[redacted] CDN per runner with a delivery of December 31, 2014. In order to meet this delivery date receipt of order must be received no later than June 15, 2014 and agreement of hydraulic performance goals no later than July 15, 2014.

Before proceeding with the design and manufacture of the Malay Falls runner, Weir American Hydro will work with Nova Scotia Power to finalize the performance goals and possibly other technical specifications. This engineering effort may result in some changes to specification Sections 20001 through 20005. These changes will be mutually agreed upon before proceeding with the final design and subsequent manufacturing.

The volatility of stainless steel material prices have recently been a point of concern. While we do not expect unusual increases in steel prices we would request a material surcharge if such an unusual spike occurred prior to the order of material. This quotation is valid for your acceptance within 90 days.

We look forward to working with Nova Scotia Power on the runner replacement of Malay Falls Unit 5 and would be pleased to answer any questions you may have.

Additional information can be obtained from Scott Parsons our Account Manager for Atlantic Canada at or .

Should Weir American Hydro be selected as the vendor of choice for this runner upgrade, please have your purchase order issued to Weir Canada Inc, 201 Brownlow Ave Suite 44, Dartmouth, Nova Scotia, B3B 1W2

These Canadian prices are based on and exchange rate of 1.0876 against the US dollar. Final price may require adjustment due to fluctuation in the Canadian and United States exchange rates.

Very truly yours,

John Caron
Vice-President and General Manager
Weir American Hydro - Canada

cc: Scott Parsons

SECTEUR INDUSTRIEL ET PRODUCTION D'ÉNERGIE

QUOTATION / ESTIMATE
SOUMISSION / ESTIMATION

FACILITY-INSTALLATION	QUOTATION No. SOUMISSION
K25	**7093153-R1**
PAGE	DATE
1 / 3	2009/11/27

To-À: **01894042**
NOVA SCOTIA POWER CORP
EASTERN SHORE HYDRO
293 MALAY FALLS RD. HWY 374
SHEET HARBOOUR NS B0J 3B0
CANADA

Attention: JAMIE YATES
Ref./Réf:
T:
F:
Email/Courriel:

From-De: RADISA TOMOVIC
8600, RUE ST-PATRICK
LASALLE, QUEBEC H8N 1V1
CANADA

T:
F:
Email/Courriel:
Sales Rep/
Représentant: SCOTT PARSONS

We appreciate the opportunity to provide you with this quote and look forward to a positive response.
Should you have any questions concerning this quote, please do not hesitate to contact us.

Nous avons préparé cette soumission à votre intention. Nous espérons qu'elle est conforme à vos attentes et vous invitons à communiquer avec nous si vous aviez des questions ou besoin de renseignements supplémentaires.

LINE LIGNE	DESCRIPTION	QTY. QTÉ	UNIT PRICE PRIX UNITAIRE	AMOUNT MONTANT
010	(1) HEADCOVER - EVALUATION OF REPAIRS	1	[redacted]	[redacted]
	Weir Reference no.: / No référence Weir : **6106118**			
	SCOPE OF WORK:			
	RECEIVING INSPECTION, PHOTOS *GRIT BLAST TO REMOVE DIRT AND CORROSION* *PERFORM M.P.I. AND ANALYSE MATERIAL* *DIMENSIONAL INSPECTION / REPORT* *EVALUATE MIN. REPAIR REQUIRED* *PREPARE QUOTE*			
020	(1) HEADCOVER REPAIRS	1	[redacted]	[redacted]
	Weir Reference no.: / No référence Weir : **6106119**			
	SCOPE OF WORK:			
	BLAST CLEAN TO SSPC - SP6 *MACHINE DIA. 48.422" MIN. CLEAN UP* *APPLY CORROSION/WEAR RESISTANT COATING ON ALL NON-MACHINED* *SURFACES (WEARGUARD EPOXY)* *(NO COATING ON W. GATE BUSHINGS, BEARING COUPLING FACE &*			

Terms and Conditions
Termes et conditions

FOB - FAB: MONTREAL SERVICE CENTRE
Validity - Validité: 2009/12/31
Taxes: EXTRA, IF APPLICABLE - SI APPLICABLE
Currency - Devise: CANADIAN
Payment Terms - Conditions de paiement: NET 30 DAYS
Delivery Terms - Conditions de livraison: **TO BE DISCUSSED**

Note: Should this quotation result in an order, it will be subject to Weir Canada Inc.'s Standard Terms and Conditions of Sale. Available at www.weircanada.ca.
Veuillez noter que dans le cas où cette soumission résultait en une commande de votre part, cette commande serait assujettie aux Termes et conditions de vente de Weir. Pour plus de renseignements à ce sujet, visitez notre site à www.weircanada.ca.

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LINE LIGNE	DESCRIPTION	QTY. QTÉ	UNIT PRICE PRIX UNITAIRE	AMOUNT MONTANT
	BORE AND MACHINED DIA. 48.422" REF.) *GRIND SMOOTH WHERE REQUIRED, CLEAN* *INSPECT, PREPARE REPORTS* *PREPARE FOR SHIPMENT* *NOTE: 48.422" DIA. IS NOT CONCENTRIC WITH W. GATE BORES OR THE CENTER BORE. RADIAL DIFFERENCE IS OVER 3/16". WHEN MACHINED CONCENTRIC IT WILL REQUIRE SOME ADDITIONAL WELDING ON THE RUNNER CROWN.* **** BY MAKING 48.422" DIA CONCENTRIC WITH W. GATE BORES, THE GAP BETWEEN HEAD COVER AND RUNNER CROWN WILL INCREASE NEARLY A 1/2". THEN, INSTEAD OF WELDING RUNNER CROWN, WEARING RING CAN BE FITTED ONTO HEAD COVER. PRICE ADJUSTMENT WILL BE REQUIRED. ****			
030	(4) NEW WICKET GATES Weir Reference no.: **6106789** No référence Weir : *FABRICATE NEW WICKET GATE AS PER SAMPLE* *SCOPE OF WORK:* *SUPPLY MATERIAL (MILD STEEL PLATES, BARS AND BRONZE*	4	[redacted]	[redacted]

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SECTEUR INDUSTRIEL ET PRODUCTION D'ÉNERGIE

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LINE LIGNE	DESCRIPTION	QTY. QTÉ	UNIT PRICE PRIX UNITAIRE	AMOUNT MONTANT
	BUSHINGS) *PREPARE MATERIAL, CUT AND FORM* *ASSEMBLE AND WELD* *STRESS RELIEVE* *MACHINE AS PER DRAWING* *INSTALL NEW BUSHINGS* *INSPECT AND RECORD* *PAINT* *PREPARE FOR SHIPMENT* *NOTE: THIS PRICE IS BUDGETARY ONLY BASED ON ESTIMATED MATERIAL COST AND NEED TO BE REVIEWED.*			

QuotationTotal
Total de la soumission [redacted]

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RADISA TOMOVIC

REVIEWED BY / RÉVISÉ PAR

Weir Canada, Inc.

Solutions d'ingénierie par excellence

SECTEUR INDUSTRIEL ET PRODUCTION D'ÉNERGIE

Services d'ingénierie Weir
8600, rue St-Patrick
LaSalle (Québec)
H8N 1V1

Tél. :
Fax :
www.weirservicesamericas.com

LaSalle, march 25th, 2011

Soumission L09-11-023 (7093539 Rev.1)

Nova Scotia Power Hydro Lakeside
25 Lakeside Park drive
B3T 1M9
Nova Scotia, Canada

Attention Malcolm Kaiser
c.c. Jamie Yates civil ing.
Tel :
e-mail :

Objet : Proposal

Title : Lower seal

Ref.: Power Station – Malay Falls, Nova Scotia

Subject: In-Situ machining of lower seal

Dear Mr Farrell,

We thank you for the time you made available to meet with our team on november 10th, 2009 and wish to provide you with the following proposal for the machining, on site at the Malay Falls power station, of a lower seal. Based on our discussions, we have made the following assumptions that a) the work is scheduled to be performed during the spring of year 2011, b) Weir is to provide two 2-man team to work , five (5) days per week, on two 12-hour shift c) the purchase order will be issued by NS Power providing Weir gets awarded the contract.

…/2

1. **Preparatory work in our shop**

- Manufacture one (1) stainless steel ring (304 type)
- Clean, inspect, verify as required and prepare for shipment the following equipment:
    - Flange facing machine (FF8000) c/w power pack unit
    - S.S.304 ring
    - Compound & electrical components
    - Various accessories
- Crate and load all equipment for transport to site

2. **Transport of equipment to/from site Montreal-Malay falls.Malay falls-Montreal**

- Transport of Weir equipment ''normal ground'' to/from site.

3. **Travelling of Weir personnel to/from site Montreal-Malay falls.Malay falls-Montreal**

- Travelling of a 2-man crew to/from site including airfare.

4. **Lower seal measurement**

- Weir will supply a technician once the existing seal is removed to verify lower sealing ring seating diameter and bolt holes pattern to facilitate ring machining at our facility.
  To fill missing dimension on dwg MF19-11-09A).

5. **Mobilization on site**

- Arrival of our crew on site
- Acquaintance to site of our personnel/Endoctrination session (safety course, contacts, site visit, etc.)
- Unloading of Weir equipment (with customer's manpower and handling equipment assistance as required)
- Transport of Weir equipment from truck unloading area to work site (with customer's manpower and handling equipment assistance as required)

…/3

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7093539 Rev.1 *3*

6. Set-up and machining

- Mount portable machine and machine lower steel casing (to suit light fit with stainless steel ring)
- Installation of stainless steel ring on casing (used dry ice if required)
- Drill, tap and install (39) flat head set screws with locking threads.
- Final machining inside diameter of lower seal ring
- Customer witnessed inspection and sign-off

7. Site demobilization

- Dismantling and removal of Weir equipment from work site to truck loading area (with customer's manpower and handling equipment assistance as required)
- Loading of Weir equipment on trucks as required (with customer's manpower and handling equipment assistance as required)
- Departure of our crew from site

6. Demobilization in the shop – Weir LaSalle, Quebec

- Unloading, inspection and storage of equipment.

WEIR TO SUPPLY:

- (1) crew of (2) men to work on (1) 12-hour shift per day, (5) days per week.
- (1) flange facing machine c/w all machining equipment required to machine, drill and tap.
- (1) stainless steel ring + flat head set screws + Loctite thread lock
- Subsistence for our crew (5) days
- Accommodation for our crew (5) days

SCHEDULE:	Preparation in our shop:	3 weeks approx.
	Work on site:	5 days approx.

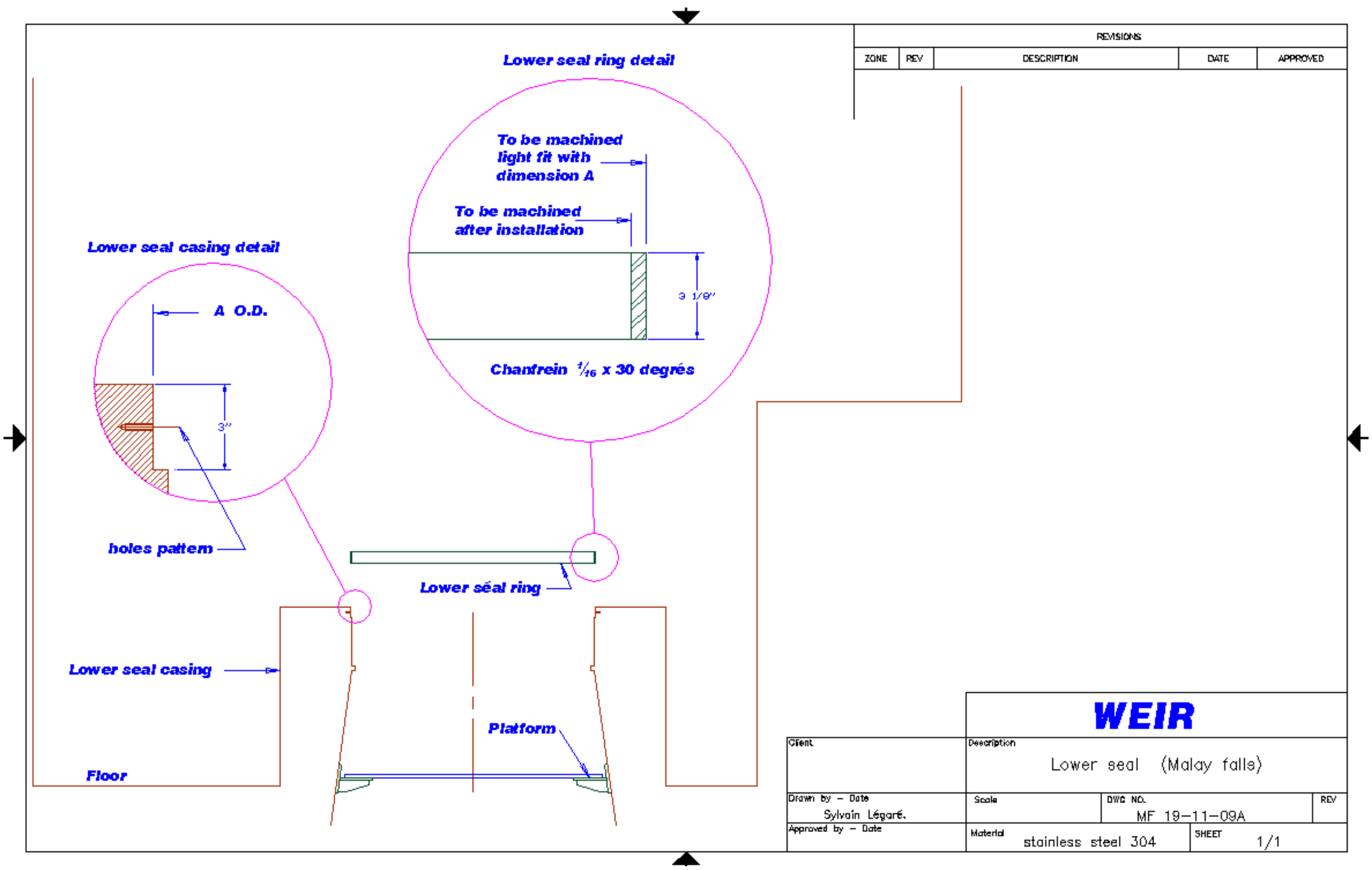
…/4

Weir Canada, Inc.

7093539 Rev.1 *4*

CUSTOMER TO SUPPLY:

- Remove or move all wicket gates to have a free access to the lower ring casing.
- Cut and remove existing stainless steel on lower seal ring.
- Platforms inside lower seal casing for easy and safe access to work site.
- Air (90 PSI).
- Electrical outlets (120V & 575V-3 phase-60Hz)
- Manpower assistance and handling equipment as noted above
- Lifting capacity on site (2 tons)
- Heat in work area



…/5

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GENERAL NOTES

1. Material to be removed not to exceed .1/16'' thick on face and 1/32'' thick on diameter.

2. Diameters will be machined within .010'' flatness, .005'' parallelism and concentricity.

3. As per Weir's Health & Safety program, we ask you to take the necessary measures to ensure that our technicians work in a safe environment, are not exposed to safety hazards and that periodic work site visits are performed by your representative to confirm the well being of our employees.

4. All waiting time on site including but not limited to non-availability of site (overhead work, etc.), non-availability of crane/lifting equipment, non-availability of manpower assistance, resolution of safety hazards, delays during customer's decisions, customer's non-availability for inspection, etc., will be charged as per the following cost chart.

5. Weir carries out a superficial cleaning of the site at the end of the job. However, appropriate measures should be taken by the customer to protect its property/equipment against any and all damages (e.g. metal chips, metal powder, lubricating oil, etc.). Weir cannot be held responsible for such damages.

6. The customer must ensure the platform is dimensionally stable and has the capacity to withstand load and forces submitted by our equipment and personnel (approximate weight required: 1000 lbs).

7. Weir is certified to ISO 9001 and ISO 14000 standards.

8. It is assumed that NS Power will remove existing ring and fasteners prior before the arrival of Weir. This quote doesn't include this existing removal but we can offer a different quote for this service

…/6

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7093539 Rev.1   ***6***

Our price is based on project duration on site of five (5) days. Days in excess of five (5) days will be charged as per the cost chart below

<u>PER DIEM CHARGE-OUT CHART (per man) CDN $</u>

Note: R/T: Regular time considered to be the first (8) hours of a week day.

O/T: Overtime considered to be the first (2) hours exceeding the first (8) hours of any normal shift or, the first (2) hours worked on a Saturday.

D/T: Double time considered to be any work done after the first (10) hours of any normal shift or, after the first (2) hours worked on a Saturday or, any work done on a Sunday or a holiday.

Travelling time:	R/T: [redacted]/hr O/T: $[redacted]/hr
On site work:	Field machining tradesmen: (including machine rates)
	R/T: $[redacted]/hr O/T: $[redacted]/hr D/T: $[redacted]/hr
Hotel, material, expenses:	Cost plus [redacted]% mark-up
Transport of equipment:	Cost plus [redacted]% mark-up
Meal allowance:	$[redacted]/day/man

TERMS:	[redacted]%, prior to mobilization on site, Balance net 30 days
TAXES:	Extra as applicable
F.O.B.:	Malay falls
VALIDITY:	This quote is valid for a period of (30) days from its signature date.

We hope that this quotation will meet with your satisfaction. Should you need additional information, please do not hesitate to contact the undersigned.

Our budgetary price...[redacted]**$Rev.1**

Sylvain Légaré
Coordonnateur de projets
Field machining specialist, Project coordinator
:sl
c.c. : Scott Parsons

CI Number: 46594

Title: HYD Sissiboo Falls Overhaul

Start Date: 2015/02
In-Service Date: 2015/08
Final Cost Date: 2016/02
Function: Hydro
Forecast Amount: $817,153

DESCRIPTION:

Sissiboo Falls is located on the Weymouth River above the Weymouth Hydro Station. The Sissiboo Falls hydro Station consists of a single 6.2MW unit that produces 27 GWh of renewable energy annually. This project is for the refurbishment of the Sissiboo Falls Generating Unit. It includes a generator rotor rewind, wicket gate linkage and bushing refurbishment as well as a new wicket gate and scroll case refurbishment.

Summary of Related CIs (+/- 2 years):
2014 CI 44887 HYD Sissiboo Pipeline Replacement $475,082
2015 CI 23125 HYD Sissiboo Electrical Refurbishment $845,755

JUSTIFICATION:

Justification Criteria: Hydro

Sub Criteria: Maintenance

Why do this project?

The Sissiboo Falls generator rotor is in a deteriorated condition where a failure has become likely. In addition to the deteriorated rotor condition, this unit is difficult to stop when shut down as the water leakage through the wicket gates is enough to drive the turbine against the unit brakes. Under heavy system load conditions this unit is critical for grid stability in the western end of the province and maintaining it in working order is vital to NS Power.

Why do this project now?

The condition of the rotor has deteriorated to a point where an electrical failure is likely to occur. Correcting the leakage with the wicket gates will give system operators additional control over the hydro unit, as well as avoid possible replacement energy costs in case of a failure. The Sissiboo river system is undergoing a pipeline replacement and switchgear replacement in 2015. Completing this work in conjunction with those outages avoids additional outages in the future and the lost generation that comes along with these outages.

As of 2015, generation from NS Power's legacy hydro facilities will qualify under the provisions of the Nova Scotia Renewable Electricity Regulations. Generation from hydro facilities is an important part of NS Powers compliance plan to serve 25 percent of sales from qualifying renewable generation sources.

Why do this project this way?

The condition of the rotor is deteriorated to the point where refurbishment is not possible and a rewind is a much more cost effective solution compared to the purchase of a new rotor. Refurbishment of the wicket gates is also a more cost effective option with the same benefits as replacement.

CI Number : 46594 - HYD Sissiboo Falls Overhaul **Project Number**

Parent CI Number : -

Cost Centre : 410 - 410-Bear River Hydro System **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		6,389	0	6,389
095		095-Thermal & Hydro Contracts AO		28,672	0	28,672
095		095-Hydro Term Labour AO		19,006	0	19,006
095		095-Hydro Regular Labour AO		50,154	0	50,154
001	024	001 - HYDRO Regular Labour	024 - HGP - Turbine (Hydro)	185,962	0	185,962
004	024	004 - HYDRO Term Labour	024 - HGP - Turbine (Hydro)	70,470	0	70,470
011	024	011 - Travel Expense	024 - HGP - Turbine (Hydro)	21,000	0	21,000
012	024	012 - Materials	024 - HGP - Turbine (Hydro)	100,000	0	100,000
013	024	013 - POWER PRODUCTION Contracts	024 - HGP - Turbine (Hydro)	320,000	0	320,000
028	024	028 - Consulting	024 - HGP - Turbine (Hydro)	5,000	0	5,000
041	024	041 - Meals & Entertainment	024 - HGP - Turbine (Hydro)	10,500	0	10,500
			Total Cost:	817,153	0	817,153
			Original Cost:	103,372		

Capital Project Detailed Estimate

Location: Hydro
CI# / FP#: 46594
Title: HYD Sissiboo Falls Overhaul
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Engineering	PD	25	$ 391	$ 9,787.25		
Hydro River Staff	PD	500	$ 352	$ 176,175.00		
			Sub-Total	$ 185,962.25		
004 Term Labour						
Hydro River Staff	PD	200.00	$ 352	$ 70,470.00		
			Sub-Total	$ 70,470.00		
011 Travel Expense						
Travel / Lodging	Lot	1.00	$ 21,000.00	$ 21,000.00		
				$ -		
			Sub-Total	$ 21,000.00		
012 Materials						
New Wicket Gates	Lot	1.00	$ 60,000.00	$ 60,000.00		
Links, Bushing material	Lot	1.00	$ 35,000.00	$ 35,000.00		
Misc. Materials	Lot	1.00	$ 5,000.00	$ 5,000.00		
			Sub-Total	$ 100,000.00		
013 Contracts						
Draft Tube Repairs	Lot	1.00	$ 15,000.00	$ 15,000.00		
Scroll Case Repairs / Recoating	Lot	1.00	$ 50,000.00	$ 50,000.00		
Rotor Rewind	Lot	1.00	$ 230,000.00	$ 230,000.00		45958 Nictaux Rotor
On Site Machining	Lot	1.00	$ 25,000.00	$ 25,000.00		
			Sub-Total	$ 320,000.00		
028 Consulting						
Inspection Services	Lot	1.00	$ 5,000.00	$ 5,000.00		
				$ -		
				$ -		
			Sub-Total	$ 5,000.00		
041 Meals & Entertainment						
Meals during travel / lodging		1.00	$ 10,500.00	$ 10,500.00		
				$ -		
			Sub-Total	$ 10,500.00		
094 Interest Capitalized						
AFUDC				$ 6,388.67		
				$ -		
			Sub-Total	$ 6,388.67		
095 Administrative Overhead						
Hydro Reg. Labour AO				$ 50,154.00		
Hydro Term Labour AO				$ 19,005.75		
Thermal / Hydro Contracts AO				$ 28,672.00		
			Sub-Total	$ 97,831.75		
			SUB-TOTAL (no AO, AFUDC)	$ 712,932.25		
			TOTAL (AO, AFUDC included)	$ 817,152.67		
Original Cost				$ 103,371.54		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

HYD Sissiboo Falls Overhaul
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Hydro	**CI Number:**	46594
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Rotor rewind / Wicket Gate refurb vs Av	6.19%	-7,173,779	5,883,895	1	50.43%	2.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to rewind the rotor, refurbish the linkage and bushings and a new wicket gate and scroll case refurbishiment on the Sissiboo Generating Unit.

Notes/Comments :

Rotor rewind / Wicket Gate refurb vs Avoided Repair and Replacement Energy Costs

This option combines the costs of a failure of the wicket gate and the rotor. Each failure carries different costs, so they were calculated as two separate alternatives, then combined and compared against the overhaul capital investment.

Test 2

Test 3

Test 4

HYD Sissiboo Falls Overhaul
Summary of Sensitivities

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Hydro	**CI Number:**	46594
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Rotor rewind / Wicket Gate refurb vs Avoided Rep	6.19%	-7,173,779	5,883,895	1	50.43%	2.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Rotor rewind / Wicket Gate refurb vs Avoided Rep	10%	-7,106,145	5,828,211	1	45.16%	3.1 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:						
	A	67,635	-55,684	0	-5.27%	0.3 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Rotor rewind / Wicket Gate refurb vs Avoided Rep	-10%	-6,388,767	5,239,822	1	44.65%	3.1 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:						
	A	785,013	-644,074	0	-5.77%	0.3 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	268,961	510,757	730,269	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

HYD Sissiboo Falls Overhaul
Avoided Cost Calculations

Division :	Power Production	Date :	27-Oct-14
Department :	Hydro	CI Number:	46594
Originator :		Project No. :	

Rotor rewind / Wicket Gate refurb vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$817,153

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			70,235	71,640		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	50%	50%	50%	50%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	6	6				
Duration (Hours)	1344	1344				
Totals	$204,241	$206,871	$35,118	$35,820	$239,359	$242,691
Total Capital Cost of Alternative						$0

Test 3

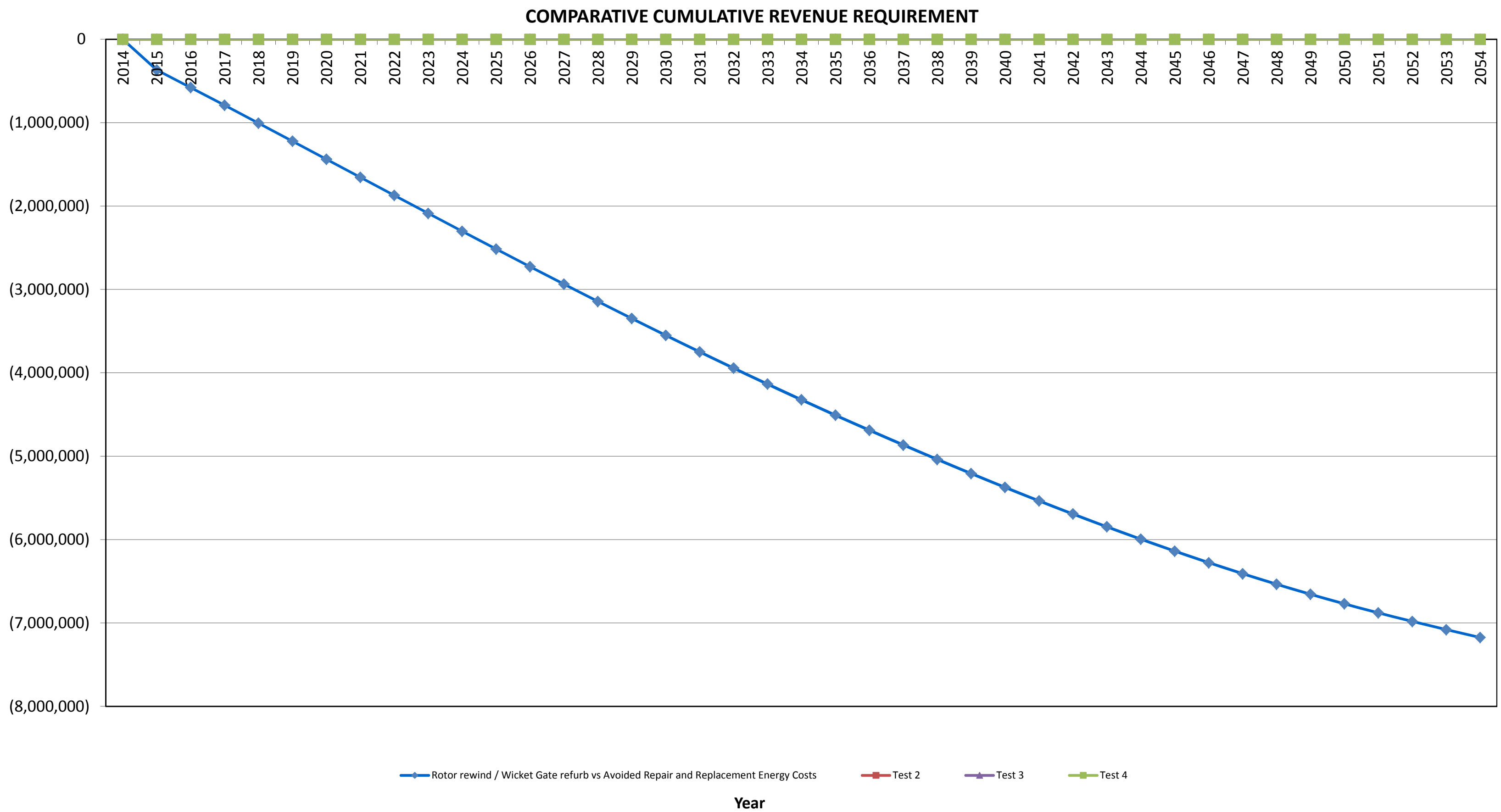
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	10%	13%	10%	13%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	10000	10000				
Duration (Hours)	1	1				
Totals	$49,021	$64,548	$0	$0	$49,021	$64,548
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

HYD Sissiboo Falls Overhaul
Rotor rewind / Wicket Gate refurb vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	288,380.0	(719,320.9)	28,517.3	711,416.5	(430,940.9)	(80,557.5)	(511,498.3)	(481,682.2)	0.94	(481,682.2)
2016	-	-	307,238.6	-	54,753.2	652,155.2	307,238.6	(78,270.5)	228,968.1	203,052.3	0.89	(278,629.9)
2017	-	-	328,577.0	-	50,372.9	597,634.9	328,577.0	(86,243.3)	242,333.7	202,377.9	0.84	(76,252.1)
2018	-	-	350,646.0	-	46,343.1	547,476.1	350,646.0	(94,333.9)	256,312.1	201,574.0	0.79	125,322.0
2019	-	-	373,466.3	-	42,635.7	501,330.1	373,466.3	(102,557.5)	270,908.8	200,634.2	0.74	325,956.2
2020	-	-	397,059.1	-	39,224.8	458,875.7	397,059.1	(110,928.6)	286,130.5	199,554.9	0.70	525,511.1
2021	-	-	421,446.3	-	36,086.8	419,817.7	421,446.3	(119,461.4)	301,984.9	198,335.2	0.66	723,846.3
2022	-	-	446,650.2	-	33,199.9	383,884.3	446,650.2	(128,169.6)	318,480.6	196,976.3	0.62	920,822.6
2023	-	-	472,693.6	-	30,543.9	350,825.6	472,693.6	(137,066.4)	335,627.2	195,481.0	0.58	1,116,303.6
2024	-	-	499,600.1	-	28,100.4	320,411.6	499,600.1	(146,164.9)	353,435.2	193,853.5	0.55	1,310,157.1
2025	-	-	527,393.8	-	25,852.3	292,430.7	527,393.8	(155,477.9)	371,916.0	192,099.0	0.52	1,502,256.1
2026	-	-	556,099.4	-	23,784.2	266,688.3	556,099.4	(165,017.7)	391,081.7	190,223.4	0.49	1,692,479.5
2027	-	-	585,742.3	-	21,881.4	243,005.3	585,742.3	(174,796.9)	410,945.4	188,233.6	0.46	1,880,713.1
2028	-	-	616,348.4	-	20,130.9	221,216.9	616,348.4	(184,827.4)	431,521.0	186,136.4	0.43	2,066,849.5
2029	-	-	647,944.5	-	18,520.4	201,171.6	647,944.5	(195,121.5)	452,823.1	183,939.2	0.41	2,250,788.6
2030	-	-	680,557.9	-	17,038.8	182,729.9	680,557.9	(205,690.9)	474,867.0	181,649.4	0.38	2,432,438.1
2031	-	-	714,216.7	-	15,675.7	165,763.5	714,216.7	(216,547.7)	497,669.0	179,274.7	0.36	2,611,712.8
2032	-	-	748,949.6	-	14,421.6	150,154.5	748,949.6	(227,703.7)	521,245.9	176,822.5	0.34	2,788,535.3
2033	-	-	784,786.1	-	13,267.9	135,794.2	784,786.1	(239,170.6)	545,615.5	174,300.2	0.32	2,962,835.5
2034	-	-	821,756.5	-	12,206.5	122,582.7	821,756.5	(250,960.5)	570,796.0	171,715.1	0.30	3,134,550.6
2035	-	-	859,891.8	-	11,230.0	110,428.1	859,891.8	(263,085.2)	596,806.6	169,074.3	0.28	3,303,624.8
2036	-	-	899,223.8	-	10,331.6	99,245.9	899,223.8	(275,556.6)	623,667.2	166,384.6	0.27	3,470,009.5
2037	-	-	939,785.1	-	9,505.0	88,958.2	939,785.1	(288,386.8)	651,398.3	163,652.8	0.25	3,633,662.3
2038	-	-	981,609.2	-	8,744.6	79,493.6	981,609.2	(301,588.0)	680,021.2	160,885.0	0.24	3,794,547.2
2039	-	-	1,024,730.3	-	8,045.1	70,786.2	1,024,730.3	(315,172.4)	709,557.9	158,087.4	0.22	3,952,634.7
2040	-	-	1,069,183.7	-	7,401.5	62,775.3	1,069,183.7	(329,152.5)	740,031.2	155,265.8	0.21	4,107,900.5
2041	-	-	1,115,005.3	-	6,809.3	55,405.3	1,115,005.3	(343,540.7)	771,464.5	152,425.7	0.20	4,260,326.2
2042	-	-	1,162,232.0	-	6,264.6	48,624.9	1,162,232.0	(358,349.9)	803,882.1	149,572.2	0.19	4,409,898.4
2043	-	-	1,210,901.9	-	5,763.4	42,387.0	1,210,901.9	(373,592.9)	837,308.9	146,710.3	0.18	4,556,608.8
2044	-	-	1,261,053.6	-	5,302.4	36,648.1	1,261,053.6	(389,282.9)	871,770.7	143,844.6	0.17	4,700,453.4
2045	-	-	1,312,727.1	-	4,878.2	31,368.3	1,312,727.1	(405,433.2)	907,293.9	140,979.4	0.16	4,841,432.8
2046	-	-	1,338,981.6	-	4,487.9	26,510.8	1,338,981.6	(413,693.0)	925,288.6	135,394.6	0.15	4,976,827.4
2047	-	-	1,365,761.2	-	4,128.9	22,042.0	1,365,761.2	(422,106.0)	943,655.2	130,033.1	0.14	5,106,860.5
2048	-	-	1,393,076.5	-	3,798.6	17,930.7	1,393,076.5	(430,676.1)	962,400.3	124,885.7	0.13	5,231,746.2
2049	-	-	1,420,938.0	-	3,494.7	14,148.3	1,420,938.0	(439,407.4)	981,530.6	119,943.6	0.12	5,351,689.8
2050	-	-	1,449,356.7	-	3,215.1	10,668.4	1,449,356.7	(448,303.9)	1,001,052.8	115,198.5	0.12	5,466,888.2
2051	-	-	1,478,343.9	-	2,957.9	7,467.0	1,478,343.9	(457,369.7)	1,020,974.2	110,642.2	0.11	5,577,530.4
2052	-	-	1,507,910.8	-	2,721.3	4,521.7	1,507,910.8	(466,608.7)	1,041,302.0	106,267.2	0.10	5,683,797.6
2053	-	-	1,538,069.0	-	2,503.6	1,812.0	1,538,069.0	(476,025.3)	1,062,043.7	102,066.0	0.10	5,785,863.6
2054	-	-	1,568,830.3	-	2,303.3	(680.9)	1,568,830.3	(485,623.4)	1,083,207.0	98,031.7	0.09	5,883,895.4
Total	**-**	**-**	**35,467,164.2**	**(719,320.9)**	**686,444.5**		**34,747,843.3**	**(10,782,023.1)**	**23,965,820.2**	**5,883,895.4**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(1,000,000)
(2,000,000)
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(5,000,000)
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(8,000,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Rotor rewind / Wicket Gate refurb vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 45370

Title: HYD – Wreck Cove Unit#1 Excitation System

Start Date:	2015/01
In-Service Date:	2015/12
Final Cost Date:	2016/06
Function:	Hydro
Forecast Amount:	$578,113

DESCRIPTION:

This project is to replace the aging excitation system on Unit 1 at the Wreck Cove Hydro Station. The excitation system for a synchronous generator provides the direct current (DC) field current to the generator rotor. The DC field current is derived from rectifying an alternating current (AC) supply. The excitation system includes the thyristor rectifier bridges, Automatic Voltage Regulator (AVR), field circuit breaker, monitoring and control.

Summary of Related CIs (+/- 2 years):
CI 44968 – 2014 – HYD – Wreck Cove Unit 2 Excitation System $601,088

JUSTIFICATION:

Justification Criteria: Hydro

Sub-Criteria: Equipment Replacement

Why do this project?

The excitation system, which was original to the plant, failed and was badly damaged in May 2013. The original manufacturer was unable to supply replacement parts or provide advice on how to proceed as they no longer supported the system. A temporary repair was implemented and the unit was returned to service. The system should be replaced to ensure the continued reliability of this valuable load-following and regulation asset.

Why do this project now?

Should the excitation system on Unit 1 fail, it is not likely NS Power will be able to repair it adequately and reliably, therefore a new system must be procured. Lead time for delivery for a new system is typically five to six months. This amount of downtime cannot be tolerated at the Wreck Cove facility as it is a key generation unit, critical for use during peak grid demands and integral to meeting NS Power's renewable energy requirements. The planned outage in 2015 is of sufficient duration to allow for the replacement of the excitation system.

Why do this project this way?

By proactively replacing the excitation system, the risk of an unplanned outage due to an excitation system failure will be mitigated. Upgrade or refurbishment of the existing system is no longer possible. Recent excitation system replacements have been completed at a number of NS Power thermal plants. The system to be installed on Wreck Cove Unit 1 is identical to that installed successfully on Unit 2

CI Number : 45370 - HYD - WRC Unit 1 Excitation System **Project Number**

Parent CI Number : -

Cost Centre : 480 - 480-Wreck Cove Hydro System **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		12,842	0	12,842
095		095-Thermal & Hydro Contracts AO		35,365	0	35,365
095		095-Hydro Regular Labour AO		11,760	0	11,760
095		095-Hydro Term Labour AO		9,313	0	9,313
001	023	001 - HYDRO Regular Labour	023 - HGP - Power Equip.-Station S	43,603	0	43,603
004	023	004 - HYDRO Term Labour	023 - HGP - Power Equip.-Station S	34,530	0	34,530
011	023	011 - Travel Expense	023 - HGP - Power Equip.-Station S	3,000	0	3,000
012	023	012 - Materials	023 - HGP - Power Equip.-Station S	30,000	0	30,000
013	023	013 - POWER PRODUCTION Contracts	023 - HGP - Power Equip.-Station S	394,700	0	394,700
041	023	041 - Meals & Entertainment	023 - HGP - Power Equip.-Station S	3,000	0	3,000
			Total Cost:	578,113	0	578,113
			Original Cost:	122,408		

Capital Project Detailed Estimate

Location: Hydro
CI# / FP#: 45370
Title: HYD - Wreck Cove Unit#1 Excitation System
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Hydro River Staff	PD	$ 123.75	$ 352.35	$ 43,603.16		
				$ -		
			Sub-Total	$ 43,603.16		
004 Term Labour						
Hydro River Staff	PD	98.00	$ 352.35	$ 34,530.18		
				$ -		
				$ -		
			Sub-Total	$ 34,530.18		
011 Travel Expense						
Travel to site	Lot	1.00	$ 3,000.00	$ 3,000.00		
				$ -		
			Sub-Total	$ 3,000.00		
012 Materials						
Wire, Misc. Connectors	Lot	1.00	$ 30,000.00	$ 30,000.00		
				$ -		
				$ -		
			Sub-Total	$ 30,000.00		
013 Contracts						
Exciter (Fabrication / Installation)	Lot	1.00	$ 394,700.00	$ 394,700.00		44968 (Unit 2)
				$ -		
				$ -		
			Sub-Total	$ 394,700.00		
041 Meals & Entertainment						
Meals during travel	Lot	1.00	$ 3,000.00	$ 3,000.00		
				$ -		
			Sub-Total	$ 3,000.00		
094 Interest Capitalized						
				$ 12,842.12		
				$ -		
			Sub-Total	$ 12,842.12		
095 Administrative Overhead						
Hydro Reg. Labour AO				$ 11,759.80		
Hydro Term Labour AO				$ 9,312.79		
Thermal / Hydro Contracts AO				$ 35,365.12		
			Sub-Total	$ 56,437.71		
			SUB-TOTAL (no AO, AFUDC)	$ 508,833.35		
			TOTAL (AO, AFUDC included)	$ 578,113.18		
Original Cost				$122,408.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

HYD – Wreck Cove Unit#1 Excitation System
Summary of Alternatives

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Hydro	**CI Number:**	45370
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Replace Exciter vs. Avoided Repair and	6.19%	-38,613,996	31,274,631	1	155.38%	1.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to replace the excitation system as the replacement energy costs in the event of a failure outweight the capital investment to replace the system.

Notes/Comments :

Replace Exciter vs. Avoided Repair and Replacement Energy Costs

Due to recent issues, assumed a 20% probability of failure of the excitation system in year 1. A failure would result in a 27 week outage. Because equipment would be irreparable, replacement would be required and lead time is anticipated to be 24 weeks. 3 additional weeks would be required for removal of the existing, and installation of the new excitation system. Due to the unplanned nature of the failure, there may also be increases in the cost of procuring and installing the new system which are not captured here.

Test 2

Test 3

Test 4

HYD – Wreck Cove Unit#1 Excitation System
Summary of Sensitivities

Nova Scotia POWE
An Emera Compa

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Hydro	**CI Number:**	45370
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Exciter vs. Avoided Repair and Replacen	6.19%	-38,613,996	31,274,631	1	155.38%	1.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Exciter vs. Avoided Repair and Replacen	10%	-38,565,978	31,234,108	1	143.04%	1.9 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change: A	48,018	-40,523	0	-12.34%	0.1 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Exciter vs. Avoided Repair and Replacen	-10%	-34,704,579	28,106,645	1	141.80%	1.9 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change: A	3,909,418	-3,167,986	0	-13.58%	0.1 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	0	849,064	1,805,706	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

HYD – Wreck Cove Unit#1 Excitation System
Avoided Cost Calculations

Nova Scotia POWER
An Emera Company

Division :	Power Production	Date :	23-Oct-14
Department :	Hydro	CI Number:	45370
Originator :		Project No. :	

Replace Exciter vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	1	0	1		
Probability of Occurance (%)	0%	25%	0%	25%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	18				
Duration (Hours)	0	4536				
Totals	$0	$996,609	$0	$0	$0	$996,609
Total Capital Cost of Alternative						$578,113

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

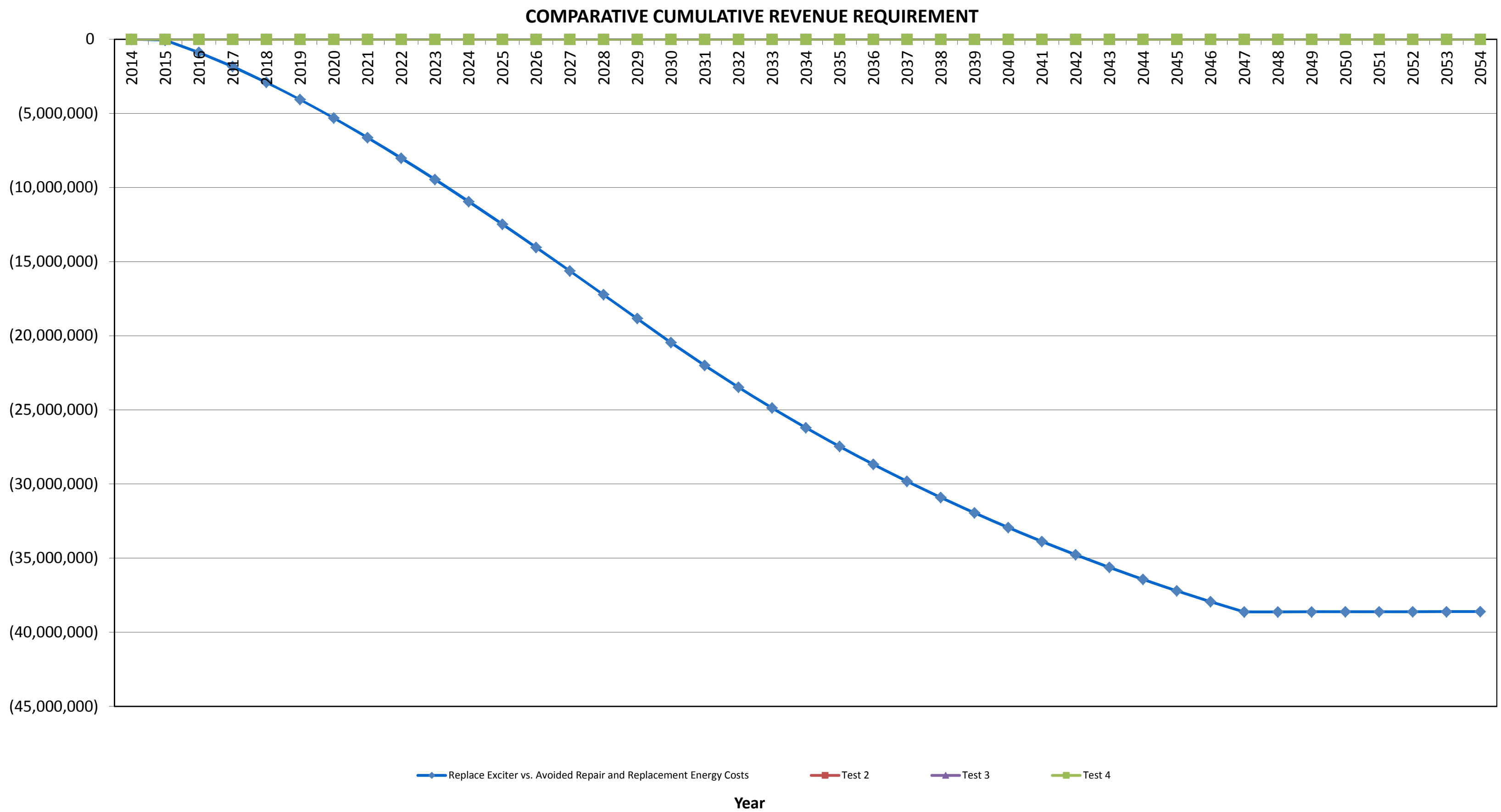
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

HYD – Wreck Cove Unit#1 Excitation System
Replace Exciter vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	-	(521,675.5)	20,353.3	504,056.8	(521,675.5)	6,309.5	(515,365.9)	(485,324.4)	0.94	(485,324.4)
2016	-	-	996,609.0	-	39,078.4	462,377.8	996,609.0	(296,834.5)	699,774.5	620,570.2	0.89	135,245.8
2017	-	-	1,219,849.4	-	35,952.1	424,033.0	1,219,849.4	(367,008.2)	852,841.3	712,225.2	0.84	847,471.0
2018	-	-	1,451,620.8	-	33,076.0	388,755.9	1,451,620.8	(439,748.9)	1,011,871.9	795,776.4	0.79	1,643,247.4
2019	-	-	1,692,175.1	-	30,429.9	356,300.9	1,692,175.1	(515,141.0)	1,177,034.1	871,707.8	0.74	2,514,955.2
2020	-	-	1,941,770.9	-	27,995.5	326,442.3	1,941,770.9	(593,270.4)	1,348,500.6	940,479.7	0.70	3,455,434.9
2021	-	-	2,200,673.7	-	25,755.9	298,972.4	2,200,673.7	(674,224.5)	1,526,449.2	1,002,529.1	0.66	4,457,964.0
2022	-	-	2,469,155.9	-	23,695.4	273,700.1	2,469,155.9	(758,092.8)	1,711,063.2	1,058,271.4	0.62	5,516,235.5
2023	-	-	2,747,497.2	-	21,799.8	250,449.6	2,747,497.2	(844,966.2)	1,902,531.0	1,108,100.5	0.58	6,624,336.0
2024	-	-	3,035,984.4	-	20,055.8	229,059.2	3,035,984.4	(934,937.9)	2,101,046.5	1,152,389.9	0.55	7,776,725.9
2025	-	-	3,334,912.0	-	18,451.3	209,379.9	3,334,912.0	(1,028,102.8)	2,306,809.2	1,191,494.0	0.52	8,968,219.9
2026	-	-	3,644,582.5	-	16,975.2	191,275.0	3,644,582.5	(1,124,558.2)	2,520,024.2	1,225,748.2	0.49	10,193,968.1
2027	-	-	3,965,305.7	-	15,617.2	174,618.5	3,965,305.7	(1,224,403.4)	2,740,902.3	1,255,470.4	0.46	11,449,438.5
2028	-	-	4,297,400.1	-	14,367.8	159,294.5	4,297,400.1	(1,327,740.0)	2,969,660.1	1,280,961.4	0.43	12,730,399.9
2029	-	-	4,641,192.1	-	13,218.4	145,196.5	4,641,192.1	(1,434,671.8)	3,206,520.2	1,302,505.8	0.41	14,032,905.7
2030	-	-	4,997,016.8	-	12,160.9	132,226.2	4,997,016.8	(1,545,305.3)	3,451,711.5	1,320,372.7	0.38	15,353,278.4
2031	-	-	5,096,957.1	-	11,188.0	120,293.6	5,096,957.1	(1,576,588.4)	3,520,368.7	1,268,138.2	0.36	16,621,416.7
2032	-	-	5,198,896.3	-	10,293.0	109,315.6	5,198,896.3	(1,608,467.0)	3,590,429.3	1,217,982.9	0.34	17,839,399.6
2033	-	-	5,302,874.2	-	9,469.6	99,215.9	5,302,874.2	(1,640,955.4)	3,661,918.8	1,169,822.3	0.32	19,009,221.9
2034	-	-	5,408,931.7	-	8,712.0	89,924.1	5,408,931.7	(1,674,068.1)	3,734,863.6	1,123,575.7	0.30	20,132,797.6
2035	-	-	5,517,110.3	-	8,015.0	81,375.7	5,517,110.3	(1,707,819.5)	3,809,290.8	1,079,165.6	0.28	21,211,963.2
2036	-	-	5,627,452.5	-	7,373.8	73,511.1	5,627,452.5	(1,742,224.4)	3,885,228.1	1,036,518.0	0.27	22,248,481.2
2037	-	-	5,740,001.6	-	6,783.9	66,275.7	5,740,001.6	(1,777,297.5)	3,962,704.1	995,562.1	0.25	23,244,043.4
2038	-	-	5,854,801.6	-	6,241.2	59,619.2	5,854,801.6	(1,813,053.7)	4,041,747.9	956,229.9	0.24	24,200,273.3
2039	-	-	5,971,897.6	-	5,741.9	53,495.1	5,971,897.6	(1,849,508.3)	4,122,389.4	918,456.3	0.22	25,118,729.5
2040	-	-	6,091,335.6	-	5,282.6	47,861.0	6,091,335.6	(1,886,676.4)	4,204,659.1	882,178.9	0.21	26,000,908.4
2041	-	-	6,213,162.3	-	4,860.0	42,677.6	6,213,162.3	(1,924,573.7)	4,288,588.6	847,337.9	0.20	26,848,246.3
2042	-	-	6,337,425.5	-	4,471.2	37,908.9	6,337,425.5	(1,963,215.9)	4,374,209.7	813,875.9	0.19	27,662,122.2
2043	-	-	6,464,174.0	-	4,113.5	33,521.7	6,464,174.0	(2,002,618.8)	4,461,555.3	781,738.1	0.18	28,443,860.3
2044	-	-	6,593,457.5	-	3,784.4	29,485.4	6,593,457.5	(2,042,798.7)	4,550,658.9	750,871.6	0.17	29,194,731.9
2045	-	-	6,725,326.7	-	3,481.6	25,772.1	6,725,326.7	(2,083,772.0)	4,641,554.7	721,225.8	0.16	29,915,957.7
2046	-	-	6,859,833.2	-	3,203.1	22,355.8	6,859,833.2	(2,125,555.3)	4,734,277.9	692,752.1	0.15	30,608,709.8
2047	-	-	6,997,029.9	-	2,946.9	19,212.9	6,997,029.9	(2,168,165.7)	4,828,864.1	665,404.1	0.14	31,274,113.9
2048	-	-	-	-	2,711.1	16,321.3	-	840.4	840.4	109.1	0.13	31,274,223.0
2049	-	-	-	-	2,494.2	13,661.1	-	773.2	773.2	94.5	0.12	31,274,317.5
2050	-	-	-	-	2,294.7	11,213.7	-	711.4	711.4	81.9	0.12	31,274,399.4
2051	-	-	-	-	2,111.1	8,962.1	-	654.4	654.4	70.9	0.11	31,274,470.3
2052	-	-	-	-	1,942.2	6,890.6	-	602.1	602.1	61.4	0.10	31,274,531.7
2053	-	-	-	-	1,786.8	4,984.9	-	553.9	553.9	53.2	0.10	31,274,585.0
2054	-	-	-	-	1,643.9	3,231.6	-	509.6	509.6	46.1	0.09	31,274,631.1
Total	**-**	**-**	**144,636,413.3**	**(521,675.5)**	**489,928.5**		**144,114,737.8**	**(44,685,410.3)**	**99,429,327.5**	**31,274,631.1**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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Replace Exciter vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 44667

Title: HYD Upper Lake Falls Unit #1 Overhaul

Start Date: 2015/05
In-Service Date: 2015/11
Final Cost Date: 2016/05
Function: Hydro
Forecast Amount: $477,533

DESCRIPTION:

The Mersey River Hydro System is rated at 42 MW of firm capacity, producing on average 240 GWH annually. Upper Lake Falls Unit#1, a 2.8 MW unit, is located upstream on the Mersey River located at Lake Rossignol. This project is intended to replace the bushings in the bottom ring to support the wicket gates, and repair the blade pitch mechanism in the Kaplan turbine head to restore the ability to pitch the blades for improved turbine efficiency.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Hydro

Sub Criteria: Maintenance

Why do this project?

Through inspections by NS Power personnel, it has been found that the damaged bushing on the wicket gate puts the gate at increased risk of misalignment and also failure. If the gate fails and passes through the machine it is likely to damage the Kaplan runner and cause a forced outage. The intent of the project is to correct this deficiency. The inoperable Kaplan head, due to the pitch mechanism, is also contributing to a 0.5 MW loss in generation of the unit which leads to replacement energy costs.

Why do this project now?

The condition of the wicket gate bushing ring is considered unacceptable to run long term in its current condition. This needs to be corrected to maintain unit reliability and safety. This also gives the opportunity to repair the Kaplan blade pitch mechanism and restore the 0.5MW in lost capacity.

As of 2015, generation from NS Power's legacy hydro facilities will qualify under the provisions of the Nova Scotia Renewable Electricity Regulations. Generation from hydro facilities is an important part of NS Powers compliance plan to serve 25 percent of sales from qualifying renewable generation sources.

Why do this project this way?

There is no method to replace the bushing without disassembling the unit due to the configuration of the bottom ring and profile of the wicket gate. The remaining bushings and linkages will be inspected and refurbished as part of this outage as well as the repair of the Kaplan blade pitch mechanism.

CI Number : 44667 - HYD Upper Lake Falls Unit #1 Overhaul

Project Number

Parent CI Number : -

Cost Centre : 470 - 470-Mersey Hydro System

Budget Version 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		5,377	0	5,377
095		095-Thermal & Hydro Contracts AO		8,064	0	8,064
095		095-Hydro Term Labour AO		19,006	0	19,006
095		095-Hydro Regular Labour AO		50,154	0	50,154
013	022	013 - POWER PRODUCTION Contracts	022 - HGP - Elec Contr.Equip.	30,000	0	30,000
001	024	001 - HYDRO Regular Labour	024 - HGP - Turbine (Hydro)	185,962	0	185,962
004	024	004 - HYDRO Term Labour	024 - HGP - Turbine (Hydro)	70,470	0	70,470
011	024	011 - Travel Expense	024 - HGP - Turbine (Hydro)	1,000	0	1,000
012	024	012 - Materials	024 - HGP - Turbine (Hydro)	42,000	0	42,000
013	024	013 - POWER PRODUCTION Contracts	024 - HGP - Turbine (Hydro)	60,000	0	60,000
028	024	028 - Consulting	024 - HGP - Turbine (Hydro)	5,000	0	5,000
041	024	041 - Meals & Entertainment	024 - HGP - Turbine (Hydro)	500	0	500
			Total Cost:	477,533	0	477,533
			Original Cost:	381,812		

Capital Project Detailed Estimate

Location: Hydro
CI# / FP#: 44667
Title: HYD Upper Lake Falls Unit#1 Rebuild
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Engineering	PD	25	$ 391.49	$ 9,787.25		
Hydro River Staff	PD	500	$ 352.35	$ 176,175.00		
	PD			$ -		
			Sub-Total	$ 185,962.25		41806 - Big Falls 6 O/H
004 Term Labour						
Hydro River Staff	PD	200	$ 352.35	$ 70,470.00		
			Sub-Total	$ 70,470.00		41806 - Big Falls 6 O/H
011 Travel Expense						
Travel / Lodging	Lot	1	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
012 Materials						
Bushings, Misc.	Lot	1	$ 35,000.00	$ 35,000.00		
Vibrator Sensors	Lot	1	$ 5,000.00	$ 5,000.00		
Generator Heater	Lot	1	$ 2,000.00	$ 2,000.00		
			Sub-Total	$ 42,000.00		41806 - Big Falls 6 O/H
013 Contracts						
Machining Services	Lot	1	$ 30,000.00	$ 30,000.00		
Blasting & Coating	Lot	1	$ 30,000.00	$ 30,000.00		
Comulator Repair	Lot	1	$ 30,000.00	$ 30,000.00		
			Sub-Total	$ 90,000.00		41806 - Big Falls 6 O/H
028 Consulting						
Inspection Services	Lot	1	$ 5,000.00	$ 5,000.00		
				$ -		
				$ -		
			Sub-Total	$ 5,000.00		
041 Meals & Entertainment						
Meals during travel		1	$ 500.00	$ 500.00		
				$ -		
			Sub-Total	$ 500.00		
094 Interest Capitalized						
AFUDC				$ 5,376.64		
				$ -		
			Sub-Total	$ 5,376.64		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 50,154.00		
Hydro Term Labour AO				$ 19,005.75		
Thermal / Hydro Contracts AO				$ 8,064.00		
			Sub-Total	$ 77,223.75		
			SUB-TOTAL (no AO, AFUDC)	$ 394,932.25		
			TOTAL (AO, AFUDC included)	$ 477,532.64		
Original Cost				$ 381,812.30		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

HYD Upper Lake Falls Unit#5 Overhaul
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Hydro & Wind	**CI Number:**	44667
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Overhaul Unit vs Avoided Repair and R	6.19%	-7,752,845	6,321,056	1	98.00%	1.5 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to rebuild in order to avoid costly equipment and energy replacement costs in the event of a failure.

Notes/Comments :

Overhaul Unit vs Avoided Repair and Replacement Energy Costs

Option reviews the repair costs if unit is left to failure, compared to the capital investment to proactively address the problem, plus the 0.5MW in capacity that isn't gained by fixing the pitch mechanism on the Kaplan head. This EAM is based on two seperate avoided cost situations. On the Avoided Expense tab, Option B considers the 0.5MW capacity loss, while Option C considers the failure of the gates. The resultant avoided costs are then totaled and applied to Option A.

Test 2

Test 3

Test 4

HYD Upper Lake Falls Unit#5 Overhaul
Summary of Sensitivities

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Hydro & Wind	**CI Number:**	44667
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Overhaul Unit vs Avoided Repair and Replaceme	6.19%	-7,752,845	6,321,056	1	98.00%	1.5 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Overhaul Unit vs Avoided Repair and Replaceme	10%	-7,714,897	6,290,037	1	85.09%	1.7 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
	A	37,948	-31,020	0	-12.91%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Overhaul Unit vs Avoided Repair and Replaceme	-10%	-6,939,612	5,657,931	1	83.89%	1.7 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
	A	813,233	-663,125	0	-14.11%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	228,762	452,873	674,240	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

HYD Upper Lake Falls Unit#5 Overhaul
Avoided Cost Calculations

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Hydro & Wind	**CI Number:**	44667
Originator :		**Project No. :**	

Overhaul Unit vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$477,533**

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**1**	**1**	**1**	**1**		
Probability of Occurance (%)	**100%**	**100%**	**100%**	**100%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**1**	**1**				
Duration (Hours)	**5840**	**5840**				
Totals	**$143,142**	**$144,984**	**$0**	**$0**	**$143,142**	**$144,984**
Total Capital Cost of Alternative						**$0**

Test 3

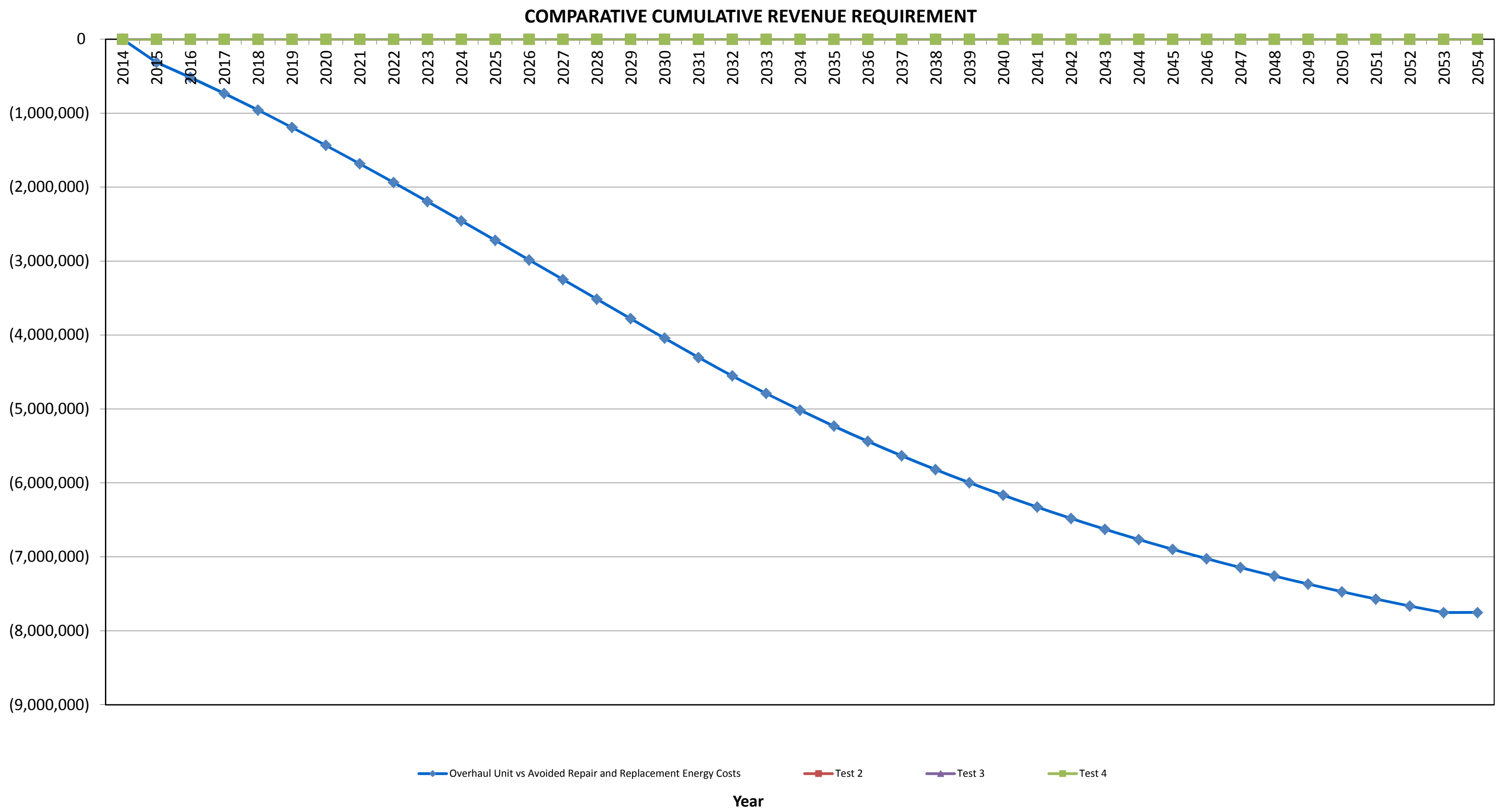
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**255,381**	**260,489**		
Events/Outages (#)	**1**	**1**	**1**	**1**		
Probability of Occurance (%)	**20%**	**25%**	**20%**	**25%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**5208**	**5208**				
Duration (Hours)	**1**	**1**				
Totals	**$51,060**	**$64,647**	**$51,076**	**$65,122**	**$102,137**	**$129,769**
Total Capital Cost of Alternative						**$0**

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

HYD Upper Lake Falls Unit#5 Overhaul
Overhaul Unit vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	245,278.2	(400,308.9)	15,797.3	400,448.7	(155,030.7)	(71,139.1)	(226,169.8)	(212,986.0)	0.94	(212,986.0)
2016	-	-	274,753.8	-	30,330.8	366,559.4	274,753.8	(75,771.1)	198,982.7	176,460.7	0.89	(36,525.3)
2017	-	-	306,721.8	-	27,904.3	335,381.3	306,721.8	(86,433.4)	220,288.4	183,967.4	0.84	147,442.1
2018	-	-	339,858.7	-	25,672.0	306,697.4	339,858.7	(97,397.9)	242,460.8	190,680.8	0.79	338,123.0
2019	-	-	374,198.3	-	23,618.2	280,308.3	374,198.3	(108,679.8)	265,518.5	196,642.2	0.74	534,765.1
2020	-	-	409,775.6	-	21,728.8	256,030.2	409,775.6	(120,294.5)	289,481.1	201,891.7	0.70	736,656.8
2021	-	-	446,626.3	-	19,990.5	233,694.5	446,626.3	(132,257.1)	314,369.2	206,468.9	0.66	943,125.7
2022	-	-	484,787.1	-	18,391.2	213,145.5	484,787.1	(144,582.7)	340,204.4	210,412.2	0.62	1,153,537.9
2023	-	-	524,295.7	-	16,919.9	194,240.5	524,295.7	(157,286.5)	367,009.2	213,759.0	0.58	1,367,296.9
2024	-	-	565,190.7	-	15,566.3	176,847.9	565,190.7	(170,383.5)	394,807.1	216,545.3	0.55	1,583,842.2
2025	-	-	607,511.8	-	14,321.0	160,846.7	607,511.8	(183,889.1)	423,622.7	218,806.1	0.52	1,802,648.3
2026	-	-	651,299.7	-	13,175.3	146,125.6	651,299.7	(197,818.5)	453,481.1	220,574.7	0.49	2,023,223.0
2027	-	-	696,596.0	-	12,121.3	132,582.2	696,596.0	(212,187.2)	484,408.9	221,883.5	0.46	2,245,106.5
2028	-	-	743,443.7	-	11,151.6	120,122.2	743,443.7	(227,010.6)	516,433.2	222,763.2	0.43	2,467,869.7
2029	-	-	791,886.7	-	10,259.5	108,659.1	791,886.7	(242,304.4)	549,582.3	223,243.3	0.41	2,691,113.0
2030	-	-	841,970.0	-	9,438.7	98,113.0	841,970.0	(258,084.7)	583,885.3	223,351.9	0.38	2,914,464.9
2031	-	-	893,739.9	-	8,683.6	88,410.6	893,739.9	(274,367.5)	619,372.5	223,115.8	0.36	3,137,580.7
2032	-	-	911,614.7	-	7,988.9	79,484.4	911,614.7	(280,124.0)	631,490.7	214,220.9	0.34	3,351,801.6
2033	-	-	929,847.0	-	7,349.8	71,272.2	929,847.0	(285,974.1)	643,872.9	205,689.1	0.32	3,557,490.7
2034	-	-	948,444.0	-	6,761.8	63,717.1	948,444.0	(291,921.5)	656,522.5	197,504.6	0.30	3,754,995.3
2035	-	-	967,412.9	-	6,220.9	56,766.4	967,412.9	(297,969.5)	669,443.4	189,652.2	0.28	3,944,647.5
2036	-	-	986,761.1	-	5,723.2	50,371.7	986,761.1	(304,121.7)	682,639.4	182,117.5	0.27	4,126,765.0
2037	-	-	1,006,496.3	-	5,265.4	44,488.6	1,006,496.3	(310,381.6)	696,114.7	174,887.0	0.25	4,301,652.0
2038	-	-	1,026,626.3	-	4,844.1	39,076.1	1,026,626.3	(316,752.5)	709,873.8	167,947.8	0.24	4,469,599.8
2039	-	-	1,047,158.8	-	4,456.6	34,096.7	1,047,158.8	(323,237.7)	723,921.1	161,287.5	0.22	4,630,887.3
2040	-	-	1,068,102.0	-	4,100.1	29,515.6	1,068,102.0	(329,840.6)	738,261.4	154,894.5	0.21	4,785,781.8
2041	-	-	1,089,464.0	-	3,772.1	25,300.9	1,089,464.0	(336,564.5)	752,899.5	148,757.6	0.20	4,934,539.4
2042	-	-	1,111,253.3	-	3,470.3	21,423.5	1,111,253.3	(343,412.7)	767,840.6	142,866.3	0.19	5,077,405.7
2043	-	-	1,133,478.4	-	3,192.7	17,856.2	1,133,478.4	(350,388.6)	783,089.8	137,210.3	0.18	5,214,615.9
2044	-	-	1,156,147.9	-	2,937.3	14,574.4	1,156,147.9	(357,495.3)	798,652.6	131,779.9	0.17	5,346,395.9
2045	-	-	1,179,270.9	-	2,702.3	11,555.1	1,179,270.9	(364,736.3)	814,534.6	126,566.1	0.16	5,472,961.9
2046	-	-	1,202,856.3	-	2,486.1	8,777.3	1,202,856.3	(372,114.8)	830,741.5	121,559.8	0.15	5,594,521.8
2047	-	-	1,226,913.4	-	2,287.2	6,221.7	1,226,913.4	(379,634.1)	847,279.3	116,752.7	0.14	5,711,274.5
2048	-	-	1,251,451.7	-	2,104.2	3,870.6	1,251,451.7	(387,297.7)	864,154.0	112,136.8	0.13	5,823,411.3
2049	-	-	1,276,480.7	-	1,935.9	1,707.6	1,276,480.7	(395,108.9)	881,371.8	107,704.2	0.12	5,931,115.4
2050	-	-	1,302,010.3	-	1,781.0	(282.4)	1,302,010.3	(403,071.1)	898,939.3	103,447.5	0.12	6,034,562.9
2051	-	-	1,328,050.6	-	1,638.5	(2,113.2)	1,328,050.6	(411,187.7)	916,862.8	99,359.7	0.11	6,133,922.6
2052	-	-	1,354,611.6	-	1,507.5	(3,797.5)	1,354,611.6	(419,462.3)	935,149.3	95,434.1	0.10	6,229,356.7
2053	-	-	1,381,703.8	-	1,386.9	(5,347.0)	1,381,703.8	(427,898.2)	953,805.5	91,664.0	0.10	6,321,020.7
2054	-	-	-	-	1,275.9	(6,772.7)	-	395.5	395.5	35.8	0.09	6,321,056.5
Total	**-**	**-**	**34,084,090.1**	**(400,308.9)**	**380,259.2**		**33,683,781.2**	**(10,448,187.6)**	**23,235,593.7**	**6,321,056.5**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(1,000,000)
(2,000,000)
(3,000,000)
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Overhaul Unit vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

Steam

Ash Site Investment

CI Number: 44267

Title: TRE – Ash Lagoon Site Closure

Start Date:	2013/05
In-Service Date:	2016/11
Final Cost Date:	2017/04
Function:	Steam
Forecast Amount:	$7,994,849

DESCRIPTION:

The Trenton Generating Station Operating Approval (2006-054488-A01), issued December 21, 2012 by Nova Scotia Environment requires the decommissioning and closure of the Trenton Ash Management Site. This project includes the closure and capping of the Ash Lagoon Site. The closing and capping will include the placement of low permeability material to reduce water infiltration into the disposed ash and improvements in drainage and run-off control for ongoing environmental site management. Vegetation will be established over the capped material to protect it from weathering and erosion.

Summary of Related CIs (+/- 2 years):
2015 CI 44188 TRE Ash Site Phase 1 Capping $4,538,289
2013 CI 43409 TRE Ash Site Covering 2013 $134,457
2015 CI 46379 TRE Ash Site Management $150,853

JUSTIFICATION:

Justification Criteria: Environment

Depreciation Class: Trenton Common Property

Estimated Useful Life: N/A

Why do this project?

Decommissioning and closure of the Trenton Ash Lagoon is required under the Trenton Generating Station Operating Approval (2006-054488-A01). Therefore, completing this project will ensure regulatory compliance with Section 6 a), b), c), d), e) of the aforementioned approval.

Why do this project now?

Under the Trenton Generating Station Operating Approval (2006-054488-A01) decommissioning and closure of the Trenton Ash Lagoon is required. Through discussions with Nova Scotia Environment, this work will be completed by the end of 2016.

Why do this project this way?

Several environmental studies have been completed with respect to the site and the best remediation approach. The environmental studies are an integral part of the overall ash lagoon closure assessment and design. The environmental studies ensure that the resulting closure design is based on specific site conditions.

CI Number : 44267-SB90 - TRE Ash Lagoon Site Closure **Project Number** SB90

Parent CI Number : -

Cost Centre : 341 341-Trenton Admin./Common Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
001		001 - T&CS Regular Labour		4,097	0	4,097
011		011 - Travel Expense		610	0	610
028		028 - Consulting		225,649	0	225,649
041		041 - Meals & Entertainment		67	0	67
094		094 - Interest Capitalized		567,794	0	567,794
095		095-Thermal Overtime Labour AO		668	0	668
095		095-Thermal Term Labour AO		1,205	0	1,205
095		095-Thermal & Hydro Contracts AO		[redacted]	0	[redacted]
095		095 - T&CS Regular Labour AO		3,745	0	3,745
095		095-Thermal Regular Labour AO		[redacted]	0	[redacted]
001	021	001 - THERMAL Regular Labour	021 - SGP - Ash Handling	14,370	0	14,370
001	021	001 - T&CS Regular Labour	021 - SGP - Ash Handling	6,948	0	6,948
002	021	002 - THERMAL Overtime Labour	021 - SGP - Ash Handling	6,664	0	6,664
004	021	004 - THERMAL Term Labour	021 - SGP - Ash Handling	6,011	0	6,011
012	021	012 - Materials	021 - SGP - Ash Handling	[redacted]	0	[redacted]
013	021	013 - POWER PRODUCTION Contracts	021 - SGP - Ash Handling	[redacted]	0	[redacted]
066	021	066 - Other Goods & Services	021 - SGP - Ash Handling	[redacted]	0	[redacted]
028	085	028 - Consulting	085 Design	56,000	0	56,000
011	087	011 - Travel Expense	087 Field Super.& Ops.	4,000	0	4,000
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	1,000	0	1,000
			Total Cost:	7,994,849	0	7,994,849
			Original Cost:			

Capital Project Detailed Estimate

Location: **Trenton Generating Station**
CI# / FP#: 44267
Title: TRE Trenton Ash Management Site Closure
Execution Year: 2015/2016

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Power Plant Technician	PD	10	$ 369.08	$ 3,690.77		
Utilityworker	PD	10	$ 231.99	$ 2,319.89		
Engineering	PD	20	$ 391.49	$ 7,829.72		
Spend to date (Studies/Design Phase)	Lot	1	$ 11,574.00	$ 11,574.00		
			Sub-Total	$ 25,414.38		
002 OT Labour						
Power Plant Technician	PD	4	$ 738.15	$ 2,952.61		
Utilityworker	PD	8	$ 463.98	$ 3,711.82		
				$ -		
			Sub-Total	$ 6,664.44		
004 Term Labour						
Power Plant Technician	PD	10	$ 369.08	$ 3,690.77		
Utilityworker	PD	10	$ 231.99	$ 2,319.89		
				$ -		
			Sub-Total	$ 6,010.66		
011 Travel Expense						
Travel	Lot	1	$ 4,000.00	$ 4,000.00		
Spend to date (Studies/Design Phase)	Lot	1	$ 609.62	$ 609.62		
			Sub-Total	$ 4,609.62		
012 Materials						
Materials	Lot	1	[redacted]	[redacted]	Cost Support Item #1	
Spend to date (Studies/Design Phase)	Lot	1	[redacted]	[redacted]		
			Sub-Total	[redacted]		
013 Contracts						
Contracts	Lot	1	[redacted]	[redacted]	Cost Support Item #1	
Spend to date (Studies/Design Phase)	Lot	1	[redacted]	[redacted]		
Project Coordination	PD	120	$ 800.00	$ 96,000.00		
			Sub-Total	[redacted]		
028 Consulting						
Engineering Site Visits	PD	24	$ 1,500.00	$ 36,000.00		
Watercourse Specialist	PD	20	$ 1,000.00	$ 20,000.00		
Spend to date (Studies/Design Phase)	Lot	1	$ 225,649.25	$ 225,649.25		
			Sub-Total	$ 281,649.25		
041 Meals & Entertainment						
Meals	Lot	1	$ 1,000.00	$ 1,000.00		
Spend to date (Studies/Design Phase)	Lot	1	$ 67.18	$ 67.18		
			Sub-Total	$ 1,067.18		
066 Contingency						
Contingency on Materials	%	10%	[redacted]	[redacted]	Please reference cost support table	
Contingency on Contracts	%	10%	[redacted]	[redacted]	Please reference cost support table	
			Sub-Total	[redacted]		
094 Interest Capitalized						
AFUDC	Lot	1	$567,794.07	$ 567,794.07		
			Sub-Total	$ 567,794.07		
095 Administrative Overhead						
Thermal Reg. Labour AO	Lot	1	[redacted]	[redacted]		
T&C Regular Labour AO	Lot	1	$ 3,745.25	$ 3,745.25		
Thermal OT Labour AO	Lot	1	$ 667.77	$ 667.77		
Thermal Term Labour AO	Lot	1	$ 1,204.54	$ 1,204.54		
Thermal Contracts AO	Lot	1	[redacted]	[redacted]		
			Sub-Total	$ 209,188.46		
			SUB-TOTAL (no AO, AFUDC)	$ 7,217,866.74		
			TOTAL (AO, AFUDC included)	$ 7,994,849.27		
Original Cost				N/A		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

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Class C Pre-Design Budget of PROBABLE CONSTRUCTION COST

NSPI Capping Ash Cell
Trenton Site, NS

DATE:	June 20, 2014
CBCL NUMBER:	131229.00
PREPARED BY:	B. Thorne
EST. DESCRIPTION:	Class C

Unit Costs include OH&P

ITEM / No.	DESCRIPTION	UNIT	EST. QUANTITY	UNIT $	TOTAL
Cap					
1.01	Rough Grading	m^2	165,000	$ [redacted]	$ [redacted]
1.02	Local Fill (working layer)	m^3	33,000	$ [redacted]	$ [redacted]
1.03	40mil LLDPE Liner or Bentofix GCL	m^2	165,000	$ [redacted]	$ [redacted]
1.04	N4-Geoxtile	m^2	165,000	$ [redacted]	$ [redacted]
1.05	Drainage Layer - Clear Stone	m^3	49,500	$ [redacted]	$ [redacted]
1.06	Topsoil - Low Grade Uncreened	m^3	32,000	$ [redacted]	$ [redacted]
1.07	Hydroseed with FRM Mulch	m^2	140,000	$ [redacted]	$ [redacted]
1.08	Soil Amendment - Biotic Earth	m^2	140,000	$ [redacted]	$ [redacted]
SW Plan					
2.01	N4-Geoxtile	m^2	2,500	$ [redacted]	$ [redacted]
2.02	40mil LLDPE Liner	m^2	2,500	$ [redacted]	$ [redacted]
2.03	R-5 Rip Rap	m^3	600	$ [redacted]	$ [redacted]
2.04	R-25 Rip Rap	m^3	500	$ [redacted]	$ [redacted]
2.05	250mm Culvert	m	20	$ [redacted]	$ [redacted]
2.06	200mm Perforated Drain Pipe	m	5,000	$ [redacted]	$ [redacted]
2.07	Pond Outlet Structure	Ea	1	$ [redacted]	$ [redacted]
2.08	Erosion Control	sum	1	$ [redacted]	$ [redacted]
2.09	Toe Butress R-2 Rip Rap	m^3	1,500	$ [redacted]	$ [redacted]
2.10	Toe Butress Clearstone	m^3	2,500	$ [redacted]	$ [redacted]
Road					
3.0	Base Gravel (31.5mm minus)	m^3	2,500	$ [redacted]	$ [redacted]
					$ -
	TOTAL CONSTRUCTION COST (Exluding Contingencies and Allowances)				$ [redacted]
	CONTINGENCIES and ALLOWANCES				
A	Design Development Contingency			0%	$ -
B	Construction Contingency			10%	$ [redacted]
C	Escalation / Inflation			0%	$ -
D	Location Factor			0%	$ -
					$ -
				TOTAL CONSTRUCTION COST without HST	$ [redacted]
	Taxes (HST)			15%	$ [redacted]
				TOTAL with HST	$ [redacted]

THIS OPINION OF PROBABLE COSTS IS PRESENTED ON THE BASIS OF EXPERIENCE. QUALIFICATIONS, AND BEST JUDGEMENT. IT HAS BEEN PREPARED IN ACCORDANCE WITH ACCEPTABLE PRINCIPLES AND PRACTICES. MARKET TRENDS, NON-COMPETITIVE BIDDING SITUATIONS, UNFORSEEN LABOUR AND MATERIAL ADJUSTMENTS AND THE LIKE ARE BEYOND THE CONTROL OF CBCL LIMITED AND AS SUCH WE CANNOT WARRANT OR GUARANTEE THAT ACTUAL COSTS WILL NOT VARY FROM THE OPINION PROVIDED

Form CBCL XX5.Rev X

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October 31, 2013

Kaylyn Monk
Project Manager
Nova Scotia Power Incorporated
1223 Lower Water Street
Halifax, NS

Dear Ms. Monk:

RE: Hydrological Assessment Report for the Trenton Ash Management Site

Please find below the hydrological assessment for the Trenton Ash Management Site.

Description of Drainage System

All surface water features, watersheds and drainage paths for the Trenton Ash Management Site are detailed on the Surface Water Engineered Survey Plan (Figure 1). As shown in Figure 1, all watersheds containing drainage from the covered ash pile cell drain from the top of the cell to a system of ditches and culverts spanning the perimeter of the site. All surface water drainage from the ash pile cell is therefore contained within the site and the site receives no surface water from neighbouring properties. Outside of the perimeter collection system, a small amount of local runoff is drained from the perimeter of the site to the East River and the neighbouring properties.

The perimeter collection system consists of two drainage paths that convey the runoff received from the ash pile cell to the Holding Pond at the southern end of the site. Runoff collected in the Holding Pond is then directed to the Treatment Pond through a 300mm diameter culvert. After the surface water has been adequately treated in the Treatment Pond, the treated surface water is discharged to the East River. The receiving waters are tidally influenced and are a mix of both salt and fresh water. The tide strongly influences the fate of pollutants discharged in the tidal section of the river, which starts upstream of the Trans-Canada Highway Bridge.

The drainage area tributary to East River at the location of the site is approximately 500 km^2. Low flows can be very limited and reach 100 L/s in very dry conditions. Tidal elevations in Pictou vary between about 0.5 to 1.7 m Chart Datum for a mean tide (1.2 m tidal range), and 0.1 to 2.1 m CD for a large tide (2 m tidal range). Tides in the estuary are mixed, predominantly semi-diurnal with a diurnal component. This combination results in tides that alternate larger and smaller at each cycle. An additional component is the bi-weekly spring/neap tide cycle resulting in a 14-day oscillation. Differences in water levels may occur during sustained strong winds or storm events resulting in short term deviations from the predictions in period and amplitude.

Hydrologic and Hydraulic Modelling

Flow characteristics of the drainage system were evaluated using Version 5 of the USEPA Storm Water Management Model (SWMM). SWMM is a hydrologic and hydraulic model that is used extensively in the scientific and engineering community and is widely recognised as one of the most comprehensive models of its kind.

Watershed characteristics used in the model are presented below in Table 1. The watershed characteristics were estimated based on survey data, aerial photos and

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observations made during site visits. Surface roughness coefficients were estimated for the impervious and pervious areas of all watersheds to be 0.016 and 0.150, respectively. Green-Ampt Infiltration parameters were estimated based on the Agriculture Canada Nova Scotia Soil Survey and the preliminary geotechnical report completed by ADI Limited in 2010. The soil was also assumed to be wet just prior to the rainfall events. The suction head, hydraulic conductivity and initial moisture deficit of the soil were estimated for all watersheds to be 110mm, 0.5mm/hr and 0.02, respectively.

Table 1: Estimated Watershed Characteristics for the Trenton Ash Management Site

Watershed	Surface Area (ha)	Percent Impervious (%)	Average Surface Slope (%)	Max. Overland Flow Length (m)
Ash_Management_Site_SC1	0.23	0	1	109
Ash_Management_Site_SC2	0.44	50	40	12
Ash_Management_Site_SC3	0.81	0	2	262
Ash_Management_Site_SC4	0.71	0	3	62
Ash_Management_Site_SC5	0.10	0	3	50
Ash_Management_Site_SC6	0.09	0	5	42
Ash_Management_Site_SC7	0.04	0	10	22
Ash_Management_Site_SC8	0.04	0	4	25
Ash_Management_Site_SC9	0.66	0	6	20
Ash_Management_Site_SC10	0.34	0	2	135
Ash_Management_Site_SC11	6.03	0	3	295
Ash_Management_Site_SC12	1.84	0	2	320
Ash_Management_Site_SC13	0.96	0	3	166
Ash_Management_Site_SC14	0.72	0	2	170
Ash_Management_Site_SC15	0.73	0	2	131
Ash_Management_Site_SC16	0.79	0	3	230
Ash_Management_Site_SC17	1.29	0	3	250
Ash_Management_Site_SC18	1.84	0	3	250
Ash_Management_Site_SC19	0.27	50	15	14
Ash_Management_Site_SC20	1.08	0	2	170

The hydraulic system of ditches, culverts and ponds was then input into the model. Flows through the drainage system were calculated by the model for the 1 in 2, 5, 20 and 100 year rainfall events. It was determined that the average summer flow is of negligible quantity for all watersheds at the Trenton Ash Management Site due to the small watershed sizes.

The 1 in 2, 5, 20 and 100 year rainfall hyetographs used for the runoff calculations follow the Chicago Distribution with 5-minute discretization intervals and are based on Intensity-Duration-Frequency (IDF) curves from Environment Canada for the Truro Climate Station. The Truro Climate Station is the closest Environment Canada climate station to the Trenton Ash Management Site and also experiences similar extreme 24-hour rainfall amounts according to the 1985 Rainfall Frequency Atlas for Canada. Estimated flows in the drainage system at each watershed discharge location are presented below in Table 2.

Table 2: Estimated Flows in the Drainage System at Each Watershed Discharge Location

Watershed Outlet / Hydraulic Structure	1 in 2 Year Flow (m^3/s)	1 in 5 Year Flow (m^3/s)	1 in 20 Year Flow (m^3/s)	1 in 100 Year Flow (m^3/s)
Ash_Management_Site_SC1	0.011	0.016	0.022	0.031
Ash_Management_Site_SC2	0.197	0.301	0.332	0.375
Ash_Management_Site_SC3	0.031	0.044	0.062	0.085
Ash_Management_Site_SC4	0.059	0.085	0.118	0.163
Ash_Management_Site_SC5	0.009	0.013	0.018	0.025
Ash_Management_Site_SC6	0.010	0.014	0.020	0.027
Ash_Management_Site_SC7	0.007	0.010	0.013	0.017
Ash_Management_Site_SC8	0.005	0.007	0.010	0.014
Ash_Management_Site_SC9	0.099	0.138	0.187	0.249
Ash_Management_Site_SC10	0.018	0.025	0.035	0.048
Ash_Management_Site_SC11	0.263	0.367	0.448	0.616
Ash_Management_Site_SC12	0.107	0.142	0.185	0.249
Ash_Management_Site_SC13	0.082	0.116	0.161	0.220
Ash_Management_Site_SC14	0.034	0.048	0.067	0.092
Ash_Management_Site_SC15	0.091	0.130	0.177	0.240
Ash_Management_Site_SC16	0.122	0.172	0.239	0.327
Ash_Management_Site_SC17	0.240	0.327	0.347	0.400
Ash_Management_Site_SC18	0.187	0.250	0.343	0.467
Ash_Management_Site_SC19	0.361	0.482	0.574	0.677
Ash_Management_Site_SC20	0.051	0.072	0.100	0.138

Assessment of Existing Drainage System

The SWMM model was then used to assess restrictions in the drainage system and determine whether overtopping of the perimeter collection system occurs during large storm events.

Estimated pipe properties, capacities and flows for the four culverts upstream of the Treatment Pond are presented below in Table 3. As shown in the table, the model results indicate that the estimated capacities of Culvert 1, Culvert 3 and Culvert 4 are exceeded during large rainfall events.

According to the model, Culvert 1 may cause overtopping of the road immediately upstream of the culvert during the 1 in 5 year storm and larger storm events. Overflow from the road would then most likely drain to East River. However, NSPI have noted that they have never witnessed any overflow of Culvert 1 during large rainfall events.

The model results also indicate that Culvert 4 restricts drainage from the site and may cause the perimeter collection system along the west side of the site to overtop during the 1 in 20 year storm and larger storm events. Overflow from the perimeter collection system at this location would then drain directly into the East River. According to the model, there is no indication that Culvert 3 causes flooding during large rainfall events.

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Table 3: Culvert Properties and Estimated Flows

Culvert Name	Pipe Diameter (mm)	Pipe Material	Pipe Properties (assumed)				Flow (m^3/s)			
			Slope (%)	Length (m)	Manning's n	Pipe Capacity (m^3/s)	1 in 2 Yr	1 in 5 Yr	1 in 20 Yr	1 in 100 Yr
Culvert 1	250	CSP	0.2	26	0.026	0.019	0.145	0.205	0.227	0.320
Culvert 2	600	CSP	1.8	12	0.026	0.362	0.122	0.172	0.239	0.327
Culvert 3	600	PVC	-0.3	9	0.011	0.372	0.187	0.250	0.343	0.467
Culvert 4	300	CSP	2.0	22	0.026	0.064	0.137	0.152	0.167	0.182

Pipe Capacity Exceeded

Pipe Capacity Exceeded and Flooding Occurs Upstream of Pipe

Surface Water Quality Assessment

All surface water runoff from the Trenton Ash Management Site is collected in the Treatment Pond where it is treated and sampled at the end of the discharge pipe prior to and during discharge to the East River. Water quality testing records for the treated discharge from 2005 to 2012 were therefore used to assess the historical surface water quality at the Trenton Ash Management Site.

According to NSPI, the Trenton Ash Management Site operated as a lagoon from 1969 to 1999, receiving sluiced ash from the Trenton Plant. During this period, surface water runoff on the site was discharged passively from a stoplog structure on the bank of the East River. In the year 2000, the site was converted to dry ash management and continued to receive ash until capacity was reached in 2007. Sections of the site were then covered with a topsoil and hydroseed layer throughout the year 2007 with the final section of the site covered by the end of the year. Since 2007, solid sludge from the Trenton Wastewater Treatment Plant and from Ponds A, B and C at the Trenton Plant Site have been deposited over limited areas of the Trenton Ash Management Site.

According to NSPI, water quality parameters are sampled and tested at the end of the Treatment Pond discharge pipe prior to each discharge. If the test results indicate that the water quality requirements are met for pH, iron and TSS, the Treatment Pond effluent is then discharged. During discharge, samples are collected approximately every two hours and combined into composite batch samples. The batch samples for all discharges during a given week are then combined into weekly composite samples and are tested. In 2013, the weekly composite requirement was changed to a monthly composite. Monthly composite samples of the Treatment Pond discharge sampling are therefore now tested instead of weekly composite samples. NSPI have also noted that water levels are managed diligently in the pond to avoid any capacity issues during large storm events.

Parameters in the historical monitoring data that are currently listed in the Canadian Council of Ministers of the Environment (CCME) "Water Quality Guidelines for the Protection of Aquatic Life" are shown in Table 4 with their associated concentration limits specified in the

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CCME guidelines. The CCME guidelines are discussed in this report for comparison purposes only and are not intended to represent water quality objectives for the Trenton Ash Management Site.

Table 4: Current CCME Concentration Limits for Parameters Monitored

Parameter	Units	CCME Limit[1]
Aluminium	µg/L	100
Arsenic	µg/L	5
Boron	µg/L	1500
Cadmium	µg/L	equation[2]
Chromium	µg/L	1 (hexavalent), 8.9 (trivalent)
Copper	µg/L	2 to 4[2]
Iron	µg/L	300
Lead	µg/L	equation[2]
Molybdenum	µg/L	73
Nickel	µg/L	equation[2]
pH		6.5 to 9.0
Phosphorus	µg/L	guidance framework[3]
Selenium	µg/L	1
Silver	µg/L	0.1
Suspended Solids	µg/L	increase of 5000 to 25000 from background levels[4]
Thallium	µg/L	0.8
Tin	µg/L	0.008 (tributyltin), 0.022 (triphenyltin)
Uranium	µg/L	15
Zinc	µg/L	30

[1]CCME Water Quality Guidelines for the Protections of Aquatic Life (Freshwater – Long Term)
[2]function of hardness of water
[3]function of trophic state index
[4]function of flow, background level and time of exposure

Results from the Treatment Pond discharge monitoring records have been summarised below in Table 4, in which annual average results are compared with the current CCME limits. For concentrations in the data set that were below the reportable detection limits, half the value of the reportable detection limit was assigned as the concentration.

It should be noted that more information is needed for several of the parameters to assess whether or not their concentration limits were above the current CCME limits. Cadmium, copper, lead and nickel could not be compared to CCME limits as the CCME limits for these parameters are a function of the hardness of the water. Chromium was reported as total chromium, whereas CCME limits are specified for trivalent chromium and hexavalent chromium. Similarly, tin was reported as total tin, whereas CCME limits are specified for tributyltin and triphenyltin. The CCME limit for phosphorous could also not be determined as the trophic state index was not reported. Finally, the CCME limits for suspended solids could not be determined as the flow and time of exposure were not reported. It should also be noted that reportable detection limits were above the current CCME limits for several of the water quality tests in 2007 for parameters including copper, silver, thallium and zinc.

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Table 5: Annual Average Concentrations of Parameters Monitored in Discharge

Parameter	Units	Year					
		2007	2008	2009	2010	2011	2012
Aluminium	µg/L	229	1568	415	192	365	117
Arsenic	µg/L	8.93	1.83	0.58	2.39	2.44	3.60
Boron	µg/L	2099	439	673	843	839	472
Cadmium	µg/L	0.88	0.31	0.12	0.12	0.10	0.02
Chromium	µg/L	3.42	0.50	0.50	1.66	1.23	0.50
Copper	µg/L	10.00	2.33	2.68	2.73	1.28	1.26
Iron	µg/L	258.3	470.8	157.3	194.0	332.0	98.0
Lead	µg/L	2.00	1.30	0.56	0.50	0.50	0.50
Molybdenum	µg/L	429	105	181	371	352	189
Nickel	µg/L	31.04	11.12	3.26	2.77	2.32	1.50
pH		-	-	-	-	-	-
Phosphorus	µg/L	268.33	62.50	50.00	50.00	50.00	50.00
Selenium	µg/L	15.88	1.21	0.50	1.06	3.07	2.56
Silver	µg/L	4.00	0.05	0.05	0.15	0.21	0.05
Suspended Solids	µg/L	-	-	-	-	-	-
Thallium	µg/L	1.87	0.46	0.40	0.40	0.40	0.40
Tin	µg/L	40.00	10.00	10.00	10.00	10.00	10.00
Uranium	µg/L	0.79	0.17	0.19	0.67	0.41	0.21
Zinc	µg/L	46.67	22.43	8.46	5.95	20.35	11.54

Concentration above current freshwater limit specified in CCME guidelines ("Water Quality Guidelines for the Protection of Aquatic Life")

More information needed for water samples to assess compliance with current CCME guidelines

Reportable detection limit above current freshwater limit specified in CCME guidelines ("Water Quality Guidelines for the Protection of Aquatic Life")

Based on the annual averages shown in Table 5, the following parameters were found to have exceeded the current CCME limits during the monitoring period in the Treatment Pond discharge: aluminium, arsenic, boron, iron, molybdenum, selenium and silver. While it is possible that these parameters have historically exceeded the current CCME limits, NSPI have noted that all parameters have complied with previous Approval limits applicable at the time. Since no monitoring data is available to assess background levels of the parameters in the surface water, additional information is needed to assess whether or not these parameters are naturally occurring in the surface water at the site.

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During the year 2007 when the Trenton Ash Management Site was still receiving ash from the Trenton Plant, high concentrations of aluminium, arsenic, boron, molybdenum, selenium and thallium were found in the discharge monitoring records. Monitoring recordings for 2008 indicate that after the site stopped receiving ash in 2007 and was covered with a topsoil and hydroseed layer, the previously high concentrations of arsenic, boron and thallium dropped to below the current CCME limits. While selenium concentrations also dropped in 2008, annual average concentrations of selenium, aluminium and molybdenum remained above the current CCME limits for most years during the 2008 to 2012 period. In addition to these three parameters, iron was also shown to exceed current CCME limits in 2008 and 2011 and silver was shown to exceed the current CCME limits in 2010 and 2011.

It should be noted that there does not appear to be very much evolution or reduction of concentrations of the various parameters tested between the years 2008 and 2012, which may indicate equilibrium conditions have been reached. This supports the need for capping of the site, addressing the issue of having parameter concentrations currently above CCME limits.

The main reason for high concentrations of some of the metals tested may be the presence of ash from coal burning operations, which is mobilised by rainfall infiltrating the topsoil cover. The current cover is not designed to have a low permeability and therefore allows a large portion of rainfall (probably more than 50%) to infiltrate through the surface. It is therefore difficult in such conditions to address efficiently the issue of leachate of metals. The proposed capping of the site would seem to be the only efficient approach to preventing rainfall from mobilising buried contaminants at this site. Once capped, most of the rainfall should run off the site without infiltrating into the contaminated material, and will not be able to mobilise any contaminated material. It should be noted that since site activities do not include the use of hydrocarbons, hydrocarbon parameters are not likely to be present in notable concentrations on the site.

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Conclusions and Recommendations

This assessment has presented a description and analysis of the drainage system of the Trenton Ash Management Site. It was found that all potential runoff from the covered ash pile drains to a perimeter collection system and is directed to a series of two ponds for treatment prior to being discharged to East River. According to model calculations, this perimeter collection system may overtop during large rainfall events on the west and north sides of the site, discharging surface runoff from the site directly into the East River.

NSPI has stated that surface water discharged from the site has complied with previous Approval limits for effluent concentrations. However, monitoring records for the Treatment Pond discharge indicate that historical concentrations for aluminium, iron, molybdenum, selenium and silver have exceeded current CCME limits during the 2008 to 2012 period after the site stopped receiving ash and was covered. If these metals are not naturally present in the surface water at this location, the current capping design for the site should address this issue and prevent rainfall from allowing contaminants to migrate to the East River. It should be noted that NSPI is currently carrying out a benthic and mixing zone study of the surrounding waters. The draft report for the study has determined that site activities at the Trenton Ash Management Site do not impact the water quality of the receiving water.

It is recommended that the future drainage system for the planned capping of the site be designed such that all surface runoff is carefully and safely controlled within the site during extreme rainfall events. Surface water runoff should also be managed in the design such that peak flows leaving the site are not increased compared to existing peak flows, in order to protect the downstream system from erosion. The future drainage system should ensure that the capped ash pile itself is also protected from erosion from surface flows, as this will ensure that no contaminants enter the surface runoff discharged from the site. The future capping of the ash pile should therefore be able to keep runoff water quality well within the new operating Approval effluent limits.

Yours truly,

CBCL Limited

Prepared by:
Jeff Marvin
Municipal EIT
Direct:
E-Mail:

Reviewed by:
Alexander Wilson, M.Eng., P.Eng.
Sr. Water Resources Engineer
Direct:
E-Mail:

Attachments: Figure 1

Project No: 131229.00

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Subcatchment	1 in 2 Year	1 in 5 Year	1 in 20 Year	1 in 100 Year
	Peak Flow (CMS)	Peak Flow (CMS)	Peak Flow (CMS)	Peak Flow (CMS)
Ash_Management_Site_SC1	0.011	0.016	0.022	0.031
Ash_Management_Site_SC10	0.018	0.025	0.035	0.048
Ash_Management_Site_SC11	0.263	0.367	0.448	0.616
Ash_Management_Site_SC12	0.107	0.142	0.185	0.249
Ash_Management_Site_SC13	0.082	0.116	0.161	0.220
Ash_Management_Site_SC14	0.034	0.048	0.067	0.092
Ash_Management_Site_SC15	0.091	0.130	0.177	0.240
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Ash_Management_Site_SC17	0.240	0.327	0.347	0.400
Ash_Management_Site_SC18	0.187	0.250	0.343	0.467
Ash_Management_Site_SC19	0.361	0.482	0.574	0.677
Ash_Management_Site_SC2	0.197	0.301	0.332	0.375
Ash_Management_Site_SC20	0.051	0.072	0.100	0.138
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Ash_Management_Site_SC4	0.059	0.085	0.118	0.163
Ash_Management_Site_SC5	0.009	0.013	0.018	0.025
Ash_Management_Site_SC6	0.010	0.014	0.020	0.027
Ash_Management_Site_SC7	0.007	0.010	0.013	0.017
Ash_Management_Site_SC8	0.005	0.007	0.010	0.014
Ash_Management_Site_SC9	0.099	0.138	0.187	0.249

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Nova Scotia Power
Trenton Ash Management Site Closure

Legend:

- Surface Runoff
- Culvert
- Ditch
- Subwatershed

Figure 1

Surface Water Engineered Survey Plan

Ash Management Site

CBCL LIMITED
Consulting Engineers

Date: September 4, 2013
CBCL Project #: 131229.00

Coordinate System:
ATS 1977 MTM 4 Nova Scotia
Projection: Transverse Mercator
Datum: ATS 1977
Units: Meter
Scale: 1:2,500

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October 31, 2013

Kaylyn Monk
Project Manager
Nova Scotia Power Incorporated
1223 Lower Water Street
Halifax, NS

Dear Ms. Monk:

RE: Surface Water Monitoring Program Assessment Report for the Trenton Ash Management Site

Please find below the surface water monitoring program assessment for the Trenton Ash Management Site.

Assessment of Existing Surface Water Monitoring Program

All surface water runoff from the Trenton Ash Management Site is collected in the Treatment Pond where it is treated and sampled at the end of the discharge pipe prior to and during discharge to the East River. Water quality testing records for the treated discharge from 2005 to 2012 were therefore used to assess the historical surface water quality at the Trenton Ash Management Site.

Monitoring Frequency of Treatment Pond Discharge

According to NSPI, water quality parameters are sampled and tested at the end of the Treatment Pond discharge pipe prior to each discharge. If the test results indicate that the water quality requirements are met for pH, iron and TSS, the Treatment Pond effluent is then discharged. During discharge, samples are collected approximately every two hours and combined into composite batch samples. The batch samples for all discharges during a given week are then combined into weekly composite samples and are tested. In 2013, the weekly composite requirement was changed to a monthly composite. Monthly composite samples of the Treatment Pond discharge sampling are therefore now tested instead of weekly composite samples.

Parameters Monitored in Treatment Pond Discharge

Parameters that were monitored in the Treatment Pond discharge from 2005 to 2012 are presented in Table 1. As mentioned above, pH, iron and TSS are monitored in the effluent prior to discharge.

Table 1: List of Parameters Monitored in the Treatment Pond Discharge

Aluminium	Chromium	Nickel	Sulphur
Antimony	Cobalt	pH	Suspended Solids
Arsenic	Copper	Phosphorus	Thallium
Barium	Iron	Potassium	Tin
Beryllium	Lead	Selenium	Titanium
Bismuth	Lithium	Silicon	Uranium
Boron	Magnesium	Silver	Vanadium
Cadmium	Manganese	Sodium	Zinc
Calcium	Molybdenum	Strontium	

CANADA'S BEST MANAGED COMPANIES

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Kaylyn Monk
October 31, 2013
Page 2 of 3

Recommendations for Upgrades to the Surface Water Monitoring Program
A proposed Surface Water Monitoring Plan showing the site drainage and recommended surface water sampling locations is presented in the attached Figure 1. According to NSPI, capping and closure of the site is planned for the near future. This surface water monitoring program is therefore recommended for both prior to and following closure of the site, as described below.

Recommended Monitoring Locations
As shown in Figure 1, the only monitoring station recommended for this site is within the Treatment Pond discharge pipe at WS 1, as all surface water runoff from the covered ash pile is currently collected by the Treatment Pond and is discharged through this pipe. Following capping and closure of the site, surface water should be monitored at all surface water discharge locations as determined in the closure design.

Recommended Monitoring Frequency
Prior to capping and closure of the site, the sampling frequency should remain the same. Samples should be continued to be taken every two hours during discharge and be combined into batch samples, which should then be combined into monthly composite samples for parameter testing. This monitoring frequency allows for seasonal trends in parameter concentrations to be evaluated and for all surface water discharge periods to be analysed (as composite batches).

Following the proposed capping and closure of the site, surface runoff from the site will no longer be treated and will instead be discharged through a free-flow system. Parameters should therefore be monitored on a quarterly basis to assess the seasonal fluctuation patterns in surface water quality of the discharge from the site.

Recommended Parameters Monitored
Since NSPI is currently carrying out a benthic and mixing zone study that will identify issues in the surrounding waters caused by surface water runoff from the Trenton Ash Management Site, it is understood that Nova Scotia Environment will determine the surface water quality monitoring requirements for the site based upon the results from this study. Thus, no changes to the parameters that are currently being monitored in the Treatment Pond discharge have been recommended.

It should be noted that the draft report for the benthic and mixing zone study has determined that high concentrations of aluminium, iron, manganese and phosphorus are found within the East River upstream of the Trenton Ash Management Site discharge location. However, continual monitoring of these three parameters is recommended to assess potential changes in concentrations with current site activities at the Trenton Ash Management Site.

It should also be noted that according to the "Hydrological Assessment Report for the Trenton Ash Management Site" prepared by CBCL Limited in 2013, arsenic, boron, thallium, uranium and zinc were shown to have concentrations that comply with the current Canadian Council of Ministers of the Environment (CCME) "Water Quality Guidelines for the Protection of Aquatic Life" during the 2008 to 2012 period after the site stopped receiving ash from the Trenton Plant and was covered. While these metals were shown over the past several years to be in low concentration, continual monitoring of arsenic, boron, thallium, uranium and zinc is recommended to show that their concentrations continue to be present in low concentrations.

Conclusions and Recommendations

The surface water monitoring program described above is recommended for the Trenton Ash Management Site. It should be noted that if the results of the benthic and mixing zone study affect the operating limits for the Trenton Ash Management Site, the surface water monitoring program may be modified to reflect the changes, as appropriate.

It should also be noted that following capping and closure of the site, surface runoff from the site will no longer be treated, as it is expected that contaminants in the surface water will be minimal or non-existent. However, the recommended quarterly surface water monitoring should continue following closure for a full year to ensure that surface water quality requirements are met. If there is strong evidence from the monitoring program following closure that the water quality is considered acceptable, it is recommended that Nova Scotia Environment consider removing the surface water sampling requirement for the Trenton Ash Management Site.

We hope this report provides the information you were looking for to describe and assess the surface water monitoring program for the Trenton Ash Management Site.

Yours truly,

CBCL Limited

Prepared by:	Reviewed by:
Jeff Marvin	Alexander Wilson, M.Eng., P.Eng.
Municipal EIT	Sr. Water Resources Engineer
Direct:	Direct:
E-Mail:	E-Mail:

Attachments: Figure 1

Project No: 131229.00

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Nova Scotia Power Trenton Ash Management Site Closure

Legend:

- Surface Water Sampling Pts
- Surface Runoff
- Culvert
- Ditch
- Subwatershed

Parameters to be monitored as required by Approval effluent limits

Figure 1

Surface Water Monitoring Plan

Ash Management Site

CBCL LIMITED
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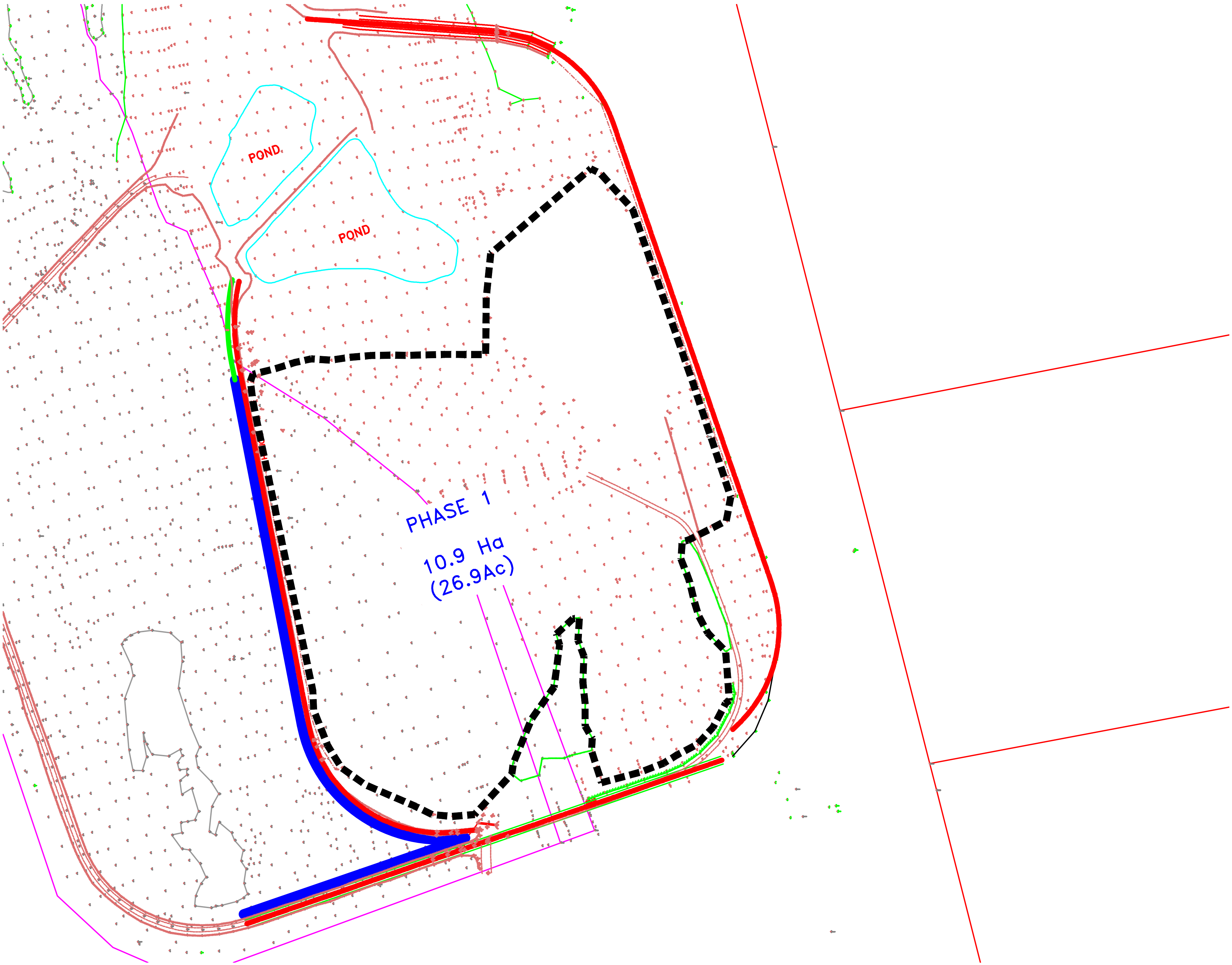
Date: September 4, 2013
CBCL Project #: 131229.00

Coordinate System:
ATS 1977 MTM 4 Nova Scotia
Projection: Transverse Mercator
Datum: ATS 1977
Units: Meter
Scale: 1:2,500


POND
POND
PHASE 1
10.9 Ha
(26.9Ac)

CI Number: 44188

Title: TRE – Ash Site Phase 1 Capping

Start Date:	2013/04
In-Service Date:	2016/09
Final Cost Date:	2017/03
Function:	Steam
Forecast Amount:	$4,538,289

DESCRIPTION:

Phase 1 of the Abercrombie Ash Management site is nearing capacity. Once at capacity for ash storage, Phase 1 of the site will require capping in order to comply with the Trenton Generating Station Operating Approval (2006-054488-A01) issued on December 21, 2012 by Nova Scotia Environment (NSE). Capping the Phase 1 cell with low permeability material will promote dust control, reduce rain water contact with the ash, and impede water infiltration into the disposed ash. Surface water runoff from the capped cell will no longer require treatment in the Surface Water Treatment System resulting in a reduction in waste water treatment volumes. The capping design will include plans for re-directing clean surface water flow from Phase 1 away from the site into vegetative areas.

Assessments of hydrogeological and hydrological conditions of the Abercrombie Ash Management Site are now complete. Benthic organism and mixing zone studies were also completed to identify the outputs from the Abercrombie Ash Management site and their potential impacts to the local environment. Results from these environmental studies will be used to determine the suitable capping design to meet NSE's requirements.

This project will be executed over two years, starting in the spring of 2015, with completion expected in late 2016.

Summary of Related CIs (+/- 2 years):
2013 CI 43409 TRE Ash Site Covering 2013 $134,457
2015 CI 44267 TRE – Ash Lagoon Site Closure $7,994,849
2015 CI 46379 TRE Ash Site Management $150,853

JUSTIFICATION:

Justification Criteria: Environment

Depreciation Class: Trenton Common Property

Estimated Useful Life: N/A

Why do this project?

Phase 1 is nearing capacity for ash storage, at which point NS Power is required to cap the disposal cell. Completing this project will enable compliance with Section 7.e) of the Trenton Generating Station Operating Approval (2006-054488-A01).

Why do this project now?

Phase 1 of the Abercrombie Ash Management site is nearing capacity. Per Section 7.e of the Trenton Generating Station Operating Approval (2006-054488-A01), NS Power is required to cap these ash cells as they become full. Because of this, it is proposed that capping of the Phase1 disposal area occur in 2015/2016.

Why do this project this way?

Capping this ash site is the only option for NS Power to comply with NSE's requirements.

CI Number : 44188-SB67 - TRE Ash Site Phase 1 Capping **Project Number** SB67

Parent CI Number : -

Cost Centre : 341 - 341-Trenton Admin./Common Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		225,335	0	225,335
095		095 - T&CS Regular Labour AO		10,823	0	10,823
095		095-Thermal Term Labour AO		930	0	930
095		095-Thermal Regular Labour AO		[redacted]	0	[redacted]
095		095-Thermal Overtime Labour AO		723	0	723
095		095-Thermal & Hydro Contracts AO		[redacted]	0	[redacted]
013	015	013 - POWER PRODUCTION Contracts	015 - SGP - Waste Water	3,303	0	3,303
001	021	001 - THERMAL Regular Labour	021 - SGP - Ash Handling	12,021	0	12,021
001	021	001 - T&CS Regular Labour	021 - SGP - Ash Handling	23,489	0	23,489
002	021	002 - THERMAL Overtime Labour	021 - SGP - Ash Handling	7,213	0	7,213
004	021	004 - THERMAL Term Labour	021 - SGP - Ash Handling	4,640	0	4,640
012	021	012 - Materials	021 - SGP - Ash Handling	[redacted]	0	[redacted]
013	021	013 - POWER PRODUCTION Contracts	021 - SGP - Ash Handling	[redacted]	0	[redacted]
028	085	028 - Consulting	085 Design	115,000	0	115,000
011	087	011 - Travel Expense	087 Field Super.& Ops.	4,102	0	4,102
021	087	021 - Telephones	087 Field Super.& Ops.	250	0	250
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	2,000	0	2,000
			Total Cost:	4,538,289	0	4,538,289
			Original Cost:			

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# / FP#: 44188
Title: TRE Ash Site Phase 1 Capping
Execution Year: 2015/2016

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Engineering	PD	60.00	$ 391.49	$ 23,489.17		
Power Plant Technician	PD	20.00	$ 369.08	$ 7,381.54		
Utilityworker	PD	20.00	$ 231.99	$ 4,639.78		
			Sub-Total	$ 35,510.48		
002 OT Labour						
Utilityworker	PD	6.00	$ 463.98	$ 2,783.87		
Power Plant Technician	PD	6.00	$ 738.15	$ 4,428.92		
			Sub-Total	$ 7,212.79		
004 Term Labour						
Utilityworker	PD	20.00	$ 231.99	$ 4,639.78		
				$ -		
			Sub-Total	$ 4,639.78		
011 Travel Expense						
Gen.Services & Env. Services	lot	1.00	$ 4,102.00	$ 4,102.00		
			Sub-Total	$ 4,102.00		
012 Materials						
Supply capping materials	sq. m.	120,000	[redacted]			CI 41074 - POA Ash Cell Site Capping
				$ -		
				$ -		
			Sub-Total	[redacted]		
013 Contracts						
Install permanent cap	sq. m.	120,000	[redacted]			CI 41074 - POA Ash Cell Site Capping
Sedimentation & erosion control	lot	1	$ 10,000.00	$ 10,000.00		
Site drainage modifications	lot	1	$ 25,000.00	$ 25,000.00		
Performance bond	lot	1	$ 10,000.00	$ 10,000.00		
Quality Control	lot	1	$ 10,000.00	$ 10,000.00		
Project coordination & management	hr	250	$ 90.00	$ 22,500.00		
				$ -		
			Sub-Total	[redacted]		
021 Phones						
Phones	lot	1.00	$ 250.00	$ 250.00		
			Sub-Total	$ 250.00		
028 Consulting						
Cap design	lot	1.00	$ 25,000.00	$ 25,000.00		
Environmental Studies	lot	1.00	$ 90,000.00	$ 90,000.00		
			Sub-Total	$ 115,000.00		
041 Meals & Entertainment						
Gen.Services & Env. Services	lot	1.00	$ 2,000.00	$ 2,000.00		
			Sub-Total	$ 2,000.00		
094 Interest Capitalized						
AFUDC				$ 225,334.98		
			Sub-Total	$ 225,334.98		
095 Administrative Overhead						
Thermal Reg. Labour AO				[redacted]		
Project Support Labour AO				$ 10,822.85		
Thermal OT Labour AO				$ 722.72		
Thermal Term Labour AO				$ 929.81		
Thermal Contracts AO				[redacted]		
			Sub-Total	$ 196,738.75		
			SUB-TOTAL (no AO, AFUDC)	$ 4,116,215.05		
			TOTAL (AO, AFUDC included)	$ 4,538,288.78		
Original Cost						

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Boiler

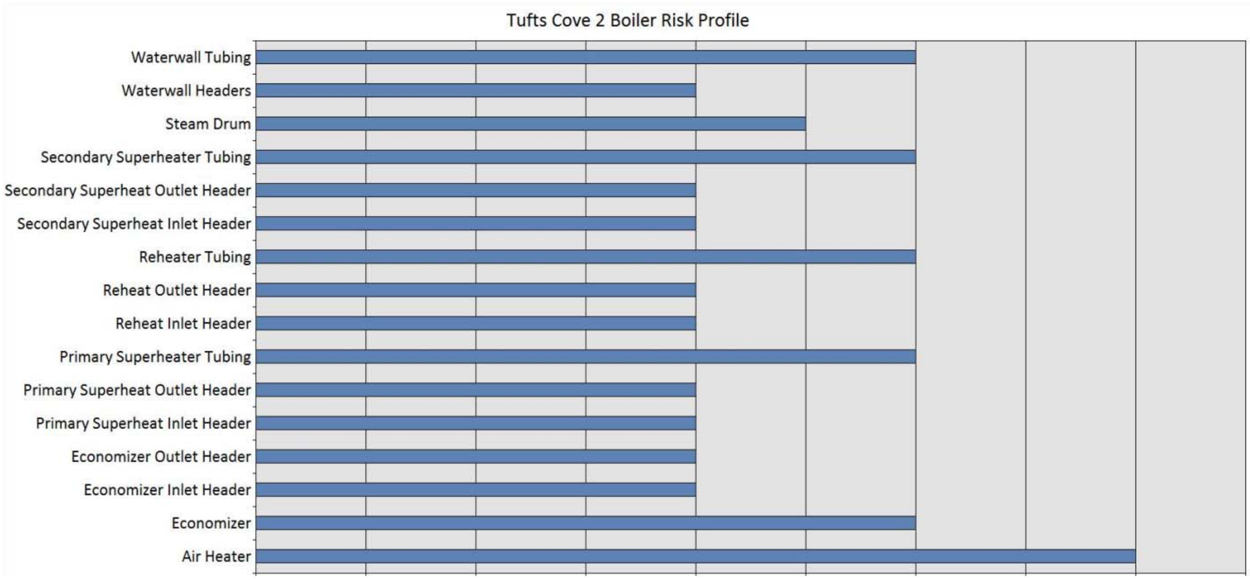
Boilers

NS Power's fleet includes 13 Boilers supplying Steam Turbine/Generator units ranging from 50MW to 185MW nominal rating. Boilers are considered complex asset classes. This asset class is generally defined by Water and Steam Circuits (Economizer, Superheaters, Reheaters, Water Walls and Division Walls, Steam Drum, Headers, Air heaters, Ash Seals, Sootblowers and Boiler Support Structures). Boilers typically include numerous other integral systems including emission controls (Baghouse and Precipitators), Burners Systems and complex control systems.

Boiler inspection and condition assessment is typically done on an annual basis during planned outages. Annual inspections typically provide early warning of impending problems and are addressed immediately or monitoring is established to project time to repair.

Boilers are composed of many sections and areas each with a different environment related to temperature, gas flow, particulate loading and resultant chemical regime. Therefore there are different tube sizes, materials and failure mechanisms to consider across the various areas of the Boiler. Fuel also represents a key variable which effects the operating environment, failure mechanisms and repairs. Due to these complexities, and the harsh operating environments, Boilers represent the single largest source of unplanned outages in the generation industry.

Nova Scotia Power has employed a rigorous Asset Management plan for Boilers for more than a decade which has resulted in excellent Boiler performance, when compared to industry norms. As the fleet continues to age, NS Power's Asset Management Plan for Boilers is evolving to project investments of a life extension nature. The following graphic illustrates the previously discussed risk profiling approach as applied to Boilers. This approach will extend to all Boilers in the fleet in near term.



In 2015, an investment in Air Heaters is occurring across the fleet of steam generating units. The timing of this investment in Air Heaters is a result of condition and does not represent a change in investment strategy. Unit utilization, type of fuel used, ash loading are some key factors that contribute to Air Heater wear and tear. Air Heaters are inspected annually to determine component condition. Condition and anticipated unit utilization are considered to determine timing of major maintenance intervals on Air Heaters. 2015 is an unusually high investment on this Asset Class but does represent an optimization of the use and maintenance cost for this equipment. This level of investment is not expected on an annual basis.

CI Number: 46299

Title: TRE6 – Boiler Refurbishment

Start Date: 2015/05
In-Service Date: 2015/09
Final Cost Date: 2016/03
Function: Steam
Forecast Amount: $873,652

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends, water wall panel, tube bifurcates, burner impellers and shields on the Trenton Unit 6 boiler as part of the planned outage in 2015. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Missing or degraded protective erosion shields identified will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

On-going asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler Tube failures represent the industry's single largest source of outages for steam based generation. NS Power has a long history of managing this with comprehensive Boiler Inspection and Investment Programs to match the various failure mechanisms.

Why do this project now?

In order to mitigate the risk of unplanned outages, annual boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete repairs or replacements. The annual planned outage duration will afford the time necessary to assess, locate and repair tubes and shields.

Why do this project this way?

Replacing tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances.

CI Number : 46299 - TRE6 Boiler Refurbishments **Project Number**

Parent CI Number : -

Cost Centre : 345 - 345-Trenton unit 6 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		7,077	0	7,077
095		095-Thermal Overtime Labour AO		930	0	930
095		095-Thermal & Hydro Contracts AO		48,666	0	48,666
095		095-Thermal Term Labour AO		3,719	0	3,719
095		095-Thermal Regular Labour AO		7,238	0	7,238
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	30,246	0	30,246
001	013	001 - Regular Labour (No AO)	013 - SGP - Boiler	3,915	0	3,915
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	9,280	0	9,280
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	18,559	0	18,559
012	013	012 - Materials	013 - SGP - Boiler	194,000	0	194,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	543,150	0	543,150
001	087	001 - THERMAL Regular Labour	087 Field Super.& Ops.	5,872	0	5,872
011	087	011 - Travel Expense	087 Field Super.& Ops.	500	0	500
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	500	0	500
			Total Cost:	873,652	0	873,652
			Original Cost:	502,100		

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# / FP#: 46299
Title: TRE6 Boiler Refurbishments
Execution Year: 2015

Item	Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
	001 Regular Labour						
	Mechanical	PD	20	$ 352	$ 7,047.00		44732 TRE5 Boiler Refurb 2014
	Utility	PD	100	$ 232	$ 23,199.00		
	Engineering	PD	10	$ 391	$ 3,914.90		
	Supervision	PD	15	$ 391.49	$ 5,872.35		
					$ -		
				Sub-Total	$ 40,033.25		
	002 Overtime Labour						
	Utility	PD	20	$ 464	$ 9,279.60		
					$ -		
					$ -		
				Sub-Total	$ 9,279.60		
	004 Term Labour						
	Utility - Confined Space Attendant	PD	80	$ 232	$ 18,559.20		
					$ -		
				Sub-Total	$ 18,559.20		
	011 Travel						
	Travel	lot	1	$ 500.00	$ 500.00		
				Sub-Total	$ 500.00		
	012 Materials						
	Waterwall Panel	lot	1	$ 16,000	$ 16,000.00		
	Tubes	lot	1	$ 20,000	$ 20,000.00		
	Bifrucates	ea	30	$ 2,600	$ 78,000.00		
	Burners	ea	16	$ 5,000	$ 80,000.00		
					$ -		
					$ -		
				Sub-Total	$ 194,000.00		44732 TRE5 Boiler 2014
	013 Contracts/Contract Labour						
	Suspended Floor	lot	1	$ 25,000	$ 25,000.00		
	Vacuum Services	lot	1	$ 50,000	$ 50,000.00		
	Inspection	PD	77	$ 950	$ 73,150.00		
	Boilermaker Labour	PD	395	$ 1,000	$ 395,000.00		
					$ -		
				Sub-Total	$ 543,150.00		44732 TRE5 Boiler 2014
	041 Meals						
	Meals	lot	1	$ 500	$ 500.00		
					$ -		
				Sub-Total	$ 500.00		
	094 Interest Capitalized						
	AFUDC				$ 7,076.57		
				Sub-Total	$ 7,076.57		
	095 Administrative Overhead						
	Thermal Regular AO				$ 7,238.12		
	Thermal Overtime AO				$ 929.82		
	Thermal Term AO				$ 3,719.26		
	Thermal Contracts AO				$ 48,666.24		
				Sub-Total	$ 60,553.44		
				SUB-TOTAL (no AO, AFUDC)	$ 806,022.05		
				TOTAL (AO, AFUDC included)	$ 873,652.06		
	Original Cost				$ 502,100.00		

Note 1: Reference to "Completed similar projects (FP#'s)" is to be provided when the item estimate is based on work of similar scope for a recently completed

TRE6 Boiler Refurbishments
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46299
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Boiler Refurbishment vs Avoided Repai	6.19%	-1,834,328	1,263,139	1	51.37%	2.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to perform planned boiler refurbishments during the 2015 TRE6 outage. This is backed by favorable economic analysis data.

Notes/Comments :

Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs

This model compares the refurbishment costs to the replacement energy costs associated with unplanned outages due to tube leaks in the boiler. Assumptions are that there will be one tube leak in 2015-2017, increasing to two tube leaks in 2018. The unit would be down an average of 120 hours to perform repairs such that the unit could be returned to service. The failure rate considers the age of the boiler (1992).

Test 2

Test 3

Test 4

TRE6 Boiler Refurbishments
Summary of Sensitivities

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46299
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs Avoided Repair and Repl	6.19%	-1,834,328	1,263,139	1	51.37%	2.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs Avoided Repair and Repl	10%	-1,754,860	1,200,198	1	45.00%	2.9 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:					
A	79,468	-62,941	0	-6.37%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs Avoided Repair and Repl	-10%	-1,571,427	1,073,884	1	44.37%	2.9 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:					
A	262,901	-189,255	0	-7.00%	0.3 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	**PV of Revenue Requirement**	**PV of Revenue Requirement**	**PV of Revenue Requirement**	**Delay?**
Yrs Delay:	1	2	3	
A	300,612	572,045	805,992	No
B	0	0	0	No
C	0	0	0	No
D	0	0	0	No

TRE6 Boiler Refurbishments
Avoided Cost Calculations

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46299
Originator :		**Project No. :**	

Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			90,000	91,800		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	160	160				
Duration (Hours)	120	120				
Totals	$232,316	$251,525	$90,000	$91,800	$322,316	$343,325

Total Capital Cost of Alternative $873,652

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative $0

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative $0

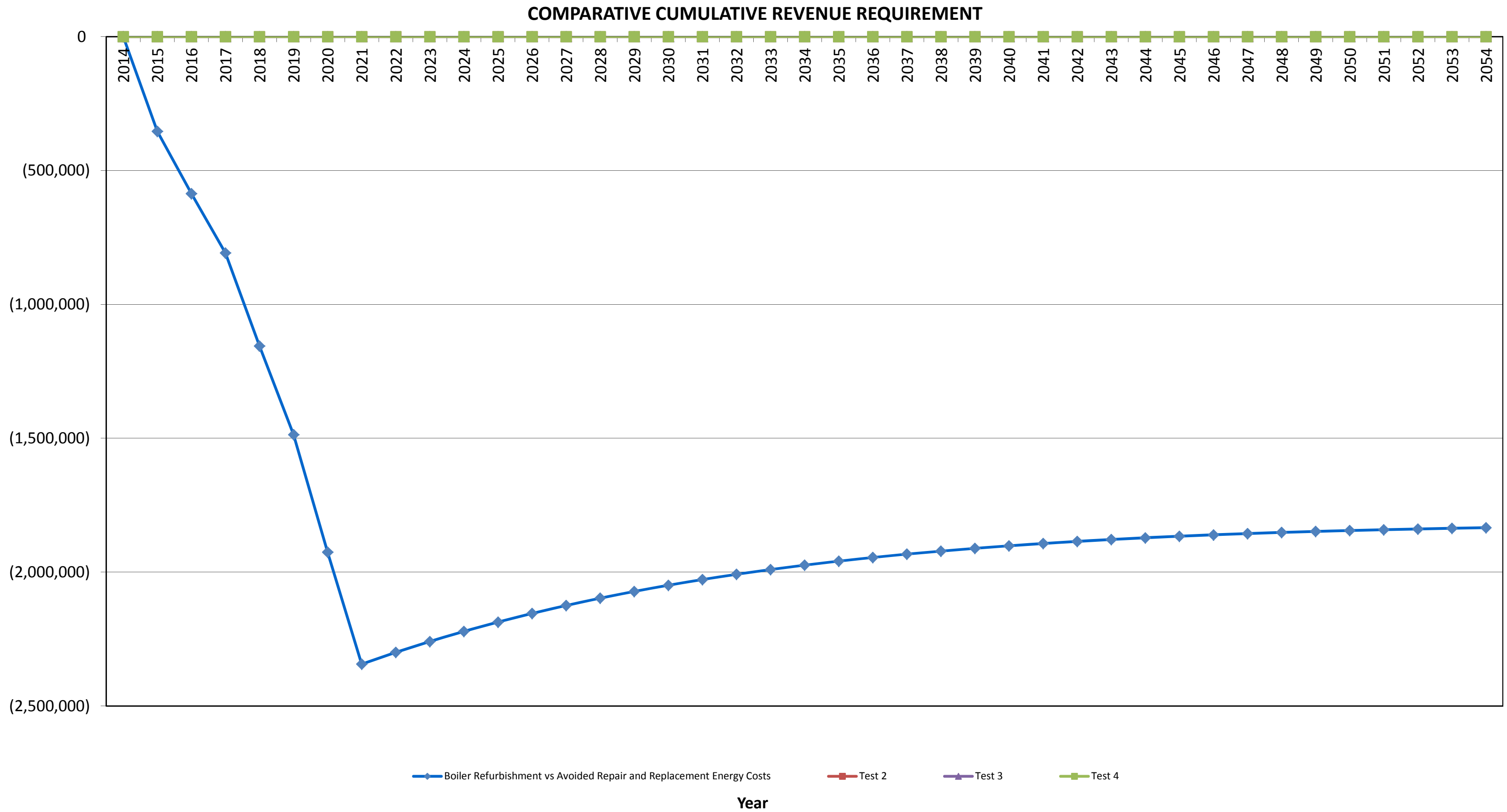
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative $0

TRE6 Boiler Refurbishments
Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	322,316.2	(813,098.8)	32,240.9	790,493.7	(490,782.6)	(89,923.4)	(580,705.9)	(546,855.6)	0.94	(546,855.6)
2016	-	-	343,324.6	-	61,902.5	725,801.0	343,324.6	(87,240.8)	256,083.7	227,098.8	0.89	(319,756.8)
2017	-	-	350,191.1	-	56,950.3	666,283.6	350,191.1	(90,904.6)	259,286.4	216,535.4	0.84	(103,221.4)
2018	-	-	535,792.3	-	52,394.3	611,527.7	535,792.3	(149,853.4)	385,938.9	303,517.8	0.79	200,296.4
2019	-	-	546,508.2	-	48,202.7	561,152.2	546,508.2	(154,474.7)	392,033.5	290,338.8	0.74	490,635.2
2020	-	-	743,251.1	-	44,346.5	514,806.7	743,251.1	(216,660.4)	526,590.7	367,258.2	0.70	857,893.4
2021	-	-	758,116.2	-	40,798.8	472,168.9	758,116.2	(222,368.4)	535,747.8	351,864.2	0.66	1,209,757.5
2022	-	-	-	-	37,534.9	432,942.1	-	11,635.8	11,635.8	7,196.6	0.62	1,216,954.1
2023	-	-	-	-	34,532.1	396,853.5	-	10,704.9	10,704.9	6,234.9	0.58	1,223,189.1
2024	-	-	-	-	31,769.5	363,651.9	-	9,848.6	9,848.6	5,401.8	0.55	1,228,590.8
2025	-	-	-	-	29,228.0	333,106.5	-	9,060.7	9,060.7	4,679.9	0.52	1,233,270.8
2026	-	-	-	-	26,889.7	305,004.7	-	8,335.8	8,335.8	4,054.6	0.49	1,237,325.3
2027	-	-	-	-	24,738.5	279,151.1	-	7,669.0	7,669.0	3,512.8	0.46	1,240,838.1
2028	-	-	-	-	22,759.5	255,365.7	-	7,055.4	7,055.4	3,043.4	0.43	1,243,881.5
2029	-	-	-	-	20,938.7	233,483.2	-	6,491.0	6,491.0	2,636.7	0.41	1,246,518.1
2030	-	-	-	-	19,263.6	213,351.3	-	5,971.7	5,971.7	2,284.3	0.38	1,248,802.5
2031	-	-	-	-	17,722.5	194,829.9	-	5,494.0	5,494.0	1,979.1	0.36	1,250,781.6
2032	-	-	-	-	16,304.7	177,790.2	-	5,054.5	5,054.5	1,714.6	0.34	1,252,496.2
2033	-	-	-	-	15,000.3	162,113.7	-	4,650.1	4,650.1	1,485.5	0.32	1,253,981.7
2034	-	-	-	-	13,800.3	147,691.4	-	4,278.1	4,278.1	1,287.0	0.30	1,255,268.7
2035	-	-	-	-	12,696.3	134,422.8	-	3,935.8	3,935.8	1,115.0	0.28	1,256,383.7
2036	-	-	-	-	11,680.6	122,215.7	-	3,621.0	3,621.0	966.0	0.27	1,257,349.7
2037	-	-	-	-	10,746.1	110,985.2	-	3,331.3	3,331.3	836.9	0.25	1,258,186.7
2038	-	-	-	-	9,886.4	100,653.1	-	3,064.8	3,064.8	725.1	0.24	1,258,911.8
2039	-	-	-	-	9,095.5	91,147.6	-	2,819.6	2,819.6	628.2	0.22	1,259,540.0
2040	-	-	-	-	8,367.9	82,402.5	-	2,594.0	2,594.0	544.3	0.21	1,260,084.2
2041	-	-	-	-	7,698.5	74,357.0	-	2,386.5	2,386.5	471.5	0.20	1,260,555.8
2042	-	-	-	-	7,082.6	66,955.2	-	2,195.6	2,195.6	408.5	0.19	1,260,964.3
2043	-	-	-	-	6,516.0	60,145.5	-	2,020.0	2,020.0	353.9	0.18	1,261,318.2
2044	-	-	-	-	5,994.7	53,880.6	-	1,858.4	1,858.4	306.6	0.17	1,261,624.8
2045	-	-	-	-	5,515.1	48,116.9	-	1,709.7	1,709.7	265.7	0.16	1,261,890.5
2046	-	-	-	-	5,073.9	42,814.2	-	1,572.9	1,572.9	230.2	0.15	1,262,120.7
2047	-	-	-	-	4,668.0	37,935.8	-	1,447.1	1,447.1	199.4	0.14	1,262,320.1
2048	-	-	-	-	4,294.6	33,447.7	-	1,331.3	1,331.3	172.8	0.13	1,262,492.8
2049	-	-	-	-	3,951.0	29,318.6	-	1,224.8	1,224.8	149.7	0.12	1,262,642.5
2050	-	-	-	-	3,634.9	25,519.8	-	1,126.8	1,126.8	129.7	0.12	1,262,772.2
2051	-	-	-	-	3,344.1	22,025.0	-	1,036.7	1,036.7	112.3	0.11	1,262,884.5
2052	-	-	-	-	3,076.6	18,809.7	-	953.7	953.7	97.3	0.10	1,262,981.8
2053	-	-	-	-	2,830.5	15,851.7	-	877.4	877.4	84.3	0.10	1,263,066.2
2054	-	-	-	-	2,604.0	13,130.3	-	807.2	807.2	73.1	0.09	1,263,139.2
Total	**-**	**-**	**3,599,499.7**	**(813,098.8)**	**776,075.7**		**2,786,401.0**	**(875,261.5)**	**1,911,139.5**	**1,263,139.2**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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2051
2052
2053
2054
Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46256

Title: POT – Boiler Refurbishment 2015

Start Date: 2015/08
In-Service Date: 2015/08
Final Cost Date: 2016/02
Function: Steam
Forecast Amount: $780,097

DESCRIPTION:

The scope of work for this project is to refurbish and replace boiler tubes, tube bends and tube shields in the Point Tupper boiler as part of a planned maintenance outage in 2015. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual planned outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs (+/- 2 years):
2013 CI 43051 POT Selective Superheater Replacement $238,286

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

On-going asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Heat transfer surfaces in coal fired boilers are subject to ash erosion which will thin the wall thickness of tubing and consume shielding materials. Boiler Tube failures represent the industry's single largest source of outages where steam based generation is concerned. NS Power has a long history of managing this concern with comprehensive Boiler Inspection and Investment Programs to match the various failure mechanisms.

Why do this project now?

Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete repairs or replacements. The annual planned outage duration will afford the time necessary to assess, locate and repair tubes and shields.

Why do this project this way?

Replacing and refurbishing the tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler.

CI Number : 46256 - POT - Boiler Refurbishment 2015 **Project Number**

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		49,280	0	49,280
095		095-Thermal Regular Labour AO		1,395	0	1,395
095		095-Thermal Overtime Labour AO		372	0	372
095		095-Thermal Term Labour AO		10,414	0	10,414
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	6,960	0	6,960
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	3,712	0	3,712
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	51,965	0	51,965
011	013	011 - Travel Expense	013 - SGP - Boiler	1,000	0	1,000
012	013	012 - Materials	013 - SGP - Boiler	101,000	0	101,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	550,000	0	550,000
028	013	028 - Consulting	013 - SGP - Boiler	1,000	0	1,000
033	013	033 - Rental and Maintenance of	013 - SGP - Boiler	1,000	0	1,000
041	013	041 - Meals & Entertainment	013 - SGP - Boiler	2,000	0	2,000
			Total Cost:	780,097	0	780,097
			Original Cost:	400,000		

Capital Project Detailed Estimate

Location: Pt. Tupper
CI# / FP#: 46256
Title: POT - Boiler Refurbishment 2015
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	30	$ 232	$ 6,959.66		
			Sub-Total	$ 6,959.66		
002 OT Labour						
Utilityworker	PD	8	$ 463.98	$ 3,711.82		
				$ -		
				$ -		
				$ -		
			Sub-Total	$ 3,711.82		
004 Term Labour						
Utilityworker	PD	224	$ 232	$ 51,965.49		
				$ -		
				$ -		
			Sub-Total	$ 51,965.49		
011 Travel Expense						
Travel	lot	1	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
012 Materials						
Tubing, flat bar, clips, shields	lot	1	$ 95,000.00	$ 95,000.00		
Misc. and consumables	lot	1	$ 6,000.00	$ 6,000.00		
			Sub-Total	$ 101,000.00		
013 Contracts						
Boiler Refurbishment	lot	1	$ 550,000.00	$ 550,000.00	NSP Estimate	
			Sub-Total	$ 550,000.00		
028 Consulting						
Misc. Consulting	lot	1	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
033 Rental & Maintenance						
Equipment Rental	lot	1	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
041 Meals & Entertainment						
Meals and expenses	lot	1	$ 2,000.00	$ 2,000.00		
				$ -		
			Sub-Total	$ 2,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO	lot	1.00	1394.72	$ 1,394.72		
Thermal OT Labour AO	lot	1.00	371.92	$ 371.92		
Thermal Term Labour AO	lot	1.00	10413.88	$ 10,413.88		
Thermal / Hydro Contracts AO	lot	1.00	49280	$ 49,280.00		
			Sub-Total	$ 61,460.52		
			SUB-TOTAL (no AO, AFUDC)	$ 718,636.98		
			TOTAL (AO, AFUDC included)	$ 780,097.50		
Original Cost				$ 400,000.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

POT - Boiler Refurbishment
Summary of Alternatives

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	46256
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Refurbish Boiler vs. Avoided Repair and	6.19%	-2,097,532	1,489,801	1	78.26%	1.9 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to complete the refurbishment of the POT boiler.

Notes/Comments :

Refurbish Boiler vs. Avoided Repair and Replacement Energy Costs

This scenario compares the cost of the boiler upgrades versus the avoided replacement energy costs due to future unplanned outages (over the next five years) if the refurbishments are not completed. Assumptions: 1) Over the next five years, the unit will experience an increasing frequency of unplanned outages 2) Average outage of 60hr 3) Average labour hours to return the asset to operation 400hr, and 4) Average cost of materials for an unplanned repair $45k.

Test 2

Test 3

Test 4

POT - Boiler Refurbishment
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	46256
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Refurbish Boiler vs. Avoided Repair and Replacer	6.19%	-2,097,532	1,489,801	1	78.26%	1.9 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Refurbish Boiler vs. Avoided Repair and Replacer	10%	-2,021,738	1,434,277	1	68.64%	2.1 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
	A	75,795	-55,523	0	-9.63%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Refurbish Boiler vs. Avoided Repair and Replacer	-10%	-1,811,985	1,285,297	1	67.69%	2.1 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
	A	285,548	-204,503	0	-10.57%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	PV of Revenue Requirement 1	PV of Revenue Requirement 2	PV of Revenue Requirement 3	Delay?
	A	277,281	636,314	1,080,883	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

POT - Boiler Refurbishment
Avoided Cost Calculations

Nova Scotia POWER
An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	46256
Originator :		**Project No. :**	

Refurbish Boiler vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**59,400**	**61,782**		
Events/Outages (#)	**2**	**3**	**2**	**3**		
Probability of Occurance (%)	**100%**	**100%**	**100%**	**100%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**150**	**150**				
Duration (Hours)	**60**	**60**				
Totals	**$178,500**	**$257,370**	**$118,800**	**$185,345**	**$297,300**	**$442,715**
Total Capital Cost of Alternative						**$780,098**

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

Test 3

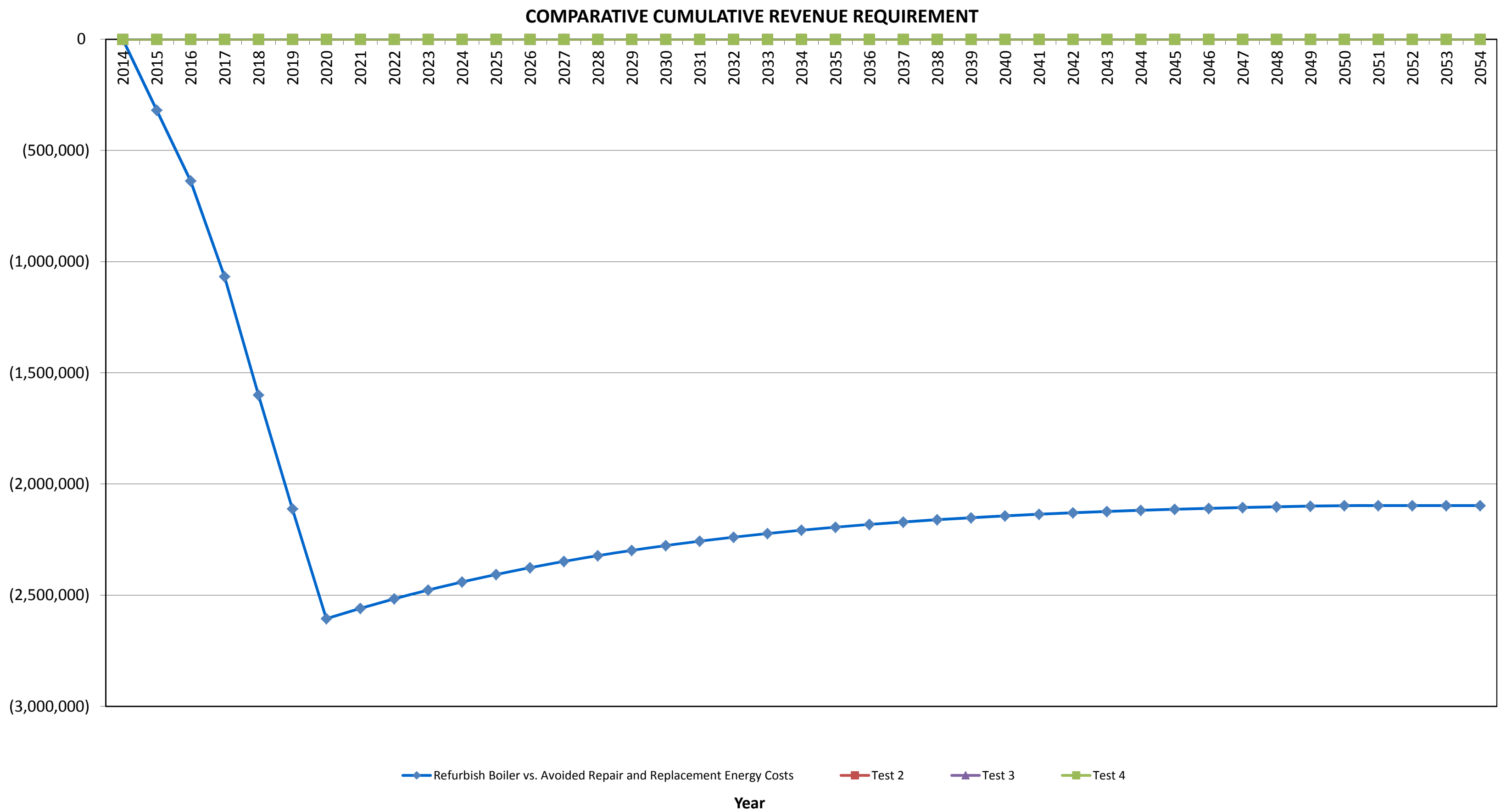
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

POT - Boiler Refurbishment
Refurbish Boiler vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	297,300.3	(718,637.0)	28,745.5	706,854.6	(421,336.6)	(83,252.0)	(504,588.6)	(475,175.3)	0.94	(475,175.3)
2016	-	-	442,715.2	-	55,191.3	648,831.2	442,715.2	(120,132.4)	322,582.8	286,071.1	0.89	(189,104.2)
2017	-	-	607,059.1	-	50,776.0	595,449.6	607,059.1	(172,447.8)	434,611.4	362,952.8	0.84	173,848.6
2018	-	-	780,457.5	-	46,713.9	546,338.6	780,457.5	(227,460.5)	552,997.0	434,898.9	0.79	608,747.5
2019	-	-	802,782.6	-	42,976.8	501,156.5	802,782.6	(235,539.8)	567,242.8	420,098.3	0.74	1,028,845.7
2020	-	-	825,823.5	-	39,538.7	459,588.9	825,823.5	(243,748.3)	582,075.2	405,954.5	0.70	1,434,800.3
2021	-	-	-	-	36,375.6	421,346.7	-	11,276.4	11,276.4	7,406.0	0.66	1,442,206.3
2022	-	-	-	-	33,465.5	386,163.9	-	10,374.3	10,374.3	6,416.4	0.62	1,448,622.7
2023	-	-	-	-	30,788.3	353,795.8	-	9,544.4	9,544.4	5,559.0	0.58	1,454,181.7
2024	-	-	-	-	28,325.2	324,017.1	-	8,780.8	8,780.8	4,816.1	0.55	1,458,997.8
2025	-	-	-	-	26,059.2	296,620.6	-	8,078.4	8,078.4	4,172.6	0.52	1,463,170.4
2026	-	-	-	-	23,974.5	271,415.9	-	7,432.1	7,432.1	3,615.0	0.49	1,466,785.4
2027	-	-	-	-	22,056.5	248,227.6	-	6,837.5	6,837.5	3,131.9	0.46	1,469,917.3
2028	-	-	-	-	20,292.0	226,894.4	-	6,290.5	6,290.5	2,713.4	0.43	1,472,630.7
2029	-	-	-	-	18,668.6	207,267.8	-	5,787.3	5,787.3	2,350.8	0.41	1,474,981.5
2030	-	-	-	-	17,175.1	189,211.3	-	5,324.3	5,324.3	2,036.7	0.38	1,477,018.2
2031	-	-	-	-	15,801.1	172,599.3	-	4,898.4	4,898.4	1,764.5	0.36	1,478,782.7
2032	-	-	-	-	14,537.0	157,316.3	-	4,506.5	4,506.5	1,528.7	0.34	1,480,311.5
2033	-	-	-	-	13,374.1	143,256.0	-	4,146.0	4,146.0	1,324.5	0.32	1,481,635.9
2034	-	-	-	-	12,304.2	130,320.4	-	3,814.3	3,814.3	1,147.5	0.30	1,482,783.4
2035	-	-	-	-	11,319.8	118,419.7	-	3,509.1	3,509.1	994.1	0.28	1,483,777.5
2036	-	-	-	-	10,414.2	107,471.1	-	3,228.4	3,228.4	861.3	0.27	1,484,638.8
2037	-	-	-	-	9,581.1	97,398.4	-	2,970.1	2,970.1	746.2	0.25	1,485,385.0
2038	-	-	-	-	8,814.6	88,131.5	-	2,732.5	2,732.5	646.5	0.24	1,486,031.5
2039	-	-	-	-	8,109.4	79,605.9	-	2,513.9	2,513.9	560.1	0.22	1,486,591.6
2040	-	-	-	-	7,460.7	71,762.4	-	2,312.8	2,312.8	485.3	0.21	1,487,076.8
2041	-	-	-	-	6,863.8	64,546.3	-	2,127.8	2,127.8	420.4	0.20	1,487,497.3
2042	-	-	-	-	6,314.7	57,907.6	-	1,957.6	1,957.6	364.2	0.19	1,487,861.5
2043	-	-	-	-	5,809.5	51,799.9	-	1,801.0	1,801.0	315.6	0.18	1,488,177.0
2044	-	-	-	-	5,344.8	46,180.9	-	1,656.9	1,656.9	273.4	0.17	1,488,450.4
2045	-	-	-	-	4,917.2	41,011.3	-	1,524.3	1,524.3	236.9	0.16	1,488,687.3
2046	-	-	-	-	4,523.8	36,255.4	-	1,402.4	1,402.4	205.2	0.15	1,488,892.5
2047	-	-	-	-	4,161.9	31,879.9	-	1,290.2	1,290.2	177.8	0.14	1,489,070.3
2048	-	-	-	-	3,829.0	27,854.5	-	1,187.0	1,187.0	154.0	0.13	1,489,224.3
2049	-	-	-	-	3,522.6	24,151.0	-	1,092.0	1,092.0	133.4	0.12	1,489,357.8
2050	-	-	-	-	3,240.8	20,743.9	-	1,004.7	1,004.7	115.6	0.12	1,489,473.4
2051	-	-	-	-	2,981.6	17,609.3	-	924.3	924.3	100.2	0.11	1,489,573.5
2052	-	-	-	-	2,743.0	14,725.5	-	850.3	850.3	86.8	0.10	1,489,660.3
2053	-	-	-	-	2,523.6	12,072.4	-	782.3	782.3	75.2	0.10	1,489,735.5
2054	-	-	-	-	2,321.7	9,631.6	-	719.7	719.7	65.1	0.09	1,489,800.6
Total	**-**	**-**	**3,756,138.2**	**(718,637.0)**	**691,937.3**		**3,037,501.2**	**(949,902.3)**	**2,087,598.9**	**1,489,800.6**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(500,000)
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Refurbish Boiler vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46451

Title: PHB – Boiler Refurbishment 2015

Start Date:	2015/05
In-Service Date:	2015/05
Final Cost Date:	2015/11
Function:	Steam
Forecast Amount:	$673,602

DESCRIPTION:

The staged refurbishment of sections of the biomass boiler is required to ensure reliable operation of the plant. Due to the significant volume of material (biomass) that passes through the boiler, it has many erosion susceptible areas including conveyors, feed screws and reciprocating grates. Pursuant to the PHB application and 2014 ACE Plan proceding, this project falls within the projected sustaining capital investment for the biomass plant. Similar to boilers on coal-fired units, the biomass boiler will require ongoing refurbishment and selective component replacements over its life in response to exposure to elevated temperatures, temperature cycling, erosion and corrosion and to ensure a high degree of operating reliability.

