December 23, 2002

The Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, NL
A1A 5B2

ATTENTION: Ms. G. Cheryl Blundon
Director, Corporate Services and
Board Secretary

Dear Ms. Blundon:

Re: Order No. P.U. 7 (2002-2003)

Enclosed please find fifteen (15) copies of the following:

1. The report on Fuel Oil Practices Review and Policy - This report is filed in compliance with paragraph 5 (ii) of Order No. P.U. 7 (2002-2003), page 176; and

2. The report on Plan of Projected Operating Maintenance Expenditures 2003-2013 for Holyrood Generating Station – This report is filed in compliance with paragraph 8 (i) of Order No. P.U. 7 (2002-2003), page 177.

Yours very truly,

Maureen P. Greene, Q.C.
Vice-President Human Resources, General Counsel
and Corporate Secretary

MPG/jc
Encls.

Plan of Projected Operating Maintenance Expenditures 2003 - 2013 For Holyrood Generating Station

Newfoundland & Labrador Hydro
December 2002

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INTRODUCTION

In the Decision and Order No. P. U. 7 (2002-2003) of the Board of Commissioners of Public Utilities ("the Board"), dated June 7, 2002 , (the 'Order) Newfoundland and Labrador Hydro ("Hydro") was required to **"*submit to the Board by December 31, 2002, a detailed plan of projected maintenance expenditures over the next ten years for the Holyrood Generating Station,*"** (p. 68 and paragraph 8(v), p. 177 of the Order).

This requirement was specifically related to system equipment maintenance costs; therefore, capital expenditures have not been included in the following report. Capital expenditures for Holyrood are submitted annually to the Board with other Hydro capital proposals as part of annual capital budget applications, and vary from year to year.

This report addresses the identified and expected operating maintenance (O&M) expenditures for the years 2003 to 2013 inclusive. With respect to the O&M expenditures it must be noted that Unit Nos. 1 and 2, as well as the gas turbine, two of the main fuel storage tanks and other associated ancillary equipment are in excess of thirty (30) years old. Unit No. 3 is in excess of twenty (20) years old, along with its associated equipment, including the other two main fuel storage tanks. While many components of this equipment have been replaced and additional items added through the capital program over the years, numerous pieces of equipment and components are the original equipment.

An accurate ten (10) year plan of system equipment maintenance is difficult to complete given the harsh operating environment and the age of the units. This report, however, outlines for the next ten (10) years, maintenance items that are anticipated at this time. This plan, of course, will change as time progresses as the operating condition of the equipment will be continuously reviewed and, undoubtedly, events will occur that are not foreseen at this time, that will require changes in the currently anticipated annual maintenance. As can be seen from

this report, there must be variation in annual operating costs for the Holyrood Thermal plant. It is not possible to “levelize” the cost of maintaining a plant such as Holyrood where there are numerous components and systems integrated together to form a fossil fired thermal electric generating system.

MAINTENANCE PHILOSOPHY

The Board, in its Order, as related to the Holyrood Thermal Plant, noted at p. 68 that **"the Holyrood Thermal Plant, because of its age will probably require more maintenance in future, in order to maintain the efficiencies required to support the system"** and that **"Mr. Brushett of GT stated that he had concerns with that portion of the system equipment maintenance expense related to Holyrood because the justifications over a number of years make it very difficult to assess what an appropriate normalized level of expenditure would be."**

It would be useful to first review the three main types or categories of maintenance undertaken at Holyrood.

1) **<u>Preventive Maintenance</u>**

While it is true that any plant will incur greater maintenance costs as it ages, Holyrood has used, and continues to use, up-to-date maintenance techniques and practices to maintain plant efficiency, availability and reliability. These include preventive, predictive and condition-based maintenance techniques, which are usually referred to by the overall term of "Preventive Maintenance". The basic principle underlying this approach to maintenance is timely intervention to prevent eminent or catastrophic failure, which may cause a substantial safety exposure, increase in cost or extended unavailability of the unit or system.

Preventive maintenance, in its specific sense, comprises routine inspections, checks and component replacement at specific time intervals, to prevent failures known, or reasonably expected, to occur within a definable time or operating hour interval during the life of the equipment, e.g. generator brush wear, air and oil filter replacements, etc. This also

includes discarding equipment or components rather than repairing them when it is less expensive to do so.

