

1 Q. Please provide Asset Management Metrics for the period 2008-2013 as the data is
2 available including:

- 3 a) % weekly schedule compliance
- 4 b) % emergency work;
- 5 c) preventative maintenance program compliance;
- 6 d) monthly review of annual work plan progress;
- 7 e) controllable operating and maintenance costs, budget to
8 actual variance; and
- 9 f) change in 5 year capital plans, scope and cost.

10 Please show the results separately for Holyrood (total plant) and the CTs.
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12 A. Hydro has always used metrics to manage and improve its business. Plans are
13 made and executed, progress and outcomes are measured using these metrics, and
14 action is taken to continually drive success. Hydro's asset management strategy
15 recognizes the importance of metrics in the plan/do/check/act cycle and uses them
16 to focus team energy on sustainable steps for continuous improvement. Hydro
17 continually evaluates its asset management maturity and uses metrics to drive
18 progress in strategic focus areas. These metrics measure essential elements of a
19 robust asset management system. The calculation of these metrics was reviewed
20 for consistency, with baseline data refreshed in 2013. Asset management metrics
21 and targets are reviewed annually for alignment with strategic priorities.
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23 Historically, some of the data has not been collected at an asset level but by
24 organizational group and therefore not all of the charts have a breakdown at the
25 gas turbine level or are for Island Interconnected System only. These differences are
26 noted as applicable in the charts. For example, data was collected for the
27 Transmission and Rural Operations (TRO) Central group that covers both Island

Interconnected and Island Isolated Systems (transmission lines, distribution networks, gas turbines and terminal stations) for the Island of Newfoundland, excluding the Great Northern Peninsula. As such, Gas Turbines were not always broken out separately. The terms Gas Turbines (GT) and Combustion Turbine (CT) are interchangeable and refer to the same type of assets.

- a) The percentage weekly schedule compliance metric measures a key element of Hydro's asset management strategy, working in a highly planned and scheduled environment. This metric is driving the focus on scheduled, deliberate, efficient execution of work. This measure represents the percentage of scheduled tasks actually completed on weekly schedules (calculated as scheduled work actually completed divided by the total work scheduled). Schedule compliance can be affected by emergency work, weather, estimate quality and other unplanned work which interrupts the schedule. This measure is not a measure of overall completion, but simply how much work was completed during the week when actually planned. For instance, although the work was completed, it may have been completed in an overtime period (unplanned) which would not be as per the plan. By measuring and understanding weekly schedule compliance, Hydro is able to identify controllable opportunities to further improve its ability to work in a highly scheduled and organized manner. The target is 75% or better, or a 10% improvement over 2013 until target is achieved. Opportunities to improve consistency of data collection and schedule robustness were identified when developing the baseline data in 2013. This is driving improvements in 2014, particularly in the TRO areas where compliance is currently below target. The focus will be on consistency of data capture and review of unplanned work which interrupts the schedule to understand and address the root causes of these for ongoing improvement.

Percentage Average Weekly Schedule Compliance	2012	2013
TRO Central	57%	56%
TRO Northern	66%	66%
Holyrood	80%	83%
Hydro Generation	73%	70%

This data represents the Island Interconnected System. It has not been tracked separately for CTs. Hardwoods and Stephenville CTs are included inside of TRO Central.

In 2014, TRO will also leverage the following actions to ensure continual improvement of its asset management activities:

1. Continue to measure weekly schedule compliance and set improvement targets.
2. Conduct quarterly reviews of the annual work plan with all those responsible for plan development and execution to ensure recovery plans are in place as required, and ensure consistent flow from the annual work plan to activities on weekly schedules.
3. Continue with the Engineering/Operations coordination meetings to ensure internal resources utilized for the capital program are optimized and properly estimated.
4. Continue with the engagement of the Short Term Planning and Scheduling Technical Council to share and implement improvements to planning and scheduling.

1 b) The percentage emergency work metric supports Hydro's asset management
2 strategy by focusing attention on reducing emergency, reactive work. Supported by
3 the Root Cause and Repeat Failure Analysis Council, Hydro has been able to
4 continually improve this metric overall by reducing unplanned failures as
5 demonstrated by the improvement trend shown in the table below.

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7 The measure compares the number of emergency work orders to the total number
8 of completed work orders (calculated as the number of emergency work orders
9 divided by the total number of completed work orders). This helps identify
10 significant reactive work for root cause analysis and improvement.

