



Nova Scotia Utility and Review Board

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October 31, 2022

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Dear Ms. Ross:

M10569 – Nova Scotia Power Inc. – 2022 Load Forecast Report – (P-194)

On April 29, 2022, Nova Scotia Power Inc. (NS Power) filed its 10-Year 2022 Load Forecast Report, as required under the Nova Scotia Wholesale and Renewable to Retail Electricity Market Rules. The Board issued an Order establishing the timeline for consideration of this matter in a paper hearing process and approved a requested Confidentiality Undertaking for this proceeding on May 2, 2022. Notices of intervention were received from the Small Business Advocate (SBA), the Consumer Advocate (CA), the Industrial Group (IG), Heritage Gas Limited (HGL), and EfficiencyOne (EOne). Synapse Energy Economics Inc. (Synapse) was engaged to review this filing on behalf of Board Counsel, as done in previous years.

On June 9, 2022, NS Power filed responses to Information Requests (IRs) received from the CA, SBA, IG, EOne, Board staff, and Synapse. NS Power refiled its IRs to the CA on July 22 and 25, 2022 addressing IR-13. Evidence was filed by the CA, EOne, and Synapse on July 29, 2022. On August 12, 2022, EOne responded to IRs from the NS Power. NS Power filed its Rebuttal Evidence on September 26, 2022.

2022 Load Forecast

NS Power uses two discrete elements for its forecast. The first is the Statistically Adjusted End-Use (SAE) Models to forecast the residential and commercial rate classes. These models incorporate end-use energy intensity projections into the forecast, which is then combined with an econometric based industrial forecast and a customer specific forecast for large customers. The process produces the Net System Requirement (NSR) forecast, which is the energy forecast for NS Power customers for the year. The second element is the Demand Side Management (DSM) adjustment. The DSM program projections are subtracted from the SAE forecast values to produce the final forecast.

Compared to the 2021 Load Forecast, the 2022 Load Forecast shows higher growth in the near term that NS Power attributes to customer growth and higher electricity use. Growth in the mid to long term is caused by more electric heating in residential and commercial classes, stronger electric vehicle (EV) uptake and anticipated large infrastructure projects. NS Power expects this growth to be offset by DSM initiatives, natural energy efficiency improvements and more small-scale solar installations. As a result, NS Power has forecasted that NSR will experience an average annual increase of 0.3 percent between 2023 and 2032. With respect to system peak, NS Power forecasts annual growth of 1.6 percent between 2023 and 2032.

These forecasts result in a projected NSR for 2032 that is 617 GWh (5.7%) higher than the 2021 actual level and a projected peak system demand in 2032 that is 28.7% (564 MW) greater than the actual peak in 2021. Much of the growth results from increases in 2022 that forecasts a 2.2% growth in NSR and 10% growth in system peak.

Table 1 below, provides a comparison of NS Power's forecasted growth in energy and peak demand. The values for the 2022 forecast and the actuals were obtained from the current application, whereas forecast values for years 2017-2021 were obtained from previous Load Forecast Reports.

Table 1 - Annual Forecast versus Actual

Report Year	One-year NSR Change ¹		One-year System Peak Demand Change ²	
	Forecast	Actual	Forecast	Actual
2022	2.2%		10.0%	
2021	2.9%	1.7%	8.6%	-4.0%
2020	-0.3%	-3.1%	8.9%	-0.5%
2019	0.7%	-1.5%	7.2%	-0.6%
2018	0.8%	3.5%	6.0%	2.7%
2017	1.0%	0.6%	-0.03%	-4.4%

The load forecast is a foundational input in relation to NS Power's overall planning, budgeting, and operating activities, including generation requirements, capital program, fuel forecasts, and customer rates, making the reliability of this forecast an essential element of accurate projections of future requirements. Because of this degree of importance, the Board has raised concerns about the accuracy and consistency of NS Power's forecasting on previous occasions.

In the Board Decision letter for the 2021 Load Forecast Report (matter M10109), the Board provided direction on enhancements in the development of the load forecasts and encouraged NS Power to continue to engage with stakeholders. NS Power revised the 2022 Load Forecast by incorporating the warming trend in peak causing weather. NS Power evaluated several stakeholder recommendations from the 2021 Load Forecast. Two other refinements to the Load Forecast are the use of the warming trend in cooling degree days (CDD) and modeling of electric vehicle take-up by NS Power's consultant E3.

The largest variances between forecast and actual in 2021 resulted from weather, representing 184 GWh and an unexplained variance of 63 GWh attributed to the COVID-19 pandemic.

