Matter No. M11108

In the Matter of Nova Scotia Power's 2023 Load Forecast Report

EVIDENCE OF

JOHN D. WILSON

ON BEHALF OF

THE CONSUMER ADVOCATE

Grid Strategies, LLC

JULY 18, 2023

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I. Identification & Qualifications

Q: Mr. Wilson, please state your name, occupation, and business address.

A: I am John D. Wilson. I am the Vice President of Grid Strategies, LLC, Bethesda, MD.

Q: Summarize your professional education and experience.

A: I received a BA degree from Rice University in 1990, with majors in physics and history, and an MPP degree from the Harvard Kennedy School of Government with an emphasis in energy and environmental policy, and economic and analytic methods. I have been employed by Grid Strategies since 2023, and previously I performed similar duties as an employee of Resource Insight.

Previously, I was deputy director of regulatory policy at the Southern Alliance for Clean Energy for more than twelve years, where I was the senior staff member responsible for SACE's utility regulatory research and advocacy, as well as energy resource analysis. I engaged with southeastern utilities through regulatory proceedings, formal workgroups, informal consultations, and research-driven advocacy.

My work has considered, among other things, the cost-effectiveness of prospective new electric generation plants and transmission lines, retrospective review of generation-planning decisions, conservation program design, ratemaking and cost recovery for utility efficiency programs, allocation of costs of service between rate classes and jurisdictions, design of retail rates, and performance-based ratemaking for electric utilities.

My professional qualifications are further summarized in Attachment 1.

Q: Have you testified previously in utility proceedings?

A: Yes. I have testified more than forty times before utility regulators in California, Colorado, Nova Scotia and the Southeast U.S., and appeared numerous additional times before various regulatory and legislative bodies.

Q: Have you previously testified in other proceedings before this Board?

A: Yes. I have filed testimony in eighteen matters. I have also assisted the Consumer Advocate in preparing comments and developing positions in numerous proceedings and stakeholder processes.

Q: On whose behalf are you testifying?

A: My testimony is sponsored by the Nova Scotia Consumer Advocate.

II. Introduction and Summary

Q: Please summarize the topics you will address in your review of the 2023 Load Forecast Report.

A: I have reviewed several improvements to NS Power's load forecast methods that are reported this year for the first time. I will also discuss several areas in which load forecast methods and documentation could be improved. Finally, I will discuss general implications of the electrification load forecast for distribution system planning.

Q: Please summarize your recommendations.

A: I recommend that NS Power make the following changes in future load forecast reports.

1. NS Power should use an estimate of 0.6 kW/vehicle for its EV charging forecast.
2. NS Power should remove the peak reduction benefits associated with time-varying pricing from its load forecast.
3. NS Power should update its load forecast documentation to include the additional details supplied in response to CA IR-10.

I also provide discussion, but no recommendation, on how NS Power should forecast the impact of customers' non-electric backup heating systems on its peak load. Finally, I also have two recommendations related to distribution system planning.

4. The Board should seek information on NS Power's updated transformer sizing charts in this or some other appropriate proceeding to verify that transformers are being sized based on the latest available information regarding EV charging loads (see Recommendation 1 above).
5. NS Power should undertake or be directed to undertake updates to its distribution system planning methods and practices to consider the potential impacts of solar systems smaller than 100 kW and electrification of heating loads, especially in the small general sector.

III. Improvements Demonstrated in 2023 Load Forecast Report

Q: Please summarize the improvements demonstrated in the 2023 Load Forecast Report.

A: NS Power made two notable improvements that I would like to comment on. First, NS Power updated the peak design temperature to reflect a lagged 12-hour average temperature as well as wind speed. Second, NS Power created a hybrid scenario for electrification of building heat to reflect peak mitigation through the use of non-electric heat sources.

I would also like to acknowledge that NS Power evaluated adding load-weighted weather from multiple weather stations for its peak model. This issue was first raised in the evidence of Mr. James F. Wilson for the 2021 Load Forecast Report.[1] I concur with the report's conclusion that the effects of using multiple weather stations has minimal impact on the load forecast model, and that it is reasonable to continue using Shearwater RCS as the only weather station informing the model.[2]

Q: Please summarize the update to the peak design temperature.