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12 The target is 10% or lower, or a 10% improvement over 2013 until target is
13 achieved. Notably, the Hardwoods GT has experienced continual improvement,
14 and TRO Central, the Stephenville GT, Holyrood and Hydro Generation are at or
15 better than target. The TRO Northern measures include data for isolated
16 distribution systems. In these systems, the urgency of dealing with customer supply
17 issues in small, geographical dispersed, isolated communities in a harsh
18 environment can drive higher levels of emergency work. TRO Northern continues
19 to investigate root causes of emergencies for opportunities to improve
20 performance in this area.

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Percentage Emergency Work	2008	2009	2010	2011	2012	2013
TRO Central	10%	8%	9%	9%	9%	10%
Hardwoods CT	35%	28%	24%	21%	18%	10%
Stephenville CT	1%	7%	9%	16%	15%	2%
TRO Northern	20%	16%	15%	18%	16%	17%
Holyrood	21%	14%	3%	11%	10%	8%
Hydro Generation	2%	2%	2%	2%	2%	2%

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The data includes isolated distribution systems as well as the Island Interconnected System. CTs are broken out separately and also included within TRO Central.

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- c) Execution of its preventative maintenance (PM) program is a cornerstone of Hydro's asset management strategy. The PM program consists of planned, proactive maintenance activities and inspections to ensure assets can operate safely and reliably for the least cost.

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The preventative maintenance program compliance metric tracks the number of completed PM work orders against those due for completion within a given year (calculated as the number of completed PM work orders divided by the number of PM work orders scheduled to be completed within the specified year). It indicates if Hydro is completing its PM work and inspections as planned. The target for 2014

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is 80% or higher. Hydro has established this as an area for focused improvement in 2014.

Percentage PM Compliance	2008	2009	2010	2011	2012	2013
TRO Central	94%	78%	88%	82%	85%	87%
Hardwoods CT	83%	58%	91%	71%	71%	73%
Stephenville CT	67%	50%	100%	79%	79%	87%
TRO Northern	N/A	N/A	N/A	93%	98%	99%
Holyrood	93%	96%	93%	89%	74%	56% (see below)
Hydro Generation	99%	95%	95%	97%	96%	94%

The table above is based on Island Interconnected System data. The CT data is broken out separately, but is also included within the TRO Central data.

Holyrood performance was lower in 2013 due to deferral of part of the Unit 2 planned outage due to the extended outage for unplanned repairs on the Unit 1 turbine as a result of the January 11, 2013 lubricating system failure. The high priority work on Unit 2 was addressed in a shorter outage late in the year. In 2012, Holyrood's lower than normal PM compliance level was the result of prioritizing overall work loads due to reductions in capacity from retirements of various experienced personnel, particularly in the electrical trade. Productivity of new hires

1 was lower than the retired workers, as would be anticipated while they familiarized
2 themselves with the plant and equipment. Holyrood subsequently prioritized its
3 total workload in light of this, deferring some lower priority PM's in favour of
4 completing higher priority refurbishments. The staff turnover situation has
5 stabilized and resource plans are in place for improved performance in 2014.

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7 Hardwoods CT PM compliance was lower in 2011-2013 than in 2010. This was the
8 result of prioritizing overall workload against available resources to address
9 unexpected repairs and refurbishments. Lower priority PM work was deferred to
10 address higher priority repairs and refurbishments to support safe, reliable
11 operation. Examples of unforeseen workload include the Hardwoods CT alternator
12 replacement project in 2013, as well as addressing high priority recommendations
13 from the January 11, 2013 system events and the earlier Henville Consulting
14 reports.

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16 TRO reviewed the status of all PM's in 2010 to ensure completeness and
17 consistency across similar assets and improvements were subsequently made. In
18 light of January 2014 events, TRO is implementing the following initiatives:

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20 1. Implement additional oversight and sign-off of annual work plans to ensure
21 a resource balanced plan, enabling continued successful execution of the
22 PM program.
- 23 2. Document PM compliance targets in performance agreements for applicable
24 managers.
- 25 3. Ensure PM backlog reviews are held bi-weekly with particular emphasis on
26 terminal stations and breakers to ensure targets are consistently met.
- 27 4. Assign a senior resource to the Eastern area office to oversee execution of
28 the PM plan in that area.