Summary of Related CIs (+/- 2 years):
2014 CI 44888 – PHB – Boiler Refurbishment 2014 $742,129
2016 CI TBD PHB Boiler Refurbishment 2016 $TBD
2017 CI TBD PHB Boiler Refurbishment 2017 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

Ongoing asset management activities have identified the requirement for selective boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. The Port Hawkesbury Biomass (PHB) Plant is a critical component of NS Power's strategy to achieve required renewable energy targets in 2015 and beyond.

Why do this project now?

Some of the boiler tubes and other equipment to be inspected and replaced are difficult to access. Work must be completed during an outage of sufficient duration to complete the necessary work. The planned outage for the biomass boiler in 2014 will be of sufficient duration to complete the work.

Why do this project this way?

The work will be completed in the most cost effective manner to ensure reliable and efficient operation of the boiler. By servicing the boiler and associated components routinely and simultaneously plant uptime will be maximized and the risk of unplanned outages associated with the generating unit will be reduced.

CI Number : 46451 - PHB Boiler Refurbishment 2015 **Project Number**

Parent CI Number : -

Cost Centre : 251 - 251-PH Biomass Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity		Forecast Amount	Amount	Variance
095		095-Thermal Term Labour AO			14,735	0	14,735
095		095-Thermal & Hydro Contracts AO			25,162	0	25,162
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler		73,529	0	73,529
012	013	012 - Materials	013 - SGP - Boiler		279,355	0	279,355
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler		280,821	0	280,821
				Total Cost:	673,602	0	673,602
				Original Cost:	505,201		

Capital Project Detailed Estimate

Location: Port Hawkesbury Biomass
CI# / FP#: 46451
Title: PHB Boiler Refurbishment 2015
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
004 Term Labour						
Electrician	PD	2	$ 346.07	$ 692.13		
Power Engineer	PD	8	$ 377.07	$ 3,016.59		
Power Plant Technician	PD	5	$ 369.08	$ 1,845.38		
Utilityworker - Kablitz system	PD	10	$ 231.99	$ 2,319.89		
Maintenance Trades - Trancel system	PD	50	$ 352.35	$ 17,617.44		
Utilityworker - Trancel system	PD	20	$ 231.99	$ 4,639.78		
Utilityworker - Boiler conveyors	PD	10	$ 231.99	$ 2,319.89		
Maintenance Trades - Boiler conveyors	PD	50	$ 352.35	$ 17,617.44		
Utilityworker - Ash conveyors	PD	10	$ 231.99	$ 2,319.89		
Maintenance Trades - Ash conveyors	PD	60	$ 352.35	$ 21,140.93		
			Sub-Total	$ 73,529.35		44888
012 Materials						
Kablitz grate castings and wear plates	ea	129	$ 745.00	$ 96,105.00		
Wear Plates	lot	1	$ 15,000.00	$ 15,000.00		
Boiler feed (Trancel) screw	ea	2	$ 22,000.00	$ 44,000.00		
Boiler feed (Trancel) screw bearings	lot	1	$ 20,000.00	$ 20,000.00		
Boiler feed (Trancel) wear liners	lot	0.75	$ 23,000.00	$ 17,250.00		
Precipitator components	lot	1	$ 20,000.00	$ 20,000.00		
Ash system conveyor components	lot	1	$ 32,000.00	$ 32,000.00		
Replacement precipitator ducting	lot	1	$ 35,000.00	$ 35,000.00		
			Sub-Total	$ 279,355.00		44888
013 Contracts						
Babcock & Wilcox - Kablitz Grate Repl	lot	1	$ 70,821.00	$ 70,821.00		
Babcock & Wilcox - Precipitator routine repairs	lot	1	$ 15,000.00	$ 15,000.00		
BM Contract for Precipitator Outlet Ducting	lot	1	$ 112,000.00	$ 112,000.00		
Scaffolding for Precipitator Ducting	lot	1	$ 20,000.00	$ 20,000.00		
Insulation and cladding for Precipitator Ducting	lot	1	$ 63,000.00	$ 63,000.00		
				$ -		
			Sub-Total	$ 280,821.00		44888
095 Administrative Overhead						
Thermal Term Labour AO				$ 14,735.28		
Thermal / Hydro Contracts AO				$ 25,161.56		
			Sub-Total	$ 39,896.84		
			SUB-TOTAL (no AO, AFUDC)	$ 633,705.35		
			TOTAL (AO, AFUDC included)	$ 673,602.19		
Original Cost				$ 505,201.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46302

Title: TRE5 – Boiler Refurbishment

Start Date: 2015/05
In-Service Date: 2015/09
Final Cost Date: 2016/03
Function: Steam
Forecast Amount: $647,845

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends and shields on the Trenton Unit 5 boiler as part of the planned outage in 2015. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs (+/- 2 years):
2014 CI 44732 TRE5 Boiler Refurbishment $626,649
2016 CI TBD TRE5 Boiler Refurbishment $TBD
2017 CI TBD TRE5 Boiler Refurbishment $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

Ongoing asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler Tube failures represent the industries single largest source of outages for steam based generation. NS Power has a long history of managing this with comprehensive Boiler Inspection and Investment Programs to match the various failure mechanisms.

Why do this project now?

In order to mitigate the risk of unplanned outage annual boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete repairs or replacements. The annual planned outage duration will afford the time necessary to assess, locate and repair tubes and shields.

Why do this project this way?

Replacing deteriorated boiler tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances.

CI Number : 46302 - TRE5 Boiler Refurbishments **Project Number**

Parent CI Number : -

Cost Centre : 340 - 340-Trenton Unit 5 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		4,389	0	4,389
095		095-Thermal Term Labour AO		5,811	0	5,811
095		095-Thermal & Hydro Contracts AO		34,675	0	34,675
095		095-Thermal Regular Labour AO		7,473	0	7,473
095		095-Thermal Overtime Labour AO		930	0	930
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	30,246	0	30,246
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	9,280	0	9,280
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	28,999	0	28,999
012	013	012 - Materials	013 - SGP - Boiler	116,595	0	116,595
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	387,000	0	387,000
001	085	001 - THERMAL Regular Labour	085 Design	3,132	0	3,132
028	085	028 - Consulting	085 Design	14,400	0	14,400
001	087	001 - THERMAL Regular Labour	087 Field Super.& Ops.	3,915	0	3,915
011	087	011 - Travel Expense	087 Field Super.& Ops.	500	0	500
021	087	021 - Telephones	087 Field Super.& Ops.	250	0	250
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	250	0	250
			Total Cost:	647,845	0	647,845
			Original Cost:	74,702		

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# / FP#: 46302
Title: TRE5 Boiler Refurbishments
Execution Year: 2015

Item	Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
	001 Regular Labour						
	Mechanical	PD	20	$ 352	$ 7,047.00		44732 - TRE5 Boiler Refurb (2014)
	Utility	PD	100	$ 232	$ 23,199.00		
	Engineering	PD	8	$ 391	$ 3,131.92		
	Supervision	PD	10	$ 391	$ 3,914.90		
					$ -		
					$ -		
				Sub-Total	$ 37,292.82		
	002 Overtime Labour						
	Utility	PD	20	$ 464	$ 9,279.60		
					$ -		
				Sub-Total	$ 9,279.60		
	004 Term Labour						
	Utility - Confined Space Attendant	PD	125	$ 232	$ 28,998.75		
					$ -		
				Sub-Total	$ 28,998.75		
	011 Travel						
	Travel	lot	1	$ 500	$ 500.00		
					$ -		
				Sub-Total	$ 500.00		
	012 Materials						
	Alignment Brackets	lot	1	$ 25,000	$ 25,000.00		44732 - TRE5 Boiler Refurb (2014)
	Tubes	lot	1	$ 20,000	$ 20,000.00		
	Vestibule Liner	lot	1	[redacted]			
	Burner Refractory	lot	1			Cost Support Item #1	
					$ -		
					$ -		
				Sub-Total	$ 116,595.00		
	013 Contracts						
	Suspended Floor	lot	1	$ 25,000	$ 25,000.00		44732 - TRE5 Boiler Refurb (2014)
	Vacuum Services	lot	1	$ 50,000	$ 50,000.00		
	Inspection	PD	100	$ 560	$ 56,000.00		
	Boilermaker Labour	PD	400	$ 640	$ 256,000.00		
					$ -		
				Sub-Total	$ 387,000.00		
	021 Telephones						
	Telephone	lot	1	$ 250	$ 250.00		
					$ -		
				Sub-Total	$ 250.00		
	028 Consultants						
	External Supervision	PD	30	$ 480	$ 14,400.00		
					$ -		
				Sub-Total	$ 14,400.00		
	041 Meals & Entertainment						
	Meals	lot	1	$ 250	$ 250.00		
				Sub-Total	$ 250.00		
	094 Interest Capitalized						
	AFUDC				$ 4,389.44		
				Sub-Total	$ 4,389.44		
	095 Administrative Overhead						
	Thermal Reg. Labour AO				$ 7,473.48		
	Thermal OT Labour AO				$ 929.82		
	Thermal Term Labour AO				$ 5,811.35		
	Thermal Contracts AO				$ 34,675.20		
				Sub-Total	$ 48,889.85		
				SUB-TOTAL (no AO, AFUDC)	$ 594,566.17		
				TOTAL (AO, AFUDC included)	$ 647,845.46		
	Original Cost				$ 74,702.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

TRE5 Boiler Refurbishments
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46302
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Boiler Refurbishment vs Avoided Repai	6.19%	-3,750,450	2,811,179	1	54.93%	2.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to perform planned boiler refurbishments during the 2015 TRE5 outage. The PV of Revenue Requirement is less for completing this refurbishment as compared to dealing with the unplanned failures and the associated costs.

Notes/Comments :

Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs

This model compares the refurbishment costs to the replacement energy costs associated with unplanned outages due to tube leaks in the boiler. Assumptions are that there will be one tube leak in 2015, with increasing likelihood of failure in subsequent years. The unit would be down an average of 120 hours to perform repairs such that the unit could be returned to service. The failure rate considers the age of the boiler (1969).

Test 2

Test 3

Test 4

TRE5 Boiler Refurbishments
Summary of Sensitivities

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46302
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs Avoided Repair and Repl	6.19%	-3,750,450	2,811,179	1	54.93%	2.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs Avoided Repair and Repl	10%	-3,690,491	2,764,829	1	49.85%	2.9 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:	**A**	59,960	-46,351	0	-5.08%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs Avoided Repair and Repl	-10%	-3,315,446	2,483,711	1	49.34%	2.9 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:	**A**	435,005	-327,469	0	-5.59%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	147,616	379,953	583,172	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

TRE5 Boiler Refurbishments
Avoided Cost Calculations

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46302
Originator :		**Project No. :**	

Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			90,000	91,800		
Events/Outages (#)	1	2	1	2		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	160	160				
Duration (Hours)	120	120				
Totals	$68,274	$106,635	$90,000	$183,600	$158,274	$290,235
Total Capital Cost of Alternative						$647,845

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

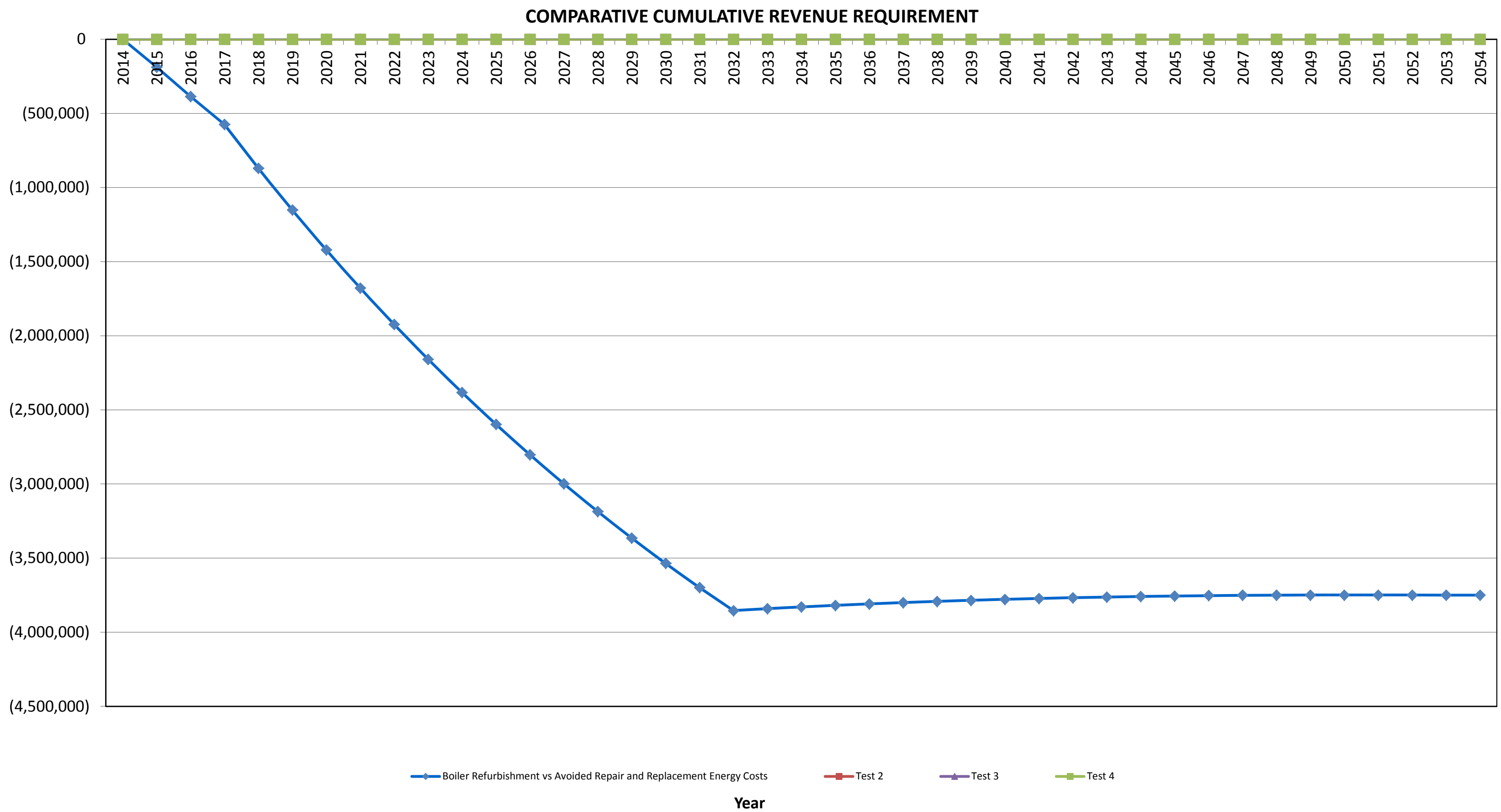
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

TRE5 Boiler Refurbishments

Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	158,274.0	(598,955.0)	23,782.6	584,277.0	(440,681.0)	(41,692.3)	(482,373.3)	(454,255.0)	0.94	(454,255.0)
2016	-	-	290,235.0	-	45,662.7	536,361.5	290,235.0	(75,817.4)	214,417.6	190,148.6	0.89	(264,106.4)
2017	-	-	296,039.7	-	42,009.7	492,279.2	296,039.7	(78,749.3)	217,290.4	181,463.6	0.84	(82,642.7)
2018	-	-	452,940.7	-	38,648.9	451,723.5	452,940.7	(128,430.5)	324,510.2	255,207.8	0.79	172,565.0
2019	-	-	461,999.5	-	35,557.0	414,412.3	461,999.5	(132,197.2)	329,802.3	244,250.6	0.74	416,815.6
2020	-	-	471,239.5	-	32,712.4	380,085.9	471,239.5	(135,943.4)	335,296.1	233,844.3	0.70	650,659.9
2021	-	-	480,664.3	-	30,095.4	348,505.7	480,664.3	(139,676.3)	340,987.9	223,951.3	0.66	874,611.2
2022	-	-	490,277.6	-	27,687.8	319,451.9	490,277.6	(143,402.8)	346,874.7	214,537.7	0.62	1,089,149.0
2023	-	-	500,083.1	-	25,472.8	292,722.4	500,083.1	(147,129.2)	352,953.9	205,572.7	0.58	1,294,721.7
2024	-	-	510,084.8	-	23,434.9	268,131.2	510,084.8	(150,861.4)	359,223.3	197,028.2	0.55	1,491,749.8
2025	-	-	520,286.5	-	21,560.1	245,507.4	520,286.5	(154,605.2)	365,681.3	188,878.7	0.52	1,680,628.5
2026	-	-	530,692.2	-	19,835.3	224,693.4	530,692.2	(158,365.6)	372,326.6	181,100.9	0.49	1,861,729.4
2027	-	-	541,306.0	-	18,248.5	205,544.6	541,306.0	(162,147.8)	379,158.2	173,673.4	0.46	2,035,402.8
2028	-	-	552,132.2	-	16,788.6	187,927.7	552,132.2	(165,956.5)	386,175.7	166,576.7	0.43	2,201,979.5
2029	-	-	563,174.8	-	15,445.5	171,720.1	563,174.8	(169,796.1)	393,378.7	159,792.6	0.41	2,361,772.1
2030	-	-	574,438.3	-	14,209.9	156,809.1	574,438.3	(173,670.8)	400,767.5	153,304.4	0.38	2,515,076.5
2031	-	-	585,927.1	-	13,073.1	143,091.0	585,927.1	(177,584.7)	408,342.3	147,096.7	0.36	2,662,173.2
2032	-	-	597,645.6	-	12,027.3	130,470.4	597,645.6	(181,541.7)	416,103.9	141,155.1	0.34	2,803,328.3
2033	-	-	-	-	11,065.1	118,859.4	-	3,430.2	3,430.2	1,095.8	0.32	2,804,424.1
2034	-	-	-	-	10,179.9	108,177.3	-	3,155.8	3,155.8	949.4	0.30	2,805,373.4
2035	-	-	-	-	9,365.5	98,349.7	-	2,903.3	2,903.3	822.5	0.28	2,806,195.9
2036	-	-	-	-	8,616.2	89,308.4	-	2,671.0	2,671.0	712.6	0.27	2,806,908.5
2037	-	-	-	-	7,926.9	80,990.4	-	2,457.4	2,457.4	617.4	0.25	2,807,525.9
2038	-	-	-	-	7,292.8	73,337.8	-	2,260.8	2,260.8	534.9	0.24	2,808,060.8
2039	-	-	-	-	6,709.4	66,297.4	-	2,079.9	2,079.9	463.4	0.22	2,808,524.2
2040	-	-	-	-	6,172.6	59,820.2	-	1,913.5	1,913.5	401.5	0.21	2,808,925.6
2041	-	-	-	-	5,678.8	53,861.3	-	1,760.4	1,760.4	347.8	0.20	2,809,273.5
2042	-	-	-	-	5,224.5	48,379.0	-	1,619.6	1,619.6	301.3	0.19	2,809,574.8
2043	-	-	-	-	4,806.5	43,335.3	-	1,490.0	1,490.0	261.1	0.18	2,809,835.9
2044	-	-	-	-	4,422.0	38,695.1	-	1,370.8	1,370.8	226.2	0.17	2,810,062.1
2045	-	-	-	-	4,068.3	34,426.2	-	1,261.2	1,261.2	196.0	0.16	2,810,258.0
2046	-	-	-	-	3,742.8	30,498.7	-	1,160.3	1,160.3	169.8	0.15	2,810,427.8
2047	-	-	-	-	3,443.4	26,885.5	-	1,067.4	1,067.4	147.1	0.14	2,810,574.9
2048	-	-	-	-	3,167.9	23,561.3	-	982.0	982.0	127.4	0.13	2,810,702.3
2049	-	-	-	-	2,914.5	20,503.0	-	903.5	903.5	110.4	0.12	2,810,812.7
2050	-	-	-	-	2,681.3	17,689.4	-	831.2	831.2	95.7	0.12	2,810,908.4
2051	-	-	-	-	2,466.8	15,100.9	-	764.7	764.7	82.9	0.11	2,810,991.3
2052	-	-	-	-	2,269.5	12,719.5	-	703.5	703.5	71.8	0.10	2,811,063.1
2053	-	-	-	-	2,087.9	10,528.5	-	647.3	647.3	62.2	0.10	2,811,125.3
2054	-	-	-	-	1,920.9	8,512.9	-	595.5	595.5	53.9	0.09	2,811,179.2
Total	**-**	**-**	**8,577,440.7**	**(598,955.0)**	**572,476.0**		**7,978,485.7**	**(2,481,539.1)**	**5,496,946.7**	**2,811,179.2**		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Boiler Refurbishment vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

C & E Refractories
PO Box 9
40 Hatheway Crescent
Saint John, N.B.
E2L 3X1
Phone: (506) 635-8803 Fax: (506) 672-6361
E-mail: cerefractories@nb.aibn.com

Aug 22nd 2014

Nova Scotia Power Inc.
108 Power Plant Road
Trenton, Nova Scotia
Canada B0K 1X0

Attention: **Peter Soley**

Our Reference#: JC2785-14

Peter, we are pleased to submit our quotation for the refractory work you require on the #5 Babcock & Wilcox Boiler, located at your facility in Trenton Nova Scotia

The work is to be confined to the following

Burners, these Burners (16 total) will have the existing refractory removed and replaced with a 2900 degree F 70% alumina castable refractory, reinforced using 3%ss Needles and anchored using 304ss V type.

Our price is based on working 10 shifts Monday through Friday and if any evenings, weekends or holidays are worked our price will be adjusted accordingly and extra charges will apply

C&E Refractories to supply the following

1. Equipment to remove and replace refractory
2. Refractory material for this project
3. Skilled masons to perform work
4. Helpers to assist our masons
5. Safety supplies for our men
6. Travel and living expense for our men

Nova Scotia Power to supply the following at no cost to C&E Refractories

1. Compressed air at 90psi
2. Electricity at 110 and 220 volt
3. Containers for and disposal of debris
4. Welding of anchors
5. Scaffold as required
6. Lunchroom and washroom facilities
7. Mixing station
8. Clean running water at normal yard pressure
9. Lock out and gas testing as required for safe entry
10. Hole-Watch as required for safe entry

Our price for above mentioned project is $[redacted] plus taxes.

Please note; should Nova Scotia Power decide to patch the damaged areas in each Burner, C&E Refractories would do this on a time and material basis.

Trusting the above mentioned meets with your approval we thank you for this opportunity to quote, and we look forward to working with you on this project.

Regards

Don Cole

CI Number: 46467

Title: LIN3 – Division Wall Replacement

Start Date: 2015/05
In-Service Date: 2015/06
Final Cost Date: 2015/12
Function: Steam
Forecast Amount: $635,747

DESCRIPTION:

The division walls are vertical tubes connected by membrane making up the walls around the combustor of the boiler. During the 2011 annual outage a section of the wall was found to be worn. Repairs were completed in order to allow the unit to operate until the next planned major outage scheduled for 2015. The 2011 repairs were not a permanent solution and this panel now needs to be replaced. This panel is 12 feet high and consists of 113 tubes.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

The division wall must be in working order, free of leaks in order for the boiler to operate. A known section of the wall is worn and if the boiler continues to run without replacing the panel past the 2015 planned outage, leaks will develop causing the unit to be taken off line.

Why do this project now?

The division wall panel on the west wall of the boiler has reached its minimum allowable wall thickness, and has been pad welded to allow the boiler to run until the planned major outage in 2015.

Why do this project this way?

Replacement of the division wall panel is the only option, as the repairs made to date are not permanent solutions and will compromise the reliability of the boiler if relied upon into the future.

CI Number : 46467 - LIN3 - Division Wall Replacement **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal Term Labour AO		2,882	0	2,882
095		095-Thermal & Hydro Contracts AO		41,216	0	41,216
095		095-Thermal Regular Labour AO		2,882	0	2,882
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	14,383	0	14,383
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	14,383	0	14,383
012	013	012 - Materials	013 - SGP - Boiler	100,000	0	100,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	460,000	0	460,000
			Total Cost:	635,747	0	635,747
			Original Cost:	195,200		

Capital Project Detailed Estimate

Location: **Lingan Generating Station**
CI# / FP#: 46467
Title: LIN3 Division Wall Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	62	$ 232	$ 14,383.31		
			Sub-Total	$ 14,383.31		
004 Term Labour						
Utilityworker	PD	62	$ 232	$ 14,383.31		
				$ -		
				$ -		
			Sub-Total	$ 14,383.31		
012 Materials						
Boiler Division Wall Panel	ea	1	$ 92,000	$ 92,000.00		
Misc. Consumables	ea	1	$ 8,000	$ 8,000.00		
			Sub-Total	$ 100,000.00		
013 Contracts						
Installation of Division Wall Panels	ea	1	$ 460,000	$ 460,000.00		43053 POT Waterwall
			Sub-Total	$ 460,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 2,882.42		
Thermal Term Labour AO				$ 2,882.42		
Thermal / Hydro Contracts AO				$ 41,216.00		
			Sub-Total	$ 46,980.84		
			SUB-TOTAL (no AO, AFUDC)	$ 588,766.61		
			TOTAL (AO, AFUDC included)	$ 635,747.45		
Original Cost				$ 195,199.68		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 Division Wall Replacement
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46467
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Division Wall Replacement vs. Avoided	6.19%	-1,829,580	1,312,794	1	38.67%	3.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

Completing the division wall replacement is a more economic option compared to incurring unplanned outages due to leaks.

Notes/Comments :

Division Wall Replacement vs. Avoided Repair and Replacement Energy Costs

This option compares replacing the division wall in 2015 versus relying on temporary repairs and dealing with unplanned outages due to leaks.

Test 2

Test 3

Test 4

LIN3 Division Wall Replacement
Summary of Sensitivities

Nova Scotia POWE
An Emera Compa

Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46467
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Division Wall Replacement vs. Avoided Repair an	6.19%	-1,829,580	1,312,794	1	38.67%	3.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Division Wall Replacement vs. Avoided Repair an	10%	-1,771,595	1,267,305	1	35.45%	4.1 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change: A	57,985	-45,489	0	-3.22%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Division Wall Replacement vs. Avoided Repair an	-10%	-1,588,637	1,136,026	1	35.12%	4.1 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change: A	240,943	-176,769	0	-3.55%	0.3 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	44,869	129,969	275,221	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN3 Division Wall Replacement
Avoided Cost Calculations

Division :	Power Production	Date :	27-Oct-14
Department :	Lingan Generating Station	CI Number:	46467
Originator :		Project No. :	

Division Wall Replacement vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			69,640	72,427		
Events/Outages (#)	1	2	1	2		
Probability of Occurance (%)	40%	50%	40%	50%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	80	80				
Totals	$20,253	$48,041	$27,856	$72,427	$48,109	$120,468
Total Capital Cost of Alternative						$635,747

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

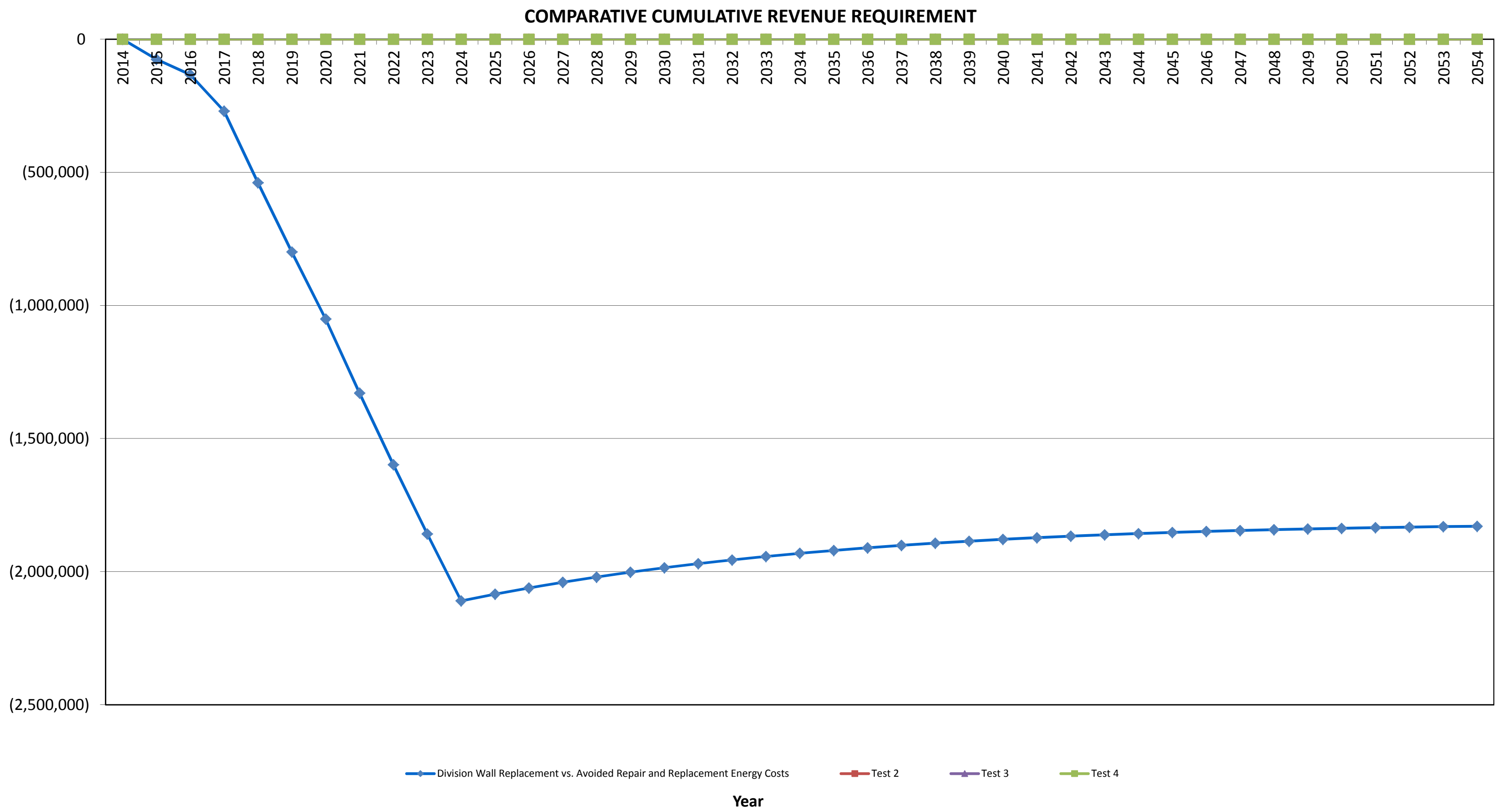
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN3 Division Wall Replacement
Division Wall Replacement vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	48,108.7	(588,766.6)	23,550.7	578,182.7	(540,657.9)	(7,613.0)	(548,270.9)	(516,311.2)	0.94	(516,311.2)
2016	-	-	120,468.2	-	45,217.3	530,800.5	120,468.2	(23,327.8)	97,140.4	86,145.5	0.89	(430,165.7)
2017	-	-	223,790.4	-	41,599.9	487,208.9	223,790.4	(56,479.1)	167,311.4	139,725.2	0.84	(290,440.6)
2018	-	-	410,634.0	-	38,271.9	447,104.7	410,634.0	(115,432.2)	295,201.7	232,158.4	0.79	(58,282.1)
2019	-	-	423,867.2	-	35,210.2	410,208.8	423,867.2	(120,483.7)	303,383.5	224,684.9	0.74	166,402.8
2020	-	-	437,566.1	-	32,393.3	376,264.5	437,566.1	(125,603.5)	311,962.5	217,570.8	0.70	383,973.6
2021	-	-	508,216.4	-	29,801.9	345,035.8	508,216.4	(148,308.5)	359,907.9	236,377.4	0.66	620,351.1
2022	-	-	524,734.6	-	27,417.7	316,305.4	524,734.6	(154,168.2)	370,566.4	229,190.7	0.62	849,541.8
2023	-	-	541,837.5	-	25,224.3	289,873.4	541,837.5	(160,150.1)	381,687.4	222,308.1	0.58	1,071,849.8
2024	-	-	559,546.9	-	23,206.4	265,556.0	559,546.9	(166,265.6)	393,281.3	215,708.4	0.55	1,287,558.3
2025	-	-	-	-	21,349.9	243,184.0	-	6,618.5	6,618.5	3,418.5	0.52	1,290,976.8
2026	-	-	-	-	19,641.9	222,601.7	-	6,089.0	6,089.0	2,961.7	0.49	1,293,938.5
2027	-	-	-	-	18,070.5	203,666.1	-	5,601.9	5,601.9	2,565.9	0.46	1,296,504.4
2028	-	-	-	-	16,624.9	186,245.2	-	5,153.7	5,153.7	2,223.1	0.43	1,298,727.5
2029	-	-	-	-	15,294.9	170,218.1	-	4,741.4	4,741.4	1,926.0	0.41	1,300,653.5
2030	-	-	-	-	14,071.3	155,473.1	-	4,362.1	4,362.1	1,668.6	0.38	1,302,322.1
2031	-	-	-	-	12,945.6	141,907.7	-	4,013.1	4,013.1	1,445.6	0.36	1,303,767.7
2032	-	-	-	-	11,909.9	129,427.5	-	3,692.1	3,692.1	1,252.5	0.34	1,305,020.2
2033	-	-	-	-	10,957.1	117,945.8	-	3,396.7	3,396.7	1,085.1	0.32	1,306,105.3
2034	-	-	-	-	10,080.6	107,382.6	-	3,125.0	3,125.0	940.1	0.30	1,307,045.4
2035	-	-	-	-	9,274.1	97,664.5	-	2,875.0	2,875.0	814.5	0.28	1,307,859.9
2036	-	-	-	-	8,532.2	88,723.8	-	2,645.0	2,645.0	705.6	0.27	1,308,565.5
2037	-	-	-	-	7,849.6	80,498.3	-	2,433.4	2,433.4	611.3	0.25	1,309,176.9
2038	-	-	-	-	7,221.7	72,930.9	-	2,238.7	2,238.7	529.7	0.24	1,309,706.5
2039	-	-	-	-	6,643.9	65,968.9	-	2,059.6	2,059.6	458.9	0.22	1,310,165.4
2040	-	-	-	-	6,112.4	59,563.8	-	1,894.8	1,894.8	397.6	0.21	1,310,562.9
2041	-	-	-	-	5,623.4	53,671.2	-	1,743.3	1,743.3	344.4	0.20	1,310,907.4
2042	-	-	-	-	5,173.5	48,250.0	-	1,603.8	1,603.8	298.4	0.19	1,311,205.8
2043	-	-	-	-	4,759.7	43,262.4	-	1,475.5	1,475.5	258.5	0.18	1,311,464.3
2044	-	-	-	-	4,378.9	38,673.9	-	1,357.5	1,357.5	224.0	0.17	1,311,688.3
2045	-	-	-	-	4,028.6	34,452.4	-	1,248.9	1,248.9	194.1	0.16	1,311,882.4
2046	-	-	-	-	3,706.3	30,568.7	-	1,148.9	1,148.9	168.1	0.15	1,312,050.5
2047	-	-	-	-	3,409.8	26,995.7	-	1,057.0	1,057.0	145.7	0.14	1,312,196.1
2048	-	-	-	-	3,137.0	23,708.5	-	972.5	972.5	126.2	0.13	1,312,322.3
2049	-	-	-	-	2,886.0	20,684.3	-	894.7	894.7	109.3	0.12	1,312,431.7
2050	-	-	-	-	2,655.2	17,902.0	-	823.1	823.1	94.7	0.12	1,312,526.4
2051	-	-	-	-	2,442.7	15,342.3	-	757.3	757.3	82.1	0.11	1,312,608.4
2052	-	-	-	-	2,247.3	12,987.4	-	696.7	696.7	71.1	0.10	1,312,679.5
2053	-	-	-	-	2,067.5	10,820.8	-	640.9	640.9	61.6	0.10	1,312,741.1
2054	-	-	-	-	1,902.1	8,827.6	-	589.7	589.7	53.4	0.09	1,312,794.5
Total	**-**	**-**	**3,798,770.0**	**(588,766.6)**	**566,892.0**		**3,210,003.4**	**(1,001,882.2)**	**2,208,121.2**	**1,312,794.5**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Division Wall Replacement vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46352

Title: TRE5 – Air Heater Refurbishment

Start Date: 2015/06
In-Service Date: 2015/10
Final Cost Date: 2016/04
Function: Steam
Forecast Amount: $527,994

DESCRIPTION:

This project includes the replacement of Air Heater components such as cold end baskets, cold end basket grids, circumferential sealing angle and seals related to the Trenton 5 Air Heater.

Air Heaters are directly in the Boiler gas pass and subjected to continuous use. These Air Heaters incorporate two layers of heat transferring elements referred to as hot-end baskets and cold-end baskets which act to recover energy and improve the operating efficiency of the unit. In order to efficiently operate an air heater of this design, metal seals are used to prevent air migration from the air stream to the gas stream during heat transfer. If an effective seal is not maintained, heat transfer is reduced, which yields a reduction in boiler efficiency and increased fuel consumption. As these operate within the hot flue gas flow of the boiler they are subject to the effects of heating and erosion. The frequency of repair is a function of operating hours, gas velocity and ash loading.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

The Air Heaters are part of the original design of the plant. Their function is to recover heat (transfer from outgoing flue gas to incoming combustion air). Air Heater performance deteriorates over operating time. Air Heater baskets wear out, seal clearances and integrity deteriorate and air heater drive components wear. Refurbishment is required to maintain the Air Heater in service and to maintain its effectiveness to transfer heat and have a positive effect on efficiency.

Why do this project now?

Regular assessment by NS Power and the OEM indicated the condition of the components is such that replacement is required at this time to ensure the reliability and performance of the generating unit. Risk profiling (compared to similar equipment in NS Power's fleet) provides guidance on the timing of refurbishment.

Why do this project this way?

As the Air Heater is situated in the Boiler Gas Pass, this work must be completed during a unit outage. Typically, the duration of the work is greater than 2 weeks (depending on scope). While investment needs to be optimized, it is not desirable to have an issue advance to critical between outage intervals. The deteriorated condition of the Air Heater components is such that they cannot be refurbished and replacement is the only option. Past refurbishment of these components has extended the life to this point but the current condition of these components requires replacement.

CI Number : 46352 - TRE5 Air Heater Refurbishments **Project Number**

Parent CI Number : -

Cost Centre : 340 - 340-Trenton Unit 5 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		4,891	0	4,891
095		095-Thermal & Hydro Contracts AO		12,768	0	12,768
095		095-Thermal Overtime Labour AO		4,228	0	4,228
095		095-Thermal Regular Labour AO		12,194	0	12,194
095		095-Thermal Term Labour AO		12,916	0	12,916
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	60,850	0	60,850
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	42,195	0	42,195
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	64,452	0	64,452
012	013	012 - Materials	013 - SGP - Boiler	169,000	0	169,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	75,000	0	75,000
013	087	013 - POWER PRODUCTION Contracts	087 Field Super.& Ops.	67,500	0	67,500
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	2,000	0	2,000
			Total Cost:	527,994	0	527,994
			Original Cost:	69,493		

Capital Project Detailed Estimate

Location: **Trenton Generating Station**
CI# / FP#: 46352
Title: TRE5 Air Heater Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	3	$ 346	$ 1,038.20		
Maintenance Trades	PD	150	$ 352	$ 52,852.32		
Utilityworker	PD	30	$ 232	$ 6,959.66		
			Sub-Total	$ 60,850.18		
002 OT Labour						
Maintenance Trades	PD	50	$ 705	$ 35,234.88		
Utilityworker	PD	15	$ 464	$ 6,959.66		
			Sub-Total	$ 42,194.54		
004 Term Labour						
Maintenance Trades	PD	150	$ 352	$ 52,852.32		
Utilityworker	PD	50	$ 232	$ 11,599.44		
			Sub-Total	$ 64,451.76		
012 Materials						
Cold End Baskets	lot	1	$ 115,000	$ 115,000.00		
Grids	lot	1	$ 24,000	$ 24,000.00		
Seals	lot	1	$ 15,000	$ 15,000.00		
Circumferential seal angles, misc steel	lot	1	$ 15,000	$ 15,000.00		
				$ -		
			Sub-Total	$ 169,000.00		
013 Contracts						
Contract Labour	PD	75	$ 1,000	$ 75,000.00		
Service supervisor	Lot	1	$ 50,000	$ 50,000.00		
External supervision	PD	25	$ 700	$ 17,500.00		
			Sub-Total	$ 142,500.00		
041 Meals & Entertainment						
Meals	Lot	1	$ 2,000.00	$ 2,000.00		
			Sub-Total	$ 2,000.00		
094 Interest Capitalized						
AFUDC				$ 4,891.19		
			Sub-Total	$ 4,891.19		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 12,194.38		
Thermal OT Labour AO				$ 4,227.89		
Thermal Term Labour AO				$ 12,916.13		
Thermal Contracts AO				$ 12,768.00		
			Sub-Total	$ 42,106.40		
			SUB-TOTAL (no AO, AFUDC)	$ 480,996.48		
			TOTAL (AO, AFUDC included)	$ 527,994.07		
Original Cost				$ 69,493.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

TRE5 – Air Heater Refurbishment
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Trenton Genrating Station	**CI Number:**	46352
Originator :	David Walker	**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Air Heater Refurbishment vs Avoided R	6.19%	-1,465,282	1,074,947	1	35.16%	3.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to perform air heater refurbishments based on favorable economic analysis results.

Notes/Comments :

Air Heater Refurbishment vs Avoided Repair and Replacement Energy Costs

This scenario measures the cost of refurbishments versus the replacement energy costs associated with an unplanned outage due to air heater failure. This model assumes a 50% chance of occurrence within the first year, increasing in probability thereafter. This model also assumes that, on average, the unplanned outage would be a full unit outage (160MW) which would last one week (168 hours) in order to complete repairs so that the unit can return to service.

Test 2

Test 3

Test 4

TRE5 – Air Heater Refurbishment
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Trenton Genrating Station	**CI Number:**	46352
Originator :	David Walker	**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Air Heater Refurbishment vs Avoided Repair and	6.19%	-1,465,282	1,074,947	1	35.16%	3.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Air Heater Refurbishment vs Avoided Repair and	10%	-1,416,826	1,037,324	1	31.84%	4.2 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
Change:	**A**	48,456	-37,623	0	-3.32%	0.4 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Air Heater Refurbishment vs Avoided Repair and	-10%	-1,270,298	929,829	1	31.50%	4.2 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
Change:	**A**	194,984	-145,118	0	-3.65%	0.4 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	PV of Revenue Requirement 1	PV of Revenue Requirement 2	PV of Revenue Requirement 3	Delay?
	A	113,404	214,492	314,742	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

TRE5 – Air Heater Refurbishment
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	Date :	30-Oct-14
Department :	Trenton Genrating Station	CI Number:	46352
Originator :	David Walker	Project No. :	

Air Heater Refurbishment vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			147,600	150,552		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	50%	60%	50%	60%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	160	160				
Duration (Hours)	168	168				
Totals	$47,792	$44,787	$73,800	$90,331	$121,592	$135,118
Total Capital Cost of Alternative						$527,994

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

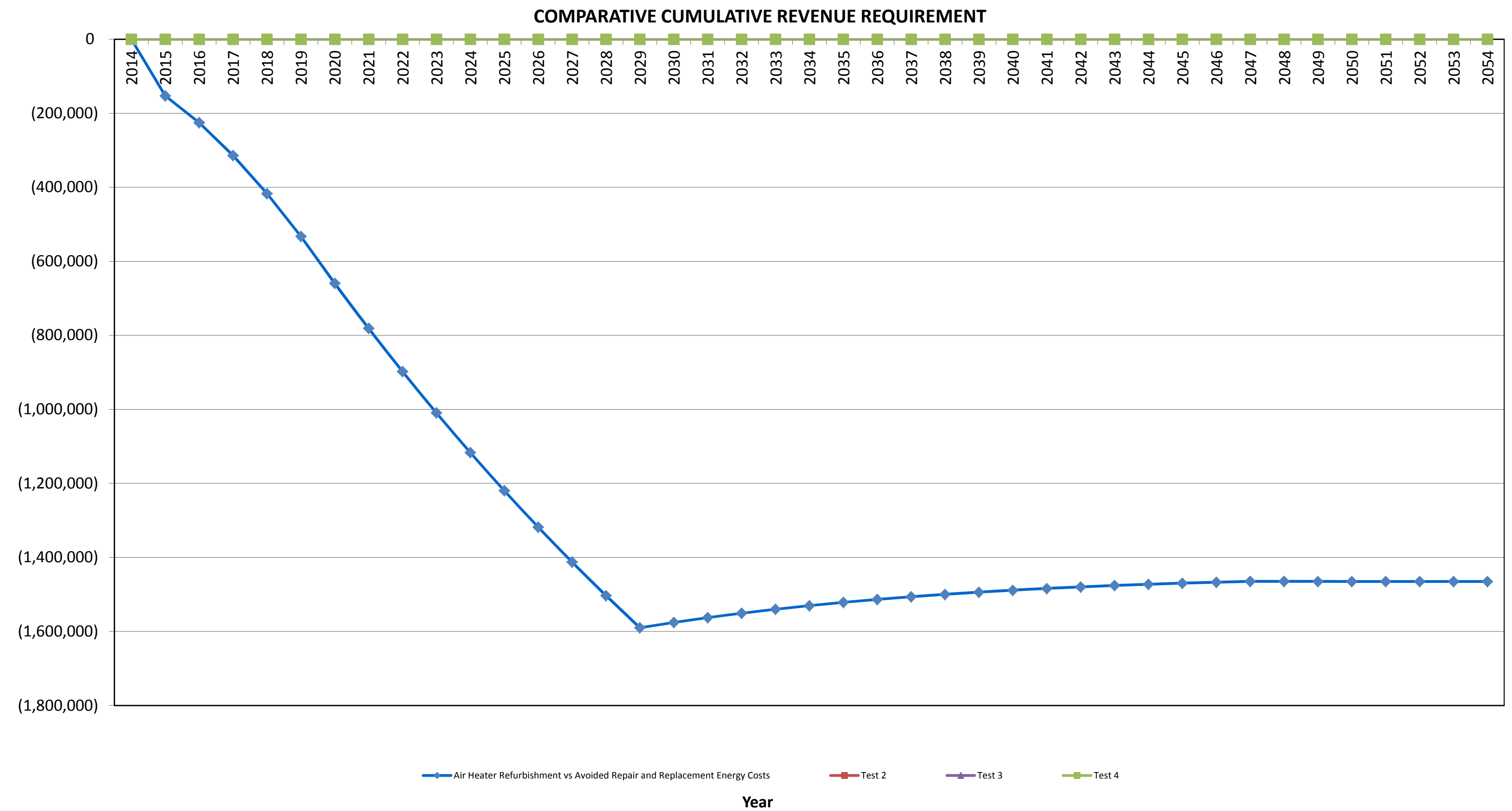
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

TRE5 – Air Heater Refurbishment

Air Heater Refurbishment vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	121,591.8	(485,887.7)	19,239.9	473,378.0	(364,295.9)	(31,729.1)	(396,025.0)	(372,940.0)	0.94	(372,940.0)
2016	-	-	135,117.9	-	36,940.5	434,497.2	135,117.9	(30,435.0)	104,682.9	92,834.3	0.89	(280,105.7)
2017	-	-	160,790.3	-	33,985.3	398,726.9	160,790.3	(39,309.5)	121,480.7	101,451.1	0.84	(178,654.6)
2018	-	-	187,435.5	-	31,266.5	365,818.2	187,435.5	(48,412.4)	139,023.1	109,333.3	0.79	(69,321.3)
2019	-	-	215,082.3	-	28,765.1	335,542.2	215,082.3	(57,758.3)	157,324.0	116,513.6	0.74	47,192.3
2020	-	-	243,759.9	-	26,463.9	307,688.2	243,759.9	(67,361.8)	176,398.2	123,024.7	0.70	170,217.0
2021	-	-	248,635.1	-	24,346.8	282,062.6	248,635.1	(69,529.4)	179,105.7	117,631.6	0.66	287,848.7
2022	-	-	253,607.8	-	22,399.1	258,487.1	253,607.8	(71,674.7)	181,933.1	112,523.4	0.62	400,372.0
2023	-	-	258,680.0	-	20,607.1	236,797.5	258,680.0	(73,802.6)	184,877.4	107,679.1	0.58	508,051.1
2024	-	-	263,853.6	-	18,958.6	216,843.2	263,853.6	(75,917.4)	187,936.1	103,079.9	0.55	611,131.0
2025	-	-	269,130.6	-	17,441.9	198,485.2	269,130.6	(78,023.5)	191,107.1	98,709.1	0.52	709,840.1
2026	-	-	274,513.2	-	16,046.5	181,595.8	274,513.2	(80,124.7)	194,388.6	94,551.2	0.49	804,391.3
2027	-	-	280,003.5	-	14,762.8	166,057.6	280,003.5	(82,224.6)	197,778.9	90,592.6	0.46	894,984.0
2028	-	-	285,603.6	-	13,581.8	151,762.4	285,603.6	(84,326.8)	201,276.8	86,820.7	0.43	981,804.6
2029	-	-	291,315.7	-	12,495.2	138,610.9	291,315.7	(86,434.3)	204,881.3	83,223.9	0.41	1,065,028.5
2030	-	-	-	-	11,495.6	126,511.5	-	3,563.6	3,563.6	1,363.2	0.38	1,066,391.7
2031	-	-	-	-	10,576.0	115,380.0	-	3,278.6	3,278.6	1,181.0	0.36	1,067,572.7
2032	-	-	-	-	9,729.9	105,139.0	-	3,016.3	3,016.3	1,023.2	0.34	1,068,595.9
2033	-	-	-	-	8,951.5	95,717.4	-	2,775.0	2,775.0	886.5	0.32	1,069,482.4
2034	-	-	-	-	8,235.4	87,049.4	-	2,553.0	2,553.0	768.0	0.30	1,070,250.4
2035	-	-	-	-	7,576.6	79,074.9	-	2,348.7	2,348.7	665.4	0.28	1,070,915.8
2036	-	-	-	-	6,970.4	71,738.4	-	2,160.8	2,160.8	576.5	0.27	1,071,492.3
2037	-	-	-	-	6,412.8	64,988.7	-	1,988.0	1,988.0	499.4	0.25	1,071,991.8
2038	-	-	-	-	5,899.8	58,779.1	-	1,828.9	1,828.9	432.7	0.24	1,072,424.5
2039	-	-	-	-	5,427.8	53,066.2	-	1,682.6	1,682.6	374.9	0.22	1,072,799.3
2040	-	-	-	-	4,993.6	47,810.4	-	1,548.0	1,548.0	324.8	0.21	1,073,124.1
2041	-	-	-	-	4,594.1	42,975.0	-	1,424.2	1,424.2	281.4	0.20	1,073,405.5
2042	-	-	-	-	4,226.6	38,526.4	-	1,310.2	1,310.2	243.8	0.19	1,073,649.3
2043	-	-	-	-	3,888.4	34,433.8	-	1,205.4	1,205.4	211.2	0.18	1,073,860.5
2044	-	-	-	-	3,577.4	30,668.5	-	1,109.0	1,109.0	183.0	0.17	1,074,043.5
2045	-	-	-	-	3,291.2	27,204.5	-	1,020.3	1,020.3	158.5	0.16	1,074,202.0
2046	-	-	-	-	3,027.9	24,017.6	-	938.6	938.6	137.3	0.15	1,074,339.4
2047	-	-	-	-	2,785.6	21,085.6	-	863.5	863.5	119.0	0.14	1,074,458.4
2048	-	-	-	-	2,562.8	18,388.2	-	794.5	794.5	103.1	0.13	1,074,561.5
2049	-	-	-	-	2,357.8	15,906.6	-	730.9	730.9	89.3	0.12	1,074,650.8
2050	-	-	-	-	2,169.1	13,623.5	-	672.4	672.4	77.4	0.12	1,074,728.2
2051	-	-	-	-	1,995.6	11,523.1	-	618.6	618.6	67.0	0.11	1,074,795.2
2052	-	-	-	-	1,836.0	9,590.7	-	569.1	569.1	58.1	0.10	1,074,853.3
2053	-	-	-	-	1,689.1	7,812.9	-	523.6	523.6	50.3	0.10	1,074,903.6
2054	-	-	-	-	1,554.0	6,177.3	-	481.7	481.7	43.6	0.09	1,074,947.2
Total	**-**	**-**	**3,489,120.7**	**(485,887.7)**	**463,125.9**		**3,003,233.1**	**(938,058.4)**	**2,065,174.7**	**1,074,947.2**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(200,000)
(400,000)
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2054
Air Heater Refurbishment vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

ALSTOM

Thermal Products
Air Preheater Company

Technical Service Report for
Nova Scotia Power
Trenton Unit #5
Trenton, Nova Scotia
How-0782 – (2) size 24 VIR Howden Air Preheaters
Visit Date: July 30 – August 24, 2012
Technical Representative: Frank R. Parise

The purpose of this service visit was to provide technical assistance with the inspection and repairs to Air Preheaters 5-1 & 5-2 on boiler #5. Both APH's 5-1 & 5-2 were not high pressured water washed before the start of this job. I arrived on site on July 30, 2012. Dion Antle, Jason Tait and Brian Noonan greeted me upon arrival. Before beginning the inspection I was able to discuss with plant personnel performance issues related to these particular units. The following report details my inspection findings and provides recommendations to improve the efficiency & reliability of these particular units while in operation. The information provided below pertains to both air preheaters unless otherwise specified.

<u>Inspection results & Worked Performed this Outage:</u>

APH 5-1 (cw from the hot end)

APH 5-2 (cw from the hot end)

Heat Transfer Elements:

Both APH's 5-1 & 5-2, the hot end baskets are in good serviceable condition. The hot end baskets were replaced in September 2010.

Both APH's 5-1 & 5-2 have the NF6 heat transfer elements in the cold end. The cold end elements remain in serviceable condition at this time. There is some noticeable pluggage in the "A" baskets on APH 5-2.

Rotor Structure:

Both APH's 5-1 & 5-2, the hot end rotor structure is in good condition with no hot end rotor diaphragm-to-rotor post, diaphragm-to-stay plate, or diaphragm-to-rotor shell cracks observed at this time. The stiffeners all seem to be in good serviceable condition.

The outer structure of APH's 5-1 & 5-2, including the supporting footpads is in serviceable condition.

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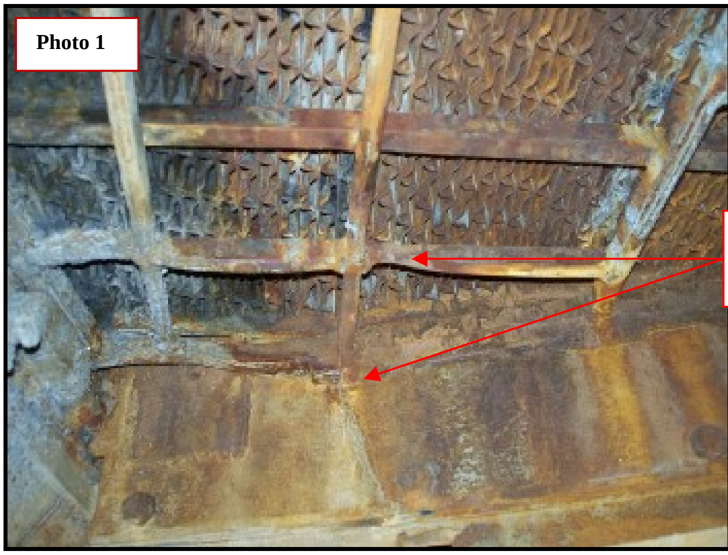
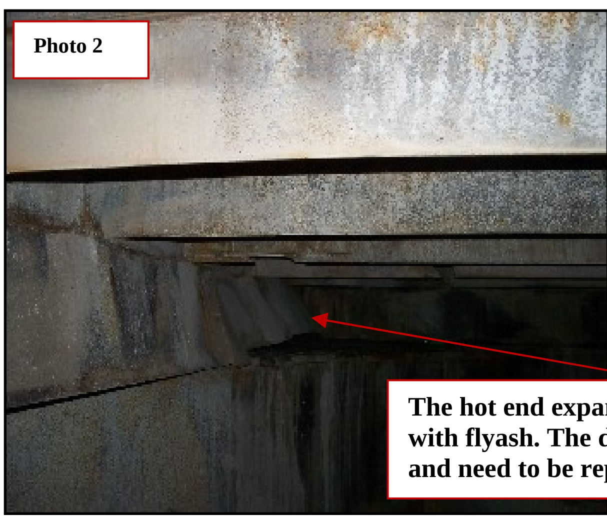
The cold end baskets support gratings and blocks were repaired this outage on APH's 5-1& 5-2 due to erosion from the swing arm soot blower. See **Photo 1. Recommend that the cold end basket support grating and blocks be replaced on APH's 5-1 & 5-2.**

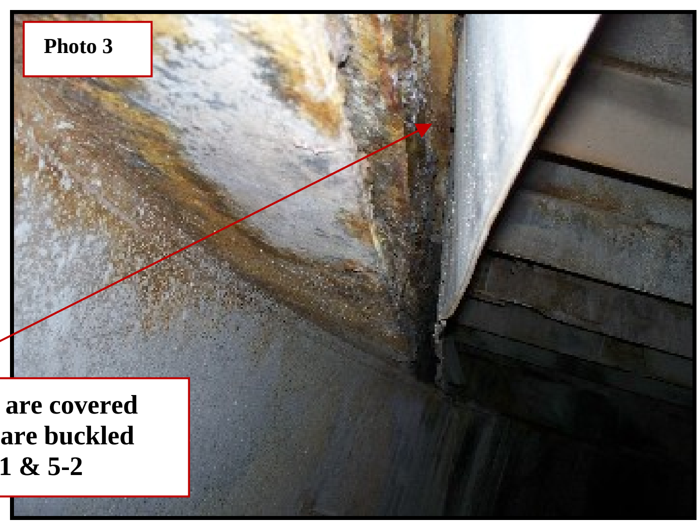


Severe erosion to the support gratings and blocks to APH's 5-1 & 5-2

Both APH's 5-1 & 5-2, there were no cold end rotor diaphragm-to-rotor post, diaphragm-to-stay plate, or diaphragm-to-rotor shell cracks observed at this time. The stiffeners all seem to be in good serviceable condition. There is some corrosion and erosion, seen at this time.

Both air preheaters 5-1 & 5-2, the hot end flue gas inlet duct expansion joint dust shields need to be removed to be able to clean all the flyash between the expansion joints bellows. See **Photo 2 & 3. Recommend inspecting the bellows for holes and any distortion that may be transferring duct-load onto the air preheater center section and/or connecting plate. Install new dust shields modified to try to prevent flyash buildups from occurring again.**





The hot end expansion joints are covered with flyash. The dust shields are buckled and need to be replaced to 5-1 & 5-2

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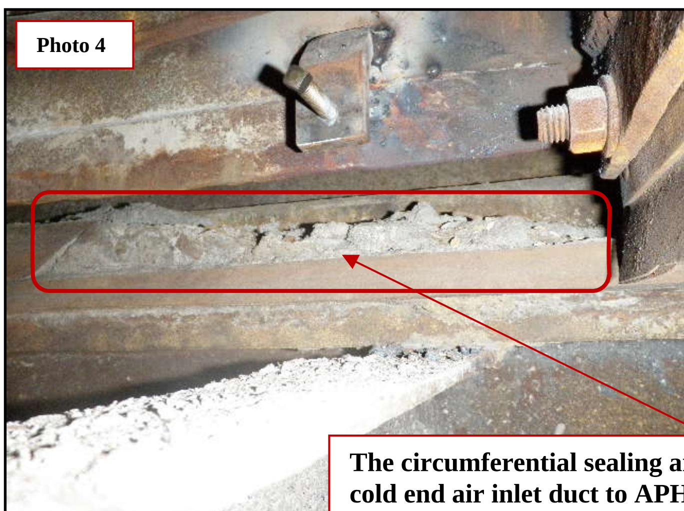
Rotor Seals:

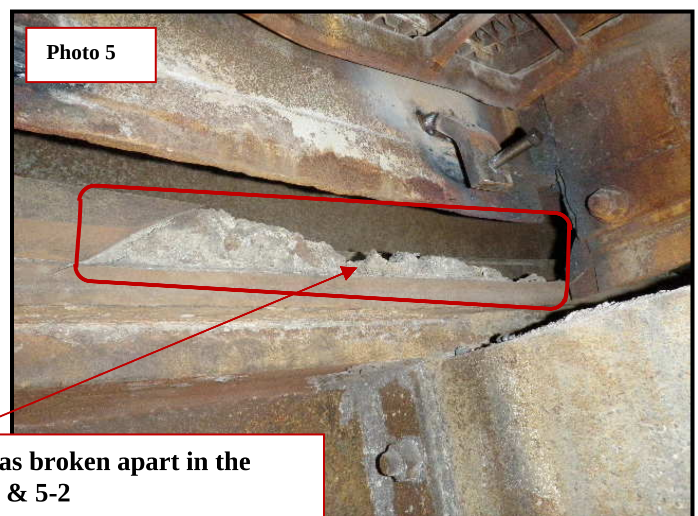
The hot end sector plate sealing surfaces on both APH's 5-1 & 5-2 are in serviceable condition. APH's 5-1 & 5-2, the hot end radial seals are in good serviceable condition and are set at the recommended seal setting specifications (inboard .180" and outboard .005").

The cold end sector plate sealing surfaces on both APH's 5-1 & 5-2 are in serviceable condition. The cold end radial seals are in good serviceable condition and are set at the recommended seal setting specifications (inboard.005" and outboard .309").

APH's 5-1 & 5-2, the hot end circumferential seals are in serviceable condition. There is moderate wear to the hot end circumferential sealing angle but remains in serviceable condition at this time to both APH's.

On APH's 5-1 & 5-2, the cold end circumferential sealing angle was found to be in poor to unsatisfactory condition. APH 5-1 the North/West corner of the sealing angle in the air inlet duct was worn out and had broken apart from the sector plate corner to center of the housing. APH 5-2 the North/East corner of the sealing angle in the air inlet duct was worn out and had broken apart from the sector plate corner to the center of the housing. See **Photo 4 & 5.** The rest of the sealing angle from the air inlet duct to the gas outlet duct has moderate wear. It was decided my Nova Scotia Power to make temporary repairs to the circumferential sealing angle due to the limited time that was available. A liner has been installed over the repaired area and the old sealing angle (sections of 6' feet long by 2" inches wide by 1/8" thick rolled carbon steel). The liner was seal welded at the top, bottom and joints.





The circumferential sealing angle has broken apart in the cold end air inlet duct to APH's 5-1 & 5-2

Photo 6

Cold end circumferential sealing angle liner installed on APH's 5-1 & 5-2

APH's 5-1 & 5-2, the hot end post seals are in serviceable condition.

APH's 5-1 & 5-2, the cold end post seals are in serviceable condition.

Soot Blower:

The (steam) swing arm cleaning device to both APH's 5-1 & 5-2 seem to be in serviceable condition. APH 5-1 the nozzle was replaced this outage. The travel to APH 5-2 swing arm cleaning device needs to be adjusted due to some pluggage observed in "A" baskets. APH 5-1 travel was set properly. **It is recommended that the sequence of operation and the steam pressure be checked when the unit is back online. High steam pressure (over 200 psi), moisture in the steam and blowing frequency will have adverse affects on the air preheater performance and reduce the life of APH's 5-1 & 5-2 heat transfer surface.**

Rotor Drive:

An external inspection was made to the rotor gearbox on APH's 5-1 & 5-2. The oil seems to be at the correct level on both APH's. The auxiliary air drives on both APH's were rebuilt this outage. The rotor started easily using the auxiliary air drive and coasted smoothly to a stop on both APH's. We did not operate the rotor drive using the main electric motor. **Recommend performing regular oil sampling/analysis on the rotor drive gearbox to the air preheaters.**

The pin rack assemblies and pinion gears on both APH's 5-1 & 5-2 were not inspected this outage. They were last inspected in Sept. 2009 and in serviceable conditions. There were no indications of any problems this outage**. Recommend inspecting the pin rack assemblies and pinion gears next outage.**

Rotor Bearings:

An external inspection of the rotor guide bearing on APH 5-1 did not find any indications of a problem to the lubrite bearing. The bearing was being cleaned and filled with high temperature grease.
An external inspection of the rotor guide bearing on APH 5-2 did not find any indications of a problem at this time. The oil was being changed this outage.

An external inspection of APH 5-1 rotor support bearing did not find any indications of a problem at this time. Internal inspection of this bearing is not practical without complete disassembly. The oil was being changed this outage to APH 5-1.

However, APH 5-2 the oil analysis report indicated a very high copper contamination, high zinc and extremely high particle count, indicating wearing of brass components. The support bearing was replaced this outage on APH 5-2.
The Support Bearing Assembly Drawing #E-1-01438 called for a SKF spherical thrust bearing (SKF RB #29476). The bearing that was installed was a FAG #29476.

After the installation of the bearing, packing assembly, thermocouple, oil piping and oil we rotated the rotor with the electric motor for about 20 minutes. The rotor rotated smoothly with no problems observed. The rotor coasted smoothly to a stop. I had the electrician check the amp draw. The max. amp draw to the motor nameplate was 8 amps. We recorded an amp draw average of about 3.5 amps.
The oil level was verified through the access cover on the top of the bearing cover due to the dipstick was misplaced. A new dipstick needed to be made. The oil level was at the max level per Support Bearing Assembly Drawing #E-1-01438. The min. level would be ¼" lower than the max.
New grade #8 bolts were installed and torqued to specifications for the bearing housing.
Recommend performing regular oil sampling/analysis on the rotor guide bearing and support bearings to the air preheaters.

APH's 5-1 & 5-2 was checked for levelness. A piece of angle iron (3" x 3" by 10" long) was bolted on to one of the hot end diaphragms so we could set the precision level on the lower leg of the angle iron. Readings recorded at points indicated, by the precision level. We referenced the level at a start point and recorded readings at subsequent points, recording plus (+) high and minus (-) low. The recorded readings are on pages 6 & 7.

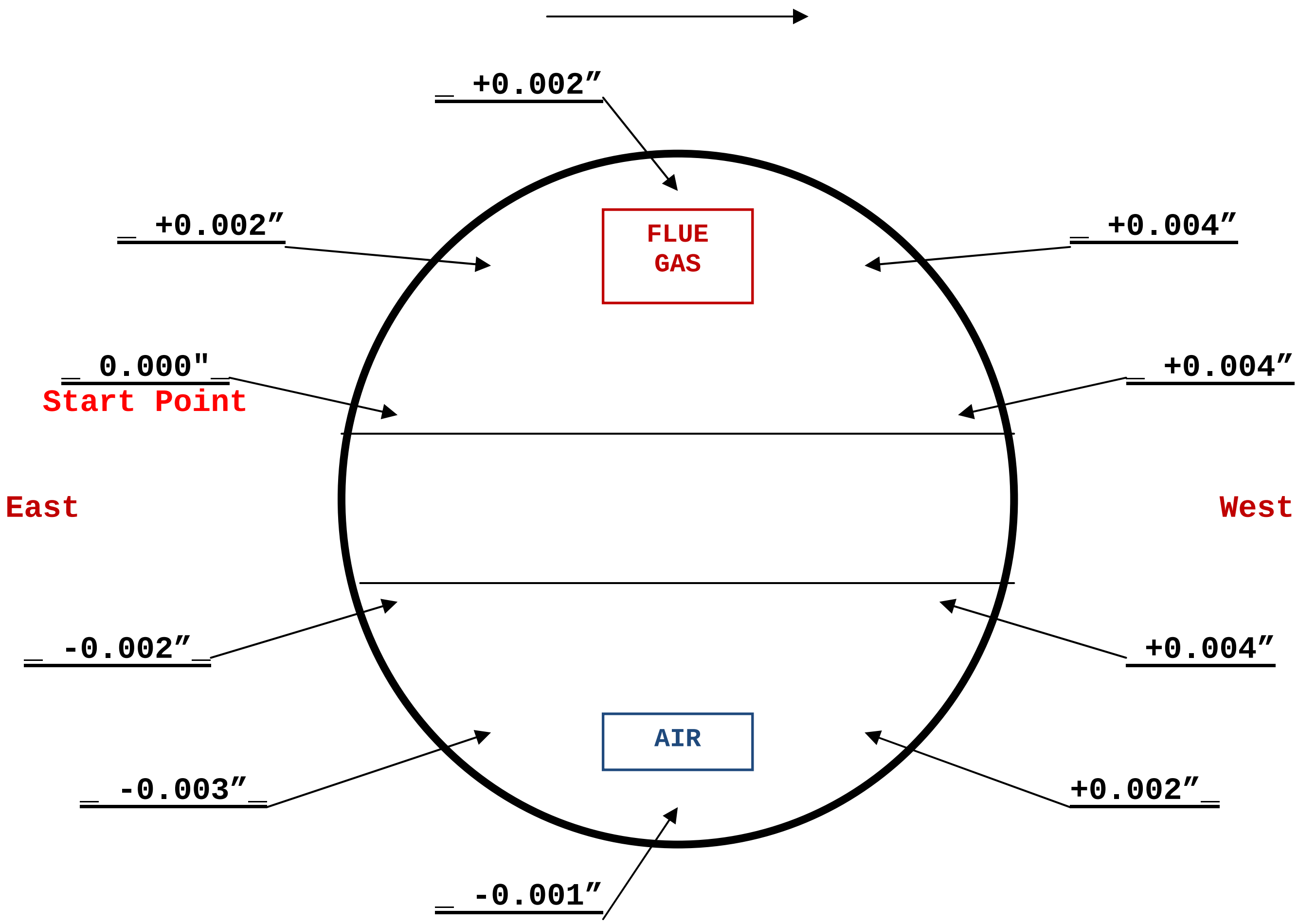
Ljungström AIR PREHEATER

INSPECTION RECORD
ROTOR LEVEL
VI

HOW-_0782   SERIAL NO.:______   APH:_5-1____

DATE:_7-31-2012   BY: __Frank R. Parise

ROTATION
as viewed from hot end



Readings recorded at points indicated, by precision level attached to a diaphragm. Referenced level at start and recorded readings at subsequent points, recording plus (+) high and minus (-) for low.

Total Allowable = _0.005"/Ft._ (new installation)

Actual = Total difference between highest and lowest readings divided by two = __.0035"/Ft.

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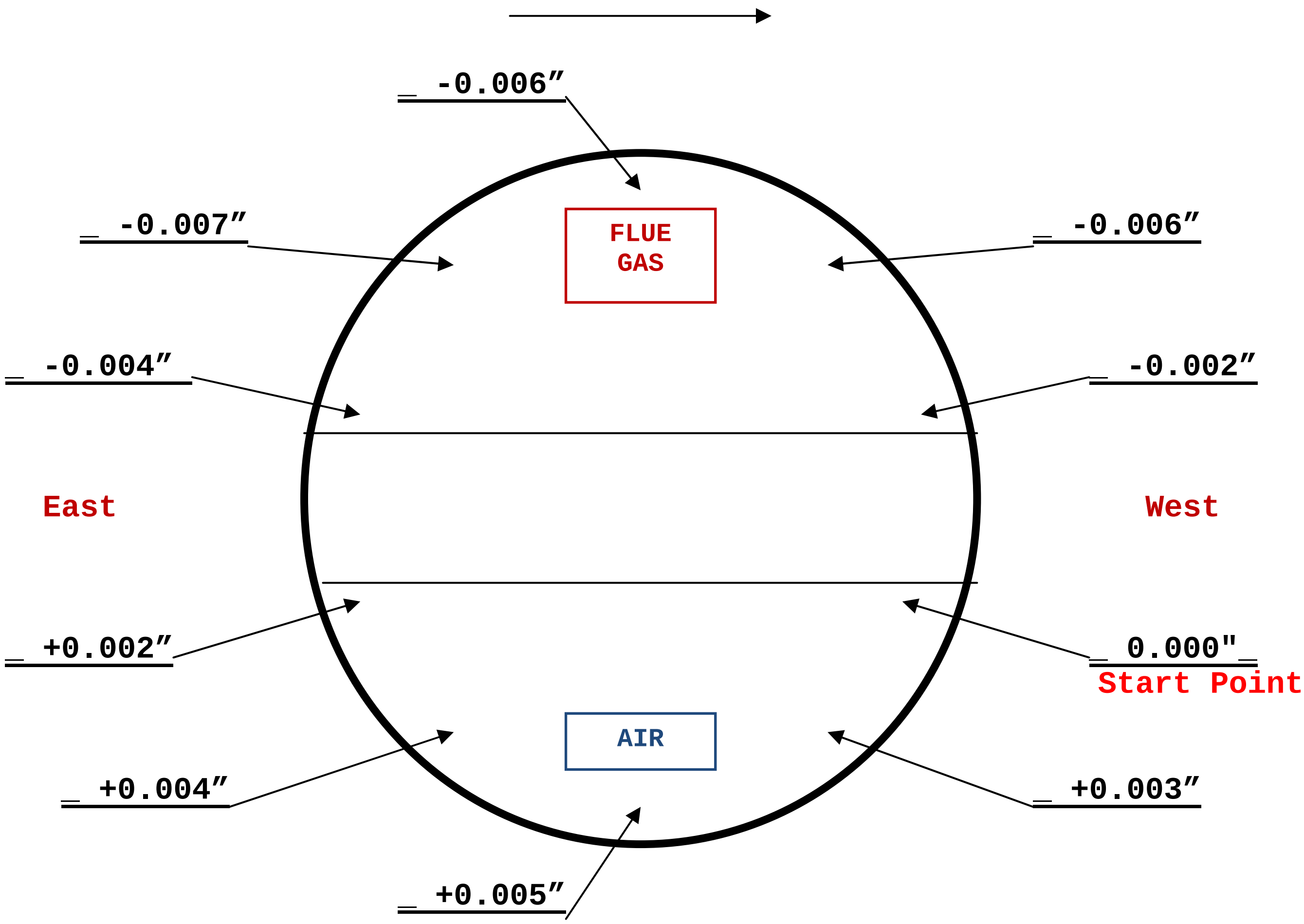
INSPECTION RECORD
ROTOR LEVEL
VI

HOW-0782 SERIAL NO.:______ APH: 5-2____

DATE: _7-31-2012 BY: __Frank R. Parise

ROTATION
as viewed from hot end



Readings recorded at points indicated, by precision level attached to a diaphragm. Referenced level at start and recorded readings at subsequent points, recording plus (+) high and minus (-) for low.

Total Allowable = _0.005"/Ft._ (new installation)

Actual = Total difference between highest and lowest readings divided by two = __0.006"/Ft._

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Future Outage Recommendations:

1) Replace the cold end support grating and blocks to APH's 5-1 & 5-2.

2) The hot end circumferential sealing angle has moderate wear to APH's 5-1 & 5-2. If the sealing angle gets worse than its current condition, recommend replacing it.

3) Temporary repairs were made and a liner was installed to the cold end circumferential sealing angle to APH's 5-1 & 5-2. Recommend inspecting the repairs next outage and replace the sealing angle at a future outage if needed to APH's 5-1 & 5-2.

4) Recommend that the sequence of operation and the steam pressure be checked on the cleaning device when the unit is back online. High steam pressure (over 200 psi), moisture in the steam and blowing frequency will have adverse affects on the air preheater performance and reduce the life of APH's 5-1 & 5-2 heat transfer surface.

5) Clean the expansion joint of flyash in the hot end gas inlet duct and inspect the bellows for holes and distortion that may be transferring duct-load onto the APH's center section and/or connecting plate. Install new dust shields modified to try to prevent flyash buildups from occurring again to APH's 5-1 & 5-2.

6) It is recommended to perform regular oil sampling/analysis on the rotor guide bearing, support bearing and main rotor drive gearbox to APH's 5-1 & 5-2.

7) Continue to maintain the air preheater as per the O&M Manual.

Thank you again for this opportunity to assist with the inspection and repairs of the air preheaters. If any questions should arise from the contents of this report feel free to contact our engineering staff at (585) 596-2700 or myself at any time. We greatly appreciate your business and look forward to assisting you with your future air preheater requirements.

Respectfully,

Frank R. Parise
Technical Advisor
Alstom Power, Inc.
Air Preheater Company
(586) 212-4909
frank.r.parise@power.alstom.com

CI Number: 46469

Title: LIN4 – Boiler Refurbishment 2015

Start Date: 2015/07
In-Service Date: 2015/07
Final Cost Date: 2015/12
Function: Steam
Forecast Amount: $501,938

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends and shields on the Lingan Unit 4 boiler as part of the planned outage in 2015. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs (+/- 2 years):
2013 CI 43165 LIN4 Boiler Refurbishment $690,490
2014 CI 44350 LIN4 Boiler Refurbishment 2014 $382,503
2016 CI TBD LIN4 Boiler Refurbishment 2016 $TBD
2017 CI TBD LIN4 Boiler Refurbishment 2017 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

On-going asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler Tube failures represent the industry's single largest source of outages for steam based generation. NS Power has a long history of managing this with comprehensive Boiler Inspection and Investment Programs to match the various failure mechanisms.

Why do this project now?

In order to mitigate the risk of an unplanned outage, annual boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete repairs or replacements. The annual planned outage duration will afford the time necessary to assess, locate and repair tubes and shields.

Why do this project this way?

Replacing deteriorated tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances.

CI Number : 46469 - LIN4 - Boiler Refurbishment 2015 **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		36,736	0	36,736
095		095-Thermal Term Labour AO		5,579	0	5,579
095		095-Thermal Regular Labour AO		465	0	465
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	2,320	0	2,320
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	27,839	0	27,839
012	013	012 - Materials	013 - SGP - Boiler	19,000	0	19,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	410,000	0	410,000
			Total Cost:	501,938	0	501,938
			Original Cost:	182,880		

Capital Project Detailed Estimate

Location: **Lingan Generating Station**
CI# / FP#: 46469
Title: LIN4 Boiler Refurbishment 2015
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	10	$ 232	$ 2,319.89		
			Sub-Total	$ 2,319.89		
004 Term Labour						
Utilityworker	PD	120	$ 232	$ 27,838.66		
			Sub-Total	$ 27,838.66		
012 Materials						
Boiler Tube	ea	1	$ 6,000	$ 6,000.00		
Boiler Shields	ea	1	$ 8,000	$ 8,000.00		
Misc. Consumables	ea	1	$ 5,000	$ 5,000.00		
			Sub-Total	$ 19,000.00		
013 Contracts						
Boiler Inspection & Refurbishment	ea	1	$ 410,000	$ 410,000.00		
			Sub-Total	$ 410,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 464.91		
Thermal Term Labour AO				$ 5,578.87		
Thermal / Hydro Contracts AO				$ 36,736.00		
			Sub-Total	$ 42,779.78		
			SUB-TOTAL (no AO, AFUDC)	$ 459,158.54		
			TOTAL (AO, AFUDC included)	$ 501,938.32		
Original Cost				$ 182,880.16		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN4 Boiler Refurbishment
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46469
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Boiler Refurbishment vs. Avoided Repa	6.19%	-1,080,330	744,931	1	54.43%	2.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to refurbish the boiler through tube leak repairs in order to avoid unplanned outages and related repair and replacement energy costs

Notes/Comments :

Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

This option compares refurbishing the boiler versus letting the boiler operate and dealing with tube failures as they arise.

Test 2

Test 3

Test 4

LIN4 Boiler Refurbishment
Summary of Sensitivities

Nova Scotia POWE
An Emera Compa

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46469
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	6.19%	-1,080,330	744,931	1	54.43%	2.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	10%	-1,035,180	709,455	1	48.16%	2.9 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
	A	45,150	-35,475	0	-6.27%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	-10%	-927,147	634,962	1	47.53%	2.9 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
	A	153,183	-109,969	0	-6.90%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	108,648	300,655	471,765	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN4 Boiler Refurbishment
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46469
Originator :		**Project No. :**	

Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			69,640	72,427		
Events/Outages (#)	1	2	1	2		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	80	80				
Totals	$46,853	$93,785	$69,640	$144,855	$116,493	$238,640
Total Capital Cost of Alternative						$501,938

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

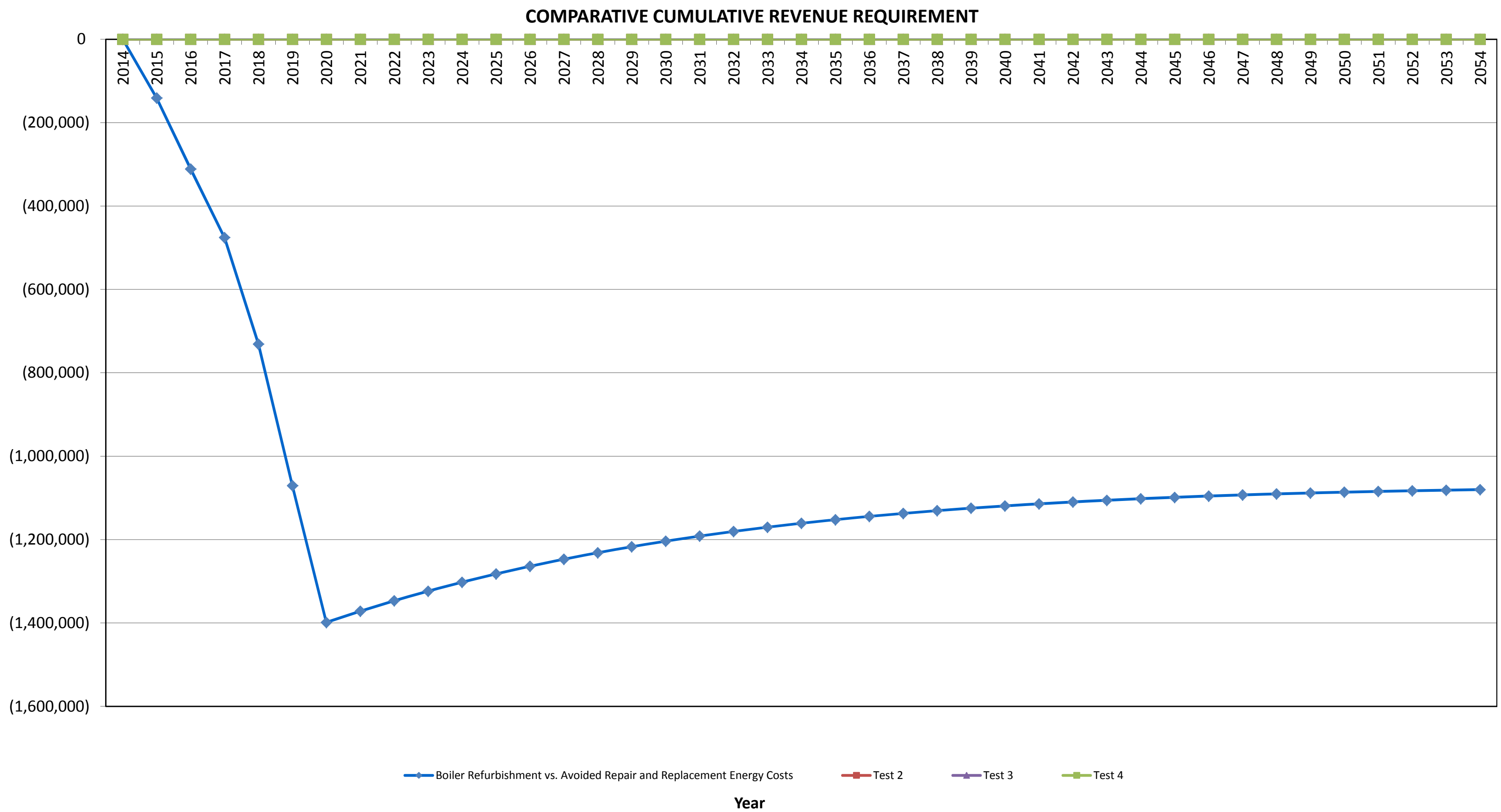
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN4 Boiler Refurbishment
Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	116,492.8	(459,158.5)	18,366.3	452,599.4	(342,665.7)	(30,419.2)	(373,084.9)	(351,337.2)	0.94	(351,337.2)
2016	-	-	238,639.5	-	35,263.4	415,364.8	238,639.5	(63,046.6)	175,592.9	155,718.3	0.89	(195,618.8)
2017	-	-	246,313.3	-	32,442.3	381,108.9	246,313.3	(66,300.0)	180,013.3	150,332.8	0.84	(45,286.1)
2018	-	-	381,384.9	-	29,846.9	349,593.4	381,384.9	(108,976.8)	272,408.1	214,232.6	0.79	168,946.6
2019	-	-	524,959.2	-	27,459.2	320,599.2	524,959.2	(154,225.0)	370,734.2	274,564.6	0.74	443,511.1
2020	-	-	541,985.2	-	25,262.4	293,924.6	541,985.2	(160,184.1)	381,801.2	266,278.1	0.70	709,789.3
2021	-	-	-	-	23,241.4	269,383.9	-	7,204.8	7,204.8	4,731.9	0.66	714,521.2
2022	-	-	-	-	21,382.1	246,806.5	-	6,628.5	6,628.5	4,099.6	0.62	718,620.8
2023	-	-	-	-	19,671.6	226,035.2	-	6,098.2	6,098.2	3,551.8	0.58	722,172.6
2024	-	-	-	-	18,097.8	206,925.7	-	5,610.3	5,610.3	3,077.2	0.55	725,249.8
2025	-	-	-	-	16,650.0	189,344.9	-	5,161.5	5,161.5	2,666.0	0.52	727,915.8
2026	-	-	-	-	15,318.0	173,170.6	-	4,748.6	4,748.6	2,309.7	0.49	730,225.5
2027	-	-	-	-	14,092.6	158,290.3	-	4,368.7	4,368.7	2,001.1	0.46	732,226.6
2028	-	-	-	-	12,965.2	144,600.3	-	4,019.2	4,019.2	1,733.7	0.43	733,960.3
2029	-	-	-	-	11,927.9	132,005.6	-	3,697.7	3,697.7	1,502.0	0.41	735,462.3
2030	-	-	-	-	10,973.7	120,418.4	-	3,401.9	3,401.9	1,301.3	0.38	736,763.6
2031	-	-	-	-	10,095.8	109,758.2	-	3,129.7	3,129.7	1,127.4	0.36	737,891.0
2032	-	-	-	-	9,288.1	99,950.9	-	2,879.3	2,879.3	976.8	0.34	738,867.7
2033	-	-	-	-	8,545.1	90,928.1	-	2,649.0	2,649.0	846.2	0.32	739,714.0
2034	-	-	-	-	7,861.5	82,627.1	-	2,437.1	2,437.1	733.2	0.30	740,447.1
2035	-	-	-	-	7,232.6	74,990.2	-	2,242.1	2,242.1	635.2	0.28	741,082.3
2036	-	-	-	-	6,654.0	67,964.3	-	2,062.7	2,062.7	550.3	0.27	741,632.6
2037	-	-	-	-	6,121.6	61,500.4	-	1,897.7	1,897.7	476.8	0.25	742,109.4
2038	-	-	-	-	5,631.9	55,553.7	-	1,745.9	1,745.9	413.1	0.24	742,522.4
2039	-	-	-	-	5,181.4	50,082.7	-	1,606.2	1,606.2	357.9	0.22	742,880.3
2040	-	-	-	-	4,766.9	45,049.4	-	1,477.7	1,477.7	310.0	0.21	743,190.3
2041	-	-	-	-	4,385.5	40,418.7	-	1,359.5	1,359.5	268.6	0.20	743,459.0
2042	-	-	-	-	4,034.7	36,158.5	-	1,250.7	1,250.7	232.7	0.19	743,691.7
2043	-	-	-	-	3,711.9	32,239.1	-	1,150.7	1,150.7	201.6	0.18	743,893.3
2044	-	-	-	-	3,414.9	28,633.2	-	1,058.6	1,058.6	174.7	0.17	744,068.0
2045	-	-	-	-	3,141.7	25,315.9	-	973.9	973.9	151.3	0.16	744,219.3
2046	-	-	-	-	2,890.4	22,263.9	-	896.0	896.0	131.1	0.15	744,350.4
2047	-	-	-	-	2,659.2	19,456.1	-	824.3	824.3	113.6	0.14	744,464.0
2048	-	-	-	-	2,446.4	16,872.9	-	758.4	758.4	98.4	0.13	744,562.4
2049	-	-	-	-	2,250.7	14,496.3	-	697.7	697.7	85.3	0.12	744,647.7
2050	-	-	-	-	2,070.7	12,309.9	-	641.9	641.9	73.9	0.12	744,721.6
2051	-	-	-	-	1,905.0	10,298.4	-	590.6	590.6	64.0	0.11	744,785.6
2052	-	-	-	-	1,752.6	8,447.8	-	543.3	543.3	55.4	0.10	744,841.0
2053	-	-	-	-	1,612.4	6,745.3	-	499.8	499.8	48.0	0.10	744,889.0
2054	-	-	-	-	1,483.4	5,178.9	-	459.9	459.9	41.6	0.09	744,930.7
Total	**-**	**-**	**2,049,774.9**	**(459,158.5)**	**442,099.3**		**1,590,616.4**	**(498,379.4)**	**1,092,236.9**	**744,930.7**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(200,000)
(400,000)
(600,000)
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46470

Title: LIN1 – Boiler Refurbishment 2015

Start Date:	2015/08
In-Service Date:	2015/08
Final Cost Date:	2015/12
Function:	Steam
Forecast Amount:	$496,369

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends and shields on the Lingan Unit 1 boiler as part of the planned outage in 2015. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs (+/- 2 years):
2013 CI 41235 LIN1 Boiler Refurbishment $823,038
2014 CI 43164 LIN1 Boiler Refurbishment $224,974
2016 CI TBD LIN1 Boiler Refurbishment 2016 $TBD
2017 CI TBD LIN1 Boiler Refurbishment 2017 $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

On-going asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler Tube failures represent the industry's single largest source of outages for steam based generation. NS Power has a long history of managing this with comprehensive Boiler Inspection and Investment Programs to match the various failure mechanisms.

Why do this project now?

In order to mitigate the risk of an unplanned outage, annual boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete repairs or replacements. The annual planned outage duration will afford the time necessary to assess, locate and repair tubes and shields.

Why do this project this way?

Replacing deteriorated tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances.

CI Number : 46470 - LIN1 - Boiler Refurbishment 2015

Project Number

Parent CI Number : -

Cost Centre : 304 - 304-Lingan 1&2 Prod. Unit

Budget Version 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal Regular Labour AO		465	0	465
095		095-Thermal Term Labour AO		4,649	0	4,649
095		095-Thermal & Hydro Contracts AO		36,736	0	36,736
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	2,320	0	2,320
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	23,199	0	23,199
012	013	012 - Materials	013 - SGP - Boiler	19,000	0	19,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	410,000	0	410,000
			Total Cost:	496,369	0	496,369
			Original Cost:	127,320		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 46470
Title: LIN1 Boiler Refurbishment 2015
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	10	$ 232	$ 2,319.89		
			Sub-Total	$ 2,319.89		
004 Term Labour						
Utilityworker	PD	100	$ 232	$ 23,198.88		43161 LIN1 Boiler Refurbishment 2014
				$ -		
				$ -		
			Sub-Total	$ 23,198.88		
012 Materials						
Boiler Tube	ea	1	$ 6,000	$ 6,000.00		
Boiler Sheilds	ea	1	$ 8,000	$ 8,000.00		
Misc. Consumables	ea	1	$ 5,000	$ 5,000.00		
			Sub-Total	$ 19,000.00		
013 Contracts						
Boiler Inspection & Refurbishment	ea	1	$ 410,000	$ 410,000.00		43161 LIN1 Boiler Refurbishment 2014
			Sub-Total	$ 410,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 464.91		
Thermal Term Labour AO				$ 4,649.06		
Thermal / Hydro Contracts AO				$ 36,736.00		
			Sub-Total	$ 41,849.97		
			SUB-TOTAL (no AO, AFUDC)	$ 454,518.77		
			TOTAL (AO, AFUDC included)	$ 496,368.74		
Original Cost				$ 127,319.98		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN1 Boiler Refurbishment
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**16-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46470
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank (based on PV of RR)**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repa	6.19%	-667,023	457,483	1	45.45%	2.5 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to refurbish the boiler through tube repairs in order to avoid unplanned outages and related repair and replacement energy costs

Notes/Comments :

Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

This option compares replacing the boiler components as part of this refurbishment versus dealing with the expected tube leaks through unplanned outages.

Test 2

Test 3

Test 4

LIN1 Boiler Refurbishment
Summary of Sensitivities

Division :	Power Production	**Date :**	**16-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46470
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	6.19%	-667,023	457,483	1	45.45%	2.5 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	10%	-620,394	422,366	1	39.04%	2.7 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:					
A	46,629	-35,117	0	-6.41%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	-10%	-553,692	376,618	1	38.40%	2.7 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:					
A	113,331	-80,865	0	-7.05%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	**PV of Revenue Requirement**	**PV of Revenue Requirement**	**PV of Revenue Requirement**	**Delay?**
Yrs Delay:	1	2	3	
A	100,852	268,803	505,880	No
B	0	0	0	No
C	0	0	0	No
D	0	0	0	No

LIN1 Boiler Refurbishment
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**16-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46470
Originator :		**Project No. :**	

Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			69,640	72,427		
Events/Outages (#)	1	2	1	2		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	80	80				
Totals	$38,494	$65,828	$69,640	$144,855	$108,134	$210,683
Total Capital Cost of Alternative						$496,369

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

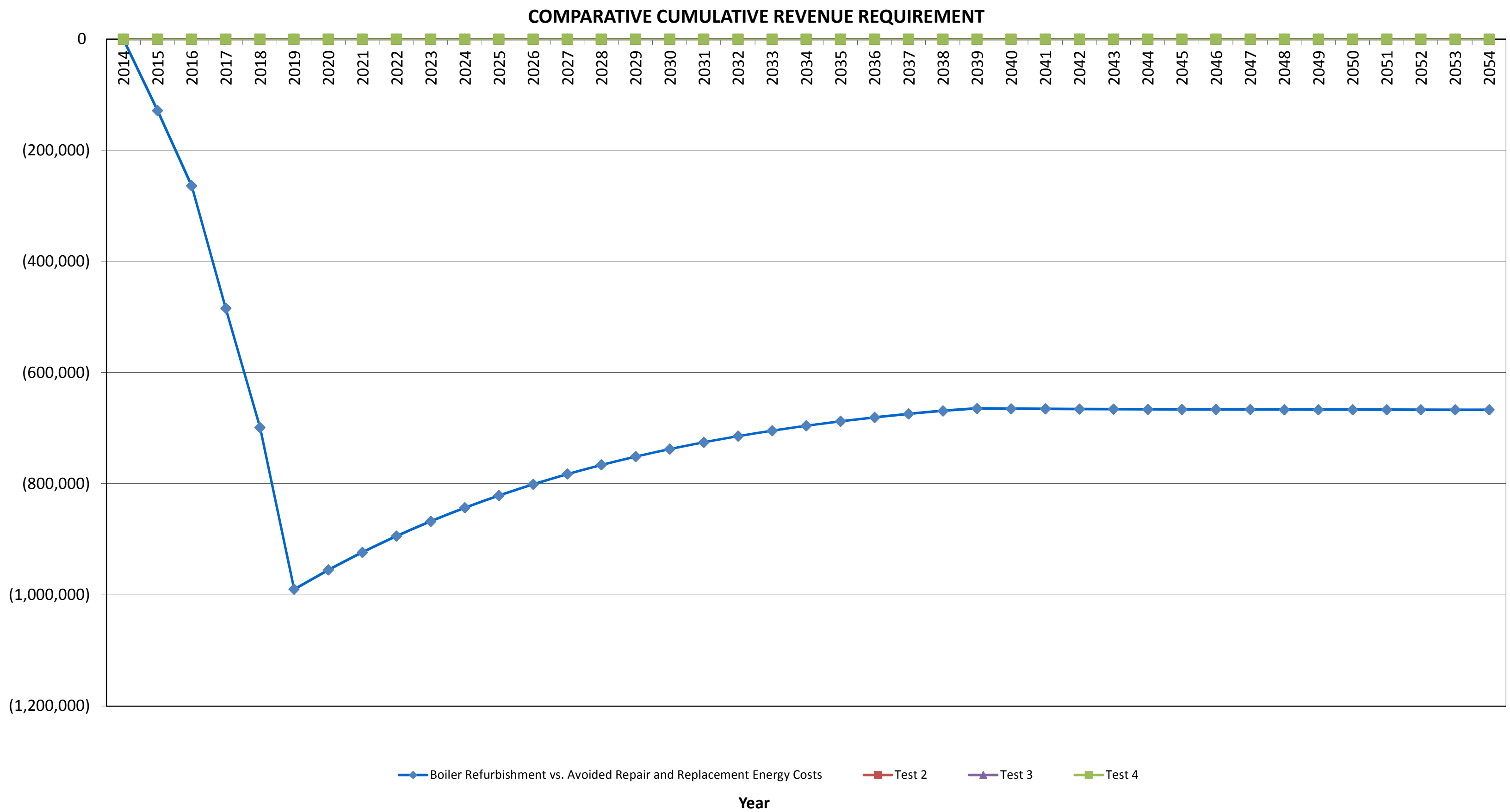
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN1 Boiler Refurbishment

Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	108,134.0	(454,518.8)	18,180.8	447,888.6	(346,384.7)	(27,885.5)	(374,270.2)	(352,453.4)	0.94	(352,453.4)
2016	-	-	210,682.7	-	34,907.0	411,053.1	210,682.7	(54,490.5)	156,192.2	138,513.5	0.89	(213,939.8)
2017	-	-	326,696.0	-	32,114.5	377,164.5	326,696.0	(91,320.3)	235,375.7	196,567.1	0.84	(17,372.8)
2018	-	-	337,755.5	-	29,545.3	345,986.9	337,755.5	(95,545.2)	242,210.4	190,483.9	0.79	173,111.1
2019	-	-	465,623.2	-	27,181.7	317,303.6	465,623.2	(135,916.9)	329,706.3	244,179.5	0.74	417,290.6
2020	-	-	-	-	25,007.2	290,914.9	-	7,752.2	7,752.2	5,406.6	0.70	422,697.2
2021	-	-	-	-	23,006.6	266,637.3	-	7,132.0	7,132.0	4,684.1	0.66	427,381.3
2022	-	-	-	-	21,166.1	244,301.9	-	6,561.5	6,561.5	4,058.2	0.62	431,439.5
2023	-	-	-	-	19,472.8	223,753.4	-	6,036.6	6,036.6	3,515.9	0.58	434,955.4
2024	-	-	-	-	17,915.0	204,848.7	-	5,553.6	5,553.6	3,046.1	0.55	438,001.5
2025	-	-	-	-	16,481.8	187,456.4	-	5,109.3	5,109.3	2,639.0	0.52	440,640.5
2026	-	-	-	-	15,163.2	171,455.5	-	4,700.6	4,700.6	2,286.4	0.49	442,926.9
2027	-	-	-	-	13,950.2	156,734.6	-	4,324.5	4,324.5	1,980.9	0.46	444,907.8
2028	-	-	-	-	12,834.1	143,191.5	-	3,978.6	3,978.6	1,716.2	0.43	446,623.9
2029	-	-	-	-	11,807.4	130,731.8	-	3,660.3	3,660.3	1,486.8	0.41	448,110.8
2030	-	-	-	-	10,862.8	119,268.8	-	3,367.5	3,367.5	1,288.1	0.38	449,398.9
2031	-	-	-	-	9,993.8	108,722.9	-	3,098.1	3,098.1	1,116.0	0.36	450,514.9
2032	-	-	-	-	9,194.3	99,020.7	-	2,850.2	2,850.2	966.9	0.34	451,481.8
2033	-	-	-	-	8,458.7	90,094.6	-	2,622.2	2,622.2	837.7	0.32	452,319.5
2034	-	-	-	-	7,782.0	81,882.7	-	2,412.4	2,412.4	725.7	0.30	453,045.2
2035	-	-	-	-	7,159.5	74,327.6	-	2,219.4	2,219.4	628.8	0.28	453,674.0
2036	-	-	-	-	6,586.7	67,377.0	-	2,041.9	2,041.9	544.7	0.27	454,218.8
2037	-	-	-	-	6,059.8	60,982.5	-	1,878.5	1,878.5	471.9	0.25	454,690.7
2038	-	-	-	-	5,575.0	55,099.5	-	1,728.3	1,728.3	408.9	0.24	455,099.6
2039	-	-	-	-	5,129.0	49,687.1	-	1,590.0	1,590.0	354.2	0.22	455,453.8
2040	-	-	-	-	4,718.7	44,707.7	-	1,462.8	1,462.8	306.9	0.21	455,760.7
2041	-	-	-	-	4,341.2	40,126.7	-	1,345.8	1,345.8	265.9	0.20	456,026.6
2042	-	-	-	-	3,993.9	35,912.2	-	1,238.1	1,238.1	230.4	0.19	456,257.0
2043	-	-	-	-	3,674.4	32,034.8	-	1,139.1	1,139.1	199.6	0.18	456,456.6
2044	-	-	-	-	3,380.4	28,467.6	-	1,047.9	1,047.9	172.9	0.17	456,629.5
2045	-	-	-	-	3,110.0	25,185.8	-	964.1	964.1	149.8	0.16	456,779.3
2046	-	-	-	-	2,861.2	22,166.6	-	887.0	887.0	129.8	0.15	456,909.1
2047	-	-	-	-	2,632.3	19,388.8	-	816.0	816.0	112.4	0.14	457,021.5
2048	-	-	-	-	2,421.7	16,833.3	-	750.7	750.7	97.4	0.13	457,119.0
2049	-	-	-	-	2,228.0	14,482.3	-	690.7	690.7	84.4	0.12	457,203.4
2050	-	-	-	-	2,049.7	12,319.3	-	635.4	635.4	73.1	0.12	457,276.5
2051	-	-	-	-	1,885.8	10,329.3	-	584.6	584.6	63.4	0.11	457,339.8
2052	-	-	-	-	1,734.9	8,498.6	-	537.8	537.8	54.9	0.10	457,394.7
2053	-	-	-	-	1,596.1	6,814.3	-	494.8	494.8	47.6	0.10	457,442.3
2054	-	-	-	-	1,468.4	5,264.8	-	455.2	455.2	41.2	0.09	457,483.5
Total	**-**	**-**	**1,448,891.4**	**(454,518.8)**	**437,631.9**		**994,372.6**	**(313,490.4)**	**680,882.2**	**457,483.5**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46463

Title: LIN3 – Air Heater Refurbishment

Start Date: 2015/04
In-Service Date: 2015/05
Final Cost Date: 2015/11
Function: Steam
Forecast Amount: $477,566

DESCRIPTION:

This project includes the replacement of Air Heater components such as hot end baskets, cold end baskets, and seals related to the Lingan Unit #3 air heater.

Air Heaters are directly in the Boiler gas pass and subjected to continuous use. These Air Heaters incorporate two layers of heat transferring elements referred to as hot-end baskets and cold-end baskets which act to recover energy and improve the operating efficiency of the unit. In order to efficiently operate an air heater of this design, metal seals are used to prevent air migration from the air stream to the gas stream during heat transfer. If an effective seal is not maintained, heat transfer is reduced, which yields a reduction in boiler efficiency and increased fuel consumption. As these operate within the hot flue gas flow of the boiler they are subject to the effects of heating and erosion. The frequency of repair is a function of operating hours, gas velocity and ash loading.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

The air heaters are part of the original design of the plant. Their function is to recover heat (transfer from outgoing flue gas to incoming combustion air). Air Heater performance deteriorates over operating time. Air Heater baskets wear out, seal clearances and integrity deteriorate and air heater drive components wear. Refurbishment is required to maintain the Air Heater in service and to maintain its effectiveness to transfer heat and have a positive effect on efficiency.

Why do this project now?

Regular assessment by NS Power and the OEM indicated the condition of the components is such that replacement is required at this time to ensure the reliability and performance of the generating unit. Risk profiling (compared to similar equipment in NS Power's fleet) provides guidance on the timing of refurbishment.

Why do this project this way?

As the Air Heater is situated in the Boiler Gas Pass, this work must be completed during a unit outage. Typically, the duration of the work is greater than 2 weeks (depending on scope). It is not desirable to have an issue advance to critical between outage intervals. The deteriorated condition of the Air Heater components is such that they cannot be refurbished and replacement is the only option.

CI Number : 46463 - LIN3 - Air Heater Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		4,301	0	4,301
095		095-Thermal Regular Labour AO		3,754	0	3,754
095		095-Thermal Term Labour AO		12,228	0	12,228
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	18,734	0	18,734
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	61,016	0	61,016
012	013	012 - Materials	013 - SGP - Boiler	329,534	0	329,534
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	48,000	0	48,000
			Total Cost:	477,566	0	477,566
			Original Cost:	362,530		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 46463
Title: LIN3 Air Heater Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Maintenance Trades	PD	40	$ 352	$ 14,093.95		
Utilityworker	PD	20	$ 232	$ 4,639.78		
			Sub-Total	$ 18,733.73		
004 Term Labour						
Maintenance Trades	PD	160	$ 352	$ 56,375.81		
Utilityworker	PD	20	$ 232	$ 4,639.78		
			Sub-Total	$ 61,015.58		
012 Materials						
Hot End Baskets	ea	1	[redacted]		Cost Support Item #1 - Inflation at 2% per year, @ $0.92 USD	
Cold End Baskets	ea	1	$ 100,000	$ 100,000.00		
Seals	ea	1	[redacted]			
Misc. Materials	ea	1	$ 10,000	$ 10,000.00		
			Sub-Total	$ 329,533.74		
013 Contracts						
Air Heater Tech. Advisor	wks	4	$ 12,000	$ 48,000.00		
			Sub-Total	$ 48,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 3,754.24		
Thermal Term Labour AO				$ 12,227.52		
Thermal / Hydro Contracts AO				$ 4,300.80		
			Sub-Total	$ 20,282.56		
			SUB-TOTAL (no AO, AFUDC)	$ 457,283.05		
			TOTAL (AO, AFUDC included)	$ 477,565.61		
Original Cost				$ 362,529.83		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 Air Heater Refurbishment
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production		**Date :**	**30-Oct-14**
Department :	Lingan Generating Station		**CI Number:**	46463
Originator :			**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Air Heater Refurbishment vs. Avoided R	6.19%	-779,426	546,554	1	28.54%	4.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

The option to refurbish the Air Heater is more economic than dealing with the associated costs of not completing this refurbishment. The PV of Revenue Requirement supports this.

Notes/Comments :

Air Heater Refurbishment vs. Avoided Repair and Replacement Energy Costs

This options compares completing the refurbishment vs the avoided repair and replacement energy costs associated with an unplanned failure of the air heater baskets or seals.

Test 2

Test 3

Test 4

LIN3 Air Heater Refurbishment
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46463
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Air Heater Refurbishment vs. Avoided Repair and	6.19%	-779,426	546,554	1	28.54%	4.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Air Heater Refurbishment vs. Avoided Repair and	10%	-734,244	511,223	1	25.46%	5.2 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change: A	45,182	-35,331	0	-3.08%	0.4 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Air Heater Refurbishment vs. Avoided Repair and	-10%	-656,301	456,568	1	25.15%	5.2 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change: A	123,124	-89,986	0	-3.39%	0.4 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	81,458	159,443	238,785	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN3 Air Heater Refurbishment
Avoided Cost Calculations

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46463
Originator :		**Project No. :**	

Air Heater Refurbishment vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			66,453	69,127		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	40%	50%	40%	50%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	240	240				
Totals	$60,758	$72,061	$26,581	$34,564	$87,339	$106,625
Total Capital Cost of Alternative						$477,566

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

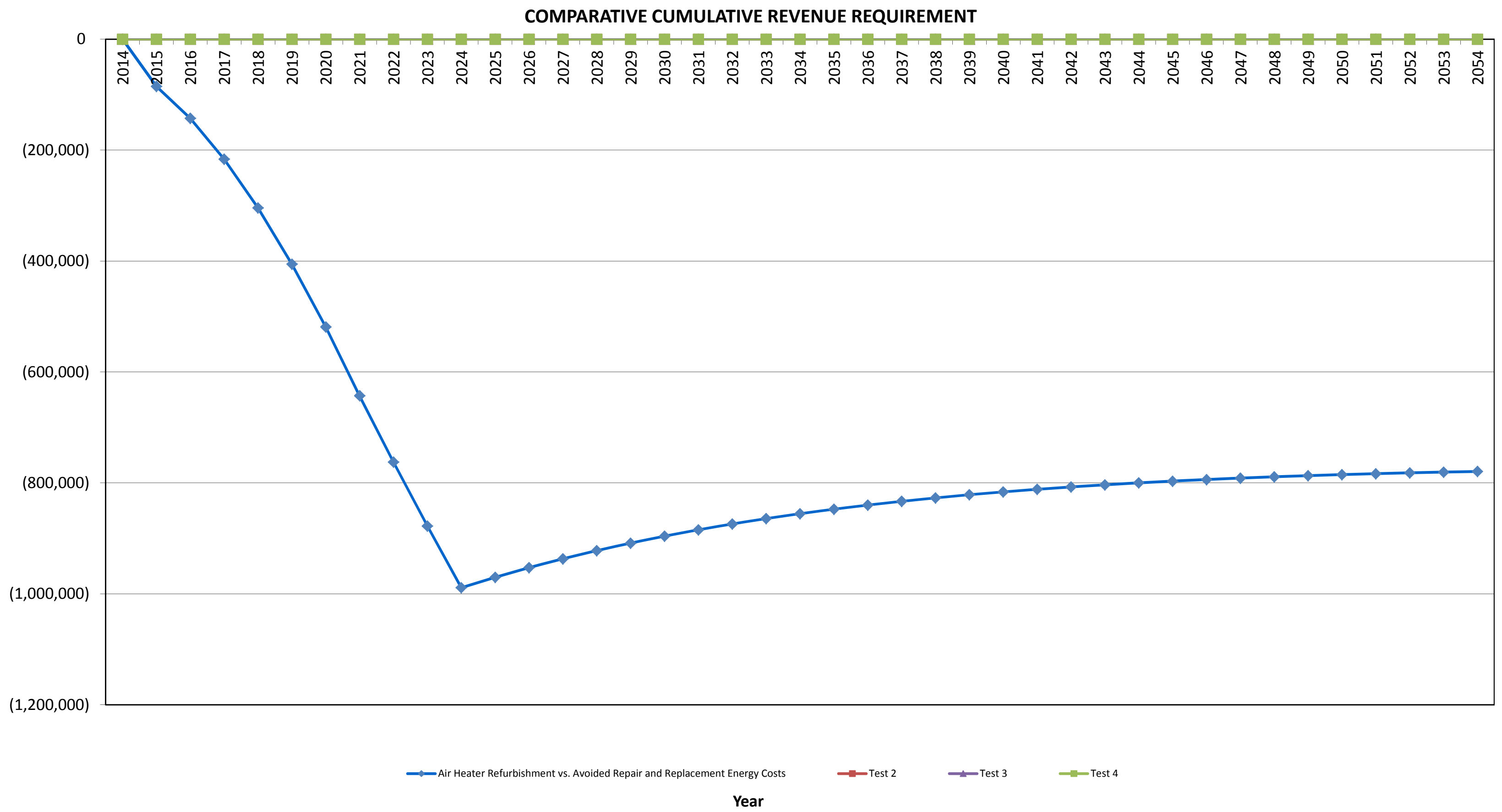
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN3 Air Heater Refurbishment
Air Heater Refurbishment vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	87,339.3	(457,283.1)	18,291.3	444,589.7	(369,943.8)	(21,404.9)	(391,348.6)	(368,536.2)	0.94	(368,536.2)
2016	-	-	106,624.8	-	35,119.3	408,535.8	106,624.8	(22,166.7)	84,458.1	74,898.7	0.89	(293,637.5)
2017	-	-	131,348.7	-	32,309.8	375,366.1	131,348.7	(30,702.1)	100,646.6	84,052.1	0.84	(209,585.5)
2018	-	-	157,324.2	-	29,725.0	344,850.0	157,324.2	(39,555.8)	117,768.5	92,617.8	0.79	(116,967.7)
2019	-	-	184,606.9	-	27,347.0	316,775.3	184,606.9	(48,750.6)	135,856.3	100,614.8	0.74	(16,352.9)
2020	-	-	213,254.6	-	25,159.2	290,946.5	213,254.6	(58,309.6)	154,945.0	108,062.7	0.70	91,709.8
2021	-	-	243,327.7	-	23,146.5	267,184.0	243,327.7	(68,256.2)	175,071.5	114,982.1	0.66	206,691.9
2022	-	-	249,899.4	-	21,294.8	245,322.5	249,899.4	(70,867.4)	179,031.9	110,729.0	0.62	317,421.0
2023	-	-	256,671.1	-	19,591.2	225,209.9	256,671.1	(73,494.8)	183,176.3	106,688.3	0.58	424,109.3
2024	-	-	263,649.7	-	18,023.9	206,706.3	263,649.7	(76,144.0)	187,505.7	102,843.8	0.55	526,953.1
2025	-	-	-	-	16,582.0	189,683.0	-	5,140.4	5,140.4	2,655.1	0.52	529,608.2
2026	-	-	-	-	15,255.4	174,021.6	-	4,729.2	4,729.2	2,300.3	0.49	531,908.5
2027	-	-	-	-	14,035.0	159,613.1	-	4,350.9	4,350.9	1,992.9	0.46	533,901.4
2028	-	-	-	-	12,912.2	146,357.3	-	4,002.8	4,002.8	1,726.6	0.43	535,628.0
2029	-	-	-	-	11,879.2	134,161.9	-	3,682.6	3,682.6	1,495.9	0.41	537,123.9
2030	-	-	-	-	10,928.9	122,942.2	-	3,388.0	3,388.0	1,296.0	0.38	538,419.8
2031	-	-	-	-	10,054.6	112,620.0	-	3,116.9	3,116.9	1,122.8	0.36	539,542.7
2032	-	-	-	-	9,250.2	103,123.6	-	2,867.6	2,867.6	972.8	0.34	540,515.4
2033	-	-	-	-	8,510.2	94,387.0	-	2,638.2	2,638.2	842.8	0.32	541,358.2
2034	-	-	-	-	7,829.4	86,349.2	-	2,427.1	2,427.1	730.2	0.30	542,088.4
2035	-	-	-	-	7,203.0	78,954.5	-	2,232.9	2,232.9	632.6	0.28	542,720.9
2036	-	-	-	-	6,626.8	72,151.4	-	2,054.3	2,054.3	548.1	0.27	543,269.0
2037	-	-	-	-	6,096.6	65,892.5	-	1,890.0	1,890.0	474.8	0.25	543,743.8
2038	-	-	-	-	5,608.9	60,134.3	-	1,738.8	1,738.8	411.4	0.24	544,155.2
2039	-	-	-	-	5,160.2	54,836.8	-	1,599.7	1,599.7	356.4	0.22	544,511.6
2040	-	-	-	-	4,747.4	49,963.0	-	1,471.7	1,471.7	308.8	0.21	544,820.4
2041	-	-	-	-	4,367.6	45,479.2	-	1,354.0	1,354.0	267.5	0.20	545,087.9
2042	-	-	-	-	4,018.2	41,354.1	-	1,245.6	1,245.6	231.8	0.19	545,319.6
2043	-	-	-	-	3,696.7	37,559.0	-	1,146.0	1,146.0	200.8	0.18	545,520.4
2044	-	-	-	-	3,401.0	34,067.5	-	1,054.3	1,054.3	174.0	0.17	545,694.4
2045	-	-	-	-	3,128.9	30,855.3	-	970.0	970.0	150.7	0.16	545,845.1
2046	-	-	-	-	2,878.6	27,900.1	-	892.4	892.4	130.6	0.15	545,975.7
2047	-	-	-	-	2,648.3	25,181.3	-	821.0	821.0	113.1	0.14	546,088.8
2048	-	-	-	-	2,436.4	22,680.0	-	755.3	755.3	98.0	0.13	546,186.8
2049	-	-	-	-	2,241.5	20,378.8	-	694.9	694.9	84.9	0.12	546,271.7
2050	-	-	-	-	2,062.2	18,261.8	-	639.3	639.3	73.6	0.12	546,345.3
2051	-	-	-	-	1,897.2	16,314.0	-	588.1	588.1	63.7	0.11	546,409.0
2052	-	-	-	-	1,745.5	14,522.1	-	541.1	541.1	55.2	0.10	546,464.3
2053	-	-	-	-	1,605.8	12,873.6	-	497.8	497.8	47.8	0.10	546,512.1
2054	-	-	-	-	1,477.4	11,356.9	-	458.0	458.0	41.4	0.09	546,553.6
Total	**-**	**-**	**1,894,046.4**	**(457,283.1)**	**440,293.5**		**1,436,763.3**	**(450,663.4)**	**986,099.9**	**546,553.6**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(200,000)
(400,000)
(600,000)
(800,000)
(1,000,000)
(1,200,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Air Heater Refurbishment vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

ALSTOM

March 12, 2012

Mr. Gerald Bedecki
Nova Scotia Power
Lingan Station Unit 3

Subj: Replacement Heating Element

File: HOW-1090 Size: (2) 23.5-VIR
Quote # 11MS-1726A
Est. 354-11aEL

Dear Mr. Bedecki:

At the request of our regional sales manager, Mr. Mark Perry; we wish to offer the following indicative pricing information for replacement hot end heating element for the above Ljungström® Air Preheaters.

Element Replacement Option:

2 Sets Hot End Heating Element, Type DN7i™ 32" in depth, fabricated from 22 USG LACR Steel

TOTAL Element Option: $[redacted] USD

The above prices are F.O.B. Shipping Point - Freight Collect. Normal lead time would be 14 weeks after the receipt of an order.

ALSTOM Power Inc., Air Preheater Company's price is not given as an offer, nor as a term of any contract. In the event that a firm price is required, please do not hesitate to contact us.

Very truly yours,

ALSTOM Power Inc.
Air Preheater Co.

Alan G. Marshall
Sr. Project Manager
Heat Recovery Services

Timothy J. McNulty
Director, Project Development
Heat Recovery Services

ALSTOM Power Inc.
Air Preheater Company

3020 Truax Rd.
P. O. Box 372
Wellsville, NY 14895

Ph: 585-596-2608
Fax: 585-593-3172
or 585-596-2631

ALSTOM AIR PREHEATER, INC.

Technical Service Report for
Nova Scotia Power
Lingan Station Unit # 3
New Waterford, NS
HOW-1090 (2) size 23.5 VIR Howden Air Preheaters
Visit Date: November 15-17, 2011
Technical Representative: Frank R. Parise

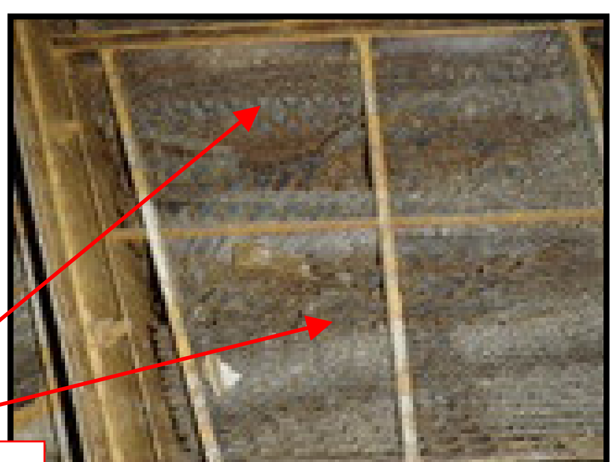
The purpose of this visit was to provide technical assistance with the inspection on Air Preheaters 3-A & 3-B. The APH's were high-pressured water washed before the start of the job. I met with Jerry Bedecki with Nova Scotia Power on arrival to discuss the scope of this work. After my safety orientation and the lock out tag out procedures were completed, I was able to start my inspection.

Inspection Results This Outage:

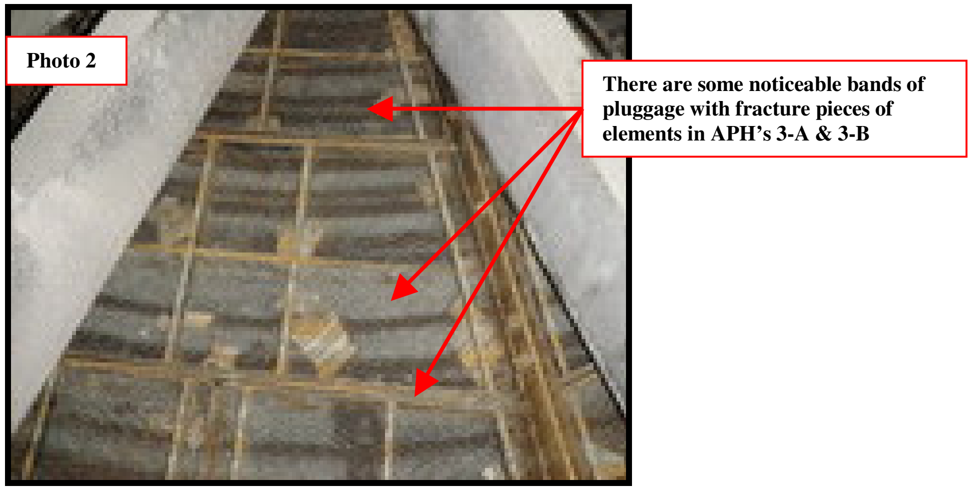
APH 3-A S/N (n.a.) (cw rotation observed from the hot end)
APH 3-B S/N (n.a.) (ccw rotation observed from the hot end)

APH's 3-A & 3-B have the FNC® (22 gauge) heat transfer profile in the hot end. There is severe spiking (2-4 inches deep) and fracturing of the element sheets in one compartment of the rotor of "D" & "E" baskets on APH 3-B. There are some noticeable bands of pluggage in both APH's. See **Photo 1 & 2. Recommend replacing the complete set of hot end baskets on APH's 3-A & 3-B next outage.**

Photo 1



Severe spiking and fracturing of the element sheets in one compartment of the rotor of "D" & " E" baskets on APH 3-B



APH's 3-A & 3-B have the NF6 (18 gauge) heat transfer profile in the cold end. The heat transfer elements have some minor fracturing of the elements, but remain in serviceable condition on both APH's.

Rotor Structure:

APH's 3-A & 3-B the hot end structure is in good serviceable condition with no hot end rotor diaphragm-to-rotor post, diaphragm-to-stay plate, or diaphragm-to-rotor shell cracks observed at this time. The stiffeners all seem to be in good serviceable condition.

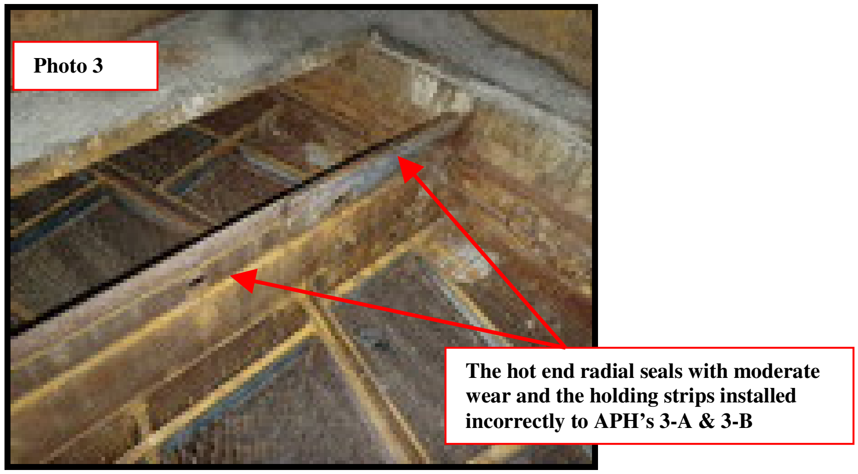
APH's 3-A & 3-B the cold end structure is in good serviceable condition with no cold end rotor diaphragm-to-rotor post, diaphragm-to-stay plate, or diaphragm-to-rotor shell cracks observed at this time. The stiffeners all seem to be in good serviceable condition.

APH's 3-A & 3-B the support feet and outside structures are all in good serviceable condition.

Rotor Seals:

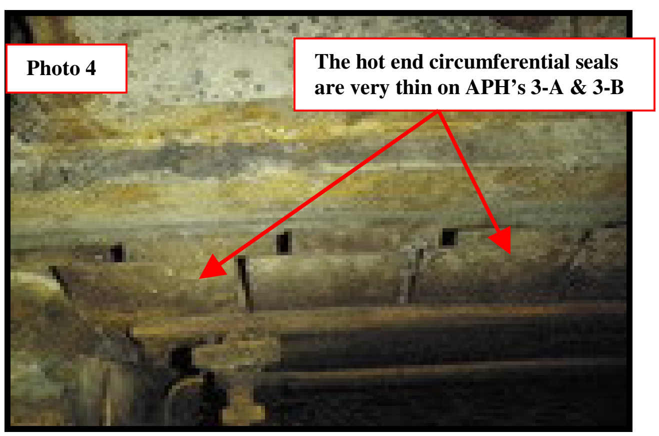
The hot end sector plate sealing surfaces on APH's 3-A & 3-B are in good serviceable condition. I was not able to perform a run-out of the sector plates but they seem to be level and in plane with each other by doing a visual check.

The hot end radial seals on APH's 3-A & 3-B have moderate wear with 1-2 of the holding strips installed incorrectly (upside down) to each APH's, but remains in serviceable condition. See **Photo 3. Recommend replacing the hot end radial seals and hardware on APH's 3-A & 3-B next outage.**



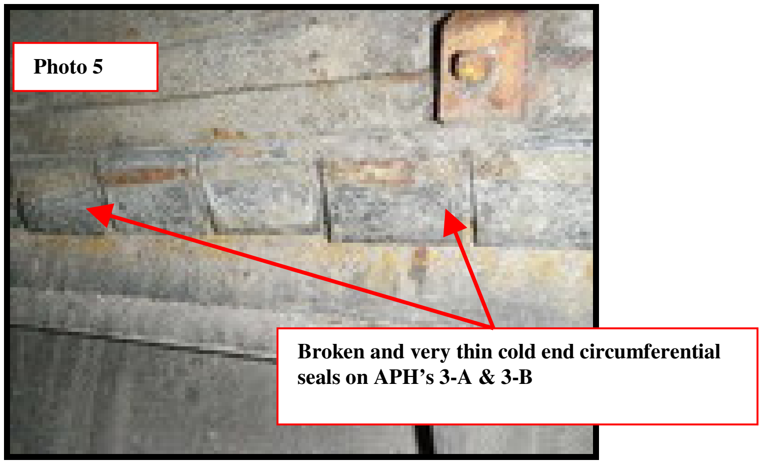
The cold end sector plate sealing surfaces on APH's 3-A & 3-B seem to be in serviceable condition. The cold end radial seals on APH's 3-A & 3-B have moderate wear but are in serviceable condition. **Recommend replacing the cold end radial seals and hardware on APH's 3-A & 3-B next outage.**

The hot end circumferential seals are very thin with many of the inner over lapping seals broken off on APH's 3-A & 3-B. See **Photo 4. Recommend replacing the hot end circumferential seals on 3-A & 3-B next outage.**



The hot end circumferential seal-sealing ring has moderate wear but remains in serviceable condition on APH's 3-A & 3-B.

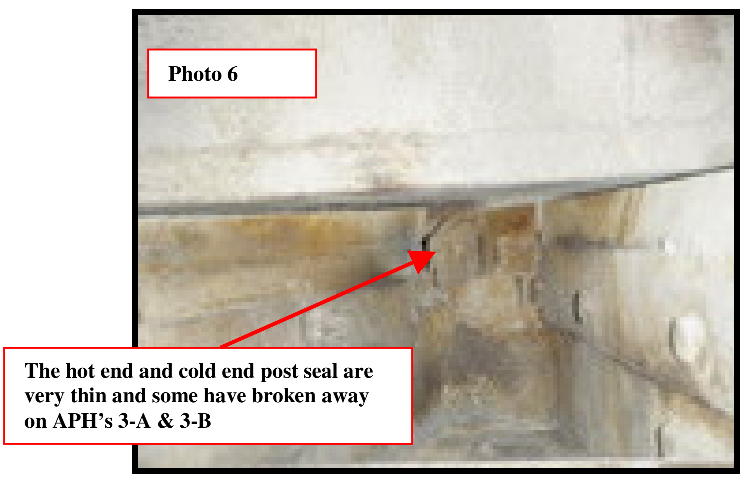
The cold end circumferential seals are very thin with some of the over lapping seals broken off on APH's 3-A & 3-B. See **Photo 5**. Recommend replacing the cold end circumferential seals on 3-A & 3-B next outage.



The cold end circumferential seal-sealing ring has moderate wear but remains in serviceable condition on APH's 3-A & 3-B.

The cold end basket support grating and support blocks are in serviceable condition with some moderate erosion to the outer support gratings on APH's 3-A & 3-B.

The hot end and cold end post seals are very thin with some erosion holes present on APH's 3-A & 3-B. See **Photo 6. Recommend replacing the hot end and cold end post seal next outage on APH's 3-A & 3-B.**

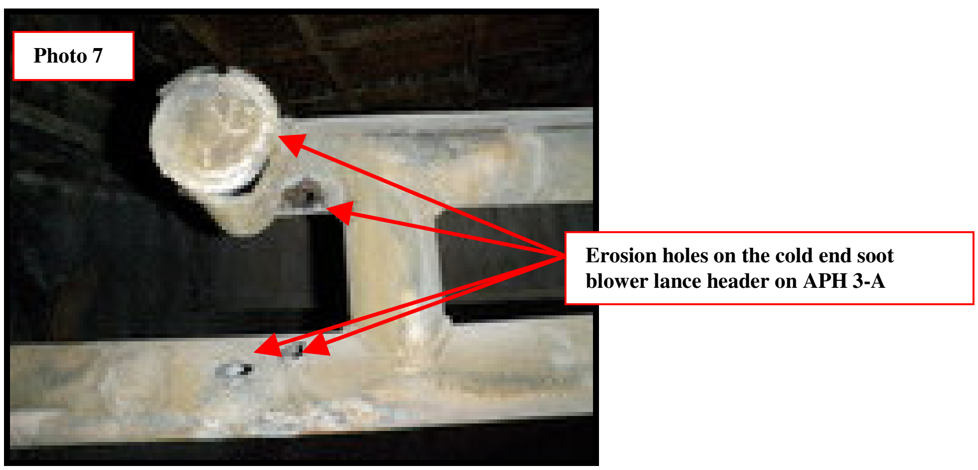


The hot end and cold end expansion joints seem to be in serviceable condition on APH's 3-A & 3-B.

Soot Blower:

APH's 3-A & 3-B the hot end gas inlet duct retractable soot blower seems to be in serviceable condition.
The normal fouling expected with the coal type used would be located in the bottom of the cold end layer only, well within reach of the cleaning medium from the cold end (bottom) soot blower.
The moderate amount of element fracturing noticed in the hot end baskets indicate over blowing, by frequency and/or pressure. If the hot end soot blowers are still going to be used, would recommend the lowest possible blowing pressure until the need for this device is determined.

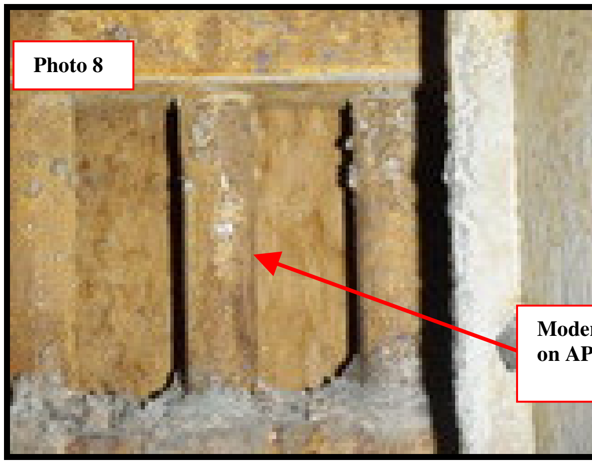
The cold end gas outlet duct retractable soot blower seems to be in serviceable condition on APH 3-B. APH 3-A the sootblower lance has about 4 erosion holes that need to be repaired or the lance replaced. See **Photo 7. Recommend repairing/replacing the lance on APH 3-A and check the sequence of operations and the steam pressure when the unit is back on line. High pressure (over 175 PSIG) and moisture in the steam may have adverse affects on the Air Preheater performance and reduce heat transfer surface life on the heat transfer profile.**

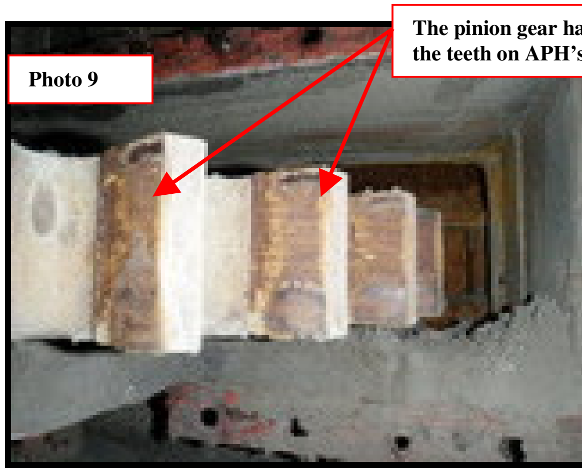


Rotor Drive:

An external inspection was made to the rotor gearbox on APH's 3-A & 3-B and seems to be in serviceable condition. The oil was at the correct level. We rotated the rotors with the auxiliary air drive. The rotor started easily and coasted smoothly to a stop. We did not operate the rotor using the main electric motor.

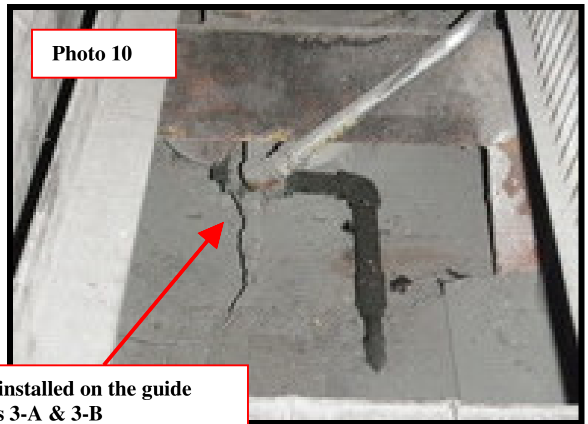
The pin rack assemblies on both APH's 3-A & 3-B were found to be in serviceable condition. There were no hot end and cold end pin rack block cracks found. The pinion cover was removed. See **Photo 8 & 9.** Wear to the pins are moderate, about 3/64". The pinion gear has approximately 1/32" wear to the teeth. The pinion gears root clearances and the clearances from the pin rack rail were within specifications.





Rotor Bearing:

An internal inspection of the rotor guide bearing on APH's 3-A & 3-B did not find any indication of a problem except for slight carbonizing of the oil. I could not inspect the rollers or the inner or outer race because there was no means to drain the oil. Plant personnel have not changed the oil in years. Oil is added when needed. See **Photo 10. Recommend installing a drain line from the bottom of the bearing housing were the thermocouple is presently installed and then extend it over the center section and down to the gearbox, were a valve can be installed for easy draining of the oil. The thermocouple can be installed off a "T" coming off a nipple from the bearing housing**.



Oil drain line needs to be installed on the guide bearing housing on APH's 3-A & 3-B

An external inspection of the rotor support bearing on APH's 3-A & 3-B was performed and did not find any indications of a problem. Internal inspection of this bearing is not practical without complete disassembly.

Recommend performing regular oil sampling/analysis on the rotor guide and support bearings.

Recommend that you contact our Performance Engineers from Alstom Air Preheater Company due to the pluggage issues that you are experiencing with injecting Carbon- (P.A.C.) powered activated carbon to remove mercury from the flue gas. They can recommend what type of heat transfer profile can be used to improve on the performance and reliability on APH's 3-A & 3-B.

Future Recommendations:

1. Replace complete set of hot end baskets on APH's 3-A & 3-B.

2. Replace complete set of cold end baskets on APH's 3-A & 3-B.

3. Replace complete set of hot end radial seals with hardware on 3-A & 3-B.

4. Replace complete set of cold end radial seals with hardware on 3-A & 3-B.

5. Replace complete set of hot end and cold end circumferential seals with hardware on 3-A & 3-B.

6. Replace a complete set of hot end and cold end post seals on 3-A & 3-B.

7. Install an oil drain line to the guide bearing on APH's 3-A & 3-B.

8. Repair/replace the cold end gas outlet duct soot blower lance on APH 3-A.

9. Check the sequence of operations and the steam pressure when the unit is back on line. High pressure (over 175 PSIG) and moisture in the steam may have adverse affects on the Air Preheater performance and reduce heat transfer surface life on the heat transfer profile.

10. It is recommended to perform regular oil sampling/analysis on the rotor guide bearing, support bearing and main rotor drive gearbox on 3-A & 3-B.

11. Continue to maintain the APH's 3-A & 3-B per the O&M Manual.

Thank you again for this opportunity to assist with the inspection of the Air Preheaters. If you need any further assistance please do not hesitate to contact the Air Preheater Company or myself.

Respectfully,
Frank R. Parise
Technical Advisor
Alstom Air Preheater Company

CI Number: 44191

Title: POT – Coal Nozzle and Bucket Replacement

Start Date: 2013/07
In-Service Date: 2015/08
Final Cost Date: 2015/12
Function: Steam
Forecast Amount: $570,309

DESCRIPTION:

The Point Tupper Unit # 2 boiler was retrofitted to burn coal in 1986. The conversion was extensive and included the installation of new coal burners designed to deliver the pulverized coal to the boiler. Over time, the plant has experienced issues with the coal. This project will replace the burners with an upgraded system designed by the boiler OEM which includes nozzle and tip as a complete unit, a design which has been used successfully in other boilers worked on by the OEM.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

The premature failure of burners has resulted in limitations to the operation of the boiler and could lead to corner fires exterior to the furnace. The cause of these failures is related to burner design and air flow and must be resolved.

Why do this project now?

Replacing the coal burners with an improved design will address the issue of premature failure. The planned outage in 2015 will allow for the replacement of all 16 burners.

Why do this project this way?

Replacing the existing burners with equipment of a proven design will rectify the premature failure of the coal burners on this boiler.

CI Number : 44191-SB74 - POT Coal Nozzle and Bucket Replacement **Project Number** SB74

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		1,604	0	1,604
095		095-Thermal & Hydro Contracts AO		90	0	90
095		095-Thermal Regular Labour AO		10,228	0	10,228
095		095-Thermal Term Labour AO		19,687	0	19,687
095		095-Thermal Overtime Labour AO		255	0	255
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	46,164	0	46,164
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	2,548	0	2,548
004	013	004 - Term Labour (NO AO)	013 - SGP - Boiler	6	0	6
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	88,952	0	88,952
012	013	012 - Materials	013 - SGP - Boiler	397,776	0	397,776
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	1,000	0	1,000
041	013	041 - Meals & Entertainment	013 - SGP - Boiler	1,000	0	1,000
011	085	011 - Travel Expense	085 Design	1,000	0	1,000
			Total Cost:	570,309	0	570,309
			Original Cost:	450,241		

Capital Project Detailed Estimate

Location: Plant / Hydro
CI# / FP#: 44191
Title: POT Coal Nozzle and Bucket Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	15.00	$ 339.28	$ 5,089.20		
Maintenance Trades	PD	80.00	$ 345.44	$ 27,635.20		
Power Plant Technician	PD	12.00	$ 361.84	$ 4,342.08		
Utilityworker	PD	40.00	$ 227.44	$ 9,097.60		
			Sub-Total	$ 46,164.08		
002 OT Labour						
Electrician	PD	1.00	$ 678.56	$ 678.56		
Maintenance Trades	PD	1.00	$ 690.88	$ 690.88		
Power Plant Technician	PD	1.00	$ 723.68	$ 723.68		
Utilityworker	PD	1.00	$ 454.88	$ 454.88		
			Sub-Total	$ 2,548.00		
004 Term Labour						
Electrician	PD	40.00	$ 339.28	$ 13,571.20		
Maintenance Trades	PD	150.00	$ 345.44	$ 51,816.00		
Power Plant Technician	PD	40.00	$ 361.84	$ 14,473.60		
Utilityworker	PD	40.00	$ 227.44	$ 9,097.60		
			Sub-Total	$ 88,958.40		
011 Travel Expense						
Travel	lot	1.00	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
012 Materials						
Replacement Nozzles	ea	16.00	[redacted]		Cost Support Item #1	
Inner Doors	ea	16.00			Cost Support Item #1	
Outer Doors	ea	16.00			Cost Support Item #1	
Misc. and consumables	lot	1.00	$ 10,000.00	$ 10,000.00		
				$ -		
			Sub-Total	$ 397,776.00		
013 Contracts						
Contracts	lot	1.00	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
041 Meals & Entertainment						
Meals and expenses	lot	1.00	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
094 Interest Capitalized						
Interest	lot	1.00	$ 1,603.69	$ 1,603.69		
				$ -		
			Sub-Total	$ 1,603.69		
095 Administrative Overhead						
Thermal & Hydro Contract AO				$ 89.60		
Thermal Regular Labour AO				$ 10,227.67		
Thermal Term Labour AO				$ 19,686.65		
Thermal OT Labour AO				$ 255.30		
			Sub-Total	$ 30,259.22		
			SUB-TOTAL (no AO, AFUDC)	$ 538,446.48		
			TOTAL (AO, AFUDC included)	$ 570,309.39		
Original Cost				$ 450,241.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

POT Coal Nozzle and Bucket Replacement
Summary of Alternatives

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	44191
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Coal Nozzle and Bucket Replacement v	6.19%	-3,950,044	2,874,852	1	253.85%	1.4 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommneded to complete this repalcement as the PV of Revenue Requirement of the capital investment is less than the repair / replacement energy costs associated with unplanned failures.

Notes/Comments :

Coal Nozzle and Bucket Replacement vs Avoided Repair and Repalcement Energy Costs

This options considers the cost of coal nozzle and bucket replacement versus the avoided replacement energy, material and labour costs is a "do nothing" option were to be selected. Four failures per year can be expected early on which incurs an full unit outage of 44 hours.

Test 2

Test 3

Test 4

POT Coal Nozzle and Bucket Replacement
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	44191
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Coal Nozzle and Bucket Replacement vs Avoided	6.19%	-3,950,044	2,874,852	1	253.85%	1.4 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Coal Nozzle and Bucket Replacement vs Avoided	10%	-3,893,155	2,833,100	1	190.33%	1.6 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

		PV of Revenue Requirement	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
Change:	**A**	56,889	-41,752	0	-63.53%	0.1 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Coal Nozzle and Bucket Replacement vs Avoided	-10%	-3,498,150	2,545,614	1	185.21%	1.6 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

		PV of Revenue Requirement	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
Change:	**A**	451,893	-329,238	0	-68.64%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	510,540	968,624	1,392,174	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

POT Coal Nozzle and Bucket Replacement
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	44191
Originator :		**Project No. :**	

Coal Nozzle and Bucket Replacement vs Avoided Repair and Repalcement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			71,400	74,128		
Events/Outages (#)	4	4	4	4		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	150	150				
Duration (Hours)	44	44				
Totals	$261,801	$251,651	$285,600	$296,512	$547,401	$548,163
Total Capital Cost of Alternative						$570,309

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

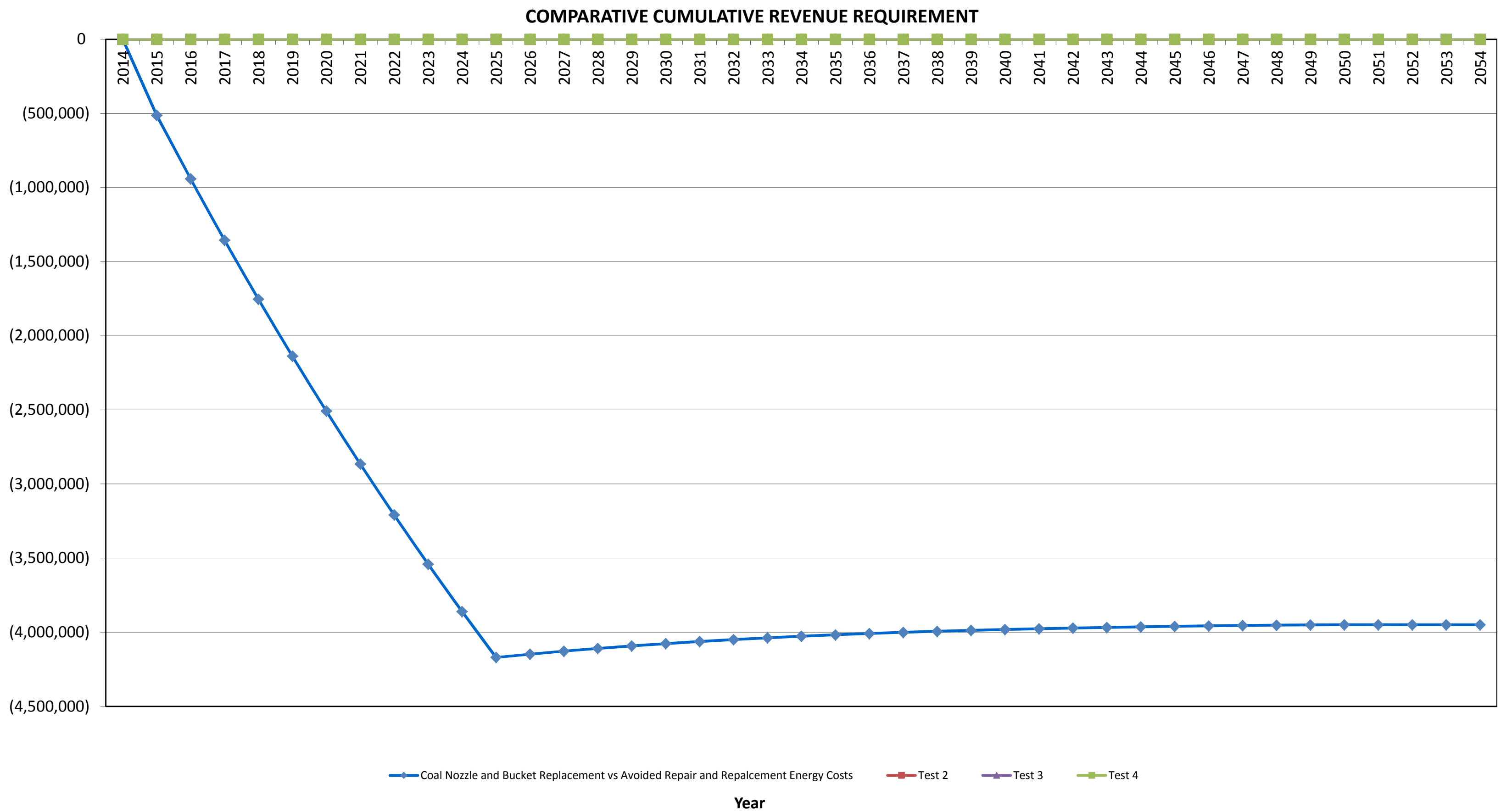
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

POT Coal Nozzle and Bucket Replacement

Coal Nozzle and Bucket Replacement vs Avoided Repair and Repalcement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	547,400.5	(540,050.2)	21,537.9	525,260.2	7,350.3	(163,017.4)	(155,667.1)	(146,593.0)	0.94	(146,593.0)
2016	-	-	548,162.5	-	41,352.7	482,513.1	548,162.5	(157,111.1)	391,051.5	346,790.1	0.89	200,197.1
2017	-	-	564,533.8	-	38,044.5	443,185.9	564,533.8	(163,211.7)	401,322.1	335,152.3	0.84	535,349.4
2018	-	-	581,448.8	-	35,000.9	407,004.8	581,448.8	(169,398.8)	412,049.9	324,052.5	0.79	859,401.9
2019	-	-	598,927.1	-	32,200.8	373,718.2	598,927.1	(175,685.1)	423,241.9	313,451.7	0.74	1,172,853.6
2020	-	-	616,988.9	-	29,624.8	343,094.5	616,988.9	(182,082.9)	434,906.0	303,314.8	0.70	1,476,168.5
2021	-	-	635,655.2	-	27,254.8	314,920.7	635,655.2	(188,604.1)	447,051.1	293,610.7	0.66	1,769,779.1
2022	-	-	654,948.0	-	25,074.4	289,000.8	654,948.0	(195,260.8)	459,687.2	284,310.8	0.62	2,054,090.0
2023	-	-	674,889.8	-	23,068.5	265,154.5	674,889.8	(202,064.6)	472,825.2	275,389.9	0.58	2,329,479.9
2024	-	-	695,504.2	-	21,223.0	243,216.0	695,504.2	(209,027.2)	486,477.0	266,824.7	0.55	2,596,304.6
2025	-	-	716,815.5	-	19,525.1	223,032.5	716,815.5	(216,160.0)	500,655.5	258,594.4	0.52	2,854,899.0
2026	-	-	-	-	17,963.1	204,463.6	-	5,568.6	5,568.6	2,708.6	0.49	2,857,607.6
2027	-	-	-	-	16,526.1	187,380.3	-	5,123.1	5,123.1	2,346.6	0.46	2,859,954.2
2028	-	-	-	-	15,204.0	171,663.7	-	4,713.2	4,713.2	2,033.1	0.43	2,861,987.3
2029	-	-	-	-	13,987.7	157,204.4	-	4,336.2	4,336.2	1,761.4	0.41	2,863,748.7
2030	-	-	-	-	12,868.7	143,901.8	-	3,989.3	3,989.3	1,526.0	0.38	2,865,274.7
2031	-	-	-	-	11,839.2	131,663.4	-	3,670.1	3,670.1	1,322.1	0.36	2,866,596.8
2032	-	-	-	-	10,892.0	120,404.1	-	3,376.5	3,376.5	1,145.4	0.34	2,867,742.2
2033	-	-	-	-	10,020.7	110,045.6	-	3,106.4	3,106.4	992.4	0.32	2,868,734.5
2034	-	-	-	-	9,219.0	100,515.7	-	2,857.9	2,857.9	859.8	0.30	2,869,594.3
2035	-	-	-	-	8,481.5	91,748.2	-	2,629.3	2,629.3	744.9	0.28	2,870,339.2
2036	-	-	-	-	7,803.0	83,682.2	-	2,418.9	2,418.9	645.3	0.27	2,870,984.5
2037	-	-	-	-	7,178.7	76,261.4	-	2,225.4	2,225.4	559.1	0.25	2,871,543.6
2038	-	-	-	-	6,604.4	69,434.2	-	2,047.4	2,047.4	484.4	0.24	2,872,028.0
2039	-	-	-	-	6,076.1	63,153.3	-	1,883.6	1,883.6	419.7	0.22	2,872,447.6
2040	-	-	-	-	5,590.0	57,374.8	-	1,732.9	1,732.9	363.6	0.21	2,872,811.2
2041	-	-	-	-	5,142.8	52,058.6	-	1,594.3	1,594.3	315.0	0.20	2,873,126.2
2042	-	-	-	-	4,731.4	47,167.7	-	1,466.7	1,466.7	272.9	0.19	2,873,399.1
2043	-	-	-	-	4,352.9	42,668.0	-	1,349.4	1,349.4	236.4	0.18	2,873,635.5
2044	-	-	-	-	4,004.6	38,528.4	-	1,241.4	1,241.4	204.8	0.17	2,873,840.4
2045	-	-	-	-	3,684.3	34,719.9	-	1,142.1	1,142.1	177.5	0.16	2,874,017.8
2046	-	-	-	-	3,389.5	31,216.1	-	1,050.8	1,050.8	153.8	0.15	2,874,171.6
2047	-	-	-	-	3,118.4	27,992.6	-	966.7	966.7	133.2	0.14	2,874,304.8
2048	-	-	-	-	2,868.9	25,026.9	-	889.4	889.4	115.4	0.13	2,874,420.2
2049	-	-	-	-	2,639.4	22,298.6	-	818.2	818.2	100.0	0.12	2,874,520.2
2050	-	-	-	-	2,428.2	19,788.5	-	752.8	752.8	86.6	0.12	2,874,606.8
2051	-	-	-	-	2,234.0	17,479.2	-	692.5	692.5	75.0	0.11	2,874,681.9
2052	-	-	-	-	2,055.3	15,354.6	-	637.1	637.1	65.0	0.10	2,874,746.9
2053	-	-	-	-	1,890.8	13,400.0	-	586.2	586.2	56.3	0.10	2,874,803.2
2054	-	-	-	-	1,739.6	11,601.8	-	539.3	539.3	48.8	0.09	2,874,852.0
Total	**-**	**-**	**6,835,274.2**	**(540,050.2)**	**518,441.5**		**6,295,224.0**	**(1,958,218.2)**	**4,337,005.9**	**2,874,852.0**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(500,000)
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2014
2054
Coal Nozzle and Bucket Replacement vs Avoided Repair and Repalcement Energy Costs
Test 2
Test 3
Test 4
Year

BEATON, TREVOR

From:	GRAHAM Leonard J
Sent:	Friday, August 29, 2014 3:27 PM
To:	BARRETT, RAYMOND; MACLEOD, BRENT
Cc:	SPARLING Rhonda M; SEGUIN Mike J
Subject:	20050436 Coal Nozzles complete with Inner and Outer Doors-Budget Price

Hello Ray & Brent.

