JUNE 25, 2014

IRP Technical Conference – Progress Update

Agenda

- Key assumptions overview
- Candidate Resource Plans
  - What is a CRP
  - Plans screened and selected for modelling
  - How plans are modelled in Strategist
- Strategist® – Output and limitations
- Assumption variations in Candidate Resource plans
- Sustaining Capital requirements – 40 vs. 50 vs 60 yr. retirements
- Strategist run results to date
- Plexos use to enhance Candidate Resource Plan Analysis
- Next Steps in Analysis phase
  - Action Plan Development
  - Finalize CRP process and modelling
  - Determine sensitivities and worlds
  - Evaluate results and update stakeholders

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2014 IRP – Finalized Assumptions

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Final Environmental & Emissions Assumptions

CO_2/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.

CO_2/Greenhouse Gases Assumptions

Scenario C

- The Company will model GHG emission cuts to 2.25MT in 2040 as a Scenario C (and associated co-benefits for other air emissions and RES targets).

Air Pollutants Regulatory Context

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

SO_2 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 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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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.

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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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Final Future Supply Side Options Assumptions

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-$2500 [1]	2	TRL-9
Solar					
Solar Thermal *	>10		$9,000	3-5	TRL-7
Photovoltaic *	>10		$3,500	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			Emission Impact %Removal			
		Low	Base	High				
		(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.

Future Supply-side Thermal Options

Alternative	Technology	Capital Cost Low	Base	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

COMFIT Assumption

- Approximately 200MW of COMFIT projects approved 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.

PPAs/Import Options

- NB IMPORT OPTIONS[1]:
  - 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[1]:
  - Mass Hub Forecast
  - Option ML1: 300MW less Base Block – nonfirm

[1] NS Power will work with Liberty and Synapse (Board Consultants) to establish price-quantity pairs for modeling imports.

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Final 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	

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
Small Biomass IPP (2016)	10
Other	**Installed Capacity (MW)**
NSPI Owned Wind	80.8
Renewable IPP (Pre 2001)	25.8
Renewable IPP (Post 2001)	250.9
Renewable Electricity Administrator Projects	115.8
COMFIT (expected in-service by end of 2014)	91
Total	**564.3**

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Final Power Plant Life Assumptions

Generating Unit Retirement Assumption for IRP (Maximum Coal Cases)

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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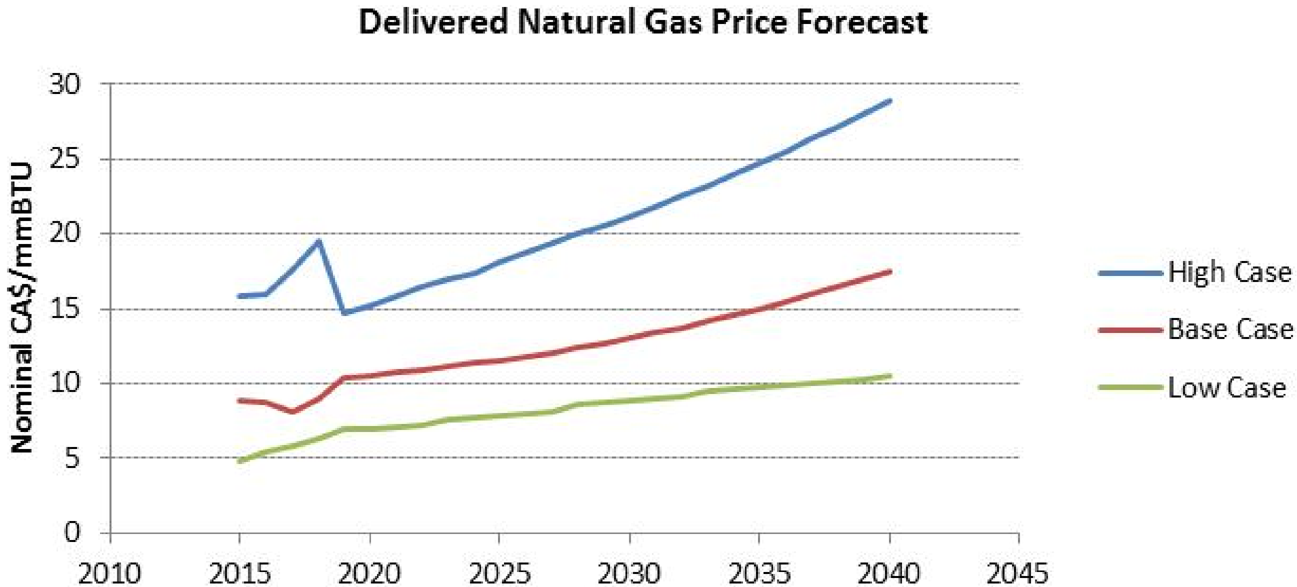
Final Fuel Price Forecast Assumptions

Natural Gas Price Assumptions



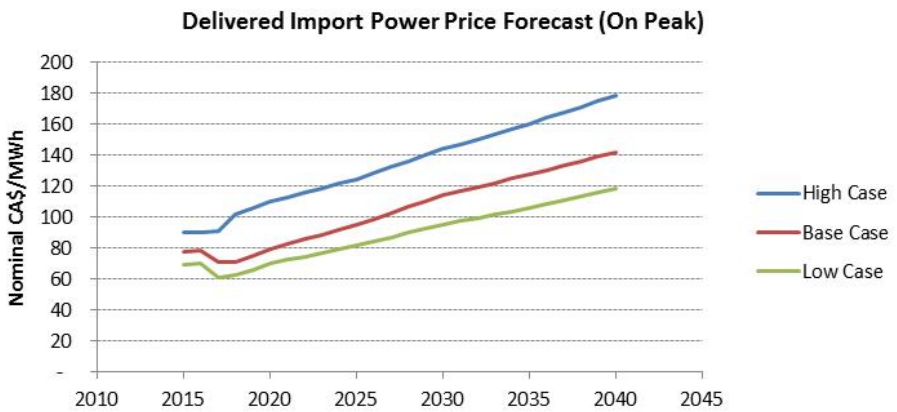
NS Natural Gas Delivered Price Forecast (Nominal CAD$/mmBTU)

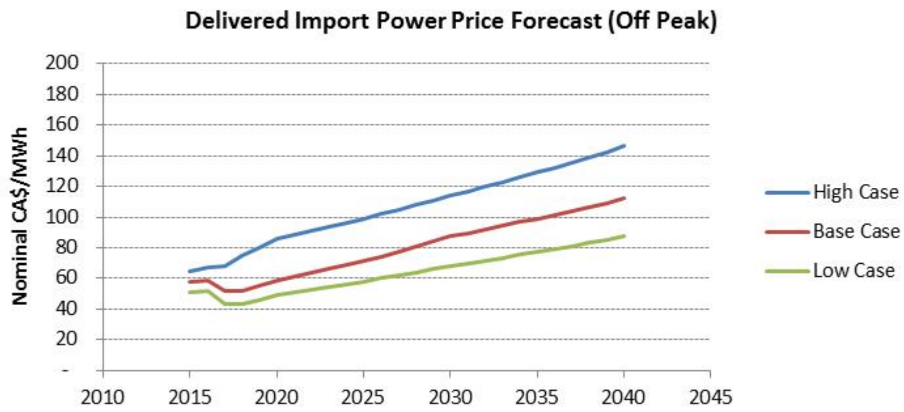
	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	15.8	16.0	17.7	19.5	14.7	15.2	15.8	16.4	16.9	17.4	18.1	21.2	24.7	28.9
Base Case	8.9	8.7	8.2	9.0	10.4	10.5	10.7	10.9	11.2	11.4	11.6	13.1	15.0	17.5
Low Case	4.8	5.4	5.8	6.3	6.9	7.0	7.1	7.2	7.6	7.8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

Long Term Price Assumptions





NS Delivered Power Forecast - On Peak (Nominal CA$/MWh)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	90	90	91	102	106	110	113	116	119	122	125	144	161	179
Base Case	78	79	71	71	75	80	83	86	89	92	95	114	128	142
Low Case	69	70	61	62	66	70	72	75	77	79	81	95	106	118

NS Delivered Power Forecast - Off Peak (Nominal CA$/MWh)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	64	67	68	75	80	86	88	91	94	96	99	114	129	146
Base Case	58	59	52	52	55	59	61	64	66	69	71	88	99	112
Low Case	51	52	43	43	46	49	51	53	54	56	58	68	77	87

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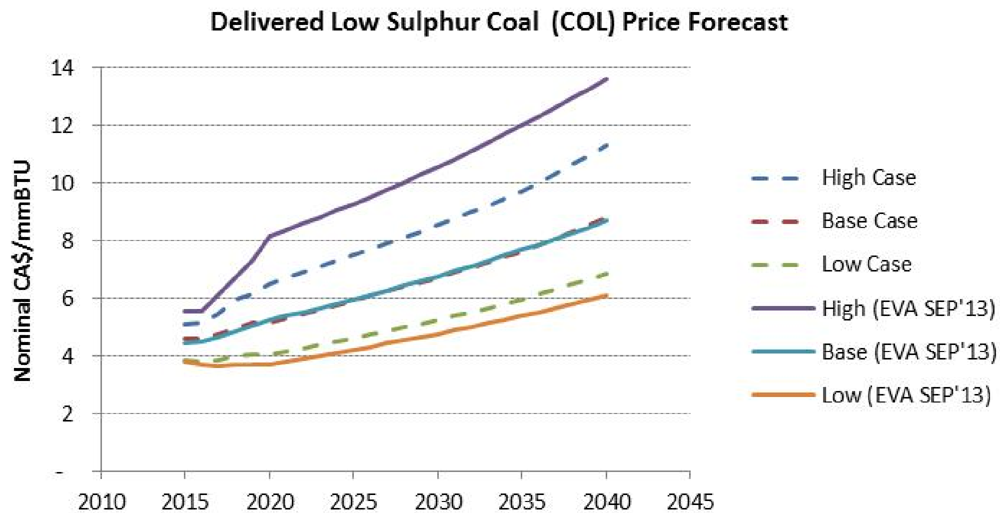
LOW-SULPHUR COAL (COL)



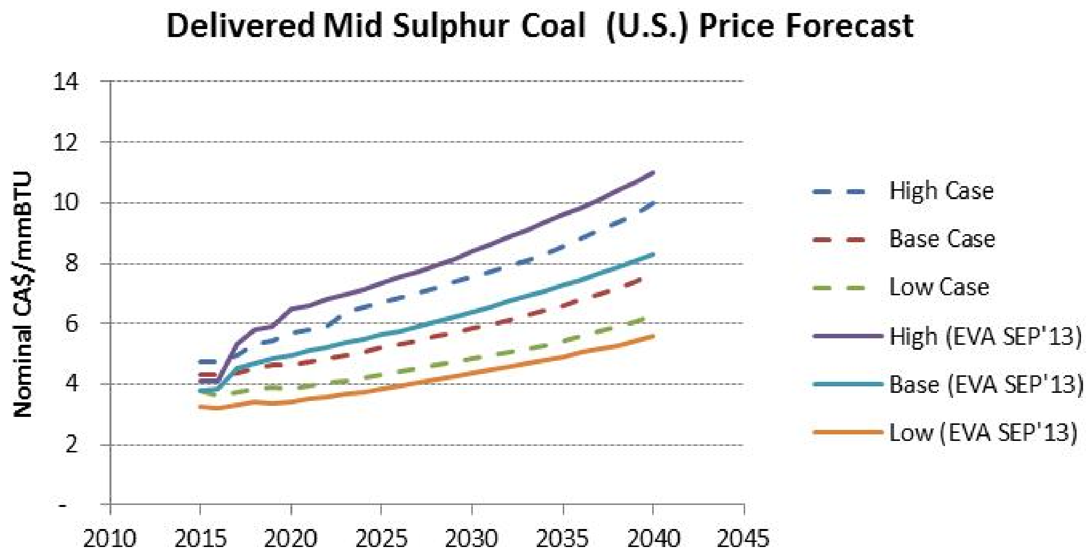
NS Delivered Low Sulphur (COL) Coal Price Forecast (Nominal CA$/mmBTU) (Plant Weighted)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	5.1	5.2	5.5	6.0	6.2	6.5	6.7	6.9	7.1	7.3	7.5	8.6	9.7	11.3
Base Case	4.6	4.6	4.8	5.0	5.2	5.2	5.3	5.5	5.6	5.8	5.9	6.7	7.6	8.8
Low Case	3.9	3.8	3.9	4.0	4.1	4.0	4.2	4.3	4.4	4.5	4.6	5.3	6.0	6.9

NS Delivered Low Sulphur (COL) Coal Price Forecast (2014 CA$/mmBTU) (Plant Weighted)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	5.0	5.0	5.2	5.5	5.6	5.8	5.8	5.9	5.9	6.0	6.0	6.2	6.4	6.8
Base Case	4.5	4.4	4.5	4.6	4.7	4.6	4.6	4.7	4.7	4.7	4.8	4.9	5.0	5.3
Low Case	3.8	3.7	3.6	3.7	3.7	3.6	3.6	3.7	3.7	3.7	3.7	3.8	3.9	4.1

MID-SULPHUR COAL (US)



NS Delivered Mid Sulphur (U.S.) Coal Price Forecast (Nominal CA$/mmBTU) (Plant Weighted)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	4.8	4.7	5.0	5.3	5.5	5.7	5.8	5.9	6.4	6.5	6.7	7.6	8.6	10.0
Base Case	4.3	4.3	4.4	4.5	4.6	4.6	4.7	4.9	5.0	5.1	5.2	5.9	6.6	7.7
Low Case	3.8	3.6	3.8	3.9	3.9	3.9	3.9	4.0	4.1	4.2	4.3	4.8	5.4	6.3

NS Delivered Mid Sulphur (U.S.) Coal Price Forecast (2014 CA$/mmBTU) (Plant Weighted)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	4.7	4.5	4.7	4.9	4.9	5.0	5.1	5.1	5.4	5.4	5.4	5.5	5.6	6.0
Base Case	4.2	4.1	4.1	4.2	4.2	4.1	4.1	4.1	4.2	4.2	4.2	4.3	4.4	4.6
Low Case	3.7	3.5	3.5	3.6	3.5	3.4	3.4	3.4	3.4	3.5	3.5	3.5	3.6	3.8

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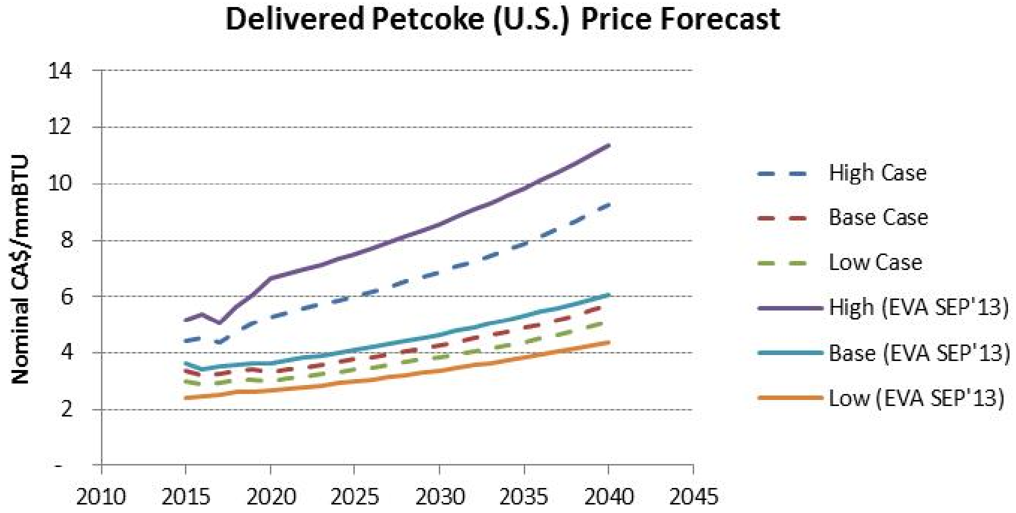
PETCOKE (US)



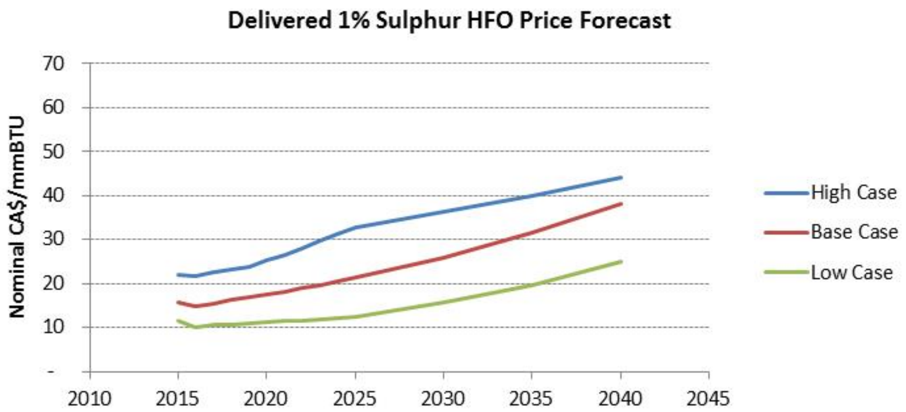
NS Delivered Pet Coke Forecast (Nominal CA$/mmBTU)

