



Nova Scotia Utility and Review Board

Mailing address

PO Box 1692, Unit "M"
Halifax, Nova Scotia
B3J 3S3
board@novascotia.ca
<http://nsuarb.novascotia.ca>

Office

3rd Floor, 1601 Lower Water Street
Halifax, Nova Scotia B3J 3P6
1 855 442-4448 (toll-free)
902 424-4448 t
902 424-3919 f

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mark.peachey@nspower.ca

Mark Peachey
Manager, Capital Filings
Nova Scotia Power
1223 Lower Water St
Halifax, NS B3J 3S8

Dear Mr. Peachey:

M11108 – Nova Scotia Power Inc. – 2023 Load Forecast Report (P-194)

Nova Scotia Power Inc. (NS Power) filed its 10-Year 2023 Load Forecast Report, as required under the Nova Scotia Wholesale and Renewable to Retail Electricity Market Rules. The Load Forecast provides NS Power's estimated energy and peak demand requirements for 2023 to 2033 based on sales, weather, demand side management (DSM), economic indicators and surveys, among other measures.

The Board issued an Order establishing the timeline for a paper hearing process and approved a requested Confidentiality Undertaking for this proceeding. Notices of intervention were received from the Industrial Group (IG), EfficiencyOne (EOne), Eastward Energy (EE), the Small Business Advocate (SBA) and the Consumer Advocate (CA). Synapse Energy Economics Inc. (Synapse) was engaged to review the NS Power filing on behalf of Board Counsel.

On June 20, 2023, NS Power filed responses to Information Requests (IRs) received from the CA, SBA, IG, EOne, Board staff, and Synapse. The Board changed the Hearing Order on June 30, 2023, at the request of Synapse, to extend the filing date for the Intervenor/Board Counsel Consultants' Evidence. Evidence was filed by the CA and Synapse and a submission was made by the SBA on July 18, 2023. The Board issued a letter to NS Power on August 28, 2023, directing the Utility to address the unplanned continuation of a medium industrial customer's service in its Rebuttal Evidence. NS Power filed its Rebuttal Evidence on September 14, 2023.

2023 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. These results are 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. This 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 2022 Load Forecast, the 2023 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 the result of expected customer growth and higher electric vehicle (EV) uptake, based on the Federal Government's target for EVs. NS Power expects this growth to be offset by DSM initiatives, natural energy efficiency improvements and more small-scale solar installations. A Renewable to Retail (RTR) customer was expected to reduce load in 2024 to 2025 by 136 GWh. As a result, NS Power has forecasted that net system energy requirements (NSR) will experience a net annual increase of 0.7 percent from 2024 to 2033. NS Power forecasts annual system peak growth of 2.3% from 2024 to 2033. This growth is attributed to customer growth and increased electrification of heating and vehicles, which will be mitigated by DSM and Demand Response (DR) activities.

These forecasts project the 2033 NSR will be 8.8% (979 GWh) higher than the 2022 actual level. The 2033 projected peak system will be 27.2% (603 MW) greater than the 2022 actual system peak. Much of the increase is the result of the growth in demand experienced in 2022.

Table 1 provides a comparison of NS Power's forecasted growth in energy and peak demand. The 2023 forecast and actual values were obtained from the current application. The forecast values for the years 2018-2022 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
2023	1.4%		1.8%	
2022	2.2%	2.1%	10.0%	12.6%
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%

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 and 2023

The load forecast is a foundational input in relation to NS Power's overall planning, budgeting, and operating activities. This includes the company's generation requirements, capital program, fuel forecasts, and customer rates. The reliability of this forecast is an essential element in accurately projecting 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 2022 Board Decision letter (matter M10569), the Board provided direction on enhancements toward continuous improvement in the development of the load forecasts, including findings from pilot projects. The Board also encouraged NS Power to continue to engage with stakeholders. NS Power conducted a virtual stakeholder consultation with the CA, SBA, EOne, IG, Synapse and Board staff on March 31, 2023. These stakeholders discussed the COVID-19 assumptions, the updated EV forecast, space heating, assumptions of peak temperatures, RTR projections, and updated small-scale solar. NS Power evaluated the Board's recommendations, and those of many of the stakeholder's, arising from the 2022 Load Forecast proceeding.

