Facilities Study Report

IR-664
50MW Battery Energy Storage System
99W - Bridgewater

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November 10, 2023

Facilities Study Report

IR-664: BESS – 99W Bridgewater

EXECUTIVE SUMMARY

This project (IR#664 – Bridgewater BESS) provides for the establishment of a 138 kV system interconnection at Nova Scotia Power Inc (NSPI) transmission substation 99W-Bridgewater for a 50MW Battery Energy Storage System (BESS) in Lunenburg County, Nova Scotia.

The Point of Interconnection (POI) is on NSPI's 138kV bus B62 at 99W-Bridgewater substation. The designated Point of Change of Ownership (PCO) is at 138kV terminals of the 138kV – 35.4kV transformer serving the BESS facility. The POI and PCO are further clarified in the Interconnection Overview Drawing provided in Appendix B.

The scope of work associated with this interconnection will consist of a new 138kV breaker terminal at 99W – Bridgewater Substation, addition of revenue metering for the new interconnection, and modifications to existing protection and control schemes, Supervisory Control and Data Acquisition (SCADA), and telecommunications at 99W-Bridgewater.

The Interconnection Customer's facilities will include a 138kV-34.5kV, 36/48/60 MVA autotransformer and associated cable interfaces to the proposed BESS. The BESS Facility will include a 34.5KV switchgear building including a 34.5kV circuit breaker, associated protection and control equipment, and cable interfaces as well as space for the transformer protection panel and communication equipment. The proposed BESS is rated 50MW at 200MWh with preliminary design consisting of e[redacted] four parallel circuits.

There are no Network Upgrades associated with this interconnection.

All interconnection facilities must meet NSPI's Transmission System Interconnection Requirements (TSIR), version 1.1 dated February 25, 2021, as published on the NSPI OASIS site.

Protection and control upgrades are required to accommodate the addition of the BESS. The existing substation Remote Terminal Unit (RTU) at 99W-Bridgewater will be replaced to accommodate the increased point count. Existing control panels will be modified to accommodate the new 138 kV circuit breaker's trip circuit monitors and breaker alarms in the 99W-Bridgewater substation building. The 99W-B62 bus protection panel and Breaker Backup panel will be modified to accept the new breaker 99W-663. NSPI will require space and unrestricted access in the BESS's substation control building for the transformer protection panel and communications equipment.

Supervisory control will be provided via a new SEL-2240 Axion RTU in the existing 99W substation building. Telecommunication will be provided by existing facilities at 99W.

The Revenue Class 138kV voltage and current transformers required for revenue metering will be supplied and installed by NSPI (Transmission Provider) at the 99W-Bridgewater substation as per NSPI specification.

All system outages required to complete the interconnection work shall require advanced planning and coordination with the NSP System Operator.

The total estimated cost to construct the required Transmission Provider's Interconnection Facilities is **$1,789,321**. There are no Network Upgrades associated with this interconnection. A detailed cost estimate

is provided in Appendix G. All cost estimates exclude allowance for funds used during construction (AFUDC) or any escalations due to timing of project execution. The customer will be responsible for paying NSPI for the actual costs associated with this project, be they higher or lower than the estimate provided herein, unless otherwise specified in the Generation Interconnection Agreement (GIA).

The Interconnection Customer's targeted commercial operation date is June 30, 2025, with first-power available by March 30, 2025. An overall preliminary project schedule is provided in Appendix H.

Part 2 of the System Impact Study (SIS) is still in progress and if any additional requirements are identified in the Part 2 Study, the Facilities Study (FAC) will be updated to reflect those additions as required.

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1.0 INTRODUCTION

This Facilities Study Report is based on the System Impact Study Report (SIS) as identified below:

System Impact Study Report (Part 1)
Report GIP-IR664-SIS-R4
Dated June 29, 2023

The SIS describes the facilities and modifications required to the Nova Scotia transmission system to add a 50 MW Battery Energy Storage System (BESS) at NSPI's 99W-Bridgewater substation. It also addresses short circuit, steady state, stability, power flow, and motor start analysis. It provides an overview of the scope of work to be completed and directions to this Facilities Study (FAC).

Part 2 of the SIS is still in progress and if any additional requirements are identified in the Part 2 Study, the FAC will be updated to reflect those additions as required.

The scope of work identified in the FAC outlines the anticipated work requirements for a conceptual level of engineering and design. Detailed design may identify additional requirements or modifications that were not anticipated or captured during the preliminary design phase.

1.1 Project Ownership and Responsibilities

Ownership, maintenance, and other commercial operation arrangements will be covered separately in a Generation Interconnection Agreement (GIA) between the Nova Scotia Power Inc (in its capacity as the Transmission Provider) and Nova Scotia Power Inc (in its capacity as the Interconnection Customer).

The Bridgewater BESS is being constructed at the existing 99W-Bridgewater substation and system device numbering for all additions will continue to be labelled under 99W.

The Point of Interconnection is the 138kV bus B62 at 99W-Bridgewater substation. Ownership of the infrastructure associated with the installation of a 50MW BESS at 99W-Bridgewater is based on the Point of Change of Ownership at the interface point between the 138kV side of the new 138kV – 34.5kV transformer and the 138kV terminal breaker 99W-663. An Interconnection Overview Diagram has been provided in Appendix B.

NSPI (Transmission Provider) will own the revenue metering located within the 99W-Bridgewater Substation.

All interconnection facilities must meet NSPI's Transmission System Interconnection Requirements (TSIR), version 1.1 dated February 25, 2021, as published on the NSPI OASIS site.

1.2 Estimated Cost

The total estimated cost to construct the required Transmission Provider's Interconnection Facilities is **$1,789,321**. There are no Network Upgrades associated with this interconnection. The detailed cost estimates are provided in Appendix G. *All cost estimates exclude allowance for funds used during construction (AFUDC) or any escalations due to timing of project execution.*

The cost estimates are based on the scope of work outlined in Section 2.0 of this Facilities Study Report excluding any costs covered under the Customer Interconnection Facilities. The cost estimate provided in Appendix G are estimates only, based on 2023 budgetary dollars. The Interconnection Customer will be responsible for paying for the actual costs associated with this project, be it higher or lower than the estimate provided herein, unless otherwise specified in the Generation Interconnection Agreement (GIA).

The cost estimate in this report is valid for one hundred eighty (180) days.

The project cannot commence until the Interconnection Customer delivers to NSPI the balance of the cost estimate for the project in a form acceptable to NSPI (Transmission Provider), or as per the terms of the GIA.

1.3 Project Schedule

The estimated project duration includes all scope of work required for the transmission interconnection as outlined in Section 2.0.

The Interconnection Customer's targeted commercial operation date is June 30, 2025, with first-power available by March 30, 2025.

An outline of major project milestones is provided in Section 5.0 and a preliminary project schedule outlining the major components of this project is provided in Appendix H.

2.0 SCOPE OF WORK

The scope of this Facilities Study is limited to providing the necessary designs, equipment, labor, and services required to interconnect the new 50MW BESS at 99W-Bridgewater substation. The interconnection will be tapped to the 138kV Bus B62 at 99W-Bridgewater via a new 138kV breaker terminal.

