Filing to the Nova Scotia Utility and Review Board on Nova Scotia Power's October 15, 2014 Integrated Resource Plan

Key Planning Observations and Action Plan Elements

Synapse Energy Economics

October 20, 2014

Bob Fagan

Rachel Wilson

David White

With contributions from

Tim Woolf

Introductory Comments

Synapse Energy Economics ("Synapse"), as consultant to the staff of the Nova Scotia Utility and Review Board ("UARB" or "Board"), has worked in a collaborative fashion with Nova Scotia Power ("NSPI") since February 2014 on the development of NSPI's Integrated Resource Plan ("IRP"). Synapse's role has been to examine modeling assumptions, offer alternative assumptions where warranted, suggest an analysis plan for use of the Strategist modeling tool, and provide feedback to NSPI on the direction of their analytical efforts. On the whole, this collaborative process has resulted in an extensive analytical effort that led to the results reported in the October 15, 2014 NSPI IRP Report. However, as we note below, Synapse and NSPI are not in agreement on all areas of interpretation of the results that flowed from that analytical effort.

This document is intended to provide the Board and stakeholders with Synapse's observations and recommended supplemental (to NSPI's) action plan elements that differ from those NSPI has presented in its final October 15, 2014 IRP Report.

Key Summary Points on the IRP Analysis

Fourteen "reference world" Candidate Resource Plans (CRPs) were explicitly modeled by NSPI over the course of the IRP analysis. In mid-September, Synapse modeled a 15th reference world CRP, referred to as the "mid-DSM" CRP. Two additional "high load" CRPs were also modeled by NSPI.

Synapse identified the mid-DSM CRP as the least cost utility resource plan over the planning period (2015-2039) based on the net present value (NPV) of NSPI revenue requirements. The mid-DSM CRP contains an assumption for DSM expenditures higher than the "base" level of DSM, and lower than the "high" level for DSM, as described in the Navigant DSM potential report.[1] The mid-DSM CRP includes no new resources other than DSM between now and 2020. As is common to all modeled CRPs, the mid-DSM CRP presumes the operation of the Maritime Link in 2017, and the retirement of the Lingan 2 coal plant in that same year.

Further analysis (as outlined in NSPI's Action Plan) is required to better understand the patterns of sustaining capital expenditures required for NSPI's thermal generation fleet and to ensure that NSPI carries a reasonable, but not excessive, level of planning reserve margin. The results of the modeling indicate that some CRPs exhibit significantly higher levels of planning reserve margin than others, indicating that potential cost savings exist in this area.

Synapse notes that the structure of the modeling tested four different levels of DSM (base, mid, high, and "50% of low"), and the modeling results provide a clear indication of the relative value of the CRPs with different levels of DSM.

[1] Navigant, "Nova Scotia 2015-2040 Demand Side Management (DSM) Potential Study", Presented to Efficiency Nova Scotia Corporation, January 7, 2014.

Key Planning Observations

1. **A CRP with a "mid" DSM level has a lower NPV of planning period revenue requirements than any of the CRPs modelled during the IRP process through September 12. A CRP with a "high" level of DSM has the lowest NPV of study period revenue requirements.**

   Subsequent to the technical conference on September 12, 2014, after reviewing the results of the full set of NSPI-modeled CRPs, Synapse used Strategist to model a CRP with mid-DSM achievable levels[2], as defined in the Navigant report. The program administrator ("PA") costs[3] (per GWh saved) for the Navigant mid-DSM achievable case were similar to the per-GWh-saved PA costs for base level DSM; and the per-GWh-saved PA costs for the high DSM case were higher than either the base DSM or the mid DSM cases. Table 1 summarizes this information through 2039 illustrating the action plan period effects.

Table 1. Comparative DSM Program Administrator Costs – Navigant Report

	Program Administrator Costs			Incremental Annual Savings			Incremental First Year Cost		
	$ milliions			GWh			$/first-year kWh		
Year	Base	Mid	High	Base	Mid	High	Base	Mid	High
2015	$50.7	$56.1	$76.3	138	164	175	$0.37	$0.34	$0.44
2016	$50.5	$57.5	$92.0	140	171	191	$0.36	$0.34	$0.48
2017	$50.0	$59.0	$104.6	142	178	206	$0.35	$0.33	$0.51
2018	$52.4	$66.1	$107.4	136	170	194	$0.38	$0.39	$0.55
2019	$57.0	$76.4	$112.8	135	167	187	$0.42	$0.46	$0.60
2020	$61.5	$86.7	$119.3	134	166	183	$0.46	$0.52	$0.65
2021	$56.9	$81.7	$106.9	130	162	178	$0.44	$0.50	$0.60
2022	$54.1	$79.1	$102.2	128	160	176	$0.42	$0.50	$0.58
2023	$51.5	$76.3	$99.0	127	159	177	$0.41	$0.48	$0.56
2024	$50.8	$76.8	$104.0	127	162	185	$0.40	$0.48	$0.56
2025	$50.6	$78.5	$110.9	130	167	196	$0.39	$0.47	$0.57
2026	$52.1	$81.9	$118.6	136	177	209	$0.38	$0.46	$0.57
2027	$54.8	$85.7	$121.1	144	188	218	$0.38	$0.46	$0.56
2028	$58.5	$90.1	$120.4	153	199	221	$0.38	$0.45	$0.55
2029	$60.7	$92.0	$114.5	163	208	217	$0.37	$0.44	$0.53
2030	$63.1	$92.2	$106.5	171	211	207	$0.37	$0.44	$0.51
2031	$62.6	$87.4	$94.6	174	207	195	$0.36	$0.42	$0.48
2032	$61.4	$82.3	$85.9	171	199	184	$0.36	$0.41	$0.47
2033	$59.3	$76.8	$65.8	166	188	174	$0.36	$0.41	$0.38
2034	$56.7	$71.2	$61.1	159	178	165	$0.36	$0.40	$0.37
2035	$47.7	$57.9	$56.6	153	170	157	$0.31	$0.34	$0.36
2036	$46.5	$54.8	$52.4	147	161	150	$0.32	$0.34	$0.35
2037	$45.4	$52.0	$49.6	142	154	145	$0.32	$0.34	$0.34
2038	$44.4	$49.0	$44.2	136	148	141	$0.33	$0.33	$0.31
2039	$43.5	$46.5	$43.4	132	143	138	$0.33	$0.33	$0.32

Note: Incremental annual savings refers to the incremental effect of the DSM procured in the first year, compared to a base load forecast. Additional savings continue in the second year, third year, etc. for DSM measures.
Source: Navigant DSM Potential Study, Table 1.4.2 "Incremental Energy Savings and Costs of Achievable Penetration Scenarios, and Synapse.

[2] Synapse and NSPI discussed this mid-DSM CRP during a September 16, 2014 conference call. Preliminary results for this CRP were sent to NSPI on September 23, 2014.

[3] These are the utility costs to procure DSM from Nova Scotia's third-party DSM provider.

