

NON-CONFIDENTIAL

1 **Request IR-48:**

2
3 **With reference to Application, page 113, lines 15-22; page 120, lines 6-15; page 121,**
4 **Figure 6-3:**

5
6 **(a) Please provide all calculations, spreadsheets, reports, other work papers Strategist**
7 **inputs and outputs and any other materials related to the establishment of the**
8 **quantity of wind generation to be added in each year through 2050 for the**
9 **“Indigenous Wind” alternative including all scenarios and sensitivity runs.**

10
11 **(b) Please provide all calculations, spreadsheets, reports, other work papers Strategist**
12 **inputs and outputs and any other materials related to the establishment of the**
13 **quantity of gas-fired or other generation required to provide back-up for the wind**
14 **generation reported in response to part (a) above.**

15
16 **(c) Please explain to what extent the quantity and timing of gas-fired addition was**
17 **determined by The Strategist software and how requirements for back-up of**
18 **intermittent generation were incorporated in the Strategist runs.**

19
20 **(d) Please provide a tabulation of the renewable energy produced by each unit**
21 **contributing to satisfying the Renewable Energy Standard for on-peak and off-peak**
22 **periods each month through 2050 including all scenarios and sensitivity runs. If**
23 **data is not available for on-peak and off-peak periods each month, please provide**
24 **most detailed data available. If on-peak data is provided, please specify if on-peak is**
25 **a 5 x 16 or 7 x 16 pattern.**

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1 Response IR-48:

2

3 (a) Please refer to Attachments 1 and 2.

4

5 (b) Please refer to Synapse IR-18 Attachment 2.

6

7 (c) For the two resource plan optimizations for the Indigenous Wind cases (base and low
8 load) Strategist was able to choose from the four natural gas options as to the timing and
9 number to add. These additions were required to meet the minimum planning reserve
10 margin and/or environmental constraints. Strategist is not able to determine the
11 operational requirements for back-up of intermittent resources. Please refer to
12 Synapse IR-18 Attachment 2 for how back-up generation was incorporated into the
13 Strategist Indigenous Wind cases.

14

15 (d) Please refer to Attachment 3. Annual data is provided. This assessment has assumed
16 surplus energy imports are RES eligible.

CA SBA-048 Att 1
 Indigenous Wind Base Load
 Incremental Wind to Add - Worksheet

	Total Sales GWh	RES% of Sales	RES Requirement GWh	RES Energy in 2020	Surplus (+) Deficit(-)	425MW @ 35%	Surplus (+) Deficit(-)	50MW blocks @ 32%	Total Wind Added	Surplus (+) Deficit(-)
				(No Maritime Link) GWh	GWh	in 2019 GWh	after 425MW added (GWh)	MW	GWh	after 425MW added & 50 MW Blocks added (GWh)
2020	10,308	40%	4123	2887	-1236.2	1303	67		1303	67
2021	10,315	40%	4126	2887	-1239.1	1303	64		1303	64
2022	10,329	40%	4132	2887	-1244.5	1303	59		1303	59
2023	10,357	40%	4143	2887	-1255.7	1303	47		1303	47
2024	10,375	40%	4150	2887	-1263.0	1303	40		1303	40
2025	10,392	40%	4157	2887	-1269.6	1303	33		1303	33
2026	10,415	40%	4166	2887	-1278.8	1303	24		1303	24
2027	10,440	40%	4176	2887	-1288.8	1303	14		1303	14
2028	10,462	40%	4185	2887	-1297.7	1303	5	50	1443	146
2029	10,495	40%	4198	2887	-1311.1	1303	-8		1443	132
2030	10,536	40%	4214	2887	-1327.2	1303	-24		1443	116
2031	10,578	40%	4231	2887	-1344.1	1303	-41		1443	99
2032	10,617	40%	4247	2887	-1360.0	1303	-57		1443	83
2033	10,716	40%	4286	2887	-1399.4	1303	-96		1443	44
2034	10,816	40%	4327	2887	-1439.6	1303	-137	50	1583	144
2035	10,919	40%	4367	2887	-1480.4	1303	-177		1583	103
2036	11,023	40%	4409	2887	-1522.0	1303	-219		1583	61
2037	11,128	40%	4451	2887	-1564.3	1303	-261	50	1724	159
2038	11,234	40%	4494	2887	-1606.7	1303	-304		1724	117
2039	11,342	40%	4537	2887	-1650.0	1303	-347		1724	74
2040	11,452	40%	4581	2887	-1694.0	1303	-391		1724	30

CA SBA-048 Att 2
Indigenous Wind Low Load
Incremental Wind to Add - Worksheet

	Total Sales GWh	RES% of Sales	RES Requirement GWh	RES Energy in 2020 (No Maritime Link) GWh	Surplus (+) Deficit(-) GWh	250MW @ 30% in 2019 GWh	Surplus (+) Deficit(-) after 250 MW added (GWh)
2020	8,977	40%	3591	2947	-643.7	657	13
2021	8,935	40%	3574	2947	-626.8	657	30
2022	8,877	40%	3551	2947	-604.0	657	53
2023	8,830	40%	3532	2947	-584.8	657	72
2024	8,766	40%	3507	2947	-559.6	657	97
2025	8,697	40%	3479	2947	-531.8	657	125
2026	8,633	40%	3453	2947	-506.2	657	151
2027	8,569	40%	3428	2947	-480.7	657	176
2028	8,501	40%	3401	2947	-453.5	657	203
2029	8,443	40%	3377	2947	-430.2	657	227
2030	8,390	40%	3356	2947	-408.9	657	248
2031	8,337	40%	3335	2947	-387.7	657	269
2032	8,279	40%	3312	2947	-364.8	657	292
2033	8,279	40%	3312	2947	-364.8	657	292
2034	8,279	40%	3312	2947	-364.8	657	292
2035	8,279	40%	3312	2947	-364.8	657	292
2036	8,279	40%	3312	2947	-364.8	657	292
2037	8,279	40%	3312	2947	-364.8	657	292
2038	8,279	40%	3312	2947	-364.8	657	292
2039	8,279	40%	3312	2947	-364.8	657	292
2040	8,279	40%	3312	2947	-364.8	657	292

RES Compliant Renewables (GWh)

Maritime Link Base Load

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3187	3192
Maritime Link (Base Block and Supplemental)	0	0	323	1135	1135	1139	1135	1038	895	897	895	895	895	897	895	895	895	897	895	895	895	897	895	895	895	895	897
Imports *	0	0	282	1288	1289	1281	1307	1392	1529	1541	1583	1583	1598	1598	1653	1608	1625	1641	1672	1710	1664	1706	1709	1717	1724	1732	
Imports over NS-NB Tieline	0	0	718	546	539	531	528	484	508	509	538	548	559	551	606	641	644	645	692	723	682	720	735	740	806	833	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	
Total RES Eligible Renewables	2859	2891	4210	5856	5851	5842	5858	5800	5818	5837	5903	5913	5938	5937	6040	6030	6050	6074	6146	6215	6128	6214	6225	6238	6312	6354	

* Surplus energy from Maritime Link

**RES Compliant Renewables (GWh)
Other Import Base Load**

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3187	3192
Other Import (Contract Energy)	0	0	235	932	932	934	932	932	932	934	932	932	932	934	932	932	932	934	932	932	932	934	932	932	932	932	934
Imports *	0	0	1241	2532	2494	2490	2531	2505	2546	2541	2599	2629	2636	2632	2684	2905	2928	2989	3067	3158	3255	3276	3276	3291	3310	3379	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	300	301
Total RES Eligible Renewables	2859	2891	4363	6350	6313	6315	6349	6323	6365	6366	6418	6447	6454	6457	6503	6723	6746	6814	6885	6976	7073	7101	7094	7110	7128	7204	

* Imports over the upgraded NS-NB Tieline

RES Compliant Renewables (GWh)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Wind Base Load - Incremental Wind																											
Wind 425MW (repowered)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1303	1308
Wind 50 MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	140	140	140	140	141
Wind 50 MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	140	140	141	140	140	140	141
Wind 50 MW	0	0	0	0	0	0	0	0	0	0	0	0	0	141	140	140	140	141	140	140	140	141	140	140	140	140	141
Wind 425MW	0	0	0	0	1303	1308	1303	1303	1303	1308	1303	1303	1303	1308	1303	1303	1303	1308	1303	1303	1303	1303	1308	1303	1303	0	0
	0	0	0	0	1,303	1,308	1,303	1,303	1,303	1,308	1,303	1,303	1,303	1,449	1,443	1,443	1,443	1,449	1,443	1,583	1,583	1,589	1,724	1,724	1,724	1,730	

Wind Base Load

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3187	3192
Incremental Wind	0	0	0	0	1303	1308	1303	1303	1303	1308	1303	1303	1303	1449	1443	1443	1443	1449	1443	1583	1583	1589	1724	1724	1724	1730	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	
Total RES Eligible Renewables	2859	2891	2887	2887	4190	4199	4190	4190	4190	4199	4190	4190	4190	4339	4330	4330	4330	4339	4330	4470	4470	4480	4610	4610	4610	4621	

RES Compliant Renewables (GWh)

Maritime Link Low Load

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3248	3253
Maritime Link (Base Block and Supplemental)	0	0	323	1135	1135	1139	1135	1038	895	897	895	895	895	897	895	895	895	897	895	895	895	897	895	895	895	895	897
Imports *	0	0	281	1264	1268	1081	1085	1138	1197	1224	1245	1230	1217	1192	1282	1280	1269	1237	1271	1278	1290	1275	1296	1296	1297	1278	
Imports over NS-NB Tieline	0	0	640	464	450	242	253	209	197	257	258	251	245	229	238	251	235	219	223	227	247	248	248	248	247	255	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	
Total RES Eligible Renewables	2859	2891	4131	5750	5740	5414	5420	5332	5237	5330	5346	5323	5305	5270	5362	5373	5346	5305	5337	5348	5379	5372	5387	5386	5386	5382	

* Surplus energy from Maritime Link

**RES Compliant Renewables (GWh)
Other Import Low Load**

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3248	3253
Other Import (Contract Energy)	0	0	235	932	932	934	932	932	932	934	932	932	932	934	932	932	932	934	932	932	932	934	932	932	932	932	934
Imports *	0	0	1216	2375	2431	1756	1756	1643	1717	1735	1794	1743	1698	1632	1723	1765	1760	1679	1735	1720	1765	1829	1807	1769	1783	1764	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	300	301
Total RES Eligible Renewables	2859	2891	4338	6193	6249	5642	5635	5522	5596	5621	5673	5622	5577	5518	5603	5645	5639	5565	5615	5599	5644	5715	5686	5648	5662	5650	

* Imports over the upgraded NS-NB Tieline

RES Compliant Renewables (GWh)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Wind Low Load - Incremental Wind	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind 250MW (repowered)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	657	659
Wind 250MW	0	0	0	0	657	659	657	657	657	659	657	657	657	659	657	657	657	659	657	657	657	659	657	657	657	657
	0	0	0	0	657	659	657	657	657	659	657	657	657	659	657	657	657	659	657	657	657	659	657	657	657	659

Wind Low Load

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3253	3248	3248	3248	3253
Incremental Wind	0	0	0	0	657	659	657	657	657	659	657	657	657	659	657	657	657	659	657	657	657	659	657	657	657	659
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301
Total RES Eligible Renewables	2859	2891	2887	2887	3544	3611	3605	3605	3605	3611	3605	3605	3605	3611	3605	3605	3605	3611	3605	3605	3605	3611	3605	3605	3605	3611

RES Compliant Renewables (GWh)

Maritime Link Base Load - High Power & Gas Price Sensitivity

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3187	3192
Maritime Link (Base Block and Supplemental)	0	0	323	1135	1135	1139	1135	1038	895	897	895	895	895	897	895	895	895	897	895	895	895	897	895	895	895	895	897
Imports *	0	0	250	1219	1220	1204	1212	1222	1362	1378	1407	1442	1469	1546	1655	1717	1723	1727	1723	1724	1726	1730	1726	1727	1727	1727	1732
Imports over NS-NB Tieline	0	0	631	210	210	216	220	181	205	218	242	267	288	380	586	796	815	820	821	830	826	829	826	833	841	857	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	301	300	300	300	300	301	300	300	300	300	301
Total RES Eligible Renewables	2859	2891	4090	5451	5452	5450	5454	5328	5349	5384	5431	5490	5539	5715	6022	6295	6320	6335	6326	6335	6333	6347	6333	6342	6349	6378	

* Surplus energy from Maritime Link

RES Compliant Renewables (GWh)

Other Import Base Load - High Power & Gas Price Sensitivity

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3187	3192
Other Import (Contract Energy)	0	0	235	932	932	934	932	932	932	934	932	932	932	934	932	932	932	934	932	932	932	934	932	932	932	932	934
Imports *	0	0	897	1424	1458	1491	1472	1378	1444	1475	1518	1576	1629	1866	2216	2584	2725	2847	3044	3219	3289	3301	3307	3310	3332	3381	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	300	301
Total RES Eligible Renewables	2859	2891	4018	5243	5277	5316	5290	5196	5262	5300	5337	5395	5447	5691	6034	6402	6544	6672	6862	7037	7107	7126	7125	7128	7150	7206	

* Imports over the upgraded NS-NB Tieline

RES Compliant Renewables (GWh)

Wind Base Load - Incremental Wind

Wind 425MW (repowered)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1303	1308					
Wind 50 MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	140	140	140	141			
Wind 50 MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	140	140	140	140	140	141		
Wind 50 MW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	141	140	140	140	141	140	140	140	140	140	140	140	140	140	140	141		
Wind 425MW	0	0	0	0	1303	1308	1303	1303	1303	1308	1303	1303	1303	1308	1303	1303	1303	1308	1303	1303	1308	1303	1303	1308	1303	1303	1303	1308	1303	1303	0	0
	0	0	0	0	1,303	1,308	1,303	1,303	1,303	1,308	1,303	1,303	1,303	1,449	1,443	1,443	1,443	1,449	1,443	1,583	1,583	1,589	1,724	1,724	1,724	1,730						

Wind Base Load - High Power & Gas Price Sensitivity

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3187	3192
Incremental Wind	0	0	0	0	1303	1308	1303	1303	1303	1308	1303	1303	1303	1449	1443	1443	1443	1449	1443	1583	1583	1589	1724	1724	1724	1730	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	301	300	300	300	300	301	
Total RES Eligible Renewables	2859	2891	2887	2887	4190	4199	4190	4190	4190	4199	4190	4190	4190	4339	4330	4330	4330	4339	4330	4470	4470	4480	4610	4610	4610	4621	

RES Compliant Renewables (GWh)

Maritime Link Base Load - Low Power & Gas Price Sensitivity

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Renewables (NSP Owned and IPPs)	2959	3041	3112	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192
Maritime Link (Base Block and Supplemental)	0	0	323	1135	1135	1139	1135	1038	895	897	895	895	895	897	895	895	895	897	895	895	895	897	895	895	895	895
Imports *	0	0	335	1333	1348	1418	1302	1436	1585	1605	1627	1633	1635	1640	1638	1659	1655	1663	1668	1675	1629	1669	1660	1670	1700	1719
Imports over NS-NB Tieline	0	0	782	638	622	605	582	610	619	616	686	694	700	691	702	692	690	684	705	698	670	677	690	695	722	802
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	301	300	300	300	300	301	300	300	300	301
Total RES Eligible Renewables	2859	2891	4327	5993	5992	6053	5906	5971	5986	6009	6094	6108	6116	6119	6121	6132	6127	6134	6154	6155	6080	6134	6132	6147	6203	6309

* Surplus energy from Maritime Link

RES Compliant Renewables (GWh)

Other Import Base Load - Low Power & Gas Price Sensitivity

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Renewables (NSPI Owned and IPPs)	2959	3041	3112	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3192	3187	3187	3187	3187	3192
Other Import (Contract Energy)	0	0	235	932	932	934	932	932	932	934	932	932	932	934	932	932	932	934	932	932	932	934	932	932	932	932	934
Imports *	0	0	1304	2614	2601	2635	2537	2533	2637	2527	2735	2830	2854	2773	2852	2750	2812	2694	2829	2846	2883	2902	2940	3062	3216	3291	
Less Community Feed in Tariff	100	151	225	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	301	300	300	300	300	301
Total RES Eligible Renewables	2859	2891	4425	6432	6419	6460	6355	6351	6456	6352	6553	6648	6673	6598	6671	6568	6630	6519	6648	6664	6701	6727	6758	6880	7034	7116	

* Imports over the upgraded NS-NB Tieline

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1 **Request IR-49:**

2
3 **With reference to Application, page 113, lines 21-22:**

4
5 **(a) Please provide all documents, including work papers, supporting the growth in the**
6 **load forecast beyond 2020.**

7
8 **(b) Please reconcile this claim of load growth with NSPI's *10 Year System Outlook 2012-***
9 ***21 Report* (June 29, 2012) tables 1 and 2, which show forecasted declines in annual**
10 **energy load and coincident peak demand from 2012 to 2022.**

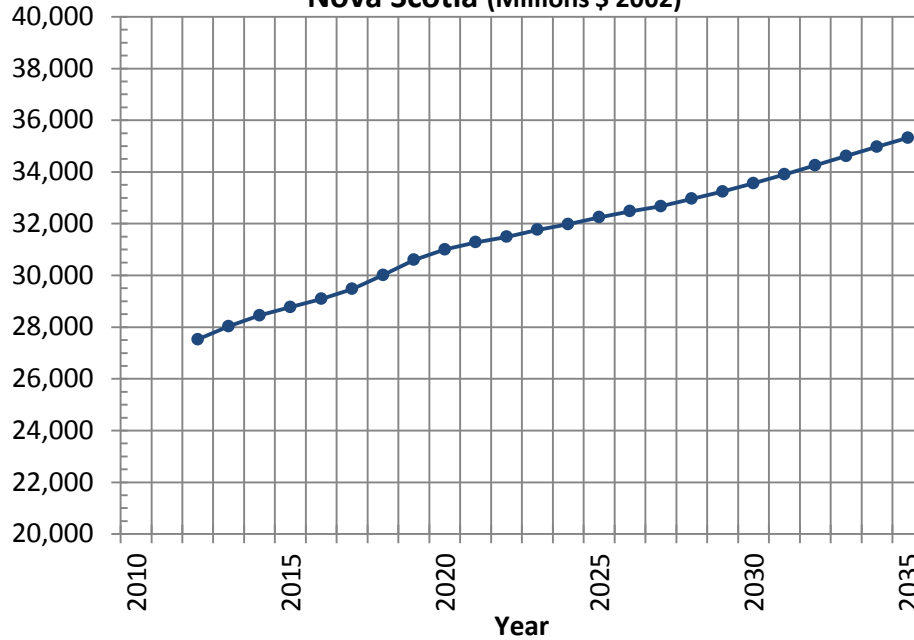
11
12 Response IR-49:

13
14 (a) The load forecast was prepared using the usual NS Power econometric modeling methods
15 based on the relationship between electricity consumption and economic indicators.
16 Descriptions of the model structure and methodology can be found in the annual NS
17 Power Load Forecast Report, last filed 30 April 2012.

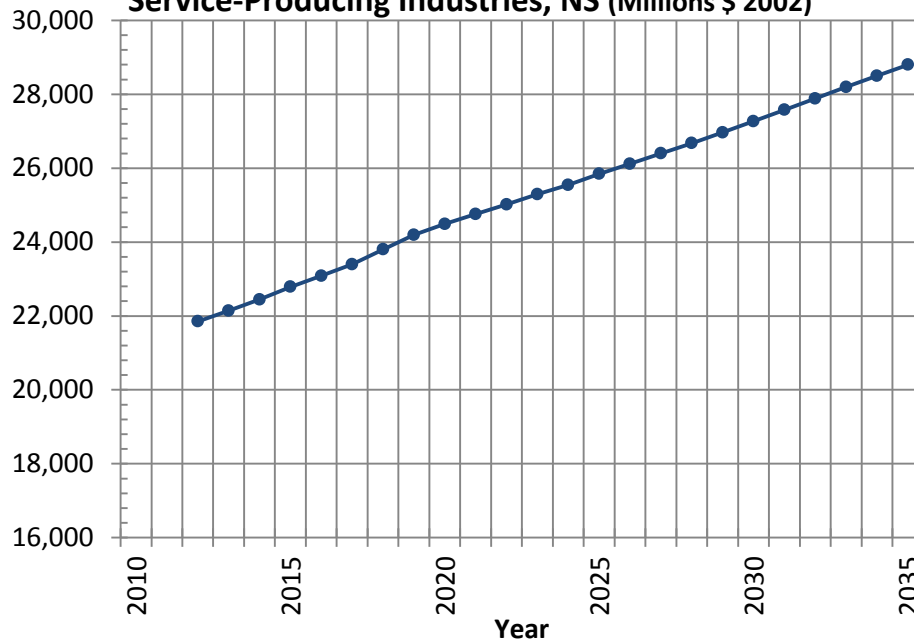
18
19 The current NS Power load forecast model is configured to provide a modeled load
20 projection to the year 2025 using the Conference Board of Canada (CBoC) economic
21 forecast. Beyond 2025, the sector growth rates (residential, commercial, industrial) are
22 assumed constant and projected at the year 2025 growth rate to 2040. This approach
23 assumes there are no specific changes to the long-term trend of the forecast inputs. The
24 long-term CBoC economic forecast extends to 2035. The charts below show the major
25 economic indicators employed in the model, plotted out to the year 2035, demonstrating
26 reasonably consistent trends from 2025 to 2035.

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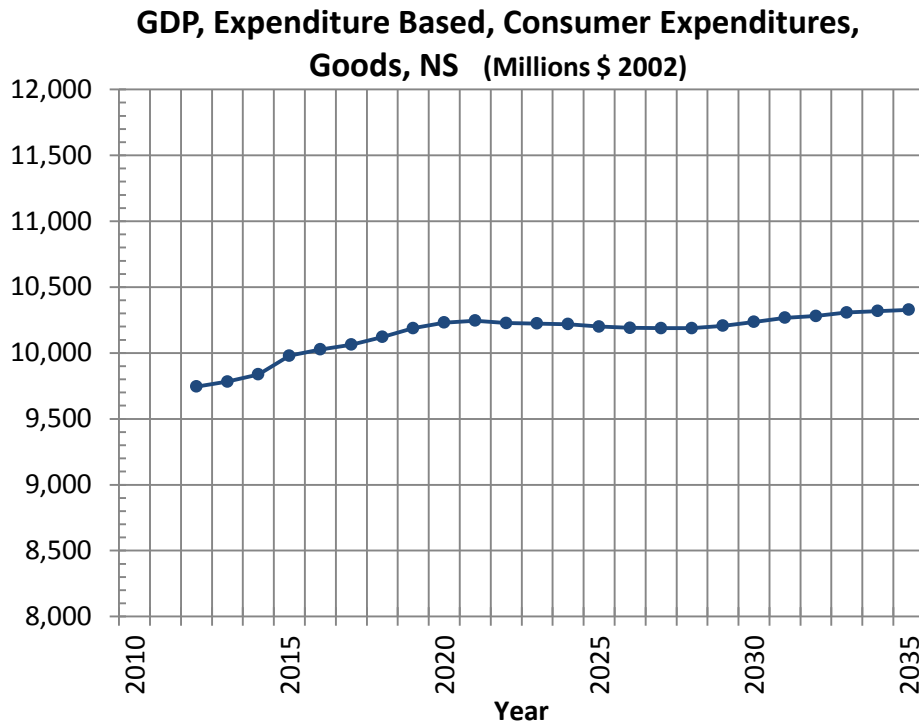
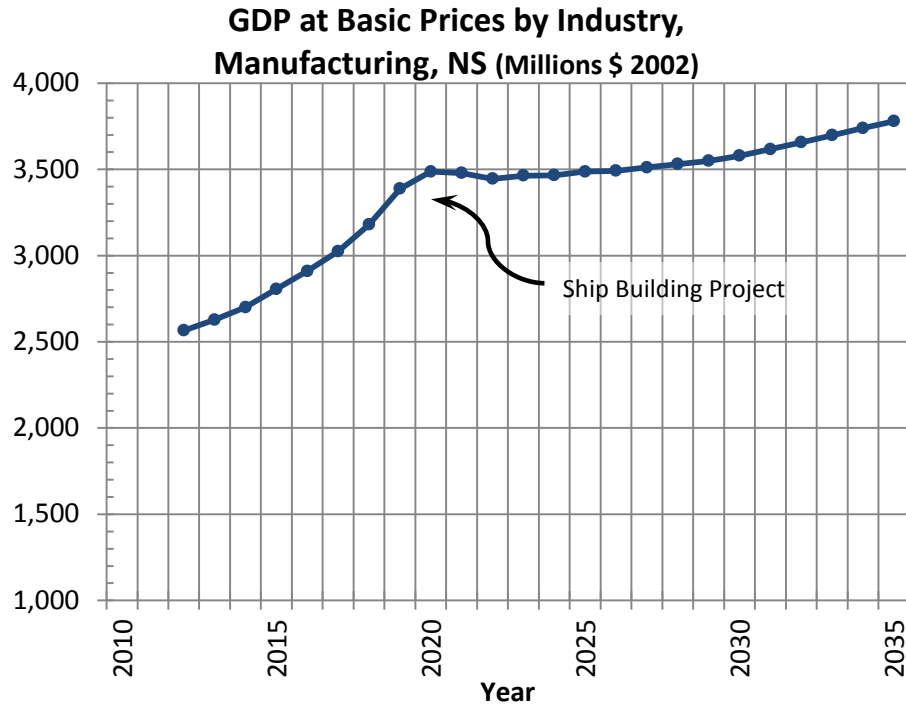
**Gross Domestic Product at Basic Prices,
Nova Scotia (Millions \$ 2002)**



**GDP at Basic Prices by Industry,
Service-Producing Industries, NS (Millions \$ 2002)**



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1
2 An example of the sector growth rates beyond 2020 for the NSPML low load forecast are
3 shown in the table below.

Maritime Link Project (NSUARB ML-2013-01)
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NSPML Low Load												
Year	Res. Sector GWh	Res. Growth Rate (%)	Comm. Sector GWh	Comm. Growth Rate (%)	Ind. Sector GWh	Ind. Growth Rate (%)	Losses GWh	System Energy GWh	DSM Savings GWh	PHP mill GWh	NSPML Low GWh	Load Growth Rate (%)
2020	4,735	1.0	3,686	1.0	1,748	1.6	791	10,961	-1,356	0	9,605	
2021	4,776	0.9	3,724	1.0	1,767	1.1	799	11,065	-1,505	0	9,560	-0.5
2022	4,810	0.7	3,757	0.9	1,776	0.5	805	11,148	-1,649	0	9,499	-0.6
2023	4,855	0.9	3,790	0.9	1,784	0.5	811	11,241	-1,793	0	9,448	-0.5
2024	4,888	0.7	3,822	0.8	1,792	0.4	817	11,318	-1,938	0	9,380	-0.7
2025	4,907	0.4	3,852	0.8	1,799	0.4	821	11,379	-2,073	0	9,306	-0.8
2026	4,926	0.4	3,883	0.8	1,807	0.4	825	11,441	-2,203	0	9,237	-0.7
2027	4,945	0.4	3,913	0.8	1,815	0.4	830	11,502	-2,333	0	9,169	-0.7
2028	4,964	0.4	3,944	0.8	1,822	0.4	834	11,565	-2,468	0	9,096	-0.8
2029	4,983	0.4	3,976	0.8	1,830	0.4	839	11,627	-2,593	0	9,034	-0.7
2030	5,002	0.4	4,007	0.8	1,838	0.4	843	11,690	-2,713	0	8,977	-0.6
2031	5,021	0.4	4,039	0.8	1,846	0.4	848	11,754	-2,833	0	8,920	-0.6
2032	5,040	0.4	4,071	0.8	1,854	0.4	853	11,817	-2,958	0	8,859	-0.7
2033	5,059	0.4	4,103	0.8	1,861	0.4	857	11,881	-3,022	0	8,859	0.0
2034	5,079	0.4	4,136	0.8	1,869	0.4	862	11,946	-3,087	0	8,859	0.0
2035	5,098	0.4	4,169	0.8	1,877	0.4	866	12,011	-3,152	0	8,859	0.0
2036	5,118	0.4	4,202	0.8	1,885	0.4	871	12,076	-3,217	0	8,859	0.0
2037	5,137	0.4	4,235	0.8	1,893	0.4	876	12,142	-3,283	0	8,859	0.0
2038	5,157	0.4	4,269	0.8	1,901	0.4	881	12,208	-3,349	0	8,859	0.0
2039	5,177	0.4	4,303	0.8	1,910	0.4	885	12,274	-3,415	0	8,859	0.0
2040	5,196	0.4	4,337	0.8	1,918	0.4	890	12,341	-3,482	0	8,859	0.0

1 (b) The load forecast presented in the NS Power’s 10 Year System Outlook 2012-21 Report
2 was developed in January 2012 with the inputs available at the time including an
3 economic forecast from the Conference Board of Canada released Oct.31, 2011. The
4 NSPML forecast was created from the GRA Refresh forecast developed in July 2012
5 with updated inputs including an economics forecast released in April 19, 2012. The July
6 forecast also included updated DSM saving as provided in the April 18, 2012 filing of the
7 2013-2015 DSM plan by Efficiency Nova Scotia (ENSC). Although these are different
8 forecasts, both show a declining growth series. The GRA Refresh load has lower growth
9 rates due in part to a less optimistic economic outlook. The NSPML Low Load forecast
10 is calculated as the GRA fresh plus the Port Hawkesbury Paper mill load (1139 GWh/yr).

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1 The table below shows the annual growth rates for the forecast cited in the *10 Year*
 2 *System Outlook* report, the GRA Refresh forecast and the NSPML Low Load forecast.

3
 4 Please also refer to CA-49.

5

Year	10-Year Sys. Outlook		GRA Refresh		PHP Mill	NSPML Low Load	
	GWh	Growth (%)	GWh	Growth (%)	GWh	GWh	Growth (%)
2012	10,839		10,315				
2013	10,721	-1.1	9,862	-4.4	1,139	11,001	
2014	10,710	-0.1	9,831	-0.3	1,139	10,970	-0.3
2015	10,694	-0.1	9,784	-0.5	1,139	10,922	-0.4
2016	10,668	-0.2	9,745	-0.4	1,139	10,884	-0.4
2017	10,646	-0.2	9,714	-0.3	1,139	10,852	-0.3
2018	10,617	-0.3	9,663	-0.5	1,139	10,802	-0.5
2019	10,623	0.1	9,644	-0.2	1,139	10,783	-0.2
2020	10,624	0.0	9,605	-0.4	0	9,605	-10.9
2021	10,604	-0.2	9,560	-0.5	0	9,560	-0.5
2022	10,562	-0.4	9,499	-0.6	0	9,499	-0.6

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1 **Request IR-50:**

2

3 **With reference to Application, page 115, line 4, please provide a copy of the study by**
4 **Garrad Hassan.**

5

6 Response IR-50:

7

8 As referenced in Footnote 48 on page 115 of the Application, the study can be found at:

9 http://www.gl-garradhassan.com/assets/downloads/The_Limiting_Factors_for_Wind_Integration.pdf

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1 **Request IR-51:**

2
3 **With reference to Application, page 115, lines 9-11:**

4
5 (a) **Please provide all calculations, spreadsheets, reports, other work papers Strategist**
6 **inputs and outputs and any other materials related to evaluation or analysis**
7 **comparing additional interconnections to other jurisdictions, additional fast acting**
8 **generation, the development of energy storage, or some combination of the three to**
9 **support more wind beyond already committed levels for the Indigenous Wind**
10 **alternative. Identify, in particular, any consideration given to combinations of the**
11 **three methods.**

12
13 (b) **Please provide copies of NSPI Integrated Resource Plans or other planning studies**
14 **containing comparisons, evaluations or analyses of methods to back-up intermittent**
15 **resources including but not limited to additional interconnections to other**
16 **jurisdictions, additional fast-acting generation, the development of energy storage,**
17 **or some combination of methods and identify the relevant sections of the documents**
18 **provided.**

19
20 Response IR-51:

21
22 (a) Please refer to Appendix 6.02 of the Application.

