Q. **Reference: Marginal Cost Study Update – 2018 – Summary Report, Nov. 15, 2018, Appendix A (Christensen Associates Energy Consulting, Cost Estimates and Methodology for Generation and Transmission Services, 2021-2029, page 22 (44 pdf)**

Preamble:

Figure 8 shows the monthly peak, off-peak and all-hours marginal transmission losses for the IIS for 2021. Values range from 8% to over 11%.

a) Are the marginal transmission losses shown in Figure 8 particularly high, compared to other systems of similar size with which CAES is familiar?

b) Is CAES familiar with the equivalent figures for the transmission systems through which Hydro's power would have to travel to reach the NEISO market? To the extent possible, please estimate marginal peak and off-peak transmission losses for January and for July, for :

   a. The Labrador and Hydro-Quebec transmission systems, and
   b. The Nova Scotia and New Brunswick transmission systems.

c) Please provide CAES' best estimate of the combined marginal transmission losses to reach the NEISO market for each of the two routes mentioned in the previous question.

A. This response has been provided by Christensen Associates Energy Consulting.

a) If size is measured by peak loads, marginal line losses for power systems of comparable size would most likely be somewhat less than marginal losses for Hydro's IIS (Note that the line loss table within the marginal cost report – 2018 Marginal Cost Update – was corrected). Line loss differences among power systems, both average and on the margin reflect three factors: differences in transmission voltages; differences in the size and characteristics of transmission line conductors; and differences in the average transport distances between power injections and power withdrawals. Hydro's IIS has

somewhat lower voltages, has comparatively smaller conductors, and has comparatively longer transport distances vis-à-vis power systems of equivalent size, by measure of peak loads. Accordingly, Hydro's IIS has comparatively high marginal (and average) line losses, particularly during high load hours. On the other hand, peak loads of Hydro's IIS are concentrated during the winter season, whereas most other comparably-sized power systems across North America experience summer season peak loads which are approximately equivalent to or above that of winter peak loads. Because losses rise with ambient temperature and temperatures are often higher elsewhere, Hydro's IIS may have modest advantage, other factors held constant. Note that, for line losses, any advantage resulting from differences in the seasonal pattern of peak loads, compared to other systems, is partially negated by sizable wholesale power sales to external markets during Hydro's off-peak seasons.

b) We are familiar with the OATT stated losses for the power system paths identified in the question and anticipate that such losses reflect average losses for months, seasons, or for an annual timeframe. Load flow analyses are not readily available for the identified power systems, in order to gauge marginal line losses with sufficient accuracy, or alternatively, to affirm nonload flow-based estimates of marginal losses. Thus, we are not able to undertake the requested estimates.

Generally speaking, transmission line losses rise with loads at approximately twice the rate of change as average losses, not accounting for transformer losses and holding voltage more-or-less constant.

c) Marginal losses over the two identified paths to organized U.S. markets—noting that Hydro's path through HQ interconnects with NYISO, not NEISO—are not known absent estimates of marginal costs of Hydro's neighboring power systems.