A: NS Power updated the peak design temperature to reflect a lagged 12-hour average temperature as well as wind speed. These issues were first raised in the evidence of Mr. James F. Wilson for the 2021 Load Forecast Report.[3] I provided further examples and analysis that verified the impact of these factors in my evidence for the 2022 Load Forecast Report.[4]

NS Power tested peak-hour-only, 12-hour-lag, and 24-hour-lag temperature models. I concur with NS Power's conclusion that the 12-hour lagged model works best. NS Power tested adding an average daily wind speed variable to its models, and I concur that this also represents an improvement.[5]

[1] Exhibit N-8, Evidence of James F. Wilson (July 21, 2021), Matter No. M10109, p. 25.

[2] Exhibit N-1, 2023 Load Forecast Report, p. 26.

[3] Exhibit N-8, Evidence of James F. Wilson (July 21, 2021), Matter No. M10109, pp. 5-6, 14, 25.

[4] Exhibit N-5, Evidence of John D. Wilson (July 29, 2022), Matter No. M10569, pp. 7-9.

[5] Exhibit N-1, 2023 Load Forecast Report, p. 22.

Q: Please summarize the hybrid scenario for electrification of building heat.

A: NS Power created a hybrid scenario for electrification of building heat to reflect peak mitigation through the use of non-electric heat sources. I raised this issue in my evidence for the 2022 Load Forecast Report.[6]

NS Power's sensitivity tests the impact of an assumed mix of heat pumps with non-electric backup systems for use during peak times. NS Power found that while it would have a moderate (perhaps insignificant) impact on energy use, changing the model assumption from customers fully relying on heat pumps to customers using some non-electric backup system during peak periods would have a "large impact on the peak impact of heating electrification."[7]

Q: What are the implications of this finding for NS Power's decarbonization strategy?

A: A key challenge to NS Power's decarbonization strategy is meeting peak winter heating load. NS Power is pursuing multiple strategies, including time-varying rates, battery storage, gas-fueled peaking units (backed up by diesel fuel), and increased transmission interconnections, especially the Atlantic Loop. Together, these strategies are intended to provide NS Power with the resources it requires to deliver reliable electricity to its customers.

There may also be a role for customer-sited resources. If customer-sited resources take up the load, so to speak, NS Power's sensitivity suggests that customer use of those resources could reduce system peak demand by 257 MW. For perspective, this is large enough to fully offset its forecast for EV charging. (Although I believe the EV charging forecast to be overstated, as discussed in Section IV.A.)

Natural gas, propane, and battery storage are leading contenders for customer-sited energy resources. None is a perfect solution. For example, the capability of Eastward Energy, Inc. (EEI) to expand service cannot be built to exceed available natural gas pipeline capacity without undermining its value to customers during peak heating demand periods.

It isn't clear that the natural gas pipeline capacity exists or that there is an opportunity to expand it. NS Power has stated that its current plans to supply its current and planned

[6] Exhibit N-5, Evidence of John D. Wilson (July 29, 2022), Matter No. M10569, p. 10.

[7] Exhibit N-1, 2023 Load Forecast Report, Appendix D, p. 9.

natural gas plants are already constrained by natural gas infrastructure. In a document supporting its Evergreen IRP development process, NS Power states,

> Based on the 2020 IRP and 2022 evergreen Early Insight modeling, new gas units are expected to operate at low capacity factors with correspondingly low natural gas offtake. Thus, for new gas resources, NS Power will model a supply source that can serve this need *without long-term infrastructure upgrades, requiring long-term fixed commitments.*[8] (*emphasis added*)

NS Power's investment strategy is to use natural gas to support peak periods of electric demand, but in combination with other fuels and resources and does not rely on development of expanded pipeline capacity.

Q: Should NS Power revise its load forecast to assume that a large number of customers will continue to rely on non-electric backup systems during peak demand periods?