This report will cover the following:

- The Transmission Provider's Interconnection Facilities (equipment located between the Point of Interconnection and the Point of Change of Ownership and within the Interconnection Customer's Substation).
- Overview of Interconnection Customer Interconnection Facilities

Note: There are no Network Upgrades associated with this interconnection request. The 138kV-34.5kV transformer is part of the Interconnection Customer's facilities located on the Interconnection Customer's side of the Point of Change of Ownership.

2.1 Interconnection Overview

An interconnection overview diagram of the 50 MW Bridgewater BESS interconnection is provided in Appendix B. The Point of Interconnection (POI) is the 138kV bus B62 at 99W-Bridgewater substation. The Point of Change of Ownership (PCO) is at the interface point between the 138kV side of the new 138kV – 34.5kV transformer and the 138kV terminal breaker 99W-663.

A Basic One Line diagram of the proposed 50MW BESS interconnection to 99W-Bridgewater substation is provided in Appendix C.

2.2 99W-B62 138kV Bus Terminal

A new 138kV breaker terminal will be established at 99W-Bridgewater on 138kV Bus B62 to accommodate the new BESS facility. A development plan view of the proposed layout is provided in Appendix D.

The scope of this work covers the Transmission Provider's Interconnection Facilities (TPIF) between the POI and the PCO.

2.2.1 Structures and Foundations

All support structures and foundations shall comply with NSPI standard designs and requirements.

Concrete foundations and steel support structures will be installed for:

- 3 – 138kV high rigid bus supports
- 1 – 138kV low rigid bus supports

- 1 – 138kV low disconnect support
- 1 – 138V combined PT/CT support

Concrete foundations only will be installed for:

- 1 – 138kV dead tank circuit breaker

2.2.2 Grounding, Conduit, and Cable Trench

The existing substation ground grid will be evaluated to ensure safe operation for updated fault levels and step/touch potentials. All new structures and equipment will be tied into the existing substation ground grid.

A concrete cable trench will be installed from the existing substation cable trench to the new equipment. Conduits will be added as required to accommodate the new control cable additions.

2.2.3 Primary Equipment

All equipment shall conform with Nova Scotia Power standard equipment specifications.

New primary equipment will consist of:

- Circuit Breaker 99W-663
  - 145kV, 2000A, 31.5kA Dead Tank circuit breaker c/w 12/8/3/200-5A multi-ratio current transformers
  - As per NSPI Standard Circuit Breaker Specification SE-14.
- Disconnect 99W-663A.
  - 145kV, 2000A, 40kA, 650kV BIL vertical break disconnect with a manual operator.
  - As per NSPI Standard Specification SE-8 (Outdoor Air Switches)
- Revenue Class Combined Potential/Current Transformer
  - Voltage: 145kV Rated; 80500V: 115/67.08 V & 115/67.08 V
  - Current: As specified during detailed design
  - Revenue Class Certified

2.2.4 L-6002 Modification

A 138kV transmission line L-6002 is currently located between the existing 99W-Bridgewater substation and the proposed location for the BESS yard. Based on the conceptual design, 34.5kV cables, in underground ductbank, will connect the BESS step-up transformer to the BESS switchgear. The ductbank will cross under the existing 138kV line L-6002.

The proposed footprint of the BESS facility necessitates the relocation of the guys on structure L6002-413. Estimated costs associated with the L-6002 modifications have been included in the cost estimate provided in this report.

2.3 Interconnection Customer Facilities - BESS

The layout and electrical design of the Interconnection Customer's substation and BESS Facility shall be the responsibility of the Interconnection Customer. A preliminary one-line of the Interconnection Customer's substation, as provided by the Interconnection Customer, is included in Appendix E. The scope of this work covers the interconnection requirements associated with the Interconnection Customer Interconnection Facilities on the BESS side of the PCO.

For this FAC, the location of the Interconnection Customer's 138kV-34.5kV transformer is assumed to be within or directly adjacent the existing 99W fenced substation area. The location may differ once detailed design is completed. A preliminary layout of the substation facilities is provided in Appendix D. Estimated costs associated with the substation expansion have been included in the cost estimate provided in this report.

2.3.1 Structures and Foundations

All support structures and foundations shall comply with NSPI standard designs and requirements.

A concrete transformer pad shall be installed for the 138kV-34.5kV transformer. The foundation will be designed with NSPI's standard oil containment system including appropriately sized oil/water separation tanks.

2.3.2 Transformer for BESS

A 138kV – 34.5kV, 36/48/60 MVA transformer labelled 99W-T63 shall be installed to interface the BESS facility with the 138kV system bus 99W-B62. The transformer will be a Wye-Wye configuration with a buried 13.2 kV tertiary winding and a +/- 10% tap changer. Surge arresters will be provided on both the high and low voltage bushing terminals.

The primary terminals of the transformer will be open-air but the low voltage terminals will be enclosed for cable termination. The secondary terminals of the transformer will be connected to the BESS facility via 34.5kV primary cables concrete duct bank encased.

An oil containment system shall be installed for the transformer as noted in section 2.3.1.

2.3.3 50 MW Battery Energy Storage System (BESS)

A preliminary layout of the BESS facility is shown in Appendix F. The proposed BESS Facility includes a 34.5KV switchgear building including a 34.5kV circuit breaker, associated protection and control equipment, and cable interfaces. The proposed BESS is rated 50MW at 200MWh with

[redacted]

All civil works, including site clearing, excavation, access roads, drainage, foundations, fencing, and ductwork associated with the BESS yard is part of the Interconnection Customer Facility's scope of work.

2.4 Protection and Control

Protection and control upgrades are required to accommodate the addition of the BESS. The existing substation Remote Terminal Unit (RTU) at 99W will be replaced to accommodate the increased point count. Existing control panels will be modified to accommodate the new 138 kV circuit breaker's trip circuit monitors and breaker alarms in the 99W substation building. The 99W-B62 bus protection panel and Breaker Backup panel will be modified to accept the new breaker.

NSPI will require space and unrestricted access in the BESS's substation control building for two transformer protection relays, and communications equipment. It is anticipated that this equipment can be housed in one single free-standing cabinet, but detailed design will be required before it can be confirmed if a second cabinet is required.

The Interconnection Customer shall provide space and unrestricted access in the Interconnection Customer's substation control building for NSPI's protection, communications, and control equipment. The Interconnection Customer shall provide NSPI with all required SCADA points as defined during detailed design.

2.4.1 Transformer 99W-T63 Protection

At 99W-Bridgewater, transformer T63 protection will consist of redundant primary and secondary protection schemes. This protection shall be located in the BESS control building.

- The primary scheme line protection relay shall be a SEL-487E, receiving currents from the 138 kV breaker 99W-663 and the 34.5 kV switchgear, and voltages from the 34.5 kV bus.
- The primary protection shall trip the 138 kV circuit breaker 99W-663 via Trip Coil #1.
- The secondary scheme transformer protection relay shall be GE T60, receiving currents from the 138 kV breaker 99W-663 and the transformer T63 LV bushing CTs.
- The secondary protection shall trip the 138 kV 99W-663 breaker via Trip Coil #2.
- AC potentials for the primary and secondary protection schemes shall be supplied from separate secondary windings in the 34.5 kV bus Potential Transformers (PTs).
- AC currents for the primary and secondary protection schemes shall be supplied from separate Current Transformer (CT) cores.