These recommendations included:

- modeling a lagged average temperature and wind speed effects on peak loads;
- using more weather station data collected from across the province;
- testing median income in place of household income in the residential model;
- adjusting for small scale solar panel installations;
- conducting additional sensitivity analyses; and,
- incorporating the results from the Smart Grid project.

The Load Forecast was adjusted for the RTR load, with planned service to customers in 2023. NS Power adjusted the forecast starting in 2024 by subtracting 14 GWh of energy. However, the peak forecast was unchanged to satisfy NS Power's legal requirements to serve the full peak load.

The largest variances between forecast and actual in 2022 were the result of weather, representing 165 GWh, and an unexplained variance of 234 GWh, that NS Power attributed to the COVID-19 pandemic and heat pump installations. The anticipated increase in net system requirement for 2023 is primarily attributed to the growth in new customers, space heating and EV adoption. The Board notes that, in the 2022 Load Forecast Report, NS Power proposed 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. This analysis was only performed for two months. NS Power indicated that AMI data will be used to test the accuracy of the forecast models and determine if the residential class has resumed its pre-pandemic consumption.

Intervenor Comments

Intervenors continue to be complimentary of NS Power's efforts toward continued improvement of its forecast and engagement with stakeholders. Like the concerns expressed in last year's report, Intervenors focused their assessment on continued improvement, rather than objecting to the load forecast filed for 2023. The primary concerns cited by Intervenors are researching the effects of electrification on energy and peak demand, and the effects of new technologies (specifically the results from the Smart Grid project, direct control of water heaters and Time Varying Pricing tariffs).

The Consumer Advocate filed evidence prepared by John Wilson, Resource Insight Inc. Mr. Wilson recommended that NS Power use an estimate of 0.6 kW/vehicle in its EV charging forecast. He said the Board should ask NS Power to provide an updated transformer sizing chart to verify that transformers are being sized based on the latest available information on EV charging loads. He suggested that NS Power remove the peak reduction benefits of 4 MW attributed to the TVP

in the load forecast because the program has reported lower levels of reduced demand. He said the program is unlikely to achieve a 4 MW reduction until 2024. Mr. Wilson recommended the load forecast documentation be updated to further explain the formulas and assumptions in the SAE models, like in the response provided to CA IR-10. Lastly, he recommended NS Power update the distribution system planning methods and practices to account for the impacts of small scale solar and electrification of heating loads, particularly for the small general sector.

The SBA raised concerns about forecasting based on electrification policy goals, the accuracy of customer surveys to predict energy demands, and the effect of RTR loads. The SBA was concerned that the model's estimated EV adoption rates and electric heating, based on Federal government targets, do not account for incentive structures and local adoption rates. The SBA recommended adding a scenario where the Federal EV policy target is not met in the province. The SBA noted that customer surveys are used for the large industrial customers, but a sensitivity analysis or a review of the accuracy of the load forecasted for these customers has not been provided. A sensitivity analysis may identify areas that will improve the forecast's accuracy. Lastly, the SBA recommended that future Load Forecast Reports include discussion on the impact of RTR loads and its effect on load forecasts in rate cases or Integrated Resource Plan matters.

Synapse noted continued improvement to the Load Forecast. However, Synapse had over 20 recommendations which focused on areas to investigate in the next load forecast report. Synapse focused on:

- validating anticipated effects to load with empirical data and monitoring trends to make changes to future forecasts;
- modeling scenarios with more solar generation against electrification and DSM measure;
- reviewing the peak forecasting method; and
- performing future sensitivity analysis based on actions to reduce projected peak increases using newly available technology.