There is a large range of DSM achievement possible between "base" and "high" achievable levels. The table above summarizes data from that key Navigant report table. It does indicate the significant benefit of moving from the base DSM to at least a "mid" level of DSM in the near-term, as the first-year per-unit savings metric indicates: mid-DSM exhibits better (or equal) near-term economics than base DSM spending (at least out to 2018). Note that the "$/first-year kWh" is not the per-unit cost of DSM, but just a metric to enable comparison across different DSM expenditure levels. The measure life of DSM must be accounted for to arrive at a total cost of saved energy for DSM.

Because of this observation (i.e., mid-DSM generally exhibiting better per-unit economics than high DSM) our expectation was that a CRP with a mid-DSM level would exhibit a lower planning period NPV[4] than CRP 5-1, which had a high DSM level. This was confirmed in our Strategist run for a CRP with a mid-DSM level.[5]

A CRP with a mid-DSM level exhibits the lowest planning period NPV cost, and is thus ranked #1 among "contender" preferred resource plans that also include CRP 2-1, 2-17, and 5-1, seen in Table 2 below. CRP 2-1 and CRP 2-17 are within 1.1% of the planning period NPV cost for the CRP with mid-DSM level. CRP 5-1 exhibits the lowest study period NPV cost, closely followed by the mid-DSM CRP, seen in Table 3 below.

As noted elsewhere in these observations, Synapse hypothesizes that the sustaining capital differences between CRP 5-1 (and likely the CRP with mid-DSM) and CRP 2-1 and 2-17 may be underestimated, especially since for CRP 5-1, no specific sustaining capital calculation was made, but rather a "representative" computation was used that failed to capture the effect of the higher planning reserve margin associated with CRP 5-1. Since CRP 5-1 and CRP mid-DSM show planning reserve margin that significantly exceeds the 20% threshold requirements (compared to CRP 2-1 and 2-17), there is room for savings on sustaining capital compared to what is shown here. Such an effect would further enhance the "winning" nature of CRP mid-DSM, and might also show CRP 5-1 to be ranked either higher than plans CRP 2-1 or CRP 2-17, or closer to those plans, over the planning period.

[4] We note that the planning period and study period NPVs include DSM Program Administrator costs, which would be a component of NSPI's revenue requirement. They do not include customer costs, which are not part of NSPI's revenue requirements.

[5] Synapse modified the system energy and firm peak load requirements in Strategist to align with the mid-DSM case savings, and ran the Strategist model with these modified inputs.

Table 2. Planning Period NPVs - Highest Ranked Plans

Planning Period NPV, $ Millions [$ 2015]							
Candidate Resource Plan	Level of DSM	Raw Result, Strategist	w/ DSM Cust Cost Adj	Sustaining Capital	w/ DSM and Sust Cap Adjustments	Planning Period Rank	% change from #1
CRP 2-1	Base	11,235	10,760	309	11,069	3	1.1%
CRP 2-17	Base	11,206	10,731	324	11,055	2	1.0%
CRP 5-1	High	11,816	10,779	309	11,088	4	1.3%
CRP w/ Mid-DSM	**Mid**	**NA***	**10,641**	**309**	**10,950**	**1**	**0.0%**
*Note: CRP w/ mid-DSM was run w/ DSM Customer Cost Adjustment already in place in Strategist.							

Table 3. Study Period NPVs - Highest Ranked Plans

Study Period NPV, $ Millions				
Candidate Resource Plan	Level of DSM	Adjusted Study Period NPV	Study Period Rank	% change from #1
CRP 2-1	Base	16,471	3	3.9%
CRP 2-17	Base	16,568	4	4.6%
CRP 5-1	**High**	**15,846**	**1**	**0.0%**
CRP w/ Mid-DSM	Mid	15,870	2	0.2%

2. A mid-level DSM CRP, compared to CRPs with a base level DSM, exhibits low incremental revenue requirement effects in the near term. This further supports a preferred resource plan with DSM levels consistent with the mid-DSM level.

NSPI has used revenue requirements in the near-term (2015-2020) as its metric for the rate effects criterion.[6] We note that this implicitly assigns a very high discount rate to the stream of later year benefits and costs for DSM. The NPV of revenue requirements for a CRP with mid-DSM is within 1% of near-term revenue requirements associated with Base DSM CRPs, thus indicating minimal rate effect differences between the top CRPs with "base" DSM and a CRP with "mid" DSM levels. [see Table 4 below] Near-term revenue requirements for CRP 5-1 are 5.1% higher than CRP 2-17. These revenue requirements do not presume any amortization of DSM program administrator costs, thus placing all the DSM costs in the year in which they are expended. If any amortization is done, the nearer-term effects would be moderated.

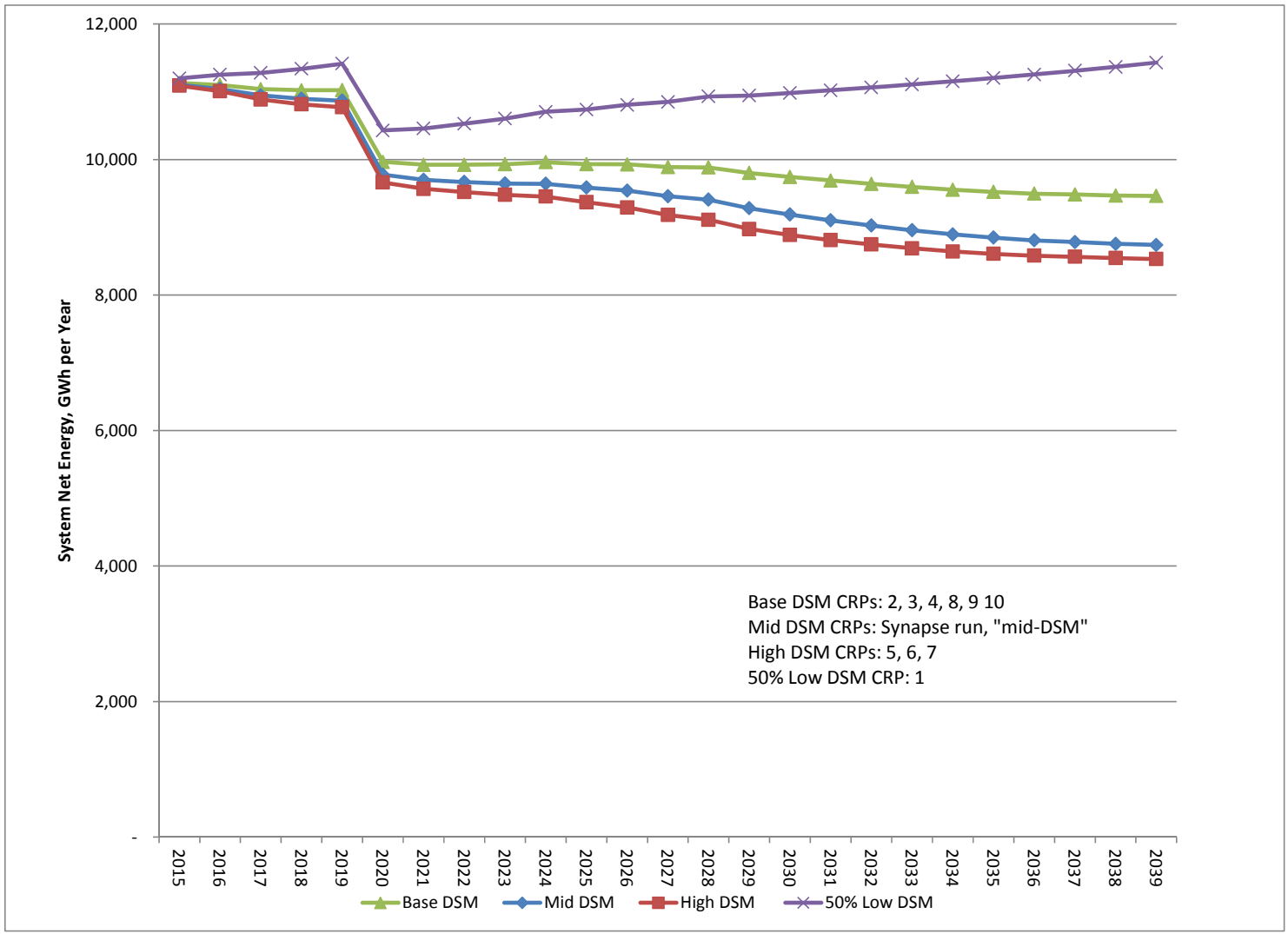
[6] IRP Report, page 60.