23
24 (b) The Integrated Resource Plans are available under matter M00904 on the UARB's
25 website:

26
27 http://www.nsuarb.ca/index.php?option=com_content&task=view&id=73&Itemid=82

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1 **Request IR-52:**

2
3 **With reference to Application, page 115, lines 17-23; page 116, lines 1-4; page 120 lines 6-**
4 **15; page121 Figure 6-3:**

5
6 **(a) Please provide all calculations, spreadsheets, reports, other work papers Strategist**
7 **inputs and outputs and any other materials related to evaluation or analysis of the**
8 **need to curtail wind production during periods of low demand for electricity in**
9 **Nova Scotia including but not limited to calculations of the hourly profile of the**
10 **forecasted system load net of wind production.**

11
12 **(b) Please explain how the minimum steam generation requirement that was assumed**
13 **to require curtailment of intermittent resources was established for periods of low**
14 **demand for electricity in Nova Scotia through 2050 and include a tabulation of the**
15 **units assumed to be operating during period when wind curtailment was required.**

16
17 **(c) Please explain how the operation of hydro units including seasonal variations in**
18 **water flow was considered in the curtailment analyses.**

19
20 **(d) Please explain how the trade-off between shutting down a steam unit and buying**
21 **imports at market prices the next day vs. running the steam unit at minimum load**
22 **and selling excess wind energy during low load periods was evaluated using**
23 **Strategist or otherwise.**

24
25 **(e) Please provide a tabulation of the curtailment in MWh, if any, of intermittent**
26 **generators for on-peak and off-peak periods each month through 2050 including all**
27 **scenarios and sensitivity runs. If data are not available for on-peak and off-peak**
28 **periods each month, please provide most detailed data available. If on-peak data are**
29 **provided, please specify if on-peak is a 5 x 16 or 7 x 16 period.**

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1 **(f) Please provide for each intermittent generator through 2050 a tabulation of the**
2 **annual capacity factors those generators would have achieved if they had not been**
3 **curtailed.**

4
5 **(g) Please provide a tabulation of the hourly exports (or imports) on the**
6 **interconnections to adjoining balancing areas during the periods of curtailment**
7 **identified in response to items (a) and (b) above. If hourly data are not available,**
8 **please provide the most detailed data available, for example by month, on-peak and**
9 **off-peak.**

10
11 Response IR-52:

12
13 (a) Please refer to Synapse IR-2.

14
15 (b) The calculation of minimum steam generation that must be on line at all times is
16 represented as follows:

- 17
18 • Two Ligan units operating at minimum stable level of 60 MW each
19 • Point Aconi operating at minimum stable level of 110 MW
20 • Three other coal units operating at minimum stable level of 70 MW
21 • One of Tufts Cove steam units operating at 50 MW

22
23 The combination of units that make up the minimum steam generation on line can change
24 based on the discretion of system dispatchers who take in account forecasted morning
25 and evening peak loads, available hydro energy, available import energy, wind forecast
26 and any known issues with thermal fleet that may be present at the time and affecting unit
27 minimum stable operating levels.

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- 1 (c) In the curtailment analysis conducted by NSPI the occurrence of must run hydro was not
2 considered in the assessment as this would add to curtailment or potential spill, tending to
3 worsen the outlook for indigenous wind.
4
- 5 (d) This was not specifically analyzed in Strategist. Numerous assumptions enter into this
6 scenario including the availability of a firm transmission path for the coming day, unit
7 start-up costs, the potential for off peak wind sales and others. These types of
8 optimizations could be possible in real-time dispatch as opportunity presents.
9
- 10 (e-f) The requested analysis was not performed in preparing this Application. Please refer to
11 Synapse IR-2 for wind curtailment forecast calculations in 2020. Future wind curtailment
12 values may be estimated by using the data presented and changing load and wind scalar
13 values.
14
- 15 (g) Experience has shown that when NS Power has high wind energy generation during low
16 load periods and exports to NB/NE are desirable, NB/NE are also under high wind
17 energy generation conditions. Under these conditions interconnected utilities are not
18 likely to purchase any excess energy from NS Power or will do so at a depressed market
19 price. This problem becomes more severe with larger quantities of wind energy on the
20 interconnected system. For the purpose of the curtailment analysis, NS Power assumed
21 that no exports during low load periods will be available for large quantities of wind on
22 the system.

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1 **Request IR-53:**

2
3 **With reference to Application page 117, lines 1-4:**

4
5 **(a) Please explain constraints in the Moncton area, and how they limit the flow amount**
6 **of energy Nova Scotia could import.**

7
8 **(b) Please provide all documents, including work papers, that quantify the "significant**
9 **capital upgrades" for expanding transmission capability between Nova Scotia and**
10 **New Brunswick.**

11
12 **Response IR-53:**

13
14 (a) There are no generation sources in the Moncton area except for the non-dispatchable
15 99 MW wind farm at Kent Hills. Power feeding the Southeast New Brunswick (Moncton)
16 area is delivered by one 345 kV line from the Southwest (L-3004/L-3013) and one
17 345 kV line from the North (L-3017/L-3018). There are smaller capacity 138 kV lines
18 and a 230 kV line in parallel with the two 345 kV lines. In addition to the load in the
19 Moncton area, power exported from New Brunswick to Prince Edward Island and power
20 exported from New Brunswick to Nova Scotia flows through the lines from the
21 Southwest and the North. Loss of either L-3004/L-3013 or L-3018/L-3017 with high load
22 in the Moncton area, export to Prince Edward Island, and export to Nova Scotia would
23 result in overloaded 138 kV transmission lines and voltage collapse. To prevent this,
24 NBSO limits firm exports towards Nova Scotia to 20 MW in the summer and zero MW
25 in the winter. Non-firm exports are subject to sudden interruption by a Special Protection
26 System which trips the lines to Nova Scotia, resulting in shedding of Nova Scotia load
27 (firm and non-firm) via under frequency relays.

28
29 (b) Please see SBA IR-220 Confidential Attachment 1.

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1 **Request IR-54:**

2

3 **With reference to Application, page 117, lines 5-7:**

4

5 (a) **Why does an alternate import option to the Maritime Link Project need to offer**
6 **similar benefits?**

7

8 (b) **Why it is not appropriate to evaluate alternatives on the basis of minimizing the**
9 **NPV of revenue requirements for Nova Scotia customers?**

10

11 **Response IR-54:**

12

13 (a) The excerpt from the Application noted above states, “In order to adequately compare an
14 alternate import option to the Maritime Link Project, it needs to offer similar benefits,
15 including the combination of firm renewable energy and the opportunity to purchase
16 additional energy at market prices.” This sentence is intended to explain that the comparison
17 of alternatives can be considered robust when the comparison is made on an “apples to
18 apples” basis. To appropriately compare the costs of an alternative, one must also assess
19 the benefits of that option to make the comparison as robust as possible.

20

21 (b) Any alternative being considered must satisfy the load requirements, emissions,
22 renewable and other legislative requirements, and offer the lowest long term cost for
23 customers. Focusing solely on revenue requirement might, for example, allow
24 alternatives that would fail to meet the legislated environmental requirements. The
25 Maritime Link is the alternative that offers the lowest long-term cost and therefore the
26 lowest long-term revenue requirement for Nova Scotia customers.

NON-CONFIDENTIAL

1 **Request IR-55:**

2
3 **With reference to Application pages 117-135, and Appendix 6.06, pages 1-3:**

4
5 **(a) Please provide details regarding the difference between the “study period” and**
6 **“planning period” NPV cost figures for the three alternatives (Maritime Link,**
7 **Other Import, and Indigenous Wind).**

8
9 **(b) What is the assumed source and cost of RES-qualifying energy with the Maritime**
10 **Link after the expiration of the 35-year Nova Scotia Block?**

11
12 **(c) How is the capital cost for the 425 MW wind repowering in 2039 recovered in the**
13 **extended study period?**

14
15 **(d) How is the energy production from the repowered wind capacity credited in the**
16 **extended period?**

17
18 **(e) Please provide a table or spreadsheet breaking down the differences between study**
19 **period and planning period NPV costs for each alternative by type (capital and**
20 **operating) and by resource (e.g., 2035 250 MW CC capital recovery, 2039 425 MW**
21 **wind repower capital recovery, ML capital recovery, NB Link capital recovery,**
22 **energy purchases from New Brunswick, energy purchases from Nalcor, etc.)**

23
24 **Response IR-55:**

25
26 **(a) Please refer to SBA IR-30 (b).**

27
28 **(b) Import energy from Nalcor.**

Maritime Link Project (NSUARB ML-2013-01)
NSPML Responses to Consumer Advocate/Small Business Advocate Information Requests

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- 1 (c-d) Please refer to SBA IR-30 (b).
- 2
- 3 (e) Please refer to Synapse IR-11.

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1 **Request IR-56:**

2

3 **With reference to Application pages 117-135:**

4

5 (a) **Was any consideration given to a hybrid alternative combining a lower capacity**
6 **transmission link upgrade with New Brunswick and a smaller amount of**
7 **incremental indigenous wind capacity designed to achieve the same RES and**
8 **emission reduction goals?**

9

10 (b) **If not, why not?**

11

12 Response IR-56:

13

14 Please refer to SBA IR-70.

NON-CONFIDENTIAL

1 **Request IR-57:**

2

3 **With reference to Application, pages 117-135:**

4

5 (a) **Was any consideration given to a hybrid alternative combining a lower capacity**
6 **transmission link upgrade with smaller enhancements at both the HQ-NB and NB-**
7 **NS interconnections to achieve the same RES and emission reduction goals?**

8

9 (b) **If not, why not?**

10

11 Response IR-57:

12

13 Please refer to SBA IR-70

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1 **Request IR-58:**

2

3 **With reference to Application, pages 117-135, please have Ventyx run a “sensitivity case”**
4 **against the base load and market price forecast scenarios for each of the three alternative**
5 **resource plans in which the RES requirement of 40% of energy from renewable resources**
6 **in 2020 is relaxed to rise 1% per year from 25% in 2020 to 35% by 2035.**

7

8 Response IR-58:

9

10 NSPML did not conduct this analysis for the purpose of the Application, and is unable to
11 undertake new Strategist analysis as part of the prehearing disclosure process.

NON-CONFIDENTIAL

1 **Request IR-59:**

2

3 **With reference to Application page 117, lines 12-14:**

4

5 (a) **Were the base coal price forecasts, the low, base and high natural gas price**
6 **forecasts for delivery to Tuft's Cove (TUC), and the Heavy Fuel Oil (HFO) and**
7 **Light Fuel Oil (LFO) price forecasts referenced as prepared by the NSPI Fuels**
8 **Group in the July 2012 and July/August 2012 updates presented in Appendix 6.04**
9 **utilized in the alternatives analysis conducted by Ventyx?**

10

11 (b) **If not, please provide the fuel price forecasts that were utilized in the Ventyx**
12 **alternatives analysis.**

13

14 (c) **If yes, please provide any documentation that describes the fuel related**
15 **assumptions and methodology utilized by Ventyx in the alternatives analysis.**

16

17 **Response IR-59:**

18

19 (a) **Yes.**

20

21 (b-c) **Please refer to Liberty IR-1 and Liberty IR-5.**

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1 **Request IR-60:**

2

3 **With reference to Application, page 117, lines 18-19:**

4

5 (a) **What is meant by evaluation of "comparable alternatives" with Strategist?**

6

7 (b) **Please explain the extent to which Strategist, as an optimization model, allows for**
8 **optimization of the least cost portfolio of resources that meet the modeled**
9 **requirements, allowing the individual resource option components to have**
10 **technology, location, timing, energy delivery profile, delivery period, firmness, and**
11 **other differences.**

12

13 **Response IR-60:**

14

15 (a) Alternatives compared in Strategist are evaluated based on the net present value of their
16 costs.

17

18 (b) Please refer to Synapse IR-14 and SBA IR-23.

NON-CONFIDENTIAL

1 **Request IR-61:**

2

3 **With reference to Application, page 118, lines 3-11:**

4

5 (a) **What is different between the Planning Period and the Study Period in the**
6 **operation of the Strategist model?**

7

8 (b) **Do you agree that the Study period does not allow for optimization of resource**
9 **capacity decisions -- only replacing any worn out assets with the same technology?**

10

11 (c) **Please explain why it is appropriate to model the Maritime Link Project for**
12 **35 years while the Strategist Planning Period is only 25 or 26 years (2015-2040), and**
13 **begins at least two years before the commercial operation date of the Maritime**
14 **Link Project.**

15

16 **Response IR-61:**

17

18 (a) The planning period is the number of years where combinations of resource options are
19 analysed. The study period is the planning period plus the end effects. The end effects
20 period is used to evaluate the differences between resource plans beyond the planning
21 period.

22

23 (b-c) Please refer to CA/SBA IR-30.

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1 **Request IR-62:**

2

3 **With reference to Application, page 118, lines 4-5:**

4

5 (a) **Please explain whether the user has any choice in the length of the Planning Period**
6 **in Strategist. Is it hardwired to only allow 25 years?**

7

8 (b) **What were the first and last months (mm/yyyy) of the Planning Period analyzed?**

9

10 Response IR-62:

11

12 (a) The user can choose the length of the planning period up to the maximum number of
13 years in the user's specific build of the program.

14

15 (b) Start date 01/2015

16 End date 12/2040

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1 **Request IR-63:**

2

3 **With reference to Application, page 118, lines 5-9:**

4

5 (a) **What were the first and last months (mm/yyyy) of the Study Period analyzed?**

6

7 (b) **Does the Strategist model include amortized capital costs over only the portion of**
8 **useful life that lies within the Study Period in the NPV?**

9

10 (c) **If yes, was real levelized, nominal levelized, or some other type of amortization**
11 **applied? If no, please explain why no end effect bias results from not crediting**
12 **residual asset values at the end of the Study Period.**

13

14 Response IR-63:

15

16 (a) Please refer to SBA IR-231 (c).

17

18 (b-c) Please refer to SBA IR-30 (b).

NON-CONFIDENTIAL

1 **Request IR-64:**

2

3 **With reference to Application, page 118, lines 12-13:**

4

5 (a) **Please provide all of the input assumptions for modeling the Nova Scotia system**
6 **from 2015 to 2040 that were provided by NSPI to Ventyx in the electronic form(s) as**
7 **provided to Ventyx.**

8

9 (b) **For any input assumptions provided by NSPI to Ventyx that were only transferred**
10 **within Strategist input data files, please provide those data in the form of Excel files**
11 **with clear labels of variables and units of measure.**

12

13 (c) **Provide all input assumptions that Ventyx revised from those provided by NSPI.**

14

15 (d) **Provide all additional model input assumptions that were used by Ventyx in order**
16 **to formulate complete model cases.**

17

18 **Response IR-64:**

19

20 (a-b) **Input assumptions were provided to Ventyx within Strategist files. Please refer to**
21 **Synapse IR-14 and UARB-McMaster IR-4.**

22

23 (c) **Ventyx did not revise any input assumptions.**

24

25 (d) **Please refer to part (a).**

NON-CONFIDENTIAL

1 **Request IR-65:**

2

3 **With reference to Application, page 118, line 24 to page 119, line 1:**

4

5 (a) **Please describe the process of finalizing the input assumptions.**

6

7 (b) **Was finalization of input assumptions, through additional or revised assumptions**
8 **performed by Ventyx based solely on its judgment, solely by NSPI, or jointly?**

9

10 (c) **Were any model runs performed before finalization of all input assumptions?**

11

12 (d) **What input assumptions were revised between the initial transfer of input**
13 **assumptions from NSPI to Ventyx and their finalization?**

14

15 **Response IR-65:**

16

17 (a) The finalized input assumptions were reviewed and approved by NSPML.

18

19 (b) Please refer to SBA-64 (c).

20

21 (c-d) The modelling work requires an iterative approach as assumptions are clarified and
22 completed, gaps are identified and corrections made. The final model results reflect the
23 final assumptions on which the Alternatives Analysis is based.

NON-CONFIDENTIAL

1 **Request IR-66:**

2
3 **With reference to Application, page 119 lines 1-3. Please fully describe the mathematical**
4 **method for how the following constraints were modeled with Strategist, given that some**
5 **pertain to resource expansion (retirement) decisions and others to hourly, seasonal, and**
6 **annual operational decisions:**

7
8 (a) **CO₂ emissions caps, with separate discussion of constraints for the years with**
9 **annual caps and those years with cumulative caps.**

10
11 (b) **SO₂ emissions caps**

12
13 (c) **NO_x emissions caps**

14
15 (d) **Hg emissions caps**

16
17 (e) **Planning reserve requirements, with discussion of whether the requirements were**
18 **endogenous to account for changes in the regional supply portfolio by type of**
19 **generation or imports.**

20
21 (f) **Energy requirements, with discussion of the individual time blocks modeled, and**
22 **whether the modeling within each block used a load duration curve or chronological**
23 **loads.**

24
25 (g) **Capacity requirements, with discussion of the individual time blocks modeled.**

NON-CONFIDENTIAL

1 Response IR-66:

2

3 (a-d) Strategist has the ability to solve for annual hard emissions caps. It cannot model multi-
4 year cumulative emission constraints. Strategist requires multiple passes through dispatch
5 and resource optimization modules in order to find an optimal solution while meeting all
6 emissions caps.

7

8 (e) Planning reserve requirements are met either by resources in Nova Scotia capable of
9 providing reserve or purchase power agreements. Each alternative resource provided to
10 Strategist has a component defining its capacity contribution to planning reserve.

11

12 (f-g) Strategist is a load duration curve based system dispatch model. Strategist is capable of
13 sub period dispatch modeling on-peak, off-peak and weekend sub periods. Strategist
14 provides a solution in which system load requirements are met by providing energy from
15 available resources, as well as ensuring sufficient capacity is available to serve peak load.

CONFIDENTIAL (Attachment only)

1 **Request IR-67:**

2
3 **With reference to Application, page 120:**

4
5 **(a) What is the current total installed capacity of wind generation in Nova Scotia?**

6
7 **(b) For each existing wind generation project, please provide the monthly and annual net energy production over the period, January 2009 through end of year 2012. For projects that have not been in commercial operation since the beginning of 2009, provide like data for the maximum number of months in operation over the last three years.**

8
9
10
11
12
13 **(c) What is the planned and committed capacity of wind generation in Nova Scotia that will start commercial operation between January 2013 and December 2016 (or other end date prior to the stated incremental wind capacity of 425 MW needed by 2020)?**

14
15
16
17 **(d) For each planned or committed wind project for the 2013 to 2016 period, please provide a net capacity factor table of hour by month (24 x 12), and indicate the source of the data (e.g., site level meteorological study).**

18
19
20
21 **(e) Please provide the base case load forecast and calculations NSPML used to quantify the 425 MW of incremental wind capacity needed to achieve the RES requirement in 2020 and the additional 150 MW of incremental wind capacity needed to achieve the RES requirement in 2040 for the base load forecast.**

22
23
24
25
26 **(f) Did NSPML consider different amounts of wind generation capacity needed to meet the 2020 and beyond RES requirements under the low load forecast case? If no, why not? If yes, please provide work papers supporting these calculations.**

NON-CONFIDENTIAL

1 Response IR-67:

2

3 (a) Please refer to CanWEA IR-001 (a).

4

5 (b) Please refer to Confidential Attachment 1.

6

7 (c) Please refer to CanWEA IR-1 (a) for installed wind generation.

8

9 In addition to installed wind generation NSPI is legislated to provide interconnection to
10 100 MW of Community Feed in Tariff (COMFIT) energy, scheduled as follows:

11

- 12 • 2014 17 MW @ 34% CF = 50 GWh
- 13 • 2015 33 MW @ 34% CF = 100 GWh
- 14 • 2016 50 MW @ 34% CF = 150 GWh
- 15 • 2017 75 MW @ 34% CF = 225 GWh
- 16 • 2018 100 MW @ 34% CF = 300 GWh

17

18 In addition to COMFIT energy, the two wind projects:

19

- 20 • South Canoe at 102 MW, 43 GWh
- 21 • Sable wind at 13.8 MW, 310 GWh

22

23 scheduled to connect in 2015.

24

25 (d) The data requested is not available.

26

27 (e-f) Please refer to SBA IR-48 (a).

CA/SBA IR-67 Attachment 1 has been removed due to confidentiality.

NON-CONFIDENTIAL

1 **Request IR-68:**

2
3 **With reference to Application, page 120, lines 6-15:**

4
5 **(a) Did Ventyx assist NSPI with Strategist modeling in estimating that 425 MW of**
6 **incremental wind capacity would be needed by 2020 and another 150 MW by 2040?**

7
8 **(b) Did Ventyx assist NSPI with Strategist modeling in determining the periods when**
9 **wind is producing more energy than is required by NSP's customers?**

10
11 **(c) Please provide a description of the method used to calculate wind curtailment by**
12 **hour over the 2017 to 2040 period for the base load forecast case and the low load**
13 **forecast case. Provide all work papers.**

14
15 **(d) Provide an Excel file table in day by hour format of potential and curtailed wind**
16 **generation for the 2017 to 2040 period for the base load forecast case. Provide a like**
17 **Excel file table for the low load forecast case.**

18
19 **(e) Please identify all changes in the resource mix in Nova Scotia over the planning**
20 **horizon that affect the curtailment of wind generation by season and/or time of day**
21 **for the base load forecast case and the low load forecast case.**

22
23 **Response IR-68:**

24
25 **(a) No.**

26
27 **(b) No. This was modeled outside of Strategist. Please refer to Synapse IR-2 (a).**

28
29 **(c-e) Please refer to Synapse IR-2 (a).**

NON-CONFIDENTIAL

1 **Request IR-69:**

2
3 **With reference to Application, page 120 lines 7-10:**

4
5 **(a) Please explain why the alternative of assuming that excess generation from wind**
6 **resources was not modeled as off-system sales.**

7
8 **(b) Are there any reasons why Emera, or, another marketer, could not sell the excess**
9 **generation from wind as renewable energy into ISO-NE (directly or via a marketer),**
10 **and thereby receive revenues from renewable energy credits available from any of**
11 **the New England states, excluding Vermont?**

12
13 **(c) What transmission limitations exist, if any, between Nova Scotia and New**
14 **Brunswick that preclude the delivery of renewable energy into ISO-NE?**

15
16 **(d) Is the Strategist model capable of optimizing hourly dispatch of generation units? If**
17 **no, is this limitation related to Strategist's load duration curve method for**
18 **balancing load and generation? If yes, did the Strategist cases for the Indigenous**
19 **Wind alternative simulate different commitment and dispatch patterns in order to**
20 **minimize wind generation curtailment?**

21
22 **Response IR-69:**

23
24 **(a) Please refer to NSUARB IR-52.**

25
26 **(b) No, provided there is demand and transmission is available. To receive Renewable**
27 **Energy Credit (REC) revenue, a project would have to qualify with each state in which it**
28 **wishes to sell the RECs.**

NON-CONFIDENTIAL

- 1 (c) There is no yearly firm transmission available from NS Power to ISO-NE
2 (MEPCO). The renewable energy would therefore be principally reliant on non-firm
3 transmission and potentially subject to curtailment.
4
- 5 (d) Strategist is primarily a long term resource optimization planning tool and as such it is
6 not a chronological hourly dispatch model, but a load duration curve dispatch model.
7 Without being able to consider chronological operating constraints issues such as
8 minimum steam generation commitment, Strategist is unable to model wind curtailment.
9 Wind curtailment was modeled outside of Strategist by taking the load-net-wind shape
10 and contrasting it to the minimum steam generation to identify periods where either
11 exports or wind curtailment would be necessary. Minimum steam generation
12 commitment constraint cannot be violated by any combination of dispatch and unit
13 commitment patterns.

NON-CONFIDENTIAL

1 **Request IR-70:**

2
3 **With reference to Application, pages 120-126, Sections 6.3.2 and 6.3.3, (the alternatives to**
4 **the Maritime Link Project analyzed by Ventyx included indigenous wind and other**
5 **imports as separate alternatives such that each alternative would individually provide the**
6 **equivalent of the entire amount of the long-term energy requirements that NSPI would**
7 **obtain from the project as the basis for analysis.**

8
9 (a) **Why was the potential for a hybrid mix of technologies including wind, other**
10 **imports, tidal power, and energy storage technologies backed by fast-start gas fired**
11 **generation not considered as an alternative to the Project in the analysis?**

12
13 (b) **In NSPML's opinion, would the Ventyx analysis be more informed and therefore**
14 **useful if a hybrid mix of technologies offering Nova Scotia the greatest**
15 **environmental, economic and/or reliability benefits been tested in Strategist? If no,**
16 **why not?**

17
18 **Response IR-70:**

19
20 (a-b) A mix of technologies was considered in the Alternatives analysis. Today the NS
21 electricity system includes a variety of technologies to generate electricity. Generation
22 sources include solid fuel, oil, natural gas, hydro, tidal and wind. Under all three
23 Alternatives presented, in the future Nova Scotia will continue to generate electricity
24 from a variety of sources. Please refer to EAC IR-32 Attachment 1 for the GWh
25 production by resource in each of the three Alternatives.

26
27 A variety of options were considered by NSPML to meet Federal and Provincial
28 environmental regulations for 2017 and beyond. As indicated in the Application many
29 options were considered, alone and in combination, before the three alternatives, the

1 “Maritime Link”, “Indigenous Wind” and “Other Import” were modeled and presented in
2 the Application.

3
4 On an annual basis NS Power reviews the NS transmission system, including the transfer
5 capacity between NS and NB. In addition, other studies have reviewed the need for
6 additional transfer capacity between the two provinces, including a study commissioned
7 jointly by NS Power and NB Power (please see CA/SBA IR-220 Attachment). In each
8 case, without building the Maritime Link, it has been concluded a second 345 kv tie to
9 NB is required be built to increase that capacity. On July 21, 2010 the NSUARB sent a
10 letter to NS Power supporting the 345 kv project and approving a capital amount to
11 purchase the necessary rights of way to widen the corridor to allow for such an
12 expansion.

13
14 A second 345 kV interconnection has the ability to carry at least 500 MW of capacity.
15 The second 345 kv tie brings with it capacity beyond the firm capacity needed to meet
16 Federal and Provincial environmental regulations. Similar to the Maritime Link, it has
17 the advantage of allowing the purchase of economy energy. Screening determined that
18 the economy energy purchased in the Maritimes and New England market via a second
19 345 kv tie to New Brunswick is more cost competitive than a purchase or build of
20 indigenous wind in Nova Scotia. In other words, given the choice for economy energy
21 the model would not choose wind if economy energy from NB and New England was
22 available. Therefore NSPML determined that the “Other Import” Alternative, that being
23 a strengthened tie to NB plus the ability to purchase energy in the NB and New England
24 market, would be a logical alternative model.

PARTIALLY CONFIDENTIAL (Attachment Only)

1 **Request IR-71:**

2
3 **With reference to Application, page 121, Figure 6-3:**

- 4
- 5 (a) **Please provide a table or spreadsheet identifying the diurnal and seasonal wind**
6 **energy production profile for wind generation plants in Nova Scotia incorporated in**
7 **Strategist.**
- 8
- 9 (b) **Please provide a table or spreadsheet identifying the level of curtailment of wind**
10 **generation for each year of the planning and study periods.**
- 11
- 12 (c) **Please clarify whether annual costs for the 425 MW wind facility are modeled at**
13 **\$80/MWh for delivered energy each year over a 20 year life or as a fixed and**
14 **variable revenue requirement stream using the \$988/kW capital cost, the specified**
15 **financial structure, and the specified variable and fixed O&M costs.**
- 16
- 17 (d) **Please specify the CCA Schedule applied to wind generators in deriving the**
18 **\$988/kW capital cost.**
- 19
- 20 (e) **Please explain why the commercial operation date was modeled as Jan. 1, 2019 if the**
21 **increase to 40% renewable electricity standard does not occur until 2020.**
- 22
- 23 (f) **Why did the model not allow for a range of dates when blocks of new wind capacity**
24 **could be added before 2020?**
- 25
- 26 (g) **What years were allowed for the commercial operation dates of the three 50 MW**
27 **blocks of wind capacity added between 2020 and 2040? Was Strategist free to**
28 **exercise discretion in order to select any years within that range?**
-

NON-CONFIDENTIAL

- 1 **(h) Provide all documents and work papers that support the use of a levelized cost of**
2 **\$80/MWh for new wind farm capacity.**
3
- 4 **(i) Provide all documents and work papers that support the assumption of 80% of**
5 **original project cost for redevelopment cost.**
6
- 7 **(j) Did the model assume that the wind to generation conversion efficiency will be**
8 **higher after redevelopment as a result of technical progress over 20 years? If so,**
9 **provide the capacity factor assumptions for the redeveloped project.**
10
- 11 **(k) Please define the terms "Base Load" and "Low Load" used for the different**
12 **capacity factor assumptions.**
13
- 14 **(l) Did the Strategist modeling assume these capacity factors for each year of operation**
15 **or allow the amount of curtailment to differ as load and other generation changes**
16 **over time?**
17
- 18 **(m) Did the Strategist modeling forecast different hour by month profiles of net**
19 **generation capacity by year?**
20
- 21 **(n) Did the Strategist modeling dynamically treat wind generation dispatch as a fixed**
22 **hourly and monthly pattern net of curtailment, or treat wind generation as**
23 **dispatchable (curtailable) to prevent dump power?**
24
- 25 **(o) What are the corresponding unadjusted (for curtailment) annual capacity factors**
26 **or incremental wind added to the resource mix over the planning horizon?**
27

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1 **(p) Please provide a complete explanation, including support work papers, memoranda,**
2 **or email, supporting the derivation of the 35% and 32% capacity factors for Base**
3 **Load wind generation, and 30% for Low Load.**

4
5 **(q) How did Ventyx transform the 80% factor used to represent redevelopment costs as**
6 **percentage of original project cost into capital cost, variable O&M cost, and fixed**
7 **O&M cost model inputs?**

8
9 **(r) What are the components of the wind turbine generator that will require**
10 **replacement at the end of the expected useful life?**

11
12 **(s) Does NSPML agree with the statement that the actual redevelopment cost at the end**
13 **of the expected useful life has the potential to be significantly lower than 80% based**
14 **on continued technology progress over time, manufacturing economies in North**
15 **America, and labor efficiency improvements? If not, provide a complete explanation**
16 **why you do not agree with this statement.**

17
18 **(t) Was the annual RES requirement from the renewable electricity resources grossed**
19 **up for distribution losses? If so, what distribution loss factor was applied for each**
20 **year?**

21
22 Response IR-71:

23
24 **(a) Please refer to Partially Confidential Attachment 1 for seasonal wind data.**

25
26 **(b) Please refer to Synapse IR-2 for wind curtailment data.**

27
28 A wind curtailment analysis for all years in the planning period was not performed in
29 preparing for this Application. Wind curtailment is a significant issue at high wind

NON-CONFIDENTIAL

- 1 penetration levels which would be necessary to meet RES requirements in 2020 and
2 beyond.
- 3
- 4 (c) The \$988M represent the total capital cost for the 425 MW Wind Farm. Please refer to
5 Synapse IR-1 Attachment 1 for the financial structure assumptions.
- 6
- 7 (d) 100 percent of the capital is assumed to have a 50 percent CCA rate. The model assumes
8 that tax losses generated are used in the whole NS Power entity.
- 9
- 10 (e) In order to ensure that the regulations can be met in 2020, adequate time is required to get
11 the wind farm on-line and operating reliably.
- 12
- 13 (f) Incremental wind generation is not required before 2020 for RES compliance.
- 14
- 15 (g) The incremental 50 MW blocks of wind were modeled outside of Strategist. Please refer
16 to SBA IR-48 Attachments 1 and 2.
- 17
- 18 (h) Please refer to Synapse IR-14 (i).
- 19
- 20 (i) Please refer to CanWEA IR-19 (l).
- 21
- 22 (j) No, similar to other technology the price of future wind turbines will likely be influenced
23 more by supply and demand principles, which we did not attempt to model.
- 24
- 25 (k) Please refer to Appendix 6.03, page 6 of the Application.
- 26
- 27 (l) The Strategist modeling assumed the capacity factors for incremental wind given in
28 Figure 6-3 on page 121 of the Application were the same in all years of the study.
- 29

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- 1 (m) Yes.
2
- 3 (n) Yes, the Strategist modeling assumed the wind generation as a fixed transaction net of
4 curtailment.
5
- 6 (o) Please refer to Synapse IR-2 Attachment 1 for unadjusted (for curtailment) wind profile
7 capacity factor.
8
- 9 (p) Please refer to Synapse IR-2 Attachments 1 and 2.
10
- 11 (q) The capital cost in the year of expenditure was decreased by 80 percent.
12
- 13 (r) The whole machine is replaced less components noted in the 20 percent economy of
14 redevelopment. Please refer to NSUARB IR-55 Attachment 1.
15
- 16 (s) It may be lower or higher than 80 percent. NSPML considers market supply and demand
17 will influence the future price of redevelopment regardless of what potential
18 improvements may emerge. It is possible that the market price for wind turbines being
19 modeled in the alternatives analysis is at a market low and these price assumptions may
20 not be attainable.
21
- 22 (t) The annual RES requirement is calculated as a percentage of NS Power energy sales.
23 Energy sales are based on the net system requirement less system losses which are
24 estimated at 7 percent (this includes distribution losses).
25
- 26 The energy from an RES compliant renewable resource is based on the output that would
27 be measured at the facility meter.

