Q. At page ix of Hydro's report "Upgrade Transmission Line Corridor" dated April 28, 2014, Hydro states that assumptions regarding the electrical characteristics of the proposed combustion turbine for Holyrood were made in its analysis of the transmission line project. Please describe in detail those assumptions and compare those assumptions to the electrical characteristics of the combustion turbine in respect of which Hydro has made Application to the Board.

A. For the purposes of the analysis, it was assumed that a nominal 60 MW aero-derivative combustion turbine (CT) complete with clutching mechanism for synchronous condenser operation would be installed at the Holyrood Thermal Generating Station (HTGS). Hydro typically considers aero-derivative 50 MW double ended (2 x 25 MW) combustion turbines when capacity is required due to the Loss of Load Hours (LOLH) criteria, which have the capability to generate at full capacity in the 10 minute time frame. The 60 MW nominal rating for the unit was selected as it also included replacement capacity for the existing 10 MW blackstart combustion turbine at Holyrood. The generator was sized much larger than the turbine, at 166 MVA, to provide additional reactive power to the system in synchronous condenser mode for operation with the Labrador – Island HVdc Link.

Hydro has since applied to the Board for the installation of a 158 MVA industrial frame CT capable of generating 120 MW. The unit currently does not have a clutching mechanism and therefore cannot be operated as a synchronous condenser. The unit will provide the pre-warming capability and ability to blackstart the HTGS in the rare event of an extended transmission supply interruption to the broader Avalon Peninsula.

Table 1 outlines the electrical characteristics of the Soldiers Pond 175 MVAR high inertia synchronous condensers, Holyrood unit 3 as a synchronous condenser, of the 60 MW aero-derivative CT and the 158 MVA industrial CT, which is the subject of a current application to the Board.

Table 1: Hydro Machine Electrical Data

	Soldiers Pond 175 MVAR HISC	Holyrood Unit 3	Proposed Holyrood CT 60 MW Aero-Derivative	Proposed Black Start - Emergency Holyrood Industrial CT
Machine Base, MVA	175.000	177.235	165.948	158.000
Machine Terminal Voltage, kV	15.0	16.0	13.8	13.8
Synchronous Condenser Capability	YES	YES	YES	NO
SC MVAR Rating	+175/-95	+150/-69	+127/-44	N/A
Generation Mode (MW)	N/A	N/A	60	123.5
Generator Power Factor	0.00	0.85	0.85	0.90
H (kW.sec/kVA	7.84*	1.29*	1.01*	1.55
X_d (pu)	1.24	2.15	2.58	1.41
X_q (pu)	0.85	1.94	2.36	1.34
X'_d (pu)	0.27	0.26	0.20	0.17
X''_d (pu)	0.165	0.220	0.143	0.113
X''_q (pu)	0.177		0.170	0.125
X_l (pu)	0.0900	0.1152		0.0880
T'_{d0} (sec)	11.0	6.8	13.0	8.1
T''_{d0} (sec)	0.08	0.06	0.05	0.04
T''_{q0} (sec)	0.29	0.06	0.05	0.04

* Calculated with machine in SC mode

Please refer to Hydro's response to CA-NLH-003 for a discussion of alternatives regarding synchronous condenser capability.