2.4.2 Breaker Failure

- Breaker failure protection shall be provided for the 138 kV circuit breaker 99W-663. This protection will be located in the existing 99W control building.
- Breaker Failure Initiate (BFI) must not be latched in the design. Breaker failure timer shall only run for (Trip active) AND (Breaker current above minimum pickup). The trip input to the BFI logic shall not be subject to a minimum trip duration.
- Note: Breaker Failure protection is referred to as Breaker Backup (BBU) in NSPI documentation. A Re-trip is referred to as "Early Trip."

2.4.3 138 kV Circuit Breaker Closing and Synchronizing

- The 138 kV circuit breaker 99W-663 will normally be closed under LIVE BUS/DEAD LINE conditions.

- The 138 kV circuit breaker 99W-663 will be capable of being closed under DEAD BUS/LIVE LINE conditions.
- The 138 kV circuit breaker 99W-663 shall be logically restricted from closing under LIVE BUS/LIVE LINE conditions.

2.4.4 DC Supply for Protection

The Interconnection Customer shall provide dedicated 125V DC circuits and conduits (if required) from Interconnection Customer's substation DC station service distribution panel to supply the protection and control panel.

Primary and secondary protection schemes shall be supplied by separate DC breakers from the DC distribution panel.

2.4.5 Station Control and Communications

- The legacy 99W substation RTU will be replaced with an SEL-2240 Axion system to accommodate the increased point count.
- Sequence of Events Recording (SER) functionality will be provided by the existing 99W substation SER.
- Communication between the 99W substation RTU and the BESS control system will use DNP3 protocol over serial fiber.
- Communication between the RTU/SER and the transformer protection relays may be over fiber Ethernet.
- A satellite clock shall be provided.
- A time signal shall be distributed to each measuring relay using either Precision Time Protocol (IEEE 1588-2008 or later) or IRIG-B time code over 50 ohm coaxial cable.
- Each protective relay shall assert an alarm to the SER in the event of a loss of satellite clock signal.
- If PTP is used for time distribution, the Ethernet switches used shall be capable of supporting PTP with the C37.238-2017 power system profile.
- In the event of a failure of the RTU, local manual operation of the 34.5 kV breakers shall be available from inside the IC control building.

2.4.6 Station Alarms

The following substation alarms will be provided to the local Sequence of Events Recorder (SER) and SCADA (unless otherwise noted):

1. Urgent (SCADA) time delayed & initiated by following SER points:
   - Station Service Failed
   - Battery Volts Low
   - Battery Charger Failed
   - Protection AC Potential Failed
   - Breaker Trip Circuit Failed
   - Fire Alarm Operated
   - Building High Temperature
   - Building Low Temperature

2. Non-Urgent (Scada) time delayed & initiated by following SER points:
   - Alternate Station Service Failed
   - Station Service Auto Transfer Operated
   - DC Supply(s) Grounded
   - Relay Time Sync Failed
3. Line 99W-T63 Primary Protection Operated (SER only)
4. Line 99W-T63 Secondary Protection Operated (SER only)
5. Local Control (Scada) initiated by following SER point:
   - Breaker 99W-663 Control Local (existing 99W control building only)
   - Breaker 99W-463 Control Local
   - Breaker 99W-431 Control Local
   - Breaker 99W-432 Control Local
   - Breaker 99W-433 Control Local
   - Breaker 99W-434 Control Local
   - Breaker 99W-435 Control Local
6. Breaker 99W-663 Closed (existing 99W control building only)
7. Breaker 99W-463 Closed
8. Breaker 99W-431 Closed
9. Breaker 99W-432 Closed
10. Breaker 99W-433 Closed
11. Breaker 99W-434 Closed
12. Breaker 99W-435 Closed
13. Breaker 99W-663 Urgent (Scada) initiated by following SER points:
   - Breaker 99W-663 SF6 Density Low (existing 99W control building only)
   - Breaker 99W-663 Motor Overload* (existing 99W control building only)
   - Breaker Trip Circuit #1 Failed (existing 99W control building only)
   - Breaker Trip Circuit #2 Failed (existing 99W control building only)
14. Breaker 99W-663 Control Blocked (Scada) initiated by following SER point:
   - Breaker 99W-663 SF6 Control Blocked (existing 99W control building only)
15. Breaker Backup Lockout (Scada) initiated by following SER points:
   - Breaker 99W-663 BBU Lockout Operated (existing 99W control building only)
16. Breaker 99W-663 BBU Initiated & Early Trip Operated (existing 99W control building SER only)
17. Substation Entry
18. Protection/DC Fail (Scada) initiated by following SER points:
   - 99W-T63 Primary Protection Relay/DC Fail
   - 99W-T63 Secondary Protection Relay/DC Fail
   - 99W-431 Protection Relay/DC Fail
   - 99W-432 Protection Relay/DC Fail
   - 99W-433 Protection Relay/DC Fail
   - 99W-434 Protection Relay/DC Fail
   - 99W-435 Protection Relay/DC Fail

Note: These alarms may differ depending on the manufacturer of the breakers purchased and additional SCADA alarms may be required related to the BESS Control System.

2.5 Supervisory Control and Data Acquisition / Remote Terminal Unit

Supervisory control will be provided via the new SEL-2240 Axion RTU in the existing 99W substation building.

2.6 Telecommunications

Telecommunication will be provided by existing facilities at 99W. Communication between the existing 99W substation building and the new BESS control building will be via a combination of serial fiber and Ethernet fiber. This arrangement will effectively separate the new BESS system from the existing substation building for NERC CIP compliance.

The location of the BESS facility will necessitate the relocation of existing communications cables from substation to the microwave radio site. The final details of the required relocations will be determined during detailed design. An estimated cost associated with the relocations has been included in the cost estimate provided in this report.

2.7 Station Service

The Interconnection customer shall provide an alternate station service supply and auto transfer switch to maintain heat/lights/battery charger while transformer 99W-T63 is out of service.

2.8 Revenue Metering

A 138kV revenue metering system, owned by NSPI (Transmission Provider), shall be installed at the 99W-Bridgewater substation.

The 138kV revenue class current and voltage transformers will be supplied and installed by NSPI (Transmission Provider) complete with supporting structures, test switch, and meter base as per Nova Scotia Power metering standard STD 5.12 (attached as Appendix I: Revenue Metering).

The revenue metering class potential and current transformers shall not be embedded in any other piece of equipment and shall be certified by Measurement Canada for three element metering. Nova Scotia Power shall provide the technical specifications for the required current and voltage transformers to the Interconnection Customer.

Nova Scotia Power will install the revenue meter at the Interconnection Customer's substation once the commissioning is complete and the system is ready for energization.

2.9 Scope of Work Categorization

In the event NSPI cannot meet the Interconnection Customer's schedule expectation or as agreed in the terms of the Generation Interconnection Agreement (GIA), the Interconnection Customer may take responsibility for design, procurement, and construction activities associated with NSPI owned assets.

These design, procurement, and construction activities are limited to upgrades deemed to be 'Transmission Providers Interconnection Facilities (TPIF)' or 'Stand Alone Network Upgrades', defined as:

> *Transmission Provider's Interconnection Facilities (TPIF) shall mean all facilities and equipment owned, controlled, or operated by the Transmission Provider from the Point of Change of Ownership to the Point of Interconnection as identified in Appendix A to the Standard Generator Interconnection and Operating Agreement, including any modifications, additions or upgrades to such facilities and equipment.*
>
> *Network Upgrades (NU) shall mean the additions, modifications, and upgrades to the Transmission Provider's Transmission System required at or beyond the point at which the Interconnection Customer interconnects to the Transmission Provider's Transmission System to accommodate the interconnection of the Generating Facility to the Transmission Provider's Transmission System.*

IR-664 BESS Bridgewater interconnection requires TPIF but no Network Upgrades and all TPIF are non-stand-alone. Therefore, all TPIF associated with interconnection shall be performed by the Transmission Provider.

