Nova Scotia
POWER
An Emera Company

MARCH 14, 2014

2014 IRP – Draft Assumptions

Agenda

- Assumptions
  - Environmental/Emissions Constraints
  - Future Supply Options
  - Wind Capacity Factor & Integration Cost
  - Hydro Generation
  - Import Options
  - Transmission
  - Existing Supply Side Options
  - Capital Planning
  - Financials
  - Fuels Forecast
  - Load Forecast
  - DSM
- Analysis Plan

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Environmental & Emissions Assumptions

CO2/Greenhouse Gases Regulatory Context

- In September 2012, the Government of Canada released its regulations for coal-fired electricity generators to come into force in 2015.
- Regulations would require coal-fired units to meet GHG emission standard of 420 t CO_2/GWh or shut down at the end of their useful life, approximately 50 years from commissioning.
- It was determined that Nova Scotia's regulatory approach can meet or exceed the federal GHG reductions in a less costly manner.

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CO2/Greenhouse Gases Regulatory Context

- In September 2012, the Federal and Provincial governments released a draft equivalency agreement which, once finalized, will ensure the provincial regulations will apply in NS.
- Nova Scotia *Greenhouse Gas Emission Regulations* outline hard caps for 2010 to 2030.

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CO2/Greenhouse Gases Assumptions

Scenario A

- Emissions limits as per *An Agreement on the Equivalency of Federal and Nova Scotia Regulations for the Control of Greenhouse Gas Emissions from Electricity Producers in Nova Scotia* (Sept. 2012)
- Limit declines to 3.4 Mt in 2040
- The downward path of the GHG constraint in Scenario A is consistent with the long range goals of the Federal Government for 2050

Scenario B

- Emissions limits as per *An Agreement on the Equivalency of Federal and Nova Scotia Regulations for the Control of Greenhouse Gas Emissions from Electricity Producers in Nova Scotia* (Sept. 2012)
- No decline in limit post 2030

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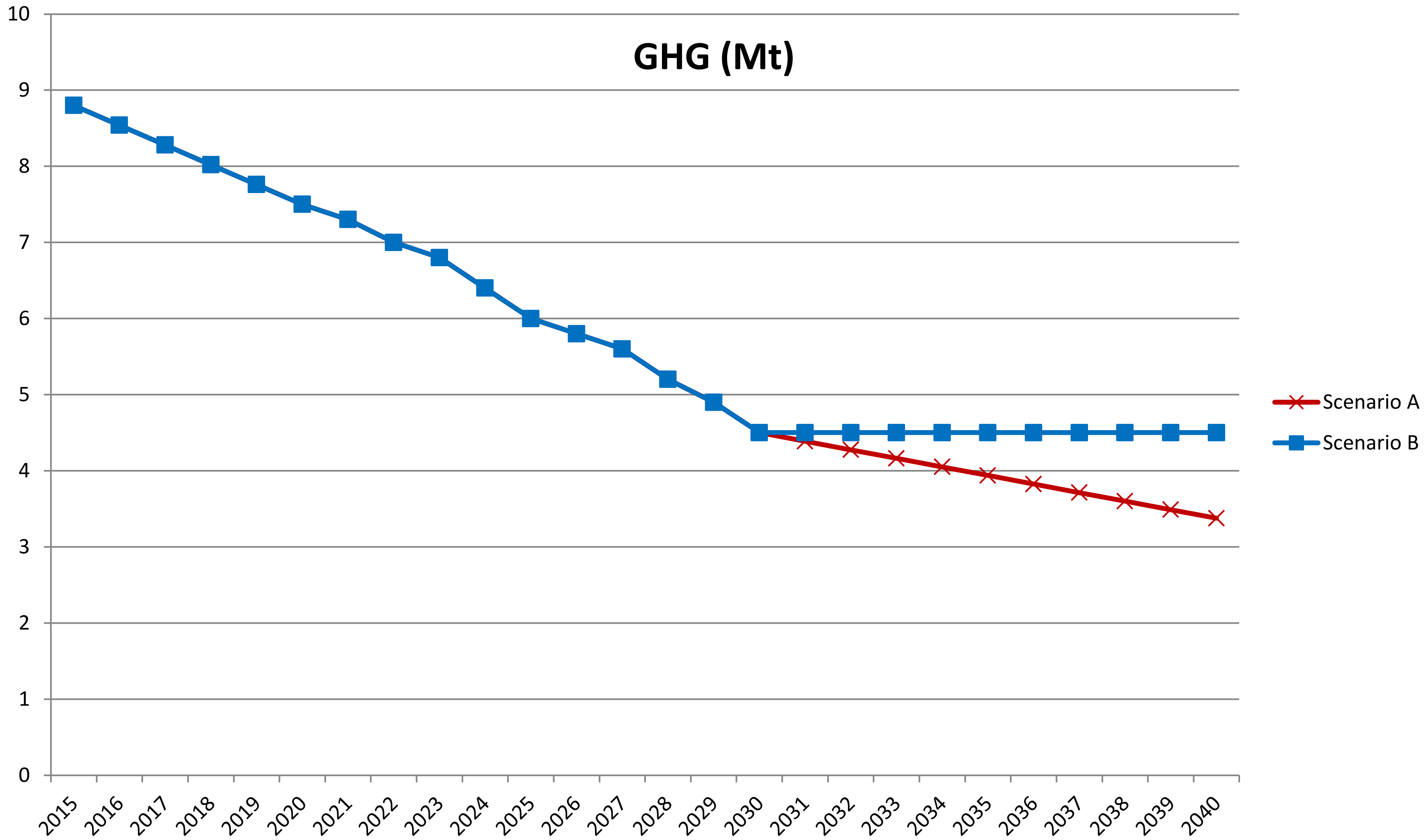
GHG Emission Targets



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Air Pollutants Regulatory Context

- Nova Scotia *Air Quality Regulations* outline hard targets for SO_2, NO_x, and Hg until 2020.
- In June 2013, Nova Scotia Environment released a discussion paper outlining emission limits for SO_2, NO_x, and Hg until 2030.

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SO2 Assumptions

- Scenario A
  - Emissions limits as per *NS Air Quality Regulations* to 2020
  - Post 2020 limits guided by *Amendments to Greenhouse Gas & Air Quality Emissions Regulations Discussion Paper* (NSE, June 2013).

- Scenario B
  - Emissions limits as per *NS Air Quality Regulations*
  - 2020 Emission limit holds through 2040.