Table 4. Nearer-Term NPV Cost Values

	Level of DSM	NPV 2015-2020, $ millions	rank	% change from #1	NPV 2015-2030, $ millions	rank	% change from #1
CRP 2-1	Base	3858	2	0.0%	8416	1	0.0%
CRP 2-17	Base	3857	1	0.0%	8420	2	0.0%
CRP 5-1	High	4054	4	5.1%	8672	4	3.0%
CRP w/ Mid-DSM	Mid	3894	3	1.0%	8453	3	0.4%
*Note: sustaining capital revenue requirement for mid-DSM CRP obtained from NSPI Sustaining Capital streams for "max" coal path.							
Nearer-term NPV #s for CRP 2-1, 2-17, 5-1 from Slide 26 of NSPI 9/12/2014 tech conf presentation. Mid-DSM #s from Synapse Strategist run.							

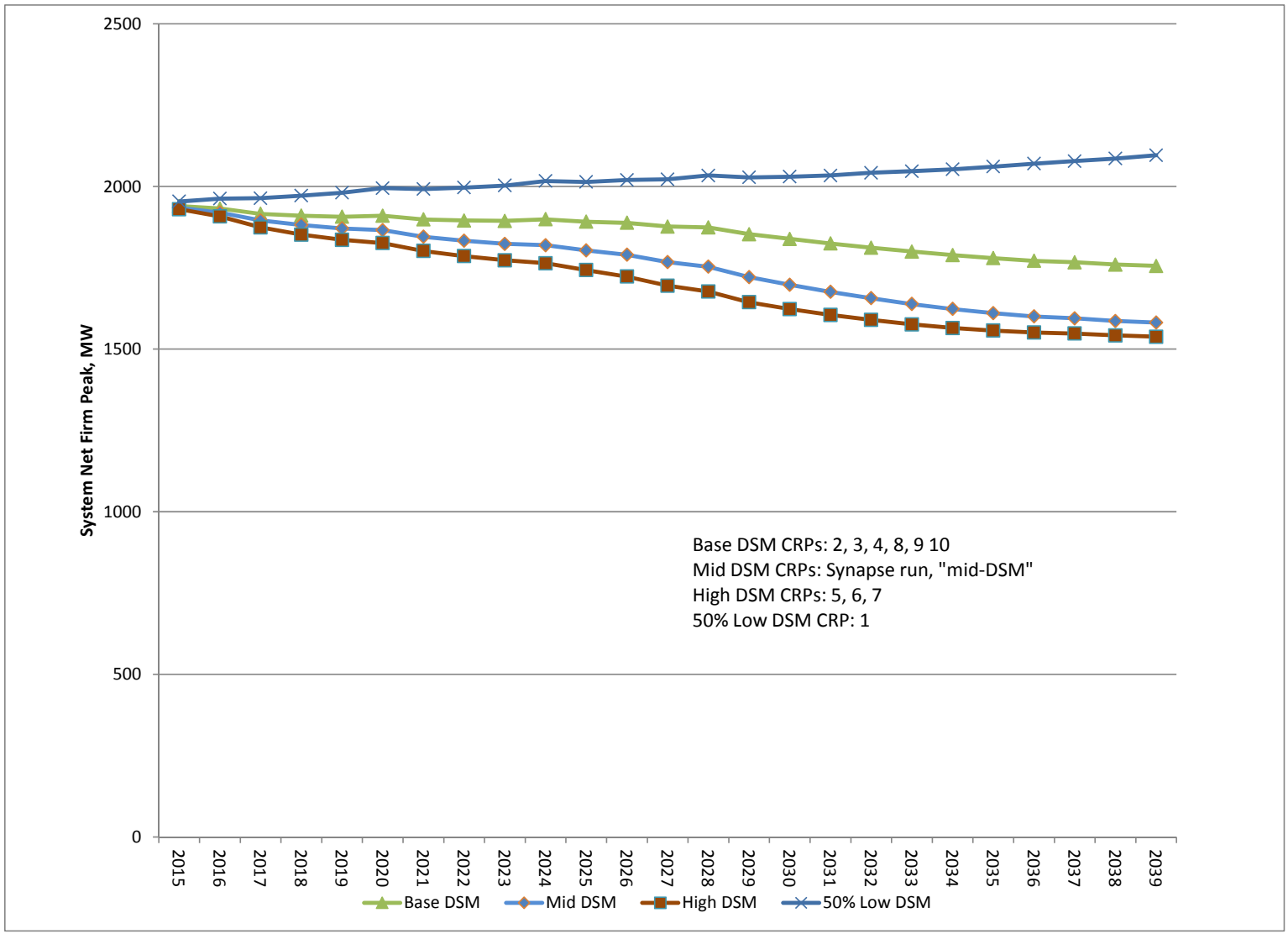
3. **Figures 1 and 2 below show the effects of "base", "mid", "high", and "50% of low" levels of DSM on NSPI's base load forecast for system energy and firm peak demand. Higher levels of DSM reduce system energy requirements and lower the projected firm peak demand. The CRPs exhibit different levels of planning reserve margin (seen in Figure 3) in part because of this effect.**