2.9.1 Network Upgrades Scope

There are no Network Upgrades required for this interconnection.

2.9.2 Transmission Provider Interconnection Facilities (TPIF) Scope

All TPIF are categorized as non-stand-alone.

The TPIF scope of work includes:

- Expansion of 99W Substation
- Addition of a 138kV breaker terminal
- Revenue Metering for the BESS terminal
- All associated protection, control, communication additions and modifications.

Interfaces and commissioning activities requiring joint collaboration shall be identified during the detailed design phase and prior to construction.

2.9.3 Customer's Interconnection Facilities Scope

The Customer's Interconnection Facilities are summarized in Section 2.3.

3.0 PERMITS, APPROVALS, AND STANDARDS

The Interconnection Customer is responsible to obtain all permits and approvals required to construct the 50W BESS Facility at the 99W-Bridgewater substation location.

The installation will be subject to the review and approval by Nova Scotia Power (Transmission Provider) to ensure coordination of the Nova Scotia Power (Transmission Provider) and Interconnection Customer's scopes of work.

All equipment and installation shall comply with NSPI standard specifications and work practices.

4.0 DESIGN AND CONSTRUCTION

NSPI will be responsible for the design and engineering drawing production for all aspects of the scope of work from the Point of Interconnection to the Point of Change of Ownership unless otherwise specified and agreed in the Generation Interconnection Agreement (GIA). NSPI will also be responsible for the design of any other associated network upgrades or modifications identified in the Study Impact Study.

NSPI will be responsible for the procurement and construction of all aspects of the scope of work from the Point of Interconnection to the Point of Change of Ownership and any associated network upgrades unless otherwise specified in the Generation Interconnection Agreement (GIA).

The Interconnection Customer shall be responsible for the design, procurement, and construction of all facilities on the Interconnection Customer side of the Point of Change of Ownership.

The construction work associated with this interconnection will require planned outages to existing system components. Planned system outages must be coordinated with NSPI System Operations and will be restricted to opportunities when system reliability risks are acceptable.

5.0 SCHEDULE MILESTONES

The Interconnection Customer's targeted commercial operation date is June 30, 2025, with first-power available by March 30, 2025.

A preliminary project schedule outlining major components is provided in Appendix H.

A series of milestone target dates (listed below) were assumed based on optimistic timelines for the purpose of drafting a schedule for this Facilities Study. The in-service dates provided in this schedule are based on achieving these milestones. Missing any of these milestones increases the risk of meeting the proposed commercial operation date.

Facilities Study Complete	November, 2023
Generation Interconnection Agreement Executed	Q4 / 2023
Detailed Design Start – 99W Interconnection	Q4 / 2023
Construction Start – 99W New 138kV Breaker Terminal	Q3 / 2024
Construction Start – 99W New 138kV-34.5kV Transformer Civil Works	Q2 / 2024
138kV Primary Equipment Delivery to Site	Q4 / 2024
138kV-34.5kV Transformer Delivery to Site	August, 2024
New 138kV Breaker Terminal and Interconnection Customer Substation (99W) Construction Complete	Q1 / 2025
Protection, Control, and Communications Modifications Complete	Q1 / 2025
First Power Available (99W)	March 30, 2025
Commercial Operation	June 30, 2025

6.0 COST ESTIMATE

The cost estimates have been produced using 2023 budgetary rates. They do not include allowance for funds during construction (AFUDC) or any escalations due to timing of project execution.

The cost estimates are based on the conceptual design outlined in this report and should be considered as a class 3 accuracy level (-20% / +30%).

The cost estimates include project overheads based on NSPI's typical internal capital administration overhead allocation process. Overhead allocations may vary depending on how the project is executed.

There are no Network Upgrades associated with this interconnection request. *The cost estimate provided is only for the Transmission Provider Interconnection Facilities and does not include any costs associated with the Customer Interconnection Facilities.*

A contingency of 10% has been included in the estimates to account for unforeseen scope changes or supply chain issues.

Cost Estimate Summary:

Upgrade Component	**Cost Estimate**
Transmission Provider Interconnection Facilities (TPIF)	
New 138kV Breaker Terminal at 99W-Bridgewater Substation, L-6002 Modifications, Protection, Control, and Telecommunication equipment modifications, and addition of Revenue Metering for BESS interconnection	$1,789,321
Total	**$1,789,321**

A more detailed breakdown of each cost estimate is provided in Appendix G.

7.0 COMMISSIONING / OPERATIONS

NSPI reserves the right to inspect all Interconnection Facilities identified in this study prior to connection to the NSPI Transmission System to ensure the facility design and construction will not adversely affect the reliability of the Transmission System. All Interconnection Facilities are subject to NSPI's review and acceptance of all testing and commissioning requirements and results. Construction, switching, testing, and commissioning schedules that affect the reliable and stable operation of the Transmission System shall be coordinated with the Nova Scotia Power System Operator.

All system outages required to complete the interconnection work shall require advanced planning and coordination with the Nova Scotia Power System Operator.

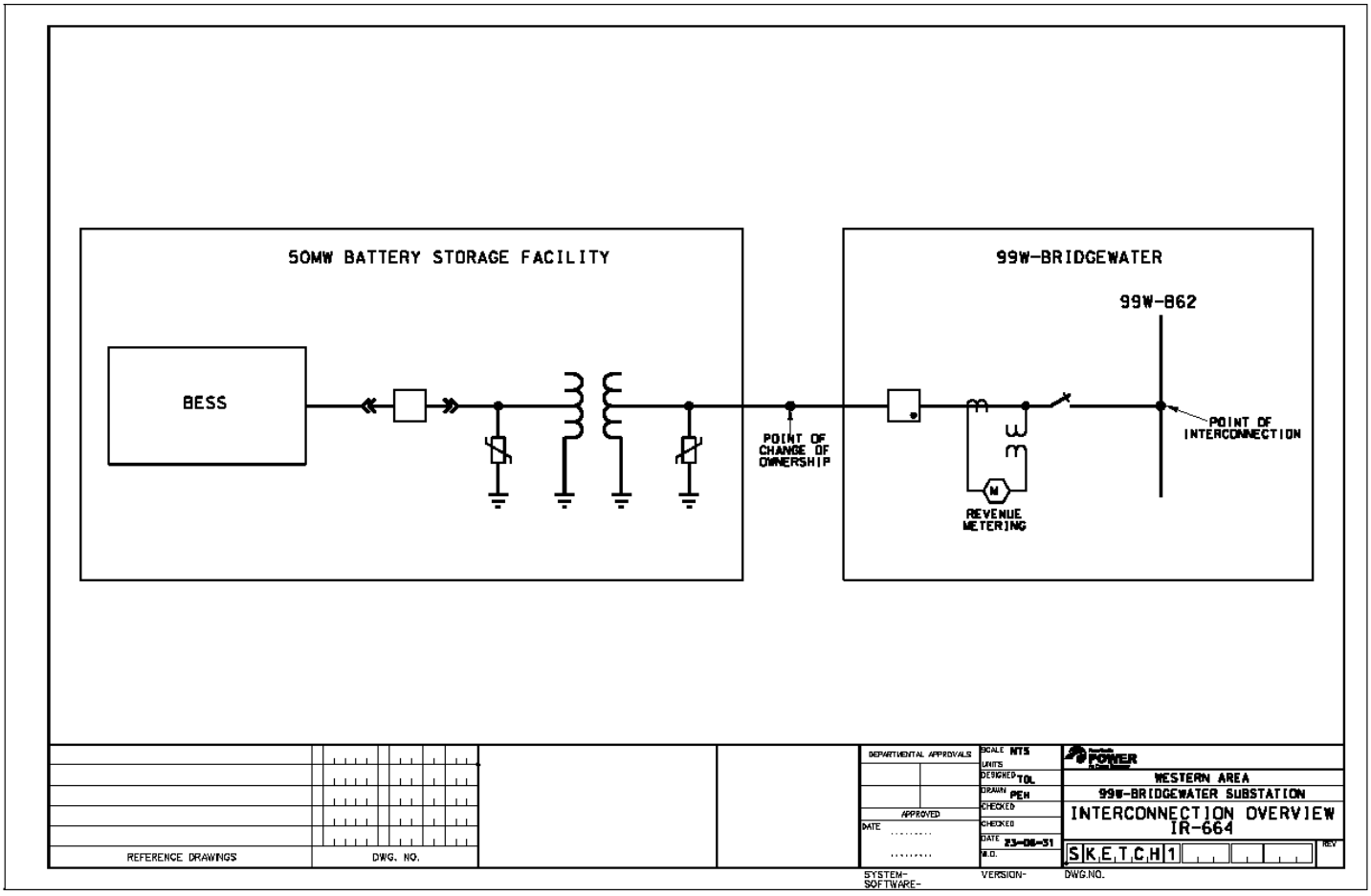
All interconnection facilities must meet NSPI's Transmission System Interconnection Requirements (TSIR), version 1.1 dated February 25, 2021, as published on the NSPI OASIS site.