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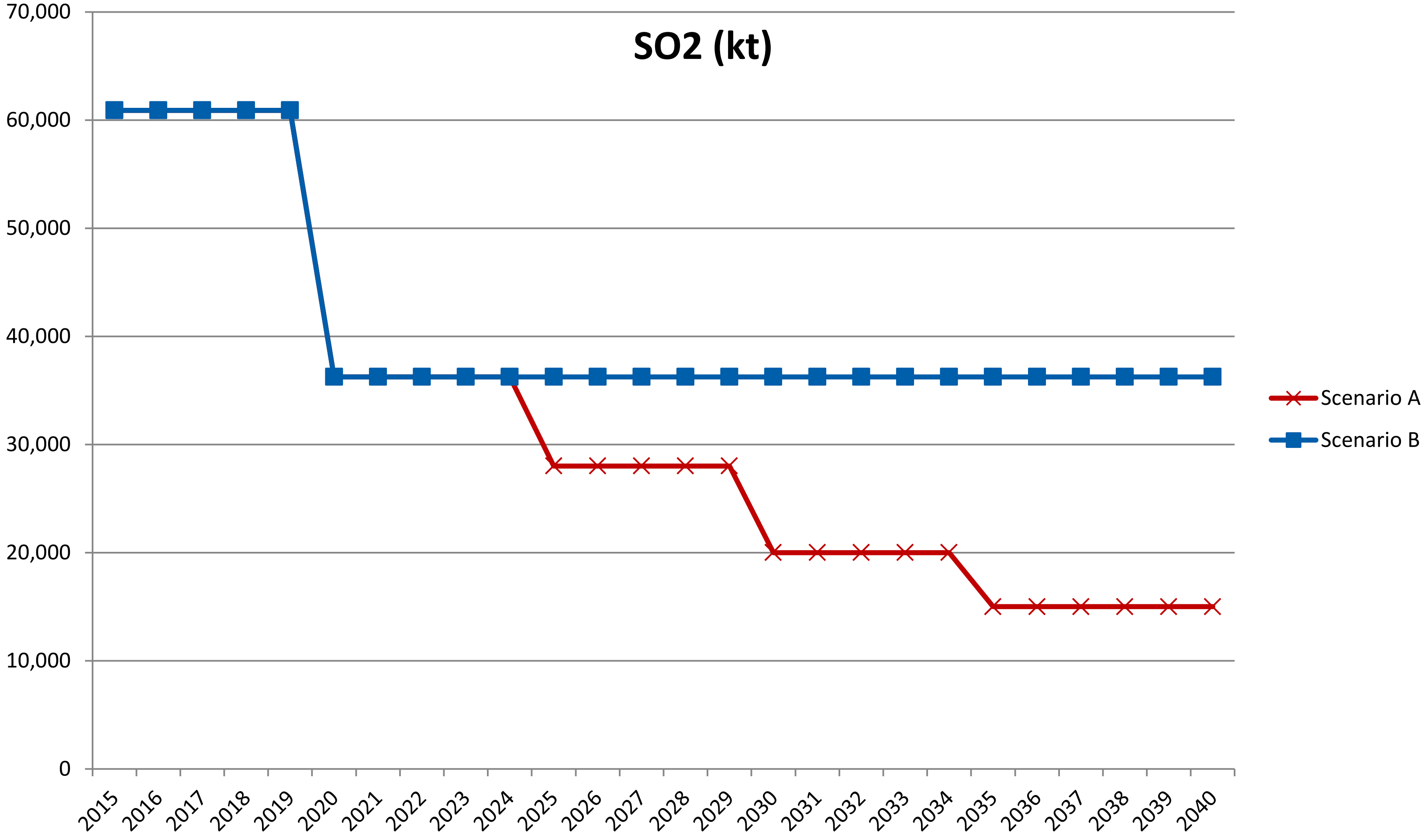
SO2 Emission Targets



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NOx Assumptions

- **Scenario A**
  - Emissions limits as per *NS Air Quality Regulations* to 2020
  - Post 2020 limits guided by *Amendments to Greenhouse Gas & Air Quality Emissions Regulations Discussion Paper* (NSE, June 2013).

- **Scenario B**
  - Emissions limits as per *NS Air Quality Regulations*
  - 2020 Emission limit holds through 2040.

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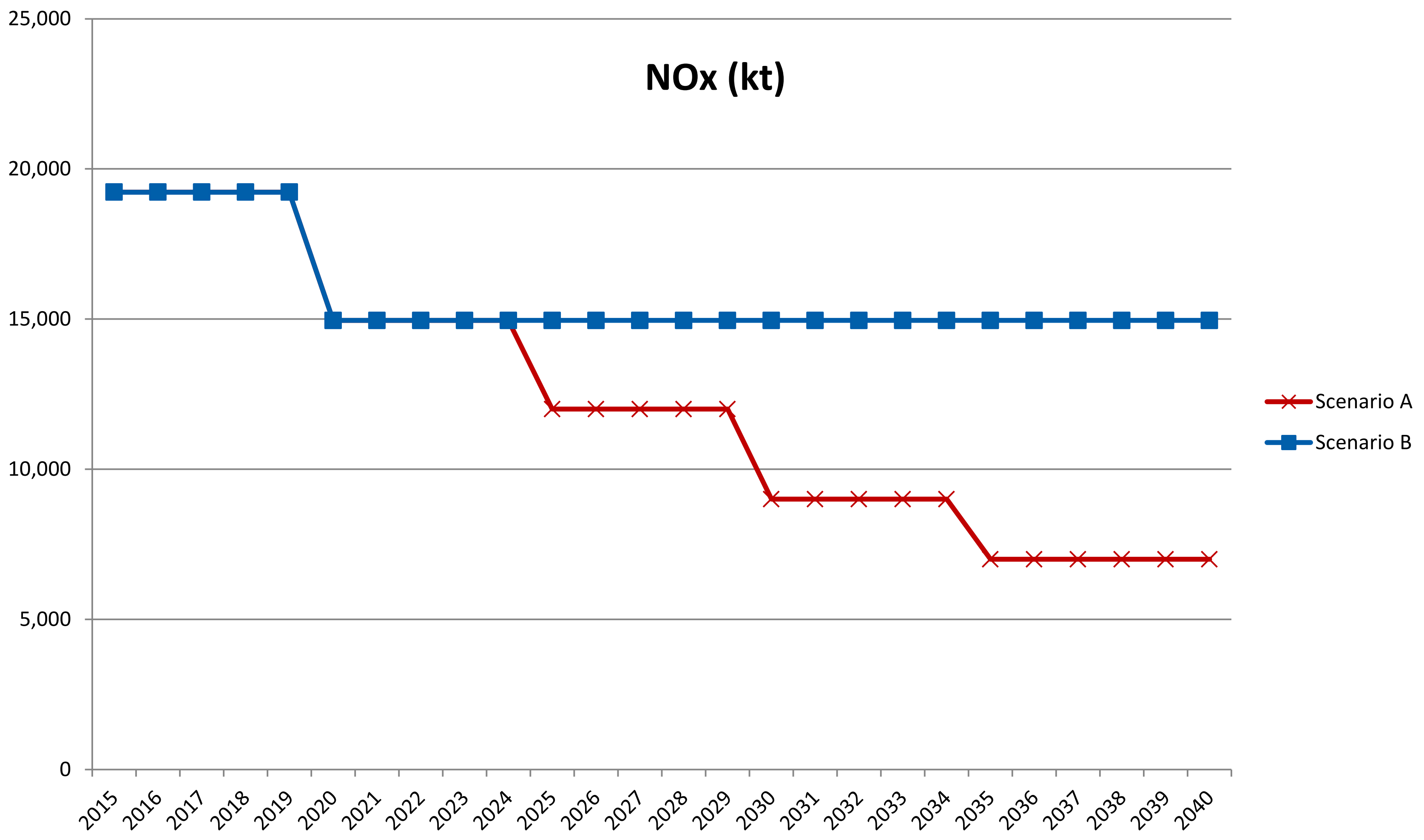
NOx Emission Targets



