Q. Further to PUB-NP-108, has Newfoundland Power considered whether it is appropriate to switch to statistical regression modelling to forecast its peak demand to make it consistent with Newfoundland and Labrador Hydro's approach? If yes, explain the advantages and disadvantages of switching. If not, why not?

A. **A. General**

Newfoundland Power and Newfoundland and Labrador Hydro ("Hydro") have been working together since 2020 to better understand the factors influencing Newfoundland Power's peak demand.[1] In addition, both utilities have shared forecasting methodologies and assumptions in order to better understand the approximate 55 MW difference in peak demand forecasts between the 2 utilities.

Historically, both forecasts have produced similar results. However, recently Newfoundland Power's forecast of peak demand has declined while Hydro's forecast of Newfoundland Power's peak demand has remained relatively unchanged.

In reviewing both the load factor methodology and Hydro's statistical regression methodology, Newfoundland Power determined that a load factor methodology was more appropriate for the purposes of estimating purchased power costs and determining appropriate billing determinants to be used in the Utility rate.

B. Forecasting Methodologies

The primary difference between Newfoundland Power's and Hydro's peak demand forecasts arises from the declining sales experienced by Newfoundland Power in recent years. Newfoundland Power's load factor methodology reflects a decline in demand corresponding to the Company's declining energy sales. Hydro's statistical regression methodology does not reflect a decline in demand corresponding to Newfoundland Power's declining energy sales, particularly as it relates to residential energy sales and the adoption of heat pumps.[2]

[1] See Hydro's presentation *Reliability and Resource Adequacy Study Review – Technical Conference #2*, November 30, 2020, page 30, filed in advance of Hydro's 2nd Technical Conference in relation to Hydro's *Reliability and Resource Adequacy Study Review.* See also, Hydro's presentation *Reliability and Resource Adequacy Study Review – Technical Conference #3*, June 9, 2021, page 91, filed in advance of Hydro's 3rd Technical Conference in relation to Hydro's *Reliability and Resource Adequacy Study Review.*

[2] Hydro states on page 30 of its November 30, 2020 presentation *Reliability and Resource Adequacy Study Review – Technical Conference #2: "Primary difference between forecast is associated with differences in methodology and associated energy savings of heat pumps translating to demand savings in Newfoundland Power's forecast."*

Load Factor Methodology

The load factor methodology captures the relationship between energy sales and peak demand.[3] Forecasts of peak demand are based on the average historical relationship between energy sales and peak demand.[4] Forecasting peak demand using Newfoundland Power's load factor methodology is relatively straight forward.[5] In Newfoundland Power's experience, the load factor methodology has been reasonably accurate.[6]

Newfoundland Power's load factor methodology will result in a decrease in peak demand as a result of declining energy sales, including those attributable to heat pumps.[7] A decline in peak demand related to the adoption of heat pumps is consistent with the *Conservation Potential Study* recently prepared by Dunsky Energy Consulting ("Dunsky") to assess electrification, conservation and demand management potential over the 2020-2034 period.[8]

Newfoundland Power is currently completing a heat pump load research study to better understand the potential impacts of heat pumps on peak demand. Initial results of the load research study provide a range of possible outcomes. For example, data compiled from eastern Newfoundland indicates peak demand savings for households with heat pumps of approximately 13%. Data compiled from western Newfoundland indicates

[3] Load factor is the ratio of the average demand on the electrical system to the peak demand on the system. Newfoundland Power's typical load factor is approximately 50%. Conceptually, this implies that the peak demand Newfoundland Power will expect in a year will be approximately twice the average demand for the year.

[4] In 2021, Newfoundland Power reduced the average historical period used to calculate its peak demand forecast from 15 years to 5 years. Use of a 5-year average load factor recognizes changes in system conditions that have occurred in recent years. This includes declining energy sales and the increased penetration of heat pumps throughout the Company's service territory. See response to Request for Information PUB-NP-053.