Predictive maintenance involves routine testing of equipment to determine deterioration rates and initiating and carrying out repairs in a timely manner before a failure occurs, e.g. ultrasonic thickness checks on fluid lines to monitor erosion wear rates, non-destructive testing of boiler and turbine components to determine corrosion rates and remaining life. Predictive maintenance items include such things as boiler and auxiliary equipment annual overhaul, among other items, wherein an assessment is made of components or subsystems that are only assessable during these overhauls.

There is also regular or continual monitoring of equipment operating parameters with a comparison of the results with optimum conditions to determine the most economic time to intervene and perform remedial work that is intended to return the equipment to optimum performance levels, e.g. air heater washes, generator winding insulation condition, oil sampling and testing, etc.

Turbine major and minor overhauls are, effectively, long-term predictive and preventive maintenance activities. A turbine major overhaul is a major disassembly, inspection and repair of the whole turbine, and since this is a very expensive and time consuming activity, the time between these overhauls is extended to minimize the recurring cost and maximize the equipment operating time, and thus useful life of the internal wearing components. Prior to 1988, these major overhauls were carried out at four-year intervals; a subsequent assessment of the risk and cost savings resulted in extending these overhauls to six-year intervals.

Turbine valve overhauls are carried out at three-year intervals, (i.e. at the same time as a major turbine overhaul, and again halfway through the six-

year turbine overhaul cycle). This has been found necessary due to the critical nature of the safety and reliability aspects of these valves to the turbine operation and integrity.

2) Corrective Maintenance

In addition to the predictive maintenance tactics outlined above, there are also corrective maintenance requirements. These include repairs to equipment as it fails or reaches the point where preventive maintenance has identified that the equipment is approaching the end of its useful service life. e.g. wear and tear on pumps, pipes and valves in the main and auxiliary systems, boiler tube failure repairs, motor rewinds due to failed or deteriorated winding insulation, or as a result of adverse conditions (humidity, salt laden atmosphere, etc), replacement of corroded piping equipment, etc.

3) Projects

Operating projects are those major cost repairs and inspections that are required to return structures and equipment to their original condition or near original condition to maintain structural integrity, possibly extend plant life, improve efficiency, improve availability and prevent or reduce environmental risks. Such projects include building structural steel, roof repairs/replacement, fuel oil tank and pipeline inspection and coating, replacement of vendor unsupported equipment or components, asbestos abatement program, etc. These activities are non-repeating or extended interval (years) activities and are thus identified and costed separately from routine corrective maintenance (discussed earlier).

COST VARIABILITY

Preventive maintenance costs are generally incurred annually at a constant level and do not significantly fluctuate. This does not apply to corrective maintenance costs, which are unavoidable and somewhat unpredictable due to the changing energy production demands on the units from year to year. These changing demands give rise to changes in wear rates, the majority of which cannot be monitored closely enough for reasonably accurate prediction, without incurring excessive inspection expenses. Excessive inspection may in itself introduce increased risk of failure and thus additional cost, so all must be considered in balancing the most appropriate process of inspection with accepted levels of failure. These generally balance from one year to another, but the root activity certainly changes in that it may be totally unrelated equipment that initiates the expense.

The turbine major and valve overhaul costs are cyclic in nature. With three units in the plant on a six-year major overhaul cycle interspersed with a three-year valve overhaul, this component of the system equipment maintenance cost is one of the major causes of the observed annual fluctuations that make normalizing annual maintenance costs difficult.

Similarly, major operating projects, because of their extended maintenance intervals (years) or non-repeatability also add to the annual fluctuations of the system equipment maintenance costs.

Maintenance projects for the Holyrood Thermal plant are planned on a five-year horizon, but as with any plan, it is not ‘fixed’ or definitive, as other events will cause a shift in the prioritization of such projects. This five-year maintenance plan is regularly updated by Hydro as time progresses.

DETAILED ANALYSIS

Attached are Appendices 1 to 7, which set out the ten-year maintenance plan for the Holyrood Thermal plant, as requested by the Board. Appendix 1 is a summary and indicates the expected expenditures in each of the major equipment groupings containing system equipment maintenance (SEM) costs for the years 2003 to 2013. Appendices 2 to 7, inclusive, show the expected SEM costs categorized according to Preventive, Corrective, Overhauls and Major Operating Projects for each of the major equipment groupings containing SEM costs.

This plan was prepared using the 2003 preventive, corrective and overhaul data and the current 2003 to 2007 operating project lists from Hydro's five-year plan for the Holyrood Thermal Plant as the base data. Considerable judgment of plant personnel had to be used to prepare a forecast ten-year plan.