SBA IR-071 Att 1

Monthly Wind Generation

GWh	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NSP-WIND												
Pubnico												
Lingan												
Glace Bay 1B												
Donkin (Glace Bay Power)												
Tiverton												
Springhill												
Higgins Mountain												
Goodwood												
Brookfield												
Fitzpatrick Mountain												
Point Tupper 1												
Digby												
Tatamagouche												
Amherst												
Dalhousie Mountain												
Glen Dhu North												
Maryvale												
Point Tupper 3												
Watts Section												
Fairmont												
Granville Ferry												
Creignish rear												
Irish Mountain												
South Cape Mabou												
Spiddle Hill												
Cape North												
Donkin												
COMFIT												
S-CANOE												
SABLE												
Total Common to all Plans:	148	142	172	144	129	98	96	90	107	161	167	171

Incremental Wind - Indigenous Wind Base Load Case

425 MW Incremental Wind 2019	124	136	133	93	85	88	88	54	100	117	133	152
50 MW Incremental Wind 2028	13	15	14	10	9	9	9	6	11	13	14	16
50 MW Incremental Wind 2034	13	15	14	10	9	9	9	6	11	13	14	16
50 MW Incremental Wind 2037	13	15	14	10	9	9	9	6	11	13	14	16
Total	164	181	176	123	112	117	116	71	133	155	176	202

Incremental Wind - Indigenous Wind Low Load Case

250 MW Incremental Wind 2019	63	69	67	47	43	44	44	27	51	59	67	77
------------------------------	----	----	----	----	----	----	----	----	----	----	----	----

NON-CONFIDENTIAL

1 **Request IR-72:**

2

3 **With reference to Application, page 121, Figure 6-4:**

4

5 (a) **Please identify the sources of data and all calculations, spreadsheets, reports, other**
6 **work papers and any other materials used to prepare the graph of wind integration**
7 **capital costs.**

8

9 (b) **Please provide an Excel file with the data values shown in the graph of wind**
10 **integration capital costs.**

11

12 (c) **Does "Installed Wind Capacity" in the graph refer to total (existing plus new) wind**
13 **capacity or only incremental wind capacity after 2016?**

14

15 (d) **If the horizontal axis refers to total wind capacity, why does the scale end at 890**
16 **MW while total installed wind capacity is assumed to be 960 MW by 2020 and 1,110**
17 **MW by 2040 (p. 120, lines 13-15)?**

18

19 **Response IR-72:**

20

21 (a-b) **Please refer to Synapse IR-18 and related attachments.**

22

23 (c) **"Installed Wind Capacity" refers to total nameplate.**

24

25 (d) **The graph was intended to provide an estimate of capital investments across the range of**
26 **possible wind additions and the horizontal axis could have been better drawn to 960 MW.**

NON-CONFIDENTIAL

1 **Request IR-73:**

2

3 **With reference to Application, page 122, lines 9-10, please explain whether the Strategist**
4 **modeling of new gas-fired peaker and combined cycle resources addressed the planning**
5 **reserves requirement.**

6

7 Response IR-73:

8

9 Yes, the natural gas combustion turbines and combined cycle units were modeled with firm
10 capacity that could be counted towards the planning reserve requirement.

NON-CONFIDENTIAL

1 **Request IR-74:**

2
3 **With reference to Application, page 123, lines 5-7:**

4
5 **(a) What gas infrastructure facility improvements would be necessary to integrate 425**
6 **MW of wind generation in Nova Scotia to ensure system stability?**

7
8 **(b) How much quick-start combustion turbine generation capacity and / or combined**
9 **cycle gas-fired generation capacity would be required to integrate 425 MW of wind**
10 **generation in Nova Scotia to ensure system stability? Provide capacities for each**
11 **technology type.**

12
13 **(c) Would the addition of quick start gas fired generation provide Nova Scotia with**
14 **additional resource adequacy benefits above and beyond the provision of an**
15 **operational hedge against intermittent generation? If no, why not?**

16
17 **(d) If your answer to sub-part (c) is yes, has Ventyx quantified the potential value**
18 **associated with resource adequacy benefits, including environmental emissions**
19 **benefits? If yes, please provide the results of this calculation.**

20
21 **Response IR-74:**

22
23 **(a) Please refer to Synapse IR-19(a).**

24
25 **(b) Please refer to Synapse IR-18 and related Attachments.**

26
27 **(c) Yes.**

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1 (d) Strategist does not model the discrete requirements for generation addition to serve wind
2 integration. Within the Strategist model runs for the wind alternative, new gas generation
3 was added to the power system through the planning period to solve for system
4 requirements against the air emission framework. Strategist will account for the costs and
5 benefits of this new generation.

6
7 Natural gas generating stations were selected by Strategist for dispatch and reserve
8 purposes, any generator added can provide generation in a given hour or it can be counted
9 for reserve to back-up wind, but it cannot do both at the same time. In the Indigenous
10 Wind alternative the natural gas plants by 2031 are providing 36 percent of the total
11 electricity in NS.

NON-CONFIDENTIAL

1 **Request IR-75:**

2
3 **With reference to Application, page 123, lines 8-9:**

4
5 (a) **Please provide all calculations, spreadsheets, reports, other work papers Strategist**
6 **inputs and outputs and any other materials related to the “Indigenous Wind”**
7 **alternative run or runs without any integration costs added including all scenarios**
8 **and sensitivity runs.**

9
10 (b) **Please confirm that the “Indigenous Wind” alternative run or runs without any**
11 **integration costs added included sufficient resources in each year to meet the**
12 **reserve requirements or explain and quantify the extent to which the reserve**
13 **requirements were not met in each year of the study.**

14
15 (c) **Please confirm that the “Indigenous Wind” alternative run or runs without any**
16 **integration costs added included sufficient resources in each year to meet the needs**
17 **for two shifting or fast acting generation or explain and quantify the extent to which**
18 **the needs for two shifting or fast acting generation were not met in each year of the**
19 **study.**

20
21 (d) **Please provide a tabulation of the curtailment in MWh, if any, of intermittent**
22 **generators in the “Indigenous Wind” alternative run or runs without any**
23 **integration costs added for on-peak and off-peak periods each month through 2050**
24 **including all scenarios and sensitivity runs. If data are not available for on-peak and**
25 **off-peak periods each month, please provide most detailed data available. If on-peak**
26 **data are provided, please specify if on-peak is a 5 x 16 or 7 x 16 period.**

27
28 (e) **Please provide the annual detailed results for the Indigenous Wind runs for the**
29 **cases with and without integration costs.**

NON-CONFIDENTIAL

1 Response IR-75:

2

3 (a) Please refer to Synapse IR-11 part (a) and CanWEA IR-20.

4

5 (b) Confirmed.

6

7 (c) We cannot confirm this without further study, which was not necessary as Indigenous
8 Wind was not the lowest long term cost alternative. Strategist is not able to determine the
9 operational requirements for back-up of intermittent resources. Please refer to SBA IR-
10 48 parts (b) and (c).

11

12 (d) Please refer to Synapse IR-2.

13

14 (e) Please refer to Attachment 1 and Synapse IR-11.

Indigenous Wind (Base Load) Comparison of Capital Costs With and Without Integration Costs**Capital Costs:**

Year	Indigenous Wind No Integration Costs (k\$)	Indigenous Wind With Integration Costs (k\$)	Annual Cost of Wind Integration (k\$)
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	60,957	137,315	76,358
2020	1,451	64,285	62,834
2021	68,682	131,907	63,225
2022	103,071	166,528	63,457
2023	119,661	183,203	63,542
2024	126,603	190,096	63,493
2025	128,316	191,635	63,320
2026	173,011	236,043	63,032
2027	169,525	232,164	62,639
2028	172,941	235,091	62,150
2029	159,849	221,421	61,572
2030	193,567	254,479	60,912
2031	192,721	252,898	60,178
2032	189,310	248,683	59,373
2033	184,508	243,014	58,506
2034	187,665	245,244	57,579
2035	227,084	283,683	56,599
2036	230,531	286,101	55,570
2037	237,921	292,415	54,494
2038	223,248	276,625	53,377
2039	259,044	311,265	52,221
2040	191,376	242,405	51,029
	1,333,228	1,922,137	588,909

Indigenous Wind (Low Load) Comparison of Capital Costs With and Without Integration Costs**Capital Costs:**

Year	Indigenous Wind No Integration Costs (k\$)	Indigenous Wind With Integration Costs (k\$)	Annual Cost of Wind Integration (k\$)
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	36,578	80,003	43,425
2020	1,563	37,297	35,734
2021	41,218	77,174	35,956
2022	61,523	97,612	36,088
2023	71,342	107,479	36,137
2024	75,476	111,585	36,109
2025	76,530	112,540	36,010
2026	75,913	111,760	35,846
2027	74,392	110,015	35,623
2028	72,380	107,725	35,345
2029	70,102	105,118	35,016
2030	117,274	151,915	34,641
2031	113,876	148,099	34,223
2032	110,436	144,202	33,766
2033	106,973	140,245	33,272
2034	103,498	136,243	32,746
2035	154,770	186,958	32,188
2036	150,294	181,896	31,603
2037	145,815	176,806	30,991
2038	141,335	171,690	30,356
2039	132,625	162,323	29,698
2040	89,131	118,152	29,021
	743,928	1,078,842	334,914

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1 **Request IR-76:**

2

3 **With reference to Application, page 123, lines 14-15, please provide the present value for**
4 **the “Indigenous Wind” alternative without any integration costs on the same basis as the**
5 **values shown in Figure 6-6 on page 128 of the application.**

6

7 Response IR-76:

8

9 Please refer to the Application, page 128, lines 3-4.

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1 **Request IR-77:**

2
3 **With reference to Application, page 123, lines 18-22:**

4
5 (a) **Please provide the dollar value of the mid-point of the range of the capital costs for**
6 **investment in transmission upgrades and deployment of energy storage and load**
7 **shifting programs used to estimate the integration costs required that was used in**
8 **subsequent analysis of the “Indigenous Wind” alternative.**

9
10 (b) **Please identify the sources of data and all calculations, spreadsheets, reports, other**
11 **work papers Strategist inputs and outputs and any other materials that document**
12 **the basis for the dollar value reported in response to item a above.**

13
14 (c) **Please quantify how much the investment in transmission upgrades and deployment**
15 **of energy storage and load shifting programs reduces the need for curtailment of**
16 **wind and other intermittent generators.**

17
18 (d) **Please explain and quantify the differences in curtailment of wind generation**
19 **between the “Indigenous Wind” alternative run or runs without any integration**
20 **costs added and the subsequent analysis of the “Indigenous Wind” alternative**
21 **including all scenarios and sensitivity runs.**

22
23 (e) **Please explain and quantify any other benefits to NSPI between the attributable to**
24 **the integration costs that were included in the subsequent analysis of the**
25 **“Indigenous Wind” alternative including all scenarios and sensitivity runs.**

26
27 **Response IR-77:**

28
29 (a) **Please refer to Synapse IR-18 Attachment 2.**

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- 1 (b) The estimates are based on NS Power derived values.
2
- 3 (c-d) NS Power has not quantified the impact of these projects on the forecasted curtailment of
4 wind generation.
5
- 6 (e) Emission and fuel cost considerations related to the addition of gas fired generation in the
7 Indigenous wind case are included in the Strategist outputs. Incremental benefits that
8 could arise from the transmission and DSM investments were not specifically quantified.

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1 **Request IR-78:**

2
3 **With reference to Application, page 124, lines 5-8. Section 6.3.3 contains the following**
4 **statement:**

5
6 **“Specifically, WKM was asked to determine the cost of adding transmission**
7 **infrastructure to the west of Nova Scotia so that NS Power could have a firm**
8 **165 MW transmission path and the opportunity to purchase additional**
9 **energy up to 500 MW less the firm portion. WKM’s report is provided in**
10 **Appendix 6.05.”**

11
12 **The WKM report in Appendix 6.05 of the Application provides cost estimates for 500 MW**
13 **of firm capacity, not 165 MW, and on page 14 of Appendix 6.03 the “Other Import”**
14 **alternative is reported to have only 159.6 MW firm.**

15
16 (a) **Was the cost for 500 MW firm capacity adjusted downward to estimate the cost of a**
17 **firm 159.6 MW or 165 MW transmission path for use in the “Other Import”**
18 **analysis?**

19
20 (b) **If the cost for 500 MW firm capacity was used, how was the option value provided**
21 **to NSPI by “the opportunity to purchase additional energy up to 500 MW”**
22 **estimated?**

23
24 **Response IR-78:**

25
26 (a) **No. Please refer to CanWEA IR-54(b) and SBA IR-70.**

27
28 (b) **The model was offered the option to import up to 500 MW less the firm import of**
29 **159.6 MW of energy at market prices.**

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1 **Request IR-79:**

2

3 **With reference to Application, page 124, lines 5-8 and 14-16, and with regard to the**
4 **instruction to WKM to evaluate the options of a 500 MW increase in transmission**
5 **capability to the West, and a 500 MW increase in capability to New Brunswick:**

6

7 (a) **Please explain why analysis of smaller transmission projects were not also**
8 **evaluated, given that either one of the smaller transmission projects could be**
9 **combined with additional Nova Scotia renewable electricity capacity, or both**
10 **smaller projects may have been superior to the modeled 500 MW project.**

11

12 (b) **Please provide the feasibility study reports and cost estimates for already submitted**
13 **transmission intertie expansion projects.**

14

15 **Response IR-79:**

16

17 (a) Please refer to CA/SBA IR-70.

18

19 (b) WKM Energy does not have access to the “feasibility study reports and cost estimates” of
20 the transmission expansion projects. Rationale concerning the need for the projects and
21 the estimation of their costs is provided in section 5, “Potential Transmission Upgrades,”
22 of the WKM Energy report (Appendix 6.05 of the Application) on pages 8 through 11.

23

24 Please refer to SBA IR-27 Att 1 for the NS Power reports.

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1 **Request IR-80:**

2
3 **With reference to Application, page 125, lines 7-9:**

4
5 (a) **Please provide the amount of energy by month assumed to be purchased by NSPI**
6 **from Quebec and New England for each of the two alternatives examined by WKM**
7 **(HQ Supply vs. Hybrid Supply) that was used to compare the two “Other Import”**
8 **alternatives.**

9
10 (b) **If assumed annual energy purchases exceeded an amount of energy equal to the**
11 **Nova Scotia Block, what was the rationale for assuming that NSPI would purchase**
12 **such additional energy in the “Other Import” alternative?**

13
14 (c) **What price, including the effects of losses and wheeling charges, was assumed to be**
15 **paid by NSPI for energy purchased from Quebec and New England and delivered to**
16 **Nova Scotia?**

17
18 (d) **Please provide details showing how the price forecasts were developed for each**
19 **scenario and each sensitivity run for all years analyzed.**

20
21 **Response IR-80:**

22
23 (a) **Please refer to Synapse IR-14 Attachment 2 for the Other Import Assumptions. Please**
24 **refer to ELECTRONIC Attachment 1 for the screening model that was used for the**
25 **Hybrid Supply case. The Hybrid was screened out as an alternative because it is \$185 M**
26 **higher than the Other Import option analyzed.**

27
28 (b) **Up to 500 MW of imports, less the firm import, were offered to the model for Other**
29 **Import alternative. The model optimized by selecting imports when they were economic.**

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- 1 (c) For the Other Import Option, please refer to Synapse IR-14 Attachment 2. For the
2 Hybrid Supply Option please refer to ELECTRONIC Attachment 1.
3
4 (d) Please refer to UARB IR-37 Attachment 1.

NSPI Transmission Costs Under NB OATT					
Case Hybrid Adj - HQ 165MW plus NE 335MW with Direct Assignment Chg					
	2003/04	2008/09	2015/16	2050/51	
Capital upgrades (\$M)					
Project		Base	IPL/NRI	HQ/NS	NS Direct
Total Cost (NS#1+HQ#3)	1		75	800	
NS Tariff Share	2			150	61.2
Net NB Tariff Cost	3=1-2-Direct		75	588.8	
Revenue Requirement (\$M)					
Transmission Service Rev Req	4	80.5	91.0	139.5	217.7
Usage (MW)					
Network	5	2100	2100	1900	2262
Long term firm	6	720	1080	1580	1580
Short term equivalent	7	300	250	200	200
Total usage	8=5+6+7	3120	3430	3680	4042
Tariff (\$/kW-yr)					
Transmission Service	9=4/8*1000	25.8	26.5	37.9	53.9
Nova Scotia Tariff costs (\$M)					
NS Firm Reservation (MW)	10			500	500
Annual charge	11=9*10/1000			19.0	26.93
2015 NPV	12=npv(11)			312.6	
Direct Assignment Charge	13=Direct*125%			76.5	
NSPI Tariff Additions	14=2*125%			187.5	
End Effects Share	15=3*10%*Share			35.8	
Total 2015 NPV cost	16=12+13+14+15			612.4	60.81%
Other Tx Customer Costs					
Total Reservations	17	3120	3430	3180	3542
Annual charge	18=17*9/1000			120.5	190.8
Annual Base Tariff Cost	19			99.4	155.2
Share of Upgrade Costs	20=18-19			21.1	35.56
NPV Share	21=npv(22)			371.6	
End Effects Share	22=3*10%*Share			23.1	
Total 2015 NPV Cost	23=21+22			394.7	39.19%
Total Additional Cost vs Base	24			1000	
Total Tariff Recovery (35 yrs)	25=16-15+21			948	95%
Tariff End Effect (Year 35-45)	26=3*10%			58.9	
Total Cost Recovery	27=25+26			1007	100.7%

	1.28%	NS Power	NB Power	
	Nominal	2015		
2015	18.95		21.09	2016
2016	19.14	18.06	21.40	20.2
2017	19.34	17.21	21.73	19.3
2018	19.53	16.40	22.05	18.5
2019	19.73	15.63	22.38	17.7
2020	19.93	14.89	22.72	17.0
2021	20.13	14.19	23.06	16.3
2022	20.33	13.52	23.41	15.6
2023	20.54	12.88	23.76	14.9
2024	20.74	12.28	24.12	14.3
2025	20.95	11.70	24.48	13.7
2026	21.16	11.15	24.85	13.1
2027	21.38	10.62	25.22	12.5
2028	21.59	10.12	25.60	12.0
2029	21.81	9.65	25.99	11.5
2030	22.03	9.19	26.38	11.0
2031	22.25	8.76	26.78	10.5
2032	22.48	8.35	27.18	10.1
2033	22.70	7.95	27.59	9.7
2034	22.93	7.58	28.00	9.3
2035	23.16	7.22	28.42	8.9
2036	23.40	6.88	28.85	8.5
2037	23.63	6.56	29.29	8.1
2038	23.87	6.25	29.73	7.8
2039	24.11	5.95	30.17	7.5
2040	24.35	5.67	30.63	7.1
2041	24.60	5.41	31.09	6.8
2042	24.85	5.15	31.55	6.5
2043	25.10	4.91	32.03	6.3
2044	25.35	4.68	32.51	6.0
2045	25.61	4.46	33.00	5.7
2046	25.87	4.25	33.50	5.5
2047	26.13	4.05	34.00	5.3
2048	26.39	3.86	34.51	5.0
2049	26.66	3.68	35.03	4.8
2050	26.925	3.50	35.56	4.6
2051 NPV Total	312.61		371.64	
2052			1.504%	
2053				
2054				
2055				
2056				
2057				
2058				
2059				
2060				

Esc = 1.009%

60.81

39.19

Inputs for Rate Base Model

Total Capital Cost, including AFUDC (2015 \$000)	\$211
Contingency	50.0% Contingency
Year of Estimate	2015
% Equity	40.0%
% Debt	60.0%
ROE	10.00%
Interest Cost	5.0%

Inputs for Firm Purchase Revenue Requirement

Firm Capacity Associated with Firm Purcl	165
Days of Energy Delivery	365
Hours per Day	16
On Peak days per week	5
Off peak days per week	2
Total Energy Purchased	963,600
Total On Peak Energy Purchased	688,286
Total Off Peak Energy Purchased	275,314
Losses to Delivery Point	3.30%
Total New Transmission Reservation	500
New NB Tariff Tranmsission Service	\$37.90
Year	2015
Escalator	1.01%
New NB Tariff Ancillary Services	\$5.11
Year	2015
Escalator	0.99%

Other

% of First year sale	25%
----------------------	-----

NPV's

	Hybrid	OI
Discount Rate	6.07%	6.07%
NPV of Firm Sale	\$732.93	\$1,132.79
NPV of Surplus Energy	\$2,679.11	\$2,093.78
Total NPV	\$3,412.04	\$3,226.57
Difference	(\$185.48)	

Year 15 2031	Year 16 2032	Year 17 2033	Year 18 2034	Year 19 2035	Year 20 2036	Year 21 2037	Year 22 2038	Year 23 2039	Year 24 2040	Year 25 2041	Year 26 2042	Year 27 2043	Year 28 2044	Year 29 2045	Year 30 2046	Year 31 2047	Year 32 2048	Year 33 2049
45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%
10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%
8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7
\$7	\$7	\$6	\$6	\$6	\$6	\$5	\$5	\$5	\$5	\$5	\$4	\$4	\$4	\$4	\$4	\$3	\$3	\$3
\$9	\$9	\$8	\$8	\$8	\$8	\$7	\$7	\$7	\$6	\$6	\$6	\$6	\$5	\$5	\$5	\$4	\$4	\$4
\$3	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$4
\$26	\$26	\$26	\$25	\$25	\$25	\$24	\$24	\$23	\$23	\$22	\$22	\$21	\$21	\$20	\$20	\$19	\$18	\$18
15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Year 34 2050	Year 35 2051	Year 36 2052	Year 37 2053	Year 38 2054	Year 39 2055	Year 40 2056	Year 41 2057	Year 42 2058	Year 43 2059	Year 44 2060	Year 45 2061	Year 46 2062
45	45	45	45	45	45	45	45	45	45	45	45	45
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	75%
2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%
60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%
10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%	10.0%
5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%	31%
8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017
34	35	36	37	38	39	40	41	42	43	44	45	46
2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062
\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$7	\$5
\$3	\$2	\$2	\$2	\$2	\$2	\$1	\$1	\$1	\$1	\$0	\$0	\$0
\$4	\$3	\$3	\$3	\$2	\$2	\$2	\$2	\$1	\$1	\$1	\$0	\$0
\$4	\$4	\$4	\$4	\$4	\$4	\$4	\$3	\$3	\$3	\$3	\$3	\$2
\$17	\$17	\$16	\$16	\$15	\$14	\$14	\$13	\$13	\$12	\$11	\$11	\$8
34	35	36	37	38	39	40	41	42	43	44	45	46

Foreign Exchange Assumptions

For 1.03

ISO Fees

	Export from NE	Import to NE
ISO schedule 1 for TOT	\$0.18	
IO Schedule 2	\$0.25	\$0.25
ISO schedule 3 Exports	\$0.34	
OATT - Schedule 2 VAR	\$0.19	
OATT - Schedule 8 TOUT	\$8.60	
GIS Costs	\$0.04	
OATT schedule 1 TOUT	\$0.20	
Real Time Marginal Loss Revenue Allocation	(\$0.44)	
External Inadvertent Cost Distribution	\$0.02	\$0.02
Regulation	\$0.11	
NCPC	\$1.31	\$1.31
Total ISO Fees	\$10.80	\$1.58
Year of estimates	2012	2012

	OI Base Load Economy Energy Purchases	Purchase Cost at MassHub Pricing]	Market pricing					Price at NS Boder (After NB Losses of 3.3%)	New \$k
			\$/MWh	Plus: ISO NE Out Fees	Plus NB Tx Fees	Sub Total	1%		
	GWh	k\$					3.30%		
2015	0.0	\$0.0							
2016	0.0	\$0.0							
2017	1241.2	\$60,390.3	\$48.65	\$11.35	\$7.35	\$67.35	\$65.13	\$80,844	
2018	2532.2	\$122,638.5	\$48.43	\$11.46	\$7.42	\$67.32	\$65.10	\$164,840	
2019	2494.3	\$124,468.3	\$49.90	\$11.58	\$7.50	\$68.98	\$66.70	\$166,374	
2020	2489.7	\$129,997.7	\$52.21	\$11.69	\$7.57	\$71.48	\$69.12	\$172,096	
2021	2531.2	\$137,173.5	\$54.19	\$11.81	\$7.65	\$73.65	\$71.22	\$180,278	
2022	2505.2	\$141,867.0	\$56.63	\$11.93	\$7.72	\$76.28	\$73.77	\$184,799	
2023	2546.3	\$147,725.9	\$58.02	\$12.05	\$7.80	\$77.87	\$75.30	\$191,730	
2024	2541.0	\$150,241.1	\$59.13	\$12.17	\$7.88	\$79.18	\$76.56	\$194,549	
2025	2599.5	\$158,709.3	\$61.05	\$12.29	\$7.96	\$81.30	\$78.62	\$204,375	
2026	2629.1	\$164,166.6	\$62.44	\$12.41	\$8.04	\$82.90	\$80.16	\$210,747	
2027	2635.8	\$167,365.5	\$63.50	\$12.54	\$8.12	\$84.15	\$81.38	\$214,494	
2028	2632.1	\$170,121.5	\$64.63	\$12.66	\$8.20	\$85.50	\$82.68	\$217,611	
2029	2684.5	\$177,955.6	\$66.29	\$12.79	\$8.28	\$87.36	\$84.48	\$226,785	
2030	2904.7	\$202,297.1	\$69.65	\$12.92	\$8.36	\$90.93	\$87.93	\$255,402	
2031	2927.5	\$206,667.4	\$70.60	\$13.05	\$8.45	\$92.09	\$89.05	\$260,701	
2032	2988.8	\$216,246.7	\$72.35	\$13.18	\$8.53	\$94.06	\$90.96	\$271,860	
2033	3067.2	\$226,108.7	\$73.72	\$13.31	\$8.62	\$95.65	\$92.49	\$283,686	
2034	3158.2	\$241,177.3	\$76.37	\$13.44	\$8.70	\$98.51	\$95.26	\$300,856	
2035	3254.6	\$256,353.7	\$78.77	\$13.58	\$8.79	\$101.14	\$97.80	\$318,294	
2036	3276.3	\$264,102.2	\$80.61	\$13.71	\$8.88	\$103.20	\$99.80	\$326,964	
2037	3275.6	\$268,689.3	\$82.03	\$13.85	\$8.97	\$104.85	\$101.39	\$332,102	
2038	3291.4	\$275,845.1	\$83.81	\$13.99	\$9.06	\$106.86	\$103.33	\$340,095	
2039	3309.8	\$282,751.1	\$85.43	\$14.13	\$9.15	\$108.71	\$105.12	\$347,921	
2040	3379.0	\$299,821.5	\$88.73	\$14.27	\$9.24	\$112.24	\$108.54	\$366,746	
NPV		6.07%						\$2,093,777.24	#####