A: I do not have a recommendation on this point. On the one hand, many customers are retaining non-electric heating systems for backup purposes. In its study of participants in NS Power's residential heat pump financing program, Itron found that over one-third of customers installed "heat pumps to supplement current heating sources and/or sizing to meet cooling loads."[9]

On the other hand, federal and provincial policy is clearly attempting to drive building electrification. Considering the constraints on natural gas pipeline capacity and other non-electric choices for customer-sited power, it isn't clear that customers will be able to maintain (or even add) backup heating sources that have greenhouse gas emissions.

This is an important area for policy and program design engagement by the Province and the Board. The Board should ask whether peak winter heating load is best met by energy delivered via wires, pipelines, or trucks. The Board should also ask whether energy to meet those peak demands should be stored in a battery, a tank, a lake or in a regionally linked, diversified energy system.

The answers to these questions have *significant* implications for the load forecast and, in turn, the optimal resource investment strategy for NS Power moving forward.

[8] NS Power, *2022 Evergreen IRP Updated Assumptions* (January 26, 2023), p. 38.

[9] Itron, *Nova Scotia Power Cold Climate Heat Pump Load Study* (July 2022), p. 18; filed as Appendix A to NS Power, *On-Bill Financing Final Report* (July 12, 2022), M09321.

IV. Issues with 2023 Load Forecast Report

A. Forecast peak demand for electric vehicle charging

Q: What is the basis for the report's forecast of peak demand for electric vehicle charging?

A: NS Power assumes that the overall peak demand contribution of EV charging is 0.9 kW/vehicle, with 70 percent of charging managed by NS Power and 30 percent of charging unmanaged.[10]

Q: Do you believe this forecast makes the best use of available evidence?

A: No. The EV charging data obtained from the Smart Grid Nova Scotia project indicate that the peak demand contribution of EV charging is likely to be significantly lower than 0.9 kW/vehicle. As shown in Figure 1, even though NS Power isn't yet offering managed charging, demand during system peak hours averages only 0.6 kW/vehicle.

Figure 1: Peak Demand Contribution of EV Charging[11]

Date/Time	System Load (MW)	EV Charging Demand (kW)	Available Vehicles	Peak kW/Vehicle
1/11/2022 18:00	2,216	44.57	84	**0.53**
1/11/2022 19:00	2,179	67.23	84	**0.80**
1/11/2022 20:00	2,147	81.81	84	**0.97**
1/11/2022 17:00	2,138	30.26	84	**0.36**
1/12/2022 9:00	2,132	12.02	84	**0.14**
1/12/2022 10:00	2,112	39.98	84	**0.48**
2/15/2022 19:00	2,112	78.11	86	**0.91**
2/16/2022 8:00	2,109	39.60	86	**0.46**
1/11/2022 21:00	2,109	67.85	84	**0.81**
1/15/2022 18:00	2,105	52.20	84	**0.62**
Average				**0.61**

Doubtless further data will result in refined estimates. However, given that NS Power intends to develop managed charging programs or tariffs, utilizing a forecast of 0.6 kW/vehicle is more reasonable than the value E3 modeled based on data from other regions.

[10] Exhibit N-1, 2023 Load Forecast Report, p. 40.
[11] Exhibit N-2, CA RIR-3(a).

Q: What would be the impact of adjusting to your proposed 0.6 kW/vehicle peak demand contribution estimate?

A: NS Power forecasts that EVs will add 240 MW to the 2033 peak using the 0.9 kW/vehicle peak demand contribution estimate. Assuming a linear response in the model, adopting my recommendation would reduce the peak demand impact by 80 MW to 160 MW in 2033.

This adjustment is significant enough to have a material impact on NS Power's resource planning process.

B. Forecast for peak demand impact of time-varying pricing tariffs

Q: What forecast is NS Power using for the peak demand impact of time-varying pricing tariffs?

A: NS Power is using the same forecast that it developed for the 2021 Load Forecast Report, except that the forecast has been shifted one year later.[12] NS Power expects time-varying pricing tariffs to reduce demand by 4 MW in 2023, 12 MW in 2024, and by 32-36 MW in 2026 and thereafter.[13]

Q: Is this forecast reasonable?