- 1 5. Conduct bi-annual PM check sheet review meetings with shop floor
- 2 employees to identify improvements to existing PMs.
- 3 6. Leverage and integrate the Project Execution and Technical Services
- 4 Planning and Scheduling resource to improve coordination with the regions
- 5 and plants.
- 6 7. Implement a campaign approach to execution of the annual work plan to
- 7 ensure required resources are available and execution is consistently
- 8 successful across all work streams, including PMs and backlogs. This may
- 9 include the increased use of contractors, pooling resources from other
- 10 regions and hiring additional temporary employees.
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- 12 d) Monthly review of annual work plan progress is part of managing the execution of
- 13 the annual maintenance work packages. They are critical for identifying how well
- 14 the plan is being carried out and provide an opportunity to implement corrective
- 15 action. This metric was identified in 2013 for base line purposes to improve
- 16 completion of the plan. Results will be reviewed after the end of 2014 to identify
- 17 opportunities and any required changes to our approach. The target is 80% or
- 18 higher. It is an indicator that Hydro is effectively managing its work execution. The
- 19 metric is tracked at the regional level led by the Short Term Work Planning and
- 20 Scheduling Supervisors to monitor whether meetings happened as planned
- 21 (calculated as number of planned meetings held divided by the number of planned
- 22 meetings).
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- 24 e) PUB-NLH-155 Attachment 1 presents the controllable cost information for each of
- 25 TRO, Holyrood and Hydro Generation, as well as the controllable cost information
- 26 for the combination of Hardwoods CT, Stephenville CT and Corner Brook Frequency
- 27 Convertor. "Controllable costs" are made up of the following accounts: allowances,

overtime, capital labour, capital overtime, materials, contract labour, tools and operating supplies, lubricating fluids, chemicals and gases, telephone and fax, memberships and dues, travel expense, employee expenses, sundry costs, safety supplies and other external costs. The target is for actual cost to be on budget. It is an indicator that Hydro is completing its operating and maintenance activities as planned and the trend helps gauge the effectiveness of cost control activities within asset management.

- f) Change in 5-year capital plans is measured in both scope and cost to ensure Hydro stays anchored to its longer term strategy, working in a planned and deliberate manner, on the highest priority work. Scope and timing adjustments are calculated by comparing the list of projects submitted to the Board for a given Capital Budget Application (CBA) year against the list of projects identified for that same year in the prior year. For example, the number of projects in the 2014 CBA that were also identified in year 2014 of the 2013 CBA divided by the total number of projects in the 2014 CBA is a measure of the robustness of the longer term capital plan. Cost change is calculated the same way by summing costs instead of numbers of projects. These measures indicate the accuracy of the capital cost estimates in the long-term capital plan. The general targets for both scope and cost are a 75% or higher match. It is understood and necessary that significant change can happen if underpinning assumptions and service requirements change from one year to the next and the plan is actively updated to reflect these changes. Some change is always to be expected and necessary due to evolving asset condition data and customer needs and the associated reprioritization and adjustment of the capital plans to reflect the most current information and address these needs. Hydro's Long Term Asset Planners are accountable to update the 5-year plan annually. This effort considers inputs such as updated asset condition data and changes in future asset utilization as part of the prioritization process, with the intent of identifying

- 1 the highest priority work to be done at the best time to support continued safe,
- 2 least cost, reliable service to customers. The tables below present the scope and
- 3 cost change summaries for Holyrood and GTs.

Holyrood (total plant) Capex Year	Percentage Projects Anchored to the Previous 5 year Plan	Percentage Cost Change vs Budget in Previous Plan	Notes on Primary Drivers of Changes
2014	69%	49% decrease	<p>The cost decrease is primarily driven by removal of projects no longer required in light of Holyrood's future role after Muskrat Falls comes into operation and where asset condition indicates the facility can continue to be safely and reliably operated. Notable changes are:</p> <ol style="list-style-type: none"> 1) Upgrade Powerhouse Roofing, rescheduled to 2015, based on condition and prioritization 2) Replace Powerhouse Overhead Doors, rescheduled to 2015 based on condition and prioritization 3) Refurbish Fuel Storage Facility Tank 1, cancelled, not required for remaining use of fuel system based on condition 4) Replace Compressor #1, rescheduled to 2015 based on condition and prioritization 5) Replace Fuel Oil Heat Exchangers Units 1 and 2, cancelled, not required for remaining use of fuel oil system based on condition 6) Synchronous Condenser Conversion Units 1 and 2, cancelled, no longer required
2013	79%	47% decrease	<p>The cost decrease is primarily driven by removal of projects no longer required in light of Holyrood's future role after Muskrat Falls comes into operation and where asset condition indicates the facility can continue to be safely and reliably operated. Notable changes are:</p> <ol style="list-style-type: none"> 1) Replace Waste Water Basin Building, rescheduled to

