Q. **Re: AMEC Report**

Set out Hydro's plans in relation to each recommendation in Section 15 of the AMEC report.

A. Many recommendations in Section 15 of the report were made primarily on safety and reliability issues. The urgency of the recommendations was considered in preparing the report and in stating suggested timelines for implementation. The Level 1 Condition Assessment and Life Extension Study was performed based on the projected scheduled modes of operation that were expected in late 2009.

Presently, it is expected that Holyrood will continue as a generating station to the end of 2016 and standby from 2017 through 2021. With the variability of inflows and hydraulic production, Holyrood must be capable of generating at full production levels through to its final year of generation. In a critical dry hydrology sequence, the production level could reach 3 TWh annually.

The AMEC recommendations can be categorized in three groups:

1. Level 2 Condition Assessment:
    - Focus primarily on high pressure /temperature components justified by safety and reliability.
2. Capital Construction Projects:
    - Some items recommended in the AMEC report were submitted to the Board in Hydro's 2011 Capital Budget Application (CBA) and subsequently approved.
    - Select items recommended in the AMEC report are submitted to the Board for approval in the 2012 CBA.

- Others will be submitted as capital projects for approval post 2012.

3. Facility management :
   - AMEC recommendations will be applied where necessary.

Hydro is taking a measured approach, and focusing on select priority items over the next three years. It is anticipated that new initiatives will be necessary in the coming years, over and above the current five-year plan, as more in-depth EPRI style assessment takes place with consideration to changes that may arise related to the projected generation schedule and further condition assessment work. Hydro's plan with respect to each of the recommendations is as follows given in bold after each item:

Overall and Station Wide

1. Implement the recommended Level 1 and 2 condition assessment tasks identified in Chapters 8 to 11 and summarized in Chapter 12, including augmented steam turbine and generator overhauls at their next normal overhaul date to the extent economically practical.
   Hydro accepts the recommendation to the extent they meet least cost tests. The focus will be on those items required to safely and reliably operate the facility. Phase 2 Condition Assessment and Life Extension proposal on page B-68 of the 2012 CBA includes further condition assessment.

2. Retain the 9 year major inspection/overhaul interval and minor 3 year valve outage timing for the steam turbines, subject to any unexpected changes in conditions found at their inspection/overhauls and, in particular, at their next inspection/overhaul. Undertake the steam turbine pre-outage actions identified in Chapters 8 to 10.

Hydro accepts the recommendation to retain the nine year major inspection/overhaul interval and minor three year valve outage timing for the steam turbines. The steam turbine pre-outage actions identified in Chapters 8 to 10 will be discussed with the OEM and steam turbine service provider.

3. Modify the generator inspection and overhaul interval back to every six years. Address the specific actions identified in Chapters 8 to 10, in particular those permitting better performance baselining in the balance of 2010 and 2011.
   The recommendation to modify the generator inspection and overhaul interval back to every six years is currently under review. The specific actions identified in Chapters 8 to 10 will be discussed with the OEM and steam turbine service provider.

4. Perform in 2011 limited generator testing, with rotor in and on all units but particularly on Unit 1, to the extent safe and economically practical to obtain baseline data. Undertake work needed to scope out the details of the inspection/testing and stator rewind during the 2012 Unit 1 outage.
   Hydro accepts the recommendation.

5. In 2011 and 2012, carry out a detailed condition assessment of high pressure and temperature feedwater and steam lines on all units as a very high priority safety and reliability due diligence task. Plan and implement an extensive high pressure and temperature pipe hanger inspection program as part of the plant's PM, safety, and reliability due diligence programs.
   Hydro accepts the recommendation and the scope of work is included in the Phase 2 Condition Assessment and Life Extension proposal on page B-68 of the 2012 CBA.

6. Carry out Level 2 inspections and testing in 2012, 2013, and 2014 for Units 1, 2, and 3 respectively on boiler components identified in Chapters 8 to 10.
   Hydro accepts the recommendation and the scope of work is included in the Phase 2 Condition Assessment and Life Extension proposal on page B-68 of the 2012 CBA.

7. Carry out Level 2 inspections and testing in 2012, 2013, and 2014 for Units 1, 2, and 3 respectively on high pressure heater components identified in Chapters 8 to 10.
   Hydro accepts the recommendation and the scope of work is included in the Phase 2 Condition Assessment and Life Extension proposal on page B-68 of the 2012 CBA.