Figure 1. Net Energy – base load forecast - for 4 different levels of DSM



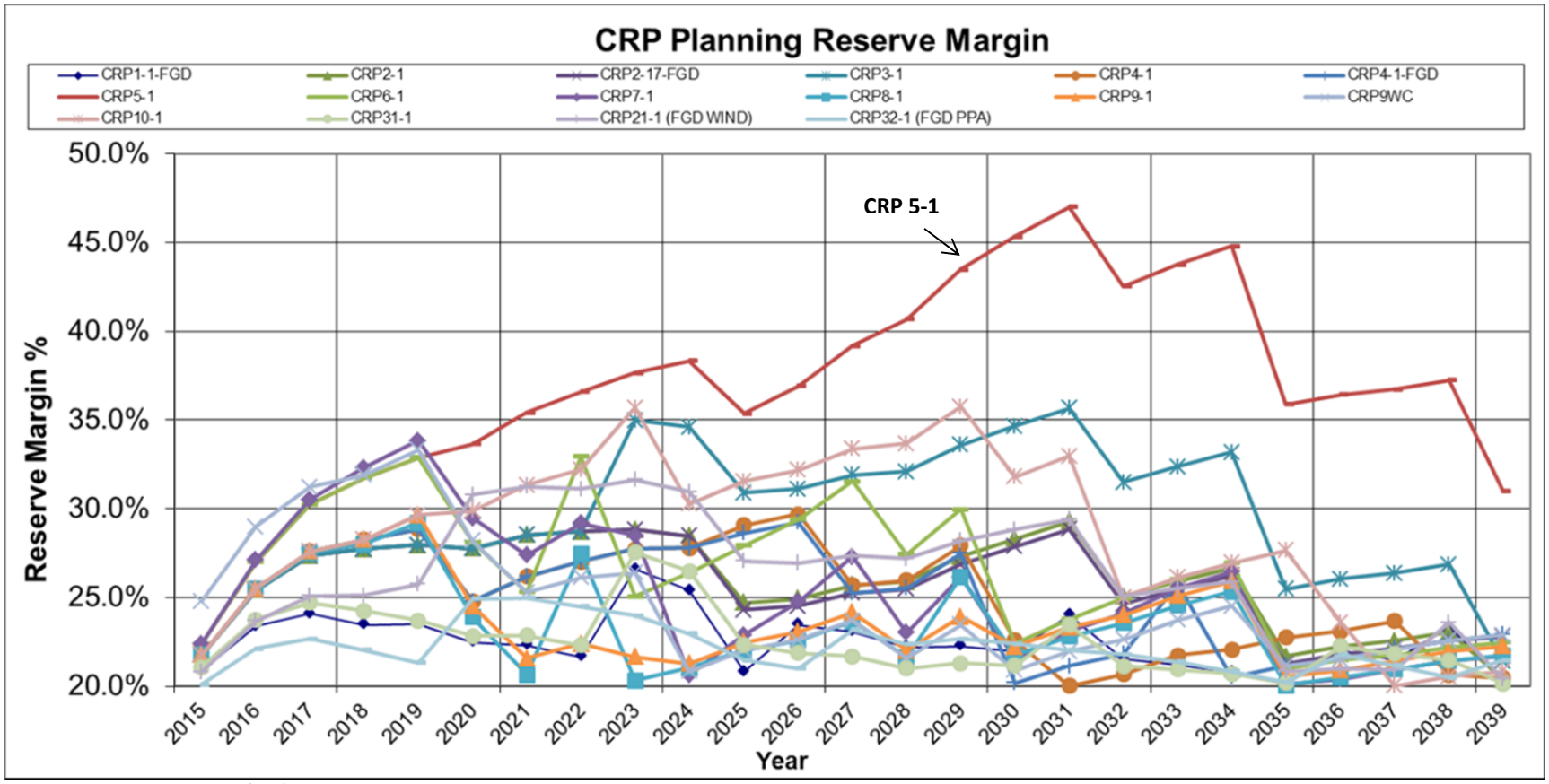
Note for Fig. 1 and Fig. 2: System energy trends include "non-firm" PHP paper mill power needs through 2019. The decline in net energy seen from 2020 onward reflects "base" load forecast that assumes that load is no longer on the system. Firm peak forecasts do not include the peak load contribution from the PHP mill.

Figure 2. Net Firm Peak – base load forecast - for 4 different levels of DSM



Note for Fig. 1 and Fig. 2: System energy trends include "non-firm" PHP paper mill power needs through 2019. The decline in net energy seen from 2020 onward reflects "base" load forecast that assumes that load is no longer on the system. Firm peak forecasts do not include the peak load contribution from the PHP mill.

Figure 3. Planning Reserve Margin by CRP



Source: NSPI, slide 34, 9/12/2014 technical conference.

Note: Synapse computes an average planning reserve margin of 32.8% over the 2015-2039 planning period for CRP mid-DSM.

4. Higher levels of DSM provide for greater customer cost savings, increased program participation, assists the transformation of markets towards greater levels of efficient energy use, and reduce lost opportunities.

There are several reasons why NSPI should choose the higher levels of DSM as part of its preferred resource plan. First and foremost, higher DSM levels reflect the lowest-cost set of resources, and will therefore lead to lower electricity bills for customers on average. For example, the mid-DSM scenario has a $105 million lower revenue requirement over the planning period than the next best indicated plan, CRP 2-17.

Second, higher levels of DSM will include expanded DSM program activities which will increase the extent to which customers participate in the programs. Expanding DSM program participation is an important policy goal, because it helps to increase the portion of customers that will experience the direct bill savings from energy efficiency programs.

Third, achieving higher levels of DSM savings can increase the potential and the opportunities for deferring or avoiding generation, transmission and distribution facilities. In Nova Scotia, this also means the potential to avoid certain sustaining capital costs for thermal plant that may not be needed to meet planning reserve requirements. If cost-effective DSM is delayed, it may be difficult to develop an increased level of DSM resources in time to defer or avoid a particular need for capacity support. A utility that consistently operates DSM programs at a relatively high level will be in a much better position to defer or avoid such new expenditures. Similarly, as is seen in Nova Scotia, high levels of DSM savings will reduce the rate of growth in electricity demand, which will provide the utility with more time and greater flexibility to respond to anticipated and unanticipated future needs.

Fourth, achieving higher levels of DSM savings will help transform the markets for energy efficiency products and related services. Increased DSM activities will advance the development and commercialization of efficient end-use equipment, and will advance the development of the equipment vendors, architects, contractors, and other installers. Promoting market transformation is an important policy goal, because it can significantly reduce the cost of energy efficiency resources over time.

Fifth, achieving higher levels of DSM savings will help to reduce “lost opportunities.” Lost opportunities occur when a utility does not implement energy efficiency measures at a point in time when they are cost effective, and those measures become uneconomic to implement in the future. The new construction market presents the clearest (but not the only) example of lost opportunities. If homes and businesses are not constructed (or renovated) using the full array of cost-effective efficiency measures available at the time of construction, then it will be much more expensive to achieve the same efficiency savings at a later date.

5. **Higher DSM plans (CRP 5-1 (high DSM), CRP mid-DSM) may fare better in planning period NPV rank (compared to plans CRP 2-1 and 2-17) than currently seen in the Strategist results if going-forward sustaining capital costs[7], and thermal plant retirement paths were optimized to reduce planning reserve margin towards levels closer to the required planning reserve margin, compared to those levels seen in Figure 3.**

Annual sustaining capital expenditure needs for a "max coal" utilization case (as reflected by CRP 2-1, see Table 5 below) are projected by NSPI to reach more than $167 million (real $2014) by 2020 and higher annual amounts in subsequent years. Over the 25-year planning period the net present value (NPV) of the annual revenue requirements associated with CRP 2-1 annual sustaining capital expenditures are projected by NSPI to be $309 million (see Table 6 below).