Appendices

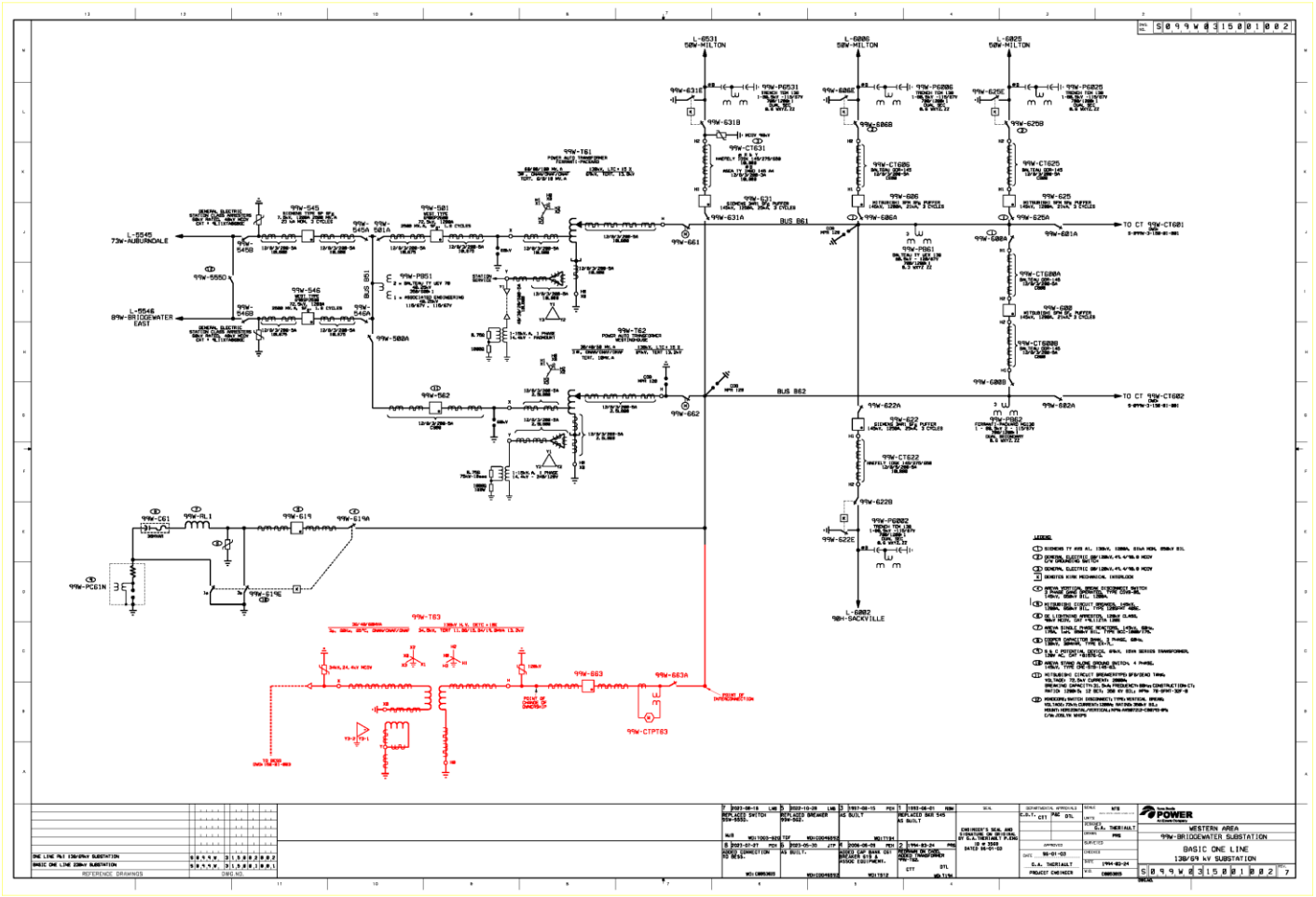
Appendix A – Interconnection Facilities Study Agreement

(attachment 1)