8. Carry out Level 2 inspections and testing in 2012, 2013, and 2014 for Units 1, 2, and 3 respectively on deaerator components identified in Chapters 8 to 10.
   Hydro accepts the recommendation and the scope of work is included in the Phase 2 Condition Assessment and Life Extension proposal on page B-68 of the 2012 CBA.

9. Carry out Level 2 inspections and testing on low pressure heaters in 2011 for Units 1, 2, and 3.
   Hydro accepts the recommendation but was unable to execute the work in 2011 due to the lack of an approved capital proposal and risk to the production schedule. The scope of work is included in the Phase 2 Condition Assessment and Life Extension proposal on page B-68 of the 2012 CBA.

10. Maintain existing programs for major equipment, pumps, and motor inspection scheduling and overall PM process.
    Hydro accepts the recommendation.

11. Procure one spare 4 kV motor for each of the boiler feedwater pumps, the forced draft fans, condensate extraction pumps, and the cooling water pumps – primarily designed for Units 1 and 2, but with plans on how to use them with Unit 3 as necessary.

    Hydro accepts the recommendation for Units 1 and 2, and is considering options for Unit 3.

12. Develop and implement an optimized plan for station switchgear (all units, common facilities), primarily breakers and motor control centres, addressing a combination of extensive replacement and sparing to maintain station reliability without interrupting normal unit operation.

    Hydro accepts the recommendation. It is planned as a 2012 initiative.

13. Inspect all condensate polishers in 2011. Replace Units 1 and 2 remaining annunciator panels (Unit 3 annunciator panel was replaced in 2007). Assess the cost-benefit of replacing polisher control panels on all units considered obsolete in light of generation end of service timeline.

    Hydro accepts the recommendation. The preventative maintenance checks have been completed on the polishers and the replacement of the annunciator panels is planned for a future capital project currently scheduled for 2013.

Site Conditions

1. Negotiate to have the plant access road repaired to reduce probability of future accident.

   Hydro accepts the recommendation. Negotiations with the Provincial Department of Works, Services and Transportation are ongoing.

2. Develop an onsite road replacement/refurbishment plan in 2011 addressing issues over next five years.
   Hydro accepts the recommendation. An onsite road replacement/refurbishment plan has been initiated and will form the basis for future capital projects.

3. Close and manage existing on-site landfill in parallel with opening of a new on-site facility or expansion of the current one.
   This recommendation is under review and discussions are ongoing with the Provincial Department of Environment.

Common Facilities

1. Replace the electric heat tracing for the heavy fuel oil transfer pipe line from the off loading dock to the main storage tanks in 2010 or early 2011.
   Hydro accepts the recommendation but was unable to execute the work in 2010/2011 as there was no approved capital project. The scope of work is included in the Upgrade Marine Terminal capital project shown on Page B-7 of the 2012 CBA.

2. Internally inspect the heavy oil day tank in 2011 for regulatory purposes.
   Hydro accepts the recommendation but was unable to execute the work in 2011 as there was no approved capital project. . The internal inspection is planned for a future capital project currently scheduled for 2013.

3. Perform transformer oil gas analyses in 2010 and 2011 and complete the Hydro transformer electrical testing as per the schedule in Chapter 11.
   Oil testing for power transformers, including gas and oil testing, has been ongoing for many years within Hydro, and has continued in 2010 and 2011 at all stations, including Holyrood Terminal Station. After all testing is completed in 2011; a new

ranking will be prepared to rank transformers by their condition to identify priorities for future upgrading work.

With respect to electrical testing, efforts have been made in 2010 and 2011 to complete the generator step up (GSU) transformers T1, T2 and T3 at Holyrood Terminal Station. The original plan outlined by AMEC identified transformer UST1 to be completed in 2010 and the spare transformer to be completed in 2011, but further review by the Long-Term Asset Planning Group responsible for Hydro's power transformers, adjusted the priorities to ensure the main GSU's were tested first. UST1 will now be completed in 2012 and Transformer T4 is targeted to be completed as per schedule, later in 2011.

4. Perform underwater inspections on circulating water intake and discharge structures and piping in 2011. Perform walk down or remote integrity inspections of the large concrete pipes from the pump houses to the condensers and to the discharge siphon pits and inspect the stop log structure in 2011.

Hydro accepts the recommendation. After the Asset Maintenance Review for Holyrood conducted in 2010/2011, this work is part of the station's annual preventative maintenance work plan.

5. Develop a program to assess the condition of underground services (raw water, fire water, grounding, waste water piping, and lighting) as the current condition is not clear.

Hydro accepts the recommendation and program development will be an initiative for 2012.