No sustaining capital assessment was made for a CRP with high levels of DSM, or for mid-levels of DSM, since a limited set of CRPs was assessed for sustaining capital needs. Given that planning reserve margin exhibited for CRP 5-1 and a mid-DSM plan significantly exceeds the 20% threshold requirement, there exists considerable room to reduce sustaining capital expenditures and reduce "surplus" planning reserve margin.

At a sustaining capital level of $309 million (NPV) for both plan CRP 2-1 and CRP 5-1 (since both were max coal utilization plans), it appears there is room for sustaining capital savings for plan CRP 5-1 since the surplus capacity (seen in graph above) significantly exceeds that of CRP 2-1. Since only $19 million (NPV of planning period revenue requirements) separates plan CRP 2-1 and CRP 5-1, if a roughly 10% reduction (NPV) in sustaining capital could be obtained by reducing planning margin surplus for CRP 5-1, it would then "outrank" CRP 2-1 over the planning period. Additional sustaining capital reductions would be required in order for it to outrank plan CRP 2-17.

Synapse has not reviewed in detail the patterns of sustaining capital by plant, on which the summary shown in the table below is based. That exercise was outside the IRP scope of work. However, a cursory review of the plant-level data illustrated projected requirements for sustaining capital that occasionally spike upwards for certain plants.[8]

The ongoing steam asset review process needs to carefully assess the extent to which certain expenditures can be delayed, or eliminated if retirement is anticipated within a certain number of years, taking into account the projected (downward) pattern of net firm peak requirements with each passing year, under even base levels of DSM. While it may not be practical to simply let the plants retire based on when major components fail, the simple logic of running plants until they wear out is not an altogether unreasonable approach, perhaps with modifications to provide more certainty to NSPI as to how long a plant is likely to remain available given delayed maintenance.

[7] Sustaining capital costs are those capital expenditures required to keep steam plants operating on a reliable basis.
[8] The information was provided to Synapse by NSPI on a plant-level basis. We report just the summary, system-wide data in Tables 5 and 6 here.

As noted in our Action Plan elements, we do not underestimate the significance of considering such a major change to NSPI's system – i.e., the operation with considerably fewer steam units – compared to past (and current) operations. This analytical exercise – an ongoing steam asset management plan - needs to simultaneously consider system-level impacts if, or when, fewer high-inertia spinning units are producing real power (MW) for the system.

Table 5. Annual Sustaining Capital – CRP 2-1

Annual Sustaining Capital		
CRP2-01		
Constant Dollars (2014$)		
Investment Year	**Total All Plants**	**Cumulative Total Sustaining Capital**
2015	37,037,500	37,037,500
2016	31,612,500	68,650,000
2017	21,735,000	90,385,000
2018	22,171,875	112,556,875
2019	25,746,875	138,303,750
2020	28,876,875	167,180,625
2021	19,383,125	186,563,750
2022	18,864,375	205,428,125
2023	21,701,875	227,130,000
2024	22,626,875	249,756,875
2025	14,840,000	264,596,875
2026	14,933,750	279,530,625
2027	24,090,000	303,620,625
2028	15,208,750	318,829,375
2029	13,816,250	332,645,625
2030	10,423,750	343,069,375
2031	9,211,250	352,280,625
2032	8,328,500	360,609,125
2033	9,905,625	370,514,750
2034	8,713,125	379,227,875
2035	12,894,375	392,122,250
2036	5,338,125	397,460,375
2037	5,769,375	403,229,750
2038	7,381,875	410,611,625
2039	7,540,625	418,152,250

Source: NSPI. Cumulative total for sustaining capital computed by Synapse.

Table 6. Revenue Requirements for Annual Sustaining Capital, CRP 2-1

CRP2-01-R03		
Maximum Coal		
Annual Revenue Requirements based on sustaining capital profile and retirement dates		
Year		**Planning Period Adder - NPV ($'000)**
		$308,854
2015		$802,599
2016		$5,066,356
2017		$8,142,717
2018		$10,362,768
2019		$12,879,889
2020		$15,868,899
2021		$18,942,569
2022		$20,961,387
2023		$23,154,320
2024		$25,714,648
2025		$28,150,794
2026		$31,605,942
2027		$33,396,388
2028		$36,060,982
2029		$37,442,243
2030		$38,702,124
2031		$37,244,195
2032		$38,062,200
2033		$42,067,818
2034		$42,793,558
2035		$43,440,831
2036		$56,486,892
2037		$55,535,945
2038		$50,955,299
2039		$50,735,260

Source: Excerpted from NSPI data.

6. **The incremental value of smaller-scale capacity additions (DR, Mersey increment, wind capacity accreditation) and the potential value of different thermal plant retirement paths are not fully captured in the IRP modeling.**

   NSPI states at page 10, "this path [common, no regrets path forward for the Action Plan] requires minimal incremental capital spending for capacity, **while maximizing the lifespan of existing generation assets**…" and at page 65 "The Company believes that **maximizing coal plant life**, not adding incremental variable generation, and a focus on affordability to be a no regrets path and has tried to reflect that in the Action Plan." [**emphasis added**]

   NSPI, in collaboration with Synapse, constructed three scenarios of retirement dates for thermal plants as an input to Strategist, but no economic assessment was made to determine if such dates were "optimal". Thus, Synapse is of the opinion that it is incorrect to draw broad conclusions at this time concerning the economically optimal lifespans for the thermal fleet based on the current Strategist results. Since the value of capacity additions from a Mersey capacity increment, demand response, and wind resources also depends on the overall level of system capacity, no conclusions can yet be drawn for the value of capacity increases from these sources, as such an assessment must proceed in tandem with assessing thermal plant retirement paths.

