

SECTION B

NEWFOUNDLAND & LABRADOR HYDRO

2006 CAPITAL BUDGET - OVERVIEW PROJECTS OVER \$50,000

(\$,000)

	Exp To 2005	2006	Future Years	Total
GENERATION	3,624	9,149	4,530	17,303
TRANSMISSION & RURAL OPERATIONS	0	16,465	522	16,987
GENERAL PROPERTIES	5,975	14,598	220	20,793
ALLOWANCE FOR UNFORSEEN EVENTS	0	1,000	0	1,000
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TOTAL CAPITAL BUDGET	<u>9,599</u>	<u>41,212</u>	<u>5,272</u>	<u>56,083</u>

**NEWFOUNDLAND & LABRADOR HYDRO
GENERATION
2006 CAPITAL BUDGET - PROJECTS OVER \$50,000 BY CATEGORY**

(\$,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
Island Pond Development - Feasibility Update		998		998	Nov. 06	B-5
Final Feasibility Study - Portland Creek Development		796		796	Nov. 06	B-7
Wind Generation Inventory Study		143	33	176	Jul. 07	B-9
Replace Penstock - Snook's Arm Generating Station	118	1,992		2,110	Nov. 06	B-119(1)
Replace Unit 1 Governor Controls - Cat Arm	378	311		689	Dec. 06	B-119 (2)
Upgrade Controls Spherical Valve #6 - Bay d'Espoir		200		200	Jul. 06	B-11
Replace Underground Fuel Tanks - Cat Arm Powerhouse		137		137	Nov. 06	B-13
Remote Operation of Fisheries Comp. By-Pass Valve - Granite Canal		107		107	Aug. 06	B-15
Install Waste Oil Holding Tanks - BDE, USL, HLK & PRV		82		82	Oct. 06	B-19
Replace Superheater Unit 2 - Holyrood		319	2,818	3,137	Oct. 07	B-20
Upgrade Control Systems - Holyrood	2,515	316		2,831	Dec. 06	B-119(3)
Addition of Disconnecting Means to 600 Volt MCC Branch Feeders -Holyrood	613	859	749	2,221	Dec. 07	B-119(4)
Fire Protection Upgrades - Holyrood		916	930	1,846	Dec. 07	B-23
Replace Warm Air Make-Up Units Steam Coil - Holyrood		602		602	Sep. 06	B-25
HVAC Replacements - Stage 1 & 2 , Relay, Control & Exciter Rms - Holyrood		565		565	Oct. 06	B-29
Study Regeneration Waste Treatment - Holyrood		172		172	Aug. 06	B-32
Modify Boiler Protection and Control - Holyrood		117		117	Nov. 06	B-34
Replacement of Paging System - Holyrood		275		275	Oct. 06	B-36
Replace Automatic Voltage Regulator - Hardwoods		242		242	Nov. 06	B-38
TOTAL GENERATION	3,624	9,149	4,530	17,303		

SECTION B

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NEWFOUNDLAND & LABRADOR HYDRO TRANSMISSION & RURAL OPERATIONS 2006 CAPITAL BUDGET - PROJECTS OVER \$50,000 BY CATEGORY (\$,000)

PROJECT DESCRIPTION	Exp To		Future Years	Total	Explanation	
	2005	2006			In-Ser Date	Page Ref.
Wood Pole Line Management - Various Sites		2,303		2,303	Dec. 06	B-39
Replace Insulators TL231 - (230kV Bay d'Espoir - Stoney Brook)		917		917	Sep. 06	B-41
Upgrade Corner Brook Frequency Converter		617		617	Nov. 08	B-43
Upgrade 138 kV and 66 kV Protection Systems - Bottom Brook		109		109	Oct. 06	B-45
Replace Data Collection and Monitoring System - Hawke Hill		56		56	Dec. 06	B-47
Replace Insulators - Various Stations		307		307	Oct. 06	B-49
Replace Battery Chargers - Various Stations (BDE, DLK, GFC & WAV)		90		90	Oct. 06	B-51
Replace Compressor and Dryer - Grand Falls Frequency Converter Station		80		80	Aug. 06	B-53
Replace Air Compressors - Holyrood Terminal Station		80		80	Aug. 06	B-55
Replace Instrument Transformers - Various Stations		78		78	Nov. 06	B-57
Replace Battery Bank - Various Stations (GBK,IRV,BDE)		72		72	Sep. 06	B-59
Replace Surge Arrestors - Various Stations		70		70	Nov. 06	B-61
Install Transformer Oil Monitoring System - Upper Salmon		53		53	Oct. 06	B-63
Upgrade Distribution Feeders - Various Locations		2,017		2,017	Oct. 06	B-65
Provide Service Extensions		1,984		1,984	Dec. 06	B-68
Upgrade Distribution Systems		1,912		1,912	Dec. 06	B-70
Replace Insulators - Various Locations		1,020		1,020	Dec. 06	B-72
Replace Poles - Various Locations		332		332	Oct. 06	B-74
Purchase and Install Voltage Regulator L7 - Happy Valley		122		122	Oct. 06	B-76
Construct New Diesel Plant - St. Lewis		2,227		2,227	Oct. 06	B-78
Installation of Fall Arrest Equipment - Various Locations		268	522	790	Dec. 06	B-81
Replace Diesel Generating Units _ Various Locations		663		663	Oct. 06	B-83
Replace Control Panel - Rigolet		135		135	Nov. 06	B-85
Install NOx Monitor - Little Bay Islands		106		106	Aug. 06	B-86
Replace Generating Unit Breakers - Francois, Grey River, Little Bay Islands		68		68	Nov. 06	B-87
Purchase Meters & Equipment - All Service Areas		93		93	Dec. 06	B-88
Legal Survey of Distribution Line Right-of-Ways - Various Sites		50		50	Oct. 06	B-89
Replace Off Road Track Vehicles		636		636	Apr. 06	B-91
TOTAL TRANSMISSION & RURAL OPERATIONS	0	16,465	522	16,987		

**NEWFOUNDLAND & LABRADOR HYDRO
GENERAL PROPERTIES
2006 CAPITAL BUDGET - PROJECTS OVER \$50,000 BY CATEGORY
(\$,000)**

PROJECT DESCRIPTION	Exp To		Future		In-Ser	Explanation
	2005	2006	Years	Total	Date	Page Ref.
Replace Energy Management System - Energy Control Centre	4,856	5,382		10,238	Jul. 06	B-120 (5)
Applications Enhancements		946		946	Dec. 06	B-93
Cost Recovery CF(L)Co		(165)		(165)		
Corporate Applications Environment		592		592	Dec. 06	B-96
Cost Recovery CF(L)Co		(36)		(36)		
Peripheral Infrastructure Replacement		199		199	Nov. 06	B-99
Replace VHF Mobile Radio System	2,915	5,473		8,388	Dec. 06	B-120 (6)
Cost Recovery - Department of Transportation and Works	(1,796)	(1,796)		(3,592)		
Replace Power Line Carrier TL240 - Happy Valley - Churchill Falls		189	220	409	Oct. 07	B-100
Microwave Site Refurbishing - Bay d'Espoir Hill and Blue Grass Hill		407		407	Dec. 06	B-101
Replace Battery System - Multiple Sites		404		404	Dec. 06	B-103
Replace Remote Terminal Units - Various Sites		351		351	Dec. 06	B-105
West Coast Communications Study - Engineering Design		175		175	Dec. 06	B-107
Replace Telephone Isolation Equipment - Happy Valley		57		57	Dec. 06	B-109
Communications Network Technology		97		97	Dec. 06	B-110
Replace Vehicles - Various Locations		1,733		1,733	Aug. 06	B-112
Construct New Warehouse - Port Saunders		431		431	Oct. 06	B-114
Replace Storage Ramps - Bishop's Falls		159		159	Sep. 06	B-117
TOTAL GENERAL PROPERTIES	5,975	14,598	220	20,793		

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Island Pond Development - Feasibility Update
Location: Island Pond
Division: Production
Category: Generation - New Generation Source
Type: Other
Classification: Normal

Project Description:

The project consists of a review of the final feasibility level capital cost estimate to construct a hydroelectric facility at Island Pond within the existing Bay d'Espoir development area. Work consists of all office and field engineering including:

- a field investigation program to confirm material sources, evaluate structure subsurface conditions, and to confirm location and topographical data;
- a review of an alternative development scheme;
- preparation and assessment of quantities and unit prices;
- preparation of preliminary drawings;
- preparation of a detailed construction schedule; and,
- preparation of a definitive cost estimate complete with quantities and cost/cash flows.

The Island Pond development is a proposed 36 MW hydroelectric facility with average and firm annual energy capability of 203 GWh and 186 GWh respectively. A feasibility study was completed in the late 1980s and later reviewed in 1996.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	0.0	0.0	0.0	0.0
Labour	65.0	0.0	0.0	65.0
Consultant	750.0	0.0	0.0	750.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	101.5	0.0	0.0	101.5
Contingency	81.5	0.0	0.0	81.5
Total	<u>998.0</u>	<u>0.0</u>	<u>0.0</u>	<u>998.0</u>

Operating Experience:

Not applicable.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Island Pond Development - Feasibility Update (**cont'd.**)

Project Justification:

The Island Pond development is one of Hydro's most competitive alternatives to address future deficits in capacity and energy. A review of the current cost estimate based on additional field data, technology improvements and market conditions, is required to ensure the level of confidence needed prior to any decision to proceed with the project.

Based on a comparison of existing system capability and the most recent load forecast, Hydro expects deficits in capacity and energy to occur in the 2009 timeframe. In order to address these deficits, Hydro must be in a position to carry out appropriate planning analyses and have identified and advanced the engineering feasibility of alternative projects sufficiently to be able to meet forecast customer load requirements.

Future Plans:

The results of this review will be incorporated in future analysis directed at deciding the next source of generation for the Island Interconnected System.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Portland Creek Development - Final Feasibility Study
Location: Portland Creek
Division: Production
Category: Generation - New Generation Source
Type: Other
Classification: Normal

Project Description:

The study consists of all office and field engineering required to bring the Portland Creek hydroelectric development to a final engineering feasibility level of study. It includes:

- hydrological studies to establish plant size, average energy, firm energy, construction flood and design flood requirements;
- a review of aerial photos of the prospective site and related infrastructure;
- a field investigation program to confirm material sources, evaluate structure subsurface conditions, and to obtain all necessary location and topographical data;
- generation and review of alternative arrangements;
- preparation and assessment of quantities and cost estimates for various alternatives;
- preparation of preliminary drawings;
- preparation of a detailed construction schedule; and,
- preparation of a definitive cost estimate complete with quantities and cost/cash flows.

The Portland Creek Development is a proposed 12 MW hydroelectric facility with an average annual energy capability of 90 GWh. The project was last reviewed in a 1987 pre-feasibility report.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		0.0	0.0	0.0	0.0
Labour		100.0	0.0	0.0	100.0
Consultant		550.0	0.0	0.0	550.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		81.0	0.0	0.0	81.0
Contingency		65.0	0.0	0.0	65.0
Total		<u>796.0</u>	<u>0.0</u>	<u>0.0</u>	<u>796.0</u>

Operating Experience:

Not applicable.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Portland Creek Development - Final Feasibility Study (**cont'd.**)

Project Justification:

The Portland Creek hydroelectric development has the potential to be a competitive source of new generation capability to address future customer requirements. A final engineering feasibility study is required to identify, with sufficient confidence, the technical and capital cost parameters for the project such that it can be included in any analysis of alternatives to meet future load requirements.