NS POWER REBUTTAL EVIDENCE

In its rebuttal evidence, NS Power addressed the concerns raised by the Intervenors. The company confirmed or justified its approach in the forecast. The CA recommended that transformers be sized based on current information of EV charging loads. NS Power confirmed that service transformers are not being replaced in anticipation of higher demand from EV charging, but this may change. NS Power confirmed that EV loads in the commercial class are based on coincident peak impacts for workplace and public charging, and the model assumes both direct control and rate related peak reduction.

NS Power confirmed that it is working on developing ways to model the distribution system using AMI meter data and customer demographics. The goal is to identify system effects at current and forecasted levels of load and solar generation.

NS Power responded to Synapse's recommendation that NS Power use data from the water heater demand response pilot to create a residential peak forecast and incorporate heat pump based hot water heating to the next Load Forecast. The company indicated that a class level peak forecast will be developed, but a bottom-up end-use specific forecast is not possible because NS Power lacks end-use load data.

NS Power identified that real time pricing is available to industrial customers but only used by one. Other industrial rates are being developed for hydrogen production facilities, however, NS Power regards testing of rate design as outside the scope of the Load Forecast. NS Power acknowledged that potential impacts will be incorporated as appropriate.

Like the 2022 Load Forecast Report matter, NS Power was agreeable to most of the intervenors' recommendations. NS Power agreed to incorporate data, and revise it where appropriate, from the Integrated Resource Plan, Smart Grid NS, and the TVP Pilot, into forecasts. NS Power will review the assumptions used to predict EV adoption. Future forecasts will examine the effects of battery storage, heat pumps, heat pump hot water heaters, and more efficient induction ovens, on energy and peak using AMI and other sources. NS Power will include more empirically validated assumptions in the 2024 forecast for any peak reduction benefits from solar generation.

NS Power agreed to provide more information about the end-use model and variables, in keeping with the response to CA IR-10, in Appendix B of the 2024 Report. A comparison of the industrial customers' historical load to the survey expectations will be provided in 2024. The Load Forecast will incorporate DSM measures associated with the large general service and industrial customer's electrification, although the total impact is expected to be small.

NS Power did not agree with some recommendations made by intervenors. The CA recommended NS Power remove savings generated from the TVP Pilot. NS Power disagreed because the system level peak demand is expected to occur during TVP peak times. NS Power did not consider applying an increase of 0.6 kW per EV to the load forecast appropriate because the current sample group charging data shows that EV load demand is variable. Therefore, a better understanding of EV's effect on peak is needed before results from the sample can be confidently applied to the forecast.

The SBA requested NS Power provide a low-adoption electrification scenario. The goal is to improve the understanding of system needs if incentives to increase electrification are ineffective and evaluate the benefits of more DSM. NS Power considers this low adoption scenario and varying levels of DSM are provided as part of the IRP and Evergreen IRP.

On August 28, 2023, the Board sent a letter to NS Power directing the Utility to address the withdrawal of an agreement for service between a RTR provider and a medium industrial customer that was to begin in September 2023. In its Rebuttal Evidence NS Power stated "The load forecast represents a point in time when the forecast was produced based on the information known at that time. Updating the load forecast for an isolated change to a single assumption would not provide additional meaningful clarity." This may be true from a modeling perspective. That said, the Board's concern is about the effect of the additional load. NS Power must be prepared to provide service to all customers, including RTR customers, if a shortfall in generation is experienced.

Board Findings

The Board acknowledges the intervenors' participation in examining changes to the Load Forecast. In keeping with the directive from the 2022 Load Forecast Report, 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 2024 Load Forecast Report. Many of the recommendations made by intervenors are important to discuss in the initial stakeholder meeting. It is helpful if NS Power shares how potential impacts were evaluated and what was incorporated into the forecast early in the process.