Holyrood (total plant) Capex Year	Percentage Projects Anchored to the Previous 5 year Plan	Percentage Cost Change vs Budget in Previous Plan	Notes on Primary Drivers of Changes
			<p>2014 based on condition and prioritization</p> <ol style="list-style-type: none"> 2) Install Nitrogen Generator for Boilers, cancelled, not justifiable for remaining use of boilers 3) Upgrade Fire Protection on Out Buildings, rescheduled to 2015 based on prioritization 4) Refurbish Fuel Storage Facility, rescheduled to 2014 pending further analysis 5) Modify Control Room, cancelled, not justifiable for future of plant 6) Install Visible Isolation for 600V HVAC System, rescheduled to 2017 based on prioritization 7) Upgrade Forced Draft Fan Ductwork Unit 3, rescheduled to 2017 based on condition and prioritization 8) Rewind Generators Units 1 and 2, rescheduled to 2015 pending review of need to convert for synchronous condenser post Muskrat Falls in-service and justification
2012	86%	21% decrease	<p>Notable projects removed or deferred are:</p> <ol style="list-style-type: none"> 1) Plant Operator Training Simulator, deferred pending further investigation, ultimately cancelled following non-approval by the Board 2) Install Backup System for Raw Water and Clarifiers, rescheduled to 2013 pending additional justification
2011	73%	5% increase	
2010	50%	0%	

Gas Turbines Capex Year	Percentage Projects Anchored to the Previous 5 year Plan	Percentage Cost Change vs Budget in Previous Plan	Notes on Primary Drivers of Changes
2014	100%	35% increase	Cost increase primarily driven by reschedule of Stephenville Gas Turbine Plant Life Extension project to accommodate alternator refurbishment in 2013
2013	100%	99% decrease	Cost decrease is driven by the following: <ul style="list-style-type: none"> 1) Removal of refurbishment projects related to the decommissioned Holyrood Gas Turbine, upon reconsideration under current circumstances 2) Reschedule of Stephenville Gas Turbine Plant Life Extension into 2014, due to the alternator failure
2012	100%	0%	
2011	67%	4% increase	
2010	67%	43% decrease	Cost decrease is driven by the following: <ul style="list-style-type: none"> 1) Cash flow change due to update of Hardwoods Gas Turbine Plant Life Extension multi-year project plan 2) Deferral of sprinkler system for Holyrood Gas Turbine pending assessment of facility

Hardwoods , Stephenville Gas Turbine and Corner Brook Frequency Converter - Controllable Operating Costs

PUB-NLH-155e

	2008			2009			2010		
	Actual	Budget	Variance	Actual	Budget	Variance	Actual	Budget	Variance
Controllable Cost	\$190,797	\$143,200	-\$47,597	\$130,253	\$185,930	\$55,677	\$327,615	\$175,354	-\$152,261
	2011			2012			2013		
	Actual	Budget	Variance	Actual	Budget	Variance	Actual	Budget	Variance
Controllable Cost	\$177,336	\$205,317	\$27,981	\$131,238	\$409,834	\$278,596	\$340,739	\$243,992	-\$96,747

Note: The above costs were extracted from Business Units 1332 &133201. These business units also include costs associated with the Corner Brook Frequency Converter that have not been removed from the above totals. The Clarity report does not segregate the costs by asset.

TRO, HRD and Hydro Generation - Controllable Operating Costs

PUB-NLH-155e

	2008			2009			2010		
	Actual	Budget	Variance	Actual	Budget	Variance	Actual	Budget	Variance
Hydro Generation									
Controllable Cost	\$2,603,817	\$2,198,600	-\$405,217	\$3,067,960	\$3,120,900	\$52,940	\$3,073,738	\$3,440,672	\$366,934
TRO Isl Interconn									
Controllable Cost	\$7,161,538	\$6,606,778	-\$554,760	\$7,329,196	\$7,387,626	\$58,430	\$7,748,225	\$8,096,201	\$347,976
Thermal Generation									
Controllable Cost	\$14,415,849	\$12,188,171	-\$2,227,678	\$13,435,142	\$12,226,221	-\$1,208,921	\$12,050,775	\$14,389,359	\$2,338,584
	2011			2012			2013		
	Actual	Budget	Variance	Actual	Budget	Variance	Actual	Budget	Variance
Hydro Generation									
Controllable Cost	\$3,634,642	\$3,273,353	-\$361,289	\$4,089,453	\$3,225,888	-\$863,565	\$3,405,731	\$3,272,597	-\$133,134
TRO Isl Interconn									
Controllable Cost	\$8,121,815	\$7,933,470	-\$188,345	\$8,264,781	\$8,448,742	\$183,961	\$10,389,479	\$8,326,941	-\$2,062,538
Thermal Generation									
Controllable Cost	\$12,385,075	\$12,046,958	-\$338,117	\$10,568,488	\$11,136,848	\$568,360	\$10,427,349	\$10,443,788	\$16,439