Hydro does not normally use any escalation in its five-year operating plan at the plant on a regional level. This plan is used for internal purposes and work planning rather than detailed financial planning. However, in the attached ten-year plan, an escalation factor has been used as recommended by Hydro's Economic Analysis Department. For SEM, the value recommended for use was 1.6% per annum and was used for each year after 2003, the base year.

Appendices 2 to 7 list the categories of SEM costs for the years 2003 to 2013 in each of the major equipment groupings containing SEM. The categories listed are:

Preventive – Annual	These are the routine preventive maintenance activities carried out every year
Corrective	These are the expected breakdown/emergency repairs carried out during the year

Turbine – Major	These are the major overhauls of the turbines, currently carried out every six (6) years
Turbine – Minor	These are major valve overhauls currently carried out with, and three years after a major turbine overhaul.
Boiler – Annual	These are boiler overhauls and carried out annually
Auxiliary Equipment	These are annual overhauls of various pieces of equipment supporting the Unit.
Operating Projects	These are non-capitalized projects, justified on the basis of Reliability, Safety, Environment or Cost Benefit Analyses.

Appendices 2, 3 and 4 (for Unit Nos. 1, 2 and 3 respectively) use all of the foregoing categories. Appendices 5, 6 and 7 are for the remaining equipment groupings of Common Equipment, Building and Grounds, and Water Treatment Plant and use only Preventive - Annual, Corrective and Major Operating Projects.

It must be noted that the Appendices do not itemize preventive annual and corrective items. It is not practical to itemize preventive-annual items, since these are a large number of relatively small jobs. Corrective items include a large number of small value jobs, the greater of which are largely unknown until they happen; thus, it is not practical to itemize these either. Projects included in the headings of Operating Projects, Turbine - Major and Turbine - Minor work have been itemized in the year that the work is planned for execution.

Hydro's normal five-year plan identifies specific projects up to 2007. For the period 2008 to 2013, Hydro used an average per unit of the project budgets for the three units over the years 2003 to 2007 as an estimate from 2008 on with escalation. This approach was taken, as it is not practical or possible to

determine specific work items, which are essentially unknown for the period of 2008 to 2013.

The fluctuating nature of the SEM Expenses is primarily caused by the large dollar value Major Turbine Overhauls and the schedule for these and Turbine Minor Overhauls is shown below:

Unit	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
No. 1	Major			Minor			Major			Minor	
No. 2			Major			Minor			Major		
No. 3		Minor			Major			Minor			Major
General Cost	↑	↓	↑	↓	↑	↓	↑	↓	↑	↓	↑

SUMMARY

This Plan presents the best available information at this time for a ten-year forecast of the maintenance projects for the Holyrood Plant and is based on the 2003 system equipment maintenance budget. As with any forecast, it is subject to change depending on the operating demands of the plant, the results of inspections and assessments of changing equipment conditions.

The Plan takes into account up-to-date maintenance tactics being used and known restoration and inspection work. As can be seen from the Plans, fluctuations in the annual cost cannot be eliminated due to the Turbine Major Overhauls every second year, alternating with the Turbine Valve Overhaul every other second year as well as the large but infrequent Major Operating projects, such as fuel oil storage tank painting and inspection.

APPENDIX 1

TOTAL HOLYROOD SEM[1] 10 YEAR MAINTENACE EXPENDITURES ESCALATED (K)

	($000)										
	Base Year 2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
UNIT #1 Total SEM	2,530	1,282	1,156	1,682	1,194	1,352	2,858	1,395	1,418	1,822	1,463
UNIT #2 Total SEM	1,120	1,191	2,911	1,175	1,384	1,710	1,373	1,395	2,950	1,440	1,463
UNIT #3 Total SEM	1,215	1,612	1,187	1,517	3,142	1,352	1,373	1,765	1,418	1,440	3,046
Common Equipment Total SEM	816	740	1,080	1,260	745	1,391	1,051	1,067	1,084	1,102	1,119
Buildings and Grounds Total SEM	1,499	1,873	1,968	1,341	714	1,513	1,537	1,562	1,587	1,612	1,638
Water Treatment Plant Total SEM	331	465	251	358	364	370	375	382	388	394	400
Total Holyrood SEM	7,512	7,163	8,554	7,332	7,542	7,687	8,568	7,567	8,845	7,811	9,130