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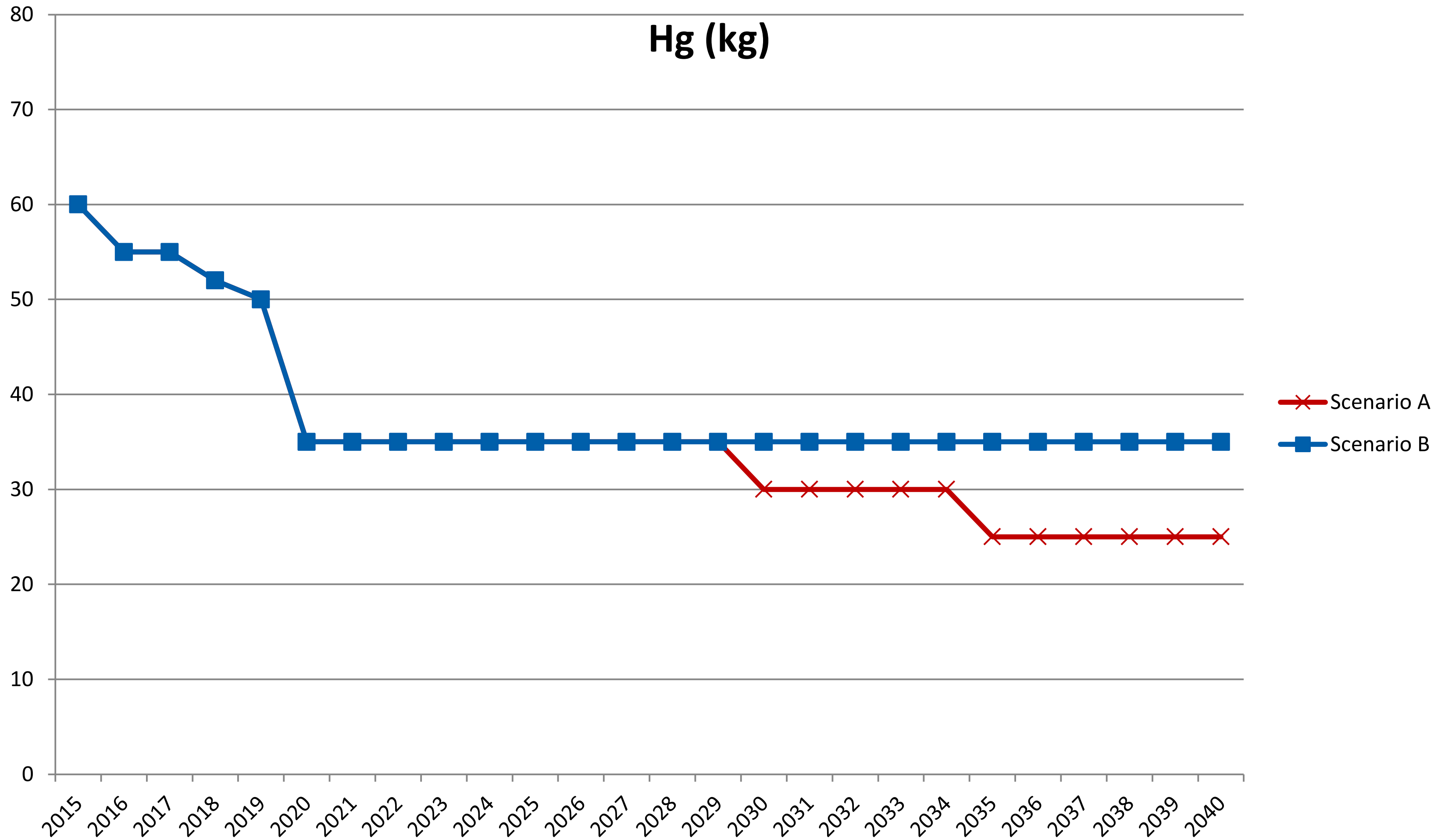
Hg Assumptions

- Scenario A
  - Emissions limits as per *NS Air Quality Regulations*
  - 2015-2019 limits based on 65 kg limit minus supplemental emissions from 2010 through 2014.
  - Post 2020 limits guided by *Amendments to Greenhouse Gas & Air Quality Emissions Regulations Discussion Paper* (NSE, June 2013).

- Scenario B
  - Emissions limits as per *NS Air Quality Regulations*
  - 2015-2019 limits based on 65 kg limit minus supplemental emissions from 2010 through 2014.
  - Post 2020 limit is 35kg - limit holds through 2040.

Hg Emission Targets



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RES Requirements

- The Renewable Electricity Standards for Nova Scotia are defined in the *Renewable Electricity Regulations* under the *Electricity Act*.
- http://www.novascotia.ca/just/regulations/regs/elecrenew.htm
- The RES requirements are outlined in the following slide with timelines.

RES Requirements

- The following RES measures must be met by NSPI
  - As of 2014, at least 10% of net sales must be generated by renewable electricity, of which 5% can be NSPI owned.
  - As of 2015, at least 25% of net sales must be generated by renewable electricity, of which at least 5% plus an additional 300 GWh must be supplied by IPPs. The additional generation may be supplied by the feed-in-tariff program, NSPI owned facilities, or other sources of renewables. NSPI can only supply 150 GWh or less from co-firing biomass.
  - As of 2020, at least 40% of net sales must be generated by renewable electricity, of which at least 5% plus an additional 300 GWh must be supplied by IPPs. The additional generation may be supplied by the feed-in-tariff program, distribution connected generators, up to 150 GWh of biomass co-firing, other NSPI owned facilities, or other sources of renewables as well as 20% of the generation of Muskrat Falls.
  - In addition there is also a requirement to procure or generate 260 GWh of firm renewable electricity in 2013 and 350 GWh of firm renewables in 2014 and subsequent years. The regulatory definition of firm indicates this generation must be from sources commissioned after December 31, 2001, of which the Port Hawkesbury Biomass facility would apply.

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Future Supply Side Options Assumptions

Background

- New supply side options reviewed and upgrades to existing assets provided
- Fuel options considered for flexibility
- Future environmental constraints considered
- Cost structure of traditional builds based on Nova Scotia Power recent activities
- Costs based on building in Nova Scotia
- Conscious effort to recognize transformation of generation technologies

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Supply-Side Options

	Capacity (MW)	Heat Rate (btu/kWh)	Capital Cost (2013$) ($/kW)	Lead Time (years)	Readiness
Coal					
Single Unit Advanced PC	300	9,600	$3,600	4-8	TRL-9
Single Unit Advanced PC with CCS	360	12,800	$6,700	5-10	TRL-7
Underground Coal Gasification	300	9,600	$4,800	10-15	TRL-6
Single Unit Integrated Gasification Combined Cycle (IGCC)	360	8,700	$4,100	4-7	TRL-8
Single Unit IGCC with CCS	520	10,700	$6,600	5-10	TRL-6
Natural Gas					
Phased-in Conversion CC (Add HRSG)	150	8,000	$1,600	4-7	TRL-9
Conventional CC (2 x 1)	145	7,200	$1,500	3-5	TRL-9
Combustion turbine	100	8,700	$1,600	3	TRL-9
Combustion turbine	49	9,600	$1,100	2-4	TRL-9
Combustion turbine	34	9,700	$1,500	2-4	TRL-9
Conventional CC (1 X 1)	253	7,200	$1,400	3-5	TRL-9
Fuel Cells	10	9,500	$7,100	10-15	TRL-5
Uranium	not considered due to legislation				

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Supply-Side Options

	Capacity (MW)	Heat Rate (btu/kWh)	Capital Cost (2013$) ($/kW)	Lead Time (years)	Readiness
Biomass					
Biomass Grate	60	13,500	$3,500	3-5	TRL-9
Wind					
Onshore Wind *	100		$2100-$3500 [1]	2	TRL-9
Solar					
Solar Thermal *	>10		$9,000	3-5	TRL-7
Photovoltaic *	>10		$5,600	3-5	TRL-7
Geothermal	Not considered although small sources available				
Municipal Solid Waste					
Municipal Solid Waste	50	18,000	$8,300	3-5	TRL-8
Hydroelectric					
Pumped Storage	100	85%	$2,700	5-10	TRL-9
Mersey Incremental Upgrade	30		$3,500	5-10	TRL-9
CAES	100	55%	$1,400	5-10	TRL-7
Tidal	10		$10,000	10-15	TRL-5
* Plus intermittent integration costs					

1) Demonstrates range of costs from utility-built to COMFIT projects.