Based on a comparison of existing system capability and the most recent load forecast, Hydro expects deficits in capacity and energy to occur in the 2009 timeframe. In order to address these deficits, Hydro must be in a position to carry out appropriate planning analyses and have identified and advanced the engineering feasibility of alternative projects sufficiently to be able to meet forecast customer load requirements.

Future Plans:

The results of this feasibility study will be incorporated in future analysis directed at deciding the next source of generation for the Island Interconnected System.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Wind Generation Inventory Study
Location: Island Interconnected System
Division: Production
Category: Generation - New Generation Source
Type: Other
Classification: Normal

Project Description:

The study consists of all office and field engineering required to identify and define a number of potential wind resource sites for development and supply of wind generation by Hydro to the Island Interconnect system. It includes:

- a review of Environment Canada's Canadian Wind Energy Atlas and other available information to identify potential sites for further investigation;
- a review of aerial photos of the prospective site and related infrastructure;
- a field investigation program to obtain all necessary location and topographic information; and,
- the erection of wind monitoring towers at two selected sites and the collection of at least a one year period of wind development related environmental data.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	0.0	0.0	0.0	0.0
Labour	11.0	5.0	0.0	16.0
Consultant	115.0	5.0	0.0	120.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	17.2	9.7	0.0	26.9
Contingency	<u>0.0</u>	<u>13.6</u>	<u>0.0</u>	<u>13.6</u>
Total	<u>143.2</u>	<u>33.3</u>	<u>0.0</u>	<u>176.5</u>

Operating Experience:

Not applicable.

Project Justification:

Wind generation has the potential to be a competitive source of new generation to address a portion of future generation requirements on the Island Interconnected system. An inventory study is required to identify and define a number of potential sites for wind generation developments such that they can be constructed by Hydro in order to provide direct experience with the technology and serve as an alternative generation supply.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Wind Generation Inventory Study (cont'd.)

Project Justification: (cont'd.)

Based on a comparison of existing system capability and the most recent load forecast, Hydro expects deficits in capacity and energy to occur in the 2009 timeframe. In order to address these deficits, Hydro must be in a position to carry out appropriate planning analyses and have identified and advanced the engineering feasibility of alternative projects sufficiently to be able to meet forecast customer load requirements.

Future Plans:

The results of this study will be incorporated in future analysis directed at deciding the next source of generation for the Island Interconnected system.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Upgrade Controls Spherical Valve No. 6
Location: Bay d'Espoir
Division: Production
Category: Generation - Hydro Plants
Type: Other
Classification: Normal

Project Description:

This project involves the upgrade of the control system for spherical valve No. 6 by replacing components, including control valves, piping, tubing and control panel. It is a continuation of a program started in 2001 to upgrade control systems on spherical valves at Bay d'Espoir. The Board has previously approved upgrades on five of the six systems at Bay d'Espoir Powerhouse No. 1. The new controls will have stainless steel mechanical components for corrosion protection and a programmable logic controller with manual over-rides.

In Hydro's 2005 Capital Budget Application, funds were requested to complete the upgrade on this unit. However, late in 2004 and early 2005 there were indications of a major problem with the maintenance seal on the adjacent Unit No. 5 which shares the same penstock. As this could have prevented maintenance on that unit because of the inability to provide adequate turbine isolation, it was decided to switch the upgrade for 2005 to that unit. The spherical valve on Unit No. 5 would have been the last unit in powerhouse No. 1 requiring the upgrade and would have normally been proposed for an upgrade in 2006 as part of the ongoing replacement program.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		100.0	0.0	0.0	100.0
Labour		61.7	0.0	0.0	61.7
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		1.5	0.0	0.0	1.5
O/H, AFUDC & Escalation		20.0	0.0	0.0	20.0
Contingency		16.3	0.0	0.0	16.3
Total		<u>199.5</u>	<u>0.0</u>	<u>0.0</u>	<u>199.5</u>

Operating Experience:

Bay d'Espoir unit No. 6 along with the existing spherical valve and control became operational in January 1972. This generating unit typically operates for 5,500 hours each year. In the last five years there have been 34 maintenance events for this control system, which is much higher than expected for this type of system. Control systems on unit Nos. 1, 2, 3, 4, and 5 have been upgraded since 2001.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Upgrade Controls Spherical Valve No. 6 **(cont'd.)**

Project Justification:

The control system for spherical valve No. 6 is obsolete and unreliable. Replacement parts have to be reverse engineered and custom made. The spherical valve is the main valve allowing water flow to the turbine. The failure of the existing control system can result in the following events:

- a) Single unit outage (75 MW) due to spherical valve not opening, with loss of generation and an extended outage;
- b) Outage of two units (150 MW) on the same penstock and potential damage to the unit if the spherical valve stays open during a unit runaway condition forcing a head gate closure; and,
- c) Loss of all six units (450 MW) in powerhouse No.1 if the spherical valve or seals fail while the turbine access door is open for maintenance resulting in the flooding of powerhouse No. 1, with the potential for the loss of life.

Depending on the time of year when a failure occurs, replacement capacity and energy, if available, would have to be obtained through increased thermal production at Holyrood or gas turbine sites at significantly higher cost. As well, a lengthy outage would increase the risk of spill during high inflow periods. The cost of replacement energy from Holyrood arising from an outage of two units (150 MW) is \$184,000/day assuming fuel at \$32.20 per barrel. It would be unacceptable to maintain the status quo and risk the loss of capacity given the significance of this generation capacity to the overall system.

Future Plans:

This is the last unit in Bay d'Espoir Powerhouse No. 1 requiring this upgrade. Unit No. 7 at Bay d'Espoir does not have a spherical valve.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Underground Fuel Tank - Cat Arm Powerhouse
Location: Cat Arm
Division: Production
Category: Generation - Hydro Plants
Type: Other
Classification: Mandatory

Project Description:

This project involves the removal and disposal of an underground fiberglass bulk storage fuel tank (31,780 litre) at the Cat Arm Powerhouse and the design, supply and installation of an above-ground, double wall steel fuel tank of the same size complete with all necessary site work including: foundation, piping, fuel monitoring system and instrumentation.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		40.0	0.0	0.0	40.0
Labour		71.7	0.0	0.0	71.7
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		13.9	0.0	0.0	13.9
Contingency		11.1	0.0	0.0	11.1
Total		136.7	0.0	0.0	136.7

Operating Experience:

The existing fiberglass underground storage tank was installed in 1984 as part of the original construction of the Cat Arm project. The tank has been in continuous service without significant maintenance work performed since it was installed.

Project Justification:

The existing bulk storage fuel tank is a single wall, fiberglass, underground tank. Neither the tank, nor the piping system has secondary containment or leak detection measures. The system is in contravention of the current Canadian Council of Ministers of the Environment (CCME) environmental code of practice for underground storage tank systems containing petroleum products and allied petroleum products, and the Provincial Gasoline and Associated Products (GAP) Regulations. As well, there is no means of quantifying the amount of fuel used by the diesel generator, for fuel reconciliation purposes as required by the provincial GAP Regulations.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Underground Fuel Tank - Cat Arm Powerhouse (cont'd.)

Project Justification: (cont'd.)

To ensure that this project will be completed at the least possible cost, Newfoundland and Labrador Hydro will solicit competitive bids for all material and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Remote Operation of Fisheries Compensation By-Pass Valve
Location: Granite Canal
Division: Production
Category: Generation - Hydro Plants
Type: Other
Classification: Justifiable

Project Description:

This project consists of motorizing the existing fisheries compensation by-pass valve and providing the Energy Control Centre (ECC) with the ability to adjust the valve's opening remotely, in order to quickly respond to changing conditions. As the bypass structure presently has remotely operated, motorized bypass gates, the electrical and communications infrastructure currently available at the site will be utilized.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		12.3	0.0	0.0	12.3
Labour		62.4	0.0	0.0	62.4
Consultant		2.5	0.0	0.0	2.5
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		10.8	0.0	0.0	10.8
O/H, AFUDC & Escalation		9.9	0.0	0.0	9.9
Contingency		8.9	0.0	0.0	8.9
Total		<u>106.8</u>	<u>0.0</u>	<u>0.0</u>	<u>106.8</u>

Operating Experience:

The environmental approval for the Granite Canal development established specific fisheries habitat management requirements. The Fisheries compensation valve located at the bypass structure is used to maintain fish habitat at Granite Canal. One requirement stipulates that an average monthly flow be maintained within the man made spawning and rearing channel called Compensation Creek. To ensure adequate year-round flow, natural inflows to the creek are supplemented from water otherwise used for hydraulic production. The supplemental volumes are dependent on creek flow requirements, which change six times per year, and natural inflows which change daily. At present, the method for managing these changing requirements is to identify when personnel will be at the remote site and to have adjustments manually made in anticipation of future flow requirements.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Remote Operation of Fisheries Compensation By-Pass Valve
(cont'd.)

Operating Experience: (cont'd.)

The Granite Canal site is remote and not regularly staffed. It has generally not been possible to have the valve's opening adjusted often in an attempt to react to changing environmental conditions. There may, at times, be a two-week period between scheduled staff availability. As a result, there is a tendency for the creek to be over compensated to avoid being in violation of the agreed compensation levels and water is lost for energy production.

Project Justification:

During 2004, approximately 27.5 Mm³ of water was contributed to compensate the creek, while an analysis indicated that 23.7 Mm³ would have been adequate. This lost hydroelectric production is the equivalent of approximately 567 barrels of fuel at Holyrood which would cost approximately \$18,000, based on the current fuel cost projection of \$32.20/bbl for 2006. The project is estimated to provide a net benefit of \$99,554 over 15 years and project costs are fully recovered in seven years (see attached Cost Benefit Analysis). To ensure that this project will be completed at the least possible cost, Newfoundland and Labrador Hydro will solicit competitive bids for all material and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

PROJECT COST / BENEFIT ANALYSIS

Granite Canal Fisheries Compensation Valve

Note: Costs are shown as positive values; Benefits as negative values

Current Year	2005
Present Worth Year	2006
Number of Years in Study	15
Discount Rate	8.4%
Total In-service Project Cost	\$ 106,800
In-service Year	2006
Other Project Cost <i>after</i> In-service (if applicable)	\$ -
Other Project Year (if applicable)	
Replacement Cost (if applicable)	\$ -
Replacement Year (if applicable)	
Project cost in Ending (E) or Beginning (B) Year	E
O&M costs - 75% Materials, 25% Labour (75) or 50% Materials, 50% Labour (50) or User (U)	50