[1] SEM – System Equipment Maintenance

APPENDIX 2

HOLYROOD 10 YEAR MAINTENANCE PLAN

	($000)										
Unit No. 1	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Preventive – Yearly	29	30	30	31	31	32	32	33	33	34	34
Corrective	290	295	299	304	309	314	319	324	329	335	340
Turbine Major Overhaul	1,350						1,485				
Turbine Valve Overhaul				347							
Boiler Annual Overhaul	580	589	599	608	618	628	638	648	659	669	680
Auxiliary Equipment Annual Overhaul	221	224	228	232	235	239	243	247	251	255	259
Operating Projects											
Recoat Condenser Waterboxes	25										
Repair Forced Draft Fan Bearings	25										
Turbine Performance Instrumentation	10										
Replace UPS Batteries		12									
Replace Boiler Scanners		102									
Relocate Hydrogen Purging Valves		30									
Air Heater Cold End Repairs				160							
Projects - Lump Sum for Future Years						139[(1)]	141	143	146	148	150
Total - Unit No. 1	2,530	1,282	1,156	1,682	1,194	1,352	2,858	1,395	1,418	1,822	1,463
Total Operating Projects Unit 1	60	144		160		139	141	143	146	148	150

[(1)] 139 - Average Project Cost Per Unit 2003 to 2005 (plus escalation)

APPENDIX 3

	($000)										
Unit No. 2	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Preventive – Yearly	29	30	30	31	31	32	32	33	33	34	34
Corrective	290	295	299	304	309	314	319	324	329	335	340
Turbine Major Overhaul			1,394						1,533		
Turbine Valve Overhaul						358					
Boiler Annual Overhaul	580	589	599	608	618	628	638	648	659	669	680
Auxiliary Equipment Annual Overhaul	221	224	228	232	235	239	243	247	251	255	259
Operating Projects											
Condenser Eddy Current Test		30									
Replace UPS Batteries		12									
Turbine Performance Instrumentation		10									
Additional Turbine Overhaul Work			258								
Replace Boiler Scanners			103								
Gen Hydrogen Purge Valve Relocation					30						
Air Heater Cold End Repairs					160						
Projects - Lump Sum for Future Years						139[1]	141	143	146	148	150
Total - Unit No. 2	**1,120**	**1,191**	**2,911**	**1,175**	**1,384**	**1,710**	**1,373**	**1,395**	**2,950**	**1,440**	**1,463**
Total Operating Projects Unit 2		53	361		190	139	141	143	146	148	150

[1] 139 - Average Project Cost Per Unit 2003 to 2005 (plus escalation)

APPENDIX 4

	($000)										
Unit No. 3	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Preventive – Yearly	29	30	30	31	31	32	32	33	33	34	34
Corrective	290	295	299	304	309	314	319	324	329	335	340
Turbine Major Overhaul					1,438						1,582
Turbine Valve Overhaul		336						370			
Boiler Annual Overhaul	580	589	599	608	618	628	638	648	659	669	680
Auxiliary Equipment Annual Overhaul	221	224	228	232	235	239	243	247	251	255	259
Operating Projects											
Noise Abatement	35										
North Extraction Pump Overhaul	25										
Replace Sootblower Controls	35										
Install Accumulator in Fuel Oil System.		30									
South Extraction Pump Overhaul		25									
Condenser Partial Retube		81									
Remove Obsolete Hitass System			21								
Turbine Performance Instrumentation			10								
Replace #3 UPS Batteries				12							
Condenser Eddy Current Test				30							
Purchase Turbine Packing for 2007				50							
Purchase Turbine Buckets for 2007				250							
Turbine Nozzle Block Repairs					100						
Turbine Snout Ring Inspection					160						
Turbine Bucket Replacement					100						
Turbine Diaphragm Major Repair					150						
Projects - Lump Sum for Future Years						139[(1)]	141	143	146	148	150
Total - Unit No. 3	1,215	1,612	1,187	1,517	3,142	1,352	1,373	1,765	1,418	1,440	3,046
Total Operating Projects Unit 3	95	137	31	342	510	139	141	143	146	148	150
Total SEM for all Three Units	4,866	4,085	5,255	4,374	5,719	4,413	5,605	4,556	5,785	4,703	5,972
Total Project Work for Three Units	155	334	392	502	700	417	423	430	437	444	451

[(1)] 139 - Average Project Cost Per Unit 2003 to 2005 (plus escalation)

