



Memorandum

TO: M08059 GENERATION UTILIZATION AND OPTIMIZATION STAKEHOLDERS
FROM: BOB FAGAN – SYNAPSE ENERGY ECONOMICS
DATE: OCTOBER 19, 2018
RE: AVOIDED ENERGY AND CAPACITY COSTS ASSOCIATED WITH DSM RESOURCES

This memo presents the results and describes our computation of the avoided energy and avoided capacity costs associated with the energy efficiency savings represented in Scenario 2, “Medium DSM”, in the Generation Utilization and Optimization Study.¹ Avoided energy and avoided capacity costs represent the costs – both fixed and variable – that are avoided when energy efficiency resources reduce the overall requirements for system energy and capacity, and thus reduce the associated revenue requirements.

We used a differential revenue requirements approach to estimate the avoided energy and capacity costs. We computed the difference in revenue requirements (between Scenario 1 – reference, and Scenario 2 – medium DSM) associated with the variable (energy related) and the fixed (capacity related) costs and divided those differences by the saved energy or saved capacity, in each of the study years (2018 through 2042). This results in a per-MWh-saved, and a per-kW-saved, avoided cost value for each year of the study.

We extracted the outputs of the Plexos modeling results, and the associated post-processing data used in the Study. Total revenue requirements as computed in the Study are composed of fixed and variable costs. Fixed (or capacity related) cost components include costs associated with fixed O&M, new construction/build costs, and sustaining capital costs. Variable (or energy related) cost components include fuel, variable O&M, renewable energy provision, interchange, and startup/shutdown elements.

¹ Final Report, “Nova Scotia Power Inc. Thermal Generation Utilization and Optimization, Economic Analysis of Retention of Fossil-Fueled Thermal Fleet To and Beyond 2030”, M08059, Prepared for Board Counsel, Nova Scotia Utility and Review Board. May 1, 2018.

We computed avoided capacity costs by dividing the total fixed cost difference in revenue requirements between the two scenarios by the peak load savings seen between the two scenarios, for each year. We computed avoided energy costs by dividing the total variable cost difference in revenue requirements between the two scenarios by the energy savings seen between the scenarios, again for each year.

Table 1 below shows the results of the analysis.

The results seen in Table 1 include the effect of “avoided emissions”, since the modeling explicitly included the emissions constraints present in the Province. These values exclude any additional avoided costs that could be seen for transmission and distribution infrastructure under the medium DSM scenario. We also included a third, “Total – energy basis” computation, that provides a single stream of avoided (energy + capacity) costs, on a per MWh basis.

The results reflect the build and dispatch patterns seen in the Study results. For example, avoided energy costs drop after the commencement of the Maritime Link / Nova Scotia Block energy in 2020. Avoided capacity costs show a noticeable increase beginning in 2023, the year in which the reference case was seen to build a new combined cycle resource. In all years, the general nature of marginal energy sources in the Province – interchange, Maritime Link surplus energy, and oil/gas sourced energy – is reflected in the relatively higher avoided energy costs, since in general DSM resources are not displacing coal energy, but instead are displacing the more-expensive resources further up the system supply curve. The Study report contains discussion of this phenomenon.

Addendum to Final Report - M08059 Generation Utilization and Optimization - DSM Avoided Costs