6. Undertake Level 2 integrity inspections of single contingency failure candidates including the dam at Quarry Brook, the raw water supply line from the dam site to

the Stage 1 pumphouse, and the original water treatment plant clarifier, sand filters, and clearwell.

Hydro accepts the recommendation. The scope of work is included in the Phase 2 Condition Assessment and Life Extension proposal on page B-68 of the 2012 CBA.

7. Develop a powerhouse and pumphouse roof replacement plan.

   Hydro accepts the recommendation and program development will be an initiative for 2012.

8. Improve, refurbish or replace CEM systems, waste water basin discharge treatment systems, oil filled exciter transformers (if and when new PCB regulations are implemented), and the oily water separator and pipes.

   Hydro accepts the recommendation for future capital projects.

9. Develop a plan for a new building heating system (auxiliary boiler/steam or electric) needed after 2015. Assess and replace existing steam fed unit heaters and piping systems that are in poor condition.

   Hydro accepts the recommendation for future capital projects.

10. Refurbish or replace the existing powerhouse elevator in the 2012 to 2015 period, and assess the timing requirements for a new administration building elevator.

    Hydro accepts the recommendation for a future capital project currently scheduled for 2014.

11. Repair the waste water basin building to address current corrosion, safe egress, and ventilation needs in 2012.

    Hydro accepts the recommendation for a future capital project currently scheduled for 2013.

12. Replace in 2011 the diesel fire pump, which is at end of life, in order to match the capacity requirements of the new fire protection system. Replace the electric firewater pump if capacity is less than the new requirement.
Hydro accepts the recommendation.

13. Replace the Stage 2 diesel generator in or about 2014.
Hydro accepts the recommendation for a future capital project currently scheduled for 2014.

14. Replace the Stage 1 air compressors that are near their end of life in 2014 and 2015.
Hydro accepts the recommendation for 2014 and 2015.

Unit 1

1. Undertake a generator stator rewind as part of the 2012 generator overhaul. Initiate planning early in 2011. Undertake the generator actions list in 2010 and 2011.
The delivery time for a new stator winding is in the order of 18 months from time of placing an order. To that end Hydro has submitted, as part of its 2012 Capital submission, a proposal to replace the stator windings in both units 1 and 2 in 2015 and 2014, respectively. Discussions and planning are ongoing with the OEM and generator service provider with respect to the generator action items.

2. Address issues and action with steam turbine, including work on main and intercept valve issues, stud bolt issues, and turning gear issues as per sections 8, 9, and 10 of this report.
Discussions and planning are ongoing with the OEM and generator service provider with respect to these items.

3. Refurbish stack breeching per current plans.
   Hydro accepts the recommendation.

4. Where economically feasible, assess and implement those efficiency improvement options for the facility which have short term economic benefits, e.g.:
   a) Addition of reheat boiler tubes to improve reheat steam conditions and cycle efficiency.
   b) Repair of previously damaged (but not fully repaired) steam turbine elements or upgrading existing elements with more efficient designs.

   Hydro accepts the recommendation.

Unit 2

1. Undertake a generator stator rewind as part of 2014 generator overhaul. Initiate pre-work early in 2013. Undertake early generator actions list in 2011.
   The delivery time for a new stator winding is in the order of 18 months from time of placing an order. To that end Hydro has submitted, as part of its 2012 Capital submission, a proposal to replace the stator windings in both units 1 and 2 in 2015 and 2014, respectively. Discussions and planning are ongoing with the OEM and generator service provider with respect to the generator action items.

2. Address issues and actions with steam turbine, including work on main and intercept valve issues, stud bolt issues, and turning gear issues.
   Discussions and planning are ongoing with the OEM and generator service provider with respect to these items.

3. Refurbish stack breeching per current plans.
   Hydro accepts the recommendation.

4. Where economically feasible, assess and implement those efficiency improvement options for the facility which have short term economic benefits, e.g.:
   a) Addition of reheat boiler tubes to improve reheat steam conditions and cycle efficiency.
   b) Repair of previously damaged (but not fully repaired) steam turbine elements or upgrading existing elements with more efficient designs.

   Hydro accepts the recommendation.

<u>Unit 3</u>

1. Undertake a generator rotor rewind at the next generator overhaul in 2016 or, with some additional reliability risk, between 2020 and 2022 subject to the findings of the 2016 inspection.

   Hydro accepts the recommendation.

2. Address issues and actions with the steam turbine, including work on main and intercept valve issues, and stud bolt issues.

   Discussions and planning are ongoing with the OEM and generator service provider with respect to these items.