¹ Based on Table A1 in each annual report starting with prior year actual

² Based on Table A2 in 2022 and 2021 Load Forecast reports and in Table A3 in each annual report from 2015 to 2020

However, the significant increase in Load for 2022 is mainly attributed to the application of estimated peak as calculated by NS Power's consultant, E3. NS Power intends to use AMI smart meter data to test the accuracy of the model and determine if the residential class continues to experience additional COVID-19 load.

Intervenor Comments

Intervenors were complimentary of NS Power's efforts toward continued improvement of its forecast and engagement with stakeholders. Participants expressed concerns with various aspects of NS Power's load forecast, however, their focus was on continued improvement as opposed to objections to the load forecast filed for 2022. The primary concerns of Intervenors are about the forecast heat pump uptake as a replacement heat source, the EV forecast, investigation of new technologies to reduce energy and peak demand, and the management of peak through the Smart Grid Nova Scotia (SGNS) project results and direct control water heaters.

The CA filed evidence prepared by John Wilson, Resource Insight Inc. Mr. Wilson recommended that NS Power continue to improve its method of addressing climate change scenarios, undertake a more fulsome analysis of the effects of adding multiple weather stations to the forecast, and re-apply a population weighted approach. Mr. Wilson considers that NS Power should continue to evaluate a multi-hour temperature average for both weather normalizing and peak load forecasting, and to include wind speed and cloud cover's impact on demand. He speculates there are modeling errors in the residential energy model because the outputs do not exhibit the trend of decreasing Heating Degree Days (HDD). Mr. Wilson questions the assumption that all heat pumps replace other heating sources. He suggests that the model be adjusted to reduce EV commuter and commercial use during storm closures at peak periods. Lastly, Mr. Wilson requested that NS Power complete the line loss determination model and report on its progress on a quarterly basis until the project is complete.

The SBA raised concerns about the accuracy of the EV and space heating forecast. It is unclear where the SGNS project data was incorporated into the forecast and the intervenor considers that the discussion in section 4.4 does not satisfy the Board's directive to report on these pilot projects and their effects on load. The SBA expressed concern about the model's estimated EV adoption rates and electric heating adoption as they are based on meeting government targets rather than incentive structures and local adoption rates. The SBA recommended that the SGNS Project data be incorporated in the Load Forecast. The SBA also suggested that NS Power should evaluate the impact of current (or planned) incentive structures for purchasing EVs and adopting electric heat.

EOne raised concerns about electrification and demand response and made suggestions to improve the Load Forecast. It recommended that NS Power's heat pump modeling be updated to reflect the adoption of cold climate heat pumps. EOne suggested that, given peak load is growing faster than NSR, NS Power should investigate electrification scenarios to evaluate the use of electric thermal storage (ETS) units to shift load off-peak, and to model other heating sources as supplemental heating sources during peak hours. EOne considers that a plan and explanation for the remaining DR capacity needed to meet the forecast 2025 capacity, including incremental program options, should be provided to stakeholders. Lastly, EOne suggested that NS Power apply the same framework to assessing the value of different DR programs and an effective load carrying capacity (ELCC) factor be applied.

In its evidence to the Board, Synapse noted continued improvement in the Load Forecast, however, they also remarked on several aspects which could be revised. As in other years, Synapse considers that NS Power should annually re-evaluate its choice of economic variables used to forecast energy demand, particularly the COVID-19 variable. Synapse recommended NS Power should investigate the peak load effects of heat pumps, consider heat pump-based hot water heating and update its water heating load control project in the next forecast. Synapse requested that more complete results of the SGNS project regarding EV impacts and battery storage be provided in the next forecast. Synapse recommended NS Power investigate the long-term impacts of commercial and industrial electrification and clarify the effects for each sector. Additionally, it requested NS Power explain why the DSM adjustment for commercial customers varies from what was used last year. With respect to peak load, Synapse requested NS Power quantify how ETS could moderate demand, investigate water heating load control measures, and evaluate induction cooking and commercial heating to better understand how to moderate their impacts on peak. Synapse asked that NS Power review its peak forecasting methodology and provide a peak sensitivity analysis as well as the assumptions and calculations used.

NS Power Reply Submission

In its Reply, NS Power addressed the concerns raised by the intervenors. NS Power agreed to include analysis of the impact of multi-hour temperature averages and windspeed on the peak in the next forecast. As well, it agreed to investigate multi-station weather for peak load forecasting and to review the methods for integrating weather data with stakeholders before filing the next forecast. NS Power will incorporate water heating load control and provide a peak sensitivity analysis in the 2023 report that is similar to the sensitivity analysis in Appendix D.

NS Power intends to refine the impact of electrification through examining existing measures and trends to achieve government electrification goals. It will investigate and include commercial and industrial electrification impacts after 2027. NS Power will evaluate the findings from the recent Itron Report on the impact of heat pumps. Information from the SGNS project and water heating load control will be incorporated in the next report. EV adoption rates will be updated in the forecast and more details on the EV high and low cases will be provided. NS Power will review how an ELCC adjustment could be applied to EV load shapes.