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Future Environmental Control Technologies

Plant/Unit	Technology	Capital Cost Low	Capital Cost Base	Capital Cost High	Emission Impact %Removal NOx	Emission Impact %Removal SO_2	Emission Impact %Removal Hg[1]	Emission Impact %Removal CO_2
		(2013M$)			NOx	SO_2	Hg[1]	CO_2
Lingan								
	Wet Limestone FGD (300MW) (parasitic power 4 MW/ unit)		220 (300MW)		n/a	95	85[2]	n/a
	2.5%S Dry Lime FGD (300MW)		210		n/a	95	85[2]	n/a
	Carbon Capture 25% Power Penalty (in addition to scrubber)		790		n/a	95	85	70
	Baghouse (adapt ACI) (150 MW)		43					
	Baghouse (adapt ACI) (300MW)		85		n/a	n/a	85	n/a
Pt. Tupper	Natural Gas Co-fire[3]	-25%	12	+30%	n/a	n/a	n/a	n/a
Trenton 5	Co-firing Biomass	-25%	23	+40%	n/a	n/a	n/a	n/a
Trenton 6	Selective Catalytic Reduction		48		50	n/a	n/a	n/a

1) Hg removal depends on coal specification
2) Hg removal with FGD assumes unit has ACI
3) Tupper NG co-fire - estimated max 53% co-fire due to other customers using gas on the pipeline. To get 100% co-fire there would be another $20-30M in NG pipeline upgrades.

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Future Supply-side Thermal Options

Alternative	Technology	Capital Cost Low	Capital Cost Base	Capital Cost High	Net Capacity	Fuel Type
		(2013M$)			MW	
BSD Gas	Gas Conversion (4 units)		6.2		4 x 33	Gas
TUC1 +20	Increase Capacity		9.2		101	HFO/Gas
TUC2 +8	Increase Capacity		3.37		101	HFO/Gas

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COMFIT Assumption

- Approximately 200MW of COMFIT projects assumed by NS Energy.
- Based on projections of advanced projects assuming 90MW of COMFIT in operation by 2015.
- Based on number of projects approved by the provincial government, assume another 60 MW phased in over the next 2 years (2015-2016).
- Total 150MW of COMFIT wind generation by the end of 2016.

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Capacity Value of Wind & Intermittent Generation Integration Costs

Wind Assumptions – Capacity Value of Wind

NS Power is conducting studies to determine the firm capacity value of wind using two methods:

1) ELCC – Effective Load Carrying Capability calculated based on LOLE (Loss of Load Expectation, NPCC criteria)

2) Capacity value of wind calculated based on statistical probabilities of wind generation being available at peak load (using actual wind data)

Studies are currently being discussed with Board staff and consultants. Additional information will be distributed for comments once finalized.

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Intermittent Generation Integration Costs

A study to determine the costs to integrate additional Intermittent generation is in progress.

The study may show that the contracted amount of wind on the system has exhausted the intermittent generation opportunities that were available on the system, and that additional firm capacity will have to be built in order to securely integrate more intermittent generation in the future.

The study may show that integration costs are in line with the estimates used in Regulatory proceedings. The study is currently being discussed with Board Staff and Consultants. Additional information will be distributed for comments once finalized.

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Hydro Generation Assumptions

Hydro Assumptions

- Company estimates there are over $500M in sustaining capital costs required to maintain the operating capability of existing hydro systems.
- Sustaining hydro investments are included across all plans.
- Incremental hydro capacity investments will be tested as discrete options. Refer to Future Supply Assumptions for Mersey River Hydro incremental development option.

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Hydro Assumptions

- Assume the sustaining capital is common to all plans on the basis that hydro is a valuable generating resource providing dispatchable firm capacity, operating reserves, and qualifies as renewable electricity for 2015 per the NS Renewable Electricity Regulations.
- Much of the power system's flexibility to integrate existing variable sources of generation is provided by legacy hydro facilities.

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Import Options Assumptions

PPAs/Import Options

- NB IMPORT OPTIONS:
  - Mass Hub Forecast plus NB Transmission Tariff
  - Option NB1: 100MW nonfirm – no transmission investments
  - Option NB2: 100MW firm – necessary transmission investments
  - Option NB3: 300MW firm – necessary transmission investments (some limits could apply with simultaneous imports from ML)
- ML SURPLUS ENERGY:
  - Mass Hub Forecast
  - Option ML1: 300MW less Base Block – nonfirm

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Transmission Assumptions

Transmission Options

Generation Alternative	Capacity (MW)	Location	Retired Units	Transmission Cost High ($M)	Transmission Cost Base ($M)	Comment
LM6000	50	HRM	TC1 or TC2	2	0	High: no TC retirement
LMS2500	34	HRM	TC1 or TC2	2	0	High: no TC retirement
LMS100	100	HRM	TC1 or TC2	2	0	High: no TC retirement
CC 150	150	HRM	TC1 or TC2	12	0	High: no TC retirement+2nd Harbour Crossing 138 kV line
CC250	250	HRM	TC1 & TC2	12	0	High: no TC retirement+2nd Harbour Crossing 138 kV line
CC250	250	HRM		20	3	Base: Brushy Hill gas lateral. High: Burnside+Spider Lake sub.
PC 360	360	Point Tupper	LG2	425	285	Base: 345kV Hastings-Spider Lake. High:Base+2nd 345 kV tie line NS-NB
PC 450	450	Point Tupper	LG2 & LG3	425	285	Base: 345kV Hastings-Spider Lake. High:Base+2nd 345 kV tie line NS-NB
Firm Import	100	From NB			45	SVC and upgrade 138 kV lines in NB & NS
Firm Import	300	From NB		440	230	Base:SVC+345kV NS-NB. High: Base+345kV Salisbury-Coleson Cove
CAES	100	Debert			20	230kV Debert-Onslow
Wind	200	Mainland			30	230kV and 138kV connections for Wind Farms
CAES+Wind	300	Deb+Main			50	230kV and 138kV connections for CAES and Wind Farms
PSH	177	Wreck Cove	LG2	265	130	Base:230kV WC-Hastings. High:345kV WC-Hastings-Onslow-Brushy Hill

Transmission Options

- System upgrades associated with the Maritime Link are in service. The Maritime Link retires one Lingan unit.
- Transmission Facility estimates were completed as if resource options were independent of each other and the cost cannot be used to sum up any combination of options.
- Any new generation in Cape Breton will supply load growth east of Onslow. This will require an increase in CBX (Cape Breton Export), ONI (Onslow Import) and ONS (Onslow South).
- Any net generation unit larger than Point Aconi net will require additional operating reserve (cost not included here).
- Transmission cost does not include generator transformer and station service cost which can be in the range of $4M - $12M.
- Back-up and Load Following for non-dispatchable renewables is assumed to be provided within NS and not included in Network Upgrades cost estimates. If back-up source is external to NS then a second NS-NB tie is required.
- Transmission cost for generation options east of Onslow includes corresponding ONS upgrades.
- The cost estimate is preliminary and in the range of -10% to +30%. In some cases, unforeseen system requirements may increase the cost significantly as complete system impact studies are not performed.