[5] See the response to Request for Information NLH-NP-082, Attachment A for the derivation of Newfoundland Power's 5-year average load factor of 50.82%. Newfoundland Power's weather adjusted produced and purchased energy requirements for 2021 are 6,013,526 MWh. The 2021 peak demand forecast is 1,350.8 MW (6,013,526 MWh/year ÷ (365 days/year x 24 hours/day x 50.82%) = 1,350.8 MW).

[6] For example, for the 10-year period 2011 to 2020, the variance between Newfoundland Power's peak demand forecast using a 5-year average system load factor ranged from -3.1% to +2.6%. The forecast was lower than the weather adjusted peak demand in 6 of those years and higher than weather adjusted peak demand in 4 of those years. The average variance over the period was -0.3%.

[7] See response to Request for Information NLH-NP-057.

[8] The Dunsky *Conservation Potential Study* was commissioned by Newfoundland Power and Hydro as part of the utilities' electrification, conservation and demand management initiatives under the takeCHARGE partnership. Dunsky states at page 83: *"The adoption of DMSHP by electric baseboard households leads to significant net energy and demand reductions as shown in Figure 5-3 and Figure 5-4, respectively. By 2034 under the Mid rate scenario, electric sales will be reduced by nearly 140 GWH annually, and peak demand will be reduced by approximately 80 MW. Compared to forecasted electric sales and demand, these represent decreases in sales and demand of approximately 2.1% and 3.8%, respectively. There is a greater proportional impact on demand due to the larger contribution of residential heating load to system-wide peak demand relative to its contribution to system-wide electricity consumption."*

peak demand reductions of 2%.[9] Newfoundland Power continues to assess data compiled from its heat pump load research study to date to understand the impact of heat pumps on peak demand and differences in results between eastern and western Newfoundland.[10]

Statistical Regression Methodology

Hydro's statistical regression methodology analyzes the historical relationship between peak demand (the "dependent variable") and independent variables that can be used to predict peak demand.[11] Hydro's statistical regression model uses a number of independent variables to model Newfoundland Power's peak demand.[12] To forecast peak demand, forecast information is required for each of the independent variables.[13]

Hydro's statistical regression model is based on approximately 40 years of annual peak demands and 40 years of data relating to the independent variables used in Hydro's model. Since Newfoundland Power's residential energy sales and heat pump usage are not independent variables in Hydro's regression model, Hydro's peak demand forecast does not reflect changes in demand due to these factors. As a result, Hydro's forecast of peak demand has not declined in a manner similar to that of Newfoundland Power.

Hydro indicates that its peak demand forecast used in its near-term reliability assessment continues to be conservative, and aligned with the intent of the analysis.[14] Hydro has not adjusted its forecast methodology to account for a reduction in demand related to Newfoundland Power's declining energy sales or heat pump adoption.

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[9] The *Heat Pump Load Study – Winter 2020 Results Final Report*, July 16, 2020 is provided as Attachment A to response to Request for Information NLH-NP-062. See section 5.2, table 7, *Peak Demand Savings* for information related to peak demand savings during the 2020 winter season.

[10] So far, load research data has been compiled during the 2019-2020 and 2020-2021 winter seasons. Each of these winter seasons have been relatively mild and did not include extended periods of cold winter conditions that can often occur in Newfoundland. As a result, Newfoundland Power, in consultation with Hydro, is considering extending the load research study into future winter seasons to better understand heat pump load behaviour during extended cold periods.

[11] The relationship between the dependent variable and each independent variable is estimated by regression coefficients. For example, the regression coefficient associated with the number of customers would define the amount of peak demand attributable to each customer (i.e. kW per customer). Statistical tests are applied to the independent variables to determine whether they are statistically significant. Independent variables that are not statistically significant are typically excluded from the regression model.

[12] Independent variables used in Hydro's regression model include: (i) the number of electric heating customers; (ii) the number of non-electric heating customers; (iii) wind chill during annual peak periods; (iv) electricity price; (v) annual general service energy consumption; (vi) a technology variable; and (vii) a variable that considers if a peak occurred in the month of December.