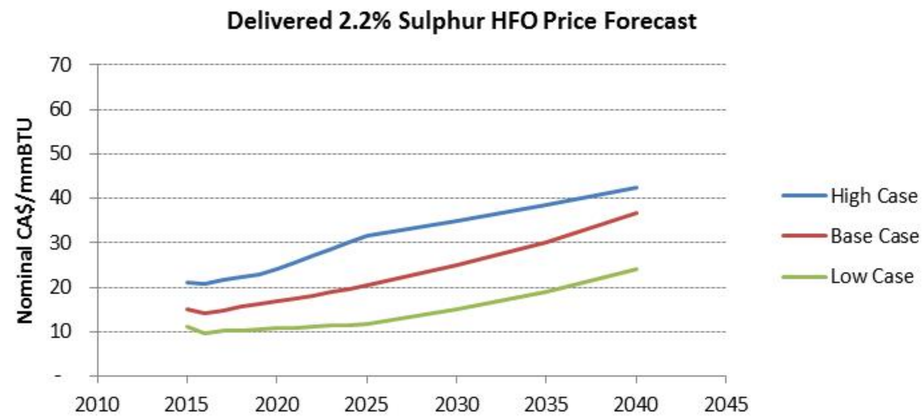
	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	4.4	4.5	4.4	4.7	5.1	5.3	5.4	5.6	5.7	5.9	6.0	6.9	7.9	9.3
Base Case	3.4	3.2	3.3	3.4	3.4	3.3	3.4	3.5	3.6	3.7	3.8	4.3	4.9	5.7
Low Case	3.0	2.9	2.9	3.0	3.1	3.0	3.1	3.2	3.2	3.3	3.4	3.9	4.4	5.1

NS Delivered Pet Coke Forecast (2014 CA$/mmBTU)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	4.4	4.3	4.1	4.4	4.6	4.7	4.7	4.8	4.8	4.8	4.8	5.0	5.2	5.5
Base Case	3.3	3.1	3.1	3.1	3.1	2.9	3.0	3.0	3.0	3.0	3.0	3.1	3.2	3.4
Low Case	2.9	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.8	2.9	3.0

HEAVY FUEL OIL PRICE ASSUMPTIONS





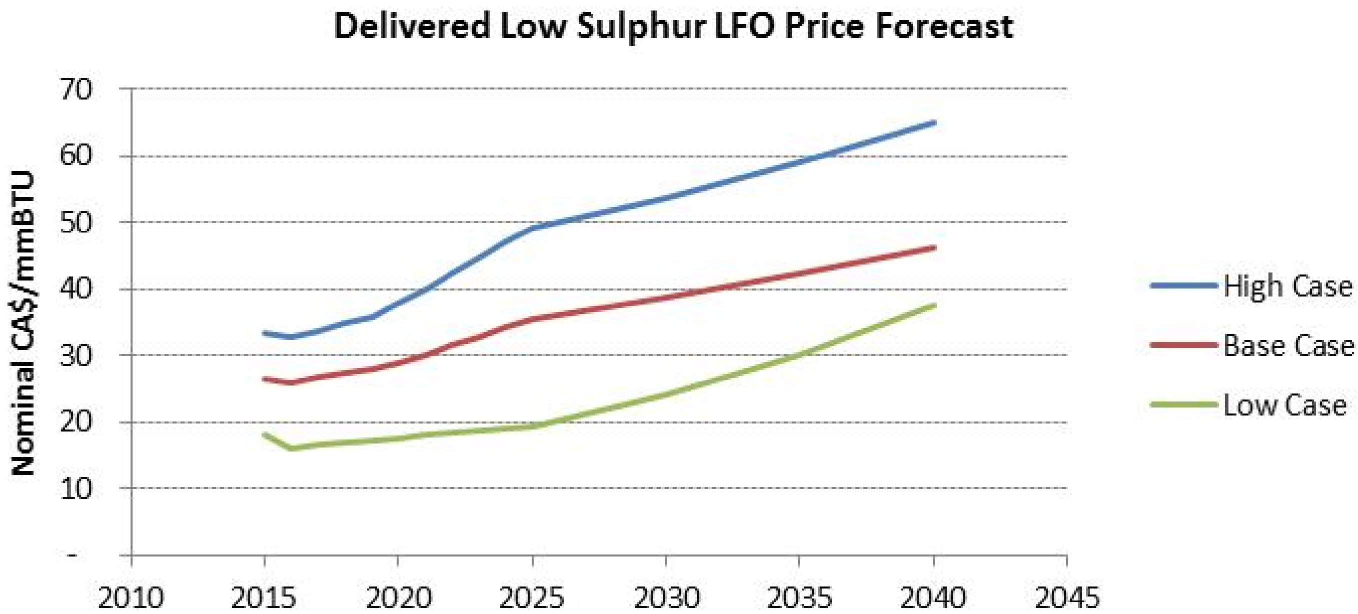
NS Delivered 1% HFO Forecast (Nominal CA$/mmBTU)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	21.9	21.8	22.5	23.2	23.8	25.2	26.6	28.1	29.6	31.2	32.9	36.3	40.0	44.2
Base Case	15.8	14.7	15.4	16.2	16.8	17.5	18.2	18.9	19.7	20.5	21.3	25.8	31.4	38.2
Low Case	11.5	10.0	10.5	10.7	10.9	11.2	11.4	11.6	11.8	12.1	12.3	15.6	19.7	25.0

NS Delivered 2.2% HFO Forecast (Nominal CA$/mmBTU)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	21.0	20.9	21.6	22.3	22.8	24.2	25.6	27.0	28.5	30.0	31.6	34.9	38.5	42.5
Base Case	15.2	14.2	14.9	15.6	16.2	16.8	17.5	18.2	18.9	19.7	20.5	24.8	30.2	36.7
Low Case	11.1	9.7	10.1	10.3	10.5	10.7	10.9	11.2	11.4	11.6	11.8	15.0	19.0	24.0

LIGHT FUEL OIL PRICE ASSUMPTIONS



NS Delivered Low S LFO Forecast (Nominal CA$/mmBTU) (Fleet Average)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2030*	*2035*	*2040*
High Case	33.2	32.8	33.7	34.8	35.6	37.7	39.9	42.3	44.7	47.0	49.2	53.8	59.2	65.2
Base Case	26.6	26.0	26.6	27.4	28.1	28.8	30.0	31.5	32.9	34.2	35.5	38.8	42.4	46.3
Low Case	18.2	15.9	16.6	16.8	17.2	17.6	18.0	18.4	18.8	19.1	19.4	24.0	30.0	37.6

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Candidate Resource Plans

Candidate Resource Plan Development

NS POWER & SYNAPSE CONSIDERED STAKEHOLDER FEEDBACK TO DEVELOP CANDIDATE RESOURCE PLANS (CRP)

- Key variables were identified as capable of significantly changing CRP outcomes
  - DSM, Variable generation levels, plant retirement dates and potential for a large PPA
- Using these variables, over 30 Draft CRPs were screened

Draft Resource Plans

- **Base Load**
  Sc. A Emissions
  40% RES 2020
  ML + Econ Purchases
  - DSM: 50% LOW
    - COAL: Max use
      - WIND: BASE
      - WIND: MED
      - WIND: HIGH
    - COAL: Med use
      - WIND: BASE
        - PPA
      - WIND: MED
      - WIND: HIGH
    - COAL: Min use
      - WIND: BASE
      - WIND: MED
      - WIND: HIGH
  - DSM: Base
    - COAL: Max use
      - WIND: BASE
      - WIND: MED
      - WIND: HIGH
    - COAL: Med use
      - WIND: BASE
        - PPA
      - WIND: MED
      - WIND: HIGH
    - COAL: Min use
      - WIND: BASE
      - WIND: MED
      - WIND: HIGH
  - DSM: HIGH
    - COAL: Max use
      - WIND: BASE
      - WIND: MED
      - WIND: HIGH
    - COAL: Med use
      - WIND: BASE
        - PPA
      - WIND: MED
      - WIND: HIGH
    - COAL: Min use
      - WIND: BASE
      - WIND: MED
      - WIND: HIGH

NOTE: Base Wind refers to existing and planned additions of 582MW. Wind Med is a higher amount than Base. Wind High is a higher amount than Med.

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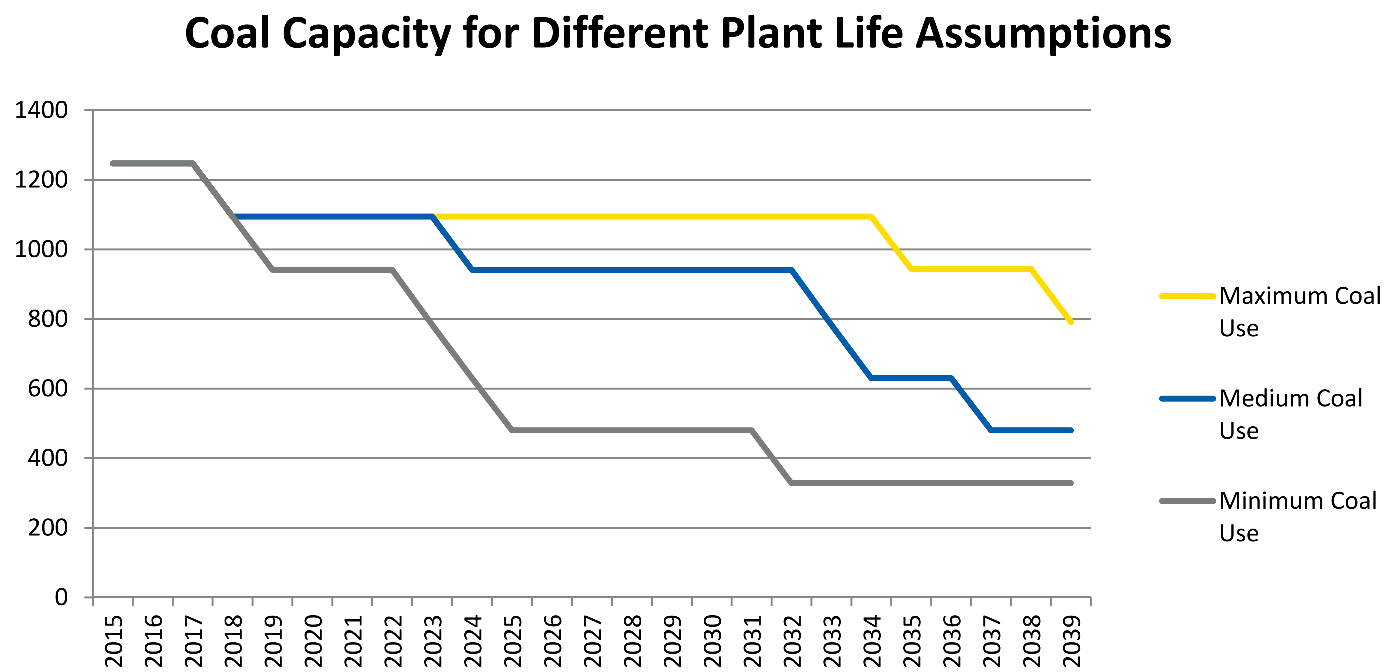
Plant Life Assumptions for Coal



Candidate Resource Plan Development

THE FOLLOWING RESOURCE PLANS HAVE BEEN CHOSEN FOR INITIAL OPTIMIZATION RUNS IN STRATEGIST®:

- Plan 1 (Base Run*): Case 1 (Low) DSM, 60 year coal plant retirements and base (currently planned – 582 MW) wind with PPA
- Plan 2: Case 2 (Base) DSM, 60 year coal plant retirements and base wind
- Plan 3: Case 2 (Base) DSM, 60 year coal plant retirements and high wind (up to 900 MW)
- Plan 4: Case 2 (Base) DSM, 50 year coal retirements and base wind
- Plan 5: Case 3 (High) DSM, 60 year coal retirements and base wind
- All plans to run under the Reference World, with assumed Scenario A emissions, 40% RES requirement by 2020 and Maritime Link + Economy energy purchases

* formerly known as the "least cost" run

Candidate Resource Plan Development

THESE 5 INITIAL CRPs WERE SELECTED BASED ON:

- Representing each of the three levels of DSM
- Exploring the range of intermittent generation
- Changing only one variable relative to Base Load, Base DSM, Base Wind to see how individual variables affect the results

Candidate Resource Plan Development

MODELLING IN STRATEGIST®

- Enter the input assumptions for the particular CRP into the model
- Include the existing resources and additional resources committed in the CRP which are fixed in the model
- Strategist® then identifies optimal resource additions under that CRP as to type, timing, and quantity of resource
- Strategist® ensures that system requirements are met (e.g. planning reserve margin, emission limits, renewable energy)

CRP - Sustaining Capital

- Output from Strategist® provides a profile of unit capacity factors over the planning period for each CRP. This includes existing units as well as new units that are added in each CRP.
- Based on the capacity factors and the timing of unit retirements assumed for each CRP, a profile of sustaining capital costs can be developed for each unit
- These sustaining capital costs will be used to account for CRPs with differing retirement schedules.

CRP Plan Numbering

STRATEGIST® PRODUCES UP TO 4000 SEQUENTIAL OPTIONS FOR EACH CANDIDATE RESOURCE PLAN. THEY ARE RANKED FROM 1 TO 4000 BASED ON NET PRESENT VALUE

- NS Power has developed a naming convention for referencing these plans
- CRP 2 – is CRP 2
- CRP 2.1 - is the first plan (Lowest NPV) derived by Strategist® for CRP 2 assumptions
- CRP 2.8 – is the eighth most cost effective plan under CRP 2 assumptions....

Strategist® Resource Optimization Model

Strategist® Detail

STRATEGIST® IS COMPOSED OF MODULES LINKED BY A GRAPHICAL USER INTERFACE. IT INCORPORATES ALL ASPECTS OF UTILITY PLANNING AND OPERATIONS INCLUDING:

- Modeling of forecasted load
- Production cost calculations including the dispatch of energy resources
- Optimization of future supply and demand side resources

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Strategist® Detail

PRODUCTION COSTING AND ENERGY DISPATCH

- Provides production costs, unit generation, fuel usage, and emissions output through dispatch of resources.
- Strategist® is a planning tool and does not capture all the operational aspects of dispatch particularly those related to high levels of intermittent resources

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Strategist® Detail

STRATEGIST® EVALUATES THE ECONOMICS OF ADDING NEW SUPPLY SIDE AND DEMAND SIDE ALTERNATIVES:

- Natural Gas CCs and CTs
- New Coal Options
- Demand Response programs
- Hydro option (Mersey upgrade)
- Renewable Options
- Control Technologies

An alternative can either be fixed in the plan as may be the case for a particular CRP and/or provided as an option for the model to pick from in the run.

Strategist® Detail

STRATEGIST® OPTIMIZATIONS:

- Strategist® optimizes the various alternatives while targeting an objective function, minimization of cost.
- The model create all possible combinations of new alternatives, subject to input constraints (reserve margin, emissions, min RES %, etc), to develop multiple resource plans.
- Several optimizations are required to get to a final set of plans because Strategist® can only solve for one hard emission cap at the time. Also, alternatives have to be introduced in a staged approach to manage problem size.
- Plans are ranked based on net present value cost.