A: No, not given the current status of the time-varying pricing program.

First, the 2023 forecast of 4 MW demand reduction is unreasonable because the current pilot is reported to have achieved load reductions of 795 *watts* through winter 2021-2022.[14] Since the pilot is not attempting to recruit enough participants to increase this number to even 1 MW, the 2023 forecast should be zero for this program.

Second, it is unlikely that the program will be substantially scaled up for 2024. The pilot is scheduled to conclude on October 31, 2023 (currently enrolled participants may remain on the tariff). The final report was due in June 2023 but it has not yet been filed. It does not seem possible for NS Power to receive approval for an expanded program in time to enroll a much larger number of customers to achieve 12 MW of demand reduction in 2024. The first year that NS Power *might* achieve demand reduction of greater than 1 MW is 2025.

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[12] Exhibit N-1, *2021 Load Forecast Report*, Matter No. M10109 (April 30, 2021), p. 74.

[13] Exhibit N-1, *2023 Load Forecast Report,* p. 78.

[14] Exhibit N-1, *Time Varying Pricing Interim Report*, Matter No. M10703 (July 29, 2022), p. 10.

Third, the current time-varying pricing program is not designed in a manner that will achieve *any* demand reduction. Substantial re-design of the program will require further testing, which would push the first year in which NS Power *might* achieve demand reduction into 2026 or later.

Q: Why do you believe that the current time-varying pricing program will not achieve *any* demand reduction?

A: The time-varying pricing program includes two pilot tariffs, a time-of-use tariff (TOU) and a critical peak pricing tariff (CPP). Neither pilot is achieving demand reduction that can be counted on to reduce peak demand.

First, the TOU period definition is not capturing the full duration of peak events. Data from the interim evaluation showed that of the top ten peak event periods, the full peak event duration occurred within an AM or PM peak TOU period in only 1 case, March 1st. In all other cases, one or more hours of peak load (as defined by Econoler) occurred during an off-peak hour. In other words, in 90% of peak events, the peak TOU rates were not in effect for at least one hour of the peak event.

Even worse, for four of these peak event periods, the peak hour occurred outside the peak TOU rate period. Three of those peak events occurred on weekends when TOU peak rates are not in effect, and the other peak event occurred midday, in between the two peak rate periods. NS Power's decision to exclude weekends and holidays from the TOU pilot is a fundamental flaw in delivering demand reduction that can be relied upon to reduce the system peak.

Second, the interim evaluation report shows that the CPP tariff is also likely to fail to deliver demand reduction that can be counted on to reduce peak demand. As with the TOU program, the CPP tariff is not in effect on weekends and holidays, so no matter how effectively the CPP tariff reduces demand when a critical peak event is in effect, due to this fundamental flaw the CPP tariff cannot be relied upon to reduce the system peak.

Furthermore, the interim report showed disappointing results in terms of demand reduction during morning peak events. The peak for electric-heat homes on AM event days occurred from 6-7 am and was actually 1.7% *higher* than on reference days.

Customer response is not the problem with the current time-varying pricing program. It is reasonable to conclude that that the average participant reduced load during TOU periods or on CPP event days. But it is not reasonable to conclude that the average pilot program participant reduced peak load because the higher rates were not, and could not, be in effect on all (or nearly all) days with peak demand and peak demands were not reduced for electric-heat customers during CPP morning events.

Q: Are there program changes that could address the issues demonstrated in the interim evaluation of the time-varying pricing program?