APPENDIX 5

	($000)										
Common Equipment	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Preventive – Yearly	228	232	235	239	243	247	251	255	259	263	267
Corrective	257	261	265	269	273	278	282	287	291	296	301
Operating Projects											
Asbestos Removal Program	175	136	207	147							
DC Lub Oil Pumps Cable Protection	25										
Luminaire Replacement	50	51	52	52							
Pipe Surveillance Program	50										
Plant Colour Coding	15	15	15	16	16	16	16	17	17	17	18
Retrofit 600v Breakers.	17										
Cold End Air Heater Baskets		30									
Hydraulic Oil System Temperature Control			12								
Install Totalizing Meters on H2 System			25								
Light Oil Temperature Controls To WDPF			10								
Motor Controls Turbine Board			4								
Pegging Steam Controls to WDPF			10								
Stage I Emergency Diesel Controls			21								
Unit 3 Fuel Oil Flow meter			17								
Warm Air Make Up Steam Coil Replacement			206	210	213						
Painting Mechanical Equipment				50							
Install Paging System				265							
Replace UPS #4 Batteries				12							
Gas Turbine Avon Major Overhaul						850					
Seal Stop Logs Between 3 &4 CW Intakes		15									
Projects – Lump Sum for Future Years							501[(1)]				
Common Equipment Total	816	740	1,080	1,260	745	1,391	1,051	1,067	1,084	1,102	1,119
Total Operating Projects Common Equipment	332	248	580	752	229	866	518	526	534	543	552

[(1)] 501 - Average Project Cost 2003 to 2005 (plus escalation)

APPENDIX 6

	($000)										
Buildings Grounds	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Preventive – Yearly	136	138	140	143	145	147	149	152	154	157	159
Corrective	185	188	191	194	197	201	204	207	210	214	217
Operating Projects											
Admin H & V Upgrade	50										
Fuel Oil Tank Inspection and Repairs	665	620	671	215							
Heat Tracing and Rejuvenate Piping	203	224	168	178							
Marine Terminal Fender & Anode Repairs	50	36	21								
Replace 6 Concrete Light Poles	20	20	21								
Replace 170 Ton Crane Hoist Rope	30										
Stack Repairs	150	152	155	157	160						
Tank Farm Dyke Erosion Repairs	10										
Coat Interior Liner Panels		102	103	105	107						
Coat Powerhouse Floors		20	21	21	21						
Powerhouse Concrete Block Coating		12		13							
Powerhouse Roof Replacements		218	165	189							
Upgrade Plant Service Elevator		51									
Landscaping/Paving			21								
Ventilation Upgrade for WWTP Basins			178								
Repair and Repaint Structural Steel		91	93	94	96						
Remote Radio Control for T/H Crane			17								
Vegetation Control			4								
Install Fire Rated Windows in Control Rm.				26							
Rehabilitation of Tank Farm Pipe Supports				42							
Projects - Lump Sum for Future Years						1,175	1,194	1,213	1,233	1,252	1,272
Total – Buildings and Grounds	1,499	1,873	1,968	1,377	726	1,523	1,547	1,572	1,597	1,623	1,649
Total Operating Projects Buildings and Grounds	1,178	1,546	1,636	1,040	384	1,175	1,194	1,213	1,233	1,252	1,272

(1) 1,175 - Average Project Cost 2003 to 2005 (plus escalation)

APPENDIX 7											
	($000)										
Buildings Grounds	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Preventive – Yearly	60	61	62	63	64	65	66	67	69	70	71
Corrective	141	143	145	148	150	152	155	157	160	162	165
Operating Projects											
Clean Sludge from WWT Periodic Basin	10										
Replace Unit 1 Condensate Polisher Resin	60										
Replace Unit 2 Condensate Polisher Resin	60										
Phosphate and Caustic Injection Skid		102									
Replace Unit 3 Condensate Polisher Resin		61									
Replace WT Plant A & B Train Resins		85									
Clean Sludge from WWT Continuous Basin		8									
Replace WT Plant C Train Resin			43								
Projects - Lump Sum for Future Years				147[(1)]	150	152	154	157	159	162	164
Sand Filter - Replace Sand		5									
Water Treatment Plant Total	331	465	251	358	364	370	375	382	388	394	400
Total Operating Projects WT Plant	130	261	43	147	150	152	154	157	159	162	164

[(1)] 147 - Average Project Cost 2003 to 2005 (plus escalation)