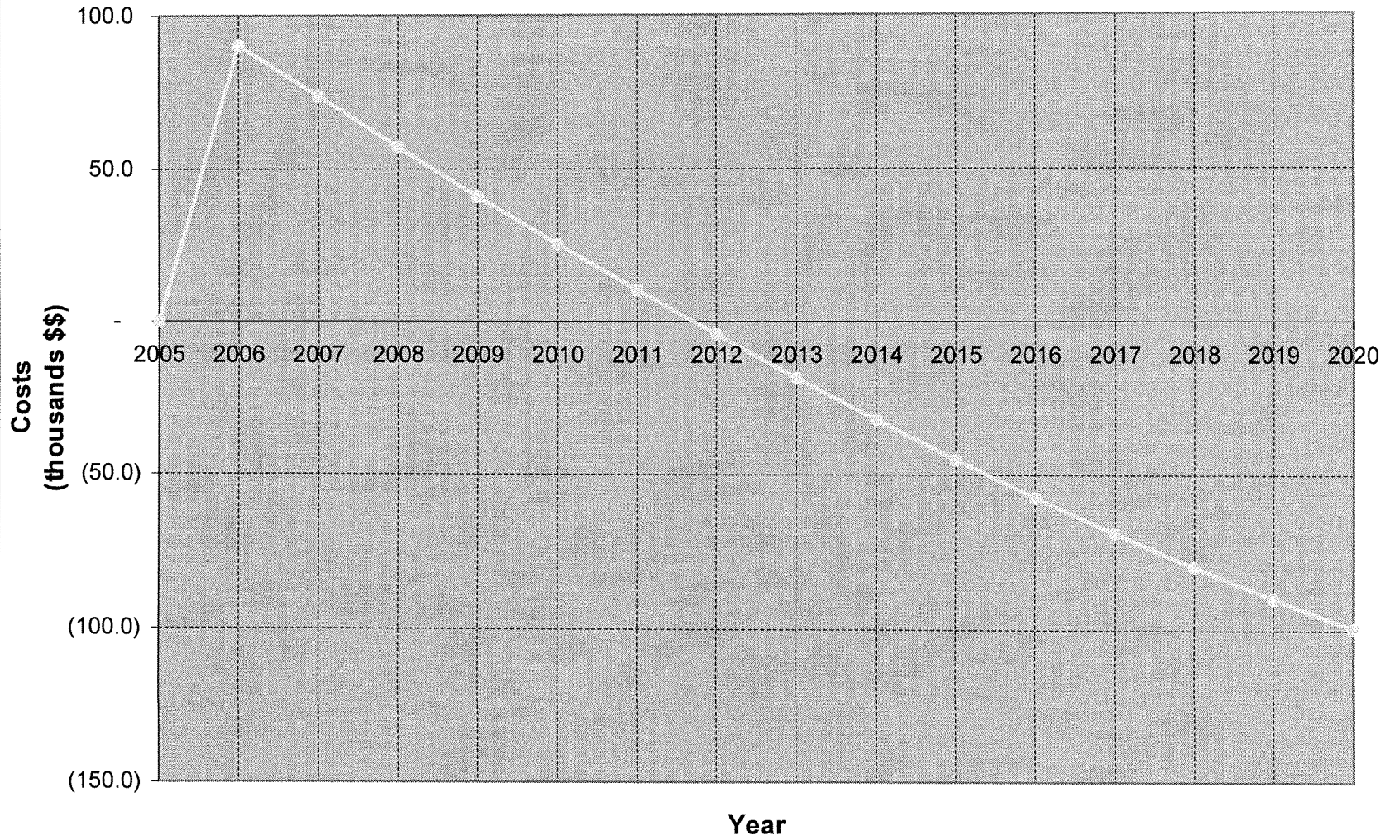
A	B	C	D	E	F	G	H	I	J	K
Year	Fuel Series \$/bbl	Annual O&M Cost \$	Annual Fuel Cost \$	Other Cost \$	Total Costs \$	Fuel Savings \$	Benefit 2 (specify) \$	NET \$	P.W. January 2006	Cumulative Present Worth
0	2005	-	-	-	-	-	-	-	-	-
1	2006	32.20	102	-	106,902	(9,129)	-	97,773	90,197	90,197
2	2007	34.15	208	-	208	(19,363)	-	(19,155)	(16,301)	73,896
3	2008	38.10	212	-	212	(21,603)	-	(21,390)	(16,793)	57,103
4	2009	39.90	217	-	217	(22,623)	-	(22,406)	(16,227)	40,875
5	2010	41.40	222	-	222	(23,474)	-	(23,252)	(15,535)	25,340
6	2011	43.80	227	-	227	(24,835)	-	(24,608)	(15,167)	10,173
7	2012	45.80	232	-	232	(25,969)	-	(25,737)	(14,634)	(4,460)
8	2013	47.83	237	-	237	(27,120)	-	(26,883)	(14,101)	(18,561)
9	2014	49.85	242	-	242	(28,265)	-	(28,023)	(13,560)	(32,121)
10	2015	51.80	247	-	247	(29,371)	-	(29,123)	(13,000)	(45,121)
11	2016	52.88	253	-	253	(29,983)	-	(29,730)	(12,243)	(57,363)
12	2017	53.95	259	-	259	(30,590)	-	(30,331)	(11,522)	(68,886)
13	2018	55.05	264	-	264	(31,213)	-	(30,949)	(10,846)	(79,731)
14	2019	56.18	270	-	270	(31,854)	-	(31,584)	(10,211)	(89,942)
15	2020	57.33	277	-	277	(32,506)	-	(32,229)	(9,612)	(99,554)
					-			-	-	-
					-			-	-	-
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					-			-	-	-

ASSUMPTIONS:

- * Fuel Series used is Thermal Fuel Price Forecast of 10-May-05
- * Granite Canal hydraulic conversion rate is 0.094 GWh/MCM
- * Holyrood thermal efficiency is 630 kWh/bbl

2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS

Cumulative Net Present Value Granite Canal Fisheries Compensation Valve



2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Install Waste Oil Holding Tanks
Location: Bay d'Espoir, Upper Salmon, Hinds Lake and Paradise River
Division: Production
Category: Generation - Hydro Plants
Type: Pooled
Classification: Mandatory

Project Description:

This project involves purchase and installation of five waste oil storage tanks at various Hydro plants. Each tank shall be equipped with the necessary instrumentation and protection devices to ensure compliance with the Newfoundland and Labrador Regulation 82/02 - Used Oil Control Regulations and all currently applicable regulations and standards including: National Fire Code (NFC), Underwriters Laboratory Canada ULC/ORD C142.22 - latest revision, Underwriters Laboratory Canada UL 142, CAN4-630-M84 and/or CAN4-601-M84.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		51.4	0.0	0.0	51.4
Labour		15.3	0.0	0.0	15.3
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		9.0	0.0	0.0	9.0
Contingency		6.7	0.0	0.0	6.7
Total		<u>82.4</u>	<u>0.0</u>	<u>0.0</u>	<u>82.4</u>

Operating Experience:

Used oil at Hydro's generation facilities is currently stored in 205 litre drums until such time as it can be collected by an approved disposal contractor.

Project Justification:

As the current waste oil storage practice is not compliant with the Newfoundland and Labrador Regulation 82/02 - Used Oil Control Regulations under the Environmental Protection Act (O.C. 2002-430), an appropriate method for storage must be made available at these locations.

To ensure that this project will be completed at the least possible cost, Newfoundland and Labrador Hydro will solicit competitive bids for all material and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Superheater - Unit No. 2
Location: Holyrood Generating Station
Division: Production
Category: Generation - Thermal Plant
Type: Other
Classification: Mandatory

Project Description:

This project consists of the removal and replacement of 31 upper secondary superheater elements within the high temperature superheater of the boiler on Unit No. 2 at the Holyrood Generating Plant.

Project Cost: (\$ x1,000)	2006	2007	Beyond	Total
Material Supply	0.0	0.0	0.0	0.0
Labour	20.0	80.0	0.0	100.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	265.0	2,145.0	0.0	2,410.0
Other Direct Costs	0.0	0.0	0.0	0.0
Corp O/H, AFUDC, Esc.	33.7	341.9	0.0	375.6
Contingency	<u>0.0</u>	<u>251.0</u>	<u>0.0</u>	<u>251.0</u>
Total	<u>318.7</u>	<u>2,817.9</u>	<u>0.0</u>	<u>3,136.6</u>

Operating Experience:

Unit No. 2 at Holyrood was placed in service in 1969. The normally accepted design life for thermal power plant boilers and their components is 30 years and it is normal for tube leaks to begin to occur after approximately 15 years of service. Although this boiler is now over 30 years old, because of the relatively low annual operating factor at Holyrood particularly in the early years, its effective operating age is considered to be about 17 years. The superheater consists of two sections (primary and secondary) and is used to raise the temperature of saturated steam to higher temperature in order to transport more energy to the turbine. Steam conditions leaving the secondary superheater are 1950 psi and 1005°F. The secondary superheater is exposed to the hottest gases exiting the furnace, at 2400°F.

The operation of the high temperature superheater has been reliable until recently. Tube leaks requiring outages to effect repairs have occurred in November 2002, April 2004, November 2004 (two failures), February 2005 and April 2005.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Superheater - Unit No. 2 (cont'd.)

Project Justification:

Holyrood Unit No. 2 with an installed capacity of 175 MW is a significant portion of Hydro's generation capacity and must be maintained to ensure system reliability and capability. The frequency of repairs to this section of the superheater has increased dramatically in recent years. Since 2004-04-01, five failures have occurred, removing the unit from service for approximately five days each time. The total cost to repair a single failure is approximately \$25,000, although it can be much greater if the failure occurs in an area which is difficult to access. Tube wall thickness has deteriorated to below that required by the Province's Boiler and Pressure Vessel Act (which uses the internationally recognized ASME Boiler and Pressure Vessel Code as its design standard). In the fall of 2004, 11 of the 31 platens in the upper section and five of the 31 platens in the lower section were surveyed and found to be below the thickness required by Code. Many locations were found where the tube thickness is less than the 80% that is required under the Boiler and Pressure Vessel Code. When a tube failure occurs, the boiler must be immediately shut down due to the high rate of water loss. The repair time varies depending on the extent of damage caused by the burst tube. If these superheater platens are not replaced, the frequency of tube failures will increase and boiler reliability will suffer significantly, compromising Hydro's ability to service its customers. The attached photos illustrate the damage.

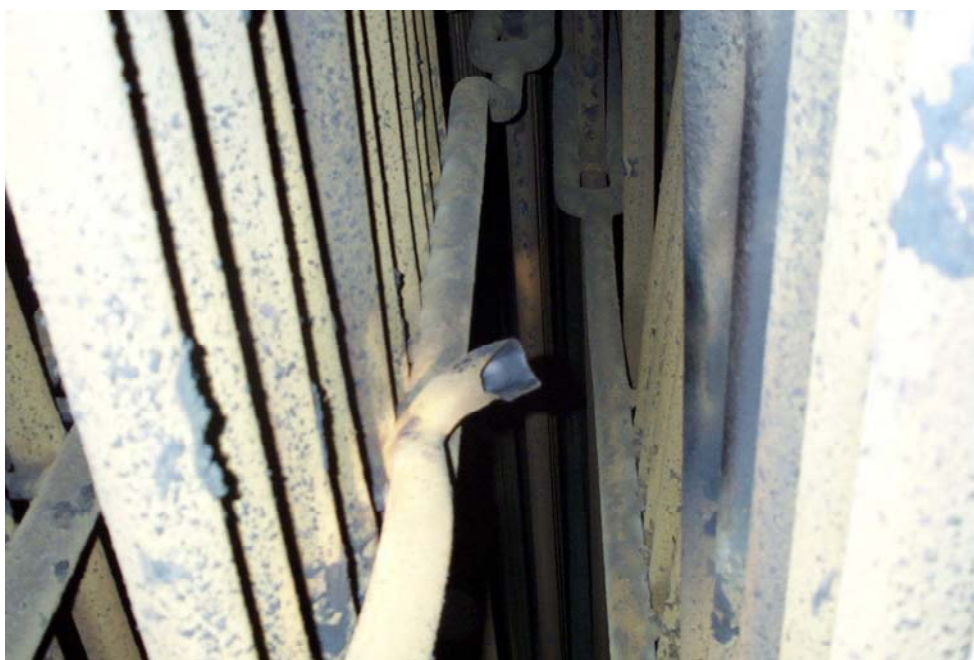
Future Plans:

None.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**



Failed superheater tube 2005-02-05



Failed superheater tube 2005-04-05

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Fire Protection Upgrade
Location: Holyrood Generating Station
Division: Production
Category: Generation - Thermal Plant
Type: Other
Classification: Normal

Project Description:

This project includes a number of measures to address fire protection issues as identified by Hydro's insurance company, Factory Mutual Global and Hydro's operating personnel. The scope of work includes the following:

1. Extend automatic sprinkler systems to provide coverage to many areas presently not covered and increase concentration in other areas. This will affect 18 individual sprinkler areas;
2. Construct metal enclosures around equipment that can potentially create an ignited oilspray situation. The purpose is to contain an oil spray and associated torch type fire inside the enclosure where it can be deluged with water. A total of 10 enclosures will be required;
3. Install fire resistant boots on flanged and threaded pipe joints that contain mineral oil at pressures above 50 psig where it is not practical to install metal enclosures as noted in item 2 above;
4. For each of units 1, 2 and 3, relocate the hydrogen and carbon dioxide manual valve stations, presently located below the generators, to an area immediately outside the operator's control room. In the event of a plant emergency requiring a quick release of the explosive hydrogen gas from the generators this modification will allow a more rapid response by operating personnel; and,
5. Engage a consultant specialized in preparing such programs for thermal generating plants, to prepare procedures and comprehensive training program for operators in responding to a large fire emergency.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		0.0	0.0	0.0	0.0
Labour		100.5	82.5	0.0	183.0
Consultant		0.0	75.0	0.0	75.0
Contract Work		720.0	444.0	0.0	1,164.0
Other Direct Costs		0.0	0.0	0.0	0.0
Corp O/H, AFUDC, Esc.		95.6	186.5	0.0	282.1
Contingency		0.0	142.2	0.0	142.2
Total		916.1	930.2	0.0	1,846.3

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Fire Protection Upgrade (cont'd.)