Hope things are well.

As requested through Mike Seguin, we have some budget pricing that you can put into your budget for next fiscal year for the burner nozzles at Pt Tupper.

The estimated lead time for the scope of this work is 16-18 weeks ARO. Priced are based on FCA Shop per INCO terms 2010, freight not included.

Option 1

1. Qty 16– Coal Nozzles complete with Aerotips and horizontal linkage rods (similar to design that was sold in 2013) = [redacted]
2. Qty 16 – Inner doors in kind replacement = [redacted]
3. Qty 16 – Outer doors in kind replacement = [redacted]

Option 2

1. Qty 12– Coal Nozzles complete with Aerotips and horizontal linkage rods (similar to design that was sold in 2013) = [redacted]
2. Qty 12 – Inner doors in kind replacement = [redacted]
3. Qty 12 – Outer doors in kind replacement = [redacted]

This budget proposal gives a preliminary indication of the basis of which the scope of work described herein can be provided,
and does not constitute a firm price, offer or commitment as to such scope.
In particular, any prices, delivery times or performance figures provided in this budget proposal are given without commitment and without regard to terms and conditions. To this end, we look forward to discussing the content of this budget proposal and, when appropriate, submitting a formal offer.
This letter forms an integral part of this budget proposal.

Best Regards,

Len Graham
Spare Parts Specialist

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CONFIDENTIALITY : This e-mail and any attachments are confidential and may be privileged. If you are not a named recipient, please notify the sender immediately and do not disclose the contents to another person, use it for any purpose or store or copy the information in any medium.

CI Number: 46472

Title: LIN3 Boiler Chemical Recondition

Start Date:	2015/03
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	Steam
Forecast Amount:	$387,649

DESCRIPTION:

This project is for the chemical reconditioning of the boiler for the removal of metal oxides from the heat transfer surfaces, which will allow for the base metal to be pacified with an uncontaminated oxide layer. The level of deposition on heat transfer surfaces inside the boiler is directly proportional to the probability for failure mechanisms to occur in the system, such as failures to the boiler tube wall. Hydrogen Damage, Caustic Gouging, and Acid Phosphate corrosion can occur underneath heavy deposits leading to boiler tube failures and subsequent forced outages. Chemical Treatment is used to remove deposits and contaminants from the oxide layer to prevent under deposit corrosion mechanisms. This type of treatment is typically only completed once in the life of a generating facility and will significantly improve the overall reliability and efficiency of the unit.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

After years of operation, waterwall tube analysis from Lingan Unit 3 has shown a high level of magnetite buildup. Based on this condition measurement the unit heat transfer surfaces should be chemically reconditioned. Operating with magnetite buildup on the boiler tubes greatly increases the probability of boiler tube failures.

Why do this project now?

Lingan Unit 3, based on measurement of corrosion product deposition, is due for cleaning in order to reduce corrosion mechanisms and subsequent tube failures. Reconditioning of the unit in 2015 will likely decrease the number of boiler tube failures resulting in forced outages and replacement energy costs.

Why do this project this way?

Using chemical agents such as EDTA, Citric Acid and HCl are proven technologies to remove metal oxides from boiler heat transfer surfaces. Chemical reconditioning of boilers is well documented by EPRI as the most effective method of deposit removal.

CI Number : 46472 - LIN3 - Boiler Chemical Recondition **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		989	0	989
095		095-Thermal & Hydro Contracts AO		24,192	0	24,192
095		095-Thermal Regular Labour AO		4,074	0	4,074
095		095-Thermal Term Labour AO		6,355	0	6,355
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	20,329	0	20,329
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	31,711	0	31,711
012	013	012 - Materials	013 - SGP - Boiler	10,000	0	10,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	270,000	0	270,000
028	013	028 - Consulting	013 - SGP - Boiler	20,000	0	20,000
			Total Cost:	387,649	0	387,649
			Original Cost:	151,459		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 46472
Title: LIN3 Boiler Chemical Recondition
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Engineering	PD	10.00	$ 391.49	$ 3,914.86		
Maintenance Trades	PD	40.00	$ 352.35	$ 14,093.95		
Utilityworker	PD	10.00	$ 231.99	$ 2,319.89		
			Sub-Total	$ 20,328.70		
004 Term Labour						
Maintenance Trades	PD	90.00	$ 352.35	$ 31,711.39		
				$ -		
				$ -		
			Sub-Total	$ 31,711.39		
012 Materials						
Pipe Fittings	ea	1	$ 10,000	$ 10,000.00		
			Sub-Total	$ 10,000.00		
013 Contracts						
Boiler Connection Services	ea	1	$ 50,000	$ 50,000.00		
Chemical Cleaning Services	ea	1	$ 220,000	$ 220,000.00	Prev. PO 198629	
			Sub-Total	$ 270,000.00		
028 Consulting						
Engineering Consultant	ea	1.00	$ 20,000.00	$ 20,000.00		
				$ -		
				$ -		
			Sub-Total	$ 20,000.00		
094 Interest Capitalized						
AFUDC				$ 988.52		
				$ -		
			Sub-Total	$ 988.52		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 4,073.87		
Thermal Term Labour AO				$ 6,354.96		
Thermal / Hydro Contracts AO				$ 24,192.00		
			Sub-Total	$ 34,620.83		
			SUB-TOTAL (no AO, AFUDC)	$ 352,040.09		
			TOTAL (AO, AFUDC included)	$ 387,649.44		
Original Cost				$ 151,459.03		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 Boiler Chemical Recondition
Summary of Alternatives

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46472
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Chemical Recondition vs. Avoided Rep	6.19%	-2,614,995	1,892,399	1	90.07%	2.0 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

The plant recommends completion of this project as treating the boiler is more economic than the costs to repair tube failures and replace the energy lost during unplanned outages.

Notes/Comments :

Chemical Recondition vs. Avoided Repair and Replacement Energy Costs

This option compares the reconditioning of the boiler versus the costs of unplanned failures and the associated material and replacement energy costs.

Test 2

Test 3

Test 4

LIN3 Boiler Chemical Recondition
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46472
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Chemical Recondition vs. Avoided Repair and Re	6.19%	-2,614,995	1,892,399	1	90.07%	2.0 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Chemical Recondition vs. Avoided Repair and Re	10%	-2,580,386	1,865,107	1	81.36%	2.2 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:					
A	34,608	-27,292	0	-8.71%	0.1 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Chemical Recondition vs. Avoided Repair and Re	-10%	-2,318,887	1,675,867	1	80.50%	2.2 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:					
A	296,108	-216,532	0	-9.57%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement

Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
A	112,173	309,747	590,205	No
B	0	0	0	No
C	0	0	0	No
D	0	0	0	No

LIN3 Boiler Chemical Recondition
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	Date :	30-Oct-14
Department :	Lingan Generating Station	CI Number:	46472
Originator :		Project No. :	

Chemical Recondition vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			69,640	72,427		
Events/Outages (#)	1	2	1	2		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	80	80				
Totals	$50,632	$96,081	$69,640	$144,855	$120,272	$240,936
Total Capital Cost of Alternative						$387,649

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

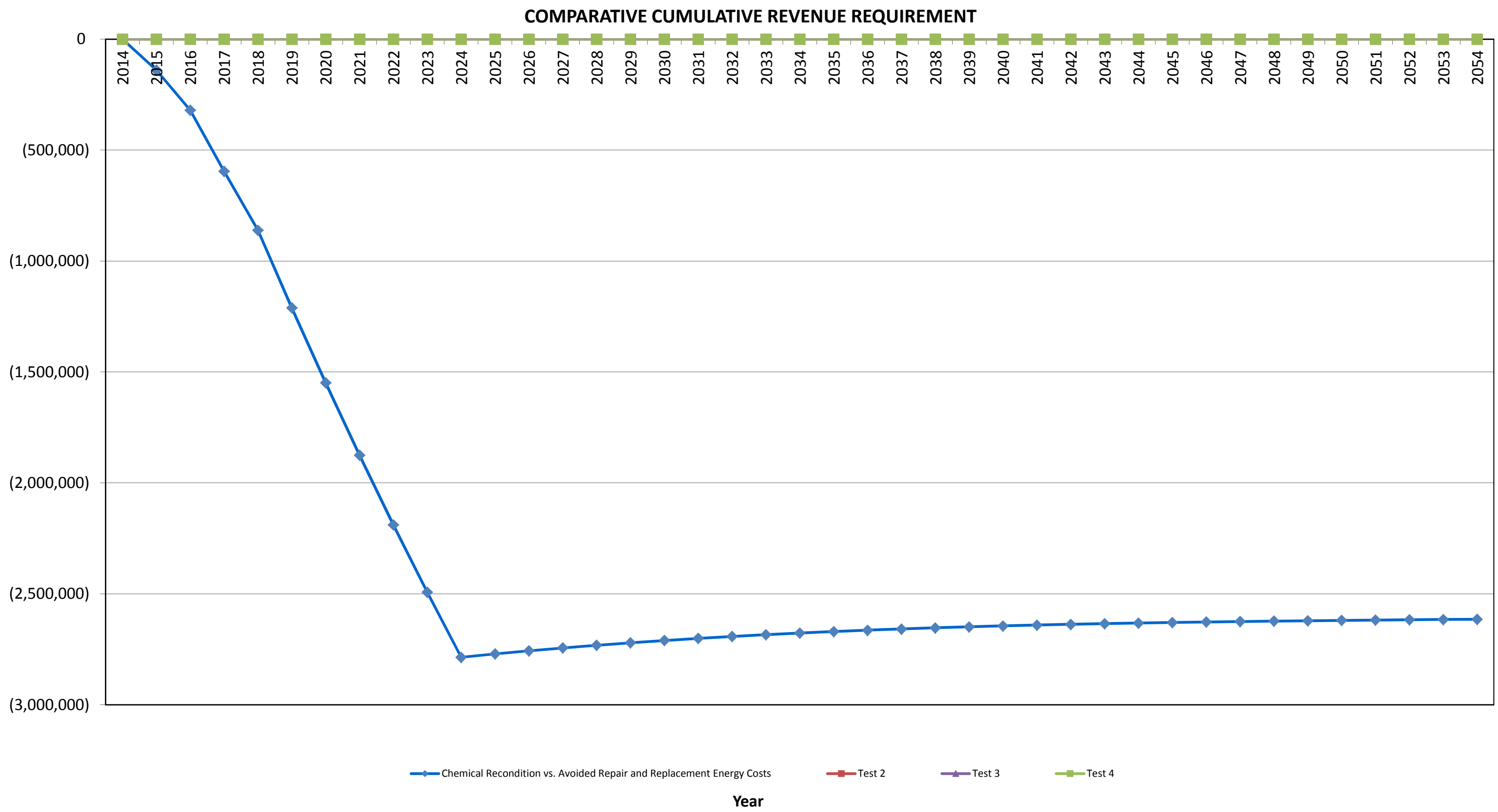
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN3 Boiler Chemical Recondition
Chemical Recondition vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	120,271.8	(353,028.6)	14,081.6	347,513.8	(232,756.8)	(32,919.0)	(265,675.8)	(250,189.1)	0.94	(250,189.1)
2016	-	-	240,936.4	-	27,036.7	318,881.8	240,936.4	(66,308.9)	174,627.5	154,862.2	0.89	(95,326.9)
2017	-	-	372,984.1	-	24,873.7	292,540.4	372,984.1	(107,914.2)	265,069.9	221,365.3	0.84	126,038.4
2018	-	-	384,969.4	-	22,883.8	268,306.3	384,969.4	(112,246.5)	272,722.9	214,480.1	0.79	340,518.5
2019	-	-	529,834.0	-	21,053.1	246,010.9	529,834.0	(157,722.1)	372,112.0	275,585.0	0.74	616,103.5
2020	-	-	546,957.6	-	19,368.9	225,499.1	546,957.6	(163,552.5)	383,405.1	267,396.8	0.70	883,500.2
2021	-	-	564,684.9	-	17,819.4	206,628.3	564,684.9	(169,528.3)	395,156.6	259,527.8	0.66	1,143,028.0
2022	-	-	583,038.4	-	16,393.8	189,267.1	583,038.4	(175,659.8)	407,378.6	251,958.6	0.62	1,394,986.7
2023	-	-	602,041.6	-	15,082.3	173,294.8	602,041.6	(181,957.4)	420,084.2	244,671.7	0.58	1,639,658.4
2024	-	-	621,718.8	-	13,875.7	158,600.3	621,718.8	(188,431.3)	433,287.4	237,651.1	0.55	1,877,309.5
2025	-	-	-	-	12,765.7	145,081.4	-	3,957.4	3,957.4	2,044.0	0.52	1,879,353.6
2026	-	-	-	-	11,744.4	132,644.0	-	3,640.8	3,640.8	1,770.9	0.49	1,881,124.4
2027	-	-	-	-	10,804.9	121,201.6	-	3,349.5	3,349.5	1,534.2	0.46	1,882,658.7
2028	-	-	-	-	9,940.5	110,674.6	-	3,081.5	3,081.5	1,329.2	0.43	1,883,987.9
2029	-	-	-	-	9,145.2	100,989.7	-	2,835.0	2,835.0	1,151.6	0.41	1,885,139.5
2030	-	-	-	-	8,413.6	92,079.6	-	2,608.2	2,608.2	997.7	0.38	1,886,137.2
2031	-	-	-	-	7,740.5	83,882.3	-	2,399.6	2,399.6	864.4	0.36	1,887,001.6
2032	-	-	-	-	7,121.3	76,340.9	-	2,207.6	2,207.6	748.9	0.34	1,887,750.5
2033	-	-	-	-	6,551.6	69,402.7	-	2,031.0	2,031.0	648.8	0.32	1,888,399.3
2034	-	-	-	-	6,027.5	63,019.6	-	1,868.5	1,868.5	562.1	0.30	1,888,961.4
2035	-	-	-	-	5,545.3	57,147.1	-	1,719.0	1,719.0	487.0	0.28	1,889,448.4
2036	-	-	-	-	5,101.6	51,744.4	-	1,581.5	1,581.5	421.9	0.27	1,889,870.3
2037	-	-	-	-	4,693.5	46,774.0	-	1,455.0	1,455.0	365.5	0.25	1,890,235.9
2038	-	-	-	-	4,318.0	42,201.2	-	1,338.6	1,338.6	316.7	0.24	1,890,552.6
2039	-	-	-	-	3,972.6	37,994.2	-	1,231.5	1,231.5	274.4	0.22	1,890,827.0
2040	-	-	-	-	3,654.8	34,123.7	-	1,133.0	1,133.0	237.7	0.21	1,891,064.7
2041	-	-	-	-	3,362.4	30,562.9	-	1,042.3	1,042.3	205.9	0.20	1,891,270.6
2042	-	-	-	-	3,093.4	27,287.0	-	959.0	959.0	178.4	0.19	1,891,449.0
2043	-	-	-	-	2,845.9	24,273.1	-	882.2	882.2	154.6	0.18	1,891,603.6
2044	-	-	-	-	2,618.3	21,500.4	-	811.7	811.7	133.9	0.17	1,891,737.5
2045	-	-	-	-	2,408.8	18,949.5	-	746.7	746.7	116.0	0.16	1,891,853.6
2046	-	-	-	-	2,216.1	16,602.6	-	687.0	687.0	100.5	0.15	1,891,954.1
2047	-	-	-	-	2,038.8	14,443.5	-	632.0	632.0	87.1	0.14	1,892,041.2
2048	-	-	-	-	1,875.7	12,457.1	-	581.5	581.5	75.5	0.13	1,892,116.6
2049	-	-	-	-	1,725.6	10,629.6	-	535.0	535.0	65.4	0.12	1,892,182.0
2050	-	-	-	-	1,587.6	8,948.4	-	492.2	492.2	56.6	0.12	1,892,238.7
2051	-	-	-	-	1,460.6	7,401.6	-	452.8	452.8	49.1	0.11	1,892,287.7
2052	-	-	-	-	1,343.7	5,978.6	-	416.6	416.6	42.5	0.10	1,892,330.2
2053	-	-	-	-	1,236.2	4,669.4	-	383.2	383.2	36.8	0.10	1,892,367.1
2054	-	-	-	-	1,137.3	3,464.9	-	352.6	352.6	31.9	0.09	1,892,399.0
Total	**-**	**-**	**4,567,437.0**	**(353,028.6)**	**338,960.7**		**4,214,408.4**	**(1,310,827.7)**	**2,903,580.7**	**1,892,399.0**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(500,000)
(1,000,000)
(1,500,000)
(2,000,000)
(2,500,000)
(3,000,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Chemical Recondition vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46394

Title: POT – Air Heater Steam Coil Replacement – North Side

Start Date: 2015/05
In-Service Date: 2015/09
Final Cost Date: 2016/03
Function: Steam
Forecast Amount: $361,514

DESCRIPTION:

There are air heater steam coil heaters in each of the North and South Forced Draft Fan ducts. The north fan coils have deteriorated to the point that they require replacement. The south air heater coils were replaced in 2013. This project will see the replacement of the coils on the north side, which have been in-service since the Pt. Tupper coal conversion in 1986.

Summary of Related CIs (+/- 2 years):
2013 – Steam Coil CI 43041

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

The air heater steam coils prevent corrosion caused by acid condensation in the downstream ductwork and stack when the unit's back end temperature from combustion is below the acid dew point (approximately 300 degrees F). At lower and variable loads, the steam coils are needed to keep the flue gas temperature above the dew point. The existing coils have deteriorated to the point that they require replacement.

Why do this project now?

The planned outage in 2015 will provide the opportunity to replace the steam coils and return the unit to original design. Without these coils, the ductwork and stack will corrode very quickly causing flue gas leaks and possible unit outages. Given the load-following service that steam units more regularly provide to help manage variable generation, the opportunity for back-end temperatures below the dew point is more common.

Why do this project this way?

As this is specialized boiler equipment, and part of the overall boiler design, replacing the coils in-kind would not require any additional modifications to the ducting and pipework to install the coils and therefore result in the lowest cost.

CI Number : 46394 - POT - Air Heater Steam Coil Replacement -North Side **Project Number**

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		1,483	0	1,483
095		095-Thermal Regular Labour AO		186	0	186
095		095-Thermal Overtime Labour AO		47	0	47
095		095-Thermal & Hydro Contracts AO		17,293	0	17,293
095		095-Thermal Term Labour AO		186	0	186
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	928	0	928
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	464	0	464
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	928	0	928
011	013	011 - Travel Expense	013 - SGP - Boiler	1,000	0	1,000
012	013	012 - Materials	013 - SGP - Boiler	145,000	0	145,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	193,000	0	193,000
041	013	041 - Meals & Entertainment	013 - SGP - Boiler	1,000	0	1,000
			Total Cost:	361,514	0	361,514
			Original Cost:	68,465		

Capital Project Detailed Estimate

Location: Pt. Tupper
CI# / FP#: 46394
Title: POT – Air Heater Steam Coil Replacement – North Side
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	4	$ 231.99	$ 927.96		
			Sub-Total	$ 927.96		
002 OT Labour						
Utilityworker	PD	1	$ 463.98	$ 463.98		
				$ -		
			Sub-Total	$ 463.98		
004 Term Labour						
Utilityworker	PD	4	$ 231.99	$ 927.96		
				$ -		
				$ -		
			Sub-Total	$ 927.96		
011 Travel Expense						
Travel	lot	1	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
012 Materials						
Replacement steam coils	lot	1	$ 95,000.00	$ 95,000.00		
Piping and valves	lot	1	$ 40,000.00	$ 40,000.00		
Misc. and consumables	lot	1	$ 10,000.00	$ 10,000.00		
				$ -		
			Sub-Total	$ 145,000.00		
013 Contracts						
Install new steam coils	lot	1	$ 126,000.00	$ 126,000.00		
Insulation and Scaffolding	lot	1	$ 42,000.00	$ 42,000.00		
Contingency	15%	1	$ 25,000.00	$ 25,000.00		
				$ -		
			Sub-Total	$ 193,000.00		
041 Meals & Entertainment						
Meals and expenses	lot	1	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
094 Interest Capitalized						
Interest				$ 1,482.54		
				$ -		
			Sub-Total	$ 1,482.54		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 185.96		
Thermal OT Labour AO				$ 46.50		
Thermal Term Labour AO				$ 185.96		
Thermal / Hydro Contracts AO				$ 17,292.80		
			Sub-Total	$ 17,711.22		
			SUB-TOTAL (no AO, AFUDC)	$ 342,319.89		
			TOTAL (AO, AFUDC included)	$ 361,513.65		
Original Cost				$ 68,464.73		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

POT – Air Heater Steam Coil Replacement – North Side
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Pt Tupper	**CI Number:**	46394
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Replace Steam Coils vs Avoided Repai	6.19%	-3,436,824	2,564,261	1	215.41%	1.1 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

This project is recommended to proceed in 2015. The outage in 2015 is of sufficient length to perform this work and another suitable unit outage is not planned until 2017.

Notes/Comments :

Replace Steam Coils vs Avoided Repair and Replacement Energy Costs

The steam coil air heaters provide heat in the back end of the boiler to prevent acid condensation and accelerated corrosion of the equipment downstream, including the ductwork, two induced draft fans, and the stack liner when flue gas temperature is reduced at lower loads. This accelerated corrosion would lead to equipment replacement much earlier than if the steam coils are in operation. The material costs in this option represent this equipment replacement increasing for 10 years, with unplanned outages increasing by a week each year.

Test 2

Test 3

Test 4

POT – Air Heater Steam Coil Replacement – North Side
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	40363
Originator :	J.March	**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Replace Steam Coils vs Avoided Repair and Repl	6.19%	-3,436,824	2,564,261	1	215.41%	1.1 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Replace Steam Coils vs Avoided Repair and Repl	10%	-3,402,371	2,537,673	1	165.52%	1.2 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:	**A**	34,453	-26,588	0	-49.89%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Replace Steam Coils vs Avoided Repair and Repl	-10%	-3,058,689	2,281,247	1	161.40%	1.3 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:	**A**	378,135	-283,014	0	-54.02%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	PV of Revenue Requirement 1	PV of Revenue Requirement 2	PV of Revenue Requirement 3	Delay?
	A	310,819	584,021	835,427	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

POT – Air Heater Steam Coil Replacement – North Side
Avoided Cost Calculations

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Pt Tupper	**CI Number:**	46394
Originator :		**Project No. :**	

Replace Steam Coils vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			83,360	86,696		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	150	150				
Duration (Hours)	168	168				
Totals	$249,900	$240,212	$83,360	$86,696	$333,260	$326,908
Total Capital Cost of Alternative						$361,514

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

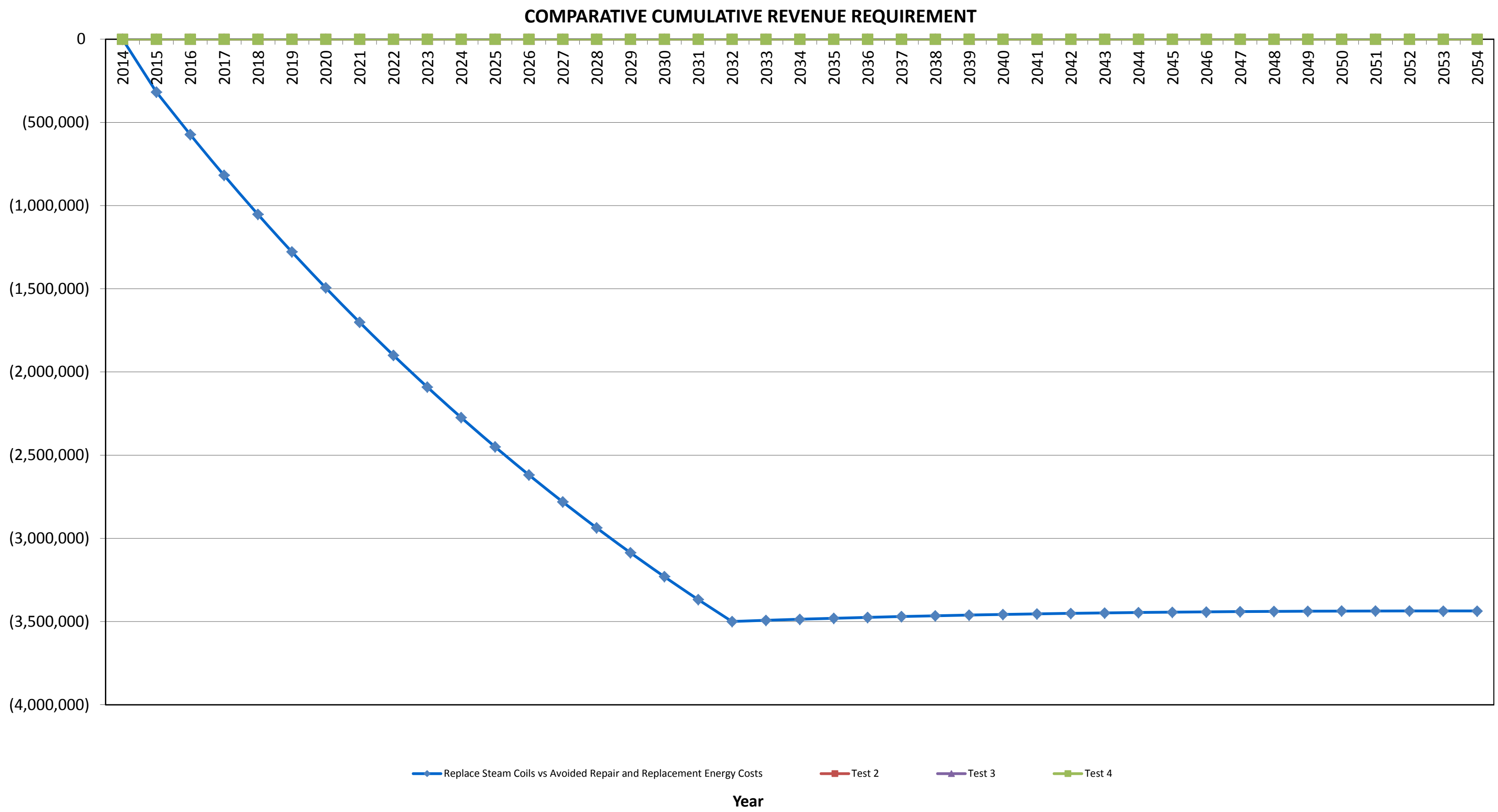
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

POT – Air Heater Steam Coil Replacement – North Side
Replace Steam Coils vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	333,260.5	(343,802.5)	13,692.8	333,515.5	(10,542.1)	(99,066.0)	(109,608.0)	(103,218.8)	0.94	(103,218.8)
2016	-	-	326,907.6	-	26,290.2	306,409.2	326,907.6	(93,191.4)	233,716.2	207,262.9	0.89	104,044.1
2017	-	-	335,181.1	-	24,187.0	281,471.4	335,181.1	(96,408.2)	238,772.9	199,404.1	0.84	303,448.3
2018	-	-	343,689.5	-	22,252.0	258,528.6	343,689.5	(99,645.6)	244,043.9	191,925.8	0.79	495,374.1
2019	-	-	352,440.2	-	20,471.8	237,421.2	352,440.2	(102,910.2)	249,530.0	184,801.2	0.74	680,175.3
2020	-	-	361,441.1	-	18,834.1	218,002.5	361,441.1	(106,208.2)	255,232.9	178,006.1	0.70	858,181.4
2021	-	-	370,700.1	-	17,327.4	200,137.2	370,700.1	(109,545.6)	261,154.6	171,519.0	0.66	1,029,700.4
2022	-	-	380,225.6	-	15,941.2	183,701.2	380,225.6	(112,928.2)	267,297.4	165,320.2	0.62	1,195,020.6
2023	-	-	390,026.0	-	14,665.9	168,580.0	390,026.0	(116,361.6)	273,664.4	159,391.7	0.58	1,354,412.3
2024	-	-	400,110.4	-	13,492.6	154,668.5	400,110.4	(119,851.5)	280,258.9	153,717.4	0.55	1,508,129.7
2025	-	-	410,487.8	-	12,413.2	141,870.0	410,487.8	(123,403.1)	287,084.6	148,282.6	0.52	1,656,412.3
2026	-	-	421,167.8	-	11,420.1	130,095.3	421,167.8	(127,021.8)	294,146.0	143,073.6	0.49	1,799,485.9
2027	-	-	432,160.2	-	10,506.5	119,262.6	432,160.2	(130,712.6)	301,447.6	138,078.1	0.46	1,937,564.0
2028	-	-	443,475.3	-	9,666.0	109,296.5	443,475.3	(134,480.9)	308,994.4	133,284.6	0.43	2,070,848.6
2029	-	-	455,123.6	-	8,892.7	100,127.7	455,123.6	(138,331.6)	316,792.1	128,682.6	0.41	2,199,531.2
2030	-	-	467,116.1	-	8,181.3	91,692.5	467,116.1	(142,269.8)	324,846.3	124,262.5	0.38	2,323,793.7
2031	-	-	479,464.1	-	7,526.8	83,932.0	479,464.1	(146,300.6)	333,163.6	120,015.1	0.36	2,443,808.8
2032	-	-	492,179.3	-	6,924.7	76,792.4	492,179.3	(150,429.0)	341,750.4	115,932.1	0.34	2,559,740.9
2033	-	-	-	-	6,370.7	70,223.9	-	1,974.9	1,974.9	630.9	0.32	2,560,371.8
2034	-	-	-	-	5,861.0	64,180.9	-	1,816.9	1,816.9	546.6	0.30	2,560,918.4
2035	-	-	-	-	5,392.2	58,621.4	-	1,671.6	1,671.6	473.6	0.28	2,561,392.0
2036	-	-	-	-	4,960.8	53,506.6	-	1,537.8	1,537.8	410.3	0.27	2,561,802.3
2037	-	-	-	-	4,563.9	48,801.0	-	1,414.8	1,414.8	355.4	0.25	2,562,157.7
2038	-	-	-	-	4,198.8	44,471.9	-	1,301.6	1,301.6	308.0	0.24	2,562,465.7
2039	-	-	-	-	3,862.9	40,489.0	-	1,197.5	1,197.5	266.8	0.22	2,562,732.5
2040	-	-	-	-	3,553.9	36,824.8	-	1,101.7	1,101.7	231.1	0.21	2,562,963.6
2041	-	-	-	-	3,269.6	33,453.8	-	1,013.6	1,013.6	200.3	0.20	2,563,163.9
2042	-	-	-	-	3,008.0	30,352.4	-	932.5	932.5	173.5	0.19	2,563,337.4
2043	-	-	-	-	2,767.4	27,499.2	-	857.9	857.9	150.3	0.18	2,563,487.7
2044	-	-	-	-	2,546.0	24,874.2	-	789.2	789.2	130.2	0.17	2,563,617.9
2045	-	-	-	-	2,342.3	22,459.1	-	726.1	726.1	112.8	0.16	2,563,730.7
2046	-	-	-	-	2,154.9	20,237.3	-	668.0	668.0	97.7	0.15	2,563,828.5
2047	-	-	-	-	1,982.5	18,193.3	-	614.6	614.6	84.7	0.14	2,563,913.2
2048	-	-	-	-	1,823.9	16,312.8	-	565.4	565.4	73.4	0.13	2,563,986.5
2049	-	-	-	-	1,678.0	14,582.7	-	520.2	520.2	63.6	0.12	2,564,050.1
2050	-	-	-	-	1,543.8	12,991.0	-	478.6	478.6	55.1	0.12	2,564,105.2
2051	-	-	-	-	1,420.3	11,526.6	-	440.3	440.3	47.7	0.11	2,564,152.9
2052	-	-	-	-	1,306.6	10,179.4	-	405.1	405.1	41.3	0.10	2,564,194.2
2053	-	-	-	-	1,202.1	8,940.0	-	372.7	372.7	35.8	0.10	2,564,230.0
2054	-	-	-	-	1,105.9	7,799.7	-	342.8	342.8	31.0	0.09	2,564,261.1
Total	**-**	**-**	**7,195,156.4**	**(343,802.5)**	**329,601.7**		**6,851,353.8**	**(2,128,321.9)**	**4,723,031.9**	**2,564,261.1**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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Replace Steam Coils vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46482

Title: LIN3 – Burner Front Refurbishment

Start Date: 2015/05
In-Service Date: 2015/06
Final Cost Date: 2015/12
Function: Steam
Forecast Amount: $299,261

DESCRIPTION:

NS Power coal fired units utilize Burner Assemblies which deliver and distribute pulverized coal and combustion air to the Boiler combustion zone. These assemblies include ductwork (and support structures) Burner Assemblies (Buckets), nozzles and associated pneumatic control mechanisms. The delivery elements are subjected to wear as a result of transporting a fuel/air mixture at high velocity. The components nearer the Boiler Front are subjected to the Boiler environment and they wear due to heat and erosion.

Repair rates, for Burner assemblies, are a function of operating hours, load and fuel quality. Regular assessments determine condition and guide scope of refurbishment and replacement of components.

This project covers the replacement of the burner front components on Unit #3. The burners fronts internal to the boiler have been inspected yearly and in 2014 were deemed to require replacement in 2015. The burner condition has a direct impact on unburned carbon, oxygen levels, and boiler temperatures which all have an effect on heat rate and fuel efficiency. 12 Burner Assemblies (Buckets) will be replaced in this project.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

Burner performance and integrity deteriorates over operating time. Burner distribution to the combustor and fuel air mix will become less uniform as elements in the burner system deteriorate resulting in less efficient utilization of fuel. Supporting structures, seal mechanisms and the integrity of ducts and buckets will deteriorate and provide opportunity for burner fires (outside the combustor) which is a safety concern. Refurbishment is required to maintain the Burner system in a safe and effective operating condition.

Why do this project now?

Regular assessment by NS Power and the OEM indicated the condition of the components is such that replacement is required at this time to ensure the reliability and performance of the generating unit. As the Burner System is essential to Boiler Operation, this work must be completed during a unit outage. Typically, the duration of the work is greater than two weeks (depending on scope).

Why do this project this way?

A combination of component refurbishment and replacement will be included in the refurbishment. Some tips, nozzles and burners will be replaced based on condition. Supporting structures are typically repaired in situ. Both replacement and repair are options on the various elements to optimize refurbishment cost and sustain burner system performance. When possible, components will be replaced if it is more cost effective.

CI Number : 46482 - LIN3 Burner Front Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		12,096	0	12,096
095		095-Thermal Regular Labour AO		697	0	697
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	3,480	0	3,480
012	013	012 - Materials	013 - SGP - Boiler	147,988	0	147,988
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	135,000	0	135,000
			Total Cost:	299,261	0	299,261
			Original Cost:	247,742		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 46482
Title: LIN3 Burner Front Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	15	$ 232	$ 3,479.83		
			Sub-Total	$ 3,479.83		
012 Materials						
Coal Nozzle Tips	ea	12	$ 5,461	$ 65,532.00	44361 - LIN4 Replace Boiler Fronts	
Coal Nozzle	ea	12	$ 6,038	$ 72,456.00		
Misc. Consumables	ea	1	$ 10,000	$ 10,000.00		
				$ -		
				$ -		
			Sub-Total	$ 147,988.00		
013 Contracts						
Burner Installation	ea	1	$ 115,000	$ 115,000.00		
Burner Inspection	ea	1	$ 20,000	$ 20,000.00		
			Sub-Total	$ 135,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 697.36		
Thermal / Hydro Contracts AO				$ 12,096.00		
			Sub-Total	$ 12,793.36		
			SUB-TOTAL (no AO, AFUDC)	$ 286,467.83		
			TOTAL (AO, AFUDC included)	$ 299,261.19		
Original Cost				$ 247,742.01		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 Burner Front Refurbishment
Summary of Alternatives

Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46482
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Refurbish Burner Front vs Avoided Rep	6.19%	-618,684	422,203	1	63.88%	2.4 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommeneded to refurbish the boiler front in order to avoid material, labour and replacement energy costs associated with a failure during service.

Notes/Comments :

Refurbish Burner Front vs Avoided Repair and Replacement Energy Costs

This option compares the cost of refurbishing the burner front as opposed to the material, labour and replacement energy costs incurred from an unplanned outage needed to complete repairs from a failure in service. An 80 hour outage would be required to return the unit to service.

Test 2

Test 3

Test 4

LIN3 Burner Front Refurbishment
Summary of Sensitivities

Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46482
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Burner Front vs Avoided Repair and Re	6.19%	-618,684	422,203	1	63.88%	2.4 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Burner Front vs Avoided Repair and Re	10%	-590,395	400,070	1	55.58%	2.6 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:					
A	28,289	-22,133	0	-8.30%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Burner Front vs Avoided Repair and Re	-10%	-528,527	357,850	1	54.76%	2.6 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:					
A	90,158	-64,353	0	-9.12%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
A	86,306	236,439	372,410	No
B	0	0	0	No
C	0	0	0	No
D	0	0	0	No

LIN3 Burner Front Refurbishment
Avoided Cost Calculations

Division :	Power Production	Date :	27-Oct-14
Department :	Lingan Generating Station	CI Number:	46482
Originator :		Project No. :	

Refurbish Burner Front vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			41,906	43,585		
Events/Outages (#)	1	2	1	2		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	80	80				
Totals	$50,632	$96,081	$41,906	$87,169	$92,537	$183,251
Total Capital Cost of Alternative						$299,261

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

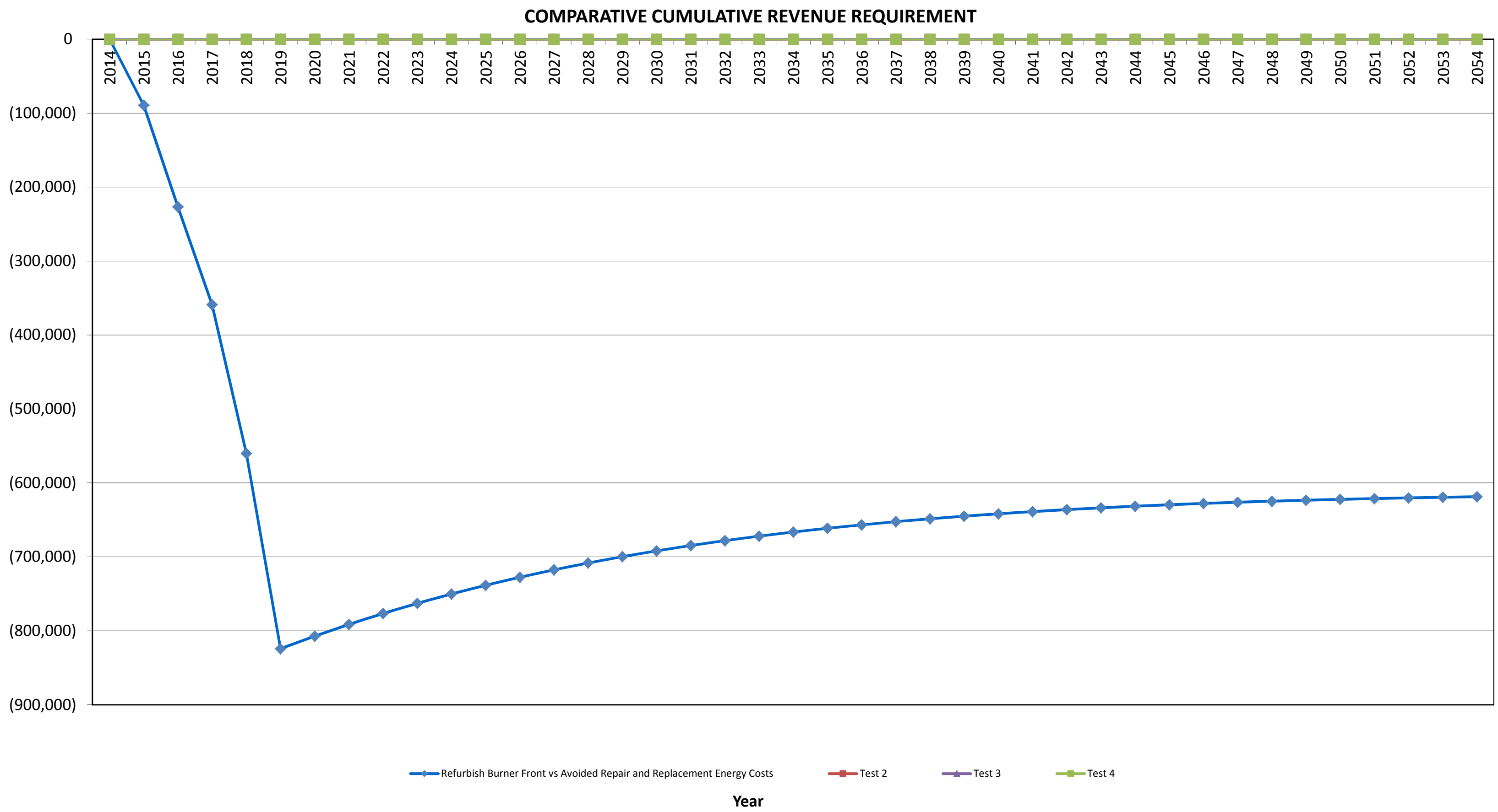
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN3 Burner Front Refurbishment
Refurbish Burner Front vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	92,537.4	(286,467.8)	11,458.7	278,540.1	(193,930.4)	(25,134.4)	(219,064.8)	(206,295.1)	0.94	(206,295.1)
2016	-	-	183,250.6	-	22,000.7	255,949.8	183,250.6	(49,987.5)	133,263.2	118,179.7	0.89	(88,115.5)
2017	-	-	188,664.8	-	20,240.7	235,166.8	188,664.8	(52,211.5)	136,453.3	113,954.9	0.84	25,839.5
2018	-	-	291,385.9	-	18,621.4	216,046.4	291,385.9	(84,557.0)	206,828.9	162,658.5	0.79	188,498.0
2019	-	-	400,069.1	-	17,131.7	198,455.7	400,069.1	(118,710.6)	281,358.5	208,373.2	0.74	396,871.2
2020	-	-	-	-	15,761.2	182,272.2	-	4,886.0	4,886.0	3,407.6	0.70	400,278.8
2021	-	-	-	-	14,500.3	167,383.4	-	4,495.1	4,495.1	2,952.2	0.66	403,231.1
2022	-	-	-	-	13,340.3	153,685.7	-	4,135.5	4,135.5	2,557.7	0.62	405,788.8
2023	-	-	-	-	12,273.0	141,083.8	-	3,804.6	3,804.6	2,216.0	0.58	408,004.8
2024	-	-	-	-	11,291.2	129,490.0	-	3,500.3	3,500.3	1,919.8	0.55	409,924.6
2025	-	-	-	-	10,387.9	118,823.8	-	3,220.2	3,220.2	1,663.3	0.52	411,587.9
2026	-	-	-	-	9,556.9	109,010.8	-	2,962.6	2,962.6	1,441.0	0.49	413,028.9
2027	-	-	-	-	8,792.3	99,982.9	-	2,725.6	2,725.6	1,248.5	0.46	414,277.4
2028	-	-	-	-	8,088.9	91,677.3	-	2,507.6	2,507.6	1,081.6	0.43	415,359.0
2029	-	-	-	-	7,441.8	84,036.0	-	2,307.0	2,307.0	937.1	0.41	416,296.1
2030	-	-	-	-	6,846.5	77,006.1	-	2,122.4	2,122.4	811.9	0.38	417,108.0
2031	-	-	-	-	6,298.8	70,538.6	-	1,952.6	1,952.6	703.4	0.36	417,811.4
2032	-	-	-	-	5,794.9	64,588.5	-	1,796.4	1,796.4	609.4	0.34	418,420.8
2033	-	-	-	-	5,331.3	59,114.3	-	1,652.7	1,652.7	528.0	0.32	418,948.8
2034	-	-	-	-	4,904.8	54,078.1	-	1,520.5	1,520.5	457.4	0.30	419,406.2
2035	-	-	-	-	4,512.4	49,444.9	-	1,398.8	1,398.8	396.3	0.28	419,802.5
2036	-	-	-	-	4,151.4	45,182.2	-	1,286.9	1,286.9	343.3	0.27	420,145.8
2037	-	-	-	-	3,819.3	41,260.6	-	1,184.0	1,184.0	297.5	0.25	420,443.2
2038	-	-	-	-	3,513.7	37,652.7	-	1,089.3	1,089.3	257.7	0.24	420,700.9
2039	-	-	-	-	3,232.6	34,333.5	-	1,002.1	1,002.1	223.3	0.22	420,924.2
2040	-	-	-	-	2,974.0	31,279.7	-	921.9	921.9	193.4	0.21	421,117.6
2041	-	-	-	-	2,736.1	28,470.3	-	848.2	848.2	167.6	0.20	421,285.2
2042	-	-	-	-	2,517.2	25,885.7	-	780.3	780.3	145.2	0.19	421,430.4
2043	-	-	-	-	2,315.8	23,507.8	-	717.9	717.9	125.8	0.18	421,556.2
2044	-	-	-	-	2,130.6	21,320.1	-	660.5	660.5	109.0	0.17	421,665.2
2045	-	-	-	-	1,960.1	19,307.5	-	607.6	607.6	94.4	0.16	421,759.6
2046	-	-	-	-	1,803.3	17,455.8	-	559.0	559.0	81.8	0.15	421,841.4
2047	-	-	-	-	1,659.1	15,752.3	-	514.3	514.3	70.9	0.14	421,912.3
2048	-	-	-	-	1,526.3	14,185.1	-	473.2	473.2	61.4	0.13	421,973.7
2049	-	-	-	-	1,404.2	12,743.2	-	435.3	435.3	53.2	0.12	422,026.9
2050	-	-	-	-	1,291.9	11,416.7	-	400.5	400.5	46.1	0.12	422,073.0
2051	-	-	-	-	1,188.5	10,196.4	-	368.4	368.4	39.9	0.11	422,112.9
2052	-	-	-	-	1,093.4	9,073.6	-	339.0	339.0	34.6	0.10	422,147.5
2053	-	-	-	-	1,006.0	8,040.7	-	311.9	311.9	30.0	0.10	422,177.5
2054	-	-	-	-	925.5	7,090.4	-	286.9	286.9	26.0	0.09	422,203.4
Total	**-**	**-**	**1,155,907.8**	**(286,467.8)**	**275,824.6**		**869,439.9**	**(272,825.8)**	**596,614.2**	**422,203.4**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(100,000)
(200,000)
(300,000)
(400,000)
(500,000)
(600,000)
(700,000)
(800,000)
(900,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Refurbish Burner Front vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46508

Title: LIN2 – Boiler Refurbishment 2015

Start Date:	2015/08
In-Service Date:	2015/08
Final Cost Date:	2015/12
Function:	Steam
Forecast Amount:	$289,345

DESCRIPTION:

The scope of work for this project is to refurbish and replace deteriorated boiler tubes, tube bends and shields on the Lingan Unit 2 boiler as part of the planned outage in 2015. The scope of this project is determined as part of the annual boiler condition data collection and analysis. This effort includes evaluation and prioritization of activities to be undertaken during the annual outage. Protective erosion shields identified as missing or degraded will be replaced with new shields. Tubes and bends will be replaced in the areas where the thickness readings are below American Society of Mechanical Engineers (ASME) specifications. This tolerance maximizes the economic tube life while maintaining boiler reliability.

Summary of Related CIs (+/- 2 years):
2014 CI 43162 LIN2 Boiler Refurbishment $200,309

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

On-going asset management activities have identified the requirement for boiler component replacement to maintain the long term reliability of the boiler and mitigate the risk of unplanned outages due to tube leaks. Boiler Tube failures represent the industry's single largest source of outages for steam based generation. NS Power has a long history of managing this with comprehensive Boiler Inspection and Investment Programs to match the various failure mechanisms. While Unit 2 is currently forecasted to be retired in 2018, this investment is required in order to reliably operate this unit until that time. Asset Management activities are aimed at minimizing the investment in Unit 2 while still providing reliable operation of the unit.

Why do this project now?

In order to mitigate the risk of an unplanned outage, annual boiler refurbishment activities are required. Some of the tubes to be inspected and replaced are difficult to access and sufficient time during a planned outage is required to complete repairs or replacements. The annual planned outage duration will afford the time necessary to assess, locate and repair tubes and shields.

Why do this project this way?

Replacing deteriorated tubes, tube bends and shields will mitigate the risk of tube leaks and minimize the number of unplanned outages. Based on boiler assessments, these upgrades are necessary to maintain reliable operation of the boiler. Refurbishment of these components is not an option once they are outside acceptable tolerances.

CI Number : 46508 - LIN2 Boiler Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 304 - 304-Lingan 1&2 Prod. Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal Regular Labour AO		465	0	465
095		095-Thermal & Hydro Contracts AO		19,712	0	19,712
095		095-Thermal Term Labour AO		4,649	0	4,649
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	2,320	0	2,320
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	23,199	0	23,199
012	013	012 - Materials	013 - SGP - Boiler	19,000	0	19,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	220,000	0	220,000
			Total Cost:	289,345	0	289,345
			Original Cost:	110,293		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 46508
Title: LIN2 Boiler Refurbishment 2015
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	10	$ 232	$ 2,319.89		
			Sub-Total	$ 2,319.89		
004 Term Labour						
Utilityworker	PD	100	$ 232	$ 23,198.88		
				$ -		
				$ -		
			Sub-Total	$ 23,198.88		
012 Materials						
Boiler Tube	ea	1	$ 6,000	$ 6,000.00		
Boiler Shields	ea	1	$ 8,000	$ 8,000.00		
Misc. Consumables	ea	1	$ 5,000	$ 5,000.00		
			Sub-Total	$ 19,000.00		
013 Contracts						
Boiler Inspection & Refurbishment	ea	1	$ 220,000	$ 220,000.00		
			Sub-Total	$ 220,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 464.91		
Thermal Term Labour AO				$ 4,649.06		
Thermal / Hydro Contracts AO				$ 19,712.00		
			Sub-Total	$ 24,825.97		
			SUB-TOTAL (no AO, AFUDC)	$ 264,518.77		
			TOTAL (AO, AFUDC included)	$ 289,344.74		
Original Cost				$ 110,293.09		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN2 Boiler Refurbishment 2015
Summary of Alternatives

Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46508
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Boiler Refurbishment vs. Avoided Repa	6.19%	-496,109	340,588	1	71.83%	1.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

Refurbishment of the boileris recommended in order to avoid unplanned outages and related repair and replacement energy costs. The PV of Revenue Requirement supports this decision.

Notes/Comments :

Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

This option compares replacing the boiler components as part of this refurbishment versus dealing with the expected tube leaks through unplanned outages.

Test 2

Test 3

Test 4

LIN2 Boiler Refurbishment 2015
Summary of Sensitivities

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Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46508
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	6.19%	-496,109	340,588	1	71.83%	1.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	10%	-468,974	320,151	1	61.61%	2.0 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change: A	27,135	-20,437	0	-10.22%	0.1 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Boiler Refurbishment vs. Avoided Repair and Rep	-10%	-419,363	286,092	1	60.60%	2.0 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change: A	76,746	-54,496	0	-11.23%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement		**PV of Revenue Requirement**	**PV of Revenue Requirement**	**PV of Revenue Requirement**	**Delay?**
	Yrs Delay:	1	2	3	
	A	81,507	231,510	445,526	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN2 Boiler Refurbishment 2015
Avoided Cost Calculations

Division :	Power Production	**Date :**	**27-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46508
Originator :		**Project No. :**	

Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			69,640	72,427		
Events/Outages (#)	1	2	1	2		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	80	80				
Totals	$17,752	$37,853	$69,640	$144,855	$87,392	$182,708
Total Capital Cost of Alternative						$289,345

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

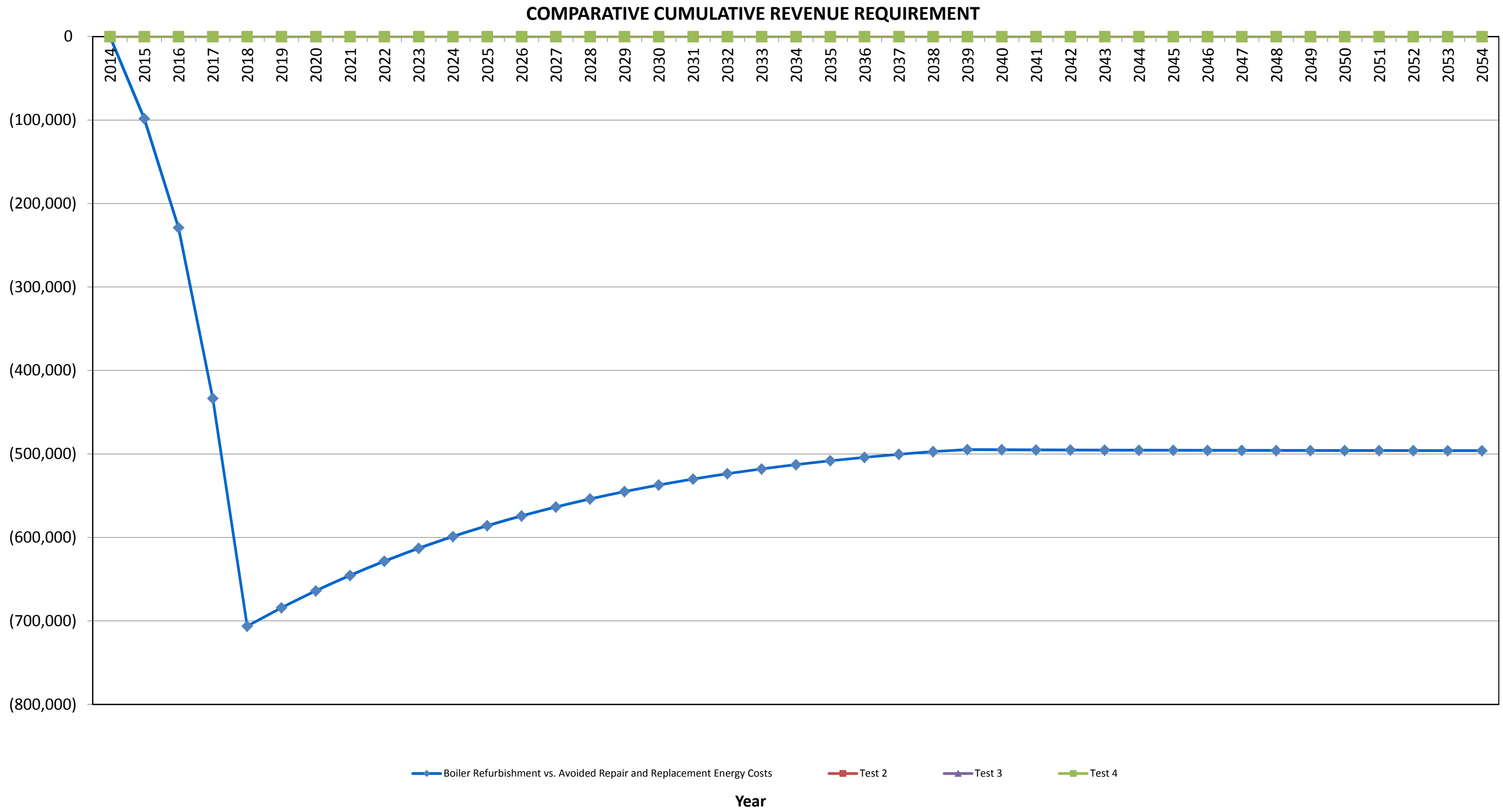
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN2 Boiler Refurbishment 2015
Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	87,391.9	(264,519.0)	10,580.8	260,790.2	(177,127.1)	(23,811.5)	(200,938.5)	(189,225.5)	0.94	(189,225.5)
2016	-	-	182,707.6	-	20,315.1	239,331.2	182,707.6	(50,341.7)	132,365.9	117,384.0	0.89	(71,841.5)
2017	-	-	283,894.1	-	18,689.9	219,588.9	283,894.1	(82,213.3)	201,680.8	168,427.7	0.84	96,586.3
2018	-	-	392,130.1	-	17,194.7	201,425.9	392,130.1	(116,230.0)	275,900.1	216,978.8	0.79	313,565.1
2019	-	-	-	-	15,819.1	184,716.0	-	4,903.9	4,903.9	3,631.8	0.74	317,196.9
2020	-	-	-	-	14,553.6	169,342.9	-	4,511.6	4,511.6	3,146.5	0.70	320,343.4
2021	-	-	-	-	13,389.3	155,199.7	-	4,150.7	4,150.7	2,726.0	0.66	323,069.5
2022	-	-	-	-	12,318.1	142,187.9	-	3,818.6	3,818.6	2,361.8	0.62	325,431.3
2023	-	-	-	-	11,332.7	130,217.0	-	3,513.1	3,513.1	2,046.2	0.58	327,477.4
2024	-	-	-	-	10,426.1	119,203.8	-	3,232.1	3,232.1	1,772.7	0.55	329,250.2
2025	-	-	-	-	9,592.0	109,071.7	-	2,973.5	2,973.5	1,535.9	0.52	330,786.0
2026	-	-	-	-	8,824.6	99,750.1	-	2,735.6	2,735.6	1,330.6	0.49	332,116.6
2027	-	-	-	-	8,118.7	91,174.3	-	2,516.8	2,516.8	1,152.8	0.46	333,269.5
2028	-	-	-	-	7,469.2	83,284.5	-	2,315.4	2,315.4	998.8	0.43	334,268.2
2029	-	-	-	-	6,871.6	76,025.9	-	2,130.2	2,130.2	865.3	0.41	335,133.5
2030	-	-	-	-	6,321.9	69,348.0	-	1,959.8	1,959.8	749.7	0.38	335,883.2
2031	-	-	-	-	5,816.1	63,204.4	-	1,803.0	1,803.0	649.5	0.36	336,532.7
2032	-	-	-	-	5,350.9	57,552.2	-	1,658.8	1,658.8	562.7	0.34	337,095.4
2033	-	-	-	-	4,922.8	52,352.2	-	1,526.1	1,526.1	487.5	0.32	337,582.9
2034	-	-	-	-	4,529.0	47,568.2	-	1,404.0	1,404.0	422.4	0.30	338,005.3
2035	-	-	-	-	4,166.6	43,166.9	-	1,291.7	1,291.7	365.9	0.28	338,371.2
2036	-	-	-	-	3,833.3	39,117.7	-	1,188.3	1,188.3	317.0	0.27	338,688.2
2037	-	-	-	-	3,526.7	35,392.5	-	1,093.3	1,093.3	274.7	0.25	338,962.9
2038	-	-	-	-	3,244.5	31,965.3	-	1,005.8	1,005.8	238.0	0.24	339,200.8
2039	-	-	-	-	2,985.0	28,812.2	-	925.3	925.3	206.2	0.22	339,407.0
2040	-	-	-	-	2,746.2	25,911.4	-	851.3	851.3	178.6	0.21	339,585.6
2041	-	-	-	-	2,526.5	23,242.7	-	783.2	783.2	154.7	0.20	339,740.4
2042	-	-	-	-	2,324.4	20,787.5	-	720.5	720.5	134.1	0.19	339,874.4
2043	-	-	-	-	2,138.4	18,528.6	-	662.9	662.9	116.2	0.18	339,990.6
2044	-	-	-	-	1,967.3	16,450.5	-	609.9	609.9	100.6	0.17	340,091.2
2045	-	-	-	-	1,809.9	14,538.7	-	561.1	561.1	87.2	0.16	340,178.4
2046	-	-	-	-	1,665.1	12,779.7	-	516.2	516.2	75.5	0.15	340,253.9
2047	-	-	-	-	1,531.9	11,161.5	-	474.9	474.9	65.4	0.14	340,319.4
2048	-	-	-	-	1,409.4	9,672.8	-	436.9	436.9	56.7	0.13	340,376.1
2049	-	-	-	-	1,296.6	8,303.1	-	402.0	402.0	49.1	0.12	340,425.2
2050	-	-	-	-	1,192.9	7,043.1	-	369.8	369.8	42.6	0.12	340,467.7
2051	-	-	-	-	1,097.5	5,883.8	-	340.2	340.2	36.9	0.11	340,504.6
2052	-	-	-	-	1,009.7	4,817.3	-	313.0	313.0	31.9	0.10	340,536.6
2053	-	-	-	-	928.9	3,836.1	-	288.0	288.0	27.7	0.10	340,564.2
2054	-	-	-	-	854.6	2,933.4	-	264.9	264.9	24.0	0.09	340,588.2
Total	**-**	**-**	**946,123.7**	**(264,519.0)**	**254,691.3**		**681,604.7**	**(214,344.0)**	**467,260.6**	**340,588.2**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(100,000)
(200,000)
(300,000)
(400,000)
(500,000)
(600,000)
(700,000)
(800,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Boiler Refurbishment vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 41645

Title: TRE6 – Bottom Ash Seal Replacement

Start Date: 2015/06
In-Service Date: 2015/09
Final Cost Date: 2016/03
Function: Steam
Forecast Amount: $307,499

DESCRIPTION:

The Trenton Unit #6 boiler has a wet bottom ash seal which allows for collection of the bottom ash while sealing the negative pressure of the boiler from atmospheric pressure. The seal is comprised of a tank (or pit) where a level of water is maintained, combined with a corrugated "dip plate" which extends into the water from the underside of the boiler. The intent of this project is to replace the seal plate.

Summary of Related CIs (+/- 2 years):
2014 CI 44723 TRE6 Bottom Ash Chain Replacement $193,819

JUSTIFICATION:

Justification Criteria: Thermal

Criteria: Equipment Replacement

Why do this project?

The bottom ash seal plate on Trenton Unit 6 boiler was discovered to be deteriorated during the latter part of the 2010 outage of Unit 6. Repairs were made by removing the damaged lower section, lapping it over the upper section and welding it together. This project will replace the seal plate with new material to ensure the integrity of the seal on an ongoing basis. Loss of the seal will result in unit deration or outage. The 2010 repairs allowed for the deferral of this replacement, but ongoing weld repair is not technically feasible. Seal integrity will continue to deteriorate if not replaced and will result in unplanned unit outages.

Why do this project now?

The seal plate repairs that have been made have extended the operating life of the seal plate but are not a long-term solution. The plate is now approximately four inches shorter than original design, and the welds holding the two sections together will eventually fail. If the components fail at an unplanned time without material readily available, the unit stability, capacity and availability will be compromised. If the seal fails, the unit must be removed from service to complete a temporary repair (short outage) or a complete replacement (long outage).

Why do this project this way?

Replacement of the corrugated seal plate during the 2015 planned outage will allow the seal to be brought back to OEM design, and is expected to last as long as the original components (approximately 20 years). Repair of the seal has extended its useful life. However, it is not technically feasible to repair and patch indefinitely. The seal must be replaced in order to ensure long-term, reliable service of the unit.

CI Number : 41645-SB25 - TRE6 Bottom Ash Seal Replacement **Project Number** SB25

Parent CI Number : -

Cost Centre : 345 - 345-Trenton unit 6 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		9,139	0	9,139
095		095-Thermal Overtime Labour AO		353	0	353
095		095-Thermal Regular Labour AO		4,937	0	4,937
095		095-Thermal Term Labour AO		1,412	0	1,412
095		095-Thermal & Hydro Contracts AO		14,406	0	14,406
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	19,937	0	19,937
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	3,524	0	3,524
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	7,047	0	7,047
012	013	012 - Materials	013 - SGP - Boiler	79,520	0	79,520
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	158,625	0	158,625
001	085	001 - THERMAL Regular Labour	085 Design	2,349	0	2,349
028	085	028 - Consulting	085 Design	3,200	0	3,200
001	087	001 - THERMAL Regular Labour	087 Field Super.& Ops.	2,349	0	2,349
011	087	011 - Travel Expense	087 Field Super.& Ops.	400	0	400
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	300	0	300
			Total Cost:	307,499	0	307,499
			Original Cost:	163,118		

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# / FP#: 41645
Title: TRE6 Bottom Ash Seal Replacement
Execution Year: 2015

Item	Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
	001 Regular Labour						
	Mechanical	PD	50	$ 352	$ 17,617.50		
	Utility	PD	10	$ 232	$ 2,319.90		
	Engineering	PD	6	$ 391	$ 2,348.94		
	Supervision	PD	6	$ 391	$ 2,348.94		
				Sub-Total	$ 24,635.28		
	002 Overtime Labour						
	Mechanical	PD	5	$ 705	$ 3,523.50		
				Sub-Total	$ 3,523.50		
	004 Term Labour						
	Mechanical	PD	20	$ 352	$ 7,047.00		
				Sub-Total	$ 7,047.00		
	011 Travel						
	Travel	lot	1	$ 400	$ 400.00		
				Sub-Total	$ 400.00		
	012 Materials						
	Skirt Plate	lot	1	$ 46,840	$ 46,840.00		
	Miscellaneous SS Plate	lot	1	[redacted]			
	Planking	lot	1	$ 1,000	$ 1,000.00		
	Boiler Armour	lot	1	[redacted]		Cost Support Item #1	
	Freight	lot	1	$ 5,000	$ 5,000.00		
					$ -		
				Sub-Total	$ 79,520.00		
	013 Contracts						
	Bottom Seal Replacements	lot	1	$ 135,825	$ 135,825.00		
	External Project Mgmt/Supervision	hr	160	$ 80	$ 12,800.00		
	Mob/Demob/Trailers	lot	1	$ 10,000	$ 10,000.00		
					$ -		
					$ -		
				Sub-Total	$ 158,625.00		
	028 Consultants						
	External Engineering	hr	40	$ 80	$ 3,200.00		
					$ -		
				Sub-Total	$ 3,200.00		
	041 Meals						
	Meals	lot	1	$ 300	$ 300.00		
				Sub-Total	$ 300.00		
	094 Interest Capitalized						
	AFUDC				$ 9,139.18		
				Sub-Total	$ 9,139.18		
	095 Administrative Overhead						
	Thermal Regular AO	lot	1	$ 4,936.91	$ 4,936.91		
	Thermal Overtime AO	lot	1	$ 353.05	$ 353.05		
	Thermal Term AO	lot	1	$ 1,412.22	$ 1,412.22		
	Thermal Contracts AO	lot	1	$ 14,406.49	$ 14,406.49		
				Sub-Total	$ 21,108.67		
				SUB-TOTAL (no AO, AFUDC)	$ 277,250.78		
				TOTAL (AO, AFUDC included)	$ 307,498.63		
10	**Original Cost**				$ 163,118.00		

Note 1: Reference to "Completed similar projects (FP#'s)" is to be provided when the item estimate is based on work of similar scope for a recently completed project

TRE6 Bottom Ash Seal Replacement
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46145
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Seal Replacement vs Avoided Repair a	6.19%	-1,609,824	1,122,249	1	166.97%	1.2 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to replace the bottom ash seal of TRE6. This project will avoid replacement energy costs associated with an unplanned outage to address/repair failed seals. This project justification is backed by favorable economic analysis data.

Notes/Comments :

Seal Replacement vs Avoided Repair and Replacement Energy Costs

Justification for replacing the seal plating for TRE6 bottom ash is based on avoided energy costs which would otherwise be incurred to take the Unit down to perform replacements. Assumptions: In the event of a failure the unit would be forced off-line for two weeks to complete the work. An annual escalation of 2% on labour estimates, and annual escalation of 5% on both materials and material cost due to the quickly deteriorating equipment.

Test 2

Test 3

Test 4

TRE6 Bottom Ash Seal Replacement
Summary of Sensitivities

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46145
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Seal Replacement vs Avoided Repair and Replac	6.19%	-1,609,824	1,122,249	1	166.97%	1.2 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Seal Replacement vs Avoided Repair and Replac	10%	-1,582,564	1,099,968	1	144.12%	1.4 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:	**A**	27,260	-22,282	0	-22.85%	0.1 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Seal Replacement vs Avoided Repair and Replac	-10%	-1,421,581	987,743	1	141.97%	1.4 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:	**A**	188,243	-134,507	0	-25.00%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	174,894	413,021	735,438	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

TRE6 Bottom Ash Seal Replacement
Avoided Cost Calculations

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46145
Originator :		**Project No. :**	

Seal Replacement vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			99,600	109,282		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	25%	35%	25%	35%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	160	160				
Duration (Hours)	336	336				
Totals	$162,621	$246,494	$24,900	$38,249	$187,521	$284,743
Total Capital Cost of Alternative						$307,499

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

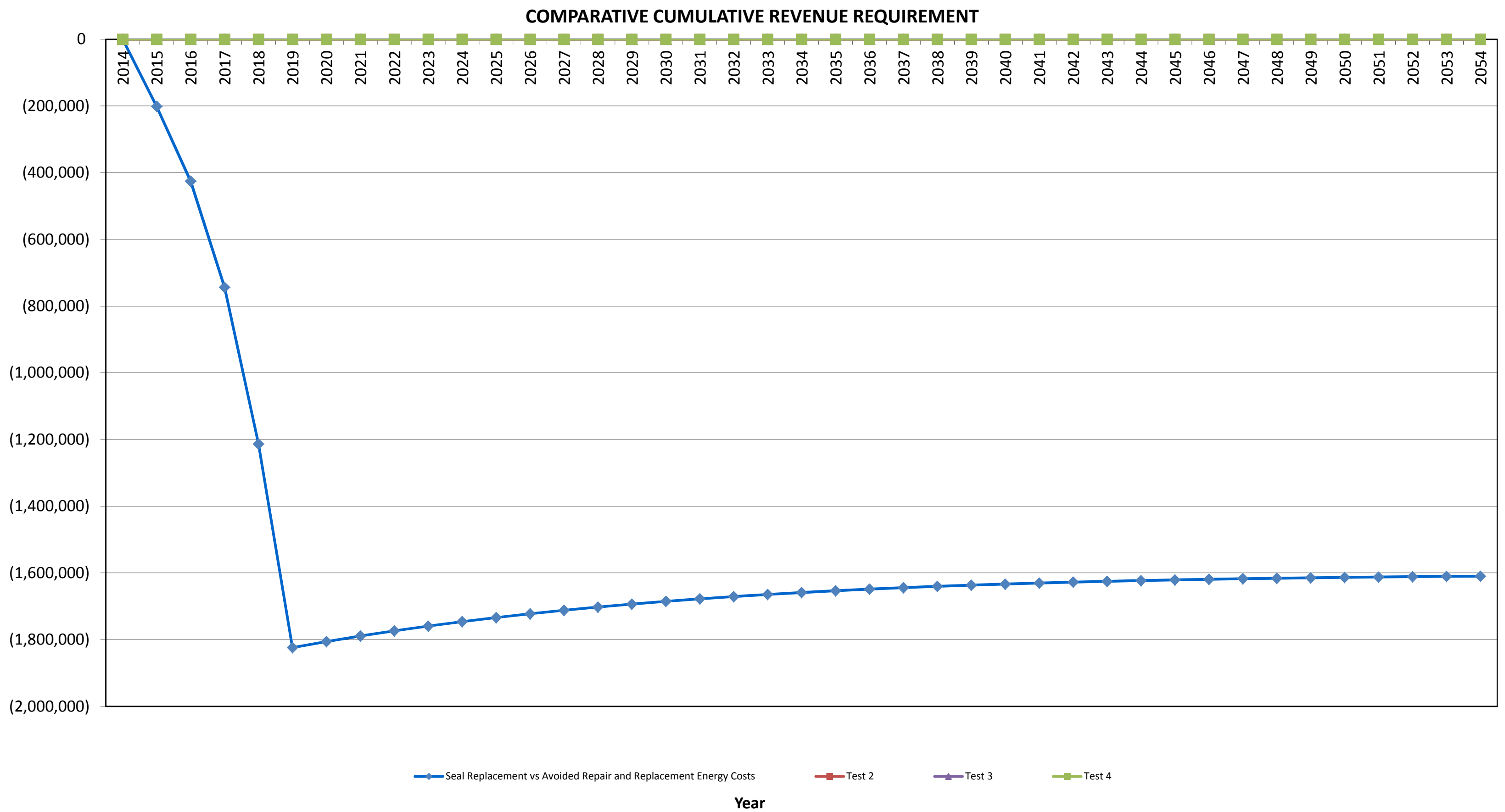
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

TRE6 Bottom Ash Seal Replacement
Seal Replacement vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	187,521.3	(286,390.0)	11,090.0	271,986.7	(98,868.6)	(54,693.7)	(153,562.3)	(144,610.9)	0.94	(144,610.9)
2016	-	-	284,742.7	-	21,292.9	249,721.2	284,742.7	(81,669.4)	203,073.2	180,088.3	0.89	35,477.4
2017	-	-	419,132.9	-	19,589.4	229,236.9	419,132.9	(123,858.5)	295,274.4	246,589.7	0.84	282,067.1
2018	-	-	648,228.5	-	18,022.3	210,391.3	648,228.5	(195,363.9)	452,864.6	356,150.8	0.79	638,217.9
2019	-	-	891,775.5	-	16,580.5	193,053.4	891,775.5	(271,310.4)	620,465.0	459,514.5	0.74	1,097,732.3
2020	-	-	-	-	15,254.1	177,102.5	-	4,728.8	4,728.8	3,298.0	0.70	1,101,030.3
2021	-	-	-	-	14,033.7	162,427.7	-	4,350.5	4,350.5	2,857.3	0.66	1,103,887.6
2022	-	-	-	-	12,911.0	148,926.9	-	4,002.4	4,002.4	2,475.4	0.62	1,106,363.0
2023	-	-	-	-	11,878.1	136,506.1	-	3,682.2	3,682.2	2,144.7	0.58	1,108,507.7
2024	-	-	-	-	10,927.9	125,079.0	-	3,387.6	3,387.6	1,858.1	0.55	1,110,365.7
2025	-	-	-	-	10,053.7	114,566.1	-	3,116.6	3,116.6	1,609.8	0.52	1,111,975.5
2026	-	-	-	-	9,249.4	104,894.2	-	2,867.3	2,867.3	1,394.7	0.49	1,113,370.2
2027	-	-	-	-	8,509.4	95,996.1	-	2,637.9	2,637.9	1,208.3	0.46	1,114,578.5
2028	-	-	-	-	7,828.7	87,809.8	-	2,426.9	2,426.9	1,046.8	0.43	1,115,625.3
2029	-	-	-	-	7,202.4	80,278.4	-	2,232.7	2,232.7	906.9	0.41	1,116,532.3
2030	-	-	-	-	6,626.2	73,349.5	-	2,054.1	2,054.1	785.8	0.38	1,117,318.0
2031	-	-	-	-	6,096.1	66,974.9	-	1,889.8	1,889.8	680.8	0.36	1,117,998.8
2032	-	-	-	-	5,608.4	61,110.3	-	1,738.6	1,738.6	589.8	0.34	1,118,588.6
2033	-	-	-	-	5,159.7	55,714.9	-	1,599.5	1,599.5	511.0	0.32	1,119,099.5
2034	-	-	-	-	4,747.0	50,751.1	-	1,471.6	1,471.6	442.7	0.30	1,119,542.2
2035	-	-	-	-	4,367.2	46,184.4	-	1,353.8	1,353.8	383.5	0.28	1,119,925.8
2036	-	-	-	-	4,017.8	41,983.0	-	1,245.5	1,245.5	332.3	0.27	1,120,258.1
2037	-	-	-	-	3,696.4	38,117.8	-	1,145.9	1,145.9	287.9	0.25	1,120,545.9
2038	-	-	-	-	3,400.7	34,561.8	-	1,054.2	1,054.2	249.4	0.24	1,120,795.4
2039	-	-	-	-	3,128.6	31,290.2	-	969.9	969.9	216.1	0.22	1,121,011.4
2040	-	-	-	-	2,878.3	28,280.4	-	892.3	892.3	187.2	0.21	1,121,198.6
2041	-	-	-	-	2,648.1	25,511.3	-	820.9	820.9	162.2	0.20	1,121,360.8
2042	-	-	-	-	2,436.2	22,963.8	-	755.2	755.2	140.5	0.19	1,121,501.4
2043	-	-	-	-	2,241.3	20,620.1	-	694.8	694.8	121.7	0.18	1,121,623.1
2044	-	-	-	-	2,062.0	18,463.9	-	639.2	639.2	105.5	0.17	1,121,728.6
2045	-	-	-	-	1,897.1	16,480.2	-	588.1	588.1	91.4	0.16	1,121,820.0
2046	-	-	-	-	1,745.3	14,655.2	-	541.0	541.0	79.2	0.15	1,121,899.1
2047	-	-	-	-	1,605.7	12,976.1	-	497.8	497.8	68.6	0.14	1,121,967.7
2048	-	-	-	-	1,477.2	11,431.4	-	457.9	457.9	59.4	0.13	1,122,027.1
2049	-	-	-	-	1,359.0	10,010.3	-	421.3	421.3	51.5	0.12	1,122,078.6
2050	-	-	-	-	1,250.3	8,702.9	-	387.6	387.6	44.6	0.12	1,122,123.2
2051	-	-	-	-	1,150.3	7,500.0	-	356.6	356.6	38.6	0.11	1,122,161.9
2052	-	-	-	-	1,058.3	6,393.4	-	328.1	328.1	33.5	0.10	1,122,195.4
2053	-	-	-	-	973.6	5,375.3	-	301.8	301.8	29.0	0.10	1,122,224.4
2054	-	-	-	-	895.7	4,438.7	-	277.7	277.7	25.1	0.09	1,122,249.5
Total	**-**	**-**	**2,431,400.9**	**(286,390.0)**	**266,950.0**		**2,145,011.0**	**(670,979.8)**	**1,474,031.2**	**1,122,249.5**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(200,000)
(400,000)
(600,000)
(800,000)
(1,000,000)
(1,200,000)
(1,400,000)
(1,600,000)
(1,800,000)
(2,000,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Seal Replacement vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

American Energy Products, Inc.
1105 Industrial Street
Lansing, KS 66043
PH: 913-351-3388 FAX: 913-351-3399
Procurement@AmericanEnergyInc.com

Proposal

Date	Proposal #
10/5/2012	4409

Bill To:	Ship To:
Nova Scotia Power c/o Accounts Payable P.O. Box 910 Halifax, NS, B3J 2W5 Canada	Nova Scotia Power Inc. c/o Thompkins, Ms. Joan F. Trenton Generating Station 108 Power Plant Road Trenton, NS B0K 1X0

EIN #	Reference #	Customer #	Quote Good Until	Sales Rep	Unit #
48-1240166	121005-GW1	S20104	11/2/2012	GW	

Stock #	Description	Qty	Unit Price	Total
*BOILER ARMOR™	BOILER ARMOR™ REPLACEMENT: (12) PANELS @ 48" WIDE X 30" O.A. HANGING DISTANCE WITH FLATBAR. MATERIAL TYPE: PROPRIETARY ALLOY FOR APPLICATIONS WITH ELEVATED HEAT - TWO PLY OPEN ENDED (8) PANELS @ 39" WIDE X 30" O.A. HANGING DISTANCE WITH FLATBAR. MATERIAL TYPE: PROPRIETARY ALLOY FOR APPLICATIONS WITH ELEVATED HEAT - TWO PLY OPEN ENDED			[redacted]

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Total $[redacted]

We are pleased to offer this proposal. Please refer to the reference # above when ordering.

Turbine

Steam Turbines & Generators

NS Power has a fleet of 13 steam turbines and electrical generators, ranging from 50MW to 185MW nominal rating. Steam turbines are considered complex asset classes, as they are composed of extremely heavy rotating elements (rotors), contain high energy steam from the boiler, include sophisticated valve and bearing systems, and are managed by state of the art supervisory systems. Generators are also considered complex asset classes, as they are composed of an extremely heavy field rotor, both filed and stator windings have insulation systems which are exposed to electromechanical and/or centrifugal stresses, are hydrogen cooled and, include bearing and lube systems similar to Turbines.

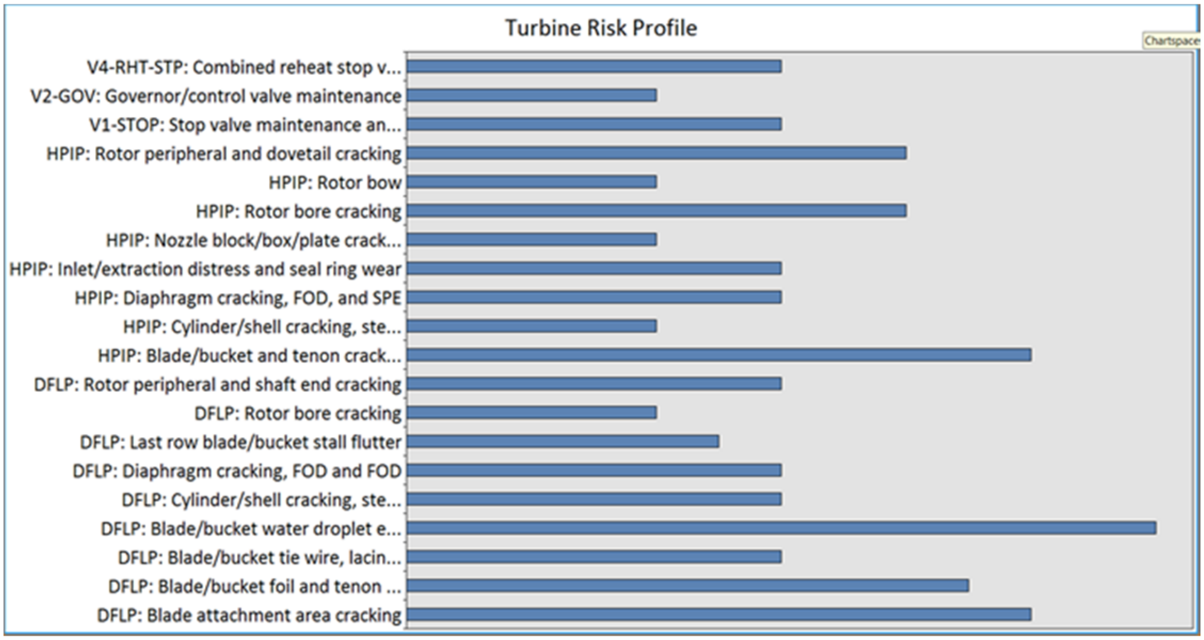
NS Power engages independent industry experts to support regular health assessments and risk profiles. Approximately 60 key condition areas are assessed and rated for each turbine and generator. (Generators are considered in the same Health Assessments as turbines as their maintenance intervals need to be considered together in order to optimize planned major outage scheduling).

The two graphics below illustrate a typical Turbine and Generator risk profile (Lingan Unit #3 is illustrated as it has a planned major outage in 2015). Each unit has a similar risk profile developed on the 25 point scale from comprehensive assessments as detailed in the Generation Asset Management overview. Risks are considered for each turbine/generator set with the highest risks typically dictating the timing of the next planned major outage. Lower risk items are considered against their anticipated risk progression, compared to the next planned major outage to determine when the risk needs to be addressed.

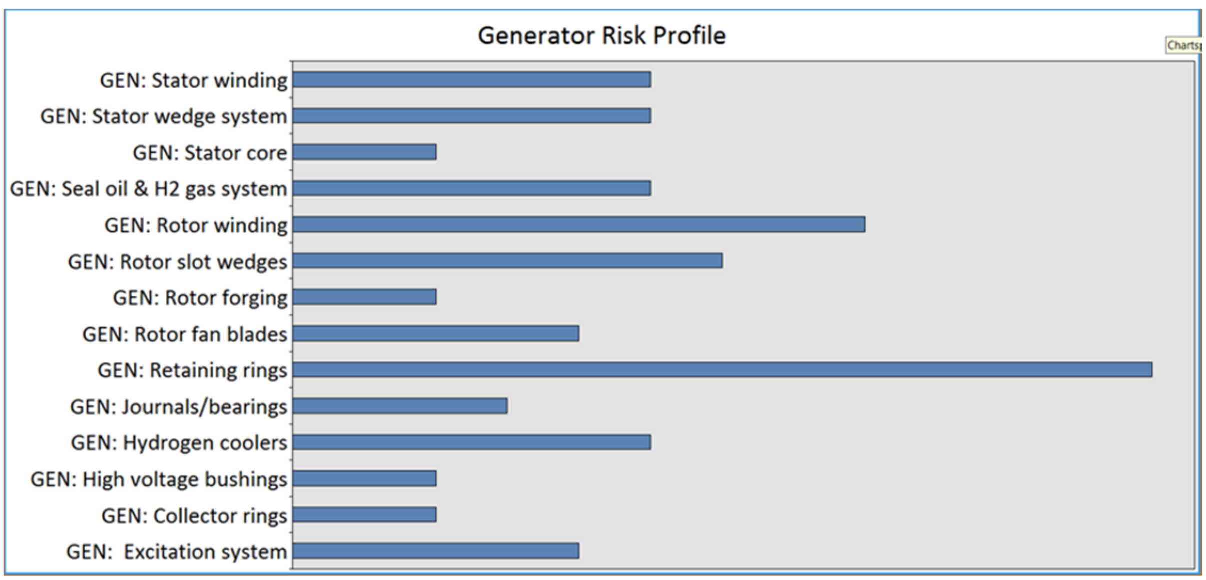
Long term maintenance planning assumes an eight year interval between planned major outages. However actual condition, operating history and anticipated unit utilization are used to optimize the actual planned major outage and associated capital investment.

In 2015, Turbine Valve refurbishments are occurring across multiple units. Turbine Valve inspection intervals are planned for regular time intervals and to align with planned outages. Previous inspections determine condition and set level of work required at next inspection interval. The timing of this large investment in Turbine Valves is a result of condition and does not represent a change in investment strategy.

Lingan Unit #3 Turbine Risk Profile



Lingan Unit#3 Generator Risk Profile



CI Number: 42806

Title: LIN3 L-0 Turbine Blade Replacements

Start Date: 2015/02
In-Service Date: 2015/05
Final Cost Date: 2015/12
Function: Steam
Forecast Amount: $4,157,741

DESCRIPTION:

This project includes the replacement of the Last Pass (L-0) turbine blades. The L-0 blades are original to the turbine and are susceptible to wear due to their location in the turbine (the L-0 blades are the last blades before the steam is condensed in the condenser).

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

Depreciation Class: Lingan Unit 3&4

Estimated Useful Life: 25 Years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

Evaluation of Unit 3 L-0 turbine blade life consumption calculations and inspection by the NS Power Turbine Generator Asset Management Team indicates that the L-0 blades are now at the end of their service life and replacement is recommended. The tips of the blades have started to erode, and erosion patterns have caused stress risers which allowed a cyclic fatigue fracture to occur with increasing risk of blade separation.

Why do this project now?

Life consumption calculations and inspection indicate that the Last Pass Blades are at the end of life and due to the reasons mentioned above are at risk of blade separation. It is necessary for safety and unit reliability to re-establish life cycle integrity of the Unit 3 L-0 blades. Extending the run beyond 2015 increases the risk of forced outages and subsequent unplanned major outages. Unit 3 has a major planned outage for 2015. This major planned outage provides sufficient time for the L-0 blades to be replaced.

Why do this project this way?

Repair of individual blades or replacement of individual blades versus replacement of the blade set is not an adequate measure to restore integrity. In certain cases, replacement of individual blades can be an option; however the failure mechanism and condition of all the last pass blades are such that full replacement is necessary.

CI Number : 42806-SA38 - LIN3 L-0 Turbine Blade Replacements **Project Numb** SA38

Parent CI Number : -

Cost Centre : 305 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		101,048	0	101,048
095		095-Thermal Overtime Labour AO		25,481	0	25,481
095		095-Thermal Term Labour AO		28,913	0	28,913
095		095-Thermal & Hydro Contracts AO		122,550	0	122,550
095		095-Thermal Regular Labour AO		27,296	0	27,296
001	010	001 - Regular Labour (No AO)	010 - SGP - Turbo Gen.Instal.	1,314	0	1,314
001	010	001 - THERMAL Regular Labour	010 - SGP - Turbo Gen.Instal.	128,180	0	128,180
002	010	002 - THERMAL Overtime Labour	010 - SGP - Turbo Gen.Instal.	253,691	0	253,691
004	010	004 - Term Labour (NO AO)	010 - SGP - Turbo Gen.Instal.	17,286	0	17,286
004	010	004 - THERMAL Term Labour	010 - SGP - Turbo Gen.Instal.	139,893	0	139,893
011	010	011 - Travel Expense	010 - SGP - Turbo Gen.Instal.	15,000	0	15,000
012	010	012 - Materials	010 - SGP - Turbo Gen.Instal.	[redacted]	0	[redacted]
013	010	013 - POWER PRODUCTION Contracts	010 - SGP - Turbo Gen.Instal.	1,337,570	0	1,337,570
041	010	041 - Meals & Entertainment	010 - SGP - Turbo Gen.Instal.	336	0	336
066	010	066 - Other Goods & Services	010 - SGP - Turbo Gen.Instal.	[redacted]	0	[redacted]
			Total Cost:	4,157,741	0	4,157,741
			Original Cost:	1,180,833		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 42806
Title: LIN3 L-0 Turbine Blade Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	10	$ 346	$ 3,460.66		
Engineering	PD	10	$ 391	$ 3,914.86		
Maintenance Trades	PD	340	$ 352	$ 119,798.59		
Utilityworker	PD	10	$ 232	$ 2,319.89		
			Sub-Total	$ 129,494.00		40406
002 OT Labour						
Maintenance Trades	PD	360	$ 705	$ 253,691.14		
				$ -		
			Sub-Total	$ 253,691.14		40406
004 Term Labour						
Maintenance Trades	PD	400	$ 352	$ 140,939.52		
Utilityworker	PD	70	$ 232	$ 16,239.22		
				$ -		
			Sub-Total	$ 157,178.74		40406
011 Travel Expense						
Travel	ea	1	$ 15,000	$ 15,000.00		
				$ -		
			Sub-Total	$ 15,000.00		
012 Materials						
L-0 Blades and Hardware	ea	1	[redacted]		Cost Support Item #1 - Inlfation at 1% per year, over 5 years, @ $0.92 USD	
Misc Consumables	ea	1	$ 25,000	$ 25,000.00		
			Sub-Total	[redacted]		
013 Contracts						
Installation of L-0 Blades	ea	1	[redacted]		Cost Support Item #2 - Inflation at 1% per year, over 4 years @ $0.92 USD	
Grit Blasting	ea	1	$ 45,000	$ 45,000.00		
Turbine Vibration Technical Advisor	ea	1	$ 30,000	$ 30,000.00		
Turbine Technical Advisor	ea	1	[redacted]			
Internal Turbine Borescope inspection	ea	1	$ 25,000	$ 25,000.00		
Onsite machining	ea	1	$ 35,000	$ 35,000.00		
			Sub-Total	$ 1,337,570.38		
041 Meals & Entertainment						
Meals				$ 335.50		
				$ -		
			Sub-Total	$ 335.50		
066 Other Goods & Services						
Contingency	%	[redacted]				
				$ -		
			Sub-Total	[redacted]		
094 Interest Capitalized						
AFUDC				$ 101,048.25		
				$ -		
			Sub-Total	$ 101,048.25		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 27,295.58		
Thermal OT Labour AO				$ 25,481.06		
Thermal Term Labour AO				$ 28,913.44		
Thermal / Hydro Contracts AO				$ 122,550.07		
			Sub-Total	$ 204,240.15		
			SUB-TOTAL (no AO, AFUDC)	$ 3,852,452.70		
			TOTAL (AO, AFUDC included)	$ 4,157,741.10		
Original Cost				$ 1,180,833.39		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 L-0 Blade Replacement
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	42806
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Replace Blades vs Avoided Repair and	6.19%	-6,675,911	4,785,006	1	21.30%	7.0 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to complete this blade replacement during the planned outage in 2015. This project can only be completed during a major planned outage which occurs approximately every 10 years. Not doing this project and incurring the replacement energy and material costs associated with unplanned failures is less economic than replacing the blades in 2015.

Notes/Comments :

Replace Blades vs Avoided Repair and Replacement Energy Costs

This option considers the replacement of the blades versus a "do nothing" option that will deal with a balde failure in an unplanned outage where a six week repair would be required to return the unit to service.

Test 2

Test 3

Test 4

LIN3 L-0 Blade Replacement
Summary of Sensitivities

Nova Scotia POWE
An Emera Compa

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	42806
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Blades vs Avoided Repair and Replacem	6.19%	-6,675,911	4,785,006	1	21.30%	7.0 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Blades vs Avoided Repair and Replacem	10%	-6,296,051	4,477,842	1	19.24%	7.6 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:					
A	379,860	-307,164	0	-2.06%	0.6 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Blades vs Avoided Repair and Replacem	-10%	-5,628,459	3,999,342	1	19.03%	7.7 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:					
A	1,047,451	-785,664	0	-2.27%	0.7 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	**PV of Revenue Requirement**	**PV of Revenue Requirement**	**PV of Revenue Requirement**	**Delay?**
Yrs Delay:	1	2	3	
A	643,363	1,153,197	1,571,058	No
B	0	0	0	No
C	0	0	0	No
D	0	0	0	No

LIN3 L-0 Blade Replacement
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	Date :	30-Oct-14
Department :	Lingan Generating Station	CI Number:	42806
Originator :		Project No. :	

Replace Blades vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			511,729	521,964		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	60%	65%	60%	65%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	1008	1008				
Totals	$382,777	$393,454	$307,037	$339,276	$689,814	$732,730
Total Capital Cost of Alternative						$4,157,741

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

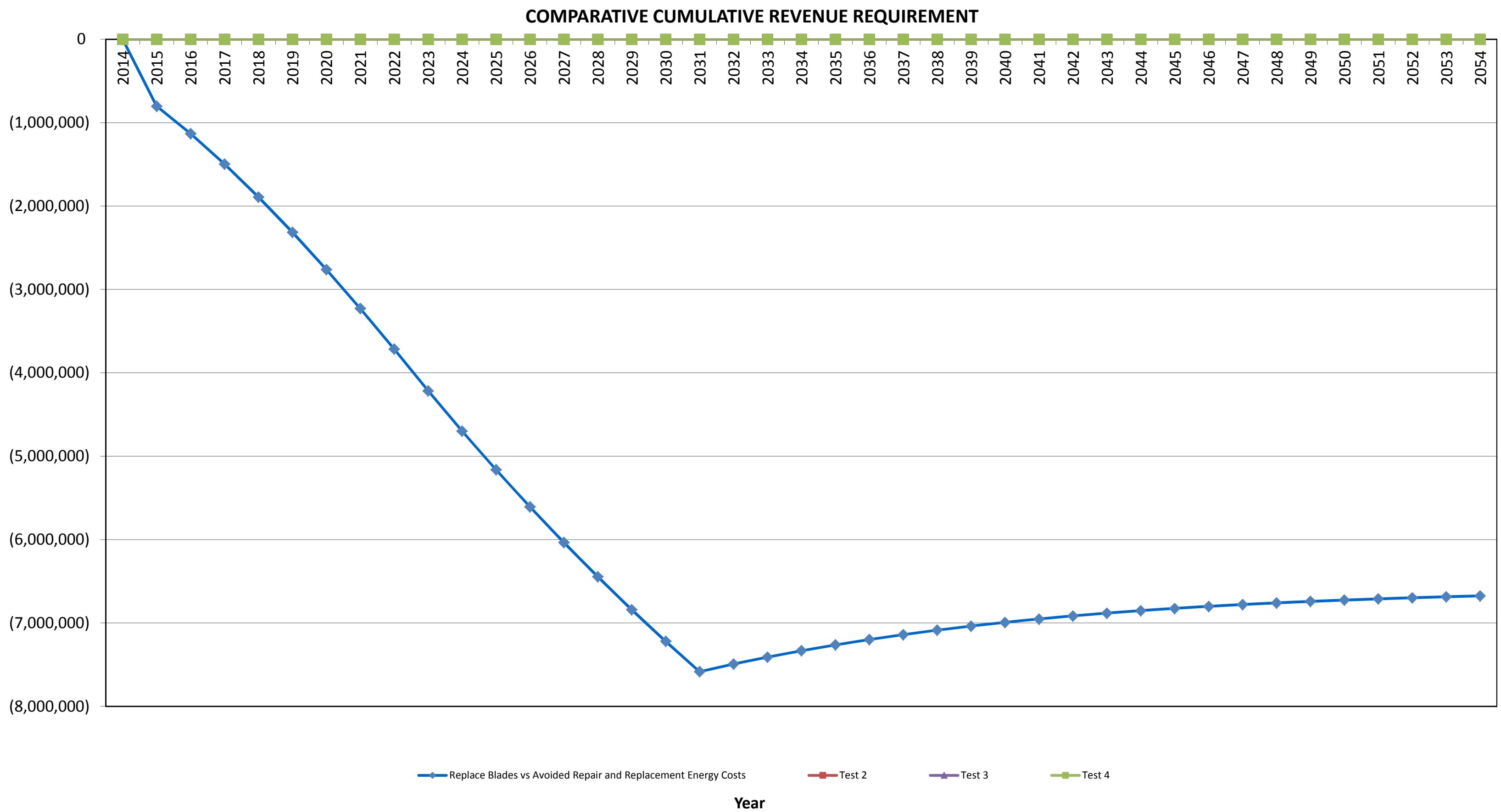
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN3 L-0 Blade Replacement
Replace Blades vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	689,813.9	(3,953,500.9)	154,098.1	3,754,724.9	(3,263,687.1)	(166,071.9)	(3,429,759.0)	(3,229,832.3)	0.94	(3,229,832.3)
2016	-	-	732,729.8	-	295,868.4	3,449,445.1	732,729.8	(135,427.1)	597,302.8	529,696.7	0.89	(2,700,135.6)
2017	-	-	804,875.6	-	272,198.9	3,168,587.7	804,875.6	(165,129.8)	639,745.8	534,264.8	0.84	(2,165,870.8)
2018	-	-	879,614.0	-	250,423.0	2,910,199.0	879,614.0	(195,049.2)	684,564.8	538,369.0	0.79	(1,627,501.8)
2019	-	-	957,020.0	-	230,389.1	2,672,481.3	957,020.0	(225,255.6)	731,764.5	541,942.5	0.74	(1,085,559.3)
2020	-	-	1,037,170.5	-	211,958.0	2,453,781.0	1,037,170.5	(255,815.9)	781,354.6	544,937.2	0.70	(540,622.1)
2021	-	-	1,120,144.1	-	195,001.4	2,252,576.8	1,120,144.1	(286,794.2)	833,349.8	547,320.9	0.66	6,698.8
2022	-	-	1,206,021.8	-	179,401.3	2,067,468.9	1,206,021.8	(318,252.4)	887,769.4	549,074.4	0.62	555,773.2
2023	-	-	1,294,886.6	-	165,049.2	1,897,169.6	1,294,886.6	(350,249.6)	944,637.0	550,189.6	0.58	1,105,962.8
2024	-	-	1,320,784.3	-	151,845.2	1,740,494.3	1,320,784.3	(362,371.1)	958,413.2	525,674.1	0.55	1,631,636.9
2025	-	-	1,347,200.0	-	139,697.6	1,596,353.0	1,347,200.0	(374,325.7)	972,874.3	502,500.9	0.52	2,134,137.8
2026	-	-	1,374,144.0	-	128,521.8	1,463,743.0	1,374,144.0	(386,142.9)	988,001.1	480,567.0	0.49	2,614,704.9
2027	-	-	1,401,626.9	-	118,240.1	1,341,741.8	1,401,626.9	(397,849.9)	1,003,777.0	459,780.1	0.46	3,074,485.0
2028	-	-	1,429,659.4	-	108,780.9	1,229,500.7	1,429,659.4	(409,472.4)	1,020,187.1	440,057.2	0.43	3,514,542.2
2029	-	-	1,458,252.6	-	100,078.4	1,126,238.8	1,458,252.6	(421,034.0)	1,037,218.6	421,323.8	0.41	3,935,865.9
2030	-	-	1,487,417.6	-	92,072.1	1,031,238.0	1,487,417.6	(432,557.1)	1,054,860.5	403,512.6	0.38	4,339,378.5
2031	-	-	1,517,166.0	-	84,706.3	943,837.2	1,517,166.0	(444,062.5)	1,073,103.5	386,562.8	0.36	4,725,941.4
2032	-	-	-	-	77,929.8	863,428.4	-	24,158.2	24,158.2	8,195.2	0.34	4,734,136.6
2033	-	-	-	-	71,695.5	789,452.4	-	22,225.6	22,225.6	7,100.1	0.32	4,741,236.7
2034	-	-	-	-	65,959.8	721,394.4	-	20,447.5	20,447.5	6,151.3	0.30	4,747,388.0
2035	-	-	-	-	60,683.0	658,781.1	-	18,811.7	18,811.7	5,329.3	0.28	4,752,717.3
2036	-	-	-	-	55,828.4	601,176.9	-	17,306.8	17,306.8	4,617.2	0.27	4,757,334.5
2037	-	-	-	-	51,362.1	548,181.0	-	15,922.3	15,922.3	4,000.2	0.25	4,761,334.7
2038	-	-	-	-	47,253.1	499,424.7	-	14,648.5	14,648.5	3,465.7	0.24	4,764,800.4
2039	-	-	-	-	43,472.9	454,569.0	-	13,476.6	13,476.6	3,002.5	0.22	4,767,802.9
2040	-	-	-	-	39,995.1	413,301.7	-	12,398.5	12,398.5	2,601.3	0.21	4,770,404.2
2041	-	-	-	-	36,795.5	375,335.8	-	11,406.6	11,406.6	2,253.7	0.20	4,772,657.9
2042	-	-	-	-	33,851.8	340,407.2	-	10,494.1	10,494.1	1,952.6	0.19	4,774,610.5
2043	-	-	-	-	31,143.7	308,272.8	-	9,654.5	9,654.5	1,691.6	0.18	4,776,302.1
2044	-	-	-	-	28,652.2	278,709.2	-	8,882.2	8,882.2	1,465.6	0.17	4,777,767.7
2045	-	-	-	-	26,360.0	251,510.7	-	8,171.6	8,171.6	1,269.7	0.16	4,779,037.4
2046	-	-	-	-	24,251.2	226,488.1	-	7,517.9	7,517.9	1,100.1	0.15	4,780,137.5
2047	-	-	-	-	22,311.1	203,467.3	-	6,916.4	6,916.4	953.1	0.14	4,781,090.6
2048	-	-	-	-	20,526.2	182,288.2	-	6,363.1	6,363.1	825.7	0.13	4,781,916.3
2049	-	-	-	-	18,884.1	162,803.3	-	5,854.1	5,854.1	715.4	0.12	4,782,631.7
2050	-	-	-	-	17,373.4	144,877.3	-	5,385.8	5,385.8	619.8	0.12	4,783,251.4
2051	-	-	-	-	15,983.5	128,385.4	-	4,954.9	4,954.9	537.0	0.11	4,783,788.4
2052	-	-	-	-	14,704.8	113,212.8	-	4,558.5	4,558.5	465.2	0.10	4,784,253.6
2053	-	-	-	-	13,528.5	99,254.0	-	4,193.8	4,193.8	403.0	0.10	4,784,656.6
2054	-	-	-	-	12,446.2	86,411.9	-	3,858.3	3,858.3	349.2	0.09	4,785,005.8
Total	**-**	**-**	**20,058,527.0**	**(3,953,500.9)**	**3,709,321.7**		**16,105,026.0**	**(5,068,253.7)**	**11,036,772.4**	**4,785,005.8**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(1,000,000)
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Replace Blades vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

Attachments 1 and 2 have been removed due to confidentiality.

CI Number: 43094

Title: LIN3 High Temperature Fastener Replacement

Start Date:	2015/05
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	Steam
Forecast Amount:	$868,348

DESCRIPTION:

This project is to replace steam turbine high temperature fasteners (bolts and studs) to maintain the integrity of the Lingan Unit 3 steam turbine for continued safe and efficient operation. The basic criteria for evaluating the consumed life for steam turbine high-temperature bolts are the material, number of times the bolts have been tightened, number of unit start/stop cycles, running hours, bolt operating temperature and critical maintenance data. Evaluation of LIN3 high temperature fasteners using Original Equipment Manufacturer (OEM) criteria indicates that these fasteners are now at the end of their service life and must be replaced.

High Temperature Fasteners are monitored for life cycle maintenance as described in NS Power's TMP (Thermal Maintenance Practice) - Steam Turbine - High Temperature Bolting Maintenance Practice. The Practice applies to the high-pressure outer casing, high-pressure inner casing, intermediate-pressure outer casing, intermediate-pressure inner casing, main stop valve cover, control valves, reheat stop valve covers, intercept valve covers, combined reheat valve covers, main and reheat steam leads.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

The function of the steam turbine high temperature bolting is to maintain a tight joint with no steam leakage into other sections of the turbine or into the plant. High pressure steam leaking from high-pressure joints is a critical safety issue and may require maintenance outages and costly repairs. Leaking joints within the steam turbine can result in steam bypassing portions of the intended steam path and a resultant loss of efficiency.

Why do this project now?

Based on the criteria mentioned above, these bolts are at the end of their service life and should be replaced during the planned major outage in 2015. Waiting until the next planned major outage would greatly increase the probability of fastener failure and the associated safety concerns.

Why do this project this way?

Replacing the bolts and studs is the only option to maintain the integrity of the steam turbine. Refurbishing these bolts and studs is not feasible as the integrity of the material cannot be re-established. Replacement with non-OEM parts is considered, but at this time, OEM parts are the most reliable and cost-effective option.

CI Number : 43094 - LIN3 HT Fastener Replacement **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		23,296	0	23,296
095		095-Thermal Regular Labour AO		14,166	0	14,166
095		095-Thermal Overtime Labour AO		2,721	0	2,721
095		095-Thermal Term Labour AO		11,298	0	11,298
001	010	001 - THERMAL Regular Labour	010 - SGP - Turbo Gen.Instal.	70,687	0	70,687
002	010	002 - THERMAL Overtime Labour	010 - SGP - Turbo Gen.Instal.	27,155	0	27,155
004	010	004 - THERMAL Term Labour	010 - SGP - Turbo Gen.Instal.	56,376	0	56,376
011	010	011 - Travel Expense	010 - SGP - Turbo Gen.Instal.	8,500	0	8,500
012	010	012 - Materials	010 - SGP - Turbo Gen.Instal.	363,000	0	363,000
013	010	013 - POWER PRODUCTION Contracts	010 - SGP - Turbo Gen.Instal.	260,000	0	260,000
066	010	066 - Other Goods & Services	010 - SGP - Turbo Gen.Instal.	31,150	0	31,150
			Total Cost:	868,348	0	868,348
			Original Cost:	277,382		

Capital Project Detailed Estimate

Location: **Lingan Generating Station**
CI# / FP#: 43094
Title: LIN3 High Temperature Fastener Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Engineering	PD	10	$ 391	$ 3,914.86		
Maintenance Trades	PD	150	$ 352	$ 52,852.32		
Utilityworker	PD	60	$ 232	$ 13,919.33		
						CI 39443 - LIN1 Turbine Fastener
			Sub-Total	$ 70,686.51		
002 OT Labour						
Maintenance Trades	PD	28	$ 705	$ 19,731.53		
Utilityworker	PD	16	$ 464	$ 7,423.64		
				$ -		
			Sub-Total	$ 27,155.17		CI 39443
004 Term Labour						
Maintenance Trades	PD	160	$ 352	$ 56,375.81		
				$ -		
			Sub-Total	$ 56,375.81		CI 39443
011 Travel Expense						
Travel	Lot	1	$ 8,500	$ 8,500.00		
				$ -		
			Sub-Total	$ 8,500.00		CI 39443
012 Materials						
Replacement Fasteners	Lot	1	$ 325,000	$ 325,000.00		CI39443
Miscellaneous Materials & Consumables	Lot	1	$ 15,000	$ 15,000.00		
Hydraulic Positioners	Lot	1	$ 8,000	$ 8,000.00		
UH Taps and Threas Chasers	Lot	1	$ 15,000	$ 15,000.00		
				$ -		
				$ -		
				$ -		
			Sub-Total	$ 363,000.00		
013 Contracts						
OEM Tech Advisor Support	Lot	1	$ 60,000	$ 60,000.00		
Fastener Removal	Lot	1	$ 150,000	$ 150,000.00		
Bolting Heating	Lot	1	$ 50,000	$ 50,000.00		
				$ -		
				$ -		
				$ -		
				$ -		
			Sub-Total	$ 260,000.00		CI39443
066 Other Goods & Services						
Contingency	%	5	$ 623,000	$ 31,150.00		
				$ -		
			Sub-Total	$ 31,150.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 14,165.58		
Thermal OT Labour AO				$ 2,720.85		
Thermal Term Labour AO				$ 11,297.71		
Thermal / Hydro Contracts AO				$ 23,296.00		
			Sub-Total	$ 51,480.14		
			SUB-TOTAL (no AO, AFUDC)	$ 816,867.49		
			TOTAL (AO, AFUDC included)	$ 868,347.63		
Original Cost				$ 277,382.11		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 High Temperature Fastener Replacement
Summary of Alternatives

Division :	Power Production		**Date :**	**23-Oct-14**
Department :	Lingan Generating Station		**CI Number:**	43094
Originator :			**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Replace Fasteners vs Avoided Repair a	6.19%	-3,537,437	2,561,710	1	50.25%	3.4 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to complete this replacement in order to avoid costly repair and replacement energy costs in the event of a fastner failure while the unit is in service

Notes/Comments :

Replace Fasteners vs Avoided Repair and Replacement Energy Costs

This option compares the cost of replacing the HT Fastener with the labour, material and replacement energy costs associated with a failure during service and the repairs to return the unit to service.

Test 2

Test 3

Test 4

LIN3 High Temperature Fastener Replacement
Summary of Sensitivities

Nova Scotia POWE
An Emera Compa

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	43094
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Fasteners vs Avoided Repair and Replac	6.19%	-3,537,437	2,561,710	1	50.25%	3.4 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Fasteners vs Avoided Repair and Replac	10%	-3,456,883	2,498,597	1	45.77%	3.7 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change: **A**	80,553	-63,113	0	-4.47%	0.3 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Fasteners vs Avoided Repair and Replac	-10%	-3,103,140	2,242,426	1	45.33%	3.7 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change: **A**	434,297	-319,284	0	-4.92%	0.3 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	230,820	457,443	691,342	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN3 High Temperature Fastener Replacement
Avoided Cost Calculations

Nova Scotia POWER
An Emera Company

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	43094
Originator :		**Project No. :**	

Replace Fasteners vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			175,990	183,090		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	50%	60%	50%	60%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	504	504				
Totals	$159,490	$181,594	$87,995	$109,854	$247,485	$291,448
Total Capital Cost of Alternative						$868,348

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

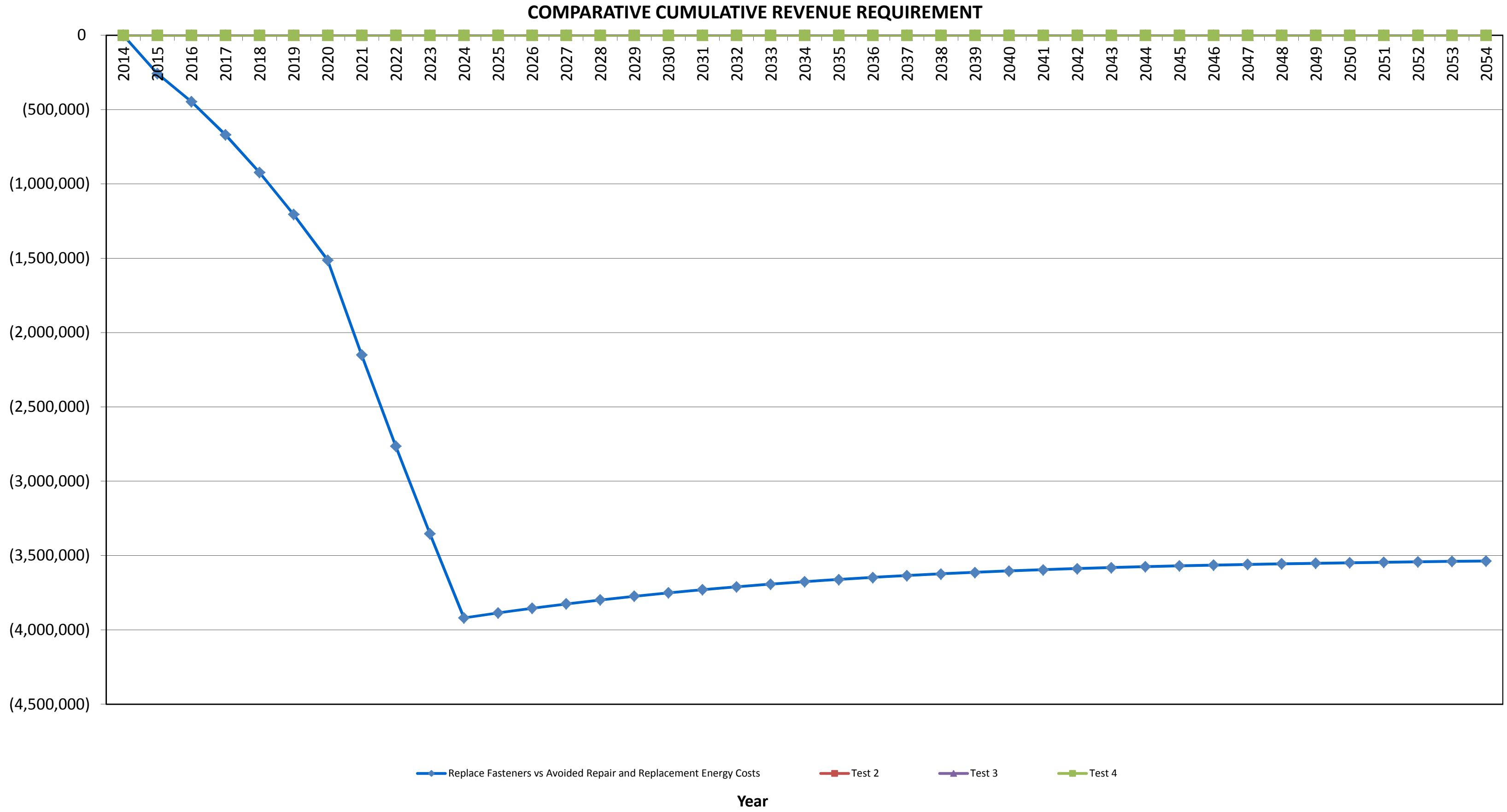
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN3 High Temperature Fastener Replacement
Replace Fasteners vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	247,485.2	(816,867.5)	32,674.7	798,401.3	(569,382.3)	(66,591.3)	(635,973.5)	(598,901.5)	0.94	(598,901.5)
2016	-	-	291,447.9	-	62,735.4	733,293.7	291,447.9	(70,900.9)	220,547.1	195,584.3	0.89	(403,317.2)
2017	-	-	349,430.3	-	57,716.6	673,394.7	349,430.3	(90,431.2)	258,999.0	216,295.4	0.84	(187,021.8)
2018	-	-	410,435.8	-	53,099.3	618,287.6	410,435.8	(110,774.3)	299,661.5	235,665.7	0.79	48,643.9
2019	-	-	474,603.2	-	48,851.3	567,589.0	474,603.2	(131,983.1)	342,620.1	253,743.4	0.74	302,387.3
2020	-	-	542,077.5	-	44,943.2	520,946.4	542,077.5	(154,111.6)	387,965.9	270,577.6	0.70	572,964.9
2021	-	-	1,114,564.2	-	41,347.8	478,035.2	1,114,564.2	(332,697.1)	781,867.1	513,508.5	0.66	1,086,473.4
2022	-	-	1,145,933.7	-	38,039.9	438,556.8	1,145,933.7	(343,447.1)	802,486.6	496,328.1	0.62	1,582,801.4
2023	-	-	1,178,296.8	-	34,996.7	402,236.8	1,178,296.8	(354,423.0)	823,873.8	479,852.9	0.58	2,062,654.3
2024	-	-	1,211,688.2	-	32,197.0	368,822.3	1,211,688.2	(365,642.3)	846,045.9	464,042.5	0.55	2,526,696.8
2025	-	-	-	-	29,621.2	338,081.0	-	9,182.6	9,182.6	4,742.9	0.52	2,531,439.7
2026	-	-	-	-	27,251.5	309,799.0	-	8,448.0	8,448.0	4,109.1	0.49	2,535,548.8
2027	-	-	-	-	25,071.4	283,779.5	-	7,772.1	7,772.1	3,560.0	0.46	2,539,108.9
2028	-	-	-	-	23,065.7	259,841.7	-	7,150.4	7,150.4	3,084.3	0.43	2,542,193.2
2029	-	-	-	-	21,220.4	237,818.8	-	6,578.3	6,578.3	2,672.2	0.41	2,544,865.3
2030	-	-	-	-	19,522.8	217,557.8	-	6,052.1	6,052.1	2,315.1	0.38	2,547,180.4
2031	-	-	-	-	17,961.0	198,917.6	-	5,567.9	5,567.9	2,005.7	0.36	2,549,186.1
2032	-	-	-	-	16,524.1	181,768.7	-	5,122.5	5,122.5	1,737.7	0.34	2,550,923.8
2033	-	-	-	-	15,202.2	165,991.7	-	4,712.7	4,712.7	1,505.5	0.32	2,552,429.3
2034	-	-	-	-	13,986.0	151,476.8	-	4,335.7	4,335.7	1,304.3	0.30	2,553,733.6
2035	-	-	-	-	12,867.1	138,123.1	-	3,988.8	3,988.8	1,130.0	0.28	2,554,863.7
2036	-	-	-	-	11,837.8	125,837.8	-	3,669.7	3,669.7	979.0	0.27	2,555,842.7
2037	-	-	-	-	10,890.7	114,535.2	-	3,376.1	3,376.1	848.2	0.25	2,556,690.9
2038	-	-	-	-	10,019.5	104,136.9	-	3,106.0	3,106.0	734.9	0.24	2,557,425.7
2039	-	-	-	-	9,217.9	94,570.4	-	2,857.6	2,857.6	636.7	0.22	2,558,062.4
2040	-	-	-	-	8,480.5	85,769.3	-	2,629.0	2,629.0	551.6	0.21	2,558,614.0
2041	-	-	-	-	7,802.0	77,672.2	-	2,418.6	2,418.6	477.9	0.20	2,559,091.8
2042	-	-	-	-	7,177.9	70,222.9	-	2,225.1	2,225.1	414.0	0.19	2,559,505.8
2043	-	-	-	-	6,603.7	63,369.5	-	2,047.1	2,047.1	358.7	0.18	2,559,864.5
2044	-	-	-	-	6,075.4	57,064.5	-	1,883.4	1,883.4	310.8	0.17	2,560,175.3
2045	-	-	-	-	5,589.3	51,263.8	-	1,732.7	1,732.7	269.2	0.16	2,560,444.5
2046	-	-	-	-	5,142.2	45,927.1	-	1,594.1	1,594.1	233.3	0.15	2,560,677.8
2047	-	-	-	-	4,730.8	41,017.5	-	1,466.6	1,466.6	202.1	0.14	2,560,879.9
2048	-	-	-	-	4,352.3	36,500.5	-	1,349.2	1,349.2	175.1	0.13	2,561,055.0
2049	-	-	-	-	4,004.2	32,345.0	-	1,241.3	1,241.3	151.7	0.12	2,561,206.6
2050	-	-	-	-	3,683.8	28,521.8	-	1,142.0	1,142.0	131.4	0.12	2,561,338.1
2051	-	-	-	-	3,389.1	25,004.6	-	1,050.6	1,050.6	113.9	0.11	2,561,451.9
2052	-	-	-	-	3,118.0	21,768.7	-	966.6	966.6	98.6	0.10	2,561,550.6
2053	-	-	-	-	2,868.6	18,791.7	-	889.3	889.3	85.5	0.10	2,561,636.0
2054	-	-	-	-	2,639.1	16,052.8	-	818.1	818.1	74.0	0.09	2,561,710.1
Total	**-**	**-**	**6,965,962.9**	**(816,867.5)**	**786,518.2**		**6,149,095.4**	**(1,915,627.9)**	**4,233,467.6**	**2,561,710.1**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(500,000)
(1,000,000)
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Replace Fasteners vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 44730

Title: TRE5 Turbine Valve Refurbishment

Start Date:	2015/03
In-Service Date:	2015/09
Final Cost Date:	2016/03
Function:	Steam
Forecast Amount:	$752,160

DESCRIPTION:

This project will replace components of the Turbine Main Steam, Reheat Steam, and Turbine Emergency Stop Valves on Trenton Unit 5.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub-Criteria: Equipment Replacement

Why do this project?

The primary function of the Main Steam and Reheat Valves is to regulate the steam flow to the turbine, and thus control the power output of the steam turbine generator. The Turbine Emergency Stop Valve interrupts the steam flow promptly during an emergency trip and cuts off the steam supply when the unit is shut down. All these valves are critical components of the steam turbine. Their functionality and reliability are crucial to the safe operation of the unit. Preventative Maintenance Inspections, as part of Fleet Equipment reliability strategies, have identified components that are out of tolerance and recommended for replacement by the OEM.

Why do this project now?

Completing this project as part of the 2015 planned outage will mitigate the risk of unplanned outages to address possible valve failures, likely to occur by operating the unit with the out of tolerance components.

Why do this project this way?

The refurbishment work is recommended by the Original Equipment Manufacturer (OEM), and is in accordance with their best practices and consistent with NS Power practice. Replacing these components with non-OEM components is being studied; however a conservative approach must be taken as these components are highly critical in unit operation. Total valve replacement is another alternative, but is a much more costly option and not considered necessary at this time.

CI Number : 44730 - TRE5 Turbine Valves Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 340 - 340-Trenton Unit 5 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		12,788	0	12,788
095		095-Thermal & Hydro Contracts AO		20,048	0	20,048
095		095-Thermal Regular Labour AO		5,037	0	5,037
095		095-Thermal Term Labour AO		1,860	0	1,860
095		095-Thermal Overtime Labour AO		3,375	0	3,375
001	010	001 - THERMAL Regular Labour	010 - SGP - Turbo Gen.Instal.	25,135	0	25,135
002	010	002 - THERMAL Overtime Labour	010 - SGP - Turbo Gen.Instal.	33,686	0	33,686
004	010	004 - THERMAL Term Labour	010 - SGP - Turbo Gen.Instal.	9,280	0	9,280
012	010	012 - Materials	010 - SGP - Turbo Gen.Instal.	410,201	0	410,201
013	010	013 - POWER PRODUCTION Contracts	010 - SGP - Turbo Gen.Instal.	173,750	0	173,750
011	087	011 - Travel Expense	087 Field Super.& Ops.	5,000	0	5,000
013	087	013 - POWER PRODUCTION Contracts	087 Field Super.& Ops.	50,000	0	50,000
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	2,000	0	2,000
			Total Cost:	752,160	0	752,160
			Original Cost:	588,707		

Capital Project Detailed Estimate

Location: **Trenton Generating**
CI# / FP#: 44730
Title: TRE5 Turbine Valve Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Mechanic	PD	45	352	$ 15,855.75		
Utility	PD	40	232	$ 9,279.60		
				$ -		
			Sub-Total	$ 25,135.35		
002 OT Labour						
Mechanic	PD	32	$ 705	$ 22,550.40		
Utility	PD	24	$ 464	$ 11,135.52		
			Sub-Total	$ 33,685.92		
004 Term Labour						
Utility	PD	40	$ 232	$ 9,279.60		
				$ -		
			Sub-Total	$ 9,279.60		
011 Travel Expense						
Travel	Lot	1	$ 5,000.00	$ 5,000.00		
				$ -		
			Sub-Total	$ 5,000.00		
012 Materials						
Turbine Valve Parts	Lot	1	[redacted]	[redacted]	Cost Support Item #1	
Miscellaneous Parts (Seals/Studs/Nuts)	Lot	1	[redacted]	[redacted]		
Insulation	Lot	1	$ 5,000.00	$ 5,000.00		
				$ -		
			Sub-Total	$ 410,201.00		
013 Contracts						
External Machining Services	Lot	1	$ 40,000.00	$ 40,000.00		
Contract Labour	PD	50	$ 1,000.00	$ 50,000.00		
Service Supervisor	PD	25	$ 2,750.00	$ 68,750.00		
External Supervision	PD	25	$ 1,200.00	$ 30,000.00		
Insulation Services	Lot	1	$ 5,000.00	$ 5,000.00		
Inspection Services	Lot	1	$ 30,000.00	$ 30,000.00		
				$ -		
			Sub-Total	$ 223,750.00		
041 Meals & Entertainment						
Meals	Lot	1	$ 2,000.00	$ 2,000.00		
				$ -		
			Sub-Total	$ 2,000.00		
094 Interest Capitalized						
AFUDC	Lot	1	$ 12,788.25	$ 12,788.25		
				$ -		
			Sub-Total	$ 12,788.25		
095 Administrative Overhead						
Thermal Reg. Labour AO	Lot	1	$ 5,037.12	$ 5,037.12		
T&C Regular Labour AO	Lot	1		$ -		
Thermal OT Labour AO	Lot	1	$ 3,375.33	$ 3,375.33		
Thermal Term Labour AO	Lot	1	$ 1,859.63	$ 1,859.63		
Thermal / Hydro Contracts AO	Lot	1	$ 20,048.00	$ 20,048.00		
			Sub-Total	$ 30,320.08		
			SUB-TOTAL (no AO, AFUDC)	$ 709,051.87		
			TOTAL (AO, AFUDC included)	$ 752,160.20		
Original Cost				$ 588,707.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

TRE5 Turbine Valve Refurbishment
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Valve Refurbishment vs. Avoided Repa	6.19%	-2,299,917	1,734,494	1	34.54%	4.6 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to refurbish the TRE5 turbine main and control valves during the 2015 planned outage for TRE5. This recommendation is backed by positive economic analysis model data.

Notes/Comments :

Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs.

If valves are not refurbished during the 2015 planned outage, risk to availability increases due to probability of an unplanned outage to address valve failure(s). An unplanned outage would incur replacement energy costs for the duration of the outage. Assumption: An unplanned outage would be an average of 168 hours in duration, with a 75% probability of failure in 2015, and increasing likelihood beyond 2015.

Test 2

Test 3

Test 4

TRE5 Turbine Valve Refurbishment
Summary of Sensitivities

Division :	Power Production		**Date :**	**29-Oct-14**
Department :	Trenton Generating Station		**CI Number:**	
Originator :			**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Valve Refurbishment vs. Avoided Repair and Rep	6.19%	-2,299,917	1,734,494	1	34.54%	4.6 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Valve Refurbishment vs. Avoided Repair and Rep	10%	-2,224,834	1,678,507	1	31.18%	5.0 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
Change:	**A**	75,083	-55,987	0	-3.36%	0.4 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Valve Refurbishment vs. Avoided Repair and Rep	-10%	-1,994,843	1,505,058	1	30.85%	5.0 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
Change:	**A**	305,074	-229,436	0	-3.70%	0.5 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	PV of Revenue Requirement 1	PV of Revenue Requirement 2	PV of Revenue Requirement 3	Delay?
	A	196,967	358,379	503,358	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

TRE5 Turbine Valve Refurbishment
Avoided Cost Calculations

Division :	Power Production	**Date :**	29-Oct-14
Department :	Trenton Generating Station	**CI Number:**	
Originator :		**Project No. :**	

Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs.

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			186,000	192,720		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	75%	80%	75%	80%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	160	160				
Duration (Hours)	168	168				
Totals	$71,688	$59,716	$139,500	$154,176	$211,188	$213,892
Total Capital Cost of Alternative						$752,160

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

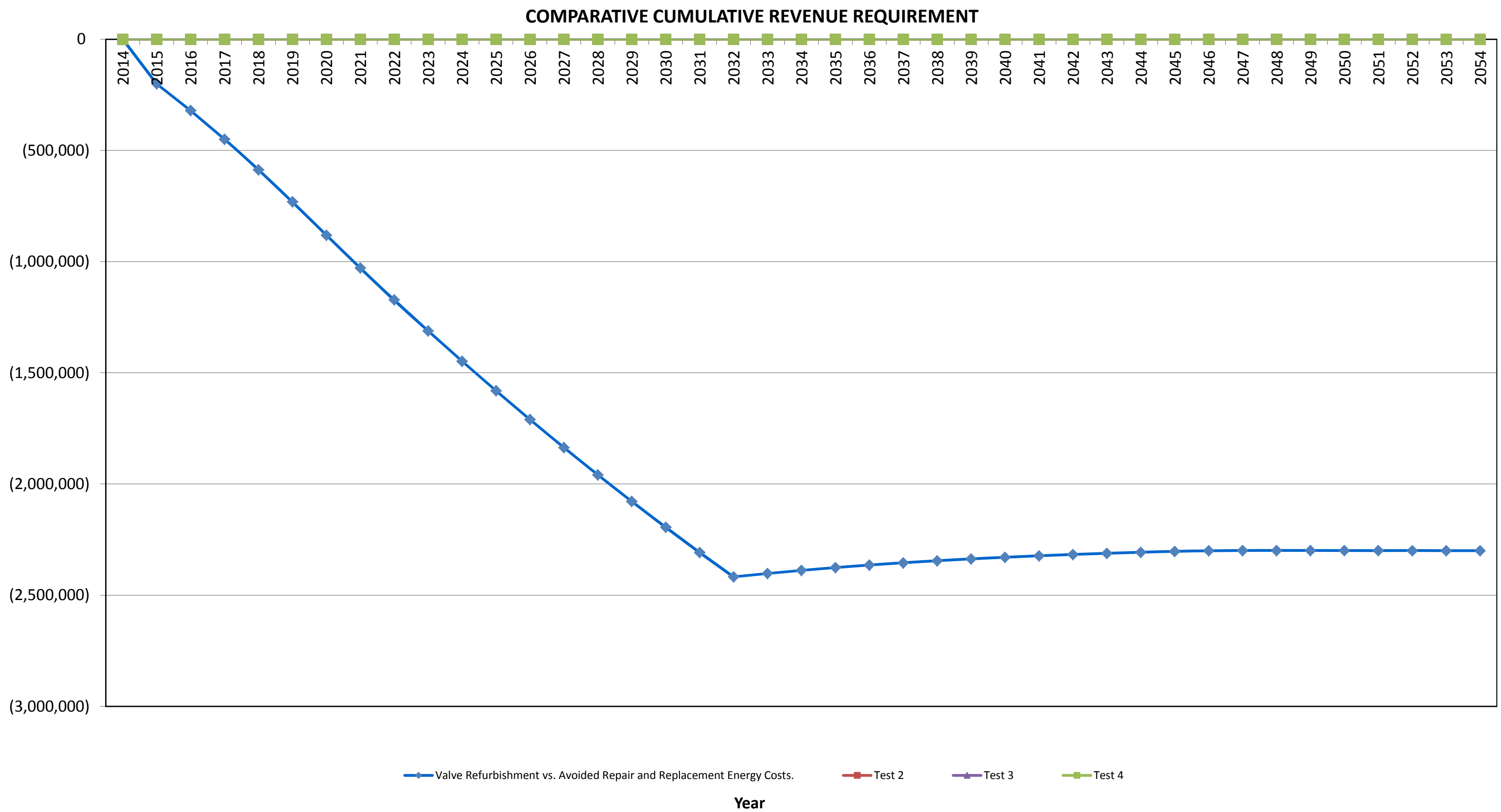
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

TRE5 Turbine Valve Refurbishment
Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs.

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	211,187.7	(721,840.1)	28,362.1	689,058.1	(510,652.5)	(56,675.9)	(567,328.4)	(534,257.8)	0.94	(534,257.8)
2016	-	-	213,891.6	-	54,455.2	633,205.8	213,891.6	(49,425.3)	164,466.3	145,851.1	0.89	(388,406.7)
2017	-	-	234,457.0	-	50,098.8	581,821.7	234,457.0	(57,151.1)	177,305.9	148,071.8	0.84	(240,334.9)
2018	-	-	256,133.9	-	46,090.9	534,548.2	256,133.9	(65,113.3)	191,020.5	150,226.2	0.79	(90,108.7)
2019	-	-	278,976.7	-	42,403.6	491,056.7	278,976.7	(73,337.7)	205,639.0	152,295.6	0.74	62,186.9
2020	-	-	303,042.4	-	39,011.3	451,044.5	303,042.4	(81,849.6)	221,192.8	154,265.6	0.70	216,452.5
2021	-	-	312,753.2	-	35,890.4	414,233.2	312,753.2	(85,827.5)	226,925.8	149,038.5	0.66	365,491.0
2022	-	-	322,804.3	-	33,019.2	380,366.9	322,804.3	(89,833.4)	232,970.9	144,089.6	0.62	509,580.6
2023	-	-	333,208.1	-	30,377.6	349,209.9	333,208.1	(93,877.5)	239,330.7	139,394.5	0.58	648,975.2
2024	-	-	343,978.0	-	27,947.4	320,545.4	343,978.0	(97,969.5)	246,008.5	134,931.7	0.55	783,906.9
2025	-	-	355,127.5	-	25,711.6	294,174.1	355,127.5	(102,118.9)	253,008.6	130,681.9	0.52	914,588.8
2026	-	-	366,670.8	-	23,654.7	269,912.5	366,670.8	(106,335.0)	260,335.8	126,628.2	0.49	1,041,217.0
2027	-	-	378,622.6	-	21,762.3	247,591.8	378,622.6	(110,626.7)	267,995.9	122,755.5	0.46	1,163,972.5
2028	-	-	390,998.1	-	20,021.3	227,056.8	390,998.1	(115,002.8)	275,995.3	119,050.4	0.43	1,283,022.9
2029	-	-	403,813.3	-	18,419.6	208,164.5	403,813.3	(119,472.0)	284,341.3	115,501.0	0.41	1,398,523.9
2030	-	-	417,084.6	-	16,946.1	190,783.7	417,084.6	(124,042.9)	293,041.6	112,096.3	0.38	1,510,620.2
2031	-	-	430,829.1	-	15,590.4	174,793.3	430,829.1	(128,724.0)	302,105.1	108,827.0	0.36	1,619,447.2
2032	-	-	445,064.6	-	14,343.1	160,082.2	445,064.6	(133,523.7)	311,541.0	105,684.2	0.34	1,725,131.4
2033	-	-	-	-	13,195.7	146,547.9	-	4,090.7	4,090.7	1,306.8	0.32	1,726,438.2
2034	-	-	-	-	12,140.0	134,096.4	-	3,763.4	3,763.4	1,132.2	0.30	1,727,570.3
2035	-	-	-	-	11,168.8	122,641.0	-	3,462.3	3,462.3	980.9	0.28	1,728,551.2
2036	-	-	-	-	10,275.3	112,102.0	-	3,185.4	3,185.4	849.8	0.27	1,729,401.0
2037	-	-	-	-	9,453.3	102,406.2	-	2,930.5	2,930.5	736.2	0.25	1,730,137.2
2038	-	-	-	-	8,697.0	93,486.0	-	2,696.1	2,696.1	637.9	0.24	1,730,775.1
2039	-	-	-	-	8,001.3	85,279.5	-	2,480.4	2,480.4	552.6	0.22	1,731,327.7
2040	-	-	-	-	7,361.2	77,729.4	-	2,282.0	2,282.0	478.8	0.21	1,731,806.5
2041	-	-	-	-	6,772.3	70,783.4	-	2,099.4	2,099.4	414.8	0.20	1,732,221.3
2042	-	-	-	-	6,230.5	64,393.0	-	1,931.5	1,931.5	359.4	0.19	1,732,580.7
2043	-	-	-	-	5,732.1	58,513.9	-	1,776.9	1,776.9	311.3	0.18	1,732,892.0
2044	-	-	-	-	5,273.5	53,105.1	-	1,634.8	1,634.8	269.7	0.17	1,733,161.8
2045	-	-	-	-	4,851.6	48,129.0	-	1,504.0	1,504.0	233.7	0.16	1,733,395.5
2046	-	-	-	-	4,463.5	43,551.0	-	1,383.7	1,383.7	202.5	0.15	1,733,597.9
2047	-	-	-	-	4,106.4	39,339.3	-	1,273.0	1,273.0	175.4	0.14	1,733,773.4
2048	-	-	-	-	3,777.9	35,464.4	-	1,171.1	1,171.1	152.0	0.13	1,733,925.3
2049	-	-	-	-	3,475.7	31,899.6	-	1,077.5	1,077.5	131.7	0.12	1,734,057.0
2050	-	-	-	-	3,197.6	28,619.9	-	991.3	991.3	114.1	0.12	1,734,171.1
2051	-	-	-	-	2,941.8	25,602.7	-	912.0	912.0	98.8	0.11	1,734,269.9
2052	-	-	-	-	2,706.5	22,826.8	-	839.0	839.0	85.6	0.10	1,734,355.5
2053	-	-	-	-	2,489.9	20,272.9	-	771.9	771.9	74.2	0.10	1,734,429.7
2054	-	-	-	-	2,290.7	17,923.4	-	710.1	710.1	64.3	0.09	1,734,494.0
Total	**-**	**-**	**5,998,643.4**	**(721,840.1)**	**682,708.3**		**5,276,803.3**	**(1,647,939.9)**	**3,628,863.4**	**1,734,494.0**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(500,000)
(1,000,000)
(1,500,000)
(2,000,000)
(2,500,000)
(3,000,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs.
Test 2
Test 3
Test 4
Year

SIEMENS

Ref: Our EH4956
Tre 5 turbine valve capital project-parts
Date: 6-Jun-2014

To: JORDAN, FRED – NSPI/Trenton

Subject: **PROPOSAL FOR Tre 5 turbine valve capital project-parts**

With reference to your request, we are now pleased to provide the following proposal for your consideration.

RFQ ITEM	DESCRIPTION	QTY	UNIT PRICE	TOTAL PRICE	EST DELIVERY (ARO)
1	NSPI Material # TBD Top Bushing (P1,2,3) OD to be supplied 1/16" oversize for fitting on site Siemens Part No. : SM15704.023	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks

2	NSPI Material # TBD
	Bottom(P1)
	OD to be supplied 1/16" oversize for fitting on site
	Siemens Part No. : SM15704.022
		2 EA	[redacted]	[redacted]	[redacted] Weeks

3	NSPI Material # TBD
	Bottom(P2)
	OD to be supplied 1/16" oversize for fitting on site
	Siemens Part No. : SM15704.041
		1 EA	[redacted]	[redacted]	[redacted] Weeks

4	NSPI Material # TBD
	Bottom(P3)
	OD to be supplied 1/16" oversize for fitting on site
	Siemens Part No. : SM15704.028
		4 EA	[redacted]	[redacted]	[redacted] Weeks

5	NSPI Material # TBD Valve Spindle (P1) Siemens Part No. : SM15704.021	2 EA	[redacted]	[redacted]	[redacted] Weeks
6	NSPI Material # TBD Valve Spindle (P2.3) Siemens Part No. : SM15704.027	2 EA	[redacted]	[redacted]	[redacted] Weeks
7	NSPI Material # TBD Gland Bottom Bush Siemens Part No. : SM15704.011	1 EA	[redacted]	[redacted]	[redacted] Weeks
8	NSPI Material # TBD Top Bush Siemens Part No. : SM15704.012	1 EA	[redacted]	[redacted]	[redacted] Weeks
9	NSPI Material # TBD No 2 ESV Spindle Siemens Part No. : SM15704.010	1 EA	[redacted]	[redacted]	[redacted] Weeks
10	NSPI Material # TBD Pilot Valve & Spindle (No 1 ESV?) Siemens Part No. : SM15704.004	1 EA	[redacted]	[redacted]	[redacted] Weeks

Siemens Canada Limited/Siemens Canada limitée
Energy Service Division/Division Services énergétiques
30 Milton Avenue
P.O. Box 2510
Hamilton, Ontario, Canada
L8N 3K2

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11	NSPI Material # TBD Pilot Piston Siemens Part No. : SL15824.018	1 EA	[redacted]	[redacted]	[redacted] Weeks
12	NSPI Material # TBD Piston Spindle Siemens Part No. : SL15824.010	1 EA	[redacted]	[redacted]	[redacted] Weeks
13	NSPI Material # TBD By-Pass Valve & Spindle Siemens Part No. : SMC64068.008	1 EA	[redacted]	[redacted]	[redacted] Weeks
14	NSPI Material # TBD Main Control Valve & Spindle Siemens Part No. : SMC64068.009	1 EA	[redacted]	[redacted]	[redacted] Weeks
15	NSPI Material # TBD Thrust Bearing Siemens Part No. : SMC64068.012	1 EA	[redacted]	[redacted]	[redacted] Weeks
16	NSPI Material # TBD Nimonic Gland Rings - HP Siemens Part No. : SMC64064.003	2 EA	[redacted]	[redacted]	[redacted] Weeks
17	NSPI Material # TBD Nimonic Gland Rings - IP 1 set = 10 ea Siemens Part No. : SMC64000.003	10 EA	[redacted]	[redacted]	[redacted] Weeks
18	NSPI Material # TBD Pilot Piston Siemens Part No. : 3902ASL15824.018	1 EA	[redacted]	[redacted]	[redacted] Weeks
19	NSPI Material # TBD Oil Relay Plunger Siemens Part No. : 3902ASL15824.151	1 EA	[redacted]	[redacted]	[redacted] Weeks
20	NSPI Material # TBD Oil Relay Plunger Bush Siemens Part No. : 3902ASL15824.152	1 EA	[redacted]	[redacted]	[redacted] Weeks
21	NSPI Material # TBD Screws Siemens Part No. : 3902ASL15824.031	4 EA	[redacted]	[redacted]	[redacted] Weeks

Siemens Canada Limited/Siemens Canada limitée
Energy Service Division/Division Services énergétiques
30 Milton Avenue
P.O. Box 2510
Hamilton, Ontario, Canada
L8N 3K2

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Prices: Price shown is in Canadian funds, include any import duties that may be applicable, DDP Trenton station, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Please note that our minimum order charge for component orders is $[redacted]

Location of Supply: Siemens Power Generation
Newcastle upon Tyne, England

Validity: This proposal is valid for a period of 30 days from date of submission, unless extended, modified or withdrawn by Siemens Energy Services and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Quality Program: This offer is based on a Quality Program in accordance with ISO 9001:2008.

Terms of Payment: Net [redacted] days. Overdue accounts will be charged a [redacted] per month carrying charge.

Conditions of Sale: As per Siemens Canada Selling policy 1200C

Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your instructions to proceed.

Regards,

Maggie Gui

Maggie Gui
Contracts Coordinator
Energy Services Division

Siemens Canada Limited/Siemens Canada limitée
Energy Service Division/Division Services énergétiques
30 Milton Avenue
P.O. Box 2510
Hamilton, Ontario, Canada
L8N 3K2

CI Number: 46336

Title: POT Turbine Valve Refurbishment

Start Date:	2015/08
In-Service Date:	2015/09
Final Cost Date:	2016/03
Function:	Steam
Forecast Amount:	$616,865

DESCRIPTION:

This project will replace components of the Turbine Main Steam, Reheat Steam, and Turbine Emergency Stop Valves.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

The primary function of the Main Steam and Reheat Valves are to regulate the steam flow to the turbine, and thus control the power output of the steam turbine generator. The Turbine Emergency Stop Valve interrupts the steam flow promptly during an emergency trip and cuts off the steam supply when the unit is shut down. These valves are critical components of the steam turbine. Their functionality and reliability are crucial to the operation of the unit. Preventative Maintenance Inspections, as part of Fleet Equipment reliability strategies, have identified components that are out of tolerances and recommended for replacement by the OEM.

Why do this project now?

Completing this project as part of the 2015 planned outage will mitigate the risk of unplanned outages to address possible valve failures, likely to occur by operating the unit with the out of tolerance components.

Why do this project this way?

The refurbishment work is recommended by the Original Equipment Manufacturer (OEM), and is in accordance with their best practices and consistent with NS Power practice. Replacing these components with non-OEM components is being studied; however, a conservative approach must be taken as these components are highly critical in unit operation. Total valve replacement is another alternative, but is a much more costly option and not considered necessary at this time.

CI Number : 46336 - POT Turbine Valve Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal Term Labour AO		5,763	0	5,763
095		095-Thermal & Hydro Contracts AO		6,810	0	6,810
095		095-Thermal Overtime Labour AO		543	0	543
095		095-Thermal Regular Labour AO		5,763	0	5,763
001	010	001 - THERMAL Regular Labour	010 - SGP - Turbo Gen.Instal.	28,756	0	28,756
002	010	002 - THERMAL Overtime Labour	010 - SGP - Turbo Gen.Instal.	5,418	0	5,418
004	010	004 - THERMAL Term Labour	010 - SGP - Turbo Gen.Instal.	28,756	0	28,756
011	010	011 - Travel Expense	010 - SGP - Turbo Gen.Instal.	1,000	0	1,000
012	010	012 - Materials	010 - SGP - Turbo Gen.Instal.	417,657	0	417,657
013	010	013 - POWER PRODUCTION Contracts	010 - SGP - Turbo Gen.Instal.	76,000	0	76,000
015	010	015 - Frt, Post & Delivery	010 - SGP - Turbo Gen.Instal.	1,000	0	1,000
028	010	028 - Consulting	010 - SGP - Turbo Gen.Instal.	25,000	0	25,000
033	010	033 - Rental and Maintenance of	010 - SGP - Turbo Gen.Instal.	1,000	0	1,000
041	010	041 - Meals & Entertainment	010 - SGP - Turbo Gen.Instal.	2,000	0	2,000
066	010	066 - Other Goods & Services	010 - SGP - Turbo Gen.Instal.	11,400	0	11,400
			Total Cost:	616,865	0	616,865
			Original Cost:	472,881		

Capital Project Detailed Estimate

Location: Pt. Tupper
CI# / FP#: 46336
Title: POT Turbine Valve Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	10.00	$ 346.07	$ 3,460.66		
Maintenance Trades	PD	60.00	$ 352.35	$ 21,140.93		
Power Plant Technician	PD	10.00	$ 369.08	$ 3,690.77		
Utilityworker	PD	2.00	$ 231.99	$ 463.98		
			Sub-Total	$ 28,756.33		
002 OT Labour						
Maintenance Trades	PD	10.00	$ 352.35	$ 3,523.49		
Utilityworker	PD	2.00	$ 231.99	$ 463.98		
Electrician	PD	2.00	$ 346.07	$ 692.13		
Power Plant Technician	PD	2.00	$ 369.08	$ 738.15		
			Sub-Total	$ 5,417.75		
004 Term Labour						
Maintenance Trades	PD	60.00	$ 352.35	$ 21,140.93		
Utilityworker	PD	2.00	$ 231.99	$ 463.98		
Electrician	PD	10.00	$ 346.07	$ 3,460.66		
Power Plant Technician	PD	10.00	$ 369.08	$ 3,690.77		
				$ -		
			Sub-Total	$ 28,756.33		
011 Travel Expense						
Travel	lot	1.00	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
012 Materials						
Turbine components	lot	1.00	[redacted]			
Misc. materials and consumable (15% of material costs)	lot	1.00				
			Sub-Total	$ 417,657.00		
013 Contracts						
Turbine contractor labor	lot	1.00	$ 50,000.00	$ 50,000.00		
NDE / Inspections	lot	1.00	$ 15,000.00	$ 15,000.00		
Insulation	lot	1.00	$ 11,000.00	$ 11,000.00		
				$ -		
			Sub-Total	$ 76,000.00		
028 Consulting						
Consulting	lot	1.00	$ 25,000.00	$ 25,000.00		
				$ -		
			Sub-Total	$ 25,000.00		
033 Rentals						
Rentals	lot	1.00	$ 1,000.00	$ 1,000.00		
			Sub-Total	$ 1,000.00		
015 Freight						
Freight	lot	1.00	$ 1,000.00	$ 1,000.00		
			Sub-Total	$ 1,000.00		
041 Meals & Entertainment						
Meals and expenses	lot	1.00	$ 2,000.00	$ 2,000.00		
			Sub-Total	$ 2,000.00		
066 Other Goods & Services						
Contingency on Contracts	%	15.00	$ 76,000.00	$ 11,400.00		
				$ -		
			Sub-Total	$ 11,400.00		
095 Administrative Overhead						
Thermal Reg. Labour AO	lot	1.00	$ 5,762.78	$ 5,762.78		
Thermal OT Labour AO	lot	1.00	$ 542.86	$ 542.86		
Thermal Term Labour AO	lot	1.00	$ 5,762.78	$ 5,762.78		
Thermal / Hydro Contracts AO	lot	1.00	$ 6,809.60	$ 6,809.60		
			Sub-Total	$ 18,878.02		
			SUB-TOTAL (no AO, AFUDC)	$ 597,987.41		
			TOTAL (AO, AFUDC included)	$ 616,865.43		
Original Cost				$ 472,881.38		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

POT Turbine Valve Refurbishment
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**5-Nov-14**
Department :	Point Tupper	**CI Number:**	46336
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Refurbish Valves vs. Avoided Repair ar	6.19%	-1,529,333	1,087,778	1	73.26%	1.9 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

This project is recommended to proceed and not be delayed as the replacement energy costs outweigh the projects costs. No planned outage of sufficient time to complete this work will occur until 2017. Completing this project now is recommended.

Notes/Comments :

Refurbish Valves vs. Avoided Repair and Replacement Energy Costs

This option considers the refurbishment of the blades versus letting them operate until failure and incur replacement energy costs.