Candidate Resource Plan Input Variables

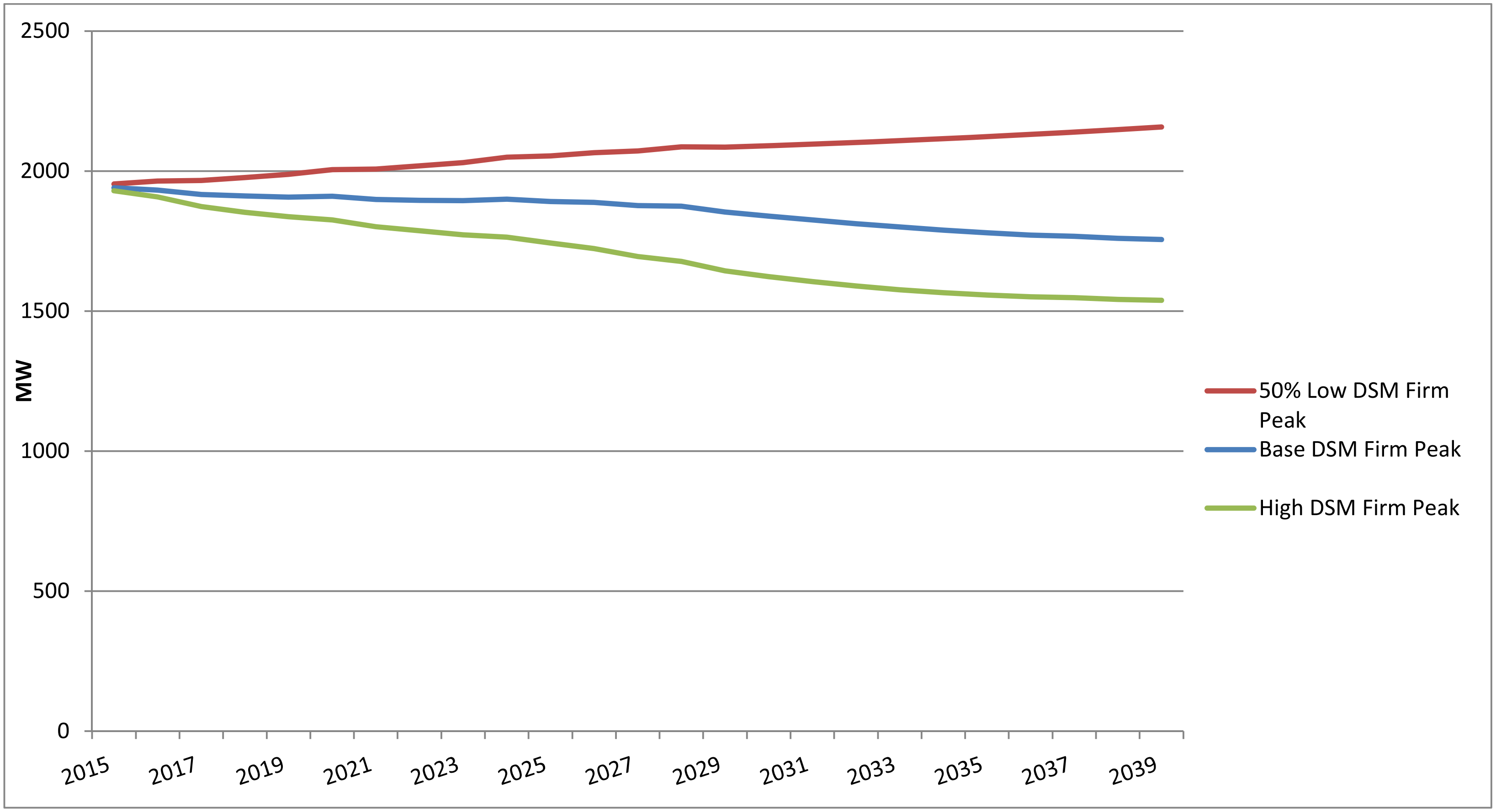
DSM Firm Demand Reduction

All Values in MWs

	No DSM Firm Peak	Base DSM Firm Peak Reduction	Base DSM Firm Peak	50% Low DSM Firm Peak Reduction	50% Low DSM Firm Peak	High DSM Firm Peak Reduction	High DSM Firm Peak
2015	1963	23	1940	9	1954	33	1930
2016	1986	54	1932	22	1964	78	1908
2017	2000	84	1916	34	1967	127	1874
2018	2020	110	1910	44	1977	168	1852
2019	2041	134	1907	53	1988	205	1836
2020	2066	156	1910	62	2005	241	1826
2021	2077	178	1899	70	2007	275	1802
2022	2097	202	1896	79	2018	311	1786
2023	2118	224	1894	88	2030	345	1773
2024	2147	247	1899	97	2050	383	1764
2025	2159	267	1892	105	2054	416	1743
2026	2178	290	1888	113	2065	455	1723
2027	2196	319	1877	125	2071	501	1695
2028	2221	347	1874	135	2086	544	1677
2029	2232	379	1853	147	2085	588	1644
2030	2251	412	1839	161	2090	628	1623
2031	2270	445	1825	174	2096	665	1605
2032	2288	476	1812	187	2102	698	1590
2033	2307	507	1800	199	2108	731	1576
2034	2326	537	1789	211	2115	761	1565
2035	2345	566	1780	223	2123	788	1557
2036	2364	593	1771	234	2130	813	1551
2037	2383	616	1767	244	2140	836	1548
2038	2403	643	1760	255	2148	861	1542
2039	2422	666	1756	264	2157	884	1538

DSM Firm Demand Reduction

20% Planning Reserve Margin requirement based on Firm Peak demand



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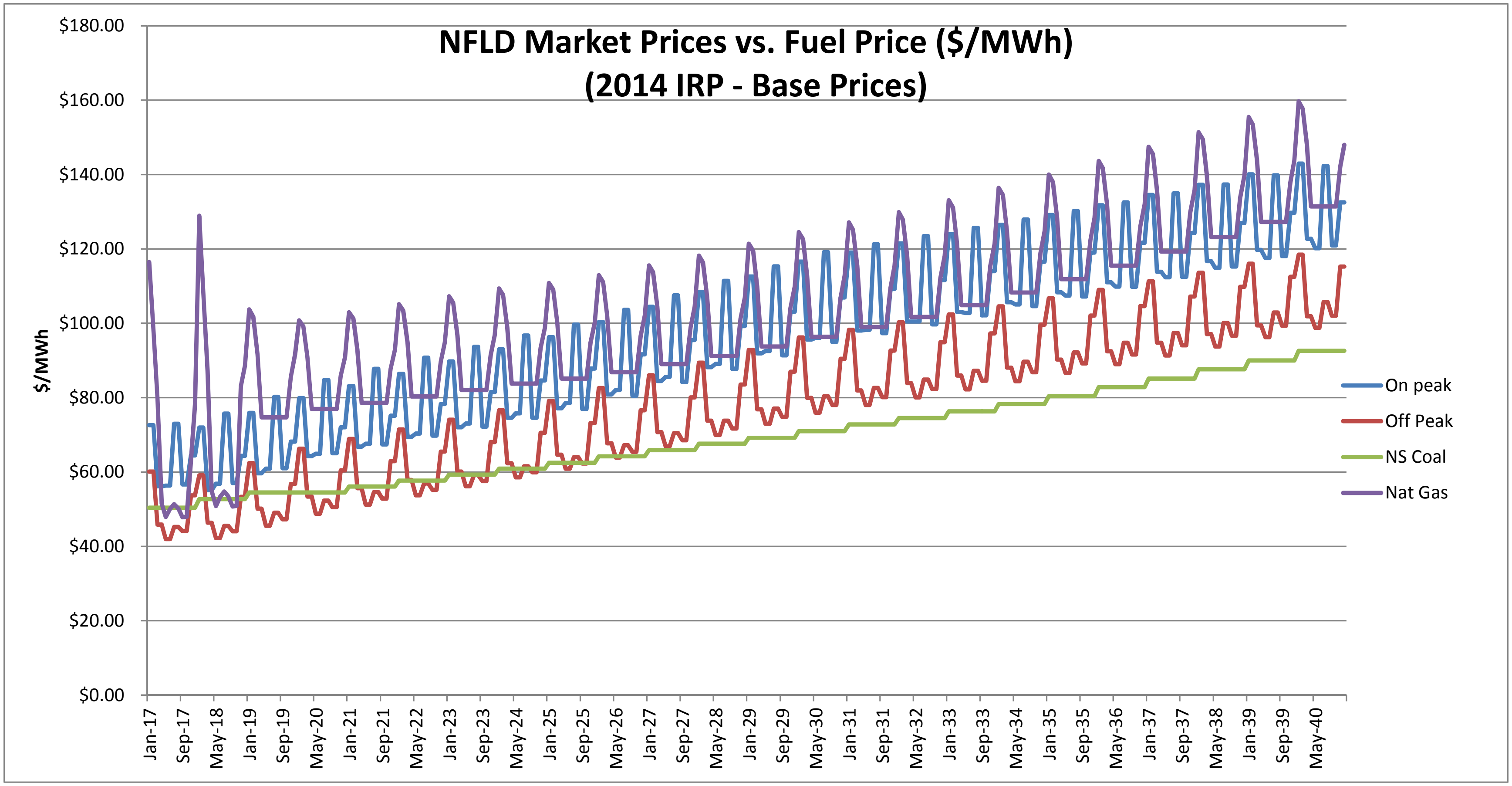
Relative Fuel and Power Costs

Base Values for Coal, Natural Gas and Power Prices



NFLD Market Prices are based on the Mass Hub forecast assuming no tariffs or netback (see Power Price forecast in April 11th Assumptions). Purchase price for Maritime Link surplus energy.

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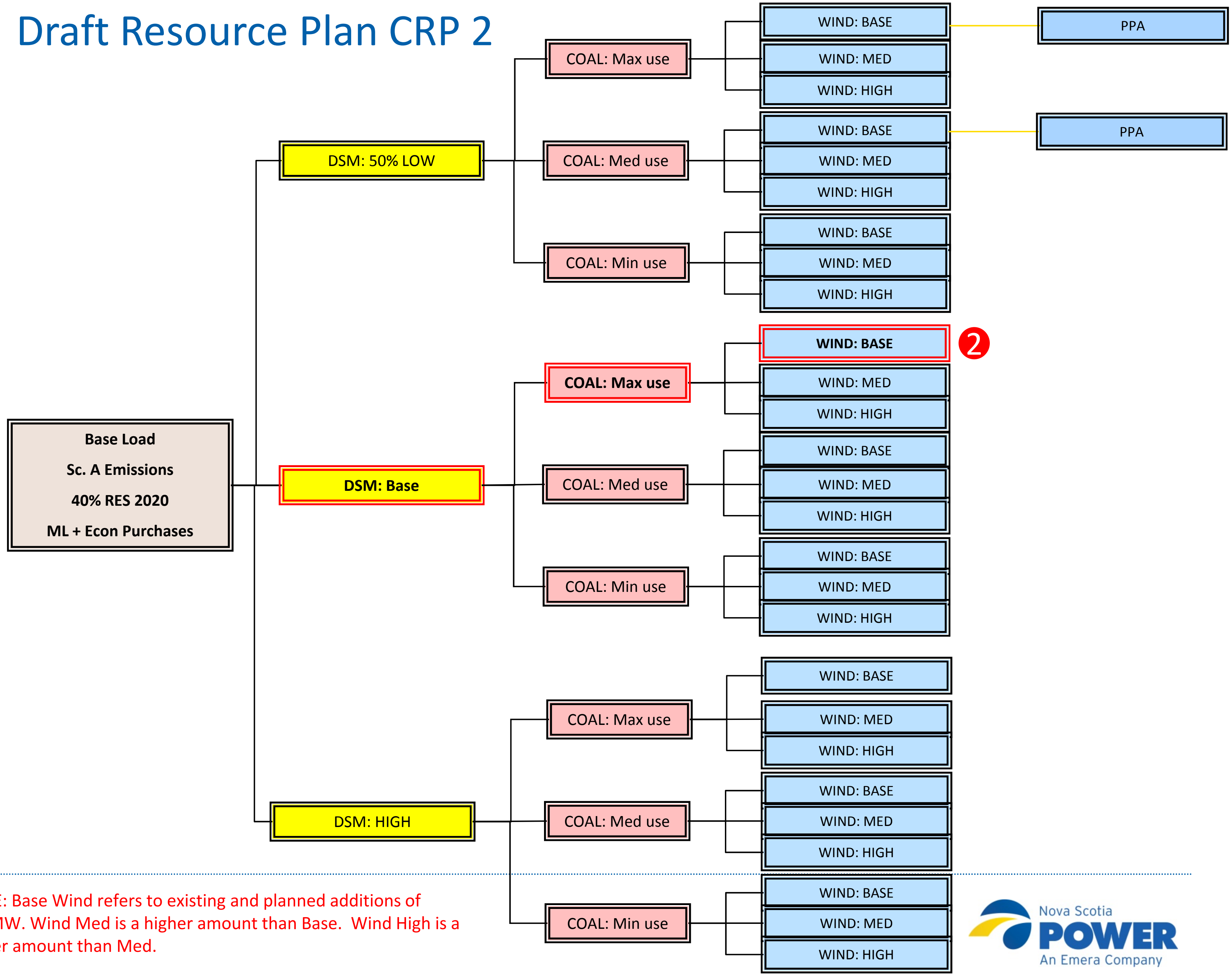
JUNE 25, 2014

Strategist® Preliminary Results

JUNE 25, 2014

CRP 2 Preliminary Results

Draft Resource Plan CRP 2



NOTE: Base Wind refers to existing and planned additions of 582MW. Wind Med is a higher amount than Base. Wind High is a higher amount than Med.

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CRP 2 Input Assumptions

- Base Load Forecast
- Base DSM
- Emissions - Scenario A
- Planned and committed resources are fixed in the plan (REA wind, COMFIT, Maritime Link/ Retire Lin #2)
- Maximum Coal Use
- Constraints
  - Planning reserve margin min = 20%
  - RES: 2015-2019 = 25%; 2020-2039 = 40%

CRP 2 Preliminary Results

	CRP2-1-R01	CRP2-8-R01	CRP2-50-R01
	Least cost study period	**Plan of interest**	**Least cost Planning period**
2015			
2016		DR - Water Heaters	
2017	ML Oct 2017	ML Oct 2017	ML Oct 2017
	Lin 2 retire	Lin 2 retire	Lin 2 retire
2018			
2019		Mersey Phase 1	
2020			
2021			
2022			
2023		Mersey Phase 2	
2024			
2025	TUC 1 Retire	TUC 1 Retire	TUC 1 Retire
			FGD (Lin 3/4 300 MW)
2026			
2027			
2028			
2029			
2030			
2031			
2032	TUC 2 Retire	TUC 2 Retire	TUC 2 Retire
2033			
2034			
2035	CT 50MW	CT 50MW	CT 50MW
	Tre 5 Retire	Tre 5 Retire	Tre 5 Retire
2036	CT100 MW & CT50 MW	CT50 MW	CT100 MW & CT50 MW
	TUC 3 Retire	TUC 3 Retire	TUC 3 Retire
2037			
2038			
2039	CT 100 MW	CT 100 MW	CC 145 MW
	Lin 1 Retire	Lin 1 Retire	Lin 1 Retire
Planning PV $M	11,274	11,365	11,247
Study PV $M	17,002	17,033	17,113

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CRP 2.1 Preliminary Results

CRP 2.1 Preliminary Results

	CRP 2.1 (Base Run)
2015	
2016	
2017	ML Oct 2017 Lin 2 retire
2018	
2019	
2020	
2021	
2022	
2023	
2024	
2025	TUC 1 Retire
2026	
2027	
2028	
2029	

2030	
2031	
2032	TUC 2 Retire
2033	
2034	
2035	CT 50MW Tre 5 Retire
2036	CT100 MW & CT50 MW TUC 3 Retire
2037	
2038	
2039	CT 100 MW Lin 1 Retire
Planning PV $M	11,274
Study PV $M	17,002

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CRP 2.1 Preliminary - Load and Resources

	2015	2016	2017	2018	2019	2020	2025	2030	2035	2036	2037	2038	2039
Firm Peak	1,963	1,986	2,000	2,020	2,041	2,066	2,159	2,251	2,345	2,364	2,383	2,403	2,422
DSM	23	54	84	110	134	156	267	412	566	593	616	643	666
Firm Peak Less DSM	1,940	1,932	1,916	1,910	1,907	1,910	1,892	1,839	1,780	1,771	1,767	1,760	1,756
RM Required	388	386	383	382	381	382	378	368	356	354	353	352	351
Required MWs	2,328	2,319	2,299	2,293	2,288	2,292	2,270	2,206	2,136	2,126	2,120	2,112	2,107
Existing MWs	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341
Resource Additions (MW):													
Burnside #4		33											
COMFIT - Biomass	4.2	6											
COMFIT - Wind	14.14	4.56	5.1										
REA Wind	2.35	17.34											
Maritime Link				153.25									
Small Biomass PPA			10										
Hydro			1.8										
Additional Wind													
Assumed Unit Retirement				-153			-81		-150	-147			-153
Natural Gas Unit									49.4	149.4			100
Total Annual Additions	20.7	60.9	16.9	0.3	0.0	0.0	-81.0	0.0	-100.6	2.4	0.0	0.0	-53.0
Total Cumulative Additions	20.7	81.6	98.5	98.7	98.7	98.7	17.7	17.7	-175.9	-173.5	-173.5	-173.5	-226.5
Total Firm Capacity	2362	2423	2440	2440	2440	2440	2359	2359	2166	2168	2168	2168	2115
Surplus (Deficit) MWs above RM	34	104	141	148	152	148	89	153	30	42	48	56	8
Reserve Margin %	21.8%	25.4%	27.3%	27.7%	28.0%	27.8%	24.7%	28.3%	21.7%	22.4%	22.7%	23.2%	20.4%