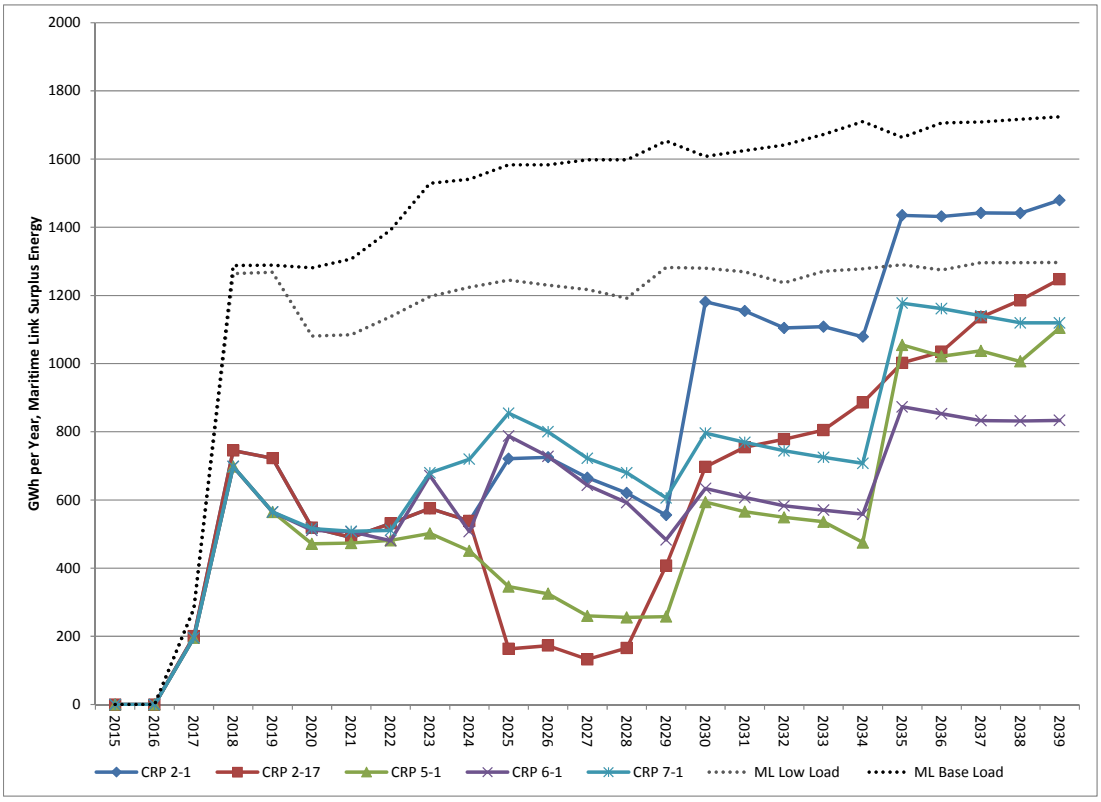
7. **The different plans use different amounts of Maritime Link "Surplus" Energy.**

   All CRPs model the Maritime Link in service in 2017. All plans model the same level of Maritime Link fixed block and supplemental energy, which together are considered as firm energy from the Maritime Link source. The plans differ in their use of surplus energy, or market energy, from the Link. Figure 4 below shows the Link surplus energy use across six of the CRPs, demonstrating that the level of net load, the level of wind energy assumed, and whether or not FGD equipment is employed for coal resources all affect the level of surplus energy taken from the Link. Essentially, the available surplus energy is one of the marginal energy sources available in the model, at a price. The different plans reflect different dispatch economics over time, and thus different levels of Link surplus energy. In the graph below, the modeled levels of Link surplus energy from the Maritime Link case are shown for comparison, labeled as "ML Low Load" and "ML Base Load".[9]

   We note that the analysis did not "demonstrate[d] the economics of the Maritime Link"[10]. It only tested the economics of more or less surplus energy from the Link.

[9] Maritime Link, Response to Synapse IR-11, Attachment 4.
[10] IRP Report, page 25.

Figure 4. Levels of Surplus Energy from the Maritime Link, by Selected CRPs (with benchmark levels of projected surplus energy utilization from the Maritime Link filing)



Source: Strategist results for CRPs. ML benchmark values from Maritime Link case.

8. **Higher capital costs for high-wind CRPs push these CRPs towards the bottom of the NPV planning period rankings, but the NPV differences are within 5% of the highest ranked plans. If wind costs decline as some industry projections indicate, and/or if integration costs prove lower than projected, higher wind level plans could become more competitive.**

   The higher costs associated with wind energy tends to push higher-wind plans (CRP 3, and CRP 6-10) towards the bottom of the rankings for the planning period, but they exhibit better rankings for the study period. When coupled with "high DSM" (plan CRP 6), the wind plans fare better than ones with "base" DSM. Plan CRP 6 is within the 5% threshold (of the highest ranked plan) for the planning period. CRP 6 is ranked better (9 instead of 10) and is closer to the #1 ranked plan (3.5% difference in NPV) for the "optimistic wind" sensitivity 9.[11]

[11] We note that careful attention to wind industry costs should be made over the action plan period. Downward real cost trends in the industry indicate the importance of scrutinizing modeling assumptions.

9. **Plexos analysis does not indicate any reliability concerns with the highest ranked plans.**

   To the extent wind costs decline over time, and NSP revisits the economics of increasing levels of wind (beyond base levels), additional work is required to assess wind curtailment, integration requirements, and regional considerations that could enhance balancing more wind on the Maritime systems.

Synapse Proposed Action Plan Elements Additional to Those in NSPI's Draft IRP

NSPI has adopted many of Synapse's suggested Action Plan elements, and they are reflected in the October 15, 2014 IRP Report. The following summarizes the major additional Action Plan elements that Synapse recommends be included in the final action plan:

1. **Target DSM resource commitments (annual system energy and peak period capacity reductions) for the 2016-2018 period consistent with the mid-DSM achievable level from the Navigant report.**
2. **Include in NSPI's continuing thermal generation asset analysis work an assessment of the industry "best practices" as pertaining to sustaining capital investments for applicably-sized systems and generation plant.**
3. **Include in NSPI's Renewable Resource Actions:**
   a. During 2015, determine the extent to which ERIS resources can count as capacity towards resource adequacy, and thus determine the appropriate level of capacity contributions from ERIS-interconnected wind plants during winter peak.
4. **File on a semi-annual basis regular progress reports on the status of all Action Plan items, in addition to the enhancements NSPI proposed for the annual 10-Year System Outlook report. This will enhance transparency to both the Board and stakeholders.**