Operating Experience:

The construction of Stage 1 and 2 of the Holyrood Thermal Generating Station commenced in 1967 and 1977 respectively. The fire protection sprinkler systems designed and installed at that time do not meet current standards.

To date, the Holyrood plant has not experienced a fire which would have resulted in a large equipment/building or associated production loss. Good operating procedures have contributed to this record, however, key areas of exposure have been identified which, under the right circumstances, could quickly escalate into a large-scale loss without additional automatic suppression and containment systems. Laboratory tests conducted at FM Global research facilities in 2004 highlight the difficulty in containing and extinguishing fires fueled by pressurized mineral oils.

Project Justification:

The Holyrood Generating facility with a capacity of 466 MW is a significant portion of Hydro's generation capability. In recent years, Hydro's insurance company (FM Global) has identified areas of significant exposure while performing regular plant inspections.

Until recently, methods for mitigating some types of exposures have not been clearly documented by recognized industry standards. Such is the case related to fires emanating from pressurized mineral oil sprays. In 2004, FM Global performed large-scale mock-up demonstrations at its research facility concerning oil fires which clearly show the difficulty in containing oil fires in turbine halls. Subsequently, an engineering bulletin of recommendations, including more detailed construction guidelines, was issued by FM Global for managing this risk.

Please refer to the report titled "Holyrood Generating Station, Fire Protection Upgrade Assessment in Section H, Tab 1.

This proposal will address the identified safety concerns for operating personnel and limit the potential damage to plant equipment and the potential for extended outage to customers which, depending on the extent of damage, can range from months to years.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Warm Air Make-Up Steam Coil
Location: Holyrood Generating Station
Division: Production
Category: Generation - Thermal Plant
Type: Other
Classification: Normal

Project Description:

This project consists of the replacement of 13 copper/nickel alloy steam coil sections of the existing Warm Air Make-Up system with stainless steel coil sections.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		378.0	0.0	0.0	378.0
Labour		35.0	0.0	0.0	35.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		79.0	0.0	0.0	79.0
Other Direct Costs		0.0	0.0	0.0	0.0
Corp O/H, AFUDC, Esc.		60.5	0.0	0.0	60.5
Contingency		<u>49.2</u>	<u>0.0</u>	<u>0.0</u>	<u>49.2</u>
Total		<u>601.7</u>	<u>0.0</u>	<u>0.0</u>	<u>601.7</u>

Operating Experience:

The Warm Air Make-Up system was installed in 1990 to address safety and health concerns with regards to improving plant ventilation and satisfy operating unit combustion air requirements. Make-up air handling units supply 100% of the boiler house and turbine hall ventilation requirements. Each of the make-up air handling units contain two copper/nickel alloy steam coil sections. These units have regularly experienced tube leaks in the steam coil sections in recent years mainly due to freezing of steam condensate in the tubes. Additionally, some of the tubes have been subjected to attack by high pH ammoniated condensate.

Project Justification:

An investigation has shown that the tubes in the steam coil sections have been subjected to freezing and corrosive attack from pH ammoniated condensate. At present, only one steam coil has not experienced a tube failure and on average 27% of the tubes in each steam coil have failed and have been removed from service. This loss of tubes has significantly reduced the heating and ventilation capacity of the system and coils must be replaced to ensure adequate ventilation of the

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Warm Air Make-Up Steam Coil (**cont'd.**)

Project Justification: (cont'd.)

powerhouse, to protect the health of personnel. As well, there are safety concerns were tubes to rupture in a confined space in the presence of operating/maintenance personnel. The attached photos illustrate the condition of the steam coils.

Future Plans:

None.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Warm Air Make-Up Steam Coil (**cont'd.**)



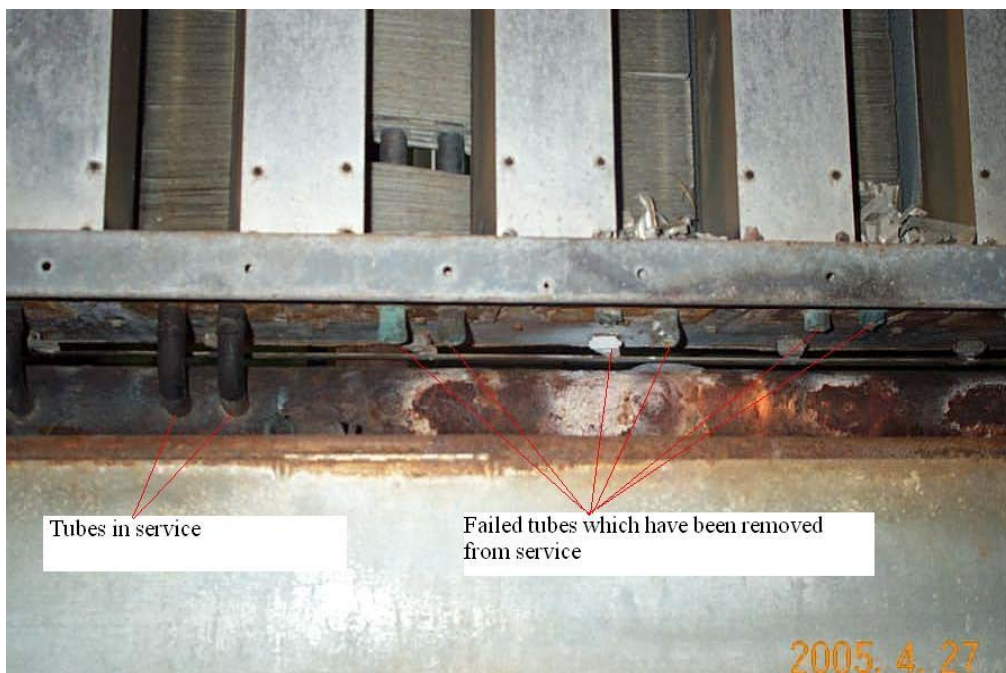
Steam coil with one ruptured tube removed and its connection capped

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Warm Air Make-Up Steam Coil (cont'd.)



Ruptured steam tube



Steam coil section with failed tubes

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: HVAC Replacements - Relay, Control and Exciter Rooms
Location: Holyrood Generating Station
Division: Production
Category: Generation - Thermal Plant
Type: Other
Classification: Normal

Project Description:

This project involves the replacement of five heating and ventilation units which serve the generating unit relay and exciter rooms and the plant control room. All but the exciter room unit will be replaced with units of similar capacity. The exciter room unit will be replaced with a unit of 50% greater capacity. This project will include the removal and disposal of the existing units in accordance with provincial environmental regulations and the supply and installation of replacement units with associated mechanical, electrical and civil work as required.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	230.0	0.0	0.0	230.0
Labour	84.5	0.0	0.0	84.5
Consultant	0.0	0.0	0.0	0.0
Contract Work	145.0	0.0	0.0	145.0
Other Direct Costs	0.0	0.0	0.0	0.0
Corp O/H, AFUDC, Esc.	59.9	0.0	0.0	59.9
Contingency	46.0	0.0	0.0	46.0
Total	<u>565.4</u>	<u>0.0</u>	<u>0.0</u>	<u>565.4</u>

Operating Experience:

Stage 1 and 2 of the Holyrood Thermal Generating Station commenced in 1967 and 1977 respectively. When the construction took place, heating and cooling equipment was installed in various areas to maintain proper environmental conditions for the production equipment and also for the operating personnel working in these areas. Over the years, some of the plant's HVAC units have been replaced at the end of their service lives. However, five units serving the relay rooms, operator's control room, and the exciter room are the original units and are now in excess of 25 years old. They are well beyond the manufacturer's recommendation for reliable life expectancy.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: HVAC Replacements - Relay, Control and Exciter Rooms (cont'd.)

Operating Experience: (cont'd.)

The existing HVAC units have met cooling demand to this point in time however maintenance issues are arising with increasing frequency. Issues in recent years include: internal controls failure, refrigerant leaks, coil leaks requiring soldering, vibration problems, compressor failure and condenser high-pressure cutout.

Additional electrical equipment has been added to the exciter room since the original construction period thereby increasing the cooling load of this room resulting in the existing HVAC unit occasionally failing to maintain the appropriate temperature. On occasion, temporary fans have had to be installed to flush air through the room to reduce temperatures.

Project Justification:

HVAC units are required to maintain proper environmental conditions inside the relay rooms, operator's control room, and exciter room. This is required to prevent overheating of critical protection and control equipment housed inside these areas which would result in component failure and disruption to power generation.

The HVAC units proposed for replacement are the original units installed with the plant and have exceeded their expected service life. They were manufactured by three different companies, two of which are no longer in business and the third has not made parts for the models at Holyrood for a number of years. A condition report prepared in 2004 by Hydro's HVAC service contractor, Black & McDonald (see attached), notes that all units are operating well beyond their life expectancy and are not reliable.

All of the HVAC units in question operate using a refrigerant R-22 which is discontinued due to environmental concerns and Federal regulations have required that production of this refrigerant be phased out commencing in 2004.

Should a failure occur to a critical generator unit protection or control component, it would likely result in an extended customer outage as these generating units provide 140 MW to 165 MW of capacity to the system. An emergency replacement of the HVAC will take three to four months to install and subject the plant and the power systems to the potential for major outages in the interim.

Future Plans:

None.

EXPLANATIONS

19 A Dundee Ave.
Mt. Pearl, NL
A1N 4R6

Newfoundland And Labrador Hydro
P. O. Box 12400
St. John's, NL
A1B 4K7

April 28, 2005

Att: Nelson Seymour

As per your request, here is a report on the following A/C units at Holyrood .

HVAC Unit Serving Exciter Rm:

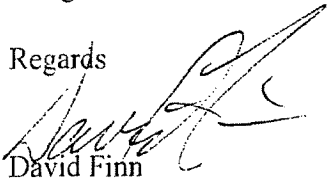
- Unit is approx. 25 to 30 years old.
- The life expectancy is 12 to 15 years according to manufacturer.
- Unit has had a high volume of repairs in the past and it is anticipated that this will continue in the future. The unit is no longer considered to be reliable.
- The capacity for cooling is too small as additional equipment has been added to this room since the A/C unit was originally installed.
- The unit has water-cooled condensers that are located in critical areas near electrical equipment. This is a poor arrangement as a water leak could damage electrical equipment.
- Energy consumption of the old unit is excessive compared to newer ones.