Resource Type	Firm MW
Thermal	1568
Diesel CTs	194
Combined Cycle	147
Hydro	376
Firm Contribution of Renewables	56
Total Existing	**2341**

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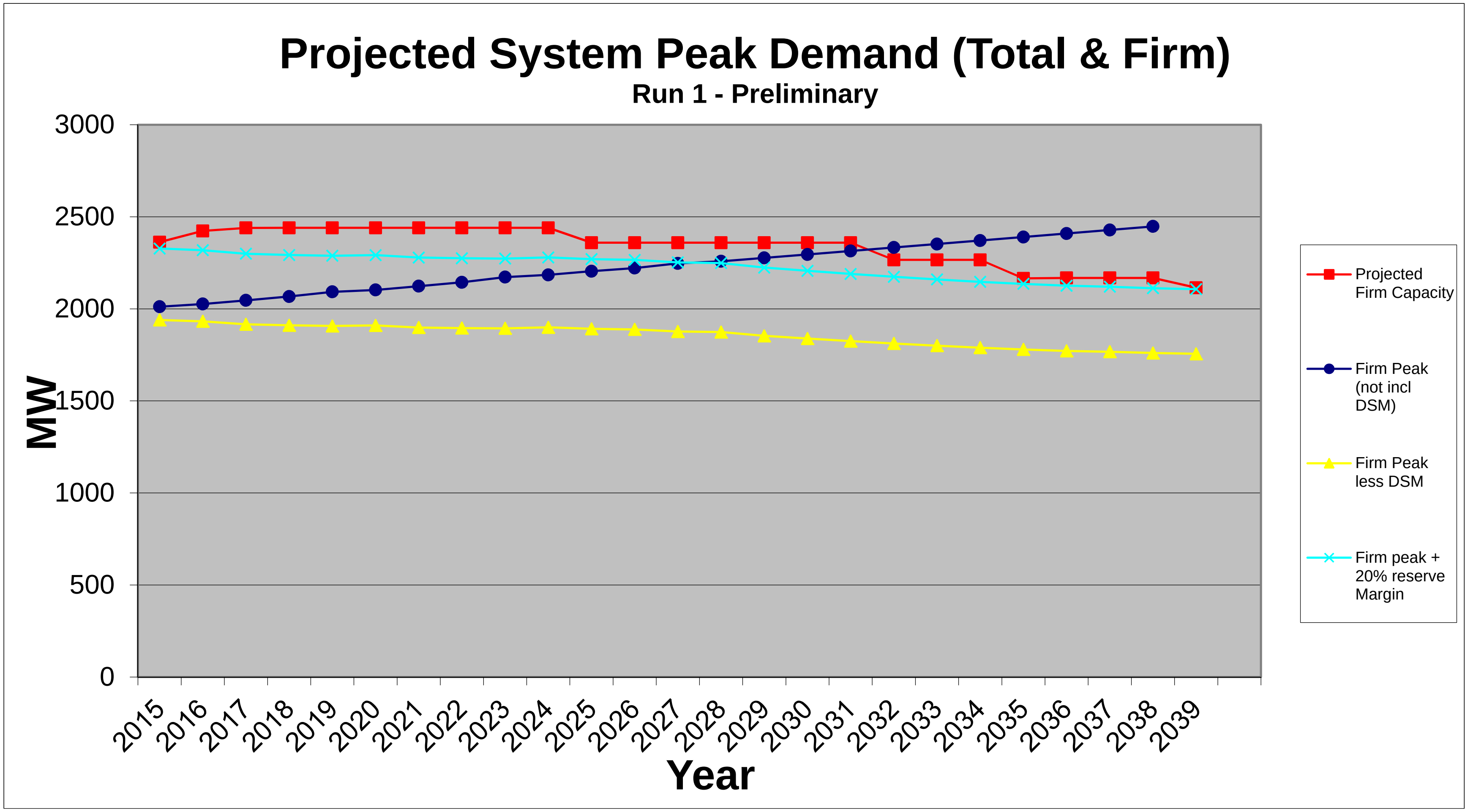
CRP 2.1 Preliminary - Demand and DSM



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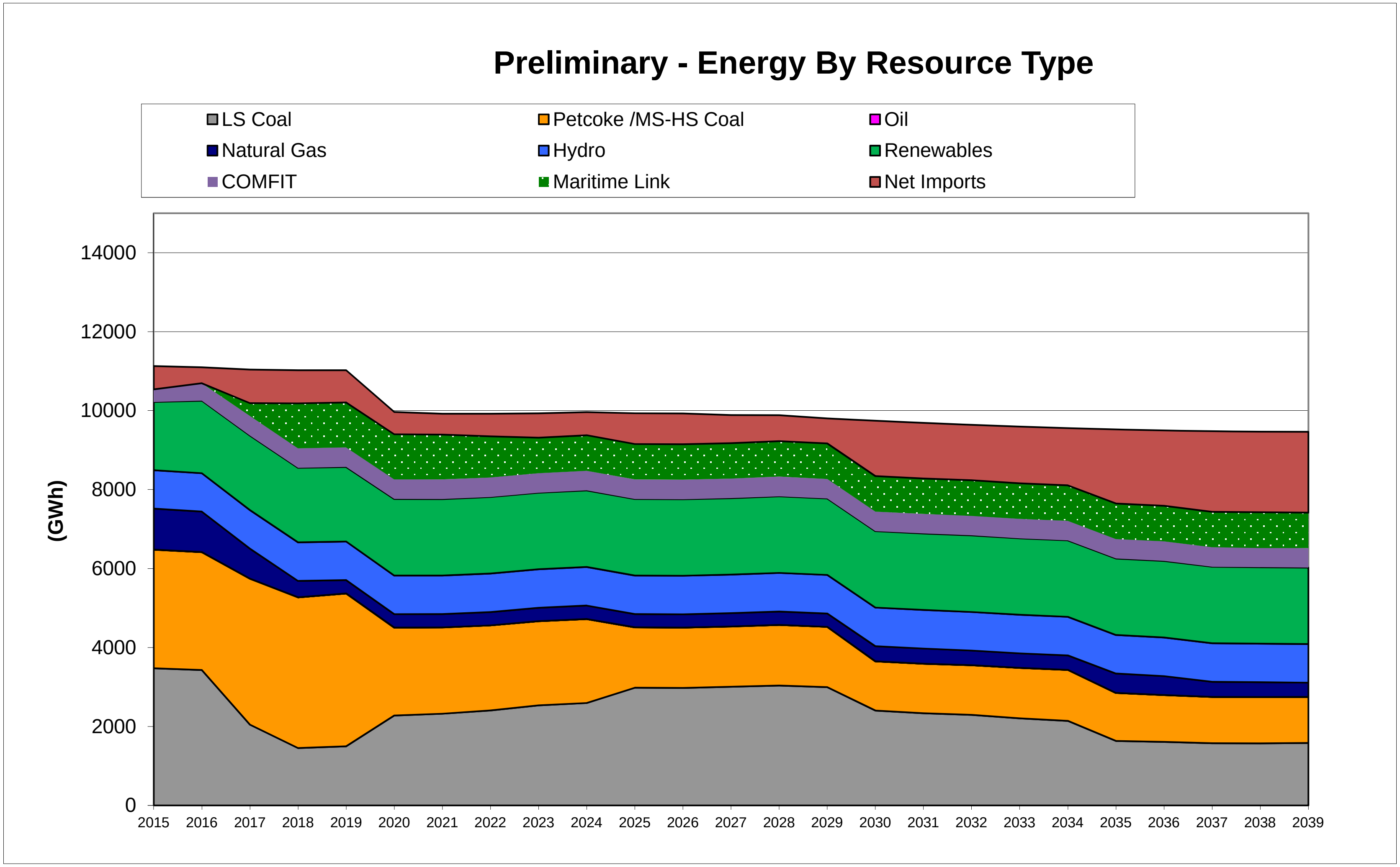
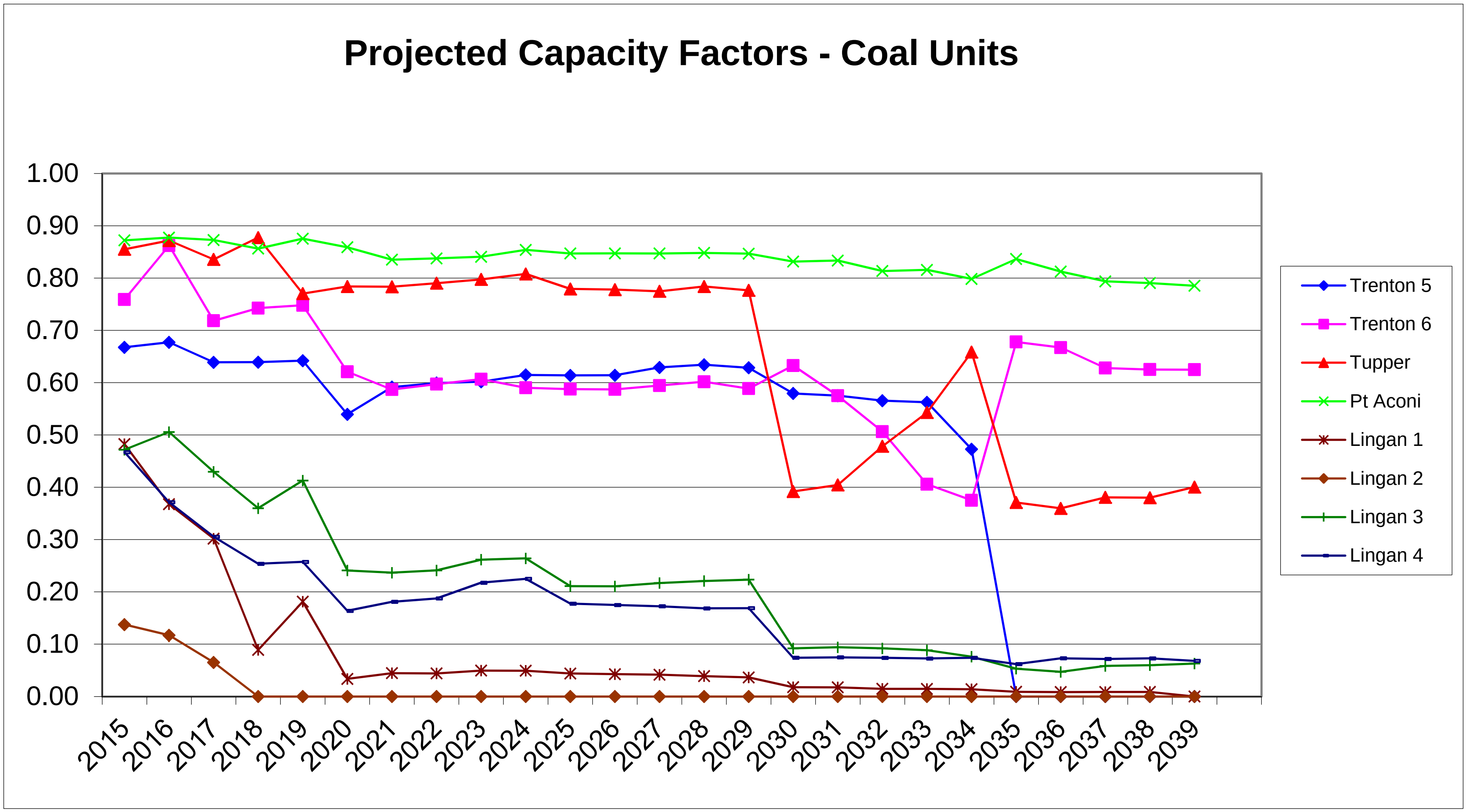
CRP 2.1 Preliminary Energy by Resource Type



Step change in load starting in 2020 - assumes a large industrial customer (PHP) is in-service until 2019 and off-line starting in 2020.

Net Imports include economy energy imports from NB and Maritime Link surplus energy.

CRP 2.1 Preliminary - Coal Capacity Factors



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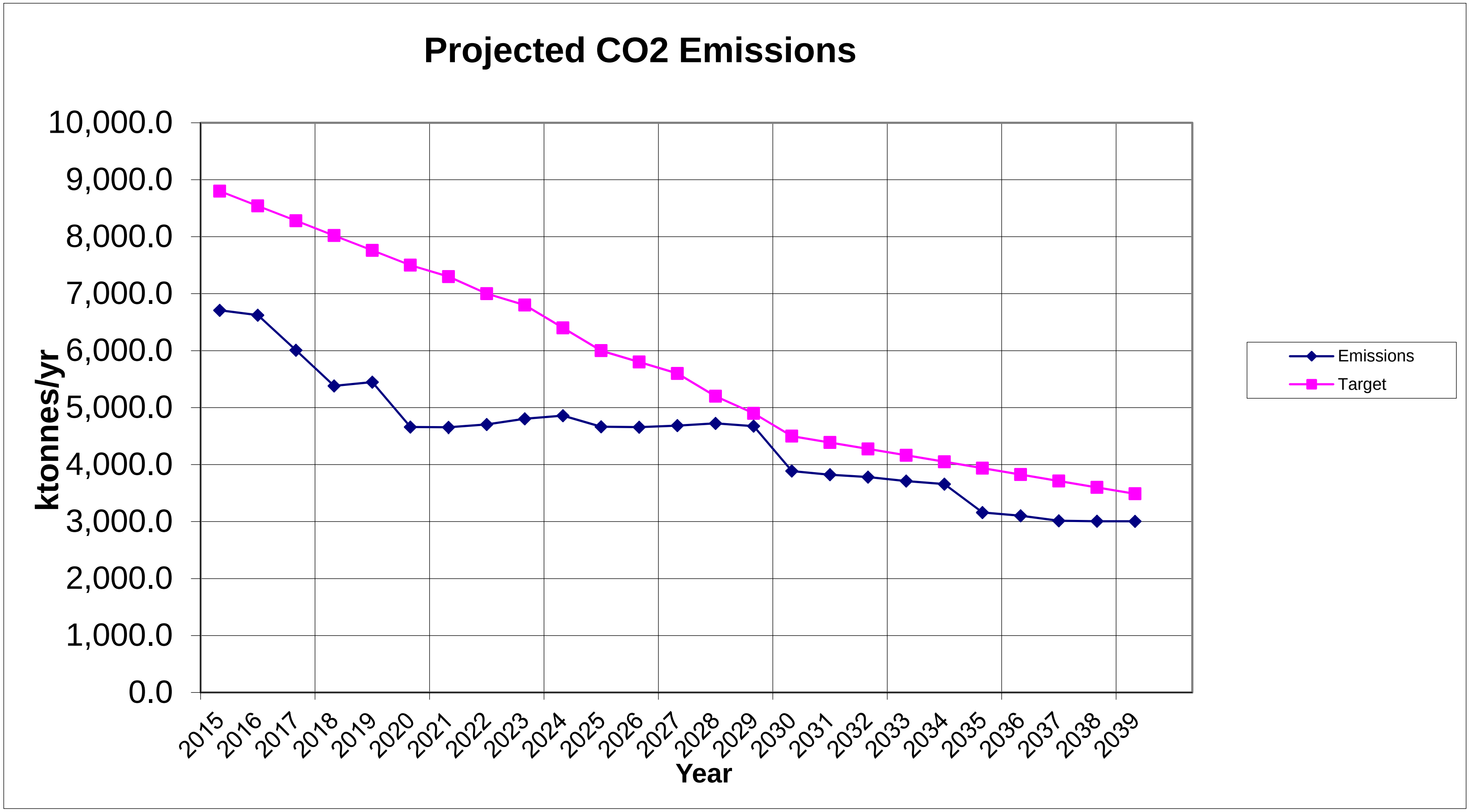
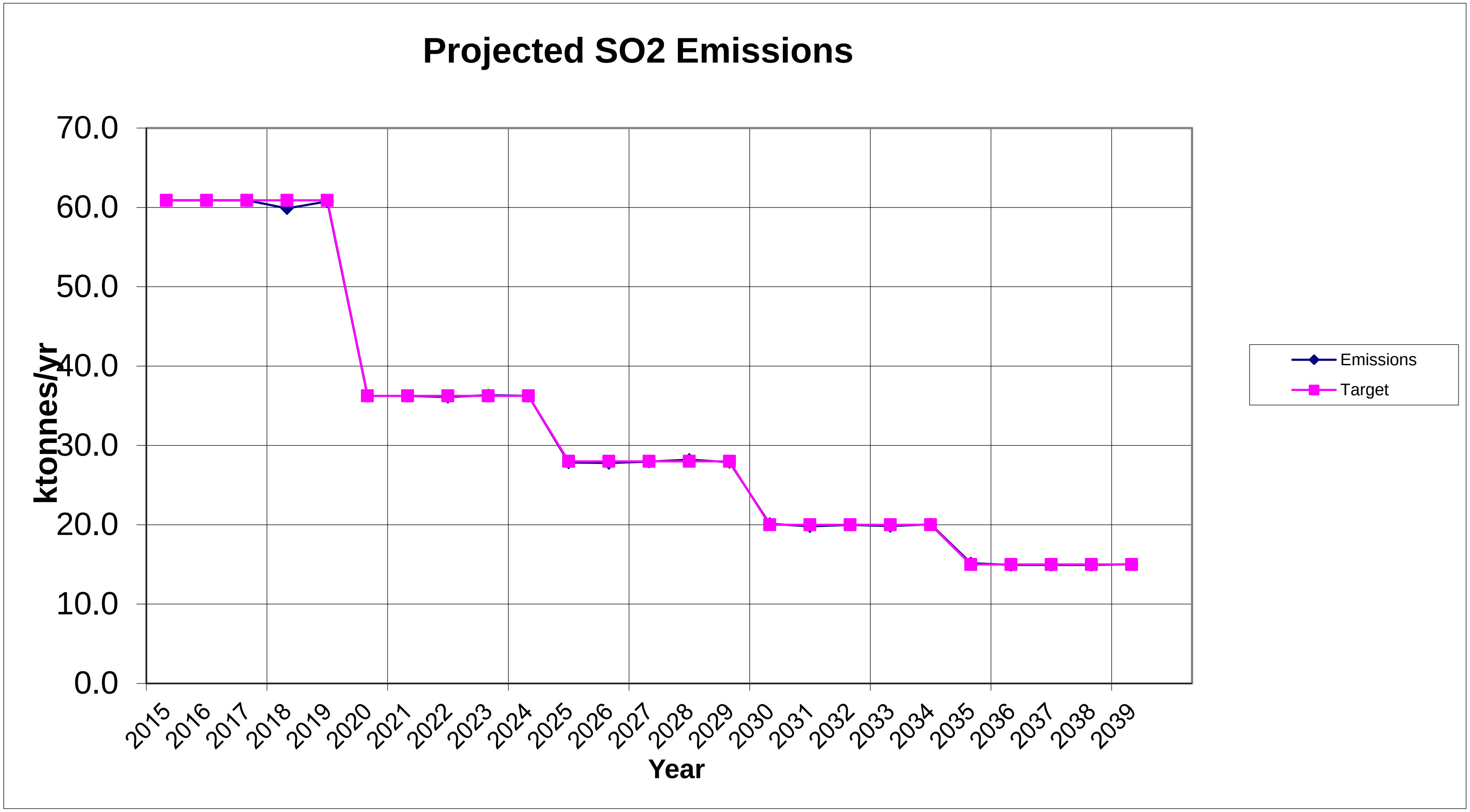
CRP 2.1 Preliminary - CO_2 Emissions



