Q. **Reference: 2018 Cost of Service Methodology Review Report dated November 15, 2018**

On page 12 (lines 10 to 12) it is stated *"Hydro recommends that the cost of wind purchases be classified as 22% demand and 78% energy reflecting the "Effective Load Carrying Capability Study" conducted by Hydro's resource planning group regarding wind availability during peak periods"*. Please file a copy of this report for the record.

A. Please see CA-NLH-011, Attachment 1 for a copy of the "Effective Load Carrying Capability Study Newfoundland and Labrador Hydro Wind Turbines", filed on November 16, 2018, with the Board of Commissioners of Public Utilities as Volume 1, Attachment 6 of the "Reliability and Resource Adequacy Study".

Effective Load Carrying Capability Study

Newfoundland and Labrador Hydro Wind Turbines

November 2018

A Report to the Board of Commissioners of Public Utilities

newfoundland labrador hydro
a nalcor energy company

Table of Contents

1 Summary

In 2007, Newfoundland and Labrador Hydro ("Hydro") secured two, 20-year Power Purchase Agreements for a total of 54 MW of wind generation on the island of Newfoundland; a 27 MW wind project located in St. Lawrence and a 27 MW project located in Fermeuse. The St. Lawrence Wind Farm is located approximately 5 km outside of the community of St. Lawrence on the Burin Peninsula. The farm is comprised of nine, 3.0 MW, Vesta V90 turbines, which have been in operation for nearly ten years. The project is owned and operated by Enel GP Newfoundland and Labrador Inc. and began producing wind power to the electricity grid in October 2008. The Fermeuse Wind Farm is located on the Southern Shore of the Avalon Peninsula. Similarly, the project consists of nine, 3 MW, Vestas V90 turbines which also have been in operation for almost ten years. The farm is owned by SkyPower and operated by EDF Énergies Nouvelles and began supplying wind energy in April 2009.

Wind generation is an intermittent, non-dispatchable resource, meaning its output cannot be controlled like a conventional resource as the output is dependent on the available wind speed. Production can also be challenging in times of very low or very high wind speeds. Low wind speeds may not reach the minimum wind speed required for the turbines to produce energy. Conversely, if wind speeds are too high, turbines may reach cut out speed, at which the turbines will shut down to prevent damage. Previously, under the Isolated Island System, Hydro has not relied upon wind farms as a reliable contribution to the islands firm capacity, meaning that wind generation was considered as purely energy on a planning basis.

Given the interconnection to the North American grid, as part of its Reliability Model, Hydro re-evaluated the contribution of wind generation to system capacity. Utilities across North America use a variety of methods to determine the capacity contribution of intermittent sources. A common approach is to use the concept of effective load carrying capability ("ELCC"). The ELCC of a unit is a measure of the additional load that the system can supply with the particular generator of interest, with no net change in reliability.

In order to determine the ELCC of the existing wind generation an ELCC study was performed. The ELCC study looked at the two existing wind farms on the island. It is assumed that new wind generation would have a similar generation profile to the existing wind farms. Therefore the ELCC determined in the study can be assumed to be applicable to all existing and new wind farms.

The ELCC study was completed using the PLEXOS model. The historical hourly wind generation data from January 2010 to June 2018 for both the Fermeuse and St. Lawrence wind farms was analyzed, resulting in a probability distribution for the wind generation in percentage by MW. The distribution was separated into winter (December to March) and non-winter (April to November) to more accurately determine the effect of the wind generation in the winter months where loss of load is more likely to occur. The distribution was then input into the PLEXOS model as a probability distribution representing each respective wind farm during the summer and winter periods. See Figure 1 to Figure 4 for the winter and non-winter generation profiles of each wind farm.