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Existing Supply Assumptions Overview

Existing Supply

Thermal Unit	Net Demonstrated Capacity (MW)	In Service	Fuel
Pt Aconi	171	1994	Coal/Petcoke & limestone sorbent (CFB)
Lingan 1	153	1979	Coal/Petcoke/HFO
Lingan 2	153	1980	Coal/Petcoke/HFO
Lingan 3	158	1983	Coal/Petcoke/HFO
Lingan 4	153	1984	Coal/Petcoke/HFO
Tupper 2	152	1973, coal conversion 1987	Coal/Petcoke/HFO
Trenton 5	150	1969	Coal/Petcoke/HFO
Trenton 6	157	1991	Coal/Petcoke/HFO
Tufts Cove 1	81	1965	NG
Tufts Cove 2	93	1972	NG / HFO
Tufts Cove 3	147	1976	NG / HFO
Total	**1568**		
Combustion Turbines			
Burnside 1 - 4	4@33	1976	LFO
Victoria Junction 1 - 2	2@33	1975	LFO
Tusket 1	29	1971	LFO
Total	**227**		
Combined Cycle			
Tufts Cove 6	147	2011	NG
Import			
Maritime Link Base Block	153	Oct 2017	

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Existing Supply

Hydro System	Net Demonstrated Capacity (MW)
Wreck Cove	210.0
Annapolis Tidal	3.5
Avon	6.8
Black River	22.5
Nictaux	8.3
Lequille	13.2
Paradise	4.7
Mersey	42.5
Sissiboo	27.0
Bear River	11.2
Tusket	2.4
Roseway/Harmony	1.8
St Margaret's Bay	10.8
Sheet Harbour	10.8
Dickie Brook	2.2
Fall River	0.5
Total	**378.1**
Biomass	
PH Biomass (mill load present/ not present)	45/52
Other	**Installed Capacity (MW)**
NSPI Owned Wind	80.8
Renewable IPP (Pre 2001)	25.8
Renewable IPP (Post 2001)	250.9
COMFIT (expected in-service by end of 2014)	91
Total	**448.5**

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Power Plant Life Assumptions

Overview

POWER PLANTS CAN LIVE LONG LIVES

- With suitable asset investment (refurbishment and replacements)
- Major investments would be associated with STGs and Boilers, Environmental and Cooling Systems.
- Other areas of investments include: Rotating Equipment, Static Equipment, I&C and Building Structures and Grounds.

DETERMINING USEFUL LIFE INCLUDES CONSIDERATION FOR:

- Asset investments required to sustain operation
- Regulatory requirements
- Performance (Efficiency and Reliability)
- Replacement cost (i.e. new generation)

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Industry Experience

NOT UNCOMMON FOR POWER PLANTS TO SEE SIGNIFICANT GENERATION FOR 50 YEARS

- Health assessments and prognostics, related to key assets, are crucial
- Many components will see midlife replacements and regular refurbishments
- Major component replacement may be required (Generators, Turbine Spindles, Boiler Components)
- Operating history is significant

AS ASSETS CONTINUE TO AGE (I.E. PAST 50 YEARS):

- Increasing uncertainty for Balance of Plant including static equipment and infrastructure
- Increasing likelihood of major component replacement

50+ YEAR LIFE IS ALSO ATTAINABLE HOWEVER:

- increased consideration for end of life and end of life planning
- likely a more modest operating regime

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Long Term Planning Approach

BEYOND 50 YEARS - ADDITIONAL 10 YEARS OF SERVICE IS REASONABLE BUT:

- Asset Management programs are necessary for reliability and investment planning
- a more modest utilization (lower annual capacity factor)
- Includes planning for retirement

EXAMPLE:

- TUC1 fits within this philosophical treatment
- Present Utilization and Investment planning fits this model.

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Generating Unit Retirement Assumption for IRP

Thermal Unit	Net Demonstrated Capacity (MW)	In Service	60 Year Life	Assumed Retirement Year for Modeling Puposes
Pt Aconi	171	1994	2054	Beyond planning horizon *
Lingan 1	153	1979	2039	2039
Lingan 2	153	1980	2040	2018 (Coincident with Maritime Link)
Lingan 3	158	1983	2043	Beyond planning horizon *
Lingan 4	153	1984	2044	Beyond planning horizon *
Tupper 2	152	1973, coal conversion 1987	2047	Beyond planning horizon *
Trenton 5	150	1969	2029	2035
Trenton 6	157	1991	2051	Beyond planning horizon *
Tufts Cove 1	81	1965	2025	2025
Tufts Cove 2	93	1972	2032	2032
Tufts Cove 3	147	1976	2036	2036

Tupper 2 assumes 60 years from date of coal conversion.
Trenton 5 expect to extend life beyond 60 years due to recent significant capital investment.
*25 year planning horizon 2015-2039.

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Financial Assumptions

Rates

Weighted Average Cost of Capital (WACC):

Before-tax = 7.78%

After-tax = 6.49%

Source: 2014 rate as approved in most recent GRA

Inflation rate:

25 year average rate = 2.0%

Based on Conference Board of Canada CPI growth forecast for NS.

Rates

US Foreign Exchange:

2015 = 1.10

2016 = 1.06

2017 = 1.07

2018-2040 = 1.08

Source: Treasury. 2015-2016 average of 6 banks.

2017-2040 average of 2 banks.

Revenue Requirement Profiles

Supply-side options that represent a capital investment require a revenue requirement profile.

Revenue requirement profiles for input into Strategist will be developed outside of the model.

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Fuel Price Forecast Assumptions

Forecasting Approach

NS POWER FUELS, ENERGY & RISK MANAGEMENT (FE&RM) UTILISED COMMERCIALLY AVAILABLE LONG TERM PRICE FORECASTS FOR *SOLID FUELS*, *NATURAL GAS*, *OIL* AND *POWER* WHICH IT SUBSEQUENTLY ADJUSTED FOR DELIVERY TO NS BASED ON:

- Current and Expected Transportation (Transmission) Costs and Tolls
- Market Insight and Proprietary Views on Long Term Market Development, including High, Low and Expected Scenarios (by third parties and NSPI)
- Proprietary Forecasts on Macroeconomic Inputs (by NSPI)

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Third Party Service Providers

PIRA ENERGY GROUP (NAT GAS, OIL & POWER)

- Long time service provider to NSPI
- World-wide perspective and insight
- Forecasts utilised in Maritime Link, 2009 IRP

ENERGY VENTURES ANALYSIS (COAL)

- Used in the Maritime Link hearing
- Comprehensive suite of forecasts for varying coal grades, other solid fuels and supply regions

Service Providers[1]

"PIRA Energy Group, founded in 1976, is a preeminent energy information provider specializing in global energy markets research, analysis, and intelligence. PIRA offers primarily Retainer Client Services, but also can perform customized consulting, on a broad range of subjects in the international crude oil (and NGLs), refined products, natural gas (and LNG), electricity, coal, biofuels, shipping and emissions markets. The full range of PIRA services provides exceptional coverage and evaluation of key U.S. and international (country by country, region by region) energy fundamentals and issues that impact the behavior and performance of the energy industry and its various markets and sectors." PIRA Energy Group; 2014

"Energy Ventures Analysis, Inc. has been a key player in the energy industry since 1981. Our unmatched success in guiding clients to sound investment and operational decisions stems from the outstanding capabilities of our expert consultants, coupled with the unique hands-on approach of our firm. Because EVA is a smaller company than most energy consulting conglomerates, we provide a much more personalized, focused, interactive, and responsive experience for our clients and customers. EVA maintains a wide range of proprietary models and databases that have evolved from over 30-years of experience in the energy industry. These proprietary models and databases are critical to the successful completion of many of EVA's consulting projects, its' suit of periodic multi-client reports, and the population of its electricity dispatch model. Detailed discussions of these models and databases are included in the pages covering each of the energy areas." Energy Ventures Analysis; 2014