HVAC Units (Four) Serving Relay Rooms 1 & 2:

- Unit is approx. 25 to 30 years old.
- The life expectancy is 12 to 15 years according to manufacturer.
- Unit has had a high volume of repairs in the past and it is anticipated that this will continue in the future. The unit is no longer considered to be reliable.
- The unit has water-cooled condensers that are located in critical areas near electrical equipment. This is a poor arrangement as a water leak could damage electrical equipment.
- Energy consumption of the old units is excessive compared to newer ones.

All of the existing air conditioning units above operate using refrigerant R 22 which is not environmentally friendly. Federal regulations required that production of this refrigerant be phased out commencing in 2004. It is recommended that your old existing A/C units be replaced with new ones operating on an approved environmentally friendly refrigerant.

Regards



David Finn
Service Division

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Study of Regeneration Waste Treatment
Location: Holyrood
Division: Production
Category: Generation - Thermal Plant
Type: Other
Classification: Mandatory

Project Description:

This project consists of a feasibility study to identify the most appropriate manner to treat the regeneration waste streams in order to satisfy the requirements of the Province's water and sewer regulations. The study will include: reviewing the operation of the existing wastewater treatment plant; investigating possible treatment methods for polisher and water deionization wastes; performing a laboratory bench scale investigation of potentially viable treatment methods; and preparing preliminary capital cost estimates for selected alternatives.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	0.0	0.0	0.0	0.0
Labour	26.0	0.0	0.0	26.0
Consultant	116.0	0.0	0.0	116.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	10.0	0.0	0.0	10.0
O/H, AFUDC & Escalation	5.0	0.0	0.0	5.0
Contingency	<u>15.2</u>	<u>0.0</u>	<u>0.0</u>	<u>15.2</u>
Total	<u>172.2</u>	<u>0.0</u>	<u>0.0</u>	<u>172.2</u>

Operating Experience:

During each operating season, the Holyrood plant performs many regenerations of the water treatment plant deionization and condensate polisher trains resulting in a discharge of large volumes of contaminated water into Conception Bay.

Project Justification:

In 2003, Hydro initiated a study to review the regeneration wastewater streams at Holyrood to identify the chemical composition at various points during the regeneration process. Water samples were collected during a number of condensate polisher and water treatment train regenerations and

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Study of Regeneration Waste Treatment (**cont'd.**)

Project Justification: (cont'd.)

were analyzed. These wastewater streams are currently discharged directly to the environment without any sort of treatment. Discharges resulting from these processes are estimated in excess of 3.4 million US gal/year. The waste streams vary from acidic to basic and contain suspended solids and chemicals, including ammonia, contravening the Province's Environmental Legislation (Regulation 65/03 Environmental Control Water and Sewage Regulations, 2003 - Water Resources Act O.C. 2003-231). Hydro has been able to continue to operate in this manner because of provisional approval provided by the Provincial and Federal Environmental Departments which permitted discharge of regeneration wastes into seal pits as long as at least one cooling water pump was operating and providing diluting flow. This study is being pursued to identify means to comply with regulations and to mitigate the plant's impact on the local environment.

Future Plans:

Following the completion of this study, Hydro will prepare a capital budget proposal and seek approval for the construction of a treatment facility.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Modify Boiler Protection and Control
Location: Holyrood
Division: Production
Category: Generation - Thermal Plant
Type: Other
Classification: Normal

Project Description:

This project consists of a review of the drum level instrumentation on the three units at Holyrood to determine the appropriate transmitter locations, the instruments to be used, and the appropriate trip level values. As well, the current 3-element drum level control will be changed to a 4-element control with the addition of drum pressure and a modification will be made to the steam flow calculation to correct steam flow for any changes in throttle conditions. The proposal includes the installation of extension piping on the lower level connections on Unit No. 3 to eliminate any effect from the economizer water discharge. The piping would be extended along the drum length towards the drum centre.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	2.0	0.0	0.0	2.0
Labour	50.0	0.0	0.0	50.0
Consultant	43.0	0.0	0.0	43.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	12.1	0.0	0.0	12.1
Contingency	<u>9.5</u>	<u>0.0</u>	<u>0.0</u>	<u>9.5</u>
Total	<u>116.6</u>	<u>0.0</u>	<u>0.0</u>	<u>116.6</u>

Operating Experience:

Boiler controls on the three units have been modified over the years consistent with changes made to the distributed control systems and as needed to correct problems. Over the past five years, there have been eight drum level trips which resulted in system underfrequency events.

A review was undertaken of the boiler/turbine protection on the three units at Holyrood and changes were identified for the drum level instrumentation, the drum level control and the steam flow calculation for all three boilers.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Modify Boiler Protection and Control (**cont'd.**)

Project Justification:

The proposed modifications are consistent with current modern utility practices and will increase the stability of the boiler during system upsets and should reduce unnecessary drum level trips. The loss of a Holyrood unit at 140 - 165 MW will always result in an underfrequency event. This project will contribute to fewer unit trips and therefore fewer under-frequency load-shedding incidents.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replacement of Paging System
Location: Holyrood Generating Station
Division: Production
Category: Generation - Thermal Plant
Type: Other
Classification: Mandatory

Project Description:

This project consists of the replacement of the paging system at the Holyrood Generating Station. The new paging system will extend coverage to plant out buildings, waste water treatment plant, pump houses, warehouse, training centre, pipe shop, chemical storage building, tank farm and the marine terminal. The system will also permit paging using the existing office telephones which will facilitate future expansion, when required.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	170.0	0.0	0.0	170.0
Labour	10.0	0.0	0.0	10.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	42.4	0.0	0.0	42.4
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	29.9	0.0	0.0	29.9
Contingency	<u>22.2</u>	<u>0.0</u>	<u>0.0</u>	<u>22.2</u>
Total	<u>274.5</u>	<u>0.0</u>	<u>0.0</u>	<u>274.5</u>

Operating Experience:

The current paging system at the Holyrood Generation Station was part of the original installation in 1970 and now is 35 years old and has reached the end of its useful life and is obsolete. The system has poor sound quality and is not able to support desired expanded functionality either in features or extended area coverage. A recent event illustrates the concerns. On July 6, 2005 a turbocharger failure on the 400 kW emergency diesel generator resulted in exhaust gas being discharged inside the powerhouse resulting in an emergency evacuation of all employees. As it looked to employees that the smoke had cleared from the lower elevations of the building and because clear and audible update instructions could not be understood in the evacuation/roll call locations, a number of employees re-entered the evacuated areas after what they had believed to be adequate time for the emergency to have been dealt with, despite communication to the contrary by operating personnel dealing with the emergency. However, this information was not received due to the inadequacy of the current paging system.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replacement of Paging System (cont'd.)

Project Justification:

The Holyrood paging system is used to page staff, and warn of potential dangerous situations. The current system cannot easily be extended to cover certain areas of the facilities out buildings. Additionally parts have deteriorated and replacement availability has been an issue with some being unavailable and obsolete.

The Holyrood paging system is the primary communications link for emergency protocols for the plant's Emergency Response Program (ERP) which covers fire, first aid, confined space rescue, marine oil spills and controlled substance spills. This system is considered critical for personnel safety and protection of the plant assets. The current system has very poor sound quality, messages are often missed and are generally difficult to discern, many of the speakers and feeds are in need of continual repair, which results in higher maintenance costs. The lack of parts and the presence of a number of areas with poor or no coverage has been identified as a safety concern.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Automatic Voltage Regulator
Location: Hardwoods Gas Turbine
Division: Production
Category: Generation - Gas Turbine
Type: Other
Classification: Normal

Project Description:

This project consists of the replacement of the original Automatic Voltage Regulator (AVR) at the Hardwoods Gas Turbine. The project will be completed by internal forces.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	145.0	0.0	0.0	145.0
Labour	49.0	0.0	0.0	49.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	2.0	0.0	0.0	2.0
O/H, AFUDC & Escalation	25.9	0.0	0.0	25.9
Contingency	19.6	0.0	0.0	19.6
Total	<u>241.5</u>	<u>0.0</u>	<u>0.0</u>	<u>241.5</u>

Operating Experience:

The 50 MW Hardwoods Gas Turbine is over 30 years old. Over the past five years, the unit has operated an average of 1722 hours providing voltage support and 27.6 hours providing generation. Problems have been experienced with the AVR, the latest occurred in 2004. Hydro has not been able to obtain technical support or locate spare parts in a timely manner as the manufacturer no longer supports the product.

Project Justification:

The existing AVR is over 30 years old and problems have been experienced. The manufacturer no longer makes replacement parts or supports the product. The AVR needs to be replaced before a major component failure renders it irreparable and results in an extended outage until a new unit is installed. This gas turbine serves as a peaking unit and provides voltage support and emergency supply to the eastern transmission system. Its loss could affect transmission and generation maintenance planning, ability to serve customers over peak and to provide critical voltage support to the eastern network.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Wood Pole Line Management
Location: Various Sites
Division: Transmission & Rural Operations
Category: Transmission
Type: Pooled
Classification: Normal

Project Description:

The project is the second year of an ongoing program of inspection, treatment and replacement of line components (poles, conductor and hardware) on Hydro's transmission system.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		295.0	0.0	0.0	295.0
Labour		1,236.0	0.0	0.0	1,236.0
Consultant		50.0	0.0	0.0	50.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		326.0	0.0	0.0	326.0
O/H, AFUDC & Escalation		204.9	0.0	0.0	204.9
Contingency		190.7	0.0	0.0	190.7
Total		<u>2,302.6</u>	<u>0.0</u>	<u>0.0</u>	<u>2,302.6</u>

Operating Experience:

Hydro operates approximately 2800 km (26,000 poles) of wood pole transmission lines operating at 69, 138 and 230 kV. Historically, Hydro's pole inspection and maintenance practices followed the traditional utility approach of sounding inspections, only. In 1998, Hydro decided to take core samples on selected poles to test for preservative retention levels and pole decay. The results of these additional tests raised concerns regarding the general preservative retention levels in wood poles. Between 1998 and 2003, additional coring and preservative testing confirmed that there were a significant number of poles which had a preservative level below what was required to maintain the design criteria for the lines. During this period, certain poles were replaced because the preservative level had lowered to the point that decay had advanced and the pole was no longer structurally sound. These inspections and analysis confirmed that a more formal wood pole line management program was required.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Wood Pole Line Management (cont'd.)

Project Justification:

A report titled "Wood Pole Line Management Using RCM Principles" was filed with Hydro's 2005 Capital Budget Application under Section G: Appendix 2. This report recommended that a formal program be established to manage wood pole line assets. The program consists of visual inspection, non-destructive testing and selected treatment of the wood poles. Poles that are deteriorated beyond the point where treatment could extend the life are identified for replacement. Field data is collected and stored electronically, and a comprehensive database of the program results is maintained. The program will extend the life of the wood pole assets by an average of ten years with a net benefit of \$4.5 million in deferred replacement costs over that same period.

An Executive Summary Report is included in Section H, Tab 2, of the Application which provides an update of the 2004 program, a progress report of 2005 work and a forecast of the proposed objectives for 2006 and beyond.