Test 2

Test 3

Test 4

POT Turbine Valve Refurbishment
Summary of Sensitivities

Division :	Power Production	**Date :**	**5-Nov-14**
Department :	Point Tupper	**CI Number:**	46336
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Valves vs. Avoided Repair and Replace	6.19%	-1,529,333	1,087,778	1	73.26%	1.9 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Valves vs. Avoided Repair and Replace	10%	-1,466,242	1,041,577	1	62.85%	2.1 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:	**A**	63,091	-46,202	0	-10.41%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Valves vs. Avoided Repair and Replace	-10%	-1,313,309	932,799	1	61.85%	2.1 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:	**A**	216,024	-154,979	0	-11.41%	0.3 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	304,911	585,521	854,199	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

POT Turbine Valve Refurbishment
Avoided Cost Calculations

Division :	Power Production	**Date :**	**5-Nov-14**
Department :	Point Tupper	**CI Number:**	46336
Originator :		**Project No. :**	

Refurbish Valves vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			186,000	192,720		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	75%	80%	75%	80%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	150	150				
Duration (Hours)	168	168				
Totals	$187,425	$192,170	$139,500	$154,176	$326,925	$346,346
Total Capital Cost of Alternative						$616,865

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

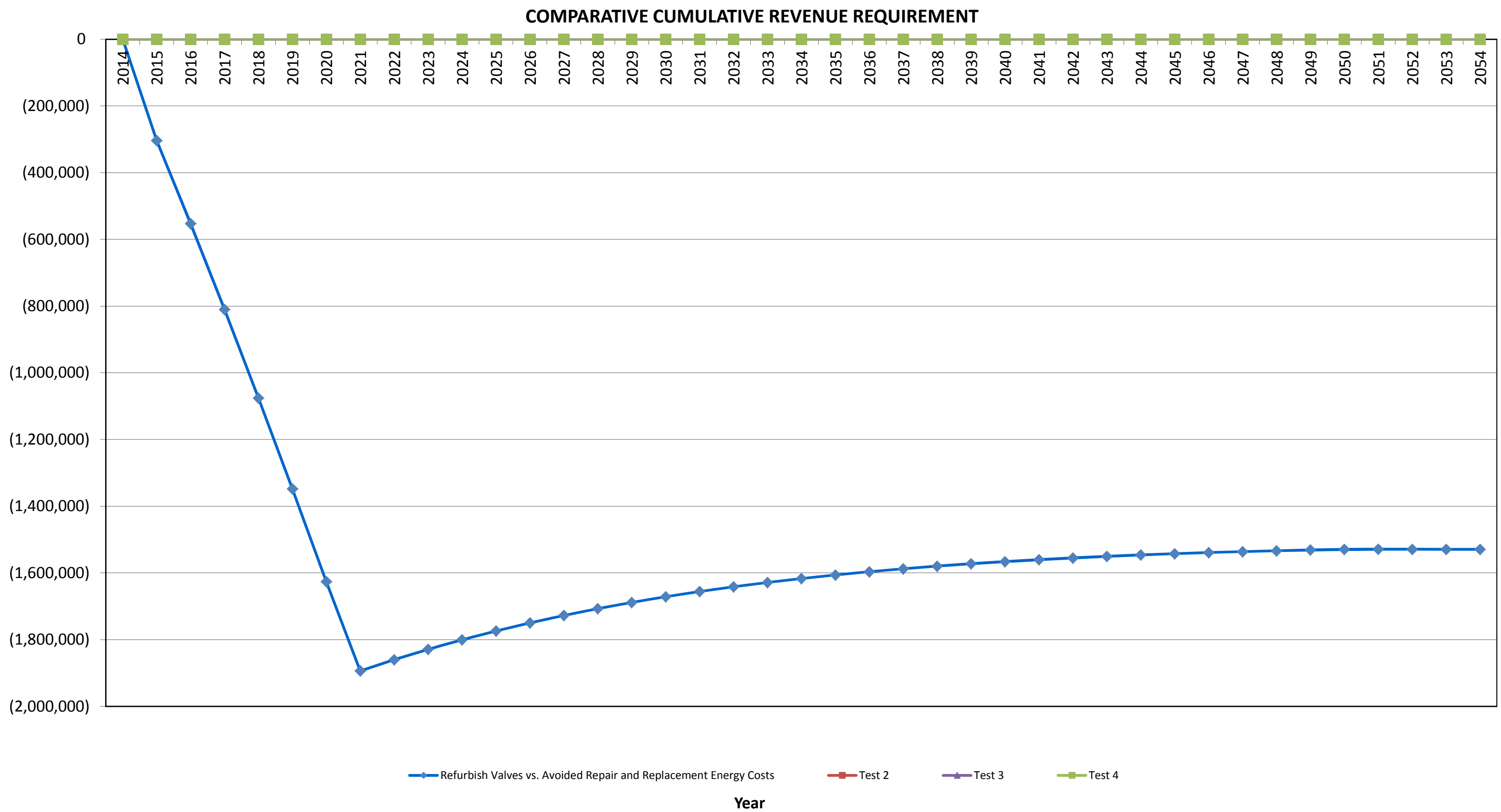
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

POT Turbine Valve Refurbishment
Refurbish Valves vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	326,925.4	(597,987.4)	23,919.5	579,278.2	(271,062.0)	(93,931.8)	(364,993.9)	(343,717.7)	0.94	(343,717.7)
2016	-	-	346,345.5	-	45,925.4	532,482.9	346,345.5	(93,130.2)	253,215.3	224,555.0	0.89	(119,162.8)
2017	-	-	378,003.9	-	42,251.4	489,431.2	378,003.9	(104,083.3)	273,920.7	228,756.7	0.84	109,594.0
2018	-	-	411,164.6	-	38,871.3	449,823.6	411,164.6	(115,410.9)	295,753.7	232,592.5	0.79	342,186.4
2019	-	-	445,893.1	-	35,761.6	413,384.7	445,893.1	(127,140.8)	318,752.3	236,067.0	0.74	578,253.4
2020	-	-	482,257.9	-	32,900.7	379,860.8	482,257.9	(139,300.7)	342,957.2	239,187.3	0.70	817,440.7
2021	-	-	495,553.0	-	30,268.6	349,018.9	495,553.0	(144,238.2)	351,314.9	230,733.8	0.66	1,048,174.5
2022	-	-	-	-	27,847.1	320,644.3	-	8,632.6	8,632.6	5,339.2	0.62	1,053,513.7
2023	-	-	-	-	25,619.3	294,539.7	-	7,942.0	7,942.0	4,625.7	0.58	1,058,139.4
2024	-	-	-	-	23,569.8	270,523.4	-	7,306.6	7,306.6	4,007.6	0.55	1,062,146.9
2025	-	-	-	-	21,684.2	248,428.5	-	6,722.1	6,722.1	3,472.0	0.52	1,065,619.0
2026	-	-	-	-	19,949.5	228,101.1	-	6,184.3	6,184.3	3,008.1	0.49	1,068,627.1
2027	-	-	-	-	18,353.5	209,400.0	-	5,689.6	5,689.6	2,606.1	0.46	1,071,233.2
2028	-	-	-	-	16,885.2	192,194.9	-	5,234.4	5,234.4	2,257.9	0.43	1,073,491.0
2029	-	-	-	-	15,534.4	176,366.2	-	4,815.7	4,815.7	1,956.2	0.41	1,075,447.2
2030	-	-	-	-	14,291.7	161,803.9	-	4,430.4	4,430.4	1,694.8	0.38	1,077,142.0
2031	-	-	-	-	13,148.3	148,406.5	-	4,076.0	4,076.0	1,468.3	0.36	1,078,610.2
2032	-	-	-	-	12,096.5	136,080.9	-	3,749.9	3,749.9	1,272.1	0.34	1,079,882.3
2033	-	-	-	-	11,128.7	124,741.4	-	3,449.9	3,449.9	1,102.1	0.32	1,080,984.4
2034	-	-	-	-	10,238.4	114,309.0	-	3,173.9	3,173.9	954.8	0.30	1,081,939.2
2035	-	-	-	-	9,419.4	104,711.2	-	2,920.0	2,920.0	827.2	0.28	1,082,766.5
2036	-	-	-	-	8,665.8	95,881.2	-	2,686.4	2,686.4	716.7	0.27	1,083,483.2
2037	-	-	-	-	7,972.6	87,757.6	-	2,471.5	2,471.5	620.9	0.25	1,084,104.1
2038	-	-	-	-	7,334.8	80,284.0	-	2,273.8	2,273.8	537.9	0.24	1,084,642.0
2039	-	-	-	-	6,748.0	73,408.2	-	2,091.9	2,091.9	466.1	0.22	1,085,108.1
2040	-	-	-	-	6,208.1	67,082.4	-	1,924.5	1,924.5	403.8	0.21	1,085,511.9
2041	-	-	-	-	5,711.5	61,262.8	-	1,770.6	1,770.6	349.8	0.20	1,085,861.7
2042	-	-	-	-	5,254.6	55,908.7	-	1,628.9	1,628.9	303.1	0.19	1,086,164.8
2043	-	-	-	-	4,834.2	50,982.9	-	1,498.6	1,498.6	262.6	0.18	1,086,427.4
2044	-	-	-	-	4,447.5	46,451.2	-	1,378.7	1,378.7	227.5	0.17	1,086,654.9
2045	-	-	-	-	4,091.7	42,282.0	-	1,268.4	1,268.4	197.1	0.16	1,086,851.9
2046	-	-	-	-	3,764.3	38,446.4	-	1,166.9	1,166.9	170.8	0.15	1,087,022.7
2047	-	-	-	-	3,463.2	34,917.6	-	1,073.6	1,073.6	147.9	0.14	1,087,170.6
2048	-	-	-	-	3,186.1	31,671.1	-	987.7	987.7	128.2	0.13	1,087,298.8
2049	-	-	-	-	2,931.2	28,684.4	-	908.7	908.7	111.0	0.12	1,087,409.9
2050	-	-	-	-	2,696.7	25,936.6	-	836.0	836.0	96.2	0.12	1,087,506.1
2051	-	-	-	-	2,481.0	23,408.6	-	769.1	769.1	83.3	0.11	1,087,589.4
2052	-	-	-	-	2,282.5	21,082.8	-	707.6	707.6	72.2	0.10	1,087,661.6
2053	-	-	-	-	2,099.9	18,943.1	-	651.0	651.0	62.6	0.10	1,087,724.2
2054	-	-	-	-	1,931.9	16,974.6	-	598.9	598.9	54.2	0.09	1,087,778.4
Total	**-**	**-**	**2,886,143.4**	**(597,987.4)**	**575,770.2**		**2,288,156.0**	**(716,215.7)**	**1,571,940.3**	**1,087,778.4**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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Refurbish Valves vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

Item #		Quantity	Quantity Planned	Unit Price	Total Price	Total Price based on Planned Qty
1	Siemens Part No. : SL17254.003 REV Spindle	1	1	[redacted]	[redacted]	[redacted]
2	Siemens Part No. : 17254.004 Intercept Valve Spindle	1	1	[redacted]	[redacted]	[redacted]
3	Siemens Part No. : SL17254.005 Top Gland Bush	1	1	[redacted]	[redacted]	[redacted]
4	Siemens Part No. : SL17254.006 Bottom Gland Bush	1	1	[redacted]	[redacted]	[redacted]
5	Siemens Part No. : SL17254.007 Bottom Gland Bush	1	1	[redacted]	[redacted]	[redacted]
6	Siemens Part No. : SL17254.008 Top Gland Bush	1	1	[redacted]	[redacted]	[redacted]
7	Siemens Part No. : SL17254.010 2" UNF Studs	28	6	[redacted]	[redacted]	[redacted]
8	Siemens Part No. : SL17254.011 2" UNF Cap Nuts	28	6	[redacted]	[redacted]	[redacted]
9	Siemens Part No. : SL17254.017 Intercept Valve	1	1	[redacted]	[redacted]	[redacted]
10	Siemens Part No. : SL17254.018 1.3/4" UNF Special Nut	1	1	[redacted]	[redacted]	[redacted]
11	Siemens Part No. : SL17254.019 Dowel	1	0	[redacted]	[redacted]	$0.00
12	Siemens Part No. : SL17254.020 Key	1	0	[redacted]	[redacted]	$0.00
13	Siemens Part No. : SL17254.021 1" NPSM Pipe PLugs	6	0	[redacted]	[redacted]	$0.00
14	ESV Seat Siemens Part No. : SL17180.001	1	0	[redacted]	[redacted]	$0.00
15	Siemens Part No. : SL17180.002 ESV Head	1	1	[redacted]	[redacted]	[redacted]
16	Siemens Part No. : SL17180.003 ESV Cap	1	0	[redacted]	[redacted]	$0.00
17	Siemens Part No. : SL17180.004 Pilot Valve & Spindle	1	1	[redacted]	[redacted]	[redacted]
18	Feather Key Siemens Part No. : SL17180.005	1	0	[redacted]	[redacted]	$0.00
19	Siemens Part No. : SL17180.010 No 2 ESV Spindle	1	1	[redacted]	[redacted]	[redacted]
20	Siemens Part No. : SL17180.011 ESV Gland Bush Bottom	1	1	[redacted]	[redacted]	[redacted]
21	Siemens Part No. : SL17180.012 ESV Gland Bush Top	1	1	[redacted]	[redacted]	[redacted]
22	Siemens Part No. : SL17180.013 3/8" UNF Special Retaining Screw	1	1	[redacted]	[redacted]	[redacted]
23	Siemens Part No. : SL17180.014 5/8" UNF Special Retaining Ring	6	6	[redacted]	[redacted]	[redacted]
24	Siemens Part No. : SL17180.015 3/4" UNFSpecial Retaining Screw	6	6	[redacted]	[redacted]	[redacted]
25	Siemens Part No. : SL17180.016 2.3/4" UN6 Stud	14	6	[redacted]	[redacted]	[redacted]
26	Siemens Part No. : SL17180.017 2.3/4" UN6 Cap Nuts	14	6	[redacted]	[redacted]	[redacted]
27	Siemens Part No. : SL17180.021 No 1 Governor Valve Spindle	1	1	[redacted]	[redacted]	[redacted]
28	Siemens Part No. : SL17180.022 No 1 Governor Valve Gland Bush Bottom	1	1	[redacted]	[redacted]	[redacted]
29	Siemens Part No. : SL17180.023 No 1 & 2 Governor Valve Gland Bush Top	2	2	[redacted]	[redacted]	[redacted]
30	Siemens Part No. : SL17180.027 No 2 Governor Valve Spindle	1	1	[redacted]	[redacted]	[redacted]
31	Siemens Part No. : SL17180.028 No 2 Governor Valve Gland Bush Bottom	1	1	[redacted]	[redacted]	[redacted]
32	Siemens Part No. : SL17180.029 2.1/4" UN6 Stud	20	6	[redacted]	[redacted]	[redacted]
33	Siemens Part No. : SL17180.030 2.1/4" UN6 Cap Nuts	20	6	[redacted]	[redacted]	[redacted]
34	Siemens Part No. : SL17180.032 ESV Gland Bush	1	1	[redacted]	[redacted]	[redacted]

Total Estimate [redacted]

* Please refer to following pages for vendor proposal.

SIEMENS

Ref: Our EH5091

Date: 5-Sep-2014

To: RAYMOND BARRETT – NSPI/Point Tupper

Subject: **Proposal for 2015 Valve Outage Spare Parts List**

We are now pleased to provide the following proposal for your consideration.

RFQ ITEM	DESCRIPTION	QTY	UNIT PRICE	TOTAL PRICE	EST DELIVERY (ARO)
1	NSPI Material # TBA REV Spindle Siemens Part No. : SL17254.003	1 EA	$ [redacted]	[redacted]	[redacted] Weeks
2	NSPI Material # TBA Intercept Valve Spindle Siemens Part No. : 17254.004	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
3	NSPI Material # TBA Top Gland Bush Siemens Part No. : SL17254.005	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
4	NSPI Material # TBA Bottom Gland Bush Siemens Part No. : SL17254.006	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
5	NSPI Material # TBA Bottom Gland Bush Siemens Part No. : SL17254.007	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
6	NSPI Material # TBA Top Gland Bush Siemens Part No. : SL17254.008	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
7	NSPI Material # TBA 2" UNF Studs Siemens Part No. : SL17254.010	28 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
8	NSPI Material # TBA 2" UNF Cap Nuts Siemens Part No. : SL17254.011	28 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
9	NSPI Material # TBA Intercept Valve Siemens Part No. : SL17254.017	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
10	NSPI Material # TBA 1.3/4" UNF Special Nut Siemens Part No. : SL17254.018	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
11	NSPI Material # TBA Dowel Siemens Part No. : SL17254.019	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
12	NSPI Material # TBA Key Siemens Part No. : SL17254.020	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
13	NSPI Material # TBA 1" NPSM Pipe PLugs Siemens Part No. : SL17254.021	6 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
14	NSPI Material # TBA ESV Seat Siemens Part No. : SL17180.001	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
15	NSPI Material # TBA ESV Head Siemens Part No. : SL17180.002	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks

Siemens Canada Limited/Siemens Canada limitée
Energy Sector/Secteur Énergie
Energy Service Division/Division Services énergétiques
P.O. Box 2510
735 South Service Road, Units 2 – 3
Stoney Creek, Ontario, Canada
L8E 5Z2

SIEMENS

16	NSPI Material # TBA ESV Cap Siemens Part No. : SL17180.003	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
17	NSPI Material # TBA Pilot Valve & Spindle Siemens Part No. : SL17180.004	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
18	NSPI Material # TBA Feather Key Siemens Part No. : SL17180.005	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
19	NSPI Material # TBA No 2 ESV Spindle Siemens Part No. : SL17180.010	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
20	NSPI Material # TBA ESV Gland Bush Bottom Siemens Part No. : SL17180.011	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
21	NSPI Material # TBA ESV Gland Bush Top Siemens Part No. : SL17180.012	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
22	NSPI Material # TBA 3/8" UNF Special Retaining Screw Siemens Part No. : SL17180.013	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
23	NSPI Material # TBA 5/8" UNF Special Retaining Ring Siemens Part No. : SL17180.014	6 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
24	NSPI Material # TBA 3/4" UNFSpecial Retaining Screw Siemens Part No. : SL17180.015	6 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
25	NSPI Material # TBA 2.3/4" UN6 Stud Siemens Part No. : SL17180.016	14 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
26	NSPI Material # TBA 2.3/4" UN6 Cap Nuts Siemens Part No. : SL17180.017	14 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
27	NSPI Material # TBA No 1 Governor Valve Spindle Siemens Part No. : SL17180.021	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
28	NSPI Material # TBA No 1 Governor Valve Gland Bush Bottom Siemens Part No. : SL17180.022	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
29	NSPI Material # TBA No 1 & 2 Governor Valve Gland Bush Top Siemens Part No. : SL17180.023	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
30	NSPI Material # TBA No 2 Governor Valve Spindle Siemens Part No. : SL17180.027	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
31	NSPI Material # TBA No 2 Governor Valve Gland Bush Bottom Siemens Part No. : SL17180.028	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
32	NSPI Material # TBA 2.1/4" UN6 Stud Siemens Part No. : SL17180.029	20 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
33	NSPI Material # TBA 2.1/4" UN6 Cap Nuts Siemens Part No. : SL17180.030	20 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
34	NSPI Material # TBA ESV Gland Bush Siemens Part No. : SL17180.032	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks

Siemens Canada Limited/Siemens Canada limitée
Energy Sector/Secteur Énergie
Energy Service Division/Division Services énergétiques
P.O. Box 2510
735 South Service Road, Units 2 – 3
Stoney Creek, Ontario, Canada
L8E 5Z2

SIEMENS

Prices: Price shown is in Canadian funds, include any import duties that may be applicable, DDP Point Tupper station, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Please note that our minimum order charge for component orders is $[redacted]

Location of Supply: Siemens Power Generation
Newcastle upon Tyne, England

Validity: This proposal is valid for a period of 30 days from date of submission, unless extended, modified or withdrawn by Siemens Energy Services and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Quality Program: This offer is based on a Quality Program in accordance with ISO 9001:2008.

Terms of Payment: Net [redacted] days. Overdue accounts will be charged a [redacted] per month carrying charge.

Conditions of Sale: As per Siemens Canada Selling Policy 1200C.

Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your instructions to proceed.

Regards,

Maggie Gui

Maggie Gui
Contracts Coordinator
Energy Services Division

Siemens Canada Limited/Siemens Canada limitée
Energy Sector/Secteur Énergie
Energy Service Division/Division Services énergétiques
P.O. Box 2510
735 South Service Road, Units 2 – 3
Stoney Creek, Ontario, Canada
L8E 5Z2

CI Number: 46473

Title: TUC3 – Turbine Valve Refurbishment

Start Date: 2015/10
In-Service Date: 2015/12
Final Cost Date: 2016/06
Function: Steam
Forecast Amount: $609,870

DESCRIPTION:

This project is for the component replacement on the Turbine's Main Steam Emergency Stop and Governor valves and the Reheat Steam Emergency Stop and Governor valves. Scope will include replacement/refurbishment of valve stems and bushings, hydraulic valves and control oil pressure regulator.

Summary of Related CIs (+/- 2 years):
2013 CI 45592 TUC3 U&U Turbine – IP Row 21 Blading Phase 1 $509,816
2014 CI 45816 TUC3 U&U Turbine Blade Replace Phase 2 $1,150,115

JUSTIFICATION:

Justification Criteria: Thermal

Criteria: Equipment Replacement

Why do this project?

The primary function of the Governor Valves is to regulate the steam flow to the turbine, and thus control the power output of the steam turbine generator. The Emergency Stop Valves (ESVs) interrupt the steam flow promptly during an emergency trip and cut-off the steam supply when the unit is shut down. All these valves are critical components of the steam turbine. Their functionality and reliability are crucial to the safe operation of the unit. Preventative Maintenance Inspections, as part of Fleet Equipment reliability strategies, have identified components that are out of tolerance and recommended for replacement by the OEM.

Why do this project now?

Completing this project as part of the 2015 planned outage will mitigate the risk of unplanned outages to address possible valve failures, likely to occur by operating the unit with the out of tolerance (physical dimensions have worn past OEM standards) components.

Why do this project this way?

The refurbishment work is recommended by the Original Equipment Manufacturer (OEM), and is in accordance with their best practices and consistent with NS Power practice. Replacing these components with non-OEM components is being studied as a potential option for the future. However, a conservative approach must be taken as these components are highly critical in unit operation. Total valve replacement is another alternative, but is a much more costly option and not considered necessary at this time.

CI Number : 46473 - TUC3 - Turbine Valve Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 319 - 319-TC Unit 3 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal Overtime Labour AO		1,342	0	1,342
095		095-Thermal & Hydro Contracts AO		21,735	0	21,735
095		095-Thermal Regular Labour AO		5,748	0	5,748
001	010	001 - THERMAL Regular Labour	010 - SGP - Turbo Gen.Instal.	28,684	0	28,684
002	010	002 - THERMAL Overtime Labour	010 - SGP - Turbo Gen.Instal.	13,389	0	13,389
012	010	012 - Materials	010 - SGP - Turbo Gen.Instal.	[redacted]	0	[redacted]
013	010	013 - POWER PRODUCTION Contracts	010 - SGP - Turbo Gen.Instal.	242,580	0	242,580
066	010	066 - Other Goods & Services	010 - SGP - Turbo Gen.Instal.	[redacted]	0	[redacted]
			Total Cost:	609,870	0	609,870
			Original Cost:	542,949		

Location: Tufts Cove Generating Station
CI# / FP#: 46473
Title: TUC3 Turbine Valve Refurbishments
Execution Year: 2015

Item	Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
	001 Regular Labour						
	Electrician	PD	3	$ 346	$ 1,038.20		
	Instrumentation	PD	3	$ 346	$ 1,038.20		
	Mechanical Trades	PD	50	$ 352	$ 17,617.44		
	Engineering	PD	20	$ 391	$ 7,829.72		
	Utility Services	PD	5	$ 232	$ 1,159.94		
				Sub-Total	$ 28,683.50		
	002 Thermal Overtime Labour						
	Maintenance Trades	PD	19	$ 705	$ 13,389.25		
				Sub-Total	$ 13,389.25		
	012 Materials						
	Replacement Valve Components & Hardware	lot	1	[redacted]	[redacted]	Cost Support Item #1	
	Misc. Consumable Materials	lot	1	[redacted]	[redacted]		
				Sub-Total	[redacted]		
	013 Power Production Contracts						
	Technical Field Advisor & Report	lot	1	$ 111,200	$ 111,200.00		
	Millwright Support	lot	1	$ 98,380	$ 98,380.00		
	Valve NDE Services	lot	1	$ 15,000	$ 15,000.00		
	Scaffolding Services	lot	1	$ 8,000	$ 8,000.00		
	Insulation Services	lot	1	$ 10,000	$ 10,000.00		
				Sub-Total	$ 242,580.00		
	066 Other Goods & Services						
	Contingency		[redacted]	[redacted]	[redacted]		
				Sub-Total	[redacted]		
	095 Administrative Overhead						
	Thermal / Hydro Contracts AO				$ 21,735.16		
	Thermal Reg. Labour AO				$ 5,748.18		
	Thermal OT Labour AO				$ 1,341.60		
				Sub-Total	$ 28,824.94		
				SUB-TOTAL (no AO, AFUDC)	$ 581,044.96		
				TOTAL (AO, AFUDC included)	$ 609,869.90		
	Original Cost				$ 542,949.00		

Note 1: Reference to "Completed similar projects (FP#'s)" is to be provided when the item estimate is based on work of similar scope for a recently completed project

TUC3 Turbine Valve Refurbishments
Summary of Alternatives

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Tufts Cove Maintenance	**CI Number:**	46473
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Turbine Valve Refurbishment vs. Avoid	6.19%	-591,549	401,092	1	21.51%	5.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

On the basis of revenue requirement, it is recommended to refurbish the valves as the avoided costs outweigh the capital investment.

Notes/Comments :

Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs

This option considers refurbishing the valves compared to running the unit until a valve failure occurs, at which time a 1 week outage would be required to return the unit to service.

Test 2

Test 3

Test 4

TUC3 Turbine Valve Refurbishments
Summary of Sensitivities

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Tufts Cove Maintenance	**CI Number:**	46473
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Turbine Valve Refurbishment vs. Avoided Repair	6.19%	-591,549	401,092	1	21.51%	5.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Turbine Valve Refurbishment vs. Avoided Repair	10%	-533,875	356,199	1	18.62%	6.4 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years
	Change:	**A**	57,674	-44,893	0	-2.89%	0.5 years
		B	0	0	0	#NUM!	0.0 years
		C	0	0	0	#NUM!	0.0 years
		D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Turbine Valve Refurbishment vs. Avoided Repair	-10%	-474,720	316,090	1	18.33%	6.4 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years
	Change:	**A**	116,829	-85,002	0	-3.18%	0.6 years
		B	0	0	0	#NUM!	0.0 years
		C	0	0	0	#NUM!	0.0 years
		D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	121,620	215,043	295,979	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

TUC3 Turbine Valve Refurbishments
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Tufts Cove Maintenance	**CI Number:**	46473
Originator :		**Project No. :**	

Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			150,000	150,000		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	75%	80%	75%	80%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	150	150				
Duration (Hours)	168	168				
Totals	$17,901	$8,896	$112,500	$120,000	$130,401	$128,896
Total Capital Cost of Alternative						$609,870

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

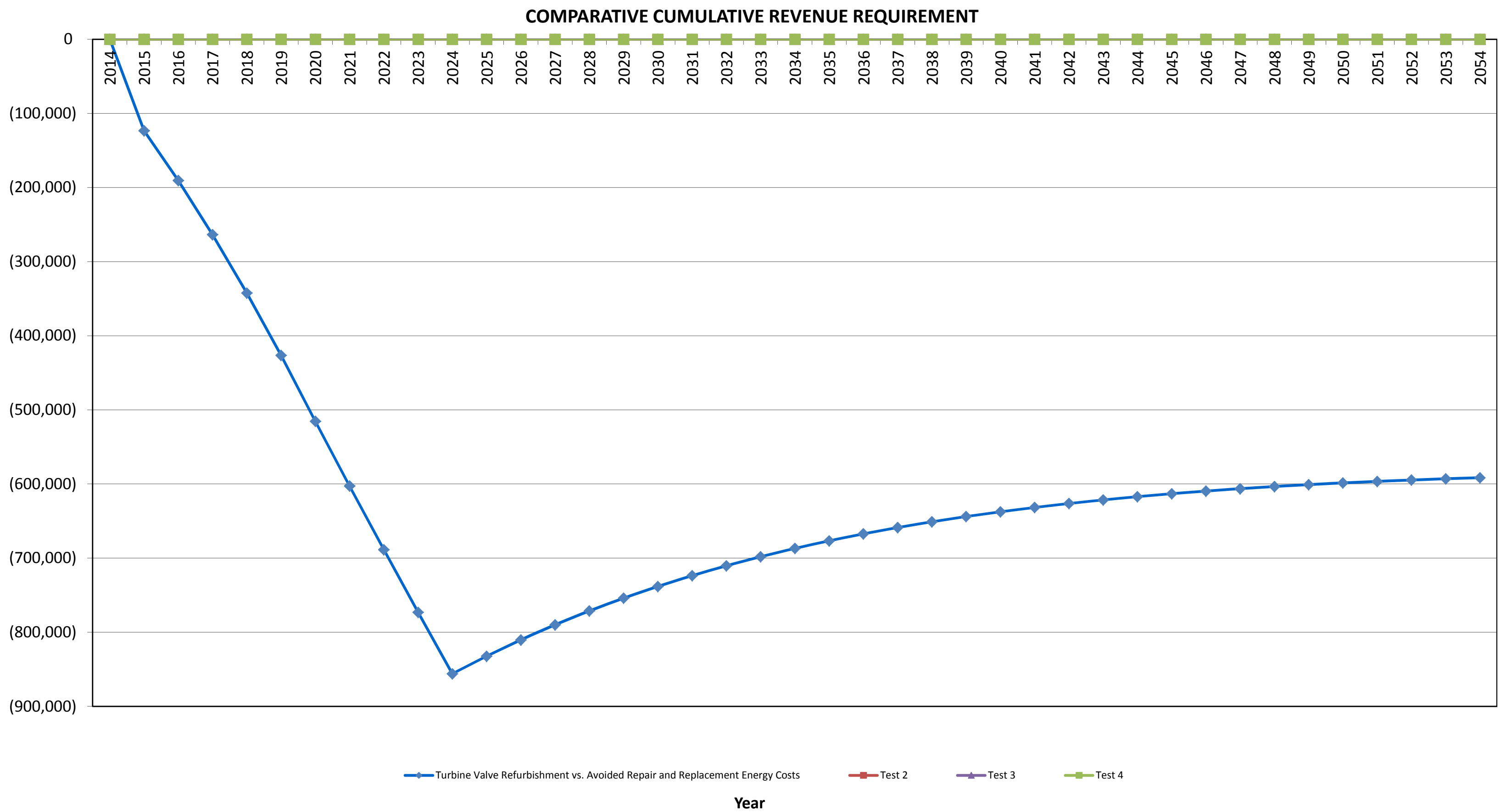
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

TUC3 Turbine Valve Refurbishments

Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	130,401.2	(581,045.0)	23,241.8	565,758.8	(450,643.7)	(33,219.4)	(483,863.1)	(455,657.9)	0.94	(455,657.9)
2016	-	-	128,895.5	-	44,624.3	519,806.3	128,895.5	(26,124.1)	102,771.4	91,139.2	0.89	(364,518.7)
2017	-	-	142,240.5	-	41,054.3	477,530.0	142,240.5	(31,367.7)	110,872.8	92,592.1	0.84	(271,926.6)
2018	-	-	156,427.8	-	37,770.0	438,635.8	156,427.8	(36,783.9)	119,643.8	94,092.7	0.79	(177,833.9)
2019	-	-	171,503.1	-	34,748.4	402,853.2	171,503.1	(42,394.0)	129,109.1	95,617.8	0.74	(82,216.1)
2020	-	-	187,514.8	-	31,968.5	369,933.1	187,514.8	(48,219.3)	139,295.4	97,148.3	0.70	14,932.2
2021	-	-	194,774.6	-	29,411.0	339,646.7	194,774.6	(51,262.7)	143,511.9	94,254.6	0.66	109,186.8
2022	-	-	202,320.1	-	27,058.1	311,783.1	202,320.1	(54,331.2)	147,988.9	91,529.3	0.62	200,716.1
2023	-	-	210,162.5	-	24,893.5	286,148.7	210,162.5	(57,433.4)	152,729.1	88,954.7	0.58	289,670.9
2024	-	-	218,313.5	-	22,902.0	262,565.0	218,313.5	(60,577.6)	157,735.9	86,515.6	0.55	376,186.5
2025	-	-	-	-	21,069.8	240,868.0	-	6,531.7	6,531.7	3,373.7	0.52	379,560.1
2026	-	-	-	-	19,384.3	220,906.8	-	6,009.1	6,009.1	2,922.9	0.49	382,483.0
2027	-	-	-	-	17,833.5	202,542.4	-	5,528.4	5,528.4	2,532.3	0.46	385,015.3
2028	-	-	-	-	16,406.8	185,647.2	-	5,086.1	5,086.1	2,193.9	0.43	387,209.2
2029	-	-	-	-	15,094.3	170,103.6	-	4,679.2	4,679.2	1,900.7	0.41	389,109.9
2030	-	-	-	-	13,886.7	155,803.6	-	4,304.9	4,304.9	1,646.7	0.38	390,756.6
2031	-	-	-	-	12,775.8	142,647.5	-	3,960.5	3,960.5	1,426.7	0.36	392,183.3
2032	-	-	-	-	11,753.7	130,543.9	-	3,643.7	3,643.7	1,236.0	0.34	393,419.4
2033	-	-	-	-	10,813.4	119,408.6	-	3,352.2	3,352.2	1,070.9	0.32	394,490.2
2034	-	-	-	-	9,948.4	109,164.1	-	3,084.0	3,084.0	927.8	0.30	395,418.0
2035	-	-	-	-	9,152.5	99,739.2	-	2,837.3	2,837.3	803.8	0.28	396,221.8
2036	-	-	-	-	8,420.3	91,068.2	-	2,610.3	2,610.3	696.4	0.27	396,918.2
2037	-	-	-	-	7,746.7	83,091.0	-	2,401.5	2,401.5	603.3	0.25	397,521.5
2038	-	-	-	-	7,126.9	75,751.9	-	2,209.4	2,209.4	522.7	0.24	398,044.2
2039	-	-	-	-	6,556.8	68,999.9	-	2,032.6	2,032.6	452.9	0.22	398,497.1
2040	-	-	-	-	6,032.2	62,788.2	-	1,870.0	1,870.0	392.3	0.21	398,889.4
2041	-	-	-	-	5,549.7	57,073.3	-	1,720.4	1,720.4	339.9	0.20	399,229.3
2042	-	-	-	-	5,105.7	51,815.6	-	1,582.8	1,582.8	294.5	0.19	399,523.8
2043	-	-	-	-	4,697.2	46,978.6	-	1,456.1	1,456.1	255.1	0.18	399,779.0
2044	-	-	-	-	4,321.5	42,528.5	-	1,339.7	1,339.7	221.0	0.17	400,000.0
2045	-	-	-	-	3,975.7	38,434.4	-	1,232.5	1,232.5	191.5	0.16	400,191.5
2046	-	-	-	-	3,657.7	34,667.9	-	1,133.9	1,133.9	165.9	0.15	400,357.4
2047	-	-	-	-	3,365.1	31,202.6	-	1,043.2	1,043.2	143.7	0.14	400,501.2
2048	-	-	-	-	3,095.9	28,014.6	-	959.7	959.7	124.5	0.13	400,625.7
2049	-	-	-	-	2,848.2	25,081.7	-	882.9	882.9	107.9	0.12	400,733.6
2050	-	-	-	-	2,620.3	22,383.3	-	812.3	812.3	93.5	0.12	400,827.1
2051	-	-	-	-	2,410.7	19,900.9	-	747.3	747.3	81.0	0.11	400,908.1
2052	-	-	-	-	2,217.9	17,617.0	-	687.5	687.5	70.2	0.10	400,978.3
2053	-	-	-	-	2,040.4	15,515.8	-	632.5	632.5	60.8	0.10	401,039.0
2054	-	-	-	-	1,877.2	13,582.8	-	581.9	581.9	52.7	0.09	401,091.7
Total	**-**	**-**	**1,742,553.6**	**(581,045.0)**	**559,457.3**		**1,161,508.6**	**(366,759.9)**	**794,748.8**	**401,091.7**		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Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

HP Steam Chest

Reference	Unit Price	Quantity	Total Cost
12	[redacted]	1	[redacted]
13		1	
14		1	
15		1	
16		1	
19		1	
22		6	
23		2	
24		4	
25		1	
26		18	
27		1	
28		2	
29		1	
30		1	
31		2	
32		3	
33		6	
		Sub-Total	

Reheat Steam Chest

Reference	Unit Price	Quantity	Total Cost
6	[redacted]	1	[redacted]
7		1	
8		1	
9		1	
10		4	
11		6	
		Sub-Total	
		Total Materials	[redacted]

SIEMENS

Ref: Our EH4967
Blaise McNeil email request on May 21, 2014
Date: 5-Aug-2014

To: Blaise McNeil – NSPI/Tufts cove

Subject: **Proposal for Tufts Cove U2 & U3 2015 outage spare parts**

We are now pleased to provide the following proposal for your consideration. Please note those highlighted in Green are Siemens recommended parts for 2015 outage.

RFQ ITEM	DESCRIPTION	QTY	UNIT PRICE	TOTAL PRICE	EST DELIVERY (ARO)
1	NSPI Material # TBA ESV Spindle End Piece Siemens Part No. : SL17183.008	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
2	NSPI Material # TBA Nut for ESV Spindle (UNF) Siemens Part No. : SL17183.027	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
3	NSPI Material # TBA Power Piston Bush * Supply - OD Oversize 1/16" Siemens Part No. : SL17183.037	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
4	NSPI Material # TBA Bush *Supply - ID Undersize 1/32", OD Oversize 1/32". Siemens Part No. : SL16828.016	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
5	NSPI Material # TBA Spindle Top Nut Siemens Part No. : SL16828.126	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
6	NSPI Material # TBA Reheat ESV Gland Bush *Supply - OD Oversize 1/16" Siemens Part No. : SL17547.005	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
7	NSPI Material # TBA Reheat ESV Bottom Gland Bush *Supply - OD Oversize 1/16" Siemens Part No. : SL17547.006	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
8	NSPI Material # TBA ICV Bottom Gland Bush *Supply - OD Oversize 1/16" Siemens Part No. : SL17547.007	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
9	NSPI Material # TBA ICV Top Gland Bush *Supply - OD Oversize 1/16" Siemens Part No. : SL17547.008	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
10	NSPI Material # TBA 2" UN8 Stud Siemens Part No. : SL17547.010	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
11	NSPI Material # TBA 2" UN8 Cap Nut Siemens Part No. : SL17547.011	6 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
12	NSPI Material # TBA ESV Seat Siemens Part No. : SL17537.001	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
13	NSPI Material # TBA ESV Head Siemens Part No. : SL17537.002	1 EA	$ [redacted]	$ [redacted]	Weeks
14	NSPI Material # TBA ESV Cap Siemens Part No. : SL17537.003	1 EA	$ [redacted]	$ [redacted]	Weeks
15	NSPI Material # TBA Pilot Valve & Spindle Siemens Part No. : SL17537.004	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks

Siemens Canada Limited/Siemens Canada limitée
Energy Sector/Secteur Énergie
Energy Service Division/Division Services énergétiques
P.O. Box 2510
735 South Service Road, Units 2 – 3
Stoney Creek, Ontario, Canada
L8E 5Z2

SIEMENS

16	NSPI Material # TBA Key *Supply - in assembled condition Siemens Part No. : SL17537.005	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
17	NSPI Material # TBA ESV Cover Siemens Part No. : SL17537.008	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
18	NSPI Material # TBA ESV Cover Siemens Part No. : SL17537.009	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
19	NSPI Material # TBA No 2 ESV Spindle Siemens Part No. : SL17537.010	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
20	NSPI Material # TBA ESV Gland Bush Bottom (No1) *Supply - OD Oversize 1/16" Siemens Part No. : SL17537.011	1 EA	$ [redacted]	$ [redacted]	Weeks
21	NSPI Material # TBA ESV Gland Bush Top Supply - OD Oversize 1/16" Siemens Part No. : SL17537.012	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
22	NSPI Material # TBA Special Retaining Screw Siemens Part No. : SL17537.014	6 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
23	NSPI Material # TBA 2.3/4" UN8 Stud Siemens Part No. : SL17537.016	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
24	NSPI Material # TBA 2.3/4" UN8 Cap Nut Siemens Part No. : SL17537.017	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
25	NSPI Material # TBA No 1 Gov Valve Seat Siemens Part No. : SL17537.019	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
26	NSPI Material # TBA 3/4" UNF Special Screw *Supply Diamensions as per drawing CTU189-04 --- Major Dia - 0.7485", Shank Dia - 0.657", 'B' - 1 1/32", 'C' - 7/8", 'E' - 1 1/4", 'F' - 3/64", 'G' - 1/4", 'H' - 5 1/16", 'J' - 1/16", 'M' - 0.055" Siemens Part No. : SL17537.020	18 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
27	NSPI Material # TBA No 1 Gov Valve Spindle Siemens Part No. : SL17537.021	3 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
28	NSPI Material # TBA No. 1 & 2 Gov. Valve Gland Bush Top *Supply - OD Oversize 1/16" Siemens Part No. : SL17537.023	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
29	NSPI Material # TBA No. 2 GOV VALVE SEAT Siemens Part No. : SL17537.026	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
30	NSPI Material # TBA No. 2 GOV VALVE SPINDLE Siemens Part No. : SL17537.027	3 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
31	NSPI Material # TBA GOV VALVE GLAND BUSH BOTTTOM *Supply - OD Oversize 1/16" Siemens Part No. : SL17537.028	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
32	NSPI Material # TBA 2 1/4" STUDS UN6 Siemens Part No. : SL17537.029	3 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
33	NSPI Material # TBA 2 1/4" CAP NUTS UN6 Siemens Part No. : SL17537.030	6 EA	$ [redacted]	$ [redacted]	[redacted] Weeks

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34	NSPI Material # TBA ESV GLAND BUSH BOTTOM No 2 *Supply - OD Oversize 1/16" Siemens Part No. : SL17537.032	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
35	NSPI Material # TBA SHAFT FOR 2ND REDUCTION PINION Siemens Part No. : SM17159.070	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
36	NSPI Material # TBA 2 1/4" NUT Siemens Part No. : SM17159.104	4 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
37	NSPI Material # TBA BUSH FOR TIE ROD GUIDE *Supply - OD Oversize 1/16", ID Undersize 1/32" Siemens Part No. : 86MC61506.030	8 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
38	NSPI Material # TBA No. 1 OIL BAFFLE PLATE & CALKLING STRIP *Supply - ID Undersize Siemens Part No. : SMC64037.003,005	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
39	NSPI Material # TBA No. 2 OIL BAFFLE PLATE & CALKLING STRIP *Supply - ID Undersize Siemens Part No. : SMC64037.004,006	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
40	NSPI Material # TBA No.3 OIL BAFFLE PLATE & CALKLING STRIP *Supply - ID Undersize Siemens Part No. : SMC64038.003,005	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
41	NSPI Material # TBA No. 4 OIL BAFFLE PLATE & CALKLING STRIP *Supply - ID Undersize Siemens Part No. : SMC 64038.004,006	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
42	NSPI Material # TBA No. 5 OIL BAFFLE PLATE & CALKLING STRIP *Supply - ID Undersize Siemens Part No. : SMC64039.003,005	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
43	NSPI Material # TBA No. 6 OIL BAFFLE PLATE & CALKLING STRIP *Supply - ID Undersize Siemens Part No. : SMC 64039.004.006	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
44	NSPI Material # TBA MOP BAFFLE PLATES (IN HALVES) *Supply - ID Undersize Siemens Part No. : SL29555.046	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
45	NSPI Material # TBA GLAND RING *Supply - ID Undersize Siemens Part No. : SMC64367.005	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
46	NSPI Material # TBA GLAND RING *Supply - ID Undersize Siemens Part No. : SMC64367.006	3 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
47	NSPI Material # TBA GLAND RING *Supply - ID Undersize Siemens Part No. : SMC64367.007	1 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
48	NSPI Material # TBA GLAND RING *Supply - ID Undersize Siemens Part No. : SMC64367.008	2 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
49	NSPI Material # TBA SPRING FOR REF 5 & 7 Siemens Part No. : SMC64367.009	39 EA	$ [redacted]	$ [redacted]	[redacted] Weeks
50	NSPI Material # TBA SPRING FOR REF 6 & 8 Siemens Part No. : SMC64367.010	90 EA	$ [redacted]	$ [redacted]	[redacted] Weeks

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L8E 5Z2

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Prices: Price shown is in Canadian funds, include any import duties that may be applicable, DDP Tufts Cove station, but do not include any taxes. Price shown is also based on the quantities quoted. Should the order quantity differ from the quoted quantity, we reserve the right to amend the prices.

Please note that our minimum order charge for component orders is $[redacted]

Location of Supply: Siemens Power Generation
Newcastle upon Tyne, England

Validity: This proposal is valid for a period of 30 days from date of submission, unless extended, modified or withdrawn by Siemens Energy Services and limits acceptance to the terms set forth herein. The return of a purchase order or any other reasonable manner of acceptance communicated to Siemens during such validity period will be sufficient to form an agreement on the terms and conditions of this offer.

Due to recent significant movements in material costs and availability, our offer is subject to review beyond the validity period.

Quality Program: This offer is based on a Quality Program in accordance with ISO 9001:2008.

Terms of Payment: Net [redacted] days. Overdue accounts will be charged a [redacted] per month carrying charge.

Conditions of Sale: As per Siemens Canada Selling Policy 1200C.

Notwithstanding any other provisions of this Contract, in no event shall the aggregate liability of Siemens Canada or its affiliates, partners and subcontractors exceed the final agreed Contract Price or any agreed increase to the Contract Price.

Siemens obligation to fulfill this agreement is subject to the proviso that the fulfillment is not prevented by any impediments arising out of national or international foreign trade and customs requirements or any embargos [or other sanctions].

Feel free to contact us should you have any questions. We look forward to receive your instructions to proceed.

Regards,

Maggie Gui
Contracts Coordinator
Energy Services Division

Siemens Canada Limited/Siemens Canada limitée
Energy Sector/Secteur Énergie
Energy Service Division/Division Services énergétiques
P.O. Box 2510
735 South Service Road, Units 2 – 3
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CI Number: 46464

Title: TUC1 – Turbine Valve Refurbishment

Start Date:	2015/03
In-Service Date:	2015/04
Final Cost Date:	2015/10
Function:	Steam
Forecast Amount:	$541,162

DESCRIPTION:

This project is for the component replacement on the Turbine's Main Steam Emergency Stop and Governor valves and the Reheat Steam Emergency Stop and Governor valves. Scope will include replacement/refurbishment of valve stems and bushings, hydraulic valves and control oil pressure regulator.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Criteria: Equipment Replacement

Why do this project?

The primary function of the Governor Valves is to regulate the steam flow to the turbine, and thus control the power output of the steam turbine generator. The HP Emergency Stop Valves (ESVs) interrupt the steam flow promptly during an emergency trip and cut off the steam supply when the unit is shut down. All these valves are critical components of the steam turbine. Their functionality and reliability are crucial to the safe operation of the unit. Preventative Maintenance Inspections, as part of Fleet Equipment reliability strategies, have identified components that are out of tolerance and recommended for replacement by the OEM.

Why do this project now?

Completing this project as part of the 2015 planned outage will mitigate the risk of unplanned outages. It will address the potential for valve failures, likely to occur by operating the unit with the out of tolerance (physical dimensions have worn past OEM standards) components.

Why do this project this way?

The refurbishment work is recommended by the Original Equipment Manufacturer (OEM), and is in accordance with their best practices and consistent with NS Power practice. Replacing these components with non-OEM components is being studied as a potential future option; however a conservative approach must be taken as these components are highly critical in unit operation. Total valve replacement is another alternative, but is a much more costly option and not considered necessary at this time.

CI Number : 46464 - TUC1 - Turbine Valve Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 317 - 317-TC Unit 1 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		31,452	0	31,452
095		095-Thermal Regular Labour AO		4,810	0	4,810
095		095-Thermal Overtime Labour AO		353	0	353
001	010	001 - THERMAL Regular Labour	010 - SGP - Turbo Gen.Instal.	24,000	0	24,000
002	010	002 - THERMAL Overtime Labour	010 - SGP - Turbo Gen.Instal.	3,523	0	3,523
012	010	012 - Materials	010 - SGP - Turbo Gen.Instal.	126,000	0	126,000
013	010	013 - POWER PRODUCTION Contracts	010 - SGP - Turbo Gen.Instal.	351,024	0	351,024
			Total Cost:	541,162	0	541,162
			Original Cost:	363,633		

Location: Tufts Cove Generating Station
CI# / FP#: 46464
Title: TUC1 Turbine Valve Refurbishments
Execution Year: 2015

Item	Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
	001 Regular Labour						
	Electrician	PD	5	$ 346	$ 1,557.30		
	Instrumentation	PD	5	$ 346	$ 1,557.30		
	Mechanical Trades	PD	38	$ 352	$ 13,389.25		
	Engineering	PD	15	$ 391	$ 5,872.29		
	Utility Services	PD	7	$ 232	$ 1,623.92		
				Sub-Total	$ 24,000.06		
	002 Thermal Overtime Labour						
	Maintenance Trades	PD	5	$ 705	$ 3,523.49		
				Sub-Total	$ 3,523.49		
	012 Materials						
	Replacement Valve Components & Hardware	lot	1	$ 120,000	$ 120,000.00		
	Misc. Consumable Materials	lot	1	$ 6,000	$ 6,000.00		
				Sub-Total	$ 126,000.00		
	013 Power Production Contracts						
	Technical Field Advisor & Report	lot	1	$ 120,000	$ 120,000.00		
	Millwright Support	lot	1	$ 101,024	$ 101,024.00		
	Welding & Machining Services	lot	1	$ 90,000	$ 90,000.00		
	Valve NDE Services	lot	1	$ 15,000	$ 15,000.00		
	Scaffolding Services	lot	1	$ 10,000	$ 10,000.00		
	Insulation Services	lot	1	$ 15,000	$ 15,000.00		
				Sub-Total	$ 351,024.00		
	095 Administrative Overhead						
	Thermal / Hydro Contracts AO				$ 31,451.76		
	Thermal Reg. Labour AO				$ 4,809.61		
	Thermal OT Labour AO				$ 353.05		
				Sub-Total	$ 36,614.42		
				SUB-TOTAL (no AO, AFUDC)	$ 504,547.55		
				TOTAL (AO, AFUDC included)	$ 541,161.97		
	Original Cost				$ 363,633.00		

Note 1: Reference to "Completed similar projects (FP#'s)" is to be provided when the item estimate is based on work of similar scope for a recently completed project

TUC1 Turbine Valve Refurbishments
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Tufts Cove Maintenance	**CI Number:**	46464
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Turbine Valve Refurbishment vs. Avoid	6.19%	-689,240	490,268	1	27.28%	4.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to refurbish the turbine valves as opposed to dealing with the unplanned costs due to valve failures. This is supported by the PV of Revenue Requirement

Notes/Comments :

Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs

The option considers refurbishing the valve components compared to running the unit until a valve failure occurs, at which time a 1 week outage would be required to return the unit to service.

Test 2

Test 3

Test 4

TUC1 Turbine Valve Refurbishments
Summary of Sensitivities

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Tufts Cove Maintenance	**CI Number:**	46464
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Turbine Valve Refurbishment vs. Avoided Repair	6.19%	-689,240	490,268	1	27.28%	4.8 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Turbine Valve Refurbishment vs. Avoided Repair	10%	-637,246	451,286	1	23.93%	5.2 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years
	Change:	**A**	51,994	-38,982	0	-3.35%	0.4 years
		B	0	0	0	#NUM!	0.0 years
		C	0	0	0	#NUM!	0.0 years
		D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Turbine Valve Refurbishment vs. Avoided Repair	-10%	-568,322	402,259	1	23.59%	5.3 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years
	Change:	**A**	120,918	-88,009	0	-3.69%	0.5 years
		B	0	0	0	#NUM!	0.0 years
		C	0	0	0	#NUM!	0.0 years
		D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	PV of Revenue Requirement 1	PV of Revenue Requirement 2	PV of Revenue Requirement 3	Delay?
	A	115,410	216,501	307,366	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

TUC1 Turbine Valve Refurbishments
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Tufts Cove Maintenance	**CI Number:**	46464
Originator :		**Project No. :**	

Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			150,000	150,000		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	75%	80%	75%	80%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	150	150				
Duration (Hours)	168	168				
Totals	$11,243	$15,123	$112,500	$120,000	$123,743	$135,123
Total Capital Cost of Alternative						$541,162

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

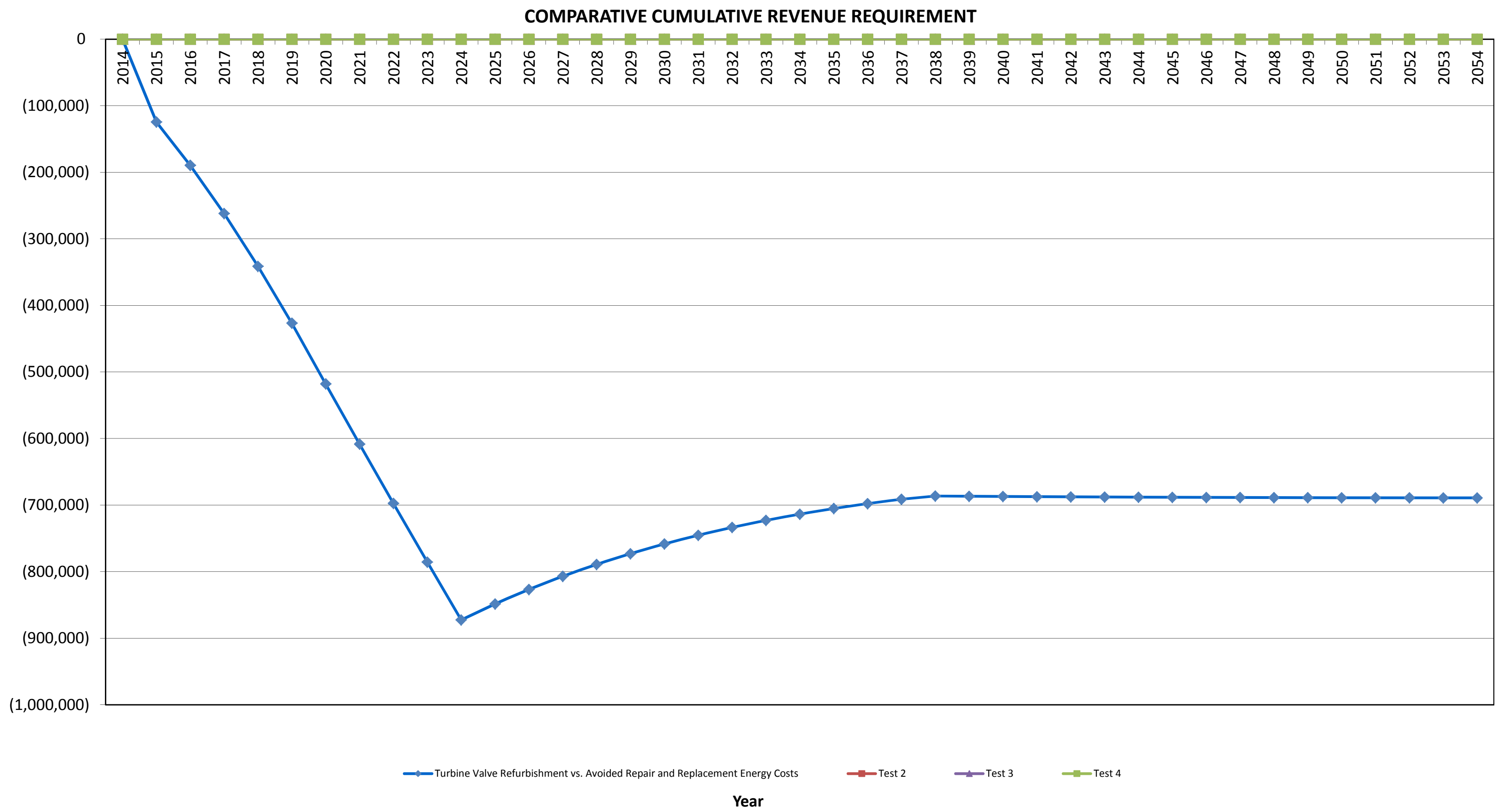
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

TUC1 Turbine Valve Refurbishments

Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	123,742.8	(504,547.6)	20,181.9	494,471.2	(380,804.8)	(32,103.9)	(412,908.7)	(388,839.5)	0.94	(388,839.5)
2016	-	-	135,122.7	-	38,749.3	454,034.8	135,122.7	(29,875.8)	105,246.9	93,334.5	0.89	(295,505.0)
2017	-	-	148,989.2	-	35,649.3	416,833.3	148,989.2	(35,135.4)	113,853.9	95,081.7	0.84	(200,423.3)
2018	-	-	163,716.4	-	32,797.4	382,607.8	163,716.4	(40,584.9)	123,131.5	96,835.5	0.79	(103,587.8)
2019	-	-	179,350.5	-	30,173.6	351,120.5	179,350.5	(46,244.9)	133,105.7	98,577.7	0.74	(5,010.1)
2020	-	-	195,940.4	-	27,759.7	322,152.1	195,940.4	(52,136.0)	143,804.4	100,293.0	0.70	95,282.8
2021	-	-	203,368.8	-	25,538.9	295,501.2	203,368.8	(55,127.3)	148,241.5	97,360.9	0.66	192,643.7
2022	-	-	211,086.1	-	23,495.8	270,982.3	211,086.1	(58,153.0)	152,933.1	94,587.3	0.62	287,231.0
2023	-	-	219,103.8	-	21,616.1	248,425.0	219,103.8	(61,221.2)	157,882.6	91,956.4	0.58	379,187.4
2024	-	-	227,433.7	-	19,886.8	227,672.3	227,433.7	(64,339.5)	163,094.2	89,454.5	0.55	468,641.9
2025	-	-	-	-	18,295.9	208,579.7	-	5,671.7	5,671.7	2,929.5	0.52	471,571.4
2026	-	-	-	-	16,832.2	191,014.6	-	5,218.0	5,218.0	2,538.0	0.49	474,109.4
2027	-	-	-	-	15,485.6	174,854.7	-	4,800.6	4,800.6	2,198.9	0.46	476,308.3
2028	-	-	-	-	14,246.8	159,987.6	-	4,416.5	4,416.5	1,905.1	0.43	478,213.4
2029	-	-	-	-	13,107.1	146,309.8	-	4,063.2	4,063.2	1,650.5	0.41	479,863.9
2030	-	-	-	-	12,058.5	133,726.3	-	3,738.1	3,738.1	1,429.9	0.38	481,293.8
2031	-	-	-	-	11,093.8	122,149.4	-	3,439.1	3,439.1	1,238.9	0.36	482,532.7
2032	-	-	-	-	10,206.3	111,498.7	-	3,164.0	3,164.0	1,073.3	0.34	483,606.0
2033	-	-	-	-	9,389.8	101,700.1	-	2,910.8	2,910.8	929.9	0.32	484,535.9
2034	-	-	-	-	8,638.6	92,685.3	-	2,678.0	2,678.0	805.6	0.30	485,341.5
2035	-	-	-	-	7,947.5	84,391.8	-	2,463.7	2,463.7	698.0	0.28	486,039.5
2036	-	-	-	-	7,311.7	76,761.7	-	2,266.6	2,266.6	604.7	0.27	486,644.2
2037	-	-	-	-	6,726.8	69,742.0	-	2,085.3	2,085.3	523.9	0.25	487,168.1
2038	-	-	-	-	6,188.6	63,283.9	-	1,918.5	1,918.5	453.9	0.24	487,621.9
2039	-	-	-	-	5,693.6	57,342.4	-	1,765.0	1,765.0	393.2	0.22	488,015.2
2040	-	-	-	-	5,238.1	51,876.3	-	1,623.8	1,623.8	340.7	0.21	488,355.9
2041	-	-	-	-	4,819.0	46,847.4	-	1,493.9	1,493.9	295.2	0.20	488,651.0
2042	-	-	-	-	4,433.5	42,220.9	-	1,374.4	1,374.4	255.7	0.19	488,906.8
2043	-	-	-	-	4,078.8	37,964.5	-	1,264.4	1,264.4	221.5	0.18	489,128.3
2044	-	-	-	-	3,752.5	34,048.6	-	1,163.3	1,163.3	191.9	0.17	489,320.3
2045	-	-	-	-	3,452.3	30,445.9	-	1,070.2	1,070.2	166.3	0.16	489,486.5
2046	-	-	-	-	3,176.1	27,131.5	-	984.6	984.6	144.1	0.15	489,630.6
2047	-	-	-	-	2,922.0	24,082.3	-	905.8	905.8	124.8	0.14	489,755.4
2048	-	-	-	-	2,688.3	21,276.9	-	833.4	833.4	108.1	0.13	489,863.6
2049	-	-	-	-	2,473.2	18,696.0	-	766.7	766.7	93.7	0.12	489,957.3
2050	-	-	-	-	2,275.4	16,321.6	-	705.4	705.4	81.2	0.12	490,038.4
2051	-	-	-	-	2,093.3	14,137.1	-	648.9	648.9	70.3	0.11	490,108.8
2052	-	-	-	-	1,925.9	12,127.4	-	597.0	597.0	60.9	0.10	490,169.7
2053	-	-	-	-	1,771.8	10,278.5	-	549.3	549.3	52.8	0.10	490,222.5
2054	-	-	-	-	1,630.0	8,577.4	-	505.3	505.3	45.7	0.09	490,268.2
Total	**-**	**-**	**1,807,854.5**	**(504,547.6)**	**485,802.0**		**1,303,307.0**	**(409,836.3)**	**893,470.7**	**490,268.2**		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2051
2052
2053
2054
Turbine Valve Refurbishment vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

Generator

CI Number: 43088

Title: LIN3 Generator Rotor Rewind

Start Date:	2015/04
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	Steam
Forecast Amount:	$1,901,480

DESCRIPTION:

This project includes rewinding the generator rotor, replacement of retaining rings, as well as repair of other generator inspection findings related to the generator rotor. Based on Generator Health Assessment and knowledge from previous refurbishment on Lingan Unit #1, Lingan Unit #3 rotor will need to be refurbished to remediate known failure mechanisms and ensure reliable service to the next planned major outage.

A generator rotor failure would result in damage to the generator and an extended un-planned outage.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

Depreciation Class: Steam Production Plant- Lingan Unit 3 and 4

Estimated Useful Life: 30 Years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

Rewinding the rotor will reduce the risk of a ground fault due to insulation and copper dusting migration. A generator outage due to a ground fault can create an unplanned outage of approximately 10 weeks. The rotor rewind will alleviate future copper dust formation and migration of mylar insulation.

Why do this project now?

A rotor rewind requires extraction of the rotor for factory refurbishment and testing. An outage window of 7-8 weeks is required. A major Unit 3 outage is planned for spring 2015 to allow the rewind work to occur as a planned activity.

Why do this project this way?

Rewinding is common practice and has been completed successfully on Unit 1 in 2010. Rewinding will restore the rotor to full capability and mitigate mylar insulation migration and copper dusting issues. The refurbished rotor is expected to operate without further rewinds for greater than 15 years. A new rotor is approximately twice the cost of a rewind and has extensive lead time.

CI Number : 43088 - LIN3 Generator Rotor Rewind **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		7,797	0	7,797
095		095-Thermal Term Labour AO		4,237	0	4,237
095		095-Thermal Regular Labour AO		19,294	0	19,294
095		095-Thermal & Hydro Contracts AO		68,541	0	68,541
095		095-Thermal Overtime Labour AO		1,412	0	1,412
001	010	001 - THERMAL Regular Labour	010 - SGP - Turbo Gen.Instal.	96,279	0	96,279
002	010	002 - THERMAL Overtime Labour	010 - SGP - Turbo Gen.Instal.	14,094	0	14,094
004	010	004 - THERMAL Term Labour	010 - SGP - Turbo Gen.Instal.	21,141	0	21,141
011	010	011 - Travel Expense	010 - SGP - Turbo Gen.Instal.	15,000	0	15,000
012	010	012 - Materials	010 - SGP - Turbo Gen.Instal.	[redacted]	0	[redacted]
013	010	013 - POWER PRODUCTION Contracts	010 - SGP - Turbo Gen.Instal.	764,971	0	764,971
066	010	066 - Other Goods & Services	010 - SGP - Turbo Gen.Instal.	[redacted]	0	[redacted]
			Total Cost:	1,901,480	0	1,901,480
			Original Cost:	740,883		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 43088
Title: LIN3 Rotor Rewind
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	120	$ 346	$ 41,527.87		
Engineering	PD	20	$ 391	$ 7,829.72		
Maintenance Trades	PD	120	$ 352	$ 42,281.86		
Utilityworker	PD	20	$ 232	$ 4,639.78		
			Sub-Total	$ 96,279.23		
002 OT Labour						
Maintenance Trades	PD	20	$ 705	$ 14,093.95		
				$ -		
			Sub-Total	$ 14,093.95		
004 Term Labour						
Maintenance Trades	PD	60	$ 352	$ 21,140.93		
				$ -		
				$ -		
			Sub-Total	$ 21,140.93		
011 Travel Expense						
Witness Rotor rewind	$	2	$ 7,500	$ 15,000.00		
				$ -		
			Sub-Total	$ 15,000.00		
012 Materials						
1 Set of Retaining Rings	$	1	[redacted]		Cost Support Item #1 - Inlfation at 2% per year, over 5 years @ $0.92 USD	
Rotor Rewind Materials	$	1	[redacted]		Cost Support Item #2 - Inflation at 2% per year, over 2 years @ $0.92 USD	
Miscellaneous Materials	$	1	$ 10,000	$ 10,000.00		
				$ -		
			Sub-Total	[redacted]		
013 Contracts						
Rewind Rotor Services	$	1	[redacted]		Cost Support Item #2 - Inflation at 2% per year,over 2 years @ $0.92 USD	
OEM Technical Advisor	$	1	[redacted]			
Misc. Contracts	$	1	$ 10,000	$ 10,000.00		
				$ -		
				$ -		
			Sub-Total	$ 764,971.38		
066 Other Goods & Services						
Contigency for Materials	%	[redacted]				
Contingency on Contracts	%	10%	$ 764,971	$ 76,497.14		
			Sub-Total	[redacted]		
094 Interest Capitalized						
AFUDC				$ 7,796.67		
				$ -		
			Sub-Total	$ 7,796.67		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 19,294.36		
Thermal OT Labour AO				$ 1,412.21		
Thermal Term Labour AO				$ 4,236.64		
Thermal / Hydro Contracts AO				$ 68,541.44		
			Sub-Total	$ 93,484.65		
			SUB-TOTAL (no AO, AFUDC)	$ 1,800,198.30		
			TOTAL (AO, AFUDC included)	$ 1,901,479.62		
Original Cost				$ 740,883.22		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 Rotor Rewind
Summary of Alternatives

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	43088
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Rotor Rewind vs. Avoided Repair and F	6.19%	-3,857,926	2,854,978	1	23.64%	6.1 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

The plant recommends completing the project.

Notes/Comments :

Rotor Rewind vs. Avoided Repair and Replacement Energy Costs

This option compares completing the rotor rewind versus the "do nothing" option and dealing with a failure in an unplanned outage and the associated replacement energy and repair costs. Only one occurrence will happen, before a long term repair is required, however as time passes the chances of failure increase. It is estimated that 5 weeks will be required to make rotor repairs in the case of a rotor failure.

Test 2

Test 3

Test 4

LIN3 Rotor Rewind
Summary of Sensitivities

Nova Scotia POWE
An Emera Compa

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	43088
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Rotor Rewind vs. Avoided Repair and Replaceme	6.19%	-3,857,926	2,854,978	1	23.64%	6.1 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Rotor Rewind vs. Avoided Repair and Replaceme	10%	-3,680,356	2,715,157	1	21.51%	6.6 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:						
	A	177,570	-139,821	0	-2.13%	0.5 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Rotor Rewind vs. Avoided Repair and Replaceme	-10%	-3,294,564	2,429,659	1	21.30%	6.6 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:						
	A	563,362	-425,319	0	-2.34%	0.6 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	257,919	513,009	777,795	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN3 Rotor Rewind
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**30-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	43088
Originator :		**Project No. :**	

Rotor Rewind vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**390,170**	**397,973**		
Events/Outages (#)	**1**	**1**	**1**	**1**		
Probability of Occurance (%)	**30%**	**40%**	**30%**	**40%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**154**	**154**				
Duration (Hours)	**840**	**840**				
Totals	**$159,490**	**$201,771**	**$117,051**	**$159,189**	**$276,541**	**$360,960**
Total Capital Cost of Alternative						**$1,901,480**

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

Test 3

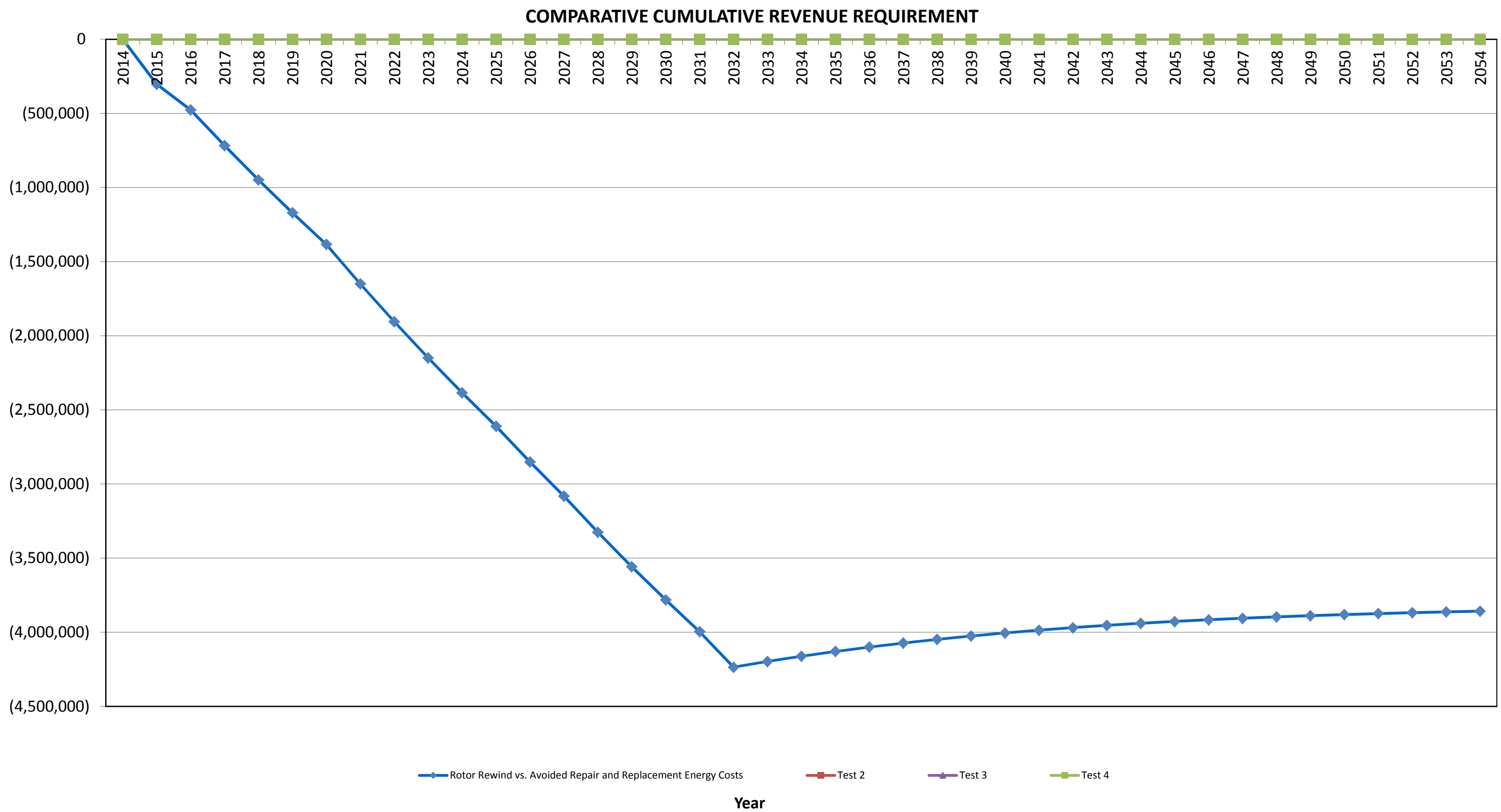
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

LIN3 Rotor Rewind
Rotor Rewind vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	276,541.1	(1,807,995.3)	72,007.9	1,753,992.2	(1,531,454.2)	(63,405.3)	(1,594,859.5)	(1,501,892.4)	0.94	(1,501,892.4)
2016	-	-	360,960.2	-	138,255.2	1,611,429.2	360,960.2	(69,038.6)	291,921.7	258,880.4	0.89	(1,243,012.0)
2017	-	-	460,224.3	-	127,194.8	1,480,271.2	460,224.3	(103,239.1)	356,985.2	298,125.6	0.84	(944,886.4)
2018	-	-	469,428.8	-	117,019.2	1,359,605.9	469,428.8	(109,247.0)	360,181.8	283,261.3	0.79	(661,625.0)
2019	-	-	478,817.4	-	107,657.7	1,248,593.8	478,817.4	(115,059.5)	363,757.9	269,398.0	0.74	(392,227.1)
2020	-	-	488,393.7	-	99,045.1	1,146,462.6	488,393.7	(120,698.1)	367,695.6	256,440.6	0.70	(135,786.5)
2021	-	-	597,793.9	-	91,121.5	1,052,502.0	597,793.9	(157,068.5)	440,725.5	289,456.2	0.66	153,669.7
2022	-	-	609,749.8	-	83,831.7	966,058.2	609,749.8	(163,034.6)	446,715.2	276,287.8	0.62	429,957.5
2023	-	-	621,944.8	-	77,125.2	886,529.9	621,944.8	(168,894.1)	453,050.7	263,872.6	0.58	693,830.1
2024	-	-	634,383.7	-	70,955.2	813,363.9	634,383.7	(174,662.8)	459,720.9	252,149.4	0.55	945,979.5
2025	-	-	647,071.4	-	65,278.8	746,051.1	647,071.4	(180,355.7)	466,715.7	241,064.1	0.52	1,187,043.6
2026	-	-	715,013.9	-	60,056.5	684,123.4	715,013.9	(203,036.8)	511,977.1	249,027.4	0.49	1,436,071.0
2027	-	-	729,314.1	-	55,252.0	627,149.9	729,314.1	(208,959.3)	520,354.9	238,348.6	0.46	1,674,419.5
2028	-	-	801,123.5	-	50,831.8	574,734.2	801,123.5	(232,590.4)	568,533.1	245,236.5	0.43	1,919,656.0
2029	-	-	817,146.0	-	46,765.3	526,511.9	817,146.0	(238,818.0)	578,328.0	234,919.9	0.41	2,154,576.0
2030	-	-	833,488.9	-	43,024.0	482,147.3	833,488.9	(245,044.1)	588,444.8	225,096.0	0.38	2,379,672.0
2031	-	-	850,158.7	-	39,582.1	441,331.9	850,158.7	(251,278.7)	598,879.9	215,733.8	0.36	2,595,405.8
2032	-	-	991,042.1	-	36,415.5	403,781.7	991,042.1	(295,934.2)	695,107.9	235,801.8	0.34	2,831,207.5
2033	-	-	-	-	33,502.3	369,235.5	-	10,385.7	10,385.7	3,317.8	0.32	2,834,525.3
2034	-	-	-	-	30,822.1	337,453.0	-	9,554.9	9,554.9	2,874.4	0.30	2,837,399.7
2035	-	-	-	-	28,356.3	308,213.1	-	8,790.5	8,790.5	2,490.3	0.28	2,839,890.1
2036	-	-	-	-	26,087.8	281,312.4	-	8,087.2	8,087.2	2,157.5	0.27	2,842,047.6
2037	-	-	-	-	24,000.8	256,563.8	-	7,440.3	7,440.3	1,869.2	0.25	2,843,916.9
2038	-	-	-	-	22,080.7	233,795.1	-	6,845.0	6,845.0	1,619.5	0.24	2,845,536.3
2039	-	-	-	-	20,314.3	212,847.8	-	6,297.4	6,297.4	1,403.0	0.22	2,846,939.4
2040	-	-	-	-	18,689.1	193,576.4	-	5,793.6	5,793.6	1,215.6	0.21	2,848,154.9
2041	-	-	-	-	17,194.0	175,846.6	-	5,330.1	5,330.1	1,053.1	0.20	2,849,208.0
2042	-	-	-	-	15,818.5	159,535.2	-	4,903.7	4,903.7	912.4	0.19	2,850,120.4
2043	-	-	-	-	14,553.0	144,528.8	-	4,511.4	4,511.4	790.5	0.18	2,850,910.9
2044	-	-	-	-	13,388.8	130,722.8	-	4,150.5	4,150.5	684.8	0.17	2,851,595.8
2045	-	-	-	-	12,317.7	118,021.4	-	3,818.5	3,818.5	593.3	0.16	2,852,189.1
2046	-	-	-	-	11,332.3	106,336.0	-	3,513.0	3,513.0	514.0	0.15	2,852,703.1
2047	-	-	-	-	10,425.7	95,585.5	-	3,232.0	3,232.0	445.4	0.14	2,853,148.5
2048	-	-	-	-	9,591.6	85,695.0	-	2,973.4	2,973.4	385.8	0.13	2,853,534.3
2049	-	-	-	-	8,824.3	76,595.8	-	2,735.5	2,735.5	334.3	0.12	2,853,868.6
2050	-	-	-	-	8,118.3	68,224.5	-	2,516.7	2,516.7	289.6	0.12	2,854,158.2
2051	-	-	-	-	7,468.9	60,522.9	-	2,315.4	2,315.4	250.9	0.11	2,854,409.2
2052	-	-	-	-	6,871.4	53,437.4	-	2,130.1	2,130.1	217.4	0.10	2,854,626.5
2053	-	-	-	-	6,321.7	46,918.8	-	1,959.7	1,959.7	188.3	0.10	2,854,814.9
2054	-	-	-	-	5,815.9	40,921.6	-	1,802.9	1,802.9	163.2	0.09	2,854,978.0
Total	**-**	**-**	**11,382,596.3**	**(1,807,995.3)**	**1,733,315.1**		**9,574,601.0**	**(2,991,277.2)**	**6,583,323.8**	**2,854,978.0**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(500,000)
(1,000,000)
(1,500,000)
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(2,500,000)
(3,000,000)
(3,500,000)
(4,000,000)
(4,500,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Rotor Rewind vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

Attachments 1 and 2 have been removed due to confidentiality.

CI Number: 40363

Title: LIN3 High Voltage Bushings Refurbishment

Start Date:	2015/05
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	Steam
Forecast Amount:	$628,531

DESCRIPTION:

The scope of this project is to refurbish the high voltage bushings on Lingan Generating Unit 3 in order to reduce the risk of an unplanned failure. This project will be completed during a planned major outage in 2015.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

High voltage bushings are installed on the three phases of the generator primary electrical connections to seal hydrogen gas in the generator. Each phase requires two bushings for phase connections. Hydrogen gas is a highly effective cooling medium commonly used in utility generators. Over time and through normal operating wear hydrogen leaks occur around the generator bushings. The Original Equipment Manufacturer (OEM) is recommending refurbishment of the generator bushings and O-ring gaskets to ensure the long term integrity of the bushings.

Why do this project now?

A minimum of a 4 week generator outage is required for this project to be completed. The Unit 3 planned major outage in 2015 provides the opportunity for the bushings to be refurbished. Without this work, the probability of bushing failures and related hydrogen leaks will increase.

Why do this project this way?

Refurbishing and re-using the bushings with new gaskets and sealing components is the most cost effective approach to restore reliability of the bushings. OEM factory refurbished bushings cost $21,000 per bushing, while new bushings cost $33,328. The expected life of new or refurbished bushings is the same.

CI Number	: 40363	- LIN3 High Voltage Bushing Refurbishment	**Project Number**	
Parent CI Number	:	-		
Cost Centre	: 305	- 305-Lingan 3&4 Prod.Unit	**Budget Version**	2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		32,256	0	32,256
095		095-Thermal Regular Labour AO		20,246	0	20,246
001	010	001 - THERMAL Regular Labour	010 - SGP - Turbo Gen.Instal.	101,029	0	101,029
012	010	012 - Materials	010 - SGP - Turbo Gen.Instal.	115,000	0	115,000
013	010	013 - POWER PRODUCTION Contracts	010 - SGP - Turbo Gen.Instal.	360,000	0	360,000
			Total Cost:	628,531	0	628,531
			Original Cost:	221,013		

Capital Project Detailed Estimate

Location: **Lingan Generating Station**
CI# / FP#: 40363
Title: LIN3 High Voltage Bushings Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	168	$ 346	$ 58,139.02		CI 38946
Engineering	PD	20	$ 391	$ 7,829.72		CI 38946
Maintenance Trades	PD	60	$ 352	$ 21,140.93		CI 38946
Utilityworker	PD	60	$ 232	$ 13,919.33		CI 38946
			Sub-Total	$ 101,029.00		
012 Materials						
HVB Insulator and Consumables	ea	1	$ 80,000	$ 80,000.00		CI 38946
Misc. Wiring and Connectors	ea	1	$ 5,000	$ 5,000.00		CI 38946
Rigging	ea	1	$ 5,000	$ 5,000.00		CI 38946
Replacement Standoff Insulators	ea	1	$ 25,000	$ 25,000.00		CI 38946
				$ -		
				$ -		
			Sub-Total	$ 115,000.00		
013 Contracts						
HVB Refurbishment	ea	1	$ 80,000	$ 80,000.00		CI 38946
TA and Winding Specialist	ea	1	$ 225,000	$ 225,000.00		CI 38946
Project Coordinator	ea	1	$ 25,000	$ 25,000.00		CI 38946
Silver Plate Contacts	ea	1	$ 10,000	$ 10,000.00		CI 38946
OEM Evaluation	ea	1	$ 20,000	$ 20,000.00		CI 38946
				$ -		
				$ -		
			Sub-Total	$ 360,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 20,246.21		
Thermal / Hydro Contracts AO				$ 32,256.00		
			Sub-Total	$ 52,502.21		
			SUB-TOTAL (no AO, AFUDC)	$ 576,029.00		
			TOTAL (AO, AFUDC included)	$ 628,531.21		
Original Cost				$ 221,012.71		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 HVB Replacement
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	40363
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Refurbish HVB vs. Avoided Repair and	6.19%	-2,617,873	1,873,497	1	75.60%	2.2 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

The plant recommends the completion of this project in order to avoid unplanned outages and the associated replacement energy costs.

Notes/Comments :

Refurbish HVB vs. Avoided Repair and Replacement Energy Costs

This options compares refurbishing the HVB vs continued operation in current state until a failure occurs.

Test 2

Test 3

Test 4

LIN3 HVB Replacement
Summary of Sensitivities

Nova Scotia POWE
An Emera Compa

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	40363
Originator :	J.March	**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish HVB vs. Avoided Repair and Replacem	6.19%	-2,617,873	1,873,497	1	75.60%	2.2 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish HVB vs. Avoided Repair and Replacem	10%	-2,561,191	1,828,992	1	66.68%	2.4 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change: **A**	56,681	-44,505	0	-8.92%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish HVB vs. Avoided Repair and Replacem	-10%	-2,299,404	1,641,642	1	65.83%	2.5 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change: **A**	318,468	-231,855	0	-9.78%	0.2 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	280,392	513,193	798,466	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN3 HVB Replacement
Avoided Cost Calculations

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	40363
Originator :		**Project No. :**	

Refurbish HVB vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**173,600**	**180,581**		
Events/Outages (#)	**1**	**1**	**1**	**1**		
Probability of Occurance (%)	**30%**	**30%**	**30%**	**30%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**150**	**150**				
Duration (Hours)	**1344**	**1344**				
Totals	**$248,556**	**$235,836**	**$52,080**	**$54,174**	**$300,636**	**$290,011**
Total Capital Cost of Alternative						**$628,531**

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

Test 3

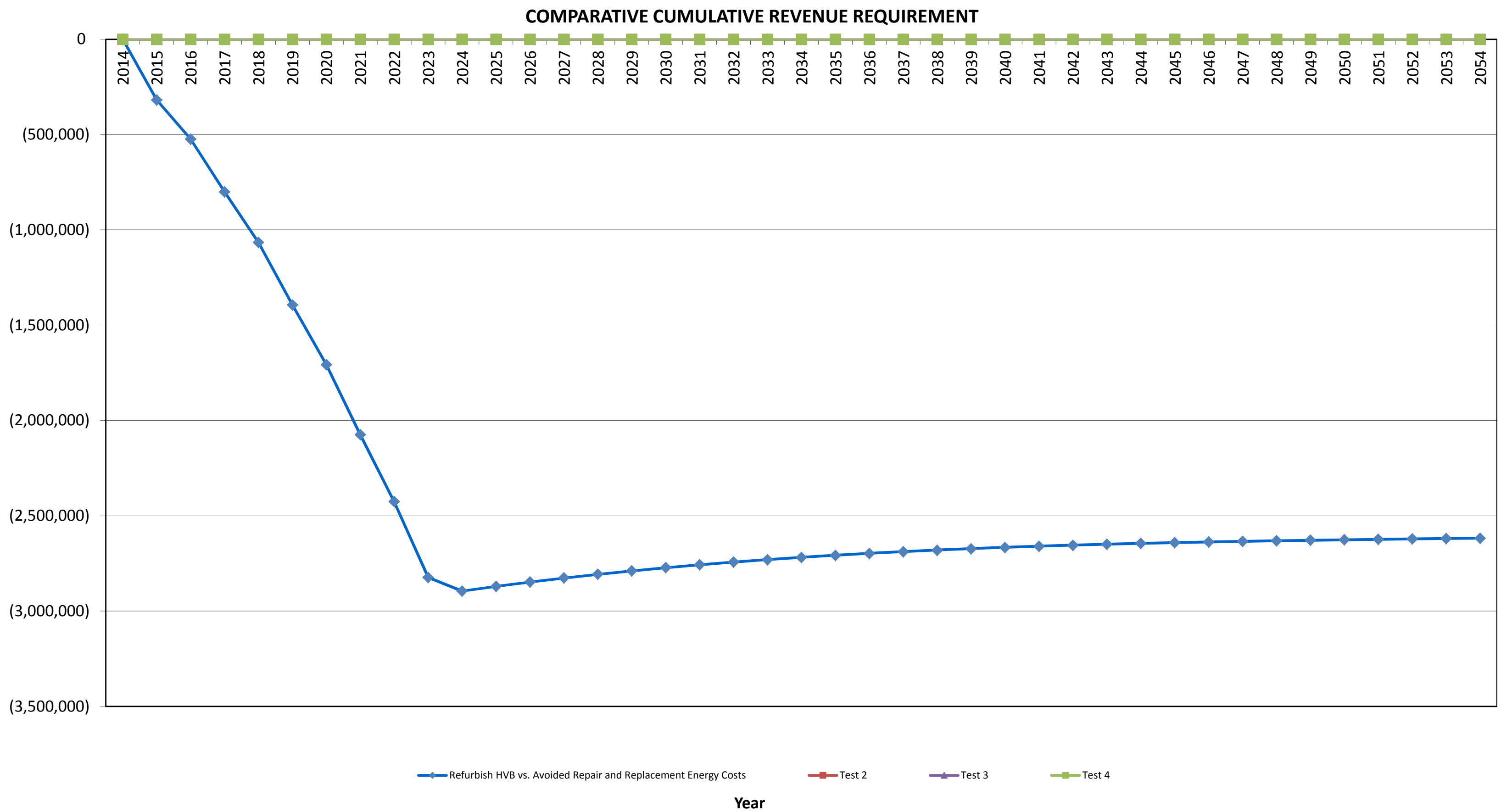
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

LIN3 HVB Replacement
Refurbish HVB vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	300,636.2	(576,029.0)	23,041.2	567,478.5	(275,392.8)	(86,054.5)	(361,447.3)	(340,377.9)	0.94	(340,377.9)
2016	-	-	290,010.7	-	44,239.0	520,820.1	290,010.7	(76,189.2)	213,821.5	189,620.0	0.89	(150,757.9)
2017	-	-	395,874.8	-	40,699.9	477,894.5	395,874.8	(110,104.2)	285,770.6	238,652.9	0.84	87,895.0
2018	-	-	405,311.3	-	37,443.9	438,402.8	405,311.3	(114,038.9)	291,272.4	229,068.2	0.79	316,963.2
2019	-	-	518,746.9	-	34,448.4	402,070.6	518,746.9	(150,132.5)	368,614.4	272,994.7	0.74	589,957.9
2020	-	-	531,176.4	-	31,692.5	368,644.9	531,176.4	(154,840.0)	376,336.4	262,466.9	0.70	852,424.7
2021	-	-	652,724.4	-	29,157.1	337,893.2	652,724.4	(193,305.9)	459,418.6	301,733.3	0.66	1,154,158.0
2022	-	-	668,446.6	-	26,824.6	309,601.7	668,446.6	(198,902.8)	469,543.8	290,407.0	0.62	1,444,565.0
2023	-	-	798,688.9	-	24,678.6	283,573.5	798,688.9	(239,943.2)	558,745.7	325,433.0	0.58	1,769,998.0
2024	-	-	198,039.0	-	22,704.3	259,627.6	198,039.0	(54,353.8)	143,685.3	78,809.0	0.55	1,848,807.1
2025	-	-	-	-	20,888.0	237,597.3	-	6,475.3	6,475.3	3,344.6	0.52	1,852,151.6
2026	-	-	-	-	19,216.9	217,329.5	-	5,957.2	5,957.2	2,897.6	0.49	1,855,049.2
2027	-	-	-	-	17,679.6	198,683.1	-	5,480.7	5,480.7	2,510.4	0.46	1,857,559.7
2028	-	-	-	-	16,265.2	181,528.4	-	5,042.2	5,042.2	2,175.0	0.43	1,859,734.6
2029	-	-	-	-	14,964.0	165,746.1	-	4,638.8	4,638.8	1,884.3	0.41	1,861,618.9
2030	-	-	-	-	13,766.9	151,226.3	-	4,267.7	4,267.7	1,632.5	0.38	1,863,251.5
2031	-	-	-	-	12,665.5	137,868.2	-	3,926.3	3,926.3	1,414.4	0.36	1,864,665.8
2032	-	-	-	-	11,652.3	125,578.7	-	3,612.2	3,612.2	1,225.4	0.34	1,865,891.2
2033	-	-	-	-	10,720.1	114,272.3	-	3,323.2	3,323.2	1,061.6	0.32	1,866,952.8
2034	-	-	-	-	9,862.5	103,870.5	-	3,057.4	3,057.4	919.8	0.30	1,867,872.6
2035	-	-	-	-	9,073.5	94,300.8	-	2,812.8	2,812.8	796.9	0.28	1,868,669.4
2036	-	-	-	-	8,347.6	85,496.7	-	2,587.8	2,587.8	690.4	0.27	1,869,359.8
2037	-	-	-	-	7,679.8	77,396.9	-	2,380.7	2,380.7	598.1	0.25	1,869,957.9
2038	-	-	-	-	7,065.4	69,945.1	-	2,190.3	2,190.3	518.2	0.24	1,870,476.1
2039	-	-	-	-	6,500.2	63,089.4	-	2,015.1	2,015.1	448.9	0.22	1,870,925.1
2040	-	-	-	-	5,980.2	56,782.2	-	1,853.9	1,853.9	389.0	0.21	1,871,314.0
2041	-	-	-	-	5,501.8	50,979.6	-	1,705.5	1,705.5	337.0	0.20	1,871,651.0
2042	-	-	-	-	5,061.6	45,641.2	-	1,569.1	1,569.1	292.0	0.19	1,871,943.0
2043	-	-	-	-	4,656.7	40,729.8	-	1,443.6	1,443.6	252.9	0.18	1,872,195.9
2044	-	-	-	-	4,284.2	36,211.4	-	1,328.1	1,328.1	219.1	0.17	1,872,415.0
2045	-	-	-	-	3,941.4	32,054.4	-	1,221.8	1,221.8	189.9	0.16	1,872,604.9
2046	-	-	-	-	3,626.1	28,230.0	-	1,124.1	1,124.1	164.5	0.15	1,872,769.4
2047	-	-	-	-	3,336.0	24,711.6	-	1,034.2	1,034.2	142.5	0.14	1,872,911.9
2048	-	-	-	-	3,069.1	21,474.6	-	951.4	951.4	123.5	0.13	1,873,035.3
2049	-	-	-	-	2,823.6	18,496.6	-	875.3	875.3	107.0	0.12	1,873,142.3
2050	-	-	-	-	2,597.7	15,756.8	-	805.3	805.3	92.7	0.12	1,873,235.0
2051	-	-	-	-	2,389.9	13,236.2	-	740.9	740.9	80.3	0.11	1,873,315.3
2052	-	-	-	-	2,198.7	10,917.2	-	681.6	681.6	69.6	0.10	1,873,384.8
2053	-	-	-	-	2,022.8	8,783.8	-	627.1	627.1	60.3	0.10	1,873,445.1
2054	-	-	-	-	1,861.0	6,821.0	-	576.9	576.9	52.2	0.09	1,873,497.3
Total	**-**	**-**	**4,759,655.2**	**(576,029.0)**	**554,627.7**		**4,183,626.2**	**(1,303,558.5)**	**2,880,067.7**	**1,873,497.3**		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Refurbish HVB vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

Chemical

Chemical Systems

NS Power has a fleet of chemical systems that include water treatment plants and boiler feed water conditioning and controls.

Each Generating Station includes a Water Treatment Plant with associated treatment systems. Equipment includes: Chemical Injection Facilities, Clarifiers, Water Filtrations, Demineralizers, Reverse Osmosis units and all associated pumping, holding, controls and electrical systems. These plants receive locally supplied domestic quality water and produce boiler grade water as boiler make up and reserve water supply. Each generating station also includes Polishing Systems (Demineralizers, dosing and monitoring) which treat boiler feedwater before returning it to the Boiler.

The equipment in this system is diverse. The internal Chemical Reliability Team rates the criticality of the key equipment in this asset class and assesses condition to produce comparative risk analysis for the fleet. (Risk listing included on next page).

As in other asset classes, this risk rating provides a comparative view of risk across the fleet and enables the development of the capital investment plan.

CI#	Project Title	Asset Class	Year	Criticality	Condition	Risk
46493	TUC2 - Polisher Upgrade	Chemical	2015	5	5	25
46497	TUC - WTP Resin Replacement	Chemical	2015	5	4	20
46496	LIN3 Chemical Sampling Panel	Chemical	2015	5	4	20
46492	TUC1 - Polisher Upgrade	Chemical	2015	4	5	20

CI Number: 46484

Title: TUC 1&2 Analytical Panel Replacement

Start Date: 2015/02
In-Service Date: 2015/04
Final Cost Date: 2015/10
Function: Steam
Forecast Amount: $386,607

DESCRIPTION:

This project is for the replacement of the Analytical Panel on Units 1 & 2 of the Tuft's Cove Generating Station.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

Reliable operation of Steam Generating units require online monitoring of Cycle Chemistry Key Performance Indicators. Analytical Panels are used to monitor water quality parameters that prevent corrosion mechanisms, enabling long operating life of the steam generator, turbine and auxiliary equipment. The TUC Units 1 & 2 analytical panel is original to the plant and its functionality is becoming less reliable at a time when feedwater chemistry analytics are becoming more critical. Flexible unit operation and asset management rely on accurate measurement and analysis to assist in decision making related to boiler components. In addition, industry standards continue to evolve in support of cycle chemistry measurements. Maintaining industry standard in steam cycle chemistry is important to monitoring operation practice and optimizing boiler life. In the event of not replacing this analytical panel, the likelihood of a chemistry upset with extensive damage to the steam generating equipment would be greatly increased.

Why do this project now?

The existing analytical panel is becoming less reliable and no longer meets EPRI (Electric Power Research Institute) standards. Completing this project will allow Units 1 & 2 to continue to provide flexible service and good asset management to the end of each unit's life. Steam cycle chemistry monitoring is vital to these units as their service is optimized.

Why do this project this way?

Replacement of the analytical panel and sample cooling system is the only method to provide reliable analysis of water and steam chemistry. Developments in online ion analysis will improve asset protection by providing unit operators real time data to proactively mitigate chemistry upsets.

CI Number : 46484 - TUC - Unit 1&2 Analytical Panel Replacement **Project Number**

Parent CI Number : -

Cost Centre : 311 - 311-Tufts Cove Admin./Common Capita **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		2,285	0	2,285
095		095-Thermal Term Labour AO		5,411	0	5,411
095		095-Thermal Regular Labour AO		8,387	0	8,387
095		095-Thermal Overtime Labour AO		597	0	597
095		095-Thermal & Hydro Contracts AO		4,122	0	4,122
001	011	001 - THERMAL Regular Labour	011 - SGP - Plant Control and Inst	41,852	0	41,852
002	011	002 - THERMAL Overtime Labour	011 - SGP - Plant Control and Inst	5,954	0	5,954
004	011	004 - THERMAL Term Labour	011 - SGP - Plant Control and Inst	27,000	0	27,000
012	011	012 - Materials	011 - SGP - Plant Control and Inst	205,000	0	205,000
013	011	013 - POWER PRODUCTION Contracts	011 - SGP - Plant Control and Inst	46,000	0	46,000
028	011	028 - Consulting	011 - SGP - Plant Control and Inst	40,000	0	40,000
			Total Cost:	386,607	0	386,607
			Original Cost:	38,456		

Capital Project Detailed Estimate

Location: Tuft's Cove Generating Station
CI# / FP#: 46484
Title: TUC1/2 - Analytical Panel Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	10	$ 346	$ 3,460.66		
Maintenance Trades	PD	50	$ 352	$ 17,617.44		
Power Plant Technician	PD	50	$ 369	$ 18,453.84		
Utilityworker	PD	10	$ 232	$ 2,319.89		
			Sub-Total	$ 41,851.82		
002 OT Labour						
Maintenance Trades	PD	3	$ 705	$ 2,202.18		
Utilityworker	PD	1	$ 464	$ 579.97		
Electrician	PD	1	$ 692	$ 865.16		
Power Plant Technician	PD	3	$ 738	$ 2,306.73		
			Sub-Total	$ 5,954.05		
004 Term Labour						
Panel Installation	lot	1	$ 27,000	$ 27,000.00		
			Sub-Total	$ 27,000.00		
012 Materials						
Analytical Panel	lot	1	$ 200,000	$ 200,000.00		39761 (TUC3 Analytical Panel)
Misc. Materials	lot	1	$ 5,000	$ 5,000.00		
			Sub-Total	$ 205,000.00		
013 Contracts						
Scaffolding	lot	1	$ 22,000	$ 22,000.00		
Panel Manufacturer Field Service Rep	lot	1	$ 24,000	$ 24,000.00		
				$ -		
			Sub-Total	$ 46,000.00		
028 Consulting						
Replacement Panel Design	lot	1	$ 40,000	$ 40,000.00		
				$ -		
				$ -		
			Sub-Total	$ 40,000.00		
094 Interest Capitalized						
AFUDC				$ 2,285.26		
				$ -		
			Sub-Total	$ 2,285.26		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 8,387.10		
Thermal OT Labour AO				$ 596.60		
Thermal Term Labour AO				$ 5,410.80		
Thermal / Hydro Contracts AO				$ 4,121.60		
			Sub-Total	$ 18,516.10		
			SUB-TOTAL (no AO, AFUDC)	$ 365,805.87		
			TOTAL (AO, AFUDC included)	$ 386,607.23		
Original Cost				$ 38,456.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46496

Title: LIN3 Replace Analytical Panel

Start Date:	2015/03
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	Steam
Forecast Amount:	$276,756

DESCRIPTION:

This project is for the replacement of the Analytical Panel on Unit 3 of the Lingan Generating Station.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

Reliable operation of Steam Generating Units require online monitoring of Cycle Chemistry Key Performance Indicators. Analytical Panels are used to monitor water quality parameters that prevent corrosion mechanisms, enabling long operating life of the steam generator, turbine and auxiliary equipment. The Lingan Unit #3 analytical panel is original to the plant and its functionality is becoming less reliable at a time when feedwater chemistry analytics are becoming more critical. Flexible unit operation and asset management rely on accurate measurement and analysis to assist in decision making related to boiler components. In addition, industry standards continue to evolve in support of cycle chemistry measurements. Maintaining industry standard in steam cycle chemistry is important to monitoring operation practice and optimizing boiler life. In the event of not replacing this analytical panel, the likelihood of a chemistry upset with extensive damage to the steam generating equipment would be greatly increased.

Why do this project now?

As Lingan Unit #3 moves to more flexible and low load operations online monitoring of cycle chemistry parameters is crucial for an effective asset protection program. Furthermore, the panel is no longer reliable and no longer meets EPRI (Electric Power Research Institute) standards and must be replaced.

Why do this project this way?

Replacement of the analytical panel and sample cooling system is the only method to provide reliable analysis of water and steam chemistry. Developments in online ion analysis will improve asset protection by providing unit operators real time data to proactively mitigate chemistry upsets.

CI Number : 46496 - LIN3 Analytical Panel Replacement **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		1,166	0	1,166
095		095-Thermal & Hydro Contracts AO		896	0	896
095		095-Thermal Term Labour AO		2,118	0	2,118
095		095-Thermal Regular Labour AO		9,338	0	9,338
001	011	001 - THERMAL Regular Labour	011 - SGP - Plant Control and Inst	46,597	0	46,597
004	011	004 - THERMAL Term Labour	011 - SGP - Plant Control and Inst	10,570	0	10,570
012	011	012 - Materials	011 - SGP - Plant Control and Inst	163,700	0	163,700
013	011	013 - POWER PRODUCTION Contracts	011 - SGP - Plant Control and Inst	10,000	0	10,000
028	011	028 - Consulting	011 - SGP - Plant Control and Inst	15,000	0	15,000
066	011	066 - Other Goods & Services	011 - SGP - Plant Control and Inst	17,370	0	17,370
			Total Cost:	276,756	0	276,756
			Original Cost:	106,924		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 46496
Title: LIN3 Replace Analytical Panel
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	20	$ 346	$ 6,921.31		
Engineering	PD	20	$ 391	$ 7,829.72		
Power Plant Technician	PD	80	$ 369	$ 29,526.14		
Utilityworker	PD	10	$ 232	$ 2,319.89		
			Sub-Total	$ 46,597.07		
004 Term Labour						
Maintenance Trades	PD	30	$ 352	$ 10,570.46		
				$ -		
				$ -		
			Sub-Total	$ 10,570.46		
012 Materials						
Anaytical Panel	ea	1	$ 125,000	$ 125,000.00		28554 POT Analytical
High Pressure Blow Down Line	ea	1	$ 4,200	$ 4,200.00		
Flush Header	ea	1	$ 2,500	$ 2,500.00		
Piping and Fittings	ea	1	$ 10,000	$ 10,000.00		
Panel Chiller	ea	1	$ 22,000	$ 22,000.00		
			Sub-Total	$ 163,700.00		
013 Contracts						
Commissioning	ea	5	$ 1,000	$ 5,000.00		
Freight	ea	1	$ 5,000	$ 5,000.00		
			Sub-Total	$ 10,000.00		
028 Consulting						
Engineering	ea	1	$ 15,000	$ 15,000.00		
			Sub-Total	$ 15,000.00		
066 Other Goods & Services						
Contingency	%	10%	$ 173,700	$ 17,370.00		
			Sub-Total	$ 17,370.00		
094 Interest Capitalized						
				$ 1,165.66		
			Sub-Total	$ 1,165.66		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 9,338.05		
Thermal Term Labour AO				$ 2,118.32		
Thermal / Hydro Contracts AO				$ 896.00		
			Sub-Total	$ 12,352.37		
			SUB-TOTAL (no AO, AFUDC)	$ 263,237.53		
			TOTAL (AO, AFUDC included)	$ 276,755.56		
Original Cost				$ 106,924.31		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Balance of Plant

CI Number: 41227

Title: LIN3 Condenser Large Bore Pipe and Valve Refurbishment

Start Date: 2015/04
In-Service Date: 2015/06
Final Cost Date: 2015/12
Function: Steam
Forecast Amount: $1,299,329

DESCRIPTION:

Steam discharge from the low pressure section of the turbine is condensed by seawater delivered through a large tubular condenser located under the turbine. The seawater is delivered from the CW Pumphouse via 72 inch diameter underground concrete pipelines. The concrete pipe connects to steel piping inside the plant near the condenser. This piping is original to the unit and was installed in 1983.

Through inspections carried out by NS Power plant personnel, it has been observed that certain areas of the piping have experienced multiple leaks. Sections of pipe that have leaks and where below-tolerance wall thinning has occurred will be cut out and replacement sections welded in. The elbows will be removed to be blasted and recoated. In addition to the piping, refurbishment of the valve seats and recoating of the valves will be completed as well.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

Depreciation Class: Steam Production Plant- Lingan Unit 3 and 4

Estimated Useful Life: 20 Years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

The steel piping at the condenser, which is over 30 years old, has been prone to leakage. The pipe is exposed to corrosive seawater conditions that have reduced the wall thickness to below tolerance levels in some areas. Leaks in the condenser contribute to condenser inefficiency. Based on Non-Destructive Testing (NDT) and past experience with the other three units at Lingan, plant engineering personnel predict pipe leaks will become more pronounced without corrective action. The valves are also original to the plant, experiencing seat wear and are no long water tight. Due to the deteriorated condition, refurbishment is necessary.

Why do this project now?

Based on the operational impact associated with leaks and the expected failure rate, this pipe is not in an acceptable prolonged operating condition and this project should be completed in 2015 to avoid costly replacement energy costs due to unplanned outages. This project needs to be executed during a planned major outage, which is scheduled for Unit 3 in 2015. Based on the degree of degradation measured and observed, waiting for another outage is not recommended.

Why do this project this way?

Conducting the work during a planned outage and completing all work in one mobilization is the most efficient approach. Based on NDT, replacement of the entire CW piping at the condenser is not necessary. Replacement of isolated sections along with refurbishment of the elbows is a more cost effective option than full replacement. The current condition of the valves is such that replacement is not considered necessary at this time.

CI Number : 41227 - LIN3 Condenser Large Bore Pipe and Valve Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		4,361	0	4,361
095		095-Thermal Term Labour AO		706	0	706
095		095-Thermal & Hydro Contracts AO		68,096	0	68,096
095		095-Thermal Regular Labour AO		7,511	0	7,511
001	014	001 - THERMAL Regular Labour	014 - SGP - Circ.Water Sys.	37,482	0	37,482
004	014	004 - THERMAL Term Labour	014 - SGP - Circ.Water Sys.	3,523	0	3,523
012	014	012 - Materials	014 - SGP - Circ.Water Sys.	339,650	0	339,650
013	014	013 - POWER PRODUCTION Contracts	014 - SGP - Circ.Water Sys.	760,000	0	760,000
028	014	028 - Consulting	014 - SGP - Circ.Water Sys.	20,000	0	20,000
066	014	066 - Other Goods & Services	014 - SGP - Circ.Water Sys.	58,000	0	58,000
			Total Cost:	1,299,329	0	1,299,329
			Original Cost:	459,378		

Capital Project Detailed Estimate

Location: **Lingan Generating Station**
CI# / FP#: 41227
Title: LIN3 Condenser Large Bore Pipe and Valve Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	60	$ 346	$ 20,763.94		
Engineering	PD	10	$ 391	$ 3,914.86		
Maintenance Trades	PD	10	$ 352	$ 3,523.49		
Utilityworker	PD	40	$ 232	$ 9,279.55		
			Sub-Total	$ 37,481.84		CI 37743
004 Term Labour						
Maintenance Trades	PD	10.00	$ 352	$ 3,523.49		
				$ -		
				$ -		
			Sub-Total	$ 3,523.49		CI 37743
012 Materials						
250' of 48" dia x .375" Steel Pipe	ea	250	$ 235	$ 58,750.00		
Rolled Steel plate for 72" Dia Steel Pipe	lot	1	$ 4,500	$ 4,500.00		
24 - 48" Dia Flanges 125lb Class	ea	24	$ 1,600	$ 38,400.00		
Replacement Fastners	lot	1	$ 8,000	$ 8,000.00		
Expansion Joints	lot	1	$ 26,000	$ 26,000.00		
48" Valve Actuators	ea	4	$ 16,000	$ 64,000.00		
Valve Refurbishment Kits	lot	1	$ 120,000	$ 120,000.00		
Miscellaneous Consumables and Materials	lot	1	$ 20,000	$ 20,000.00		
			Sub-Total	$ 339,650.00		CI 37743
013 Contracts						
Installation of Piping and Valves	lot	1	$ 580,000	$ 580,000.00		
Fabrication of piping, elbows and application of coating	lot	1	$ 80,000	$ 80,000.00		
Refurbishment of 8 Valves	lot	1	$ 75,000	$ 75,000.00		
Industrial Cleaning	lot	1	$ 5,000	$ 5,000.00		
Project Management	lot	1	$ 20,000	$ 20,000.00		
				$ -		
				$ -		
			Sub-Total	$ 760,000.00		CI37743
028 Consulting						
Engineering Consulting	lot	1	$ 20,000	$ 20,000.00		CI37743
				$ -		
				$ -		
			Sub-Total	$ 20,000.00		
066 Other Goods & Services						
Contingency	%	10%	$ 580,000	$ 58,000.00		
				$ -		
			Sub-Total	$ 58,000.00		
094 Interest Capitalized						
AFUDC				$ 4,360.69		
				$ -		
			Sub-Total	$ 4,360.69		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 7,511.36		
Thermal Term Labour AO				$ 706.11		
Thermal / Hydro Contracts AO				$ 68,096.00		
			Sub-Total	$ 76,313.47		
			SUB-TOTAL (no AO, AFUDC)	$ 1,218,655.33		
			TOTAL (AO, AFUDC included)	$ 1,299,329.49		
Original Cost				$ 459,378.20		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 Condenser Large Bore Piping and Valve Refurbishment
Summary of Alternatives

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	41227
Originator :	J.March	**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Replace Piping and Valve Refurb vs. A	6.19%	-4,746,934	3,616,310	1	24.27%	5.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

Completing this project is of an economic benefit when compared to a "do nothing" option and dealing with unplanned failures.

Notes/Comments :

Replace Piping and Valve Refurb vs. Avoided Repair and Replacement Energy Costs

This option compares the refurbishment of the piping and valves versus a "do nothing" option which deals with unplanned failures as they arise. Failure scenario is a forced outage due to failure of a section of CW pipe. Large sections of CW can fail due to corrosion / erosion. Due to the size of the pipe (48"), under floor location (condenser pit), and connections to 72" concrete CW piping, significant mobilzation is required to access and repair / replace pipe sections.

Test 2

Test 3

Test 4

LIN3 Condenser Large Bore Piping and Valve Refurbishment
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	41227
Originator :	J.March	**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Piping and Valve Refurb vs. Avoided Re	6.19%	-4,746,934	3,616,310	1	24.27%	5.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Piping and Valve Refurb vs. Avoided Re	10%	-4,616,558	3,514,615	1	22.70%	5.7 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:	**A**	130,376	-101,695	0	-1.56%	0.0 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Replace Piping and Valve Refurb vs. Avoided Re	-10%	-4,141,864	3,152,984	1	22.54%	6.1 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:	**A**	605,069	-463,326	0	-1.72%	0.4 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	126,075	228,358	380,570	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN3 Condenser Large Bore Piping and Valve Refurbishment
Avoided Cost Calculations

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	41227
Originator :	J.March	**Project No. :**	

Replace Piping and Valve Refurb vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			287,906	299,455		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	30%	35%	30%	35%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	154	154				
Duration (Hours)	504	504				
Totals	$95,694	$105,930	$86,372	$104,809	$182,066	$210,739

Total Capital Cost of Alternative **$1,299,329**

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative **$0**

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative **$0**

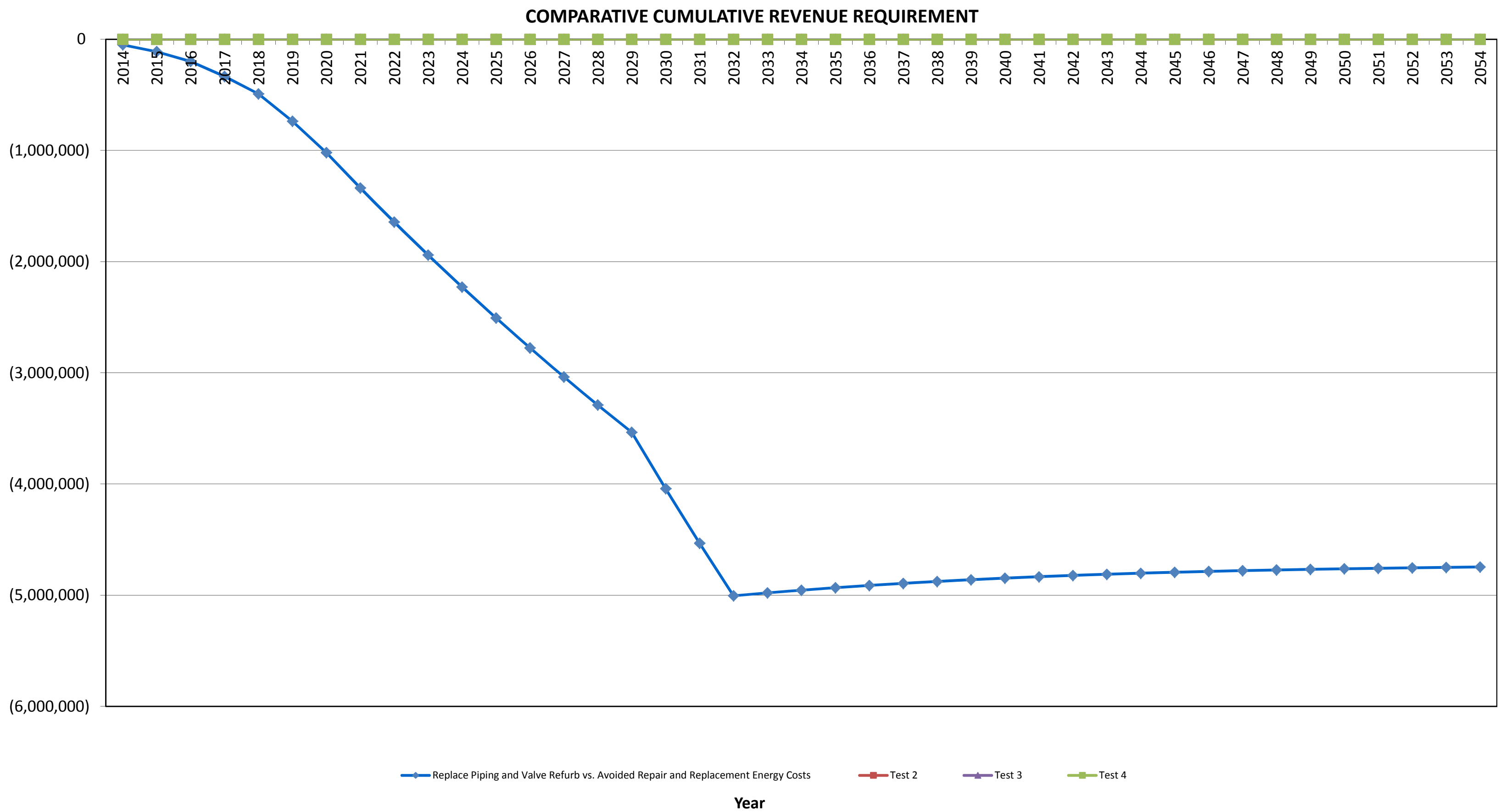
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0

Total Capital Cost of Alternative **$0**

LIN3 Condenser Large Bore Piping and Valve Refurbishment
Replace Piping and Valve Refurb vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	(1,223,016.0)	-	-	(1,223,016.0)	-	(1,223,016.0)	(1,223,016.0)	1.00	(1,223,016.0)
2015	-	-	182,065.8	-	48,746.2	1,190,971.6	182,065.8	(41,329.1)	140,736.7	132,532.9	0.94	(1,090,483.1)
2016	-	-	210,739.0	-	93,592.7	1,093,862.4	210,739.0	(36,315.4)	174,423.7	154,681.4	0.89	(935,801.6)
2017	-	-	279,079.8	-	86,105.3	1,004,521.9	279,079.8	(59,822.1)	219,257.7	183,106.6	0.84	(752,695.0)
2018	-	-	319,423.1	-	79,216.9	922,328.6	319,423.1	(74,463.9)	244,959.2	192,645.7	0.79	(560,049.4)
2019	-	-	460,697.8	-	72,879.5	846,710.8	460,697.8	(120,223.7)	340,474.1	252,154.1	0.74	(307,895.3)
2020	-	-	542,464.4	-	67,049.2	777,142.4	542,464.4	(147,378.7)	395,085.7	275,543.1	0.70	(32,352.1)
2021	-	-	628,822.9	-	61,685.2	713,139.5	628,822.9	(175,812.7)	453,010.2	297,524.4	0.66	265,172.3
2022	-	-	647,998.8	-	56,750.4	654,256.8	647,998.8	(183,287.0)	464,711.8	287,418.5	0.62	552,590.8
2023	-	-	667,823.0	-	52,210.4	600,084.7	667,823.0	(190,839.9)	476,983.1	277,811.6	0.58	830,402.4
2024	-	-	688,319.1	-	48,033.6	550,246.4	688,319.1	(198,488.5)	489,830.5	268,664.1	0.55	1,099,066.5
2025	-	-	709,511.5	-	44,190.9	504,395.2	709,511.5	(206,249.4)	503,262.1	259,940.8	0.52	1,359,007.3
2026	-	-	731,425.6	-	40,655.6	462,212.1	731,425.6	(214,138.7)	517,286.9	251,610.1	0.49	1,610,617.3
2027	-	-	754,087.9	-	37,403.2	423,403.6	754,087.9	(222,172.3)	531,915.6	243,644.0	0.46	1,854,261.3
2028	-	-	777,525.8	-	34,410.9	387,699.8	777,525.8	(230,365.6)	547,160.2	236,017.3	0.43	2,090,278.6
2029	-	-	801,767.6	-	31,658.0	354,852.3	801,767.6	(238,734.0)	563,033.6	228,707.3	0.41	2,318,985.9
2030	-	-	1,653,685.8	-	29,125.4	324,632.5	1,653,685.8	(503,613.7)	1,150,072.1	439,933.6	0.38	2,758,919.5
2031	-	-	1,705,564.8	-	26,795.4	296,830.4	1,705,564.8	(520,418.5)	1,185,146.3	426,923.8	0.36	3,185,843.3
2032	-	-	1,759,235.8	-	24,651.7	271,252.5	1,759,235.8	(537,721.1)	1,221,514.8	414,375.0	0.34	3,600,218.3
2033	-	-	-	-	22,679.6	247,720.7	-	7,030.7	7,030.7	2,246.0	0.32	3,602,464.3
2034	-	-	-	-	20,865.2	226,071.6	-	6,468.2	6,468.2	1,945.9	0.30	3,604,410.2
2035	-	-	-	-	19,196.0	206,154.3	-	5,950.8	5,950.8	1,685.8	0.28	3,606,096.0
2036	-	-	-	-	17,660.3	187,830.4	-	5,474.7	5,474.7	1,460.6	0.27	3,607,556.6
2037	-	-	-	-	16,247.5	170,972.5	-	5,036.7	5,036.7	1,265.4	0.25	3,608,822.0
2038	-	-	-	-	14,947.7	155,463.2	-	4,633.8	4,633.8	1,096.3	0.24	3,609,918.3
2039	-	-	-	-	13,751.9	141,194.6	-	4,263.1	4,263.1	949.8	0.22	3,610,868.1
2040	-	-	-	-	12,651.7	128,067.5	-	3,922.0	3,922.0	822.9	0.21	3,611,691.0
2041	-	-	-	-	11,639.6	115,990.6	-	3,608.3	3,608.3	712.9	0.20	3,612,403.9
2042	-	-	-	-	10,708.4	104,879.8	-	3,319.6	3,319.6	617.7	0.19	3,613,021.5
2043	-	-	-	-	9,851.8	94,657.9	-	3,054.0	3,054.0	535.1	0.18	3,613,556.7
2044	-	-	-	-	9,063.6	85,253.7	-	2,809.7	2,809.7	463.6	0.17	3,614,020.3
2045	-	-	-	-	8,338.5	76,601.9	-	2,584.9	2,584.9	401.7	0.16	3,614,421.9
2046	-	-	-	-	7,671.4	68,642.2	-	2,378.1	2,378.1	348.0	0.15	3,614,769.9
2047	-	-	-	-	7,057.7	61,319.3	-	2,187.9	2,187.9	301.5	0.14	3,615,071.4
2048	-	-	-	-	6,493.1	54,582.3	-	2,012.9	2,012.9	261.2	0.13	3,615,332.6
2049	-	-	-	-	5,973.7	48,384.2	-	1,851.8	1,851.8	226.3	0.12	3,615,558.9
2050	-	-	-	-	5,495.8	42,681.9	-	1,703.7	1,703.7	196.1	0.12	3,615,755.0
2051	-	-	-	-	5,056.1	37,435.8	-	1,567.4	1,567.4	169.9	0.11	3,615,924.8
2052	-	-	-	-	4,651.6	32,609.4	-	1,442.0	1,442.0	147.2	0.10	3,616,072.0
2053	-	-	-	-	4,279.5	28,169.2	-	1,326.6	1,326.6	127.5	0.10	3,616,199.5
2054	-	-	-	-	3,937.1	24,084.1	-	1,220.5	1,220.5	110.5	0.09	3,616,309.9
Total	**-**	**-**	**13,520,238.5**	**(1,223,016.0)**	**1,173,378.4**		**12,297,222.5**	**(3,827,526.6)**	**8,469,695.8**	**3,616,309.9**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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(1,000,000)
(2,000,000)
(3,000,000)
(4,000,000)
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Replace Piping and Valve Refurb vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 28288

Title: POT Turbine Supervisory Equipment Upgrade

Start Date: 2015/05
In-Service Date: 2015/09
Final Cost Date: 2016/03
Function: Steam
Forecast Amount: $822,535

DESCRIPTION:

Point Tupper Unit 2 is a 150 MW boiler/turbine/generator unit, primarily coal-fired, that has been in service since 1972. The Original Equipment Manufacturer (OEM) for the turbine/generator set is C.A. Parsons & Co. of Newcastle, UK. The original turbine vibration monitoring & protection system (or Turbine Supervisory Equipment - TSE) was supplied with the turbine by the OEM. The instrumentation and controls group of the OEM also supplied the upgraded vibration system in 1986 as part of the overall Point Tupper coal conversion/upgrade. Siemens AG acquired Parsons in 1997 and their control group was phased out. As the installed TSE was an OEM proprietary system, spares and technical support are no longer available.

Point Tupper has been able to maintain the existing system through knowledgeable staff and an inventory of spare parts. The Trenton Unit 5 turbine is also a Parsons machine, very similar to that of Point Tupper Unit 2. It had the same OEM TSE system, but was upgraded to a modern Bently Nevada system in 2009. The resulting spare parts from Trenton 5 augmented the spares inventory at Point Tupper and helped to maintain the system for several more years.

However, with the depletion of spares, maintenance of the system is no longer viable. NS Power has selected Bently Nevada as the standard for TSE upgrades across multiple plants. The TSEs for all 4 Lingan units, Tufts Cove Units 1 & 2 and Trenton Units 5 & 6 are Bently Nevada equipment. Bently Nevada (a GE company) has become the leading supplier of turbo-equipment vibration monitoring systems in North America.

A major outage for Point Tupper Unit 2 is scheduled in 2015. The scope/duration of a major outage is required for a project such as a TSE replacement. This project includes the procurement and commissioning of a turbine vibration monitoring system. The vibration monitoring is critical to running the turbine in a safe manner. Although, ostensibly, this is an upgrade from an existing instrumentation system to a modern counterpart, the components are not directly a one-to-one replacement. There will be mechanical design required to fit the new components to the turbine / generator set.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

The Point Tupper turbine vibration monitoring system was replaced once in 1986/87 and is now over 25 years old. This is beyond the expected life of 15 years for this class of equipment. The technology is obsolete and no longer supported. The OEM supplier company no longer exists. Failure to address obsolescence issues could result in costly down time.

Why do this project now?

The probability of failure increases with the age of the equipment, for which there are no longer any replacement spares. This replacement requires a major unit shutdown. The 2015 shutdown is a major shutdown for Point Tupper Unit 2. There will be sufficient access to the turbine for machining and mounting probes as the turbine will be disassembled for other work associated with the major shutdown. Installation of the upgraded TSE equipment will be planned in conjunction with this other work.

Why do this project this way?

Bently Nevada has become the NS Power standard with Trenton 6, Trenton 5, Tufts Cove and Lingan Units 1, 2, 3, 4 all deploying Bently Nevada turbine vibration monitoring equipment. They offer modern equivalents as replacements for the existing equipment. NS Power has developed a strong relationship with Bently Nevada as they have supplied upgraded systems, training, and service contracts and are seen as the industry standard for this type of equipment.

CI Number : 28288 - POT Turbine Supervisory Equipment Upgrade **Project Number**

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		4,295	0	4,295
095		095-Thermal Term Labour AO		2,925	0	2,925
095		095-Thermal Overtime Labour AO		740	0	740
095		095-Thermal & Hydro Contracts AO		8,142	0	8,142
095		095-Thermal Regular Labour AO		4,779	0	4,779
001	011	001 - THERMAL Regular Labour	011 - SGP - Plant Control and Inst	23,846	0	23,846
002	011	002 - THERMAL Overtime Labour	011 - SGP - Plant Control and Inst	7,382	0	7,382
004	011	004 - THERMAL Term Labour	011 - SGP - Plant Control and Inst	14,596	0	14,596
012	011	012 - Materials	011 - SGP - Plant Control and Inst	642,920	0	642,920
013	011	013 - POWER PRODUCTION Contracts	011 - SGP - Plant Control and Inst	90,870	0	90,870
011	085	011 - Travel Expense	085 Design	2,000	0	2,000
014	085	014 - Overtime Meals	085 Design	250	0	250
015	085	015 - Frt, Post & Delivery	085 Design	8,000	0	8,000
028	085	028 - Consulting	085 Design	10,542	0	10,542
033	085	033 - Rental and Maintenance of	085 Design	1,000	0	1,000
041	085	041 - Meals & Entertainment	085 Design	250	0	250
			Total Cost:	822,535	0	822,535
			Original Cost:	384,606		

Location: Pt. Tupper
CI# / FP#: 28288
Title: POT - Turbine Supervisory Equipment Upgrade
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						29120-S412
Engineering	PD	20	$ 391.49	$ 7,829.72		
Maintenance Trades	PD	10	$ 352.35	$ 3,523.49		
Power Plant Technician	PD	30	$ 369.08	$ 11,072.30		
CADD Operators	PD	5	$ 284.05	$ 1,420.25		
			Sub-Total	$ 23,845.76		
002 OT Labour						
Power Plant Technician	PD	20	$ 369.08	$ 7,381.54		
				$ -		
			Sub-Total	$ 7,381.54		
004 Term Labour						
Maintenance Trades	PD	10	$ 352.35	$ 3,523.49		
Power Plant Technician	PD	30	$ 369.08	$ 11,072.30		
				$ -		
			Sub-Total	$ 14,595.79		
011 Travel Expense						
Travel	lot	1	$ 2,000.00	$ 2,000.00		
				$ -		
			Sub-Total	$ 2,000.00		
012 Materials						
Bently Nevada supplied TSE	lot	1	$ 623,620.17	$ 623,620.17		CI 29120 (Trenton Turbine Supervisory Upgrade)
Electrical JB's, cables, etc.	lot	1	$ 15,000.00	$ 15,000.00		
Miscellaneous materials	lot	1	$ 4,300.00	$ 4,300.00		
				$ -		
			Sub-Total	$ 642,920.17		
013 Contracts						
BN - site commissioning service	lot	1	$ 11,870.00	$ 11,870.00		
Fundy - mechanical services	lot	1	$ 79,000.00	$ 79,000.00		
				$ -		
			Sub-Total	$ 90,870.00		
028 Consulting						
Consulting	lot	1	$ 3,600.00	$ 3,600.00		
Field Supervision	lot	1	$ 6,942.00	$ 6,942.00		
				$ -		
			Sub-Total	$ 10,542.00		
041 Meals & Entertainment						
Meals and expenses	lot	1	$ 250.00	$ 250.00		
			Sub-Total	$ 250.00		
014 Overtime Meals						
Overtime Meals	lot	1	$ 250.00	$ 250.00		
			Sub-Total	$ 250.00		
015 Freight						
Freight, post, delivery	lot	1	$ 8,000.00	$ 8,000.00		
			Sub-Total	$ 8,000.00		
033 Rentals						
Rentals	lot	1	$ 1,000.00	$ 1,000.00		
			Sub-Total	$ 1,000.00		
094 Interest Capitalized						
AFUDC				$ 4,294.95		
				$ -		
			Sub-Total	$ 4,294.95		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 4,778.70		
Thermal OT Labour AO				$ 739.64		
Thermal Term Labour AO				$ 2,925.00		
Thermal / Hydro Contracts AO				$ 8,141.94		
			Sub-Total	$ 16,585.28		
			SUB-TOTAL (no AO, AFUDC)	$ 801,655.26		
			TOTAL (AO, AFUDC included)	$ 822,535.49		
Original Cost				$ 384,605.55		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

POT Turbine Supervisory Equipment Upgrade
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	28288
Originator :	B. MacLeod	**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Upgrade Turbine Supervisory Equipme	6.19%	-9,435,037	7,053,807	1	308.43%	0.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

Based on the economic analysis, it's recommended to upgrade this equipment.

Notes/Comments :

Upgrade Turbine Supervisory Equipment vs. Avoided Repair and Replacement Energy Costs

This option compares completing the upgrades versus the replacement energy costs incurred in the event of a failure. The probability of a failure is considered high (75%) and would require a outage of slightly more than 4 weeks where the Pt. Tupper Generating unit would not operate, leading to replacement energy costs.

Test 2

Test 3

Test 4

POT Turbine Supervisory Equipment Upgrade
Summary of Sensitivities

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	28288
Originator :	B. MacLeod	**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Upgrade Turbine Supervisory Equipment vs. Avoi	6.19%	-9,435,037	7,053,807	1	308.43%	0.7 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Upgrade Turbine Supervisory Equipment vs. Avoi	10%	-9,354,320	6,991,465	1	221.51%	0.8 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years
	Change:	**A**	80,718	-62,342	0	-86.92%	0.1 years
		B	0	0	0	#NUM!	0.0 years
		C	0	0	0	#NUM!	0.0 years
		D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Upgrade Turbine Supervisory Equipment vs. Avoi	-10%	-8,410,816	6,286,084	1	214.83%	0.8 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years
	Change:	**A**	1,024,222	-767,723	0	-93.59%	0.2 years
		B	0	0	0	#NUM!	0.0 years
		C	0	0	0	#NUM!	0.0 years
		D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	808,241	1,521,318	2,185,975	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

POT Turbine Supervisory Equipment Upgrade
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	Date :	15-Oct-14
Department :	Point Tupper Generating Station	CI Number:	28288
Originator :	B. MacLeod	Project No. :	

Upgrade Turbine Supervisory Equipment vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			120,160	122,160		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	75%	76%	75%	76%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	150	150				
Duration (Hours)	696	696				
Totals	$776,476	$756,324	$90,120	$92,842	$866,596	$849,166
Total Capital Cost of Alternative						$822,535

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

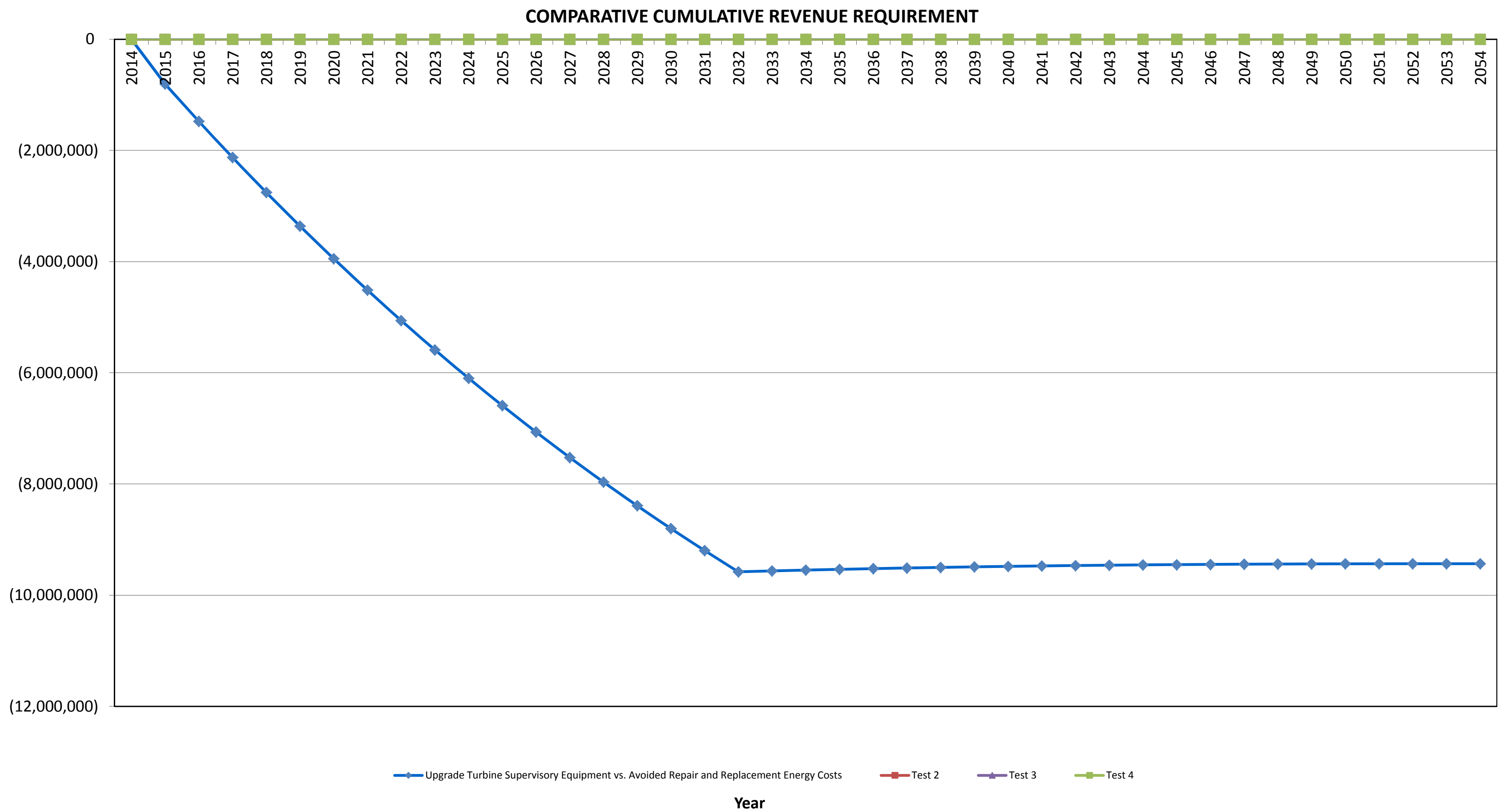
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

POT Turbine Supervisory Equipment Upgrade
Upgrade Turbine Supervisory Equipment vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	866,596.5	(805,950.2)	32,066.2	774,166.6	60,646.3	(258,704.4)	(198,058.1)	(186,512.9)	0.94	(186,512.9)
2016	-	-	849,165.9	-	61,567.1	711,835.2	849,165.9	(244,155.6)	605,010.3	536,531.8	0.89	350,018.9
2017	-	-	877,235.4	-	56,641.8	654,490.3	877,235.4	(254,384.0)	622,851.4	520,155.9	0.84	870,174.8
2018	-	-	906,086.1	-	52,110.4	601,733.1	906,086.1	(264,732.5)	641,353.7	504,386.1	0.79	1,374,560.9
2019	-	-	935,738.2	-	47,941.6	553,196.4	935,738.2	(275,216.9)	660,521.2	489,180.0	0.74	1,863,740.9
2020	-	-	966,212.0	-	44,106.3	508,542.6	966,212.0	(285,852.8)	680,359.3	474,500.4	0.70	2,338,241.3
2021	-	-	997,528.9	-	40,577.8	467,461.2	997,528.9	(296,654.9)	700,874.0	460,314.5	0.66	2,798,555.8
2022	-	-	1,029,710.3	-	37,331.5	429,666.2	1,029,710.3	(307,637.4)	722,072.9	446,593.2	0.62	3,245,148.9
2023	-	-	1,062,778.5	-	34,345.0	394,894.9	1,062,778.5	(318,814.4)	743,964.1	433,310.7	0.58	3,678,459.6
2024	-	-	1,096,756.0	-	31,597.4	362,905.2	1,096,756.0	(330,199.2)	766,556.8	420,444.0	0.55	4,098,903.6
2025	-	-	1,131,666.2	-	29,069.6	333,474.8	1,131,666.2	(341,804.9)	789,861.2	407,972.6	0.52	4,506,876.2
2026	-	-	1,167,532.7	-	26,744.0	306,398.8	1,167,532.7	(353,644.5)	813,888.2	395,878.0	0.49	4,902,754.1
2027	-	-	1,204,380.1	-	24,604.5	281,488.8	1,204,380.1	(365,730.4)	838,649.7	384,143.5	0.46	5,286,897.7
2028	-	-	1,242,233.2	-	22,636.2	258,571.7	1,242,233.2	(378,075.1)	864,158.1	372,754.2	0.43	5,659,651.8
2029	-	-	1,281,117.6	-	20,825.3	237,487.9	1,281,117.6	(390,690.6)	890,427.0	361,696.2	0.41	6,021,348.1
2030	-	-	1,321,059.5	-	19,159.2	218,090.8	1,321,059.5	(403,589.1)	917,470.5	350,957.2	0.38	6,372,305.3
2031	-	-	1,362,085.8	-	17,626.5	200,245.5	1,362,085.8	(416,782.4)	945,303.4	340,525.5	0.36	6,712,830.8
2032	-	-	1,404,223.9	-	16,216.4	183,827.8	1,404,223.9	(430,282.3)	973,941.6	330,390.6	0.34	7,043,221.5
2033	-	-	-	-	14,919.1	168,723.5	-	4,624.9	4,624.9	1,477.5	0.32	7,044,698.9
2034	-	-	-	-	13,725.6	154,827.6	-	4,254.9	4,254.9	1,280.0	0.30	7,045,978.9
2035	-	-	-	-	12,627.5	142,043.3	-	3,914.5	3,914.5	1,109.0	0.28	7,047,087.9
2036	-	-	-	-	11,617.3	130,281.8	-	3,601.4	3,601.4	960.8	0.27	7,048,048.7
2037	-	-	-	-	10,687.9	119,461.2	-	3,313.3	3,313.3	832.4	0.25	7,048,881.1
2038	-	-	-	-	9,832.9	109,506.3	-	3,048.2	3,048.2	721.2	0.24	7,049,602.3
2039	-	-	-	-	9,046.3	100,347.7	-	2,804.3	2,804.3	624.8	0.22	7,050,227.1
2040	-	-	-	-	8,322.6	91,921.9	-	2,580.0	2,580.0	541.3	0.21	7,050,768.4
2041	-	-	-	-	7,656.8	84,170.1	-	2,373.6	2,373.6	469.0	0.20	7,051,237.3
2042	-	-	-	-	7,044.2	77,038.4	-	2,183.7	2,183.7	406.3	0.19	7,051,643.7
2043	-	-	-	-	6,480.7	70,477.3	-	2,009.0	2,009.0	352.0	0.18	7,051,995.7
2044	-	-	-	-	5,962.2	64,441.1	-	1,848.3	1,848.3	305.0	0.17	7,052,300.6
2045	-	-	-	-	5,485.2	58,887.7	-	1,700.4	1,700.4	264.2	0.16	7,052,564.9
2046	-	-	-	-	5,046.4	53,778.7	-	1,564.4	1,564.4	228.9	0.15	7,052,793.8
2047	-	-	-	-	4,642.7	49,078.3	-	1,439.2	1,439.2	198.3	0.14	7,052,992.1
2048	-	-	-	-	4,271.3	44,754.0	-	1,324.1	1,324.1	171.8	0.13	7,053,163.9
2049	-	-	-	-	3,929.6	40,775.7	-	1,218.2	1,218.2	148.9	0.12	7,053,312.8
2050	-	-	-	-	3,615.2	37,115.6	-	1,120.7	1,120.7	129.0	0.12	7,053,441.7
2051	-	-	-	-	3,326.0	33,748.3	-	1,031.1	1,031.1	111.7	0.11	7,053,553.5
2052	-	-	-	-	3,059.9	30,650.4	-	948.6	948.6	96.8	0.10	7,053,650.3
2053	-	-	-	-	2,815.1	27,800.3	-	872.7	872.7	83.9	0.10	7,053,734.2
2054	-	-	-	-	2,589.9	25,178.2	-	802.9	802.9	72.7	0.09	7,053,806.8
Total	**-**	**-**	**19,702,106.9**	**(805,950.2)**	**771,871.2**		**18,896,156.7**	**(5,868,373.1)**	**13,027,783.6**	**7,053,806.8**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
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2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Upgrade Turbine Supervisory Equipment vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 43031

Title: POT – #5 HP Feedwater Heater Replacement

Start Date:	2014/07
In-Service Date:	2015/09
Final Cost Date:	2016/03
Function:	Steam
Forecast Amount:	$812,644

DESCRIPTION:

This project allows for the replacement of Unit 2 #5 High Pressure (HP) Feedwater Heater as part of the ongoing preventative maintenance/planned heater replacement program related to HP feed-water heater performance.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Heat Rate

Why do this project?

Feedwater heaters are utilized in steam turbine based power systems by transferring heat from various turbine steam extractions to the feedwater before the feedwater enters the economizer section of the boiler. This regenerative feedwater heating improves the overall efficiency of the steam power cycle. NS Power has a preventative maintenance program which encompasses HP feedwater heater performance, mechanical integrity and life cycle management. The program was developed to manage the rate of tube failures in HP heaters. Tubes that leak are plugged after being identified. Eventually, heaters reach a point in which feedwater velocities through the remaining tubes exceed those recommended by the Heat Exchange Institute (HEI) standards. To preclude exceeding the standards, a bypass orifice is installed that causes some inlet feedwater to bypass the heater and mix with the heated water on the outlet side of the heater. This process slows down wear to the remaining tubes but significantly reduces the overall efficiency of the heat exchanger's heat transfer. Prolonged operation in this state is not advised and heater replacement is recommended. Without replacement, the tube failure will result in a derating of the unit and incurrence of replacement energy costs. Moreover, the reduced efficiency using bypass orifices reduces heat rate efficiency resulting in less economic operation of the unit.

Why do this project now?

Suppliers have quoted a delivery time of approximately twelve (12) months for an HP Feedwater Heater replacement. This does not include installation and commissioning, which adds additional time to the replacement timeline. A failure of the heater would lead to a unit derate of 20MW while a new heater is procured and installed, which has a lead time of approximately 40 weeks. This project is planned for the 2015 planned outage, as in 2016, the planned outage is only one week, which does not allow the required time to complete this replacement.

Why do this project this way?

This has been identified as the most economically feasible alternative. Replacing the full heater ensures reliability of the tube sheets and the main shell of the heater. An alternative would consist of just re-tubing. If this alternative were to be chosen, the tube sheets and the main shell of the heater would not be replaced and they would still be subject to failure and the associated replacement energy costs mentioned above and outlined in the EAM.

CI Number : 43031-SD18 - POT - #5 HP Feedwater Heater Replacement **Project Number** SD18

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
001		001 - Proj Supp Regular Labour		899	0	899
094		094 - Interest Capitalized		1,844	0	1,844
095		095-Thermal Regular Labour AO		4,591	0	4,591
095		095-Thermal & Hydro Contracts AO		30,902	0	30,902
095		095-Thermal Overtime Labour AO		346	0	346
095		095-Thermal Term Labour AO		1,873	0	1,873
095		095 - Proj Supp Regular Labour AO		422	0	422
001	016	001 - THERMAL Regular Labour	016 - SGP - Feed Water Sys.	16,133	0	16,133
002	016	002 - THERMAL Overtime Labour	016 - SGP - Feed Water Sys.	3,454	0	3,454
004	016	004 - THERMAL Term Labour	016 - SGP - Feed Water Sys.	9,347	0	9,347
011	016	011 - Travel Expense	016 - SGP - Feed Water Sys.	1,000	0	1,000
012	016	012 - Materials	016 - SGP - Feed Water Sys.	337,428	0	337,428
013	016	013 - POWER PRODUCTION Contracts	016 - SGP - Feed Water Sys.	[redacted]	0	[redacted]
041	016	041 - Meals & Entertainment	016 - SGP - Feed Water Sys.	1,000	0	1,000
066	016	066 - Other Goods & Services	016 - SGP - Feed Water Sys.	[redacted]	0	[redacted]
001	085	001 - THERMAL Regular Labour	085 Design	6,778	0	6,778
			Total Cost:	812,644	0	812,644
			Original Cost:	153,729		

Capital Project Detailed Estimate

Location: Pt. Tupper
CI# / FP#: 43031
Title: POT - #5 HP Feedwater Heater Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						CI 25398
Electrician	PD	20.00	$ 339.28	$ 6,785.60		
Engineering	PD	20.00	$ 383.81	$ 7,676.20		
Maintenance Trades	PD	10.00	$ 345.44	$ 3,454.40		
Power Plant Technician	PD	10.00	$ 361.84	$ 3,618.40		
Utilityworker	PD	10.00	$ 227.44	$ 2,274.40		
	PD					
			Sub-Total	$ 23,809.00		
002 OT Labour						
Maintenance Trades	PD	5.00	$ 690.88	$ 3,454.40		CI 25398
			Sub-Total	$ 3,454.40		
004 Term Labour						
Maintenance Trades	PD	10.00	$ 345.44	$ 3,454.40		CI 25398
Power Plant Technician	PD	10.00	$ 361.84	$ 3,618.40		
Utilityworker	PD	10.00	$ 227.44	$ 2,274.40		
			Sub-Total	$ 9,347.20		
011 Travel Expense						
Travel	lot	1.00	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
012 Materials						
HP heater	ea	1.00	[redacted]		Cost Support Item #1 - Page 3 @ $0.92USD	
Valves, instrumentation, etc.	lot	1.00	$ 15,000.00	$ 15,000.00		
Misc. and consumables	lot	1.00	[redacted]			
			Sub-Total	$ 337,428.26		
013 Contracts						
Installation	lot	1.00	[redacted]		Cost Support Item #2 (with 3 years inflation added)	
				$ -		
			Sub-Total	[redacted]		
041 Meals & Entertainment						
Meals and expenses	lot	1.00	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
066 Other Goods & Services						
Contingency on Installation	%	15%	[redacted]			
				$ -		
			Sub-Total	[redacted]		
094 Interest Capitalized						
Interest				$ 1,844.11		
				$ -		
			Sub-Total	$ 1,844.11		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 4,591.24		
Project Support Labour AO				$ 421.88		
Thermal OT Labour AO				$ 346.12		
Thermal Term Labour AO				$ 1,873.16		
Thermal / Hydro Contracts AO				$ 30,902.36		
			Sub-Total	$ 38,134.76		
			SUB-TOTAL (no AO, AFUDC)	$ 772,665.35		
			TOTAL (AO, AFUDC included)	$ 812,644.22		
Original Cost				$ 153,729.24		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

POT #5 HP Heater Replacement
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Pt Tupper	**CI Number:**	43031
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank (based on PV of RR)**	**IRR**	**Disc Pay**
A	Refurbish Heater vs Avoided Repair an	6.19%	-3,662,672	2,788,437	1	35.31%	4.3 years
B	Retube vs Avoided Repair and Replace	6.19%	-1,871,136	1,436,754	2	30.46%	6.0 years
C	Test 3	6.19%	0	0	3	#NUM!	0.0 years
D	Test 4	6.19%	0	0	3	#NUM!	0.0 years

Recommendation :

This project is recommended to proceed with the heater replacement as the avoided costs related to eliminating tube failures and main shell failure in the heater are greater than the cost of replacing the HP heater.

Notes/Comments :

Refurbish Heater vs Avoided Repair and Replacement Energy Costs

This option compares the replacement of the HP Heater versus the "do nothing" option and the replacement energy, material and labour costs associated with tube failures that can be expected if the refurbishment is not complete. In addition to tube failures, a main shell failure is also considered as an avoided cost.

Retube vs Avoided Repair and Replacement Energy Costs

This option compares the retubing of the HP Heater versus the "do nothing" option and the replacement energy, material and labour costs associated with tube failures that can be expected if the refurbishment is not complete. The avoided costs of the main shell failure are not factored in as the main shell is not replaced in this alternative.