[1] From their respective websites as accessed on March 06, 2014

Fundamental Price Forecasts

Commodity	Pricing Point	Provider	Updated
Nat. Gas	(N.A.) Henry Hub	PIRA Energy Group	FEB 2014
	(LNG) UK Nat'l Balancing Pt.		
	New England Basis		FEB 2014
Coal[1]	FOB Colombia	Energy Ventures Analysis	SEP 2013
	FOB Baltimore/US Gulf		
Imported Power	MASS HUB	PIRA Energy Group	FEB 2014
Fuel Oil	NY Harbour	PIRA Energy Group	FEB 2014

[1] Pending update with revised fundamental forecast (expected in March 2014)

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FUNDAMENTAL NAT GAS SCENARIOS (PIRA ENERGY GROUP)

	Likelihood (PIRA)	Highlights
Base Case (Expected)	45%	• North American nat gas demand grows at 2.4% p.a. (2.2% in the US) (Revised upwards) • Power generation leads the way and some penetration into transportation • Modest carbon cost introduced to power generation in 2020 rising through to 2030 • Supply continues to rise in Canada and the US but Canada begins exporting to Asia pre-2020 and exports to the US fall • Growth in the short term met by "low cost" Marcellus but higher cost un-conventional supplies are introduced by 2020
High Case	25%	• High oil prices pull natural gas into higher value markets overseas • Much tougher environmental constraints reduce N.A. shale gas supply or significantly raise prices
Low Case	30%	• Supply keeps up with increasing demand • Productivity improvements offset the cost of lower quality resources • Supplier competition keeps prices in check

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NATURAL GAS PRICE ASSUMPTIONS

- Case development
- Pricing methodology
- Long Term Prices

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NS Case Development (Nat Gas)

	Highlights
Base Case (Expected)	• Based on PIRA Expected Case for North American Gas at Henry Hub • New pipeline capacity comes on line in 2018 (TGP) and sets the marginal gas price into New England
High Case	• Based on PIRA High Case for North American Gas at Henry Hub and UK Nat'l Balancing Point (High) • New pipeline capacity comes on line in 2019 but is fully contracted by LNG exporters. As a result, gas has to be "bid-away" from European markets • Prices until the January 2019 pipeline expansion are volatile (similar to what was experienced in 2013/14) and the market premium for gas is very high
Low Case	• Based on PIRA Low Case for North American Gas at Henry Hub • New pipeline capacity comes on line in 2017 (PNGTS) and sets the marginal gas price into New England in the winter • Summer pricing is set by Atlantic Bridge expansion

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Natural Gas – Base Case (Expected)

Delivered Price	=	Commodity	+	Basis	+	Transportation	+	Market Premium
2015 - 2018	=	**Henry Hub** Source: PIRA Annual Guidebook 2014 Reference Case	+	**Algonquin** Source: PIRA Long Term Price Forecast (2014FEB20) (Basis) & PIRA Short Term Price Forecast (2014FEB25) (Monthly Profile)	+	**nil**	+	**Premium** Source: NSPI
2018 - 2030	=	**Henry Hub** Source: Same	+	**Transco Zone 6** Source: Same	+	**Fuel & Tolls: Wright to Tufts Cove** Source: Current Tolls (escalated)	+	**nil**
2030 - 2040	=	**Henry Hub** Source: Same (escalated)	+	**Transco Zone 6** Source: Same (escalated)	+	**Fuel & Tolls: Wright to Tufts Cove** Source: Same (escalated)	+	**nil**

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Natural Gas – Low Case

Delivered Price	=	Commodity	+	Basis	+	Transportation	+	Market Premium
2015 – 2017	=	**Henry Hub** Source: PIRA Annual Guidebook 2014 Low Case	+	**Algonquin** Source: Historical (2011/12) & PIRA Long Term Price Forecast (2014FEB20) (Basis) & PIRA Short Term Price Forecast (2014FEB25) (Monthly Profile)	+	**nil**		**Premium** Source: NSPI
2017 – 2040 Winter	=	**Henry Hub** Source: Same; escalated 2030+	+	**Dawn** Source: Same; escalated 2030+	+	**Fuel & Tolls: Dawn to Tufts Cove** Source: Current Tolls (escalated)		**nil**
2017-2040 Summer	=	**Henry Hub** Source: Same	+	**Algonquin** Source: Same	+	**Fuel & Tolls: Wright to Tufts Cove** Source: Same		**nil**

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Natural Gas – High Case

Delivered Price	=	Commodity	+/-	Basis	+	Transportation	+	Market Premium
2015 – 2018	=	**Henry Hub** Source: PIRA Annual Guidebook 2014 High Case	+	**Algonquin** Source: Platts Inside FERC FOM; ICE (2013/14)	+	**nil**	+	**Premium** Source: NSPI
2019 – 2040	=	**UK Nat'l Balancing Point** Source: PIRA Annual Guidebook 2014 High Case (escalated 2030+)	-	**● % of Liquefaction & Transportation Cost** Source: NSPI	+	**nil**	+	**nil**

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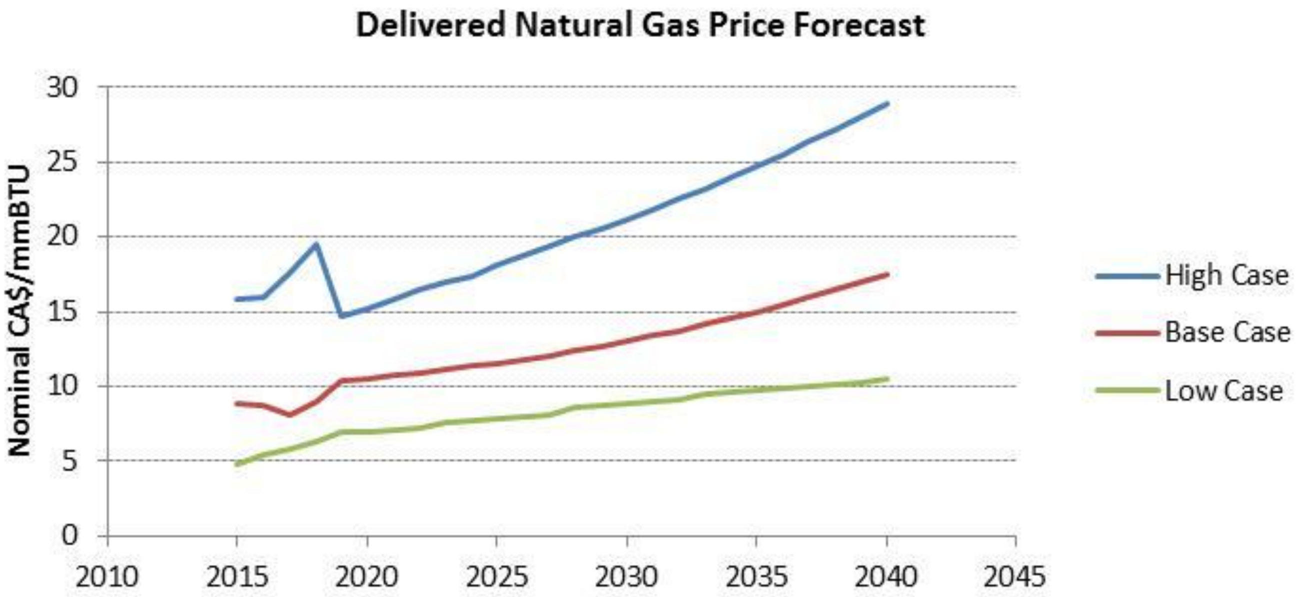
Natural Gas Price Assumptions