Changes to the DR estimates in the IRP Action Plan will be incorporated into the forecast. NS Power will consider hybrid scenarios where customers keep their existing non-electric heating as backup, through the 2022 IRP Evergreen process, as well as a scenario analysis for ETS to moderate peak load. It will monitor growth in heating load for commercial customers and work with EOne on possible firm peak mitigation strategies.

NS Power confirmed that the model used a COP of 2.3 at -15°C for new heat pumps. It clarified that an analysis removing lock-out temperature is in the IRP Action Plan. NS Power will continue consulting with EOne and other stakeholders on DR implementation. NS Power confirmed that about 15 percent of the commercial and industrial DSM effects are allocated to the industrial class and 85 percent are allocated to the commercial class. It also confirmed that the DSM coefficients vary each year and the change to the commercial and industrial adjustment is the result of underlying end-use data, particularly the commercial lighting efficiency and intensity.

NS Power's reply submission did not agree with a few of the intervenors' requests. NS Power does not consider the line loss determination model as a tool for load planning and said a report on this topic is not required. NS Power considers an ELCC factor is not needed for the Large Industrial Interruptible Rider (LIIR) because these customers do not contribute to peak demand

needs; however, it will considers applying an ELCC adjustment to EV load shapes. A request for the information on the benefits and costs of commercial electrification programs was denied as NS Power has not performed such an analysis.

Board Findings

The Board notes that NS Power has agreed to many of the intervenors' recommendations and acknowledges this commitment as a positive step toward continuous improvement of the Load Forecast. The Board directs NS Power to proceed with implementing the recommendations it has agreed to in the next Load Forecast report, including providing greater details and investigation of the impact to energy and peak from electrification as well as from new technologies, especially findings from pilot projects. Further, NS Power is directed to continue evaluating and implementing improvements to the calculation of weather-normalized values for energy and peak as recommended by intervenors.

The Board directs NS Power to evaluate the model's economic inputs, including the COVID-19 variable and the assumptions and calculations used to assess the impact of DSM, Solar PV, EVs, battery storage, and weather.

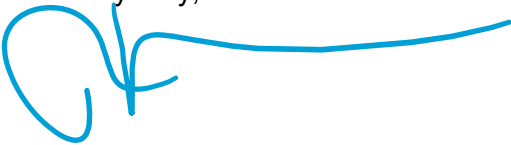
The Board acknowledges the intervenors' participation in examining changes to the Load Forecast. The Board directs NS Power to continue to actively engage with intervenors as well as other stakeholders and their consultants well in advance of filing its 2023 Load Forecast Report. As many of the recommendations made by intervenors are important to discuss in the initial stakeholder meeting, it is prudent that NS Power share how potential impacts were evaluated and what was incorporated into the forecast early in the process.

In addition to the above directives, the Board encourages NS Power to include information on each of the following in future load forecasts:

- Examine the elasticity used in the SAE model to exclude elasticities calculated from non-winter peaking utilities or to apply elasticities from Canadian studies of Canadian electric utilities;
- Evaluate the input variables in the residential model and test, over a period of time, if alternative inputs make the residential model more robust, considering the following:
 - o Given the continued population growth in Nova Scotia and ongoing housing shortage in the province, re-evaluate the use of housing completions for the near-term;
 - o Given the current inflationary environment, evaluate the use of Median Household Income in place of Total Household Income, as it is biased by outliers. Should the Conference Board of Canada be unable to provide the Median, NS Power could use data published by Statistics Canada and apply the Conference Board of Canada's annual growth rate to estimate the long-term Median Household Income;
 - o Consider incorporating household size and age of household residents, to determine if a better understanding of demand on load by time of day is achieved.

- Revisit the short-term economic inputs provided by the Conference Board of Canada to ensure data are close to those used in the forecasts of Canada's major Banks.
- Revisit the model's EV adoption rates and examine EV rebates to ensure that the model is using data that is in line with the data reported by Statistics Canada and Nova Scotia Open data³.
- With respect to the unresolved status of large infrastructure projects, NS Power is encouraged to maintain communications with those customers to ensure system adequacy.

Yours very truly,



Richard J. Melanson LL.B.
Member



Julia E. Clark, LL.B.
Member

cc: S. Bruce Outhouse, K.C., Board Counsel
Interested Parties

³ Registration: <https://data.novascotia.ca/Permits-and-Licensing/Electric-Vehicle-Registration-Data/avxy-ifhs> and <https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=2310006701> Rebates: <https://data.novascotia.ca/Mines-and-Minerals/Rebates-for-New-and-Used-Electric-Vehicles-in-Nova/fwin-zgki>