Test 3

Test 4

POT #5 HP Heater Replacement
Summary of Sensitivities

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Pt Tupper	**CI Number:**	43031
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Heater vs Avoided Repair and Replace	6.19%	-3,662,672	2,788,437	1	35.31%	4.3 years
B	Retube vs Avoided Repair and Replacement Ener	6.19%	-1,871,136	1,436,754	2	30.46%	6.0 years
C	Test 3	6.19%	0	0	3	#NUM!	0.0 years
D	Test 4	6.19%	0	0	3	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Heater vs Avoided Repair and Replace	10%	-3,584,943	2,728,565	1	32.49%	4.7 years
B	Retube vs Avoided Repair and Replacement Ener	10%	-1,831,392	1,406,203	2	28.43%	6.3 years
C	Test 3	10%	0	0	3	#NUM!	0.0 years
D	Test 4	10%	0	0	3	#NUM!	0.0 years

Change:					
A	77,729	-59,871	0	-2.82%	0.4 years
B	39,744	-30,551	0	-2.04%	0.4 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Refurbish Heater vs Avoided Repair and Replace	-10%	-3,218,676	2,449,722	1	32.21%	4.8 years
B	Retube vs Avoided Repair and Replacement Ener	-10%	-1,644,279	1,262,528	2	28.22%	6.4 years
C	Test 3	-10%	0	0	3	#NUM!	0.0 years
D	Test 4	-10%	0	0	3	#NUM!	0.0 years

Change:					
A	443,996	-338,715	0	-3.10%	0.4 years
B	226,857	-174,226	0	-2.24%	0.4 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
A	166,263	316,507	461,568	No
B	41,957	86,909	136,534	No
C	0	0	0	No
D	0	0	0	No

POT #5 HP Heater Replacement
Avoided Cost Calculations

Division :	Power Production	**Date :**	**29-Oct-14**
Department :	Pt Tupper	**CI Number:**	43031
Originator :		**Project No. :**	

Refurbish Heater vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			9,800	10,194		
Events/Outages (#)	2	3	2	3		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	20	20				
Duration (Hours)	64	64				
Totals	$25,387	$36,604	$19,600	$30,582	$44,987	$67,185
Total Capital Cost of Alternative						$812,644

Retube vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			9,800	9,996		
Events/Outages (#)	2	3	2	3		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	20	20				
Duration (Hours)	64	64				
Totals	$25,387	$36,604	$19,600	$29,988	$44,987	$66,592
Total Capital Cost of Alternative						$425,295

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	10%	10%	10%	10%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	20	21				
Duration (Hours)	6720	6720				
Totals	$133,280	$134,519	$0	$0	$133,280	$134,519
Total Capital Cost of Alternative						$0

Test 4

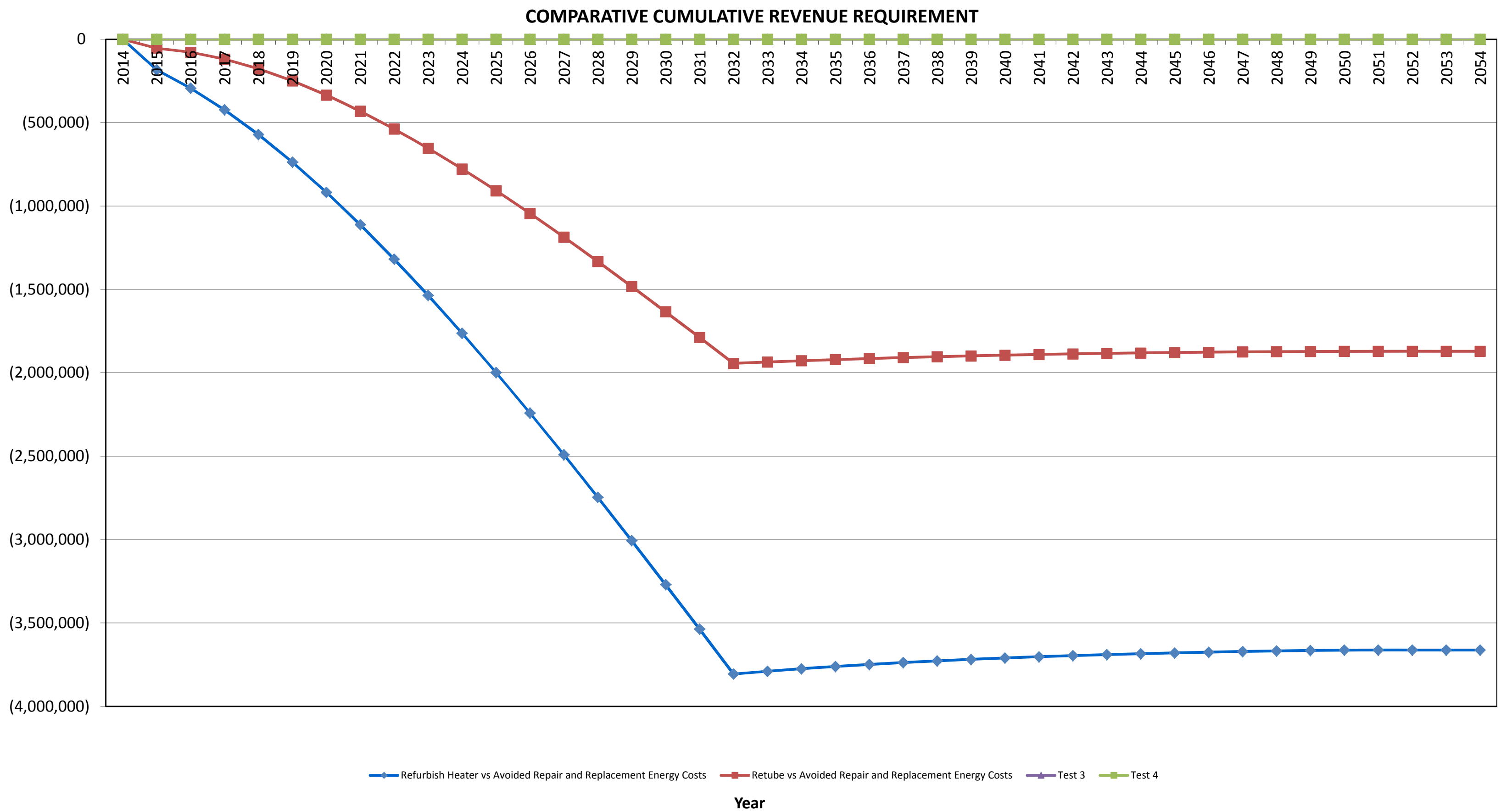
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

POT #5 HP Heater Replacement
Refurbish Heater vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	178,267.0	(774,509.5)	30,906.6	752,283.9	(596,242.5)	(45,681.7)	(641,924.2)	(604,505.3)	0.94	(604,505.3)
2016	-	-	201,704.1	-	59,340.7	691,186.0	201,704.1	(44,132.7)	157,571.5	139,736.7	0.89	(464,768.7)
2017	-	-	235,938.5	-	54,593.4	634,975.9	235,938.5	(56,217.0)	179,721.6	150,089.2	0.84	(314,679.5)
2018	-	-	271,902.4	-	50,226.0	583,262.6	271,902.4	(68,719.7)	203,182.7	159,791.0	0.79	(154,888.5)
2019	-	-	309,673.3	-	46,207.9	535,686.3	309,673.3	(81,674.3)	227,999.0	168,855.4	0.74	13,966.9
2020	-	-	349,332.2	-	42,511.3	491,916.2	349,332.2	(95,114.5)	254,217.7	177,298.1	0.70	191,265.0
2021	-	-	390,963.7	-	39,110.4	451,647.7	390,963.7	(109,074.5)	281,889.2	185,136.9	0.66	376,401.9
2022	-	-	434,656.3	-	35,981.5	414,600.6	434,656.3	(123,589.2)	311,067.1	192,391.2	0.62	568,793.0
2023	-	-	480,502.2	-	33,103.0	380,517.3	480,502.2	(138,693.8)	341,808.5	199,081.2	0.58	767,874.2
2024	-	-	528,598.2	-	30,454.8	349,160.7	528,598.2	(154,424.5)	374,173.7	205,228.2	0.55	973,102.4
2025	-	-	579,044.9	-	28,018.4	320,312.6	579,044.9	(170,818.2)	408,226.7	210,853.9	0.52	1,183,956.3
2026	-	-	631,947.8	-	25,776.9	293,772.4	631,947.8	(187,913.0)	444,034.8	215,980.0	0.49	1,399,936.3
2027	-	-	687,417.0	-	23,714.8	269,355.3	687,417.0	(205,747.7)	481,669.3	220,628.6	0.46	1,620,565.0
2028	-	-	745,567.6	-	21,817.6	246,891.7	745,567.6	(224,362.5)	521,205.1	224,821.5	0.43	1,845,386.5
2029	-	-	806,519.7	-	20,072.2	226,225.1	806,519.7	(243,798.7)	562,721.0	228,580.3	0.41	2,073,966.8
2030	-	-	870,399.2	-	18,466.4	207,211.9	870,399.2	(264,099.2)	606,300.0	231,926.1	0.38	2,305,892.9
2031	-	-	937,337.1	-	16,989.1	189,719.7	937,337.1	(285,307.9)	652,029.2	234,879.7	0.36	2,540,772.6
2032	-	-	1,007,470.9	-	15,630.0	173,626.9	1,007,470.9	(307,470.7)	700,000.2	237,461.4	0.34	2,778,234.0
2033	-	-	-	-	14,379.6	158,821.5	-	4,457.7	4,457.7	1,424.0	0.32	2,779,658.0
2034	-	-	-	-	13,229.2	145,200.5	-	4,101.1	4,101.1	1,233.7	0.30	2,780,891.8
2035	-	-	-	-	12,170.9	132,669.3	-	3,773.0	3,773.0	1,068.9	0.28	2,781,960.7
2036	-	-	-	-	11,197.2	121,140.5	-	3,471.1	3,471.1	926.0	0.27	2,782,886.7
2037	-	-	-	-	10,301.4	110,534.0	-	3,193.4	3,193.4	802.3	0.25	2,783,689.0
2038	-	-	-	-	9,477.3	100,776.1	-	2,938.0	2,938.0	695.1	0.24	2,784,384.1
2039	-	-	-	-	8,719.1	91,798.7	-	2,702.9	2,702.9	602.2	0.22	2,784,986.3
2040	-	-	-	-	8,021.6	83,539.6	-	2,486.7	2,486.7	521.7	0.21	2,785,508.0
2041	-	-	-	-	7,379.9	75,941.2	-	2,287.8	2,287.8	452.0	0.20	2,785,960.0
2042	-	-	-	-	6,789.5	68,950.7	-	2,104.7	2,104.7	391.6	0.19	2,786,351.6
2043	-	-	-	-	6,246.3	62,519.4	-	1,936.4	1,936.4	339.3	0.18	2,786,690.9
2044	-	-	-	-	5,746.6	56,602.6	-	1,781.4	1,781.4	293.9	0.17	2,786,984.9
2045	-	-	-	-	5,286.9	51,159.2	-	1,638.9	1,638.9	254.7	0.16	2,787,239.5
2046	-	-	-	-	4,863.9	46,151.2	-	1,507.8	1,507.8	220.6	0.15	2,787,460.2
2047	-	-	-	-	4,474.8	41,543.9	-	1,387.2	1,387.2	191.2	0.14	2,787,651.3
2048	-	-	-	-	4,116.8	37,305.1	-	1,276.2	1,276.2	165.6	0.13	2,787,816.9
2049	-	-	-	-	3,787.5	33,405.5	-	1,174.1	1,174.1	143.5	0.12	2,787,960.4
2050	-	-	-	-	3,484.5	29,817.8	-	1,080.2	1,080.2	124.3	0.12	2,788,084.7
2051	-	-	-	-	3,205.7	26,517.1	-	993.8	993.8	107.7	0.11	2,788,192.4
2052	-	-	-	-	2,949.3	23,480.5	-	914.3	914.3	93.3	0.10	2,788,285.7
2053	-	-	-	-	2,713.3	20,686.9	-	841.1	841.1	80.8	0.10	2,788,366.6
2054	-	-	-	-	2,496.3	18,116.7	-	773.8	773.8	70.0	0.09	2,788,436.6
Total	**-**	**-**	**9,647,242.1**	**(774,509.5)**	**743,958.3**		**8,872,732.6**	**(2,760,018.0)**	**6,112,714.6**	**2,788,436.6**		

POT #5 HP Heater Replacement
Retube vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	44,986.7	(395,256.8)	15,780.0	403,151.6	(350,270.1)	(9,054.1)	(359,324.2)	(338,378.5)	0.94	(338,378.5)
2016	-	-	66,591.7	-	30,297.6	355,329.3	66,591.7	(11,251.2)	55,340.6	49,076.8	0.89	(289,301.7)
2017	-	-	90,564.7	-	27,873.8	326,182.0	90,564.7	(19,434.2)	71,130.6	59,402.6	0.84	(229,899.2)
2018	-	-	115,470.0	-	25,643.9	299,366.6	115,470.0	(27,846.1)	87,623.9	68,911.0	0.79	(160,988.2)
2019	-	-	141,335.3	-	23,592.4	274,696.3	141,335.3	(36,500.3)	104,835.0	77,640.5	0.74	(83,347.7)
2020	-	-	168,189.0	-	21,705.0	251,999.7	168,189.0	(45,410.0)	122,779.0	85,629.3	0.70	2,281.6
2021	-	-	196,060.4	-	19,968.6	231,118.8	196,060.4	(54,588.4)	141,471.9	92,914.8	0.66	95,196.4
2022	-	-	224,979.3	-	18,371.1	211,908.4	224,979.3	(64,048.5)	160,930.7	99,533.7	0.62	194,730.1
2023	-	-	254,976.5	-	16,901.4	194,234.8	254,976.5	(73,803.3)	181,173.2	105,521.6	0.58	300,251.7
2024	-	-	286,083.6	-	15,549.3	177,975.1	286,083.6	(83,865.6)	202,218.0	110,913.3	0.55	411,165.0
2025	-	-	318,333.1	-	14,305.4	163,016.2	318,333.1	(94,248.6)	224,084.5	115,742.3	0.52	526,907.2
2026	-	-	351,758.0	-	13,160.9	149,253.9	351,758.0	(104,965.1)	246,792.9	120,040.9	0.49	646,948.1
2027	-	-	386,392.7	-	12,108.1	136,592.7	386,392.7	(116,028.2)	270,364.4	123,840.4	0.46	770,788.6
2028	-	-	422,272.0	-	11,139.4	124,944.4	422,272.0	(127,451.1)	294,820.9	127,170.8	0.43	897,959.4
2029	-	-	459,431.9	-	10,248.3	114,227.9	459,431.9	(139,246.9)	320,185.0	130,060.9	0.41	1,028,020.3
2030	-	-	497,909.3	-	9,428.4	104,368.7	497,909.3	(151,429.1)	346,480.3	132,538.0	0.38	1,160,558.3
2031	-	-	537,742.1	-	8,674.1	95,298.3	537,742.1	(164,011.1)	373,731.0	134,628.7	0.36	1,295,187.0
2032	-	-	578,969.0	-	7,980.2	86,953.5	578,969.0	(177,006.5)	401,962.5	136,357.9	0.34	1,431,544.9
2033	-	-	-	-	7,341.8	79,276.3	-	2,276.0	2,276.0	727.1	0.32	1,432,272.0
2034	-	-	-	-	6,754.4	72,213.3	-	2,093.9	2,093.9	629.9	0.30	1,432,901.9
2035	-	-	-	-	6,214.1	65,715.3	-	1,926.4	1,926.4	545.7	0.28	1,433,447.6
2036	-	-	-	-	5,717.0	59,737.2	-	1,772.3	1,772.3	472.8	0.27	1,433,920.4
2037	-	-	-	-	5,259.6	54,237.3	-	1,630.5	1,630.5	409.6	0.25	1,434,330.1
2038	-	-	-	-	4,838.8	49,177.4	-	1,500.0	1,500.0	354.9	0.24	1,434,685.0
2039	-	-	-	-	4,451.7	44,522.3	-	1,380.0	1,380.0	307.5	0.22	1,434,992.4
2040	-	-	-	-	4,095.6	40,239.6	-	1,269.6	1,269.6	266.4	0.21	1,435,258.8
2041	-	-	-	-	3,767.9	36,299.5	-	1,168.1	1,168.1	230.8	0.20	1,435,489.6
2042	-	-	-	-	3,466.5	32,674.6	-	1,074.6	1,074.6	199.9	0.19	1,435,689.5
2043	-	-	-	-	3,189.2	29,339.7	-	988.6	988.6	173.2	0.18	1,435,862.8
2044	-	-	-	-	2,934.1	26,271.6	-	909.6	909.6	150.1	0.17	1,436,012.8
2045	-	-	-	-	2,699.3	23,449.0	-	836.8	836.8	130.0	0.16	1,436,142.9
2046	-	-	-	-	2,483.4	20,852.1	-	769.8	769.8	112.6	0.15	1,436,255.5
2047	-	-	-	-	2,284.7	18,463.0	-	708.3	708.3	97.6	0.14	1,436,353.1
2048	-	-	-	-	2,101.9	16,265.1	-	651.6	651.6	84.6	0.13	1,436,437.7
2049	-	-	-	-	1,933.8	14,242.9	-	599.5	599.5	73.3	0.12	1,436,510.9
2050	-	-	-	-	1,779.1	12,382.6	-	551.5	551.5	63.5	0.12	1,436,574.4
2051	-	-	-	-	1,636.8	10,671.1	-	507.4	507.4	55.0	0.11	1,436,629.4
2052	-	-	-	-	1,505.8	9,096.5	-	466.8	466.8	47.6	0.10	1,436,677.0
2053	-	-	-	-	1,385.3	7,647.8	-	429.5	429.5	41.3	0.10	1,436,718.3
2054	-	-	-	-	1,274.5	6,315.1	-	395.1	395.1	35.8	0.09	1,436,754.0
	-	**-**	**5,142,045.3**	**(395,256.8)**	**379,843.6**		**4,746,788.5**	**(1,476,282.5)**	**3,270,506.0**	**1,436,754.0**		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Refurbish Heater vs Avoided Repair and Replacement Energy Costs
Retube vs Avoided Repair and Replacement Energy Costs
Test 3
Test 4
Year

BEATON, TREVOR

From: Hartley, Richard
Sent: Monday, August 25, 2014 12:46 PM
To: FOX, RON
Subject: RE: RFP - 14-193 Heater Replacement Point Tupper

Ron,

We have reviewed our pricing internally and with our vendors. Because we value your business, we can pass on to you a reduction of [redacted]% for a selling price of $[redacted]. Let me know if this will work for you. If so, to hold this price, we need a letter of intent or PO by August 29, 2014. Thank you for this opportunity and we look forward to working with you.

Sincerely,

SPX
HEAT TRANSFER

Dick Hartley
Proposal Manager
SPX Heat Transfer LLC

2121 North 161st East Avenue
Tulsa OK 74116
TEL
FAX

www.spxheattransfer.com

BEATON, TREVOR

From:	GILLIS Archie M
Sent:	Thursday, October 25, 2012 10:22 AM
To:	MACLEOD, BRENT
Cc:	FRAPPIER Michel; LEBLANC Gerard L; MACDONNELL Gary A
Subject:	FW heater information

Brent,

Alstom Budgetary Offer for the removal & installation of the FW heater is [redacted]
.... [redacted]

NSPI would have look after the review of the building steel for the monorail, and insulation & lagging (including building).

"This response to your request for budget information gives a preliminary indication of the basis of which the scope of work described herein can be provided, and does not constitute a firm price, offer or commitment as to such scope. In particular, any prices, delivery times or performance figures provided in this response to your request for budget information is given without commitment and without regard to terms and conditions. This budget price has been prepared with only the minimum technical investigation to determine the feasibility of the requirements, if any, that your organization provided to ours. To this end, we look forward to discussing the content of this response to your request for budget information and, when appropriate, submitting a formal offer. At that time, we can review and comment to your organization's terms and conditions or we will reference our standard terms and conditions or a previously agreed upon set of terms with your organization that may be appropriate for this project. This letter forms an integral part of this budget information."

Regards,
Archie M. Gillis
Area Construction Manager – Atlantic Region
Thermal Power Thermal Services

:.________________

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CI Number: 46055

Title: LIN Coal Mill Refurbishment 2015

Start Date: 2015/05
In-Service Date: 2015/10
Final Cost Date: 2016/04
Function: Steam
Forecast Amount: $736,546

DESCRIPTION:

This project is to replace coal mill components that have reached the end of their useful life. Based on experienced wear characteristics, component failures will occur if a replacement plan is not performed. The consequence of such a failure could include unplanned unit derating. This capital item includes the replacement of welded steel rollers and tables with ceramic wear components, worm gear & shaft, vertical shaft and other non-repairable mill components. The scope of this project is to refurbish two of the sixteen mills with new ceramic tables and rollers. Components either to be replaced or refurbished will be decided based on the condition assessment when teardown is undertaken as part of the planned outage for each mill. Mills 1D (Unit 1) and 2C (Unit 2) are planned for refurbishment in 2014. Going forward, regular refurbishments of the Lingan mills will still be required to extend asset life and ensure the reliability of this equipment is maintained.

Summary of Related CIs (+/- 2 years):
2014 CI 44351 LIN Pulverizer Refurbishment $536,481
2013 CI 43166 LIN Mill Refurbishment $548,565
2016 CI TBD LIN Coal Mill Refurbishment $TBD
2017 CI TBD LIN Coal Mill Refurbishment $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

A failed mill could limit peak generation of a unit depending on the fuel blend in service. This makes it imperative that the mills are available and able to operate for extended lengths between scheduled outages. The replacement of mechanical components and the upgrading of the ceramics help to achieve this initiative.

Why do this project now?

A phased approach to upgrading the mills allows for scheduled outages of selected mills, reducing the risk of extended unplanned outages. By planning refurbishments in a given year, the refurbishment efforts can be made more efficiently, with dedicated labour and parts available as required.

Why do this project this way?

A total of sixteen coal mills are installed on the four units at Lingan. An orderly approach to mill refurbishment manages the availability of the assets and supports the operation of the generating units that they serve. Operating and maintenance experience with the mills has identified several areas of concern that need to be addressed in order for the mills to meet availability targets. Replacement parts are now needed due to age and wear on many of the components. During periods of lower load it is possible to take 1 of 4 mills out of service without affecting generation. Isolated repairs and minor refurbishment are not typically possible for the mills. To access components and complete the required equipment replacement, it is necessary to disassemble the mill and therefore an overall refurbishment versus isolated repairs is more effective.

CI Number : 46055 - LIN - Coal Mill Refurbishment 2015 **Project Number**

Parent CI Number : -

Cost Centre : 301 - 301-Lingan Admin./Common Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		7,270	0	7,270
095		095-Thermal & Hydro Contracts AO		896	0	896
095		095-Thermal Regular Labour AO		25,367	0	25,367
095		095-Thermal Term Labour AO		19,771	0	19,771
001	018	001 - THERMAL Regular Labour	018 - SGP - Fuel Hndlg.Coal	126,584	0	126,584
004	018	004 - THERMAL Term Labour	018 - SGP - Fuel Hndlg.Coal	98,658	0	98,658
012	018	012 - Materials	018 - SGP - Fuel Hndlg.Coal	448,000	0	448,000
013	018	013 - POWER PRODUCTION Contracts	018 - SGP - Fuel Hndlg.Coal	10,000	0	10,000
			Total Cost:	736,546	0	736,546
			Original Cost:	539,022		

Capital Project Detailed Estimate

Location: **Lingan Generating Station**
CI# / FP#: 46055
Title: LIN Mill Refurbishment 2015
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Maintenance Trades	PD	300	$ 352	$ 105,704.64		43166, 44351
Utilityworker	PD	90	$ 232	$ 20,879.10		43166, 44351
			Sub-Total	$ 126,583.74		
004 Term Labour						
Maintenance Trades	PD	280	$ 352	$ 98,658.00		43166, 44351
				$ -		
				$ -		
			Sub-Total	$ 98,658.00		
012 Materials						
OEM and Locally Manufactured Parts	Lot	1	$ 448,000	$ 448,000.00		43166, 44351
				$ -		
				$ -		
			Sub-Total	$ 448,000.00		
013 Contracts						
Misc. Machining	Lot	1	$ 10,000	$ 10,000.00		
			Sub-Total	$ 10,000.00		
094 Interest Capitalized						
AFUDC				$ 7,269.96		
				$ -		
			Sub-Total	$ 7,269.96		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 25,367.38		
Thermal Term Labour AO				$ 19,771.06		
Thermal / Hydro Contracts AO				$ 896.00		
			Sub-Total	$ 46,034.44		
			SUB-TOTAL (no AO, AFUDC)	$ 683,241.74		
			TOTAL (AO, AFUDC included)	$ 736,546.14		
Original Cost				$ 539,022.36		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN - Mill Refurbishment 2015
Summary of Alternatives

Division :	Power Production		**Date :**	**24-Oct-14**
Department :	Lingan		**CI Number:**	46055
Originator :			**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Mill Refurbishment vs. Avoided Repair a	6.19%	-453,968	288,999	1	22.00%	3.4 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to refurbish the mills as opposed to run to failure.

Notes/Comments :

Mill Refurbishment vs. Avoided Repair and Replacement Energy Costs

Failure scenario is loss of a Mill during peak unit load. With current coal blends (Low sulf., low BTU) , all four Mills are required for peak load. A derate of approx 20 MW is expected if a Mill is not available. A significant Mill repair, including material lead time, is 2 - 4 weeks. This scenario assumes the Mill is unavailable for 4 weeks due to teardown and materials lead time.

Test 2

Test 3

Test 4

LIN - Mill Refurbishment 2015
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**24-Oct-14**
Department :	Lingan	**CI Number:**	46055
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Refurbishment vs. Avoided Repair and Repla(	6.19%	-453,968	288,999	1	22.00%	3.4 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Refurbishment vs. Avoided Repair and Repla(	10%	-383,955	235,526	1	17.77%	3.6 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years
	Change:	**A**	70,013	-53,473	0	-4.23%	0.2 years
		B	0	0	0	#NUM!	0.0 years
		C	0	0	0	#NUM!	0.0 years
		D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Refurbishment vs. Avoided Repair and Repla(	-10%	-338,558	206,626	1	17.35%	3.6 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years
	Change:	**A**	115,410	-82,373	0	-4.65%	0.3 years
		B	0	0	0	#NUM!	0.0 years
		C	0	0	0	#NUM!	0.0 years
		D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	112,780	273,560	455,761	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN - Mill Refurbishment 2015
Avoided Cost Calculations

Division :	Power Production	Date :	24-Oct-14
Department :	Lingan	CI Number:	46055
Originator :		Project No. :	

Mill Refurbishment vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			159,544	175,235		
Events/Outages (#)	2	2	2	2		
Probability of Occurance (%)	30%	50%	30%	50%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	20	20				
Duration (Hours)	672	672				
Totals	$25,196	$35,906	$95,726	$175,235	$120,922	$211,141
Total Capital Cost of Alternative						$736,546

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

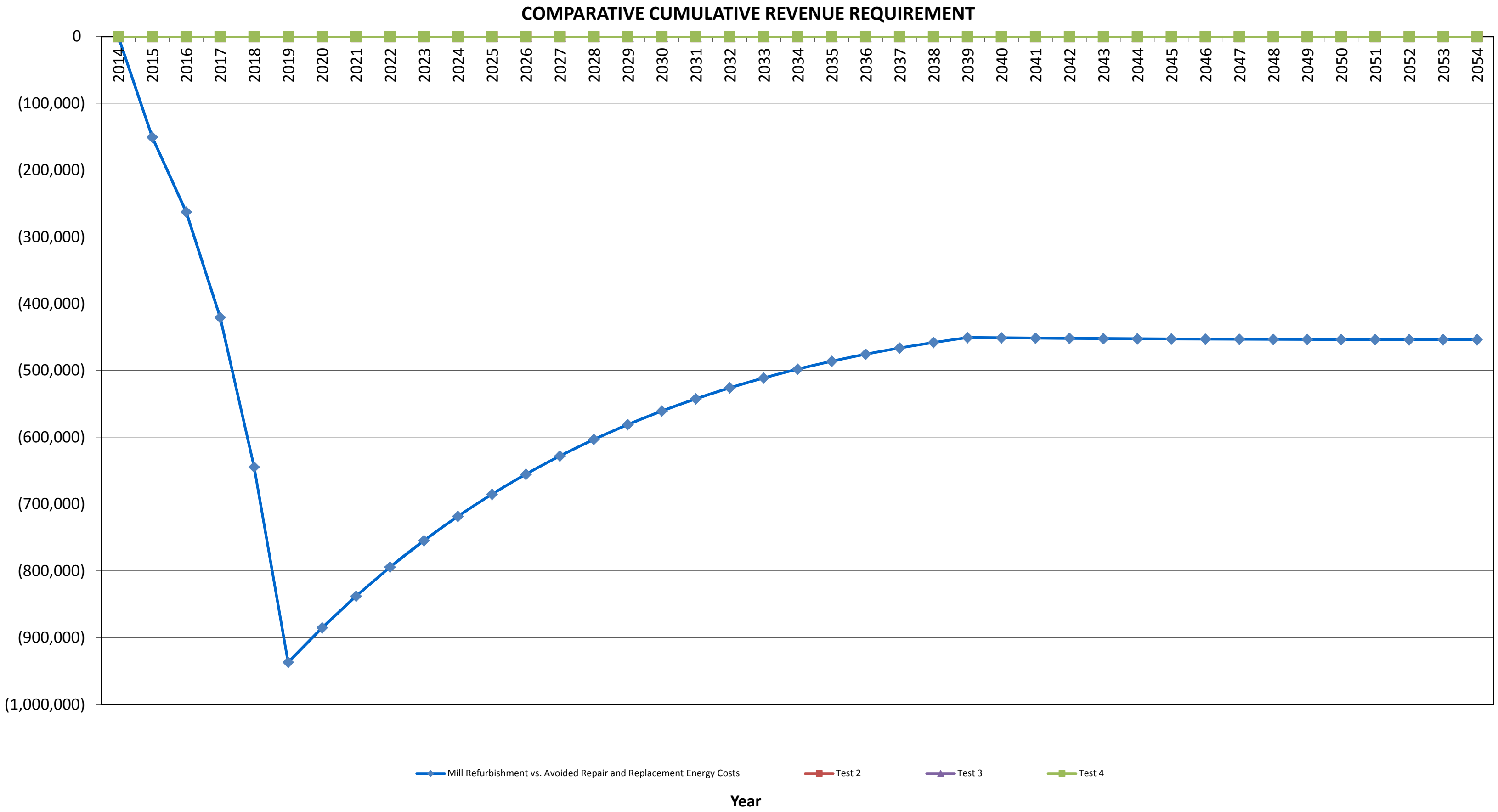
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN - Mill Refurbishment 2015
Mill Refurbishment vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	120,922.5	(690,512.0)	27,329.7	668,617.7	(569,589.5)	(29,013.8)	(598,603.3)	(563,709.6)	0.94	(563,709.6)
2016	-	-	211,140.9	-	52,473.0	614,023.5	211,140.9	(49,187.1)	161,953.9	143,623.0	0.89	(420,086.6)
2017	-	-	276,099.1	-	48,275.1	563,796.8	276,099.1	(70,625.4)	205,473.7	171,595.3	0.84	(248,491.4)
2018	-	-	376,668.1	-	44,413.1	517,588.2	376,668.1	(102,999.0)	273,669.0	215,224.2	0.79	(33,267.1)
2019	-	-	494,053.1	-	40,860.1	475,076.3	494,053.1	(140,489.8)	353,563.2	261,847.8	0.74	228,580.7
2020	-	-	-	-	37,591.3	435,965.4	-	11,653.3	11,653.3	8,127.3	0.70	236,708.0
2021	-	-	-	-	34,584.0	399,983.4	-	10,721.0	10,721.0	7,041.3	0.66	243,749.3
2022	-	-	-	-	31,817.3	366,879.9	-	9,863.3	9,863.3	6,100.4	0.62	249,849.7
2023	-	-	-	-	29,271.9	336,424.7	-	9,074.3	9,074.3	5,285.2	0.58	255,134.9
2024	-	-	-	-	26,930.1	308,405.9	-	8,348.3	8,348.3	4,578.9	0.55	259,713.8
2025	-	-	-	-	24,775.7	282,628.6	-	7,680.5	7,680.5	3,967.1	0.52	263,680.8
2026	-	-	-	-	22,793.7	258,913.5	-	7,066.0	7,066.0	3,436.9	0.49	267,117.8
2027	-	-	-	-	20,970.2	237,095.6	-	6,500.8	6,500.8	2,977.7	0.46	270,095.5
2028	-	-	-	-	19,292.6	217,023.1	-	5,980.7	5,980.7	2,579.8	0.43	272,675.2
2029	-	-	-	-	17,749.1	198,556.5	-	5,502.2	5,502.2	2,235.0	0.41	274,910.3
2030	-	-	-	-	16,329.2	181,567.1	-	5,062.1	5,062.1	1,936.4	0.38	276,846.6
2031	-	-	-	-	15,022.9	165,937.0	-	4,657.1	4,657.1	1,677.6	0.36	278,524.3
2032	-	-	-	-	13,821.0	151,557.2	-	4,284.5	4,284.5	1,453.4	0.34	279,977.7
2033	-	-	-	-	12,715.4	138,327.8	-	3,941.8	3,941.8	1,259.2	0.32	281,236.9
2034	-	-	-	-	11,698.1	126,156.7	-	3,626.4	3,626.4	1,091.0	0.30	282,327.9
2035	-	-	-	-	10,762.3	114,959.4	-	3,336.3	3,336.3	945.2	0.28	283,273.0
2036	-	-	-	-	9,901.3	104,657.8	-	3,069.4	3,069.4	818.9	0.27	284,091.9
2037	-	-	-	-	9,109.2	95,180.4	-	2,823.9	2,823.9	709.4	0.25	284,801.3
2038	-	-	-	-	8,380.5	86,461.1	-	2,597.9	2,597.9	614.6	0.24	285,416.0
2039	-	-	-	-	7,710.0	78,439.4	-	2,390.1	2,390.1	532.5	0.22	285,948.5
2040	-	-	-	-	7,093.2	71,059.5	-	2,198.9	2,198.9	461.4	0.21	286,409.9
2041	-	-	-	-	6,525.8	64,269.9	-	2,023.0	2,023.0	399.7	0.20	286,809.6
2042	-	-	-	-	6,003.7	58,023.5	-	1,861.1	1,861.1	346.3	0.19	287,155.8
2043	-	-	-	-	5,523.4	52,276.8	-	1,712.3	1,712.3	300.0	0.18	287,455.9
2044	-	-	-	-	5,081.5	46,989.8	-	1,575.3	1,575.3	259.9	0.17	287,715.8
2045	-	-	-	-	4,675.0	42,125.8	-	1,449.3	1,449.3	225.2	0.16	287,941.0
2046	-	-	-	-	4,301.0	37,650.9	-	1,333.3	1,333.3	195.1	0.15	288,136.1
2047	-	-	-	-	3,956.9	33,534.1	-	1,226.6	1,226.6	169.0	0.14	288,305.1
2048	-	-	-	-	3,640.4	29,746.5	-	1,128.5	1,128.5	146.4	0.13	288,451.5
2049	-	-	-	-	3,349.1	26,262.0	-	1,038.2	1,038.2	126.9	0.12	288,578.4
2050	-	-	-	-	3,081.2	23,056.2	-	955.2	955.2	109.9	0.12	288,688.3
2051	-	-	-	-	2,834.7	20,106.9	-	878.8	878.8	95.2	0.11	288,783.6
2052	-	-	-	-	2,607.9	17,393.5	-	808.5	808.5	82.5	0.10	288,866.1
2053	-	-	-	-	2,399.3	14,897.2	-	743.8	743.8	71.5	0.10	288,937.6
2054	-	-	-	-	2,207.4	12,600.6	-	684.3	684.3	61.9	0.09	288,999.5
Total	**-**	**-**	**1,478,883.6**	**(690,512.0)**	**657,857.4**		**788,371.6**	**(254,518.1)**	**533,853.5**	**288,999.5**		



COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(100,000)
(200,000)
(300,000)
(400,000)
(500,000)
(600,000)
(700,000)
(800,000)
(900,000)
(1,000,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Mill Refurbishment vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46301

Title: TRE6 6A & 6B Mill Refurbishments

Start Date: 2015/04
In-Service Date: 2015/10
Final Cost Date: 2016/04
Function: Steam
Forecast Amount: $665,045

DESCRIPTION:

This project will allow for the refurbishment of two coal mills on Unit 6 at the Trenton Generating Station. Unit 6 utilizes two Foster Wheeler D-10 Ball Mill Coal Pulverizers (6A & 6B) to prepare the coal for combustion in the boiler. These mills were originally installed and commissioned in 1991 and have been subjected to continuous use since this time, with the exception of shutdowns. Each mill supports 50 percent of the unit output requiring both mills in service for the unit to make full rated output.

Refurbishments for these mills are planned every two years to coincide with planned outages. These mills were last refurbished in early 2013; therefore, completing refurbishments during the 2015 planned outage is important with regards to unit reliability until the next planned outage.

Scope for this project includes the following:

- Replace raw coal pipes
- Replace trunion bearing seals
- Replace ribbon conveyors and bearings
- Replace grinding media

Summary of Related CIs (+/- 2 years):
2013 CI 38163 TRE6 U&U Pulverizer Refurbishment $707,081
2017 CI TBD TRE6 Mill Refurbishments $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

The plant requires a high degree of mill efficiency and availability to generate electricity. Coal pulverizer operation presents severe duty to many of the equipment components and a number of initiatives have been undertaken to extend component life, reduce mill forced outages, maximize mill availability, and extend running hours between overhauls. This project, similar to previous mill refurbishment projects, focuses on employing experience gained in mill maintenance practices to improve the performance of the raw coal supply system to each mill, as well as extend the reliability of mill rotating elements, and associated components.

Why do this project now?

The 2015 Unit 6 planned outage is a six-week shutdown, and will provide the ideal timeframe to complete the aforementioned refurbishment of both mills in a planned and cost effective manner. If not completed now, reliability of the mills will be lessened and unit production and capacity could be affected.

Why do this project this way?

Replacement parts are now required due to age and wear on many of the mill components. Refurbishment of these components is not an option due to the age and wear. Re-establishing the Original Equipment Manufacturer (OEM) physical specifications and the replacement of worn components will prevent degradation in mill and Unit performance.

CI Number : 46301 - TRE6 6A 6B Mills Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 345 - 345-Trenton unit 6 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		4,966	0	4,966
095		095-Thermal Regular Labour AO		19,567	0	19,567
095		095-Thermal Term Labour AO		19,271	0	19,271
095		095-Thermal Overtime Labour AO		7,026	0	7,026
095		095-Thermal & Hydro Contracts AO		5,869	0	5,869
001	013	001 - THERMAL Regular Labour	013 - SGP - Boiler	87,850	0	87,850
002	013	002 - THERMAL Overtime Labour	013 - SGP - Boiler	70,121	0	70,121
004	013	004 - THERMAL Term Labour	013 - SGP - Boiler	96,164	0	96,164
012	013	012 - Materials	013 - SGP - Boiler	224,000	0	224,000
013	013	013 - POWER PRODUCTION Contracts	013 - SGP - Boiler	65,500	0	65,500
066	013	066 - Other Goods & Services	013 - SGP - Boiler	43,425	0	43,425
028	085	028 - Consulting	085 Design	10,000	0	10,000
001	087	001 - THERMAL Regular Labour	087 Field Super.& Ops.	9,787	0	9,787
011	087	011 - Travel Expense	087 Field Super.& Ops.	1,000	0	1,000
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	500	0	500
			Total Cost:	665,045	0	665,045
			Original Cost:	536,976		

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# / FP#: CI 46301
Title: TRE6 6A 6B Mill Refurbishments
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Mechanical	PD	200	$ 352	$ 70,470.00		38163
Utility	PD	60	$ 232	$ 13,919.40		
Electrical/Instrumentation	PD	10	$ 346	$ 3,460.70		
Internal Supervision	PD	25	$ 391	$ 9,787.25		
			Sub-Total	$ 97,637.35		
002 OT Labour						
Mechanical	PD	60	$ 705	$ 42,282.00		
Utility	PD	60	$ 464	$ 27,838.80		
				$ -		
			Sub-Total	$ 70,120.80		
004 Term Labour						
Mechanical	PD	240	$ 352	$ 84,564.00		
Utility	PD	50	$ 232	$ 11,599.50		
				$ -		
			Sub-Total	$ 96,163.50		
011 Travel Expense						
Travel	lot	1	$ 1,000.00	$ 1,000.00		
			Sub-Total	$ 1,000.00		
012 Materials						
Ribbon Conveyors	ea	4	$ 18,500.00	$ 74,000.00		
Grinding Media (Balls)	lot	1	$ 60,000.00	$ 60,000.00		
Trunion Bearing Seals	lot	1	$ 12,000.00	$ 12,000.00		
Ribbon Conveyor Bearings	lot	1	$ 13,000.00	$ 13,000.00		
Trunion Plates/Fabrication	lot	1	$ 28,000.00	$ 28,000.00		
Plate	lot	1	$ 4,000.00	$ 4,000.00		
Spokes	lot	1	$ 8,000.00	$ 8,000.00		
Fire Sprinklers	lot	1	$ 5,000.00	$ 5,000.00		
Consumables	lot	1	$ 20,000.00	$ 20,000.00		
			Sub-Total	$ 224,000.00		
013 Contracts						
Ball Sorter Rental	lot	1	$ 6,500.00	$ 6,500.00		
Forklift Rental	lot	1	$ 7,000.00	$ 7,000.00		
Vacuum Services	lot	1	$ 30,000.00	$ 30,000.00		
Freight	lot	1	$ 20,000.00	$ 20,000.00		
Boom Truck Rental	lot	1	$ 2,000.00	$ 2,000.00		
			Sub-Total	$ 65,500.00		
028 Consulting						
Tech Support (Engineering)	lot	1	$ 10,000.00	$ 10,000.00		
			Sub-Total	$ 10,000.00		
041 Meals & Entertainment						
Meals	lot	1	$ 500.00	$ 500.00		
			Sub-Total	$ 500.00		
066 Other Goods & Services						
Contingency on Materials / Contracts	%	15%	$ 289,500.00	$ 43,425.00		
			Sub-Total	$ 43,425.00		
094 Interest Capitalized						
AFUDC	lot	1	$ 4,965.97	$ 4,965.97		
			Sub-Total	$ 4,965.97		
095 Administrative Overhead						
Thermal Reg. Labour AO	lot	1	18619.44	$ 19,566.52		
Thermal OT Labour AO	lot	1	6686.02	$ 7,026.10		
Thermal Term Labour AO	lot	1	18338.38	$ 19,271.17		
Thermal Contracts AO	lot	1	7359.25	$ 5,868.80		
			Sub-Total	$ 51,732.59		
			SUB-TOTAL (no AO, AFUDC)	$ 608,346.65		
			TOTAL (AO, AFUDC included)	$ 665,045.21		
Original Cost				$ 536,976		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

TRE6 6A 6B Mill Refurbishment
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46301
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Mill Refurbishment vs Avoided Repair a	6.19%	-2,810,767	1,957,654	1	386.06%	1.3 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommended to fund this project to perform Unit 6 mill refurbishments. Work can be completed during the planned outage, therefore avoiding unplanned replacement energy costs associated with an unplanned outage. This decision is backed by economic analysis data.

Notes/Comments :

Mill Refurbishment vs Avoided Repair and Repalcement Energy Costs

This option considers the cost of refurbishing the milll versus the replacement energy costs if refurbishments aren't completed. Avoided replacement energy costs were calculated assuming that there would be a 50% chance (per unit) of an unplanned outage within 2015 to perform repairs if the refurbishments were not completed at this time. The likelihood of failure increases to 75% in 2016 and 100% in 2017. An unavailable Unit 6 pulverizer results in an average 70MW derating of the unit.

Test 2

Test 3

Test 4

TRE6 6A 6B Mill Refurbishment
Summary of Sensitivities

Nova Scotia POWE An Emera Compa

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46301
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Refurbishment vs Avoided Repair and Repalc	6.19%	-2,810,767	1,957,654	1	386.06%	1.3 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Refurbishment vs Avoided Repair and Repalc	10%	-2,747,279	1,910,184	1	315.14%	1.3 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change: **A**	63,487	-47,470	0	-70.92%	0.1 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Refurbishment vs Avoided Repair and Repalc	-10%	-2,466,202	1,714,419	1	308.73%	1.3 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change: **A**	344,564	-243,235	0	-77.33%	0.1 years
B	0	0	0	#NUM!	0.0 years
C	0	0	0	#NUM!	0.0 years
D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	440,435	1,739,777	3,383,210	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

TRE6 6A 6B Mill Refurbishment
Avoided Cost Calculations

Division :	Power Production	**Date :**	**23-Oct-14**
Department :	Trenton Generating Station	**CI Number:**	46301
Originator :		**Project No. :**	

Mill Refurbishment vs Avoided Repair and Repalcement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**233,000**	**242,363**		
Events/Outages (#)	**1**	**2**	**1**	**2**		
Probability of Occurance (%)	**50%**	**75%**	**50%**	**75%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**70**	**70**				
Duration (Hours)	**840**	**840**				
Totals	**$355,734**	**$1,155,441**	**$116,500**	**$363,545**	**$472,234**	**$1,518,986**

Total Capital Cost of Alternative	**$665,045**

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Total Capital Cost of Alternative	**$0**

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Total Capital Cost of Alternative	**$0**

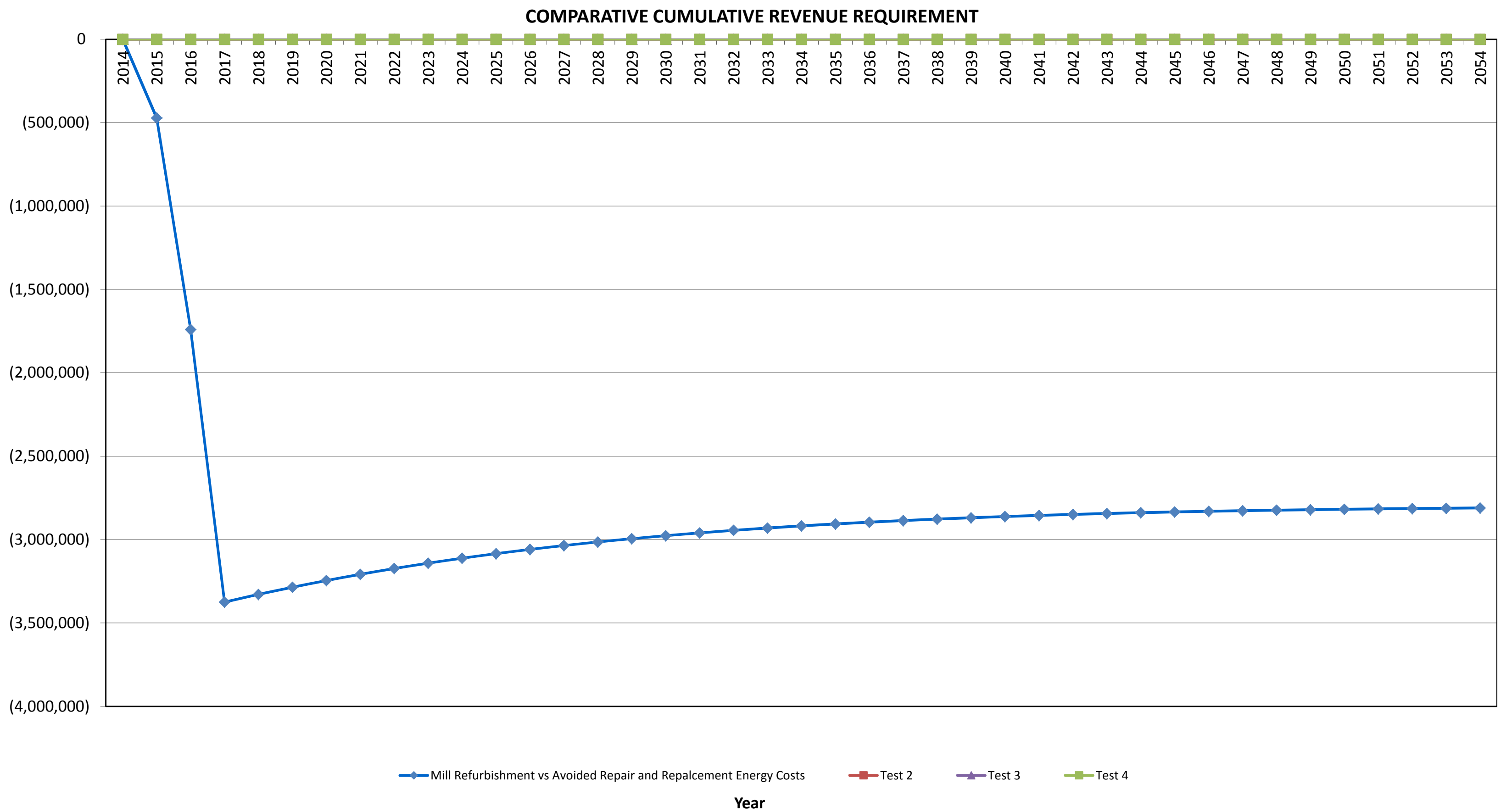
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**

Total Capital Cost of Alternative	**$0**

TRE6 6A 6B Mill Refurbishment
Mill Refurbishment vs Avoided Repair and Repalcement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	472,234.2	(613,312.6)	24,333.9	598,291.0	(141,078.4)	(138,849.1)	(279,927.5)	(263,610.1)	0.94	(263,610.1)
2016	-	-	1,518,985.9	-	46,721.0	549,186.1	1,518,985.9	(456,402.1)	1,062,583.8	942,314.6	0.89	678,704.6
2017	-	-	2,075,605.2	-	42,983.3	504,009.6	2,075,605.2	(630,112.8)	1,445,492.4	1,207,160.3	0.84	1,885,864.9
2018	-	-	-	-	39,544.7	462,447.3	-	12,258.8	12,258.8	9,640.8	0.79	1,895,505.7
2019	-	-	-	-	36,381.1	424,209.9	-	11,278.1	11,278.1	8,352.6	0.74	1,903,858.3
2020	-	-	-	-	33,470.6	389,031.6	-	10,375.9	10,375.9	7,236.4	0.70	1,911,094.7
2021	-	-	-	-	30,793.0	356,667.4	-	9,545.8	9,545.8	6,269.4	0.66	1,917,364.2
2022	-	-	-	-	28,329.5	326,892.5	-	8,782.2	8,782.2	5,431.7	0.62	1,922,795.8
2023	-	-	-	-	26,063.2	299,499.5	-	8,079.6	8,079.6	4,705.8	0.58	1,927,501.6
2024	-	-	-	-	23,978.1	274,297.9	-	7,433.2	7,433.2	4,077.0	0.55	1,931,578.6
2025	-	-	-	-	22,059.9	251,112.5	-	6,838.6	6,838.6	3,532.2	0.52	1,935,110.8
2026	-	-	-	-	20,295.1	229,781.9	-	6,291.5	6,291.5	3,060.2	0.49	1,938,171.0
2027	-	-	-	-	18,671.5	210,157.8	-	5,788.2	5,788.2	2,651.3	0.46	1,940,822.3
2028	-	-	-	-	17,177.7	192,103.6	-	5,325.1	5,325.1	2,297.0	0.43	1,943,119.3
2029	-	-	-	-	15,803.5	175,493.7	-	4,899.1	4,899.1	1,990.0	0.41	1,945,109.3
2030	-	-	-	-	14,539.2	160,212.6	-	4,507.2	4,507.2	1,724.1	0.38	1,946,833.4
2031	-	-	-	-	13,376.1	146,154.1	-	4,146.6	4,146.6	1,493.7	0.36	1,948,327.1
2032	-	-	-	-	12,306.0	133,220.1	-	3,814.9	3,814.9	1,294.1	0.34	1,949,621.3
2033	-	-	-	-	11,321.5	121,321.0	-	3,509.7	3,509.7	1,121.2	0.32	1,950,742.4
2034	-	-	-	-	10,415.8	110,373.7	-	3,228.9	3,228.9	971.4	0.30	1,951,713.8
2035	-	-	-	-	9,582.5	100,302.2	-	2,970.6	2,970.6	841.6	0.28	1,952,555.4
2036	-	-	-	-	8,815.9	91,036.5	-	2,732.9	2,732.9	729.1	0.27	1,953,284.5
2037	-	-	-	-	8,110.7	82,512.0	-	2,514.3	2,514.3	631.7	0.25	1,953,916.2
2038	-	-	-	-	7,461.8	74,669.4	-	2,313.2	2,313.2	547.3	0.24	1,954,463.4
2039	-	-	-	-	6,864.9	67,454.3	-	2,128.1	2,128.1	474.1	0.22	1,954,937.6
2040	-	-	-	-	6,315.7	60,816.4	-	1,957.9	1,957.9	410.8	0.21	1,955,348.3
2041	-	-	-	-	5,810.4	54,709.5	-	1,801.2	1,801.2	355.9	0.20	1,955,704.2
2042	-	-	-	-	5,345.6	49,091.1	-	1,657.1	1,657.1	308.3	0.19	1,956,012.6
2043	-	-	-	-	4,917.9	43,922.3	-	1,524.6	1,524.6	267.1	0.18	1,956,279.7
2044	-	-	-	-	4,524.5	39,166.9	-	1,402.6	1,402.6	231.4	0.17	1,956,511.1
2045	-	-	-	-	4,162.5	34,792.0	-	1,290.4	1,290.4	200.5	0.16	1,956,711.6
2046	-	-	-	-	3,829.5	30,767.0	-	1,187.2	1,187.2	173.7	0.15	1,956,885.3
2047	-	-	-	-	3,523.2	27,064.1	-	1,092.2	1,092.2	150.5	0.14	1,957,035.8
2048	-	-	-	-	3,241.3	23,657.4	-	1,004.8	1,004.8	130.4	0.13	1,957,166.2
2049	-	-	-	-	2,982.0	20,523.2	-	924.4	924.4	113.0	0.12	1,957,279.2
2050	-	-	-	-	2,743.5	17,639.8	-	850.5	850.5	97.9	0.12	1,957,377.1
2051	-	-	-	-	2,524.0	14,987.0	-	782.4	782.4	84.8	0.11	1,957,461.9
2052	-	-	-	-	2,322.1	12,546.5	-	719.8	719.8	73.5	0.10	1,957,535.3
2053	-	-	-	-	2,136.3	10,301.2	-	662.3	662.3	63.6	0.10	1,957,599.0
2054	-	-	-	-	1,965.4	8,235.5	-	609.3	609.3	55.1	0.09	1,957,654.1
Total	**-**	**-**	**4,066,825.3**	**(613,312.6)**	**585,744.6**		**3,453,512.6**	**(1,079,135.0)**	**2,374,377.6**	**1,957,654.1**		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0
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Mill Refurbishment vs Avoided Repair and Repalcement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46392

Title: POT – Plant Siding Replacement

Start Date:	2015/08
In-Service Date:	2015/09
Final Cost Date:	2016/04
Function:	Steam
Forecast Amount:	$547,659

DESCRIPTION:

As part of life cycle management at the Point Tupper Generating Station, the condition of buildings, pipe bridges, walkways, and other structural components are regularly assessed. Several areas of the plant's siding have been identified as requiring replacement.

This project includes replacement of Galbestos plant siding, fasteners, and structural components at the site. Galbestos is an asbestos containing siding product that was used extensively in the industry before the occupational hazards of asbestos were understood. The Galbestos siding has deteriorated to the point that the asbestos in the siding coating may become loose and become a health hazard. This project is intended to address that concern before it occurs. The Water Treatment Plant Siding project (CI 44590) in 2014 replaced approximately 50 percent of the siding. This project will see the remaining siding replaced as well as the siding on the CW pumphouse.

Summary of Related CIs (+/- 2 years):
2013 – 40256 POT Plant Siding Replacement $355,134
2014 – 44590 POT Water Treatment Plant Siding $382,406

JUSTIFICATION:

Justification Criteria: Health & Safety

Sub Criteria: Buildings

Why do this project?

Replacing the siding will mitigate the risk of further deterioration of the siding resulting in asbestos fibres being replaced and prevent separation from the building structure. Replacing the siding will also ensure the building envelope is adequately sealed, prevent premature damage to the building's interior structural components and ensure equipment inside the plant is protected.

Why do this project now?

The siding to be replaced under this project has reached the end of its useful life and must be replaced. The water treatment plant siding is 46 years old and the CW pumphouse siding is 28 years old. Further deterioration could result in asbestos fibres being released. Minor repairs have been completed in recent years, but the degree of deterioration of both the siding and some of the support structure no longer allows for repairs to be completed.

Why do this project this way?

Replacing the siding is economically feasible and the most practical solution to preserving the building structure. The removal of Galbestos siding is treated as an outdoor asbestos remediation.

CI Number : 46392 - POT - Plant Siding Replacement **Project Number**

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal & Hydro Contracts AO		36,079	0	36,079
095		095-Thermal Regular Labour AO		568	0	568
001	003	001 - THERMAL Regular Labour	003 - SGP - Bldg.,Struct.Grnd.	2,834	0	2,834
012	003	012 - Materials	003 - SGP - Bldg.,Struct.Grnd.	104,507	0	104,507
013	003	013 - POWER PRODUCTION Contracts	003 - SGP - Bldg.,Struct.Grnd.	402,671	0	402,671
011	085	011 - Travel Expense	085 Design	500	0	500
041	085	041 - Meals & Entertainment	085 Design	500	0	500
			Total Cost:	547,659	0	547,659
			Original Cost:	39,353		

Capital Project Detailed Estimate

Location: Pt. Tupper
CI# / FP#: 46392
Title: POT Plant Siding Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	5	$ 339.28	$ 1,696.40		
Utilityworker	PD	5	$ 227.44	$ 1,137.20		
			Sub-Total	$ 2,833.60		
011 Travel Expense						
Travel	lot	1	$ 500.00	$ 500.00		
				$ -		
			Sub-Total	$ 500.00		
012 Materials						
Water Treatment Plant Siding	lot	1	$ 62,510.47	$ 62,510.47		44590
CW Pump House	lot	1	[redacted]	[redacted]	Cost Support Item #1 - Chlorine Line Materials	
Misc. and consumables	lot	1	[redacted]	[redacted]		
				$ -		
			Sub-Total	$ 104,507.27		
013 Contracts						
Water Treatment Plant Siding Replacement	lot	1	[redacted]	[redacted]		44590
CW Pump House Replacement	lot	1	[redacted]	[redacted]	Cost Support Item #1 - Chlorine Line Labour	
			Sub-Total	$ 402,671.00		
041 Meals & Entertainment						
Meals and expenses	lot	1	$ 500.00	$ 500.00		
				$ -		
			Sub-Total	$ 500.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 567.86		
Thermal / Hydro Contracts AO				$ 36,079.32		
			Sub-Total	$ 36,647.18		
			SUB-TOTAL (no AO, AFUDC)	$ 511,011.87		
			TOTAL (AO, AFUDC included)	$ 547,659.05		
Original Cost				$ 39,353.29		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

BEATON, TREVOR

From: Kevin Sampson
Sent: Friday, August 09, 2013 10:45 AM
To: MACLEOD, BRENT
Cc: 'Paul Decoste'; 'Greg Mombourquette'
Subject: WTP and CW pumphouse

Hi Brent, Here you go. Thanks

	Materials Sub Total	Labour Sub Total	Equipment Sub Total	Total
Water Treat	$ [redacted]	$ [redacted]	$ [redacted]	
Chorine	$ [redacted]	$ [redacted]	$ [redacted]	
	$ [redacted]	$ [redacted]	$ [redacted]	$ [redacted]

From: MACLEOD, BRENT
Sent: August-08-13 8:12 AM
To: Kevin Sampson
Cc: 'Paul Decoste'; 'Greg Mombourquette'
Subject: RE: Budget Pump House

Please separate the two buildings and also separate labour and materials. Thank you.

CI Number: 46058

Title: LIN Coal Plant Structural Refurbishment – Phase 1

Start Date:	2015/05
In-Service Date:	2015/10
Final Cost Date:	2016/04
Function:	Steam
Forecast Amount:	$516,818

DESCRIPTION:

This project is for the refurbishment of the structural system in the Lingan coal reclaim. Lingan Generating Station has extensive coal handling facilities moving on average more than two million tonnes per year. Extending from the rotary rail car dumper though the stacker, coal reclaims, crushers, and conveyor systems, the coal handling system is supported by structural steel components installed in the mid-1970s. This project will be part of a program approach, expected over a three year period, to refurbish the coal system structural steel at Lingan. Phase 1 will be focused on the coal system conveyor support structures mainly in coal reclaim (D belts), and the B belt which travels outside along the coal pile

Summary of Related CIs (+/- 2 years):
2016 CI TBD LIN Coal Plant Structural Refurbishment – Phase 2 $TBD
2017 CI TBD LIN Coal Plant Structural Refurbishment – Phase 3 $TBD

JUSTIFICATION:

Justification Criteria: Health & Safety

Sub Criteria: Maintenance

Why do this project?

Coal must be delivered into the Lingan Plant through a coal conveyor system. An integral part of the conveyor system is the support structure and roller support system. Due to the corrosive nature of the coal and the high humidity conditions which exist in the conveyor system galleries, the support structure suffers corrosive damage over time. The conveyor support structure must be in maintained in design condition in order to allow safe operation coal handling equipment and reliable performance of the generating units at Lingan.

Why do this project now?

The conveyor support structure must be refurbished to meet the expected service requirements. In order to maintain safe operation of the coal system and reliable supply of coal to the generating units, this project needs to be undertaken now.

Why do this project this way?

Refurbishment of the support structure is the only option to allow coal supply to the plant to continue, while completing the work on the non-hoisting or opposite shifts. Phase 1 of this project will inform NS Power as to the scope and schedule of the subsequent phases of this project.

CI Number : 46058 - LIN Coal Plant Structural Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 301 - 301-Lingan Admin./Common Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		5,438	0	5,438
095		095-Thermal Regular Labour AO		28,069	0	28,069
095		095-Thermal Term Labour AO		28,244	0	28,244
001	018	001 - THERMAL Regular Labour	018 - SGP - Fuel Hndlg.Coal	140,066	0	140,066
004	018	004 - THERMAL Term Labour	018 - SGP - Fuel Hndlg.Coal	140,940	0	140,940
012	018	012 - Materials	018 - SGP - Fuel Hndlg.Coal	174,060	0	174,060
			Total Cost:	516,818	0	516,818
			Original Cost:	124,358		

Capital Project Detailed Estimate

Location: **Lingan Generating Station**
CI# / FP#: 46058
Title: LIN Coal System Structural Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Maintenance Trades	PD	200	$ 352	$ 70,469.76		
Utilityworker	PD	300	$ 232	$ 69,596.64		
				$ -		
			Sub-Total	$ 140,066.40		
004 Term Labour						
Maintenance Trades	PD	400	$ 352	$ 140,939.52		
				$ -		
				$ -		
			Sub-Total	$ 140,939.52		
012 Materials						
Structural Steel	ea	1	$ 50,000	$ 50,000.00		
Troughing Roller	ea	900	$ 54	$ 48,960.00		
Trough Roller Support	ea	300	$ 217	$ 65,100.00		
Miscellaneous Consumables	ea	1	$ 10,000	$ 10,000.00		
				$ -		
				$ -		
			Sub-Total	$ 174,060.00		
094 Interest Capitalized						
AFUDC				$ 5,438.11		
				$ -		
			Sub-Total	$ 5,438.11		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 28,069.31		
Thermal Term Labour AO				$ 28,244.28		
			Sub-Total	$ 56,313.59		
			SUB-TOTAL (no AO, AFUDC)	$ 455,065.92		
			TOTAL (AO, AFUDC included)	$ 516,817.62		
Original Cost				$ 124,357.57		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46395

Title: TRE5 Baghouse Filter Replacements

Start Date:	2015/05
In-Service Date:	2015/10
Final Cost Date:	2016/04
Function:	Steam
Forecast Amount:	$489,517

DESCRIPTION:

The Trenton Unit 5 baghouse was constructed and commissioned in 2009. The baghouse consists of eight modules, each containing 493 filter bags, for a total of 3944 filter bags. The filter bags have a finite life of approximately five to six years and are now reaching the end of their useful life, and must be replaced. The original plan for replacements was to replace filter bags over a three-year phased approach. In 2014, upon disassembly, the filter bags were found to be in deteriorated condition. Approximately half the filter bags were replaced at that time. Based on the condition of the filter bags, the decision has been made to address the remainder of the bag replacements in 2015.

Summary of Related CIs (+/- 2 years):
2014 CI 44725 TRE5 Baghouse Filter Replacements $420,975

JUSTIFICATION:

Justification Criteria: Environment

Criteria: Equipment Replacement

Why do this project?

The baghouse is used in series with an electrostatic precipitator to remove fly ash and other particulate from the boiler flue gas prior to release to the atmosphere, thus reducing the amount of particulate and mercury emissions. Testing that has been completed by the baghouse Original Equipment Manufacturer (OEM) on samples of bags provided by NS Power, are showing that the bags are aging as expected. The OEM is recommending that bags be replaced prior to end of life to allow the baghouse to remain operational.

Why do this project now?

This project must be executed in order to allow the baghouse to remain operational. The baghouse is required equipment in providing particulate removal in order to reduce the impact to the environment and meet regulatory guidelines. The Trenton Generating Station Operating Approval (2006-054488-A01) issued on December 21, 2012 by Nova Scotia Environment (NSE), requires that the baghouse must be operational for the Unit to run. The baghouse also allows for greater flexibility in coal fuel blends because of its high fly ash capture rate. The project will be completed during the 2015 planned outage.

Why do this project this way?

Filter bag replacement is the only option to enable continued, reliable option of the baghouse, and removal of particulate.

CI Number : 46395 - TRE5 Baghouse Filter Replacements 2015 **Project Number**

Parent CI Number : -

Cost Centre : 340 - 340-Trenton Unit 5 Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		4,810	0	4,810
095		095-Thermal Overtime Labour AO		1,310	0	1,310
095		095-Thermal & Hydro Contracts AO		17,920	0	17,920
095		095-Thermal Term Labour AO		1,379	0	1,379
095		095-Thermal Regular Labour AO		3,534	0	3,534
001	017	001 - THERMAL Regular Labour	017 - SGP - Draft Equip./Stacks	9,803	0	9,803
002	017	002 - THERMAL Overtime Labour	017 - SGP - Draft Equip./Stacks	13,071	0	13,071
004	017	004 - THERMAL Term Labour	017 - SGP - Draft Equip./Stacks	6,882	0	6,882
012	017	012 - Materials	017 - SGP - Draft Equip./Stacks	183,617	0	183,617
013	017	013 - POWER PRODUCTION Contracts	017 - SGP - Draft Equip./Stacks	200,000	0	200,000
066	017	066 - Other Goods & Services	017 - SGP - Draft Equip./Stacks	38,362	0	38,362
001	087	001 - THERMAL Regular Labour	087 Field Super.& Ops.	7,830	0	7,830
011	087	011 - Travel Expense	087 Field Super.& Ops.	500	0	500
041	087	041 - Meals & Entertainment	087 Field Super.& Ops.	500	0	500
			Total Cost:	489,517	0	489,517
			Original Cost:	369,915		

Capital Project Detailed Estimate

Location: Trenton Generating Station
CI# / FP#: 46395
Title: TRE5 Baghouse Filter Replacements
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Mechanical	PD	15	$ 352.35	$ 5,285.25	CI 44725 (2014)	
Utility	PD	15	$ 231.99	$ 3,479.85	CI 44725 (2014)	
Electrical/Instrumentation	PD	3	$ 346.07	$ 1,038.21	CI 44725 (2014)	
Project Management/Supervision	PD	20	$ 391.49	$ 7,829.80	CI 44725 (2014)	
				$ -		
			Sub-Total	$ 17,633.11		
002 OT Labour						
Mechanical	PD	10	$ 704.70	$ 7,047.00	CI 44725 (2014)	
Utility	PD	10	$ 463.98	$ 4,639.80	CI 44725 (2014)	
Electrical/Instrumentation	PD	2	$ 692.14	$ 1,384.28	CI 44725 (2014)	
			Sub-Total	$ 13,071.08		
004 Term Labour						
Mechanical	PD	10	$ 352.35	$ 3,523.50	CI 44725 (2014)	
Utility	PD	10	$ 231.99	$ 2,319.90	CI 44725 (2014)	
Electrical/Instrumentation	PD	3	$ 346.07	$ 1,038.21	CI 44725 (2014)	
			Sub-Total	$ 6,881.61		
011 Travel Expense						
Travel	Lot	1	$ 500.00	$ 500.00		
				$ -		
			Sub-Total	$ 500.00		
012 Materials						
Filter Bags (1CDN=0.92USD)	Each	2000	[redacted]	[redacted]	Cost Support Item #1 - $1 CDN = $0.92 USD	
Cages (1CDN=0.92USD)	Each	250	[redacted]	[redacted]	Cost Support Item #2 - Line 2 - $1 CDN = $0.92 USD	
Level Switch (Probe) (1CDN=0.92USD)	Each	2	[redacted]	[redacted]	Cost Support Item #3 - $1 CDN = $0.92 USD	
Miscellaneous Materials	Lot	1	$ 2,500.00	$ 2,500.00		
				$ -		
				$ -		
				$ -		
			Sub-Total	$ 183,616.85		
013 Contracts						
Boilermakers - Changing Filter Bags	Lot	1	$ 175,000.00	$ 175,000.00	CI 44725 (2014)	
Vacuum Truck Services	Lot	1	$ 25,000.00	$ 25,000.00	CI 44725 (2014)	
				$ -		
				$ -		
			Sub-Total	$ 200,000.00		
041 Meals & Entertainment						
Meals	Lot	1	$ 500.00	$ 500.00		
				$ -		
			Sub-Total	$ 500.00		
066 Other Goods & Services						
Contingency on Materials / Contracts	%	10%	$ 383,616.85	$ 38,361.68		
				$ -		
			Sub-Total	$ 38,361.68		
094 Interest Capitalized						
AFUDC	Lot	1	$ 4,810.22	$ 4,810.22		
				$ -		
			Sub-Total	$ 4,810.22		
095 Administrative Overhead						
Thermal Reg. Labour AO	Lot			$ 3,533.67		
Thermal OT Labour AO	Lot			$ 1,309.72		
Thermal Term Labour AO	Lot			$ 1,379.07		
Thermal / Hydro Contracts AO	Lot			$ 17,920.00		
			Sub-Total	$ 24,142.46		
			SUB-TOTAL (no AO, AFUDC)	$ 460,564.33		
			TOTAL (AO, AFUDC included)	$ 489,517.01		
Original Cost				$ 369,915.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

DUSTEX CORPORATION

Quotation

Date	Page
Apr 14, 2014	1
Order Number QT02605	

322 NORTH POINTE PKWY
SUITE K
ACWORTH, GA 30201
Phone: (678) 574-4535
Fax: (678) 574-4980

Sold To:

XXXXXXXXNova Scotia Power, IncXXXXXXXXXXXXXXXXX
PO 910
Halifax, Nova Scotia B3J2W5
CANADA

Ship To:

XXXXXXXXNova Scotia Power, IncXXXXXXXXXXXXXXXXX
PO 910
Halifax, Nova Scotia, B3J2W5
CANADA

Reference	PO Number	Customer No.	Salesperson	Order Date	Ship Via	Terms
		19653US		Apr 14, 2014	UPS	NET30

Qty. Ord.	Qty. Shp.	Qty. B/O	Item Number	Description	Unit Price	UOM	Extended Price
2,000.0	0.0000	2,000.0	07-B16-07266-B1	[redacted]	[redacted]	EA	[redacted]

Comments:

THANKS FOR THE ORDER!

FOR QUESTIONS CONCERNING THIS ORDER PLEASE CONTACT
SHERRI OLLIS @

Tax Summary:

GSTHST [redacted]

Less	
Included Tax	0.00
Order Discount	0.00
Subtotal	[redacted]
Total sales tax	[redacted]
Total order	[redacted]

DUSTEX CORPORATION
322 NORTH POINTE PKWY
SUITE K
ACWORTH, GA 30201
Phone: (678) 574-4535
Fax: (678) 574-4980

Quotation

Date	Page
Aug 18, 2014	1
Order Number	
QT02681	

Sold To:
XXXXXXXXNova Scotia Power, IncXXXXXXXXXXXXXXXX
PO 910
Halifax, Nova Scotia B3J2W5
CANADA

Ship To:
XXXXXXXXNova Scotia Power, IncXXXXXXXXXXXXXXXX
PO 910
Halifax, Nova Scotia, B3J2W5
CANADA

Reference	PO Number	Customer No.	Salesperson	Order Date	Ship Via	Terms
		19653US		Aug 18, 2014	UPS	NET30

Qty. Ord.	Qty. Shp.	Qty. B/O	Item Number	Description	Unit Price	UOM	Extended Price
100.000	0.0000	100.000	07-B17-07266-C1	[redacted]	[redacted]	EA	[redacted]
250.000	0.0000	250.000	07-B17-07266-C1	[redacted]	[redacted]	EA	[redacted]
500.000	0.0000	500.000	07-B17-07266-C1	[redacted]	[redacted]	EA	[redacted]

Comments:

THANKS FOR THE ORDER!

FOR QUESTIONS CONCERNING THIS ORDER PLEASE CONTACT
SHERRI OLLIS @

Tax Summary:

GSTHST [redacted]

Less	
Included Tax	0.00
Order Discount	0.00
Subtotal	[redacted]
Total sales tax	[redacted]
Total order	[redacted]

DUSTEX CORPORATION
322 NORTH POINTE PKWY
SUITE K
ACWORTH, GA 30201
Phone: (678) 574-4535
Fax: (678) 574-4980

Quotation

Date	Page
Aug 20, 2014	1
Order Number	
QT02684	

Sold To:
XXXXXXXXNova Scotia Power, IncXXXXXXXXXXXXXXXX
PO 910
Halifax, Nova Scotia B3J2W5
CANADA

Ship To:
XXXXXXXXNova Scotia Power, IncXXXXXXXXXXXXXXXX
PO 910
Halifax, Nova Scotia, B3J2W5
CANADA

Reference	PO Number	Customer No.	Salesperson	Order Date	Ship Via	Terms
		19653US		Aug 20, 2014	UPS	NET30

Qty. Ord.	Qty. Shp.	Qty. B/O	Item Number	Description	Unit Price	UOM	Extended Price
2.0000	0.0000	2.0000	07-301-AGE55-15	[redacted]	[redacted]	EA	[redacted]

Comments:

THANKS FOR THE ORDER!

FOR QUESTIONS CONCERNING THIS ORDER PLEASE CONTACT
SHERRI OLLIS @

Tax Summary:
GSTHST [redacted]

Less	
Included Tax	0.00
Order Discount	0.00
Subtotal	[redacted]
Total sales tax	[redacted]
Total order	[redacted]

CI Number: 46070

Title: LIN3 Bottom Ash Refurbishment

Start Date: 2015/04
In-Service Date: 2015/05
Final Cost Date: 2015/11
Function: Steam
Forecast Amount: $475,908

DESCRIPTION:

This project is for the refurbishment of the boiler bottom ash system seal trough, dip plate, drip screen, discharge hopper structural steel refurbishment and replacement of refractory. The seal is comprised of a trough where a level of water is maintained, combined with a corrugated "dip plate" which extends into the water from the underside of the boiler.

Summary of Related CIs (+/- 2 years):
2014 CI 45108 LIN3&4 Inclined Bottom Ash Conveyor Upgrades

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

The bottom ash system is exposed to severe operating conditions that have weakened the structural integrity of the seal trough, discharge hopper and support systems, and refractory. Due to this deteriorated condition, refurbishment is necessary and will ensure the integrity of the bottom ash system on an ongoing basis.

Why do this project now?

This work should be completed during the 2015 planned outage so the unit can operate without a lengthy shutdown for bottom ash repairs. If the components fail at an unplanned time without material readily available, the unit stability, capacity and availability will be compromised. The de-ashing system is not sustainable until the next planned outage based on its current condition.

Why do this project this way?

The Plant maintenance and engineering personnel assessed the bottom ash system during the 2014 outage and wear and corrosion noted on the hopper slope steel dictates that replacement is required along with the associated refractory. The seal trough and dip plate refurbishments will correct leaks which have developed in the seal trough allowing for an extended operating period. Refurbishment of these components is the most economical way to complete this work as full replacement of the bottom ash system is not feasible.

CI Number : 46070 - LIN3 Bottom Ash Replacement

Project Number

Parent CI Number : -

Cost Centre : 305 - 305-Lingan 3&4 Prod.Unit

Budget Version 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal Regular Labour AO		8,783	0	8,783
095		095-Thermal & Hydro Contracts AO		14,784	0	14,784
095		095-Thermal Term Labour AO		16,447	0	16,447
001	018	001 - THERMAL Regular Labour	018 - SGP - Fuel Hndlg.Coal	43,825	0	43,825
004	018	004 - THERMAL Term Labour	018 - SGP - Fuel Hndlg.Coal	82,069	0	82,069
012	018	012 - Materials	018 - SGP - Fuel Hndlg.Coal	145,000	0	145,000
013	018	013 - POWER PRODUCTION Contracts	018 - SGP - Fuel Hndlg.Coal	165,000	0	165,000
			Total Cost:	475,908	0	475,908
			Original Cost:	355,871		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 46070
Title: LIN3 Bottom Ash Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Maintenance Trades	PD	75	$ 352	$ 26,426.16		
Utilityworker	PD	75	$ 232	$ 17,399.16		
			Sub-Total	$ 43,825.32		35082
004 Term Labour						
Maintenance Trades	PD	200	$ 352	$ 70,469.76		
Utilityworker	PD	50	$ 232	$ 11,599.44		
			Sub-Total	$ 82,069.20		35082
012 Materials						
Seal Trough Guard Mesh	ea	1	$ 25,000	$ 25,000.00		35082
Steel Plate for Chute and Seal Trough	ea	1	$ 70,000	$ 70,000.00		35082
Stainless Steel Dip Plate	ea	1	$ 30,000	$ 30,000.00		
Seal Trough Piping	ea	1	$ 10,000	$ 10,000.00		
Consumables and Safety Equipment	ea	1	$ 10,000	$ 10,000.00		
				$ -		
				$ -		
			Sub-Total	$ 145,000.00		
013 Contracts						
Install Refractory	ea	1	$ 140,000	$ 140,000.00		35082
Installation of Seal Plate to Boiler Tubes	ea	1	$ 25,000	$ 25,000.00		35082
			Sub-Total	$ 165,000.00		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 8,782.59		
Thermal Term Labour AO				$ 16,446.67		
Thermal / Hydro Contracts AO				$ 14,784.00		
			Sub-Total	$ 40,013.26		
			SUB-TOTAL (no AO, AFUDC)	$ 435,894.52		
			TOTAL (AO, AFUDC included)	$ 475,907.78		
Original Cost				$ 355,871.12		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN3 Bottom Ash Refurbishment
Summary of Alternatives

Division :	Power Production	**Date :**	**5-Nov-14**
Department :	Lingan Generating Station	**CI Number:**	46070
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Bottom Ash Refurbish vs. Avoided Rep	6.19%	-1,687,692	1,227,860	1	38.34%	4.6 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

The economic analysis shows that completing this refurbishment is recommended as opposed incurring unplanned failures in the "do nothing" option.

Notes/Comments :

Bottom Ash Refurbish vs. Avoided Repair and Replacement Energy Costs

If the project is not completed, failures can be expected to occur and the associated repairs will take a minimum of 2 weeks with the unit offline. As the unit continues to operate, the probability of repairs increases.

Test 2

Test 3

Test 4

LIN3 Bottom Ash Refurbishment
Summary of Sensitivities

Nova Scotia POWE
An Emera Compa

Division :	Power Production	**Date :**	**5-Nov-14**
Department :	Lingan Generating Station	**CI Number:**	46070
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Bottom Ash Refurbish vs. Avoided Repair and Re	6.19%	-1,687,692	1,227,860	1	38.34%	4.6 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Bottom Ash Refurbish vs. Avoided Repair and Re	10%	-1,644,779	1,194,182	1	35.53%	4.8 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:						
	A	42,913	-33,678	0	-2.81%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Bottom Ash Refurbish vs. Avoided Repair and Re	-10%	-1,476,010	1,071,396	1	35.24%	4.8 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:						
	A	211,682	-156,464	0	-3.10%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	50,099	103,356	162,864	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN3 Bottom Ash Refurbishment
Avoided Cost Calculations

Division :	Power Production	Date :	5-Nov-14
Department :	Lingan Generating Station	CI Number:	46070
Originator :		Project No. :	

Bottom Ash Refurbish vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			61,453	63,927		
Events/Outages (#)	1	1	1	1		
Probability of Occurance (%)	20%	30%	20%	30%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	150	150				
Duration (Hours)	336	336				
Totals	$41,426	$58,959	$12,291	$19,178	$53,717	$78,137
Total Capital Cost of Alternative						$475,908

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

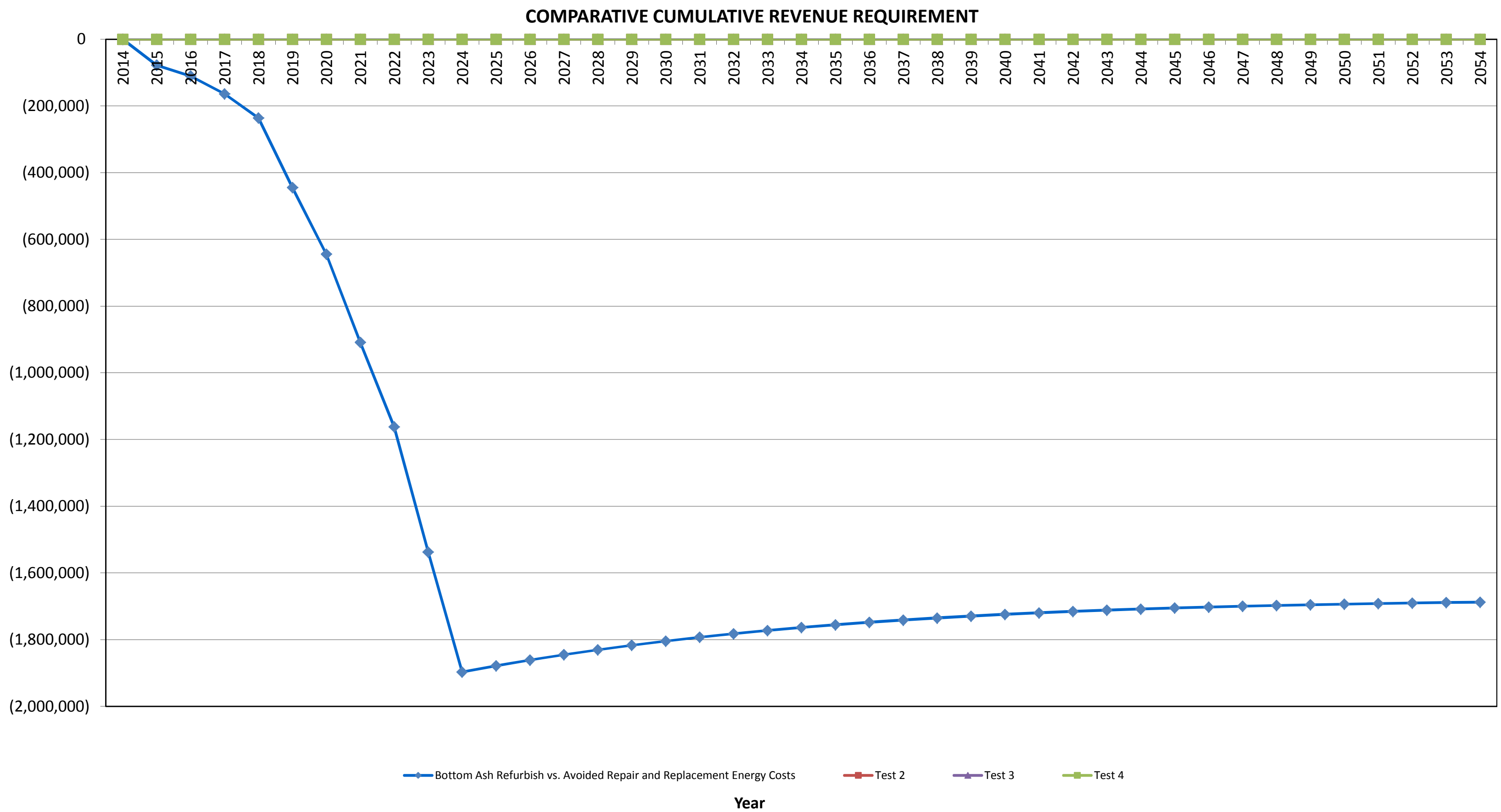
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	2015	2016	2015	2016	2015	2016
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

LIN3 Bottom Ash Refurbishment

Bottom Ash Refurbish vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	53,716.6	(435,894.5)	17,435.8	429,502.4	(382,177.9)	(11,247.1)	(393,425.0)	(370,491.6)	0.94	(370,491.6)
2016	-	-	78,137.3	-	33,476.7	394,181.9	78,137.3	(13,844.8)	64,292.5	57,015.5	0.89	(313,476.0)
2017	-	-	106,785.1	-	30,798.6	361,687.0	106,785.1	(23,555.8)	83,229.3	69,506.5	0.84	(243,969.6)
2018	-	-	136,825.0	-	28,334.7	331,791.7	136,825.0	(33,632.0)	103,193.0	81,155.1	0.79	(162,814.5)
2019	-	-	336,630.2	-	26,067.9	304,288.1	336,630.2	(96,274.3)	240,355.9	178,006.8	0.74	15,192.4
2020	-	-	345,113.3	-	23,982.5	278,984.7	345,113.3	(99,550.6)	245,562.8	171,261.9	0.70	186,454.3
2021	-	-	471,782.1	-	22,063.9	255,705.6	471,782.1	(139,412.7)	332,369.5	218,291.0	0.66	404,745.2
2022	-	-	483,743.5	-	20,298.8	234,288.9	483,743.5	(143,667.9)	340,075.6	210,332.6	0.62	615,077.8
2023	-	-	744,068.8	-	18,674.9	214,585.4	744,068.8	(224,872.1)	519,196.7	302,398.3	0.58	917,476.1
2024	-	-	763,050.1	-	17,180.9	196,458.3	763,050.1	(231,219.5)	531,830.6	291,700.5	0.55	1,209,176.6
2025	-	-	-	-	15,806.4	179,781.3	-	4,900.0	4,900.0	2,530.9	0.52	1,211,707.5
2026	-	-	-	-	14,541.9	164,438.5	-	4,508.0	4,508.0	2,192.7	0.49	1,213,900.2
2027	-	-	-	-	13,378.5	150,323.1	-	4,147.3	4,147.3	1,899.7	0.46	1,215,799.9
2028	-	-	-	-	12,308.3	137,336.9	-	3,815.6	3,815.6	1,645.8	0.43	1,217,445.7
2029	-	-	-	-	11,323.6	125,389.6	-	3,510.3	3,510.3	1,425.9	0.41	1,218,871.6
2030	-	-	-	-	10,417.7	114,398.2	-	3,229.5	3,229.5	1,235.4	0.38	1,220,107.0
2031	-	-	-	-	9,584.3	104,286.0	-	2,971.1	2,971.1	1,070.3	0.36	1,221,177.3
2032	-	-	-	-	8,817.5	94,982.8	-	2,733.4	2,733.4	927.3	0.34	1,222,104.6
2033	-	-	-	-	8,112.1	86,423.8	-	2,514.8	2,514.8	803.4	0.32	1,222,907.9
2034	-	-	-	-	7,463.2	78,549.6	-	2,313.6	2,313.6	696.0	0.30	1,223,603.9
2035	-	-	-	-	6,866.1	71,305.3	-	2,128.5	2,128.5	603.0	0.28	1,224,206.9
2036	-	-	-	-	6,316.8	64,640.6	-	1,958.2	1,958.2	522.4	0.27	1,224,729.3
2037	-	-	-	-	5,811.5	58,509.0	-	1,801.6	1,801.6	452.6	0.25	1,225,181.9
2038	-	-	-	-	5,346.6	52,868.0	-	1,657.4	1,657.4	392.1	0.24	1,225,574.1
2039	-	-	-	-	4,918.8	47,678.2	-	1,524.8	1,524.8	339.7	0.22	1,225,913.8
2040	-	-	-	-	4,525.3	42,903.6	-	1,402.9	1,402.9	294.3	0.21	1,226,208.1
2041	-	-	-	-	4,163.3	38,511.0	-	1,290.6	1,290.6	255.0	0.20	1,226,463.1
2042	-	-	-	-	3,830.2	34,469.8	-	1,187.4	1,187.4	220.9	0.19	1,226,684.1
2043	-	-	-	-	3,523.8	30,751.9	-	1,092.4	1,092.4	191.4	0.18	1,226,875.5
2044	-	-	-	-	3,241.9	27,331.5	-	1,005.0	1,005.0	165.8	0.17	1,227,041.3
2045	-	-	-	-	2,982.6	24,184.6	-	924.6	924.6	143.7	0.16	1,227,185.0
2046	-	-	-	-	2,744.0	21,289.5	-	850.6	850.6	124.5	0.15	1,227,309.4
2047	-	-	-	-	2,524.4	18,626.1	-	782.6	782.6	107.8	0.14	1,227,417.3
2048	-	-	-	-	2,322.5	16,175.7	-	720.0	720.0	93.4	0.13	1,227,510.7
2049	-	-	-	-	2,136.7	13,921.3	-	662.4	662.4	80.9	0.12	1,227,591.6
2050	-	-	-	-	1,965.8	11,847.3	-	609.4	609.4	70.1	0.12	1,227,661.8
2051	-	-	-	-	1,808.5	9,939.2	-	560.6	560.6	60.8	0.11	1,227,722.5
2052	-	-	-	-	1,663.8	8,183.7	-	515.8	515.8	52.6	0.10	1,227,775.2
2053	-	-	-	-	1,530.7	6,568.7	-	474.5	474.5	45.6	0.10	1,227,820.8
2054	-	-	-	-	1,408.3	5,082.9	-	436.6	436.6	39.5	0.09	1,227,860.3
Total	**-**	**-**	**3,519,852.0**	**(435,894.5)**	**419,699.6**		**3,083,957.5**	**(961,047.2)**	**2,122,910.3**	**1,227,860.3**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(200,000)
(400,000)
(600,000)
(800,000)
(1,000,000)
(1,200,000)
(1,400,000)
(1,600,000)
(1,800,000)
(2,000,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Bottom Ash Refurbish vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46372

Title: POT – Coal Mill Overhauls

Start Date: 2015/02
In-Service Date: 2015/11
Final Cost Date: 2016/05
Function: Steam
Forecast Amount: $418,292

DESCRIPTION:

Point Tupper Unit 2 employs four Raymond Bowl style mills to pulverize coal for combustion in the boiler. This project will replace mill components that have reached the end of their useful life on two of the four mills. Based on experienced wear characteristics, there is risk that component failures will occur if a replacement and refurbishment plan is not performed. This capital item includes the replacement of welded steel rollers and tables with ceramic wear components, and other non-repairable mill components. Components either to be replaced or refurbished will be decided based on the condition assessment when teardown is undertaken as part of the planned outage for the mill. Going forward, regular refurbishments of the mills will still be required to extend asset life and maintain the reliability of this equipment.

Summary of Related CIs (+/- 2 years):
2014 CI 46334 - POT 2C Mill Overhaul $176,534

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

This project is being completed to mitigate the risk of mill failure. A mill failure could limit peak generation of the unit depending on the fuel blend in service. It is imperative that the mills are available full time between planned outages in order to maintain unit performance at rated capacity. The replacement of mechanical components and the upgrading of the ceramics surfaces is necessary to achieve the most economic operation of the unit.

Why do this project now?

Operating and maintenance experience with the mills has identified several areas of concern that need to be addressed in order for the mills to meet availability targets. Replacement parts are now needed due to age and wear on many of the components. During periods of lower load it is possible to take 1 of 4 mills out of service without affecting generation. Isolated repairs and minor refurbishment are not typically possible for the mills. It is often necessary to disassemble major components and therefore an overall refurbishment versus isolated repairs is more effective.

Why do this project this way?

A phased approach to maintaining the mills allows for scheduled outages of selected mills, reducing the risk of extended unplanned outages. By planning refurbishments and replacements in a given year, the refurbishment and replacement efforts can be made more efficient with dedicated labour and parts available as required.

CI Number : 46372 - POT - Coal Mill Overhauls **Project Number**

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		7,337	0	7,337
095		095-Thermal Term Labour AO		10,592	0	10,592
095		095-Thermal & Hydro Contracts AO		358	0	358
095		095-Thermal Regular Labour AO		9,936	0	9,936
095		095-Thermal Overtime Labour AO		331	0	331
001	018	001 - THERMAL Regular Labour	018 - SGP - Fuel Hndlg.Coal	49,582	0	49,582
002	018	002 - THERMAL Overtime Labour	018 - SGP - Fuel Hndlg.Coal	3,304	0	3,304
004	018	004 - THERMAL Term Labour	018 - SGP - Fuel Hndlg.Coal	52,852	0	52,852
012	018	012 - Materials	018 - SGP - Fuel Hndlg.Coal	271,000	0	271,000
013	018	013 - POWER PRODUCTION Contracts	018 - SGP - Fuel Hndlg.Coal	4,000	0	4,000
014	018	014 - Overtime Meals	018 - SGP - Fuel Hndlg.Coal	1,000	0	1,000
015	018	015 - Frt, Post & Delivery	018 - SGP - Fuel Hndlg.Coal	5,000	0	5,000
033	018	033 - Rental and Maintenance of	018 - SGP - Fuel Hndlg.Coal	1,000	0	1,000
011	085	011 - Travel Expense	085 Design	1,000	0	1,000
041	085	041 - Meals & Entertainment	085 Design	1,000	0	1,000
			Total Cost:	418,292	0	418,292
			Original Cost:	217,773		

Location: Pt. Tupper
CI# / FP#: 46372
Title: POT - Mill Overhaul
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	4.00	$ 346.07	$ 1,384.26		
Maintenance Trades	PD	50.00	$ 352.35	$ 17,617.44		
Power Plant Technician	PD	20.00	$ 369.08	$ 7,381.54		
Utilityworker	PD	100.00	$ 231.99	$ 23,198.88		
			Sub-Total	$ 49,582.12		
002 OT Labour						
Electrician	PD	1.00	$ 692.13	$ 692.13		
Maintenance Trades	PD	2.00	$ 704.70	$ 1,409.40		
Power Plant Technician	PD	1.00	$ 738.15	$ 738.15		
Utilityworker	PD	1.00	$ 463.98	$ 463.98		
			Sub-Total	$ 3,303.66		
004 Term Labour						
Maintenance Trades	PD	150.00	$ 352.35	$ 52,852.32		
			Sub-Total	$ 52,852.32		
011 Travel Expense						
Travel	lot	1.00	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
012 Materials						
Mill rolls	lot	2.00	$ 33,000.00	$ 66,000.00		
Grinding table	lot	2.00	$ 33,000.00	$ 66,000.00		
Rejects table	lot	2.00	$ 6,000.00	$ 12,000.00		
Roll seals	lot	2.00	$ 2,000.00	$ 4,000.00		
Main table seals	lot	2.00	$ 2,000.00	$ 4,000.00		
Riffle boxes	lot	2.00	$ 6,000.00	$ 12,000.00		
Scraper assemblies	lot	2.00	$ 2,500.00	$ 5,000.00		
Mill side liners	lot	2.00	$ 10,000.00	$ 20,000.00		
Rejects side liners	lot	2.00	$ 10,000.00	$ 20,000.00		
Door assemblies	lot	2.00	$ 3,000.00	$ 6,000.00		
Trunion bushings	lot	2.00	$ 3,500.00	$ 7,000.00		
Exhauster fan	lot	2.00	$ 5,000.00	$ 10,000.00		
Exhauster bearings	lot	2.00	$ 2,000.00	$ 4,000.00		
Feeder parts	lot	2.00	$ 5,000.00	$ 10,000.00		
Lubricating oil	lot	2.00	$ 4,500.00	$ 9,000.00		
Misc. and consumables	lot	2.00	$ 8,000.00	$ 16,000.00		
			Sub-Total	$ 271,000.00		
013 Contracts						
Cranes, etc.	lot	2.00	$ 2,000.00	$ 4,000.00		
			Sub-Total	$ 4,000.00		
015 Freight						
Freight (015)	lot	1.00	$ 5,000.00	$ 5,000.00		
				$ -		
				$ -		
			Sub-Total	$ 5,000.00		
033 Rentals						
Rentals(033)	lot	1.00	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 1,000.00		
041 Meals & Entertainment						
Meals and expenses	lot	1.00	$ 1,000.00	$ 1,000.00		
			Sub-Total	$ 1,000.00		

014 OT Meals							
Overtime meals	lot	1.00	$ 1,000.00	$	1,000.00		
				$	-		
			Sub-Total	$	1,000.00		
094 Interest Capitalized							
Interest	lot	1.00	$ 7,336.89	$	7,336.89		
				$	-		
			Sub-Total	$	7,336.89		
095 Administrative Overhead							
Thermal Reg. Labour AO	lot	1.00	9936.24	$	9,936.24		
Thermal OT Labour AO	lot	1.00	331.04	$	331.04		
Thermal Term Labour AO	lot	1.00	10591.6	$	10,591.60		
Thermal / Hydro Contracts AO	lot	1.00	358.4	$	358.40		
			Sub-Total	$	21,217.28		
			SUB-TOTAL (no AO, AFUDC)	$	389,738.10		
			TOTAL (AO, AFUDC included)	$	418,292.27		
Original Cost				$	217,773.16		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

POT - Coal Mill Overhaul
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	46372
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	Mill Overhaul vs Avoided Repair and Re	6.19%	-1,656,215	1,166,590	1	145.48%	1.9 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

This project is recommended to proceed based on good economics. A planned outage of sufficient time is not going to occur until 2017. It is recommended to complete this project in 2015 because of this.

Notes/Comments :

Mill Overhaul vs Avoided Repair and Replacement Energy Costs

This option compares overhauling the two mills versus the replacement energy costs associated with potential failures if refurbishment is not completed.

Test 2

Test 3

Test 4

POT - Coal Mill Overhaul
Summary of Sensitivities

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	46372
Originator :		**Project No. :**	

	Alternative	**After Tax WACC**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Overhaul vs Avoided Repair and Replacemen	6.19%	-1,656,215	1,166,590	1	145.48%	1.9 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Overhaul vs Avoided Repair and Replacemen	10%	-1,615,078	1,135,788	1	124.59%	2.0 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:						
	A	41,137	-30,803	0	-20.89%	0.1 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	**Variance (%)**	**PV of Revenue Requirement**	**PV of EVA / NPV**	**Rank**	**IRR**	**Disc Pay**
A	Mill Overhaul vs Avoided Repair and Replacemen	-10%	-1,449,456	1,019,129	1	122.62%	2.0 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:						
	A	206,758	-147,462	0	-22.86%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	**PV of Revenue Requirement** 1	**PV of Revenue Requirement** 2	**PV of Revenue Requirement** 3	**Delay?**
	A	235,538	549,839	944,412	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

POT - Coal Mill Overhaul
Avoided Cost Calculations

Nova Scotia POWER An Emera Company

Division :	Power Production	**Date :**	**15-Oct-14**
Department :	Point Tupper Generating Station	**CI Number:**	46372
Originator :		**Project No. :**	

Mill Overhaul vs Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			27,436	28,538		
Events/Outages (#)	4	6	4	6		
Probability of Occurance (%)	100%	100%	100%	100%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	50	50				
Duration (Hours)	72	72				
Totals	$142,800	$205,896	$109,743	$171,229	$252,544	$377,125
Total Capital Cost of Alternative						$418,292

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 3

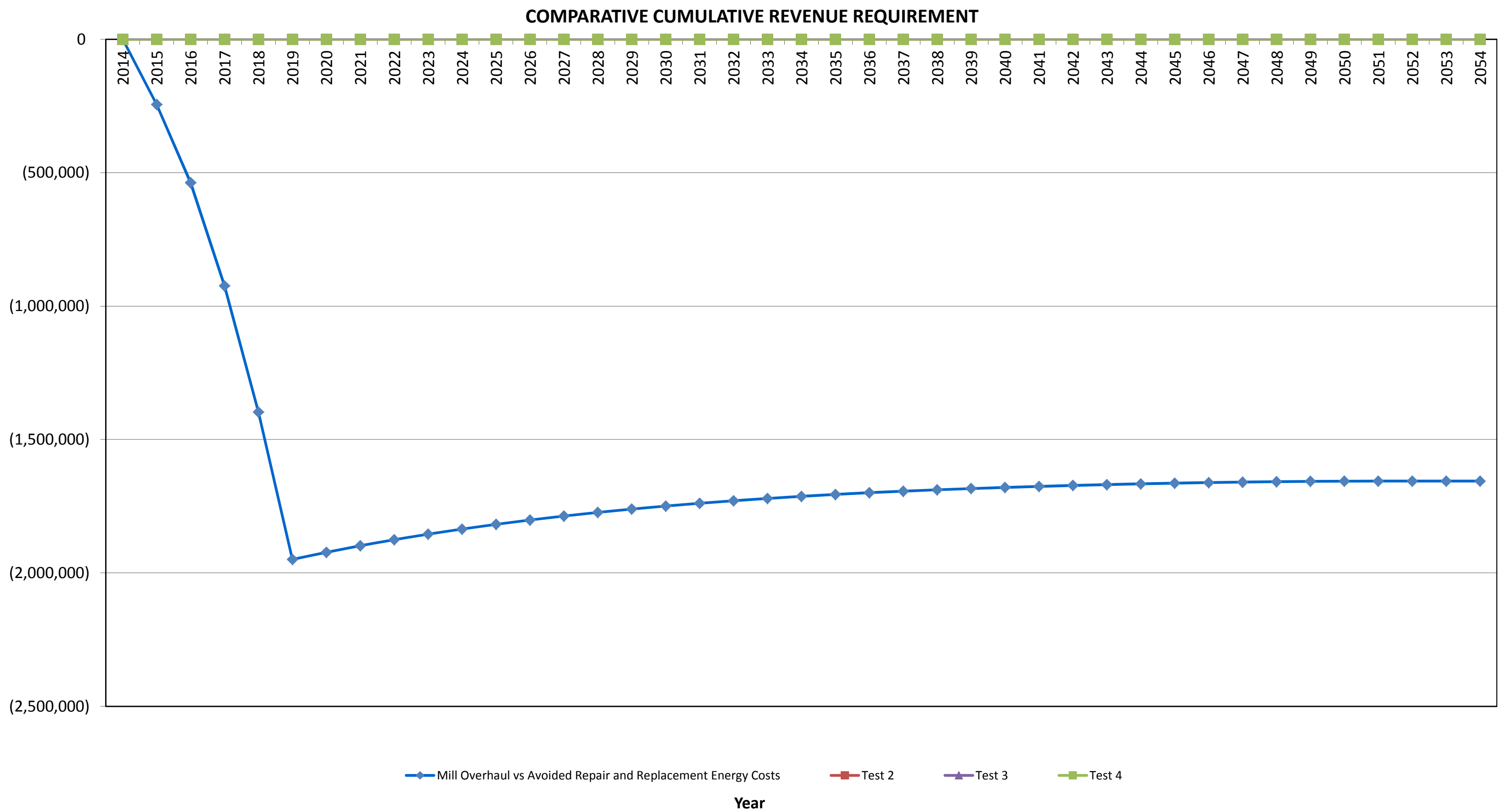
	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			0	0		
Events/Outages (#)	0	0	0	0		
Probability of Occurance (%)	0%	0%	0%	0%		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	0	0				
Duration (Hours)	0	0				
Totals	$0	$0	$0	$0	$0	$0
Total Capital Cost of Alternative						$0

POT - Coal Mill Overhaul
Mill Overhaul vs Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	252,543.6	(397,075.0)	15,589.5	380,004.5	(144,531.4)	(73,455.8)	(217,987.1)	(205,280.3)	0.94	(205,280.3)
2016	-	-	377,125.4	-	29,931.9	349,095.0	377,125.4	(107,630.0)	269,495.4	238,992.4	0.89	33,712.1
2017	-	-	517,498.0	-	27,537.3	320,658.2	517,498.0	(151,887.8)	365,610.2	305,328.6	0.84	339,040.7
2018	-	-	665,800.8	-	25,334.3	294,496.3	665,800.8	(198,544.6)	467,256.2	367,468.9	0.79	706,509.6
2019	-	-	822,418.1	-	23,307.6	270,427.4	822,418.1	(247,724.3)	574,693.9	425,616.5	0.74	1,132,126.1
2020	-	-	-	-	21,443.0	248,284.0	-	6,647.3	6,647.3	4,636.0	0.70	1,136,762.2
2021	-	-	-	-	19,727.6	227,912.0	-	6,115.5	6,115.5	4,016.5	0.66	1,140,778.7
2022	-	-	-	-	18,149.3	209,169.9	-	5,626.3	5,626.3	3,479.8	0.62	1,144,258.5
2023	-	-	-	-	16,697.4	191,927.1	-	5,176.2	5,176.2	3,014.8	0.58	1,147,273.3
2024	-	-	-	-	15,361.6	176,063.7	-	4,762.1	4,762.1	2,611.9	0.55	1,149,885.2
2025	-	-	-	-	14,132.7	161,469.4	-	4,381.1	4,381.1	2,262.9	0.52	1,152,148.1
2026	-	-	-	-	13,002.1	148,042.6	-	4,030.6	4,030.6	1,960.5	0.49	1,154,108.6
2027	-	-	-	-	11,961.9	135,690.0	-	3,708.2	3,708.2	1,698.5	0.46	1,155,807.2
2028	-	-	-	-	11,004.9	124,325.6	-	3,411.5	3,411.5	1,471.6	0.43	1,157,278.7
2029	-	-	-	-	10,124.6	113,870.3	-	3,138.6	3,138.6	1,274.9	0.41	1,158,553.6
2030	-	-	-	-	9,314.6	104,251.5	-	2,887.5	2,887.5	1,104.6	0.38	1,159,658.2
2031	-	-	-	-	8,569.4	95,402.1	-	2,656.5	2,656.5	957.0	0.36	1,160,615.2
2032	-	-	-	-	7,883.9	87,260.7	-	2,444.0	2,444.0	829.1	0.34	1,161,444.2
2033	-	-	-	-	7,253.2	79,770.7	-	2,248.5	2,248.5	718.3	0.32	1,162,162.5
2034	-	-	-	-	6,672.9	72,879.8	-	2,068.6	2,068.6	622.3	0.30	1,162,784.8
2035	-	-	-	-	6,139.1	66,540.2	-	1,903.1	1,903.1	539.1	0.28	1,163,324.0
2036	-	-	-	-	5,647.9	60,707.8	-	1,750.9	1,750.9	467.1	0.27	1,163,791.1
2037	-	-	-	-	5,196.1	55,341.9	-	1,610.8	1,610.8	404.7	0.25	1,164,195.8
2038	-	-	-	-	4,780.4	50,405.4	-	1,481.9	1,481.9	350.6	0.24	1,164,546.4
2039	-	-	-	-	4,398.0	45,863.7	-	1,363.4	1,363.4	303.8	0.22	1,164,850.1
2040	-	-	-	-	4,046.1	41,685.4	-	1,254.3	1,254.3	263.2	0.21	1,165,113.3
2041	-	-	-	-	3,722.5	37,841.4	-	1,154.0	1,154.0	228.0	0.20	1,165,341.3
2042	-	-	-	-	3,424.7	34,304.8	-	1,061.6	1,061.6	197.5	0.19	1,165,538.8
2043	-	-	-	-	3,150.7	31,051.2	-	976.7	976.7	171.1	0.18	1,165,710.0
2044	-	-	-	-	2,898.6	28,057.9	-	898.6	898.6	148.3	0.17	1,165,858.2
2045	-	-	-	-	2,666.7	25,304.1	-	826.7	826.7	128.5	0.16	1,165,986.7
2046	-	-	-	-	2,453.4	22,770.5	-	760.6	760.6	111.3	0.15	1,166,098.0
2047	-	-	-	-	2,257.1	20,439.7	-	699.7	699.7	96.4	0.14	1,166,194.4
2048	-	-	-	-	2,076.6	18,295.3	-	643.7	643.7	83.5	0.13	1,166,277.9
2049	-	-	-	-	1,910.4	16,322.5	-	592.2	592.2	72.4	0.12	1,166,350.3
2050	-	-	-	-	1,757.6	14,507.4	-	544.9	544.9	62.7	0.12	1,166,413.0
2051	-	-	-	-	1,617.0	12,837.6	-	501.3	501.3	54.3	0.11	1,166,467.3
2052	-	-	-	-	1,487.6	11,301.4	-	461.2	461.2	47.1	0.10	1,166,514.4
2053	-	-	-	-	1,368.6	9,888.1	-	424.3	424.3	40.8	0.10	1,166,555.2
2054	-	-	-	-	1,259.1	8,587.8	-	390.3	390.3	35.3	0.09	1,166,590.5
Total	**-**	**-**	**2,635,386.0**	**(397,075.0)**	**375,258.1**		**2,238,311.0**	**(700,639.7)**	**1,537,671.4**	**1,166,590.5**		


COMPARATIVE CUMULATIVE REVENUE REQUIREMENT
0
(500,000)
(1,000,000)
(1,500,000)
(2,000,000)
(2,500,000)
2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054
Mill Overhaul vs Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 45851

Title: POT – Stack Repairs

Start Date: 2014/07
In-Service Date: 2015/09
Final Cost Date: 2016/03
Function: Steam
Forecast Amount: $381,316

DESCRIPTION:

The stack at the Point Tupper Generating Station is inspected during routine shutdown work in accordance with Nova Scotia Power Thermal Maintenance Practices. Recent inspection work has identified components of the Point Tupper stack which are in need of replacement or refurbishment. This project includes the refurbishment/replacement of electrical conduit, ladder bracket, grating, gate, and handrails, as well as the removal and installation of the external liner insulation.

Summary of Related CIs (+/- 2 years):
No other projects in 2012, 2013, 2014, 2015 or 2016.

JUSTIFICATION:

Justification Criteria: Health & Safety

Sub Criteria: Maintenance

Why do this project?

In order for the stack to be accessed safely from the inside and to protect personnel from a risk of falling and/or debris falling from the stack exterior, the items listed above must be addressed.

Why do this project now?

This project must be completed now in order to mitigate the risk of debris falling off the stack. Completing this as part of the 2015 planned outage eliminates the need for an additional outage.

Why do this project this way?

The nature of the proposed work is beyond the technical expertise of NS Power's work-crews. This work will be contracted out to specialists who were trained to handle all repairs in remote, high angle confined spaces. Repairing the stack is the only feasible option to enable safe access in and around the Point Tupper stack.

CI Number : 45851-SC91 - POT - Stack Repairs **Project Number** SC91

Parent CI Number : -

Cost Centre : 351 - 351-Pt.Tupper Admin./Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
095		095-Thermal Term Labour AO		912	0	912
095		095-Thermal Overtime Labour AO		91	0	91
095		095-Thermal Regular Labour AO		[redacted]	0	[redacted]
095		095-Thermal & Hydro Contracts AO		[redacted]	0	[redacted]
001	017	001 - THERMAL Regular Labour	017 - SGP - Draft Equip./Stacks	4,549	0	4,549
002	017	002 - THERMAL Overtime Labour	017 - SGP - Draft Equip./Stacks	910	0	910
004	017	004 - THERMAL Term Labour	017 - SGP - Draft Equip./Stacks	4,549	0	4,549
012	017	012 - Materials	017 - SGP - Draft Equip./Stacks	[redacted]	0	[redacted]
013	017	013 - POWER PRODUCTION Contracts	017 - SGP - Draft Equip./Stacks	[redacted]	0	[redacted]
			Total Cost:	381,316	0	381,316
			Original Cost:	72,677		

Capital Project Detailed Estimate

Location: Pt. Tupper
CI# / FP#: 45851
Title: POT - Stack Repairs
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	20.00	$ 227.44	$ 4,548.80		
			Sub-Total	$ 4,548.80		
002 OT Labour						
Utilityworker	PD	2.00	$ 454.88	$ 909.76		
				$ -		
			Sub-Total	$ 909.76		
004 Term Labour						
Utilityworker	PD	20.00	$ 227.44	$ 4,548.80		
				$ -		
				$ -		
			Sub-Total	$ 4,548.80		
012 Materials						
Insulation	lot	1.00	[redacted]		Cost Support Item #2 - General - Line 2	
Chicken wire	lot	1.00			Cost Support Item #2 - General - Line 3	
Insulation pins and plates	lot	1.00			Cost Support Item #2 - General - Line 4	
Insulation Banding and Fasteners	lot	1.00			Cost Support Item #2 - General - Line 5	
Consumables and misc.	lot	1.00			Cost Support Item #2 - General - Line 6	
			Sub-Total	[redacted]		
013 Contracts						
Insulation repairs	lot	1.00	[redacted]		Cost Support Item #1 - All remaining line items	
Stack repairs	lot	1.00			Cost Support Item #2	
			Sub-Total	[redacted]		
095 Administrative Overhead						
Thermal Reg. Labour AO	lot	1.00	[redacted]			
Thermal OT Labour AO	lot	1.00	$ 91.16	$ 91.16		
Thermal Term Labour AO	lot	1.00	$ 911.58	$ 911.58		
Thermal / Hydro Contracts AO	lot	1.00	[redacted]			
			Sub-Total	$ 29,750.16		
			SUB-TOTAL (no AO, AFUDC)	$ 351,565.36		
			TOTAL (AO, AFUDC included)	$ 381,315.52		
Original Cost				$ 72,677.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Remote Access Technology
61 Atlantic Street.
Dartmouth, NS
B2Y 4P4

JOB ESTIMATE

Estimate No. 11431
Project ID No. 5741
Estimated By Nathanial Bowlby

Project Description: NS Pt. Tupper Stack Maintenance

Customer: Nova Scotia Power Inc.

Phone: (902) 428-6960

Address: ATTN: ACCOUNTS PAYABLE
1894 Barrington Street
Halifax, NS B3J 2W5

ItemCode	Description	Quantity	Unit	Price	Extension
Materials:					
Total Material					.00
Labour:					
	Per Diem	180.00	EA	[redacted]	[redacted]
	Report Writing	8.00	HR	[redacted]	[redacted]
	L1 Rope	320.00	HR	[redacted]	[redacted]
	L1 Rope (Overtime)	280.00	HR	[redacted]	[redacted]
	L2 Rope	296.00	HR	[redacted]	[redacted]
	L2 Rope (Overtime)	304.00	HR	[redacted]	[redacted]
	L3 Supervisor	144.00	HR	[redacted]	[redacted]
	L3 Supervisor (Overtime)	156.00	HR	[redacted]	[redacted]
	Mobilization	224.00	HR	[redacted]	[redacted]
	Mobilization	56.00	HR	[redacted]	[redacted]
Total Labour					[redacted]
Travel:					
	T-Kilometers	4,800	KM	[redacted]	[redacted]
	T-RAT Vehicle Daily	36	EA	[redacted]	[redacted]
Travel Total					[redacted]
Equipment:					
	E-Access & Rescue Equipment	150	EA	[redacted]	[redacted]
	Pin Welder	30	EA	[redacted]	[redacted]
	Swing Stage Rental	3	EA	[redacted]	[redacted]
	E-Equipment Shipping / Brokerage	1	EA	[redacted]	[redacted]
Equipment Total					[redacted]
General:					
	T-Lodging	150	EA	[redacted]	[redacted]
	Insulation	1	EA	[redacted]	[redacted]
	Chicken Wire	1	EA	[redacted]	[redacted]
	Insulation Pins and Plates	1	EA	[redacted]	[redacted]
	Insulation Banding and Fasteners	1	EA	[redacted]	[redacted]
	C-Consumables/Materials/Supplies	1	EA	[redacted]	[redacted]
General Total:					[redacted]

Total Job [redacted]

Remote Access Technology
61 Atlantic Street.
Dartmouth, NS
B2Y 4P4

JOB ESTIMATE

Estimate No. 11429
Project ID No. 5741
Estimated By Nathanial Bowlby

Project Description: NS Pt. Tupper Stack Maintenance

Customer: Nova Scotia Power Inc.

Phone: (902) 428-6960

Address: ATTN: ACCOUNTS PAYABLE
1894 Barrington Street
Halifax, NS B3J 2W5

ItemCode	Description	Quantity	Unit	Price	Extension
Materials:					
Total Material					.00
Labour:					
	Per Diem	80.00	EA	[redacted]	[redacted]
	Report Writing	8.00	HR	[redacted]	[redacted]
	L1 Rope	224.00	HR	[redacted]	[redacted]
	L1 Rope (Overtime)	56.00	HR	[redacted]	[redacted]
	L2 Rope	224.00	HR	[redacted]	[redacted]
	L2 Rope (Overtime)	56.00	HR	[redacted]	[redacted]
	L3 Supervisor	112.00	HR	[redacted]	[redacted]
	L3 Supervisor (Overtime)	28.00	HR	[redacted]	[redacted]
	Mobilization	96.00	HR	[redacted]	[redacted]
	Mobilization	24.00	HR	[redacted]	[redacted]
Total Labour					[redacted]
Travel:					
	T-Kilometers	2,400	KM	[redacted]	[redacted]
	T-RAT Vehicle Daily	16	EA	[redacted]	[redacted]
Travel Total					[redacted]
Equipment:					
	E-Access & Rescue Equipment	70	EA	[redacted]	[redacted]
	E-Equipment Shipping / Brokerage	1	EA	[redacted]	[redacted]
Equipment Total					[redacted]
General:					
	T-Lodging	75	EA	[redacted]	[redacted]
	C-Consumables/Materials/Supplies	1	EA	[redacted]	[redacted]
	Metal for Hand Rail, Toe Board, Ladder, Hatch	1	EA	[redacted]	[redacted]
	Electrical Conduit, New Lights and Supplies	1	EA	[redacted]	[redacted]
	Expansion Joint Cloth and Materials	1	EA	[redacted]	[redacted]
General Total:					[redacted]

Total Job [redacted]

CI Number: 45246

Title: LIN Cooling Water MCC Refurbishment

Start Date: 2014/06
In-Service Date: 2015/06
Final Cost Date: 2015/12
Function: Steam
Forecast Amount: $327,633

DESCRIPTION:

This project will include relocation of the cooling water equipment motor control centre (MCC) cabinets for Units 3 and 4 to a climate controlled building outside of the cooling water (CW) pump building to provide a less corrosive operating environment for this critical electrical equipment.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Health & Safety

Sub Criteria: Maintenance

Why do this project?

The CW Pump system MCCs are currently located adjacent to a walkway in the CW pump building where the conditions in the building are humid with salt water spray in the air resulting in a harsh environment for electrical switch gear. This environment has caused the MCC cabinets to begin to breakdown from corrosion around the door seals allowing humid air from the pumphouse to infiltrate into the cabinets, which increases the possibility of arcing and MCC failure creating a long term safety and/or operational reliability risk. An MCC failure could result in a trip of the generating unit until repairs are complete.

Why do this project now?

The project needs to be completed now in order mitigate the long term safety risks and risks to the unit's reliability caused by the harsh environment.

Why do this project this way?

Relocation of the MCC is the only long-term solution, as the environment in the building cannot be changed to allow the MCC to operate without further degradation and causing hazards and or reliability issues.

CI Number : 45246-SD09 - LIN Cooling Water MCC Refurbishment **Project Number** SD09

Parent CI Number : -

Cost Centre : 301 - 301-Lingan Admin./Common Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		4,880	0	4,880
095		095-Thermal Regular Labour AO		14,202	0	14,202
095		095-Thermal & Hydro Contracts AO		5,684	0	5,684
001	022	001 - THERMAL Regular Labour	022 - SGP - Elec Contr.Equip.	71,156	0	71,156
012	022	012 - Materials	022 - SGP - Elec Contr.Equip.	140,000	0	140,000
013	022	013 - POWER PRODUCTION Contracts	022 - SGP - Elec Contr.Equip.	61,489	0	61,489
066	022	066 - Other Goods & Services	022 - SGP - Elec Contr.Equip.	30,223	0	30,223
			Total Cost:	327,633	0	327,633
			Original Cost:	33,693		

Capital Project Detailed Estimate

Location: **Plant / Hydro**
CI# / FP#: 45246
Title: LIN CW MCC Refurbishment
Execution Year: 2014

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	160	$ 339.28	$ 54,284.80		
Engineering	PD	20	$ 383.81	$ 7,676.20		
Utilityworker	PD	40	$ 229.88	$ 9,195.20		
			Sub-Total	$ 71,156.20		
012 Materials						
MCC Cabinets and starters		2	$ 47,500.00	$ 95,000.00		
Cable Trays		1	$ 15,000.00	$ 15,000.00		
Cable Wiring		1	$ 30,000.00	$ 30,000.00		
				$ -		
			Sub-Total	$ 140,000.00		
013 Contracts						
Concrete Slab Installation		1	[redacted]			
Supply and install steel building		1	$ 26,000.00	$ 26,000.00		
Installation of HVAC unit in CW MCC		1	[redacted]		Cost Support Item #1	
				$ -		
			Sub-Total	$ 61,489.19		
066 Other Goods & Services						
Contingency	%	15%	$ 201,489.19	$ 30,223.38		
				$ -		
			Sub-Total	$ 30,223.38		
094 Interest Capitalized						
				$ 4,879.72		
				$ -		
			Sub-Total	$ 4,879.72		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 14,201.50		
Thermal / Hydro Contracts AO				$ 5,683.50		
			Sub-Total	$ 19,885.00		
			SUB-TOTAL (no AO, AFUDC)	$ 302,868.77		
			TOTAL (AO, AFUDC included)	$ 327,633.49		
Original Cost				$ 33,693.41		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Attachment 1 has been removed due to confidentiality.

CI Number: 46057

Title: LIN CW Screen Refurbishment 2015

Start Date: 2015/03
In-Service Date: 2015/11
Final Cost Date: 2016/05
Function: Steam
Forecast Amount: $292,634

DESCRIPTION:

There are eight travelling screens (two per unit) at the Lingan Generating Station. The self-cleaning screens remove sea debris from the incoming seawater before it enters the circulating water (CW) pump and downstream cooling systems including unit condensers.

The travelling screen assemblies consist of bottom, top and intermediate sections. The bottom section includes the tail sprocket assembly and support structure. The top section is comprised of the drive sprocket assembly and the support structure. The intermediate section spans vertically between the bottom and top sections, and supports the entire structure. The bottom and intermediate sections are submerged in salt seawater, and the upper sections are wetted components, and in a salt spray environment.

During periods of low seaweed loading, screens can be taken out of service with no impact to production, and refurbished. Screens are selected for refurbishment based on performance, condition and operational strategy for the unit. Screens 3A (Unit 3) and 4B (Unit 4) are identified for refurbishment in 2015.

Summary of Related CIs (+/- 2 years):
2013 CI 41124 LIN-Cooling Water (CW) Screen Refurbishment $292,708
2013 CI 43169 LIN CW Screen Refurbishment $218,217
2014 CI 44352 LIN CW Travelling Screen Refurbish $255,007
2016 CI TBD LIN CW Screen Refurbishment $TBD
2017 CI TBD LIN CW Screen Refurbishment $TBD

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Equipment Replacement

Why do this project?

Eel grass passing through degraded or non-functioning travelling screen panels results in downstream fouling of strainers at CW and Auxiliary CW locations and increases the risk of unit de-rating or outages due to inadequate cooling capacity, particularly during the late summer and fall. The degree of eel grass fouling also results in high mechanical loading on the screens and drive systems and on the circulating water pumps. This high loading causes component failure at the screens and CW pumps and increases the risk of unit de-rating or forced outages due to insufficient cooling water flow.

Why do this project now?

The screens have degraded over time and are in need of refurbishment. Completing this project will reduce existing issues with the circulating water system during periods of heavy seaweed and debris. This will reduce the risk of unit de-ratings and subsequent associated replacement energy costs.

Why do this project this way?

The screens operate in an aggressive seawater environment and have experienced related corrosion and wear. The most cost effective solution is to replace the corroded and worn components as opposed to replacing the complete screen. Primary components to be refurbished include the top drives (sprocket refurbishment, bearing replacement, shaft refurbishment, top boot replacement with stainless steel material), Intermediate Section (guides, supports and screen panels replacement) and Lower Section (sprocket refurbishment, bearing replacement, shaft refurbishment, bottom boot replacement with stainless steel material).

CI Number : 46057 - LIN - CW Screen Refurbishment 2015 **Project Number**

Parent CI Number : -

Cost Centre : 301 - 301-Lingan Admin./Common Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		8,758	0	8,758
095		095-Thermal Term Labour AO		10,592	0	10,592
095		095-Thermal Regular Labour AO		15,562	0	15,562
095		095-Thermal & Hydro Contracts AO		717	0	717
001	016	001 - THERMAL Regular Labour	016 - SGP - Feed Water Sys.	77,654	0	77,654
004	016	004 - THERMAL Term Labour	016 - SGP - Feed Water Sys.	52,852	0	52,852
012	016	012 - Materials	016 - SGP - Feed Water Sys.	118,500	0	118,500
013	016	013 - POWER PRODUCTION Contracts	016 - SGP - Feed Water Sys.	8,000	0	8,000
			Total Cost:	292,634	0	292,634
			Original Cost:	216,342		

Capital Project Detailed Estimate

Location: Lingan Generating Station
CI# / FP#: 46057
Title: LIN CW Screen Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician	PD	4.00	$ 346.07	$ 1,384.26		
Maintenance Trades	PD	200.00	$ 352.35	$ 70,469.76		
Utilityworker	PD	25.00	$ 231.99	$ 5,799.72		
			Sub-Total	$ 77,653.74	43169, 41124,44352	
004 Term Labour						
Maintenance Trades	PD	150.00	$ 352.35	$ 52,852.32		
				$ -		
				$ -		
			Sub-Total	$ 52,852.32		
012 Materials						
Top boot screen components	lot	2	$ 21,000	$ 42,000.00		
Screen Section Panels -stainless	lot	2	$ 15,000	$ 30,000.00		
Bottom Boot screen components	lot	2	$ 18,250	$ 36,500.00		
Contingency	lot	1	$ 10,000	$ 10,000.00		
				$ -		
				$ -		
				$ -		
			Sub-Total	$ 118,500.00	43169, 41124,44352	
013 Contracts						
Machining and Refurb Contingency	lot	2	$ 4,000	$ 8,000.00		
			Sub-Total	$ 8,000.00		
094 Interest Capitalized						
AFUDC				$ 8,757.79		
				$ -		
			Sub-Total	$ 8,757.79		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 15,561.81		
Thermal Term Labour AO				$ 10,591.60		
Thermal / Hydro Contracts AO				$ 716.80		
			Sub-Total	$ 26,870.21		
			SUB-TOTAL (no AO, AFUDC)	$ 257,006.06		
			TOTAL (AO, AFUDC included)	$ 292,634.06		
Original Cost				$ 216,341.85		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

LIN CW Screen Refurbishment
Summary of Alternatives

Division :	Power Production	**Date :**	**24-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46057
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank (based on PV of RR)	IRR	Disc Pay
A	CW Screen Refurbish vs. Avoided Rep	6.19%	-770,494	525,308	1	60.39%	2.1 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

Recommendation :

It is recommened to complete the refurbishment of the CW Screens in order to avoid material and replacement energy costs due to unplanned failures. This is reflected in the lower PV of Revenue Requirement

Notes/Comments :

CW Screen Refurbish vs. Avoided Repair and Replacement Energy Costs

This options considers the CW Refurbishment versus a "do nothing" option and the material and replacement energy costs associated with the unplanned failures.

Test 2

Test 3

Test 4

LIN CW Screen Refurbishment
Summary of Sensitivities

Division :	Power Production	**Date :**	**24-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46057
Originator :		**Project No. :**	

	Alternative	After Tax WACC	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	CW Screen Refurbish vs. Avoided Repair and Re	6.19%	-770,494	525,308	1	60.39%	2.1 years
B	Test 2	6.19%	0	0	2	#NUM!	0.0 years
C	Test 3	6.19%	0	0	2	#NUM!	0.0 years
D	Test 4	6.19%	0	0	2	#NUM!	0.0 years

	Alternative Variance on Capital Spend	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	CW Screen Refurbish vs. Avoided Repair and Re	10%	-745,849	504,627	1	53.62%	2.3 years
B	Test 2	10%	0	0	2	#NUM!	0.0 years
C	Test 3	10%	0	0	2	#NUM!	0.0 years
D	Test 4	10%	0	0	2	#NUM!	0.0 years

Change:		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
	A	24,645	-20,681	0	-6.78%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

	Alternative Variance on Avoided Expenses	Variance (%)	PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
A	CW Screen Refurbish vs. Avoided Repair and Re	-10%	-668,800	452,096	1	52.94%	2.3 years
B	Test 2	-10%	0	0	2	#NUM!	0.0 years
C	Test 3	-10%	0	0	2	#NUM!	0.0 years
D	Test 4	-10%	0	0	2	#NUM!	0.0 years

Change:		PV of Revenue Requirement	PV of EVA / NPV	Rank	IRR	Disc Pay
	A	101,694	-73,212	0	-7.45%	0.2 years
	B	0	0	0	#NUM!	0.0 years
	C	0	0	0	#NUM!	0.0 years
	D	0	0	0	#NUM!	0.0 years

Alternative Variance on Avoided Expenses - Change in Revenue Requirement	Yrs Delay:	PV of Revenue Requirement 1	PV of Revenue Requirement 2	PV of Revenue Requirement 3	Delay?
	A	69,322	190,723	320,684	No
	B	0	0	0	No
	C	0	0	0	No
	D	0	0	0	No

LIN CW Screen Refurbishment
Avoided Cost Calculations

Division :	Power Production	**Date :**	**24-Oct-14**
Department :	Lingan Generating Station	**CI Number:**	46057
Originator :		**Project No. :**	

CW Screen Refurbish vs. Avoided Repair and Replacement Energy Costs

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**82,453**	**85,767**		
Events/Outages (#)	**1**	**2**	**1**	**2**		
Probability of Occurance (%)	**60%**	**60%**	**60%**	**60%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**20**	**20**				
Duration (Hours)	**504**	**504**				
Totals	**$24,856**	**$47,167**	**$49,472**	**$102,921**	**$74,327**	**$150,088**
Total Capital Cost of Alternative						**$292,634**

Test 2

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

Test 3

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

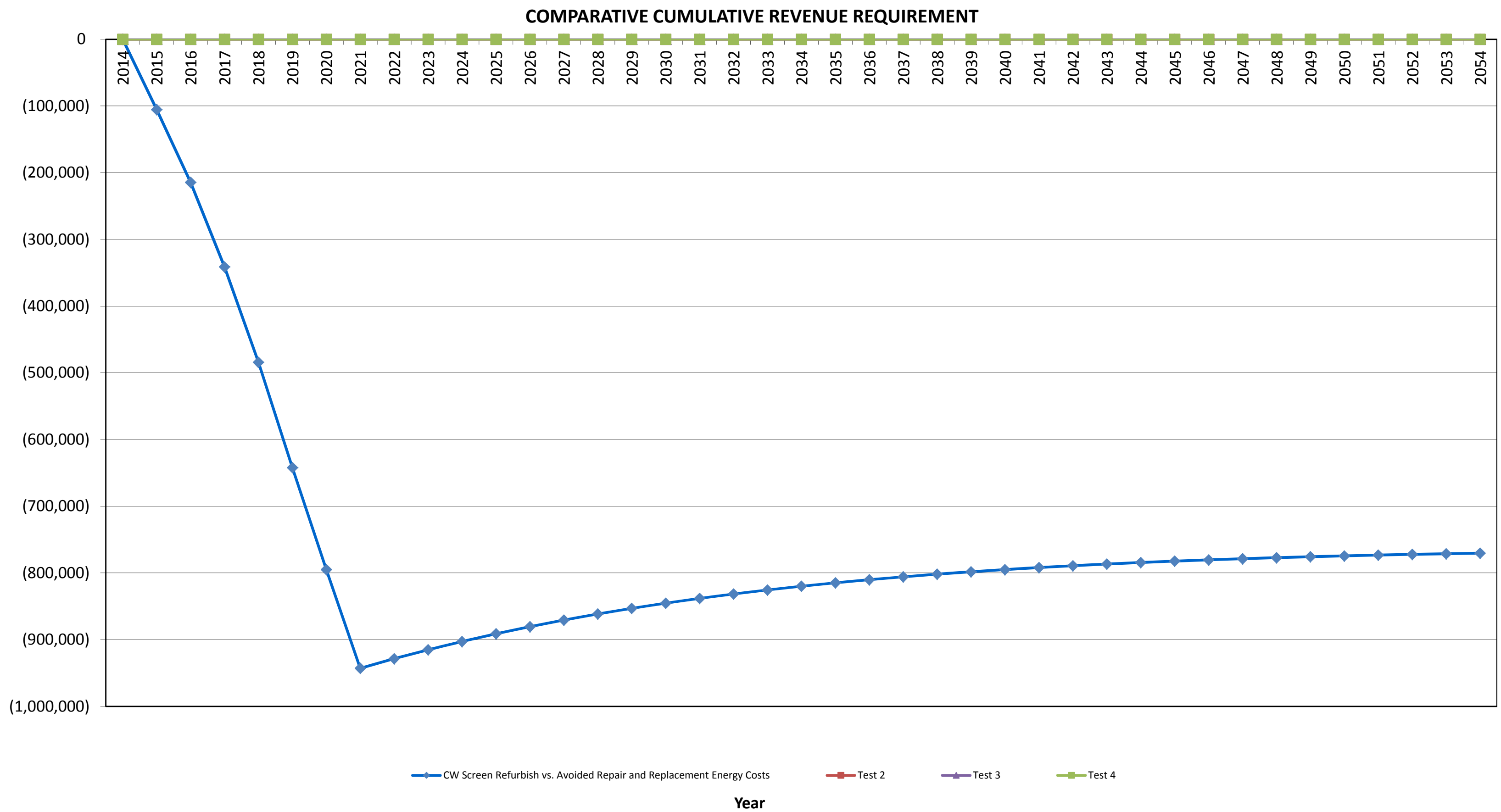
Test 4

	Avoided Replacement Energy Costs		Avoided Unplanned Repair Costs		Total Annual Avoided Costs	
Year	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Replacement Energy Cost ($/MWh)	[redacted]					
Repair Cost ($)			**0**	**0**		
Events/Outages (#)	**0**	**0**	**0**	**0**		
Probability of Occurance (%)	**0%**	**0%**	**0%**	**0%**		
Capacity Factor (%)	[redacted]					
Energy Replaced (MW)	**0**	**0**				
Duration (Hours)	**0**	**0**				
Totals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Total Capital Cost of Alternative						**$0**

LIN CW Screen Refurbishment

CW Screen Refurbish vs. Avoided Repair and Replacement Energy Costs

Year	Total Revenue	Operating Costs	Avoided Expenses	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2014	-	-	-	-	-	-	-	-	-	-	1.00	-
2015	-	-	74,327.3	(265,763.9)	10,280.2	254,142.0	(191,436.6)	(19,854.6)	(211,291.1)	(198,974.6)	0.94	(198,974.6)
2016	-	-	150,088.2	-	19,738.1	233,165.8	150,088.2	(40,408.6)	109,679.7	97,265.5	0.89	(101,709.1)
2017	-	-	181,030.7	-	18,159.0	213,867.6	181,030.7	(50,490.2)	130,540.5	109,017.0	0.84	7,307.9
2018	-	-	213,913.6	-	16,706.3	196,113.3	213,913.6	(61,134.3)	152,779.4	120,151.8	0.79	127,459.7
2019	-	-	248,840.4	-	15,369.8	179,779.4	248,840.4	(72,375.9)	176,464.5	130,689.1	0.74	258,148.8
2020	-	-	257,327.3	-	14,140.2	164,752.1	257,327.3	(75,388.0)	181,939.3	126,889.3	0.70	385,038.0
2021	-	-	266,125.2	-	13,009.0	150,927.1	266,125.2	(78,466.0)	187,659.1	123,249.3	0.66	508,287.3
2022	-	-	-	-	11,968.3	138,208.0	-	3,710.2	3,710.2	2,294.7	0.62	510,582.0
2023	-	-	-	-	11,010.8	126,506.5	-	3,413.4	3,413.4	1,988.1	0.58	512,570.1
2024	-	-	-	-	10,129.9	115,741.1	-	3,140.3	3,140.3	1,722.4	0.55	514,292.4
2025	-	-	-	-	9,319.6	105,836.9	-	2,889.1	2,889.1	1,492.2	0.52	515,784.7
2026	-	-	-	-	8,574.0	96,725.1	-	2,657.9	2,657.9	1,292.8	0.49	517,077.5
2027	-	-	-	-	7,888.1	88,342.2	-	2,445.3	2,445.3	1,120.1	0.46	518,197.6
2028	-	-	-	-	7,257.0	80,629.9	-	2,249.7	2,249.7	970.4	0.43	519,168.0
2029	-	-	-	-	6,676.5	73,534.6	-	2,069.7	2,069.7	840.7	0.41	520,008.7
2030	-	-	-	-	6,142.3	67,007.0	-	1,904.1	1,904.1	728.4	0.38	520,737.1
2031	-	-	-	-	5,651.0	61,001.5	-	1,751.8	1,751.8	631.0	0.36	521,368.1
2032	-	-	-	-	5,198.9	55,476.5	-	1,611.7	1,611.7	546.7	0.34	521,914.9
2033	-	-	-	-	4,783.0	50,393.5	-	1,482.7	1,482.7	473.7	0.32	522,388.5
2034	-	-	-	-	4,400.3	45,717.2	-	1,364.1	1,364.1	410.4	0.30	522,798.9
2035	-	-	-	-	4,048.3	41,414.9	-	1,255.0	1,255.0	355.5	0.28	523,154.4
2036	-	-	-	-	3,724.4	37,456.8	-	1,154.6	1,154.6	308.0	0.27	523,462.4
2037	-	-	-	-	3,426.5	33,815.4	-	1,062.2	1,062.2	266.9	0.25	523,729.3
2038	-	-	-	-	3,152.4	30,465.3	-	977.2	977.2	231.2	0.24	523,960.5
2039	-	-	-	-	2,900.2	27,383.2	-	899.1	899.1	200.3	0.22	524,160.8
2040	-	-	-	-	2,668.2	24,547.6	-	827.1	827.1	173.5	0.21	524,334.4
2041	-	-	-	-	2,454.7	21,938.9	-	761.0	761.0	150.4	0.20	524,484.7
2042	-	-	-	-	2,258.3	19,538.9	-	700.1	700.1	130.3	0.19	524,615.0
2043	-	-	-	-	2,077.7	17,330.9	-	644.1	644.1	112.9	0.18	524,727.8
2044	-	-	-	-	1,911.5	15,299.6	-	592.6	592.6	97.8	0.17	524,825.6
2045	-	-	-	-	1,758.5	13,430.7	-	545.1	545.1	84.7	0.16	524,910.3
2046	-	-	-	-	1,617.9	11,711.4	-	501.5	501.5	73.4	0.15	524,983.7
2047	-	-	-	-	1,488.4	10,129.6	-	461.4	461.4	63.6	0.14	525,047.3
2048	-	-	-	-	1,369.4	8,674.3	-	424.5	424.5	55.1	0.13	525,102.3
2049	-	-	-	-	1,259.8	7,335.5	-	390.5	390.5	47.7	0.12	525,150.1
2050	-	-	-	-	1,159.0	6,103.8	-	359.3	359.3	41.3	0.12	525,191.4
2051	-	-	-	-	1,066.3	4,970.6	-	330.6	330.6	35.8	0.11	525,227.2
2052	-	-	-	-	981.0	3,928.1	-	304.1	304.1	31.0	0.10	525,258.3
2053	-	-	-	-	902.5	2,968.9	-	279.8	279.8	26.9	0.10	525,285.2
2054	-	-	-	-	830.3	2,086.5	-	257.4	257.4	23.3	0.09	525,308.5
Total	**-**	**-**	**1,391,652.7**	**(265,763.9)**	**247,457.5**		**1,125,888.9**	**(354,700.5)**	**771,188.3**	**525,308.5**		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CW Screen Refurbish vs. Avoided Repair and Replacement Energy Costs
Test 2
Test 3
Test 4
Year

CI Number: 46293

Title: LIN Coal Bunker Chute Refurbishment

Start Date: 2015/05
In-Service Date: 2015/07
Final Cost Date: 2015/12
Function: Steam
Forecast Amount: $291,730

DESCRIPTION:

This project is for the refurbishment of the coal bunker chutes in order to eliminate the safety hazard of falling coal.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Health & Safety

Sub Criteria: Maintenance

Why do this project?

At Lingan Generating Station, the coal bunkers are used to store and feed the coal into the gravimetric feeders before pulverization in mills. The bunkers are filled via two coal trippers which travel along the length of the plant stopping at each of the 16 bunkers filling them with coal. Each of the bunkers has four chutes where the trippers enter and exit the top of the bunker to capture coal as the tripper moves to the next bunker. Having handled millions of tonnes of coal, these chutes have worn, and now have holes allowing coal to fall to the floors below, creating a safety hazard for plant personnel. Refurbishing these chutes will address a safety risk (fire hazard from coal spillage) and eliminate the need to monitor the area for falling coal and the cleanup associated with it.

Why do this project now?

Completing this project now will eliminate the concern of potential coal spillage and the associated fire hazard.

Why do this project this way?

Refurbishment of the chutes is the only option as the chutes have reached the end of their service life. Replacement of the chutes is a more costly option with minimal added benefit as compared to refurbishment

CI Number : 46293 - LIN Coal Bunker Chute Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 301 - 301-Lingan Admin./Common Capital **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		1,675	0	1,675
095		095-Thermal & Hydro Contracts AO		18,637	0	18,637
095		095-Thermal Regular Labour AO		5,579	0	5,579
001	018	001 - THERMAL Regular Labour	018 - SGP - Fuel Hndlg.Coal	27,839	0	27,839
012	018	012 - Materials	018 - SGP - Fuel Hndlg.Coal	30,000	0	30,000
013	018	013 - POWER PRODUCTION Contracts	018 - SGP - Fuel Hndlg.Coal	208,000	0	208,000
			Total Cost:	291,730	0	291,730
			Original Cost:	101,069		

Capital Project Detailed Estimate

Location: **Lingan Generating Station**
CI# / FP#: 46293
Title: LIN Coal Bunker Chute Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Utilityworker	PD	120.00	$ 231.99	$ 27,838.66		
			Sub-Total	$ 27,838.66		
012 Materials						
Structural Steel	lot	1	$ 20,000	$ 20,000.00		
Miscellaneous Supplies	lot	1	$ 10,000	$ 10,000.00		
			Sub-Total	$ 30,000.00		
013 Contracts						
Install Chute Sealing Material	ea	32	$ 3,000.00	$ 96,000.00		
Chute Structural Steel Refurbishment	ea	32	$ 3,500.00	$ 112,000.00		
			Sub-Total	$ 208,000.00		
094 Interest Capitalized						
AFUDC				$ 1,675.37		
			Sub-Total	$ 1,675.37		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 5,578.87		
Thermal / Hydro Contracts AO				$ 18,636.80		
			Sub-Total	$ 24,215.67		
			SUB-TOTAL (no AO, AFUDC)	$ 265,838.66		
			TOTAL (AO, AFUDC included)	$ 291,729.70		
Original Cost				$ 101,068.82		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Gas Turbine

Combustion Turbines (CTs)

NS Power has a fleet of nine CTs ranging from 30MW Pratt & Whitney FT4C engines to 50MW GE LM6000 PC engines.

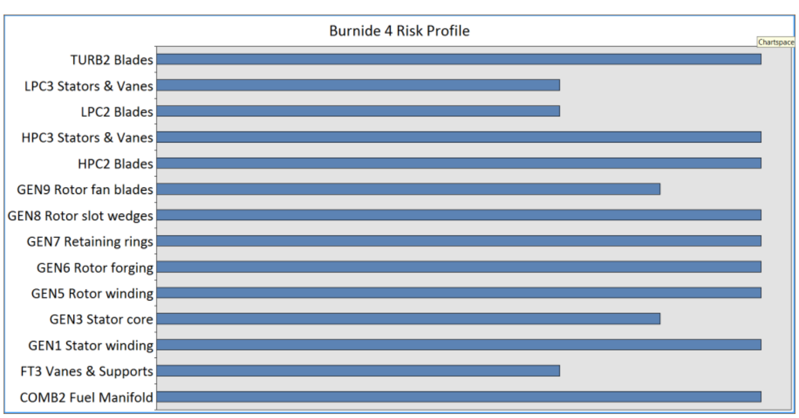
Combustion turbines and their associated generators are considered complex asset classes, as they are composed of large rotating masses, high speed rotational elements, miniscule clearances and precision controls. All NS Power Combustion Turbines are based on aero-derivatives, and therefore are compact relative to frame units and have a high degree of remote control capability.

NS Power engages independent industry experts to support regular health assessments and risk profiles. Over 40 key problem areas are assessed and rated for each Unit.

The following graphic illustrates Generator Unit risk profile of the Burnside Unit 4 Combustion Turbine. Each unit has a similar risk profile developed through comprehensive assessments. Risks are considered for each turbine generator set with the highest risks typically dictating the timing of the next planned major outage. Lower risk items are considered against their anticipated risk progression, compared to the next planned major outage to determine when the risk needs to be addressed.

For the LM6000's, long term maintenance planning anticipates 25,000 and 50,000 hours of operation as the planned major outage intervals. These intervals are influenced by health assessments to determine actual outage intervals and scope.

With respect to the Pratt and Whitney units, recent assessments were conducted to determine their suitability for operation well into the future. Based on this work it is expected that these units could be operated in the long term and that reinvestment in this legacy fleet would be dramatically less expensive than building new capacity. Near term investment is based on recent health assessments and is influenced by regular inspections.



CI Number: 45116

Title: CT – Burnside Gas Turbine 1 GG4C-1D Engine Refurbishment

Start Date: 2015/03
In-Service Date: 2015/06
Final Cost Date: 2015/12
Function: Gas Turbines
Forecast Amount: $1,168,167

DESCRIPTION:

This project is to complete the refurbishment of the Burnside Unit 1 engine, enabling operation through to the next planned major outage, currently expected in five years. The refurbishment will include all necessary repairs and implementation of applicable Service Bulletins. Refurbishment is based on standard Original Equipment Manufacturer (OEM) teardown, inspection and refurbishment criteria.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

Depreciation Class: Gas Turbines- Burnside

Estimated Useful Life: 20 years

JUSTIFICATION:

Justification Criteria: Thermal

Sub Criteria: Maintenance

Why do this project?

Burnside Unit 1 is required to support system black-start capability, 10 minute operating reserve, metro Halifax VAR support, peak generating capacity, load-following and regulation, and fuel flexibility. As determined by boroscope inspection and independent third party assessment, this engine is due for major refurbishment. Refurbishing this engine will enable operation of the unit to the next major refurbishment interval. This project is in line with the combustion turbine fleet health assessment and multi-year plan.

Why do this project now?

NS Power's planned inspection has revealed that this engine is in need of refurbishment now. This finding is consistent with independent, third party assessment and the long-term investment plan for the combustion turbine fleet.

Why do this project this way?

Refurbishment of engines in this manner will keep maximum availability for the seven liquid-fired units. Components for each of the seven liquid-fired engines are transferrable, so any and all equipment can be re-located to another unit if strategic planning for these units changes over time. NS Power will continue to review the needs of the fleet, including the need for fast-acting generation to support the increasing amount of renewables, VAR support and black-start capabilities, and re-confirm the path-forward for each refurbishment.

CI Number : 45116 - CT - BGT1 GG4C-1D Engine Refurbishment **Project Number**

Parent CI Number : -

Cost Centre : 393 - 393-Burnside C/T **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		389	0	389
095		095-Thermal Overtime Labour AO		1,040	0	1,040
095		095-Thermal & Hydro Contracts AO		73,138	0	73,138
095		095-Thermal Regular Labour AO		1,387	0	1,387
001	030	001 - THERMAL Regular Labour	030 - GTG - Gas Turbine Engines	6,921	0	6,921
002	030	002 - THERMAL Overtime Labour	030 - GTG - Gas Turbine Engines	10,382	0	10,382
012	030	012 - Materials	030 - GTG - Gas Turbine Engines	151,500	0	151,500
013	030	013 - POWER PRODUCTION Contracts	030 - GTG - Gas Turbine Engines	816,272	0	816,272
015	030	015 - Frt, Post & Delivery	030 - GTG - Gas Turbine Engines	10,000	0	10,000
041	030	041 - Meals & Entertainment	030 - GTG - Gas Turbine Engines	360	0	360
066	030	066 - Other Goods & Services	030 - GTG - Gas Turbine Engines	96,777	0	96,777
			Total Cost:	1,168,167	0	1,168,167
			Original Cost:	262,668		

Capital Project Detailed Estimate

Location: Gas Turbine
CI# / FP#: 45116
Title: BGT1 GG4C-1D Engine Refurbishment
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Gas Turbine Operators	PD	20	$ 346	$ 6,921.32		
			Sub-Total	$ 6,921.32		
002 OT Labour						
Gas Turbine Operators	PD	30	$ 346	$ 10,381.98		
				$ -		
			Sub-Total	$ 10,381.98		
012 Materials						
Other Materials to complete engine refurbishment	Lot	1	$ 150,000	$ 150,000.00		CI42907 Burnside FT Overhaul
Consumables	Lot	1	$ 1,500	$ 1,500.00		
				$ -		
				$ -		
			Sub-Total	$ 151,500.00		
013 Contracts						
OEM Field Service Support	ea	1	[redacted]			
OEM Engine Refurbishment	ea	1	[redacted]		Cost Support Item #1 @ $0.92 USD	
AW Leil Crane rental	ea	2	$ 1,000	$ 2,000.00		
				$ -		
			Sub-Total	$ 816,272.38		
015 Freight						
Shipping to/from OEM	ea	1	$ 10,000	$ 10,000.00		
				$ -		
			Sub-Total	$ 10,000.00		
041 Meals & Entertainment						
Meals	ea	24	$ 15	$ 360.00		
				$ -		
			Sub-Total	$ 360.00		
066 Other Goods & Services						
Contingency and Currency Risk 20%	%	10%	$ 967,772	$ 96,777.24		
				$ -		
			Sub-Total	$ 96,777.24		
094 Interest Capitalized						
AFUDC				$ 388.83		
				$ -		
			Sub-Total	$ 388.83		
095 Administrative Overhead						
Thermal Reg. Labour AO		1.00	1387.04	$ 1,387.04		
Thermal OT Labour AO		1.00	1040.28	$ 1,040.28		
Thermal / Hydro Contracts AO		1.00	80956.34	$ 73,138.01		
			Sub-Total	$ 75,565.33		
			SUB-TOTAL (no AO, AFUDC)	$ 1,092,212.92		
			TOTAL (AO, AFUDC included)	$ 1,168,167.08		
Original Cost				$ 262,667.97		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Wood Group Pratt & Whitney
Industrial Turbine Services, LLC.
1460 Blue Hills Avenue
Bloomfield, Connecticut 06002
(860) 286-4600

WGPW

August 21, 2014

Dean Webb
Nova Scotia Power
Halifax, NS B3J 2W5
Canada

Subject: **Request for Proposal to Repair Gas Generator Model GG4C-1D S/N P686630**

Reference: WGP&W Quotation No. 14G099MT

Dear Dean:

Wood Group Pratt & Whitney is pleased to provide Nova Scotia Power pricing for the repair of Gas Generator S/N P686630 Model GG4C-1D. Assuming no changes, pricing is based on WGP&W previously supplied cost estimate and paid invoices by Nova Scotia Power as previously identified.

As per our discussion, WGPW is offering "Zinc" filled HPC stators as an alternative to this engine's original configuration. Note: both solid box and zinc stators are used in the GG4C-1D model engines.

Recognizing Nova Scotia as a valued customer, WGPW will hold the submitted 2012 pricing with the additional charge to inspect and repair your LPT and HPT modules. Total estimated price of $[redacted]. Additional charges are based on all material being repairable and subject to change upon complete detailed inspection.

WGP&W will assign a customer support representative to monitor your gas generator during the entire repair process communicating status, costs to repair, and other conditions.

Upon completion of material inventory, cursory inspection, and vendor reports, WGPW will issue a cost estimate with final pricing noting all additional repair and replacement material required.

Please Note the Following:

- Additional repairs that may be identified during the repair process and material that may be determined non-repairable will be considered over and above costs.
- Pricing does not include taxes, custom fee, duties, etc
- Above and all supplied pricing will be in USD
- All parts are subject to prior sale
- Shipping: Ex Works Bloomfield CT
- Quotation is valid for 30 Days
- Subject to the attached negotiated terms and conditions

Wood Group Pratt & Whitney
Industrial Turbine Services, LLC.
1460 Blue Hills Avenue
Bloomfield, Connecticut 06002
(860) 286-4600

WGPW

If you require any additional information please do not hesitate to contact us.

Sincerely,

Mark Taylor
Vice President of Sale
Wood Group Pratt & Whitney
Industrial Turbine Services, LLC
1460 Blue Hills Avenue
P.O. Box 45
Bloomfield, CT 06002
Office:
Mobile:

CI Number: 20511

Title: CT – Victoria Junction Replace Halon Fire Protection System

Start Date:	2015/01
In-Service Date:	2015/04
Final Cost Date:	2015/10
Function:	Gas Turbines
Forecast Amount:	$268,467

DESCRIPTION:

This project is to replace the current Halon fire protection system with an environmentally friendly one at Victoria Junction Combustion Turbine facility. The new system is expected to be a fine mist (water) spray system, although alternatives are being explored.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Health & Safety

Sub Criteria: Equipment Replacement

Why do this project?

The Combustion Turbines require a fire suppression system for safe operation. The existing system uses Halon Gas for fire suppression, which is being removed from use in order to comply with environmental legislation. This project will also provide NS Power with knowledge to plan for removing Halon from the Burnside and Tusket locations.

Why do this project now?

Halon, an ozone depleting substance, is no longer available for purchase due to its environmental effects. NS Power does not have spare Halon with which to replenish the current fire protection system with. A release from one of the existing enclosures would render the unit unavailable.

Why do this project this way?

Replacement of the fire protection system is the only option due to the environmental legislation.

