Q. The response to GT-NP-NLH-007 states the start up time for the proposed 100 MW (nominal) CT is 40 minutes. The response to GT-CA-NLH-005, Attachment, page 1 of 2, states the start up time is 21 minutes. The response to GT-PUB-NLH-006, page 9, states that a total of 276.2 MW of standby generation, including the new CT, would be available in 10 to 20 minutes, if not already online. Confirm the start time for the proposed new Holyrood CT and explain how its full capability could be available in 10- 20 minutes as stated in GT-PUB-NLH-006.

A. The 21-minute start up time referenced in Hydro's response to GT-CA-NLH-005 and the 10 to 20 minutes referenced in response to GT-PUB-NLH-006 were based upon the start time provided by the vendor at the bid submission stage.

The vendor has provided additional information from the equipment manufacturer. In starting the Holyrood CT, the units must first be in a ready to start condition. That is, the unit must not be undergoing maintenance and the auxiliaries are available for example. To start the unit, it must be accelerated from standstill to 3600 rpm (i.e., rated speed). The manufacturer requires that the acceleration time to 3600 rpm be no faster than 20.0 minutes. Acceleration rates faster than 20 minutes may result in compressor disc migration resulting in subsequent issues with the machine (i.e., damage). Once the unit is rotating at rated speed the machine is ready to be synchronized to the Island Interconnected System. The time to synchronize the unit and pick up minimum load is estimated at 0.5 minutes. This brings the fastest total time to connect the Holyrood CT to the Island Interconnected System equal to 20.5 minutes. From this point in time the unit loading is increased. The manufacturer indicates a minimum total time of 7.5 minutes to load from minimum load to the unit’s ISO rating. Assuming a minimum

load of 5 MW, the manufacturer has set the maximum load rate (ramp rate) from minimum load to ISO base load (i.e., 123 MW) at approximately 15.7 MW per minute. Therefore the total time to start and fully load the Holyrood CT is 28 minutes (i.e., 20 min acceleration + 0.5 min synchronize + 7.5 min to full load). The 28 minute start time is the fastest start time for the Holyrood CT.

Based upon Hydro's operating experience with its combustion turbines, a more practical ramp rate would be between 5 and 7 MW per minute to ensure continued operability of the unit long term. For the Hardwoods and Stephenville CTs this results in a 0 to 50 MW loading in seven to ten minutes. For the Holyrood CT if one assumes a ramp rate of 6 MW/min, it would take approximately 19.5 minutes to fully load the machine. The total time to start and load the Holyrood CT under normal circumstances equals 40 minutes (i.e., 20 min acceleration + 0.5 min synchronize + 19.5 min to full load). The 40 minute practical start time is consistent with the response to GT-NP-NLH-007.

Given a time from standstill to full load of approximately 40 minutes for the Holyrood CT, a total of 156.2 MW of stand by generation could be brought on line and fully loaded in the 10 to 20 minute time frame. At the 20 minute mark, the Holyrood CT would be ready to synchronize to the system and the additional 120 MW of standby generation would be fully in service within the subsequent 20 minutes. That is, 156.2 MW available in 10 to 20 minutes with an additional 120 MW available in 40 minutes from the start of the event.