CRP 2.1 Preliminary - SO_2 Emissions



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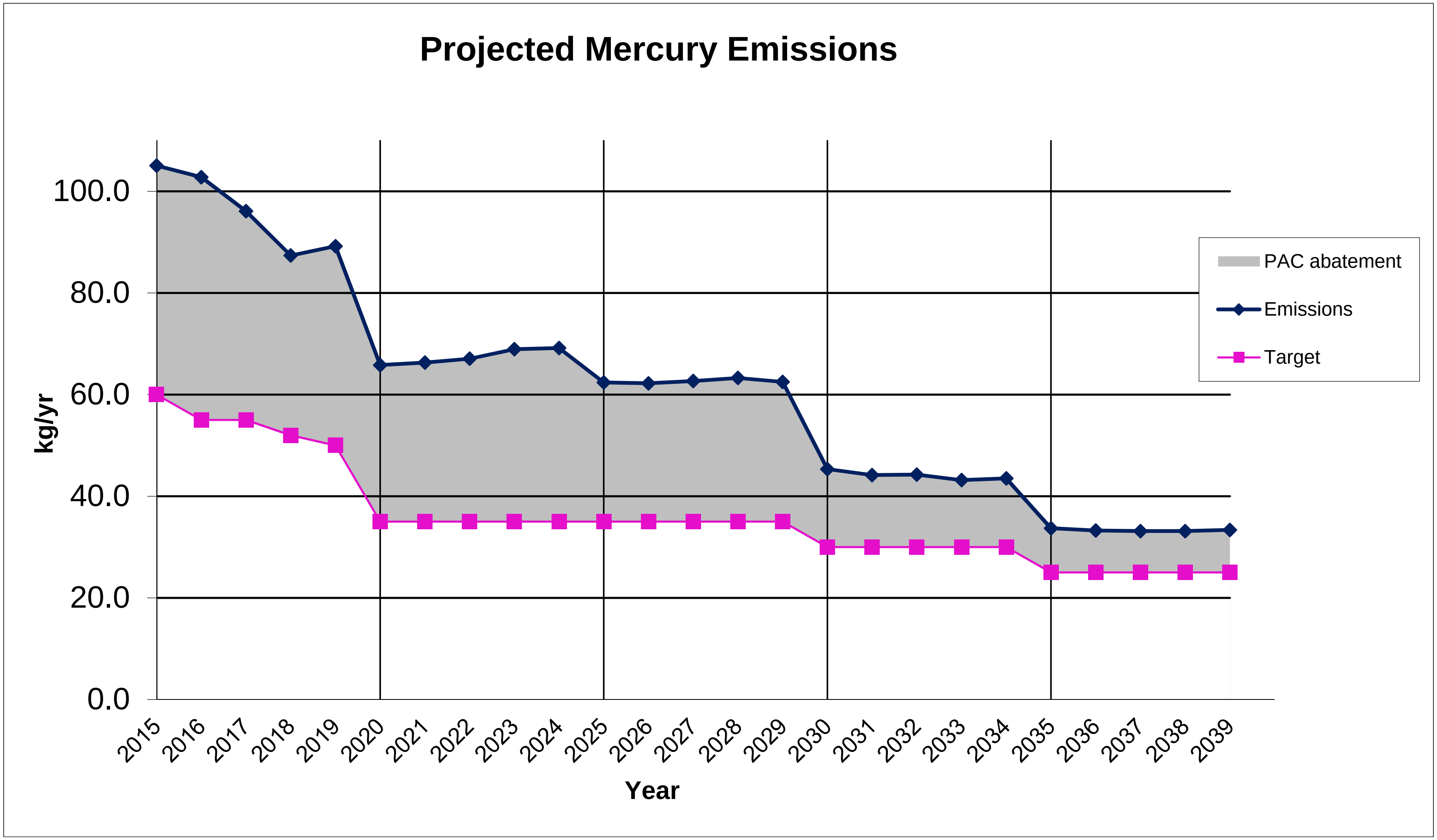
CRP 2-1 Preliminary Hg Emissions



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CRP 2-8 Preliminary Results

CRP 2-8 Preliminary Load and Resources

	2015	2016	2017	2018	2019	2020	2025	2030	2035	2036	2037	2038	2039
Firm Peak	1,963	1,986	2,000	2,020	2,041	2,066	2,159	2,251	2,345	2,364	2,383	2,403	2,422
DSM	23	54	84	110	134	156	267	412	566	593	616	643	666
Firm Peak Less DSM	1,940	1,932	1,916	1,910	1,907	1,910	1,892	1,839	1,780	1,771	1,767	1,760	1,756
DRWH Reduction	0	1	2	4	7	10	39	60	62	60	62	62	62
Firm Peak Less DR	1,940	1,931	1,914	1,906	1,900	1,900	1,852	1,779	1,718	1,712	1,705	1,698	1,694
RM Required	388	386	383	381	380	380	370	356	344	342	341	340	339
Required MWs	2,328	2,317	2,296	2,287	2,280	2,280	2,223	2,134	2,062	2,054	2,046	2,038	2,033
Existing MWs	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341
Resource Additions (MW):													
Burnside #4		33											
COMFIT - Biomass	4.2	6											
COMFIT - Wind	14.1	4.6	5.1										
REA Wind	2.4	17.3											
Maritime Link				153									
Small Biomass PPA			10										
Hydro			1.8		15								
FGD parasitic power													
Additional Wind													
Assumed Unit Retirement				-153			-81		-150	-147			-153
Natural Gas Unit									49.4	49.4			100
Total Annual Additions	20.7	60.9	16.9	0.3	15.0	0.0	-81.0	0.0	-100.6	-97.6	0.0	0.0	-53.0
Total Cumulative Additions	20.7	81.6	98.5	98.7	113.7	113.7	47.7	47.7	-145.9	-243.5	-243.5	-243.5	-296.5
Total Firm Capacity	2362	2423	2440	2440	2455	2455	2389	2389	2196	2098	2098	2098	2045
Surplus (Deficit) MWs above RM	34	106	143	153	175	175	167	255	134	44	52	60	12
Reserve Margin %	21.8%	25.5%	27.5%	28.0%	29.2%	29.2%	29.0%	34.3%	27.8%	22.6%	23.0%	23.5%	20.7%

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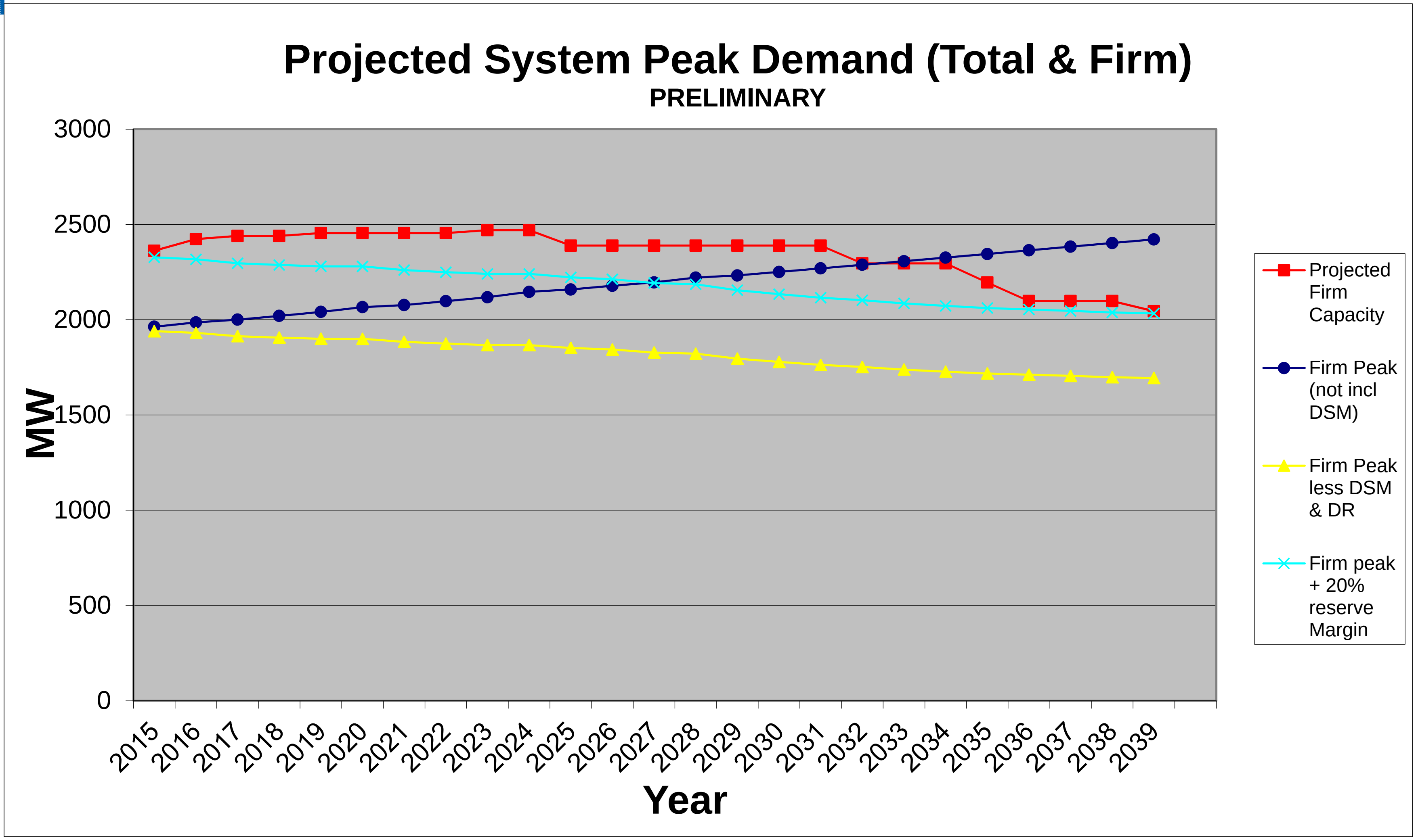
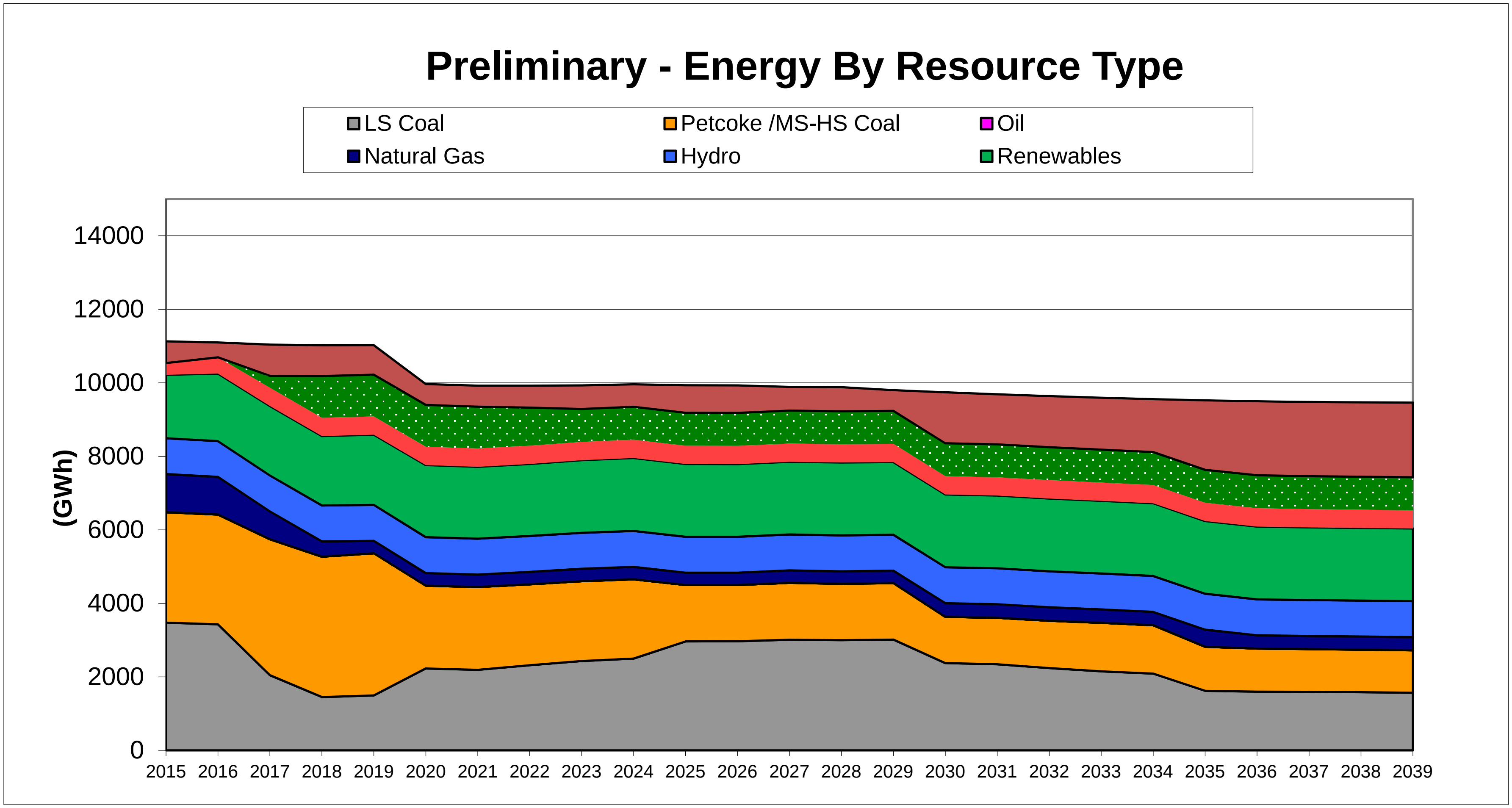
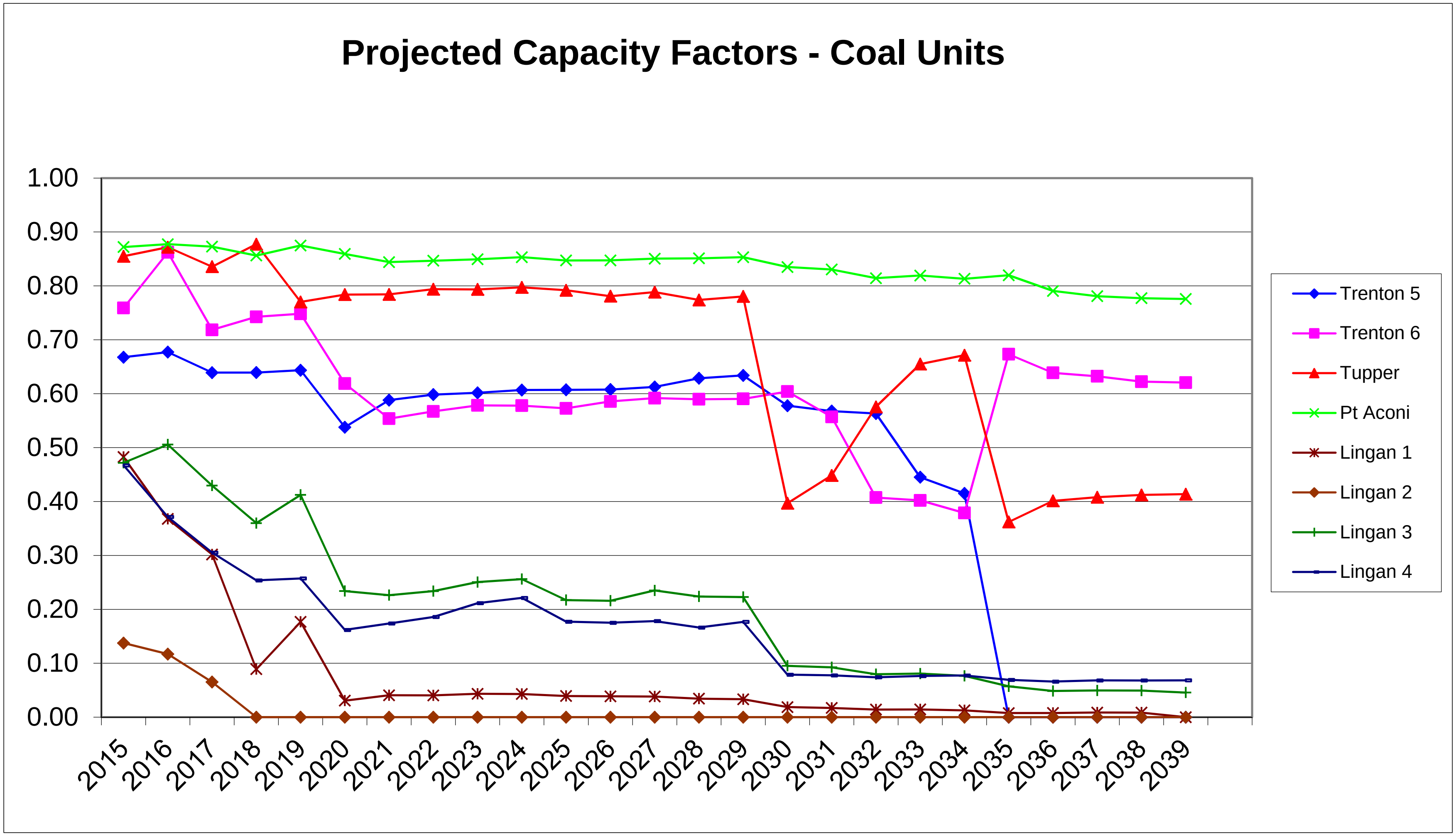
CRP 2-8 Preliminary Demand and DSM