A: Yes. In the settlement agreement for the time-varying pricing program, NS Power committed to implement a CPP Advanced Tariff Pilot that would include weekends, holidays, and greater flexibility as to the time of day in which CPP events could be called. The settlement agreement stated:

> In addition to the foregoing, NS Power commits to work with the parties to develop and implement a pilot version of the CPP Advanced tariff offerings proposed by Resource Insight, Inc. in Section VII of its February 24, 2021 evidence filed on behalf of the CA, such that they are offered from November 1, 2022 to October 31, 2023 ("CPP Advanced Tariff Pilot"). It is understood and agreed to by the parties that the development and implementation of the CPP Advanced Tariff Pilot will be subject to and will need to accommodate the practical limitations of NS Power's Customer Information System, that it will be informed by the pilot interim reporting in June 2022, and that it will be subject to approval by the NSUARB.[15]

Nova Scotia Power unilaterally decided not to offer the CPP Advanced Tariff Pilot in winter 2022/2023 even though participants it surveyed preferred an alternative to the CPP Tariff currently being offered on the basis that pricing for the CPP Advanced Tariff Pilot "would have a significant bearing on customer preference."[16] This claim was not supported by any survey data and I do not believe that NS Power has any intent to test it by offering the CPP Advanced Tariff Pilot in winter 2023/2024.

Until NS Power tests and deploys a time-varying pricing program that includes incentives to reduce peak demand during weekends and, ideally, has flexibility in terms of daily schedules, there is zero chance that the program will provide peak load reductions that meet the standard for use in the load forecast report.

[15] Consensus Agreement (May 12, 2022), Matter No. M09777, Attachment A, p. 3.
[16] NS Power, CA RIR-2(c), Matter No. M09777.

Q: What estimated load reduction for time-varying pricing (or CPP) programs should be included in the load forecast?

A: NS Power should remove the peak reduction benefits associated with time-varying pricing from its load forecast. If NS Power proposes a program that is effective on all days in which a peak load event is likely to occur, then it would be reasonable to develop a new forecast of such benefits.

It may be reasonable to include some amount of energy savings or peak shifting from the current time-varying pricing program. The final evaluation report, which is overdue at this time, should include information that NS Power can use for this purpose.

C. Load forecast documentation

Q: Does the load forecast report fully document all methods and inputs?

A: No. As shown in Exhibit N-2, response to CA IR-10, NS Power's load forecast report does not include the formulas for HeatUse, CoolUse, and OtherUse, along with certain key assumptions. Furthermore, Attachment 1 to the same response provides monthly multipliers that shape appliance usage over a 12-month period.

Q: Do you have any concerns or recommendations related to the additional explanation for the load forecast methods?

A: I do not have any concerns with the methods at this time. As the additional explanation is useful, I recommend that NS Power provide this explanation in future load forecast reports and update it as multipliers or methods are revised.

V. Implications of Electrification Forecast for Distribution Planning

Q: What aspects of electrification is NS Power considering in its distribution facilities planning?

A: NS Power states that large loads (>1 MW) and generation (>100 kW) are evaluated in distribution system impact studies. NS Power also states that it has updated its transformer sizing charts to account for increased load from EVs.[17]

[17] Exhibit N-2, CA RIR-4.

NS Power has not provided any information indicating that its distribution system planning includes consideration of smaller impacts, such as due to solar systems smaller than 100 kW or electrification of heating loads.[18] NS Power specifically notes that electrification of heating in the small general service sector will be a significant factor in future load trends.[19]

Q: Do you have any concerns regarding the changes that NS Power has made to its distribution facilities planning?

A: Yes. As discussed in Section IV.A, NS Power appears to be overstating the on-peak demand of EV charging. If that finding is correct, then NS Power's updated transformer sizing charts may result in oversized transformers, which would result in unnecessarily large capital expenditures. I recommend that the Board seek information on the updated transformer sizing charts in this or some other appropriate proceeding to verify that transformers are being sized based on the latest available information regarding EV charging loads.

I am also concerned that NS Power's distribution system planning is not beginning to consider the potential impacts of solar systems smaller than 100 kW or electrification of heating loads, especially in the small general sector. NS Power should undertake or be directed to undertake updates, such as updating transformer sizing charts and evaluating whether voltage upgrades may be necessary, particularly on high-demand circuits.

Q: Does this conclude your testimony?

A: Yes.

[18] Exhibit N-2, CA RIR-4.

[19] Exhibit N-1, 2023 Load Forecast Report, p. 64.