Table 1. Summary Avoided Energy and Capacity Costs – 2018-2042

Avoided Energy and Avoided Capacity Computation - Reference Scenario vs. Medium DSM Scenario																										
Differential Revenue Requirements (Wholesale) Basis																										
Variable Cost Components	Fuel, VOM, RE, Interchange, Startup/Shutdown	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Ref	Sc 1 energy related costs \$000	\$534,475	\$570,999	\$559,945	\$520,616	\$520,950	\$541,105	\$558,318	\$562,059	\$588,495	\$606,388	\$616,302	\$623,633	\$663,509	\$660,884	\$679,356	\$676,628	\$714,087	\$723,742	\$735,546	\$736,439	\$763,442	\$782,747	\$800,384	\$834,914	\$837,866
MedDSM	Sc 2 energy related costs \$000	\$530,193	\$565,586	\$558,826	\$514,698	\$515,851	\$527,585	\$531,335	\$545,571	\$549,327	\$566,576	\$564,516	\$582,009	\$617,198	\$603,382	\$613,690	\$608,053	\$629,545	\$659,681	\$649,628	\$653,622	\$662,560	\$676,993	\$676,156	\$701,412	\$701,125
	Avoided Energy Costs, = Sc 2 vs Sc 1, \$000	\$4,282	\$5,413	\$1,119	\$5,918	\$5,099	\$13,520	\$26,983	\$16,488	\$39,168	\$39,812	\$51,786	\$41,624	\$46,311	\$57,502	\$65,666	\$68,575	\$84,542	\$64,061	\$85,919	\$82,817	\$100,882	\$105,754	\$124,228	\$133,502	\$136,741
	Sc 1 Energy, GWh	11,098.1	11,098.3	11,060.6	11,043.3	10,990.6	11,155.7	11,171.1	11,046.7	11,044.2	11,068.9	10,980.9	11,107.2	11,136.0	11,029.0	11,057.4	10,985.3	11,179.5	11,126.1	11,015.8	11,032.3	11,047.6	10,968.5	11,138.5	11,168.4	11,012.0
	Sc 2 Energy, GWh	11,083.8	11,077.1	11,035.0	10,983.2	10,870.9	10,940.2	10,866.8	10,663.4	10,583.7	10,540.9	10,399.3	10,462.8	10,438.6	10,281.3	10,253.0	10,130.0	10,256.1	10,151.0	9,998.7	9,960.9	9,921.9	9,795.2	9,895.5	9,877.0	9,680.8
	GWh Saved by Sc 2 DSM relative to Sc 1	14.3	21.1	25.6	60.1	119.7	215.5	304.2	383.3	460.5	528.1	581.6	644.4	697.4	747.8	804.3	855.4	923.4	975.1	1,017.1	1,071.4	1,125.7	1,173.2	1,243.0	1,291.4	1,331.2
	Avoided energy cost, \$/MWh saved	\$299.68	\$256.24	\$43.71	\$98.53	\$42.61	\$62.73	\$88.69	\$43.02	\$85.06	\$75.39	\$89.05	\$64.59	\$66.41	\$76.90	\$81.64	\$80.17	\$91.55	\$65.70	\$84.47	\$77.30	\$89.61	\$90.14	\$99.94	\$103.38	\$102.72
Fixed Cost Components	FOM, SusCap, New build	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Ref	Sc 1 capacity related costs \$000	\$73,630	\$81,885	\$109,448	\$114,237	\$126,040	\$175,502	\$185,203	\$193,719	\$201,912	\$211,113	\$221,458	\$232,573	\$242,591	\$254,264	\$270,306	\$277,340	\$290,350	\$301,347	\$315,153	\$327,228	\$354,068	\$366,570	\$378,413	\$392,423	\$412,746
MedDSM	Sc 2 capacity related costs \$000	\$73,630	\$81,885	\$109,448	\$112,810	\$124,613	\$135,665	\$145,278	\$153,705	\$161,807	\$170,916	\$184,980	\$195,999	\$205,918	\$204,924	\$220,152	\$229,833	\$240,918	\$251,801	\$262,526	\$274,484	\$293,332	\$307,557	\$320,420	\$336,666	\$385,865
	Avoided Capacity Costs, = Sc 2 vs. Sc 1, \$000	\$0	\$0	\$0	\$1,427	\$1,427	\$39,838	\$39,925	\$40,014	\$40,105	\$40,197	\$36,478	\$36,574	\$36,673	\$49,340	\$50,155	\$47,506	\$49,432	\$49,546	\$52,626	\$52,744	\$60,736	\$59,013	\$57,993	\$55,757	\$26,881
	Sc 1 Peak Load, MW	1,993.0	2,010.0	2,029.0	2,038.0	2,053.0	2,073.0	2,080.0	2,084.0	2,083.0	2,086.0	2,096.2	2,106.5	2,116.8	2,127.2	2,137.6	2,148.1	2,158.6	2,169.2	2,179.8	2,190.4	2,201.1	2,211.9	2,222.7	2,233.7	2,244.8
	Sc 2 Peak Load, MW	1,980.2	1,993.4	2,014.5	2,016.9	2,022.5	2,024.9	2,014.3	2,003.0	1,986.8	1,977.0	1,976.4	1,975.7	1,975.0	1,974.3	1,973.6	1,973.0	1,972.3	1,971.6	1,970.9	1,970.2	1,969.5	1,968.9	1,968.2	1,967.6	1,967.1
	Peak Savings Delta, Sc 2 vs. Sc 1, MW	12.8	16.6	14.5	21.1	30.5	48.1	65.7	81.0	96.2	109.0	119.9	130.8	141.8	152.9	164.0	175.1	186.3	197.6	208.9	220.2	231.6	243.0	254.5	266.1	277.7
	Avoided capacity costs, \$/Kw saved	0.00	0.00	0.00	67.78	46.76	828.69	608.13	493.89	417.07	368.94	304.32	279.56	258.56	322.72	305.85	271.26	265.30	250.78	251.97	239.53	262.26	242.83	227.87	209.53	96.78
Total - Energy basis		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
	Avoided Costs, \$000	\$4,282	\$5,413	\$1,119	\$7,345	\$6,526	\$53,358	\$66,908	\$56,502	\$79,272	\$80,010	\$88,264	\$78,198	\$82,984	\$106,842	\$115,820	\$116,081	\$133,974	\$113,607	\$138,545	\$135,561	\$161,618	\$164,766	\$182,221	\$189,259	\$163,621
	Delta GWh	14.3	21.1	25.6	60.1	119.7	215.5	304.2	383.3	460.5	528.1	581.6	644.4	697.4	747.8	804.3	855.4	923.4	975.1	1,017.1	1,071.4	1,125.7	1,173.2	1,243.0	1,291.4	1,331.2
	Cost per MWh, Capacity + Energy	\$299.68	\$256.24	\$43.71	\$122.30	\$54.54	\$247.58	\$219.92	\$147.42	\$172.16	\$151.52	\$151.77	\$121.35	\$119.00	\$142.88	\$143.99	\$135.70	\$145.08	\$116.51	\$136.22	\$126.53	\$143.57	\$140.44	\$146.60	\$146.55	\$122.91
Note: All avoided energy costs included the avoided emissions costs associated with the emission caps in Nova Scotia. No additional avoided T or D costs are included.																										