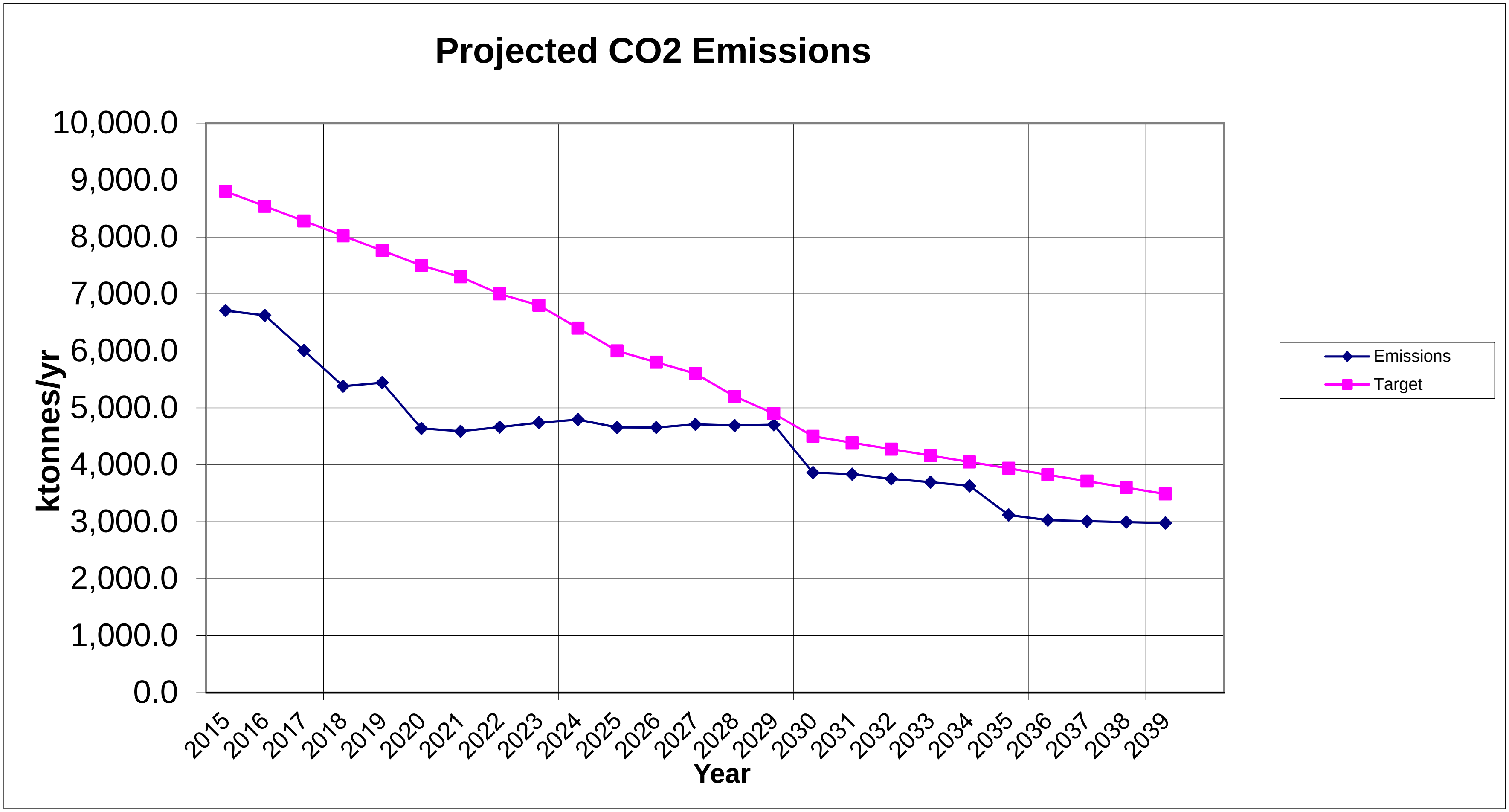
CRP 2-8 Preliminary Energy by Resource Type



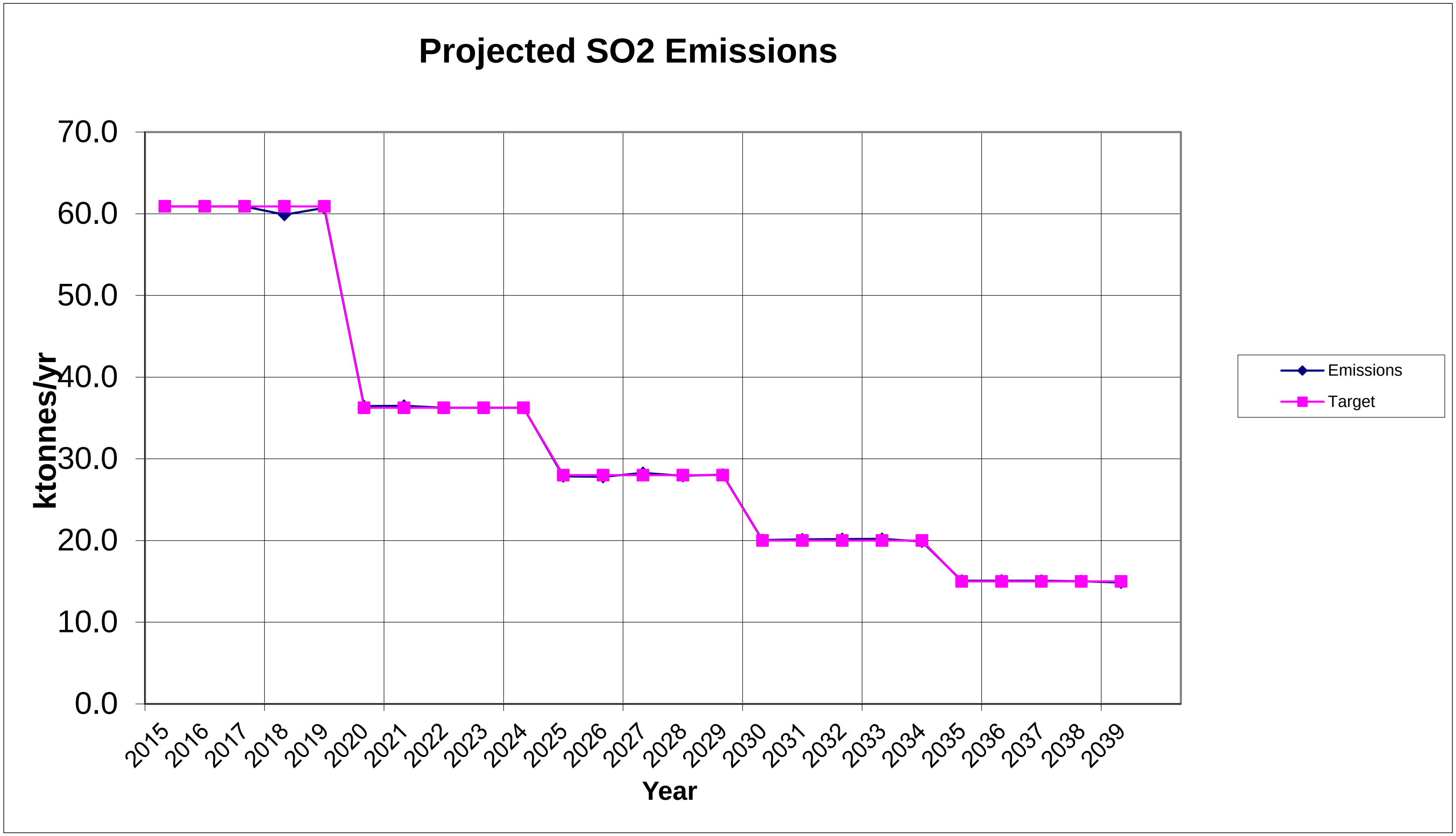
CRP 2-8 Preliminary Coal Capacity Factors



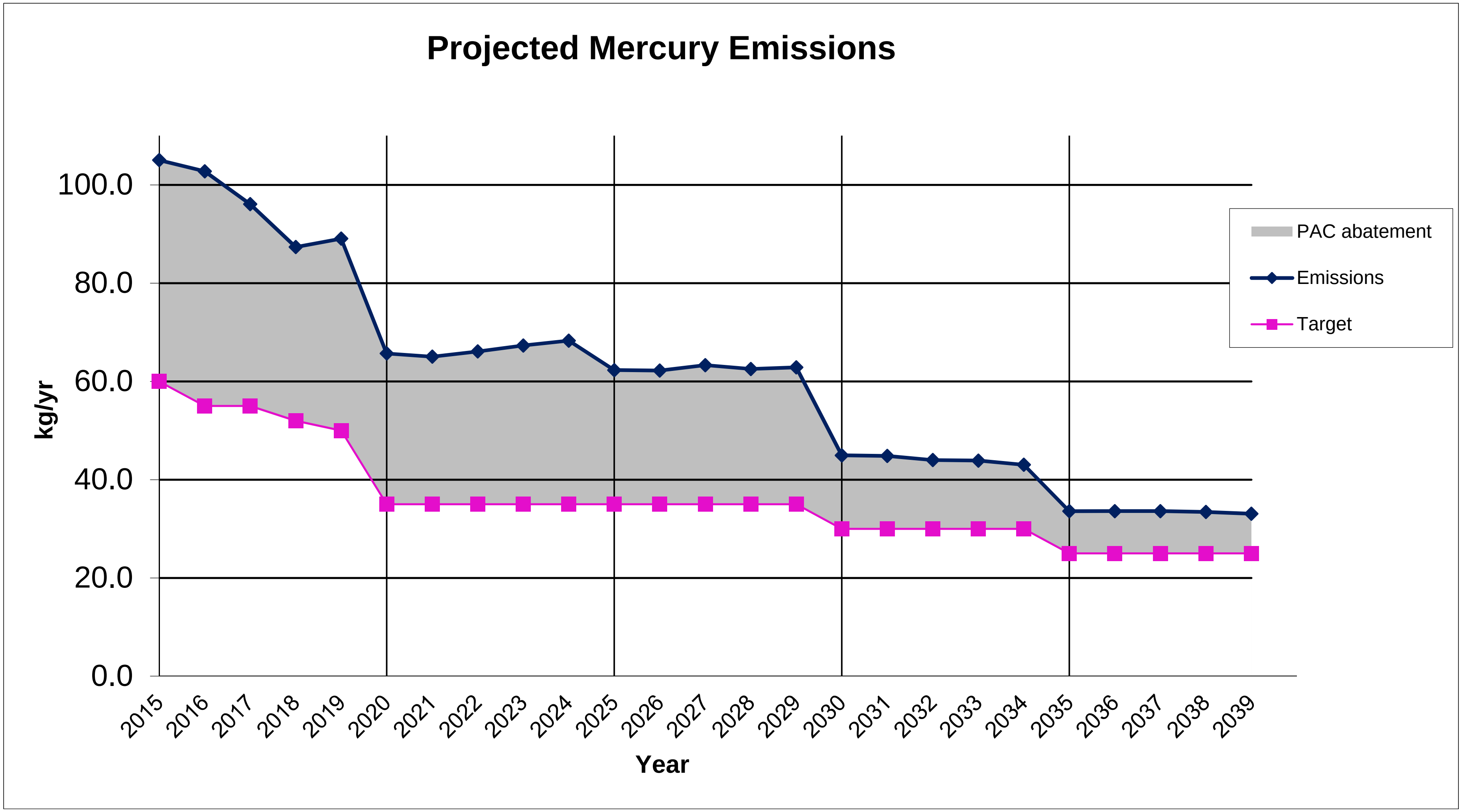
CRP 2-8 Preliminary CO_2 Emissions



CRP 2-8 Preliminary SO_2 Emissions



CRP 2-8 Preliminary Hg Emissions



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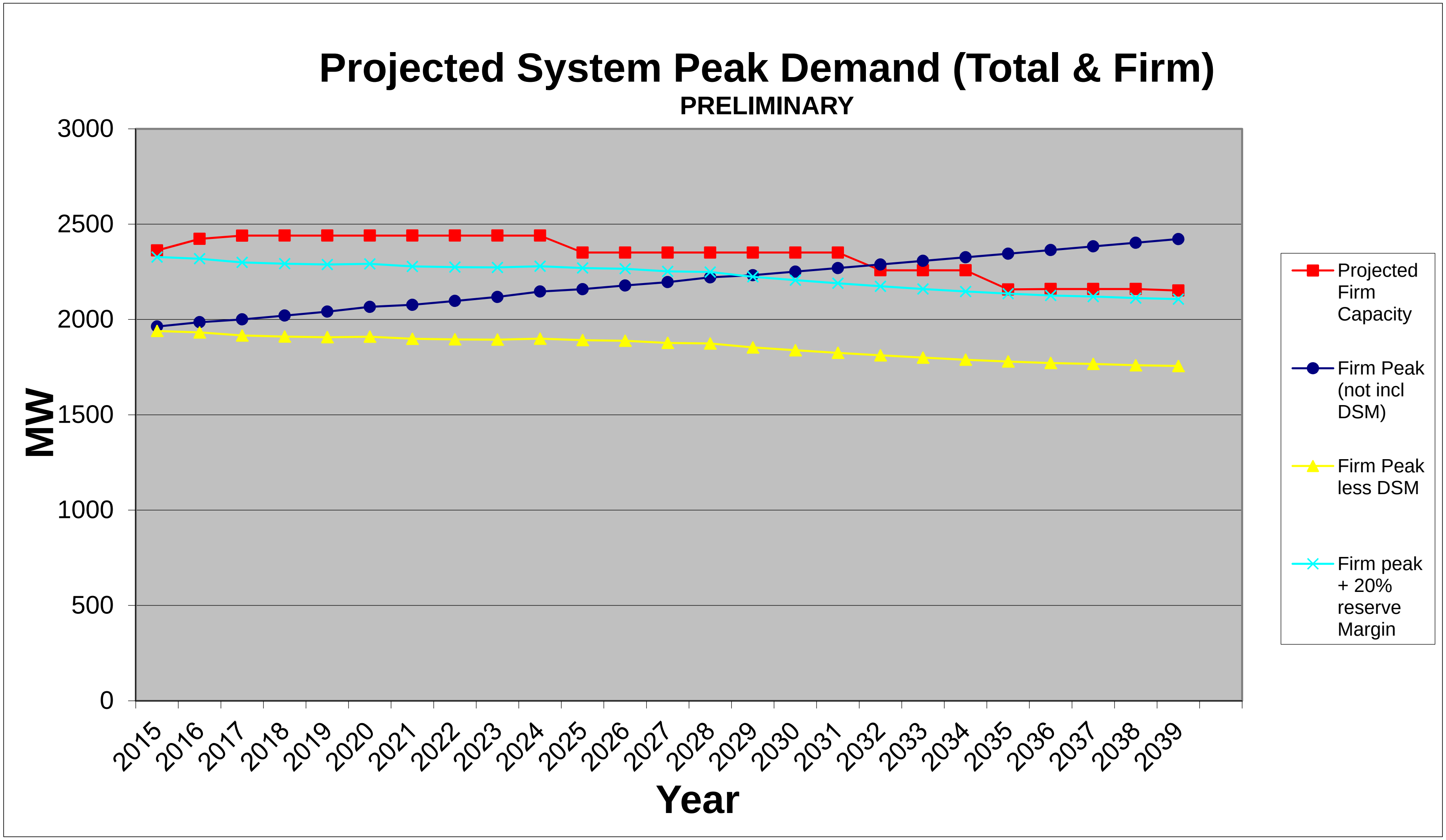
CRP 2-50 Preliminary Results

