Q. **Re Upgrade Gas Turbine Plant Life Extension - Hardwoods, page B-2**
How does the increased availability of Holyrood units for use as synchronous condensers affect the demand for use of the Hardwoods gas turbine as a synchronous condenser?

A. In the context of the existing 230 kV transmission system east of Bay d'Espoir Generating Station, operation of the Hardwoods gas turbine in synchronous condenser mode along with Holyrood Unit 3 as a synchronous condenser and the shunt capacitor banks at Hardwoods, Oxen Pond and Long Harbour Terminal Stations, enables Hydro to maximize power deliveries to the Avalon Peninsula from non thermal sources between mid spring and early fall without consuming fuel at Holyrood. The system is configured such that power deliveries can be achieved during loss of any one of the voltage support devices (i.e. synchronous condenser or capacitor bank). In this context, as load on the eastern portion of the system increases, one can expect the demand for all voltage support devices east of Bay d'Espoir to increase.

In the context of an HVdc connection to the Island Interconnected System, there will be an increased requirement for synchronous condensers on the Avalon Peninsula. There are several reasons for this increased synchronous condenser requirement. First, the line commutated converter technology used for HVdc systems consumes reactive power (MVAR) at a level equal to approximately one half of its power rating (MW). Therefore an 800 MW converter will consume approximately 400 MVAR. While approximately one half of the MVAR requirement is supplied by capacitor banks at the converter, the remainder must come from the connected ac transmission system to ensure acceptable voltage response and control. Given that the eastern portion of the system is heavily loaded, there is no "spare" reactive power capacity to supply the HVdc converter station. As a result additional synchronous condenser capacity will be required. Second, proper operation of the HVdc converter station requires a minimum three phase short circuit level. The existing three phase short circuit level must be increased to provide the minimum acceptable level and the method of achieving the desired increase is through the addition of synchronous machines (i.e. synchronous condensers in this case). Finally, the increased synchronous condenser requirement provides additional system inertia and voltage control through excitation system action to provide acceptable system response during system disturbances.

The Hardwoods gas turbine in synchronous condenser mode, along with conversion of all three units at Holyrood to synchronous condenser operation and installation of three new synchronous condensers at the HVdc converter station will provide the necessary support for successful integration of the HVdc converter station on the Island Interconnected System. The synchronous condenser plan for the HVdc has been envisioned to ensure continued operation for unplanned loss of any one condenser. In this context, it is expected that all synchronous condensers will be operated year round with individual units shut down only for scheduled maintenance.

Beyond the synchronous condenser requirement of the Hardwoods gas turbine, gas turbine capacity will continue to be required on the Island Interconnected System to assist in meeting the Loss of Load Hours expectation criteria and to provide back up generating capacity during outages to HVdc equipment.