On Peak Excess Energy Sales								Off Peak Excess Energy Sales							
	MassHub On Peak	Less: ISO NE Out	Sub Total	Annual Esc: 1.00%		Price at HQ/NB Border	Plus Tx to NS <i>NB Tx Charges are paid for as part of our Capital Investment so are not added here</i>	Net On Peak Price delivered to NS	MassHub Off Peak	Less: ISO NE Out	Sub Total	Less: NB Tx	Price at HQ/NB Border	Less: Tx to NS <i>NB Tx Charges are paid for as part of our Capital Investment so are not added here</i>	Net Price Off Peak
				Less: NB Tx	Less: NB Tx										
Jan-17	\$106.92	\$0.00	\$110.13	\$0.00	\$110.13	\$110.13	\$0.00	\$110.13	\$70.73	\$0.00	\$72.85	\$0.00	\$72.85	\$0.00	\$72.85
Feb-17	\$77.22	\$0.00	\$79.54	\$0.00	\$79.54	\$79.54	\$0.00	\$79.54	\$63.87	\$0.00	\$65.78	\$0.00	\$65.78	\$0.00	\$65.78
Mar-17	\$51.09	\$0.00	\$52.62	\$0.00	\$52.62	\$52.62	\$0.00	\$52.62	\$42.34	\$0.00	\$43.61	\$0.00	\$43.61	\$0.00	\$43.61
Apr-17	\$46.18	\$0.00	\$47.57	\$0.00	\$47.57	\$47.57	\$0.00	\$47.57	\$37.49	\$0.00	\$38.62	\$0.00	\$38.62	\$0.00	\$38.62
May-17	\$45.48	\$0.00	\$46.84	\$0.00	\$46.84	\$46.84	\$0.00	\$46.84	\$37.74	\$0.00	\$38.87	\$0.00	\$38.87	\$0.00	\$38.87
Jun-17	\$54.36	\$0.00	\$56.00	\$0.00	\$56.00	\$56.00	\$0.00	\$56.00	\$37.64	\$0.00	\$38.77	\$0.00	\$38.77	\$0.00	\$38.77
Jul-17	\$69.85	\$0.00	\$71.94	\$0.00	\$71.94	\$71.94	\$0.00	\$71.94	\$41.15	\$0.00	\$42.39	\$0.00	\$42.39	\$0.00	\$42.39
Aug-17	\$59.46	\$0.00	\$61.24	\$0.00	\$61.24	\$61.24	\$0.00	\$61.24	\$40.72	\$0.00	\$41.94	\$0.00	\$41.94	\$0.00	\$41.94
Sep-17	\$46.23	\$0.00	\$47.62	\$0.00	\$47.62	\$47.62	\$0.00	\$47.62	\$39.72	\$0.00	\$40.91	\$0.00	\$40.91	\$0.00	\$40.91
Oct-17	\$43.84	\$0.00	\$45.15	\$0.00	\$45.15	\$45.15	\$0.00	\$45.15	\$37.17	\$0.00	\$38.29	\$0.00	\$38.29	\$0.00	\$38.29
Nov-17	\$47.77	\$0.00	\$49.20	\$0.00	\$49.20	\$49.20	\$0.00	\$49.20	\$41.31	\$0.00	\$42.55	\$0.00	\$42.55	\$0.00	\$42.55
Dec-17	\$74.18	\$0.00	\$76.41	\$0.00	\$76.41	\$76.41	\$0.00	\$76.41	\$55.58	\$0.00	\$57.25	\$0.00	\$57.25	\$0.00	\$57.25
Jan-18	\$104.65	\$0.00	\$107.79	\$0.00	\$107.79	\$107.79	\$0.00	\$107.79	\$71.43	\$0.00	\$73.57	\$0.00	\$73.57	\$0.00	\$73.57
Feb-18	\$76.17	\$0.00	\$78.46	\$0.00	\$78.46	\$78.46	\$0.00	\$78.46	\$64.25	\$0.00	\$66.18	\$0.00	\$66.18	\$0.00	\$66.18
Mar-18	\$51.45	\$0.00	\$52.99	\$0.00	\$52.99	\$52.99	\$0.00	\$52.99	\$43.04	\$0.00	\$44.33	\$0.00	\$44.33	\$0.00	\$44.33
Apr-18	\$46.96	\$0.00	\$48.37	\$0.00	\$48.37	\$48.37	\$0.00	\$48.37	\$38.15	\$0.00	\$39.30	\$0.00	\$39.30	\$0.00	\$39.30
May-18	\$47.60	\$0.00	\$49.03	\$0.00	\$49.03	\$49.03	\$0.00	\$49.03	\$38.94	\$0.00	\$40.10	\$0.00	\$40.10	\$0.00	\$40.10
Jun-18	\$55.88	\$0.00	\$57.55	\$0.00	\$57.55	\$57.55	\$0.00	\$57.55	\$38.94	\$0.00	\$40.11	\$0.00	\$40.11	\$0.00	\$40.11
Jul-18	\$71.31	\$0.00	\$73.45	\$0.00	\$73.45	\$73.45	\$0.00	\$73.45	\$42.78	\$0.00	\$44.06	\$0.00	\$44.06	\$0.00	\$44.06
Aug-18	\$58.82	\$0.00	\$60.58	\$0.00	\$60.58	\$60.58	\$0.00	\$60.58	\$42.17	\$0.00	\$43.44	\$0.00	\$43.44	\$0.00	\$43.44
Sep-18	\$47.33	\$0.00	\$48.75	\$0.00	\$48.75	\$48.75	\$0.00	\$48.75	\$40.44	\$0.00	\$41.66	\$0.00	\$41.66	\$0.00	\$41.66
Oct-18	\$44.96	\$0.00	\$46.30	\$0.00	\$46.30	\$46.30	\$0.00	\$46.30	\$38.16	\$0.00	\$39.31	\$0.00	\$39.31	\$0.00	\$39.31
Nov-18	\$48.93	\$0.00	\$50.39	\$0.00	\$50.39	\$50.39	\$0.00	\$50.39	\$42.36	\$0.00	\$43.63	\$0.00	\$43.63	\$0.00	\$43.63
Dec-18	\$74.04	\$0.00	\$76.26	\$0.00	\$76.26	\$76.26	\$0.00	\$76.26	\$56.15	\$0.00	\$57.84	\$0.00	\$57.84	\$0.00	\$57.84
Jan-19	\$106.18	\$0.00	\$109.36	\$0.00	\$109.36	\$109.36	\$0.00	\$109.36	\$71.78	\$0.00	\$73.94	\$0.00	\$73.94	\$0.00	\$73.94
Feb-19	\$76.48	\$0.00	\$78.77	\$0.00	\$78.77	\$78.77	\$0.00	\$78.77	\$64.55	\$0.00	\$66.49	\$0.00	\$66.49	\$0.00	\$66.49
Mar-19	\$52.98	\$0.00	\$54.57	\$0.00	\$54.57	\$54.57	\$0.00	\$54.57	\$43.97	\$0.00	\$45.29	\$0.00	\$45.29	\$0.00	\$45.29
Apr-19	\$48.70	\$0.00	\$50.16	\$0.00	\$50.16	\$50.16	\$0.00	\$50.16	\$39.13	\$0.00	\$40.31	\$0.00	\$40.31	\$0.00	\$40.31
May-19	\$49.75	\$0.00	\$51.24	\$0.00	\$51.24	\$51.24	\$0.00	\$51.24	\$40.02	\$0.00	\$41.22	\$0.00	\$41.22	\$0.00	\$41.22
Jun-19	\$58.08	\$0.00	\$59.82	\$0.00	\$59.82	\$59.82	\$0.00	\$59.82	\$40.31	\$0.00	\$41.52	\$0.00	\$41.52	\$0.00	\$41.52
Jul-19	\$74.80	\$0.00	\$77.05	\$0.00	\$77.05	\$77.05	\$0.00	\$77.05	\$44.15	\$0.00	\$45.48	\$0.00	\$45.48	\$0.00	\$45.48
Aug-19	\$59.90	\$0.00	\$61.70	\$0.00	\$61.70	\$61.70	\$0.00	\$61.70	\$43.44	\$0.00	\$44.74	\$0.00	\$44.74	\$0.00	\$44.74
Sep-19	\$48.57	\$0.00	\$50.03	\$0.00	\$50.03	\$50.03	\$0.00	\$50.03	\$41.31	\$0.00	\$42.55	\$0.00	\$42.55	\$0.00	\$42.55
Oct-19	\$46.15	\$0.00	\$47.53	\$0.00	\$47.53	\$47.53	\$0.00	\$47.53	\$39.40	\$0.00	\$40.58	\$0.00	\$40.58	\$0.00	\$40.58
Nov-19	\$50.65	\$0.00	\$52.17	\$0.00	\$52.17	\$52.17	\$0.00	\$52.17	\$43.81	\$0.00	\$45.12	\$0.00	\$45.12	\$0.00	\$45.12
Dec-19	\$76.40	\$0.00	\$78.69	\$0.00	\$78.69	\$78.69	\$0.00	\$78.69	\$57.71	\$0.00	\$59.44	\$0.00	\$59.44	\$0.00	\$59.44
Jan-20	\$110.28	\$0.00	\$113.59	\$0.00	\$113.59	\$113.59	\$0.00	\$113.59	\$74.19	\$0.00	\$76.41	\$0.00	\$76.41	\$0.00	\$76.41
Feb-20	\$79.06	\$0.00	\$81.43	\$0.00	\$81.43	\$81.43	\$0.00	\$81.43	\$66.85	\$0.00	\$68.86	\$0.00	\$68.86	\$0.00	\$68.86
Mar-20	\$55.55	\$0.00	\$57.21	\$0.00	\$57.21	\$57.21	\$0.00	\$57.21	\$46.05	\$0.00	\$47.43	\$0.00	\$47.43	\$0.00	\$47.43
Apr-20	\$50.62	\$0.00	\$52.14	\$0.00	\$52.14	\$52.14	\$0.00	\$52.14	\$41.18	\$0.00	\$42.42	\$0.00	\$42.42	\$0.00	\$42.42
May-20	\$52.59	\$0.00	\$54.16	\$0.00	\$54.16	\$54.16	\$0.00	\$54.16	\$42.39	\$0.00	\$43.66	\$0.00	\$43.66	\$0.00	\$43.66
Jun-20	\$62.94	\$0.00	\$64.82	\$0.00	\$64.82	\$64.82	\$0.00	\$64.82	\$43.16	\$0.00	\$44.45	\$0.00	\$44.45	\$0.00	\$44.45
Jul-20	\$77.08	\$0.00	\$79.40	\$0.00	\$79.40	\$79.40	\$0.00	\$79.40	\$46.23	\$0.00	\$47.62	\$0.00	\$47.62	\$0.00	\$47.62
Aug-20	\$61.69	\$0.00	\$63.55	\$0.00	\$63.55	\$63.55	\$0.00	\$63.55	\$45.28	\$0.00	\$46.63	\$0.00	\$46.63	\$0.00	\$46.63
Sep-20	\$50.33	\$0.00	\$51.84	\$0.00	\$51.84	\$51.84	\$0.00	\$51.84	\$43.17	\$0.00	\$44.47	\$0.00	\$44.47	\$0.00	\$44.47
Oct-20	\$47.90	\$0.00	\$49.33	\$0.00	\$49.33	\$49.33	\$0.00	\$49.33	\$41.32	\$0.00	\$42.56	\$0.00	\$42.56	\$0.00	\$42.56
Nov-20	\$54.00	\$0.00	\$55.62	\$0.00	\$55.62	\$55.62	\$0.00	\$55.62	\$45.79	\$0.00	\$47.17	\$0.00	\$47.17	\$0.00	\$47.17
Dec-20	\$79.90	\$0.00	\$82.30	\$0.00	\$82.30	\$82.30	\$0.00	\$82.30	\$59.77	\$0.00	\$61.57	\$0.00	\$61.57	\$0.00	\$61.57
Jan-21	\$116.83	\$0.00	\$116.21	\$0.00	\$116.21	\$116.21	\$0.00	\$116.21	\$75.93	\$0.00	\$78.21	\$0.00	\$78.21	\$0.00	\$78.21
Feb-21	\$81.56	\$0.00	\$84.01	\$0.00	\$84.01	\$84.01	\$0.00	\$84.01	\$68.03	\$0.00	\$70.07	\$0.00	\$70.07	\$0.00	\$70.07
Mar-21	\$57.25	\$0.00	\$58.97	\$0.00	\$58.97	\$58.97	\$0.00	\$58.97	\$47.50	\$0.00	\$48.93	\$0.00	\$48.93	\$0.00	\$48.93
Apr-21	\$52.48	\$0.00	\$54.05	\$0.00	\$54.05	\$54.05	\$0.00	\$54.05	\$42.46	\$0.00	\$43.73	\$0.00	\$43.73	\$0.00	\$43.73
May-21	\$55.85	\$0.00	\$57.52	\$0.00	\$57.52	\$57.52	\$0.00	\$57.52	\$43.83	\$0.00	\$45.14	\$0.00	\$45.14	\$0.00	\$45.14
Jun-21	\$64.46	\$0.00	\$66.39	\$0.00	\$66.39	\$66.39	\$0.00	\$66.39	\$44.87	\$0.00	\$46.21	\$0.00	\$46.21	\$0.00	\$46.21
Jul-21	\$78.35	\$0.00	\$80.70	\$0.00	\$80.70	\$80.70	\$0.00	\$80.70	\$47.65	\$0.00	\$49.08	\$0.00	\$49.08	\$0.00	\$49.08
Aug-21	\$62.36	\$0.00	\$64.23	\$0.00	\$64.23	\$64.23	\$0.00	\$64.23	\$46.58	\$0.00	\$47.98	\$0.00	\$47.98	\$0.00	\$47.98
Sep-21	\$51.41	\$0.00	\$52.95	\$0.00	\$52.95	\$52.95	\$0.00	\$52.95	\$44.52	\$0.00	\$45.85	\$0.00	\$45.85	\$0.00	\$45.85
Oct-21	\$49.03	\$0.00	\$50.50	\$0.00	\$50.50	\$50.50	\$0.00	\$50.50	\$42.52	\$0.00	\$43.80	\$0.00	\$43.80	\$0.00	\$43.80
Nov-21	\$55.97	\$0.00	\$57.65	\$0.00	\$57.65	\$57.65	\$0.00	\$57.65	\$47.11	\$0.00	\$48.53	\$0.00	\$48.53	\$0.00	\$48.53
Dec-21	\$81.50	\$0.00	\$83.95	\$0.00	\$83.95	\$83.95	\$0.00	\$83.95	\$61.37	\$0.00	\$63.21	\$0.00	\$63.21	\$0.00	\$63.21
Jan-22	\$116.15	\$0.00	\$119.63	\$0.00	\$119.63	\$119.63	\$0.00	\$119.63	\$78.48	\$0.00	\$80.83	\$0.00	\$80.83	\$0.00	\$80.83
Feb-22	\$84.25	\$0.00	\$86.78	\$0.00	\$86.78	\$86.78	\$0.00	\$86.78	\$70.64	\$0.00	\$72.76	\$0.00	\$72.76	\$0.00	\$72.76
Mar-22	\$59.30	\$0.00	\$61.08	\$0.00	\$61.08	\$61.08	\$0.00	\$61.08	\$49.71	\$0.00	\$51.20	\$0.00	\$51.20	\$0.00	\$51.20
Apr-22	\$55.44	\$0.00	\$57.11	\$0.00	\$57.11	\$57.11	\$0.00	\$57.11	\$44.58	\$0.00	\$45.92	\$0.00	\$45.92	\$0.00	\$45.92
May-22	\$62.65	\$0.00	\$64.53	\$0.00	\$64.53	\$64.53	\$0.00	\$64.53	\$46.20	\$0.00	\$47.58	\$0.00	\$47.58	\$0.00	\$47.58
Jun-22	\$66.32	\$0.00	\$68.31	\$0.00	\$68.31	\$68.31	\$0.00	\$68.31	\$47.33	\$0.00	\$48.75	\$0.00	\$48.75	\$0.00	\$48.75
Jul-22	\$80.98	\$0.00	\$83.41	\$0.00	\$83.41	\$83.41	\$0.00	\$83.41	\$49.83	\$0.00	\$51.33	\$0.00	\$51.33	\$0.00	\$51.33
Aug-22	\$63.31	\$0.00	\$65.21	\$0.00	\$65.21	\$65.21	\$0.00	\$65.21	\$49.06	\$0.00	\$50.53	\$0.00	\$50.53	\$0.00	\$50.53
Sep-22	\$53.27	\$0.00	\$54.87	\$0.00	\$54.87	\$54.87	\$0.00	\$54.87	\$46.65	\$0.00	\$48.05	\$0.00	\$48.05	\$0.00	\$48.05
Oct-22	\$50.96	\$0.00	\$52.49	\$0.00	\$52.49	\$52.49	\$0.00	\$52.49	\$44.59	\$0.00	\$45.92	\$0.00	\$45.92	\$0.00	\$45.92
Nov-22	\$58.55	\$0.00	\$60.31	\$0.00	\$60.31	\$60.31	\$0.00	\$60.31	\$49.12	\$0.00	\$50.59	\$0.00	\$50.59	\$0.00	\$50.59
Dec-22	\$84.55	\$0.00	\$87.08	\$0.00	\$87.08	\$87.08	\$0.00	\$87.08	\$63.97	\$0.00	\$65.89	\$0.00	\$65.89	\$0.00	\$65.89
Jan-23	\$118.47	\$0.00	\$122.02	\$0.00	\$122.02	\$122.02	\$0.00	\$122.02	\$80.05	\$0.00	\$82.45	\$0.00	\$82.45	\$0.00	\$82.45
Feb-23	\$85.93	\$0.00	\$88.51	\$0.00	\$88.51	\$88.51	\$0.00	\$88.51	\$72.06	\$0.00	\$74.22	\$0.00	\$74.22	\$0.00	\$74.22
Mar-23	\$60.49	\$0.00	\$62.30	\$0.00	\$62.30	\$62.30	\$0.00	\$62.30	\$50.70	\$0.00	\$52.22	\$0.00	\$52.22	\$0.00	\$52.22
Apr-23															

Jun-25	\$70.38	\$0.00	\$72.49	\$0.00	\$72.49	\$0.00	\$72.49	\$50.22	\$0.00	\$51.73	\$0.00	\$51.73	\$0.00	\$51.73
Jul-25	\$85.94	\$0.00	\$88.51	\$0.00	\$88.51	\$0.00	\$88.51	\$52.88	\$0.00	\$54.47	\$0.00	\$54.47	\$0.00	\$54.47
Aug-25	\$67.19	\$0.00	\$69.20	\$0.00	\$69.20	\$0.00	\$69.20	\$52.07	\$0.00	\$53.63	\$0.00	\$53.63	\$0.00	\$53.63
Sep-25	\$56.53	\$0.00	\$58.23	\$0.00	\$58.23	\$0.00	\$58.23	\$49.50	\$0.00	\$50.99	\$0.00	\$50.99	\$0.00	\$50.99
Oct-25	\$54.08	\$0.00	\$55.70	\$0.00	\$55.70	\$0.00	\$55.70	\$47.31	\$0.00	\$48.73	\$0.00	\$48.73	\$0.00	\$48.73
Nov-25	\$62.13	\$0.00	\$64.00	\$0.00	\$64.00	\$0.00	\$64.00	\$52.12	\$0.00	\$53.69	\$0.00	\$53.69	\$0.00	\$53.69
Dec-25	\$89.72	\$0.00	\$92.41	\$0.00	\$92.41	\$0.00	\$92.41	\$67.89	\$0.00	\$69.92	\$0.00	\$69.92	\$0.00	\$69.92
Jan-26	\$125.72	\$0.00	\$129.49	\$0.00	\$129.49	\$0.00	\$129.49	\$84.95	\$0.00	\$87.49	\$0.00	\$87.49	\$0.00	\$87.49
Feb-26	\$91.19	\$0.00	\$93.93	\$0.00	\$93.93	\$0.00	\$93.93	\$76.47	\$0.00	\$78.76	\$0.00	\$78.76	\$0.00	\$78.76
Mar-26	\$64.19	\$0.00	\$66.12	\$0.00	\$66.12	\$0.00	\$66.12	\$53.80	\$0.00	\$55.42	\$0.00	\$55.42	\$0.00	\$55.42
Apr-26	\$60.01	\$0.00	\$61.81	\$0.00	\$61.81	\$0.00	\$61.81	\$48.26	\$0.00	\$49.71	\$0.00	\$49.71	\$0.00	\$49.71
May-26	\$67.82	\$0.00	\$69.85	\$0.00	\$69.85	\$0.00	\$69.85	\$50.01	\$0.00	\$51.51	\$0.00	\$51.51	\$0.00	\$51.51
Jun-26	\$71.79	\$0.00	\$73.94	\$0.00	\$73.94	\$0.00	\$73.94	\$51.23	\$0.00	\$52.76	\$0.00	\$52.76	\$0.00	\$52.76
Jul-26	\$87.65	\$0.00	\$90.28	\$0.00	\$90.28	\$0.00	\$90.28	\$53.94	\$0.00	\$55.36	\$0.00	\$55.36	\$0.00	\$55.36
Aug-26	\$68.53	\$0.00	\$70.59	\$0.00	\$70.59	\$0.00	\$70.59	\$53.11	\$0.00	\$54.70	\$0.00	\$54.70	\$0.00	\$54.70
Sep-26	\$57.66	\$0.00	\$59.39	\$0.00	\$59.39	\$0.00	\$59.39	\$50.49	\$0.00	\$52.01	\$0.00	\$52.01	\$0.00	\$52.01
Oct-26	\$55.16	\$0.00	\$56.82	\$0.00	\$56.82	\$0.00	\$56.82	\$48.26	\$0.00	\$49.71	\$0.00	\$49.71	\$0.00	\$49.71
Nov-26	\$63.38	\$0.00	\$65.28	\$0.00	\$65.28	\$0.00	\$65.28	\$53.16	\$0.00	\$54.76	\$0.00	\$54.76	\$0.00	\$54.76
Dec-26	\$91.52	\$0.00	\$94.26	\$0.00	\$94.26	\$0.00	\$94.26	\$69.25	\$0.00	\$71.32	\$0.00	\$71.32	\$0.00	\$71.32
Jan-27	\$128.23	\$0.00	\$132.08	\$0.00	\$132.08	\$0.00	\$132.08	\$86.65	\$0.00	\$89.24	\$0.00	\$89.24	\$0.00	\$89.24
Feb-27	\$93.02	\$0.00	\$95.81	\$0.00	\$95.81	\$0.00	\$95.81	\$78.00	\$0.00	\$80.34	\$0.00	\$80.34	\$0.00	\$80.34
Mar-27	\$65.47	\$0.00	\$67.44	\$0.00	\$67.44	\$0.00	\$67.44	\$54.88	\$0.00	\$56.53	\$0.00	\$56.53	\$0.00	\$56.53
Apr-27	\$61.21	\$0.00	\$63.05	\$0.00	\$63.05	\$0.00	\$63.05	\$49.22	\$0.00	\$50.70	\$0.00	\$50.70	\$0.00	\$50.70
May-27	\$69.17	\$0.00	\$71.25	\$0.00	\$71.25	\$0.00	\$71.25	\$51.01	\$0.00	\$52.54	\$0.00	\$52.54	\$0.00	\$52.54
Jun-27	\$73.22	\$0.00	\$75.42	\$0.00	\$75.42	\$0.00	\$75.42	\$52.25	\$0.00	\$53.82	\$0.00	\$53.82	\$0.00	\$53.82
Jul-27	\$89.41	\$0.00	\$92.09	\$0.00	\$92.09	\$0.00	\$92.09	\$55.02	\$0.00	\$56.67	\$0.00	\$56.67	\$0.00	\$56.67
Aug-27	\$69.90	\$0.00	\$72.00	\$0.00	\$72.00	\$0.00	\$72.00	\$54.17	\$0.00	\$55.79	\$0.00	\$55.79	\$0.00	\$55.79
Sep-27	\$58.81	\$0.00	\$60.58	\$0.00	\$60.58	\$0.00	\$60.58	\$51.50	\$0.00	\$53.05	\$0.00	\$53.05	\$0.00	\$53.05
Oct-27	\$56.26	\$0.00	\$57.95	\$0.00	\$57.95	\$0.00	\$57.95	\$49.23	\$0.00	\$50.70	\$0.00	\$50.70	\$0.00	\$50.70
Nov-27	\$64.64	\$0.00	\$66.58	\$0.00	\$66.58	\$0.00	\$66.58	\$54.23	\$0.00	\$55.85	\$0.00	\$55.85	\$0.00	\$55.85
Dec-27	\$93.35	\$0.00	\$96.15	\$0.00	\$96.15	\$0.00	\$96.15	\$70.63	\$0.00	\$72.75	\$0.00	\$72.75	\$0.00	\$72.75
Jan-28	\$130.80	\$0.00	\$134.72	\$0.00	\$134.72	\$0.00	\$134.72	\$88.38	\$0.00	\$91.03	\$0.00	\$91.03	\$0.00	\$91.03
Feb-28	\$94.88	\$0.00	\$97.73	\$0.00	\$97.73	\$0.00	\$97.73	\$79.56	\$0.00	\$81.94	\$0.00	\$81.94	\$0.00	\$81.94
Mar-28	\$66.78	\$0.00	\$68.79	\$0.00	\$68.79	\$0.00	\$68.79	\$55.98	\$0.00	\$57.66	\$0.00	\$57.66	\$0.00	\$57.66
Apr-28	\$62.44	\$0.00	\$64.31	\$0.00	\$64.31	\$0.00	\$64.31	\$50.21	\$0.00	\$51.72	\$0.00	\$51.72	\$0.00	\$51.72
May-28	\$70.56	\$0.00	\$72.67	\$0.00	\$72.67	\$0.00	\$72.67	\$52.03	\$0.00	\$53.59	\$0.00	\$53.59	\$0.00	\$53.59
Jun-28	\$74.69	\$0.00	\$76.93	\$0.00	\$76.93	\$0.00	\$76.93	\$53.30	\$0.00	\$54.90	\$0.00	\$54.90	\$0.00	\$54.90
Jul-28	\$91.20	\$0.00	\$93.93	\$0.00	\$93.93	\$0.00	\$93.93	\$56.12	\$0.00	\$57.80	\$0.00	\$57.80	\$0.00	\$57.80
Aug-28	\$71.30	\$0.00	\$73.44	\$0.00	\$73.44	\$0.00	\$73.44	\$55.25	\$0.00	\$56.91	\$0.00	\$56.91	\$0.00	\$56.91
Sep-28	\$59.99	\$0.00	\$61.79	\$0.00	\$61.79	\$0.00	\$61.79	\$52.53	\$0.00	\$54.11	\$0.00	\$54.11	\$0.00	\$54.11
Oct-28	\$57.39	\$0.00	\$59.11	\$0.00	\$59.11	\$0.00	\$59.11	\$50.21	\$0.00	\$51.72	\$0.00	\$51.72	\$0.00	\$51.72
Nov-28	\$65.94	\$0.00	\$67.92	\$0.00	\$67.92	\$0.00	\$67.92	\$55.31	\$0.00	\$56.97	\$0.00	\$56.97	\$0.00	\$56.97
Dec-28	\$95.21	\$0.00	\$98.07	\$0.00	\$98.07	\$0.00	\$98.07	\$72.04	\$0.00	\$74.20	\$0.00	\$74.20	\$0.00	\$74.20
Jan-29	\$133.41	\$0.00	\$137.42	\$0.00	\$137.42	\$0.00	\$137.42	\$90.15	\$0.00	\$92.85	\$0.00	\$92.85	\$0.00	\$92.85
Feb-29	\$96.78	\$0.00	\$99.68	\$0.00	\$99.68	\$0.00	\$99.68	\$81.15	\$0.00	\$83.58	\$0.00	\$83.58	\$0.00	\$83.58
Mar-29	\$68.12	\$0.00	\$70.16	\$0.00	\$70.16	\$0.00	\$70.16	\$57.10	\$0.00	\$58.81	\$0.00	\$58.81	\$0.00	\$58.81
Apr-29	\$63.69	\$0.00	\$65.60	\$0.00	\$65.60	\$0.00	\$65.60	\$51.21	\$0.00	\$52.75	\$0.00	\$52.75	\$0.00	\$52.75
May-29	\$71.97	\$0.00	\$74.13	\$0.00	\$74.13	\$0.00	\$74.13	\$53.07	\$0.00	\$54.66	\$0.00	\$54.66	\$0.00	\$54.66
Jun-29	\$76.18	\$0.00	\$78.47	\$0.00	\$78.47	\$0.00	\$78.47	\$54.36	\$0.00	\$55.99	\$0.00	\$55.99	\$0.00	\$55.99
Jul-29	\$93.02	\$0.00	\$95.81	\$0.00	\$95.81	\$0.00	\$95.81	\$57.24	\$0.00	\$58.96	\$0.00	\$58.96	\$0.00	\$58.96
Aug-29	\$72.73	\$0.00	\$74.91	\$0.00	\$74.91	\$0.00	\$74.91	\$56.36	\$0.00	\$58.05	\$0.00	\$58.05	\$0.00	\$58.05
Sep-29	\$61.19	\$0.00	\$63.03	\$0.00	\$63.03	\$0.00	\$63.03	\$53.59	\$0.00	\$55.19	\$0.00	\$55.19	\$0.00	\$55.19
Oct-29	\$58.54	\$0.00	\$60.29	\$0.00	\$60.29	\$0.00	\$60.29	\$51.21	\$0.00	\$52.75	\$0.00	\$52.75	\$0.00	\$52.75
Nov-29	\$67.26	\$0.00	\$69.27	\$0.00	\$69.27	\$0.00	\$69.27	\$56.42	\$0.00	\$58.11	\$0.00	\$58.11	\$0.00	\$58.11
Dec-29	\$97.12	\$0.00	\$100.03	\$0.00	\$100.03	\$0.00	\$100.03	\$73.48	\$0.00	\$75.69	\$0.00	\$75.69	\$0.00	\$75.69
Jan-30	\$136.08	\$0.00	\$140.17	\$0.00	\$140.17	\$0.00	\$140.17	\$91.95	\$0.00	\$94.71	\$0.00	\$94.71	\$0.00	\$94.71
Feb-30	\$98.71	\$0.00	\$101.67	\$0.00	\$101.67	\$0.00	\$101.67	\$82.77	\$0.00	\$85.25	\$0.00	\$85.25	\$0.00	\$85.25
Mar-30	\$69.48	\$0.00	\$71.57	\$0.00	\$71.57	\$0.00	\$71.57	\$58.24	\$0.00	\$59.99	\$0.00	\$59.99	\$0.00	\$59.99
Apr-30	\$64.96	\$0.00	\$66.91	\$0.00	\$66.91	\$0.00	\$66.91	\$52.24	\$0.00	\$53.80	\$0.00	\$53.80	\$0.00	\$53.80
May-30	\$73.41	\$0.00	\$75.61	\$0.00	\$75.61	\$0.00	\$75.61	\$54.13	\$0.00	\$55.75	\$0.00	\$55.75	\$0.00	\$55.75
Jun-30	\$77.70	\$0.00	\$80.04	\$0.00	\$80.04	\$0.00	\$80.04	\$55.45	\$0.00	\$57.11	\$0.00	\$57.11	\$0.00	\$57.11
Jul-30	\$94.88	\$0.00	\$97.73	\$0.00	\$97.73	\$0.00	\$97.73	\$58.38	\$0.00	\$60.14	\$0.00	\$60.14	\$0.00	\$60.14
Aug-30	\$74.18	\$0.00	\$76.41	\$0.00	\$76.41	\$0.00	\$76.41	\$57.48	\$0.00	\$59.21	\$0.00	\$59.21	\$0.00	\$59.21
Sep-30	\$62.41	\$0.00	\$64.29	\$0.00	\$64.29	\$0.00	\$64.29	\$54.66	\$0.00	\$56.30	\$0.00	\$56.30	\$0.00	\$56.30
Oct-30	\$59.71	\$0.00	\$61.50	\$0.00	\$61.50	\$0.00	\$61.50	\$52.24	\$0.00	\$53.81	\$0.00	\$53.81	\$0.00	\$53.81
Nov-30	\$68.60	\$0.00	\$70.66	\$0.00	\$70.66	\$0.00	\$70.66	\$57.55	\$0.00	\$59.27	\$0.00	\$59.27	\$0.00	\$59.27
Dec-30	\$99.06	\$0.00	\$102.03	\$0.00	\$102.03	\$0.00	\$102.03	\$74.95	\$0.00	\$77.20	\$0.00	\$77.20	\$0.00	\$77.20
Jan-31	\$138.80	\$0.00	\$142.97	\$0.00	\$142.97	\$0.00	\$142.97	\$93.79	\$0.00	\$96.60	\$0.00	\$96.60	\$0.00	\$96.60
Feb-31	\$100.69	\$0.00	\$103.71	\$0.00	\$103.71	\$0.00	\$103.71	\$84.43	\$0.00	\$86.96	\$0.00	\$86.96	\$0.00	\$86.96
Mar-31	\$70.87	\$0.00	\$73.00	\$0.00	\$73.00	\$0.00	\$73.00	\$59.40	\$0.00	\$61.18	\$0.00	\$61.18	\$0.00	\$61.18
Apr-31	\$66.26	\$0.00	\$68.25	\$0.00	\$68.25	\$0.00	\$68.25	\$53.28	\$0.00	\$54.88	\$0.00	\$54.88	\$0.00	\$54.88
May-31	\$74.88	\$0.00	\$77.12	\$0.00	\$77.12	\$0.00	\$77.12	\$55.21	\$0.00	\$56.87	\$0.00	\$56.87	\$0.00	\$56.87
Jun-31	\$79.26	\$0.00	\$81.64	\$0.00	\$81.64	\$0.00	\$81.64	\$56.56	\$0.00	\$58.26	\$0.00	\$58.26	\$0.00	\$58.26
Jul-31	\$96.78	\$0.00	\$99.68	\$0.00	\$99.68	\$0.00	\$99.68	\$59.55	\$0.00	\$61.34	\$0.00	\$61.34	\$0.00	\$61.34
Aug-31	\$75.66	\$0.00	\$77.93	\$0.00	\$77.93	\$0.00	\$77.93	\$58.63	\$0.00	\$60.39	\$0.00	\$60.39	\$0.00	\$60.39
Sep-31	\$63.66	\$0.00	\$65.57	\$0.00	\$65.57	\$0.00	\$65.57	\$55.75	\$0.00	\$57.42	\$0.00	\$57.42	\$0.00	\$57.42
Oct-31	\$60.90	\$0.00	\$62.73	\$0.00	\$62.73	\$0.00	\$62.73	\$53.28	\$0.00	\$54.88	\$0.00	\$54.88	\$0.00	\$54.88
Nov-31	\$69.97	\$0.00	\$72.07	\$0.00	\$72.07	\$0.00	\$72.07	\$58.70	\$0.00	\$60.46	\$0.00	\$60.46	\$0.00	\$60.46
Dec-31	\$101.04	\$0.00	\$104.07	\$0.00	\$104.07	\$0.00	\$104.07	\$76.45	\$0.00	\$78.75	\$0.00	\$78.75	\$0.00	\$78.75
Jan-32	\$141.58	\$0.00	\$145.83	\$0.00	\$145.83	\$0.00	\$145.83	\$95.66	\$0.00	\$98.53	\$0.00	\$98.53	\$0.00	\$98.53
Feb-32	\$102.70	\$0.00	\$105.78	\$0.00	\$105.78	\$0.00	\$105.78	\$86.11	\$0.00	\$88.70	\$0.00	\$88.70	\$0.00	\$88.70
Mar-32	\$72.29	\$0.00	\$74.46	\$0.00	\$74.46	\$0.00	\$74.46	\$60.59	\$0.00	\$62.41	\$0.00	\$62.41	\$0.00	\$62.41
Apr-32	\$67.58	\$0.00	\$69.61	\$0.00	\$69.61	\$0.00	\$69.61	\$54.35	\$0.00	\$				