The Board notes that NS Power has agreed to many of the Intervenor's recommendations and acknowledges this commitment towards 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:

- the IRP, SGNS, AMI, TVP Pilot outcomes;
- reviewing the assumptions applied in the model to reduce carbon emissions; and,
- assessing the historical load of survey sales realization, to compare how the historical load compares with the survey results.

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

- Evaluate the elasticity used in the SAE model with the elasticity estimation from the TVP Pilot EM&V in matter M11267 and assess if the results provide a more robust model.
- 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:
 - Given the continued population growth in Nova Scotia and ongoing housing shortage, re-evaluate the use of housing completions for the near-term.
 - Consider incorporating household size and age of household residents, to determine if a better understanding on demand load by time of day is achieved.
 - Revisiting the short-term economic inputs provided by the Conference Board of Canada to ensure the data is close to what is used in the forecasts of Canada's major Banks.
 - Revisit the model's EV adoption rates to ensure that the model's inputs are in keeping with the data reported by Statistics Canada and Nova Scotia Open data.³
 - With respect to the status of large infrastructure projects, NS Power is encouraged to maintain communications with those customers to ensure system adequacy.

The Board asked an IR about the impact of the Province's hydrogen strategy on load forecasting. NS Power responded that it was working with government and industry proponents to better understand hydrogen development plans and requirements. The company said this should become clearer in the coming year and should be reflected in the 2024 Load forecast, as appropriate. NS Power advised as the company acquires a better understanding of these needs, the Power System Planning Team will conduct more resource modelling "...to assess the potential load impacts and the balance of energy and capacity requirements to meet the net demand of hydrogen facilities."

The Board agrees the issue of commercial hydrogen production must be addressed as soon as possible. The Board is aware Everwind Fuels has recently applied for Environmental Assessments to construct wind farms which will generate energy to power its green ammonia production. Self-generation for hydrogen production could be substantial. Where NS Power's grid is used to transmit self-generated power, NS Power will have to understand the impact of carrying this load

³ Registration: Statistics Canada. Table 20-10-0025-01 New zero-emission vehicle registrations, quarterly and <https://data.novascotia.ca/Permits-and-Licensing/Electric-Vehicle-Registration-Data/avxy-ifhs>
Rebates: <https://data.novascotia.ca/Mines-and-Minerals/Rebates-for-New-and-Used-Electric-Vehicles-in-Nova/fwin-zgki>

on all customers. As well, NS Power energy might be needed as a backup or while proponents await completion of their own generating projects.

The Board expects NS Power to continue exploring all realistic scenarios related to commercial hydrogen production and, where there is sufficient data, incorporate them to the extent possible, in load forecast modelling.

The Board notes that there is a significant variance between the 2022 forecast and the actual Net System Requirement of 234 GWh. This variance has been attributed to the COVID-19 pandemic and heat pump installations, which are confounding factors during a year of warm weather. The Board finds that given the size of the unexplained variance, this category needs to be revisited. NS Power is encouraged to consider the following potential effects on load:

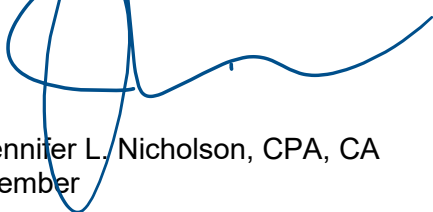
- cooling demand during the summer months;
- increased demand from customers upgrading the electrical capacity of their homes to accommodate heat pumps and large back-up generators; and,
- any other factors that NS Power considers a driver to increased electricity demand in the residential class.

The Board directs NS Power to examine the 2022 unexplained variance and report on its findings in the 2024 Load Forecast Report.

Yours very truly,



Richard J. Melanson, LL.B.
Member



Jennifer L. Nicholson, CPA, CA
Member



Julia E. Clark, LL.B.
Member

c. William Mahody K.C., Board Counsel
Interested Parties