Attachment

Synapse CRP and Sensitivity NPV Revenue Requirements – Summary Data and Rankings

CRP and Sensitivity NPV RR Matrix

Cost unchanged from Original Case

					CRP Results - Raw and With DSM Customer Cost Adjustment and Sustaining Capital Adder																															
					Original Strategist Data - Raw Results - DSM Includes Customer Costs and Utility Costs					DSM Cust Cost Adj - Millions		Orig Data w DSM Cust Cost Adjustment							Estimated Sustaining Capital Adder		Orig Data w/ DSM Customer Cost Adjustment and Sustaining Capital Adder (Study Per. Ranking Doesn't Account for Study Period Sustain Capital Effect)							S1 - Emissions B						S2 - Emissions C					
CRP	DSM	WIND	COAL	Ave Plan Rsve Margin, 2015-2039	Planning Period Cost ($M)	Rank	% change from #1	Study Period Cost ($M)	Rank	% change from #1	Planning Period DSM Customer Costs	Study Period DSM Customer Costs	Planning Period Cost ($M)	Plan Per Rank	% change from #1	Study Period Cost ($M)	Study Per Rank	% change from #1	$ Millions Plan Period Only	% of Planning Period NPV	Adj. Planning Period Cost ($M)	Plan Per Rank	Plan Period Delta from #1, $ Millions	% change from #1	Adj. Study Period	Study Per Rank	% change from #1	Planning Period Cost ($M)	Rank	% change from #1	Study Period Cost ($M)	Rank	% change from #1	Planning Period Cost ($M)	Rank	% change from #1	Study Period Cost ($M)	Rank	% change from #1
World 1 - REFERENCE																																				
CRP 1 (FGD-PPA)	50% LOW	BASE	MAX	22.5%	$12,125	**12**	8.2%	$19,450	**14**	16.0%	($363)	($504)	$11,762	**14**	9.6%	$18,946	**14**	21.9%	$324	2.8%	$12,086	**14**	$1,031	9.3%	$19,270	**14**	21.6%	$12,007	**14**	9.9%	$19,113	**14**	22.4%		**#N/A**			**#N/A**	
CRP 2-1 R03	BASE	BASE	MAX	25.8%	$11,235	**2**	0.3%	$16,794	**2**	0.2%	($475)	($633)	$10,760	**2**	0.3%	$16,162	**3**	4.0%	$309	2.9%	$11,069	**2**	$14	0.1%	$16,471	**3**	3.9%	$10,930	**1**	0.0%	$16,169	**2**	3.5%	$11,076	**1**	0.0%	$16,559	**1**	0.0%
CRP 2-17 (FGD)-R03	BASE	BASE	MAX	25.7%	$11,206	**1**	0.0%	$16,876	**3**	0.7%	($475)	($633)	$10,731	**1**	0.0%	$16,244	**4**	4.5%	$324	3.0%	$11,055	**1**	$0	0.0%	$16,568	**4**	4.6%	$11,014	**3**	0.8%	$16,469	**4**	5.4%	$11,105	**2**	0.3%	$16,758	**3**	1.2%
CRP 3	BASE	MED	MAX	29.5%	$11,516	**5**	2.8%	$17,110	**4**	2.0%	($475)	($633)	$11,041	**6**	2.9%	$16,477	**6**	6.1%	$309	2.8%	$11,350	**6**	$295	2.7%	$16,786	**6**	5.9%	$11,229	**6**	2.7%	$16,517	**5**	5.8%		**#N/A**			**#N/A**	
CRP 4 -01-FGD	BASE	BASE	MED	24.9%	$11,372	**3**	1.5%	$17,149	**5**	2.3%	($475)	($633)	$10,897	**4**	1.5%	$16,516	**7**	6.3%	$320	2.9%	$11,217	**4**	$162	1.5%	$16,836	**7**	6.2%	$11,179	**5**	2.3%	$16,710	**7**	7.0%	$11,259	**3**	1.7%	$16,961	**4**	2.4%
CRP 4-1	BASE	BASE	MED	24.8%	$11,419	**4**	1.9%	$17,326	**6**	3.3%	($475)	($633)	$10,944	**5**	2.0%	$16,693	**8**	7.4%	$317	2.9%	$11,261	**5**	$206	1.9%	$17,010	**8**	7.3%	$11,134	**4**	1.9%	$16,803	**8**	7.6%	$11,268	**4**	1.7%	$17,053	**5**	3.0%
CRP 5	HIGH	BASE	MAX	**36.9%**	$11,816	**9**	5.4%	$16,767	**1**	0.0%	($1,037)	($1,230)	$10,779	**3**	0.4%	$15,537	**1**	0.0%	$309	2.9%	$11,088	**3**	$33	0.3%	$15,846	**1**	0.0%	$10,990	**2**	0.6%	$15,619	**1**	0.0%		**#N/A**			**#N/A**	
CRP 6	HIGH	HIGH	MIN	26.4%	$12,334	**14**	10.1%	$17,525	**10**	4.5%	($1,037)	($1,230)	$11,297	**10**	5.3%	$16,295	**5**	4.9%	$304	2.7%	$11,601	**10**	$546	4.9%	$16,599	**5**	4.8%	$11,580	**10**	5.9%	$16,578	**6**	6.1%	$11,601	**5**	4.7%	$16,599	**2**	0.2%
CRP 7	HIGH	MED	MIN	25.2%	$12,208	**13**	8.9%	$17,362	**7**	3.5%	($1,037)	($1,230)	$11,171	**8**	4.1%	$16,132	**2**	3.8%	$304	2.7%	$11,475	**8**	$420	3.8%	$16,436	**2**	3.7%	$11,442	**9**	4.7%	$16,403	**3**	5.0%		**#N/A**			**#N/A**	
CRP 8	BASE	HIGH	MIN	23.4%	$11,936	**11**	6.5%	$17,791	**13**	6.1%	($475)	($633)	$11,461	**13**	6.8%	$17,158	**13**	10.4%	$304	2.7%	$11,765	**13**	$710	6.4%	$17,462	**13**	10.2%	$11,730	**13**	7.3%	$17,426	**13**	11.6%	$11,765	**8**	6.2%	$17,462	**8**	5.5%
CRP 9	BASE	MED	MIN	23.5%	$11,896	**10**	6.2%	$17,787	**12**	6.1%	($475)	($633)	$11,421	**12**	6.4%	$17,154	**12**	10.4%	$304	2.7%	$11,725	**12**	$670	6.1%	$17,458	**12**	10.2%	$11,683	**12**	6.9%	$17,416	**12**	11.5%	$11,725	**7**	5.9%	$17,458	**7**	5.4%
CRP 9- Wind_cap	BASE	MED (Optimist Cap Cred)	MIN	24.6%	$11,797	**8**	5.3%	$17,664	**11**	5.4%	($475)	($633)	$11,322	**11**	5.5%	$17,031	**11**	9.6%	$304	2.7%	$11,626	**11**	$571	5.2%	$17,335	**11**	9.4%	$11,584	**11**	6.0%	$17,293	**11**	10.7%	$11,626	**6**	5.0%	$17,335	**6**	4.7%
CRP 10	BASE	MED	MED	28.6%	$11,665	**7**	4.1%	$17,396	**8**	3.8%	($475)	($633)	$11,190	**9**	4.3%	$16,763	**9**	7.9%	$335	3.0%	$11,525	**9**	$470	4.3%	$17,098	**9**	7.9%	$11,429	**8**	4.6%	$16,933	**10**	8.4%		**#N/A**			**#N/A**	
CRP 31	BASE 50% PEAK 100% ENERGY	MED	MAX	22.4%	$11,625	**6**	3.7%	$17,522	**9**	4.5%	($475)	($633)	$11,150	**7**	3.9%	$16,889	**10**	8.7%	$309	2.8%	$11,459	**7**	$404	3.7%	$17,198	**10**	8.5%	$11,340	**7**	3.8%	$16,930	**9**	8.4%		**#N/A**			**#N/A**	
World 2- HIGH LOAD																																				
CRP 21 (FGD Wind)	BASE	MED Optimize	MAX	26.2%	$12,722		13.5%	$19,503		16.3%	($475)	($633)	$12,247		14.1%	$18,870		21.5%	$349	2.8%	**$12,596**			13.9%	$19,219		21.3%	$12,515		14.5%	$19,079		22.2%	$12,682		14.5%	$19,656		18.7%
CRP 32 (FGD PPA)	BASE 50% PEAK 100% ENERGY	MED Optimize	MAX	22.1%	$12,907		15.2%	$20,236		20.7%	($475)	($633)	$12,432		15.9%	$19,604		26.2%	$349	2.8%	**$12,781**			15.6%	$19,953		25.9%	$12,691		16.1%	$19,756		26.5%						

CRP and Sensitivity NPV RR Matrix

Cost unchanged from Original C

CRP Sensitivity Results - All w/ DSM Customer Cost Adjustment and Sustaining Capital Adder