3. Assess the cost-benefit of replacing the existing steam turbine mechanical governor system in 2011 for implementation during the 2013 minor valve outage.

   Discussions and planning are ongoing with the OEM and generator service provider with respect to these items.

4. Refurbish stack breeching per current plans.

   Hydro accepts the recommendation.

5. For safety reasons, replace the Unit 3 control room relay panels as soon as practical to accommodate the current and required wiring.

   Hydro accepts the recommendation – a 2011/2012 capital project is ongoing.

6. Implement Unit 3 generator thrust bearing retrofit to address lateral movement during synchronous generator operation to eliminate long term vibration and damage.

   Hydro accepts the recommendation – a 2011/2012 capital project is ongoing.

Black Start Gas Turbine

1. In 2010 inspect/assess the power turbine, gas turbine, gearbox, and generator without removing the unit to confirm major inspection/overhaul requirement.
2. Complete 2010 boroscope inspections on gas and power turbine, combustor, and gearbox.
3. Inspect and assess in 2010 the air intake and exhaust stack structure.
4. Undertake in 2010 off-site overhaul of power turbine and gas turbine, and on-site or off-site gear-box inspection and gearbox seal replacement.
5. Undertake in 2011 detailed inspection/testing of generator and electrical auxiliaries.
6. Develop a design and implement the replacement the fuel handling and lube oil coolers inside an enclosure.
7. Assess in 2010 the alternative of replacing the black start generator with a new or refurbished unit.

   For 2011 Hydro has undertaken a level 2 condition assessment and life extension study of the gas turbine. The study will provide recommendations and cost estimates to extend the life of the gas turbine plant as a highly reliable operation to the year 2020. A scope of work and cost estimate to replace the existing gas

turbine plant with a new mobile generating plant will be considered and compared to the cost of refurbishing the existing unit.

Switchyard

1. Implement identified Level 2 transformer gas in oil testing in 2010 and 2011. Catch up on backlogged electrical testing using full Hydro test protocol and report during these and future regularly scheduled electrical testing periods.

   Oil testing for power transformers, including gas and oil testing, has been ongoing for many years within Hydro, and has continued in 2010 and 2011 at all stations, including Holyrood Terminal Station. After all testing is completed in 2011, a new ranking will be prepared to rank transformers by their condition to identify priorities for future upgrading work.

   With respect to backlogged electrical testing, efforts have been made in 2010 and 2011 to complete the generator step up (GSU) transformers T1, T2 and T3 at Holyrood Terminal Station. The original plan outlined by AMEC identified transformer UST1 to be completed in 2010 and the spare transformer to be completed in 2011, but further review by the Long Term Asset Planning Group responsible for Hydro's power transformers, adjusted the priorities to ensure the main GSU's were tested first. UST1 will now be completed in 2012 and Transformer T4 is targeted to be completed as per schedule, later in 2011.

2. Considering the requirements going forward, assess the cost-benefit of additional transformer equipment sparing and configurational sparing possibilities. Undertake more frequent and complete Hydro condition monitoring.

   As a part of Hydro's Asset Management objectives, there is plan to complete a review for critical spares in 2012. This will be covered during this initiative. With respect to condition monitoring, Hydro uses condition monitoring to help rank power transformers within Hydro for upgrading. For example oil condition

monitoring ranked Transformers T1 and T2 to have their oil reclaimed in 2008. Transformer T8 radiators will be changed later in 2011 due to a ranking of radiator condition of transformers across Hydro's system, including the transformers at Holyrood.

3. Maintaining station reliability without interrupting normal unit operation, develop and implement an optimized plan for switchyard equipment such as switchgear (primarily older breakers) as well as other components such as potential transformers (PT's) and current transformers (CT's), addressing a combination of extensive refurbishment and/or replacement and sparing.

   Hydro has developed plans for switchyard equipment replacement and/or refurbishment for its equipment across the system, including Holyrood Terminal Station. Consideration is given to age, condition and legislative requirements such as PCB reduction. Separate 2012 capital budget proposals have been developed for Circuit Breaker Upgrading (replacement and refurbishment), Disconnect Replacements, and Instrument Transformer (PT's and CT's) Replacements to aid in the implementation of the plans.

Management

1. Upgrade the existing document management procedures, systems, and resources at the plant.

   Hydro accepts the recommendation – this will be initiated in 2012.

2. Implement current station staffing plan, including some moderate additions in operational, on-site engineering support. Develop and implement a succession planning process.

   Hydro accepts the recommendation – plan is being developed.