Appendix B – Interconnection Overview

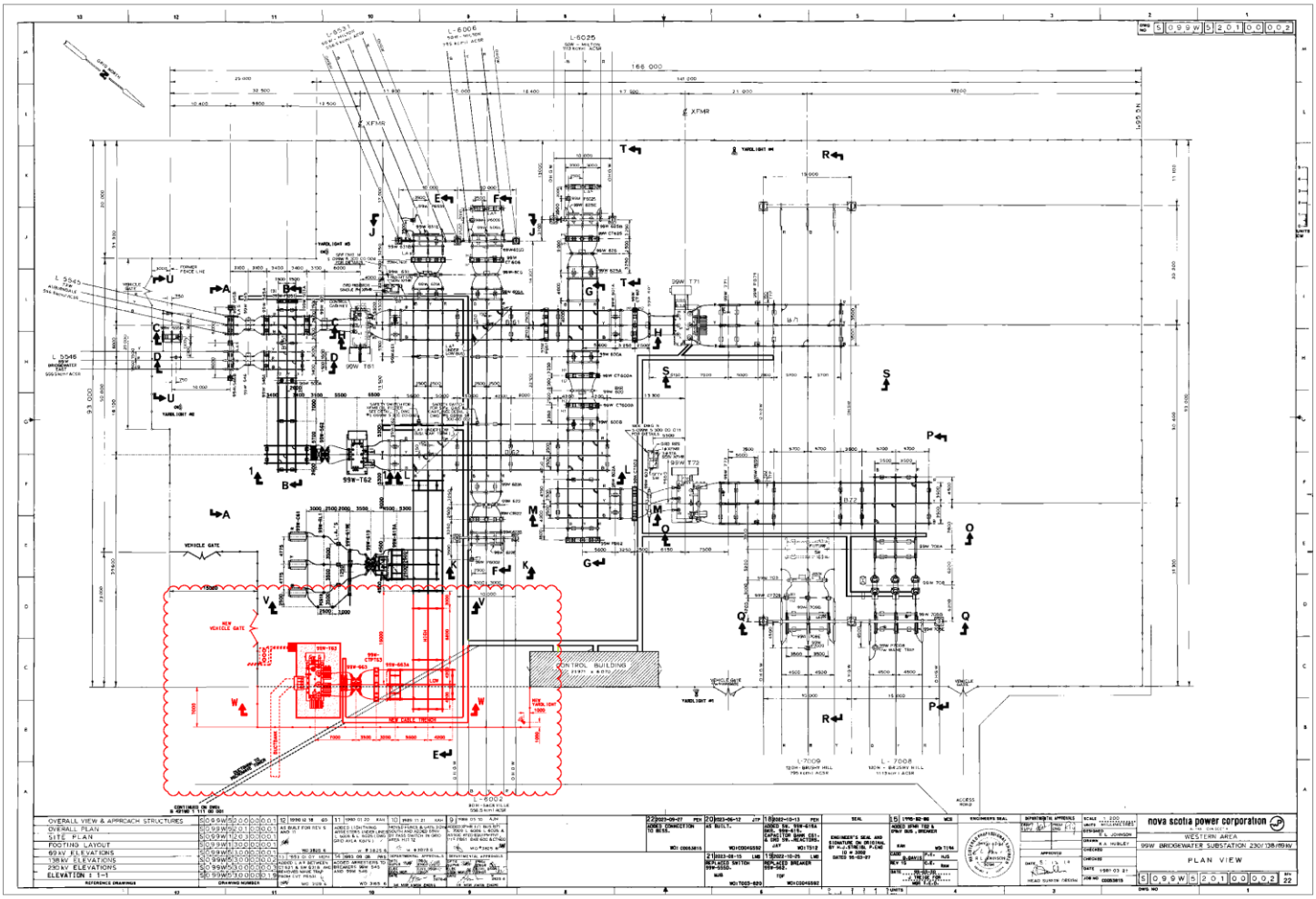


Appendix C – 99W BESS Developmental One Line



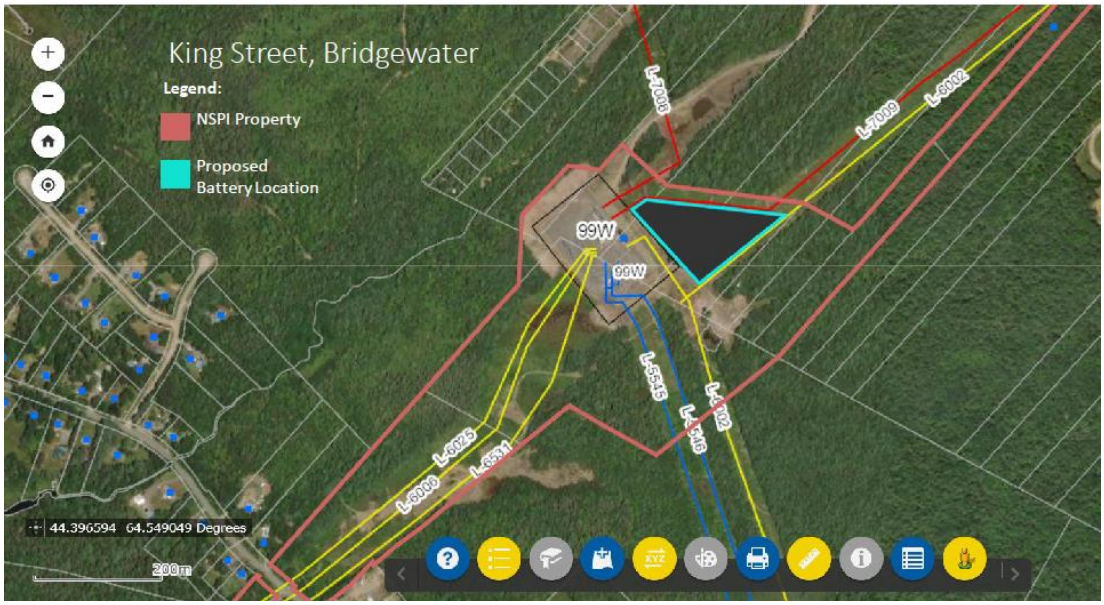
Appendix D – 99W-B62 Bus Tap Configuration

Note: The new 138kV-34.5kV transformer is shown located within the expanded substation area at 99W. The costs associated with the new 138kV-34.5kV transformer, transformer foundation, or 34.5kV cable and ductbank to the BESS Facility are not included in the TPIF estimate. These additions are beyond the Point of Change of Ownership and part of the Customer Interconnection Facilities.



Appendix E – BESS INTERCONNECTION FACILITY ONE LINE

Appendix F – BESS Preliminary Layout (99W)



Appendix G – Cost Estimate Details

Transmission Provider Interconnection Facilities (TPIF):

Note: This estimate includes the estimated costs for the TPIF only. This includes the expansion of 99W Substation, the addition of a 138kV breaker terminal, L-6002 modifications, revenue metering, and associated protection, control, communication additions and modifications.