Future Plans:

This is an ongoing program that will provide for all poles to be inspected and treated and any poles rejected will be replaced.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Insulators TL 231 (230 kV Bay d'Espoir - Stoney Brook)
Location: Bay d'Espoir to Stoney Brook
Division: Transmission & Rural Operations
Category: Transmission
Type: Other
Classification: Normal

Project Description:

TL231 is a 230 kV transmission line connecting Bay d'Espoir to the Stoney Brook Terminal Station - a distance of 105.3 km. It is a steel tower line constructed in 1976 to link the Bay d'Espoir generating plant to the central region of the island. To date all COB insulators on the angle and dead-end structures have been replaced. This project consists of the replacement of the remaining COB insulators on the tangent structures on the line.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	332.0	0.0	0.0	332.0
Labour	100.0	0.0	0.0	100.0
Consultant	20.0	0.0	0.0	20.0
Contract Work	270.0	0.0	0.0	270.0
Other Direct Costs	22.0	0.0	0.0	22.0
O/H, AFUDC & Escalation	98.2	0.0	0.0	98.2
Contingency	74.4	0.0	0.0	74.4
Total	<u>916.6</u>	<u>0.0</u>	<u>0.0</u>	<u>916.6</u>

Operating Experience:

Each year, the annual Preventive Maintenance (PM) cycle indicates the number of defective insulators is rising as the line ages due to the known problem with COB insulators.

Project Justification:

These insulators were manufactured by the Canadian Ohio Brass Company, commonly referred to as COB, and were installed during the original construction of TL231 in 1976. These COB insulators are a part of a group of insulators that have experienced industry wide failures due to cement growth causing radial cracks that resulted in moisture intrusion. With more failures expected with each PM cycle, the replacement of only the defective insulators is cost prohibitive and a poor long-term maintenance strategy. The most effective remedy at this time is to replace all the remaining units.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Insulators TL 231 (230 kV Bay d'Espoir - Stoney Brook) (cont'd.)

Project Justification: (cont'd.)

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Upgrade Corner Brook Frequency Converter
Location: Corner Brook
Division: Transmission & Rural Operations
Category: Transmission
Type: Clustered
Classification: Normal

Project Description:

This project consists of the rewinding of frequency converter transformer T1 and an upgrade of the converter building cooling and ventilation systems.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		337.0	0.0	0.0	337.0
Labour		129.2	0.0	0.0	129.2
Consultant		0.0	0.0	0.0	0.0
Contract Work		37.5	0.0	0.0	37.5
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		62.4	0.0	0.0	62.4
Contingency		50.4	0.0	0.0	50.4
Total		616.5	0.0	0.0	616.5

Operating Experience:

Transformer maintenance tests have shown the transformer's condition to be suspect and the probability of a catastrophic failure to be high. The converter is operating satisfactorily, however the lack of adequate ventilation results in the unit operating at higher than recommended temperatures which could lead to unit outages.

Project Justification:

This work is recommended as a result of an Engineering Condition Assessment of the Corner Brook Frequency Converter completed in April, 2005. Please refer to Section H, Tab 3. It is recommended that the transformer be rewound, to avoid a catastrophic failure, and possible damage to other equipment. The recommendations also include an upgrade to the converter building ventilation and cooling systems so that the converter overheating problems are eliminated. The loss of the converter for an extended period would result in Deer Lake Power being unable to convert 50 Hz generation to 60 Hz for the paper mill's consumption and would consequently increase the mill's requirement from Hydro for the duration of the outage and would pose a risk of spill at the Deer Lake Plant depending on the reservoir conditions.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Upgrade Corner Brook Frequency Converter (**cont'd.**)

Project Justification: (cont'd.)

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Upgrade 138 kV and 66 kV Protection Systems
Location: Bottom Brook Terminal Station
Division: Transmission & Rural Operations
Category: Transmission
Type: Other
Classification: Normal

Project Description:

This project consists of the purchase and installation of microprocessor based relays and associated equipment, to upgrade the protection on the 138 kV and 66 kV systems in the Bottom Brook Terminal Station. The station serves Newfoundland Power, Abitibi Consolidated and Hydro Rural.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	38.0	0.0	0.0	38.0
Labour	50.0	0.0	0.0	50.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	1.0	0.0	0.0	1.0
O/H, AFUDC & Escalation	11.0	0.0	0.0	11.0
Contingency	<u>8.9</u>	<u>0.0</u>	<u>0.0</u>	<u>8.9</u>
Total	<u>108.9</u>	<u>0.0</u>	<u>0.0</u>	<u>108.9</u>

Operating Experience:

The existing protection equipment is the older electromagnetic relays, which are difficult to maintain and calibrate.

Project Justification:

This project will improve the protection on the 138 kV and 66 kV systems which presently have electromagnetic relays for both zone and ground protection. The new equipment will provide faster fault clearing times and will be self-monitoring to the extent that if there are problems with the relay it will be alarmed, functionally blocked, and addressed before the relay fault causes any problem. The relays will also provide remotely retrievable fault distance location information. This new equipment will provide significant improvements to line reliability by enabling improved and timely analysis for correction of problems. This is part of an ongoing initiative to improve protection systems on the bulk electrical system.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Upgrade 138 kV and 66 kV Protection Systems (**cont'd.**)

Project Justification: (cont'd.)

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Data Collection and Monitoring System
Location: Hawke Hill Monitoring Site
Division: Transmission & Rural Operations
Category: Transmission
Type: Other
Classification: Normal

Project Description:

This project consists of the replacement of existing data collection and monitoring system at the Hawke Hill Test Site with all new data collection A/D boards, serial ports and counter boards, and software. A radio link is included to provide higher reliability and security in the acquisition of data.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	0.0	0.0	0.0	0.0
Labour	20.0	0.0	0.0	20.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	25.0	0.0	0.0	25.0
O/H, AFUDC & Escalation	6.5	0.0	0.0	6.5
Contingency	<u>4.5</u>	<u>0.0</u>	<u>0.0</u>	<u>4.5</u>
Total	<u>56.0</u>	<u>0.0</u>	<u>0.0</u>	<u>56.0</u>

Operating Experience:

The Hawke Hill Test Site was commissioned in 1993. This site is operating satisfactorily and has collected data from several icing storms. The data collected is used by Hydro to develop and validate design criteria for existing lines and for line upgrades and to validate ice models for long-term operational needs.

Project Justification:

The data acquisition and collection system presently in place is the original system installed in 1993. The operating system is DOS based, the hardware is outdated and manufacturer support is not readily available. When problems occur, it is difficult to source the parts needed and it is very cumbersome to maintain. The system is obsolete and therefore, any new hardware would not be supported by the existing software.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Data Collection and Monitoring System (cont'd.)

Project Justification: (cont'd.)

The upgrade is required to maintain reliability, improve processing and ensure a faster solution to any problems that occur. As well, it will ensure the continuity of support in the future as repairs to the existing site may no longer be possible.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Insulators
Location: Various Terminal Stations
Division: Transmission & Rural Operations
Category: Terminals
Type: Pooled
Classification: Normal

Project Description:

This project consists of the purchase, installation and replacement of 230, 138, 69 and 25 kV, station post and suspension insulators at various terminal stations. Due to the quantity of insulators to be changed and the number of outages required to complete this work, it is planned to complete the replacements over a 5-year period. This proposal is for the first year of the replacement program.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		120.0	0.0	0.0	120.0
Labour		114.0	0.0	0.0	114.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		14.0	0.0	0.0	14.0
O/H, AFUDC & Escalation		34.0	0.0	0.0	34.0
Contingency		24.8	0.0	0.0	24.8
Total		<u>306.8</u>	<u>0.0</u>	<u>0.0</u>	<u>306.8</u>

Operating Experience:

In 2005, a survey of all terminal stations was completed and all suspect insulators were identified. These suspect insulators have a history of creating problems throughout the Hydro system where failures occur during adverse weather conditions and as a result, restoration times are impacted considerably. Inspections have identified hairline cracks in the porcelain and in the cement bonding between the porcelain, and the metal castings.

Project Justification:

The insulators identified for this proposal were manufactured by the Canadian Ohio Brass Company (COB). These are part of a group of insulators that exhibit failures due to cement growth causing radial cracks that result in moisture intrusion. The cracking porcelain and consequent decrease in mechanical strength has the potential for the insulator to break apart, thus presenting a safety hazard for workers. As well, insulator failure will result in delivery point interruptions and decrease the level of service to customers. The most effective remedy is to replace these insulators.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Insulators (cont'd.)

Project Justification: (cont'd.)

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

This is the first year of a program of replacement of insulators at various stations. Replacements in future years will be proposed separately. This project will be complete in 2006.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Battery Chargers
Location: Various Terminal Stations
Division: Transmission & Rural Operations
Category: Terminals
Type: Pooled
Classification: Normal

Project Description:

The project consists of the purchase and installation of replacement battery chargers at Deer Lake, Bay d'Espoir, Western Avalon and Corner Brook Frequency Converter terminal stations. The battery chargers will be designed to be compatible with the existing battery banks.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		50.0	0.0	0.0	50.0
Labour		24.0	0.0	0.0	24.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		8.3	0.0	0.0	8.3
Contingency		<u>7.4</u>	<u>0.0</u>	<u>0.0</u>	<u>7.4</u>
Total		<u>89.7</u>	<u>0.0</u>	<u>0.0</u>	<u>89.7</u>

Operating Experience:

A review of the maintenance history on battery chargers was completed and indicated problems caused by Staticon and Cigentic chargers which were 15 years old or more. The Cigentic chargers in Deer Lake and Bay d'Espoir were installed in 1980 and 1981 respectively. The Staticon charger in Western Avalon was installed in 1986 and the charger in Corner Brook Frequency Converter was a unit originally installed in another location. These chargers have recently required significant repairs and are approaching or beyond the normal expected service life.

Project Justification:

The station service direct current (DC) system consists of a battery charger, battery bank and DC distribution panel. This DC source provides the control voltage for the station protection, remote and local controls, event logging, and annunciation. With the loss of the charger, the battery bank will discharge and be depleted such that station protection and control and information to ECC would become unavailable. Given the importance of the battery chargers in providing system reliability, Hydro considers it prudent to implement a program to replace the outdated chargers on the system.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Battery Chargers (cont'd.)

Project Justification: (cont'd.)

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

This is the first year of a multi-year program for replacement of battery chargers at various stations. Replacements in future years will be proposed separately.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Air Compressor and Dryer
Location: Grand Falls Frequency Converter Station
Division: Transmission & Rural Operations
Category: Terminals
Type: Other
Classification: Normal

Project Description:

This project consists of replacing a compressor, and heat-regenerated air dryer at the Grand Falls Frequency Converter Terminal Station. The replacement compressor will be similar to the other unit in the station for parts compatibility and stocking purposes. The dryer will be an electronically controlled, low air consumption, energy efficient model. Permitting and inspection is required under the Boiler, Pressure Vessel, and Compressed Gas Regulations.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	40.0	0.0	0.0	40.0
Labour	23.0	0.0	0.0	23.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	2.5	0.0	0.0	2.5
O/H, AFUDC & Escalation	7.6	0.0	0.0	7.6
Contingency	<u>6.6</u>	<u>0.0</u>	<u>0.0</u>	<u>6.6</u>
Total	<u>79.7</u>	<u>0.0</u>	<u>0.0</u>	<u>79.7</u>

Operating Experience:

The compressor is a Broomwade unit that has been in service since 1964 and has a cumulative run time of 19,558 hours. When the other compressor in the station was replaced in 2000, it was stripped for parts to extend the life of this compressor. These parts have now all been used. Since late 1999 the compressor has had a total of 20 corrective maintenance jobs completed at a total cost of \$8,560. Currently, parts for the 1964 vintage compressor are unavailable.