NS Natural Gas Delivered Price Forecast (Nominal CAD$/mmBTU)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	15.8	16.0	17.7	19.5	14.7	15.2	15.8	16.4	16.9	17.4	18.1	21.2	24.7	28.9
Base Case	8.9	8.7	8.2	9.0	10.4	10.5	10.7	10.9	11.2	11.4	11.6	13.1	15.0	17.5
Low Case	4.8	5.4	5.8	6.3	6.9	7.0	7.1	7.2	7.6	7.8	7.9	8.8	9.8	10.4

NS Natural Gas Delivered Price Forecast (2014$/mmBTU)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	15.6	15.5	16.8	18.1	13.4	13.6	13.9	14.1	14.2	14.3	14.6	15.4	16.3	17.2
Base Case	8.8	8.4	7.7	8.4	9.5	9.4	9.4	9.4	9.4	9.4	9.3	9.5	9.9	10.4
Low Case	4.7	5.3	5.5	5.9	6.3	6.3	6.2	6.2	6.4	6.4	6.4	6.4	6.4	6.2

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IMPORT POWER PRICE ASSUMPTIONS

- Case development
- Pricing methodology
- Forecast prices

Case Development (Power)

	Highlights
Base Case (Expected)	• Driven by PIRA Annual Guidebook Natural Gas Scenario (Expected) and economics of Natural Gas Combined Cycle (NGCC) generation • Carbon cost of US$15 in 2020 escalating to US$37/Ton CO_2 in 2030
High Case	• Driven by PIRA Annual Guidebook Natural Gas Scenario (High) and economics of Natural Gas Combined Cycle (NGCC) generation
Low Case	• Driven by PIRA Annual Guidebook Natural Gas Scenario (Low) and economics of Natural Gas Combined Cycle (NGCC) generation

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Power Forecast (Base, High & Low)

Delivered Price	=	Commodity	+	NB Transmission
2015 – 2040	=	**Mass Hub** Source: PIRA on PIRA Annual Guidebook 2014 Reference, High and Low North American Natural Gas Cases	+	**Transmission Tariffs** Source: Current Tariffs

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Long Term Price Assumptions

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SOLID FUEL PRICE ASSUMPTIONS

- Case development
- Pricing methodology
- Long term prices

Case Development (Solid Fuels)

	Highlights
Base Case (Expected)	• Current (bearish) market continues
High Case	• High electricity demand growth, high natural gas prices, no carbon controls and the construction of Pacific Northwest coal terminals drive demand growth in seaborne coal trade • Higher prices go unchecked while supply cannot keep up with demand
Low Case	• Stringent carbon policies, low natural gas prices, higher renewable generation, lower GDP growth and evergreen renewals of nuclear power plants keep demand for coal low

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Solid Fuel

Delivered Price	=	Commodity	+	Marine Freight	+	Land Transportation
Low Sulphur Coal	=	**Low Sulphur Colombian** Source: EVA Long Term Forecast (Sept '13) FOB Vessel	+	**Marine Freight** Source: NSPI Current Contracts (Bolivar) escalated (2016+)	+	**Terminaling** Source: NSPI 2014 Contract Prices escalated 2015+
Mid Sulphur Coal	=	**NAPP Pittsburgh Seam** Source: EVA Long Term Forecast (Sept '13) Northern Appalachia Pittsburgh Seam FOB Vessel	+	**Marine Freight** Source: same	+	**Terminaling** Source: same
Pet Coke (for POA)	=	**US Gulf Coast Pet Coke** Source: EVA Long Term Forecast (Sept '13) Pet Coke U.S. Gulf Coast FOB Vessel	+	**Marine Freight** Source: NSPI Current Contracts (escalated 2016+)	+	**Terminaling** Source: same
Domestic (for TR6)	=	**Domestic Coal** Source: NSPI Current Contracts	+	**nil**	+	**nil**

SOLID FUEL PRICE ASSUMPTIONS

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SOLID FUEL PRICE ASSUMPTIONS (cont'd)

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FUEL OIL PRICE ASSUMPTIONS

- Case development
- Pricing methodology
- Long term prices

Case Development (Fuel Oil)

	Highlights
Base Case (Expected)	• Driven by PIRA Annual Guidebook 2014 Global Oil Price Scenarios
High Case	
Low Case	

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HFO Price Assumptions

Delivered Price	=	Commodity	x	NY Harbour Basis	+	Supplier Delivery Premium
2.2% Sulphur	=	**Brent** Source: PIRA Annual Guidebook 2014; High, Low and Expected Cases	x	**● %** Source: NSPI	+	**Premium** Source: NSPI
1% Sulphur	=	**Brent** Source: Same	x	**● %** Source: NSPI	+	**Premium** Source: NSPI

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LFO Price Assumptions

Delivered Price	=	Commodity	x	ULSD Basis Adjustment	+	NS Delivery Premium
Ultra Low Sulphur Diesel	=	**Ultra Low Sulphur Diesel** Source: PIRA Annual Guidebook 2014; High, Low and Expected Cases	x	**N/A**	+	**Premium** + $0.06/litre per NS Government pricing regulation Source: NS Department of Energy
Heating Oil	=	**Ultra Low Sulphur Diesel** Source: Same	x	**Historic Annual Discount, Profiled by month** Source: NSPI	+	**Premium** + $0.06/litre per NS Government pricing regulation Source: NS Department of Energy

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HEAVY FUEL OIL PRICE ASSUMPTIONS

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LIGHT FUEL OIL PRICE ASSUMPTIONS

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MARCH 14, 2014

IRP Load Assumptions

Introduction

- The end use model was chosen to provide the load forecast for the IRP
- Residential and commercial forecasts are from the end use model, the industrial forecast uses the same methodology used in our annual 10 year load forecast filing
- Base, high, and low load scenarios have been developed
- PHP energy amounts are included in the energy forecast in order to calculate RES and emission compliance
- PHP demand is not included in planning for firm capacity resources

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End Use Inputs

- Inputs to the end use model include:
- Economic data from Conference Board of Canada (CPI, GDP, employment, disposable income, population, housing starts)
- Natural Resources Canada Comprehensive End Use Database tables for Nova Scotia (residential lighting, air conditioning, heating, water heat, refrigerators, freezers, dishwashers, clothes washers, dryers, ranges, other appliances)
- Natural Resources Canada Comprehensive End Use Database tables for Atlantic provinces (commercial lighting, heating, air conditioning, auxiliary equipment)
- Environment Canada weather data (hourly temperatures)
- Energy Information Administration equipment shares and stock efficiency forecast for New England
- NS Power billing and customer count data

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Differences

Econometric

- Major input - CBoC economic forecast
- Number of customers based on Nova Scotia Power Customer count
- Calibrated to annual sector sales
- Heating component - # of electric heating customers * HDD
- No specific cooling component

End Use

- Major input - US Energy Information Administrator (EIA) New England end use forecast and NR Can data
- Number of customers based on number of house holds in NS as per NR Can
- Calibrated to average annual household consumption (sales/customer count)
- Heating Component – heating intensity * heat use
- Cooling Component – cool intensity * cool use

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Base Scenario

- Developed using the end use model approach
- Additional adjustment for heat pump uptake
- 42 GWh (20%) of Municipal load is served by an independent wind farm beginning in 2016
- PHP operating for the duration of the Load Retention Tariff

High Scenario

- Same assumptions as the Maritime Link base load case
  - Economy growth rates accelerated by 50%
  - Electric Vehicles 1% of vehicle sales by 2023
- PHP online for the duration of the forecast
- 20% increase in heat pump load compared to base case