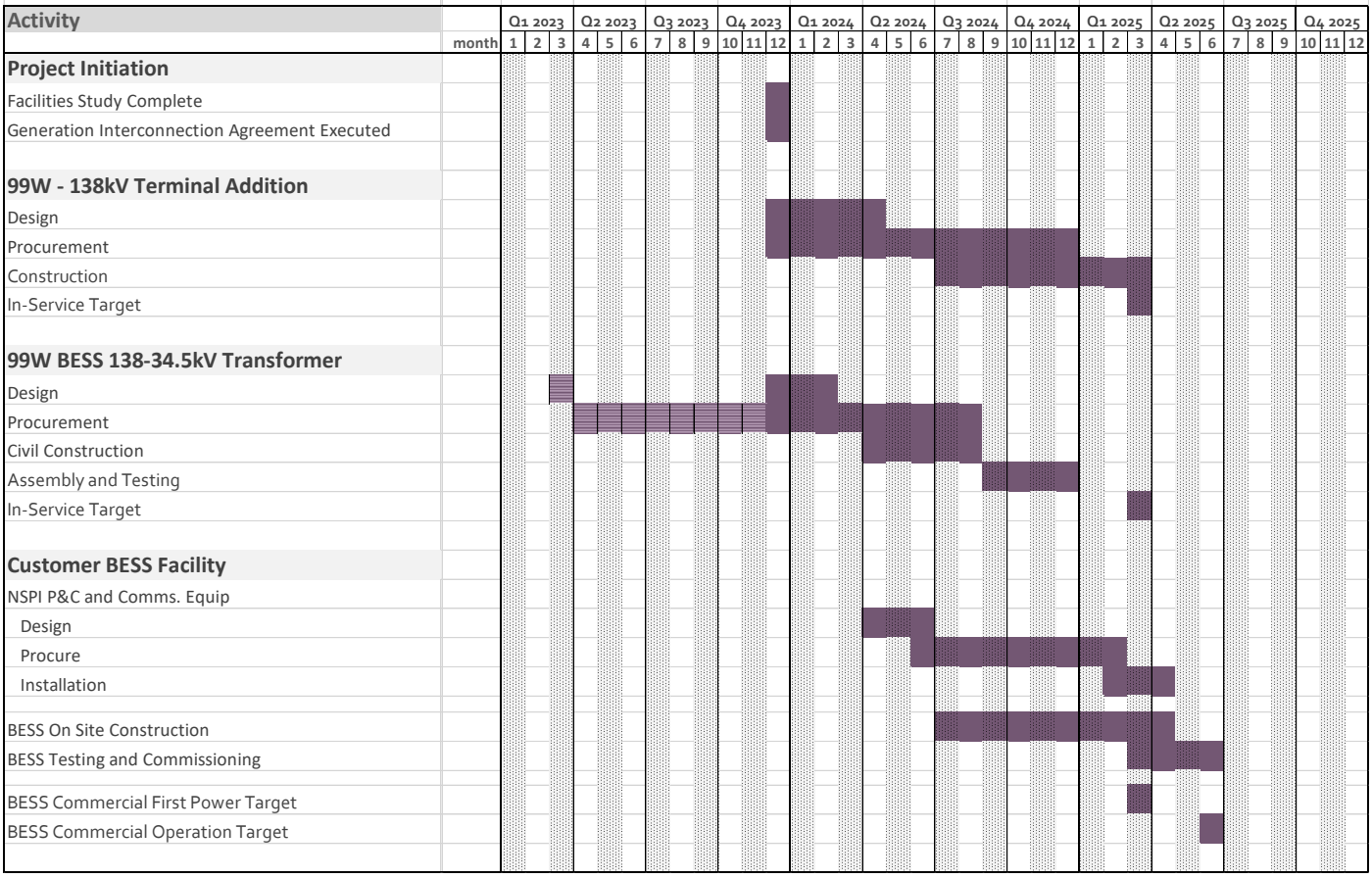
This estimate does not include the new 138kV-34.5kV transformer, transformer foundation, or 34.5kV cable and ductbank to the BESS Facility which are part of the Customer Interconnection Facilities.

99W BESS TPIF Only		CI Number:								
		Project Number:								
		Cost Centre:		900						
Activity	Accounts	Labour		Material	Expenses			Contracts	Consulting	Totals
		Regular	OT		Travel	OT Meals	Meals			
		530050	530200	531400	530950	533410	533400	531550	532500	
003	Buildings, Structures and Grounds	0	0	32,372	0	0	0	300,021		332,393
022	Electrical Control Equipment	22,999	0	166,625	0	0	0	0		189,624
035	Wood Poles	3,513	0	4,500	0	0	0	7,500		15,513
043	Substation Devices	15,264	0	292,910	0	0	0	34,000		342,174
061	Telephone / Communications Equipment	14,335	0	40,000	0	0	0	100,000		154,335
085	Design (i.e. Engineering)	120,226		1,000	4,555		1,000	0	0	126,781
086	Commissioning	32,693	0	0	0	0	0	0		32,693
087	Field Supervision and Operations	5,463	0	0	2,600		1,000	17,000		26,063
	Sub-Total	**214,493**	**0**	**537,407**	**4,555**	**0**	**1,000**	**458,521**	**0**	**1,215,975**
085	Contingency	21,449	0	53,741	456	0	100	45,852	0	121,598
	Sub-Total	**235,942**	**0**	**591,147**	**5,011**	**0**	**1,100**	**504,373**	**0**	**1,337,573**
005	Vehicle Allocation (Labour & Engineering)				88,809					88,809
005	Construction Overhead (Labour)							176,566		176,566
005	Construction Overhead (Eng. Labour)							98,968		98,968
005	Construction Overhead (Contracts)							87,405		87,405
	Sub-Total				**88,809**			**362,939**		**451,748**
	Grand Total	**235,942**	**0**	**591,147**	**93,820**	**0**	**1,100**	**867,312**	**0**	**1,789,321**

Appendix H – Preliminary Project Schedule

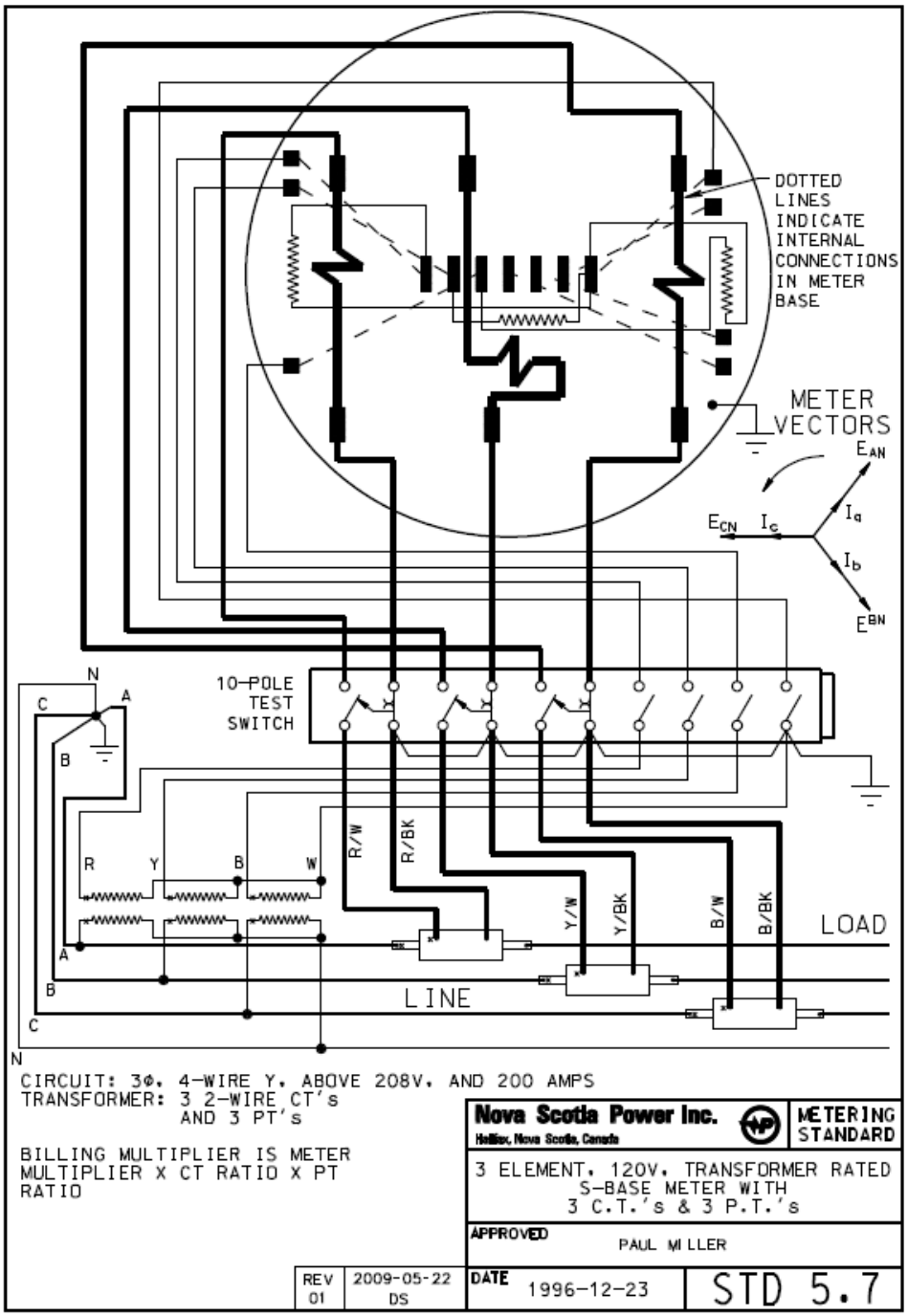
Note: Primary Equipment supply chain volatility may introduce significant and unpredictable procurement timelines to the overall project schedule.