Sep-34	\$67.56	\$0.00	\$69.58	\$0.00	\$69.58	\$0.00	\$69.58	\$59.16	\$0.00	\$60.94	\$0.00	\$60.94	\$0.00	\$60.94
Oct-34	\$64.63	\$0.00	\$66.57	\$0.00	\$66.57	\$0.00	\$66.57	\$56.55	\$0.00	\$58.24	\$0.00	\$58.24	\$0.00	\$58.24
Nov-34	\$74.26	\$0.00	\$76.48	\$0.00	\$76.48	\$0.00	\$76.48	\$62.29	\$0.00	\$64.16	\$0.00	\$64.16	\$0.00	\$64.16
Dec-34	\$107.22	\$0.00	\$110.44	\$0.00	\$110.44	\$0.00	\$110.44	\$81.13	\$0.00	\$83.57	\$0.00	\$83.57	\$0.00	\$83.57
Jan-35	\$150.25	\$0.00	\$154.75	\$0.00	\$154.75	\$0.00	\$154.75	\$101.52	\$0.00	\$104.56	\$0.00	\$104.56	\$0.00	\$104.56
Feb-35	\$108.99	\$0.00	\$112.26	\$0.00	\$112.26	\$0.00	\$112.26	\$91.38	\$0.00	\$94.13	\$0.00	\$94.13	\$0.00	\$94.13
Mar-35	\$76.71	\$0.00	\$79.01	\$0.00	\$79.01	\$0.00	\$79.01	\$64.30	\$0.00	\$66.23	\$0.00	\$66.23	\$0.00	\$66.23
Apr-35	\$71.72	\$0.00	\$73.87	\$0.00	\$73.87	\$0.00	\$73.87	\$57.67	\$0.00	\$59.40	\$0.00	\$59.40	\$0.00	\$59.40
May-35	\$81.05	\$0.00	\$83.48	\$0.00	\$83.48	\$0.00	\$83.48	\$59.76	\$0.00	\$61.56	\$0.00	\$61.56	\$0.00	\$61.56
Jun-35	\$85.79	\$0.00	\$88.37	\$0.00	\$88.37	\$0.00	\$88.37	\$61.22	\$0.00	\$63.06	\$0.00	\$63.06	\$0.00	\$63.06
Jul-35	\$104.75	\$0.00	\$107.90	\$0.00	\$107.90	\$0.00	\$107.90	\$64.46	\$0.00	\$66.40	\$0.00	\$66.40	\$0.00	\$66.40
Aug-35	\$81.90	\$0.00	\$84.36	\$0.00	\$84.36	\$0.00	\$84.36	\$63.47	\$0.00	\$65.37	\$0.00	\$65.37	\$0.00	\$65.37
Sep-35	\$68.91	\$0.00	\$70.98	\$0.00	\$70.98	\$0.00	\$70.98	\$60.35	\$0.00	\$62.16	\$0.00	\$62.16	\$0.00	\$62.16
Oct-35	\$65.92	\$0.00	\$67.90	\$0.00	\$67.90	\$0.00	\$67.90	\$57.68	\$0.00	\$59.41	\$0.00	\$59.41	\$0.00	\$59.41
Nov-35	\$75.74	\$0.00	\$78.01	\$0.00	\$78.01	\$0.00	\$78.01	\$63.54	\$0.00	\$65.44	\$0.00	\$65.44	\$0.00	\$65.44
Dec-35	\$109.37	\$0.00	\$112.65	\$0.00	\$112.65	\$0.00	\$112.65	\$82.75	\$0.00	\$85.24	\$0.00	\$85.24	\$0.00	\$85.24
Jan-36	\$153.25	\$0.00	\$157.85	\$0.00	\$157.85	\$0.00	\$157.85	\$103.55	\$0.00	\$106.66	\$0.00	\$106.66	\$0.00	\$106.66
Feb-36	\$111.17	\$0.00	\$114.50	\$0.00	\$114.50	\$0.00	\$114.50	\$93.21	\$0.00	\$96.01	\$0.00	\$96.01	\$0.00	\$96.01
Mar-36	\$78.25	\$0.00	\$80.60	\$0.00	\$80.60	\$0.00	\$80.60	\$65.59	\$0.00	\$67.55	\$0.00	\$67.55	\$0.00	\$67.55
Apr-36	\$73.15	\$0.00	\$75.35	\$0.00	\$75.35	\$0.00	\$75.35	\$58.83	\$0.00	\$60.59	\$0.00	\$60.59	\$0.00	\$60.59
May-36	\$82.67	\$0.00	\$85.15	\$0.00	\$85.15	\$0.00	\$85.15	\$60.96	\$0.00	\$62.79	\$0.00	\$62.79	\$0.00	\$62.79
Jun-36	\$87.51	\$0.00	\$90.13	\$0.00	\$90.13	\$0.00	\$90.13	\$62.45	\$0.00	\$64.32	\$0.00	\$64.32	\$0.00	\$64.32
Jul-36	\$106.85	\$0.00	\$110.06	\$0.00	\$110.06	\$0.00	\$110.06	\$65.75	\$0.00	\$67.72	\$0.00	\$67.72	\$0.00	\$67.72
Aug-36	\$83.54	\$0.00	\$86.05	\$0.00	\$86.05	\$0.00	\$86.05	\$64.74	\$0.00	\$66.68	\$0.00	\$66.68	\$0.00	\$66.68
Sep-36	\$70.29	\$0.00	\$72.40	\$0.00	\$72.40	\$0.00	\$72.40	\$61.55	\$0.00	\$63.40	\$0.00	\$63.40	\$0.00	\$63.40
Oct-36	\$67.24	\$0.00	\$69.26	\$0.00	\$69.26	\$0.00	\$69.26	\$58.83	\$0.00	\$60.59	\$0.00	\$60.59	\$0.00	\$60.59
Nov-36	\$77.26	\$0.00	\$79.57	\$0.00	\$79.57	\$0.00	\$79.57	\$64.81	\$0.00	\$66.75	\$0.00	\$66.75	\$0.00	\$66.75
Dec-36	\$111.56	\$0.00	\$114.90	\$0.00	\$114.90	\$0.00	\$114.90	\$84.41	\$0.00	\$86.94	\$0.00	\$86.94	\$0.00	\$86.94
Jan-37	\$156.32	\$0.00	\$161.01	\$0.00	\$161.01	\$0.00	\$161.01	\$105.62	\$0.00	\$108.79	\$0.00	\$108.79	\$0.00	\$108.79
Feb-37	\$113.39	\$0.00	\$116.79	\$0.00	\$116.79	\$0.00	\$116.79	\$95.08	\$0.00	\$97.93	\$0.00	\$97.93	\$0.00	\$97.93
Mar-37	\$79.81	\$0.00	\$82.21	\$0.00	\$82.21	\$0.00	\$82.21	\$66.90	\$0.00	\$68.90	\$0.00	\$68.90	\$0.00	\$68.90
Apr-37	\$74.62	\$0.00	\$76.86	\$0.00	\$76.86	\$0.00	\$76.86	\$60.00	\$0.00	\$61.80	\$0.00	\$61.80	\$0.00	\$61.80
May-37	\$84.32	\$0.00	\$86.85	\$0.00	\$86.85	\$0.00	\$86.85	\$62.18	\$0.00	\$64.04	\$0.00	\$64.04	\$0.00	\$64.04
Jun-37	\$89.26	\$0.00	\$91.94	\$0.00	\$91.94	\$0.00	\$91.94	\$63.69	\$0.00	\$65.61	\$0.00	\$65.61	\$0.00	\$65.61
Jul-37	\$108.99	\$0.00	\$112.26	\$0.00	\$112.26	\$0.00	\$112.26	\$67.07	\$0.00	\$69.08	\$0.00	\$69.08	\$0.00	\$69.08
Aug-37	\$85.21	\$0.00	\$87.77	\$0.00	\$87.77	\$0.00	\$87.77	\$66.03	\$0.00	\$68.01	\$0.00	\$68.01	\$0.00	\$68.01
Sep-37	\$71.69	\$0.00	\$73.84	\$0.00	\$73.84	\$0.00	\$73.84	\$62.78	\$0.00	\$64.67	\$0.00	\$64.67	\$0.00	\$64.67
Oct-37	\$68.59	\$0.00	\$70.64	\$0.00	\$70.64	\$0.00	\$70.64	\$60.01	\$0.00	\$61.81	\$0.00	\$61.81	\$0.00	\$61.81
Nov-37	\$78.80	\$0.00	\$81.17	\$0.00	\$81.17	\$0.00	\$81.17	\$66.10	\$0.00	\$68.09	\$0.00	\$68.09	\$0.00	\$68.09
Dec-37	\$113.79	\$0.00	\$117.20	\$0.00	\$117.20	\$0.00	\$117.20	\$86.10	\$0.00	\$88.68	\$0.00	\$88.68	\$0.00	\$88.68
Jan-38	\$159.44	\$0.00	\$164.23	\$0.00	\$164.23	\$0.00	\$164.23	\$107.73	\$0.00	\$110.96	\$0.00	\$110.96	\$0.00	\$110.96
Feb-38	\$115.66	\$0.00	\$119.13	\$0.00	\$119.13	\$0.00	\$119.13	\$96.98	\$0.00	\$99.89	\$0.00	\$99.89	\$0.00	\$99.89
Mar-38	\$81.41	\$0.00	\$83.85	\$0.00	\$83.85	\$0.00	\$83.85	\$68.24	\$0.00	\$70.28	\$0.00	\$70.28	\$0.00	\$70.28
Apr-38	\$76.11	\$0.00	\$78.39	\$0.00	\$78.39	\$0.00	\$78.39	\$61.20	\$0.00	\$63.04	\$0.00	\$63.04	\$0.00	\$63.04
May-38	\$86.01	\$0.00	\$88.59	\$0.00	\$88.59	\$0.00	\$88.59	\$63.42	\$0.00	\$65.32	\$0.00	\$65.32	\$0.00	\$65.32
Jun-38	\$91.04	\$0.00	\$93.77	\$0.00	\$93.77	\$0.00	\$93.77	\$64.97	\$0.00	\$66.92	\$0.00	\$66.92	\$0.00	\$66.92
Jul-38	\$111.17	\$0.00	\$114.50	\$0.00	\$114.50	\$0.00	\$114.50	\$68.41	\$0.00	\$70.46	\$0.00	\$70.46	\$0.00	\$70.46
Aug-38	\$86.91	\$0.00	\$89.52	\$0.00	\$89.52	\$0.00	\$89.52	\$67.35	\$0.00	\$69.37	\$0.00	\$69.37	\$0.00	\$69.37
Sep-38	\$73.13	\$0.00	\$75.32	\$0.00	\$75.32	\$0.00	\$75.32	\$64.04	\$0.00	\$65.96	\$0.00	\$65.96	\$0.00	\$65.96
Oct-38	\$69.96	\$0.00	\$72.06	\$0.00	\$72.06	\$0.00	\$72.06	\$61.21	\$0.00	\$63.04	\$0.00	\$63.04	\$0.00	\$63.04
Nov-38	\$80.38	\$0.00	\$82.79	\$0.00	\$82.79	\$0.00	\$82.79	\$67.43	\$0.00	\$69.45	\$0.00	\$69.45	\$0.00	\$69.45
Dec-38	\$116.06	\$0.00	\$119.55	\$0.00	\$119.55	\$0.00	\$119.55	\$87.82	\$0.00	\$90.45	\$0.00	\$90.45	\$0.00	\$90.45
Jan-39	\$162.63	\$0.00	\$167.51	\$0.00	\$167.51	\$0.00	\$167.51	\$109.89	\$0.00	\$113.18	\$0.00	\$113.18	\$0.00	\$113.18
Feb-39	\$117.97	\$0.00	\$121.51	\$0.00	\$121.51	\$0.00	\$121.51	\$98.92	\$0.00	\$101.89	\$0.00	\$101.89	\$0.00	\$101.89
Mar-39	\$83.04	\$0.00	\$85.53	\$0.00	\$85.53	\$0.00	\$85.53	\$69.60	\$0.00	\$71.69	\$0.00	\$71.69	\$0.00	\$71.69
Apr-39	\$77.63	\$0.00	\$79.96	\$0.00	\$79.96	\$0.00	\$79.96	\$62.43	\$0.00	\$64.30	\$0.00	\$64.30	\$0.00	\$64.30
May-39	\$87.73	\$0.00	\$90.36	\$0.00	\$90.36	\$0.00	\$90.36	\$64.69	\$0.00	\$66.63	\$0.00	\$66.63	\$0.00	\$66.63
Jun-39	\$92.86	\$0.00	\$95.65	\$0.00	\$95.65	\$0.00	\$95.65	\$66.27	\$0.00	\$68.26	\$0.00	\$68.26	\$0.00	\$68.26
Jul-39	\$113.39	\$0.00	\$116.79	\$0.00	\$116.79	\$0.00	\$116.79	\$99.78	\$0.00	\$102.87	\$0.00	\$102.87	\$0.00	\$102.87
Aug-39	\$88.65	\$0.00	\$91.31	\$0.00	\$91.31	\$0.00	\$91.31	\$68.70	\$0.00	\$70.76	\$0.00	\$70.76	\$0.00	\$70.76
Sep-39	\$74.59	\$0.00	\$76.83	\$0.00	\$76.83	\$0.00	\$76.83	\$65.32	\$0.00	\$67.28	\$0.00	\$67.28	\$0.00	\$67.28
Oct-39	\$71.36	\$0.00	\$73.50	\$0.00	\$73.50	\$0.00	\$73.50	\$62.43	\$0.00	\$64.30	\$0.00	\$64.30	\$0.00	\$64.30
Nov-39	\$81.99	\$0.00	\$84.44	\$0.00	\$84.44	\$0.00	\$84.44	\$68.77	\$0.00	\$70.84	\$0.00	\$70.84	\$0.00	\$70.84
Dec-39	\$118.38	\$0.00	\$121.94	\$0.00	\$121.94	\$0.00	\$121.94	\$89.58	\$0.00	\$92.26	\$0.00	\$92.26	\$0.00	\$92.26
Jan-40	\$165.88	\$0.00	\$170.86	\$0.00	\$170.86	\$0.00	\$170.86	\$112.08	\$0.00	\$115.45	\$0.00	\$115.45	\$0.00	\$115.45
Feb-40	\$120.33	\$0.00	\$123.94	\$0.00	\$123.94	\$0.00	\$123.94	\$100.90	\$0.00	\$103.92	\$0.00	\$103.92	\$0.00	\$103.92
Mar-40	\$84.70	\$0.00	\$87.24	\$0.00	\$87.24	\$0.00	\$87.24	\$70.99	\$0.00	\$73.12	\$0.00	\$73.12	\$0.00	\$73.12
Apr-40	\$79.18	\$0.00	\$81.56	\$0.00	\$81.56	\$0.00	\$81.56	\$63.68	\$0.00	\$65.59	\$0.00	\$65.59	\$0.00	\$65.59
May-40	\$89.48	\$0.00	\$92.17	\$0.00	\$92.17	\$0.00	\$92.17	\$65.98	\$0.00	\$67.96	\$0.00	\$67.96	\$0.00	\$67.96
Jun-40	\$94.72	\$0.00	\$97.56	\$0.00	\$97.56	\$0.00	\$97.56	\$67.59	\$0.00	\$69.62	\$0.00	\$69.62	\$0.00	\$69.62
Jul-40	\$115.66	\$0.00	\$119.13	\$0.00	\$119.13	\$0.00	\$119.13	\$71.17	\$0.00	\$73.31	\$0.00	\$73.31	\$0.00	\$73.31
Aug-40	\$90.43	\$0.00	\$93.14	\$0.00	\$93.14	\$0.00	\$93.14	\$70.07	\$0.00	\$72.18	\$0.00	\$72.18	\$0.00	\$72.18
Sep-40	\$76.08	\$0.00	\$78.36	\$0.00	\$78.36	\$0.00	\$78.36	\$66.63	\$0.00	\$68.63	\$0.00	\$68.63	\$0.00	\$68.63
Oct-40	\$72.78	\$0.00	\$74.97	\$0.00	\$74.97	\$0.00	\$74.97	\$63.68	\$0.00	\$65.59	\$0.00	\$65.59	\$0.00	\$65.59
Nov-40	\$83.62	\$0.00	\$86.13	\$0.00	\$86.13	\$0.00	\$86.13	\$70.15	\$0.00	\$72.25	\$0.00	\$72.25	\$0.00	\$72.25
Dec-40	\$120.75	\$0.00	\$124.38	\$0.00	\$124.38	\$0.00	\$124.38	\$91.37	\$0.00	\$94.11	\$0.00	\$94.11	\$0.00	\$94.11

Levelized Prices

6.0%														
0.5%	\$57.07		\$58.79		\$58.79		\$58.79	\$43.61		\$44.92		\$44.92		\$44.92
Average Prices	\$79.42		\$81.80		\$81.80		\$81.80	\$60.77		\$62.59		\$62.59		\$62.59

Base of price assumptions:

HQ Sale
 Price backed up to HQ/NB Border
 Price = Mass Hub MINUS ISO charges MINUS New NB Tx
 EQUALS Price at NB/PQ Border
 No adder for transmission as it is included in our capital investment
 EQUALS Price at NS Border

NSPI Transmission Costs Under NB OATT

Base Case - No Upgrades to the NB System

1.28%

						2003/04	2008/09	2015/16	2050/51				
Capital upgrades (\$M)						Base	IPL/NRI	HQ/NS					
Project						Per 10 MW			100	105.10			
Total Cost (NS#1+HQ#3)	1		75	0		Nominal	2015		0.068				
NS Tariff Share	2			0		2015	99.44	400	5.2	6.8			
Net NB Tariff Cost	3=1-2		75	0		2016	100.73	95.03	5.304	4.93395	6.8	6.42	
Revenue Requirements (\$M)													
Transmission Service Rev Req	4=1-2-3	80.5	91.0	99.4	155.2	2017	102.04	90.82	5.41008	4.68	6.8	6.05	
<i>Ancillary Services</i>													
System Control (Sched 1)	5	4.5	7.9	9.1	18.1	2018	103.37	86.79	5.51828	4.44	6.8	5.71	
Voltage Control (Sched 2)	6	5.6	6.3	7.2	14.4	2019	104.71	82.94	5.62865	4.21	6.8	5.39	
Total Compulsory AS	7=5+6	10.1	14.2	16.3	32.5	2020	106.07	79.27	5.74122	4.00	6.8	5.08	
						2021	107.45	75.75	5.85604	3.79	6.8	4.79	
						2022	108.85	72.39	5.97317	3.60	6.8	4.52	
						2023	110.27	69.18	6.09263	3.42	6.8	4.27	
						2024	111.70	66.11	6.21448	3.24	6.8	4.02	
						2025	113.15	63.18	6.33877	3.08	6.8	3.80	
						2026	114.62	60.38	6.46555	2.92	6.8	3.58	
						2027	116.11	57.70	6.59486	2.77	6.8	3.38	
						2028	117.62	55.15	6.72675	2.63	6.8	3.19	
						2029	119.15	52.70	6.86129	2.49	6.8	3.01	
						2030	120.70	50.36	6.99852	2.37	6.8	2.84	
						2031	122.27	48.13	7.13849	2.24	6.8	2.68	
						2032	123.86	46.00	7.28126	2.13	6.8	2.53	
						2033	125.47	43.96	7.42688	2.02	6.8	2.38	
						2034	127.10	42.01	7.57542	1.92	6.8	2.25	
						2035	128.75	40.15	7.72693	1.82	6.8	2.12	
						2036	130.43	38.37	7.88146	1.73	6.8	2.00	
						2037	132.12	36.66	8.03909	1.64	6.8	1.89	
						2038	133.84	35.04	8.19988	1.55	6.8	1.78	
						2039	135.58	33.49	8.36387	1.47	6.8	1.68	
						2040	137.34	32.00	8.53115	1.40	6.8	1.58	
						2041	139.13	30.58	8.70177	1.33	6.8	1.49	
						2042	140.94	29.23	8.87581	1.26	6.8	1.41	
						2043	142.77	27.93	9.05333	1.20	6.8	1.33	
						2044	144.62	26.69	9.23439	1.13	6.8	1.25	
						2045	146.50	25.51	9.41908	1.08	6.8	1.18	
						2046	148.41	24.38	9.60746	1.02	6.8	1.12	
						2047	150.34	23.30	9.79961	0.97	6.8	1.05	
						2048	152.29	22.26	9.9956	0.92	6.8	0.99	
						2049	154.27	21.28	10.1955	0.87	6.8	0.94	
						2050	156.28	20.33	10.3994	0.83	6.8	0.88	
						2051 NPV Total	1705.041		81.09		6.8	0.83	98.59
						2052					6.8	0.79	
						2053					6.8	0.74	
						2054			0.4	1.05	0.42	0.70	
						2055			0.6	0.75	0.45	0.66	
						2056				0.87	0.62	0.62	
						2057					0.59	0.59	
						2058					0.56	0.56	
						2059					0.52	0.52	
						2060					0.49	0.49	
											105.10	105.10	

Usage (MW)

Network	8	2100	2100	1900	2262
Long term firm	9	720	1080	1080	1080
Short term equivalent	10	300	250	200	200
Total usage	11=8+9+10	3120	3430	3180	3542

Tariffs (\$/kW-yr)

Transmission Service	12=4/11*1000	25.8	26.5	31.3	43.81	44.14	0.99%
Ancillary Services	13=7/11*1000	3.24	4.13	5.1	9.18		

Transmission Customer Costs (\$M)

Total Reservations	14=11		3180	3542
Tariff Annual charges	15=14*12/1000		99.4	155.2
Uniform Escalation from 2015	15		1.300%	
2015 NPV Tariff Cost	16=npv(15)		1705	

NSPI Transmission Costs Under NB OATT					
Case HQ500Adj - 500 MW HQ to NS with Direct Assignment					
	2003/04	2008/09	2015/16	2050/51	
Capital upgrades (\$M)					
Project		Base	IPL/NRI	HQ/NS	NS Direct
Total Cost (NS#1+HQ#3)	1		75	1050	
NS Tariff Share	2			150	292.0
Net NB Tariff Cost	3=1-2-Direct		75	608	
Revenue Requirement (\$M)					
Transmission Service Rev Req	4 (Note)	80.5	91.0	140.8	219.7
Usage (MW)					
Network	5	2100	2100	1900	2262
Long term firm	6	720	1080	1580	1580
Short term equivalent	7	300	250	200	200
Total usage	8=5+6+7	3120	3430	3680	4042
Tariff (\$/kW-yr)					
Transmission Service	9=4/8*1000	25.8	26.5	38.3	54.4
Nova Scotia Tariff costs (\$M)					
NS Firm Reservation (MW)	10			500	500
Annual charge	11=9*10/1000			19.1	27.18
2015 NPV	12=npv(11)			315.5	
Direct Assignment Charge	13=Direct*125%			365.0	
NSPI Tariff Additions	14=2*125%			187.5	
End Effects Share	15=3*10%*Share			41.9	
Total 2015 NPV cost	16=12+13+14+15			910.0	68.95%
Other Tx Customer Costs					
Total Reservations	17	3120	3430	3180	3542
Annual charge	18=17*9/1000			121.7	192.6
Annual Base Tariff Cost	19			99.4	155.2
Share of Upgrade Costs	20=18-19			22.2	37.35
NPV Share	21=npv(22)			391.0	
End Effects Share	22=3*10%*Share			18.9	
Total 2015 NPV Cost	23=21+22			409.9	31.05%
Total Additional Cost vs Base	24			1313	
Total Tariff Recovery (35 yrs)	25=16-15+21			1259	95.9%
Tariff End Effect (Year 35-45)	26=3*10%			60.8	
Total Cost Recovery	27=25+26			1320	100.5%

1.28%		NS Power		NB Power	
	Nominal	2015			
2015	19.13		22.22		
2016	19.32	18.23	22.55	21.3	
2017	19.52	17.37	22.88	20.4	
2018	19.71	16.55	23.23	19.5	
2019	19.91	15.77	23.57	18.7	
2020	20.11	15.03	23.93	17.9	
2021	20.32	14.32	24.28	17.1	
2022	20.52	13.65	24.65	16.4	
2023	20.73	13.00	25.01	15.7	
2024	20.94	12.39	25.39	15.0	
2025	21.15	11.81	25.77	14.4	
2026	21.36	11.25	26.15	13.8	
2027	21.58	10.72	26.54	13.2	
2028	21.79	10.22	26.94	12.6	
2029	22.01	9.74	27.34	12.1	
2030	22.24	9.28	27.75	11.6	
2031	22.46	8.84	28.16	11.1	
2032	22.69	8.42	28.59	10.6	
2033	22.92	8.03	29.01	10.2	
2034	23.15	7.65	29.45	9.7	
2035	23.38	7.29	29.89	9.3	
2036	23.62	6.95	30.33	8.9	
2037	23.85	6.62	30.79	8.5	
2038	24.09	6.31	31.25	8.2	
2039	24.34	6.01	31.71	7.8	
2040	24.58	5.73	32.19	7.5	
2041	24.83	5.46	32.67	7.2	
2042	25.08	5.20	33.15	6.9	
2043	25.33	4.96	33.65	6.6	
2044	25.59	4.72	34.15	6.3	
2045	25.85	4.50	34.66	6.0	
2046	26.11	4.29	35.18	5.8	
2047	26.37	4.09	35.71	5.5	
2048	26.64	3.89	36.24	5.3	
2049	26.91	3.71	36.78	5.1	
2050	27.18	3.54	37.33	4.9	
NPV Total	315.53		390.99		
			1.49%		

Esc = 1.009%

68.95

31.05

	Gas Prices - US\$/MMBtu				7.5	Power Prices - US\$/MWh		
	Henry Hub	Differential	ACG	Differential	Dracut	MassHub		
	2.0%		2.0%			7 X 24	On Peak	Off Peak
Nov-12	\$3.07	\$1.09	\$4.15			\$35.25	\$37.85	\$32.71
Dec-12	\$3.33	\$2.37	\$5.69			\$51.51	\$60.38	\$44.21
Jan-13	\$3.65	\$4.59	\$8.23			\$81.46	\$98.77	\$64.52
Feb-13	\$3.53	\$3.42	\$6.95			\$56.96	\$61.30	\$53.01
Mar-13	\$3.40	\$1.14	\$4.54			\$37.13	\$40.72	\$34.17
Apr-13	\$3.27	\$0.37	\$3.64			\$31.14	\$33.84	\$28.56
May-13	\$3.41	\$0.39	\$3.79			\$31.83	\$34.65	\$29.06
Jun-13	\$3.55	\$0.39	\$3.94			\$36.14	\$44.41	\$29.52
Jul-13	\$3.70	\$0.40	\$4.10			\$47.48	\$63.41	\$31.90
Aug-13	\$3.59	\$0.41	\$4.00			\$38.05	\$46.12	\$30.80
Sep-13	\$3.46	\$0.41	\$3.87			\$32.91	\$35.91	\$30.03
Oct-13	\$3.48	\$0.41	\$3.88			\$33.08	\$36.01	\$30.17
Nov-13	\$3.66	\$0.52	\$4.18			\$35.57	\$38.34	\$33.02
Dec-13	\$3.88	\$2.62	\$6.50			\$58.72	\$68.28	\$50.13
Jan-14	\$4.18	\$4.96	\$9.14			\$87.80	\$104.68	\$71.29
Feb-14	\$4.18	\$4.12	\$8.29			\$66.98	\$71.78	\$62.62
Mar-14	\$4.02	\$0.92	\$4.94			\$39.54	\$43.19	\$36.53
Apr-14	\$3.83	\$0.29	\$4.11			\$34.49	\$37.52	\$31.59
May-14	\$3.96	\$0.30	\$4.26			\$34.95	\$38.38	\$31.87
Jun-14	\$4.02	\$0.30	\$4.32			\$39.79	\$48.43	\$32.23
Jul-14	\$4.11	\$0.31	\$4.42			\$51.62	\$69.35	\$34.28
Aug-14	\$4.12	\$0.32	\$4.44			\$41.22	\$50.21	\$33.81
Sep-14	\$4.00	\$0.31	\$4.31			\$36.14	\$39.25	\$33.08
Oct-14	\$3.86	\$0.31	\$4.17			\$35.23	\$38.20	\$32.28
Nov-14	\$4.05	\$0.44	\$4.49			\$38.22	\$41.38	\$35.49
Dec-14	\$4.27	\$2.25	\$6.52			\$60.67	\$71.05	\$50.51
Jan-15	\$4.57	\$4.26	\$8.83			\$86.78	\$105.73	\$69.76
Feb-15	\$4.56	\$3.53	\$8.10			\$66.78	\$72.25	\$61.80
Mar-15	\$4.36	\$0.79	\$5.15			\$42.47	\$46.64	\$38.73
Apr-15	\$4.11	\$0.28	\$4.39			\$37.46	\$41.12	\$33.95
May-15	\$4.29	\$0.29	\$4.58			\$38.11	\$42.55	\$34.45
Jun-15	\$4.37	\$0.29	\$4.66			\$43.77	\$53.08	\$34.87
Jul-15	\$4.48	\$0.30	\$4.78			\$52.40	\$68.13	\$37.02
Aug-15	\$4.49	\$0.31	\$4.80			\$43.47	\$52.11	\$36.37
Sep-15	\$4.35	\$0.30	\$4.65			\$38.78	\$42.02	\$35.59
Oct-15	\$4.15	\$0.30	\$4.46			\$37.48	\$40.59	\$34.47
Nov-15	\$4.38	\$0.42	\$4.80			\$41.44	\$45.25	\$37.97
Dec-15	\$4.63	\$2.14	\$6.77			\$62.04	\$71.65	\$52.65
Jan-16	\$4.83	\$4.05	\$8.88			\$87.84	\$108.64	\$70.71
Feb-16	\$4.82	\$3.36	\$8.19			\$68.08	\$74.10	\$62.47
Mar-16	\$4.59	\$0.75	\$5.34			\$44.05	\$47.92	\$40.26
Apr-16	\$4.32	\$0.26	\$4.58			\$39.28	\$43.35	\$35.72
May-16	\$4.54	\$0.27	\$4.81			\$44.15	\$52.79	\$36.39
Jun-16	\$4.63	\$0.28	\$4.91			\$47.28	\$57.83	\$37.19
Jul-16	\$4.77	\$0.29	\$5.05			\$55.53	\$75.19	\$39.33
Aug-16	\$4.77	\$0.29	\$5.07			\$46.59	\$54.77	\$38.59
Sep-16	\$4.59	\$0.29	\$4.88			\$40.78	\$44.05	\$37.56

Oct-16	\$4.35	\$0.29	\$4.63	\$39.20	\$42.44	\$36.19
Nov-16	\$4.61	\$0.40	\$5.01	\$44.44	\$49.03	\$40.00
Dec-16	\$4.88	\$2.04	\$6.92	\$63.62	\$73.94	\$54.34
Jan-17	\$5.06	\$3.85	\$8.92	\$87.85	\$106.92	\$70.73
Feb-17	\$5.06	\$3.20	\$8.26	\$70.23	\$77.22	\$63.87
Mar-17	\$4.79	\$0.71	\$5.50	\$46.67	\$51.09	\$42.34
Apr-17	\$4.50	\$0.25	\$4.75	\$41.36	\$46.18	\$37.49
May-17	\$4.76	\$0.26	\$5.03	\$41.57	\$45.48	\$37.74
Jun-17	\$4.87	\$0.26	\$5.13	\$45.82	\$54.36	\$37.64
Jul-17	\$5.03	\$0.27	\$5.30	\$54.11	\$69.85	\$41.15
Aug-17	\$5.03	\$0.28	\$5.31	\$49.99	\$59.46	\$40.72
Sep-17	\$4.80	\$0.27	\$5.08	\$42.89	\$46.23	\$39.72
Oct-17	\$4.50	\$0.27	\$4.78	\$40.43	\$43.84	\$37.17
Nov-17	\$4.80	\$0.38	\$5.19	\$44.49	\$47.77	\$41.31
Dec-17	\$5.11	\$1.94	\$7.04	\$63.98	\$74.18	\$55.58
Jan-18	\$5.26	\$3.67	\$8.92	\$87.86	\$104.65	\$71.43
Feb-18	\$5.26	\$3.05	\$8.30	\$69.93	\$76.17	\$64.25
Mar-18	\$4.95	\$0.68	\$5.63	\$47.01	\$51.45	\$43.04
Apr-18	\$4.64	\$0.24	\$4.88	\$42.27	\$46.96	\$38.15
May-18	\$4.95	\$0.25	\$5.20	\$43.22	\$47.60	\$38.94
Jun-18	\$5.07	\$0.25	\$5.32	\$46.85	\$55.88	\$38.94
Jul-18	\$5.26	\$0.26	\$5.52	\$56.28	\$71.31	\$42.78
Aug-18	\$5.26	\$0.26	\$5.52	\$50.41	\$58.82	\$42.17
Sep-18	\$4.95	\$0.26	\$5.21	\$43.73	\$47.33	\$40.44
Oct-18	\$4.64	\$0.26	\$4.90	\$41.55	\$44.96	\$38.16
Nov-18	\$4.95	\$0.37	\$5.31	\$45.59	\$48.93	\$42.36
Dec-18	\$5.26	\$1.85	\$7.10	\$64.23	\$74.04	\$56.15
Jan-19	\$5.42	\$3.49	\$8.91	\$88.79	\$106.18	\$71.78
Feb-19	\$5.42	\$2.90	\$8.31	\$70.23	\$76.48	\$64.55
Mar-19	\$5.10	\$0.64	\$5.74	\$48.04	\$52.98	\$43.97
Apr-19	\$4.78	\$0.23	\$5.00	\$43.81	\$48.70	\$39.13
May-19	\$5.10	\$0.23	\$5.33	\$44.83	\$49.75	\$40.02
Jun-19	\$5.22	\$0.24	\$5.46	\$48.21	\$58.08	\$40.31
Jul-19	\$5.42	\$0.24	\$5.66	\$59.31	\$74.80	\$44.15
Aug-19	\$5.42	\$0.25	\$5.67	\$51.23	\$59.90	\$43.44
Sep-19	\$5.10	\$0.25	\$5.34	\$44.83	\$48.57	\$41.31
Oct-19	\$4.78	\$0.25	\$5.02	\$42.76	\$46.15	\$39.40
Nov-19	\$5.10	\$0.37	\$5.47	\$47.07	\$50.65	\$43.81
Dec-19	\$5.42	\$1.86	\$7.28	\$66.55	\$76.40	\$57.71
Jan-20	\$5.58	\$3.52	\$9.10	\$92.04	\$110.28	\$74.19
Feb-20	\$5.58	\$2.93	\$8.51	\$72.46	\$79.06	\$66.85
Mar-20	\$5.25	\$0.65	\$5.90	\$50.54	\$55.55	\$46.05
Apr-20	\$4.92	\$0.23	\$5.15	\$45.79	\$50.62	\$41.18
May-20	\$5.25	\$0.24	\$5.49	\$46.99	\$52.59	\$42.39
Jun-20	\$5.38	\$0.24	\$5.62	\$52.83	\$62.94	\$43.16
Jul-20	\$5.58	\$0.25	\$5.82	\$61.49	\$77.08	\$46.23
Aug-20	\$5.58	\$0.25	\$5.83	\$52.69	\$61.69	\$45.28
Sep-20	\$5.25	\$0.25	\$5.50	\$46.72	\$50.33	\$43.17
Oct-20	\$4.92	\$0.25	\$5.17	\$44.54	\$47.90	\$41.32
Nov-20	\$5.25	\$0.37	\$5.62	\$49.69	\$54.00	\$45.79
Dec-20	\$5.58	\$1.88	\$7.46	\$69.73	\$79.90	\$59.77