[13] For example, to forecast peak demand in 2023 would require a forecast of the number of customers expected to be served in that year.

[14] See Hydro's presentation *Reliability and Resource Adequacy Study Review – Technical Conference #2*, November 30, 2020, page 30, filed in advance of Hydro's 2nd Technical Conference in relation to Hydro's *Reliability and Resource Adequacy Study Review.*

C. Continued Appropriateness of Load Factor Methodology

The primary difference between Newfoundland Power's load factor methodology and Hydro's statistical regression methodology for forecasting peak demand is related to Newfoundland Power's declining energy sales and the subsequent impact on peak demand. Newfoundland Power's peak demand forecast reflects a decline in demand corresponding to a decline in energy sales whereas Hydro's does not.

Newfoundland Power's load factor methodology is appropriate for forecasting the Company's peak demand. The methodology is consistent with sound public utility practice.[15] It has also been reasonably accurate in the past. Furthermore, it appropriately reflects a reduction in peak demand that is likely to occur in a year due to the increased adoption of heat pumps by residential customers. This is consistent with the analysis completed in the *Conservation Potential Study* as well as initial results provided in the Company's ongoing heat pump load research study.

Adopting Hydro's statistical regression methodology to forecast peak demand would not be appropriate at this time. Hydro's statistical regression methodology does not account for changes in demand that are resulting from Newfoundland Power's declining energy sales, including a reduction in load due to the increased adoption of heat pumps by residential customers. Adoption of Hydro's methodology would result in a peak demand forecast that is too high, particularly for the purposes of estimating purchased power costs and determining appropriate billing determinants to be used in the Utility rate.

In 2020 and 2021, Newfoundland Power's purchased demand was below Hydro's Minimum Billing Demand.[16] Newfoundland Power is forecasting that the Company's peak demand will continue to be below Hydro's Minimum Billing Demand until a lower Minimum Billing Demand is established.[17] Use of Hydro's current peak demand forecast would result in a *higher* Minimum Billing Demand for Newfoundland Power at a time when the Company's peak demand is decreasing.[18] This provides greater likelihood that demand charges included in Hydro's Utility rate will be limited to Hydro's Minimum

[15] See *2022/2023 General Rate Application, Volume 2, Supporting Materials, Tab 3, Customer, Energy and Demand Forecast*, page 3, footnote 8.

[16] Hydro's Utility rate includes a Minimum Billing Demand for Newfoundland Power. The intent of the Minimum Billing Demand is to limit Hydro's risk to 99% of Newfoundland Power's test year Native Load less the Generation Credit. Newfoundland Power's current minimum billing demand was established following Hydro's *2017 General Rate Application* which was approved by the Board in Order No. P.U. 30 (2019). See *2022/2023 2023 General Rate Application, Volume 1, Application, Company Evidence and Exhibits, Section 4.2.2: Forecast*, page 5-6 for a derivation of Hydro's current Minimum Billing Demand as well as Newfoundland Power's demand forecast.

[17] See the *2022/2023 General Rate Application, Volume 1, Application, Company Evidence and Exhibits, Section 5.2.2: Forecast*, page 5-6, table 5-4.

[18] Hydro's current Minimum Billing Demand is based on a Newfoundland Power peak demand forecast of 1,392.7 MW. Hydro's current forecast of Newfoundland Power's peak demand for the 2021-2022 winter season is estimated to be 1,405.8 MW, 55 MW higher than Newfoundland Power's forecast of 1,350.8 MW. This compares to Newfoundland Power's peak demand in the 2019-2020 and 2020-2021 winter seasons of 1,367.3 MW and 1,299.8 MW, respectively.

Billing Demand and demonstrates why the Company's load factor methodology remains appropriate for the purposes of estimating purchased power costs and determining appropriate billing determinants to be used in the Utility rate.