CRP 2-50 Preliminary Load and Resources

	2015	2016	2017	2018	2019	2020	2025	2030	2035	2036	2037	2038	2039
Firm Peak	1,963	1,986	2,000	2,020	2,041	2,066	2,159	2,251	2,345	2,364	2,383	2,403	2,422
DSM	23	54	84	110	134	156	267	412	566	593	616	643	666
Firm Peak Less DSM	1,940	1,932	1,916	1,910	1,907	1,910	1,892	1,839	1,780	1,771	1,767	1,760	1,756
RM Required	388	386	383	382	381	382	378	368	356	354	353	352	351
Required MWs	2,328	2,319	2,299	2,293	2,288	2,292	2,270	2,206	2,136	2,126	2,120	2,112	2,107
Existing MWs	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341	2341
Resource Additions (MW):													
Burnside #4		33											
COMFIT - Biomass	4.2	6											
COMFIT - Wind	14.14	4.56	5.1										
REA Wind	2.35	17.34											
Maritime Link				153									
Small Biomass PPA			10										
Hydro			1.8										
FGD parasitic power							-8.0						
Additional Wind													
Assumed Unit Retirement				-153			-81		-150	-147			-153
Natural Gas Unit									49.4	149.4			145
Total Annual Additions	20.7	60.9	16.9	0.3	0.0	0.0	-89.0	0.0	-100.6	2.4	0.0	0.0	-8.0
Total Cumulative Additions	20.7	81.6	98.5	98.7	98.7	98.7	9.7	9.7	-183.9	-181.5	-181.5	-181.5	-189.5
Total Firm Capacity	2362	2423	2440	2440	2440	2440	2351	2351	2158	2160	2160	2160	2152
Surplus (Deficit) MWs above RM	34	104	141	148	152	148	81	145	22	34	40	48	45
Reserve Margin %	21.8%	25.4%	27.3%	27.7%	28.0%	27.8%	24.3%	27.9%	21.2%	21.9%	22.2%	22.7%	22.6%

CRP 2-50 Preliminary Demand and DSM



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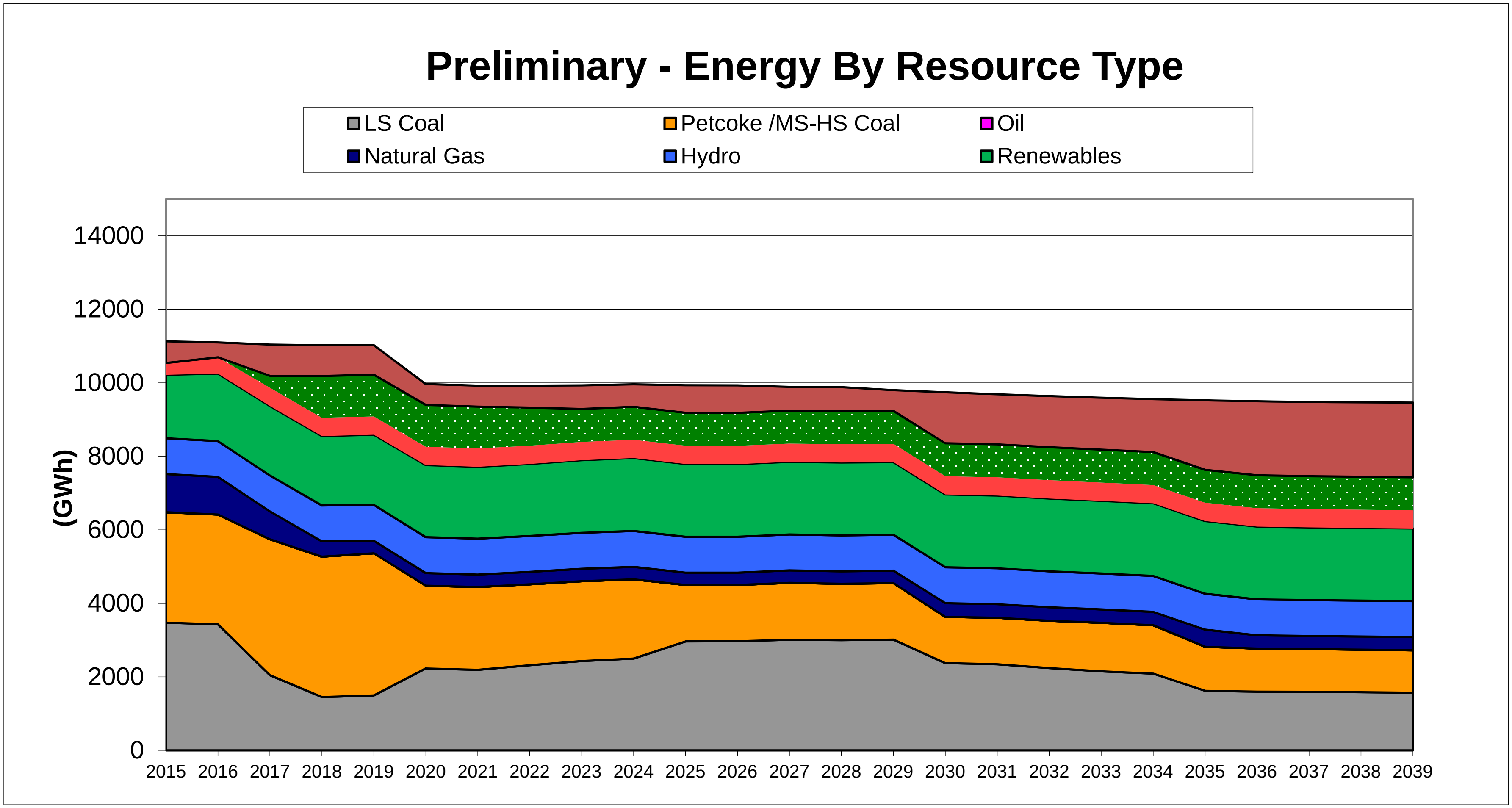
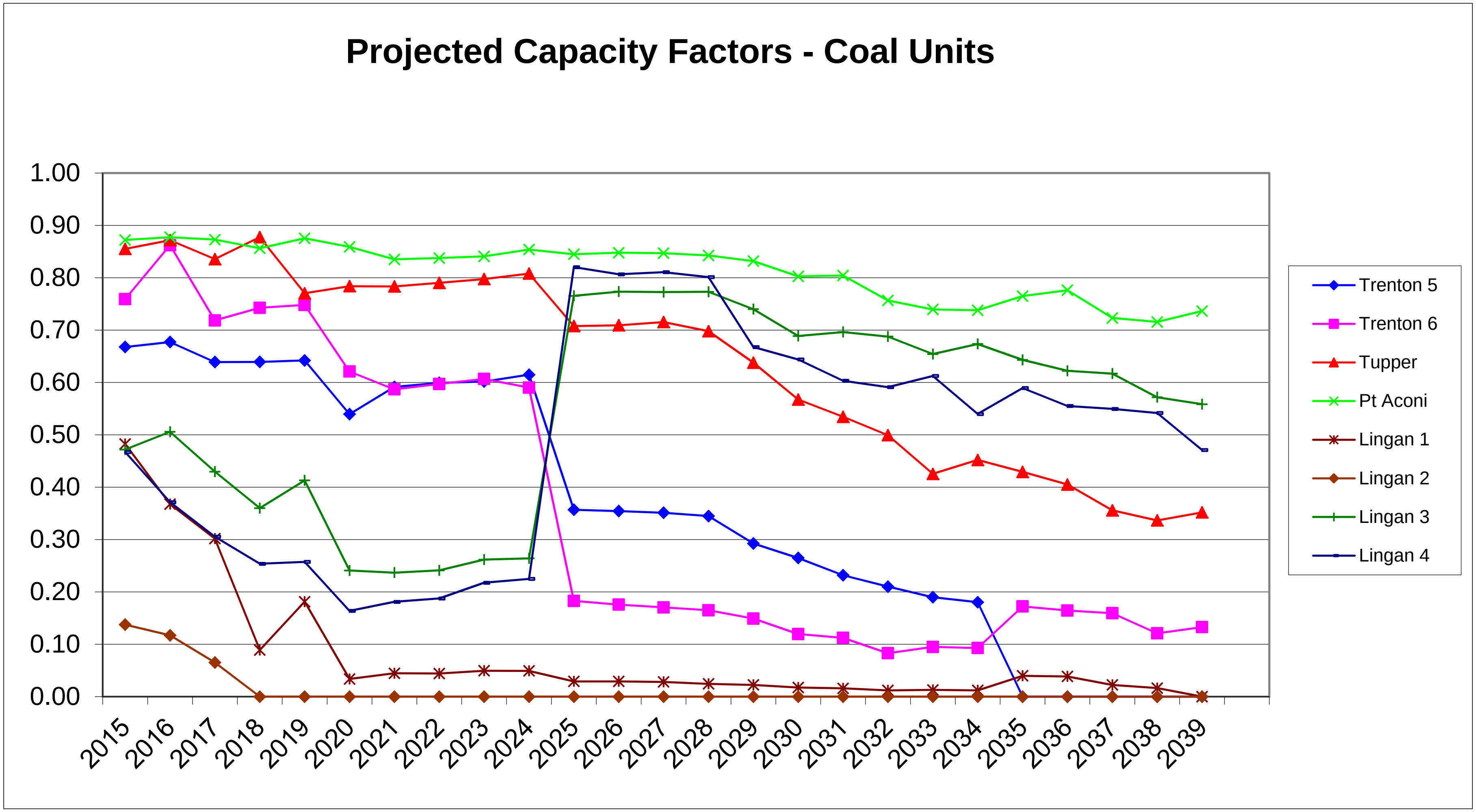
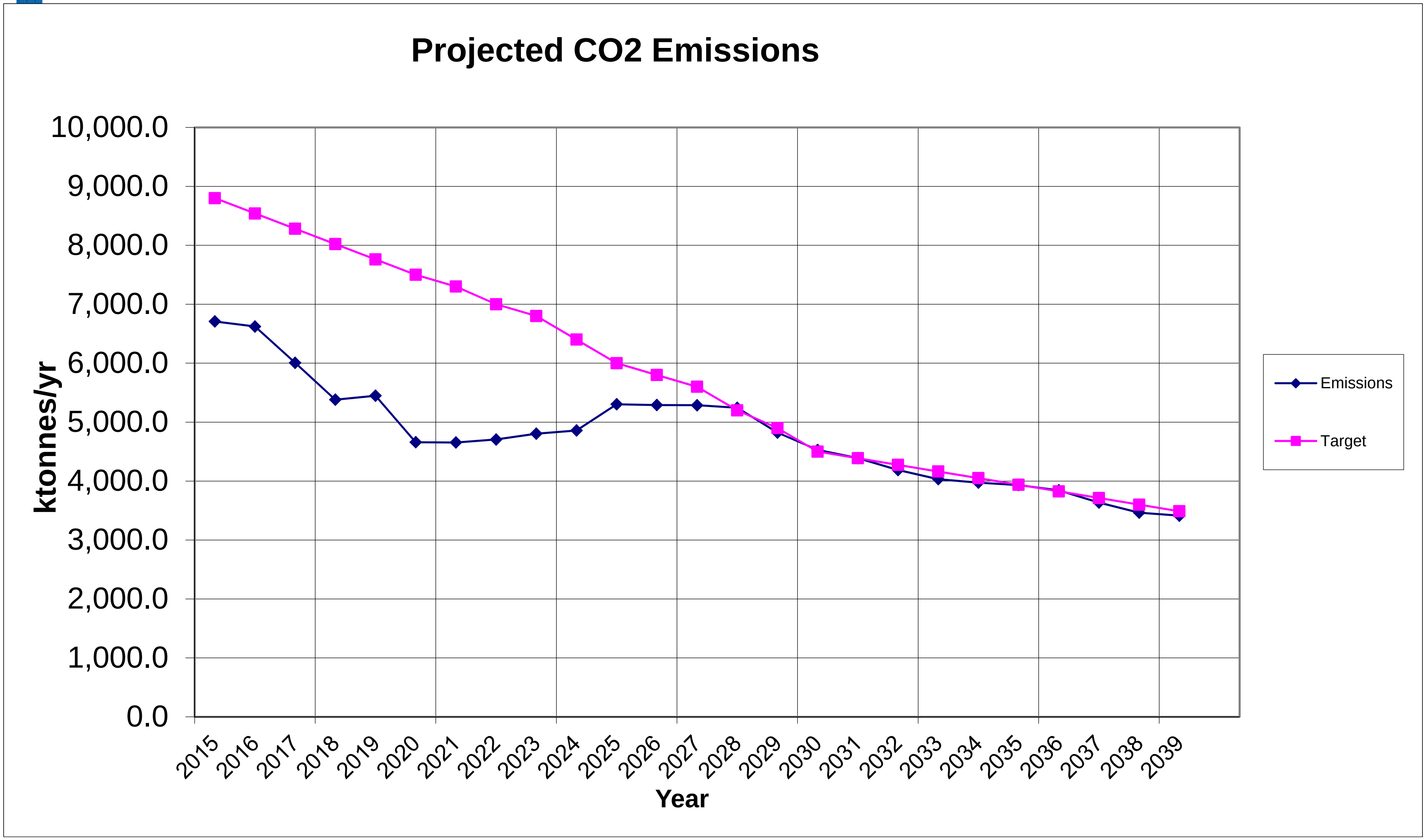
CRP 2-50 Preliminary Energy by Resource Type