CI Number : 20511 - CT - Victoria Junction Replace Halon Fire Protection System **Project Number**

Parent CI Number : -

Cost Centre : 392 - 392-Victoria Junction C/T **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		2,076	0	2,076
095		095-Thermal & Hydro Contracts AO		12,902	0	12,902
095		095-Thermal Overtime Labour AO		694	0	694
095		095-Thermal Regular Labour AO		1,387	0	1,387
001	003	001 - THERMAL Regular Labour	003 - GTG - Bldg.,Struct.Grnd.	6,921	0	6,921
002	003	002 - THERMAL Overtime Labour	003 - GTG - Bldg.,Struct.Grnd.	6,921	0	6,921
011	003	011 - Travel Expense	003 - GTG - Bldg.,Struct.Grnd.	3,565	0	3,565
012	003	012 - Materials	003 - GTG - Bldg.,Struct.Grnd.	90,000	0	90,000
013	003	013 - POWER PRODUCTION Contracts	003 - GTG - Bldg.,Struct.Grnd.	144,000	0	144,000
			Total Cost:	268,467	0	268,467
			Original Cost:	47,136		

Capital Project Detailed Estimate

Location: Gas Turbine
CI# / FP#: 20511
Title: CT - Victoria Junction Replace Halon Fire Protection System
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Gas Turbine Operators	PD	20	$ 346	$ 6,921.31		
			Sub-Total	$ 6,921.31		
002 OT Labour						
Gas Turbine Operators	PD	10	$ 692	$ 6,921.31		
				$ -		
			Sub-Total	$ 6,921.31		
011 Travel Expense						
Lodging / Vehicle Rental	lot	1	$ 3,565	$ 3,565.00		
				$ -		
			Sub-Total	$ 3,565.00		
012 Materials						
Materials required for upgrade	lot	1	$ 90,000	$ 90,000.00		
				$ -		
			Sub-Total	$ 90,000.00		
013 Contracts						
Supply and installation of new suppression system	lot	1	$ 144,000	$ 144,000.00		
				$ -		
			Sub-Total	$ 144,000.00		
094 Interest Capitalized						
AFUDC				$ 2,076.25		
				$ -		
			Sub-Total	$ 2,076.25		
095 Administrative Overhead						
Thermal Reg. Labour AO				$ 1,387.03		
Thermal OT Labour AO				$ 693.52		
Thermal / Hydro Contracts AO				$ 12,902.40		
			Sub-Total	$ 14,982.95		
			SUB-TOTAL (no AO, AFUDC)	$ 251,407.62		
			TOTAL (AO, AFUDC included)	$ 268,466.82		
Original Cost				$47,136.04		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Transmission

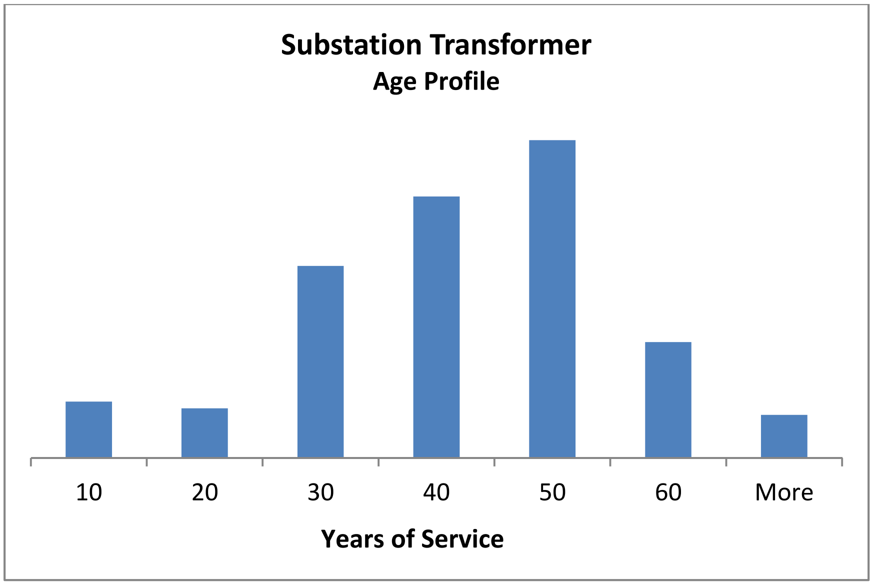
Transmission

The Transmission capital investment included in this plan is focused on system reliability through sustaining capital programs and the integration of renewable projects such as South Canoe, Sable Wind Farms and the Maritime Link. These investments can be categorized into four categories: Sustaining, Customer Driven, Compliance and Renewables Integration.

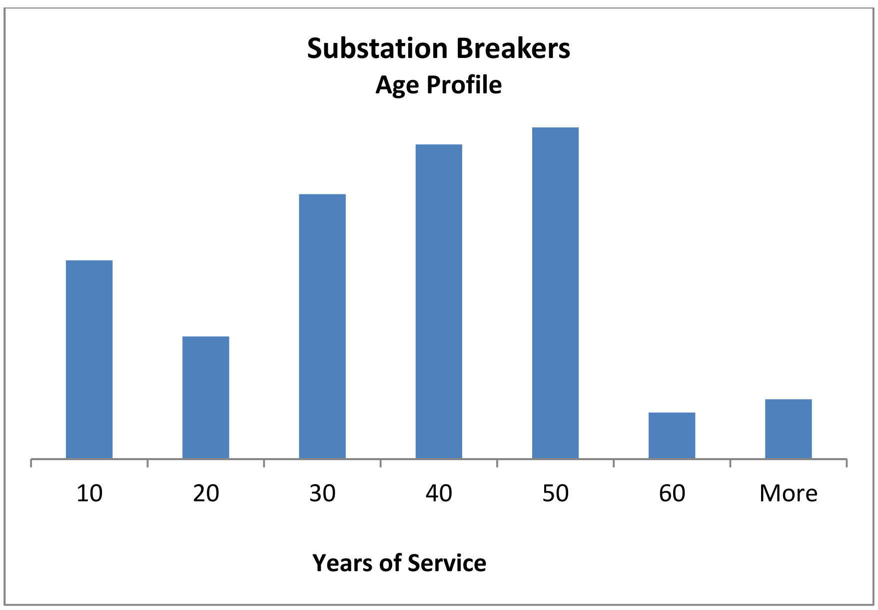
Category	2015 ACE Plan ($M)
Sustaining	37.8
Customer Driven	5.6
Compliance	4.9
Renewables Integration	19.7
Total Capital Program	**68.0**

Sustaining

Sustaining capital investment projects target asset replacement and refurbishment identified through NS Power's transmission line and substation inspection program. These investments are based on health assessments and the criticality of the asset, and include the replacement of transmission line and substation assets, transmission right of way widening, critical spares and protection modifications and replacements. The average age of transmission assets being replaced under this plan is 45 years of service. The age profiles for the substation transformer and breaker assets illustrate the aging transmission infrastructure and necessity for sustaining capital. In 2015, three substation transformers will be replaced based on health assessment and criticality.



Additionally, there are fourteen breaker replacements and two spare breakers planned in the 2015 capital program.



Transmission line investments are determined based on the results of the transmission line inspection program. Inspection results are utilized to perform health assessments on the transmission structures. Transmission line investments are prioritized based on the transmission lines criticality and health assessment.

Customer Driven

Customer driven investments on the transmission system are determined based on load growth and have been identified through transmission system planning studies. This investment is required to ensure the reliable operation of the transmission system.

Compliance

Compliance investments in 2015 are required to comply with NPCC standards surrounding bulk power system (BPS) and environmental regulations. Investments in BPS upgrades have been ongoing for three years and will be completed by the end of 2016. Planned replacement of equipment containing PCBs in substations is required to meet federal environmental regulations surrounding the removal of PCB from electrical equipment by 2025.

CI Number: 46339

Title: 120H Brushy Hill - SVC Controls Replacement

Start Date: 2015/03
In-Service Date: 2016/11
Final Cost Date: 2017/05
Function: Transmission
Forecast Amount: $9,959,330

DESCRIPTION:

The project provides for the replacement of the Static Var Compensator (SVC) controls at the 120H - Brushy Hill Substation. The SVC provides/absorbs reactive power to the 230kV and 138kV transmission system in the Metro area to support the stability of the Bulk Power System. If the SVC is not operational, reactive power needs to be provided/absorbed by our generating stations and could lead to non-optimal generation dispatch. This project involves the replacement of the SVCs control system, thyristors, cooling system, AC/DC System and replacement of SVC internal protection. This project is to be completed in two stages, over two years.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

Depreciation Class: Transmission Plant Station Equipment

Estimated Useful Life: Approximately 25 Years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The Static Var Compensator (SVC) located at 120H - Brushy Hill was installed in the mid 1980s and has reached the end of its designed service life (approximately 25 years). The SVC is required to provide reactive power and voltage support to the Metro region serving 230kV and 138kV systems for the next 15-20 years. To do so reliably requires this project to be completed. The existing control system, thyristors, cooling, internal protection and AC/DC systems are in need of replacement to allow the SVC to continue operating reliably for the required time period.

Why do this project now?

Spare parts and product support are no longer available for the existing SVC control system. The control system replacement is planned to take place over two years due to the long lead time of the required parts. The normal manufacturer supported life cycle of a modern control system is approximately 15 to 20 years. The existing controls have reached the end of their lives.

Why do this project this way?

Refurbishment of a control system is not feasible. Replacement with more modern controls (that are supported by the manufacturer) is the only feasible option. This work will be completed with a combination of internal and external resources. A contractor will be used for the installation and commissioning of the new controls package. Internal resources will be used to interface these new controls with existing NS Power equipment (protection, SCADA, etc.).

CI Number : 46339 - 120H Brushy Hill - SVC Controls Replacement **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D OT Labour AO		3,758	0	3,758
092		092-Vehicle T&D Reg. Labour AO		52,590	0	52,590
094		094 - Interest Capitalized		356,560	0	356,560
095		095-COPS Overtime Labour AO		5,797	0	5,797
095		095-COPS Regular Labour AO		[redacted]	0	[redacted]
095		095-COPS Contracts AO		[redacted]	0	[redacted]
001	022	001 - T&D Regular Labour	022 - TP - Elec Contr.Equip.	6,200	0	6,200
002	022	002 - T&D Overtime Labour	022 - TP - Elec Contr.Equip.	7,085	0	7,085
012	022	012 - Materials	022 - TP - Elec Contr.Equip.	30,000	0	30,000
013	022	013 - COPS Contracts	022 - TP - Elec Contr.Equip.	3,800	0	3,800
012	023	012 - Materials	023 - TP - Power Equip.-Station S	3,000	0	3,000
001	043	001 - T&D Regular Labour	043 - TP - Substn Dev.	18,598	0	18,598
002	043	002 - T&D Overtime Labour	043 - TP - Substn Dev.	7,085	0	7,085
012	043	012 - Materials	043 - TP - Substn Dev.	[redacted]	0	[redacted]
013	043	013 - COPS Contracts	043 - TP - Substn Dev.	[redacted]	0	[redacted]
001	085	001 - Regular Labour (No AO)	085 Design	23,330	0	23,330
001	085	001 - T&D Regular Labour	085 Design	59,193	0	59,193
011	085	011 - Travel Expense	085 Design	10,880	0	10,880
066	085	066 - Other Goods & Services	085 Design	754,320	0	754,320
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	15,160	0	15,160
			Total Cost:	9,959,330	0	9,959,330
			Original Cost:	3,915,071		

Capital Project Detailed Estimate

Location: **Transmission**
CI# / FP#: 46339
Title: 120H Brushy Hill - SVC Controls Replacement
Execution Year: 2015/2016

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	70.00	$ 354.26	$ 24,798.00		
T&D Labour - Site Supervision	PD	40.00	$ 379.00	$ 15,160.00		
T&D Labour - Design	PD	170.59	$ 347.00	$ 59,193.00		
Procurement / Financial (No AO)	Lot	1.00	$ 23,330.00	$ 23,330.00		
				$ -		
			Sub-Total	$ 122,481.00		
002 OT Labour						
T&D Labour - Electrician/Technician	PD	20.00	708.52	$ 14,170.00		
			$ -	$ -		
			$ -	$ -		
			Sub-Total	$ 14,170.00		
011 Travel Expense						
Travel	Lot	1	$ 10,880.00	$ 10,880.00		
				$ -		
				$ -		
			Sub-Total	$ 10,880.00		
012 Materials						
SVC EPC Supplier Materials	Lot	1	[redacted]			
Communications & Controls Equipment	Lot	1				
				$ -		
			Sub-Total	[redacted]		
013 Contracts						
SVC EPC Contract	Lot	1	[redacted]			
Misc. Contracts	Lot	1				
				$ -		
			Sub-Total	[redacted]		
066 Other Goods & Services						
Contingency	%	[redacted]		$ 754,320.00		
				$ -		
				$ -		
			Sub-Total	$ 754,320.00		
094 Interest Capitalized						
Interest				$ 356,560.17		
				$ -		
				$ -		
			Sub-Total	$ 356,560.17		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 52,589.69		
Vehicle T&D Labour Overtime AO				$ 3,757.88		
			Sub-Total	$ 56,347.57		
095 Administrative Overhead						
COPS T&D Labour Regular AO				[redacted]		
COPS T&D Labour Overtime AO				$ 5,796.95		
COPS Contract AO				[redacted]		
			Sub-Total	$ 1,282,770.93		
			SUB-TOTAL (no AO, AFUDC)	$ 8,263,651.00		
			TOTAL (AO, AFUDC included)	$ 9,959,329.68		
Original Cost				$ 3,915,070.84		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Attachment 1 has been removed due to confidentiality.

CI Number: 46513

Title: 3C-Port Hastings BPS Upgrades 230kV

Start Date:	2015/01
In-Service Date:	2016/03
Final Cost Date:	2016/09
Function:	Transmission
Forecast Amount:	$3,684,823

DESCRIPTION:

This project provides for upgrades to the protection system at 3C-Port Hastings (230kV) to comply with Northeast Power Coordination Council (NPCC) bulk power system protection risk reduction plan.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: System Protection

Depreciation Class: Transmission Plant – Station Equipment

Estimated Useful Life: 30 years

Why do this project?

On August 30, 2010, NPCC requested a Mitigation Plan (please refer to Attachment 2) for bulk power system (BPS) facilities that lack a second set of protective relays on a BPS element and/or second battery at a BPS substation. The substation at Port Hastings lacks these requirements. NS Power identified the work provided in this project as part of its compliance plan (please refer to Attachment 1). NS Power complies with UARB approved NPCC criteria such as their requirements around bulk power systems.

Why do this project now?

Implementation of all redundant protection and second battery is required to be completed by the end of 2016. NS Power has four stations requiring this upgrade (120H-Brushy Hill, 67N-Onslow, 3C-Port Hastings & 88S-Lingan). Because this work is significant, NS Power chose to complete the four stations requiring this upgrade starting in 2013. NS Power has completed 120H-Brushy Hill 230kV in 2014 and plans to complete 67N-Onslow in 2015, 3C-Port Hasting in early 2016 and 88S-Lingan by the end of 2016.

Why do this project this way?

The project must be completed this way in order to comply with the NPCC Request dated August 30, 2010 to submit to NPCC a Mitigation Plan for bulk power system (BPS) facilities that lack a second set of protective relays on a BPS element and/or a second battery at a BPS substation.

CI Number : 46513 - 3C Port Hastings BPS Upgrade **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		19,094	0	19,094
094		094 - Interest Capitalized		145,011	0	145,011
095		095 - T&CS Regular Labour AO		98,818	0	98,818
095		095-COPS Contracts AO		331,318	0	331,318
095		095-COPS Regular Labour AO		29,455	0	29,455
095		095 - T&CS Term Labour AO		47,520	0	47,520
012	003	012 - Materials	003 - DP - Bldg.,Struct.Grnd.	360,000	0	360,000
013	003	013 - COPS Contracts	003 - TP - Bldg.,Struct.Grnd.	240,000	0	240,000
012	022	012 - Materials	022 - TP - Elec Contr.Equip.	202,000	0	202,000
066	022	066 - Other Goods & Services	022 - TP - Elec Contr.Equip.	273,964	0	273,964
001	043	001 - T&D Regular Labour	043 - DP - Substn Dev.	24,000	0	24,000
011	043	011 - Travel Expense	043 - DP - Substn Dev.	33,000	0	33,000
012	043	012 - Materials	043 - TP - Substn Dev.	335,000	0	335,000
013	043	013 - COPS Contracts	043 - TP - Substn Dev.	1,010,700	0	1,010,700
041	043	041 - Meals & Entertainment	043 - DP - Substn Dev.	10,000	0	10,000
001	061	001 - T&D Regular Labour	061 - GP - Switched Telecomm. Sys	12,000	0	12,000
012	061	012 - Materials	061 - TP - Switched Telecomm. Sys	60,000	0	60,000
013	061	013 - COPS Contracts	061 - TP - Switched Telecomm. Sys	30,000	0	30,000
001	085	001 - T&CS Regular Labour	085 Design	168,142	0	168,142
013	085	013 - COPS Contracts	085 Design	30,800	0	30,800
028	085	028 - Consulting	085 Design	63,000	0	63,000
004	087	004 - T&CS Term Labour	087 Field Super.& Ops.	80,000	0	80,000
013	087	013 - COPS Contracts	087 Field Super.& Ops.	81,000	0	81,000
			Total Cost:	3,684,823	0	3,684,823
			Original Cost:			

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46513
Title: 3C Port Hasting BPS Upgrades
Execution Year: 2015/2016

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Electrician / Technician	PD	75	$ 346.07	$ 25,954.92		
Communication Tech.	PD	35	$ 346.07	$ 12,112.30		
Engineering	PD	200	$ 391.49	$ 78,297.24		
Project Support	lot	1	$ 15,750.00	$ 15,750.00		
CADD Operators	PD	135	$ 284.05	$ 38,346.70		
Technologists	PD	105	$ 320.77	$ 33,680.81		
	PD			$ -		
			Sub-Total	$ 204,141.96		43291 67N Onslow BPS Upgrades
002 OT Labour						
				$ -		
				$ -		
				$ -		
				$ -		
			Sub-Total	$ -		
004 Term Labour						
Contractor Supervision - Electrical	PD	200	$ 400	$ 80,000.00		
				$ -		
				$ -		
			Sub-Total	$ 80,000.00		
011 Travel Expense						
Travel to site	lot	1.00	$ 33,000.00	$ 33,000.00		
				$ -		
			Sub-Total	$ 33,000.00		
012 Materials						
Battery Charger	Unit	1	$ 10,000	$ 10,000.00		
Battery Bank	Unit	1	$ 35,000	$ 35,000.00		
Cables	LS	1	$ 160,000	$ 160,000.00		
Building / Trenches	LS	1	$ 360,000	$ 360,000.00		
Communication Materials	LS	1	$ 60,000	$ 60,000.00		
DC Panels & Splitters (Fuses)	LS	1	$ 22,000	$ 22,000.00		
Building Misc.(J-Box, Trays, Grounding etc)	LS	1	$ 130,000	$ 130,000.00		
P&C Protection Panels	Unit	6	$ 20,000	$ 120,000.00		
Tools & Equipment for erection the work	LS	1	$ 60,000	$ 60,000.00		
				$ -		
			Sub-Total	$ 957,000.00		43291 67N Onslow BPS Upgrades
013 Contracts						
Civil Work	LS	1	$ 240,000	$ 240,000.00		
CADD Consulting	hr	560	$ 55.00	$ 30,800.00		
Site Supervisor - Civil	hr	900	$ 90.00	$ 81,000.00		
Communication	LS	1	$ 30,000.00	$ 30,000.00		
Contracted PLT(4)	hr	5000	$ 202.14	$ 1,010,700.00		
				$ -		
				$ -		
			Sub-Total	$ 1,392,500.00		43291 67N Onslow BPS Upgrades
028 Consulting						
Protection & Controls Consulting	hr	600	$ 105.00	$ 63,000.00		
				$ -		
				$ -		
			Sub-Total	$ 63,000.00		
037 Legal						
				$ -		
				$ -		
			Sub-Total	$ -		
041 Meals & Entertainment						
Meals during travel / construction	lot	1.00	$ 10,000.00	$ 10,000.00		
				$ -		
			Sub-Total	$ 10,000.00		
066 Other Goods & Services						
Contingency on Project Costs	%	10.00	$ 2,739,641.96	$ 273,964.20		
				$ -		
			Sub-Total	$ 273,964.20		
094 Interest Capitalized						
				$ 145,011.40		
				$ -		
			Sub-Total	$ 145,011.40		
095 Administrative Overhead						
T&D Reg. Labour AO				$ 29,455.20		
T&D Vehicle Labour AP				$ 19,094.40		
Project Support Labour AO				$ 98,818.07		
T&C Term Labour AO				$ 47,520.00		
COPS Contracts AO				$ 331,318.22		
			Sub-Total	$ 526,205.89		
			SUB-TOTAL (no AO, AFUDC)	$ 3,013,606.16		
			TOTAL (AO, AFUDC included)	$ 3,684,823.45		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Nova Scotia POWER
An Emera Company

PO Box 910 • Halifax, Nova Scotia • Canada • B3J 2W5

December 9, 2011

Northeast Power Coordinating Council Inc.
1040 Avenue of the Americas - 10th Floor
New York, NY 10018

Dear Mr. Quoc Le:

In accordance with the Implementation Plan for the Bulk Power System Protection Risk Reduction, approved by the Reliability Coordinating Committee (RCC) at the June 9, 2010 meeting, Nova Scotia Power Inc. has identified bulk power system (BPS) facilities lacking either or both of the following two attributes:

1. lack of a second set of protective relays on a BPS element,
2. the lack of a second battery at a BPS substation.

and has established a mitigation plan. This plan is outlined in the attached document.

Yours truly,

Ron Tutty

Ron Tutty, P.Eng.
Protection & Control Specialist
Transmission Engineering
Nova Scotia Power Inc.

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energy everywhere.

Mitigation Plan for NPCC Bulk Power System Protection Risk Reduction

This Plan is being submitted in accordance with the NPCC Request dated August 30, 2010 (reference Attachment) to submit to NPCC a Mitigation Plan for bulk power system (BPS) facilities that lack either or both of the following two attributes:

1. lack of a second set of protective relays on a BPS element,
2. the lack of a second battery at a BPS substation.

Mitigation Plan Scope of Work

After reviewing the Task Force on System Protection (TFSP) survey completed in 2007-2008, Nova Scotia Power has determined that the following 230 kV substations have BPS facilities that lack a second battery or a second set of protective relays on a BPS element.

At 120H Brushy Hill a second set of bus protection relays will be installed on bus 120H-B71 and bus 120H-B72 and transformer protections will be added to 120H-T71 and 120H-T72. A second DC supply will also be added to this substation which will include a 125 V battery, a charger and a DC distribution panel with transfer capability.

At 67N Onslow a second set of bus protection relays will be installed on bus 67N-B5, 67N-B7 and 67N-B9 and transformer protection will be added to 67N-T71. The DC supply for the B protection schemes will be modified to ensure compliance with NPCC Directory #4 Section 5.8.

At 3C Port Hastings a second set of bus protection relays will be installed on bus 3C-B71 and bus 3C-B72 and transformer protections will be added to 3C-T71 and 3C-T72. The DC supply for the B protection schemes will be modified to ensure compliance with NPCC Directory #4 Section 5.8.

At 88S Lingan a second set of bus protection relays will be installed on bus 88S-B71 and bus 88S-B72 and transformer protections will be added to 88S-T71, 88S-T72, 88S-GT1, 88S-GT2, 88S-GT3 and 88S-GT4. A second DC supply will also be added to this substation which will include a 125 V battery, a charger and a DC distribution panel with transfer capability.

The estimated completion dates for these projects are as follows:
120H Brushy Hill – Q4 2013
67N Onslow – Q4 2014
3C Port Hastings – Q4 2015
88S Lingan – Q4 2016

NPCC, Inc.

NORTHEAST POWER COORDINATING COUNCIL, INC.
1040 AVE OF THE AMERICAS, NEW YORK, NY 10018 TELEPHONE (212) 840-1070 FAX (212) 302-2782

August 30, 2010

Members, Northeast Power Coordinating Council, Inc.

Re: Approved Implementation Plan for Bulk Power System Protection Risk Reduction

Ladies and Gentlemen:

This is to inform you that the Reliability Coordinating Committee (RCC) at the June 9, 2010 meeting approved the attached Implementation Plan for the Bulk Power System Protection Risk Reduction. As required in the Implementation Plan, affected Facility Owner that has identified bulk power system (bps) facility(ies) lacking either or both of the following two attributes:

1. lack of a second set of protective relays on a bps element,
2. the lack of a second battery at a bps substation.

must establish a mitigation plan and submit that plan to the NPCC Task Force on System Protection (TFSP) within 18 months of the approval of the Implementation Plan or by December 9, 2011; the mitigation plan must identify the time-period needed to acquire and install equipment to bring those existing facility(ies) in conformance with the following, with explanations of any delays beyond five years. Delays beyond five years must be approved by the RCC.

- For those stations which have only a single battery bank, add a second battery bank in accordance with the requirements of Section 5.8 of Directory #4, and
- For those **elements** whose **protection** does not include two independent sets of **protective relays**, add a second set of **protective relays**, and associated auxiliary relays (if used), that meet the required operating time consistent with Section 5.5 of Directory #4. The second set of **protective relays** and associated auxiliary relays shall be physically separated from the existing **protective relays**.

If you have BPS facilities lacking one or both of two attributes identified above, please submit a mitigation plan by December 9, 2011. TFSP maintains a record of the survey completed in 2007-2008 of facilities which were identified to be lacking one or both of these attributes and would be glad to review your facilities on the list. Your prompt attention and response to this request will be appreciated. Mitigation plan should be submitted to NPCC to the attention of Mr. Quoc Le at quoc@npcc.org.

Please do not hesitate to contact Quoc at 212-840-1070, Extension 4908 with any questions regarding this. Thank you for your assistance in this matter.

Yours very truly,

Bryan

Bryan Gwyn, Chairman
Task Force on System Protection

Attachment (1):

- Approved Implementation Plan for Bulk Power System Risk Reduction

CC: Members, Task Force on System Protection
Members, Reliability Coordinating Committee

Implementation Plan for Bulk Power System Protection Risk Reduction

RCC Approved - June 9, 2010

I. Introduction

At the request of the RCC, an assessment of all NPCC BPS facilities was conducted in 2007-2008. The result of this assessment was presented to the RCC at the March 4, 2009 and September 10, 2009 meetings. The predominant risk presented was judged to be due to the lack of two attributes: specifically, lack of a second set of protection relays, and the lack of a second battery. This implementation plan is intended to mitigate the identified higher risk protection attributes at these facilities but does not necessary imply conformance with all provisions of Directory 4.

II. Facility Owner Mitigation Plan

An affected Facility Owner that has identified BPS facility(ies) lacking either of the two attributes above, must establish a mitigation plan and submit that plan to the TFSP within 18 months of the approval of this Implementation Plan by the RCC; the mitigation plan must identify the time-period needed to acquire and install equipment to bring those existing facility(ies) in conformance with the following, with explanations of any delays beyond five years. Delays beyond five years must be approved by the RCC.

- For those stations which have only a single battery bank, add a second battery bank in accordance with the requirements of Section 5.8 of Directory #4, and
- For those **elements** whose **protection** does not include two independent sets of **protective relays**, add a second set of **protective relays**, and associated auxiliary relays (if used), that meet the required operating time consistent with Section 5.5 of Directory #4. The second set of **protective relays** and associated auxiliary relays shall be physically separated from the existing **protective relays**.

The affected Facility Owner must submit a Periodic Progress Report (see III Below) to the TFSP to demonstrate efforts and schedules to attain conformance with respect to the above attributes. Deviations from previously submitted schedules resulting in extension of the mitigation dates will be reported to the TFSP, who will submit the information to the RCC along with the Facility Owner's explanations for the delays. Any previously approved plans with delays beyond five years must be re-approved by the RCC.

III. Periodic Progress Report

TFSP will report to the RCC regarding receipt of all necessary mitigation plans.

The Facility Owner must provide annual progress reports to the TFSP for monitoring of project schedules.

TFSP will forward a summary report to the RCC annually on the progress of the implementation plans, until those plans are complete.

Developed by Task Force on System Protection

CI Number: 46340

Title: 2015 Transmission Switch & Breaker Replacement

Start Date:	2015/03
In-Service Date:	2015/03
Final Cost Date:	2015/12
Function:	Transmission
Forecast Amount:	$1,581,599

DESCRIPTION:

This project provides for reliability improvements on the NS Power transmission system through the replacement of deteriorated substation switches and circuit breakers. This estimate includes the procurement and installation of five 69kV and three 138kV circuit breakers, and the installation of five 69kV and one 138kV switches.

Summary of Related CIs (+/- 2 years):
2013 CI 43226 2013 Transmission Switch & Breaker Replacements $1,969,767
2014 CI 44980 2014 Transmission Switch & Breaker Replacements $1,095,553
2016 CI TBD 2016 Transmission Switch & Breaker Replacements $TBD
2017 CI TBD 2017 Transmission Switch & Breaker Replacements $TBD

Depreciation Class: Transmission Plant Station Equipment

Estimated Useful Life: 40 Years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

This project will replace circuit breakers that are malfunctioning due to age. The circuit breakers have an average age of 55 years. In addition, switch modifications/additions will result in improved switching capability and improved customer reliability.

Why do this project now?

Completing this project now will mitigate transmission supply interruptions related to switch and breaker failures and provide reliability improvements for customers.

Why do this project this way?

In the majority of cases, spare parts are no longer available for the circuit breakers that are being replaced due to the age of the devices. Various switches are being modified or changed out due to either operational issues or targeted improvements to the capability of the switch. These modifications will result in improved customer reliability.

CI Number : 46340 - 2015 Transmission Switch & Breaker Replacements **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		116,414	0	116,414
095		095-COPS Contracts AO		6,083	0	6,083
095		095-COPS Regular Labour AO		179,581	0	179,581
001	003	001 - T&D Regular Labour	003 - TP - Bldg.,Struct.Grnd.	709	0	709
012	003	012 - Materials	003 - TP - Bldg.,Struct.Grnd.	161	0	161
013	003	013 - COPS Contracts	003 - TP - Bldg.,Struct.Grnd.	16,462	0	16,462
001	022	001 - T&D Regular Labour	022 - TP - Elec Contr.Equip.	7,440	0	7,440
012	022	012 - Materials	022 - TP - Elec Contr.Equip.	13,308	0	13,308
013	022	013 - COPS Contracts	022 - TP - Elec Contr.Equip.	9,120	0	9,120
012	023	012 - Materials	023 - TP - Power Equip.-Station S	8,400	0	8,400
001	043	001 - T&D Regular Labour	043 - TP - Substn Dev.	186,783	0	186,783
012	043	012 - Materials	043 - TP - Substn Dev.	823,388	0	823,388
066	043	066 - Other Goods & Services	043 - TP - Substn Dev.	14,840	0	14,840
001	085	001 - Regular Labour (No AO)	085 Design	8,453	0	8,453
001	085	001 - T&D Regular Labour	085 Design	21,154	0	21,154
011	085	011 - Travel Expense	085 Design	114	0	114
066	085	066 - Other Goods & Services	085 Design	165,791	0	165,791
001	086	001 - T&D Regular Labour	086 Commissioning	2,790	0	2,790
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	607	0	607
			Total Cost:	1,581,599	0	1,581,599
			Original Cost:	210,331		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46340
Title: 2015 Transmission Switch and Breaker Replacements
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	558	$ 354	$ 197,722.00		
T&D Labour - Design	PD	61	$ 347	$ 21,154.00		
T&D Labour - Project Support	PD	2	$ 379	$ 607.00		
Procurement / Financial (No AO)	Lot	1	$ 8,453	$ 8,453.00		
			Sub-Total	$ 227,936.00		
011 Travel Expense						
Travel - Engineering Design	Lot	1	$ 114	$ 114.00		
				$ -		
				$ -		
			Sub-Total	$ 114.00		
012 Materials						
69kV Circuit Breaker	Each	5	$ 55,000	$ 275,000.00		
138kV Circuit Breaker	Each	3	$ 110,000	$ 330,000.00		
69kV Surge Arrestor	Each	15	$ 1,440	$ 21,600.00		
138kV Surge Arrestor	Each	9	$ 10,800	$ 97,200.00		
69kV Switch	Each	5	$ 12,000	$ 60,000.00		
138kV Switch	Each	1	$ 18,000	$ 18,000.00		
Misc. Materials Wiring, Lugs, Terminations	Lot	1	$ 43,457	$ 43,457.00		
				$ -		
			Sub-Total	$ 845,257.00		
013 Contracts						
Electrical Control Equipment	Lot	1	$ 9,120	$ 9,120.00		
Civil Construction	Lot	1	$ 16,462	$ 16,462.00		
				$ -		
			Sub-Total	$ 25,582.00		
066 Other Goods & Services						
Other Goods	Lot	1	$ 14,840	$ 14,840.00		
Contingency	%	15%	$ 1,105,276	$ 165,791.40		
				$ -		
			Sub-Total	$ 180,631.40		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 116,413.80		
			Sub-Total	$ 116,413.80		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 179,581.05		
COPS Contract AO				$ 6,083.40		
			Sub-Total	$ 185,664.45		
			SUB-TOTAL (no AO, AFUDC)	$ 1,279,520.40		
			TOTAL (AO, AFUDC included)	$ 1,581,598.65		
Original Cost				$ 210,330.62		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 43490

Title: Steel Tower Life Extension – Halifax Harbour

Start Date: 2015/07
In-Service Date: 2015/07
Final Cost Date: 2016/12
Function: Transmission
Forecast Amount: $1,441,709

DESCRIPTION:

This project is to apply protective coating to lattice steel towers around the Halifax Harbour in order to extend the life of the structures. The 13 towers to be coated will be prioritized based on the latest inspection data. Current inspection results would indicate towers on L6014 near the Halifax Harbour should be targeted first. The cost includes the removal and collection of the existing loose lead paint, the proper disposal of this lead paint, working at heights up to 300 feet in the air, working in proximity to energized lines as well as material costs.

Summary of Related CIs (+/- 2 years):
2014 CI 44975 2014 Sacrificial Anode Installation Program $290,047
2015 CI 46356 2015 Sacrificial Anode Installation Program $304,612

Depreciation Class: Transmission Equipment – Towers and Fixtures

Estimated Useful Life: 60 years

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Maintenance

Why do this project?

The environmental conditions that these towers are exposed to have led to the deterioration of the protective coating on the structures and they are showing signs of steel structure corrosion.

Why do this project now?

These towers require recoating to be completed in order to reduce the loss of metal, which will extend the life of the towers beyond their originally estimate useful life. The towers will be selected based on the age of the structures and the latest inspection data. Restoration of protective coating before failure of the paint system prevents corrosion damage to structural steel tower components.

Why do this project this way?

The most cost effective approach is to recoat the steel towers prior to the failure of the protective coating which would lead to corrosion damage to the structural steel. If corrosion damage occurs in the structural steel components of a transmission tower, costly replacement of steel members may be necessary to preserve the integrity of the tower.

This work is being completed by an external consultant.

CI Number : 43490 - Steel Tower Life Extension - Halifax Harbour **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		12,738	0	12,738
095		095-COPS Contracts AO		231,855	0	231,855
095		095-COPS Regular Labour AO		19,650	0	19,650
012	037	012 - Materials	037 - TP - Steel Towers	30,000	0	30,000
013	037	013 - COPS Contracts	037 - TP - Steel Towers	975,000	0	975,000
001	085	001 - Regular Labour (No AO)	085 Design	1,000	0	1,000
001	085	001 - T&D Regular Labour	085 Design	7,616	0	7,616
011	085	011 - Travel Expense	085 Design	1,200	0	1,200
066	085	066 - Other Goods & Services	085 Design	146,250	0	146,250
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	16,400	0	16,400
			Total Cost:	1,441,709	0	1,441,709
			Original Cost:	104,501		

Capital Project Detailed Estimate

Location: **Transmission**
CI# / FP#: 43490
Title: Steel Tower Life Extension - Halifax Harbour
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	43	$ 379	$ 16,400.00		
T&D Labour - Design	PD	22	$ 347	$ 7,616.00		
Procurement / Financial (No AO)	Lot	1	$ 1,000	$ 1,000.00		
			Sub-Total	$ 25,016.00		
011 Travel Expense						
Travel	Lot	1	$ 1,200	$ 1,200.00		
				$ -		
				$ -		
			Sub-Total	$ 1,200.00		
012 Materials						
Paint	Lot	1	$ 30,000	$ 30,000.00		
				$ -		
				$ -		
			Sub-Total	$ 30,000.00		
013 Contracts						
Tower Re-Coating	Sites	13	$ 75,000	$ 975,000.00		
				$ -		
				$ -		
			Sub-Total	$ 975,000.00		
066 Other Goods & Services						
Contingency	%	15	$ 975,000	$ 146,250.00		
				$ -		
				$ -		
			Sub-Total	$ 146,250.00		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 12,738.09		
				$ -		
			Sub-Total	$ 12,738.09		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 19,649.89		
COPS Contract AO				$ 231,855.00		
				$ -		
			Sub-Total	$ 251,504.89		
			SUB-TOTAL (no AO, AFUDC)	$ 1,177,466.00		
			TOTAL (AO, AFUDC included)	$ 1,441,708.98		
Original Cost				$ 104,500.87		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 43267

Title: 13V Gulch Hydro Replace 13V-GT1 and 13V-VR1

Start Date: 2015/03
In-Service Date: 2015/12
Final Cost Date: 2016/06
Function: Transmission
Forecast Amount: $1,061,902

DESCRIPTION:

The scope of this project includes the replacement of the existing 13V-T51 generator step-up transformer (GSU) and 13V-VR1 3-phase voltage regulator with new transformers. The replacement GSU will be placed in the same position and connected to the existing high voltage wiring. An interface box will be installed to allow extension and reconnection of the existing protection and control wiring. The winding arrangement will be changed to wye/delta from the existing delta/wye to align with standard industry practice. The existing 3-phase voltage regulator will be replaced with (3) new single phase units conforming to NS Power's current distribution standards along with a separate grounding transformer to compensate for the change to a delta connected LV winding. The replacement regulators and new grounding transformer will be located in the regulator yard, which will be expanded to accommodate the increased size of the replacement regulators and the additional grounding transformer.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

Depreciation Class: Transmission Station Equipment and Transmission Poles and Fixtures

Estimated Useful Life: Approximately 45 years.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

Results from electrical insulation testing indicate the existing 63 year old 13V-T51 transformer is at end of life. The 13V-VR1 regulator is 58 years old and overloaded. Spare parts are also no longer available for this unit.

Why do this project now?

Transformer test results indicate it will not be reasonable to continue to expect reliable performance from the existing 13V-T51 GSU. Proactive replacement will avoid the loss of generation in the event of an equipment failure. The 13V-VR1 regulator is overloaded and must be replaced for reasons of capacity as well as age.

Why do this project this way?

The 13V-T51 generator transformer is the interface between the 13V-G1 (Gulch Hydro) generator and the 69kV transmission line that delivers output energy to the NS Power system. There is no other way to transfer energy from the generator to the system except through a generator step up transformer.

CI Number : 43267 - 13V Gulch Hydro Replace 13V-GT1 and 13V-VR1 **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		27,873	0	27,873
094		094 - Interest Capitalized		17,560	0	17,560
095		095-COPS Contracts AO		50,053	0	50,053
095		095-COPS Regular Labour AO		42,997	0	42,997
012	003	012 - Materials	003 - TP - Bldg.,Struct.Grnd.	2,667	0	2,667
013	003	013 - COPS Contracts	003 - TP - Bldg.,Struct.Grnd.	27,388	0	27,388
012	007	012 - Materials	007 - TP - Environmental	11,700	0	11,700
013	007	013 - COPS Contracts	007 - TP - Environmental	14,000	0	14,000
012	022	012 - Materials	022 - TP - Elec Contr.Equip.	5,850	0	5,850
013	022	013 - COPS Contracts	022 - TP - Elec Contr.Equip.	3,200	0	3,200
012	035	012 - Materials	035 - TP - Wood Poles	21,000	0	21,000
033	035	033 - Rental and Maintenance of	035 - TP - Wood Poles	1,040	0	1,040
012	039	012 - Materials	039 - TP - O/H Cond.	810	0	810
012	043	012 - Materials	043 - TP - Substn Dev.	20,482	0	20,482
033	043	033 - Rental and Maintenance of	043 - TP - Substn Dev.	2,800	0	2,800
011	044	011 - Travel Expense	044 - TP - Substn.Transf.	1,400	0	1,400
012	044	012 - Materials	044 - TP - Substn.Transf.	420,000	0	420,000
013	044	013 - COPS Contracts	044 - TP - Substn.Transf.	165,895	0	165,895
041	044	041 - Meals & Entertainment	044 - TP - Substn.Transf.	700	0	700
066	044	066 - Other Goods & Services	044 - TP - Substn.Transf.	1,800	0	1,800
001	085	001 - T&D Regular Labour	085 Design	34,875	0	34,875
001	085	001 - Regular Labour (No AO)	085 Design	9,650	0	9,650
011	085	011 - Travel Expense	085 Design	124	0	124
028	085	028 - Consulting	085 Design	40,000	0	40,000
066	085	066 - Other Goods & Services	085 Design	119,737	0	119,737
001	086	001 - T&D Regular Labour	086 Commissioning	10,096	0	10,096
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	7,580	0	7,580
011	087	011 - Travel Expense	087 Field Super.& Ops.	624	0	624
			Total Cost:	1,061,902	0	1,061,902
			Original Cost:	65,481		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 43267
Title: 13V Gulch Hydro Replace 13V-GT1 and 13V-VR1
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	28.50	$ 354.26	$ 10,096.00		
T&D Labour - Site Supervision	PD	20.00	$ 379.00	$ 7,580.00		
T&D Labour - Design	PD	100.50	$ 347.00	$ 34,875.00		
Procurement / Financial (No AO)	Lot	1.00	$ 9,650.00	$ 9,650.00		
			Sub-Total	$ 62,201.00		
011 Travel Expense						
Travel				$ 2,148.00		
				$ -		
				$ -		
			Sub-Total	$ 2,148.00		
012 Materials						
Buildings, Structures and Grounds	Lot	1	$ 2,667.00	$ 2,667.00		
Environmental Equipment	Lot	1	$ 11,700.00	$ 11,700.00		
Electrical Control Equipment	Lot	1	$ 5,850.00	$ 5,850.00		
Wood Poles	Lot	1	$ 21,000.00	$ 21,000.00		
Overhead Conductor	Lot	1	$ 810.00	$ 810.00		
Substation Devices	Lot	1	$ 20,482.00	$ 20,482.00		
Substation Transformers	Lot	1	$ 420,000.00	$ 420,000.00		
			Sub-Total	$ 482,509.00		
013 Contracts						
Contract Line Work	Hrs	[redacted]		$ 140,895.10		
Civil	Lot	1	$ 27,388.00	$ 27,388.00		
Environmental Equipment	Lot	1	$ 14,000.00	$ 14,000.00		
Electrical Control Equipment	Lot	1	$ 3,200.00	$ 3,200.00		
Substation Transformer	Lot	1	$ 25,000.00	$ 25,000.00		
			Sub-Total	$ 210,483.10		
028 Consulting						
Consulting - Design	Lot	1	$ 40,000.00	$ 40,000.00		
				$ -		
				$ -		
			Sub-Total	$ 40,000.00		
033 Rental						
Crane / Back Hoe Rental	Lot	1	$ 3,840.00	$ 3,840.00		
				$ -		
				$ -		
			Sub-Total	$ 3,840.00		
041 Meals & Entertainment						
Meals				$ 700.00		
				$ -		
				$ -		
			Sub-Total	$ 700.00		
066 Other Goods & Services						
Misc Goods	Lot	1	$ 2,350.00	$ 2,350.00		
Contingency	%	15%	$ 794,581.09	$ 119,187.16		
			Sub-Total	$ 121,537.16		
094 Interest Capitalized						
AFUDC				$ 17,560.45		
				$ -		
				$ -		
			Sub-Total	$ 17,560.45		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 27,873.06		
				$ -		
			Sub-Total	$ 27,873.06		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 42,997.24		
COPS Contract AO				$ 50,052.91		
			Sub-Total	$ 93,050.15		
			SUB-TOTAL (no AO, AFUDC)	$ 923,418.26		
			TOTAL (AO, AFUDC included)	$ 1,061,901.92		
Original Cost				$ 65,480.97		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 44976

Title: 10H 25kV Breaker Replacement

Start Date:	2015/04
In-Service Date:	2015/10
Final Cost Date:	2016/04
Function:	Transmission
Forecast Amount:	$953,521

DESCRIPTION:

This project is for the retirement and replacement of the existing 25 kV switchgear (four breakers, one potential transformer, lightening arrestor and disconnect vault) at 10H Victoria General Hospital substation in peninsula Halifax. This set of switchgear is used to supply the Victoria General Hospital in downtown Halifax. These four breakers allow three separate 25 kV feeds from three different substations to serve the hospital's 4kV bus. This configuration improves the reliability of service to the hospital, providing alternate service options in the event of feeder outages on the peninsula.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The existing four (4) 25kV breakers at the 10H - Victoria General Substation are deteriorated. All three breakers and associated equipment are from 1968 and are beyond their designed service life. The original equipment manufacturer has not been in business for many years, which makes sourcing spare parts and technical support very difficult.

Why do this project now?

The 25 kV switchgear set is beyond its designed service life and serves a critical load, the Victoria General Hospital. The breakers are deteriorated and sourcing spare parts and technical service is very difficult.

Why do this project this way?

Replacing the four breakers, associated hardware and cabinetry is the most cost effective way to remediate this substation and provide the reliability required for such a customer.

This project, due to its specialized nature, will be mostly completed by an external contractor.

CI Number : 44976 - 10H 25kV Breaker Replacement **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D OT Labour AO		470	0	470
092		092-Vehicle T&D Reg. Labour AO		15,687	0	15,687
094		094 - Interest Capitalized		11,181	0	11,181
095		095-COPS Contracts AO		82,041	0	82,041
095		095-COPS Overtime Labour AO		725	0	725
095		095-COPS Regular Labour AO		24,199	0	24,199
001	043	001 - T&D Regular Labour	043 - TP - Substn Dev.	7,086	0	7,086
002	043	002 - T&D Overtime Labour	043 - TP - Substn Dev.	1,771	0	1,771
012	043	012 - Materials	043 - TP - Substn Dev.	[redacted]	0	[redacted]
013	043	013 - COPS Contracts	043 - TP - Substn Dev.	[redacted]	0	[redacted]
001	085	001 - T&D Regular Labour	085 Design	15,034	0	15,034
001	085	001 - Regular Labour (No AO)	085 Design	6,900	0	6,900
066	085	066 - Other Goods & Services	085 Design	90,972	0	90,972
001	086	001 - T&D Regular Labour	086 Commissioning	1,771	0	1,771
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	5,685	0	5,685
			Total Cost:	953,521	0	953,521
			Original Cost:	142,181		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 44976
Title: 10H 25kV Breaker Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	25.00	$ 354.26	$ 8,857.00		
T&D Labour - Site Supervision	PD	15.00	$ 379.00	$ 5,685.00		
T&D Labour - Design	PD	43.33	$ 347.00	$ 15,034.00		
Project Support (No AO)	Lot	1.00	$ 6,900.00	$ 6,900.00		
			Sub-Total	$ 36,476.00		
002 OT Labour						
T&D Labour - Electrician/Technician	PD	2.50	$ 708.52	$ 1,771.00		
			$ -	$ -		
			Sub-Total	$ 1,771.00		
012 Materials						
Substation Devices	Lot	50%	[redacted]		Cost Support Item 1	
				$ -		
				$ -		
			Sub-Total	[redacted]		
013 Contracts						
Contract Labour for Switchgear Replacement	Lot	50%	[redacted]		Cost Support Item 1	
				$ -		
				$ -		
			Sub-Total	[redacted]		
066 Other Goods & Services						
Contingency	Lot	1	$ 90,972.00	$ 90,972.00		
				$ -		
				$ -		
			Sub-Total	$ 90,972.00		
094 Interest Capitalized						
AFUDC				$ 11,180.77		
				$ -		
				$ -		
			Sub-Total	$ 11,180.77		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 15,687.11		
Vehicle T&D Labour Overtime AO				$ 469.67		
				$ -		
			Sub-Total	$ 16,156.78		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 24,199.08		
COPS T&D Labour Overtime AO				$ 724.52		
COPS Contract AO				$ 82,041.01		
			Sub-Total	$ 106,964.61		
			SUB-TOTAL (no AO, AFUDC)	$ 819,219.00		
			TOTAL (AO, AFUDC included)	$ 953,521.16		
Original Cost				$ 142,180.90		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

BORDEN, SEAN

Subject: FW: 10H Breaker replacements

Importance: High

From: Jason Campbell
Sent: Monday, June 30, 2014 4:31 PM
To: MACNEILL, RORY
Subject: RE: 10H Breaker replacements
Importance: High

Hi Rory,

For a turnkey change out of the current breakers with new Unigear Z31 25 kV Switchgear from Brno, Czech Republic, **ABB Budgetary Estimate for the works is** [redacted] **Cdn**. Note that this is the same gear that was recently installed in the Lower Water Street substation. This estimate includes supply, installation, commissioning and disposal of the old breakers. It also assumes customization (eg for 10H-403 switch) and FAT would occur in our Brampton, ON, facility before final shipment to site.

For the installation portion we have assumed the following:

1/ manpower based from New Brunswick Office and Brampton office

2/ Utility responsible for Cable work/modifications/disconnections and reconnections (ABB can assist for guidance for terminating new ABB SWGR)

3/ Utility responsible for isolation , grounding and permits

4/ Utility to supply Relays settings and programming .

5/ Old swgr - assumption that old swgr can be scrapped at minimal costs (work with preferred scrap metal dealer from the utility)

6/ Assumed all work will be concurrent and completed within a 2 week period.

This ABB budgetary offer is preliminary and not final and as such non-binding. It is tendered for discussion only, does not constitute a term to contract and ABB can, without notice, make any change in ABB's own discretion.

Please give me a call when you get a chance to discuss.

Jason Campbell
Account Manager Maritimes
Power Products and Power Systems
201 Brownlow Ave, Unit 48
Dartmouth, NS, Canada, B3B 1W2
Phone:
Mobile:

ABB Power and productivity for a better world™

From: MACNEILL, RORY
Sent: Thursday, June 19, 2014 4:10 PM
To: Jason Campbell
Subject: 10H Breaker replacements

Hi Jason, we have a set of 4 25kV, 1200A metal clad (Allis Chalmers Brand) circuit breakers in our 10H (VG Hospital) substation that we want to replace next year. I have some experience with ABB's MV breaker group and wanted to know if you could help me get a ballpark estimate for the 2015 capital submission this year.

I would expect that we would be looking for your forces to do the supply + installation + commissioning + disposal of the old breakers. We would be able to give you 2 breakers at a time to work on before we would need to do some switching to give you the other 2.

I know you'll need more information, so please let me know what you need to get me a ballpark estimate.

Thanks…

Rory MacNeill, P.Eng. | Substation Engineer | **Nova Scotia Power**

www.nspower.ca

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CI Number: 46583

Title: L6511 Replacements

Start Date: 2015/05
In-Service Date: 2015/08
Final Cost Date: 2016/02
Function: Transmission
Forecast Amount: $905,745

DESCRIPTION:

This project is required to replace assets on transmission line L6511 that have reached the end of their service lives and need to be retired. This project provides for the replacement of 20 spar arms, 20 poles and 243 insulators. The line was inspected in June of 2014 and 85 timber structures were identified as requiring component replacements. L6511 is a 138kV transmission line that runs from 50N Trenton Generating Station to 93N Glen Dhu Wind Farm.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The transmission inspection program identified 85 structures that require asset replacements.

Why do this project now?

This work has been prioritized based on transmission inspection results. The assets on the line have reached the end of their service lives and if replacements are not completed, the reliability of the line will be compromised.

Why do this project this way?

This work has been scoped in such a way to minimize costs associated with working in environmentally sensitive areas.

This work is expected to be completed by an external contractor.

CI Number : 46583 - L6511 Replacements **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		13,120	0	13,120
094		094 - Interest Capitalized		7,146	0	7,146
095		095-COPS Regular Labour AO		20,239	0	20,239
095		095-COPS Contracts AO		131,473	0	131,473
013	007	013 - COPS Contracts	007 - TP - Environmental	17,835	0	17,835
012	035	012 - Materials	035 - TP - Wood Poles	42,204	0	42,204
013	035	013 - COPS Contracts	035 - TP - Wood Poles	150,975	0	150,975
013	037	013 - COPS Contracts	037 - TP - Steel Towers	7,231	0	7,231
012	038	012 - Materials	038 - TP - Insulators	34,417	0	34,417
013	038	013 - COPS Contracts	038 - TP - Insulators	150,262	0	150,262
013	039	013 - COPS Contracts	039 - TP - O/H Cond.	226,570	0	226,570
001	085	001 - Regular Labour (No AO)	085 Design	1,532	0	1,532
066	085	066 - Other Goods & Services	085 Design	78,006	0	78,006
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	24,736	0	24,736
			Total Cost:	905,745	0	905,745
			Original Cost:	51,102		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46583
Title: L6511 Replacements
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	65	$ 379	$ 24,736.00		
Procurement / Financial (No AO)	Lot	1	$ 1,532	$ 1,532.42		
			Sub-Total	$ 26,268.42		
012 Materials						
Wood Poles	Lot	1	$ 42,204	$ 42,204.04		
Insulators	Lot	1	$ 34,417	$ 34,416.82		
			Sub-Total	$ 76,620.86		
013 Contracts						
Contractor Line Work	Hrs	[redacted]		$ 520,037.65		
Environmental Bog Mats	$	1	$ 12,300	$ 12,300.00		
Environmental Bridges	$	1	$ 5,535	$ 5,535.00		
Rockbreaker	$	1	$ 15,000	$ 15,000.00		
				$ -		
				$ -		
			Sub-Total	$ 552,872.65		
066 Other Goods & Services						
Contingency	%	15%	$ 520,038	$ 78,005.65		
				$ -		
				$ -		
			Sub-Total	$ 78,005.65		
094 Interest Capitalized						
AFUDC				$ 7,145.61		
				$ -		
				$ -		
			Sub-Total	$ 7,145.61		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 13,119.96		
				$ -		
			Sub-Total	$ 13,119.96		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 20,239.00		
COPS Contract AO				$ 131,473.12		
			Sub-Total	$ 151,712.11		
			SUB-TOTAL (no AO, AFUDC)	$ 733,767.57		
			TOTAL (AO, AFUDC included)	$ 905,745.26		
Original Cost				$ 51,102.47		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46331

Title: L7001 Replacements – Phase 2

Start Date: 2015/07
In-Service Date: 2015/08
Final Cost Date: 2016/02
Function: Transmission
Forecast Amount: $888,192

DESCRIPTION:

This project is to replace 16 deteriorated timber structures on 230 kV transmission line L7001 that have reached the end of their service lives. This work has been identified and prioritized as part of our transmission inspection program. Work of a similar nature was conducted on 10 structures in 2014 and is planned on 20 additional structures on this line over 2016 and 2017.

Summary of Related CIs (+/- 2 years):
2014 CI 45033 L7001 Replacements Phase 1 $813,226
2016 CI TBD L7001 Replacements Phase 3 $TBD
2017 CI TBD L7001 Replacements Phase 4 $TBD

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The structures and spar arms scheduled for replacement have reached the end of their service lives. This work will enhance the reliability performance of L7001 which is a Bulk Power transmission line with terminal points at Brushy Hill and Onslow substations.

Why do this project now?

16 deteriorated timber structures on 230 kV transmission line L7001 have reached the end of their service lives. This work has been prioritized based on transmission inspection results, with the most critical repairs slated for 2015.

Why do this project this way?

This work has been scoped in such a way to minimize costs associated with working in environmentally sensitive areas.

This work will be completed by an external contractor.

CI Number : 46331 - L7001 Replacements - Phase 2 **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		14,187	0	14,187
095		095-COPS Contracts AO		120,670	0	120,670
095		095-COPS Regular Labour AO		21,885	0	21,885
013	002	013 - COPS Contracts	002 - TP - Land Rights	9,700	0	9,700
012	035	012 - Materials	035 - TP - Wood Poles	109,520	0	109,520
013	035	013 - COPS Contracts	035 - TP - Wood Poles	349,397	0	349,397
012	038	012 - Materials	038 - TP - Insulators	9,244	0	9,244
013	038	013 - COPS Contracts	038 - TP - Insulators	63,776	0	63,776
013	039	013 - COPS Contracts	039 - TP - O/H Cond.	84,572	0	84,572
001	085	001 - Regular Labour (No AO)	085 Design	2,375	0	2,375
001	085	001 - T&D Regular Labour	085 Design	11,963	0	11,963
066	085	066 - Other Goods & Services	085 Design	76,117	0	76,117
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	14,785	0	14,785
			Total Cost:	888,192	0	888,192
			Original Cost:	202,746		

Capital Project Detailed Estimate

Location: **Transmission**
CI# / FP#: 46331
Title: L7001 Replacements Phase 2
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	39	$ 379	$ 14,784.55		
T&D Labour - Design	PD	34	$ 347	$ 11,963.12		
Procurement / Financial (No AO)	Lot	1	$ 2,375	$ 2,375.29		
			Sub-Total	$ 29,122.96		
012 Materials						
Materials	Lot	1	$ 118,764	$ 118,764.33		
				$ -		
				$ -		
			Sub-Total	$ 118,764.33		
013 Contracts						
Contract Labour	Hrs	[redacted]		$ 480,745.30		
Tree Trimming	$	1	$ 9,700	$ 9,700.00		
Pole Haulage	$	1	$ 7,000	$ 7,000.00		
Rockbreaker	$	1	$ 10,000	$ 10,000.00		
			Sub-Total	$ 507,445.30		
066 Other Goods & Services						
Contingency	%	15%	$ 507,445	$ 76,116.79		
				$ -		
				$ -		
			Sub-Total	$ 76,116.79		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 14,186.96		
				$ -		
			Sub-Total	$ 14,186.96		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 21,884.94		
COPS Contract AO				$ 120,670.49		
				$ -		
			Sub-Total	$ 142,555.43		
			SUB-TOTAL (no AO, AFUDC)	$ 731,449.38		
			TOTAL (AO, AFUDC included)	$ 888,191.78		
Original Cost				$ 202,746.37		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46335

Title: L5511 Replacements

Start Date: 2015/08
In-Service Date: 2015/10
Final Cost Date: 2016/04
Function: Transmission
Forecast Amount: $722,934

DESCRIPTION:

This project is for the replacement of transmission line assets on L5511. L5511 is a 32 km 69kV radial line from 89H Trafalgar to 88H Upper Musquodoboit. This line was built in 1966. The transmission inspection program has identified 21 poles, 65 spar arms and 26 insulators for replacement.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

Replacement of these line assets will improve the reliability performance of this line. This line is a radial line to 3,075 customers supplied from the 88H Upper Musquodoboit substation and experienced two failures in 2013.

Why do this project now?

The assets identified through the transmission line inspection program for replacement have reached the end of their service lives and need to be replaced.

Why do this project this way?

This work has been scoped in such a way to minimize costs associated with working in environmentally sensitive areas.

This work will be completed by an external contractor.

CI Number : 46335 - L5511 Replacements **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		12,086	0	12,086
094		094 - Interest Capitalized		3,683	0	3,683
095		095-COPS Contracts AO		107,742	0	107,742
095		095-COPS Regular Labour AO		18,645	0	18,645
013	007	013 - COPS Contracts	007 - TP - Environmental	29,315	0	29,315
012	035	012 - Materials	035 - TP - Wood Poles	34,526	0	34,526
013	035	013 - COPS Contracts	035 - TP - Wood Poles	147,691	0	147,691
012	038	012 - Materials	038 - TP - Insulators	1,687	0	1,687
013	038	013 - COPS Contracts	038 - TP - Insulators	17,273	0	17,273
012	039	012 - Materials	039 - TP - O/H Cond.	12	0	12
013	039	013 - COPS Contracts	039 - TP - O/H Cond.	258,801	0	258,801
001	085	001 - T&D Regular Labour	085 Design	10,192	0	10,192
001	085	001 - Regular Labour (No AO)	085 Design	725	0	725
066	085	066 - Other Goods & Services	085 Design	67,962	0	67,962
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	12,595	0	12,595
			Total Cost:	722,934	0	722,934
			Original Cost:	26,099		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46335
Title: L5511 Replacments
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	33	$ 379	$ 12,595.48		
T&D Labour - Design	PD	29	$ 347	$ 10,191.81		
Procurement / Financial (No AO)	Lot	1	$ 725	$ 724.51		
			Sub-Total	$ 23,511.80		
012 Materials						
Wood Poles	Lot	1	$ 34,526	$ 34,525.59		
Insulators	Lot	1	$ 1,687	$ 1,687.44		
Overhead Conductor	Lot	1	$ 12	$ 12.34		
			Sub-Total	$ 36,225.37		
013 Contracts						
Contract Line Work	Hrs	[redacted]		$ 409,563.80		
Environmental Bridges and Bog Mats	Lot	1	$ 29,315	$ 29,315.00		
Rockbreaker	Lot	1	$ 10,000	$ 10,000.00		
Pole Haulage	Lot	1	$ 4,200	$ 4,200.00		
			Sub-Total	$ 453,078.80		
066 Other Goods & Services						
Contingency	%	15%	$ 453,079	$ 67,961.82		
				$ -		
				$ -		
			Sub-Total	$ 67,961.82		
094 Interest Capitalized						
AFUDC				$ 3,683.29		
			Sub-Total	$ 3,683.29		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 12,086.38		
			Sub-Total	$ 12,086.38		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 18,644.56		
COPS Contract AO				$ 107,742.14		
			Sub-Total	$ 126,386.70		
			SUB-TOTAL (no AO, AFUDC)	$ 580,777.79		
			TOTAL (AO, AFUDC included)	$ 722,934.16		
Original Cost				$ 26,099.37		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 44979

Title: L5527 Structure Replacement

Start Date: 2015/05
In-Service Date: 2015/05
Final Cost Date: 2015/11
Function: Transmission
Forecast Amount: $721,068

DESCRIPTION:

This project is required to replace 32 deteriorated structures on transmission line L5527 that have reached the end of the service life. Replacement will be same for same with timber structures. L5527 is a 57 km 69kV radial transmission line from 57C Salmon River Substation to the Town of Canso. Additionally, there are 24 cross arms that have been identified for replacement.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The timber structures and cross arms scheduled for replacement have reached the end of their service lives. This work has been identified and prioritized as part of our inspection program. L5527 has experienced five outage events and 18 hours of customer service interruption in 2012 and 2013 and an extended outage in 2014 due to extreme ice loading. This work will enhance the overall reliability performance of L5527 which is a radial feed to Canso.

Why do this project now?

The timber structures and cross arms scheduled for replacement have reached the end of their service lives. This work has been prioritized based on provincial inspection results. In March 2014, this line had an extended outage due to ice loading that led to 40 cross arm failures.

Why do this project this way?

This work has been scoped in such a way to minimize costs associated with working in environmentally sensitive areas.

This work is expected to be completed by an external contractor.

CI Number : 44979 - L5527 Structure Replacements

Project Number

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin.

Budget Version 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		12,014	0	12,014
095		095-COPS Regular Labour AO		18,533	0	18,533
095		095-COPS Contracts AO		101,744	0	101,744
013	007	013 - COPS Contracts	007 - TP - Environmental	19,795	0	19,795
012	035	012 - Materials	035 - TP - Wood Poles	71,829	0	71,829
013	035	013 - COPS Contracts	035 - TP - Wood Poles	169,330	0	169,330
012	038	012 - Materials	038 - TP - Insulators	796	0	796
013	038	013 - COPS Contracts	038 - TP - Insulators	4,930	0	4,930
001	039	001 - T&D Regular Labour	039 - TP - O/H Cond.	3,454	0	3,454
012	039	012 - Materials	039 - TP - O/H Cond.	12	0	12
013	039	013 - COPS Contracts	039 - TP - O/H Cond.	233,801	0	233,801
001	085	001 - Regular Labour (No AO)	085 Design	1,453	0	1,453
066	085	066 - Other Goods & Services	085 Design	64,178	0	64,178
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	19,197	0	19,197
			Total Cost:	721,068	0	721,068
			Original Cost:	43,567		

Capital Project Detailed Estimate

Location: **Transmission**
CI# / FP#: 44979
Title: L5527 Structure Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	9.75	354.26	$ 3,454.04		
T&D Labour - Site Supervision	PD	50.65	379.00	$ 19,197.00		
Project Support (No AO)	Lot	1.00	1452.76	$ 1,452.76		
				$ -		
			Sub-Total	$ 24,103.80		
012 Materials						
Wood Poles	Lot	1	$ 71,829.06	$ 71,829.06		
Insulators	Lot	1	$ 796.48	$ 796.48		
Overhead Conductor	Lot	1	$ 12.34	$ 12.34		
			Sub-Total	$ 72,637.88		
013 Contracts						
Contract Labour	Hrs	[redacted]		$ 388,061.52		
Enviornmental Bridges and Bog Mats	Lot	1	$ 19,795.00	$ 19,795.00		
Rock Breaker	Lot	1	$ 20,000.00	$ 20,000.00		
			Sub-Total	$ 427,856.52		
066 Other Goods & Services						
Contingency	Lot	1	$ 64,178.48	$ 64,178.48		
				$ -		
				$ -		
			Sub-Total	$ 64,178.48		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 12,014.11		
Vehicle T&D Labour Overtime AO				$ -		
				$ -		
			Sub-Total	$ 12,014.11		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 18,533.08		
COPS Contract AO				$ 101,744.28		
				$ -		
			Sub-Total	$ 120,277.36		
			SUB-TOTAL (no AO, AFUDC)	$ 588,776.68		
			TOTAL (AO, AFUDC included)	$ 721,068.15		
Original Cost				$ 43,566.75		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46362

Title: L5560 Transmission Line Reconductor

Start Date: 2015/07
In-Service Date: 2015/09
Final Cost Date: 2016/03
Function: Transmission
Forecast Amount: $626,895

DESCRIPTION:

This project is to re-conductor parts of transmission line L5560, a 69kV Transmission Line, from 4S Townsend Street substation to 2S Victoria Junction substation as recommended in the Sydney Transmission Planning Study Report: Report 049-2013-TSMG. The conductor was installed in 1949 and needs to be replaced to ensure reliable operation of the Sydney transmission system.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Capacity

Why do this project?

L5560 must be re-conductored to maintain the reliability of the transmission system in the Sydney area. Transmission lines L5563 and L5560 serve 4S Townsend Street in a loop configuration. If L5563 failed, L5560 does not have the capacity to support the load flow into the 4S Townsend Street Substation. The transmission requirements for completing this project are further outlined in the Sydney Transmission Planning Study Report: Report 049-2013-TSMG.

Why do this project now?

This project needs to be completed now to resolve potential for 69 kV transmission overload in the Sydney area.

Why do this project this way?

The reconductoring of this line as opposed to a complete replacement is the most economical way to increase the line's capacity.

This work will be completed by an external contractor.

CI Number : 46362 - L5560 Transmission Line Reconductor **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		10,034	0	10,034
094		094 - Interest Capitalized		2,637	0	2,637
095		095-COPS Regular Labour AO		15,479	0	15,479
095		095-COPS Contracts AO		88,700	0	88,700
001	039	001 - T&D Regular Labour	039 - TP - O/H Cond.	1,758	0	1,758
012	039	012 - Materials	039 - TP - O/H Cond.	56,233	0	56,233
013	039	013 - COPS Contracts	039 - TP - O/H Cond.	373,002	0	373,002
001	085	001 - Regular Labour (No AO)	085 Design	1,125	0	1,125
066	085	066 - Other Goods & Services	085 Design	60,766	0	60,766
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	17,160	0	17,160
			Total Cost:	626,895	0	626,895
			Original Cost:	46,582		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46362
Title: L5560 Reconductor
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - PLT	PD	4.88	$ 360.65	$ 1,758.17		
T&D Labour - Site Supervision	PD	45.28	$ 379.00	$ 17,160.00		
Procurement / Financial (No AO)	Lot	1.00	$ 1,124.67	$ 1,124.67		
				$ -		
			Sub-Total	$ 20,042.84		
012 Materials						
Materials	Lot	1	$ 56,233.44	$ 56,233.44		
				$ -		
				$ -		
			Sub-Total	$ 56,233.44		
013 Contracts						
Contract Labour - PLT	HR	[redacted]		$ 353,002.32		
Misc. Contracts	Lot	1	$ 20,000.00	$ 20,000.00		
				$ -		
			Sub-Total	$ 373,002.32		
066 Other Goods & Services						
Contingency	%	15%	$ 373,002.32	$ 55,950.35		
Misc.		1	$ 4,815.45	$ 4,815.45		
				$ -		
			Sub-Total	$ 60,765.80		
094 Interest Capitalized						
AFUDC				$ 2,637.32		
				$ -		
				$ -		
			Sub-Total	$ 2,637.32		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 10,034.19		
				$ -		
			Sub-Total	$ 10,034.19		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 15,478.85		
COPS Contract AO				$ 88,699.95		
				$ -		
			Sub-Total	$ 104,178.80		
			SUB-TOTAL (no AO, AFUDC)	$ 510,044.40		
			TOTAL (AO, AFUDC included)	$ 626,894.71		
Original Cost				$ 46,582.11		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Sydney Transmission Planning Study Report
Report 049-2013-TSMG

Transmission Planning
Nova Scotia Power Inc.

November 29, 2013

Hung Van Huynh, P.Eng.

Executive Summary

This transmission planning study provides the solution for the overload of local 69 kV lines serving the Sydney area: 84S-V.J. Distribution, 4S-Townsend Street, 6S-Terrace Street, 11S-Keltic Drive, and 3S-Gannon Road.

This transmission planning study takes into account the distribution planning study report number 283-0212-E27 which had already recommended a new 138 kV to 12 kV substation to be tapped from L-6539 and the retirement of 6S-Terrace Street substation due to the 4 kV aging and deterioration.

To resolve the 69 kV transmission overload in the area, this transmission planning report recommends the following system upgrades by 2015:

- Complete re-conductoring of L-5563 remaining 2/0 Copper sections to Linnet (336 ACSR).
- Upgrade L-5560 to Linnet (336 ACSR) with a designed operating temperature of 60^0 C or higher.
- Upgrade L-5560 full scale metering at 2S-VJ to 60 MVA or higher.

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1.0 Introduction

This transmission planning study is necessary due to the overload of local 69 kV lines serving the Sydney area. The area covers 5 substations: 84S-V.J. Distribution, 4S-Townsend Street, 6S-Terrace Street, 11S-Keltic Drive, and 3S-Gannon Road.

The situation will become severe with a predicted stepped load growth in the Membertou area of Sydney. A distribution planning study was undertaken (Report number 283-0212-E27) and recommended a new 138 kV to 12 kV substation to be tapped from L-6539 at Membertou. The new substation may utilize compact padmount transformer at 138 kV. The same report also recommended the retirement of 6S-Terrace Street substation due to the 4 kV aging and deterioration.

2.0 Scope

The area to be covered in this study consists of 6 substations: 84S-VJ Distribution, 4S-Townsend Street, 6S-Terrace Street, 11S-Keltic Drive, 3S-Gannon Road and a new 138 kV to 12 kV substation at Membertou as identified in the distribution planning report 283-0212-E27.

3.0 Existing System

The four substations at 84S-V.J. Distribution, 4S-Townsend Street, 6S-Terrace Street, 11S-Keltic Drive, and 3S-Gannon Road are fed from the transmission system via three 69 kV lines L-5560, L-5563, and L-5564 from 2S-V.J. substation and via 3S-T1 (138kV/69kV transformer) at 3S-Gannon Road substation.

The normally opened points are at 11S-508 switch at 11S-Keltic Drive and at 4S-509 breaker at 4S-Townsend Street. Thus, 3S-Gannon Road substation is normally fed from the 138 kV at 3S-Gannon Road and the other three substations are normally fed from the 69 kV lines at 2S-V.J. substation.

The system one-line is shown on Figure 1:

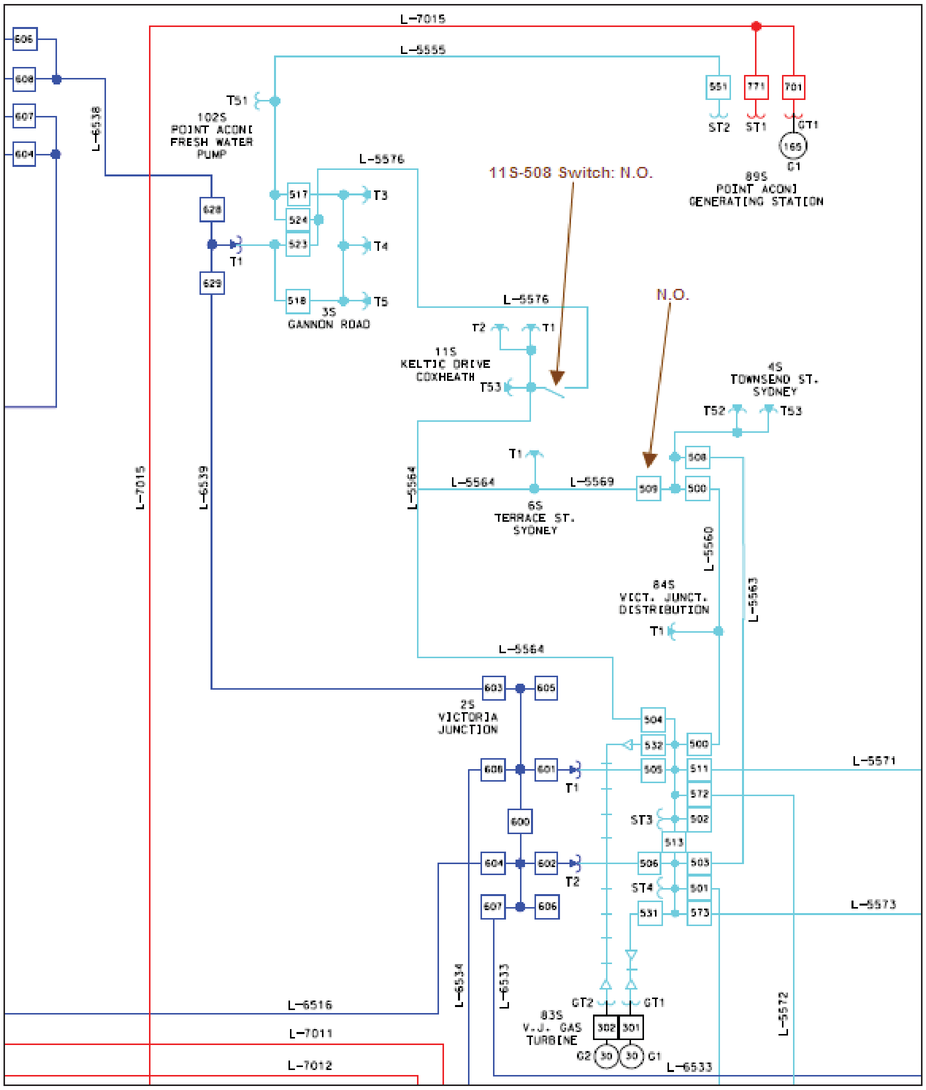

Figure 1: Existing System

4.0 Load History and Forecast

From the transmission point of view, the relevant load forecast will be on loading of 3S-T1 at 3S-Gannon Road and loading on the three 69 kV lines from 2S-V.J. substation.

The load forecast for 3S-T1 is based on the archived SCADA data in past years. Linear regression with 90% tile is applied for future load prediction consistent with NSPI's practice for substation load forecast for distribution planning studies.

The load forecast for 3S-T1 is shown on Figure 2.

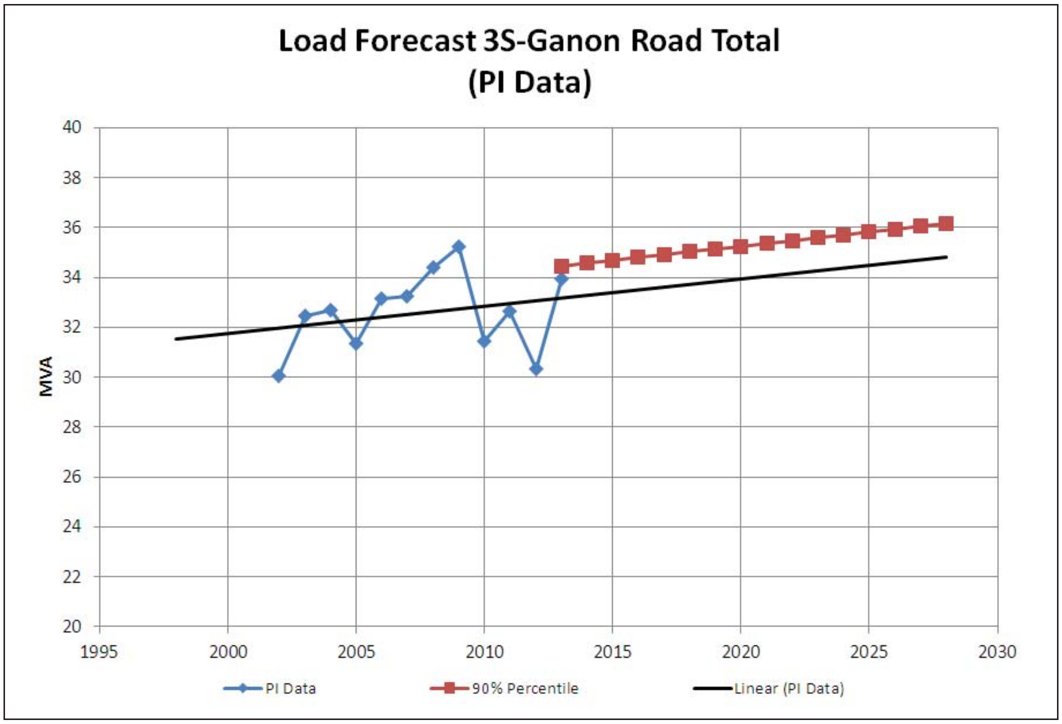

Figure 2: 3S-T1 Load Forecast

The load forecast for the three lines from 2S-V.J. substation is shown on Figure 3.

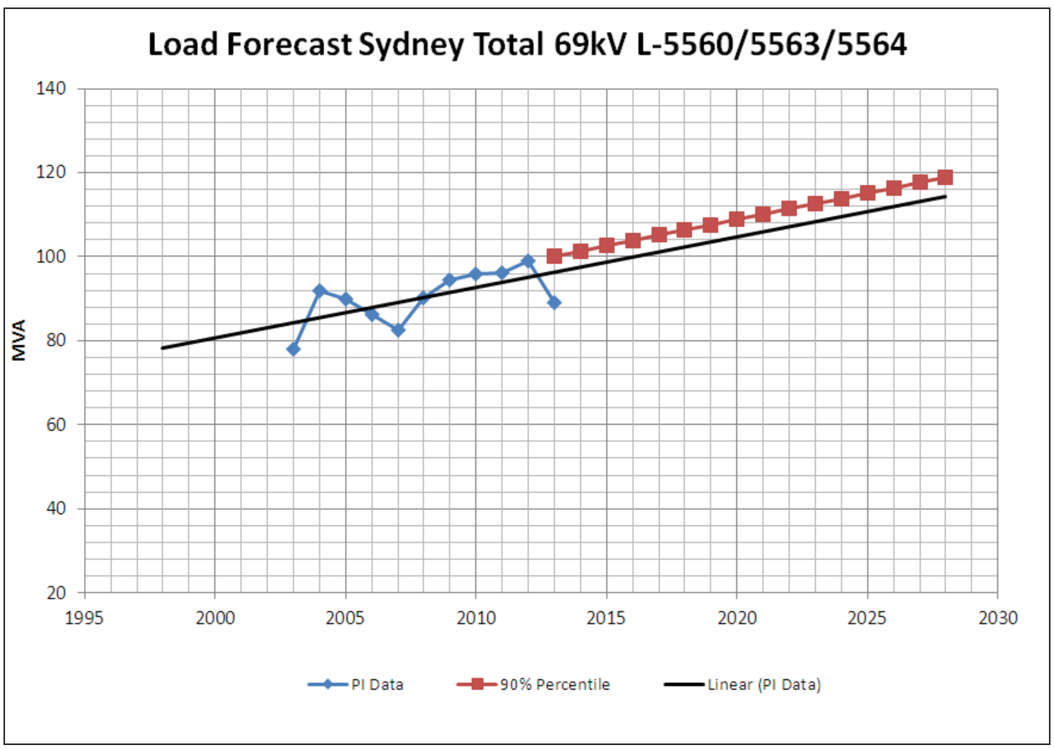

Figure 3: L-5560/5563/5564 Load Forecast

However, based on the distribution planning report 283-0212-E27, a new 138 kV to 12 kV substation is expected in the Membertou area in around 2015 to 2018 time frame to relieve the overload on the 69 kV lines. The load forecast for these three 69 kV lines is changed as shown on Figure 4.

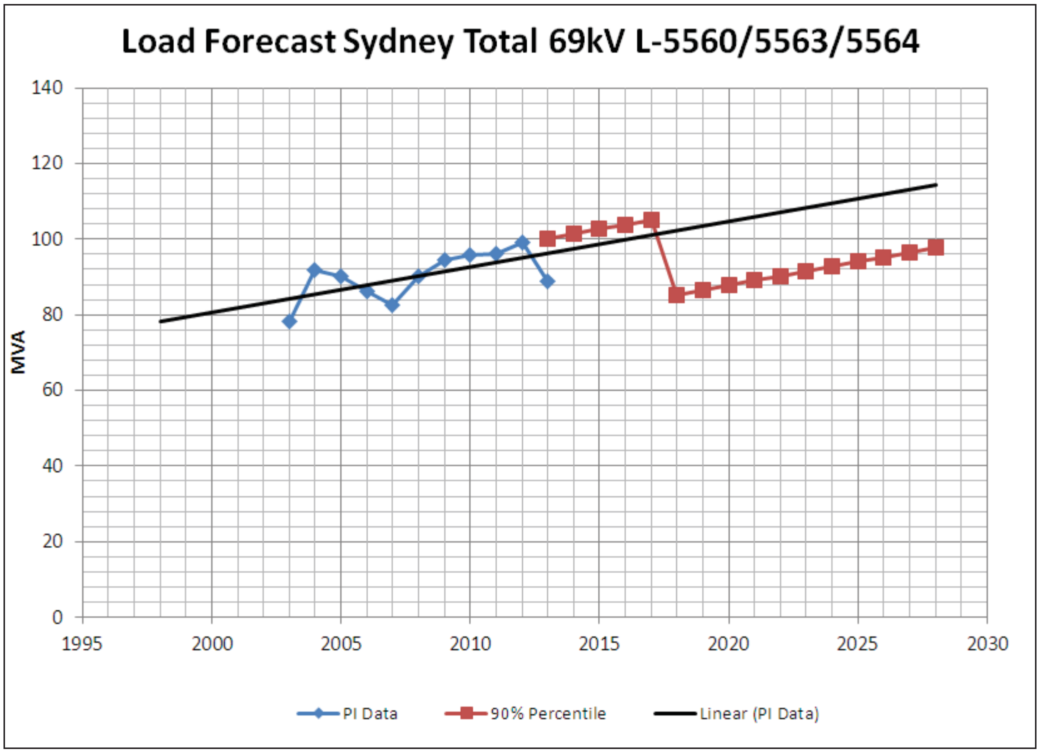

Figure 4: L-5560/5563/5564 Load Forecast

Individual substation load forecast for the 69 kV substations being fed from these three 69 kV lines are shown on Figure 5, 6, 7, and 8. The historical values for these substations are based on the substation load checks as the archived SCADA data are not available.

The distribution planning report 283-0212-E27 recommends the retirement of 6S-Terrace St substation starting in 2015 and complete by 2018. This retirement is due to the 4 kV line deterioration and not by the transformer capacity. The load forecast for 6S-T1 is shown on Figure 5.

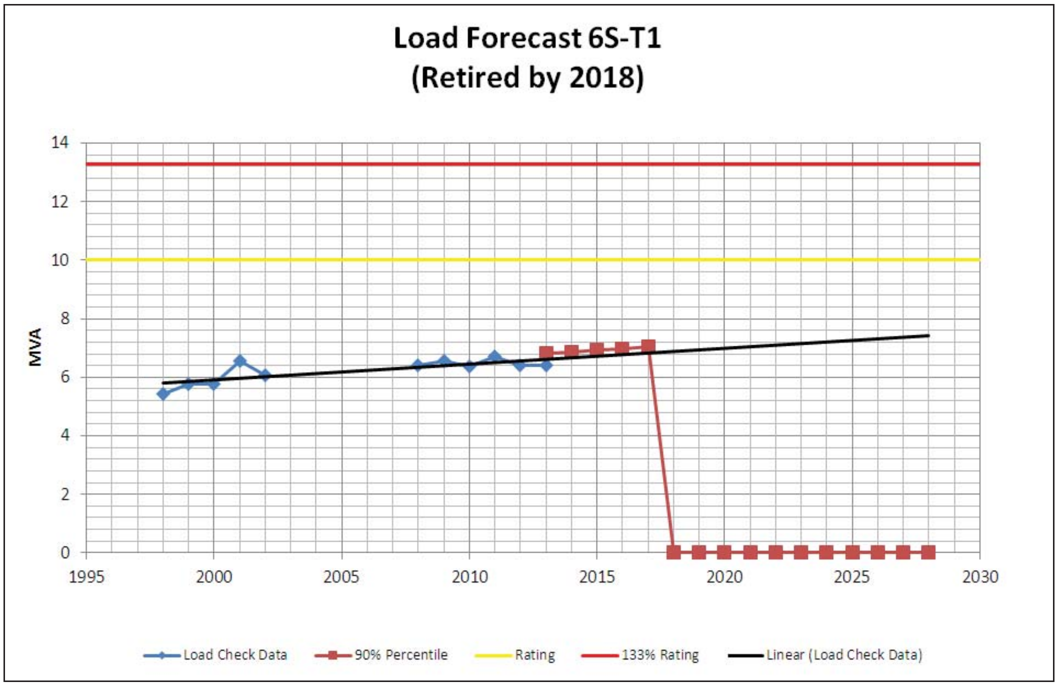

Figure 5: 6S-T1 Load Forecast

The load check data from 2002 to 2008 are missing as they were not read during those years.

The total 12 kV and 25 kV load at 11S-Keltic Drive substation, taking into some load transfer to the new 138 kV substation in 2018, is shown on Figure 6.

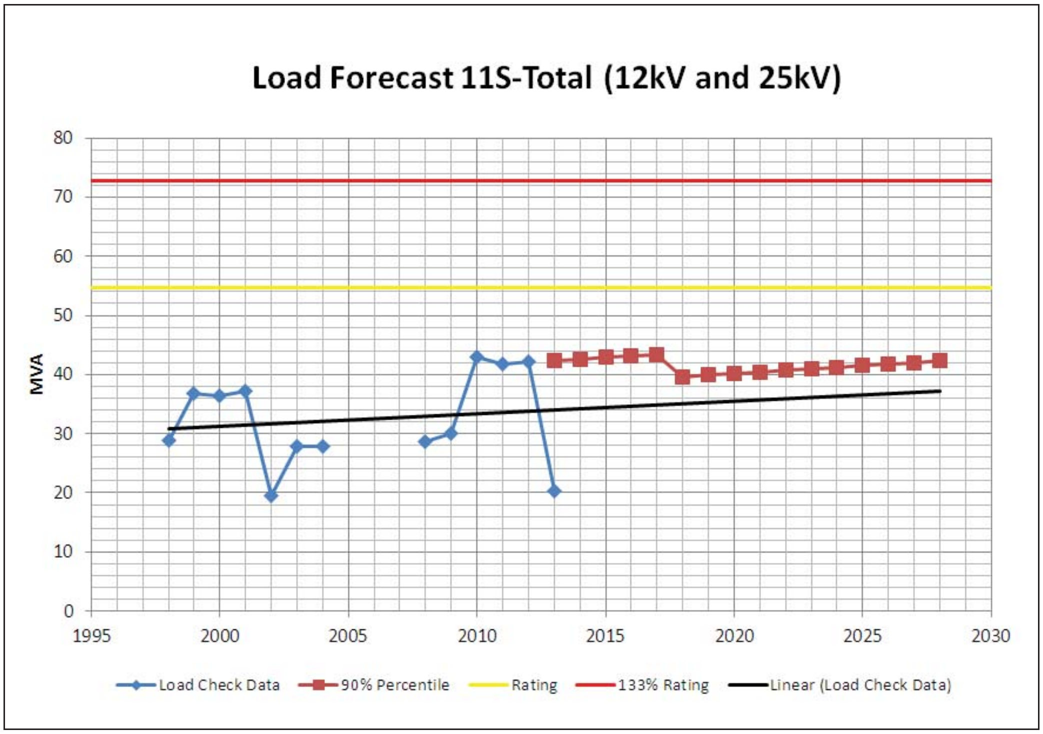

Figure 6: 6S-T1 Load Forecast

Due to the load transfers during different times of the years to and from 4S-Townsend with other nearby substations, the historical substation load check values are not suitable for doing load forecast. Attempt to use the historical load check values for the load forecast led to unrealistically high loads in future years. Instead, the load forecast is based on the difference between the archived SCADA data for the three 69 kV lines from 2S-V.J. substation and the total load checks at the other substations 11S-Keltic Drive, 6S-Terrace St and 84S-V.J. Distribution. The load forecast for 4S-Townsend substation is shown on Figure 7. Some load transfer to the new 138 kV to 12 kV substation is reflected in 2018.

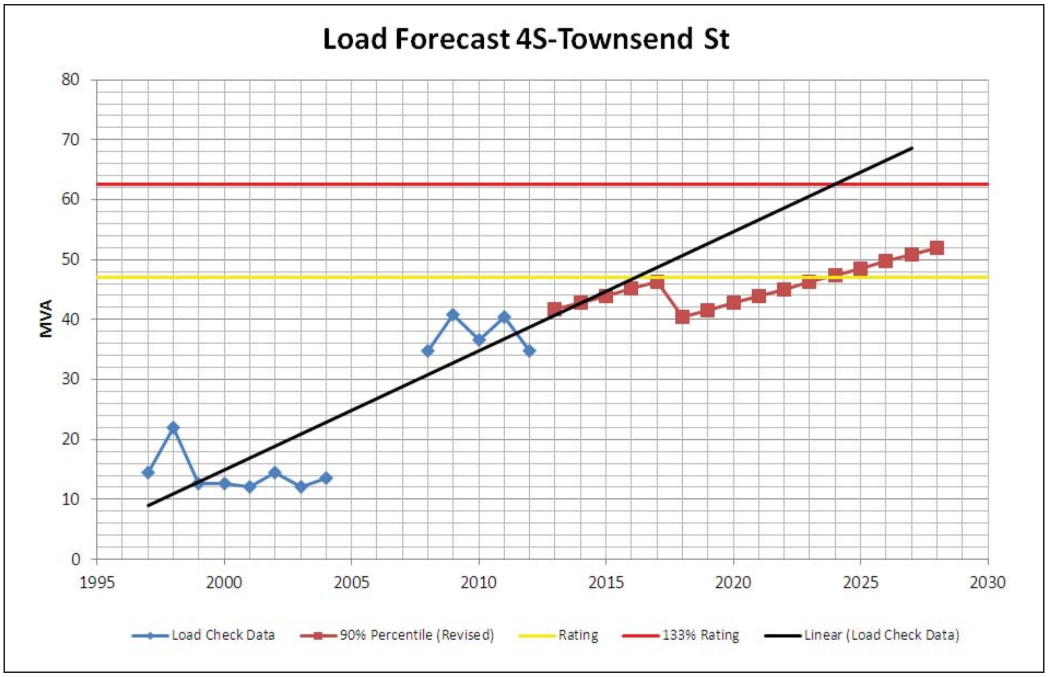

Figure 7: 4S-Townsend St Load Forecast

The load forecast for 84S-V.J. Distribution based on substation load checks is shown on Figure 8.

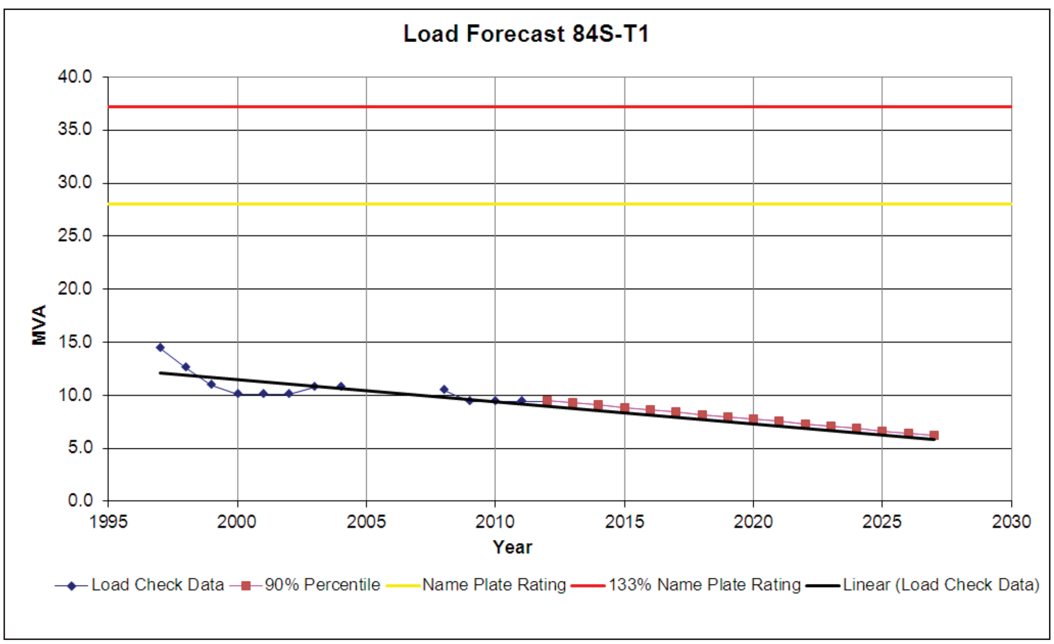

Figure 8: 4S-Townsend St Load Forecast

5.0 Modelling

The above load forecast is modelled in this transmission study for three discreet years: 2015, 2018 and 2028.

2028 is the horizon year for distribution planning studies. The retirement of 6S-Terrace St substation is expected to complete by 2018 and the 4 kV conversion will be completed by around 2015 and 2018 time frame.

The load forecast for these three discreet years are shown on Table 1 and Table 2 for winter peak and summer peak respectively:

Table 1: Winter Peak Load Forecast

Winter Peak	2015			2018			2028		
Substation	MW	MVAR	MVA	MW	MVAR	MVA	MW	MVAR	MVA
3S-Ganon Rd	33.0	10.8	34.7	33.3	10.9	35.0	34.4	11.3	36.2
4S-Townsend St	41.8	13.7	44.0	38.4	12.6	40.4	49.4	16.2	52.0
6S-Terrace St	6.6	2.2	6.9	0.0	0.0	0.0	0.0	0.0	0.0
11S-Keltic Drive	40.8	13.4	42.9	37.7	12.4	39.7	40.2	13.2	42.3
84S VJ	8.5	2.8	8.9	7.8	2.6	8.2	5.7	1.9	6.0
New Substation	0.0	0.0	0.0	20.0	6.6	21.1	22.1	7.3	23.3

Table 2: Summer Peak Load Forecast

Summer Peak	2015			2018			2028		
Substation	MW	MVAR	MVA	MW	MVAR	MVA	MW	MVAR	MVA
3S-Ganon Rd	23.4	11.3	26.0	23.6	11.4	26.3	24.4	11.8	27.2
4S-Townsend St	28.9	14.0	32.1	26.5	12.9	29.5	34.2	16.5	38.0
6S-Terrace St	4.7	2.3	5.2	0.0	0.0	0.0	0.0	0.0	0.0
11S-Keltic Drive	30.1	14.6	33.5	27.9	13.5	31.0	29.7	14.4	33.0
84S VJ	6.3	3.1	7.0	5.8	2.8	6.5	4.3	2.1	4.7
New Substation	0.0	0.0	0.0	14.2	6.9	15.8	15.7	7.6	17.5

These load scenarios are modelled in the load flow analysis for winter peak cases WP_2015A, WP_2018A and WP_2028A; and summer peak cases SP_2015A, SP_2018A and SP_2028A.

To include the effect of the large but occasional backup station service load at Point Aconi via the 69 kV line L-5555 at 3S-Gannon Rd substation, a series “B” cases are created from the series “A” by adding this station service load: WP_2015B, WP_2018B, WP_2028B, SP_2015B, SP_2018B and SP_2028B.

The results of the load flow for series “A” and “B” are shown in Appendix A.

6.0 Transmission Evaluation and Solution

In the allocation of the substation loads as per Table 1 and Table 2, there were a number of scenarios attempted and a number of bases cases tried with different system configurations other than the normally opened points at 11S-508 switch and at 4S-509 breaker, but it is concluded that the present configuration is the most versatile.

In reviewing the results of the load flow analysis as shown in Appendix A, a number of system elements are observed to be thermally overloaded and discussed below:

6.1 L-5560 between 2S-V.J. and 4S-Townsend St

Appendix A shows L-5560 overloaded for the following base case and contingencies as shown on Table 3.

Table 3: L-5560 Loading

Base Case	Contingency	Figure	% Loaded
SP_2015A	L-5563	2	131
	2S-B52	4	133
SP_2018A	L-5563	9	120
	2S-B52	11	122
SP_2028A	L-5563	16	144
	2S-B52	18	147
WP_2015A	L-5563	23	124
	2S-B52	25	128
WP_2018A	L-5563	30	114
	2S-B52	32	114
WP_2028A	L-5563	37	137
	2S-B52	39	137

L-5560 has a summer rating of 29 MVA and a winter rating of 42 MVA. The line was built in 1949 (64 year olds) with 2/0 Copper. This line has been identified in NSPI's "**10 Year System Outlook 2013-2022 Report"** that was submitted to the Nova Scotia Utility and Review Board (NS-UARB) on July 2, 2013. The report referred to this line as "The second 69 kV line between Victoria Junction and Townsend Street will be reconductored." in 2015.

Figure 16 and 18 of Appendix A show that L-5560 can be loaded to 44 MVA under contingencies in summer peak 2028; hence it is recommended that the line be upgraded to Linnet (336ACSR) at a designed conductor operating temperature of 60^0 C or higher. This will provide the line with a minimum summer rating of 51.9 MVA whereas a 50^0 C conductor operating temperature only provides a summer rating of 41.7 MVA which is not sufficient.

Figure 37 and 39 of Appendix A show that L-5560 attends the highest loading of 60 MVA in winter peak 2028. With L-5560 upgraded to 60^0 C Linnet, the line will have a winter rating of 67.9 MVA which will be sufficient.

NSPI's "Transmission Line Rating" book shows L-5560 full scale metering being rated at 58 MVA at 2S-VJ. This full scale metering will need to be moved to or upgraded to 60 MVA or higher.

6.2 Transformer 2S-T1 or 2S-T2 at 2S-V.J.

Appendix A shows a number of instances of 2S-T1 overload as shown on Table 4.

Table 4: 2S-T1 Loading

Base Case	Contingency	Figure	% Loaded
SP_2015A	2S-T2	3	109
	2S-B52	4	105
	2S-B65	5	108
SP_2028A	2S-T2	17	107
	2S-B52	18	103
	2S-B65	19	106
WP_2015A	2S-B52	25	119

Since the overload is below 110% in summer peak and below 120% in winter peak for the transformer and there is opportunity for load transfer, mobile transformer to off load or gas turbine start up to reduce the loading as necessary, the transformers do not need to be upgraded in this study.

6.3 L-5563 between 2S-V.J. and 4S-Townsend St

Appendix A shows L-5563 overload for a number of occasions as shown on Table 5.

Table 5: L-5563 Loading			
Base Case	**Contingency**	**Figure**	**% Loaded**
SP_2015A	L-5560	6	100
	2S-B51	7	100
SP_2028A	L-5560	20	120
	2S-B51	21	120
WP_2028A	L-5560	41	115
	2S-B51	42	115

L-5560 has a summer rating of 31 MVA and a winter rating of 45 MVA. The line was originally built in 1949 (64 year olds) with 2/0 Copper, but it was mostly re-conductored a few years ago to Linnet 336 ACSR with a designed temperature of 50^0 C. Due to the difficulty of obtaining the outages to complete the work, these short line sections still remain 2/0 Copper which limits the rating of this line to 31 MVA and 45 MVA. Thus, the re-conductoring of these sections to Linnet must be completed to provide the line with a summer rating of 41.7 MVA and a winter rating of 61 MVA to meet the thermal rating requirement.

In addition, NSPI's "Transmission Line Rating" book shows the line switches for L-5563 being rated at 48 MVA. However, these switches have been confirmed that they had been upgraded to 1200A in recent years, hence there is no issue with these switches.

6.4 Transformer 3S-T1 at 3S-Gannon Road

As shown on the existing one line for 3S-Gannon Road on Figure 1 in Section 3.0, transformer 3S-T1provides the power for 3S-T3, T4, and T5 as well as the back-up station service for Point Aconi thermal plant via L-5555.

This back-up station service load occurs very rarely. SCADA archived data show that from 2001 to 2012, this service was used twice from May to October 2003 and from Jan to July 2004. The data also shows that when the service was used, it drew a peak of 24 MVA as shown on Figure 9 and 10.

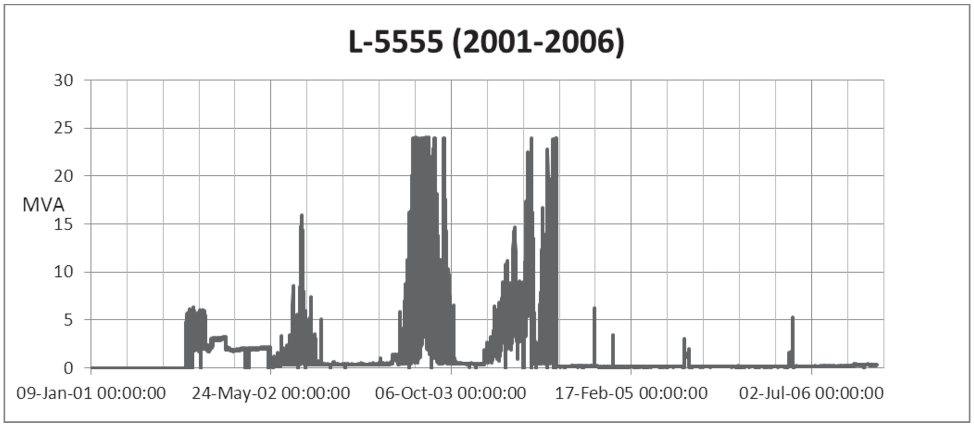

Figure 9: L-5555 PI data from 2001 to 2006

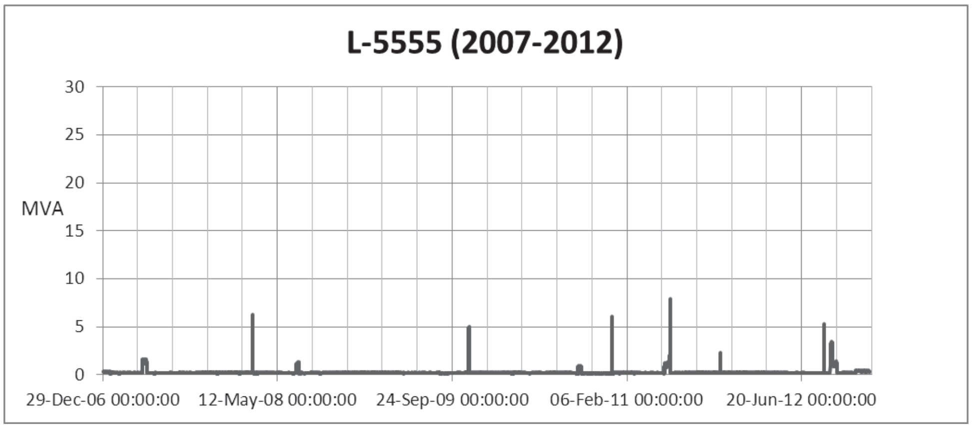

Figure 10: L-5555 PI data from 2007 to 2012

To account for this occasional but important load, the load flow models of series "A" are modified to include this load and are referred to as series "B".

Appendix A for series "B" show that 3S-T1 can be overloaded under winter peak system condition with this station service included as shown on Table 6.

Table 6: 3S-T1 Loading			
Base Case	**Figure**	**% Loaded**	**Comment**
SP_2015B	43	92	OK
SP_2018B	44	92	OK
SP_2028B	45	94	OK
WP_2015B	46	109	*
WP_2018B	47	110	*
WP_2028B	48	113	*

*: Since the overload is below 120% in winter peak for the transformer and there is opportunity for load transfer or mobile transformer to off load as necessary, the transformer do not need to be upgraded in this study.

7.0 Conclusion

Based on the above analysis and evaluation, the report recommends the following system upgrades by 2015:

- Complete re-conductoring of L-5563 2/0 Copper sections to Linnet (336 ACSR).
- Upgrade L-5560 to Linnet (336 ACSR) with a designed operating temperature of 60^0 C or higher to provide a minimum summer rating of 51.9 MVA and a minimum winter rating of 67.9 MVA.
- Upgrade L-5560 full scale metering at 2S-VJ to 60 MVA or higher.

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Appendix A

Load Flow One-Line Diagrams

Pages 19-66 of Attachment 1 have been removed due to confidentiality.

CI Number: 46353

Title: 2015 Substation Recloser Replacements

Start Date:	2015/03
In-Service Date:	2015/12
Final Cost Date:	2016/06
Function:	Transmission
Forecast Amount:	$596,893

DESCRIPTION:

This project is required for the retirement and replacement of 12 substation reclosers on the NS Power system. Nova Scotia Power has an in-service inventory of over 440 substation reclosers, with an estimated useful life of 30 years. Oil filled reclosers have been targeted for replacement due to recent failures. The solid dielectric models with microprocessor controls that are being installed through this program have many benefits. They have an increased number of protection curves making it easier to coordinate protection on a feeder. Integrated instrument transformers provide data collection capabilities for planning studies and operations. It is also easier to integrate these into existing protection schemes due to the availability of programmable I/O. The substation recloser replacement program was initiated in 2010 and 180 of 440 substation reclosers have been replaced to date.

Summary of Related CIs (+/- 2 years):
2013 CI 43237 2013 Substation Recloser Replacements $1,863,378
2014 CI 44973 2014 Substation Recloser Replacements $307,115
2016 CI TBD 2016 Substation Recloser Replacements $TBD
2017 CI TBD 2017 Substation Recloser Replacements $TBD

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

Failures of reclosers have occurred at the following substations: 113H - Dartmouth East, 126H-Porters Lake, 131H-Lucasville, 129H-Kearney Lake Road, 4S-Townsend Street and 101H-Cobequid Road. The associated reliability impact makes it necessary to mitigate the issues with this equipment through removal and replacement.

Why do this project now?

Failures of reclosers at substations have occurred. This project targets the replacement of oil filled reclosers that have reached the end of their useful life. To mitigate the risk of an in service failure, replacement is necessary.

Why do this project this way?

Spare parts are becoming increasingly hard to acquire for the installed fleet of oil filled reclosers. This necessitates replacing them with a modern solid dielectric equivalent. This also serves to remove oil filled equipment from the fleet, reducing environmental liability.

CI Number : 46353 - 2015 Substation Recloser Replacements **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		31,719	0	31,719
095		095-COPS Contracts AO		1,427	0	1,427
095		095-COPS Regular Labour AO		48,930	0	48,930
012	022	012 - Materials	022 - TP - Elec Contr.Equip.	5,760	0	5,760
001	043	001 - T&D Regular Labour	043 - TP - Substn Dev.	24,334	0	24,334
012	043	012 - Materials	043 - TP - Substn Dev.	366,048	0	366,048
013	043	013 - COPS Contracts	043 - TP - Substn Dev.	6,000	0	6,000
066	043	066 - Other Goods & Services	043 - TP - Substn Dev.	3,200	0	3,200
012	045	012 - Materials	045 - TP - U/G Conduit	384	0	384
001	085	001 - T&D Regular Labour	085 Design	28,029	0	28,029
001	085	001 - Regular Labour (No AO)	085 Design	7,444	0	7,444
066	085	066 - Other Goods & Services	085 Design	66,179	0	66,179
001	086	001 - T&D Regular Labour	086 Commissioning	7,439	0	7,439
			Total Cost:	596,893	0	596,893
			Original Cost:	264,788		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46353
Title: 2015 Substation Recloser Replacements
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	90	$ 354	$ 31,773.00		
T&D Labour - Design	PD	81	$ 347	$ 28,029.00		
Procurement / Financial (No AO)	Lot	1	$ 7,444	$ 7,444.00		
			Sub-Total	$ 67,246.00		
012 Materials						
Reclosers	ea	12	$ 30,000.00	$ 360,000.00		
Misc Materials	lot	1	$ 12,192.00	$ 12,192.00		
			Sub-Total	$ 372,192.00		
013 Contracts						
Misc Contracts	Lot	1	$ 6,000	$ 6,000.00		
				$ -		
				$ -		
			Sub-Total	$ 6,000.00		
066 Other Goods & Services						
Other Goods & Services	Lot	1	$ 3,200	$ 3,200.00		
Contingency	%	15%	$ 441,194	$ 66,179.10		
			Sub-Total	$ 69,379.10		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 31,718.98		
			Sub-Total	$ 31,718.98		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 48,930.00		
COPS Contract AO				$ 1,426.80		
			Sub-Total	$ 50,356.80		
			SUB-TOTAL (no AO, AFUDC)	$ 514,817.10		
			TOTAL (AO, AFUDC included)	$ 596,892.87		
Original Cost				$ 264,788.30		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 43261

Title: 6V-GT1 Hollow Bridge Hydro Transformer Replacement

Start Date:	2015/04
In-Service Date:	2015/12
Final Cost Date:	2016/06
Function:	Transmission
Forecast Amount:	$550,938

DESCRIPTION:

The scope of this project is for the replacement of 6V-GT1 transformer at the 6V Hollow Bridge Hydro Substation. It is the oldest transformer in NS Power's fleet and is at end-of-life. The replacement transformer will be placed in the same position and connected to the existing high voltage wiring. An interface box will be installed to allow extension and reconnection of the existing protection and control wiring. The winding arrangement will remain Delta Wye.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

6V-GT1 is the oldest transformer in the NS Power fleet at 70 years old and power factor testing indicates that this transformer is at end of life. Power factor results are expected to be less than one and not increasing significantly between subsequent tests.

Why do this project now?

Test results indicate that the transformer is at end of life. Replacing the transformer before an in service failure occurs protects against loss of generation.

Why do this project this way?

Refurbishment of this transformer is not operationally practical as a spare transformer is not available. In the event of a failure a mobile transformer would need to be installed. Utilizing a mobile transformer for the duration of a refurbishment would impede Substation Operations from completing their preventative maintenance program.

CI Number : 43261 - 6V-GT1 Hollow Bridge Hydro Transformer Replacement **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		9,593	0	9,593
094		094 - Interest Capitalized		15,975	0	15,975
095		095-COPS Contracts AO		22,047	0	22,047
095		095-COPS Regular Labour AO		14,799	0	14,799
012	022	012 - Materials	022 - TP - Elec Contr.Equip.	1,900	0	1,900
013	022	013 - COPS Contracts	022 - TP - Elec Contr.Equip.	1,600	0	1,600
012	043	012 - Materials	043 - TP - Substn Dev.	8,760	0	8,760
013	043	013 - COPS Contracts	043 - TP - Substn Dev.	77,686	0	77,686
012	044	012 - Materials	044 - TP - Substn.Transf.	250,000	0	250,000
013	044	013 - COPS Contracts	044 - TP - Substn.Transf.	10,128	0	10,128
066	044	066 - Other Goods & Services	044 - TP - Substn.Transf.	46,800	0	46,800
001	085	001 - Regular Labour (No AO)	085 Design	5,213	0	5,213
001	085	001 - T&D Regular Labour	085 Design	9,585	0	9,585
011	085	011 - Travel Expense	085 Design	1,400	0	1,400
041	085	041 - Meals & Entertainment	085 Design	700	0	700
066	085	066 - Other Goods & Services	085 Design	62,949	0	62,949
001	086	001 - T&D Regular Labour	086 Commissioning	8,502	0	8,502
013	087	013 - COPS Contracts	087 Field Super.& Ops.	3,300	0	3,300
			Total Cost:	550,938	0	550,938
			Original Cost:	28,192		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 43261
Title: 6V-GT1 Hollow Bridge Hydro Transformer Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	$ 24.0	$ 354.26	$ 8,502.00		
T&D Labour - Design	PD	$ 27.6	$ 347.00	$ 9,585.00		
Project Support (No AO)	Lot	$ 1.0	$ 5,213.00	$ 5,213.00		
			Sub-Total	$ 23,300.00		
011 Travel Expense						
Travel	Lot	1	$ 1,400.00	$ 1,400.00		
				$ -		
				$ -		
			Sub-Total	$ 1,400.00		
012 Materials						
Electrical Control Equipment	Lot	1	$ 1,900.00	$ 1,900.00		
Substation Devices	Lot	1	$ 8,760.00	$ 8,760.00		
Substation Transformer	Lot	1	$ 250,000.00	$ 250,000.00		
			Sub-Total	$ 260,660.00		
013 Contracts						
Contract Line Labour	Hrs	[redacted]		$ 71,214.12		
Field Supervision	Lot	1	$ 3,300.00	$ 3,300.00		
Electrical Control Equipment	Lot	1	$ 1,600.00	$ 1,600.00		
Substation Devices	Lot	1	$ 16,600.00	$ 16,600.00		
				$ -		
				$ -		
			Sub-Total	$ 92,714.12		
041 Meals & Entertainment						
Meals	Lot	1	$ 700.0	$ 700.00		
				$ -		
				$ -		
			Sub-Total	$ 700.00		
066 Other Goods & Services						
Other Goods & Services	Lot	1	$ 46,800.00	$ 46,800.00		
Contingency	%	15	$ 419,661.12	$ 62,949.17		
				$ -		
			Sub-Total	$ 109,749.17		
094 Interest Capitalized						
AFUDC				$ 15,974.91		
				$ -		
				$ -		
			Sub-Total	$ 15,974.91		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 9,593.34		
				$ -		
			Sub-Total	$ 9,593.34		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 14,798.78		
COPS Contract AO				$ 22,047.42		
				$ -		
			Sub-Total	$ 36,846.20		
			SUB-TOTAL (no AO, AFUDC)	$ 488,523.29		
			TOTAL (AO, AFUDC included)	$ 550,937.74		
Original Cost				$ 28,191.96		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46337

Title: L6535 / L6551 Insulator Replacements

Start Date: 2015/03
In-Service Date: 2015/05
Final Cost Date: 2015/11
Function: Transmission
Forecast Amount: $459,422

DESCRIPTION:

This project is required to replace insulators and worn attachments on transmission lines L6535 and L6551. L6535 is a 138kV line that connects the New Brunswick Memramcook Station to 92N Amherst Wind Farm. L6551 is a 138kV line that connects 92N Amherst Wind Farm to 30N Maccan Substation. These lines were built in 1960.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

Replacement of these insulators will improve the reliability performance of this line. The type of insulator on these lines has failed due to an industry known cement growth failure mechanism. Worn attachments on this line were identified during a line clearance upgrade project. These lines are an underlying 138kV tie between the Nova Scotia Power and New Brunswick Power transmission systems. Insulator replacement is important to maintain the reliable performance of transmission tie lines interconnecting with the neighbouring NB Power system.

Why do this project now?

The insulators on 34 structures on these lines have reached the end of their service lives and need to be replaced.

Why do this project this way?

This work has been scoped in such a way to minimize costs associated with working in environmentally sensitive areas.

This project is expected to be completed by an external contractor.

CI Number : 46337 - L6535/L6551 Insulator Replacements **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		7,022	0	7,022
095		095-COPS Contracts AO		68,462	0	68,462
095		095-COPS Regular Labour AO		10,832	0	10,832
013	007	013 - COPS Contracts	007 - TP - Environmental	49,950	0	49,950
012	035	012 - Materials	035 - TP - Wood Poles	2,472	0	2,472
013	035	013 - COPS Contracts	035 - TP - Wood Poles	8,665	0	8,665
012	037	012 - Materials	037 - TP - Steel Towers	216	0	216
013	037	013 - COPS Contracts	037 - TP - Steel Towers	693	0	693
012	038	012 - Materials	038 - TP - Insulators	25,449	0	25,449
013	038	013 - COPS Contracts	038 - TP - Insulators	105,889	0	105,889
012	039	012 - Materials	039 - TP - O/H Cond.	85	0	85
013	039	013 - COPS Contracts	039 - TP - O/H Cond.	122,699	0	122,699
001	085	001 - Regular Labour (No AO)	085 Design	564	0	564
001	085	001 - T&D Regular Labour	085 Design	5,921	0	5,921
066	085	066 - Other Goods & Services	085 Design	43,184	0	43,184
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	7,318	0	7,318
			Total Cost:	459,422	0	459,422
			Original Cost:	27,313		

Capital Project Detailed Estimate

Location: **Transmission**
CI# / FP#: 46337
Title: L6535/L6551 Insulator Replacements
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	19	$ 379	$ 7,317.66		
T&D Labour - Design	PD	17	$ 347	$ 5,921.19		
Procurement / Financial (No AO)	Lot	1	$ 564	$ 564.43		
			Sub-Total	$ 13,803.28		
012 Materials						
Wood Poles	Lot	1	$ 2,471.86	$ 2,471.86		
Steel Towers	Lot	1	$ 215.69	$ 215.69		
Insulators	Lot	1	$ 25,448.60	$ 25,448.60		
Overhead Conductor	Lot	1	$ 85.45	$ 85.45		
			Sub-Total	$ 28,221.60		
013 Contracts						
Contractor Line Work	Hrs	[redacted]		$ 237,946.49		
Environmental Bog Mats	Lot	1	$ 49,950.00	$ 49,950.00		
			Sub-Total	$ 287,896.49		
066 Other Goods & Services						
Contingency	%	15%	$ 287,896.49	$ 43,184.47		
			Sub-Total	$ 43,184.47		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 7,021.89		
				$ -		
			Sub-Total	$ 7,021.89		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 10,832.03		
COPS Contract AO				$ 68,461.78		
				$ -		
			Sub-Total	$ 79,293.81		
			SUB-TOTAL (no AO, AFUDC)	$ 373,105.84		
			TOTAL (AO, AFUDC included)	$ 459,421.54		
Original Cost				$ 27,312.98		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46354

Title: 2015 Reactor Breaker Replacements

Start Date: 2015/05
In-Service Date: 2015/10
Final Cost Date: 2016/03
Function: Transmission
Forecast Amount: $460,691

DESCRIPTION:

This project includes the retirement and replacement of three shunt reactor bank breakers. Breaker replacements will be prioritized based on age, number of operations, maintenance history and criticality to the transmission system.

Summary of Related CIs (+/- 2 years):
2014 CI 44983 Reactor Bank Breaker Replacements $385,032
2016 CI TBD Reactor Bank Breaker Replacements $TBD
2017 CI TBD Reactor Bank Breaker Replacements $TBD

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

A shunt reactor is an inductor that is generally connected to the tertiary winding (generally a low capacity, medium voltage transformer winding that can be used for many purposes, one of which is connection of shunt reactors or capacitors to help maintain transmission system voltage during light and heavy loading conditions) of some of our 345kV Transformers. The reactor is used to control the 345kV System Voltage. The 11 shunt reactors on the system are the devices most frequently used to control the transmission system voltage during times of low load. The reactors are used mainly in the summer and are cycled a few times per day. NS Power has seen an increase in forced reactor outages due to an increased rate of reactor bank breaker failures. The existing breakers have been operated beyond the manufacturer's recommended life. In 2014 three reactor bank breakers were replaced. This is the continuation of that program with 3 more replacements in 2015.

Why do this project now?

An increasing failure rate in these reactors has been seen over the past several years. Overall reliability of the 11 shunt reactor banks on the transmission system is critical and replacement in 2015 is recommended.

Why do this project this way?

The age of the installed breakers means that overhauls are not an option as spare parts are not available. Replacement with new breakers suited for the duty is the only option.

CI Number : 46354 - 2015 Reactor Breaker Replacements **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D OT Labour AO		940	0	940
092		092-Vehicle T&D Reg. Labour AO		38,293	0	38,293
094		094 - Interest Capitalized		7,301	0	7,301
095		095-COPS Regular Labour AO		59,072	0	59,072
095		095-COPS Overtime Labour AO		1,449	0	1,449
095		095-COPS Contracts AO		4,358	0	4,358
001	003	001 - T&D Regular Labour	003 - TP - Bldg.,Struct.Grnd.	709	0	709
012	003	012 - Materials	003 - TP - Bldg.,Struct.Grnd.	253	0	253
013	003	013 - COPS Contracts	003 - TP - Bldg.,Struct.Grnd.	9,205	0	9,205
001	022	001 - T&D Regular Labour	022 - TP - Elec Contr.Equip.	2,126	0	2,126
012	022	012 - Materials	022 - TP - Elec Contr.Equip.	2,250	0	2,250
013	022	013 - COPS Contracts	022 - TP - Elec Contr.Equip.	9,120	0	9,120
001	023	001 - T&D Regular Labour	023 - TP - Power Equip.-Station S	5,314	0	5,314
001	043	001 - T&D Regular Labour	043 - TP - Substn Dev.	38,614	0	38,614
002	043	002 - T&D Overtime Labour	043 - TP - Substn Dev.	3,543	0	3,543
012	043	012 - Materials	043 - TP - Substn Dev.	195,240	0	195,240
066	043	066 - Other Goods & Services	043 - TP - Substn Dev.	5,240	0	5,240
001	085	001 - Regular Labour (No AO)	085 Design	3,955	0	3,955
001	085	001 - T&D Regular Labour	085 Design	17,277	0	17,277
011	085	011 - Travel Expense	085 Design	114	0	114
041	085	041 - Meals & Entertainment	085 Design	75	0	75
066	085	066 - Other Goods & Services	085 Design	47,186	0	47,186
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	5,314	0	5,314
011	087	011 - Travel Expense	087 Field Super.& Ops.	900	0	900
001	088	001 - T&D Regular Labour	088 Survey/Mapping	2,843	0	2,843
			Total Cost:	460,691	0	460,691
			Original Cost:	95,383		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46354
Title: 2015 Reactor Breaker Replacements
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	132	$ 354	$ 46,762.99		
T&D Labour - Site Supervision	PD	14	$ 379	$ 5,314.00		
T&D Labour - Design	PD	58	$ 347	$ 20,120.00		
Procurement / Financial (No AO)	Lot	1	$ 3,955	$ 3,955.00		
				$ -		
			Sub-Total	$ 76,151.99		
002 OT Labour						
T&D Labour - Electrician/Technician	PD	5	$ 709	$ 3,543.00		
			$ -	$ -		
			Sub-Total	$ 3,543.00		
011 Travel Expense						
Travel	Lot	1	$ 1,014	$ 1,014.00		
				$ -		
				$ -		
			Sub-Total	$ 1,014.00		
012 Materials						
Materials	Lot	1	$ 197,743	$ 197,743.00		
				$ -		
				$ -		
			Sub-Total	$ 197,743.00		
013 Contracts						
Contract Labour	Lot	1	$ 18,325	$ 18,325.00		
				$ -		
				$ -		
			Sub-Total	$ 18,325.00		
041 Meals & Entertainment						
Meals	Lot	1	$ 75	$ 75.00		
				$ -		
				$ -		
			Sub-Total	$ 75.00		
066 Other Goods & Services						
Other Goods & Services	Lot	1	$ 5,240	$ 5,240.00		
Contingency	Lot	1	$ 47,186	$ 47,186.00		
				$ -		
			Sub-Total	$ 52,426.00		
094 Interest Capitalized						
AFUDC				$ 7,301.28		
				$ -		
				$ -		
			Sub-Total	$ 7,301.28		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 38,293.26		
Vehicle T&D Labour Overtime AO				$ 939.61		
				$ -		
			Sub-Total	$ 39,232.87		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 59,071.58		
COPS T&D Labour Overtime AO				$ 1,449.44		
COPS Contract AO				$ 4,357.69		
				$ -		
			Sub-Total	$ 64,878.71		
			SUB-TOTAL (no AO, AFUDC)	$ 349,277.99		
			TOTAL (AO, AFUDC included)	$ 460,690.85		
Original Cost				$ 95,382.67		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46582

Title: L5569 Upgrade

Start Date: 2015/05
In-Service Date: 2015/08
Final Cost Date: 2015/12
Function: Transmission
Forecast Amount: $369,032

DESCRIPTION:

This project is to replace 95 insulators on transmission line L5569. L5569 is a 69kV line that connects 6S Terrace Street Substation to 4S Townsend Street substation in Sydney. This line was built in 1966 and has recently been experiencing insulator failures leading to customer outages.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Equipment Replacement

Why do this project?

The insulators on this line have reached the end of their service life and need to be replaced. Insulators targeted for replacement have a known failure mechanism resulting from cement growth which leads to unplanned transmission line and customer outages.

Why do this project now?

There have been multiple insulator failures on this line over the past number of years that have led to customer outages. Replacement of these insulators will improve the reliability performance of this line as the condition of the insulators will continue to deteriorate if not replaced.

Why do this project this way?

Replacement of the insulators is the only option to complete this work. This work has been scoped in such a way to be completed in a manner that minimizes costs associated with working in environmentally sensitive areas.

This work will be completed by an external contractor.

CI Number : 46582 - L5569 Upgrade **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		5,547	0	5,547
094		094 - Interest Capitalized		3,030	0	3,030
095		095-COPS Regular Labour AO		8,557	0	8,557
095		095-COPS Contracts AO		54,662	0	54,662
013	035	013 - COPS Contracts	035 - DP - Wood Poles	10,000	0	10,000
012	038	012 - Materials	038 - TP - Insulators	21,392	0	21,392
013	038	013 - COPS Contracts	038 - TP - Insulators	76,831	0	76,831
012	039	012 - Materials	039 - TP - O/H Cond.	601	0	601
013	039	013 - COPS Contracts	039 - TP - O/H Cond.	143,034	0	143,034
001	085	001 - Regular Labour (No AO)	085 Design	440	0	440
066	085	066 - Other Goods & Services	085 Design	34,480	0	34,480
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	10,458	0	10,458
			Total Cost:	369,032	0	369,032
			Original Cost:	39,882		

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46582
Title: L5569 Upgrade
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	28	$ 379	$ 10,458.00		
Procurement / Financial (No AO)	Lot	1	$ 440	$ 439.87		
			Sub-Total	$ 10,897.87		
012 Materials						
Insulators	Lot	1	$ 21,392	$ 21,392.39		
Overhead Conductor	Lot	1	$ 601	$ 601.35		
			Sub-Total	$ 21,993.74		
013 Contracts						
Contract Line Work	Hrs	[redacted]	[redacted]	$ 219,865.01		
Traffic Control	Lot	1	$ 10,000	$ 10,000.00		
				$ -		
			Sub-Total	$ 229,865.01		
066 Other Goods & Services						
Contingency	%	15%	$ 229,865	$ 34,479.75		
			Sub-Total	$ 34,479.75		
094 Interest Capitalized						
AFUDC				$ 3,030.31		
			Sub-Total	$ 3,030.31		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 5,546.92		
			Sub-Total	$ 5,546.92		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 8,556.74		
COPS Contract AO				$ 54,661.90		
			Sub-Total	$ 63,218.63		
			SUB-TOTAL (no AO, AFUDC)	$ 297,236.37		
			TOTAL (AO, AFUDC included)	$ 369,032.24		
Original Cost				$ 39,881.55		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46356

Title: 2015 Sacrificial Anode Installation Program

Start Date:	2015/08
In-Service Date:	2015/10
Final Cost Date:	2016/04
Function:	Transmission
Forecast Amount:	$304,612

DESCRIPTION:

Sacrificial anodes are highly active metals that are used for cathodic protection to prevent a less active material surface from corroding. This project will systematically install sacrificial anodes on steel transmission structures and key anchors identified as corroding or at a high risk for corrosion. This program, along with a specialized transmission steel towers inspection and the steel tower refurbishment will identify, quantify and address corrosion issues on steel assets throughout the province.

Summary of Related CIs (+/- 2 years):
2014 CI 44970 2014 Steel Tower Refurbishment $492,271
2014 CI 44975 2014 Sacrificial Anode Installation Program $290,047
2016 CI TBD 2016 Sacrificial Anode Installation Program $TBD

JUSTIFICATION:

Justification Criteria: Transmission Plant

Sub Criteria: Maintenance

Why do this project?

Based on transmission line inspections, the age of NS Power infrastructure and the corrosion rate of steel once galvanization is breached, sacrificial anodes have been recommended by the T&D Engineering Group and have proven effective in other jurisdictions to protect steel transmission structure assets and slow the rate of corrosion.

Why do this project now?

Due to the age of NS Power steel transmission structure assets, the galvanization is at or near the end of the anticipated life. The cathodic protection provided by the installation of sacrificial anodes will effectively extend the life of the steel structure.

Why do this project this way?

The installation of sacrificial anodes protects the existing assets once the galvanization is ineffective, deferring costly replacement.

This project is expected to be completed by external resources.

CI Number : 46356 - 2015 Sacrificial Anode Installation Program **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		4,973	0	4,973
094		094 - Interest Capitalized		1,010	0	1,010
095		095-COPS Regular Labour AO		7,671	0	7,671
095		095-COPS Contracts AO		40,909	0	40,909
013	007	013 - COPS Contracts	007 - TP - Environmental	17,630	0	17,630
013	035	013 - COPS Contracts	035 - TP - Wood Poles	25,000	0	25,000
012	037	012 - Materials	037 - TP - Steel Towers	42,000	0	42,000
013	037	013 - COPS Contracts	037 - TP - Steel Towers	129,400	0	129,400
001	085	001 - T&D Regular Labour	085 Design	3,220	0	3,220
001	085	001 - Regular Labour (No AO)	085 Design	840	0	840
066	085	066 - Other Goods & Services	085 Design	25,805	0	25,805
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	6,155	0	6,155
			Total Cost:	304,612	0	304,612
			Original Cost:			

Capital Project Detailed Estimate

Location: Transmission
CI# / FP#: 46356
Title: 2015 Sacrificial Anode Installation Program
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	16.24	$ 379.00	$ 6,155.00		
T&D Labour - Design	PD	9.28	$ 347.00	$ 3,220.00		
Procurement / Financial (No AO)	Lot	1.00	$ 840.00	$ 840.00		
			Sub-Total	$ 10,215.00		
012 Materials						
Anodes	ea	280	$ 150.00	$ 42,000.00		
				$ -		
				$ -		
			Sub-Total	$ 42,000.00		
013 Contracts						
Contract Labour	Hrs	[redacted]		$ 129,400.32		
Environmental Bridges and Bog Mats	Lot	1	$ 17,630.00	$ 17,630.00		
Rock Breaker	Lot	1	$ 25,000.00	$ 25,000.00		
			Sub-Total	$ 172,030.32		
066 Other Goods & Services						
Contingency	%	15%	$ 172,030.32	$ 25,804.55		
				$ -		
				$ -		
			Sub-Total	$ 25,804.55		
094 Interest Capitalized						
AFUDC				$ 1,009.97		
				$ -		
				$ -		
			Sub-Total	$ 1,009.97		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 4,972.50		
			Sub-Total	$ 4,972.50		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 7,670.62		
COPS Contract AO				$ 40,908.82		
			Sub-Total	$ 48,579.44		
			SUB-TOTAL (no AO, AFUDC)	$ 250,049.87		
			TOTAL (AO, AFUDC included)	$ 304,611.78		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.


010A

Distribution

Distribution

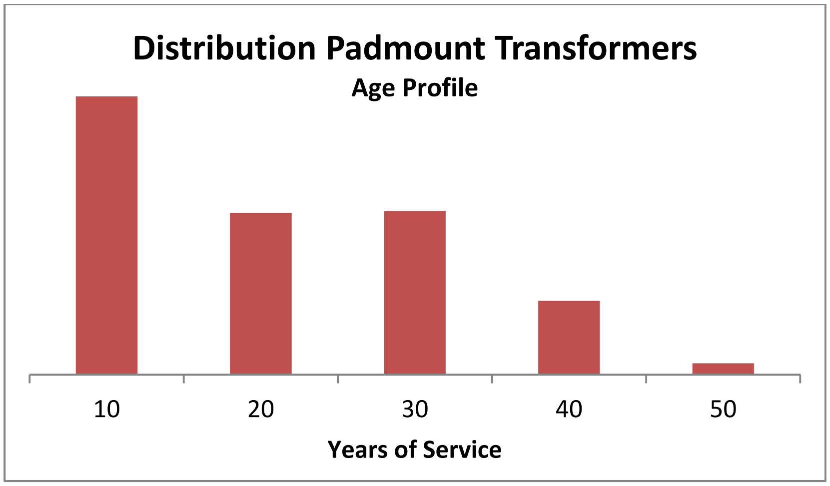
The Distribution capital investment included in this plan is based on asset management strategies to further optimize the reliability and performance of NS Power's plant. Investments in the distribution system have been identified through routine inspections, test results and analysis of opportunities to improve overall fleet performance. These investments can be categorized into three categories: Sustaining, Customer Driven and Compliance.

Category	2015 ACE ($M)
Sustaining	32.3
Customer Driven	24.0
Compliance	8.0
Total Capital Program	**64.2**

Sustaining Capital

Sustaining capital investment targets the upgrade and replacement of key infrastructure like padmount transformers, reclosers, poles and conductor, which have reached end-of-life. The investment in these assets is based on inspections and is well-aligned with the overall quantity and age of assets in the distribution fleet. The average age of distribution equipment being replaced in 2015 is 45 years old.

An example of sustaining investment on an asset is the padmount transformer replacement program. This program is developed through inspection results, in conjunction with age profiles, to determine the quantity of padmount transformers to be replaced in a given year. There are 80 padmount transformers planned for replacement in the 2015 capital program. The age profile of the padmount transformer fleet shows the progress that has been made in the last ten years to replace assets that have reached the end of their service lives. The expected useful life for a padmount transformer is 30 years.



Customer Driven

Customer driven capital investment projects are completed in response to new customer installations and load growth, identified through planning studies or from analysis of equipment test results. Load growth is triggering investments in upgrades to higher capacity feeders, transformers and conductor in 2015.

Compliance

Compliance capital investments are projects required in order to meet environmental and legislative regulations. An example of a compliance driven project is the 2015 PCB Phase-out for Pole Top Transformers which is required to meet federal environmental regulations surrounding the removal of PCB from electrical equipment by 2025. In addition, NS Power is required to replace all street lights with LED street lights by December 31, 2019 and 2015 capital investment reflects this.

CI Number: 46292

Title: 2015 Padmount Transformer Replacement Program

Start Date:	2015/02
In-Service Date:	2015/03
Final Cost Date:	2015/12
Function:	Distribution
Forecast Amount:	$1,536,110

DESCRIPTION:

This project will provide for costs associated with the replacement of 80 padmount transformers identified through the padmount inspection program. NS Power has 4,058 padmount transformers across its fleet, which are inspected every year through the padmount inspection program. This will be an ongoing program as part of lifecycle and condition management of the inservice distribution padmount transformer inventory.

Summary of Related CIs (+/- 2 years):
2016 CI TBD 2016 Padmount Replacements $TBD
2017 CI TBD 2017 Padmount Replacements $TBD

Depreciation Class: Distribution Equipment, Underground Line Trasnformers

Estimated Useful Life: 30 years

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Equipment Replacement

Why do this project?

Padmount transformer inspections have identified transformers that need to be replaced next year due to deterioration. Environmental regulations prohibit the release of mineral oil into the environment. Proactive, planned replacement of end of life padmount transformers mitigates the potential for environmental impact from oil-filled equipment.

Why do this project now?

At or near end of life padmount transformers were identified through the padmount inspection process, and prioritized for replacement. They will be replaced in a planned manner as part of NS Power's environmental due diligence.

Why do this project this way?

Padmount transformers are typically associated with commercial customers. Planned replacement of end of life padmount transformers is conducted during an outage coordinated at the convenience of the customer. The replacement of these transformers will minimize unplanned customer outages and mitigate potential environmental impact.

CI Number : 46292 - 2015 Padmount Transformer Replacement Program **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		37,842	0	37,842
095		095-COPS Regular Labour AO		58,376	0	58,376
095		095-COPS Contracts AO		31,177	0	31,177
001	048	001 - T&D Regular Labour	048 - DP - U/G Line Transf.	63,767	0	63,767
012	048	012 - Materials	048 - DP - U/G Line Transf.	1,182,400	0	1,182,400
013	048	013 - COPS Contracts	048 - DP - U/G Line Transf.	131,104	0	131,104
001	085	001 - Regular Labour (No AO)	085 Design	4,198	0	4,198
066	085	066 - Other Goods & Services	085 Design	19,666	0	19,666
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	7,580	0	7,580
			Total Cost:	1,536,110	0	1,536,110
			Original Cost:	697,158		

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 46292
Title: 2015 Padmount Transformer Replacement Program
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	180	$ 354.26	$ 63,766.80		
T&D Labour - Project Support	PD	1	$ 7,580.00	$ 7,580.00		
Procurement / Financial (No AO)	Lot	1	$ 4,198.31	$ 4,198.31		
				$ -		
			Sub-Total	$ 75,545.11		
012 Materials						
Padmount Transformers	ea	80	$ 14,780.00	$ 1,182,400.00		
				$ -		
				$ -		
			Sub-Total	$ 1,182,400.00		
013 Contracts						
Contractor Labour	Lot	1	$ 131,104.00	$ 131,104.00		
				$ -		
				$ -		
			Sub-Total	$ 131,104.00		
066 Other Goods & Services						
Contingency	%	15%	$ 131,104.00	$ 19,665.60		
				$ -		
				$ -		
			Sub-Total	$ 19,665.60		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 37,842.32		
Vehicle T&D Labour Overtime AO				$ -		
				$ -		
			Sub-Total	$ 37,842.32		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 58,375.92		
COPS Contract AO				$ 31,176.56		
				$ -		
			Sub-Total	$ 89,552.48		
			SUB-TOTAL (no AO, AFUDC)	$ 1,408,714.71		
			TOTAL (AO, AFUDC included)	$ 1,536,109.51		
Original Cost				$ 697,158.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46458

Title: 16N-302 Stewiacke Reconductor

Start Date:	2014/10
In-Service Date:	2015/04
Final Cost Date:	2015/10
Function:	Distribution
Forecast Amount:	$965,830

DESCRIPTION:

This project is to rebuild a 10 km section of the three-phase primary feeder 16N-302 along Highway 2 in Stewiacke. The conductor on this section of the feeder is at the end of its useful life, as evidenced by multiple splices, wear and oxidation. The poles along this section of Highway 2 are also at the end of life and will be replaced.

This project will replace 135 deteriorated poles and upgrade the overhead conductors: from #2 ACSR (aluminum conductor steel reinforced) to 336 ASC (aluminum stranded conductor) for the first 2.7 km from the 16N substation to Mackay Siding Road, and from #2 conductor to 2/0 conductor from Mackay Siding Road to Brentwood Road.

Additionally, 2MVA of additional commercial load is anticipated to be added to this feeder in 2015, which translates to 93A per phase. The documented 2014 peak load on the feeder is 100A per phase, so the additional load will overload the feeder at peak by 54 percent. A load transfer project is planned for 2016 to address the overload.

Summary of Related CIs (+/- 2 years):
2016 CI TBD – 16N-302 Stewiacke Load Transfer $TBD

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

The existing conductor along Highway 2 from the 16N substation to Brentwood Road is deteriorated and at end of life. The poles along this section of the feeder are also deteriorated and should be replaced prior to installing the new conductor.

Why do this project now?

A commercial development has started in 2014 which will push the existing conductor's ampacity to its limit. The #2 conductor is structurally compromised and subject to breakage, especially under increased load conditions. Upgrading the line will reduce the risk of power outages.

Why do this project this way?

Reconductoring with a standard size conductor and replacing deteriorated poles is the accepted method of rebuilding deteriorated distribution lines. The increase in conductor size to 336 will improve the capacity of the feeder in anticipation of increased commercial load.

CI Number : 46458 - 16N-302 Stewiacke Reconductor **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		117,684	0	117,684
094		094 - Interest Capitalized		15,554	0	15,554
095		095-COPS Regular Labour AO		175,766	0	175,766
095		095-COPS Contracts AO		52,457	0	52,457
013	002	013 - COPS Contracts	002 - DP - Land Rights	3,000	0	3,000
020	002	020 - Royalties, Easements, App	002 - DP - Land Rights	5,000	0	5,000
001	035	001 - T&D Regular Labour	035 - DP - Wood Poles	70,921	0	70,921
012	035	012 - Materials	035 - DP - Wood Poles	76,400	0	76,400
013	035	013 - COPS Contracts	035 - DP - Wood Poles	203,700	0	203,700
001	038	001 - T&D Regular Labour	038 - DP - Insulators	799	0	799
012	038	012 - Materials	038 - DP - Insulators	240	0	240
001	039	001 - T&D Regular Labour	039 - DP - O/H Cond.	129,997	0	129,997
012	039	012 - Materials	039 - DP - O/H Cond.	51,470	0	51,470
001	040	001 - T&D Regular Labour	040 - DP - O/H Cond.Devices	1,802	0	1,802
012	040	012 - Materials	040 - DP - O/H Cond.Devices	1,358	0	1,358
001	041	001 - T&D Regular Labour	041 - DP - O/H Line Transf.	7,678	0	7,678
012	041	012 - Materials	041 - DP - O/H Line Transf.	28,950	0	28,950
001	050	001 - T&D Regular Labour	050 - DP - Street Lights	110	0	110
001	052	001 - T&D Regular Labour	052 - DP - Services	4,218	0	4,218
012	052	012 - Materials	052 - DP - Services	318	0	318
001	085	001 - Regular Labour (No AO)	085 Design	18,409	0	18,409
			Total Cost:	965,830	0	965,830
			Original Cost:	147,267		

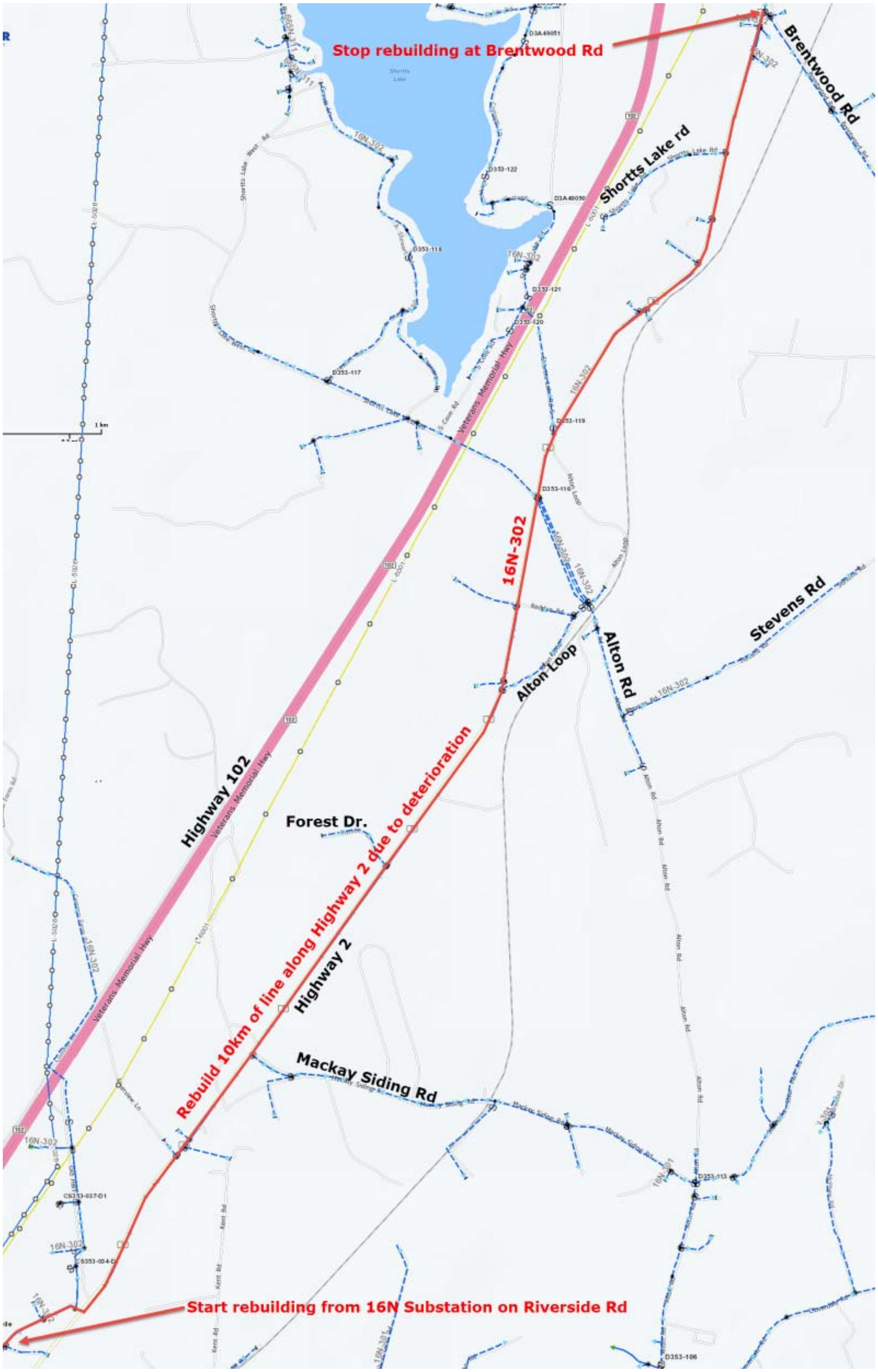
Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 46458
Title: 16N-302 Stewiacke Reconductor
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - PLT 2014	PD	233	$ 353	$ 82,373.44		
T&D Labour - PLT 2015	PD	369	$ 361	$ 133,151.79		
Procurement / Financial (No AO)	Lot	1	$ 18,409	$ 18,408.68		
			Sub-Total	$ 233,933.91		
012 Materials						
Wood Poles	Lot	1	$ 76,400	$ 76,399.69		
Insulators	Lot	1	$ 240	$ 239.65		
Overhead Conductor	Lot	1	$ 51,470	$ 51,469.97		
Overhead Conductor Devices	Lot	1	$ 1,358	$ 1,358.44		
Ovehead Line Transformer	Lot	1	$ 28,950	$ 28,949.86		
Service	Lot	1	$ 318	$ 318.13		
			Sub-Total	$ 158,735.74		
013 Contracts						
Backhoe	Lot	1	$ 60,750	$ 60,750.00		
Traffic Control	Lot	1	$ 142,950	$ 142,950.00		
Tree Trimming	Lot	1	$ 3,000	$ 3,000.00		
			Sub-Total	$ 206,700.00		
020 Easements						
Easement	Lot	1	$ 5,000	$ 5,000.00		
			Sub-Total	$ 5,000.00		
094 Interest Capitalized						
AFUDC				$ 15,553.88		
			Sub-Total	$ 15,553.88		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 117,683.67		
			Sub-Total	$ 117,683.67		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 175,766.11		
COPS Contract AO				$ 52,457.04		
			Sub-Total	$ 228,223.15		
			SUB-TOTAL (no AO, AFUDC)	$ 604,369.65		
			TOTAL (AO, AFUDC included)	$ 965,830.35		
Original Cost				$ 147,266.79		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Project Name: 16N-302 Stewiacke Rebuild
Capital Item # 46458



CI Number: 43234

Title: 104S-313 Baddeck Rebuild

Start Date:	2015/02
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	Distribution
Forecast Amount:	$778,470

DESCRIPTION:

This project will re-build the 8.1 km of feeder 104S-313 along the Trans-Canada Highway at Baddeck. By rebuilding this feeder, the existing off-road portion of the feeder along Highway 205 will become a branch line and the reliability to the remainder of the 104S-313 feeder will improve through greater access from the roadway. This project also provides for the installation of switches, which will provide isolation and alternate loading capabilities for the branch line, a further reliability enhancement.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

Approximately 8.1 km of the 104S-313 feeder from the end of MacLeod Street, Baddeck to the intersection of Highway 205 and Highway 105 (Trans-Canada Highway) is located off-road, subject to tree contacts and is difficult to access when repairs are required. The 104S-313 conductor is 46 year old #4 ACSR and has experienced 51 outage events over the last 5 years. This feeder serves customers from Baddeck to Englishtown.

Why do this project now?

Due to the age and deteriorated condition of the feeder, this work should be completed now in order to improve reliability through an estimated 3,861 avoided customer hour interruptions. Bypassing the initial section of the feeder will eliminate outages to down line customers when issues arise on the off-road portion of 104S-313.

Why do this project this way?

Re-building the first 8.1 km feeder along the Trans-Canada Highway will greatly reduce the exposure of the main line due to line faults on the off-road portion of the feeder and therefore the reliability of the rest of the feeder will improve. This will also provide contingency during outages on the branch line by installing isolating switches and creating the capability to feed the branch line from either direction.

This work is expected to be completed by an external contractor.

CI Number : 43234 - 104S-313 Baddeck Rebuild **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		10,046	0	10,046
095		095-COPS Contracts AO		99,371	0	99,371
013	002	013 - COPS Contracts	002 - DP - Land Rights	70,000	0	70,000
012	035	012 - Materials	035 - DP - Wood Poles	107,136	0	107,136
013	035	013 - COPS Contracts	035 - DP - Wood Poles	262,474	0	262,474
066	035	066 - Other Goods & Services	035 - DP - Wood Poles	10,000	0	10,000
012	039	012 - Materials	039 - DP - O/H Cond.	61,969	0	61,969
013	039	013 - COPS Contracts	039 - DP - O/H Cond.	83,847	0	83,847
012	040	012 - Materials	040 - DP - O/H Cond.Devices	651	0	651
013	040	013 - COPS Contracts	040 - DP - O/H Cond.Devices	1,557	0	1,557
001	085	001 - Regular Labour (No AO)	085 Design	10,597	0	10,597
066	085	066 - Other Goods & Services	085 Design	60,823	0	60,823
			Total Cost:	778,470	0	778,470
			Original Cost:			

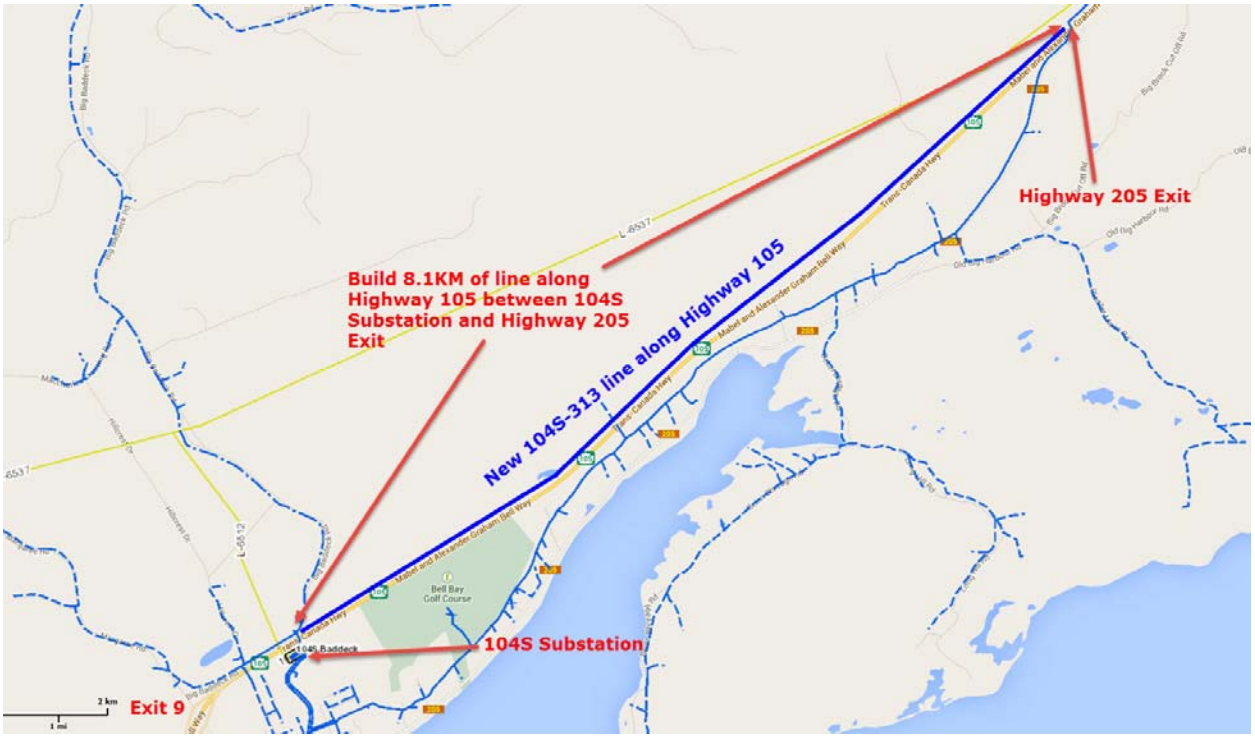
Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 43234
Title: 104S-313 Baddeck Rebuild
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Project Support (No AO)	Lot	1	$ 10,596.65	$ 10,596.65		
				$ -		
			Sub-Total	$ 10,596.65		
012 Materials						
Wood Poles	Lot	1	$ 107,135.76	$ 107,135.76		
Overhead Conductor	Lot	1	$ 61,969.00	$ 61,969.00		
Overhead Conductor Devices	Lot	1	$ 651.15	$ 651.15		
			Sub-Total	$ 169,755.91		
013 Contracts						
Contract Line Work	Hrs	[redacted]		$ 265,077.61		
Tree Trimming	Lot	1	$ 70,000.00	$ 70,000.00		
Backhoe	Lot	1	$ 52,800.00	$ 52,800.00		
Traffic Control	Lot	1	$ 30,000.00	$ 30,000.00		
			Sub-Total	$ 417,877.61		
066 Other Goods & Services						
Permit	Lot	1	$ 10,000	$ 10,000.00		
Contingency	%	10%	$ 608,230	$ 60,823.02		
				$ -		
			Sub-Total	$ 70,823.02		
094 Interest Capitalized						
AFUDC				$ 10,045.75		
				$ -		
				$ -		
			Sub-Total	$ 10,045.75		
095 Administrative Overhead						
COPS Contract AO				$ 99,371.30		
				$ -		
			Sub-Total	$ 99,371.30		
			SUB-TOTAL (no AO, AFUDC)	$ 669,053.19		
			TOTAL (AO, AFUDC included)	$ 778,470.23		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 43234
Title: 104S-313 Baddeck Re-build



CI Number: 46576

Title: 2015 PCB Phase-out for Pole Top Transformers

Start Date: 2015/02
In-Service Date: 2015/02
Final Cost Date: 2016/03
Function: Distribution
Forecast Amount: $733,503

DESCRIPTION:

This project provides for the systematic removal of the second phase of potentially PCB contaminated material in 2015 in accordance with federal and provincial guidelines. Regulations state that all pole top equipment containing PCBs in a concentration greater than 50mg/kg must be removed from service by December 31, 2025. Based on the results of feeder inspections, NS Power estimates there are approximately 45,000 pole top transformers on the distribution system which may contain PCBs. Feeder inspectors identified potential PCB transformers based on the apparent age of the equipment, and visual inspection of bushings, connections, color, etc.