Adjustment to Economic Growth Rates		
Sector	CBoC	Adjusted
Residential	.34% per year	.50% per year
Commercial	1.21% per year	1.82% per year

Low Scenario

- 40% decrease in heat pump load compared to base case
- Customer count driven by population not new construction
- 42 GWh (20%) of Municipal load is served by an independent wind farm beginning in 2016
- HDD's based on 5 year average not 10 year (~ -100 HDD)
- Reduction in Large Industrial load of 40 GWh in 2016
- PHP operating for the duration of the Load Retention Tariff

IRP Forecast - NSR

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IRP Forecast - NSR

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IRP Forecast – Residential (Econometric)

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IRP Forecast – Residential (End Use)

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IRP Forecast – Commercial (Econometric)

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IRP Forecast – Commercial (End Use)

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IRP Forecast - Industrial

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Industrial Forecast Additional Information

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Industrial Forecast Additional Information

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IRP Forecast – Firm Demand (Econometric & End Use)

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IRP Forecast – Firm Demand (End Use Base, High and Low)

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DSM Assumptions

DSM to Date

- In 2005/06 DSM was proposed as a formal planning option in NS
  - In 2006, NSPI filed Summit Blue's DSM report, which benchmarked NS DSM potential
- In 2007 IRP, DSM was included as supply-side alternative
  - a High level scenario of DSM was indicated as economic (expenditures up to 5% of revenue)
- New DSM programs were launched in 2008
- In 2009 IRP was refreshed
  - DSM was pre-screened and determined to be cost effective versus alternatives.
  - DSM was embedded in load forecast at a projection similar to the 2007 DSM level
- ENSC was established in 2010 and has administered DSM since
- ENSC filed a DSM potential study in January 2014
- ENSC has postponed its 2015 plan submission pending new legislation

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DSM Potential study

- ENSC with its consultant, Navigant, has prepared an Electric DSM Potential Study for Nova Scotia
- Energy efficiency focus
- Technical, economic and achievable market potentials
- Base, Low, mid and high achievable potential scenarios based on a range of incentive levels from .5 current incentives to 2x
- The EERAM needs further study and input assumptions may need to be updated
  - We will work with ENSC/Navigant to advance

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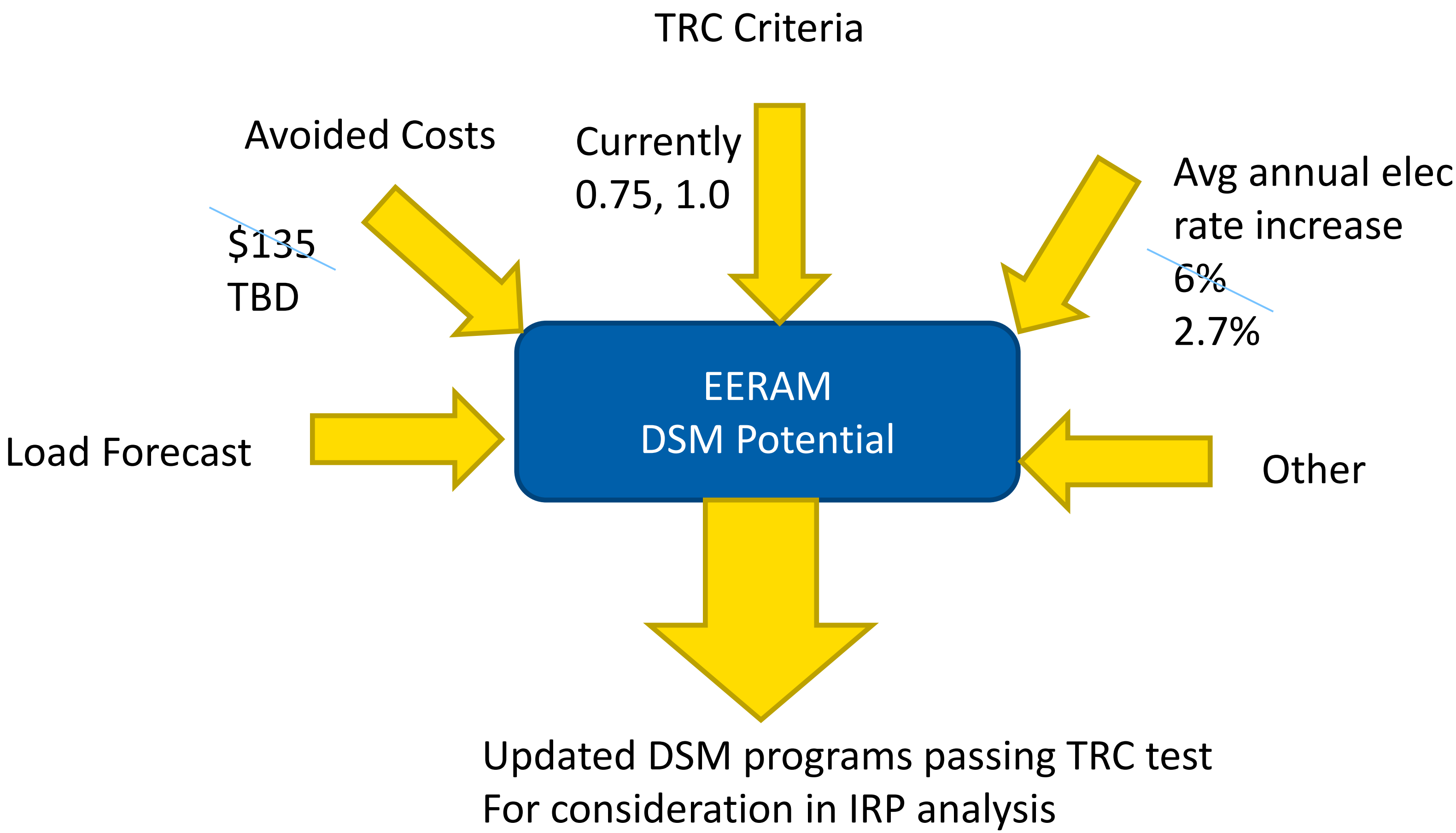
EERAM Inputs



DSM & IRP Process

DSM Potential

- Update EERAM inputs
- Develop DR candidate programs
- Model EE and DR programs
- Economic Screening

DSM passing TRC

Integrated Resource Plan

- Model several "layers" of DSM including Demand Response options
- The IRP action plan will define the course for future supply and demand-side initiatives
- Through the IRP, updated system benefits for future DSM planning, design and screening will be determined

DSM Planning

Future plans created and approved with updated system benefits as an input

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Next Steps

- NS Power continues to work with ENSC and Synapse to develop DSM levels
- Will consider intervenor feedback on DSM levels to be modelled and propose “layers” as soon as available for comment before April 11
- Further develop DR potential programs for screening
- Model several “layers” of DSM using Strategist to determine the best combinations of supply/demand
- Determine DSM system benefits through the IRP process

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Analysis Plan Overview

Analysis Plan Overview

- Begin with a broad range of <u>draft</u> resource plans
- Evaluate them under a Reference World (using base, most likely assumptions)
- Narrow those resource plans down to a set of <u>candidate</u> resource plans
- Evaluate the candidate plans under different "views of the world" or different sets of assumptions for key inputs.

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Conclusion

- Additional information on wind integration cost, wind capacity factor studies, and DSM Assumptions will be distributed.
- All assumptions are under review and are subject to change prior to the Assumption release April 11, 2014.
- Stakeholder comments on Draft Assumptions – March 26, 2014.

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