Jan-21	\$5.75	\$3.56	\$9.30	\$92.59	\$112.83	\$75.93
Feb-21	\$5.75	\$2.96	\$8.70	\$74.48	\$81.56	\$68.03
Mar-21	\$5.41	\$0.66	\$6.06	\$52.32	\$57.25	\$47.50
Apr-21	\$5.07	\$0.23	\$5.30	\$47.36	\$52.48	\$42.46
May-21	\$5.41	\$0.24	\$5.65	\$49.26	\$55.85	\$43.83
Jun-21	\$5.54	\$0.24	\$5.79	\$54.44	\$64.46	\$44.87
Jul-21	\$5.75	\$0.25	\$5.99	\$62.17	\$78.35	\$47.65
Aug-21	\$5.75	\$0.26	\$6.00	\$54.05	\$62.36	\$46.58
Sep-21	\$5.41	\$0.25	\$5.66	\$47.93	\$51.41	\$44.52
Oct-21	\$5.07	\$0.25	\$5.32	\$45.66	\$49.03	\$42.52
Nov-21	\$5.41	\$0.38	\$5.78	\$51.46	\$55.97	\$47.11
Dec-21	\$5.75	\$1.90	\$7.65	\$71.33	\$81.50	\$61.37
Jan-22	\$5.92	\$3.59	\$9.51	\$95.49	\$116.15	\$78.48
Feb-22	\$5.92	\$2.99	\$8.90	\$77.12	\$84.25	\$70.64
Mar-22	\$5.57	\$0.66	\$6.23	\$54.45	\$59.30	\$49.71
Apr-22	\$5.22	\$0.23	\$5.45	\$49.65	\$55.44	\$44.58
May-22	\$5.57	\$0.24	\$5.81	\$53.98	\$62.65	\$46.20
Jun-22	\$5.71	\$0.25	\$5.95	\$56.61	\$66.32	\$47.33
Jul-22	\$5.92	\$0.25	\$6.17	\$63.90	\$80.98	\$49.83
Aug-22	\$5.92	\$0.26	\$6.18	\$56.11	\$63.31	\$49.06
Sep-22	\$5.57	\$0.25	\$5.82	\$49.93	\$53.27	\$46.65
Oct-22	\$5.22	\$0.25	\$5.48	\$47.66	\$50.96	\$44.59
Nov-22	\$5.57	\$0.38	\$5.95	\$53.75	\$58.55	\$49.12
Dec-22	\$5.92	\$1.92	\$7.84	\$73.71	\$84.55	\$63.97
Jan-23	\$6.04	\$3.67	\$9.70	\$97.40	\$118.47	\$80.05
Feb-23	\$6.04	\$3.05	\$9.08	\$78.67	\$85.93	\$72.06
Mar-23	\$5.68	\$0.68	\$6.36	\$55.54	\$60.49	\$50.70
Apr-23	\$5.33	\$0.24	\$5.56	\$50.64	\$56.55	\$45.48
May-23	\$5.68	\$0.25	\$5.93	\$55.06	\$63.91	\$47.12
Jun-23	\$5.82	\$0.25	\$6.07	\$57.74	\$67.65	\$48.27
Jul-23	\$6.04	\$0.26	\$6.29	\$65.18	\$82.60	\$50.83
Aug-23	\$6.04	\$0.26	\$6.30	\$57.23	\$64.58	\$50.04
Sep-23	\$5.68	\$0.26	\$5.94	\$50.93	\$54.33	\$47.58
Oct-23	\$5.33	\$0.26	\$5.58	\$48.61	\$51.98	\$45.48
Nov-23	\$5.68	\$0.39	\$6.07	\$54.82	\$59.72	\$50.10
Dec-23	\$6.04	\$1.96	\$8.00	\$75.18	\$86.24	\$65.25
Jan-24	\$6.16	\$3.74	\$9.90	\$99.35	\$120.84	\$81.65
Feb-24	\$6.16	\$3.11	\$9.26	\$80.24	\$87.65	\$73.50
Mar-24	\$5.80	\$0.69	\$6.49	\$56.65	\$61.70	\$51.71
Apr-24	\$5.43	\$0.24	\$5.67	\$51.66	\$57.68	\$46.39
May-24	\$5.80	\$0.25	\$6.05	\$56.16	\$65.18	\$48.07
Jun-24	\$5.94	\$0.26	\$6.20	\$58.90	\$69.00	\$49.24
Jul-24	\$6.16	\$0.26	\$6.42	\$66.48	\$84.25	\$51.84
Aug-24	\$6.16	\$0.27	\$6.43	\$58.38	\$65.87	\$51.04
Sep-24	\$5.80	\$0.26	\$6.06	\$51.95	\$55.42	\$48.53
Oct-24	\$5.43	\$0.26	\$5.70	\$49.58	\$53.02	\$46.39
Nov-24	\$5.80	\$0.40	\$6.19	\$55.92	\$60.92	\$51.10
Dec-24	\$6.16	\$2.00	\$8.16	\$76.68	\$87.96	\$66.56
Jan-25	\$6.28	\$3.81	\$10.10	\$101.33	\$123.25	\$83.28
Feb-25	\$6.28	\$3.17	\$9.45	\$81.84	\$89.41	\$74.97
Mar-25	\$5.91	\$0.70	\$6.62	\$57.79	\$62.93	\$52.75

Apr-25	\$5.54	\$0.25	\$5.79	\$52.69	\$58.84	\$47.31
May-25	\$5.91	\$0.26	\$6.17	\$57.29	\$66.49	\$49.03
Jun-25	\$6.06	\$0.26	\$6.32	\$60.08	\$70.38	\$50.22
Jul-25	\$6.28	\$0.27	\$6.55	\$67.81	\$85.94	\$52.88
Aug-25	\$6.28	\$0.27	\$6.55	\$59.55	\$67.19	\$52.07
Sep-25	\$5.91	\$0.27	\$6.18	\$52.99	\$56.53	\$49.50
Oct-25	\$5.54	\$0.27	\$5.81	\$50.57	\$54.08	\$47.31
Nov-25	\$5.91	\$0.40	\$6.31	\$57.04	\$62.13	\$52.12
Dec-25	\$6.28	\$2.04	\$8.32	\$78.22	\$89.72	\$67.89
Jan-26	\$6.41	\$3.89	\$10.30	\$103.36	\$125.72	\$84.95
Feb-26	\$6.41	\$3.23	\$9.64	\$83.48	\$91.19	\$76.47
Mar-26	\$6.03	\$0.72	\$6.75	\$58.94	\$64.19	\$53.80
Apr-26	\$5.65	\$0.25	\$5.90	\$53.74	\$60.01	\$48.26
May-26	\$6.03	\$0.26	\$6.29	\$58.43	\$67.82	\$50.01
Jun-26	\$6.18	\$0.27	\$6.45	\$61.28	\$71.79	\$51.23
Jul-26	\$6.41	\$0.27	\$6.68	\$69.17	\$87.65	\$53.94
Aug-26	\$6.41	\$0.28	\$6.68	\$60.74	\$68.53	\$53.11
Sep-26	\$6.03	\$0.27	\$6.30	\$54.05	\$57.66	\$50.49
Oct-26	\$5.65	\$0.27	\$5.93	\$51.59	\$55.16	\$48.26
Nov-26	\$6.03	\$0.41	\$6.44	\$58.18	\$63.38	\$53.16
Dec-26	\$6.41	\$2.08	\$8.49	\$79.78	\$91.52	\$69.25
Jan-27	\$6.53	\$3.97	\$10.50	\$105.43	\$128.23	\$86.65
Feb-27	\$6.53	\$3.30	\$9.83	\$85.15	\$93.02	\$78.00
Mar-27	\$6.15	\$0.73	\$6.88	\$60.12	\$65.47	\$54.88
Apr-27	\$5.77	\$0.26	\$6.02	\$54.82	\$61.21	\$49.22
May-27	\$6.15	\$0.27	\$6.42	\$59.60	\$69.17	\$51.01
Jun-27	\$6.30	\$0.27	\$6.57	\$62.50	\$73.22	\$52.25
Jul-27	\$6.53	\$0.28	\$6.81	\$70.55	\$89.41	\$55.02
Aug-27	\$6.53	\$0.28	\$6.82	\$61.95	\$69.90	\$54.17
Sep-27	\$6.15	\$0.28	\$6.43	\$55.13	\$58.81	\$51.50
Oct-27	\$5.77	\$0.28	\$6.05	\$52.62	\$56.26	\$49.23
Nov-27	\$6.15	\$0.42	\$6.57	\$59.34	\$64.64	\$54.23
Dec-27	\$6.53	\$2.12	\$8.66	\$81.38	\$93.35	\$70.63
Jan-28	\$6.66	\$4.05	\$10.71	\$107.54	\$130.80	\$88.38
Feb-28	\$6.66	\$3.36	\$10.03	\$86.85	\$94.88	\$79.56
Mar-28	\$6.27	\$0.75	\$7.02	\$61.32	\$66.78	\$55.98
Apr-28	\$5.88	\$0.26	\$6.14	\$55.91	\$62.44	\$50.21
May-28	\$6.27	\$0.27	\$6.55	\$60.79	\$70.56	\$52.03
Jun-28	\$6.43	\$0.28	\$6.71	\$63.75	\$74.69	\$53.30
Jul-28	\$6.66	\$0.28	\$6.95	\$71.96	\$91.20	\$56.12
Aug-28	\$6.66	\$0.29	\$6.95	\$63.19	\$71.30	\$55.25
Sep-28	\$6.27	\$0.29	\$6.56	\$56.23	\$59.99	\$52.53
Oct-28	\$5.88	\$0.29	\$6.17	\$53.67	\$57.39	\$50.21
Nov-28	\$6.27	\$0.43	\$6.70	\$60.53	\$65.94	\$55.31
Dec-28	\$6.66	\$2.16	\$8.83	\$83.00	\$95.21	\$72.04
Jan-29	\$6.80	\$4.13	\$10.93	\$109.69	\$133.41	\$90.15
Feb-29	\$6.80	\$3.43	\$10.23	\$88.59	\$96.78	\$81.15
Mar-29	\$6.40	\$0.76	\$7.16	\$62.55	\$68.12	\$57.10
Apr-29	\$6.00	\$0.27	\$6.26	\$57.03	\$63.69	\$51.21
May-29	\$6.40	\$0.28	\$6.68	\$62.01	\$71.97	\$53.07
Jun-29	\$6.56	\$0.28	\$6.84	\$65.03	\$76.18	\$54.36

Jul-29	\$6.80	\$0.29	\$7.09	\$73.40	\$93.02	\$57.24
Aug-29	\$6.80	\$0.30	\$7.09	\$64.45	\$72.73	\$56.36
Sep-29	\$6.40	\$0.29	\$6.69	\$57.36	\$61.19	\$53.59
Oct-29	\$6.00	\$0.29	\$6.29	\$54.74	\$58.54	\$51.21
Nov-29	\$6.40	\$0.44	\$6.83	\$61.74	\$67.26	\$56.42
Dec-29	\$6.80	\$2.21	\$9.00	\$84.67	\$97.12	\$73.48
Jan-30	\$6.93	\$4.21	\$11.15	\$111.88	\$136.08	\$91.95
Feb-30	\$6.93	\$3.50	\$10.43	\$90.36	\$98.71	\$82.77
Mar-30	\$6.53	\$0.78	\$7.30	\$63.80	\$69.48	\$58.24
Apr-30	\$6.12	\$0.27	\$6.39	\$58.17	\$64.96	\$52.24
May-30	\$6.53	\$0.28	\$6.81	\$63.25	\$73.41	\$54.13
Jun-30	\$6.69	\$0.29	\$6.98	\$66.33	\$77.70	\$55.45
Jul-30	\$6.93	\$0.29	\$7.23	\$74.87	\$94.88	\$58.38
Aug-30	\$6.93	\$0.30	\$7.24	\$65.74	\$74.18	\$57.48
Sep-30	\$6.53	\$0.30	\$6.82	\$58.50	\$62.41	\$54.66
Oct-30	\$6.12	\$0.30	\$6.42	\$55.84	\$59.71	\$52.24
Nov-30	\$6.53	\$0.45	\$6.97	\$62.98	\$68.60	\$57.55
Dec-30	\$6.93	\$2.25	\$9.18	\$86.36	\$99.06	\$74.95
Jan-31	\$7.07	\$4.30	\$11.37	\$114.12	\$138.80	\$93.79
Feb-31	\$7.07	\$3.57	\$10.64	\$92.17	\$100.69	\$84.43
Mar-31	\$6.66	\$0.79	\$7.45	\$65.08	\$70.87	\$59.40
Apr-31	\$6.24	\$0.28	\$6.52	\$59.34	\$66.26	\$53.28
May-31	\$6.66	\$0.29	\$6.95	\$64.51	\$74.88	\$55.21
Jun-31	\$6.82	\$0.29	\$7.12	\$67.66	\$79.26	\$56.56
Jul-31	\$7.07	\$0.30	\$7.37	\$76.36	\$96.78	\$59.55
Aug-31	\$7.07	\$0.31	\$7.38	\$67.06	\$75.66	\$58.63
Sep-31	\$6.66	\$0.30	\$6.96	\$59.67	\$63.66	\$55.75
Oct-31	\$6.24	\$0.30	\$6.54	\$56.96	\$60.90	\$53.28
Nov-31	\$6.66	\$0.45	\$7.11	\$64.24	\$69.97	\$58.70
Dec-31	\$7.07	\$2.30	\$9.37	\$88.09	\$101.04	\$76.45
Jan-32	\$7.21	\$4.38	\$11.60	\$116.40	\$141.58	\$95.66
Feb-32	\$7.21	\$3.64	\$10.85	\$94.01	\$102.70	\$86.11
Mar-32	\$6.79	\$0.81	\$7.60	\$66.38	\$72.29	\$60.59
Apr-32	\$6.37	\$0.28	\$6.65	\$60.52	\$67.58	\$54.35
May-32	\$6.79	\$0.30	\$7.09	\$65.80	\$76.37	\$56.32
Jun-32	\$6.96	\$0.30	\$7.26	\$69.01	\$80.84	\$57.69
Jul-32	\$7.21	\$0.31	\$7.52	\$77.89	\$98.71	\$60.74
Aug-32	\$7.21	\$0.31	\$7.53	\$68.40	\$77.18	\$59.81
Sep-32	\$6.79	\$0.31	\$7.10	\$60.87	\$64.93	\$56.87
Oct-32	\$6.37	\$0.31	\$6.67	\$58.09	\$62.12	\$54.35
Nov-32	\$6.79	\$0.46	\$7.25	\$65.52	\$71.37	\$59.87
Dec-32	\$7.21	\$2.34	\$9.56	\$89.85	\$103.06	\$77.98
Jan-33	\$7.36	\$4.47	\$11.83	\$118.73	\$144.41	\$97.58
Feb-33	\$7.36	\$3.71	\$11.07	\$95.89	\$104.75	\$87.84
Mar-33	\$6.93	\$0.82	\$7.75	\$67.71	\$73.73	\$61.80
Apr-33	\$6.49	\$0.29	\$6.78	\$61.73	\$68.94	\$55.43
May-33	\$6.93	\$0.30	\$7.23	\$67.12	\$77.90	\$57.44
Jun-33	\$7.10	\$0.30	\$7.40	\$70.39	\$82.46	\$58.84
Jul-33	\$7.36	\$0.31	\$7.67	\$79.45	\$100.69	\$61.96
Aug-33	\$7.36	\$0.32	\$7.68	\$69.77	\$78.72	\$61.00
Sep-33	\$6.93	\$0.32	\$7.24	\$62.08	\$66.23	\$58.00

Oct-33	\$6.49	\$0.32	\$6.81	\$59.26	\$63.36	\$55.44
Nov-33	\$6.93	\$0.47	\$7.40	\$66.83	\$72.80	\$61.07
Dec-33	\$7.36	\$2.39	\$9.75	\$91.64	\$105.12	\$79.54
Jan-34	\$7.51	\$4.56	\$12.06	\$121.10	\$147.30	\$99.53
Feb-34	\$7.51	\$3.79	\$11.29	\$97.81	\$106.85	\$89.59
Mar-34	\$7.06	\$0.84	\$7.91	\$69.06	\$75.21	\$63.04
Apr-34	\$6.62	\$0.29	\$6.92	\$62.97	\$70.31	\$56.54
May-34	\$7.06	\$0.31	\$7.37	\$68.46	\$79.46	\$58.59
Jun-34	\$7.24	\$0.31	\$7.55	\$71.80	\$84.11	\$60.02
Jul-34	\$7.51	\$0.32	\$7.82	\$81.04	\$102.70	\$63.20
Aug-34	\$7.51	\$0.33	\$7.83	\$71.16	\$80.30	\$62.22
Sep-34	\$7.06	\$0.32	\$7.39	\$63.33	\$67.56	\$59.16
Oct-34	\$6.62	\$0.32	\$6.94	\$60.44	\$64.63	\$56.55
Nov-34	\$7.06	\$0.48	\$7.55	\$68.17	\$74.26	\$62.29
Dec-34	\$7.51	\$2.44	\$9.94	\$93.48	\$107.22	\$81.13
Jan-35	\$7.66	\$4.65	\$12.31	\$123.52	\$150.25	\$101.52
Feb-35	\$7.66	\$3.86	\$11.52	\$99.77	\$108.99	\$91.38
Mar-35	\$7.21	\$0.86	\$8.06	\$70.44	\$76.71	\$64.30
Apr-35	\$6.76	\$0.30	\$7.06	\$64.23	\$71.72	\$57.67
May-35	\$7.21	\$0.31	\$7.52	\$69.83	\$81.05	\$59.76
Jun-35	\$7.39	\$0.32	\$7.70	\$73.23	\$85.79	\$61.22
Jul-35	\$7.66	\$0.33	\$7.98	\$82.66	\$104.75	\$64.46
Aug-35	\$7.66	\$0.33	\$7.99	\$72.59	\$81.90	\$63.47
Sep-35	\$7.21	\$0.33	\$7.53	\$64.59	\$68.91	\$60.35
Oct-35	\$6.76	\$0.33	\$7.08	\$61.65	\$65.92	\$57.68
Nov-35	\$7.21	\$0.49	\$7.70	\$69.53	\$75.74	\$63.54
Dec-35	\$7.66	\$2.48	\$10.14	\$95.35	\$109.37	\$82.75
Jan-36	\$7.81	\$4.74	\$12.55	\$126.00	\$153.25	\$103.55
Feb-36	\$7.81	\$3.94	\$11.75	\$101.76	\$111.17	\$93.21
Mar-36	\$7.35	\$0.88	\$8.23	\$71.85	\$78.25	\$65.59
Apr-36	\$6.89	\$0.31	\$7.20	\$65.51	\$73.15	\$58.83
May-36	\$7.35	\$0.32	\$7.67	\$71.23	\$82.67	\$60.96
Jun-36	\$7.53	\$0.32	\$7.86	\$74.70	\$87.51	\$62.45
Jul-36	\$7.81	\$0.33	\$8.14	\$84.31	\$106.85	\$65.75
Aug-36	\$7.81	\$0.34	\$8.15	\$74.04	\$83.54	\$64.74
Sep-36	\$7.35	\$0.33	\$7.68	\$65.88	\$70.29	\$61.55
Oct-36	\$6.89	\$0.33	\$7.22	\$62.88	\$67.24	\$58.83
Nov-36	\$7.35	\$0.50	\$7.85	\$70.92	\$77.26	\$64.81
Dec-36	\$7.81	\$2.53	\$10.34	\$97.25	\$111.56	\$84.41
Jan-37	\$7.97	\$4.84	\$12.80	\$128.52	\$156.32	\$105.62
Feb-37	\$7.97	\$4.02	\$11.98	\$103.80	\$113.39	\$95.08
Mar-37	\$7.50	\$0.89	\$8.39	\$73.29	\$79.81	\$66.90
Apr-37	\$7.03	\$0.31	\$7.34	\$66.82	\$74.62	\$60.00
May-37	\$7.50	\$0.33	\$7.82	\$72.65	\$84.32	\$62.18
Jun-37	\$7.68	\$0.33	\$8.01	\$76.19	\$89.26	\$63.69
Jul-37	\$7.97	\$0.34	\$8.30	\$86.00	\$108.99	\$67.07
Aug-37	\$7.97	\$0.35	\$8.31	\$75.52	\$85.21	\$66.03
Sep-37	\$7.50	\$0.34	\$7.84	\$67.20	\$71.69	\$62.78
Oct-37	\$7.03	\$0.34	\$7.37	\$64.14	\$68.59	\$60.01
Nov-37	\$7.50	\$0.51	\$8.01	\$72.34	\$78.80	\$66.10
Dec-37	\$7.97	\$2.59	\$10.55	\$99.20	\$113.79	\$86.10

Jan-38	\$8.12	\$4.93	\$13.06	\$131.09	\$159.44	\$107.73
Feb-38	\$8.12	\$4.10	\$12.22	\$105.87	\$115.66	\$96.98
Mar-38	\$7.65	\$0.91	\$8.56	\$74.75	\$81.41	\$68.24
Apr-38	\$7.17	\$0.32	\$7.49	\$68.16	\$76.11	\$61.20
May-38	\$7.65	\$0.33	\$7.98	\$74.11	\$86.01	\$63.42
Jun-38	\$7.84	\$0.34	\$8.17	\$77.72	\$91.04	\$64.97
Jul-38	\$8.12	\$0.35	\$8.47	\$87.72	\$111.17	\$68.41
Aug-38	\$8.12	\$0.35	\$8.48	\$77.03	\$86.91	\$67.35
Sep-38	\$7.65	\$0.35	\$7.99	\$68.55	\$73.13	\$64.04
Oct-38	\$7.17	\$0.35	\$7.52	\$65.42	\$69.96	\$61.21
Nov-38	\$7.65	\$0.52	\$8.17	\$73.79	\$80.38	\$67.43
Dec-38	\$8.12	\$2.64	\$10.76	\$101.18	\$116.06	\$87.82
Jan-39	\$8.29	\$5.03	\$13.32	\$133.71	\$162.63	\$109.89
Feb-39	\$8.29	\$4.18	\$12.47	\$107.99	\$117.97	\$98.92
Mar-39	\$7.80	\$0.93	\$8.73	\$76.25	\$83.04	\$69.60
Apr-39	\$7.31	\$0.32	\$7.64	\$69.52	\$77.63	\$62.43
May-39	\$7.80	\$0.34	\$8.14	\$75.59	\$87.73	\$64.69
Jun-39	\$7.99	\$0.34	\$8.34	\$79.27	\$92.86	\$66.27
Jul-39	\$8.29	\$0.35	\$8.64	\$89.47	\$113.39	\$69.78
Aug-39	\$8.29	\$0.36	\$8.65	\$78.57	\$88.65	\$68.70
Sep-39	\$7.80	\$0.35	\$8.15	\$69.92	\$74.59	\$65.32
Oct-39	\$7.31	\$0.35	\$7.67	\$66.73	\$71.36	\$62.43
Nov-39	\$7.80	\$0.53	\$8.33	\$75.26	\$81.99	\$68.77
Dec-39	\$8.29	\$2.69	\$10.98	\$103.21	\$118.38	\$89.58
Jan-40	\$8.45	\$5.13	\$13.59	\$136.38	\$165.88	\$112.08
Feb-40	\$8.45	\$4.26	\$12.72	\$110.15	\$120.33	\$100.90
Mar-40	\$7.96	\$0.95	\$8.90	\$77.77	\$84.70	\$70.99
Apr-40	\$7.46	\$0.33	\$7.79	\$70.91	\$79.18	\$63.68
May-40	\$7.96	\$0.35	\$8.30	\$77.10	\$89.48	\$65.98
Jun-40	\$8.15	\$0.35	\$8.50	\$80.86	\$94.72	\$67.59
Jul-40	\$8.45	\$0.36	\$8.81	\$91.26	\$115.66	\$71.17
Aug-40	\$8.45	\$0.37	\$8.82	\$80.14	\$90.43	\$70.07
Sep-40	\$7.96	\$0.36	\$8.32	\$71.31	\$76.08	\$66.63
Oct-40	\$7.46	\$0.36	\$7.82	\$68.07	\$72.78	\$63.68
Nov-40	\$7.96	\$0.54	\$8.50	\$76.77	\$83.62	\$70.15
Dec-40	\$8.45	\$2.74	\$11.20	\$105.27	\$120.75	\$91.37

Annualized

2012	\$3.20	\$1.73	\$4.92	\$43.38	\$49.12	\$38.46
2013	\$3.55	\$1.25	\$4.80	\$43.37	\$50.15	\$37.07
2014	\$4.05	\$1.24	\$5.28	\$47.22	\$54.45	\$40.47
2015	\$4.40	\$1.10	\$5.50	\$49.25	\$56.76	\$42.30
2016	\$4.64	\$1.05	\$5.69	\$51.74	\$60.34	\$44.06
2017	\$4.86	\$1.00	\$5.86	\$52.45	\$60.22	\$45.46
2018	\$5.04	\$0.95	\$5.98	\$53.24	\$60.67	\$46.40
2019	\$5.19	\$0.91	\$6.10	\$54.64	\$62.39	\$47.47
2020	\$5.34	\$0.92	\$6.26	\$57.13	\$65.16	\$49.61
2021	\$5.50	\$0.93	\$6.43	\$58.59	\$66.92	\$51.03
2022	\$5.67	\$0.94	\$6.61	\$61.03	\$69.64	\$53.35

2023	\$5.78	\$0.96	\$6.74	\$62.25	\$71.04	\$54.41
2024	\$5.90	\$0.98	\$6.88	\$63.50	\$72.46	\$55.50
2025	\$6.02	\$1.00	\$7.01	\$64.77	\$73.91	\$56.61
2026	\$6.14	\$1.02	\$7.15	\$66.06	\$75.38	\$57.74
2027	\$6.26	\$1.04	\$7.30	\$67.38	\$76.89	\$58.90
2028	\$6.38	\$1.06	\$7.44	\$68.73	\$78.43	\$60.08
2029	\$6.51	\$1.08	\$7.59	\$70.10	\$80.00	\$61.28
2030	\$6.64	\$1.10	\$7.74	\$71.51	\$81.60	\$62.50
2031	\$6.77	\$1.12	\$7.90	\$72.94	\$83.23	\$63.75
2032	\$6.91	\$1.15	\$8.06	\$74.40	\$84.90	\$65.03
2033	\$7.05	\$1.17	\$8.22	\$75.88	\$86.59	\$66.33
2034	\$7.19	\$1.19	\$8.38	\$77.40	\$88.33	\$67.66
2035	\$7.33	\$1.22	\$8.55	\$78.95	\$90.09	\$69.01
2036	\$7.48	\$1.24	\$8.72	\$80.53	\$91.89	\$70.39
2037	\$7.63	\$1.27	\$8.89	\$82.14	\$93.73	\$71.80
2038	\$7.78	\$1.29	\$9.07	\$83.78	\$95.61	\$73.23
2039	\$7.94	\$1.32	\$9.25	\$85.46	\$97.52	\$74.70
2040	\$8.10	\$1.34	\$9.44	\$87.17	\$99.47	\$76.19

1 2 3 4 5 6 7 8 9 10 # 12 13 14

Capacity Market Forecast

Capacity Year	ESAI Nominal	Calendar Year	ESAI Nominal	Inflation	Nominal	Nominal	MW	MWh	US\$/MWh
	US\$ - \$/kW-		US\$ - \$/kW-		Escalation	Forecast -			
	mo		mo			US\$/kW-mo			
2016/17	\$3.15	2017	\$3.19	2.0%		\$3.19	165	963,600	\$6.56
2017/18	\$3.25	2018	\$3.98	2.0%	25%	\$3.98	165	963,600	\$8.18
2018/19	\$5.00	2019	\$5.63	2.0%	41%	\$5.63	165	963,600	\$11.56
2019/20	\$6.50	2020	\$7.08	2.0%	26%	\$7.08	165	963,600	\$14.55
2020/21	\$7.90	2021	\$8.67	2.0%	22%	\$8.67	165	963,600	\$17.82
2021/22	\$9.75	2022	\$10.16	2.0%	17%	\$10.16	165	963,600	\$20.88
2022/23	\$10.74	2023	\$10.83	2.0%	7%	\$10.83	165	963,600	\$22.26
2023/24	\$10.96	2024	\$11.05	2.0%	2%	\$11.05	165	963,600	\$22.70
2024/25	\$11.17	2025	\$11.27	2.0%	2%	\$11.27	165	963,600	\$23.15
2025/26	\$11.40	2026			2%	\$11.49	165	963,600	\$23.61
		2027			2%	\$11.72	165	963,600	\$24.07
		2028			2%	\$11.95	165	963,600	\$24.55
		2029			2%	\$12.18	165	963,600	\$25.03
Capacity Year = June - May		2030			2%	\$12.42	165	963,600	\$25.53
		2031			2%	\$12.67	165	963,600	\$26.03
		2032			2%	\$12.92	165	963,600	\$26.55
		2033			2%	\$13.18	165	963,600	\$27.07
		2034			2%	\$13.44	165	963,600	\$27.61
		2035			2%	\$13.70	165	963,600	\$28.15
		2036			2%	\$13.97	165	963,600	\$28.71
		2037			2%	\$14.25	165	963,600	\$29.28
		2038			2%	\$14.53	165	963,600	\$29.86
		2039			2%	\$14.82	165	963,600	\$30.45
		2040			2%	\$15.11	165	963,600	\$31.05

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NON-CONFIDENTIAL

1 **Request IR-81:**

2

3 **With reference to Application, pages 123-126, Appendix 6.03 and Appendix 6.06, please**
4 **provide a tabulation of the operating reserve margin and the ICAP of all generating units**
5 **operating in the modeling analysis for each of alternatives considered in Section 6.3.3 and**
6 **Appendices 6.03 and 6.06, including each scenario and each sensitivity run for all years**
7 **analyzed.**

8

9 Response IR-81:

10

11 NS Power has not attempted to tabulate hourly operating reserve margins for the planning period
12 out to 2040.

13

14 Please refer to SBA IR-243 Attachment 2 for tabulated planning reserve margins.

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1 **Request IR-82:**

2

3 **With reference to Application, page 126, Figure 6-5:**

4

5 (a) **Please explain why only the same commercial operation date (Oct. 1, 2017) as for**
6 **the Maritime Link project was assumed in Strategist, given that a capacity**
7 **expansion model can choose the optimal timing of new investments, and that the**
8 **40% renewable electricity standard requirement is not reached until 2020. Please**
9 **explain why the depreciation period is 45 years for the Other Import alternative,**
10 **and provide the expected useful life of the transmission investment.**

11

12 (b) **Why is the annual energy (before supplemental energy) for the Other Import**
13 **alternative (932 GWh) larger than for the Maritime Link Project (895 GWh)?**

14

15 **Response IR-82:**

16

17 (a) In order to ensure that the regulations can be met in 2020 investments are given time to
18 be on-line and operating reliably. The 45 year depreciation period represents the expected
19 useful life of the transmission asset.

20

21 (b) The Other Import alternative is slightly larger because there are less line losses.