In 2015, the second of multiple projects, NS Power will test 2,250 pole top transformers that have been identified as potentially PCB contaminated and change out approximately 100 of these transformers. The 2015 project is focused on identification of PCB containing transformers through sampling, enabling the development of a strategic replacement plan, which will be executed in future year ACE Plan projects.

Summary of Related CIs (+/- 2 years):
2014 CI 45046 PCB Phase-out for Pole Top Transformers $779,620
2016 CI TBD PCB Phase-Out for Pole Top Transformer Program $TBD
2017 CI TBD PCB Phase-Out for Pole Top Transformer Program $TBD

JUSTIFICATION:

Justification Criteria: Environment

Sub Criteria: Requirement to Serve

Why do this project?

The Canadian Council of Ministers of the Environment (CCME) has committed to a policy of phasing out the use of all PCBs in Canada. In support of this policy, NS Power will be focusing on eliminating all pole-top electrical transformers and their pole-top auxiliary electrical equipment containing PCBs in a concentration of 50 mg/kg or more before December 31, 2025.

Why do this project now?

The volume of potentially PCB contaminated pole top transformers in our system is estimated at approximately 45,000. Proceeding with this work over a 12 year timeframe will allow the work to be incorporated into our existing work plan and resources.

Why do this project this way?

An inventory of pole top assets will be completed to identify the location and number of potentially contaminated transformers. NS Power will engage a contractor to obtain oil samples of these units. All units that test greater than the 50mg/kg limit will be changed out. This project provides for testing and destruction of materials, as required.

Based on pole top transformer disposal data from 2004 to 2013, 8.5 percent of the pole-top transformers replaced contain PCB concentration equal to or above 50 mg/kg. Accordingly, NS Power anticipates 2,125 transformers of the 45,000 will be replaced throughout the multiple annual projects. The 2015 project is focused on identification of PCB containing transformers through sampling, enabling the development of a strategic replacement plan, which will be executed in future year ACE Plan projects.

This work will be completed by an external contractor.

CI Number : 46576 - 2015 PCB Phase-out for Pole Top Transformers **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		24,620	0	24,620
095		095-COPS Contracts AO		87,259	0	87,259
095		095-COPS Regular Labour AO		37,980	0	37,980
001	041	001 - T&D Regular Labour	041 - DP - O/H Line Transf.	38,469	0	38,469
012	041	012 - Materials	041 - DP - O/H Line Transf.	164,993	0	164,993
013	041	013 - COPS Contracts	041 - DP - O/H Line Transf.	366,943	0	366,943
001	085	001 - T&D Regular Labour	085 Design	7,950	0	7,950
001	085	001 - Regular Labour (No AO)	085 Design	5,290	0	5,290
			Total Cost:	733,503	0	733,503
			Original Cost:	316,521		

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 46576
Title: 2015 PCB Phase out for Pole Top Transformers
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - PLT	PD	107	$ 361	$ 38,468.88		
T&D Labour - Design	PD	23	$ 347	$ 7,949.69		
Procurement / Financial (No AO)	Lot	1	$ 5,290.11	$ 5,290.11		
				$ -		
				$ -		
			Sub-Total	$ 51,708.68		
012 Materials						
Pole Top Transformers	Ea	100	$ 1,650	$ 164,992.86		
				$ -		
				$ -		
			Sub-Total	$ 164,992.86		
013 Contracts						
PCB Testing	Lot	1	$ 32,314	$ 32,313.78		
PCB Oil Sampling	ea	2250	$ 125	$ 281,250.00		
PCB Destruction	Lot	1	$ 25,245	$ 25,245.00		
Traffic Control	Lot	1	$ 28,134	$ 28,134.00		
				$ -		
				$ -		
			Sub-Total	$ 366,942.78		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 24,620.42		
				$ -		
			Sub-Total	$ 24,620.42		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 37,979.69		
COPS Contract AO				$ 87,259.02		
				$ -		
			Sub-Total	$ 125,238.71		
			SUB-TOTAL (no AO, AFUDC)	$ 583,644.32		
			TOTAL (AO, AFUDC included)	$ 733,503.45		
Original Cost				$ 316,521.49		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 45031

Title: 3N Oxford 25 kV Conversion Phase 1

Start Date: 2015/05
In-Service Date: 2015/07
Final Cost Date: 2015/12
Function: Distribution
Forecast Amount: $716,167

DESCRIPTION:

Increasing load at 3N-Oxford Junction substation has caused both the primary feeder 3N-411 to peak above 300A, and the 69 kV substation transformer 3N-T51 to exceed its nameplate rating. The partial conversion of the 25 kV load at 3N-Oxford Junction consists of the conversion of the mainline of 3N-303 to 25 kV and the placement of 25:12kV stepdown transformers at several locations, in subsequent years.

This is the beginning of a three year partial conversion of the 12 kV feeders in the Oxford area. In 2015, plans call for the extension of 25 kV feeder 3N-411 along Main Street to Little River Road. Feeder 3N-303 will be converted to 25 kV along Lower Main Street and also along Little River Road.

Summary of Related CIs (+/- 2 years):
2013 CI 43726 Replacement of 3N Transformer $1,109,247
2016 CI TBD Oxford Conversion Phase 2 $TBD
2017 CI TBD Oxford Conversion Phase 3 $TBD

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Capacity

Why do this project?

Due to increasing load, both the primary feeders and transformer at 3N Oxford are overloaded. This must be addressed to avoid prolonged outages due to failures and equipment damage.

Why do this project now?

With the current overload on these feeders, as well as the forecasted load increase, this issue should be addressed as planned to avoid equipment failure and prolonged outages, and to avoid accelerated aging of existing plant.

Why do this project this way?

When reviewing the loading at 3N, a transformer replacement and partial conversion were chosen as the most appropriate way to address the overload conditions at 3N. The transformer was replaced with a re-purposed transformer in 2013 (under CI 43726), and this project will complete the partial conversion which is a more cost effective option than a full conversion.

This work is expected to be completed by an external contractor.

CI Number : 45031 - 3N Oxford Conversion Phase 1 **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		5,149	0	5,149
095		095-COPS Contracts AO		73,842	0	73,842
013	002	013 - COPS Contracts	002 - DP - Land Rights	5,000	0	5,000
013	004	013 - COPS Contracts	004 - DP - Misc.Equipment	3,460	0	3,460
012	035	012 - Materials	035 - DP - Wood Poles	8,927	0	8,927
013	035	013 - COPS Contracts	035 - DP - Wood Poles	73,870	0	73,870
066	035	066 - Other Goods & Services	035 - DP - Wood Poles	10,000	0	10,000
012	039	012 - Materials	039 - DP - O/H Cond.	5,037	0	5,037
013	039	013 - COPS Contracts	039 - DP - O/H Cond.	89,971	0	89,971
012	040	012 - Materials	040 - DP - O/H Cond.Devices	227,133	0	227,133
013	040	013 - COPS Contracts	040 - DP - O/H Cond.Devices	10,597	0	10,597
013	041	013 - COPS Contracts	041 - DP - O/H Line Transf.	109,769	0	109,769
012	048	012 - Materials	048 - DP - U/G Line Transf.	16,141	0	16,141
013	048	013 - COPS Contracts	048 - DP - U/G Line Transf.	6,228	0	6,228
013	050	013 - COPS Contracts	050 - DP - Street Lights	3,028	0	3,028
012	052	012 - Materials	052 - DP - Services	472	0	472
013	052	013 - COPS Contracts	052 - DP - Services	8,598	0	8,598
001	085	001 - Regular Labour (No AO)	085 Design	12,368	0	12,368
066	085	066 - Other Goods & Services	085 Design	46,578	0	46,578
			Total Cost:	716,167	0	716,167
			Original Cost:	133,707		

Capital Project Detailed Estimate

Location: **Distribution**
CI# / FP#: 45031
Title: 3N Oxford Conversion Phase 1
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Procurement / Financial (No AO)	Lot	1	$ 12,367.78	$ 12,367.78		
				$ -		
			Sub-Total	$ 12,367.78		
012 Materials						
Wood Poles, Conductor, Cutouts, Overhead transformers, Padmount Transformers, Overhead Services	Lot	1	$ 257,710.25	$ 257,710.25		
				$ -		
				$ -		
			Sub-Total	$ 257,710.25		
013 Contracts						
Contractor PLT	Hrs	[redacted]		$ 265,520.89		
Tree Trimming	Lot	1	$ 5,000.00	$ 5,000.00		
Backhoe & Flagging	Lot	1	$ 40,000.00	$ 40,000.00		
			Sub-Total	$ 310,520.89		
066 Other Goods & Services						
Navigable Waters Permit	Lot	1	$ 10,000.00	$ 10,000.00		
Contingency	%	15%	$ 310,520.89	$ 46,578.13		
				$ -		
			Sub-Total	$ 56,578.13		
094 Interest Capitalized						
Interest				$ 5,148.52		
				$ -		
				$ -		
			Sub-Total	$ 5,148.52		
095 Administrative Overhead						
COPS Contract AO				$ 73,841.87		
				$ -		
			Sub-Total	$ 73,841.87		
			SUB-TOTAL (no AO, AFUDC)	$ 637,177.06		
			TOTAL (AO, AFUDC included)	$ 716,167.45		
Original Cost				$ 133,707.24		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 45031

Title: 3N - Oxford Conversion

<u>Extend existing 25kV</u>

This portion of the project will extend the existing 25kV line on Main Street to Little River Road. Refer to Figure 1. This is being done to prepare for the conversion of 3N-303 from 12kV to 25kV. The details of this work are as follows:

- Replacement on existing poles(approximately 10 poles)
- Extension of 25kV.

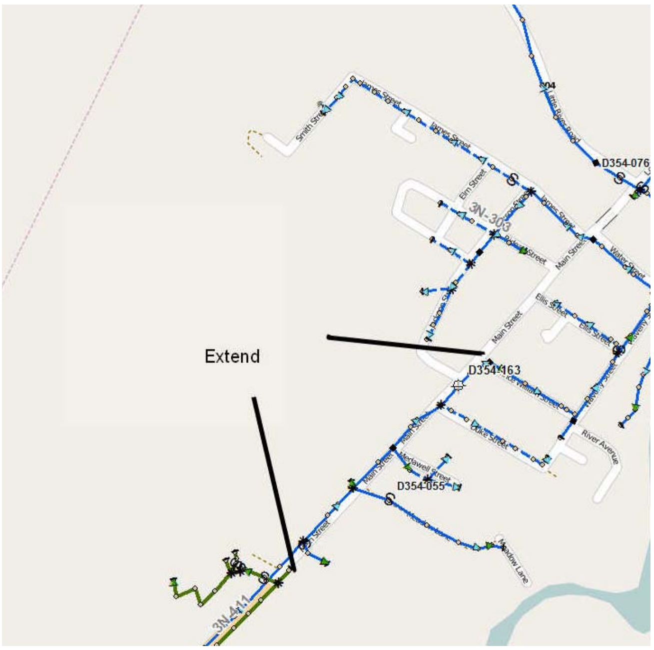


Figure 1 Main Street to Little River Road

<u>Lower Main Street</u>

This portion of the project will convert Lower Main Street. Refer to the Figure 2; the details of this work are as follows;

- Convert 3N-303, on Lower Main Street, from D354-075 to the end of the line, to 25kV.

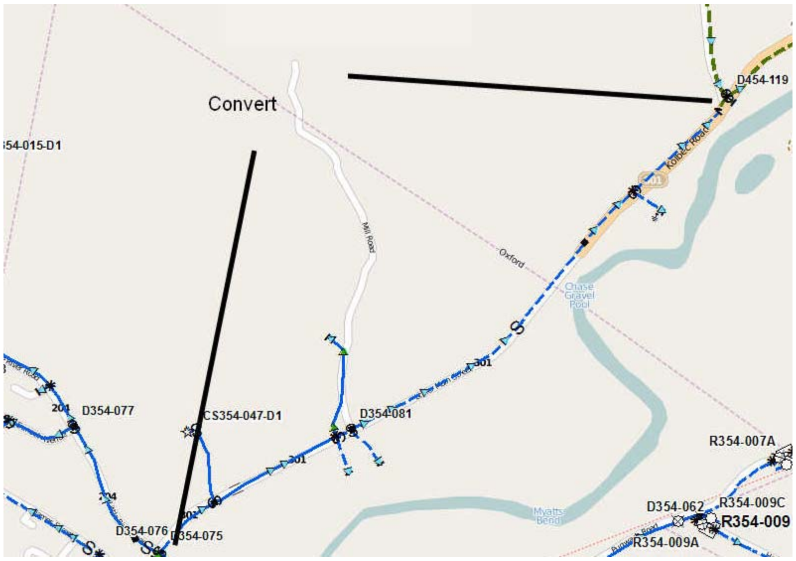


Figure 2 Lower Main Street from D354-075 to end of line

<u>Little River Road</u>

This portion of the project will convert Little River Road. Refer to Figure 3; the details of this work are as follows;

- Convert 3N-303, on Little River Road, from Lower Main Street to the end of the line, to 25kV.

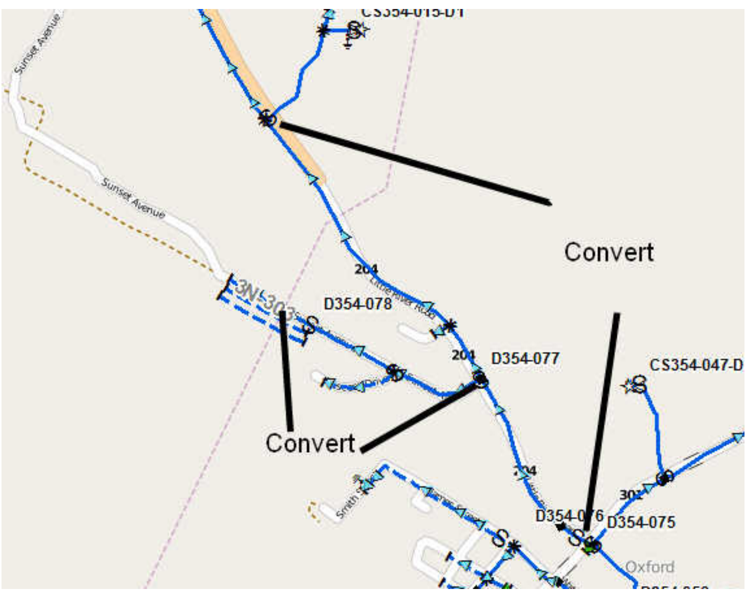


Figure 3 Little River Road to end of line

CI Number: 46457

Title: 79V-401 Cameron Lake Voltage Conversion

Start Date:	2014/10
In-Service Date:	2015/03
Final Cost Date:	2015/09
Function:	Distribution
Forecast Amount:	$637,939

DESCRIPTION:

A new residential development, Forest Lakes, is in progress in the area of Ardoise. The existing 642V-301 stepdown transformer is rated for 1.5 MVA and was confirmed to have been loaded at 55 percent in 2013. The projected load at the end of 2014 will be 1.5MVA due to a new residential development in the area and will continue to increase on the feeder as the residential development is being completed in phases. To mitigate the overload, NS Power will relocate the stepdown from its current location between Ardoise School Road and Collier Road to between Robert Drive and Coles Road along Highway 1 and convert all services between these locations to 25kV.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Capacity

Why do this project?

The new residential development requires additional primary feeder capacity which is currently unavailable due to the location of the upstream stepdown transformer.

Why do this project now?

The new subdivision is starting development in 2014 and full capacity is anticipated within five years.

Why do this project this way?

The stepdown configuration is 3x500kVA, which is NS Power's largest standard configuration. The only option to allow for more load is converting all or part of the downstream circuits to 25kV. To enable converting a part of the feeder, the stepdown transformer can be moved downstream beyond the new subdivision and the circuits in between will be converted to 25 kV. This would provide the required primary feeder capacity to serve the new development. Consideration was given to converting a portion of the feeder and relocating the stepdown to an interim location, but this would only defer the required investment and incur additional costs to relocate the stepdown a second time.

This work will be completed by an external contractor.

CI Number : 46457 - 79V-401 Cameron Lake Voltage Conversion **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		10,083	0	10,083
095		095-COPS Contracts AO		94,119	0	94,119
013	002	013 - COPS Contracts	002 - DP - Land Rights	40,608	0	40,608
020	002	020 - Royalties, Easements, App	002 - DP - Land Rights	5,000	0	5,000
012	035	012 - Materials	035 - DP - Wood Poles	22,610	0	22,610
013	035	013 - COPS Contracts	035 - DP - Wood Poles	113,464	0	113,464
012	038	012 - Materials	038 - DP - Insulators	406	0	406
013	038	013 - COPS Contracts	038 - DP - Insulators	4,634	0	4,634
012	039	012 - Materials	039 - DP - O/H Cond.	33,709	0	33,709
013	039	013 - COPS Contracts	039 - DP - O/H Cond.	147,753	0	147,753
012	040	012 - Materials	040 - DP - O/H Cond.Devices	1,245	0	1,245
013	040	013 - COPS Contracts	040 - DP - O/H Cond.Devices	7,722	0	7,722
012	041	012 - Materials	041 - DP - O/H Line Transf.	71,070	0	71,070
013	041	013 - COPS Contracts	041 - DP - O/H Line Transf.	38,301	0	38,301
013	050	013 - COPS Contracts	050 - DP - Street Lights	412	0	412
013	052	013 - COPS Contracts	052 - DP - Services	13,488	0	13,488
001	085	001 - Regular Labour (No AO)	085 Design	7,415	0	7,415
066	085	066 - Other Goods & Services	085 Design	25,901	0	25,901
			Total Cost:	637,939	0	637,939
			Original Cost:	85,036		

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 46457
Title: 79V-401 Cameson Lake Voltage Conversion
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Procurement / Financial (No AO)	Lot	1	$ 7,415.32	$ 7,415.32		
				$ -		
			Sub-Total	$ 7,415.32		
012 Materials						
Wood Poles	Lot	1	$ 22,610.06	$ 22,610.06		
Insulators	Lot	1	$ 405.52	$ 405.52		
Overhead Conductor	Lot	1	$ 33,708.71	$ 33,708.71		
Overhead Conductor Devices	Lot	1	$ 1,244.91	$ 1,244.91		
Overhead Line Tranformers	Lot	1	$ 71,069.60	$ 71,069.60		
			Sub-Total	$ 129,038.80		
013 Contracts						
2014 Line Work	Hrs	[redacted]	[redacted]	$ 152,700.56		
2015 Line Work	Hrs	[redacted]	[redacted]	$ 155,212.67		
Tree Trimming	Lot	1	$ 40,608.00	$ 40,608.00		
Backhoe and Flagging	Lot	1	$ 16,860.00	$ 16,860.00		
Pole Permit	Lot	1	$ 1,000.00	$ 1,000.00		
				$ -		
			Sub-Total	$ 366,381.23		
020 Royalties, Easements						
Easements	Lot	1	$ 5,000.00	$ 5,000.00		
				$ -		
				$ -		
			Sub-Total	$ 5,000.00		
066 Other Goods & Services						
Contingency	Lot	1	$ 25,900.90	$ 25,900.90		
				$ -		
				$ -		
			Sub-Total	$ 25,900.90		
094 Interest Capitalized						
AFUDC				$ 10,082.96		
				$ -		
				$ -		
			Sub-Total	$ 10,082.96		
095 Administrative Overhead						
COPS Contract AO				$ 94,119.35		
				$ -		
			Sub-Total	$ 94,119.35		
			SUB-TOTAL (no AO, AFUDC)	$ 533,736.25		
			TOTAL (AO, AFUDC included)	$ 637,938.56		
Original Cost				$ 85,035.74		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI 46457

642V - Cameron Lake - Voltage Conversion

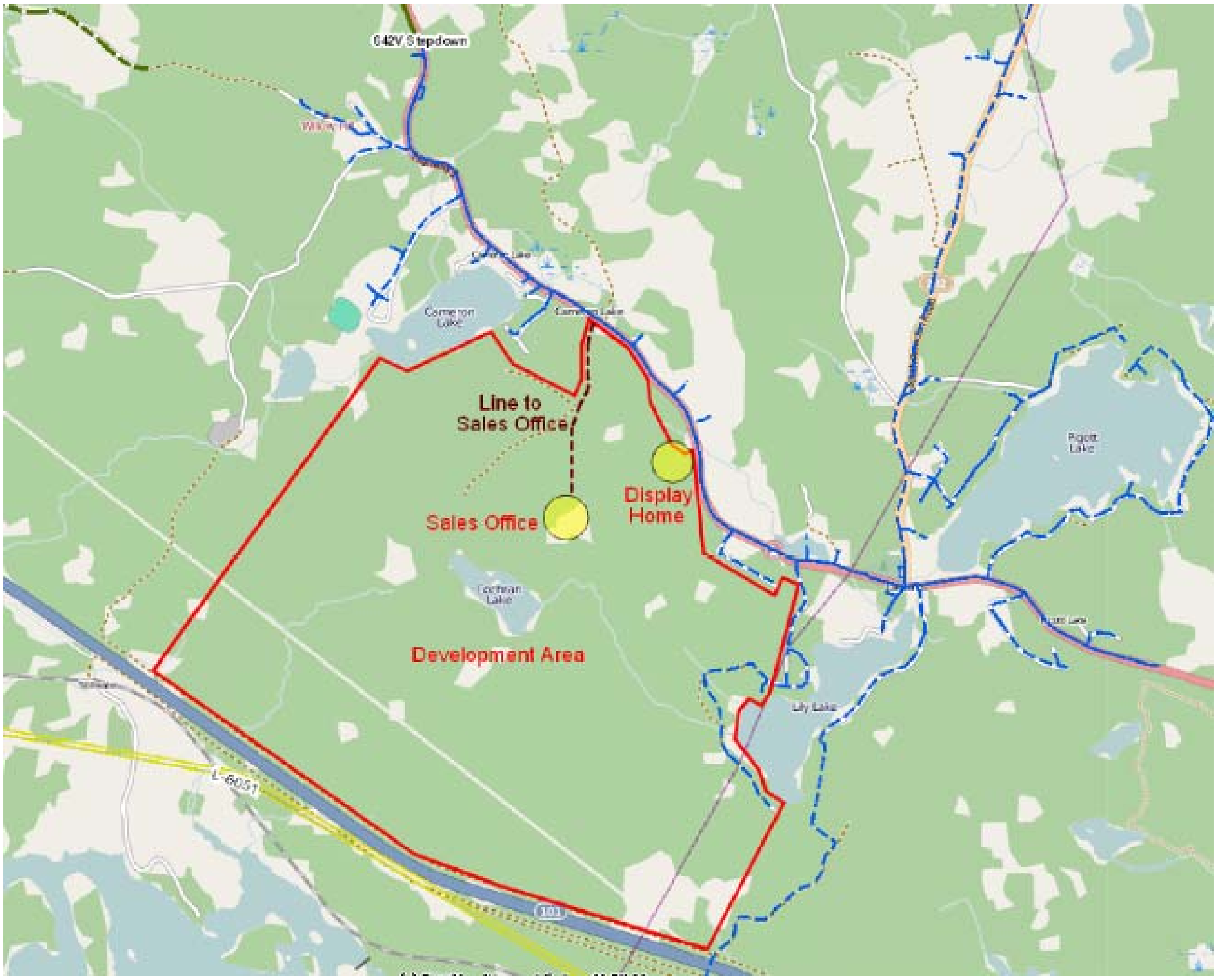


Figure 1. Forest Lakes Development

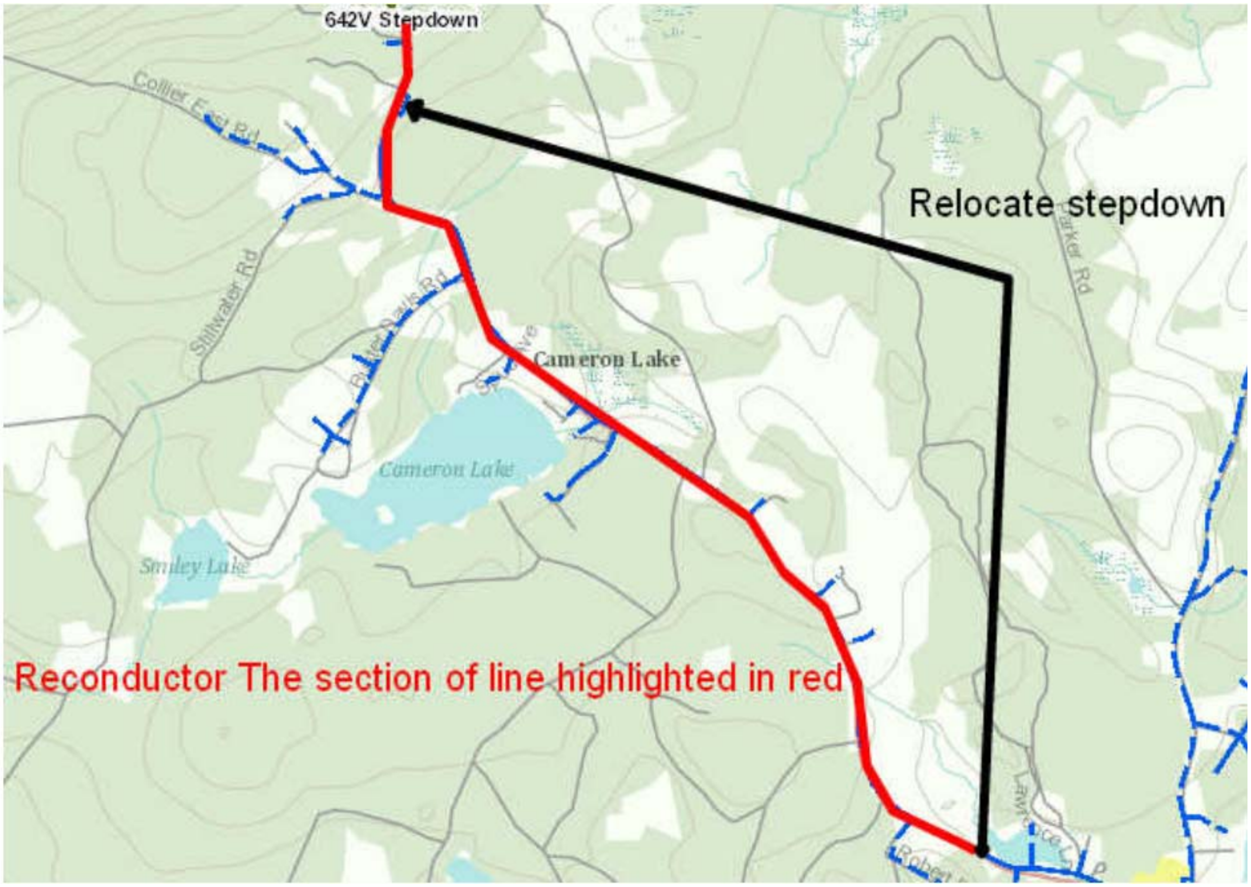


Figure 2. Stepdown Relocation

CI Number: 46456

Title: 11W Yarmouth 4kV Conversion

Start Date:	2014/09
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	Distribution
Forecast Amount:	$545,514

DESCRIPTION:

This project allows for the conversion of the 11W-201 and 11W-203 primary feeders from 4 kV to 12 kV, putting the majority of the load on the new 88W-313 feeder installed in 2012. By offloading the 11W transformer to 88W-313, this transformer will now be removed from service.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Equipment Replacement

Why do this project?

The 11W King Street substation transformer in Yarmouth, manufactured in 1965, is at end of life and requires significant servicing or replacement in the near future. Additionally, the 4kV system in downtown Yarmouth is deteriorated and is islanded with no ability to be fed from the surrounding feeders (which are all 12kV) should the 11W transformer fail or as part of a power restoration effort. The conversion of the 11W-201 (200 customers) and 11W-203 (475 customers) feeders from 4 kV to 12 kV will facilitate the removal of the 11W transformer.

Why do this project now?

The 11W substation transformer is at end of life. If the transformer fails, NS Power cannot feed downtown Yarmouth from the surrounding 12kV system. The conversion will also mitigate the need to perform significant maintenance on the 11W substation transformer.

Why do this project this way?

By offloading the 11W transformer, it can be removed from service. Having all loads in downtown Yarmouth at the same voltage level eliminates the need to maintain the aging 4kV system.

CI Number : 46456-D592 - 11W Yarmouth 4kV Conversion **Project Number** D592

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		59,014	0	59,014
094		094 - Interest Capitalized		13,239	0	13,239
095		095-COPS Contracts AO		17,335	0	17,335
095		095-COPS Regular Labour AO		88,073	0	88,073
013	002	013 - COPS Contracts	002 - DP - Land Rights	1,000	0	1,000
001	004	001 - T&D Regular Labour	004 - DP - Misc.Equipment	5,940	0	5,940
001	035	001 - T&D Regular Labour	035 - DP - Wood Poles	17,226	0	17,226
012	035	012 - Materials	035 - DP - Wood Poles	13,626	0	13,626
013	035	013 - COPS Contracts	035 - DP - Wood Poles	64,207	0	64,207
001	038	001 - T&D Regular Labour	038 - DP - Insulators	843	0	843
012	038	012 - Materials	038 - DP - Insulators	260	0	260
001	039	001 - T&D Regular Labour	039 - DP - O/H Cond.	26,093	0	26,093
012	039	012 - Materials	039 - DP - O/H Cond.	1,732	0	1,732
001	040	001 - T&D Regular Labour	040 - DP - O/H Cond.Devices	12,080	0	12,080
012	040	012 - Materials	040 - DP - O/H Cond.Devices	7,092	0	7,092
001	041	001 - T&D Regular Labour	041 - DP - O/H Line Transf.	16,826	0	16,826
012	041	012 - Materials	041 - DP - O/H Line Transf.	91,247	0	91,247
001	046	001 - T&D Regular Labour	046 - DP - U/G Conductor	3,712	0	3,712
012	046	012 - Materials	046 - DP - U/G Conductor	2,471	0	2,471
001	047	001 - T&D Regular Labour	047 - DP - U/G Conductor Devices	248	0	248
012	047	012 - Materials	047 - DP - U/G Conductor Devices	166	0	166
001	048	001 - T&D Regular Labour	048 - DP - U/G Line Transf.	6,458	0	6,458
012	048	012 - Materials	048 - DP - U/G Line Transf.	39,250	0	39,250
013	048	013 - COPS Contracts	048 - DP - U/G Line Transf.	2,000	0	2,000
001	050	001 - T&D Regular Labour	050 - DP - Street Lights	1,278	0	1,278
012	051	012 - Materials	051 - DP - Meters	5,000	0	5,000
001	052	001 - T&D Regular Labour	052 - DP - Services	1,894	0	1,894
012	052	012 - Materials	052 - DP - Services	1,601	0	1,601
001	085	001 - Regular Labour (No AO)	085 Design	9,769	0	9,769
001	085	001 - T&D Regular Labour	085 Design	1,735	0	1,735
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	11,115	0	11,115
001	090	001 - T&D Regular Labour	090 - DP - LED Street Lights	2,555	0	2,555

CI Number : 46456-D592 - 11W Yarmouth 4kV Conversion **Project Number** D592

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2014 08/04 Forecast

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
012	090	012 - Materials	090 - DP - LED Street Lights	20,428	0	20,428
			Total Cost:	545,514	0	545,514
			Original Cost:	176,688		

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 46456
Title: 11W Yarmouth 4 kV Conversion
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - PLT 2014	PD	119.66	$ 353.25	$ 42,269.24		
T&D Labour - PLT 2015	PD	146.64	$ 360.65	$ 52,884.36		
T&D Labour - Site Supervision 2015	PD	29.33	$ 379.00	$ 11,115.03		
T&D Labour - Design 2015	PD	5.00	$ 347.00	$ 1,735.00		
Procurement / Financial (No AO)	Lot	1.00	$ 9,769.06	$ 9,769.06		
				$ -		
			Sub-Total	$ 117,772.69		
012 Materials						
Wood Poles	Lot	1	$ 13,626.21	$ 13,626.21		
Insulators	Lot	1	$ 260.20	$ 260.20		
Overhead Conductor	Lot	1	$ 1,732.26	$ 1,732.26		
Overhead Conductor Device	Lot	1	$ 7,091.50	$ 7,091.50		
Overhead Line Transformers	Lot	1	$ 91,247.31	$ 91,247.31		
Underground Conductor	Lot	1	$ 2,471.48	$ 2,471.48		
Underground Conductor Device	Lot	1	$ 165.54	$ 165.54		
Underground Line Transformers	Lot	1	$ 39,250.34	$ 39,250.34		
Meters	Lot	1	$ 5,000.00	$ 5,000.00		
Services	Lot	1	$ 1,601.25	$ 1,601.25		
Streetlights	Lot	1	$ 20,428.17	$ 20,428.17		
				$ -		
				$ -		
			Sub-Total	$ 182,874.26		
013 Contracts						
Tree Trimming	Lot	1	$ 1,000.00	$ 1,000.00		
Traffic Control	Lot	1	$ 46,507.01	$ 46,507.01		
Backhoe	Lot	1	$ 2,700.00	$ 2,700.00		
Crane	Lot	1	$ 2,000.00	$ 2,000.00		
Vault Upgrade	Lot	1	$ 15,000.00	$ 15,000.00		
				$ -		
			Sub-Total	$ 67,207.01		
094 Interest Capitalized						
AFUDC				$ 13,238.62		
				$ -		
				$ -		
			Sub-Total	$ 13,238.62		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 59,013.93		
				$ -		
			Sub-Total	$ 59,013.93		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 88,072.71		
COPS Contract AO				$ 17,334.62		
				$ -		
			Sub-Total	$ 105,407.33		
			SUB-TOTAL (no AO, AFUDC)	$ 367,853.96		
			TOTAL (AO, AFUDC included)	$ 545,513.84		
Original Cost				$ 176,687.81		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

11W Yarmouth 4kV Conversion

CI 46456

Photo 1: 11W transformer

CI Number: 46304

Title: 20W-311 Argyle Sound Reconductor

Start Date: 2015/03
In-Service Date: 2015/05
Final Cost Date: 2015/11
Function: Distribution
Forecast Amount: $430,435

DESCRIPTION:

This project entails the reconductoring of a 4.2 km section of primary feeder 20W-311. The project will start at the intersection of Highway 335 and Highway 325 (disconnect switch D321-052) and extend to the intersection of Argyle Sound Road and Highway 3 (disconnect switch D321-032).

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

The existing primary conductor is in excess of 40 years old and in a deteriorated condition. Reconductoring the section of line along Highway 3 from Pubnico to Argyle Sound will allow for the deteriorated conductor to be upgraded from #2 ACSR (Aluminum Conductor Steel Reinforced) to 336 AAC (All Aluminum Conductor). An additional benefit of doing the project this way is that it will facilitate the ability to transfer load from 19W-312 to 20W-311, or vice versa if required, as part of outage restoration efforts.

Why do this project now?

The condition of the conductor along Highway 3 to Argyle Sound is deteriorated and requires replacement. During the winter of 2013, 20W-T51 failed and load needed to be transferred from 20W-311 to 19W-312 until the mobile transformer could be installed. While attempting to pick up the load, the 20W-311 #2 ACSR conductor along Highway 3 from Pubnico to Argyle Sound failed, resulting in a longer customer outage.

Why do this project this way?

Reconductoring is a standard practice to replace deteriorated conductor. The 40 year old conductor will be upgraded from #2 ACSR to 336 AAC to bring it in compliance with current overhead distribution standards. Reconductoring with a larger wire size will also provide load transferring capability.

This work will be completed by an external contractor.

CI Number : 46304 - 20W-311 Argyle Sound Reconductor

Project Number

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin.

Budget Version 2014 08/04 Forecast

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		5,650	0	5,650
094		094 - Interest Capitalized		1,605	0	1,605
095		095-COPS Contracts AO		62,129	0	62,129
095		095-COPS Regular Labour AO		8,716	0	8,716
012	039	012 - Materials	039 - DP - O/H Cond.	34,742	0	34,742
013	039	013 - COPS Contracts	039 - DP - O/H Cond.	261,267	0	261,267
001	085	001 - Regular Labour (No AO)	085 Design	6,483	0	6,483
066	085	066 - Other Goods & Services	085 Design	39,190	0	39,190
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	10,652	0	10,652
			Total Cost:	430,435	0	430,435
			Original Cost:	35,694		

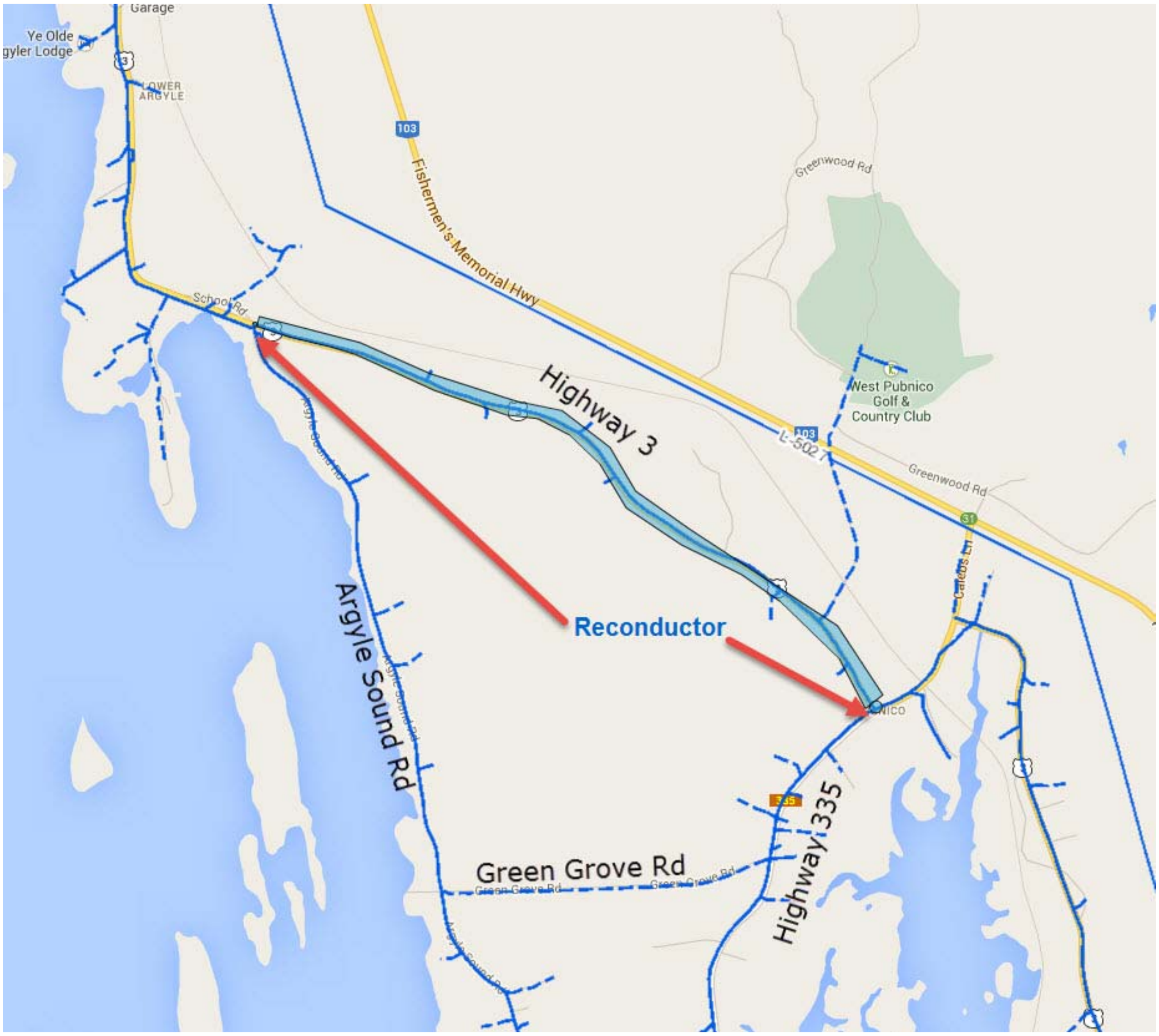
Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 46304
Title: 20W-311 Argyle Sound Reconductor
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	28	$ 379	$ 10,652.16		
Procurement / Financial (No AO)	Lot	1	$ 6,483	$ 6,482.73		
			Sub-Total	$ 17,134.89		
012 Materials						
Materials	Lot	1	$ 34,742	$ 34,742.45		
				$ -		
				$ -		
			Sub-Total	$ 34,742.45		
013 Contracts						
Contract Labour	hrs	[redacted]		$ 213,043.14		
Flagging, Misc.	Lot	1	$ 48,224	$ 48,224.36		
				$ -		
			Sub-Total	$ 261,267.50		
066 Other Goods & Services						
Contingency	%	15%	$ 261,268	$ 39,190.12		
				$ -		
				$ -		
			Sub-Total	$ 39,190.12		
094 Interest Capitalized						
AFUDC				$ 1,605.24		
				$ -		
				$ -		
			Sub-Total	$ 1,605.24		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 5,649.90		
Vehicle T&D Labour Overtime AO				$ -		
				$ -		
			Sub-Total	$ 5,649.90		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 8,715.60		
COPS Contract AO				$ 62,129.41		
				$ -		
			Sub-Total	$ 70,845.01		
			SUB-TOTAL (no AO, AFUDC)	$ 352,334.96		
			TOTAL (AO, AFUDC included)	$ 430,435.11		
Original Cost				$ 35,694.17		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46304
Title: 20W-311 Argyle Sound Reconductor



CI Number: 46251

Title: 36V-303 Saxon St Double Circuit

Start Date:	2015/03
In-Service Date:	2015/05
Final Cost Date:	2015/11
Function:	Distribution
Forecast Amount:	$425,838

DESCRIPTION:

This project is to off-load primary distribution feeder 36V-303 by rebuilding the existing three-phase line between 36V substation and Middle Dyke Road in Port Williams as a double circuit. The double circuit will allow for transferring a portion of 36V-303 load to an adjacent feeder 36V-302 to manage peak loading.

Summary of Related CIs (+/- 2 years):
2014 CI 44833 99V-312 – Highbury New Feeder $256,828

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Capacity

Why do this project?

This project is necessary to transfer load from primary feeder 36V-303 to an adjacent feeder as it has exceeded the 325A peak load limit for overhead distribution circuits during the past two winters.

Why do this project now?

Feeder 36V-303 is overloaded causing voltage issues at different parts of the feeder. Customers have reported equipment not operating properly, which is an indicator of voltage levels outside NS Power normal operating conditions.

Why do this project this way?

This project resolves the low voltage issue on 36V-303. Additionally, this approach aligns with the future recommendations of the New Minas Feeder Reconfiguration planning study (Report 315-1115-W69) which addresses the reconfiguration of 99V-Highbury and 22V-New Minas feeders, as well as those at 36V-Hillaton to reduce transformer loading.

This work will be completed by an external contractor.

CI Number : 46251 - 36V-303 Saxon Double Circuit **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		5,035	0	5,035
094		094 - Interest Capitalized		2,062	0	2,062
095		095-COPS Regular Labour AO		7,766	0	7,766
095		095-COPS Contracts AO		59,238	0	59,238
012	035	012 - Materials	035 - DP - Wood Poles	28,443	0	28,443
013	035	013 - COPS Contracts	035 - DP - Wood Poles	159,883	0	159,883
012	039	012 - Materials	039 - DP - O/H Cond.	15,026	0	15,026
013	039	013 - COPS Contracts	039 - DP - O/H Cond.	53,156	0	53,156
012	041	012 - Materials	041 - DP - O/H Line Transf.	10,196	0	10,196
013	041	013 - COPS Contracts	041 - DP - O/H Line Transf.	36,070	0	36,070
001	085	001 - Regular Labour (No AO)	085 Design	2,105	0	2,105
066	085	066 - Other Goods & Services	085 Design	37,366	0	37,366
001	087	001 - T&D Regular Labour	087 Field Super.& Ops.	9,492	0	9,492
			Total Cost:	425,838	0	425,838
			Original Cost:			

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 46251
Title: 36V-303 Saxon Double Circuit
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Site Supervision	PD	25.05	$ 379.00	$ 9,492.08		
Procurement / Financial (No AO)	Lot	1	$ 2,104.82	$ 2,104.82		
				$ -		
			Sub-Total	$ 11,596.90		
012 Materials						
Poles, Overhead Conductor and Transfomers	$	1	$ 53,665.72	$ 53,665.72		
				$ -		
			Sub-Total	$ 53,665.72		
013 Contracts						
Contract Line Work	Hrs	[redacted]		$ 189,841.55		
Traffic Control	$	1	$ 38,516.99	$ 38,516.99		
Backhoe	$	1	$ 15,750.00	$ 15,750.00		
Tree Trimming	$	1	$ 5,000.00	$ 5,000.00		
				$ -		
				$ -		
			Sub-Total	$ 249,108.54		
066 Other Goods & Services						
Contingency	$	1	$ 37,366.28	$ 37,366.28		
				$ -		
				$ -		
			Sub-Total	$ 37,366.28		
094 Interest Capitalized						
Interest	$	1	$ 2,061.97	$ 2,061.97		
				$ -		
				$ -		
			Sub-Total	$ 2,061.97		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 5,034.60		
				$ -		
			Sub-Total	$ 5,034.60		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 7,766.42		
COPS Contract AO				$ 59,238.01		
				$ -		
			Sub-Total	$ 67,004.43		
			SUB-TOTAL (no AO, AFUDC)	$ 351,737.44		
			TOTAL (AO, AFUDC included)	$ 425,838.44		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

New Minas Feeder Reconfiguration
DISTRIBUTION PLANNING STUDY

Report number 315-1115-W69

Revision		Date	Prepared by	Reviewed by	Approved by
0	Issued for Study	15-Nov-2012	JMQ		
1	Issued for Release	21-Oct-2013	JMQ	JC	

EXECUTIVE SUMMARY

This study was initiated by the construction of the new 99V-Highbury substation, constructed on Highbury School Road, outside of New Minas. This study is an update of the New Minas Planning Study, report 261-0608-W66.5. This study will outline the feeder extents for the new 99V-Highbury substation, created by transferring load from 22V-New Minas to 99V-Highbury.

The study will revise the feeder configurations of 99V-Highbury, 22V-New Minas, as well as 36V-Hillaton to reduce transformer loading.

A future study will be required to investigate the feasibility of introducing automatic transfer schemes. These schemes are recommended to be introduced in the 2015 capital year.

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1.0 SCOPE

This study was initiated as a result of the construction of the new 99V-Highbury substation, outside of New Minas. The construction of this substation had been recommended by a previous study, 261-0608-W66.5. Given the time between completion of the initial study and the construction of the substation, a review of the new and existing distribution feeders was required.

This study will define the feeder extents for the new feeders, supplied by 99V-Highbury as well as the reallocation of the existing feeders to more evenly distribute load in the area. The reduction in load will be realized at the transformers located at the 22V-New Minas and 36V-Hillaton substations.

A future protection study will be required, to determine the location and application of down-line reclosers and to investigate the application of automatic transfer schemes that could be created between the 22V-New Minas, 36V-Hilaton and 99V-Highbury feeders.

2.0 EXISTING SYSTEMS

The existing system has been fully described in the previous study. A brief summary has been included, in the following sections of the report.

2.1 Transmission

The existing 138kV, at 43V-Canaan Road, is supplied via L-6012 from 17V-St.Croix and L-6004 from 90H-Sackville. The 138kV at 43V-Canaan Road is stepped down to 69kV, via the two autotransformers, 43V-T61 and 43V-T62.

Both 22V-New Minas and 36V-Hillaton are supplied via L-5033 from 43V-Canaan Road. The 50V-Klondike substation is supplied via L-5021, from 43V-Canaan Road. The 55V-Waterville substation is supplied via the 56V-Waterville Tap, off of L-5053.

A new 138kV transmission line, L-6052, has been constructed from 43V-Canaan Road, to the new substation, 99V-Highbury.

2.2 Sub-Transmission

The eastern Annapolis Valley is supplied at 69kV via the two autotransformers at 43V-Canaan Road. The new 99V-Highbury substation will be supplied via 138kV. The System Operating Diagrams are attached in Appendix A.

Table 1 Valley Area Sub-Transmission

Substation	Auto-Transformer Data				
	ID	MAN	kV	Rating	Age
43V-Canaan Road	T61	Westinghouse	138-72	30/40/50//56	1969
43V-Canaan Road	T62	Maloney Electric	138-72	33.6/44.8//56	1990

2.3 Distribution

The distribution system being studied, in this report is the area supplied by 22V-New Minas and 36V-Hillaton. Load data from 50V-Klondike and 55V-Waterville has been included in this study as these substations were considered as potential areas where load could be transferred, for contingency purposes.

These substations have also been included because of their close proximity to the 99V-Highbury substation.

Table 2 New Minas Area Distribution Transformers

Substation	Transformer Data				
	ID	MAN	kV	Rating	Age
22V-New Minas	T51	Federal Pioneer	69-13.2	7.5/10/12.5	1987 R
22V-New Minas	T52	Westinghouse	69-13.2	7.5/10/12.5//14	1987
36V-Hillaton	T1	Federal Pioneer	69-12.47	7.5/10//11.2	1974
50V-Klondike	T51	ABB	69-26.4	15/20//25	1993
55V-Waterville	T51	Federal Pioneer	69-13.2	7.5/10/12.5//14	1976
55V-Waterville	T52	Westinghouse	69-12.47	7.5/10//11.2	1972

2.3.1 22V-New Minas

The 22V-New Minas substation is supplied via L-5033, from 43V-Canaan Road. The two transformers, 22V-T51 and 22V-T52, have both been trending at or above their nameplate ratings for the past several years winter peak (refer to Appendix B). In addition to the transformers trending above nameplate, three of the feeders from this substation have been trending above 300A during winter peak. With the construction of the new substation, 99V-Highbury, the reallocation of the 22V-New Minas load will alleviate the heavily loaded transformers and feeders.

2.3.2 36V-Hillaton

Currently, 36V-Hillaton is radially fed via an extension of L-5033 from 22V-New Minas. The load supplied via this substation mostly radiates outward from the substation with few opportunities to transfer load between feeders. The substation transformer, 36V-T1 has been trending above its nameplate rating, in each of the last 10 winters (where load check data has been available).

2.3.3 99V-Highbury

The new 99V-Highbury Road substation is located adjacent to Highway 101 near Highbury School Road. This location places this new source in a central location to a large portion of the load currently supplied via 22V-New Minas allowing for the transfer of load to the new substation.

3.0 LOAD HISTORY AND FORECAST

The loading for those feeders being studied is largely residential, with a small number of commercial customers. As illustrated in the load history for these feeders (Appendix B), the feeders being studied have had a larger winter peak than summer peak. Historical load data for the feeders and transformers being studied was collected from the Distribution Load Check Database and presented in Table 3 below. SCADA data is available for the 69kV line (L-5033) supplying both 22V-New Minas and 36V-Hilaton substations. The combined load and associated load growth rate from this data is also included below for comparison purposes.

3.1 Load History

Customer load has been generally consistent in this portion of the Annapolis Valley, with a slight increase due to increased residential developments. Load growth projections for the area have been outlined below in Table 3. Overall growth rates have been determined based on 15 years of load data, as presented in the table below:

Table 3 **Growth Rates; 1998 - 2013**

Transformer	2013 Load in MVA	Load Growth	Notes
22V-T51	13.0	1.75%	
22V-T52	18.4	1.28%	
22V Total	30.4	1.62%	Total Substation Load
36V-T1	13.5	0.83%	
L-5033	45.6	0.72%	Radial supply to 22V and 36V
55V-T51	8.6	-4.28%	2nd Transformer added in 2009
55V-T52	10.4		Not enough data to forecast
55V Total	18.7	2.09%	Total Substation Load
50V-T51	21.4	0.44%	New 25kV Transformer installed 2008
43V-505	21.0	0.32%	Breaker supplying L-5021 to 50V-Klondike
Feeder	**2013 Load in AMPS**	**Load Growth**	**Notes**
22V-312	303	0.83%	
22V-313	183	0.75%	
22V-314	128	-0.27%	
22V-321	276	1.39%	
22V-322	325	-0.54%	
22V-323	317	1.51%	
36V-301	191	-1.50%	
36V-302	191	0.39%	
36V-303	177	-1.21%	
55V-313	224	3.03%	
55V-314	189	-4.07%	
55V-322	235		New feeder added in 2009
55V-323	223		New feeder added in 2009
50V-401	184	-2.44%	25kV Feeder
50V-402	254	0.49%	25kV Feeder

3.2 Load Forecast

The 90th percentile load forecasts for the 12kV feeders at 22V-New Minas and 36V-Hillaton are presented in the following tables. The overall growth, in the area, is forecasted to be approximately 0.72%, as determined by the radial 69kV line (L-5033) supplying both the 22V-New Minas and 36V-Hilaton substations. The tables below illustrate the overall projected load growth, by feeders and transformers.

Table 4 **90th Percentile Load Forecast for 22V-New Minas feeders**

	22V-312	22V-313	22V-314	22V-321	22V-322	22V-323
2012 / 2013	315	214	148	265	303	348
2013 / 2014	318	216	148	269	302	354
2014 / 2015	321	218	148	274	300	360
2015 / 2016	324	219	147	278	298	366
2016 / 2017	326	221	147	282	297	372
2017 / 2018	329	223	147	286	295	377
2018 / 2019	332	224	146	290	294	383
2019 / 2020	335	226	146	294	292	389
2020 / 2021	337	228	145	298	290	395
2021 / 2022	340	230	145	302	289	401
2022 / 2023	343	231	145	306	287	407
2023 / 2024	347	233	144	310	286	412
2024 / 2025	348	234	144	314	284	418
2025 / 2026	351	236	144	318	283	424
2026 / 2027	354	238	143	322	281	430
2027 / 2028	357	240	143	326	279	436

Table 5 **90th Percentile Load Forecast 36V-Hillaton feeders**

	36V-301	36V-302	36V-303
2012 / 2013	189	236	239
2013 / 2014	187	237	236
2014 / 2015	184	238	234
2015 / 2016	182	239	231
2016 / 2017	179	240	228
2017 / 2018	176	240	226
2018 / 2019	174	242	223
2019 / 2020	171	242	220
2020 / 2021	169	243	218
2021 / 2022	166	244	215
2022 / 2023	164	245	212
2023 / 2024	161	246	210
2024 / 2025	158	247	207
2025 / 2026	156	248	204
2026 / 2027	153	249	202
2027 / 2028	151	250	199

Table 6 90th Percentile Load Forecast for Eastern Valley Transformers

	22V-T51 7.5/10/12.5	22V-T52 7.5/10/12.5//14	22V Total	36V-T1 7.5/10//11.2	L-5033	55V-T51 7.5/10/12.5//14	55V-T52 7.5/10//11.2	55V-Total	50V-T51 15/20//25
2012 / 2013	14.4	19.1	34.7	13.9	46.4	13.2	15.0	22.4	22.3
2013 / 2014	14.7	19.4	35.3	14.0	46.7	12.8	17.0	22.9	22.4
2014 / 2015	15.0	19.7	36.0	14.1	47.1	12.4	19.1	23.5	22.5
2015 / 2016	15.2	19.9	36.6	14.3	47.4	12.0	21.1	24.0	22.6
2016 / 2017	15.5	20.2	37.2	14.4	47.8	11.5	23.2	24.5	22.7
2017 / 2018	15.8	20.5	37.9	14.5	48.1	11.1	25.2	25.1	22.8
2018 / 2019	16.1	20.7	38.5	14.6	48.5	10.7	27.2	25.6	22.9
2019 / 2020	16.4	21.0	39.1	14.8	48.8	10.3	29.3	26.2	23.0
2020 / 2021	16.7	21.3	39.8	14.9	49.2	9.8	31.3	26.7	23.1
2021 / 2022	17.0	21.5	40.4	15.0	49.6	9.4	33.4	27.3	23.2
2022 / 2023	17.2	21.8	41.0	15.1	49.9	9.0	35.4	27.8	23.3
2023 / 2024	17.5	22.1	41.7	15.2	50.3	8.6	37.5	28.3	23.4
2024 / 2025	17.8	22.3	42.3	15.4	50.6	8.1	39.5	28.9	23.5
2025 / 2026	18.1	22.6	42.9	15.5	51.0	7.7	41.5	29.4	23.6
2026 / 2027	18.4	22.9	43.6	15.6	51.3	7.3	43.6	30.0	23.7
2027 / 2028	18.7	23.1	44.2	15.7	51.7	6.9	45.6	30.5	23.8

4.0 OVERLOADS AND OTHER CONSIDERATIONS

The following section identifies issues that warrant correction based on NSPI's *Capital Expenditure Justification Criteria*.

4.1 Substation Transformer Overloads

The following substation transformers have peaked above their nameplate ratings, but below 133% of their top rating, for the following years;

- 22V-T51 2013, 2011. 2010, 2009, 2008
- 22V-T52 2013, 2012, 2011, 2010, 2009, 2008, 2006, 2005, 2002
- 36V-T1 2013, 2012, 2011, 2010, 2009, 2008, 2006, 2005, 2004, 2003, 2002,

4.2 Feeder Overloads

The following list of feeders has peaked above 300A for the following years;

- 22V-312 2013, 2010, 2004
- 22V-322 2013, 2010, 2005, 2004, 2003, 2001
- 22V-323 2013, 2012, 2011, 2003, 2002

5.0 SOLUTIONS AND EVALUATION

This study is examining the eastern Annapolis Valley distribution system, with consideration of the new substation, 99V-Highbury. The alternatives outlined below will discuss various options to offload existing substations via the new source.

These alternatives focus on the transfer of existing load from 36V-Hillaton and 22V-New Minas onto the new 99V-Highbury substation. Feeders from these two 12kV substations are in close proximity to the new substation and the transformers at these substations have seen peak loading above nameplate rating in recent years.

The recommendations for the report will be compiled from the alternatives outlined below.

5.1 99V-Highbury Feeder Extents

There are a variety of feeder configurations possible with respect to the addition of the new source, 99V-T61. Given the location of the substation, and its proximity to a large portion of load currently serviced by 22V-New Minas, a large reduction of 22V-323 and 22V-312 load is possible without much difficulty.

22V-323 is the longest feeder supplied by 22V-New Minas, with a portion containing densely populated suburban residential load, as well as a large portion of rural residential load. This feeder can be divided at the intersection of New Minas Connector Road and Prospect Road. This will enable the separation of the suburban and rural customers on a feeder that is greater than 100kms in length.

Further subdividing the remaining portion of 22V-323 along Highbury Road to Commercial Street in New Minas will further reduce the load on 22V-T52.

The third new feeder to be supplied via 99V-Highbury is a large portion of the existing 22V-312 feeder from the intersection of Highbury Road and Prospect Road to Commercial Street. Reallocating this load to a new feeder will reduce the overall loading on 22V-T51.

The fourth feeder to be supplied via 99V-Highbury will be used to transfer load from 22V-322. Transferring load from 22V-322 by way of a line extension along the New Minas Connector Road via the Cornwallis River Crossing, to Belcher Street will enable the transferring of load from 22V-322 to further enable the offloading of 36V-301. The construction of this new express feeder also enables the creation of an additional feeder tie with 22V-314 at the intersection of Commercial Street and the New Minas Connector Road, at some point in the future.

5.2 36V-Hillaton Load Reduction

Reducing the loading on 36V-Hillaton needs to be addressed in the feeder reconfigurations associated with the new substation, 99V-Highbury. Given the loading on 36V-T1 has exceeded its nameplate rating in the past several winters, the opportunity to address these issues needs to be considered where a new source is being added in the area. The opportunity to transfer load to adjacent substations and the replacement of 36V-T1 is outlined below.

Replacing the existing 36V-T1, a 7.5/10//11.2MVA, with a larger 15/20/25MVA unit will meet the current loading requirements, for the future. The load growth, in the area is roughly 0.83% annually. In replacing the 36V-T1 with a larger unit, there would be a requirement to install a mobile substation for the duration of work required, to replace the substation transformer and base. The installation of a transfer bus and SCADA controls would also be required.

However given the proximity of 36V-Hillaton feeders with the feeders from adjacent substations, there exists the potential to transfer load from 36V-Hillaton, onto the adjacent feeders from 22V-New Minas and 50V-Klondike.

22V-New Minas has only one feeder currently crossing the Cornwallis River, 22V-322. This crossing consists of a double circuit with the 36V-Hillaton 69kV supply, L-5039. Currently, this feeder is approaching its loading limits during winter operations. Construction of another Cornwallis River crossing will require the construction of a new distribution line, as well as securing a new right of way (ROW). The locations for this new crossing are limited to the two existing road crossings at Highway 358 and Cornwallis River Crossing.

Of these two crossing alternatives, the Cornwallis River Crossing is the better choice. In that a new line constructed at this location offers the ability for the crossing to be supplied by a feeder from either 22V-New Minas or 99V-Highbury and the pole line is relatively straight in comparison to Highway 358 which has more curves which would require additional guying and anchoring. In either case, there will be a requirement to obtain environmental permits prior to construction.

An alternative to constructing a new river crossing would be to use the existing infrastructure, via 50V-Klondike by way of placing a stepdown at the end of the 50V-401, on Aldershot Road. In placing the stepdown at this location, the existing 12kV feeder, 36V-303 would need to have either a two phase addition or a partial conversion to the Lakewood Road intersection and place the stepdowns at that location. In adding these stepdowns, the overall load able to be transferred would be less than that available with a new river crossing and lightly loaded feeder.

5.2.1 Alternative A Replace 36V-T1

The existing 36V-Hillaton transformer, 36V-T1 has been exceeding its nameplate rating, 7.5/10//11.2MVA, during the winter peak, for the last several years. The three feeders supplied via 36V-T1 are not presently heavily loaded, with 36V-303 peaking beyond 250A, in the past two winters.

The top rating on the existing transformer, 36V-T1 is 11.2MVA. A larger 15/20/25MVA transformer would meet the current needs, as well as the future load growth, in the area. Additionally, the installation of a larger transformer will increase the contingency opportunities with the adjacent substations, in the area, including 55V-Waterville.

To implement this alternative, a variety of substation upgrades would be required, including the construction of a transfer bus and the installation of an RTU, for SCADA controls.

5.2.2 Alternative B 36V-Hillaton Load Reduction via 22V-New Minas

In conjunction with the construction of the 99V-Highbury substation, the construction of an express feeder from the Prospect Road to Belcher Street, will allow for the offloading of 22V-322. This load reduction would then be able to be cascaded to the 36V-Hillaton feeders, by way of a load transfers.

These load reductions would commence with transferring the load on 22V-322, east of the existing Cornwallis River crossing to the new 99V-Highbury feeder. Upon completion of this load transfer, load from 36V-301 would then be transferred to 22V-322.

The completion of these load transfers would reduce the overall loading on 36V-T1, such that the load peak would not exceed 133% of nameplate rating for the foreseeable future.

5.2.3 Alternative C 36V-Hillaton Load Reduction via 50V-Klondike

An additional alternative, to reduce the load on 36V-303, would be the addition of 3x500kVA stepdowns at the end of 50V-401, on Aldershot Road. These new stepdowns would assume the load from 36V-303, along Aldershot Road, to the intersection at Sherman Belcher Road. D316-110, on Lydiard Road would need to be opened.

To offset the load added to 50V-Klondike a conversion of the existing 4kV stepdowns, 652V and 653V, will be required.

5.2.4 Recommended Alternative

Alternative B has been selected as the recommended alternative because it is the least cost alternative; refer to the Economic Analysis Model in Appendix C. This alternative reduces the load on 36V-T1, while offering the greatest flexibility to supply future load growth in the Williamsport and Canning areas for the foreseeable future.

6.0 RECOMMENDATIONS

This study recommends the offloading of two 22V-New Minas feeders, 22V-323 and 22V-312, to three new feeders supplied from the new substation, 99V-Highbury. The study also recommends the construction of a new feeder from 99V-Highbury to Belcher Street via Cornwallis River Crossing. This new feeder will assume a portion of load from 22V-322. The load reduction will then be cascaded to adjacent 36V-Hilaton feeders, to reduce the overall load on 36V-T1. The details of these recommendations are outline below, by capital year.

Also included in the recommendations of this study are plans for future load transfers within the 36V-Hilaton feeders to further balance the loading across the three feeders.

6.1 2013 Capital Year

For the 2013 capital year, the construction of the 99V-Highbury Road substation will be completed. In conjunction with this, the determination of the feeder extents will be completed.

6.1.1 99V-Highbury Feeder Extents Part-1

This portion of the project will outline the feeder extents for one new feeder, 99V-3X1, to be supplied via the new 99V-Highbury substation. This feeder will assume all of load from the existing 22V-323 beyond the Prospect Road and New Minas Connector Road intersection (approximately 250A, under peak loading). Refer to Figure 1 below. This will be accomplished by:

- Using the existing routing for 22V-323, exit the 99V-Highbury substation and ensure that all existing taps are transferred to 99V-3X1 up to the Prospect Road and New Minas Connector Road intersection.
- Remove recloser R316-014 from its current location on Prospect Road.
- Remove capacitor P316-011.

Figure 1 New 99V-Highbury Feeder, 99V-3X1

6.1.2 99V-Highbury Feeder Extents Part-2

This portion of the project will outline the feeder extents for two feeders, 99V-3X2 and 99V-3X3, to be supplied via the new 99V-Highbury substation. These feeders will assume portions of load from the existing 22V-323 and 22V-312 (approximately 40A and 93A respectively, under peak loading). Refer to Figure 2 below. This will be accomplished by:

- Construct a double circuit on Prospect Road, from New Minas Connector Road to Highbury Road.
- Highbury Road, east of New Minas Connector Road will be supplied via 99V-3X2, on the newly constructed portion of the double circuit. A new open point will be installed at the intersection of Highbury Road and Commercial Street, in New Minas.
- Prospect Road, including the load currently being supplied via 22V-323, will be supplied via 99V-3X3. Open D316-356, on Prospect Road.

Figure 2 **99V-3X2 and 99V-3X3 feeder extents**

6.2 2014 Capital Year

The 2014 capital year will see the construction of a fourth feeder from 99V-Highbury, to Belcher Street, to enable the offloading of 36V-Hillaton resulting in a load reduction on 36V-T1

6.2.1 99V-Highbury New Feeder

This portion of the project will see the construction of a new feeder, 99V-3X4, from the underground to overhead transition on the New Minas Connector Road to Belcher Street. This new feeder will be used to offload 22V-322. Refer to Figure 3 and Figure 4 below. This will be accomplished by:

- Construct new three phase 336AASC and 4/0 neutral on the New Minas Connector Road from Prospect Road to Commercial Street.
- Construct new three phase 336AASC and 4/0 neutral on the Cornwallis River Crossing from Commercial Street to Belcher Street.
- Install a new recloser on Cornwallis River Crossing, at Belcher Street.

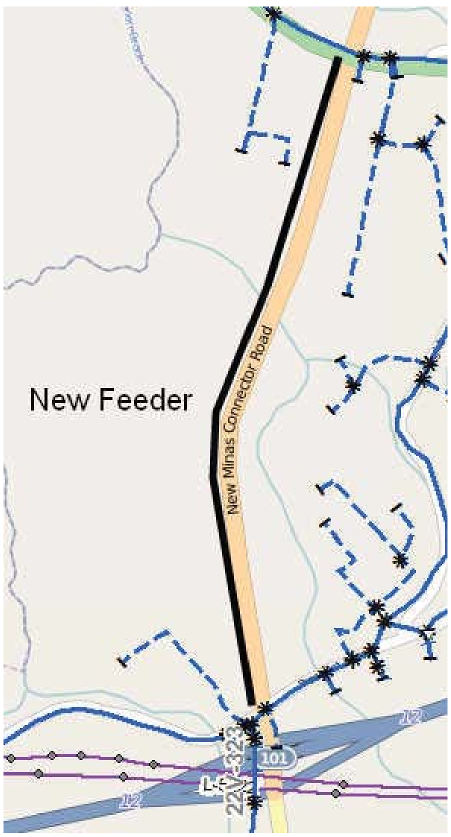


Figure 3 99V-3X4 New Feeder Construction Part-1

Figure 4 99V-3X4 New Feeder Construction Part-2

6.2.2 22V-322 Load Transfer

This portion of the project will outline the load transfer from 22V-322 to 99V-3X4 (approximately 167A, under peak loading). This will transfer the western portion of Belcher Street. Refer to Figure 5 below. This work will be accomplished by:

- Open R3A04201 on Belcher Street.

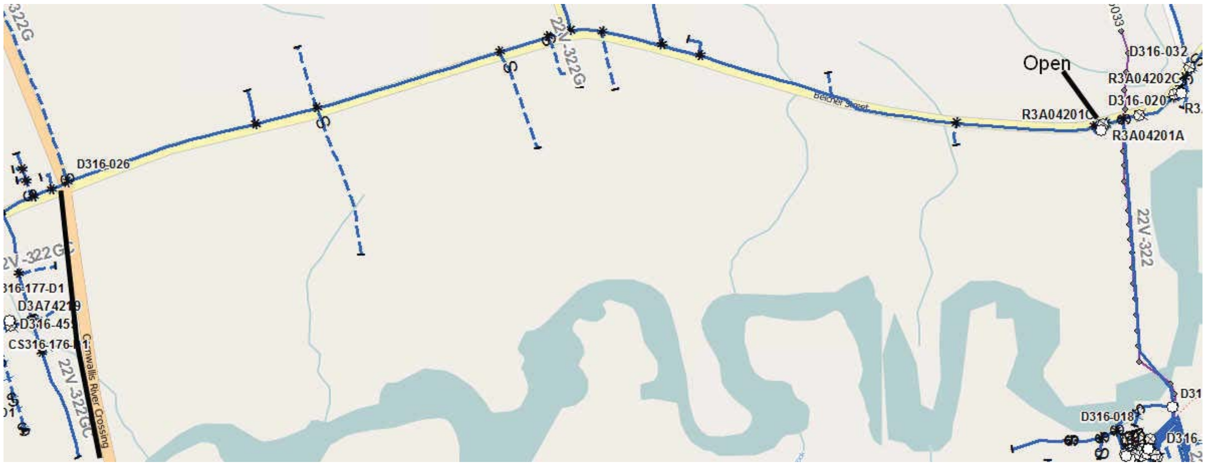


Figure 5 22V-322 Load Transfer

6.2.3 36V-301 Load Transfer

This portion of the project will outline the load transfer from 36V-301 to 22V-322. This will transfer a large portion of 36V-301 load (approximately 112A, under peak loading). Refer to Figure 6 below. This work will be accomplished by:

- Close switches D3A21690 and D316-045, on Highway 358, prior to Church Street.
- Install new open point on Highway 358, north of the intersection with Highway 341.

Figure 6 36V-301 Load Transfer

6.3 2015 Capital Year

For the 2015 capital year, the installation of new automatic transfer schemes between 22V-New Minas, 36V-Hilaton and 99V-Highbury feeders will be completed. These transfer schemes will reduce the number of Customer Hours of Interruption (CH) in the area, as well as increasing the contingencies between the three substations.

6.4 2018 Capital Year

The capital items outlined below are to be considered for advancement, in the event that the load increases at 36V-Hilaton in the coming years. A review of the requirement of these items will be required, in 2017.

6.4.1 36V-302 Load Transfer Part-1

This portion of the project will see the transfer of load from 36V-302 to 36V-301. To accomplish this, a double circuit will need to be constructed on Saxon Road (approximately 24A, under peak loading). Refer to Figure 7 below. This work will be accomplished by:

- Construct Double Circuit along Saxon Street, from 36V-Hillaton to Middle Dyke Road.
- Rebuild Highway 221 to three phase 4/0, on Highway 221, from Black Hole Road to Hillaton Road.
- Change Taps on Middle Dyke Road from 36V-303 to 36V-302.

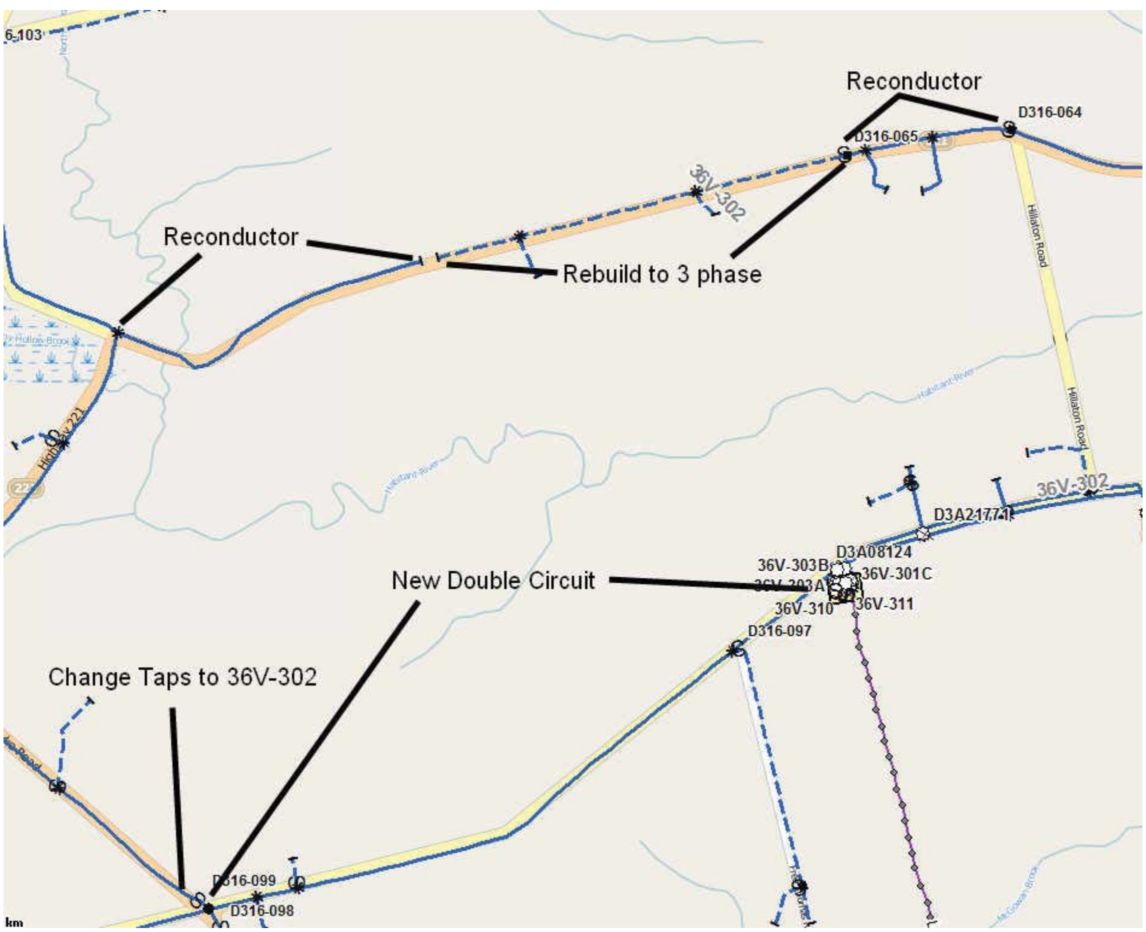


Figure 7 **36V-302 Load Transfer Part-1**

6.4.2 36V-302 Load Transfer Part-2

This portion of the project will see the completion of the remainder of work required to transfer load from 36V-302 to 36V-301 (approximately 112A, under peak loading). Refer to Figure 8 and Figure 9 below. This work will be accomplished by:

- Rebuild North Avenue from D316-094 to Bessie North Road, to three phase 4/0.
- Install new normally closed switch on Bessie North Avenue and North Avenue.
- Install new normally open switch at Rabbit Square Road and North Avenue.
- Open D316-469 at the intersection of Highway 221, Sheffield Road and Main Street.
- Create a new feeder tie between 36V-301 and 36V-302 on Highway 358, prior to the intersection with Saxon Street.
- Install new normally closed open point on Highway 358, between 36V-301 and 36V-302.
- Install new normally open point on Saxon Road, at the intersection to Highway 358.

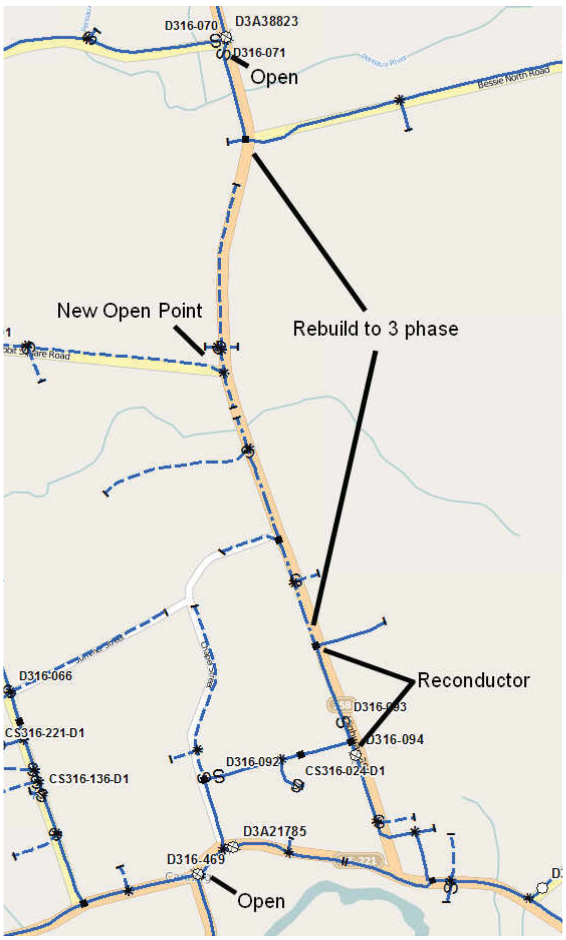


Figure 8 **36V-302 Load Transfer Part-2**

Figure 9 **36V-302 / 36V-301 Tie**

6.4.3 36V-303 Load Transfer Part-1

This portion of the project will transfer load from 36V-303 to 36V-302 (approximately 20A, under peak loading). Refer to Figure 10 below. This work will be accomplished by:

- Install a new open point on Highway 341, east of Middle Dyke Road.
- Rebuild Highway 341, from Middle Dyke Road to D316-108, Gibson Woods Road.
- Reconductor Middle Dyke Road from Saxon Street to Highway 341.
- Close D316-055 and D316-056.
- Install new normally open point at Saxon Street and Sherman Belcher Road.
- Change tap for Middle Dyke Road, at Saxon Street, from 36V-303 to 36V-302.

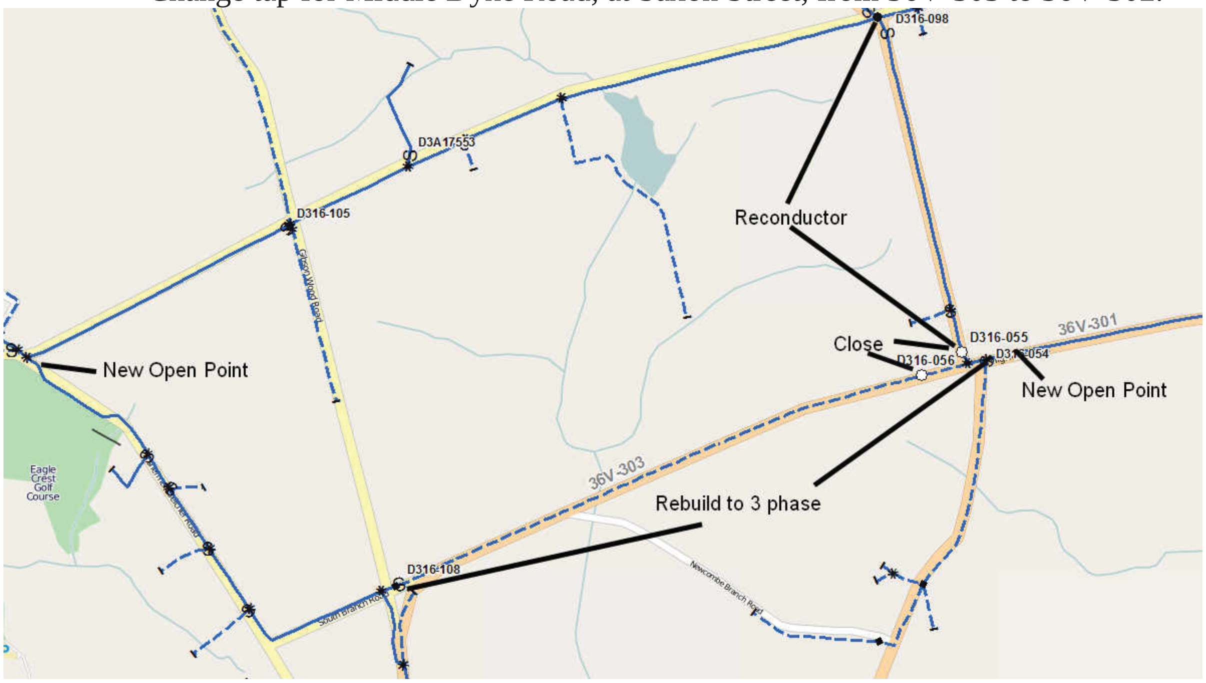


Figure 10 **36V-303 Load Transfer Part-1**

6.4.4 36V-303 Load Transfer Part-2

This portion of the project will complete the load transfer from 36V-303 to 36V-302 (approximately 32A, under peak loading). Refer to Figure 11 below. This work will be accomplished by:

- Reconductor Lakewood Road and filing in the gap with 2/0 ACSR, primary and neutral.
- Open D316-110 on Lydiard Road.

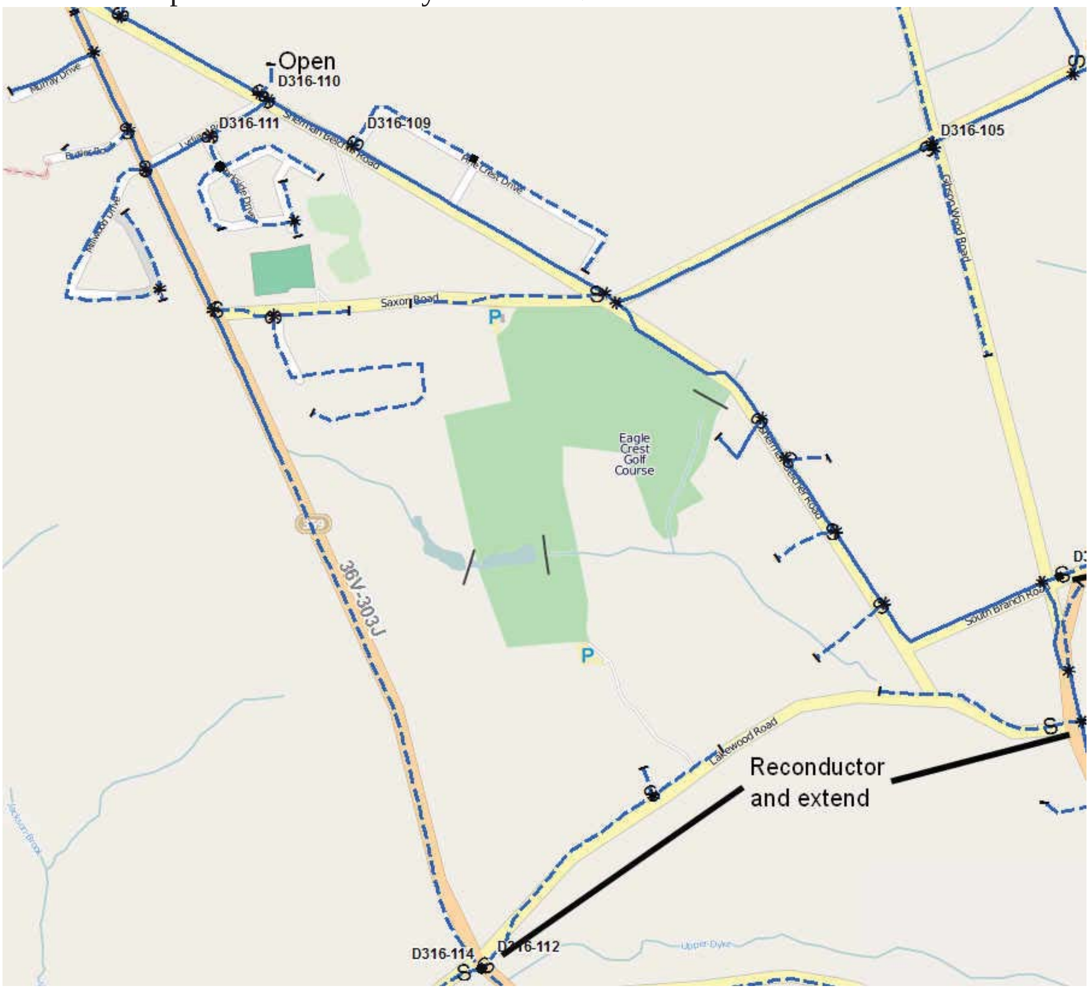


Figure 11 **36V-303 Load Transfer Part2**

APPENDIX A

System Operating Diagrams

Appendix A: System Operating Diagrams

[redacted]

Figure 12 System Operating Diagram 43V-Canaan Road

Appendix A: System Operating Diagrams

[redacted]

Figure 13 System Operating Diagram 22V-New Minas

Appendix A: System Operating Diagrams

[redacted]

Figure 14 **System Operating Diagram 36V-Hillaton**

[redacted]

Figure 15 System Operating Diagram 50V-Klondike

[redacted]

Figure 16 **System Operating Diagram 55V-Waterville**

Appendix A: System Operating Diagrams

[redacted]

Figure 17 System Operating Diagram 99V-Highbury

APPENDIX B

Load History and Forecast

Appendix B: Load History and Forecast

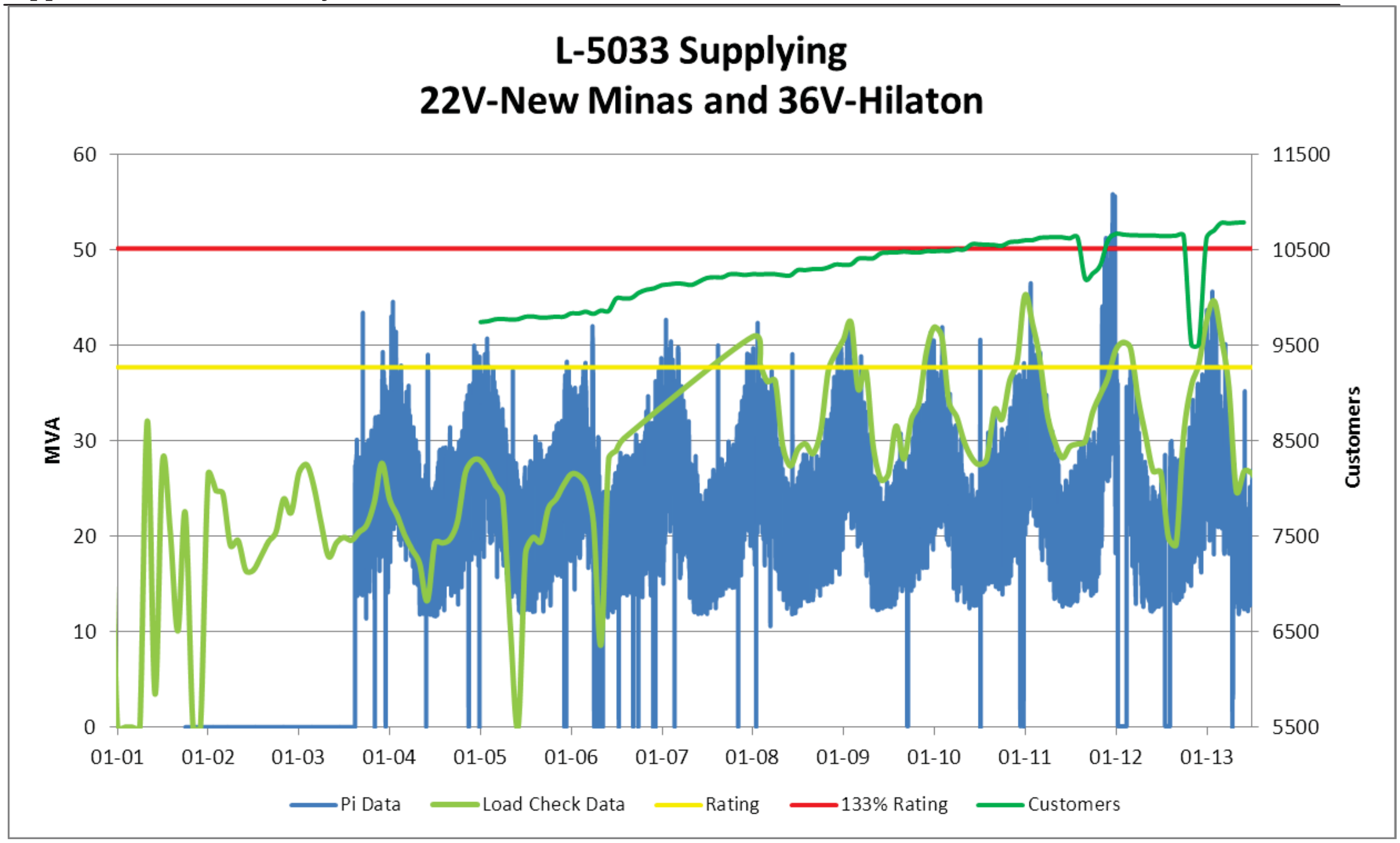


Figure 18 L-5033 Load History

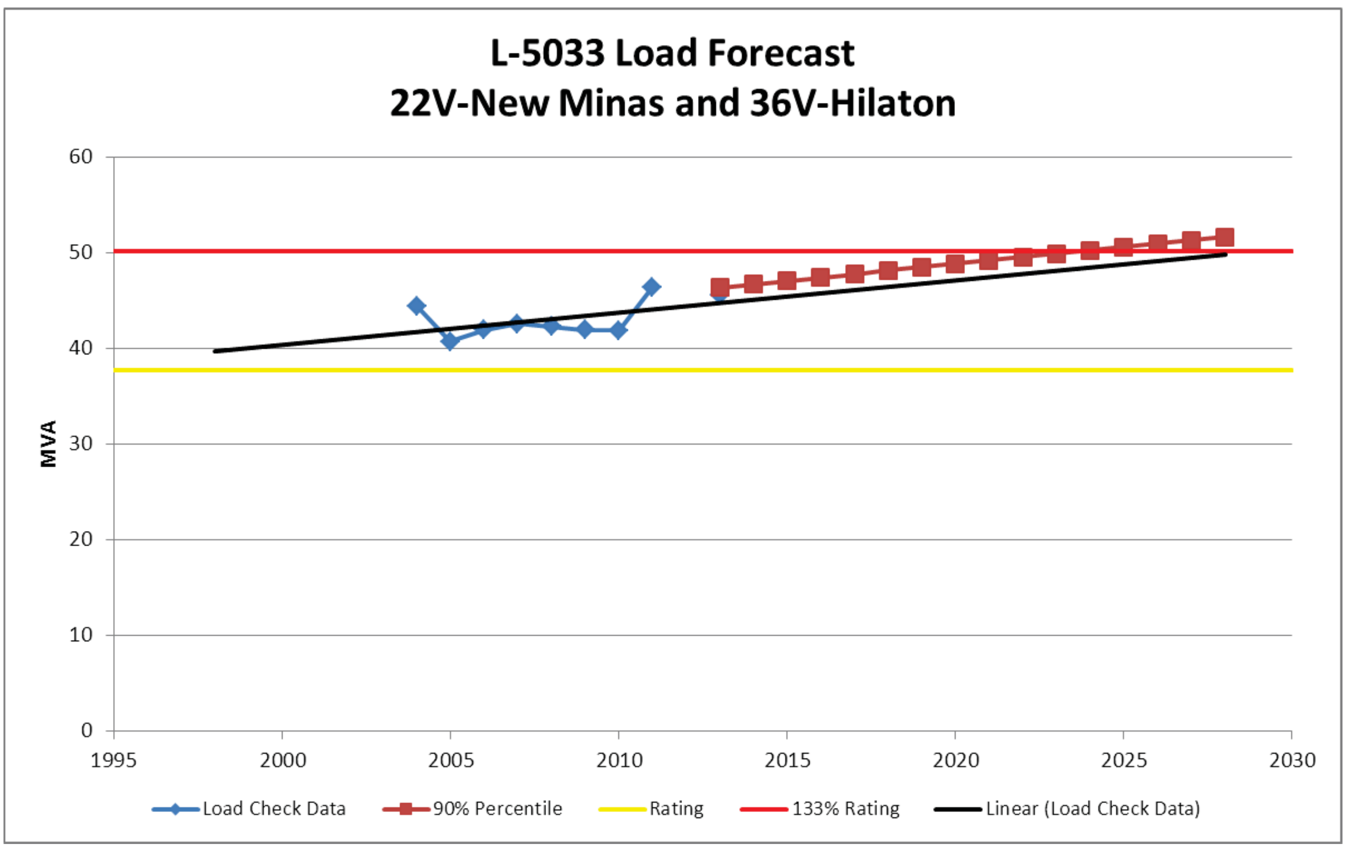


Figure 19 L-5033 Load Forecast

Appendix B: Load History and Forecast

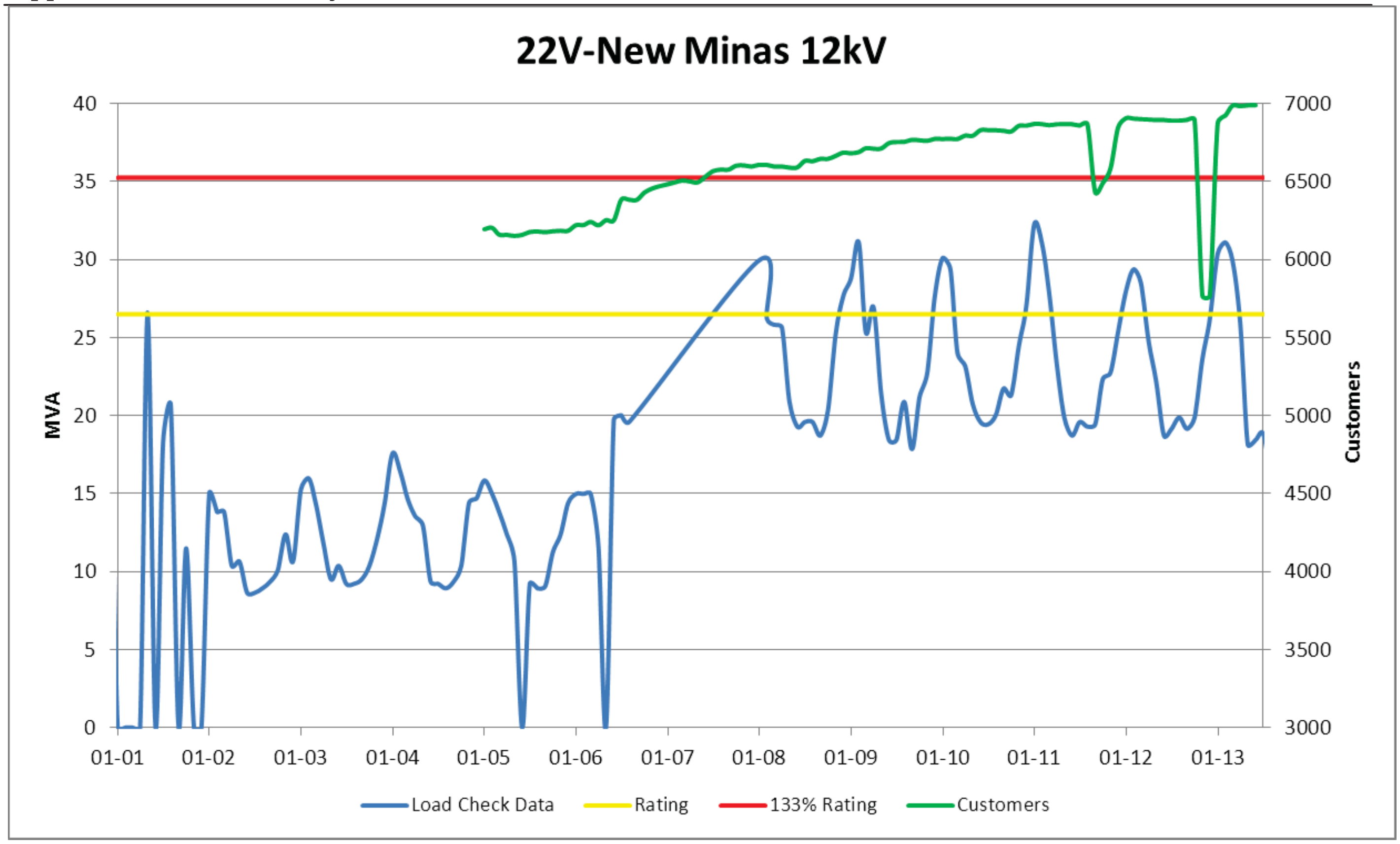


Figure 20 22V-New Minas Load History

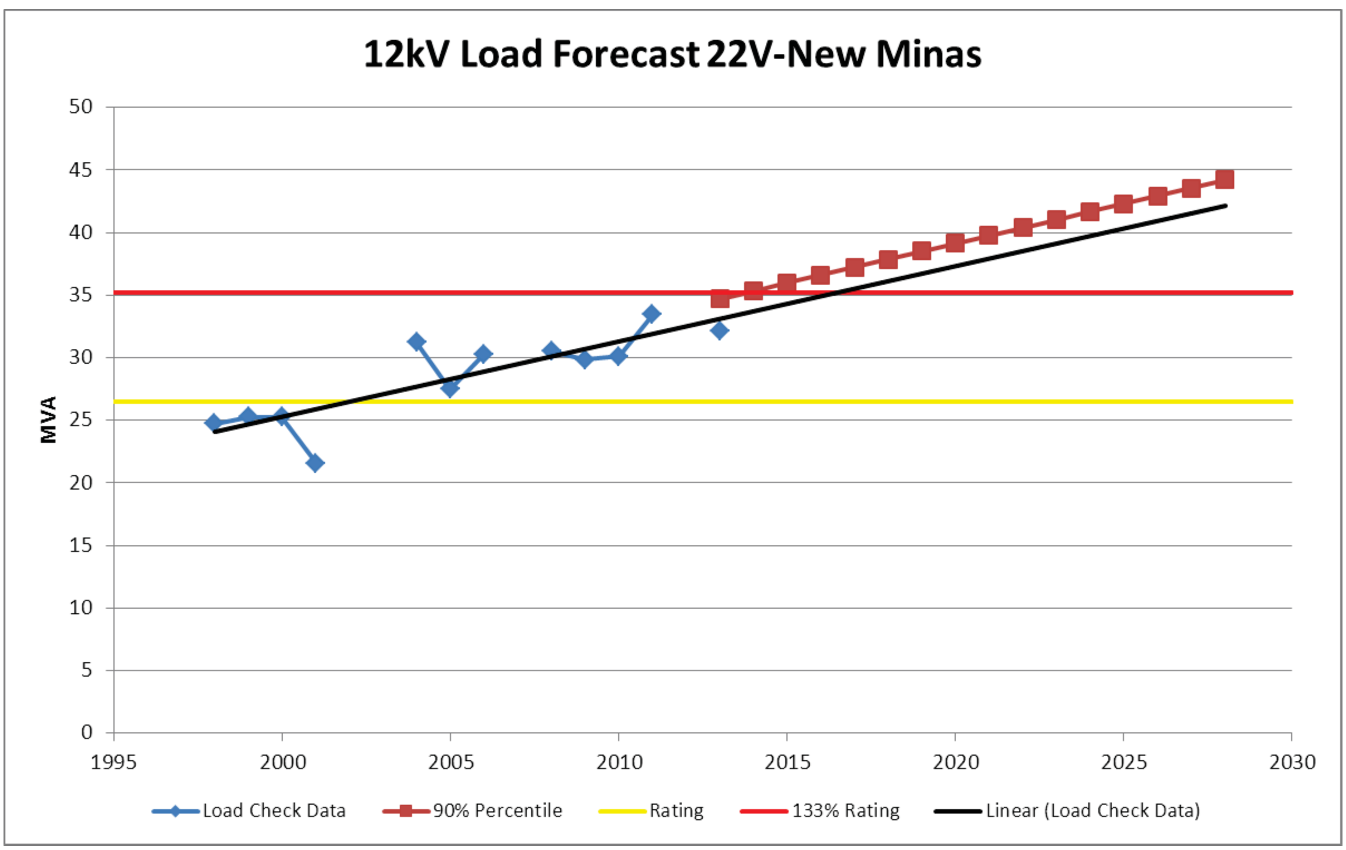


Figure 21 22V-New Minas 12kV Load History

Note: This load forecast is prior to the 99V-Highbury substation being in-service.