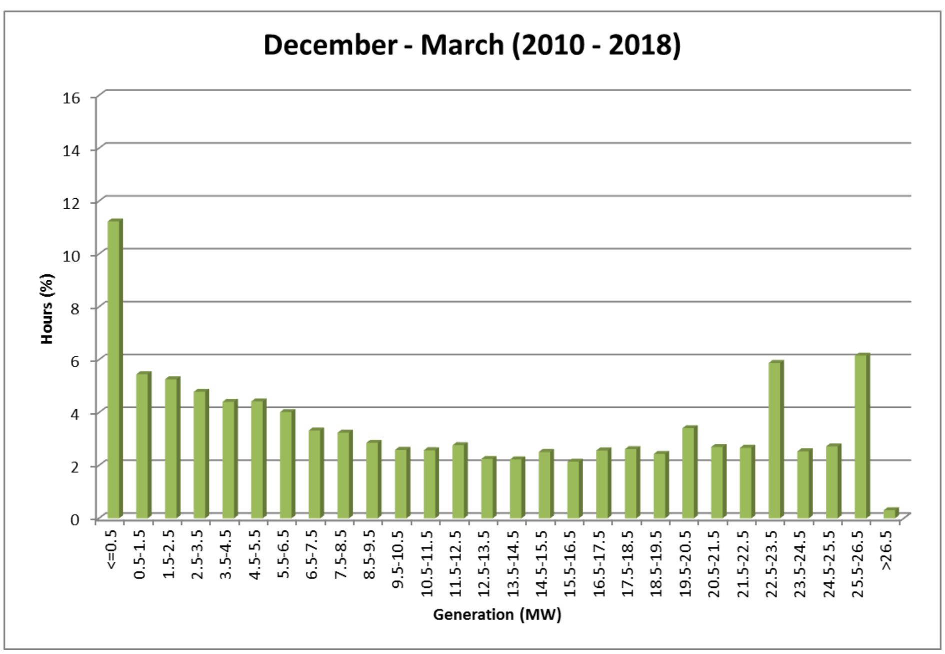

Figure 1: Fermuse Wind Farm Winter Generation Profile

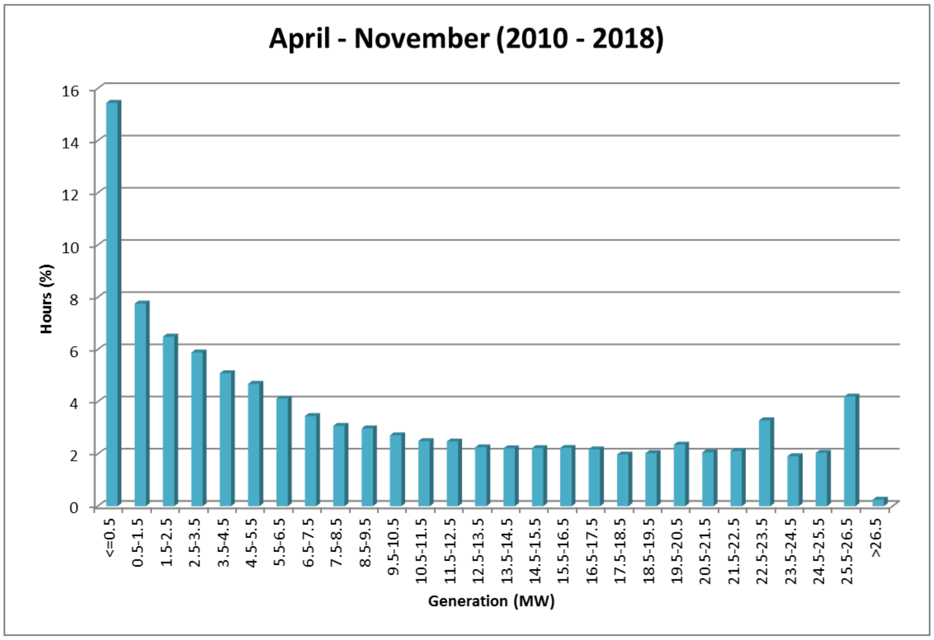

Figure 2: Fermuse Wind Farm Non-Winter Generation Profile

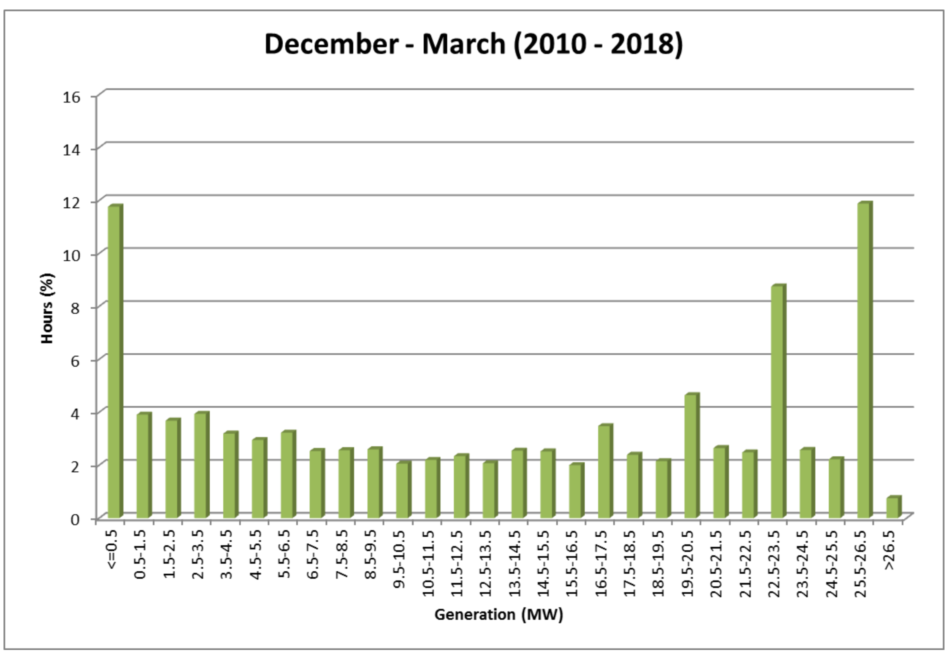

Figure 3: St. Lawrence Wind Farm Winter Generation Profile

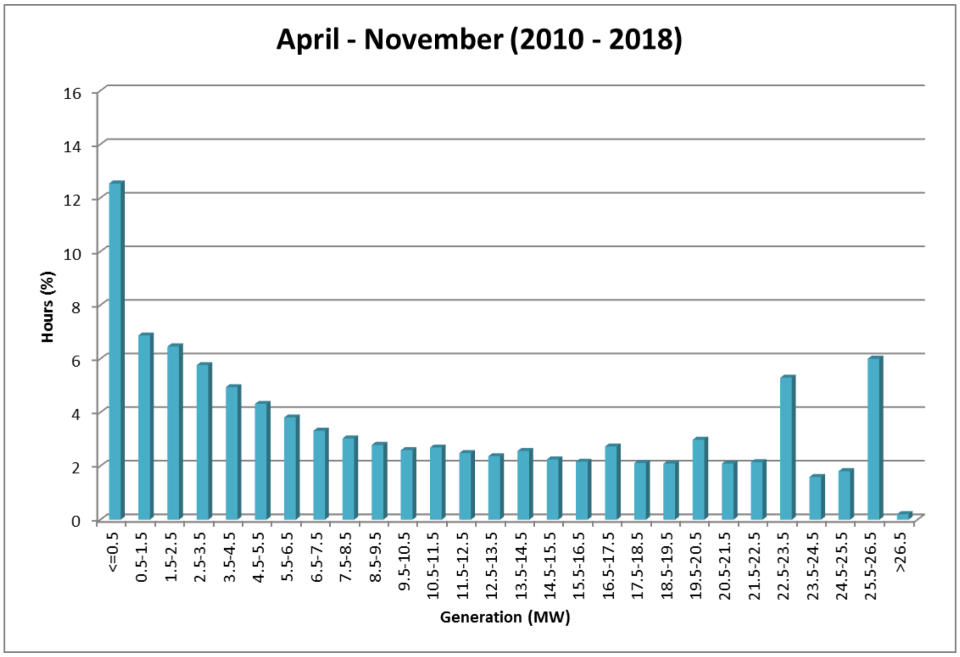

Figure 4: St. Lawrence Wind Farm Non-Winter Generation Profile

The steps taken to complete the ELCC study in PLEXOS® are as follows:

1) Run the model with both wind farms included in the system model. For this model, the wind farms were modeled using the probability curves described above.
2) Adjust loads using an escalator value in PLEXOS®, which linearly scales the system load, until the system loss of load hours ("LOLH") reaches 2.8 hours per year. Starting with a baseline LOLH of 2.8 allows the effect of changing generation resources to be clearly seen.
3) Remove both wind farms from the system and run the model again to determine the effect on system LOLH.
4) Add an "ideal" generator to the system with a capacity close to the expected ELCC value and rerun the model
5) Adjust the capacity of the ideal unit up or down and rerun the model until the system LOLH returns to 2.8.
6) The capacity of the ideal generator which produces a system LOLH of 2.8 determines the ELCC of the wind units.

The study found that the ELCC of the existing wind generators was approximately 12 MW, or 22%, based on an installed capacity of 54 MW.