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1 **Request IR-83:**

2

3 **With reference to Application, page 127, lines 5-8:**

4

5 (a) **Please explain whether the Strategist model was allowed to reoptimize the scale and**
6 **timing of investments in Nova Scotia generation capacity for the low load sensitivity**
7 **case when considering each of the three major investment alternatives.**

8

9 (b) **Please provide all work papers or other documents that discuss the real option value**
10 **from being able to defer capital investment commitment decisions and utilize**
11 **information known at future decision dates to dynamically modify the capital**
12 **investment decisions represented in each of the options evaluated by Ventyx in the**
13 **Strategist model.**

14

15 **Response IR-83:**

16

17 (a) Yes.

18

19 (b) There are no work papers or other documents on this topic.

NON-CONFIDENTIAL

1 **Request IR-84:**

2

3 **With reference to Application, page 127, lines 11-14:**

4

5 (a) **Please describe the methods and assumptions used to develop consistent sets of high**
6 **power and gas prices for the high market price sensitivity case, and low power and**
7 **gas prices for the low price sensitivity case.**

8

9 (b) **Provide all work papers that perform the calculations of the dependency of power**
10 **prices on gas prices.**

11

12 Response IR-84:

13

14 (a-b) Please refer to Synapse IR-33.

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1 **Request IR-85:**

2

3 **With reference to Application, page 133, lines 11-13, please discuss whether the high**
4 **market prices cases would be less of a disadvantage for an alternative that was composed of**
5 **some Nova Scotia wind capacity additions plus some transmission additions tied to**
6 **hydroelectric generation to supplement wind generation.**

7

8 Response IR-85:

9

10 Please refer to SBA IR-70.

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1 **Request IR-86:**

2

3 **With reference to Application, page 135, lines 8-13:**

4

5 (a) **Please provide all documents, reports, and work papers that analyze the additional**
6 **benefit to the Maritime Link Project of \$495 million by increasing transmission**
7 **capability from 300 MW to 500 MW in 2025.**

8

9 (b) **Please provide all additional documents, reports, and work papers that analyze the**
10 **additional benefits to the Other Import alternative and the Indigenous Wind**
11 **alternative of the same transmission upgrade project in 2025.**

12

13 Response IR-86:

14

15 (a) Please refer to CA IR-77 (a).

16

17 (b) This analysis was not conducted as the Other Import was modeled with a 500 MW limit
18 already and did not produce the lowest long term cost and the Indigenous Wind has been
19 discussed in terms of the curtailment with excess wind added and that the economics are
20 not improved by adding capital which is only partially recovered by dumping surplus
21 energy.

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1 **Request IR-87:**

2

3 **With reference to Application, page 137, Figure 7-1, which of the decision gates and**
4 **milestones are contingent on achieving completion of the design, procurement, or**
5 **construction of any portion of the upstream project in Newfoundland and Labrador?**

6

7 Response IR-87:

8

9 In Decision Gate 3, the DC Converter Station engineering and procurement milestones are co-
10 dependent between the Maritime Link Project and the upstream projects in Newfoundland and
11 Labrador. In Decision Gates 4 and 5 completion of construction and in-service commissioning
12 must be coordinated between the projects in order to achieve full commercial power.

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1 **Request IR-88:**

2

3 **With reference to Application, page 138, line 5:**

4

5 **(a) Please provide a copy of the Environmental Assessment Report for the Maritime**
6 **Link Project, including all appendices, that was filed with Nova Scotia**
7 **Environment.**

8

9 **(b) Please provide a copy of the Environmental Management Plan and the**
10 **Environmental Protection Plan for the Maritime Link Project. If these documents**
11 **are not yet available, provide the status and expected completion or filing date.**

12

13 **Response IR-88:**

14

15 (a) The Environmental Assessment Report for the Maritime Link, including all appendices,
16 can be downloaded from:

17 <http://www.emeranl.com/en/home/environment/environmentalreviewprocess.aspx>

18

19 (b) The Environmental Management Plan and Environmental Protections Plans will be
20 developed following the completion of the Environmental Assessment Process. The
21 Environmental Assessment report discusses the scope of these plans in Sections 2.12.2
22 (Environmental Management Plan) and 2.12.3 (Environmental Protection Plans).

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1 **Request IR-89:**

2

3 **With reference to Application, page 140, lines 10-11, please identify all project components**
4 **which will not have been procured or under contract by October 1, 2013.**

5

6 Response IR-89:

7

No	Contracts signed after DG3 / Oct 2013
1	Converter Stations, Switch Yards, Transition Compounds and Other (EPC2)*
2	Structures and Grillage*
3	Transmission Line Construction Services *
4	Transmission Line Accommodations
6	Telecom Engineering Services
7	GS - Grounding Site Tech supply and Install
8	GS - Grounding Site Civil Construction Services
9	HDD Construction Program

8

9 Those contracts with an “ * ” will be in the evaluation phase where the RFP is closed and the
10 prices for the services and products will be known to a high degree of certainty for DG3.

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1 **Request IR-90:**

2
3 **With reference to Application, page 142, lines 21-27:**

4
5 **(a) Please provide the characteristics of NSPI's existing hydro systems that are needed**
6 **to demonstrate that the Nova Scotia Block can be planned and dispatched to serve**
7 **customers in a manner not much different from NSPI's existing hydro systems.**

8
9 **(b) How was the flexibility of NSPI's existing hydro systems considered in**
10 **thetermination of the resources needed for backup of intermittent resources?**

11
12 **(c) To the extent that NSPI's existing hydro systems can be scheduled with an**
13 **hourlyprofile of output subject to a daily energy target please provide the allowable**
14 **output range and daily energy target by season for each of NSPI's existing hydro**
15 **stations.**

16
17 **(d) To the extent that NSPI's existing hydro systems can provide regulation**
18 **pleaseprovide the allowable regulating range with seasonal variations if applicable.**

19
20 **Response IR-90:**

21
22 **(a) Please refer to CanWEA IR-1 for the list of NS Power hydro generators and hydro**
23 **systems. Each hydro system has a set of unique operating parameters some of which vary**
24 **seasonally. Please refer to section (c) for details. The dispatch limits of NS Power hydro**
25 **systems are determined by factors such as: run-off, storage capacity and influenced by**
26 **other considerations like fish ladder operations, and riparian flows. Most of NS Power's**
27 **hydro systems can provide regulation and are tied to Automatic Generator Control (AGC)**
28 **which can dispatch these hydro systems to follow load and wind generation. Maritime**
29 **Link is expected to operate similarly to the NS Power hydro system in being able to**

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- 1 provide regulation and load following within the operating limits specific to each
2 contracted block and dependent on seasonal energy availability.
3
- 4 (b) NS Power would expect the continued use of its hydro facilities to provide load following
5 and regulation service in addition to operating reserve and renewable energy generation.
6 NS Power's hydro facilities are a finite generating resource having limited storage
7 capability. The need for additional regulating assets is anticipated for high wind
8 penetration scenarios.
9
- 10 (c-d) Please refer to CA IR-36 Confidential Attachment 2.

**NON-CONFIDENTIAL or CONFIDENTIAL or PARTIALLY CONFIDENTIAL or
CONFIDENTIAL (Attachment Only)**

1 **Request IR-91:**

2

3 **With reference to Application pages 143-145, Section 8.2.1, the requirement for a path**
4 **through Nova Scotia for the Nalcor Surplus Energy led to the Nova Scotia Transmission**
5 **Utilization Agreement. Figure 8-1 (the Nova Scotia Power Network Upgrades) in the**
6 **Application (page 144) lists the capital projects associated with the transit of Nalcor**
7 **Surplus Energy through Nova Scotia. Please identify where in the Nova Scotia**
8 **Transmission Utilization Agreement specific mention is made of the Nova Scotia Power**
9 **Network Upgrades.**

10

11 **Response IR-91:**

12

13 There is no specific mention of upgrades in the Nova Scotia Transmission Utilization
14 Agreement. However, Section 2.2(d) of the Agreement provides, in part:

15

16 Emera Responsibilities and Covenants:

17

18 Emera covenants to Nalcor that:

19

...

20

2.2(d) during the Term, and absent the occurrence of Forgivable Events, the
transmission Capacity of the Emera Facilities and the Emera Firm Point-
to-Point Transmission Service shall be sufficient to allow transmission of
the Nalcor Maximum Transmission Capacity Level;

21

22

23

24

25 As set out in the Application, in order to fulfill this obligation NS Power anticipates having to
26 redispach its fleet on occasion and undertake Network Upgrades.

NON-CONFIDENTIAL

1 **Request IR-92:**

2

3 **With reference to Application page 144, line 14, please provide the most recent Annual**
4 **Capital Expenditure (ACE) Plan 5-year outlook.**

5

6 Response IR-92:

7

8 The 2013 ACE Plan process is an open matter (M05339) before the UARB and can be accessed
9 at the Board's website:

10

11 http://www.nsuarb.ca/index.php?option=com_content&task=view&id=73&Itemid=82

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1 **Request IR-93:**

2
3 **With reference to Application, page 144, Figure 8-1:**

- 4
- 5 (a) **Please provide the names of the transmission lines listed as L-6513, L-8004, L-7005,**
6 **L-6511, L-6515 and L-6552. For each of these lines please also provide the “From”**
7 **and “To” substations and the voltage levels.**
- 8
- 9 (b) **What is the scope of the “L-6513 Rebuild”?**
- 10
- 11 (c) **What is the scope of “Separate L-8004/L-7005”?**
- 12
- 13 (d) **What is the scope of “L-6511/L-6515/L-6552 Upgrades”?**
- 14
- 15 (e) **Please explain whether or not Nova Scotia ratepayers receive a reliability benefit**
16 **from the Nova Scotia Power Network Upgrades associated with the transit of Nalcor**
17 **Surplus Energy through Nova Scotia.**
- 18
- 19 (f) **Please explain whether or not other than for the purposes of providing a path for**
20 **Nalcor Surplus Energy there is a reliability need for the Nova Scotia Power**
21 **Network Upgrades.**
- 22
- 23 (g) **When does NSPI intend to seek regulatory approval for the Nova Scotia Power**
24 **Network Upgrades?**
- 25
- 26 (h) **If the Board does not confirm the need for the Nova Scotia Power Network**
27 **Upgrades, will the Maritime Link still go ahead?**
- 28
29

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1 Response IR-93:

2

3 (a)

4

Transmission Line	From	To	Voltage Level
L-6513	1N-Onslow	74N-Springhill	138 kV
L-8004	79N-Hopewell	101S-Woodbine	345 kV
L-7005	67N-Onslow	3C-Port Hastings	230 kV
L-6511	50N-Trenton	93N-GlenDhu	138 kV
L-6515	2C-Port Hastings	4C-Lochaber Road	138 kV
L-6552	4C-Lochaber Road	93N-GlenDhu	138 kV

5

6 (b) The requirement for rebuild of L-6513 is still being assessed, the rebuild includes:

7

8 • Building a new wood pole 138 kV line from 1N-Onslow to 74N-Springhill on the
9 same corridor as the existing L-6513.

10

11 • New line will be constructed with 1113 ACSR Beaumont conductor with 100 deg
12 Celsius thermal rating.

13

14 • Upgrade of terminals at 1N-Onslow and 74N-Springhill as required to
15 accommodate new line rating.

16

17 (c) The scope of the L-8004/L-7005 Separation includes:

18

19 • Replacing the steel towers located on the south side of the Canso Causeway that
20 currently carry the 138 kV line L-6515.

21

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- 1 • Moving L-7005, currently sharing the double circuit steel tower approximately
2 1km north of the Canso Causeway with L-8004, to the new steel towers on the
3 south side of the Canso Causeway.
4
- 5 • Moving L-6515, currently on the south side of the Canso Causeway, to the double
6 circuit tower shared with L-8004
7
- 8 • Modifying the L-7005 and L-6515 approaches on both land sides of the Canso
9 Causeway to accommodate the line swap
10
- 11 (d) The full scope of the L-6511/L-6515/L-6552 upgrades are yet to be determined. The
12 138 kV lines have potential thermal overloads that will need to be resolved. Thermal
13 overloads result in transmission lines physically not meeting vertical line clearances to
14 ground. The lines will need to be surveyed to determine what structures need to be raised
15 to meet the line height requirements. Identified line spans with clearance issues will be
16 remedied by replacing existing wood pole structures with taller poles.
17
- 18 (e-f) Absent the Nalcor Surplus Energy, reliability upgrades to the system aren't necessary.
19 However, any upgrade to the system will provide an inherent reliability benefit to
20 customers. The benefit results from greater capacity and enhanced system equipment.
21
- 22 (g-h) NS Power will seek approval for the projects as transmission studies are completed and
23 the scope of the required work defined. The Company would assess the implications at
24 the time the studies are completed.

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1 **Request IR-94:**

2
3 **With reference to Application, page 144, line 19 to page 145, line 3:**

4
5 **(a) Did the Strategist modeling of alternatives reported throughout the Application**
6 **include or exclude the redispatch costs of Nalcor Surplus Energy for the Maritime**
7 **Link Project alternative?**

8
9 **(b) Were the incremental cost estimates for redispatch from a Strategist case or**
10 **separate calculations?**

11
12 **(c) If redispatch costs were not from a Strategist case, please provide all documents and**
13 **work papers that support the estimates of incremental costs of \$4 million to \$8**
14 **million annually. If from a Strategist case, provide all documents and work papers**
15 **that support the estimate over the Study Period.**

16
17 **(d) If redispatch costs were not from a Strategist case, please explain why not.**

18
19 **(e) Please provide a table of detailed annual results of the incremental impacts on fuel**
20 **use, emissions, and fuel costs in Nova Scotia corresponding to the estimated**
21 **incremental costs of \$4 million to \$8 million annually in the period through 2030.**
22 **Indicate whether the table of incremental results was produced from comparing**
23 **Strategist cases or from other calculations.**

24
25 **Response IR-94:**

26
27 **(a) The study was not completed in Strategist. The redispatch cost was based on a separate**
28 **study in which NS Power studied the case where all of Nalcor surplus energy would flow**
29 **through Nova Scotia, and no energy would be kept in Nova Scotia. The purpose of this**
30 **study was to examine the bookend scenario designed to determine whether the NS Power**

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- 1 system could accommodate such a transaction and if so at what cost. In reality, the cost of
2 system re-dispatch would be offset by the tariff charge which NS Power charges for the
3 energy to flow through the system.
4
- 5 (b) The incremental cost of redispatch was completed in PLEXOS security constrained
6 commitment based chronological dispatch model. PLEXOS dispatch optimization
7 software was chosen for this study due to its ability to model hourly chronological system
8 dispatch and transmission system constraints.
9
- 10 (c) Please refer to Attachment 1 for the results of the PLEXOS total Nalcor energy flow
11 through study.
12
- 13 (d-e) Please refer to section (c).



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NALCOR Total Flow Through Energy Study Overview

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Executive Summary

The NALCOR energy flow through study is designed as a bookends exercise answering the following question: Can we redispatch NS Power system to allow all 1.48 TWh of NALCOR surplus energy to flow through NS, and if so at what cost?

This question was answered by running two simulations for each test year and looking at the difference in operating cost:

1. No NALCOR surplus energy flowing through NS
2. All 1.48 TWh of NALCOR surplus energy flowing through NS into NE market

It is important to note that both of these cases are extreme and unrealistic. They are only used as a modeling exercise in order to test NSPI generation/transmission system for robustness. In reality, NSP will likely take advantage of being able to purchase some of NALCOR surplus energy, over and above the contracted energy blocks, which can only benefit both parties. Determining the economical energy flow from NFL through NS is outside of the scope of this study.

As will be seen from the analysis that follows, the study was able to show that it is possible to redispatch NSPI system in order to allow all NALCOR surplus energy flow through into NE market and the associated costs of doing so are reasonable.

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Approach

Study goal:

Determine the incremental costs associated with NSPI system re-dispatch due to NALCOR energy flow through NS into New England market.

Study method:

Simulate NS Power system dispatch by the means of chronological hourly system dispatch model with and without NALCOR energy flow through and analyze the effect on dispatch cost.

Study scope:

Test three years, 2018, 2020 and 2030 with base fuel and low load assumptions set.

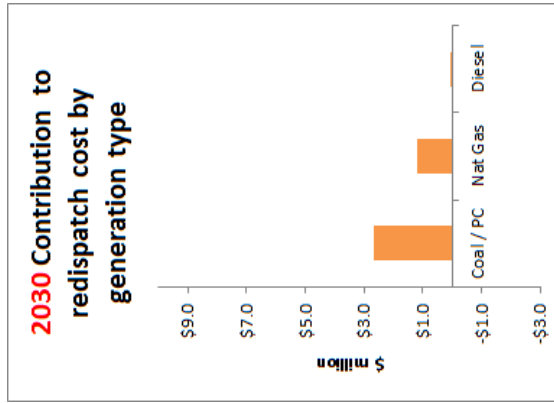
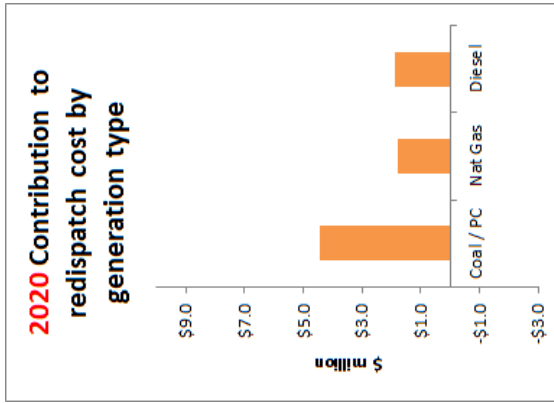
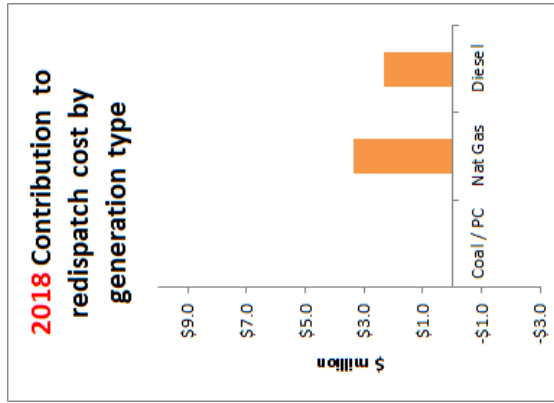
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Study results:

Total incremental cost of re-dispatch in order to allow 1.48 TWh of NALCOR energy to flow through Nova Scotia is:

Costs (\$million)	2018	2020	2030
	5.6	8.0	3.9



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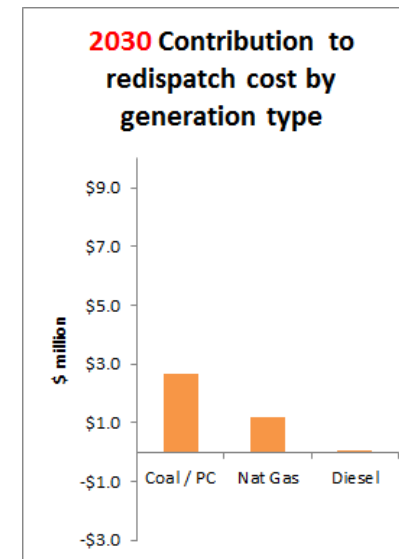
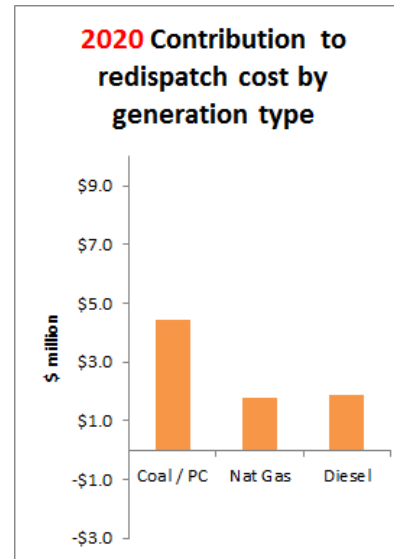
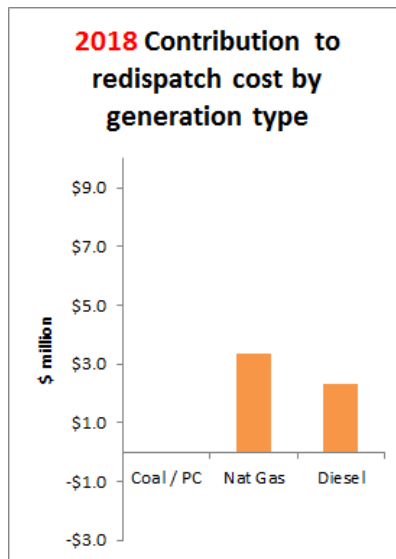
Study scope:

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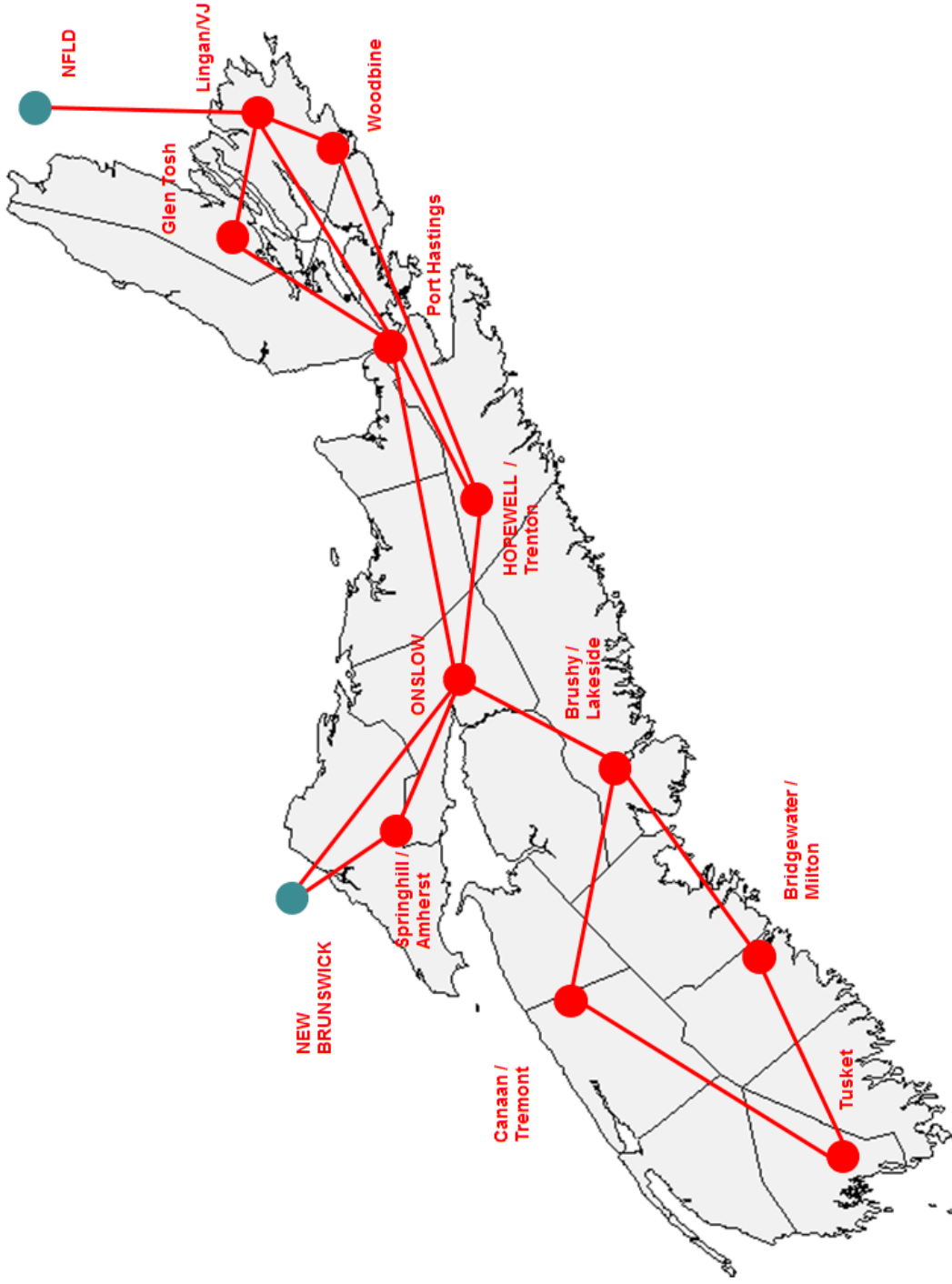
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Study results: Interface Congestion Analysis



Study results: Interface Congestion Analysis

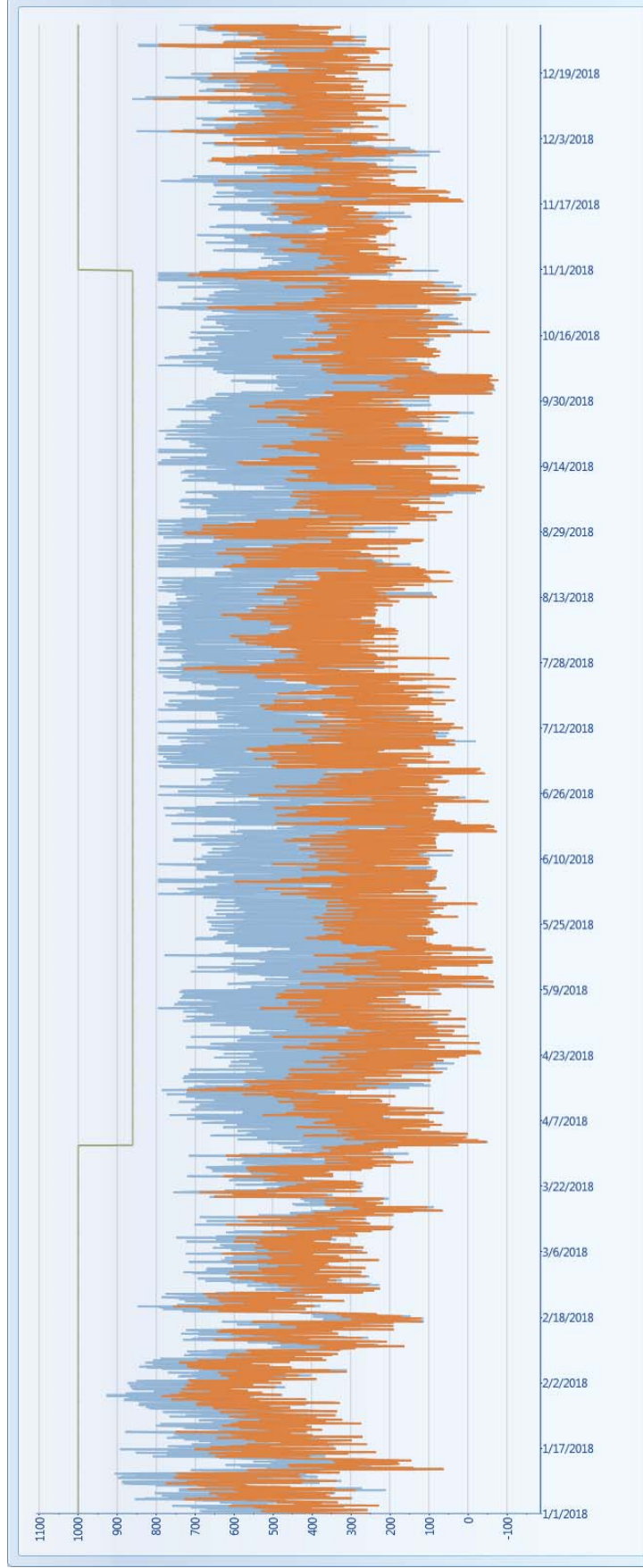
Number of hours per year interface is at maximum energy flow

Interface	2018 base	2018 flow through	2020 base	2020 flow through	2030 base	2030 flow through
Maritime Link import	0	1240	0	1264	0	1307
Cape Breton export	0	0	0	177	0	57
Onslow import	0	0	0	0	0	0
Onslow south	0	0	0	0	0	0
NS export to NB	0	0	0	0	0	0

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Study results: Interface Congestion Analysis

2018 Cape Breton Export hourly flow with and without NALCOR flow through energy

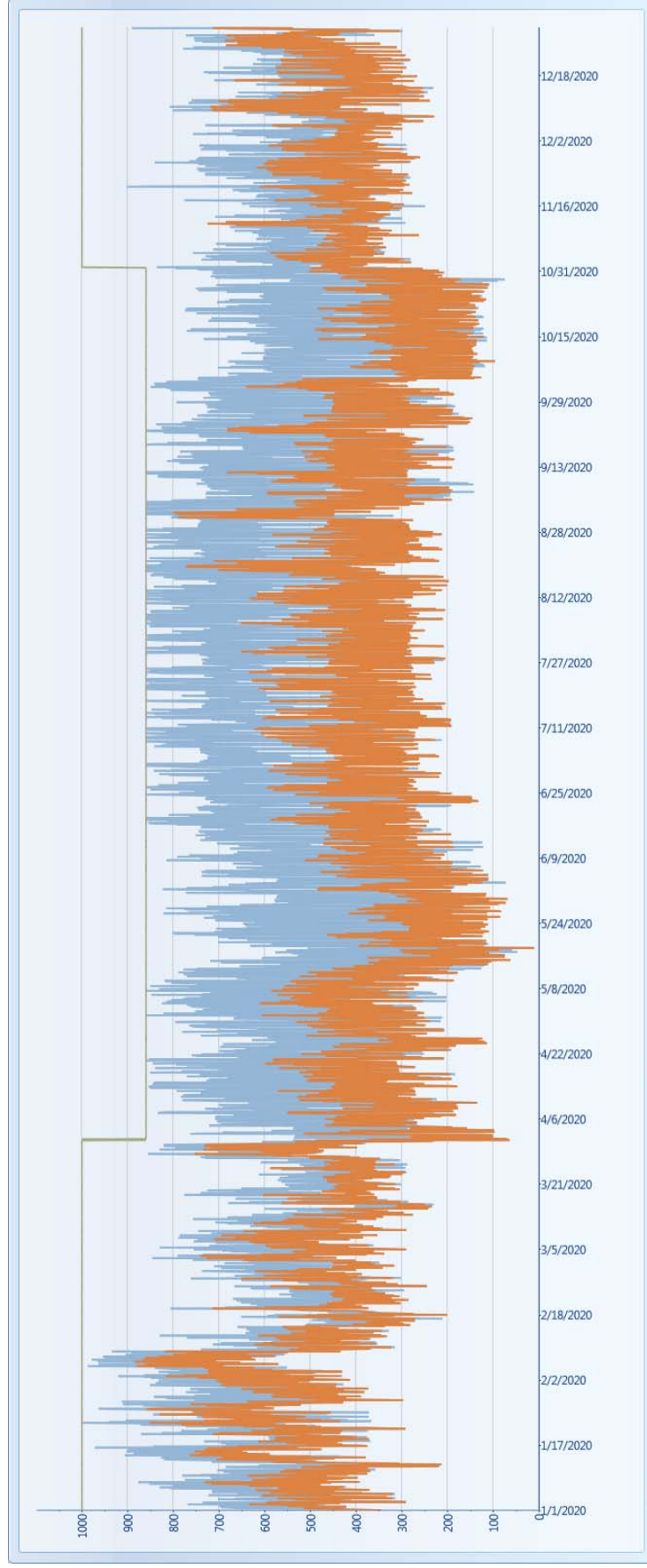


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Study results: Interface Congestion Analysis

2020 Cape Breton Export hourly flow with and without NALCOR flow through energy



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NALCOR Total Flow Through Energy Study Overview