Similarly, the air dryer, a 1972 vintage unit has been subject to failures. In particular, in recent years critical repair parts have been virtually impossible to source. As a result, the long-term reliability of this asset cannot be assured.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Air Compressor and Dryer (cont'd.)

Project Justification:

The compressed air system is critical to the terminal station's air operated equipment and due to age, operating hours, reduced reliability and lack of availability of replacement parts the compressor and the air dryer must be replaced. As parts are unavailable due to the age of the compressor and air dryer, a repair option is not practical.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Air Compressors
Location: Holyrood Terminal Station
Division: Transmission & Rural Operations
Category: Terminals
Type: Other
Classification: Normal

Project Description:

This project consists of the replacement of two Ingersoll Rand 3-stage high-pressure compressors and associated condensate oil/water separator at the Holyrood Terminal Station. Permitting and inspection of the new installation is required under the Boiler, Pressure Vessel, and Compressed Gas Regulations.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	45.0	0.0	0.0	45.0
Labour	21.0	0.0	0.0	21.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	7.2	0.0	0.0	7.2
Contingency	<u>6.7</u>	<u>0.0</u>	<u>0.0</u>	<u>6.7</u>
Total	<u>79.9</u>	<u>0.0</u>	<u>0.0</u>	<u>79.9</u>

Operating Experience:

These compressors have been in service since the early 1970's and each have approximately 13,000 operating hours. Since late 1999, there have been 62 corrective maintenance jobs on the compressors for a total cost of \$73,447.

Project Justification:

The compressed air system is critical to the operation of 230 kV air blast circuit breakers in the Holyrood Terminal Station. The compressed air has a dual function in that it provides the mechanical energy to close the breaker as well as provide the interrupting medium to extinguish the arc during the breaker opening operation. If the compressed air supply to the breaker fails, the breaker will not operate. This will result in a higher risk of equipment damage as remote breakers will have to operate on back-up protection and as an added consequence it poses a safety risk because of the delayed isolation of faulted equipment. As well, the extent and duration of any outage to customers will increase.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Air Compressors (cont'd.)

Project Justification: (cont'd.)

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Instrument Transformers
Location: Various Terminal Stations
Division: Transmission & Rural Operations
Category: Terminals
Type: Pooled
Classification: Normal

Project Description:

This project consists of the purchase and installation of replacement instrument transformers (potential transformers, capacitive voltage transformers and current transformers) at various terminal stations across the Hydro system.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		60.0	0.0	0.0	60.0
Labour		4.5	0.0	0.0	4.5
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.6	0.0	0.0	0.6
O/H, AFUDC & Escalation		6.8	0.0	0.0	6.8
Contingency		<u>6.5</u>	<u>0.0</u>	<u>0.0</u>	<u>6.5</u>
Total		<u>78.4</u>	<u>0.0</u>	<u>0.0</u>	<u>78.4</u>

Operating Experience:

Instrument transformers have a typical service life of 30 - 40 years, depending on the service conditions. Units are inspected and tested regularly and replacements are made based on these maintenance assessments or on "in-service" failures. The maintenance assessments for instrument transformers are visual inspection and voltage/current checks of the secondary circuits. Typically, approximately six instrument transformers fail or need to be replaced each year.

Project Justification:

Instrument transformers provide critical input to protection, control and metering equipment required for the reliable operation and protection of the electrical system. Instrument transformers which fail in-service can result in faults on the electrical system and outages to customers.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Instrument Transformers (cont'd.)

Project Justification: (cont'd.)

When these units fail the normal utility practice is to replace them as they are not repairable and to hold a reserve inventory sufficient to replace in service units based on maintenance assessments or failure.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials.

Future Plans:

This is an annual allotment which will be adjusted from year to year depending on ongoing performance.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Battery Banks
Location: Various Terminal Stations
Division: Transmission & Rural Operations
Category: Terminals
Type: Pooled
Classification: Normal

Project Description:

The project consists of the purchase and installation of new lead/calcium, flooded cell, battery banks at Grandy Brook, Indian River and Bay d'Espoir Terminal Stations. The batteries will be designed to be mounted on the existing battery racks and will be compatible with the existing chargers, which are fully operational and do not need to be replaced at this time. The old batteries will be removed from service and disposed of at an approved disposal site. The replacement batteries will be the same size and rating as the existing units because the station DC load requirements have not changed.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		35.0	0.0	0.0	35.0
Labour		24.0	0.0	0.0	24.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		6.7	0.0	0.0	6.7
Contingency		5.9	0.0	0.0	5.9
Total		<u>71.6</u>	<u>0.0</u>	<u>0.0</u>	<u>71.6</u>

Operating Experience:

The station batteries proposed for replacement are approaching or beyond the normal expected service life. For Grandy Brook, Indian River and Bay d'Espoir stations, the flooded cell batteries were installed in 1985, 1987 and 1987 respectively. Through maintenance inspections, the batteries show signs of deterioration and are approaching or beyond the expected 20 year service life for a flooded cell battery bank.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Battery Banks (cont'd.)

Project Justification:

The direct current (DC) station service system consists of a battery charger, battery bank and DC distribution panel. This DC source provides the control voltage for the station protection, remote and local controls, event logging, and annunciation. With the loss of the battery bank, the station protection and control and information to Energy Control Centre would not be available. Given the importance of the battery banks in providing system reliability, it is necessary to replace these battery banks at this time.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Surge Arrestors
Location: Various Terminal Stations
Division: Transmission & Rural Operations
Category: Terminals
Type: Pooled
Classification: Normal

Project Description:

This project consists of the purchase and installation of replacement surge arrestors at various terminal stations across the system.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		48.0	0.0	0.0	48.0
Labour		10.0	0.0	0.0	10.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		6.2	0.0	0.0	6.2
Contingency		5.8	0.0	0.0	5.8
Total		70.0	0.0	0.0	70.0

Operating Experience:

Surge arrestors provide critical overvoltage protection for power system equipment from lightning and switching surges. Throughout the system there are surge arrestors in the 69 kV, 138 kV and 230 kV voltage classes. Replacements are typically required as a result of maintenance assessments, in-service failures, and equipment that has reached the end of its useful service life. Equipment manufacturers indicate the useful service life of surge arrestors as twenty years. Typically, fifteen surge arrestors will require replacement per year across the system.

Project Justification:

In-service failures of surge arrestors due to severe lightning strikes and switching surges are unavoidable and require immediate replacement to ensure system overvoltage protection. Lightning arrestors can fail catastrophically resulting in system disturbances, and a high potential for damage to adjacent equipment. The timely replacement of surge arrestors prior to age or condition related in-service failures will improve system reliability.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Surge Arrestors (cont'd.)

Project Justification: (cont'd.)

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Install Transformer Oil Monitoring System
Location: Upper Salmon Terminal Station
Division: Transmission & Rural Operations
Category: Terminals
Type: Other
Classification: Normal

Project Description:

This project consists of the purchase and installation of an on-line transformer oil monitoring and alarm system for the Upper Salmon Transformer. The monitoring system will continually monitor and trend dissolved gases and the temperature of the transformer oil.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	29.0	0.0	0.0	29.0
Labour	14.0	0.0	0.0	14.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	5.3	0.0	0.0	5.3
Contingency	<u>4.3</u>	<u>0.0</u>	<u>0.0</u>	<u>4.3</u>
Total	<u>52.6</u>	<u>0.0</u>	<u>0.0</u>	<u>52.6</u>

Operating Experience:

The unit transformer at Upper Salmon is consistently operating at 8 - 10 °C higher than other unit transformers, with the same operating range. Oil samples are regularly taken to measure oil quality and analyze dissolved gases.

Project Justification:

Higher operating temperatures have an accelerated aging effect on power transformers. The oil quality results of this transformer show several parameters outside the American Society for Testing and Materials ASTM D3487 standard which places the unit at a high risk for failure.

Electrical and thermal stresses lead to the breakdown of transformer dielectric oil and the development of a variety of gases. These gases indicate the presence of developing faults. On-line gas in oil and temperature monitoring will provide daily information on the condition of the transformer and provide data to help to detect faults and minimize downtime and increase

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Install Transformer Oil Monitoring System (cont'd.)

Project Justification: (cont'd.)

equipment availability. The data will also serve as a tool to trend gases, temperature and loading for transformer condition assessment and life extension purposes.

Should the transformer fail, the cost of replacement is in the order of \$1.5 million and the installation could take up to one year to complete due to the long delivery time for system transformers. In that event, the Upper Salmon plant's capacity of 84 MW would be unavailable to the system and it would be necessary to spill water around the facility to maintain generation at Bay d'Espoir. This spillage would be equivalent to approximately \$77,000 per day assuming replacement energy from Holyrood at \$32.20/bbl. The oil monitoring equipment is deemed the only alternative that will enable operation and loading of the transformer while providing a continuous feedback of the transformer's condition. This should defer the cost of replacement, while minimizing the risk of having the unit fail and having to manage without it.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Upgrade Distribution Feeders
Location: Various Locations
Division: Transmission & Rural Operations
Category: Distribution
Type: Pooled
Classification: Normal

Project Description:

The project consists of general upgrades to the following distribution systems:

1. St. Anthony L6 (Feeder No. 30106): This system serves the communities from St. Lunaire to L'Anse aux Meadows;
2. Bear Cove L6 (Feeder No. 20806): This system serves the communities from Bear Cove to Eddies Cove East;
3. Hawkes Bay L1 & L3 (Feeder Nos. 20101 and 20103): This system serves the communities from Hawkes Bay to Port aux Choix; and,
4. Black Tickle (Feeder No. 40801): This system serves the isolated communities of Black Tickle and Domino.

For St. Anthony, the project consists of the replacement of 123 blackjack poles, 350 insulators and 380 suspension insulators, 163 cutouts and 190 spans of primary conductor.

At Bear Cove, the project consists of the replacement of 121 blackjack poles, 431 pin type insulators, 347 suspension insulators and 314 cutouts.

The project at Hawkes Bay consists of the replacement of 113 spans of primary conductor, 55 blackjack poles 340 insulators.

At Black Tickle, the upgrading consists of the re-installation of approximately 20 poles servicing the airport and the installation of 20 sets of storm guys on the line to Domino, installation of two gang switches and the re-installation of 10 poles in the community which are presently installed above rock with rock anchors and pins. Also included is the re-sagging of conductor, tightening of guys, and the replacement of service drops.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Upgrade Distribution Feeders (cont'd.)

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		524.5	0.0	0.0	524.5
Labour		225.0	0.0	0.0	225.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		860.0	0.0	0.0	860.0
Other Direct Costs		52.0	0.0	0.0	52.0
O/H, AFUDC & Escalation		201.7	0.0	0.0	201.7
Contingency		154.2	0.0	0.0	154.2
Total		<u>2,017.4</u>	<u>0.0</u>	<u>0.0</u>	<u>2,017.4</u>

The breakdown of the total project cost by individual systems is as follows:

Project Cost:	(\$ x1,000)	<u>St. Anthony</u>	<u>Bear Cove</u>	<u>Hawkes Bay</u>	<u>Black</u>
		<u>L6</u>	<u>L6</u>	<u>L1 & L3</u>	<u>Tickle</u>
Material Supply		211.5	192.0	64.5	56.5
Labour		72.0	62.0	44.0	47.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		340.0	205.0	190.0	125.0
Other Direct Costs		16.0	12.0	11.5	12.5
O/H, AFUDC & Escalation		74.8	59.6	38.6	28.7
Contingency		64.0	47.1	31.0	12.1
Total		<u>778.3</u>	<u>577.7</u>	<u>379.6</u>	<u>281.8</u>

Operating Experience:

For all these systems, the poles, conductors, hardware, etc. is the original equipment, and has been in service for approximately 30 years or more. The systems are in coastal regions where they are regularly subjected to extreme winds and salt spray off the ocean. Over the years, numerous outages have occurred due to long spans, salt contamination and insulator failures. Past upgrading has included midspan pole installations and some insulator and cross arm replacements which have improved feeder performance.