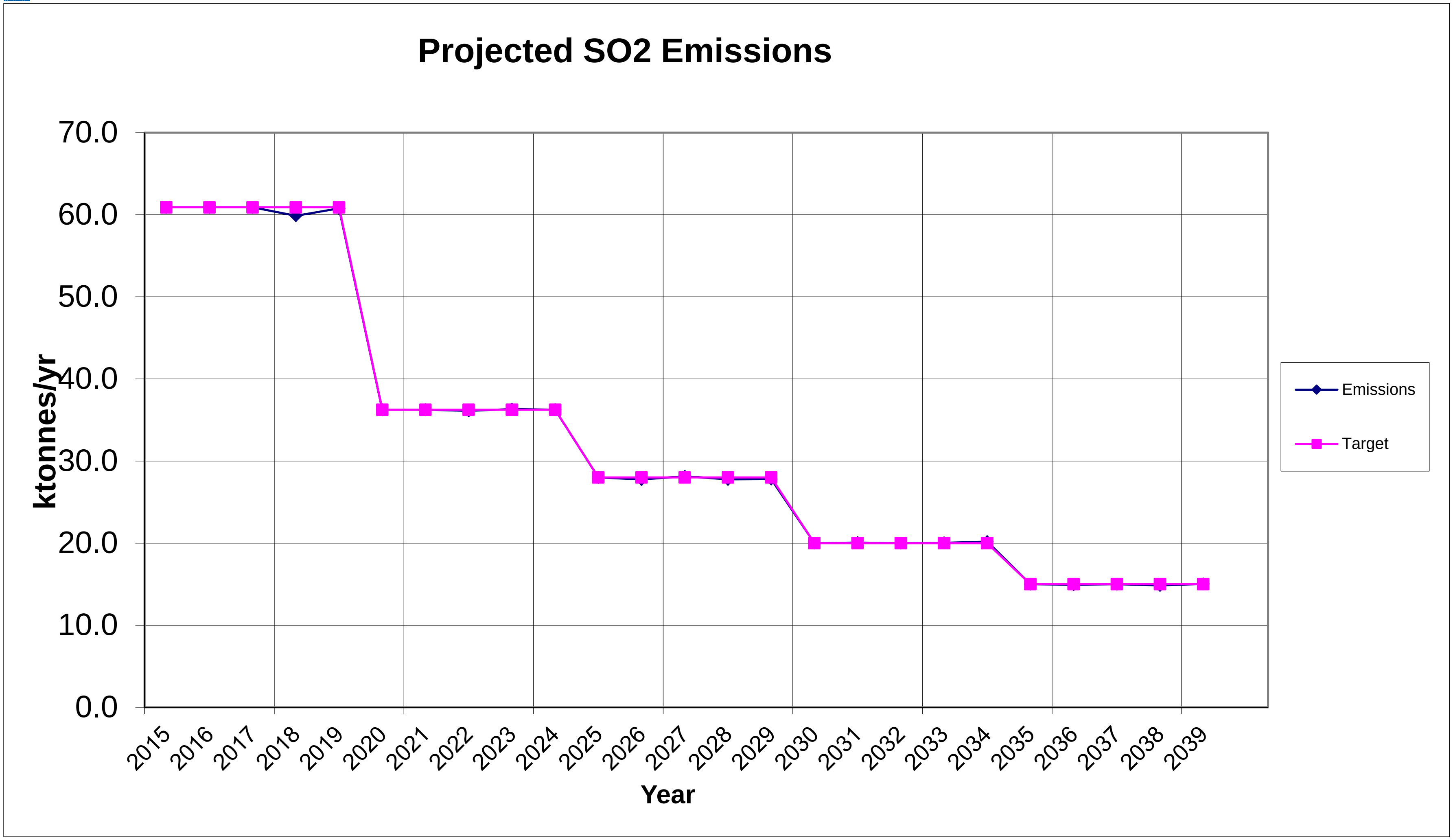
CRP 2-50 Preliminary Coal Capacity Factors



CRP 2-50 Preliminary CO_2 Emissions



CRP 2-50 Preliminary SO_2 Emissions



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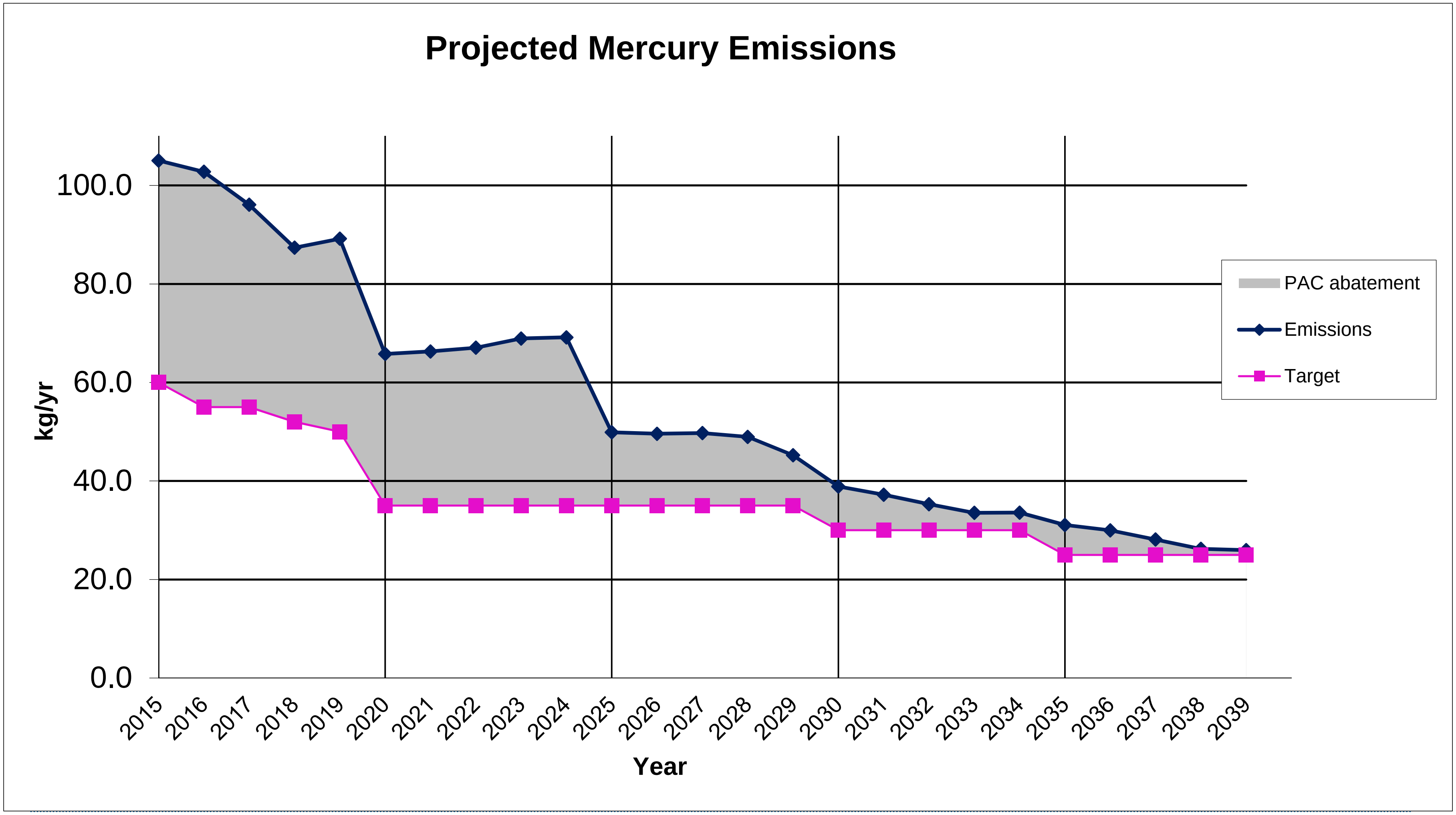
CRP 2-50 Preliminary Hg Emissions



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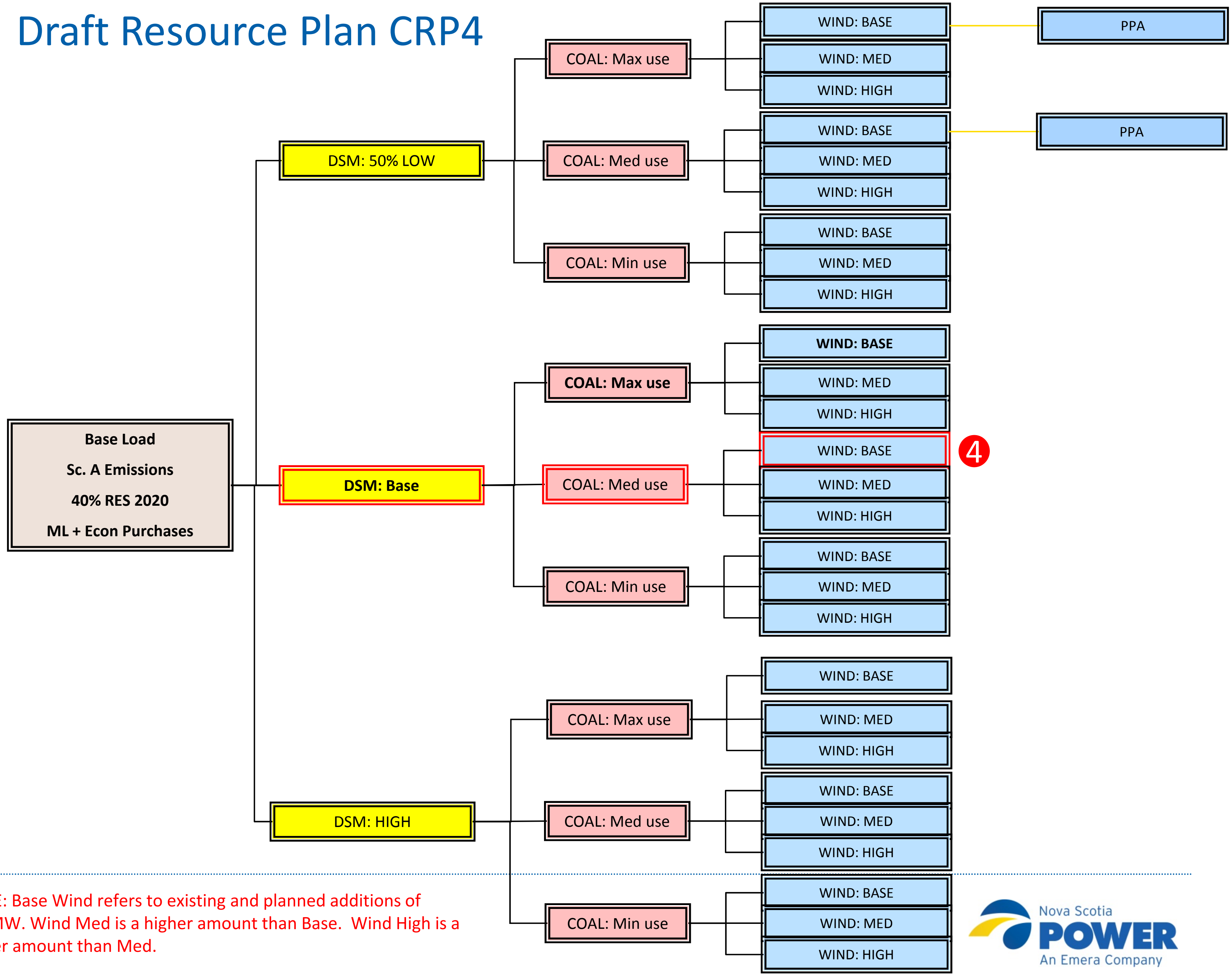
CRP 4 Preliminary Results

Draft Resource Plan CRP4



NOTE: Base Wind refers to existing and planned additions of 582MW. Wind Med is a higher amount than Base. Wind High is a higher amount than Med.

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CRP 4 Input Assumptions

- Base Load Forecast
- Base DSM
- Emissions - Scenario A
- Planned and committed resources are fixed in the plan (REA wind, COMFIT, Maritime Link/ Retire Lin #2)
- Medium Coal Use
- Constraints
  - Planning reserve margin min = 20%
  - RES: 2015-2019 = 25%; 2020-2039 = 40%

CRP 4 Preliminary Results

	CRP4-1-R01	CRP4-8-R01	CRP4-34-R01	CRP4-1-FGD-R01
	Least cost study period	**Plan of Interest**	**Least cost planning period**	**Least cost study period (w FGD)**
2015				
2016	DR Water H & DR Comm	DR Water H & DR Comm		DR Water H & DR Comm
2017	ML Oct 2017	ML Oct 2017	ML Oct 2017	ML Oct 2017
	Lin 2 retire	Lin 2 retire	Lin 2 retire	Lin 2 retire
2018				
2019		Mersey Phase 1		
2020	TUC 1 Retire	TUC 1 Retire	TUC 1 Retire	TUC 1 Retire
2021				
2022				
2023		Mersey Phase 2		
2024				
2025				FGD (Lin3/4 300 MW)
2026				
2027	TUC 2 Retire	TUC 2 Retire	TUC 2 Retire	TUC 2 Retire
2028				
2029				
2030	CT 34MW		2 x CT 50MW	
	Tre 5 Retire	Tre 5 Retire	Tre 5 Retire	Tre 5 Retire
2031	CT 50MW & CT 34MW	2 x CT 50MW	CT 100MW & CT 34MW	CC 145MW
	TUC 3 Retire	TUC 3 Retire	TUC 3 Retire	TUC 3 Retire
2032				
2033				CT 50MW
2034	CC 145MW	CC 145MW	CT 100MW	CT 50MW
	Lin 1 Retire	Lin 1 Retire	Lin 1 Retire	Lin 1 Retire
2035				
2036				
2037				
2038	2 x CT 50MW	CT 50MW & CT 34MW	CC 145 MW	
	Lin 3 Retire	Lin 3 Retire	Lin 3 Retire	
2039	CC 145MW	CC 145MW	CC 145 MW	
	Lin 4 Retire	Lin 4 Retire	Lin 4 Retire	
Planning PV $M	11,419	11,461	11,388	11,372
Study PV $M	17,326	17,349	17,380	17,149 *
				* Study PV needs to be adjusted for retirements

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Plexos in the IRP

Use of Plexos in 2014 IRP

Plexos software is a security constrained commitment based chronological system dispatch simulator.

Plexos system dispatch simulator is capable of evaluating system operability with respect to constraints having to do with: capacity adequacy, dispatch, transmission, reserve, reactive power, voltage support, emissions and other system constraints simultaneously.

Plexos will be used to evaluate:

1. operability of a selection of Candidate Resource Plans developed by Strategist®.

2. operability of Medium and High wind penetration cases and with various levels of DSM and to calculate operating portion of wind integration costs.

3. collateral benefit of system upgrades required to integrate further wind energy on the system

NOTE: Due to nature of select CRPs, system complexity, and the work involved in developing and analyzing system simulations in Plexos, a limited number of Plexos runs will be conducted in the time allotted for the completion of the IRP.

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Next steps in Analysis Phase

Finalize CRPs Process and Sensitivities

ONCE CANDIDATE RESOURCE PLANS HAVE BEEN OPTIMIZED SOME WILL BE SELECTED FOR ROBUSTNESS TESTING IN ORDER TO IDENTIFY THE PREFERRED PLAN:

- Sensitivity Analysis and Alternative Worlds: Plans will be evaluated under conditions where changes to load, fuel prices and environmental constraints (list non- exhaustive) are made to the assumptions
- Ranking: The plan performance will be evaluated based on cost-effectiveness, system stability, environmental benefits, operational flexibility, etc.

DEVELOPING RESOURCE PLANS THIS WAY ALLOWS FOR THE BROADEST CONSIDERATION OF CHANGES TO ASSUMPTIONS AND POTENTIAL SHIFTS IN POLICY

Sensitivity Analysis & Alternative Worlds

- Potential sensitivities for CRP evaluation:
  - Gas prices
  - Coal prices
  - Import pricing
  - Wind performance
  - Wind contribution to capacity
- Potential changes for Alternative Worlds testing:
  - Varying load forecast
  - Scenario B and C emissions constraints

Customer Engagement Sessions

OBJECTIVES:

- To provide interested customers an opportunity to increase awareness of the IRP process.
- To collect qualitative feedback from customers to identify opportunities to make business improvements .
- Validate themes that are important to customers for long-term electricity planning.

APPROACH:

- Provide different ways for customers to become engaged.
- Generate open and transparent dialogue.
- Ensure engagement is anchored in as broad a context as possible to help foster a big picture focus.

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Customer Engagement Activities & Feedback

- 8 sessions held across the province in April and May. Approximately 200 customers participated in person.
- Additional sessions continuing in June and July.
- Website set up for customers who prefer web content and engagement (tomorrowspower.ca/IRP).
- Another round of sessions being planned in the fall to create awareness of the final IRP outcomes.
- An email address created for customers with direct queries.
- An electricity primer for customers interested in fundamental NS electricity facts and issues. Shared with all session participants, plus many more.
- Positive feedback from customers, particularly around awareness and NSP's openness to engage them. Clear appetite for additional activity.
- A report to be created in the near future, summarizing customer feedback.

Action Plan Development

- NS Power will develop a detailed action plan based on the reference world:
  - The plan will identify specific actions to take place over the next 5 to 7 years.
  - Plan action items will be based on the type and timing of resource in the preferred resource plan, findings from analysis completed over the course of the IRP modeling, and feedback received from stakeholders.
  - Identify driving factors the Company will monitor to identify if the future is unfolding differently than the reference world. The Action Plan will determine actions NS Power should take a result of these changes.

Action Plan Development

- The following areas will have specific actions:
  - *Renewable Resource*
  - *Distributed Generation*
  - *Firm Market Purchases*
  - *Flexible Resources*
  - *Demand Side Management*
  - *Demand Response*
  - *Coal Resources*
  - *Transmission Actions*
  - *Planning Reserve Margin*
  - *IRP Planning and Modeling Process Improvement*