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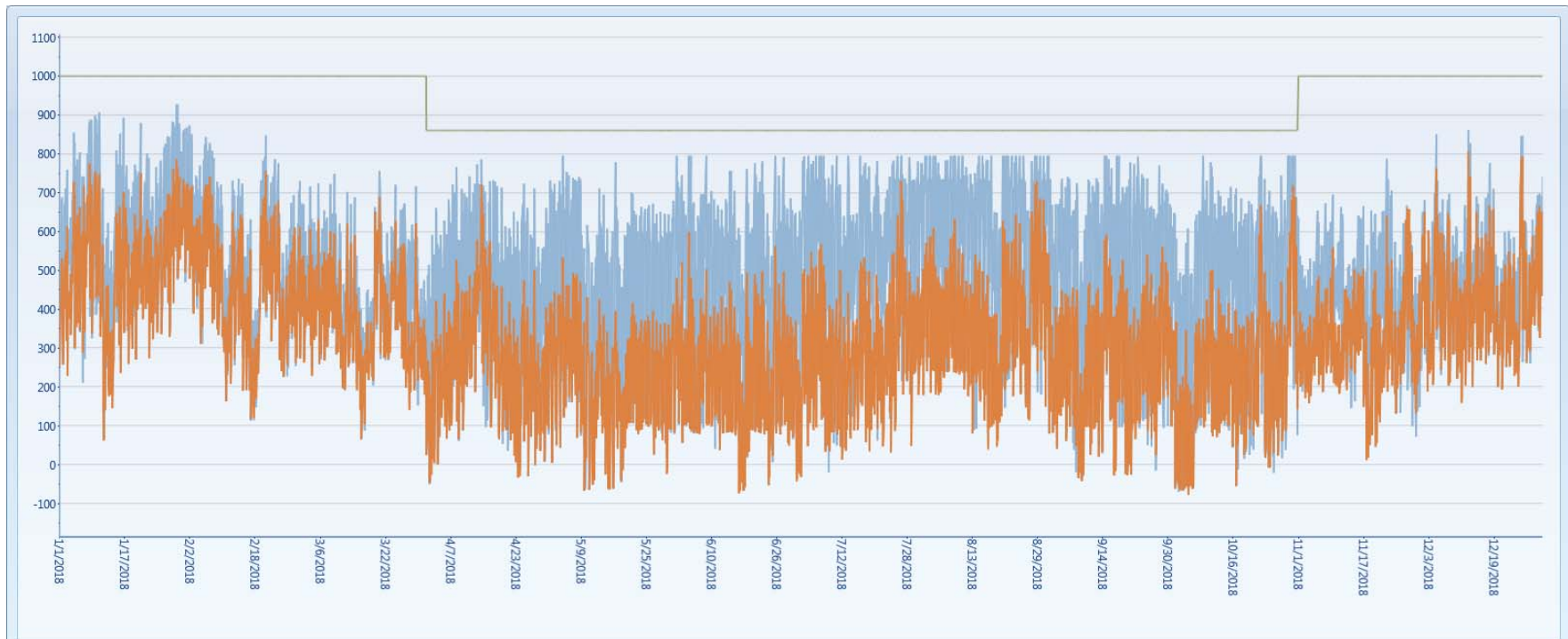
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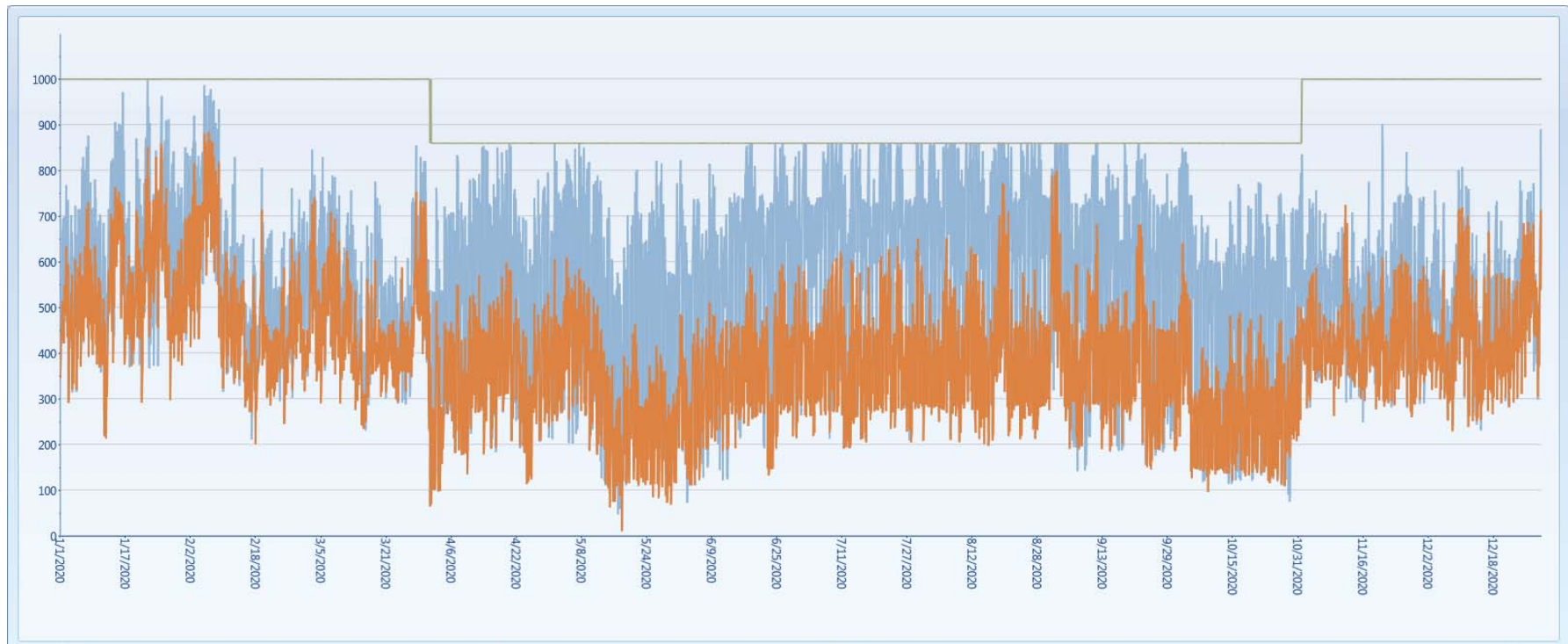
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2018 Cape Breton Export hourly flow with and without NALCOR flow through energy



Study results: Interface Congestion Analysis

2020 Cape Breton Export hourly flow with and without NALCOR flow through energy



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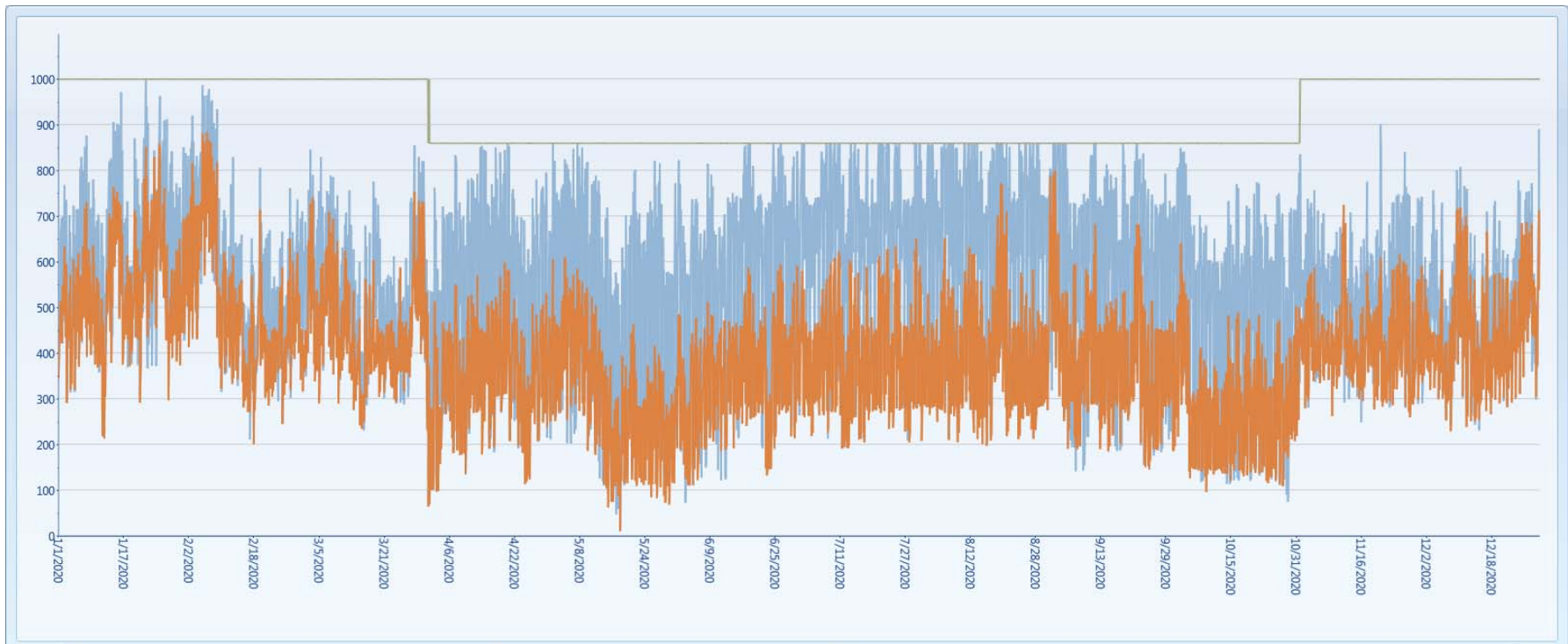
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Study results: Interface Congestion Analysis

2020 Cape Breton Export hourly flow with and without NALCOR flow through energy





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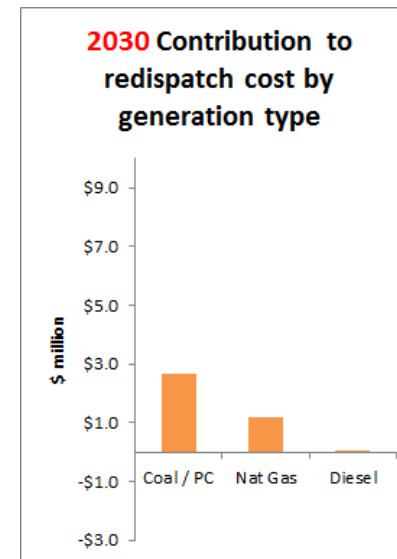
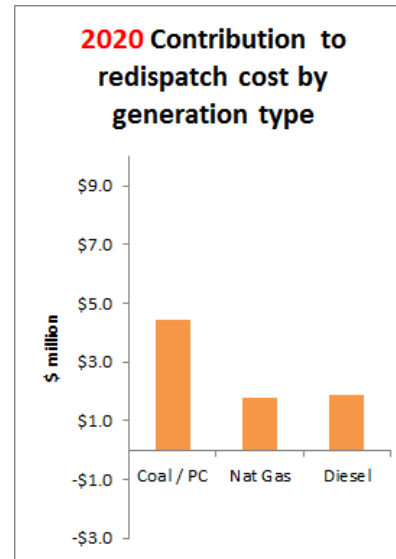
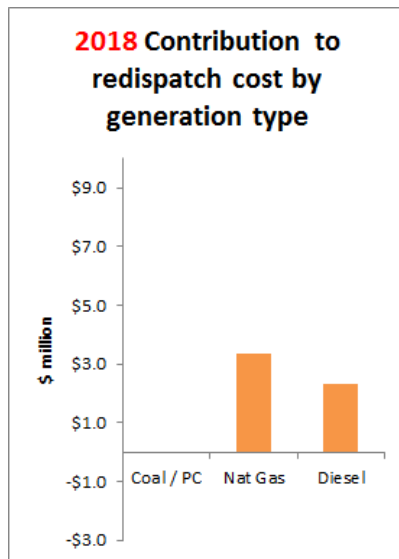
Study scope:

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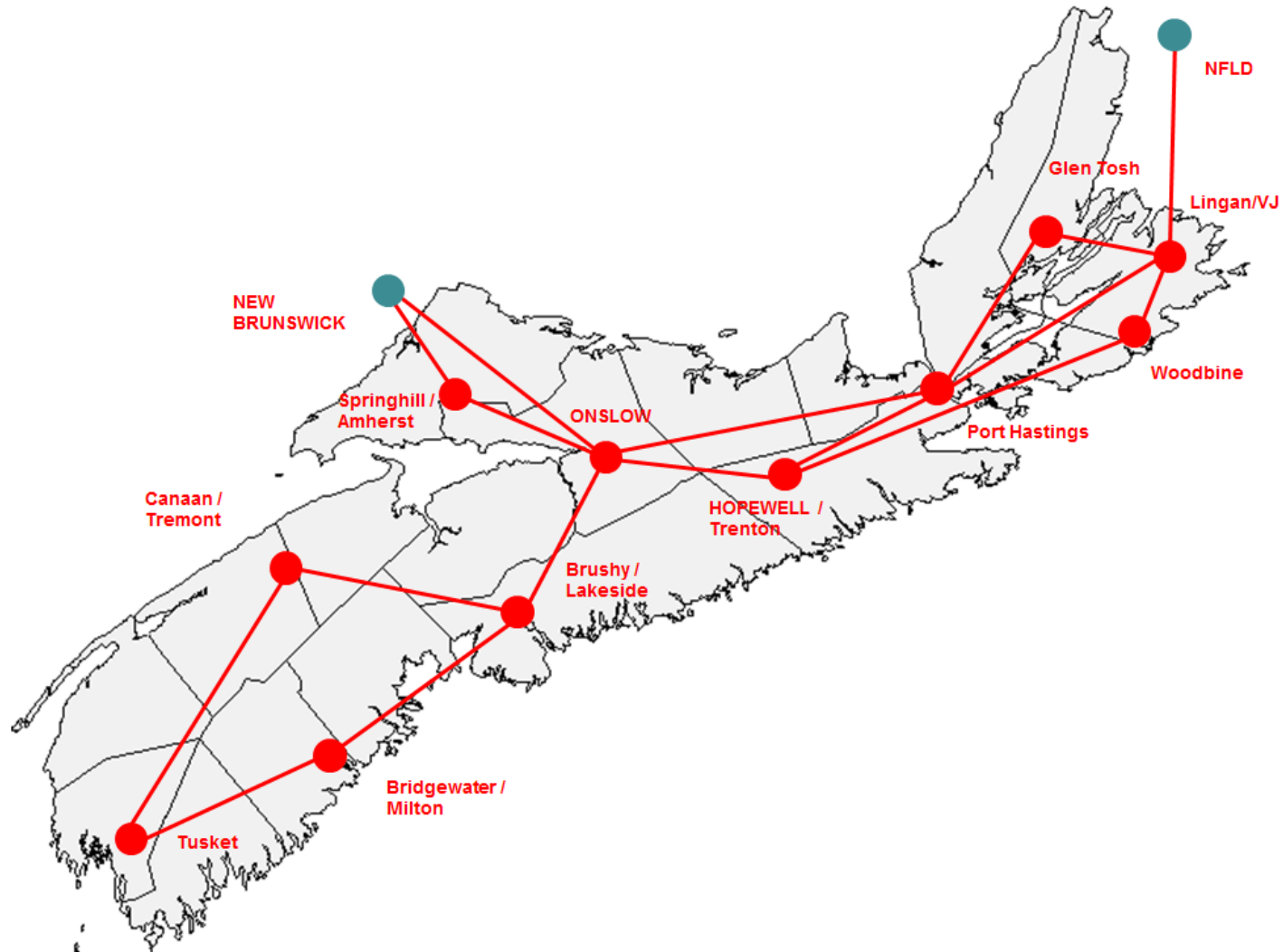
Study results:

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Study results: Interface Congestion Analysis



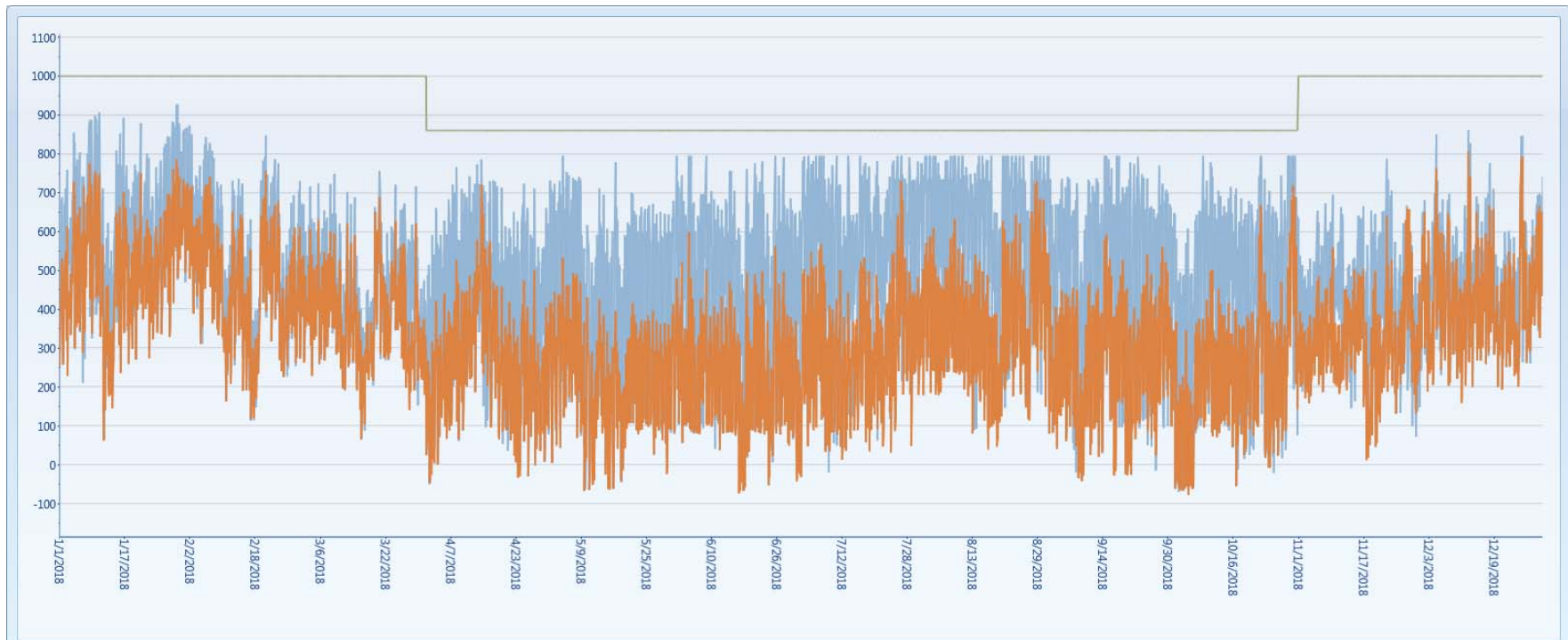
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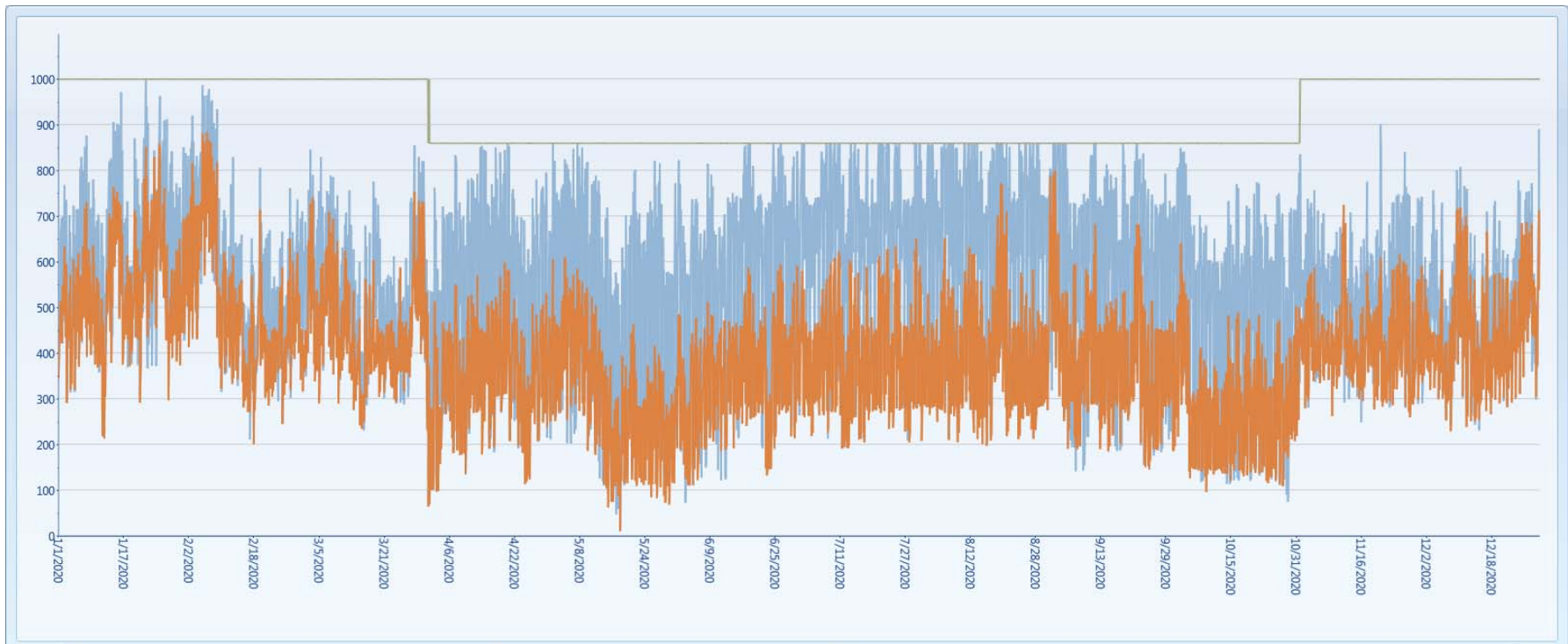
Study results: Interface Congestion Analysis

2018 Cape Breton Export hourly flow with and without NALCOR flow through energy



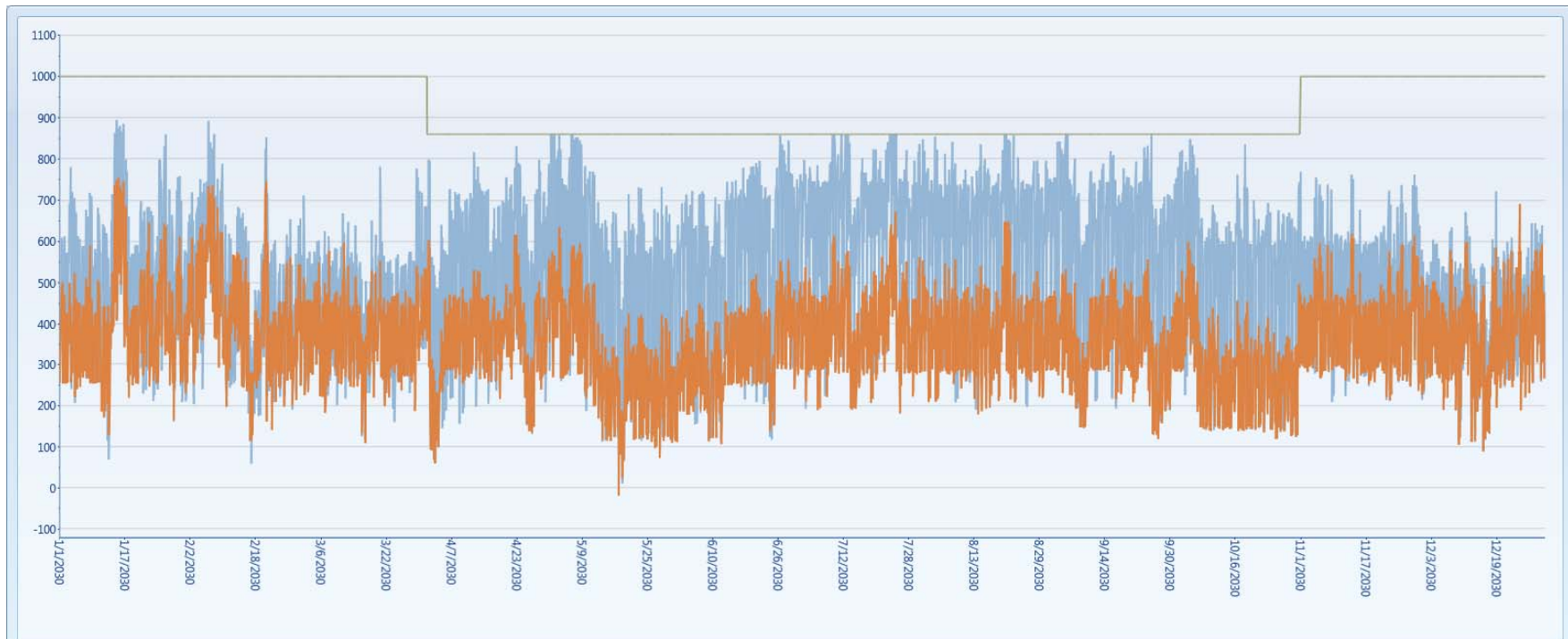
Study results: Interface Congestion Analysis

2020 Cape Breton Export hourly flow with and without NALCOR flow through energy



Study results: Interface Congestion Analysis

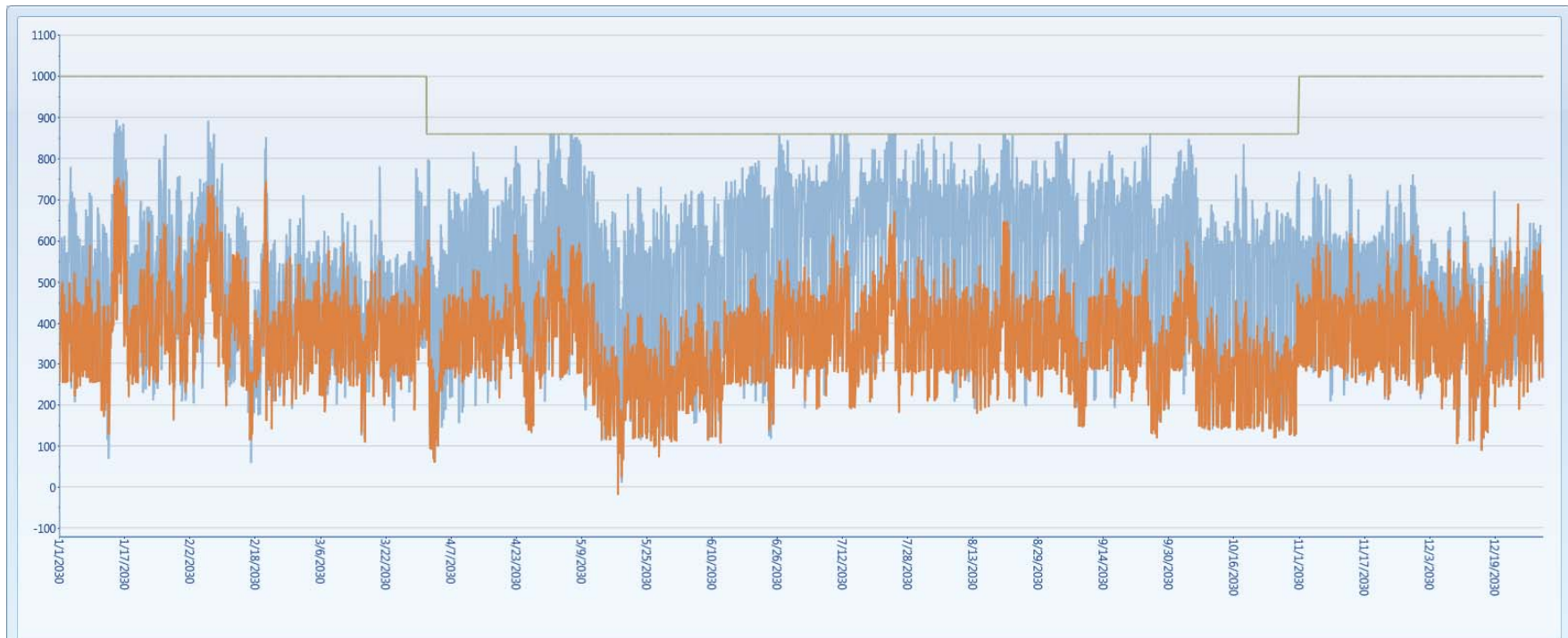
2030 Cape Breton Export hourly flow with and without NALCOR flow through energy



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Study results: Interface Congestion Analysis

2030 Cape Breton Export hourly flow with and without NALCOR flow through energy



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1 **Request IR-95:**

2

3 **With reference to Application, page 144, footnote 57, please provide a copy of the non-**
4 **redacted 2013 ACE report. Please include the 2013 spend profile as well as the 5-year**
5 **outlook filed with ACE as referenced in the footnote.**

6

7 Response IR-95:

8

9 Please refer to SBA IR-92.

NON-CONFIDENTIAL

1 **Request IR-96:**

2

3 **With reference to Application page 145, lines 1-3:**

4

5 (a) **Please explain constraints that currently limit the flow of energy from Cape Breton**
6 **to the mainland.**

7

8 (b) **Please provide a table of the expected plant retirements, including but not limited**
9 **to, the plant (unit) name, unit capacity (summer and winter), plant (unit) operating**
10 **and maintenance costs, year placed in service, and expected retirement date.**
11 **Indicate reason for retirement decision, *i.e.*, regulatory requirement or economic**
12 **basis.**

13

14 **Response IR-96:**

15

16 (a) **Please refer to CanWEA IR-27.**

17

18 (b) **Please refer to Attachment 1.**

Retirements to 2030: Maritime Link - Base Load							
Unit	Net Operating Capacity Summer (MW)	Net Operating Capacity Winter (MW)	Estimated Fixed O&M Costs (2015 \$000/year)	Estimated Variable O&M Cost (2015 \$/MWh)	In Service Date	Forecasted Retirement Date	Retirement Reason
Lingan #2	153	153	\$669**	\$0.98	1980	March 2015	Economic
Lingan #1	153	153	\$1,025**	\$0.98	1979	October 2017	Economic
Coal Unit*	153	153	-	-	-	January 2030	Economic

*Specific unit to be determined as forecasted retirement date approaches based on System Requirements and Regulatory Compliance

**Fixed Costs based on partial year operation

Retirements to 2030: Maritime Link - Low Load							
Unit	Net Operating Capacity Summer (MW)	Net Operating Capacity Winter (MW)	Estimated Fixed O&M Costs (2015 \$000/year)	Estimated Variable O&M Cost (2015 \$/MWh)	In Service Date	Forecasted Retirement Date	Retirement Reason
Lingan #2	153	153	\$669**	\$0.98	1980	March 2015	Economic
Lingan #1	153	153	\$1,025**	\$0.98	1979	October 2017	Economic
Tufts Cove 1	81	81	\$2,024	\$0.92	1965	January 2020	Economic
Coal Unit*	153	153	-	-	-	January 2029	Economic

*Specific unit to be determined as forecasted retirement date approaches based on System Requirements and Regulatory Compliance

**Fixed Costs based on partial year operation

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1 **Request IR-97:**

2

3 **With reference to Application, page 145, lines 6-10, please provide the quantity of Nalcor**
4 **Surplus Energy assumed to flow through Nova Scotia to New Brunswick by month over the**
5 **study period and the basis for that assumption.**

6

7 Response IR-97:

8

9 Please refer to EAC IR-19 and SBA IR-94 Attachment 1.

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1 **Request IR-98:**

2

3 **With reference to Application, page 145, lines 10-18:**

4

5 (a) **Please explain constraints that would cause a transmission revenue shortfall in the**
6 **early years of the transactions.**

7

8 (b) **Do the present value costs for the Maritime Link Project include an allowance for**
9 **true up charges to the extent that they will be borne by NSPI customers?**

10

11 (c) **If so, what is the value assumed for that allowance?**

12

13 **Response IR-98:**

14

15 (a) The constraints that occur in the early years are paths off of Cape Breton as coal
16 generation that may be economic and not yet constrained by emissions are redispatched
17 off to allow for the export energy to flow. As the air emissions caps in Nova Scotia
18 decline the coal plants are constrained off opening up the transmission path.

19

20 (b-c) No. As costs and revenues are expected to offset, no allowance is needed to be included.

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1 **Request IR-99:**

2

3 **With reference to Application, page 145, lines 20-24:**

4

5 **(a) Do the present value costs for the Maritime Link Project include an allowance for**
6 **maintenance of the Woodbine Upgrades to the extent that they will be borne by**
7 **NSPI customers?**

8

9 **(b) If so, what is the value assumed for that allowance?**

10

11 Response IR-99:

12

13 All O&M costs (including those for the Woodbine upgrades) have been included in NSPML's
14 O&M estimate as contained in the financial model. No costs relating to the Woodbine upgrades
15 are expected to be borne directly by NS Power.

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1 **Request IR-100:**

2

3 **With reference to Application, page 146, lines 1-8:**

4

5 **(a) Do the present value costs for the Maritime Link Project include an allowance for**
6 **charges associated with the Agency and Service Agreement to the extent that they**
7 **will be borne by NSPI customers?**

8

9 **(b) If so, what is the value assumed for that allowance?**

10

11 Response IR-100:

12

13 NSPML does not expect NS Power to incur incremental costs relating to the Agency and
14 Services Agreement that will not be offset by transmission revenues received from Nalcor.
15 Please see response to SBA IR-118 part (b).