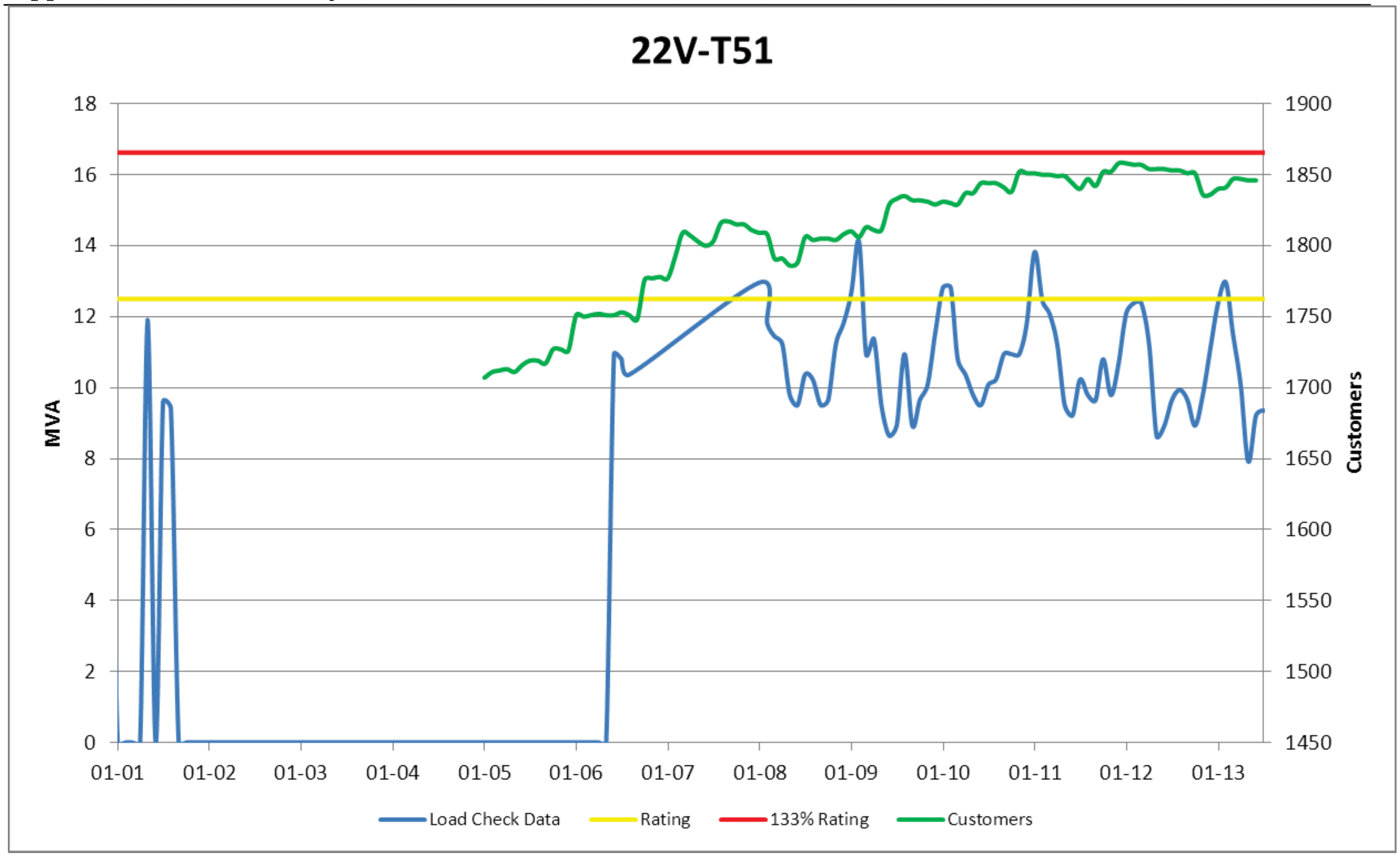


Figure 22 22V-T51 Load History

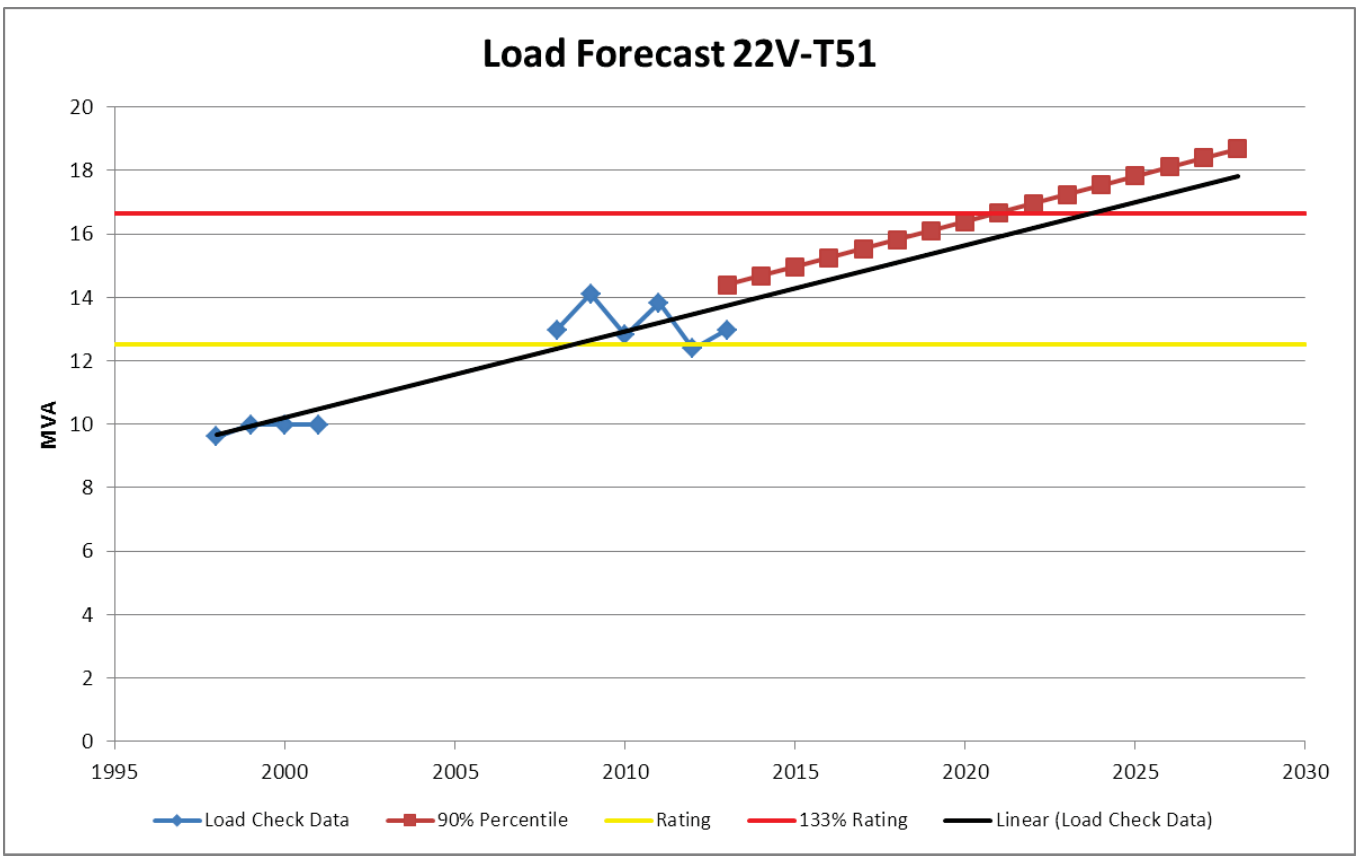


Figure 23 22V-T51 Load Forecast

Appendix B: Load History and Forecast

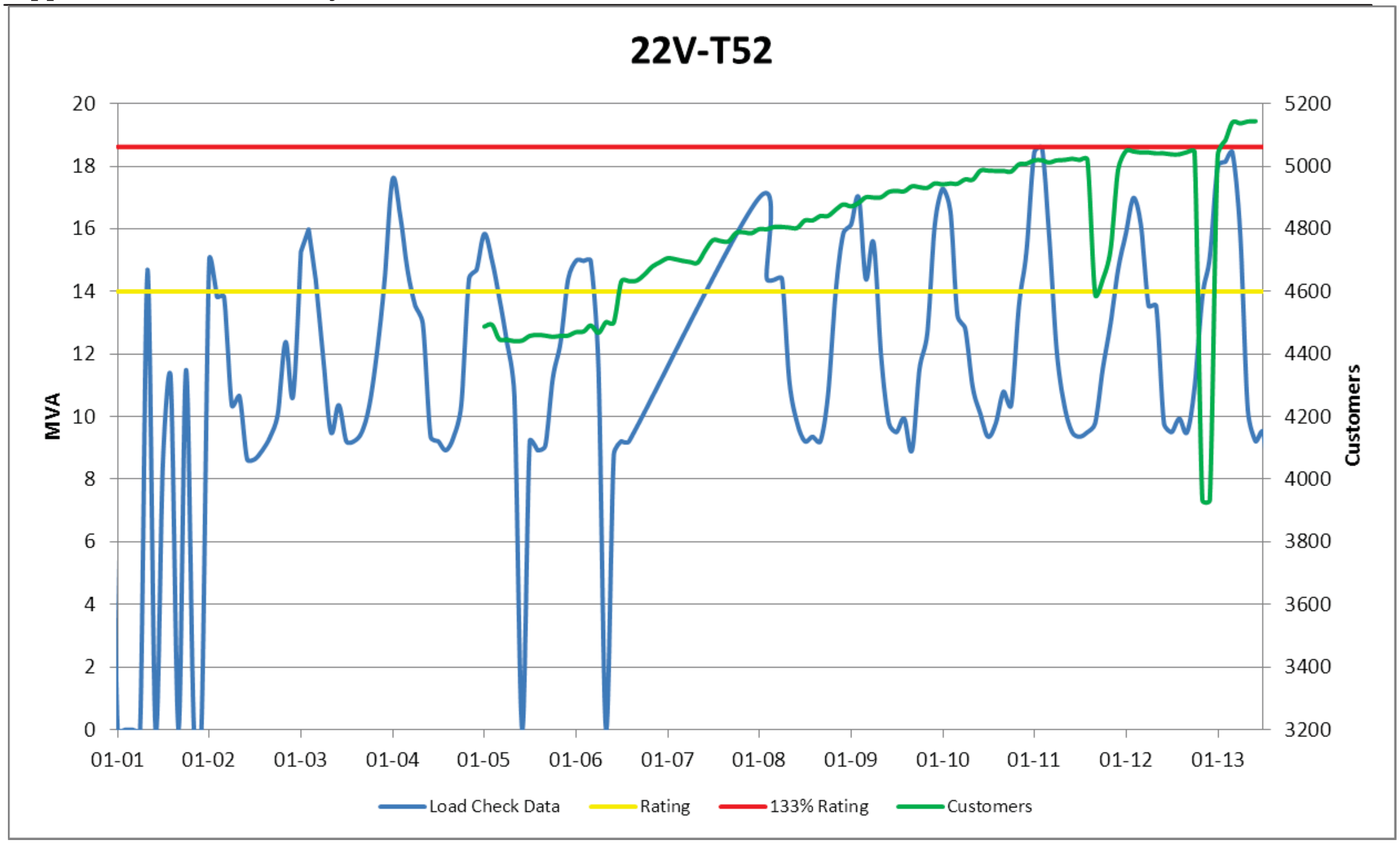


Figure 24 **22V-T52 Load History**

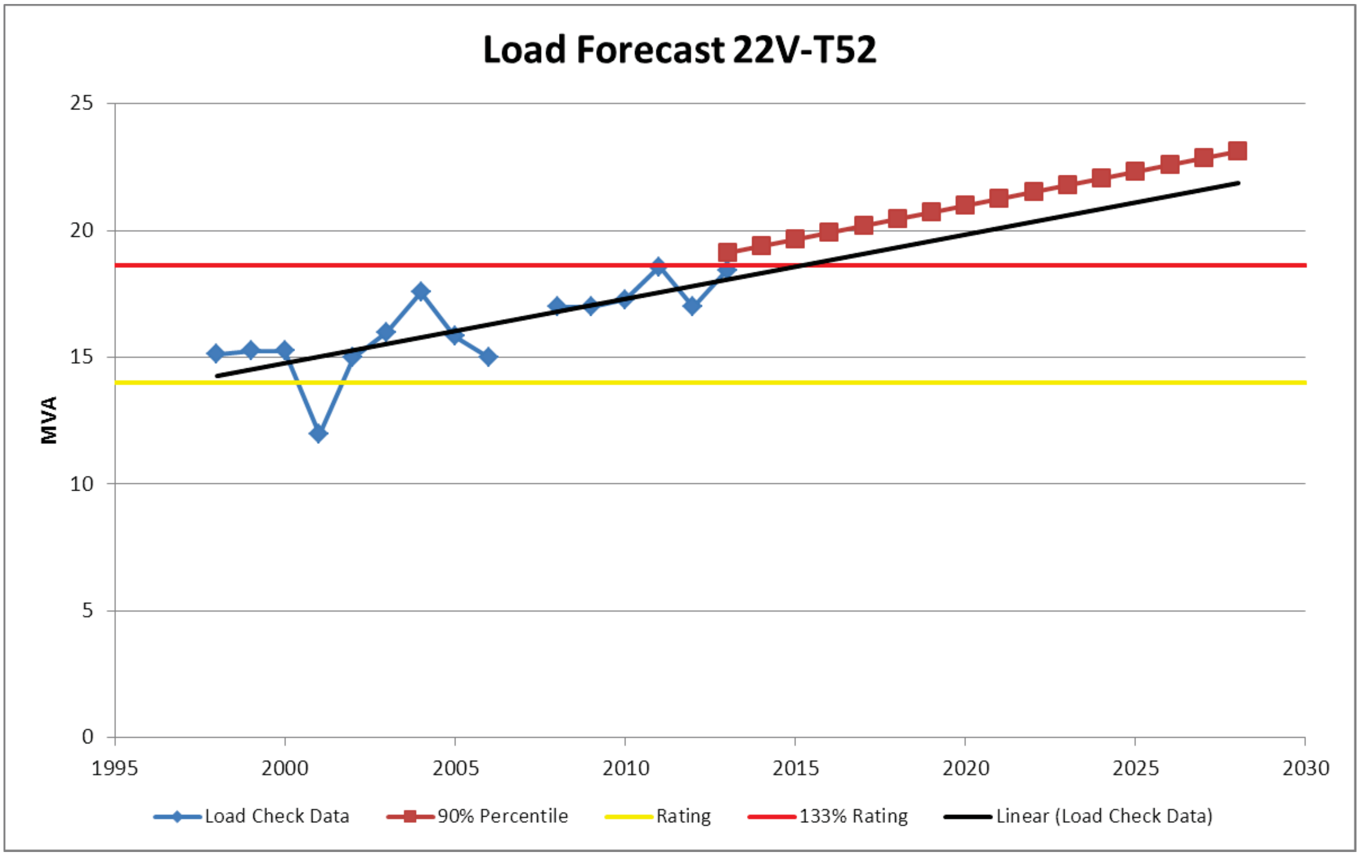


Figure 25 **22V-T52 Load Forecast**

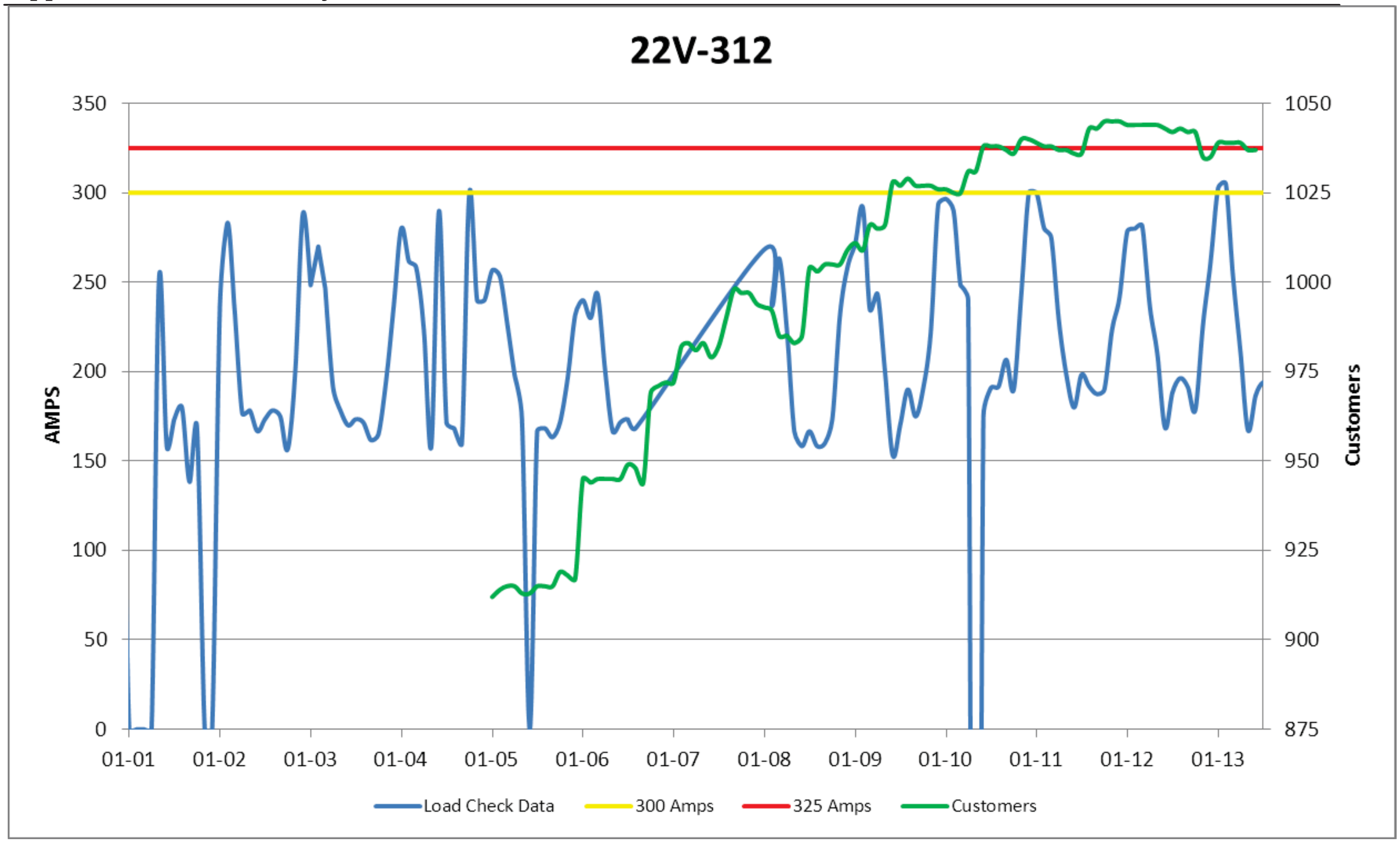


Figure 26 **22V-312 Load History**

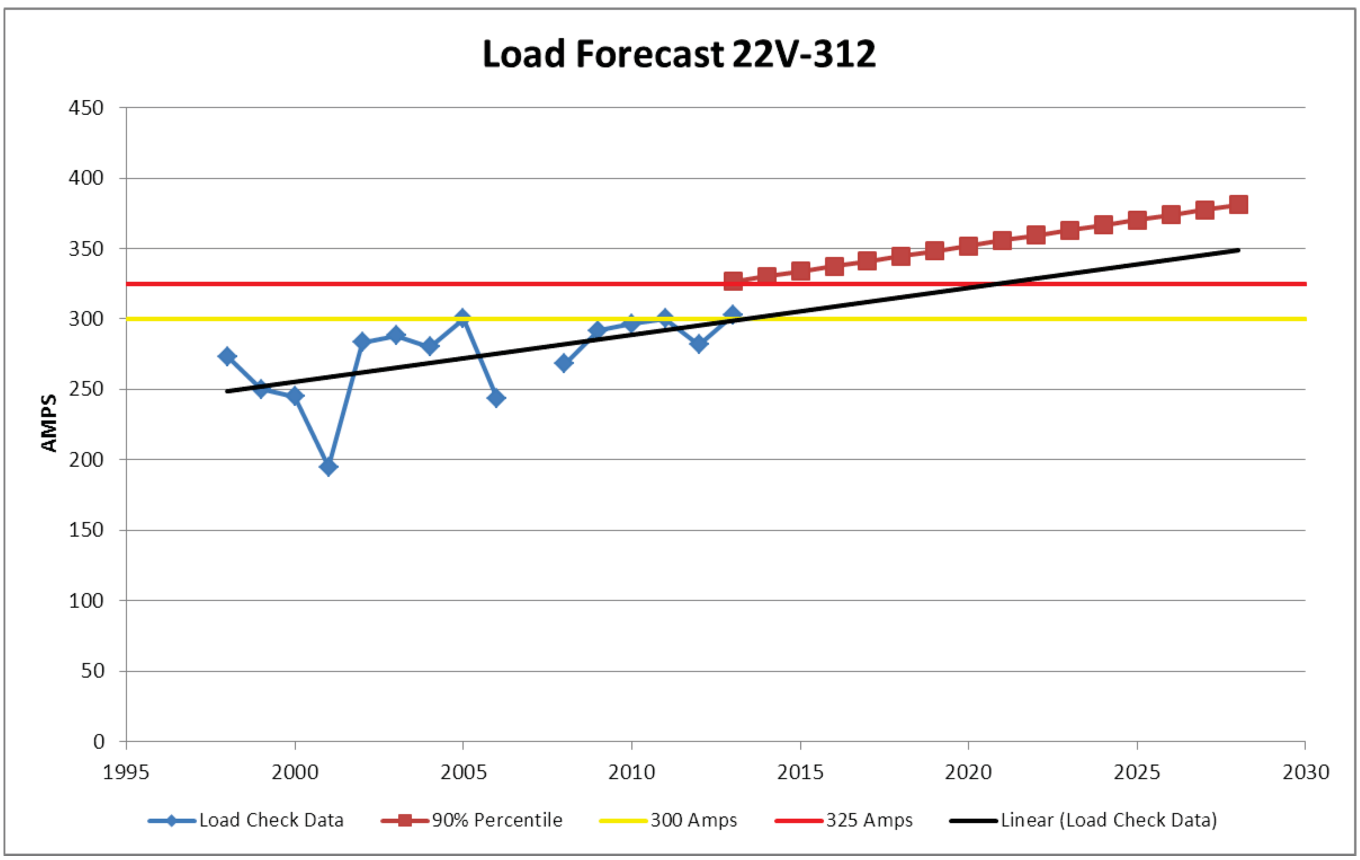


Figure 27 **22V-312 Load Forecast**

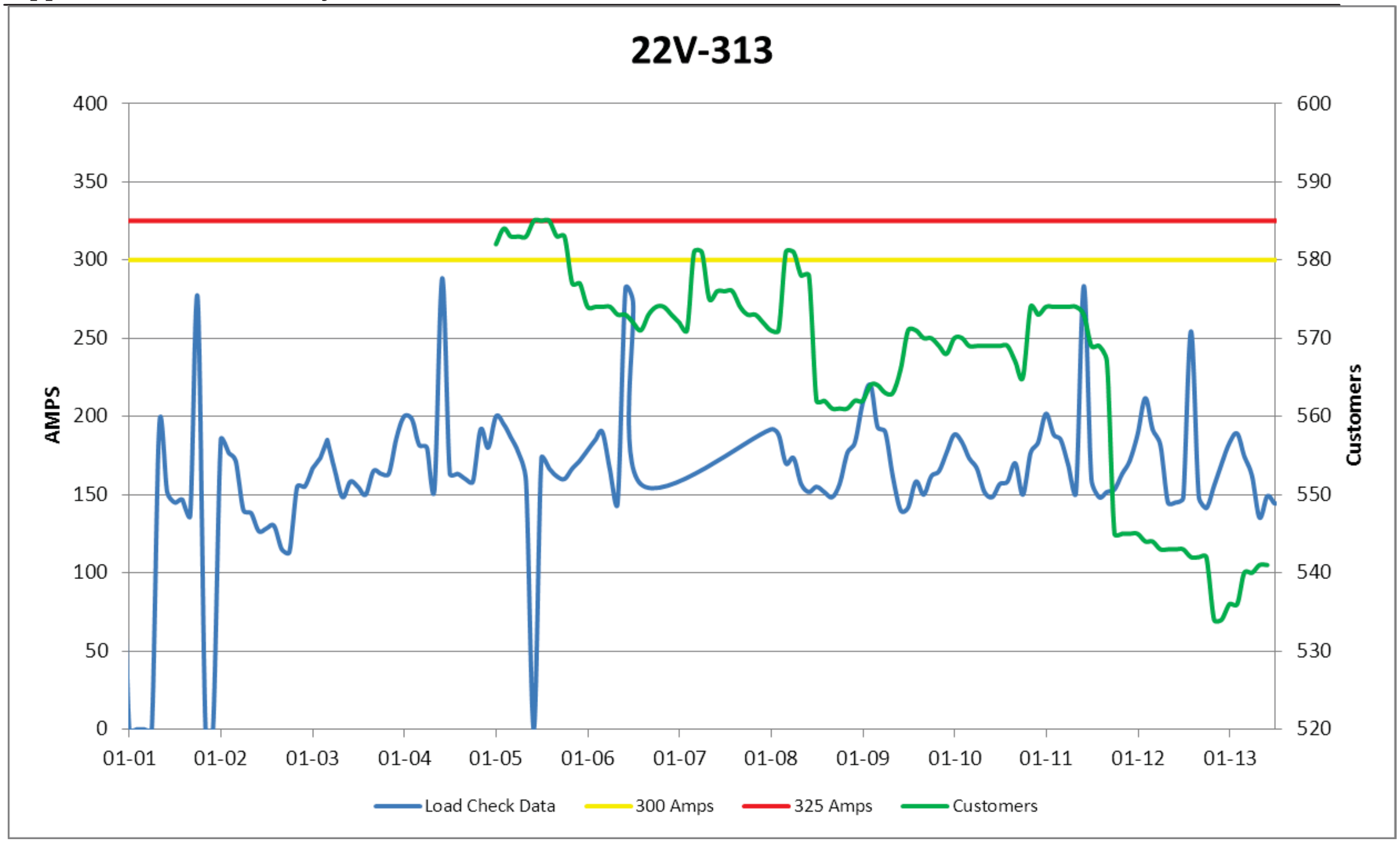


Figure 28 **22V-313 Load History**

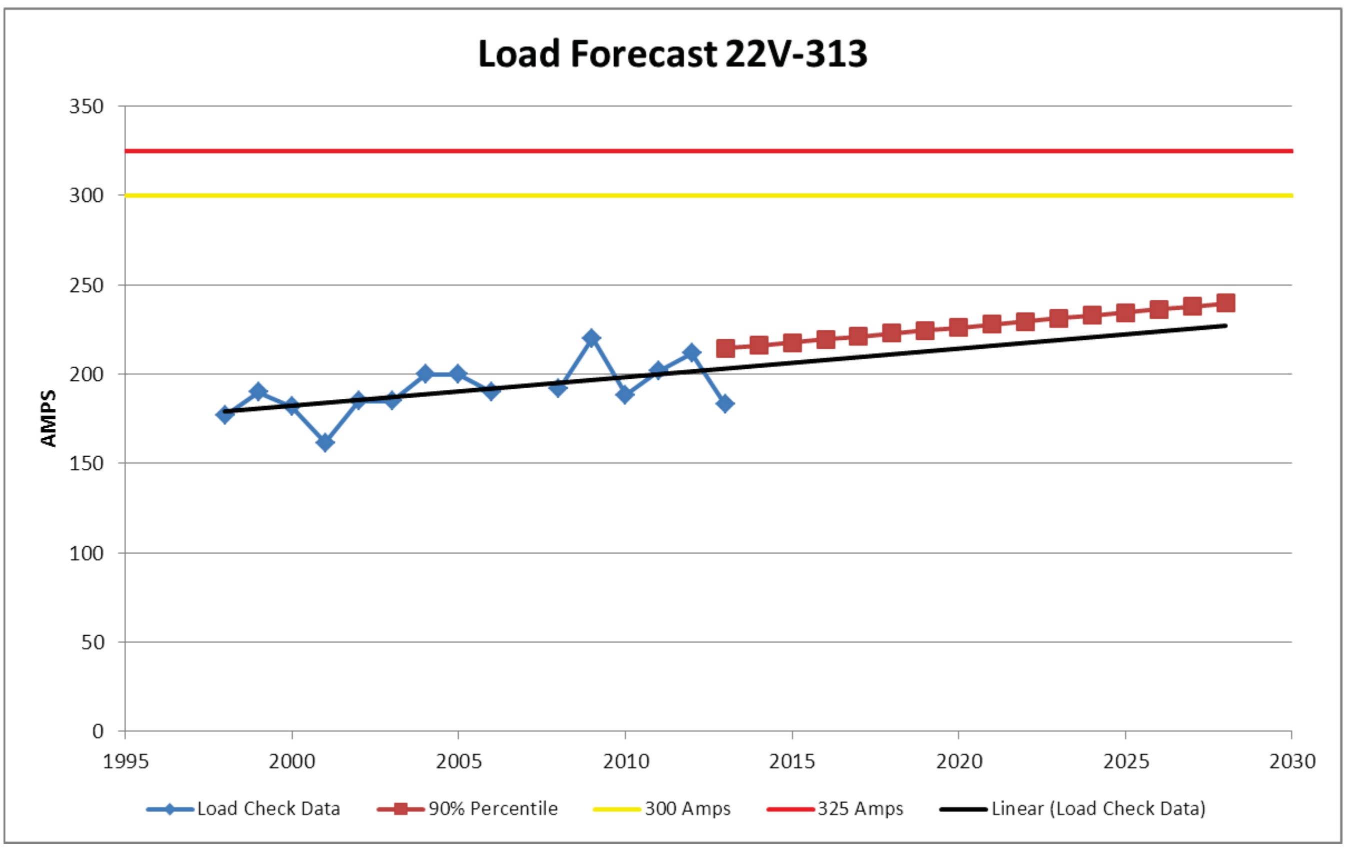


Figure 29 **22V-313 Load Forecast**

Appendix B: Load History and Forecast

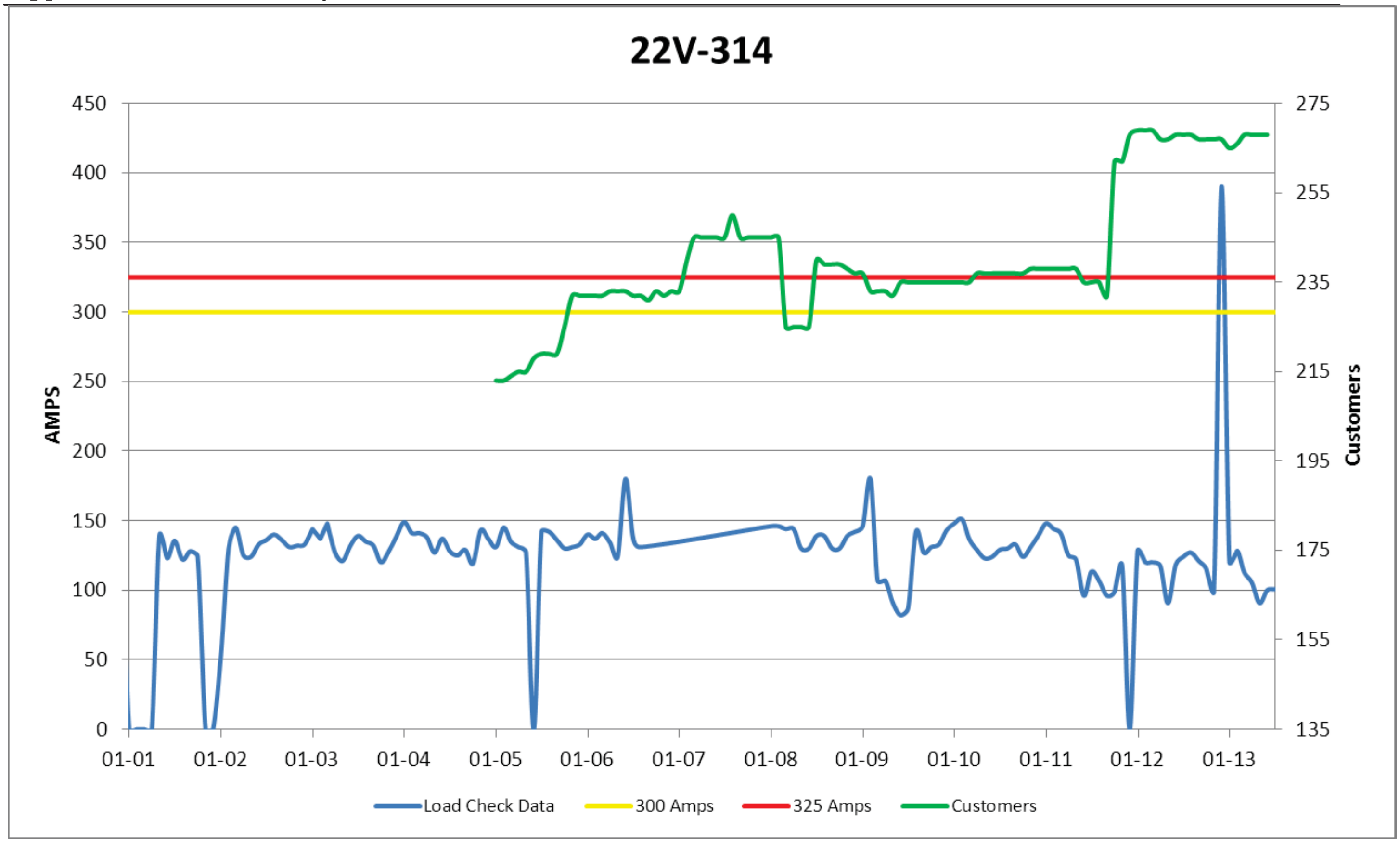


Figure 30 22V-314 Load History

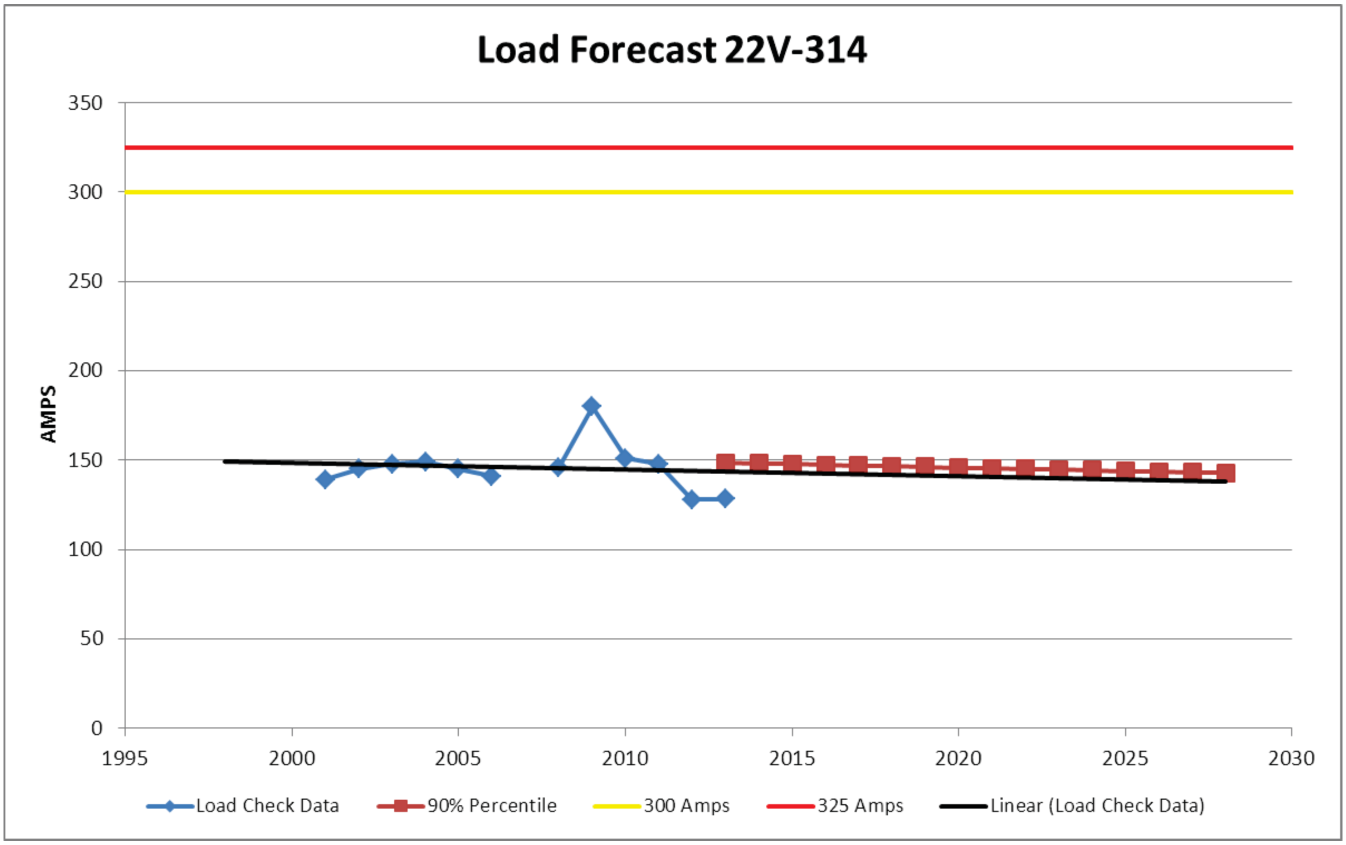


Figure 31 22V-314 Load Forecast

Appendix B: Load History and Forecast

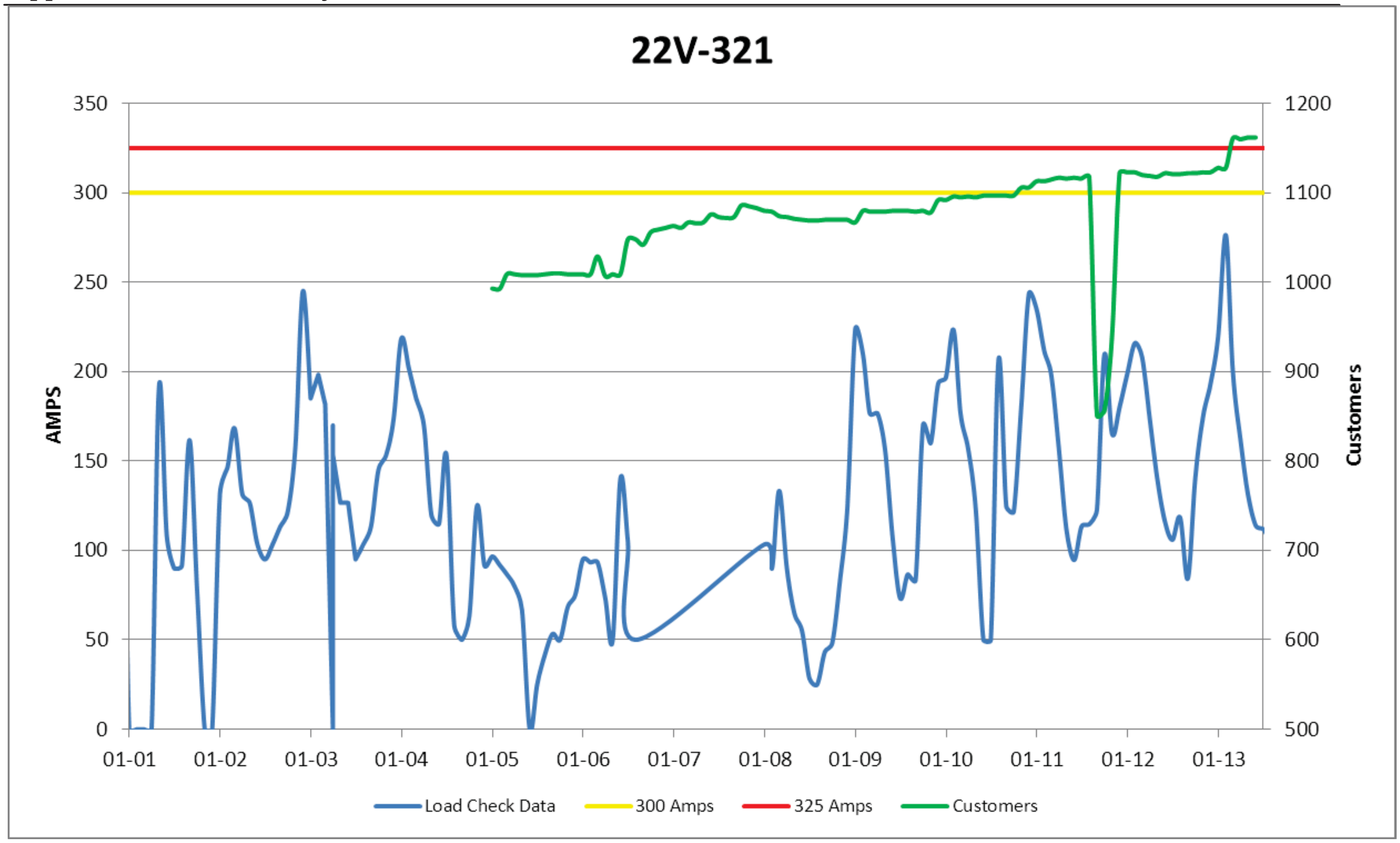


Figure 32 22V-321 Load History

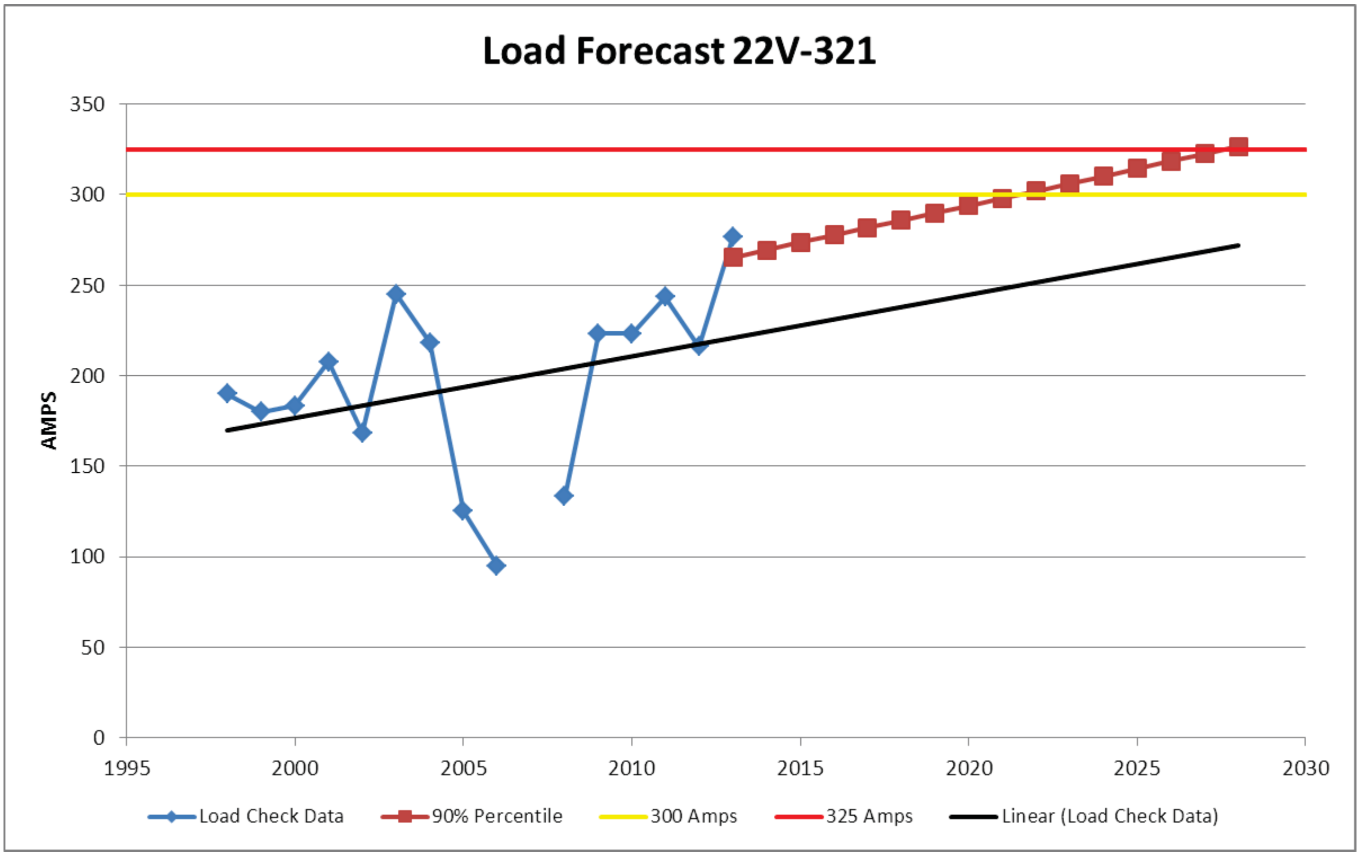


Figure 33 22V-321 Load Forecast

Appendix B: Load History and Forecast

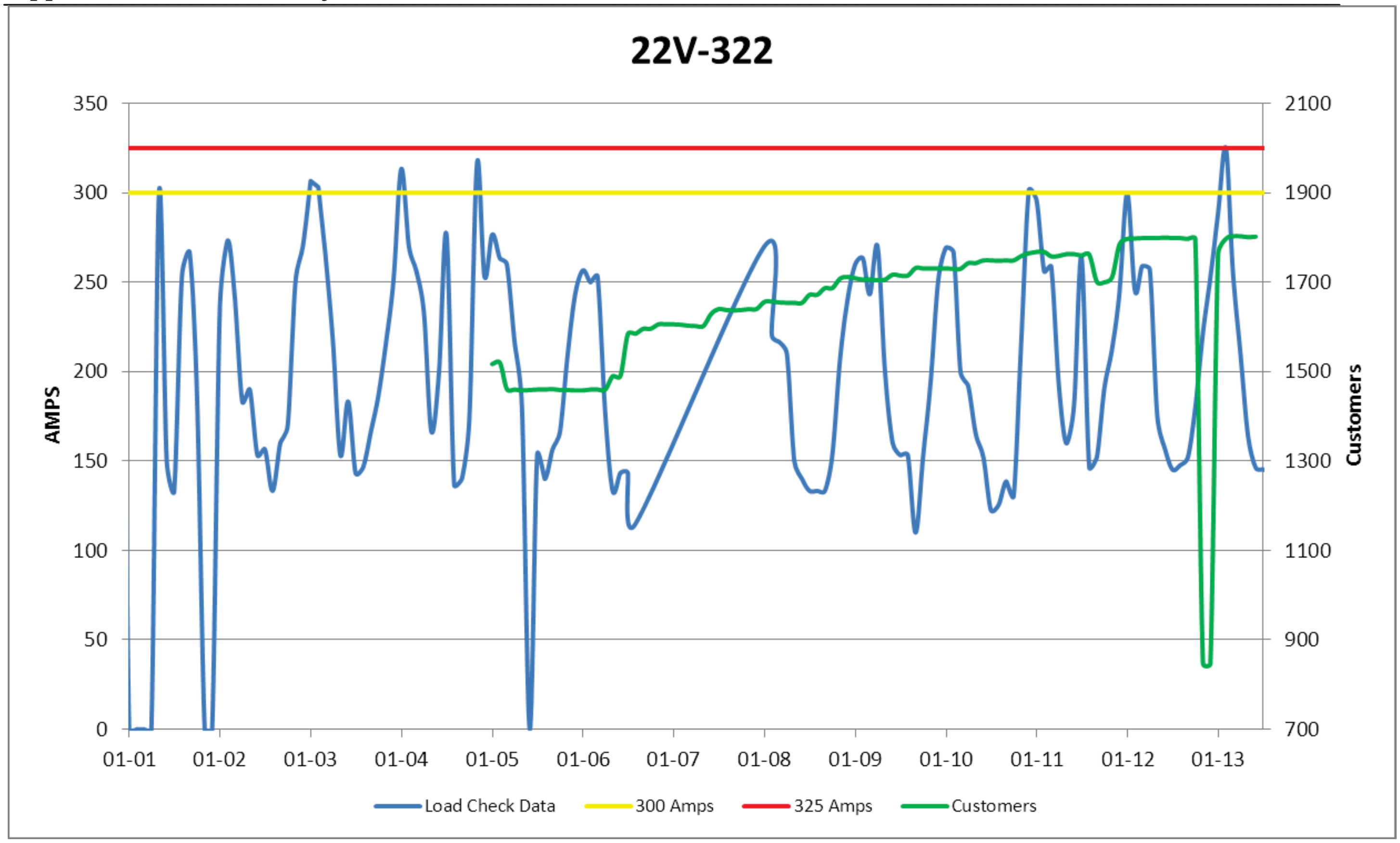


Figure 34 22V-322 Load History

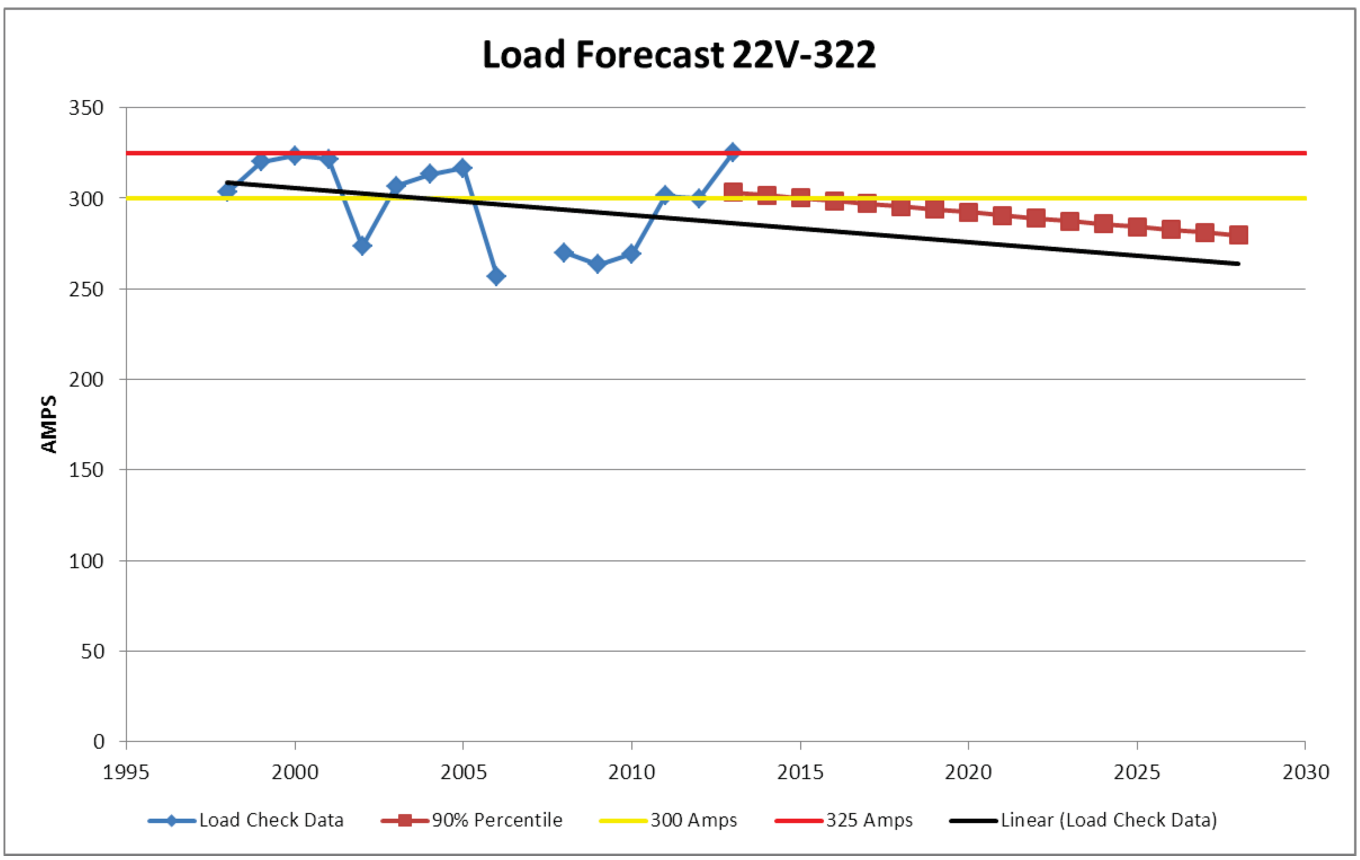


Figure 35 22V-322 Load Forecast

Appendix B: Load History and Forecast

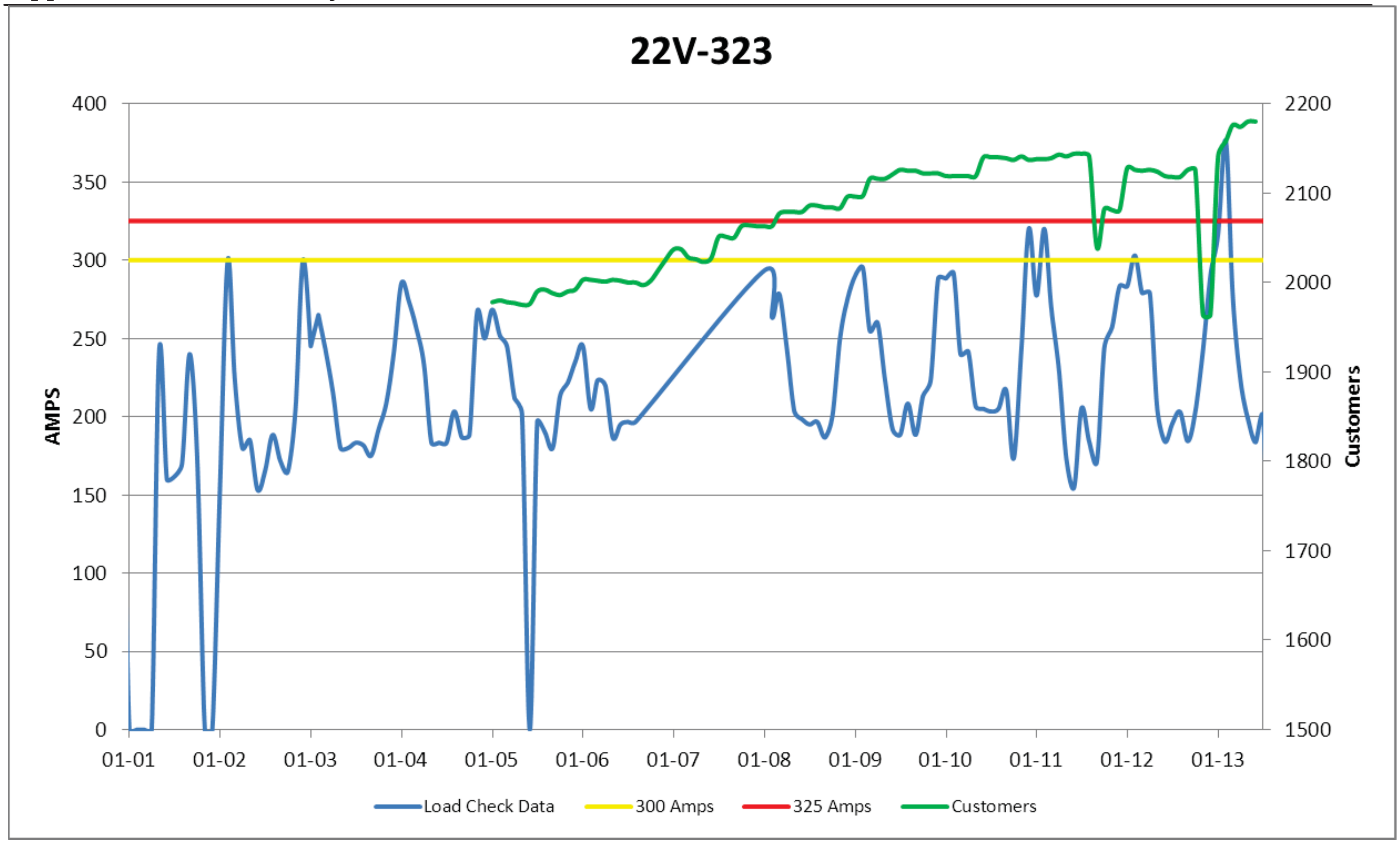


Figure 36 **22V-323 Load History**

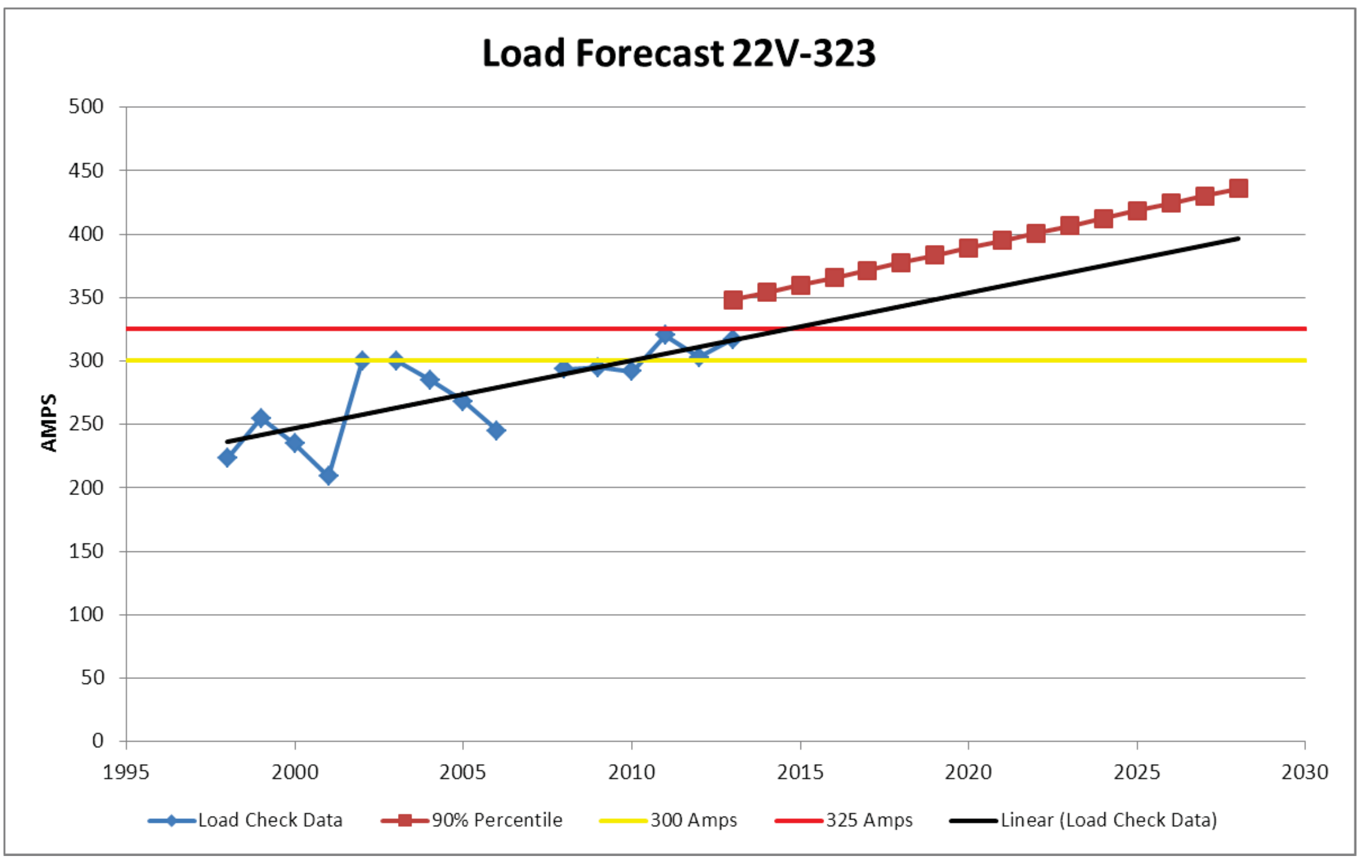


Figure 37 **22V-323 Load Forecast**

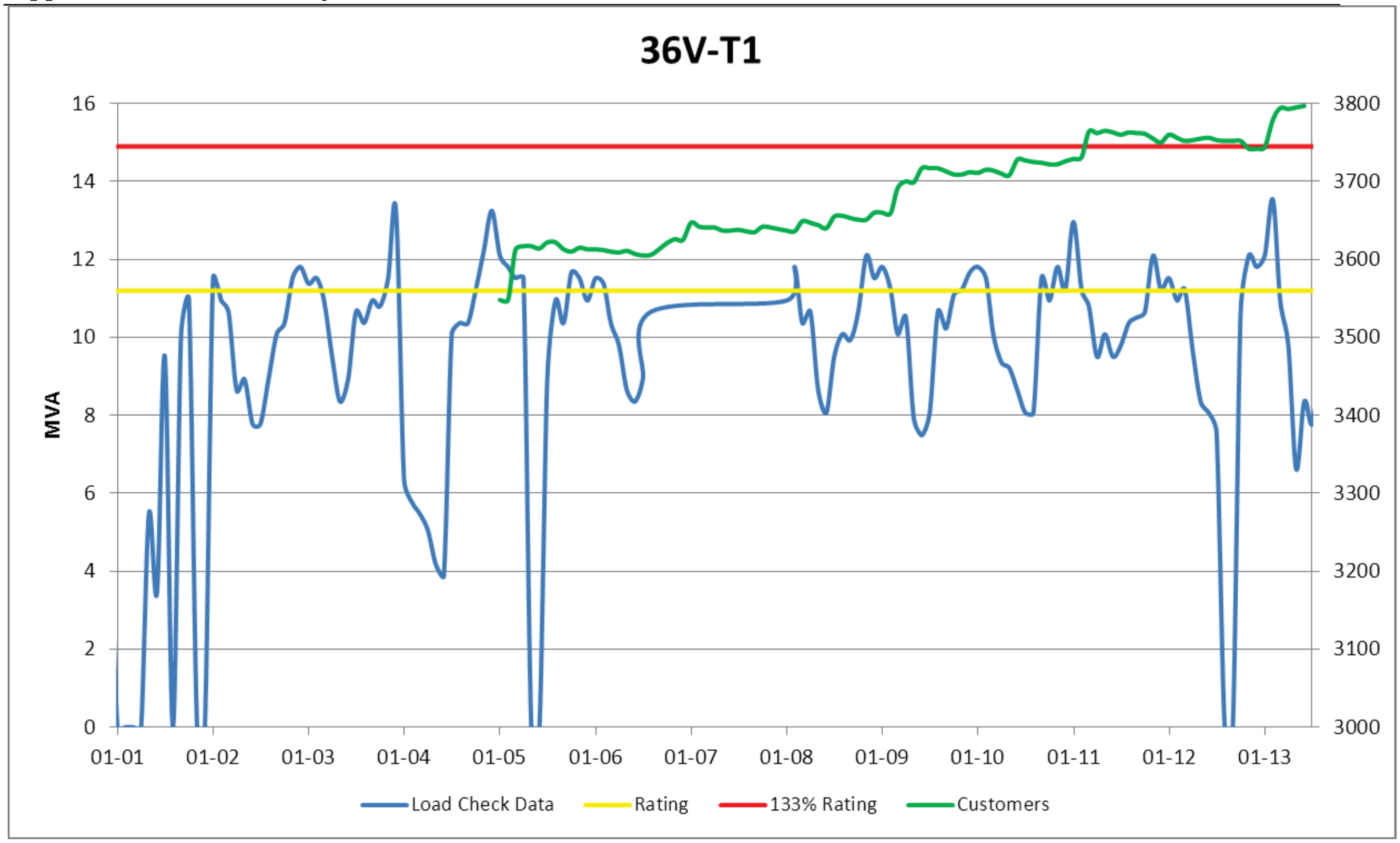


Figure 38 **36V-T1 Load History**

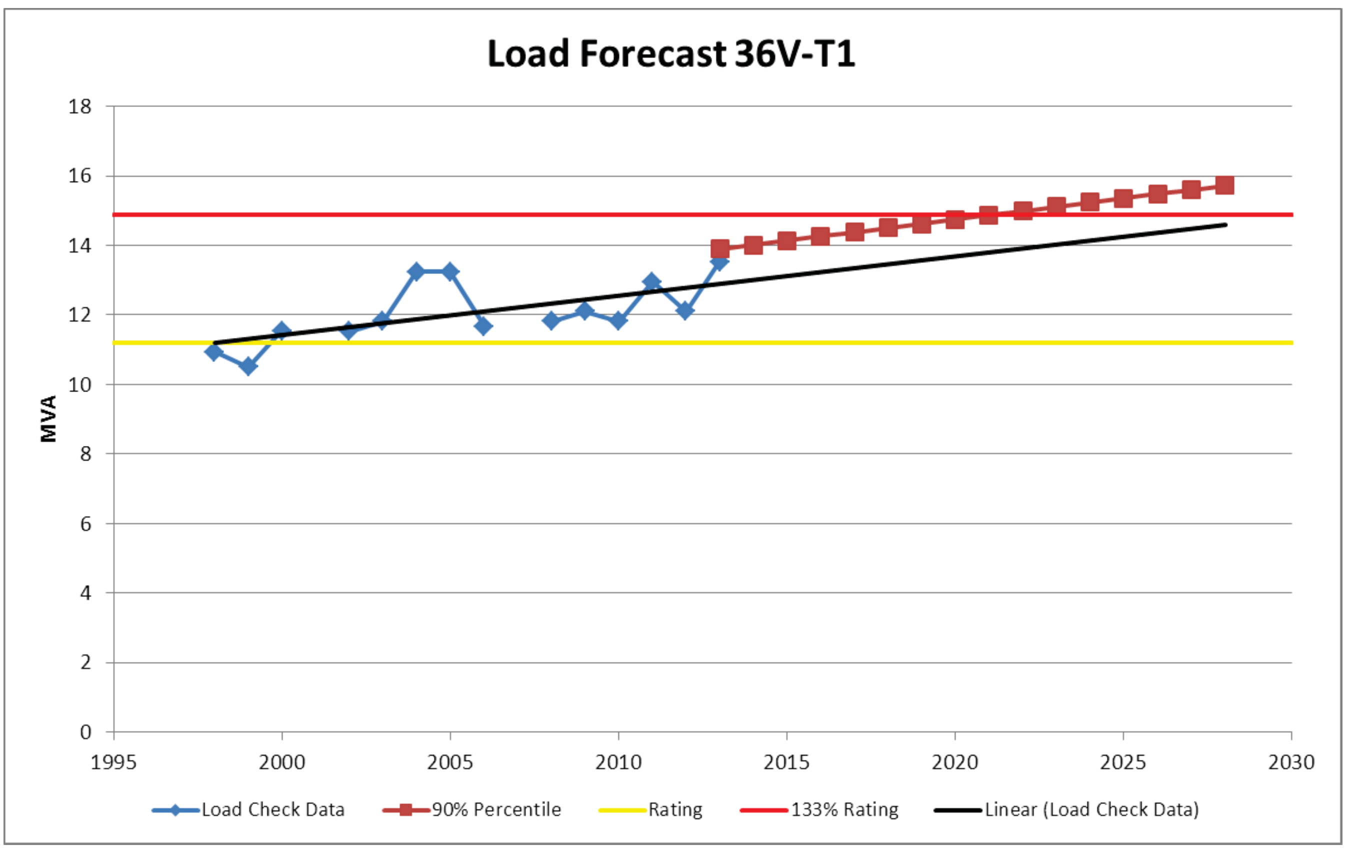


Figure 39 **36V-T1 Load Forecast**

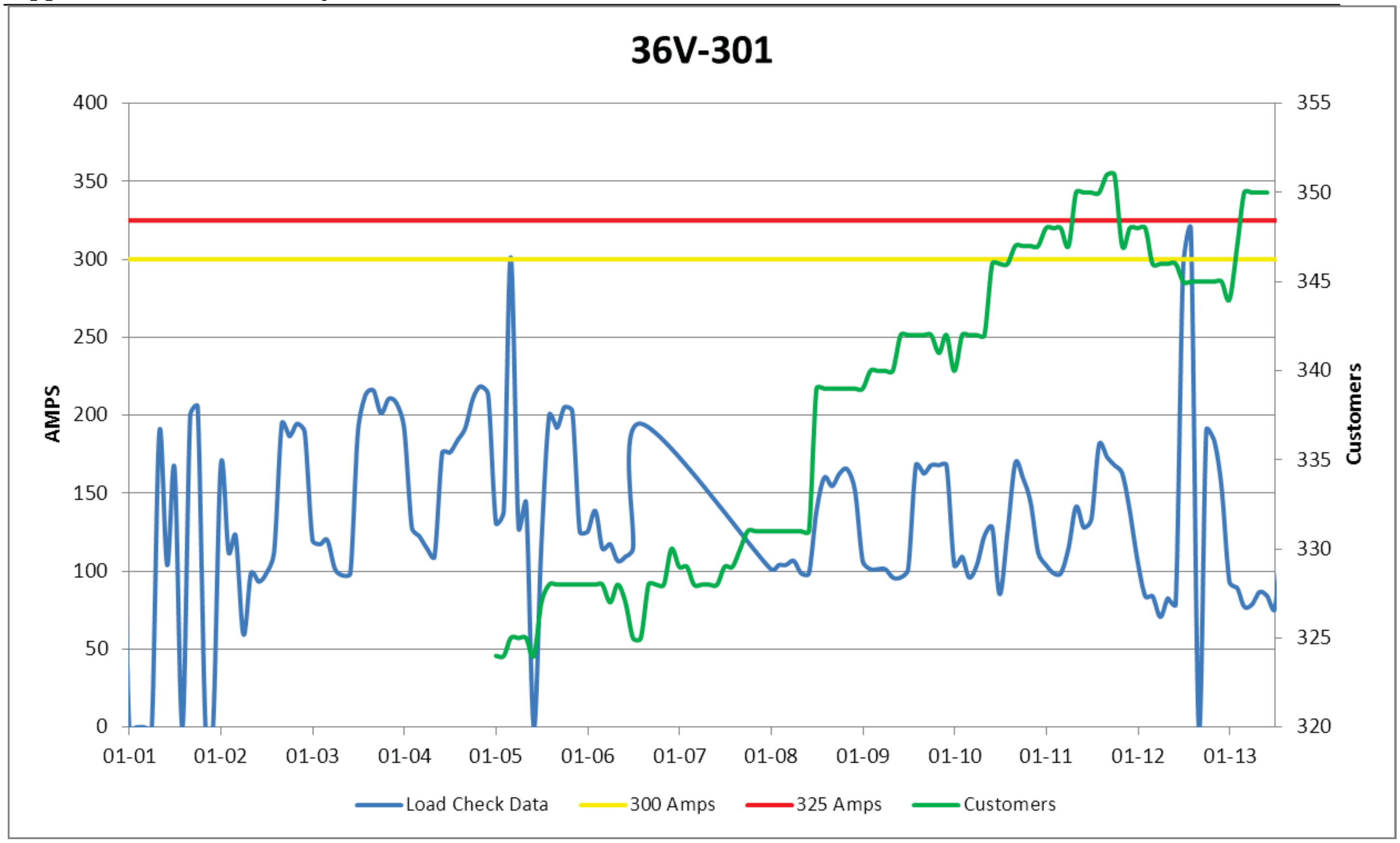


Figure 40 36V-301 Load History

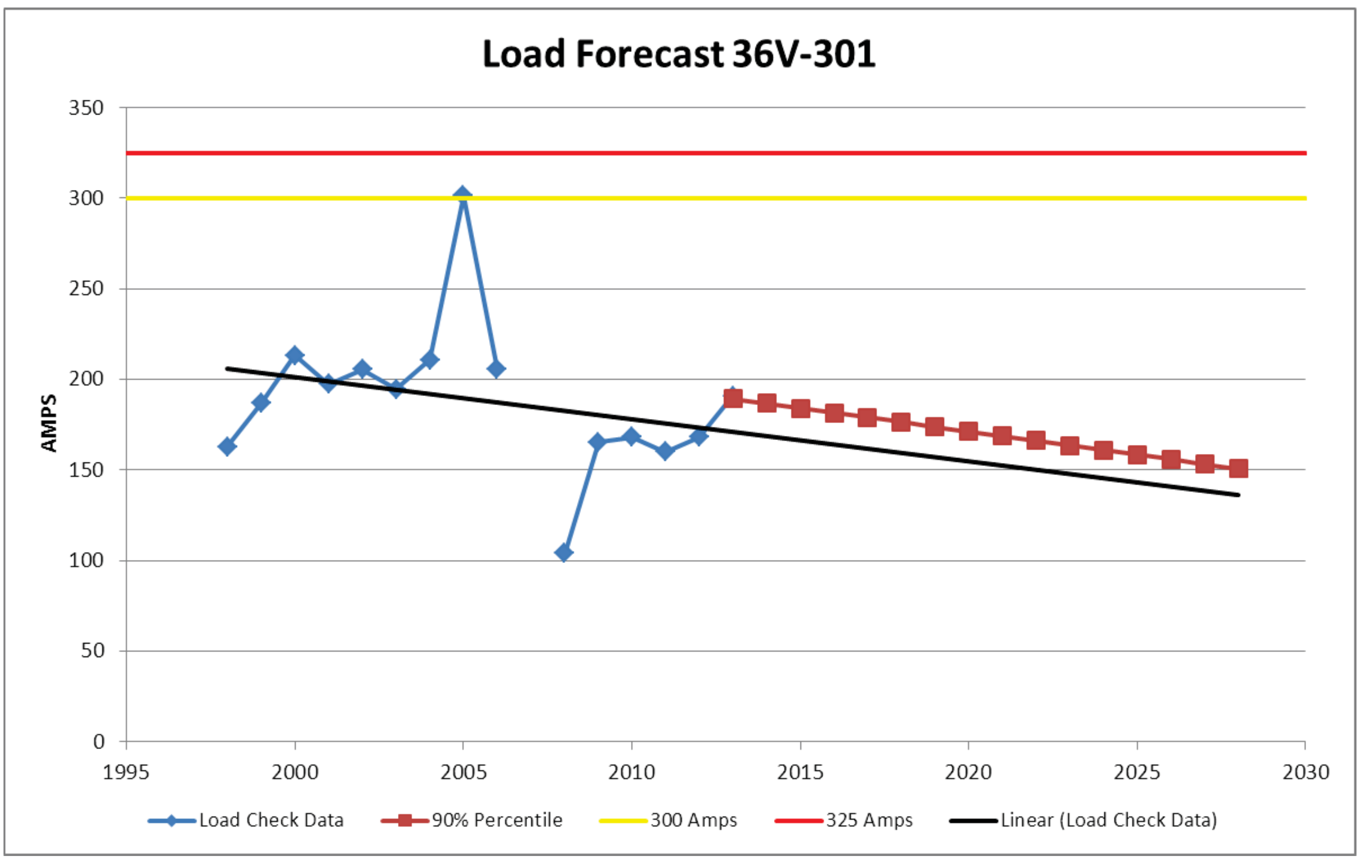


Figure 41 36V-301 Load Forecast

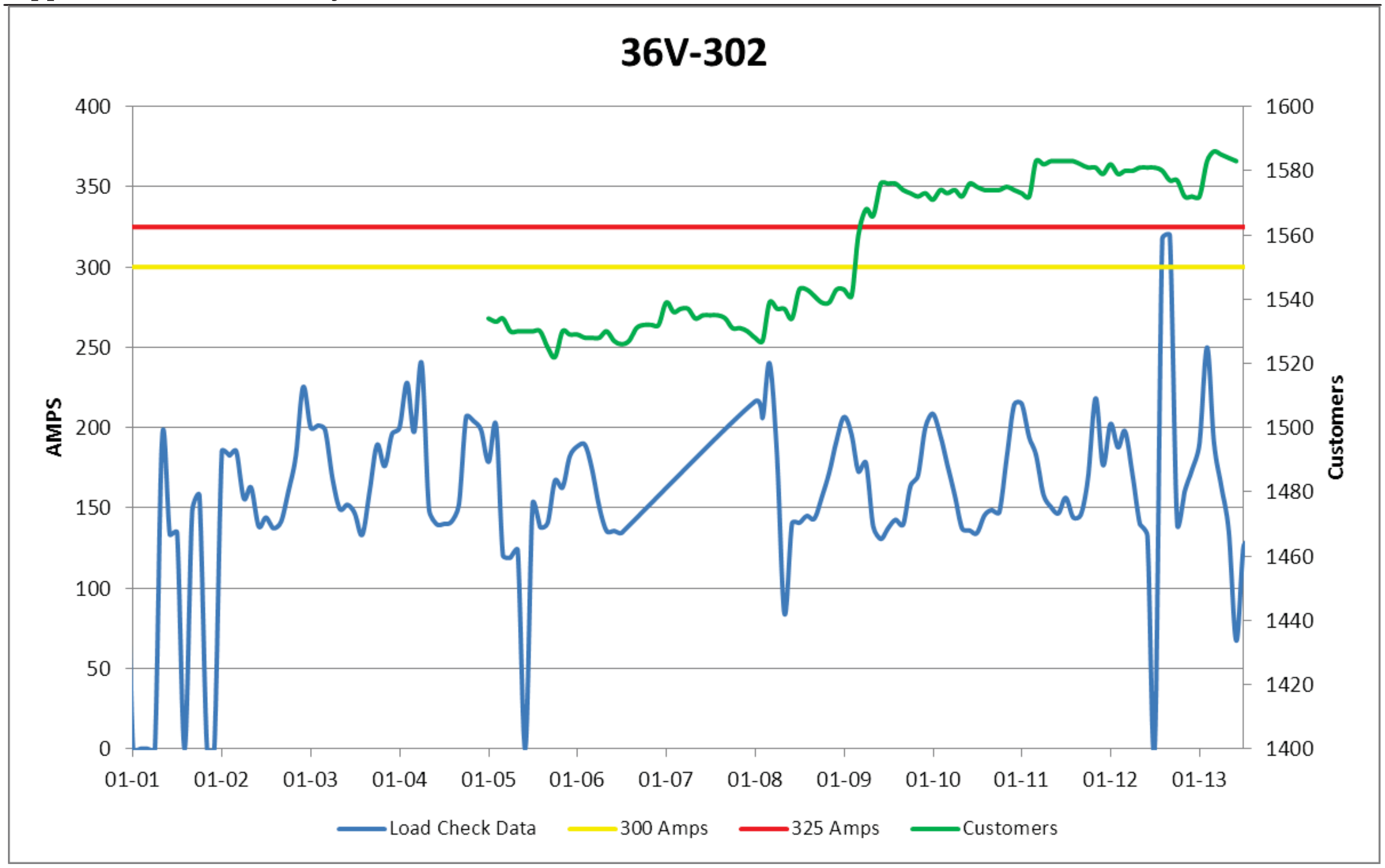


Figure 42 36V-302 Load History

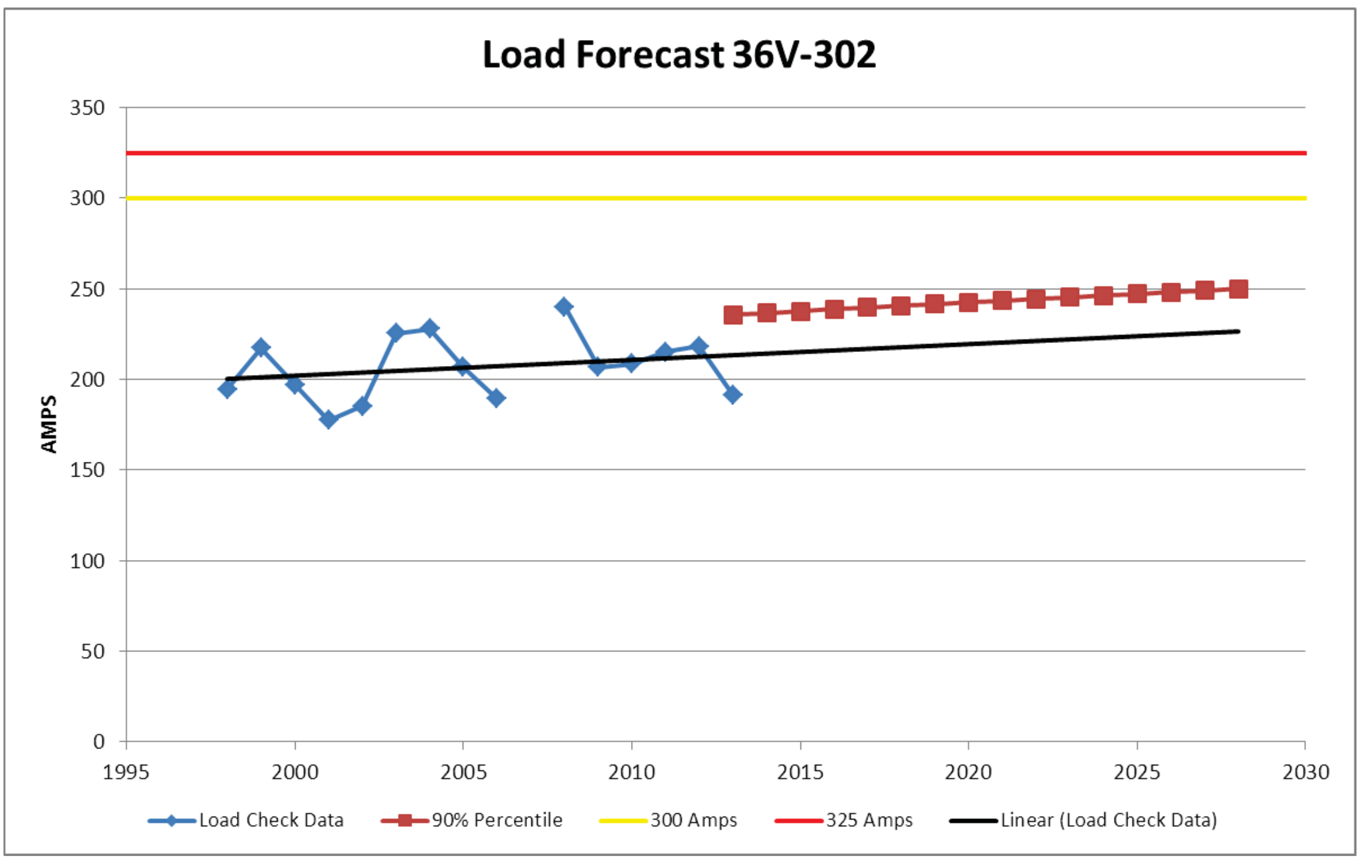


Figure 43 36V-302 Load Forecast

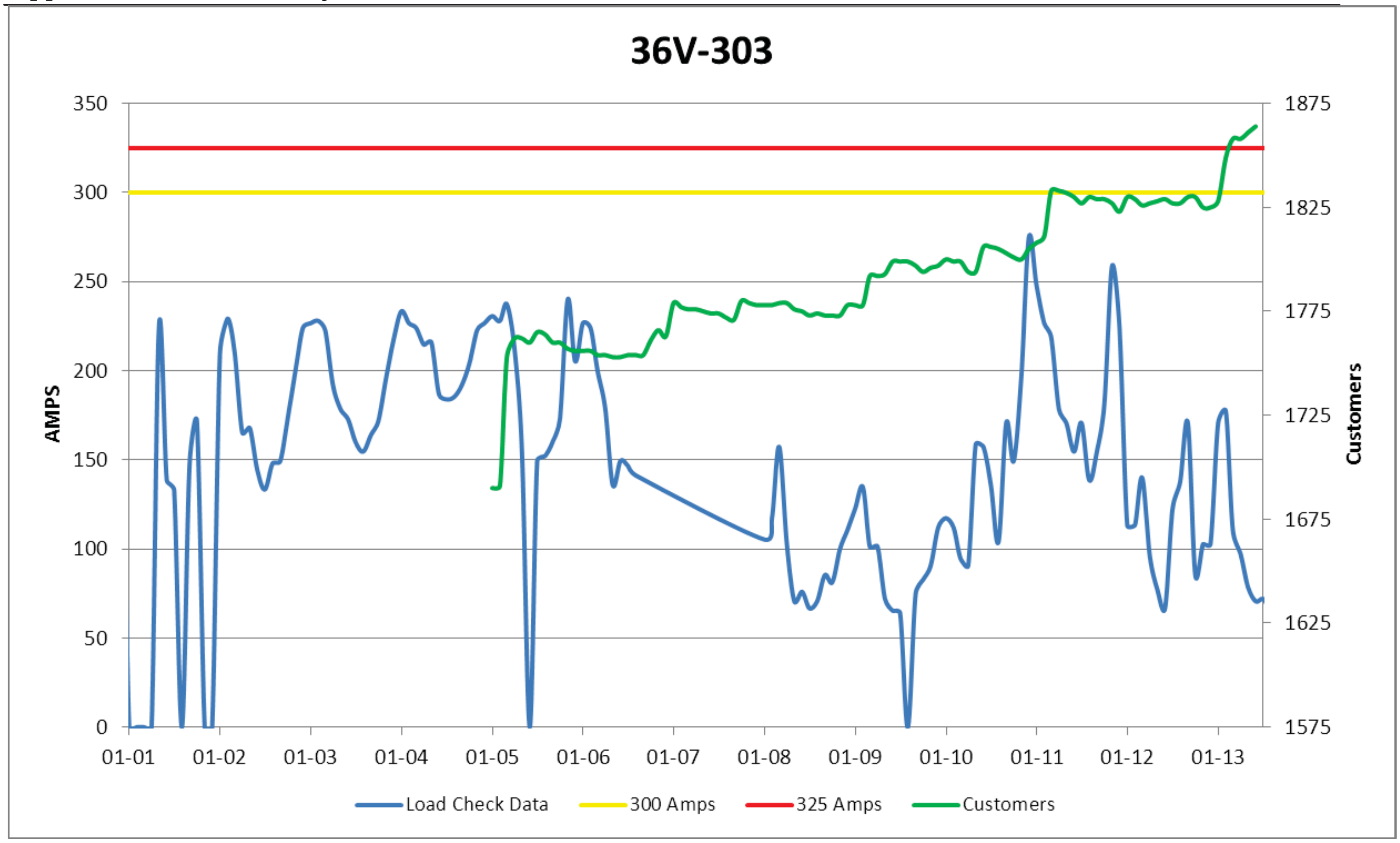


Figure 44 36V-303 Load History

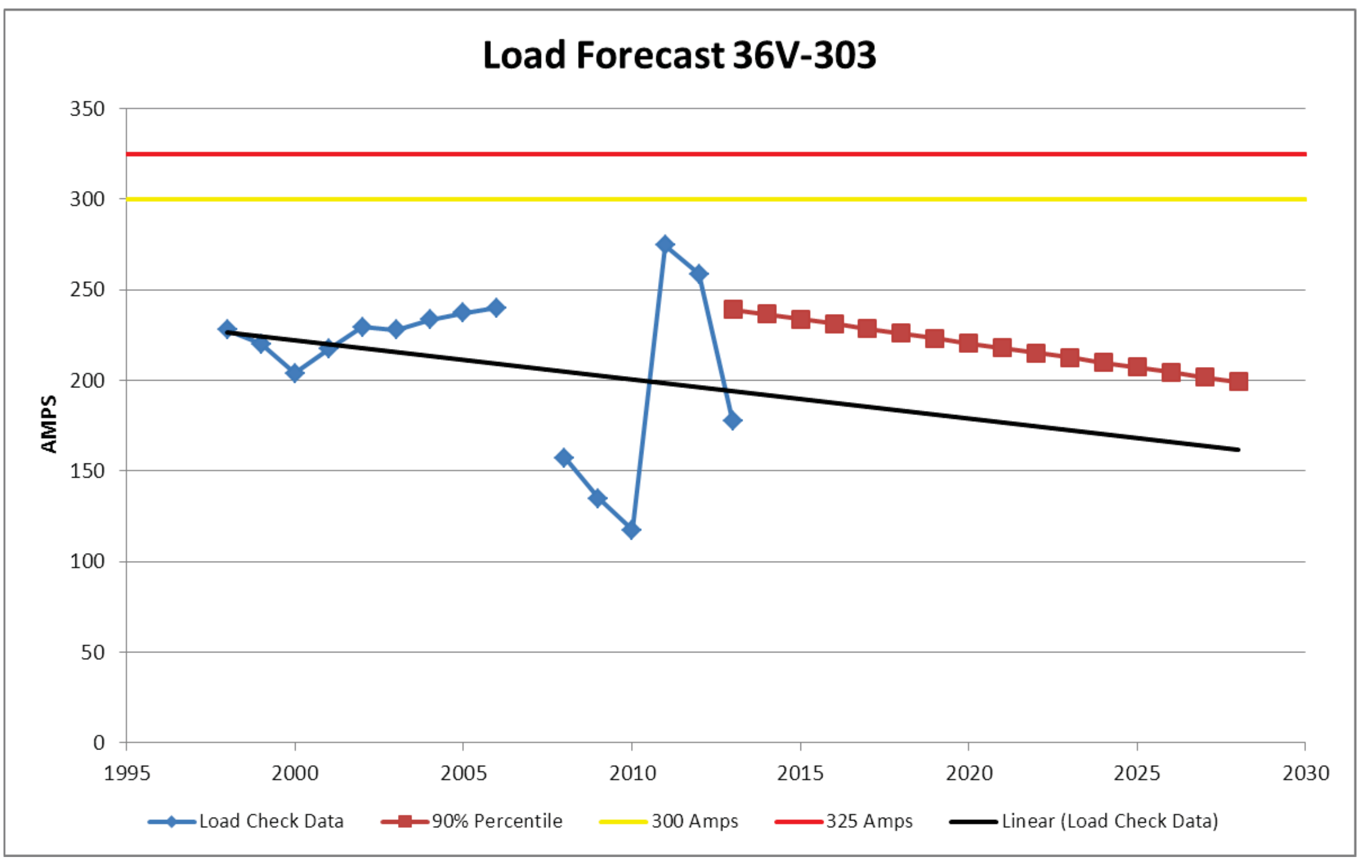


Figure 45 36V-303 Load Forecast

Appendix B: Load History and Forecast

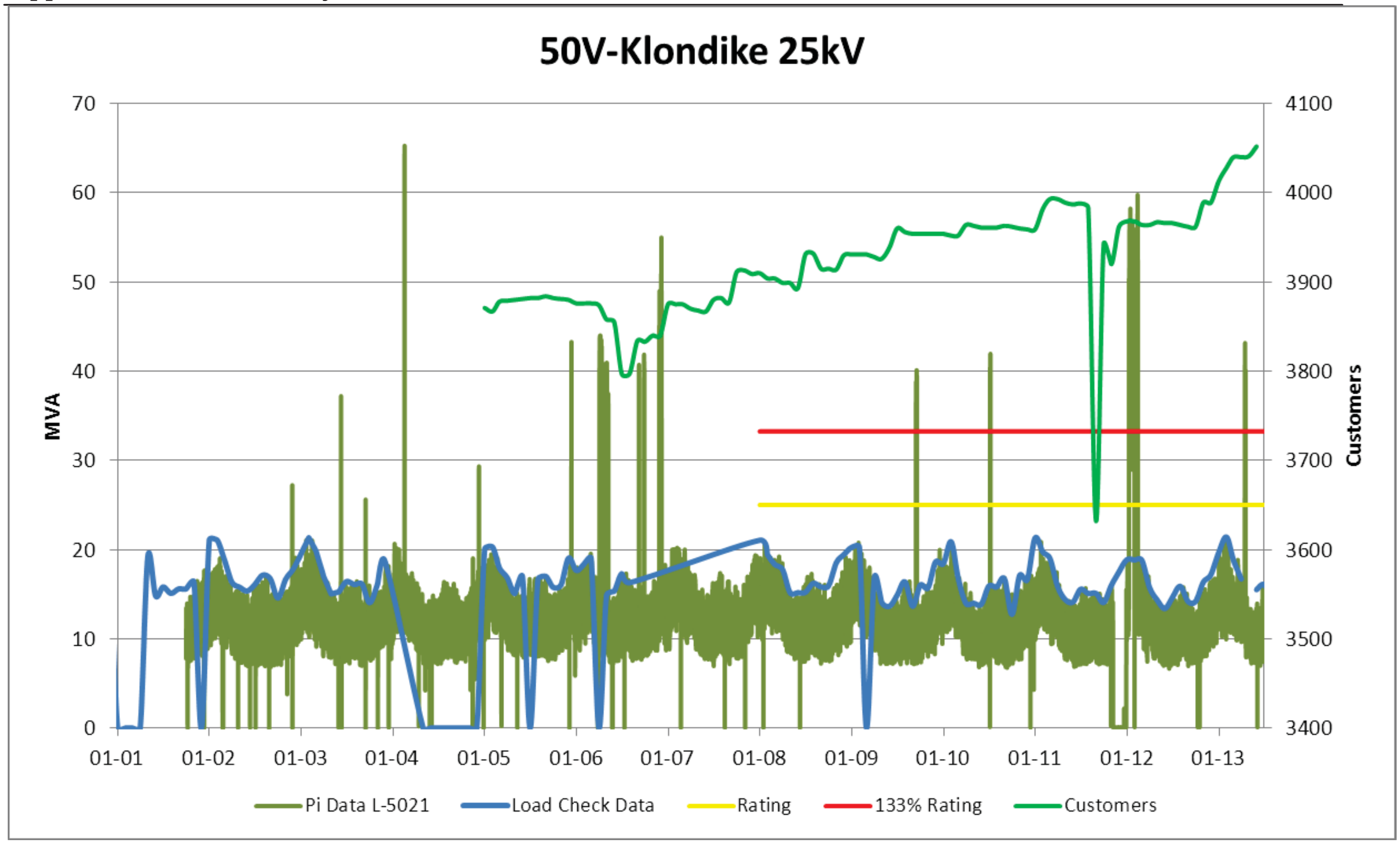


Figure 46 **50V-Klondike Load History**

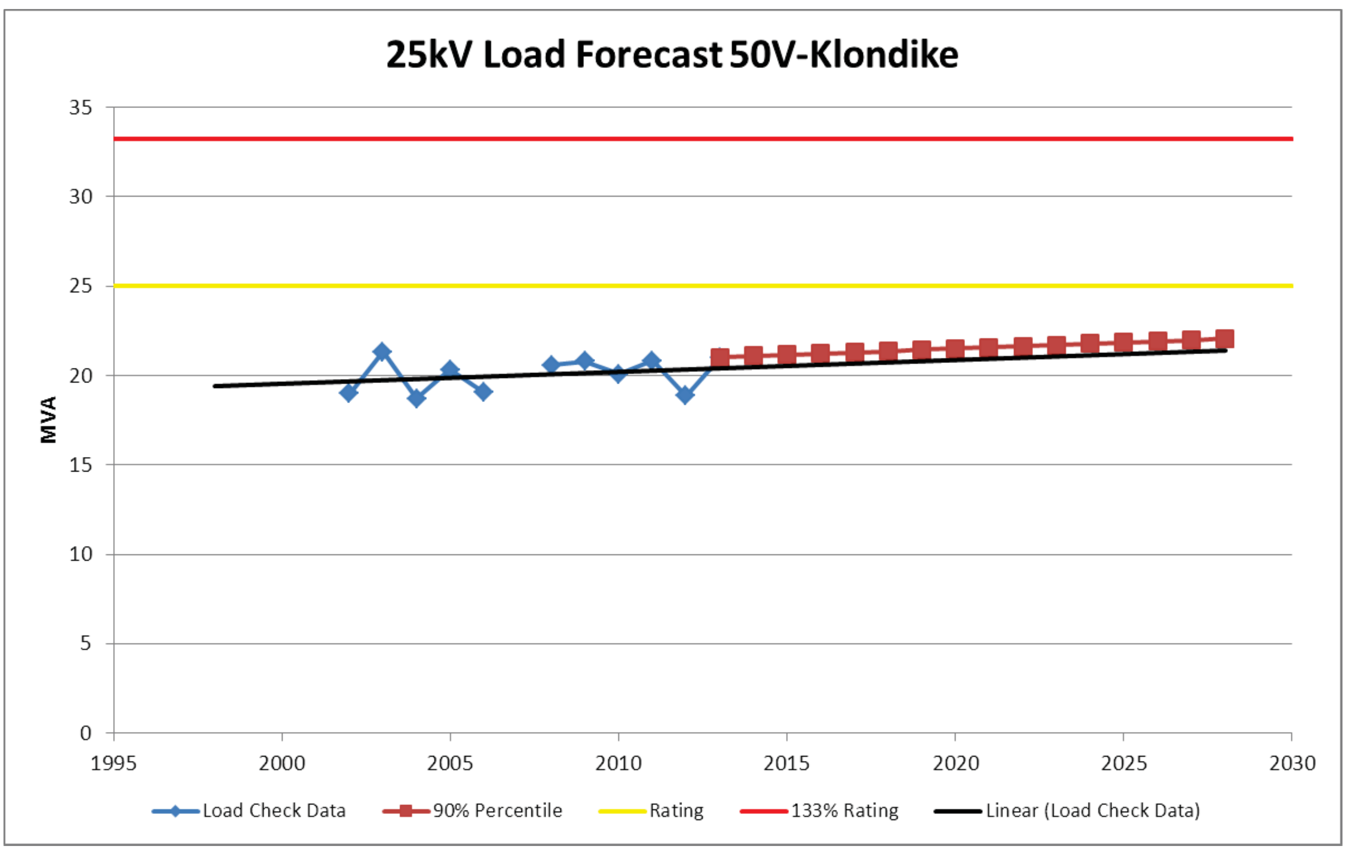


Figure 47 **50V-Klondike Load Forecast**

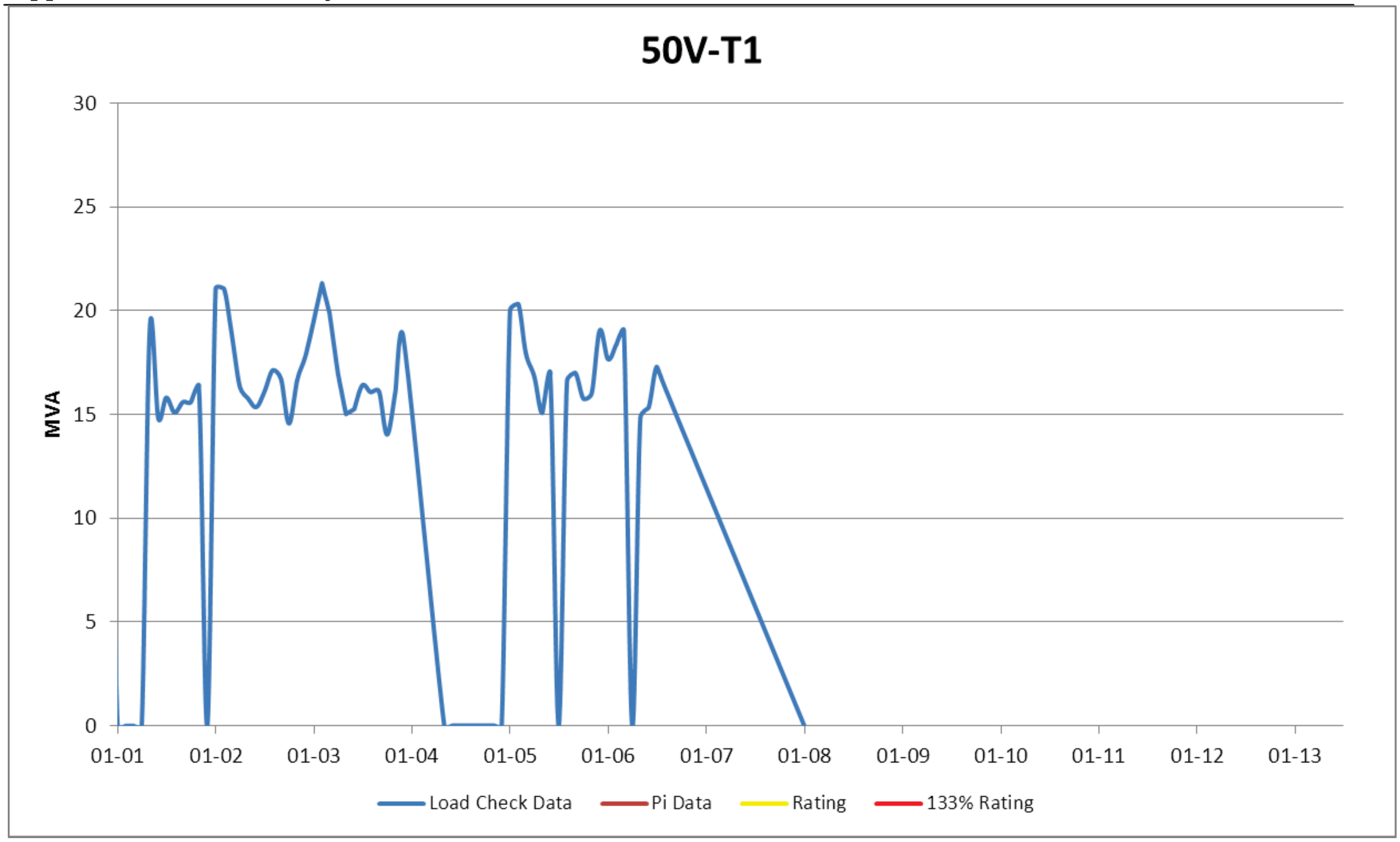


Figure 48 **50V-T1 Load History**

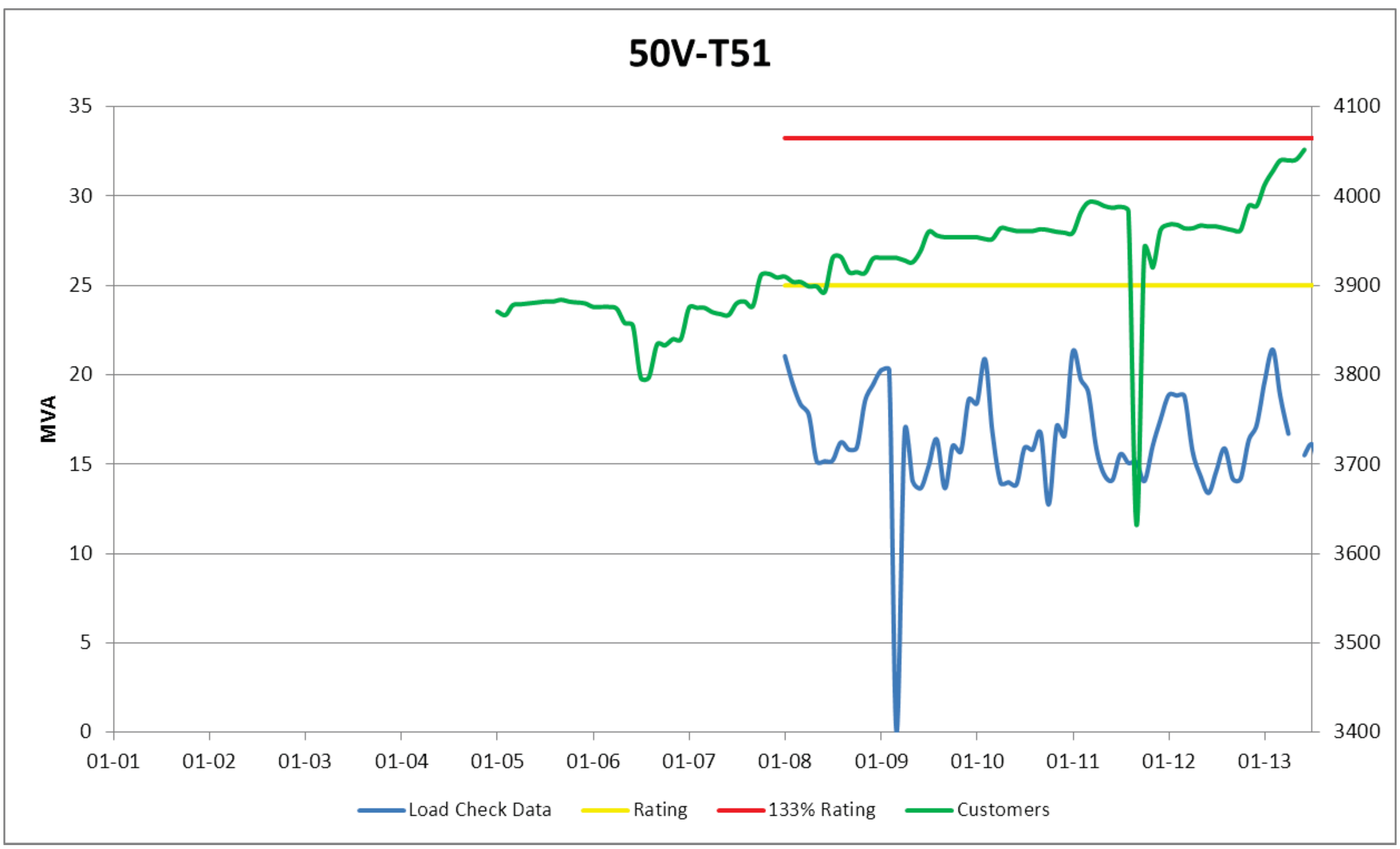


Figure 49 **50V-T51 Load History**

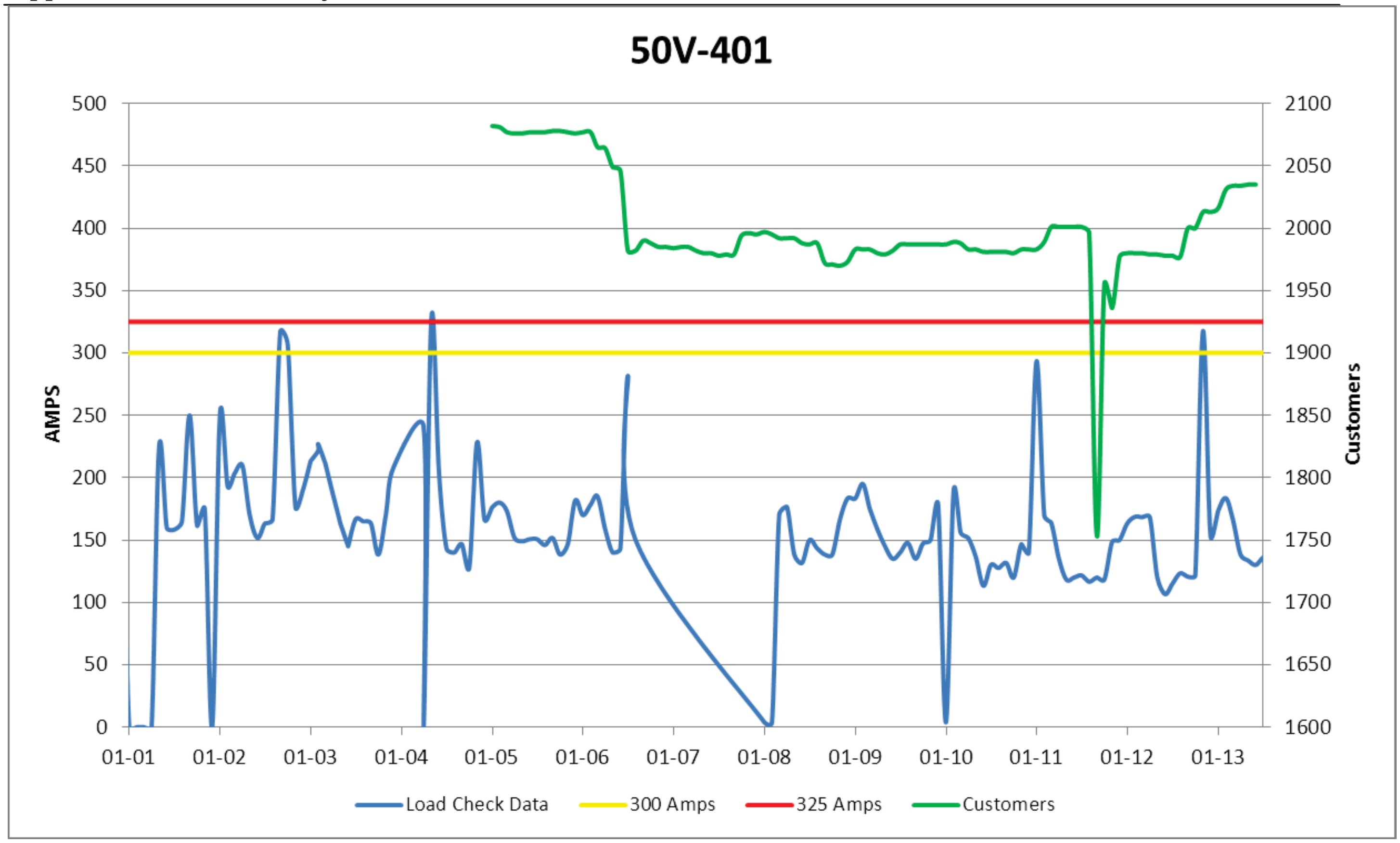


Figure 50 50V-401 Load History

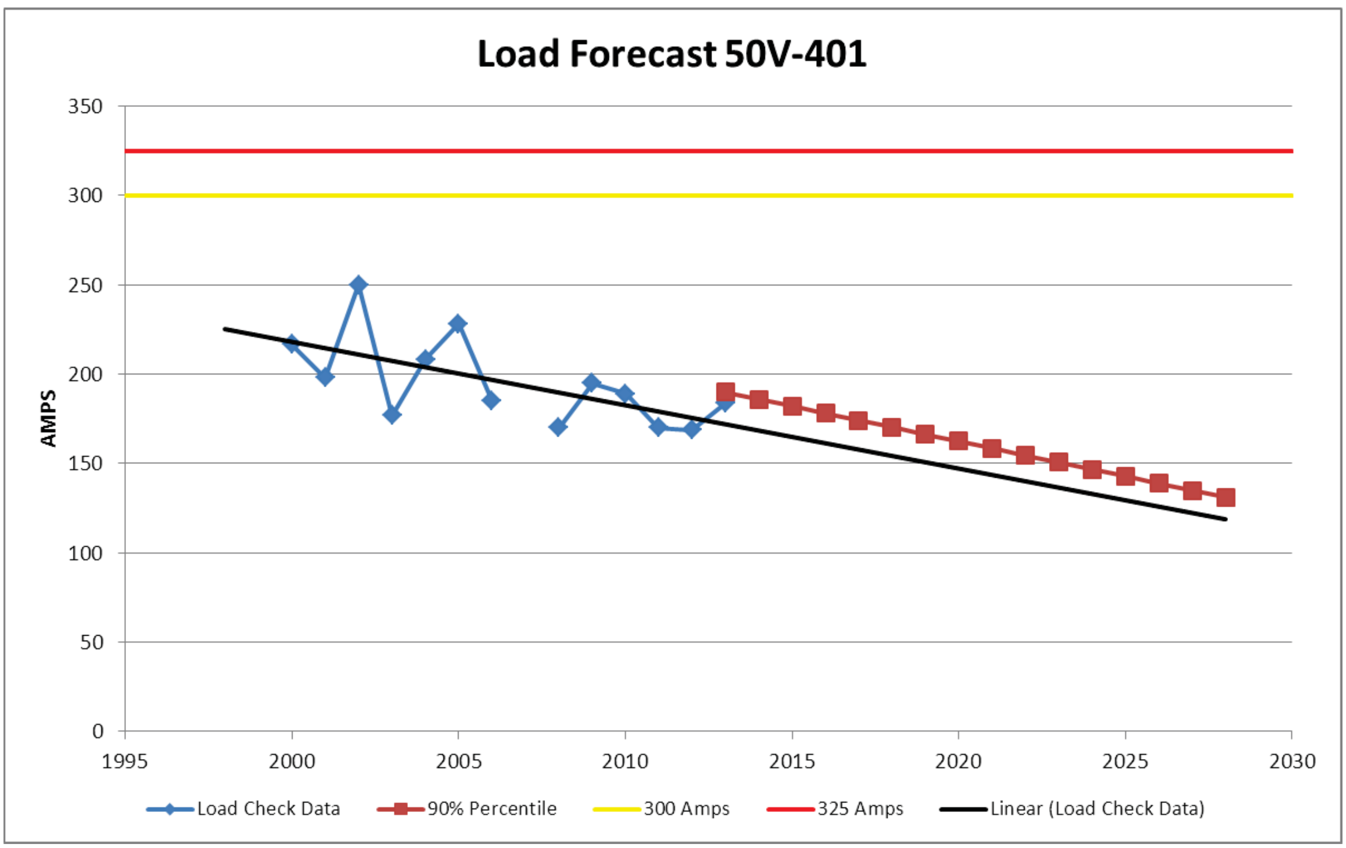


Figure 51 50V-401 Load Forecast

Appendix B: Load History and Forecast

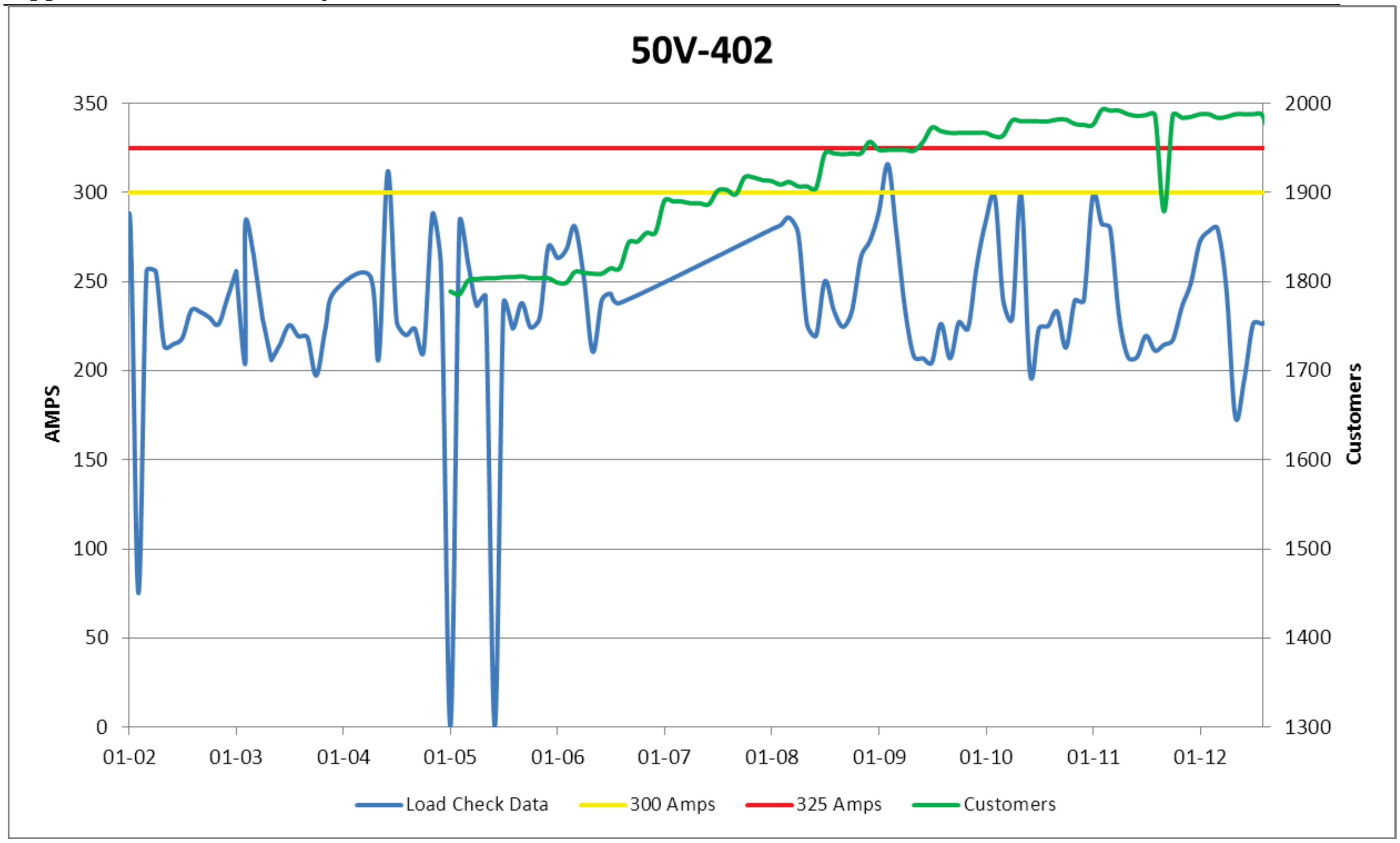


Figure 52 50V-402 Load History

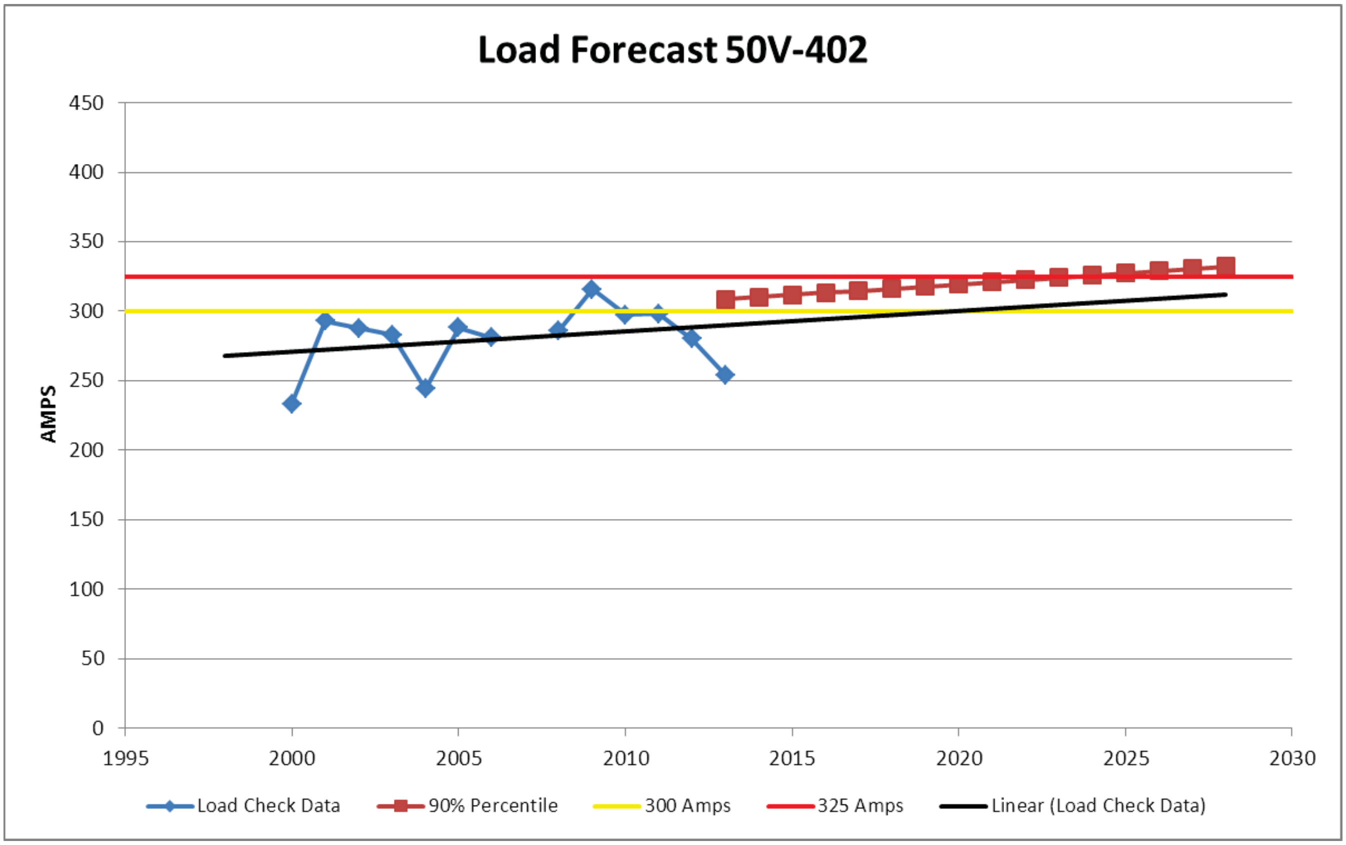


Figure 53 50V-402 Load Forecast

APPENDIX C

Economic Analysis

Summary of Alternatives

99V-Highbury Road
Summary of Alternatives

Nova Scotia POWER An Emera Company

Division :	Distribution Planning	**Date :**	**17-May-13**
Department :	Planning and Performance	**CI Number:**	
Originator :	James MacQueen	**Project No. :**	

	Alternative	After Tax WACC	PV of EVA / NPV	Rank	IRR	Disc Pay
A	Replacement of 36V-Hilaton	6.48%	-1,282,883	3	-7.62%	0.0 years
B	Reconfiguration of 36V-Hilaton and 22V-New Minas Feeders	6.48%	-481,726	1	-7.52%	0.0 years
C	Reconfiguration of 36V-Hilaton with Load transfer to 50V-Klon	6.48%	-1,282,395	2	-7.83%	0.0 years
	0	NA	NA	NA	#NUM!	0.0 years

Recommendation :

This Economic Assessment Model recommends the reconfiguration of 22V-New Minas and 36V-Hilaton feeders.

Notes/Comments :

Replacement of 36V-Hilaton

This alternative will see the replcament of 36V-Hilaton. This will include:
- Replacement of 36V-T1 with a 10/12/15MVA transformer
- Creation of 4th feeder, at 36V-Hilaton
- Reconfiguration of 36V-Hilaton feeders

Reconfiguration of 36V-Hilaton and 22V-New Minas Feeders

This alternative will include:
- Creation of new express feeder from 99V-Highbury Road to Blecher Street
- Reconfiguration of existing feeders north of Cornwallis River

Reconfiguration of 36V-Hilaton with Load transfer to 50V-Klondoke

This alternative will see include:
- The addition of 25-12kV stepdowns
- Conversion of existing 4kV stepdowns

0

2013 EAM Rev-2.xls 5/17/2013

NPV Comparison

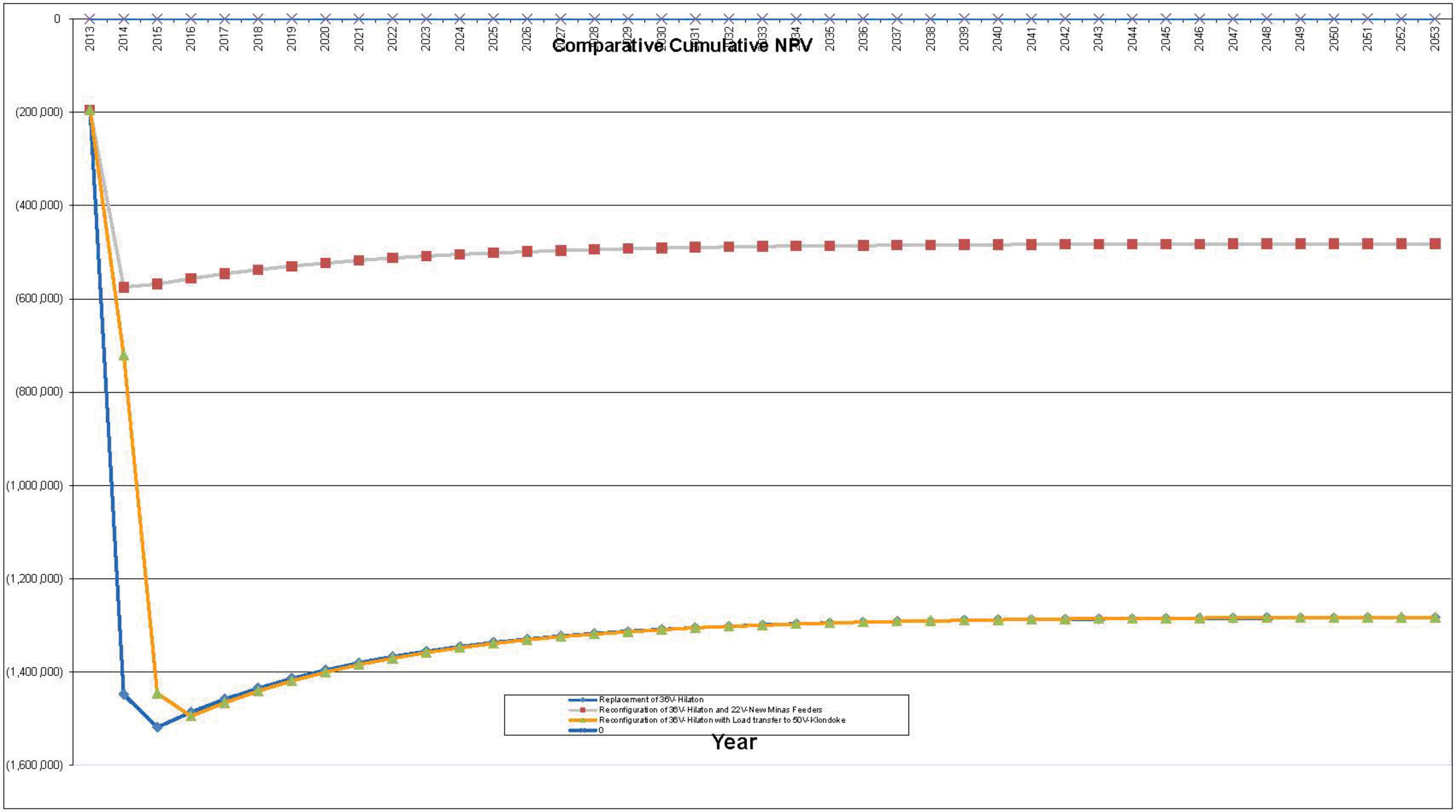


Figure 54 **Economic Assessment Model NPV**

Alternative 1- Replace 36V-T1

Table 7 Alternative 1- Replace 36V-T1

99V-Highbury Road
Replacement of 36V-Hilaton

Year	Total Revenue	Operating Costs	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2013	-	-	(195,000.0)	-	-	(195,000.0)	-	(195,000.0)	(195,000.000)	1.0	(195,000.0)
2014	-	-	#########	-	-	##########	-	(1,334,000.0)	(1,252,817.431)	0.9	(1,447,817.4)
2015	-	-	(100,000.0)	65,160.0	1,563,840.0	(100,000.0)	20,199.6	(79,800.4)	(70,383.196)	0.9	(1,518,200.6)
2016	-	-	-	125,107.2	1,438,732.8	-	38,783.2	38,783.2	32,124.758	0.8	(1,486,075.9)
2017	-	-	-	115,098.6	1,323,634.2	-	35,680.6	35,680.6	27,756.177	0.8	(1,458,319.7)
2018	-	-	-	105,890.7	1,217,743.4	-	32,826.1	32,826.1	23,981.671	0.7	(1,434,338.0)
2019	-	-	-	97,419.5	1,120,324.0	-	30,200.0	30,200.0	20,720.452	0.7	(1,413,617.6)
2020	-	-	-	89,625.9	1,030,698.0	-	27,784.0	27,784.0	17,902.720	0.6	(1,395,714.8)
2021	-	-	-	82,455.8	948,242.2	-	25,561.3	25,561.3	15,468.165	0.6	(1,380,246.7)
2022	-	-	-	75,859.4	872,382.8	-	23,516.4	23,516.4	13,364.680	0.6	(1,366,882.0)
2023	-	-	-	69,790.6	802,592.2	-	21,635.1	21,635.1	11,547.245	0.5	(1,355,334.8)
2024	-	-	-	64,207.4	738,384.8	-	19,904.3	19,904.3	9,976.958	0.5	(1,345,357.8)
2025	-	-	-	59,070.8	679,314.0	-	18,311.9	18,311.9	8,620.212	0.5	(1,336,737.6)
2026	-	-	-	54,345.1	624,968.9	-	16,847.0	16,847.0	7,447.967	0.4	(1,329,289.6)
2027	-	-	-	49,997.5	574,971.4	-	15,499.2	15,499.2	6,435.133	0.4	(1,322,854.5)
2028	-	-	-	45,997.7	528,973.7	-	14,259.3	14,259.3	5,560.032	0.4	(1,317,294.5)
2029	-	-	-	42,317.9	486,655.8	-	13,118.5	13,118.5	4,803.934	0.4	(1,312,490.5)
2030	-	-	-	38,932.5	447,723.3	-	12,069.1	12,069.1	4,150.657	0.3	(1,308,339.9)
2031	-	-	-	35,817.9	411,905.5	-	11,103.5	11,103.5	3,586.218	0.3	(1,304,753.6)
2032	-	-	-	32,952.4	378,953.0	-	10,215.3	10,215.3	3,098.535	0.3	(1,301,655.1)
2033	-	-	-	30,316.2	348,636.8	-	9,398.0	9,398.0	2,677.172	0.3	(1,298,977.9)
2034	-	-	-	27,890.9	320,745.8	-	8,646.2	8,646.2	2,313.108	0.3	(1,296,664.8)
2035	-	-	-	25,659.7	295,086.2	-	7,954.5	7,954.5	1,998.554	0.3	(1,294,666.3)
2036	-	-	-	23,606.9	271,479.3	-	7,318.1	7,318.1	1,726.774	0.2	(1,292,939.5)
2037	-	-	-	21,718.3	249,760.9	-	6,732.7	6,732.7	1,491.954	0.2	(1,291,447.6)
2038	-	-	-	19,980.9	229,780.1	-	6,194.1	6,194.1	1,289.066	0.2	(1,290,158.5)
2039	-	-	-	18,382.4	211,397.7	-	5,698.5	5,698.5	1,113.768	0.2	(1,289,044.7)
2040	-	-	-	16,911.8	194,485.8	-	5,242.7	5,242.7	962.309	0.2	(1,288,082.4)
2041	-	-	-	15,558.9	178,927.0	-	4,823.2	4,823.2	831.447	0.2	(1,287,251.0)
2042	-	-	-	14,314.2	164,612.8	-	4,437.4	4,437.4	718.380	0.2	(1,286,532.6)
2043	-	-	-	13,169.0	151,443.8	-	4,082.4	4,082.4	620.689	0.2	(1,285,911.9)
2044	-	-	-	12,115.5	139,328.3	-	3,755.8	3,755.8	536.283	0.1	(1,285,375.6)
2045	-	-	-	11,146.3	128,182.0	-	3,455.3	3,455.3	463.355	0.1	(1,284,912.3)
2046	-	-	-	10,254.6	117,927.5	-	3,178.9	3,178.9	400.344	0.1	(1,284,511.9)
2047	-	-	-	9,434.2	108,493.3	-	2,924.6	2,924.6	345.902	0.1	(1,284,166.0)
2048	-	-	-	8,679.5	99,813.8	-	2,690.6	2,690.6	298.864	0.1	(1,283,867.1)
2049	-	-	-	7,985.1	91,828.7	-	2,475.4	2,475.4	258.222	0.1	(1,283,608.9)
2050	-	-	-	7,346.3	84,482.4	-	2,277.4	2,277.4	223.107	0.1	(1,283,385.8)
2051	-	-	-	6,758.6	77,723.8	-	2,095.2	2,095.2	192.767	0.1	(1,283,193.0)
2052	-	-	-	6,217.9	71,505.9	-	1,927.6	1,927.6	166.553	0.1	(1,283,026.5)
2053	-	-	-	5,720.5	65,785.4	-	1,773.3	1,773.3	143.904	0.1	(1,282,882.6)
Total	-	-	#########	1,563,214.6		##########	484,596.5	(1,144,403.5)	(1,282,882.6)		

Alternative 2- 99V-Highbury, 22V-New Minas, and 36V-Hillaton Load Transfers

Table 8 Alternative 2- 12kV Load Transfers

99V-Highbury Road
Reconfiguration of 36V-Hilaton and 22V-New Minas Feeders

Year	Total Revenue	Operating Costs	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2013	-	-	(195,000.0)	-	-	(195,000.0)	-	(195,000.0)	(195,000.000)	1.0	(195,000.0)
2014	-	-	(404,500.0)	-	-	(404,500.0)	-	(404,500.0)	(379,883.546)	0.9	(574,883.5)
2015	-	-	-	23,980.0	599,500.0	-	7,433.8	7,433.8	6,556.541	0.9	(568,327.0)
2016	-	-	-	46,041.6	529,478.4	-	14,272.9	14,272.9	11,822.463	0.8	(556,504.5)
2017	-	-	-	42,358.3	487,120.1	-	13,131.1	13,131.1	10,214.750	0.8	(546,289.8)
2018	-	-	-	38,969.6	448,150.5	-	12,080.6	12,080.6	8,825.667	0.7	(537,464.1)
2019	-	-	-	35,852.0	412,298.5	-	11,114.1	11,114.1	7,625.482	0.7	(529,838.6)
2020	-	-	-	32,983.9	379,314.6	-	10,225.0	10,225.0	6,588.509	0.6	(523,250.1)
2021	-	-	-	30,345.2	348,969.4	-	9,407.0	9,407.0	5,692.551	0.6	(517,557.6)
2022	-	-	-	27,917.6	321,051.9	-	8,654.4	8,654.4	4,918.432	0.6	(512,639.2)
2023	-	-	-	25,684.2	295,367.7	-	7,962.1	7,962.1	4,249.584	0.5	(508,389.6)
2024	-	-	-	23,629.4	271,738.3	-	7,325.1	7,325.1	3,671.692	0.5	(504,717.9)
2025	-	-	-	21,739.1	249,999.2	-	6,739.1	6,739.1	3,172.386	0.5	(501,545.5)
2026	-	-	-	19,999.9	229,999.3	-	6,200.0	6,200.0	2,740.980	0.4	(498,804.5)
2027	-	-	-	18,399.9	211,599.4	-	5,704.0	5,704.0	2,368.239	0.4	(496,436.3)
2028	-	-	-	16,927.9	194,671.4	-	5,247.7	5,247.7	2,046.187	0.4	(494,390.1)
2029	-	-	-	15,573.7	179,097.7	-	4,827.9	4,827.9	1,767.930	0.4	(492,622.2)
2030	-	-	-	14,327.8	164,769.9	-	4,441.6	4,441.6	1,527.513	0.3	(491,094.6)
2031	-	-	-	13,181.6	151,588.3	-	4,086.3	4,086.3	1,319.790	0.3	(489,774.8)
2032	-	-	-	12,127.1	139,461.2	-	3,759.4	3,759.4	1,140.314	0.3	(488,634.5)
2033	-	-	-	11,156.9	128,304.3	-	3,458.6	3,458.6	985.245	0.3	(487,649.3)
2034	-	-	-	10,264.3	118,040.0	-	3,181.9	3,181.9	851.264	0.3	(486,798.0)
2035	-	-	-	9,443.2	108,596.8	-	2,927.4	2,927.4	735.502	0.3	(486,062.5)
2036	-	-	-	8,687.7	99,909.0	-	2,693.2	2,693.2	635.483	0.2	(485,427.0)
2037	-	-	-	7,992.7	91,916.3	-	2,477.7	2,477.7	549.065	0.2	(484,878.0)
2038	-	-	-	7,353.3	84,563.0	-	2,279.5	2,279.5	474.398	0.2	(484,403.6)
2039	-	-	-	6,765.0	77,798.0	-	2,097.2	2,097.2	409.886	0.2	(483,993.7)
2040	-	-	-	6,223.8	71,574.1	-	1,929.4	1,929.4	354.146	0.2	(483,639.5)
2041	-	-	-	5,725.9	65,848.2	-	1,775.0	1,775.0	305.987	0.2	(483,333.6)
2042	-	-	-	5,267.9	60,580.3	-	1,633.0	1,633.0	264.376	0.2	(483,069.2)
2043	-	-	-	4,846.4	55,733.9	-	1,502.4	1,502.4	228.424	0.2	(482,840.8)
2044	-	-	-	4,458.7	51,275.2	-	1,382.2	1,382.2	197.361	0.1	(482,643.4)
2045	-	-	-	4,102.0	47,173.2	-	1,271.6	1,271.6	170.523	0.1	(482,472.9)
2046	-	-	-	3,773.9	43,399.3	-	1,169.9	1,169.9	147.334	0.1	(482,325.5)
2047	-	-	-	3,471.9	39,927.4	-	1,076.3	1,076.3	127.298	0.1	(482,198.2)
2048	-	-	-	3,194.2	36,733.2	-	990.2	990.2	109.987	0.1	(482,088.3)
2049	-	-	-	2,938.7	33,794.5	-	911.0	911.0	95.030	0.1	(481,993.2)
2050	-	-	-	2,703.6	31,091.0	-	838.1	838.1	82.107	0.1	(481,911.1)
2051	-	-	-	2,487.3	28,603.7	-	771.1	771.1	70.942	0.1	(481,840.2)
2052	-	-	-	2,288.3	26,315.4	-	709.4	709.4	61.294	0.1	(481,778.9)
2053	-	-	-	2,105.2	24,210.2	-	652.6	652.6	52.959	0.1	(481,725.9)
Total	-	-	(599,500.0)	575,289.8		(599,500.0)	178,339.8	(421,160.2)	(481,725.9)		

Alternative 3- 50V-Klondike 4kV Conversions, 36V-Hillaton Load Transfers

Table 9 Alternative 3- 50V-Klondike 4kV Conversions, 36V-Hillaton Load Transfers

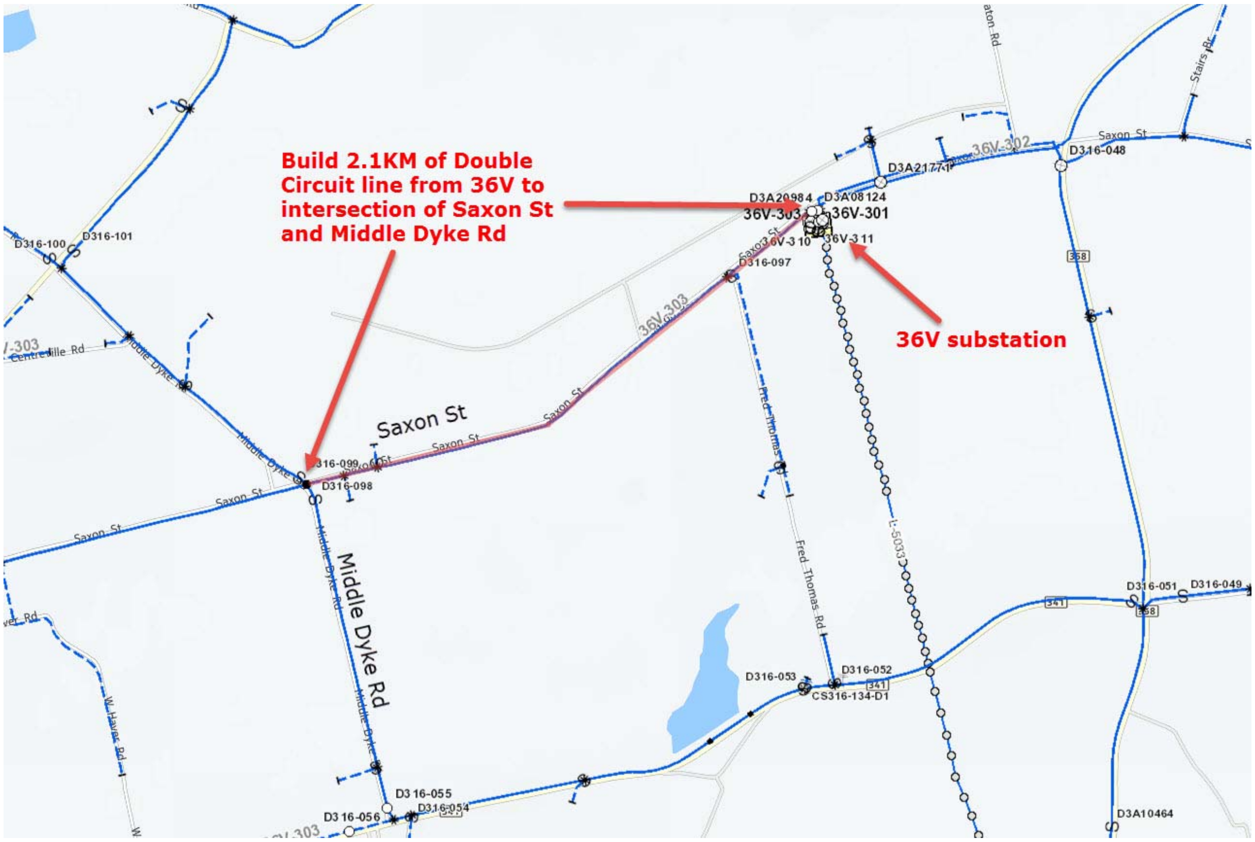
99V-Highbury Road

Reconfiguration of 36V-Hilaton with Load transfer to 50V-Klondoke

Year	Total Revenue	Operating Costs	Capital	CCA	UCC	CFBT	Applicable Taxes	CFAT	PV of CF	Discount Factor	CNPV
2013	-	-	(195,000.0)	-	-	(195,000.0)	-	(195,000.0)	(195,000.000)	1.0	(195,000.0)
2014	-	-	(559,000.0)	-	-	(559,000.0)	-	(559,000.0)	(524,981.217)	0.9	(719,981.2)
2015	-	-	(842,000.0)	63,840.0	1,596,000.0	(842,000.0)	19,790.4	(822,209.6)	(725,181.069)	0.9	(1,445,162.3)
2016	-	-	(100,000.0)	130,572.8	1,501,587.2	(100,000.0)	40,477.6	(59,522.4)	(49,303.363)	0.8	(1,494,465.6)
2017	-	-	-	120,127.0	1,381,460.2	-	37,239.4	37,239.4	28,968.771	0.8	(1,465,496.9)
2018	-	-	-	110,516.8	1,270,943.4	-	34,260.2	34,260.2	25,029.366	0.7	(1,440,467.5)
2019	-	-	-	101,675.5	1,169,267.9	-	31,519.4	31,519.4	21,625.673	0.7	(1,418,841.8)
2020	-	-	-	93,541.4	1,075,726.5	-	28,997.8	28,997.8	18,684.842	0.6	(1,400,157.0)
2021	-	-	-	86,058.1	989,668.4	-	26,678.0	26,678.0	16,143.928	0.6	(1,384,013.1)
2022	-	-	-	79,173.5	910,494.9	-	24,543.8	24,543.8	13,948.548	0.6	(1,370,064.5)
2023	-	-	-	72,839.6	837,655.3	-	22,580.3	22,580.3	12,051.713	0.5	(1,358,012.8)
2024	-	-	-	67,012.4	770,642.9	-	20,773.9	20,773.9	10,412.825	0.5	(1,347,600.0)
2025	-	-	-	61,651.4	708,991.5	-	19,111.9	19,111.9	8,996.806	0.5	(1,338,603.2)
2026	-	-	-	56,719.3	652,272.1	-	17,583.0	17,583.0	7,773.348	0.4	(1,330,829.8)
2027	-	-	-	52,181.8	600,090.4	-	16,176.3	16,176.3	6,716.266	0.4	(1,324,113.6)
2028	-	-	-	48,007.2	552,083.1	-	14,882.2	14,882.2	5,802.935	0.4	(1,318,310.6)
2029	-	-	-	44,166.7	507,916.5	-	13,691.7	13,691.7	5,013.806	0.4	(1,313,296.8)
2030	-	-	-	40,633.3	467,283.2	-	12,596.3	12,596.3	4,331.988	0.3	(1,308,964.8)
2031	-	-	-	37,382.7	429,900.5	-	11,588.6	11,588.6	3,742.890	0.3	(1,305,221.9)
2032	-	-	-	34,392.0	395,508.5	-	10,661.5	10,661.5	3,233.902	0.3	(1,301,988.0)
2033	-	-	-	31,640.7	363,867.8	-	9,808.6	9,808.6	2,794.130	0.3	(1,299,193.9)
2034	-	-	-	29,109.4	334,758.4	-	9,023.9	9,023.9	2,414.162	0.3	(1,296,779.7)
2035	-	-	-	26,780.7	307,977.7	-	8,302.0	8,302.0	2,085.865	0.3	(1,294,693.9)
2036	-	-	-	24,638.2	283,339.5	-	7,637.8	7,637.8	1,802.212	0.2	(1,292,891.7)
2037	-	-	-	22,667.2	260,672.3	-	7,026.8	7,026.8	1,557.133	0.2	(1,291,334.5)
2038	-	-	-	20,853.8	239,818.5	-	6,464.7	6,464.7	1,345.382	0.2	(1,289,989.2)
2039	-	-	-	19,185.5	220,633.1	-	5,947.5	5,947.5	1,162.426	0.2	(1,288,826.7)
2040	-	-	-	17,650.6	202,982.4	-	5,471.7	5,471.7	1,004.350	0.2	(1,287,822.4)
2041	-	-	-	16,238.6	186,743.8	-	5,034.0	5,034.0	867.771	0.2	(1,286,954.6)
2042	-	-	-	14,939.5	171,804.3	-	4,631.2	4,631.2	749.764	0.2	(1,286,204.8)
2043	-	-	-	13,744.3	158,060.0	-	4,260.7	4,260.7	647.805	0.2	(1,285,557.0)
2044	-	-	-	12,644.8	145,415.2	-	3,919.9	3,919.9	559.712	0.1	(1,284,997.3)
2045	-	-	-	11,633.2	133,782.0	-	3,606.3	3,606.3	483.597	0.1	(1,284,513.7)
2046	-	-	-	10,702.6	123,079.4	-	3,317.8	3,317.8	417.834	0.1	(1,284,095.9)
2047	-	-	-	9,846.4	113,233.0	-	3,052.4	3,052.4	361.014	0.1	(1,283,734.9)
2048	-	-	-	9,058.6	104,174.4	-	2,808.2	2,808.2	311.920	0.1	(1,283,423.0)
2049	-	-	-	8,334.0	95,840.5	-	2,583.5	2,583.5	269.503	0.1	(1,283,153.5)
2050	-	-	-	7,667.2	88,173.2	-	2,376.8	2,376.8	232.854	0.1	(1,282,920.6)
2051	-	-	-	7,053.9	81,119.4	-	2,186.7	2,186.7	201.188	0.1	(1,282,719.4)
2052	-	-	-	6,489.5	74,629.8	-	2,011.8	2,011.8	173.829	0.1	(1,282,545.6)
2053	-	-	-	5,970.4	68,659.4	-	1,850.8	1,850.8	150.190	0.1	(1,282,395.4)
Total	-	-	#########	1,627,340.6		##########	504,475.6	(1,191,524.4)	(1,282,395.4)		

CI Number: 46251

Title: 36V-303 Saxon Double Circuit



CI Number: 43203

Title: 58C-405 / 11C Belle Cote Phase 1

Start Date:	2015/02
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	Distribution
Forecast Amount:	$339,419

DESCRIPTION:

This project is Phase 1 of a two phase project to replace deteriorated poles and remove the deteriorated 11C Belle Cote distribution substation. The first phase of this project will re-route a portion of primary feeder 58C-405 to roadside through a 700 metre extension of two phases and construction of a 400 metre three phase line along the East Margaree Road and install a stepdown transformer. Phase 2 of this project, to be completed in 2016, will convert the remaining 25 kV customers to 12 kV, remove 11C Belle Cote substation and remove the deteriorated off-road 25 kV feeder.

Summary of Related CIs (+/- 2 years):
2016 CI TBD 58C-405 Belle Cote Phase 2 $TBD

JUSTIFICATION:

Justification Criteria: Distribution System

Sub Criteria: Deteriorated Conductor

Why do this project?

The main line of 58C-405 is located off-road which limits NS Power's access and can reduce the reliability of the line. Also, the poles are greater than 40 years old and are deteriorated to the point that climbing is not recommended, limiting NS Power’s maintenance options. This line feeds a small deteriorated 11C distribution substation at Belle Cote where the equipment, including a voltage regulator and step down transformer, is near the end of its useful life.

Why do this project now?

This project should be completed now in order to ensure the reliability of the main line on primary feeder 58C-405. This Phase 1 work must be completed to allow for retirement of the end of life equipment at 11C Belle Cote substation in Phase 2 of the project in 2016.

Why do this project this way?

Re-routing this section of primary feeder to roadside will improve the reliability in the area by reducing the response time to outages on this section of line. The completion of this project in 2015 will facilitate the removal of the 11C Belle Cote substation in 2016, which has reached the end of its useful life. Completing both phases of the project will assist in the future creation of a transfer scheme between 58C-405 and 103C-314 to improve reliability to this area.

This work will be completed by external resources.

CI Number : 43203 - 58C-405 / 11C Belle Cote Phase 1 **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
094		094 - Interest Capitalized		4,255	0	4,255
095		095-COPS Contracts AO		38,182	0	38,182
013	002	013 - COPS Contracts	002 - DP - Land Rights	15,000	0	15,000
020	002	020 - Royalties, Easements, App	002 - DP - Land Rights	13,500	0	13,500
013	004	013 - COPS Contracts	004 - DP - Misc.Equipment	1,384	0	1,384
012	035	012 - Materials	035 - DP - Wood Poles	19,889	0	19,889
013	035	013 - COPS Contracts	035 - DP - Wood Poles	83,411	0	83,411
066	035	066 - Other Goods & Services	035 - DP - Wood Poles	15,000	0	15,000
012	039	012 - Materials	039 - DP - O/H Cond.	5,321	0	5,321
013	039	013 - COPS Contracts	039 - DP - O/H Cond.	34,766	0	34,766
012	040	012 - Materials	040 - DP - O/H Cond.Devices	1,072	0	1,072
013	040	013 - COPS Contracts	040 - DP - O/H Cond.Devices	6,315	0	6,315
012	041	012 - Materials	041 - DP - O/H Line Transf.	49,787	0	49,787
013	041	013 - COPS Contracts	041 - DP - O/H Line Transf.	13,754	0	13,754
013	050	013 - COPS Contracts	050 - DP - Street Lights	433	0	433
012	052	012 - Materials	052 - DP - Services	602	0	602
013	052	013 - COPS Contracts	052 - DP - Services	4,636	0	4,636
001	085	001 - Regular Labour (No AO)	085 Design	4,709	0	4,709
066	085	066 - Other Goods & Services	085 Design	24,084	0	24,084
012	090	012 - Materials	090 - DP - LED Street Lights	2,455	0	2,455
013	090	013 - COPS Contracts	090 - DP - LED Street Lights	865	0	865
			Total Cost:	339,419	0	339,419
			Original Cost:	20,686		

Capital Project Detailed Estimate

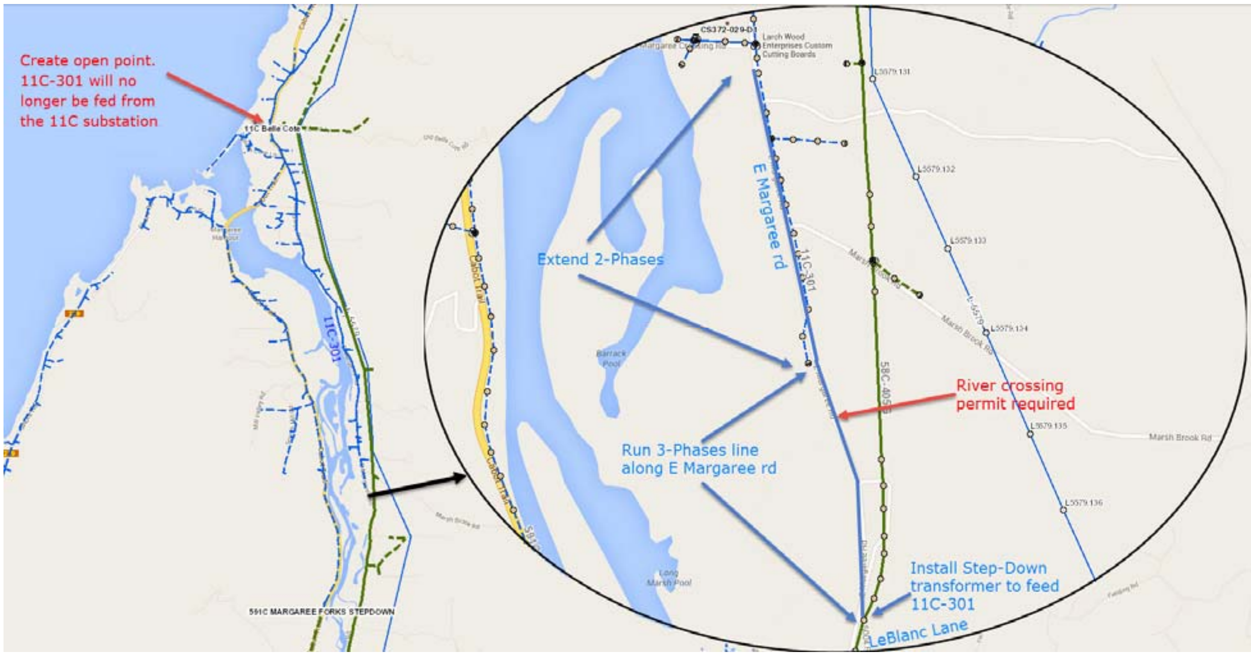
Location: Distribution
CI# / FP#: 43203
Title: 58C-405 / 11C Belle Cote Phase 1
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
Procurement / Financial (No AO)	Lot	1	$ 4,709	$ 4,709.33		
			Sub-Total	$ 4,709.33		
012 Materials						
Wood Poles	Lot	1	$ 19,889.33	$ 19,889.33		
Overhead Conductor	Lot	1	$ 5,321.28	$ 5,321.28		
Overhead Conductor Devices	Lot	1	$ 1,071.63	$ 1,071.63		
Overhead Line Tranformers	Lot	1	$ 49,786.62	$ 49,786.62		
Services	Lot	1	$ 601.68	$ 601.68		
Streetlights	Lot	1	$ 2,455.40	$ 2,455.40		
			Sub-Total	$ 79,125.94		
013 Contracts						
Contract Line Work	Hrs	[redacted]		$ 115,093.12		
Tree Trimmng	Lot	1	$ 15,000.00	$ 15,000.00		
Backhoe	Lot	1	$ 17,700.00	$ 17,700.00		
Traffic Control	Lot	1	$ 12,770.00	$ 12,770.00		
	Lot	1				
			Sub-Total	$ 160,563.12		
020 Easements						
Easements	Lot	1	$ 13,500.00	$ 13,500.00		
			Sub-Total	$ 13,500.00		
066 Other Goods & Services						
Permit	Lot	1	$ 15,000.00	$ 15,000.00		
Contingency on Contracts	%	15%	$ 160,563.12	$ 24,084.47		
				$ -		
			Sub-Total	$ 39,084.47		
094 Interest Capitalized						
AFUDC				$ 4,254.68		
				$ -		
				$ -		
			Sub-Total	$ 4,254.68		
095 Administrative Overhead						
COPS Contract AO				$ 38,181.91		
				$ -		
			Sub-Total	$ 38,181.91		
			SUB-TOTAL (no AO, AFUDC)	$ 296,982.86		
			TOTAL (AO, AFUDC included)	$ 339,419.45		
Original Cost				$ 20,686.05		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 43203

Title: 58C-405 Belle Cote Phase 1



CI Number: 45003

Title: 2015 Hydraulic Recloser Replacements

Start Date:	2015/03
In-Service Date:	2015/03
Final Cost Date:	2016/05
Function:	Distribution
Forecast Amount:	$260,524

DESCRIPTION:

This project includes the replacement of hydraulic reclosers with electronic reclosers. In 2015, we plan to replace seven hydraulic reclosers on the distribution system. Reclosers are a heavy duty power switch capable of detecting abnormal power flows, then automatically opening and closing according to preset instructions.

Summary of Related CIs (+/- 2 years):
2016 CI TBD 2016 Hydraulic Recloser Replacements $TBD
2017 CI TBD 2017 Hydraulic Recloser Replacements $TBD

JUSTIFICATION:

Justification Criteria: Distribution Plant

Sub Criteria: Equipment Replacement

Why do this project?

This project is required to improve distribution system reliability. An estimated 9,000 customer hours of interruption will be avoided annually through the replacement of these seven hydraulic reclosers.

Why do this project now?

The hydraulic reclosers being targeted were manufactured between 1956 and 1989, with an average age of 39 years. They are at their end of life, and pose a reliability risk through failure of the device and subsequent reduction in protection on the distribution feeder.

Why do this project this way?

Replacement of the targeted reclosers prior to failure is the most cost effective approach, and minimizes the reliability impact and exposure of the targeted feeders. Additionally, the replacement electronic reclosers have the capability to provide a status (open/closed) indication to the distribution control centre should the communication network be expanded to incorporate these locations.

CI Number : 45003 - 2015 Hydraulic Recloser Replacements **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D OT Labour AO		1,148	0	1,148
092		092-Vehicle T&D Reg. Labour AO		14,147	0	14,147
095		095-COPS Contracts AO		7,491	0	7,491
095		095-COPS Overtime Labour AO		1,771	0	1,771
095		095-COPS Regular Labour AO		21,824	0	21,824
001	035	001 - T&D Regular Labour	035 - DP - Wood Poles	3,607	0	3,607
002	035	002 - T&D Overtime Labour	035 - DP - Wood Poles	1,082	0	1,082
012	035	012 - Materials	035 - DP - Wood Poles	7,000	0	7,000
001	040	001 - T&D Regular Labour	040 - DP - O/H Cond.Devices	10,820	0	10,820
002	040	002 - T&D Overtime Labour	040 - DP - O/H Cond.Devices	3,246	0	3,246
012	040	012 - Materials	040 - DP - O/H Cond.Devices	140,000	0	140,000
013	040	013 - COPS Contracts	040 - DP - O/H Cond.Devices	31,500	0	31,500
001	085	001 - Regular Labour (No AO)	085 Design	3,343	0	3,343
001	085	001 - T&D Regular Labour	085 Design	7,287	0	7,287
011	085	011 - Travel Expense	085 Design	1,000	0	1,000
041	085	041 - Meals & Entertainment	085 Design	300	0	300
001	086	001 - T&D Regular Labour	086 Commissioning	4,960	0	4,960
			Total Cost:	260,524	0	260,524
			Original Cost:	51,531		

Capital Project Detailed Estimate

Location: Distribution
CI# / FP#: 45003
Title: 2015 Hydraulic Recloser Replacements
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - PLT	PD	40	$ 360.65	$ 14,426.00		
T&D Labour - Electrician/Technician	PD	14	$ 354.26	$ 4,959.64		
T&D Labour - Design	PD	21	$ 347.00	$ 7,287.00		
Project Support (No AO)	Lot	1	$ 3,343.49	$ 3,343.49		
			Sub-Total	$ 30,016.13		
002 OT Labour						
T&D Labour - PLT	PD	6	$ 721.30	$ 4,327.82		
			Sub-Total	$ 4,327.82		
011 Travel Expense						
Travel - Engineering	Lot	1	$ 1,000.00	$ 1,000.00		
				$ -		
				$ -		
			Sub-Total	$ 1,000.00		
012 Materials						
OH Conductor Devices, Reclosers	ea	7	$ 20,000.00	$ 140,000.00		
Poles	ea	7	$ 1,000.00	$ 7,000.00		
				$ -		
				$ -		
			Sub-Total	$ 147,000.00		
013 Contracts						
Traffic Control	ea	1	$ 21,000.00	$ 21,000.00		
Crane	days	7	$ 1,500.00	$ 10,500.00		
				$ -		
				$ -		
			Sub-Total	$ 31,500.00		
041 Meals & Entertainment						
Meals - Engineering	Lot	1	$ 300.00	$ 300.00		
				$ -		
				$ -		
			Sub-Total	$ 300.00		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 14,147.17		
Vehicle T&D Labour Overtime AO				$ 1,147.74		
				$ -		
			Sub-Total	$ 15,294.91		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 21,823.55		
COPS T&D Labour Overtime AO				$ 1,770.51		
COPS Contract AO				$ 7,490.70		
				$ -		
			Sub-Total	$ 31,084.77		
			SUB-TOTAL (no AO, AFUDC)	$ 214,143.95		
			TOTAL (AO, AFUDC included)	$ 260,523.62		
Original Cost				$ 51,531.39		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

General Plant

Telecommunications

CI Number: 46307

Title: 2015 Multiplexer Network Upgrade

Start Date: 2015/02
In-Service Date: 2015/11
Final Cost Date: 2016/05
Function: General Plant
Forecast Amount: $446,538

DESCRIPTION:

This project is for the deployment of a new network technology as a replacement for NS Power's 3600 Newbridge Mainstreet multiplexer network that was manufacturer discontinued over five years ago. This network carries data which is essential to the safe control of the power system and the effective operation of the business activities.

This deployment will target 10 multiplexers of the 130 multiplexers NS Power has in its network. This will allow NS Power to start moving some traffic off the old network, including voice, mobile radio, SCADA/RTU and IT network, to this new platform. This is part of an ongoing program to replace this MD multiplexer equipment to allow the NS Power telecommunication network to reliably support critical infrastructure communications during routine operations and periods of increased demand, such as during storm events.

Summary of Related CIs (+/- 2 years):
2014 – CI 44967 2014 Multiplexer Network Upgrades $435,618
2016 – CI TBD 2016 Multiplexer Network Upgrades $TBD

JUSTIFICATION:

Justification Criteria: Work Support Facilities

Sub Criteria: Telecommunication

Why do this project?

Replacement of the multiplexer equipment at these sites is required to maintain reliability and provide the required system capacity of the telecom network infrastructure. This network carries data which is essential to the safe control of the power system and the effective operation of the business activities.

Why do this project now?

The existing 3600 Newbridge Mainstreet multiplexer network carries most of NS Power's telecommunications traffic including critical teleprotection communication, SCADA/RTU, voice traffic such as System Operations Phones and internal PBX network trunks and corporate IT network traffic. This equipment was manufacturer discontinued over 5 years ago. By starting to move to a newer platform we will be able to transition the 3600/3630 Newbridge network over time without jeopardizing the network reliability that is necessary to support the operation of NS Power's critical infrastructure.

Why do this project this way?

Replacing the obsolete 3600 Newbridge Mainstreet multiplexer equipment with more modern technology will maintain the reliability of the NS Power telecommunications network supporting NS Power critical infrastructure. This project will allow for the installation of new multiplexer equipment complete with the required redundancy. This new equipment will allow the NS Power telecom network to transition to a full IP network platform. This will ensure that these sites share the same spares, common maintenance practices, training and expertise. This new multiplexer equipment will interface with our new network manager 5620 Service Access Multiplexer (SAM) that is now in service.

CI Number : 46307 - 2015 Multiplexer Network Upgrades **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		28,576	0	28,576
094		094 - Interest Capitalized		15,829	0	15,829
095		095-COPS Regular Labour AO		44,082	0	44,082
001	059	001 - T&D Regular Labour	059 - GP - Multiplex	34,098	0	34,098
012	059	012 - Materials	059 - GP - Multiplex	212,750	0	212,750
028	059	028 - Consulting	059 - GP - Multiplex	50,400	0	50,400
056	059	056 - Training & Development	059 - GP - Multiplex	33,275	0	33,275
001	085	001 - Regular Labour (No AO)	085 Design	4,255	0	4,255
001	085	001 - T&D Regular Labour	085 Design	19,779	0	19,779
011	085	011 - Travel Expense	085 Design	3,000	0	3,000
041	085	041 - Meals & Entertainment	085 Design	495	0	495
			Total Cost:	446,538	0	446,538
			Original Cost:	313,380		

Capital Project Detailed Estimate

Location: General Plant
CI# / FP#: 46307
Title: 2015 Multiplexer Network Upgrades
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	96	$ 354	$ 34,097.53		
T&D Labour - Design	PD	57	$ 347	$ 19,779.00		
Procurement / Financial (No AO)	Lot	1	$ 4,255	$ 4,255.00		
			Sub-Total	$ 58,131.53		
011 Travel Expense						
Hotel	lot	1	$ 3,000.00	$ 3,000.00		
				$ -		
				$ -		
			Sub-Total	$ 3,000.00		
012 Materials						
MPLS Routers	lot	10	$ 18,000	$ 180,000.00		
5650 CPAM	lot	1	$ 13,750	$ 13,750.00		
7701 Control Plane Assurance Appliance	lot	1	$ 11,000	$ 11,000.00		
Miscellaneous Hardware	lot	1	$ 8,000	$ 8,000.00		
			Sub-Total	$ 212,750.00		
028 Consulting						
Alcatel-Lucent	Hrs	168	$ 300	$ 50,400.00		
			Sub-Total	$ 50,400.00		
041 Meals & Entertainment						
Meals	lot	1	$ 495	$ 495.00		
			Sub-Total	$ 495.00		
056 Training						
5620 SAM IP/MPLS Services Provisioning	lot	1	$ 33,275	$ 33,275.00		
			Sub-Total	$ 33,275.00		
094 Interest Capitalized						
AFUDC				$ 15,828.98		
			Sub-Total	$ 15,828.98		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 28,576.11		
			Sub-Total	$ 28,576.11		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 44,081.77		
			Sub-Total	$ 44,081.77		
			SUB-TOTAL (no AO, AFUDC)	$ 358,051.53		
			TOTAL (AO, AFUDC included)	$ 446,538.39		
Original Cost				$ 313,380.00		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46308

Title: 2015 Microwave System Capacity Upgrade

Start Date:	2015/02
In-Service Date:	2015/11
Final Cost Date:	2016/05
Function:	General Plant
Forecast Amount:	$316,142

DESCRIPTION:

NS Power's microwave system carries NS Power's telecommunication traffic including teleprotection, Remote Terminal Unit (RTU), all voice traffic including internal Private Branch Exchange (PBX) network and corporate IT traffic. This project is for the capacity upgrade for one hop on the Western Microwave Links. These links are approaching their traffic capacity limit, and will reach their limits in the near future due to traffic growth. The second part of this project is to expand the existing network by one hop to help with SCADA RTU expansion.

Summary of Related CIs (+/- 2 years):
2013 CI 43190 Replace Microwave Radio System 2013 $351,087
2014 CI 44966 2014 Replace Microwave Radio System $397,729

JUSTIFICATION:

Justification Criteria: Work Support Facilities

Sub Criteria: Telecommunication

Why do this project?

This project is for capacity upgrade between 421W Bridgewater radio and 408W Great Hill radio, as well as the addition of a new hop between Nuttby Radio and Mt. Pleasant Radio.

Why do this project now?

This link is approaching its traffic capacity limits. It carries the entire NS Power telecommunication traffic including teleprotection, RTU, all voice traffic including internal PBX network and corporate IT traffic. This makes these telecommunications links critical to safe and effective system and business operations. Increasing the capacity will give NS Power room to add additional services and slowly migrate from Time Division Multiplexing (TDM) network to Internal Protocol (IP) network. The new hop addition is to help with SCADA RTU expansion. This RTU expansion extends the portion of the power system that is under real time control by System Operators at the Control Centre.

Why do this project this way?

The capacity upgrade kit is the most efficient and cost effective way of achieving the necessary performance improvements for these portions of the South Shore Microwave Radio Systems. Purchasing new radios for the new capacity would cost approximately $72,000 per radio link versus the cost of approximately $52,000 per radio link for the capacity upgrade kit. The upgrade kit includes new power amplifiers, new oscillator boards, new filters, new crystals and new capacity keys. The upgrade kit can be easily implemented in the field without an outage or interruption to the radio system network. For the 408N Nuttby to 413N Mt Pleasant microwave radio link, this link will be a new Frequency Diversity protected radio link necessary for constant expansion demand.

The alternative of moving our non-critical traffic over to a third party was investigated and found to be more costly than this investment.

CI Number : 46308 - 2015 Microwave System Capacity Upgrade **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		12,876	0	12,876
094		094 - Interest Capitalized		12,155	0	12,155
095		095-COPS Contracts AO		11,890	0	11,890
095		095-COPS Regular Labour AO		19,863	0	19,863
001	060	001 - T&D Regular Labour	060 - GP - Broadband Radio	16,296	0	16,296
012	060	012 - Materials	060 - GP - Broadband Radio	171,000	0	171,000
013	060	013 - COPS Contracts	060 - GP - Broadband Radio	50,000	0	50,000
028	060	028 - Consulting	060 - GP - Broadband Radio	4,000	0	4,000
001	085	001 - T&D Regular Labour	085 Design	7,981	0	7,981
001	085	001 - Regular Labour (No AO)	085 Design	3,420	0	3,420
011	085	011 - Travel Expense	085 Design	6,000	0	6,000
041	085	041 - Meals & Entertainment	085 Design	660	0	660
			Total Cost:	316,142	0	316,142
			Original Cost:			

Capital Project Detailed Estimate

Location: General Plant
CI# / FP#: 46308
Title: 2015 Microwave System Capacity Upgrade
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	46	$ 354	$ 16,295.96		
T&D Labour - Design	PD	23	$ 347	$ 7,981.00		
Procurement / Financial (No AO)	Lot	1	$ 3,420	$ 3,420.00		
			Sub-Total	$ 27,696.96		
011 Travel Expense						
Hotel	lot	1	$ 6,000.00	$ 6,000.00		
				$ -		
				$ -		
			Sub-Total	$ 6,000.00		
012 Materials						
7 GHz Microwave Radio Hop Upgrade Kits	lot	1	$ 55,000	$ 55,000.00		
7 GHz Microwave Radio Hop Nuttby - Mt Pleasan	lot	1	$ 60,000	$ 60,000.00		
Antenna & Feedline	lot	2	$ 13,000	$ 26,000.00		
MPLS routers	lot	1	$ 20,000	$ 20,000.00		
Battery Charger	lot	1	$ 5,000	$ 5,000.00		
Miscellenous	lot	1	$ 5,000	$ 5,000.00		
			Sub-Total	$ 171,000.00		
013 Contracts						
Rigging Services	lot	1	$ 20,000	$ 20,000.00		
Tower Upgrade	lot	1	$ 30,000	$ 30,000.00		
				$ -		
			Sub-Total	$ 50,000.00		
028 Consulting						
Tower Study	lot	1	$ 4,000.00	$ 4,000.00		
				$ -		
				$ -		
			Sub-Total	$ 4,000.00		
041 Meals & Entertainment						
Meals	lot	1	$ 660.00	$ 660.00		
				$ -		
				$ -		
			Sub-Total	$ 660.00		
094 Interest Capitalized						
AFUDC				$ 12,154.85		
				$ -		
				$ -		
			Sub-Total	$ 12,154.85		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 12,876.50		
				$ -		
			Sub-Total	$ 12,876.50		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 19,863.41		
COPS Contract AO				$ 11,890.00		
				$ -		
			Sub-Total	$ 31,753.41		
			SUB-TOTAL (no AO, AFUDC)	$ 259,356.96		
			TOTAL (AO, AFUDC included)	$ 316,141.72		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46306

Title: 2015 Telecom Building Replacement

Start Date:	2015/04
In-Service Date:	2015/12
Final Cost Date:	2016/06
Function:	General Plant
Forecast Amount:	$251,727

DESCRIPTION:

This project is for the replacement of the Maple Ridge radio building with a new telecommunications building. The Maple Ridge radio site is an important site for the existing mobile radio system as it contains a VHF (Very High Frequency) repeater which provides radio coverage for the Antigonish area for Power Line Technicians, System Maintenance and other field crews in the area. This site also provides a critical radio link to Lochaber Road Substation, Glen Dhu Wind Farm and other mobile radio repeater sites.

Included in the project is the cost of the electrical wiring and heating, ventilation and air conditioning (HVAC) system in a new building complete with a backup generator to provide emergency backup power for this important radio site.

This is the third year of a multi-year project to replace and upgrade NS Power's radio site buildings and the associated back-up generators. These buildings were installed in the late 1970s and are now over 30 years old and contain asbestos wallboard. Priority for replacement will be given to the buildings that contain asbestos and show the highest degree of deterioration.

Summary of Related CIs (+/- 2 years):
2013 CI 43174 2013 Telecom Building Replacement Project $206,455
2014 CI 44972 2014 Telecom Building Replacement Project $218,455
2016 CI TBD 2016 Telecom Building Replacement $TBD
2017 CI TBD 2017 Telecom Building Replacement $TBD

JUSTIFICATION:

Justification Criteria: Work Support Facilities

Sub Criteria: Buildings

Why do this project?

This project will replace the Maple Ridge telecommunications building which was installed around 1978. The building is deteriorated and replacement of the entire building is required. The building also contains asbestos wallboard which is a hazard if disturbed in any way.

By not completing this work, radio coverage over a significant area could be lost. In this event SCADA communication would be lost with Glen Dhu and Maryvale Wind Farms. The mobile radio system would also be lost in the Antigonish area for Power Line Technicians, System Maintenance Technicians and other field crews.

Why do this project now?

The Maple Ridge telecommunications building was installed around 1978. The building is deteriorated and replacement of the entire building is required. The Maple Ridge telecommunication building must be replaced now to allow proper shelter and backup power for the important equipment at this site. The back-up generator equipment within the building must also be replaced as it is over thirty years old and difficult to maintain due to a lack of availability of spare parts.

Why do this project this way?

Replacing the existing telecom building and generator at Maple Ridge is the most cost effective option to allow proper shelter and backup power for the important equipment at this site. Further maintenance and/or modifications to the building risks the disturbance of the asbestos contained within the wallboard of the building which would be a safety concern.

CI Number : 46306 - 2015 Telecom Building Replacement **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		11,421	0	11,421
092		092-Vehicle T&D OT Labour AO		470	0	470
094		094 - Interest Capitalized		8,357	0	8,357
095		095-COPS Overtime Labour AO		725	0	725
095		095-COPS Contracts AO		9,631	0	9,631
095		095-COPS Regular Labour AO		17,619	0	17,619
001	003	001 - T&D Regular Labour	003 - GP - Bldg.,Struct.Grnd.	10,628	0	10,628
002	003	002 - T&D Overtime Labour	003 - GP - Bldg.,Struct.Grnd.	1,771	0	1,771
011	003	011 - Travel Expense	003 - GP - Bldg.,Struct.Grnd.	1,100	0	1,100
012	003	012 - Materials	003 - GP - Bldg.,Struct.Grnd.	125,000	0	125,000
013	003	013 - COPS Contracts	003 - GP - Bldg.,Struct.Grnd.	40,500	0	40,500
028	003	028 - Consulting	003 - GP - Bldg.,Struct.Grnd.	10,000	0	10,000
041	003	041 - Meals & Entertainment	003 - GP - Bldg.,Struct.Grnd.	1,100	0	1,100
001	085	001 - Regular Labour (No AO)	085 Design	2,500	0	2,500
001	085	001 - T&D Regular Labour	085 Design	10,906	0	10,906
			Total Cost:	251,727	0	251,727
			Original Cost:	66,323		

Capital Project Detailed Estimate

Location: General Plant
CI# / FP#: 46306
Title: 2015 Telecom Building Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Electrician/Technician	PD	30	$ 354	$ 10,627.80		
T&D Labour - Design	PD	31	$ 347	$ 10,905.71		
Procurement / Financial (No AO)	Lot	1	$ 2,500	$ 2,500.00		
			Sub-Total	$ 24,033.51		
002 OT Labour						
T&D Labour - Electrician/Technician	PD	3	$ 709	$ 1,771.30		
			$ -	$ -		
			Sub-Total	$ 1,771.30		
011 Travel Expense						
Field expenses	ea	1	$ 1,100	$ 1,100.00		
				$ -		
			Sub-Total	$ 1,100.00		
012 Materials						
New Telecom Building	ea	1	$ 100,000	$ 100,000.00		
Backup generator	es	1	$ 25,000	$ 25,000.00		
				$ -		
			Sub-Total	$ 125,000.00		
013 Contracts						
Install new building	ea	1	$ 11,000	$ 11,000.00		
Install new generator	ea	1	$ 5,500	$ 5,500.00		
Site upgrades	ea	1	$ 24,000	$ 24,000.00		
			Sub-Total	$ 40,500.00		
028 Consulting						
Prepare Electrical and Mechanical Drawings	Lot	1	$ 10,000	$ 10,000.00		
				$ -		
				$ -		
			Sub-Total	$ 10,000.00		
041 Meals						
Meals	Lot	1	$ 1,100	$ 1,100.00		
				$ -		
				$ -		
			Sub-Total	$ 1,100.00		
094 Interest Capitalized						
AFUDC				$ 8,356.69		
				$ -		
				$ -		
			Sub-Total	$ 8,356.69		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 11,421.38		
Vehicle T&D Labour Overtime AO				$ 469.75		
				$ -		
			Sub-Total	$ 11,891.12		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 17,618.72		
COPS T&D Labour Overtime AO				$ 724.64		
COPS Contract AO				$ 9,630.90		
				$ -		
			Sub-Total	$ 27,974.26		
			SUB-TOTAL (no AO, AFUDC)	$ 203,504.81		
			TOTAL (AO, AFUDC included)	$ 251,726.89		
Original Cost				$ 66,323.29		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Computers

CI Number: 46365

Title: Maximo Enhancements for Substation Operations

Start Date: 2015/03
In-Service Date: 2015/12
Final Cost Date: 2016/06
Function: General Plant
Forecast Amount: $315,242

DESCRIPTION:

This project is to extend the asset management use of Maximo for Substation Operations by providing field mobility to substation technicians. Substation work orders will be generated in Maximo and sent to a tablet device for all field technicians. All substation inspections and asset test results will be performed on site electronically versus on paper stored in filing cabinets. This project includes the procurement of tablets for field technicians. This project also includes configuration of a mobile inspection data collection application that will be integrated with Maximo.

Summary of Related CIs (+/- 2 years):
2013 CI 43368 Maximo Enhancements for System Maintenance $204,313
2015 CI 46364 Maximo Enhancements for Telecom & Relay $272,539

JUSTIFICATION:

Justification Criteria: Work Support Facilities

Sub Criteria: Computers

Why do this project?

Currently all substation inspections are performed on paper checklists and stored in filing cabinets in depots. All asset test results are stored on individual computer hard drives or on paper in filing cabinets. A centralized depository for this information does not currently exist. Work packages are provided to the crews in paper format. This project will digitize Substation Operations and improve productivity by providing important work order information to crews instantaneously and remotely. This project will also provide a means to capture relevant asset information in Maximo as technicians complete the work in the field. This will dramatically improve the information flow and availability of information between the field and head office.

Why do this project now?

All asset information that is captured electronically will further enhance the asset management capabilities for NS Power and allow for trending and cost savings analysis going forward.

Why do this project this way?

The Maximo program is currently in-use in the Transmission & Distribution department of NS Power and it has strong functionality in both Work Management and Asset Management. Providing mobility to substation field crews will provide many opportunities to capture field information in an electronic format in Maximo.

CI Number : 46365 - Maximo Enhancements for Substation Field Mobility **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		11,043	0	11,043
094		094 - Interest Capitalized		10,168	0	10,168
095		095-IT Regular Labour AO		11,435	0	11,435
095		095-IT Overtime Labour AO		10,618	0	10,618
095		095-COPS Regular Labour AO		17,035	0	17,035
001	072	001 - T&D Regular Labour	072 - GP - Computer Equipment	8,675	0	8,675
035	072	035 - Comp.Hrdwr & Op.Sftwr	072 - GP - Computer Equipment	100,000	0	100,000
001	078	001 - IT Regular Labour	078 - GP - Comp. Appl. Software	21,000	0	21,000
002	078	002 - IT Overtime Labour	078 - GP - Comp. Appl. Software	39,000	0	39,000
028	078	028 - Consulting	078 - GP - Comp. Appl. Software	60,000	0	60,000
001	085	001 - T&D Regular Labour	085 Design	12,145	0	12,145
001	085	001 - Regular Labour (No AO)	085 Design	2,000	0	2,000
066	085	066 - Other Goods & Services	085 Design	12,123	0	12,123
			Total Cost:	315,242	0	315,242
			Original Cost:			

Capital Project Detailed Estimate

Location: General Plant
CI# / FP#: 46365
Title: Maximo Enhancements for Substation Field Mobility
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Design	PD	60	$ 347	$ 20,820.00		
Project Support (No AO)	Lot	1	$ 2,000	$ 2,000.00		
IT Labour	PD	70	$ 300.00	$ 21,000.00		
				$ -		
			Sub-Total	$ 43,820.00		
002 OT Labour						
IT Labour	PD	65	$ 600	$ 39,000.00		
			$ -	$ -		
			$ -	$ -		
			Sub-Total	$ 39,000.00		
028 Consulting						
Maximo Consultants	Days	50	$ 1,200	$ 60,000.00		
				$ -		
				$ -		
			Sub-Total	$ 60,000.00		
035 Computer Hardware						
Tablets	Each	50	$ 2,000	$ 100,000.00		
				$ -		
				$ -		
			Sub-Total	$ 100,000.00		
066 Other Goods & Services						
Contingency (T&D Labour & IT Labour)	%	15%	$ 80,820	$ 12,123.00		
				$ -		
				$ -		
			Sub-Total	$ 12,123.00		
094 Interest Capitalized						
Interest				$ 10,168.41		
				$ -		
				$ -		
			Sub-Total	$ 10,168.41		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 11,042.90		
Vehicle T&D Labour Overtime AO				$ -		
				$ -		
			Sub-Total	$ 11,042.90		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 17,034.90		
IT Labour Regular AO				$ 11,434.50		
IT Labour Overtime AO				$ 10,617.80		
			Sub-Total	$ 39,087.20		
			SUB-TOTAL (no AO, AFUDC)	$ 254,943.00		
			TOTAL (AO, AFUDC included)	$ 315,241.51		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

CI Number: 46364

Title: Maximo Enhancement for Telecom & Relay

Start Date:	2014/09
In-Service Date:	2015/06
Final Cost Date:	2015/12
Function:	General Plant
Forecast Amount:	$272,539

DESCRIPTION:

This project is to extend the asset management functionality of Maximo for Telecom Operations. All telecommunication assets and protective relay assets will be migrated from legacy systems into the Maximo database. Automatic Preventative Maintenance work orders will be created against the assets in the database and job plans with standard work units will be attached to the work orders.

Summary of Related CIs (+/- 2 years):
2013 CI 43368 Maximo Enhancements for System Maintenance $204,313
2015 CI 46365 Maximo Enhancements for Substation Operations $315,242

JUSTIFICATION:

Justification Criteria: Work Support Facilities

Sub Criteria: Computers

Why do this project?

The current asset information for telecommunication and protective relays is stored in spreadsheets and legacy systems which have reached the end of their useful lives. Adding additional functionality to Maximo to manage these assets leverages current infrastructure and centralizes transmission and distribution asset information. This will also enable Nova Scotia Power to use the full asset management functionality of Maximo for these asset classes by configuring the Maximo application to manage the full life cycle of these assets. This allows us to further optimize the investment decisions in our plant.

Why do this project now?

Current tools being utilized to manage Telecom assets have reached the end of their useful life. A similar project was recently completed for migrating substation asset classes (transformers, breakers, etc.) to the Maximo database with the retirement of legacy systems. This project is intended to build on the success of the previous project and further enhance the asset management capabilities of Maximo.

Why do this project this way?

The Maximo application is currently in-use in the Transmission & Distribution Department of NS Power as the Work Management and Asset Management system. Migrating all telecommunication and protective relay asset information to Maximo will further capitalize on the investment in Maximo.

CI Number : 46364-P945 - Maximo Enhancements for Telecom & Relays **Project Number**

Parent CI Number : -

ost Centre : 620 - 620-Control Centre Operations **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		9,790	0	9,790
094		094 - Interest Capitalized		6,938	0	6,938
095		095-COPS Regular Labour AO		14,488	0	14,488
095		095-IT Regular Labour AO		13,330	0	13,330
095		095-IT Overtime Labour AO		15,552	0	15,552
001	078	001 - IT Regular Labour	078 - GP - Comp. Appl. Software	26,607	0	26,607
001	078	001 - T&D Regular Labour	078 - GP - Comp. Appl. Software	8,891	0	8,891
002	078	002 - IT Overtime Labour	078 - GP - Comp. Appl. Software	62,082	0	62,082
028	078	028 - Consulting	078 - GP - Comp. Appl. Software	90,000	0	90,000
001	085	001 - T&D Regular Labour	085 Design	8,891	0	8,891
066	085	066 - Other Goods & Services	085 Design	15,971	0	15,971
			Total Cost:	272,539	0	272,539
			Original Cost:			

Capital Project Detailed Estimate

Location: General Plant
CI# / FP#: 46364
Title: Maximo Enhancements for Telecom & Relay
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
IT Labour	PD	88.69	$ 300.00	$ 26,606.70		
T&D Labour - Project Management	PD	25.62	$ 347.00	$ 8,891.00		
T&D Labour - Engineering Design	PD	25.62	$ 347.00	$ 8,891.00		
				$ -		
				$ -		
			Sub-Total	$ 44,388.70		
002 OT Labour						
IT Labour	PD	103.47	$ 600.00	$ 62,082.30		
				$ -		
				$ -		
			Sub-Total	$ 62,082.30		
028 Consulting						
Maximo Consultants	PD	75.00	$ 1,200.00	$ 90,000.00		
				$ -		
			Sub-Total	$ 90,000.00		
066 Other Goods & Services						
Contingency	$	1	$ 15,970.65	$ 15,970.65		
				$ -		
				$ -		
			Sub-Total	$ 15,970.65		
094 Interest Capitalized						
AFUDC				$ 6,938.01		
				$ -		
				$ -		
			Sub-Total	$ 6,938.01		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 9,789.86		
Vehicle T&D Labour Overtime AO				$ -		
				$ -		
			Sub-Total	$ 9,789.86		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 14,487.90		
IT Labour Regular AO				$ 13,330.05		
IT Labour Overtime AO				$ 15,551.69		
			Sub-Total	$ 43,369.64		
			SUB-TOTAL (no AO, AFUDC)	$ 212,441.65		
			TOTAL (AO, AFUDC included)	$ 272,539.16		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

Other General Plant

CI Number: 46050

Title: Operator Training Simulator

Start Date: 2014/07
In-Service Date: 2015/12
Final Cost Date: 2016/06
Function: General Plant
Forecast Amount: $531,119

DESCRIPTION:

This project is for the implementation of an Operator Training Simulator (OTS) for training NS Power's NERC Certified system operators at the Ragged Lake Control Centre.

Summary of Related CIs (+/- 2 years):
No other projects in 2013, 2014, 2015, 2016 or 2017.

JUSTIFICATION:

Justification Criteria: Work Support Facilities

Sub Criteria: Computers

Why do this project?

The implementation of the OTS is required to meet requirement 3.1 of NERC standard PER-005-1 System Personnel Training.

Why do this project now?

NERC standard PER-005-1 System Personnel Training requirement 3.1 requires that System Operators be trained using simulation technology by the effective date of July 1, 2015.

Why do this project this way?

NERC standard PER-005-1 System Personnel Training requirement 3.1 requires that System Operators be trained using simulation technology. Implementation of the OTS will accomplish this requirement.

CI Number : 46050-P944 - Operator Training Simulator **Project Number**

Parent CI Number : -

Cost Centre : 800 - 800-Services - Admin. **Budget Version** 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
092		092-Vehicle T&D Reg. Labour AO		42,802	0	42,802
094		094 - Interest Capitalized		25,237	0	25,237
095		095-COPS Regular Labour AO		64,188	0	64,188
095		095-COPS Term Labour AO		119,117	0	119,117
001	064	001 - T&D Regular Labour	064 - GP - Sup. Control and DA	78,675	0	78,675
004	064	004 - COPS Term Labour	064 - GP - Sup. Control and DA	146,000	0	146,000
011	064	011 - Travel Expense	064 - GP - Sup. Control and DA	9,500	0	9,500
012	064	012 - Materials	064 - GP - Sup. Control and DA	1,800	0	1,800
041	064	041 - Meals & Entertainment	064 - GP - Sup. Control and DA	3,800	0	3,800
056	064	056 - Training & Development	064 - GP - Sup. Control and DA	10,000	0	10,000
066	064	066 - Other Goods & Services	064 - GP - Sup. Control and DA	30,000	0	30,000
			Total Cost:	531,119	0	531,119
			Original Cost:			

Capital Project Detailed Estimate

Location: General Plant
CI# / FP#: 46050
Title: Operator Training Simulator
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
001 Regular Labour						
T&D Labour - Design	PD	175.79	347.00	$ 61,000.00		
T&D Labour - Procurement / Financial	PD	72.14	245.00	$ 17,675.00		
				$ -		
			Sub-Total	$ 78,675.00		
004 Term Labour						
T&D Labour - Project Support	PD	536.77	272.00	$ 146,000.33		
				$ -		
			Sub-Total	$ 146,000.33		
011 Travel Expense						
Accomodations	Lot	1	$ 7,000.00	$ 7,000.00		
Travel	Lot	1	$ 2,500.00	$ 2,500.00		
				$ -		
			Sub-Total	$ 9,500.00		
012 Materials						
Supervisory Control and Data Acquistion	Lot	1	$ 1,800.00	$ 1,800.00		
				$ -		
				$ -		
			Sub-Total	$ 1,800.00		
056 Training						
OTS Training Course	Lot	2	$ 2,500.00	$ 5,000.00		
OpenNET Training Course	Lot	2	$ 2,500.00	$ 5,000.00		
				$ -		
			Sub-Total	$ 10,000.00		
041 Meals & Entertainment						
Meals	Lot	1	$ 3,800.00	$ 3,800.00		
				$ -		
				$ -		
			Sub-Total	$ 3,800.00		
066 Other Goods & Services						
Contingency	Lot	1	$ 30,000.00	$ 30,000.00		
				$ -		
				$ -		
			Sub-Total	$ 30,000.00		
094 Interest Capitalized						
AFUDC				$ 25,236.76		
				$ -		
				$ -		
			Sub-Total	$ 25,236.76		
092 Vehicle Overhead						
Vehicle T&D Labour Regular AO				$ 42,801.82		
				$ -		
			Sub-Total	$ 42,801.82		
095 Administrative Overhead						
COPS T&D Labour Regular AO				$ 64,188.28		
COPS T&D Labour Term AO				$ 119,116.80		
				$ -		
			Sub-Total	$ 183,305.08		
			SUB-TOTAL (no AO, AFUDC)	$ 279,775.33		
			TOTAL (AO, AFUDC included)	$ 531,118.99		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

A. Introduction

1. **Title:** **System Personnel Training**
2. **Number:** PER-005-1
3. **Purpose:** To ensure that System Operators performing real-time, reliability-related tasks on the North American Bulk Electric System (BES) are competent to perform those reliability-related tasks. The competency of System Operators is critical to the reliability of the North American Bulk Electric System.
4. **Applicability:**

   4.1. Functional Entities:

   4.1.1 Reliability Coordinator.

   4.1.2 Balancing Authority.

   4.1.3 Transmission Operator.
5. **Proposed Effective Date for Regulatory Approvals:**

   5.1. In those jurisdictions where regulatory approval is required, Requirement R1 and Requirement R2 shall become effective on the first day of the first calendar quarter, 24 months after applicable regulatory approval. In those jurisdictions where no regulatory approval is required, Requirement R1 and Requirement R2 shall become effective on the first day of the first calendar quarter, 24 months after Board of Trustees adoption.

   5.2. In those jurisdictions where regulatory approval is required, Requirement R3 shall become effective on the first day of the first calendar quarter after applicable regulatory approval. In those jurisdictions where no regulatory approval is required, Requirement R3 shall become effective on the first day of the first calendar quarter after Board of Trustees adoption.

   5.3. In those jurisdictions where regulatory approval is required Sub-requirement R3.1 shall become effective on the first day of the first calendar quarter, 36 months after applicable regulatory approval. In those jurisdictions where no regulatory approval is required, the Sub-requirement R3.1 shall become effective on the first day of the first calendar quarter, 36 months after Board of Trustees adoption.

B. Requirements

R1. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall use a systematic approach to training to establish a training program for the BES company-specific reliability-related tasks performed by its System Operators and shall implement the program. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*

R1.1. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall create a list of BES company-specific reliability-related tasks performed by its System Operators.

R1.1.1. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall update its list of BES company-specific reliability-related tasks performed by its System Operators each calendar year to identify new or modified tasks for inclusion in training.

R1.2. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall design and develop learning objectives and training materials based on the task list created in R1.1.

R1.3. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall deliver the training established in R1.2.

R1.4. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall conduct an annual evaluation of the training program established in R1, to identify any needed changes to the training program and shall implement the changes identified.

R2. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall verify each of its System Operator's capabilities to perform each assigned task identified in R1.1 at least one time. *[Violation Risk Factor: High] [Time Horizon: Long-term Planning]*

R2.1. Within six months of a modification of the BES company-specific reliability-related tasks, each Reliability Coordinator, Balancing Authority and Transmission Operator shall verify each of its System Operator's capabilities to perform the new or modified tasks.

R3. At least every 12 months each Reliability Coordinator, Balancing Authority and Transmission Operator shall provide each of its System Operators with at least 32 hours of emergency operations training applicable to its organization that reflects emergency operations topics, which includes system restoration using drills, exercises or other training required to maintain qualified personnel. *[Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]*

R3.1. Each Reliability Coordinator, Balancing Authority and Transmission Operator that has operational authority or control over Facilities with established IROLs or has established operating guides or protection systems to mitigate IROL violations shall provide each System Operator with emergency operations training using simulation technology such as a simulator, virtual technology, or other technology that replicates the operational behavior of the BES during normal and emergency conditions.

C. Measures

M1. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall have available for inspection evidence of using a systematic approach to training to establish and implement a training program, as specified in R1.

M1.1 Each Reliability Coordinator, Balancing Authority, and Transmission Operator shall have available for inspection its company-specific reliability-related task list, with the date of the last review and/or revision, as specified in R1.1.

M1.2 Each Reliability Coordinator, Balancing Authority, and Transmission Operator shall have available for inspection its learning objectives and training materials, as specified in R1.2.

M1.3 Each Reliability Coordinator, Balancing Authority, and Transmission Operator shall have available for inspection System Operator training records showing the names of the people trained, the title of the training delivered and the dates of delivery to show that it delivered the training, as specified in R1.3.

M1.4 Each Reliability Coordinator, Balancing Authority, and Transmission Operator shall have available for inspection evidence (such as instructor observations, trainee feedback, supervisor feedback, course evaluations, learning assessments, or internal audit results) that it performed an annual training program evaluation, as specified in R1.4

M2. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall have available for inspection evidence to show that it verified that each of its System Operators is capable of performing each assigned task identified in R1.1, as specified in R2. This evidence can be documents such as training records showing successful completion of tasks with the employee name and date; supervisor check sheets showing the employee name, date, and task completed; or the results of learning assessments.

M3. Each Reliability Coordinator, Balancing Authority and Transmission Operator shall have available for inspection training records that provide evidence that each System Operator has obtained 32 hours of emergency operations training, as specified in R3.

M3.1 Each Reliability Coordinator, Balancing Authority and Transmission Operator shall have available for inspection training records that provide evidence that each System Operator received emergency operations training using simulation technology, as specified in R3.1.

D. Compliance

1. Compliance Monitoring Process

1.1. Compliance Enforcement Authority

For Reliability Coordinators and other functional entities that work for their Regional Entity, the ERO shall serve as the Compliance Enforcement Authority.

For entities that do not work for the Regional Entity, the Regional Entity shall serve as the Compliance Enforcement Authority.

1.2. Compliance Monitoring Period and Reset

Not Applicable.

1.3. Compliance Monitoring and Enforcement Processes:

Compliance Audits

Self-Certifications

Spot Checking

Compliance Violation Investigations

Self-Reporting

Complaints

1.4. Data Retention

Each Reliability Coordinator, Balancing Authority and Transmission Operator shall keep data or evidence to show compliance for three years or since its last compliance audit, whichever time frame is the greatest, unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.

If a Reliability Coordinator, Balancing Authority and Transmission Operator is found non-compliant, it shall keep information related to the non-compliance until found compliant.

The Compliance Enforcement Authority shall keep the last audit records and all requested and submitted subsequent audit records.

1.5. Additional Compliance Information

None.

2. Violation Severity Levels

R#	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1	N/A	The responsible entity failed to update its BES company-specific reliability-related task list to identify new or modified tasks each calendar year. (R1.1.1) OR The responsible entity failed to evaluate its training program to identify needed changes to its training program(s). (R1.4) OR An entity evaluated its training program and identified changes, but failed to implement them. (R1.4)	The responsible entity failed to design and develop learning objectives and training materials based on the BES company specific reliability related tasks. (R1.2)	The responsible entity failed to prepare a BES company-specific reliability-related task list. (R1.1) OR The responsible entity failed to deliver training based on the BES company specific reliability related tasks. (R1.3)
R2	N/A	The responsible entity failed to verify 5% or less of its System Operators' capabilities to perform each assigned task from its list of BES company-specific reliability-related tasks. (R2)	The responsible entity failed to verify more than 5% up to (and including) 10% of its System Operators' capabilities to perform each assigned task from its list of BES company-specific reliability-related tasks. (R2) OR The responsible entity verified its System Operator's capabilities to perform each new or modified task more than six months but fewer than twelve months after making a modification to its BES company-specific reliability-related task list. (R2.1)	The responsible entity failed to verify more than 10% of its System Operators' capabilities to perform each assigned task from its list of BES company-specific reliability-related tasks. (R2) OR The responsible entity failed to verify its System Operator's capabilities to perform each new or modified task within twelve months of making a modification to its BES company-specific reliability-related task list. (R2.1)
R3	N/A	The responsible entity failed to provide at least 32 hours of emergency operations training applicable to its organization, affecting 5% or less of their System Operators. (R3)	The responsible entity failed to provide at least 32 hours of emergency operations training applicable to its organization, affecting more than 5% and up to (and including) 10% of its System Operators. (R3)	The responsible entity failed to provide at least 32 hours of emergency operations training applicable to its organization, affecting more than 10% its System Operators (R3) OR

R#	Lower VSL	Moderate VSL	High VSL	Severe VSL
				The responsible entity did not include simulation technology replicating the operational behavior of the BES in its emergency operations training. (R3.1)

E. Regional Variances

None.

Version History

Version	Date	Action	Change Tracking
1	2/10/2009	Adopted by the NERC Board of Trustees	
1	11/18/2010	FERC Approved	
1	8/26/2013	Updated VSLs based on June 24, 2013 approval.	

CI Number: 46657

Title: Meter & Inspection Services – Analyzer Replacement Project

Start Date: 2015/01
In-Service Date: 2015/01
Final Cost Date: 2015/07
Function: General Plant
Forecast Amount: $448,300

DESCRIPTION:

The analyzer tools being purchased under this project are used to verify the accuracy of NS Power equipment used for revenue metering (Current Transformers, Partial Transformers and meters). This tool ensures accurate billing for revenue protection purposes and fulfills Measurement Canada requirements for quality assurance purposes. Tools in NS Power's current inventory are 10-25 years old and have reached end-of-life. Replacement parts are either discontinued or are higher cost than the current value of the analyzer. This project includes replacing the current inventory of mixed analyzer tools with 20 new analyzers.

Summary of Related CIs (+/- 2 years):
No other projects in 2012, 2013, 2014, 2015 or 2016.

JUSTIFICATION:

Justification Criteria: Work Support Facilities

Sub Criteria: Computers

Why do this project?

Measurement Canada mandates that installed revenue metering equipment is commissioned to allow for accurate data to be measured by the meter for customer billing purposes. Commissioning the meter equipment includes verifying the Current Transformer/Partial Transformer ratios and all phases are correct (vector diagram). The analyzer tool is necessary to commission primary metering and three phase metering with large, complex or highly variable load.

Why do this project now?

The current analyzer inventory has reached end-of-life and replacement parts are either discontinued or of a higher cost than the current value of the analyzer.

Why do this project this way?

Replacing the current inventory of mixed analyzer tools with 20 standard analyzers provides for consistency in training, process, and maintenance, and allows NS Power to continue to meet Measurement Canada requirements.

CI Number : 46657 - Meter & Inspection Services - Analyzer Replacement

Project Number

Parent CI Number : -

Cost Centre : 570 - 570-Meter Serv.-Admin

Budget Version 2015 ACE Plan

Capital Item Accounts

Acct	Actv	Account	Activity	Forecast Amount	Amount	Variance
012	072	012 - Materials	072 - GP - Computer Equipment	448,300	0	448,300
			Total Cost:	448,300	0	448,300
			Original Cost:			

Capital Project Detailed Estimate

Location: **General Plant**
CI# / FP#: 46657
Title: Meter & Inspection Services - Analyzer Replacement
Execution Year: 2015

Description	Unit	Quantity	Unit Estimate	Total Estimate	Cost Support Reference	Completed Similar Projects (FP#'s)
012 Materials						
Analyzer Replacement	ea	[redacted]		$ 409,300.00	Cost Support Item 1 - Item 3302	
Flexible Current Probes	ea			$ 29,000.00	Cost Support Item 1 - Item 1	
Misc. Materials	lot	1	$ 10,000	$ 10,000.00		
			Sub-Total	$ 448,300.00		
			SUB-TOTAL (no AO, AFUDC)	$ 448,300.00		
			TOTAL (AO, AFUDC included)	$ 448,300.00		
Original Cost				$ -		

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.
Note 2: Small differences in totals are attributable to rounding.

POWER SOURCE INSTRUMENTS INC. 1111 Burns Street E., Unit 1
Whitby, ON CANADA L1N 6A6
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Tuesday, October 14, 2014

Nova Scotia Power
25 Lakeside Park Dr.
Halifax, Nova Scotia

ATTENTION:	**Lynne Drover,** Metering
Subject:	***Powermaster Proposal***
Our Reference:	***14-130R1***

Dear Lynne:
Please find below our quote for the 3-Series power analyzers. After further discussion and Nova Scotia Power's requirements for a specific kit, the price below reflects all the accessories and style of analyzer best suited for your application. The price also reflects a qty. of 20 or more units purchased in this calendar year.

Equipment Description:

All-Series Powermaster(s):

All accessories included with each Powermaster purchase are:

CATIII (1000V) Voltage Leads (x4), 0-10A small clamp-on probes secondary current measurement, IR magnetic pulse pickup as well as a manual thumb-switch for manual pulsing. Communication wiring (USB), power adaptor also included.

Other highlighted Features Include:

- Harmonics analysis up to the 100th
- 3 Phase Simultaneous CT Testing *with applicable probes*
- Full Colour-Transflective VGA Display with Windows CE software built in
- **Better than 0.05% field Accuracy with Duck-Bill probes**
- Built-in user friendly menu with 'End-To-End' testing
- Wiring Verification Colour Screens
- **1-Year Warranty**
- Two External USB ports for device connect-ability (i.e. storage dongle, mouse etc.)
- **Includes MSM (Meter Site Manager) software database**
- Includes 6 Analog Probe Channels
- External USB memory card for expanded memory

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Pricing (3-Series Powermaster):

Item	***Qty. 20+, 3-Series Powermaster Analyzers***	***Extension***
3302-Package	3-Series Powermaster (**3302**) Standard meter test system with CT testing. Set of Three MN375 Clamp-On Current Probes (0.1-10A, 600V max) for secondary current measurement complete with three-phase probe adaptor for Powermaster connectivity. Flexible Current Probe used for CT testing. Rating – 600V/1000A complete with three phase probe adaptor. Also included is the magnetic pickup and thumb switch for pulse pickup.	**$ [redacted] ea.**
	Optional Accessories (Probes)	
1	Duck-Bill current probes, not included in the packaged kit (above).	**$ [redacted]** Price per set

*All additional accessories are optional to the prices shown above; please feel to call anytime for pricing and / or technical information.

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General Terms:

1. *The quotation is firm for fifteen (15) days.*
2. *All taxes apply to this quotation (HST).*
3. *Terms of payment are net thirty (30) days.*
4. *All prices in Canadian Currency*
5. *FOB – Whitby, Ontario*

I trust that this proposal will suit your needs. In the meantime, should any questions arise regarding this or any other matter, please do not hesitate to contact the undersigned at any time.

Sincerely,
Power Source Instruments Inc.

Paul Beckman,
Powermetrix Products