CRP	DSM	WIND	COAL	S3 - High NG & IMPORT Prices				S4 - Low NG & IMPORT Prices					S6 -Low Price High S Coal				S7-High Price High S Coal				S9- Optimistic Wind -cost -output			
				Planning Period Cost ($M)	Plan Per Rank	% change from #1	Study Per Rank	% change from #1	Planning Period Cost ($M)	Rank	% change from #1	Study Period Cost ($M)	Rank	% change from #1	Planning Period Cost ($M)	Rank	% change from #1	Study Period Cost ($M)	Rank	% change from #1	Planning Period Cost ($M)	Plan Per Rank	% change from #1	Study Period Cost ($M)	Rank	% change from #1	Planning Period Cost ($M)	Plan Per Rank	% change from #1	Study Period Cost ($M)	Study Per Rank	% change from #1
World 1 - REFERENCE																														
CRP 1 (FGD-PPA)	50% LOW	BASE	MAX	$12,803	**14**	11.2%	**14**	24.7%	$11,536	**14**	8.7%	$17,827	**14**	19.2%	$12,048	**12**	8.2%	$19,276	**14**	15.0%	$12,256	**14**	10.7%	$19,699	**14**	24.3%	$12,086	**14**	9.3%	$19,270	**14**	21.6%
CRP 2-1 R03	BASE	BASE	MAX	$11,622	**3**	1.0%	**4**	5.5%	$10,615	**1**	0.0%	$15,360	**2**	2.7%	$11,235	**2**	0.9%	$16,794	**3**	0.2%	$11,069	**1**	0.0%	$16,471	**3**	3.9%	$11,069	**2**	0.1%	$16,471	**4**	3.9%
CRP 2-17 (FGD)-R03	BASE	BASE	MAX	$11,521	**2**	0.1%	**5**	5.9%	$10,682	**2**	0.6%	$15,626	**5**	4.5%	$11,136	**1**	0.0%	$16,769	**2**	0.0%	$11,229	**3**	1.4%	$16,851	**6**	6.3%	$11,055	**1**	0.0%	$16,568	**6**	4.6%
CRP 3	BASE	MED	MAX	$11,833	**5**	2.8%	**6**	6.5%	$10,931	**6**	3.0%	$15,779	**8**	5.5%	$11,516	**5**	3.4%	$17,110	**5**	2.0%	$11,350	**5**	2.5%	$16,786	**5**	5.9%	$11,267	**6**	1.9%	$16,566	**5**	4.5%
CRP 4 -01-FGD	BASE	BASE	MED	$11,681	**4**	1.5%	**7**	7.6%	$10,830	**5**	2.0%	$15,768	**7**	5.4%	$11,302	**3**	1.5%	$17,006	**4**	1.4%	$11,388	**6**	2.9%	$17,080	**8**	7.8%	$11,217	**4**	1.5%	$16,836	**7**	6.2%
CRP 4-1	BASE	BASE	MED	$11,834	**6**	2.8%	**9**	9.0%	$10,778	**4**	1.5%	$15,625	**4**	4.5%	$11,419	**4**	2.5%	$17,326	**6**	3.3%	$11,261	**4**	1.7%	$17,010	**7**	7.3%	$11,261	**5**	1.9%	$17,010	**10**	7.3%
CRP 5	HIGH	BASE	MAX	$11,511	**1**	0.0%	**1**	0.0%	$10,709	**3**	0.9%	$14,955	**1**	0.0%	$11,816	**9**	6.1%	$16,767	**1**	0.0%	$11,088	**2**	0.2%	$15,846	**1**	0.0%	$11,088	**3**	0.3%	$15,846	**1**	0.0%
CRP 6	HIGH	HIGH	MIN	$12,073	**10**	4.9%	**3**	5.0%	$11,227	**12**	5.8%	$15,735	**6**	5.2%	$12,334	**14**	10.8%	$17,525	**10**	4.5%	$11,601	**10**	4.8%	$16,599	**4**	4.8%	$11,441	**9**	3.5%	$16,175	**2**	2.1%
CRP 7	HIGH	MED	MIN	$11,979	**8**	4.1%	**2**	4.5%	$11,071	**8**	4.3%	$15,497	**3**	3.6%	$12,208	**13**	9.6%	$17,362	**7**	3.5%	$11,475	**8**	3.7%	$16,436	**2**	3.7%	$11,393	**8**	3.1%	$16,222	**3**	2.4%
CRP 8	BASE	HIGH	MIN	$12,336	**12**	7.2%	**11**	11.8%	$11,309	**13**	6.5%	$16,358	**13**	9.4%	$11,936	**11**	7.2%	$17,791	**13**	6.1%	$11,765	**13**	6.3%	$17,462	**13**	10.2%	$11,599	**12**	4.9%	$17,019	**11**	7.4%
CRP 9	BASE	MED	MIN	$12,349	**13**	7.3%	**13**	12.6%	$11,205	**11**	5.6%	$16,137	**12**	7.9%	$11,896	**10**	6.8%	$17,787	**12**	6.1%	$11,725	**12**	5.9%	$17,458	**12**	10.2%	$11,642	**13**	5.3%	$17,237	**13**	8.8%
CRP 9- Wind_cap	BASE	MED (Optimist Cap Cred)	MIN	$12,243	**11**	6.4%	**12**	11.9%	$11,125	**10**	4.8%	$16,103	**11**	7.7%	$11,797	**8**	5.9%	$17,664	**11**	5.4%	$11,626	**11**	5.0%	$17,335	**11**	9.4%	$11,542	**11**	4.4%	$17,110	**12**	8.0%
CRP 10	BASE	MED	MED	$12,015	**9**	4.4%	**8**	8.6%	$11,101	**9**	4.6%	$16,061	**10**	7.4%	$11,665	**7**	4.8%	$17,396	**8**	3.8%	$11,525	**9**	4.1%	$17,098	**9**	7.9%	$11,444	**10**	3.5%	$16,882	**8**	6.5%
CRP 31	BASE 50% PEAK 100% ENERGY	MED	MAX	$11,949	**7**	3.8%	**10**	9.1%	$11,030	**7**	3.9%	$16,057	**9**	7.4%	$11,625	**6**	4.4%	$17,522	**9**	4.5%	$11,459	**7**	3.5%	$17,198	**10**	8.5%	$11,381	**7**	2.9%	$16,987	**9**	7.2%
World 2- HIGH LOAD																														
CRP 21 (FGD Wind)	BASE	MED Optimize	MAX	$13,231		14.8%		23.8%	$12,118		14.2%	$18,057		20.7%	$12,613		13.3%	$19,336		15.3%	$12,847		16.1%	$19,613		23.8%	$12,504		13.1%	$18,991		19.9%
CRP 32 (FGD PPA)	BASE 50% PEAK 100% ENERGY	MED Optimize	MAX	$13,581		17.9%		29.1%	$12,222		15.1%	$18,434		23.3%	$12,794		14.9%	$20,022		19.4%	$13,033		17.7%	$20,451		29.1%	$12,781		15.6%	$19,953		25.9%