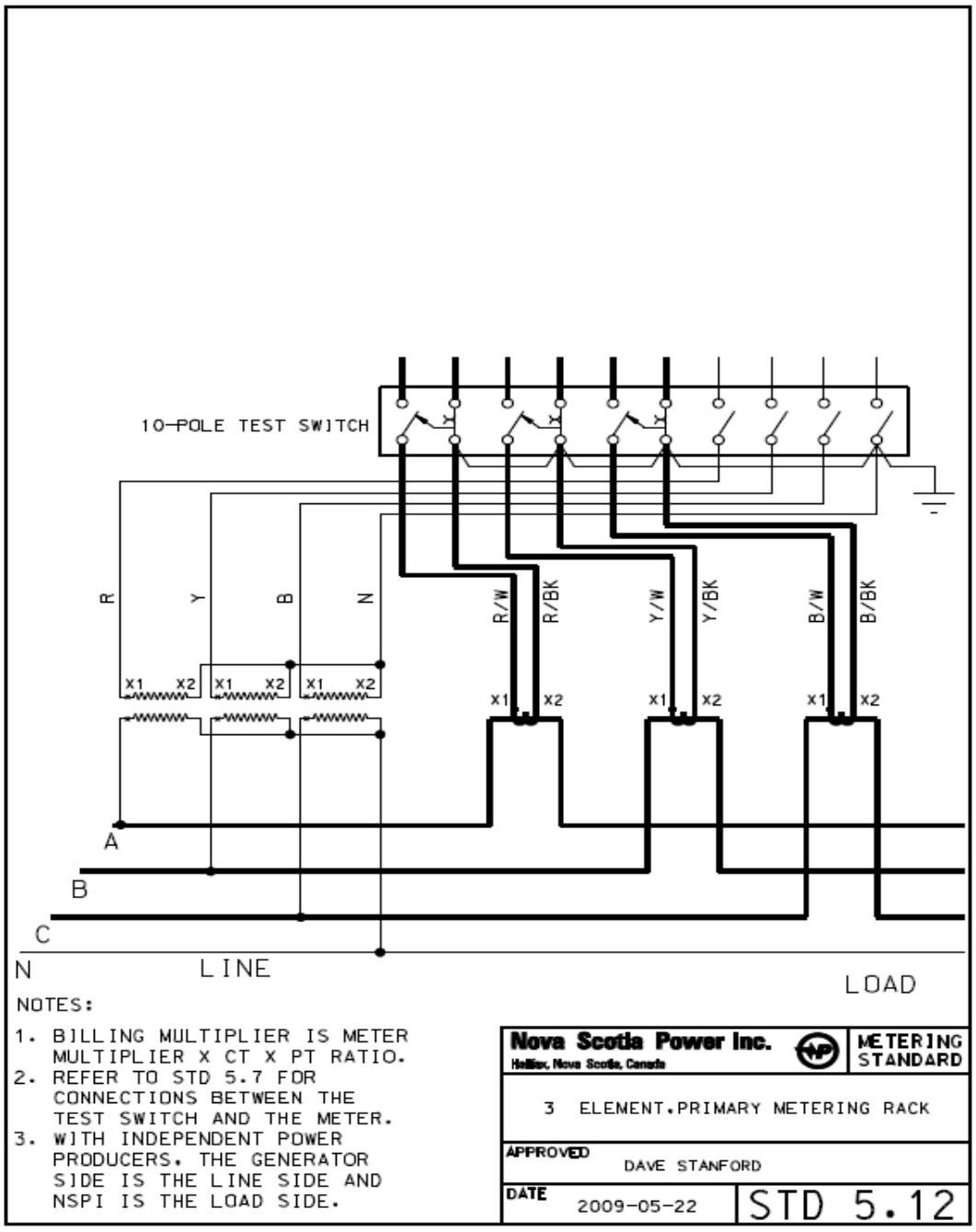
IR 664: BESS - 99W-Bridgewater - Preliminary Schedule



Appendix I – Revenue Metering

NSPI Standards 5.7 and 5.12




10-POLE TEST SWITCH
R
Y
B
N
R/W
R/BK
Y/W
Y/BK
B/W
B/BK
X1
X2
A
B
C
N
LINE
LOAD
NOTES:
1. BILLING MULTIPLIER IS METER MULTIPLIER X CT X PT RATIO.
2. REFER TO STD 5.7 FOR CONNECTIONS BETWEEN THE TEST SWITCH AND THE METER.
3. WITH INDEPENDENT POWER PRODUCERS, THE GENERATOR SIDE IS THE LINE SIDE AND NSPI IS THE LOAD SIDE.
Nova Scotia Power Inc.
Halifax, Nova Scotia, Canada
METERING STANDARD
3 ELEMENT.PRIMARY METERING RACK
APPROVED
DAVE STANFORD
DATE
2009-05-22
STD 5.12

Appendix J – Minutes of Facilities Study Review Meeting

Notes:

- Attendees:Debra McLellan, Elizabeth Dionne, Timothy Leopold, Mohit Agarwal
- Introductions:Date: November 30th 2023
- Review of questions provided by the Interconnection Customer (IC) on the draft Facilities Study (FAC):No questions submitted by IC
- Meeting Notes:
  - IC is working to negotiate the contract and added buffer so that they have [redacted] at COD and adding two additional containers to accommodate the degradation of batteries.
  - The reports will be public.
  - Waiting for confirmation if there is any confidential information that should be redacted from the report.
  - Provided high-level overview of transmission work for IR662 & IR664
  - No network upgrades are identified for any of these two IRs
  - More cost for Bridgewater interconnection is due to relocation of L-6002
  - The dates on FAC are based on what we know today like breakers are ordered, transformer are arriving in Aug 2024 for Bridgewater and Nov 2024 for Spider lake and these date can change in GIA and when GIA is executed.
  - SOW doesn't include Transformer and foundation work.
  - GIA will only be executed once we have all SIS is completed
  - Financial security is required 30 days in advance to begin any design/construction and this will be a milestone in GIA and will be negotiated to achieve COD
  - There is very little risk that any change in SIS would impact TPIF
  - FEAS identified some Network upgrade and is there a chance that Network upgrade would come back? They were identified in Feas as possibility and removed from SIS so we would go by the system impact study more so than the feasibility study.
  - Project size is capped 50MW

- Request from IC:Any information that is specific to the Battery vendor is considered Confidential at this time. This includes the number of inverters and transformers, site layout, Single lines, any Battery type or model information. Information that can be included is the specific SMA 3600 model as long as there is no reference to the number of units that will be use. This information is design specifically for this Battery Vendor