Q. Reference PUB-NLH-265: Has Hydro made any progress towards determining an appropriate protection scheme for post LIL? If so, please explain the general principles of the proposed new scheme. If not, when will it be completed?

A. The study outlining the Under Frequency Load Shedding (UFLS) scheme for post Labrador – island HVdc Link (LIL) implementation has not been completed. The analysis is expected to be complete at the end of 2016. The high level guiding principles for the study are summarized as follows:

- The existing UFLS for the isolated Island Interconnected System permits ULFS operation for a single contingency loss of on Island generation;
- The post LIL UFLS will prevent load loss (i.e. no operation of UFLS) for the following single contingency events:
    - Temporary loss of one pole of the LIL bipole (temporary block and restart of a pole);
    - Permanent loss of one pole of the LIL bipole (2 p.u. current operation on healthy pole for ten minutes with continuous operation of the monopole at 1.5 p.u. current);
    - Temporary loss of the LIL bipole (temporary bipole block and restart);
    - Curtailment of Maritime Link exports is acceptable for LIL pole and bipole contingencies;
    - Single generation contingencies on the Island Interconnected System including:
        - Bay d'Espoir Unit 7 - 154 MW (Largest single generator)

- Bay d'Espoir Units 1 & 2, 3 & 4 or 5 & 6 – 150 MW max (units are connected in groups of two on a common 230 kV bus – 230 kV bus fault results in loss of two units)
- Cat Arm Plant 127 – 136 MW max (fault on TL247/248 radially connected plant)
- Holyrood Combustion Turbine – 124.5 MW
- Upper Salmon – 84 MW
- Hinds Lake – 75 MW
- Hardwoods/Stephenville Combustion Turbine – 50 MW
- Granite Canal – 40 MW

- The post LIL UFLS must prevent collapse of the Island Interconnected System when LIL is out for maintenance;
  - The Island Interconnected System is operating in an isolated mode during LIL bipole maintenance, UFLS operation is acceptable but load shed is minimized
- The study will consider the appropriate NERC standards and NPCC directories with respect to ULFS for guidance;
- The existing isolated Island Interconnected System operates with up to 240 MW of spinning reserve (i.e. 170 MW for largest Holyrood unit plus 70 MW) to assist in speedy system restoration;
- To ensure no UFLS operation for a single contingency loss in the post LIL implementation, the Island Interconnected System must have a minimum of the largest generation contingency as spinning reserve. Therefore a minimum of 154 MW of spinning reserve is required depending upon generation dispatch. Preliminary analysis has determined that approximately 120 MW of the required spinning reserve must be carried on

the LIL to ensure that the Island Interconnected System frequency does not fall below 59 Hz for loss of the 154 MW;

- The study will consider the appropriate NERC standards and NPCC directories with respect to an appropriate level of spinning reserve for on island generator contingencies;
    - Notionally the concept of spinning and non-spinning reserves (synchronized or non-synchronized) and ten minute and 30 minute reserves will be considered given the HVdc links to the North American grid
    - The applicability of having spinning reserve for the first generation loss and one half the capacity for the second contingency loss will be explored (i.e. 154 MW plus 75 MW or 229 MW).