The systems have a high number of blackjack poles that have been in place since the original construction and have been identified as "B" condition (one - five years life remaining). The insulators are the original equipment that have a history of failure due to cement growth and hairline cracks of the porcelain which results in electrical and mechanical breakdown. The conductor is the original conductor and in many cases has a steel core which is corroded. The cutouts are prone to porcelain failure when being opened or closed and are a safety risk to employees.

At Black Tickle, in particular, there have been several storms which resulted in problems with the distribution system. There are poles requiring resetting, problems with line slapping and blown fuses due to primary faults and transformer failures. The entire system requires upgrading, re-sagging of conductor, re-tensioning of guys and replacement of non-standard connectors.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Upgrade Distribution Feeders (cont'd.)

Project Justification:

The deteriorated poles on these systems create climbing hazards for line personnel due to spur kick out and/or pole failure which is more prevalent with the blackjack species. The insulators have been identified as a problem throughout the Hydro system and have been targeted for replacement due to the undesirable impact they have on the system performance. Safety Alerts have been issued on these insulators due to the possibility of insulator failure while a worker is climbing the pole. This could create a flash incident, or possible injury from falling porcelain. The cutouts are prone to failure of the porcelain when opened or closed and are a safety risk to employees. Falling shards of the broken porcelain pose a risk to the worker and the dangling energized lead could contact other equipment putting the worker at risk of electrical contact. In summary, this project is proposed in order to improve distribution feeder performance and to eliminate the safety hazards caused by old and worn equipment.

In 2005, Newfoundland and Labrador Hydro conducted a review of its isolated and interconnected distribution feeders to determine which systems should be targeted for reliability improvements. These reliability improvements were prioritized to justify capital spending beginning in 2006. The performance indices for all feeders were analyzed and improvement targets for the poor performers were established. Based on these targets, upgrades to specific feeders or groups of feeders were defined and scheduled to be completed over a five-year period. A report titled "A Performance Target Methodology for the Distribution Feeders of the Newfoundland and Labrador Hydro Electrical System - June 15, 2005" is contained in Section H, Tab 4. This report summarizes how the study was completed, and provides more detail on the analysis. The report's appendix contains tables showing the SAIFI and SAIDI Indices for each of the feeders proposed to be upgraded. These upgrades are intended to bring the indices to the target values stated in the tables. The upgrades to the Black Tickle system did not originate from the feeder performance review, however they were identified in a operational review completed in 2004.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Provide Service Extensions
Location: All Service Areas
Division: Transmission & Rural Operations
Category: Distribution
Type: Pooled
Classification: Normal

Project Description:

This project is an annual allotment based on past expenditures to provide for service connections (including street lights) to new customers. This summary identifies the total budget for all three operating regions.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		843.0	0.0	0.0	843.0
Labour		810.0	0.0	0.0	810.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		151.0	0.0	0.0	151.0
Contingency		<u>180.0</u>	<u>0.0</u>	<u>0.0</u>	<u>180.0</u>
Total		<u>1,984.0</u>	<u>0.0</u>	<u>0.0</u>	<u>1,984.0</u>

Operating Experience:

An analysis of average historical expenditure (i.e. 2000 - 2004) on new customer connections is shown in the following table. All historical dollars were converted to 2004 dollars using the GDP Implicit Price Deflator and a 5-year average calculated.

Region	Avg. Yearly Expenditures (2000 - 2004) (\$000)
Central	\$ 730
Northern	\$ 556
Labrador	\$ 616
Total	\$ 1,902

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Provide Service Extensions (cont'd.)

Project Justification:

Based on the five-year average of service extension expenditures for the period 2000 - 2004 (in 2004 dollars) the following budget was developed assuming escalation in 2005 and 2006 of approximately 2.0%.

Region	2006 Budget (\$000)
Central	\$ 761
Northern	\$ 580
Labrador	\$ 643
Total	\$ 1,984

To ensure that this project is completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

This is an annual allotment, which is adjusted from year to year depending on historical expenditures.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Upgrade Distribution Systems
Location: All Service Areas
Division: Transmission & Rural Operations
Category: Distribution
Type: Pooled
Classification: Normal

Project Description:

This project is an annual allotment based on past expenditures to provide for the replacement of deteriorated poles, substandard structures, corroded and damaged conductors, rusty and overloaded transformers/street lights/reclosers and other associated equipment. This upgrading is identified through preventive maintenance inspections or damage caused by storms and adverse weather conditions and salt contamination. This summarizes the total budget for all three regions.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		812.0	0.0	0.0	812.0
Labour		780.0	0.0	0.0	780.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		145.0	0.0	0.0	145.0
Contingency		<u>175.0</u>	<u>0.0</u>	<u>0.0</u>	<u>175.0</u>
Total		<u>1,912.0</u>	<u>0.0</u>	<u>0.0</u>	<u>1,912.0</u>

Operating Experience:

An analysis of historical expenditures (i.e. 2000 - 2004) on distribution upgrades is shown in the following table. All historical dollars (table below) were converted to 2004 dollars using the GDP Implicit Price Deflator and 5-year average calculated.

Region	Avg. Yearly Expenditures (2000 - 2004) (\$000)
Central	\$ 672
Northern	\$ 802
Labrador	\$ 360
Total	\$ 1,834

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Upgrade Distribution Systems (cont'd.)

Project Justification:

Based on this five-year average for distribution system upgrades for the period 2000 - 2004 the following budget was developed using an escalation in 2005 and 2006 of approximately 2.0%.

Region	2006 Budget (\$000)
Central	\$ 701
Northern	\$ 836
Labrador	\$ 375
Total	\$ 1,912

To ensure that this project is completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

This is an annual allotment which is adjusted from year to year depending on historical expenditures.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Insulators
Location: Various Locations
Division: Transmission & Rural Operations
Category: Distribution
Type: Pooled
Classification: Normal

Project Description:

This project consists of insulator replacements on the following systems:

1. South Brook L5 & L7 (Feeder Nos. 10105 and 10107): Serving the communities Roberts' Arm, Pilley's Island, Long Island, Port Anson, Miles Cove, Brighton and Triton;
2. Farewell Head L4 & L5 (Feeder Nos. 11004 and 11005): Serving the communities of Shoal Bay, Barr'd Island, Joe Batt's Arm, Tilting and Fogo; and,
3. Bottom Waters L4, L6, L7 & L8 (Feeder Nos. 10204, 10206, 10207 and 10208): Serving the communities of Brent's Cove, Harbour Round, Burlington, Middle Arm and Smith's Harbour, La Scie and Nipper's Harbour.

This project consists of replacement of all remaining Canadian Porcelain (CP) and Canadian Ohio Brass (COB) insulators on these distribution systems.

Project Cost: (\$ x1,000)	2006	2007	Beyond	Total
Material Supply	313.5	0.0	0.0	313.5
Labour	135.0	0.0	0.0	135.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	345.5	0.0	0.0	345.5
Other Direct Costs	48.0	0.0	0.0	48.0
O/H, AFUDC & Escalation	104.7	0.0	0.0	104.7
Contingency	73.5	0.0	0.0	73.5
Total	1,020.2	0.0	0.0	1,020.2

The breakdown of these total costs by the individual system is as follows:

Project Cost: (\$ x1,000)	South Brook	Farewell Head	Bottom Waters
Material Supply	161.0	54.0	98.5
Labour	54.0	34.0	47.0
Consultant	0.0	0.0	0.0
Contract Work	130.5	121.0	94.0
Other Direct Costs	14.0	14.0	20.0
O/H, AFUDC & Escalation	45.1	26.5	33.1
Contingency	36.1	11.3	26.1
Total	440.7	260.8	318.7

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Insulators (cont'd.)

Operating Experience:

These insulators have been in service for approximately 35 years and were manufactured by Canadian Ohio Brass and Canadian Porcelain. They have been a problem throughout the system because of the history of failures due to cement growth and hairline cracks of the porcelain which results in electrical and mechanical breakdown.

Project Justification:

Replacement of these insulators is essential to improve system security and reliability. Mechanical breakdown of the insulators reduces their mechanical strength and creates a safety hazard during climbing activities by line workers.

In 2005, Newfoundland and Labrador Hydro conducted a review of its isolated and interconnected distribution feeders to determine which systems should be targeted for reliability improvements. These reliability improvements were prioritized to justify capital spending beginning in 2006. The performance indices for all feeders were analyzed and improvement targets for the poor performers were established. Based on these targets, upgrades to specific feeders or groups of feeders were defined and scheduled to be completed over a five-year period. A report titled "A Performance Target Methodology for the Distribution Feeders of the Newfoundland and Labrador Hydro Electrical System - June 15, 2005" is contained in Section H, Tab 4. This report summarizes how the study was completed, and provides more detail on the analysis. The report's appendix contains tables showing the SAIFI and SAIDI Indices for each of the feeders where insulators are being replaced. These replacements are intended to bring the indices to the target values stated in the tables.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Poles
Location: Various Locations
Division: Transmission & Rural Operations
Category: Transmission
Type: Pooled
Classification: Normal

Project Description:

This project consists of the replacement of 35 deteriorated poles in Nain and 30 deteriorated poles on the portion of the Bottom Waters system serving the communities of Woodstock, Pacquet and Ming's Bight.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	71.0	0.0	0.0	71.0
Labour	79.0	0.0	0.0	79.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	113.0	0.0	0.0	113.0
Other Direct Costs	20.0	0.0	0.0	20.0
O/H, AFUDC & Escalation	34.6	0.0	0.0	34.6
Contingency	<u>14.2</u>	<u>0.0</u>	<u>0.0</u>	<u>14.2</u>
Total	<u>331.8</u>	<u>0.0</u>	<u>0.0</u>	<u>331.8</u>

The breakdown of costs for each system is:

Project Cost: (\$ x1,000)	<u>Nain</u>	<u>Bottom Waters</u>
Material Supply	35.0	36.0
Labour	41.0	38.0
Consultant	0.0	0.0
Contract Work	67.0	46.0
Other Direct Costs	10.0	10.0
O/H, AFUDC & Escalation	18.7	15.9
Contingency	<u>7.7</u>	<u>6.5</u>
Total	<u>179.4</u>	<u>152.4</u>

Operating Experience:

The systems are operating satisfactorily however, when deteriorated poles fail customer outages occur and repair crews are dispatched to complete repairs. Extensive outages have occurred on those occasions where it has been difficult to access the repair site, particularly for the Nain system.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Poles (cont'd.)

Project Justification:

Preventative maintenance inspections have identified 30 poles on the Bottom Waters system and 35 poles on the Nain system to be of substandard quality due to age deterioration resulting in unacceptable number of near vertical splits. The poles are over 30 years old and were identified as being "B" condition which indicates that they be replaced in one - five years. Deteriorated poles create climbing hazards for the line personnel, and failures will result in significant interruptions of power supply to the customers in these communities.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Purchase and Install Voltage Regulator L7 - Happy Valley
Location: Happy Valley/Goose Bay
Division: Transmission & Rural Operations
Category: Distribution
Type: Other
Classification: Normal

Project Description:

The project consists of the purchase and installation of three, single-phase 7.2/14.4 kV, 200 A voltage regulators on feeder L7 at the Happy Valley distribution system. The regulators will be placed approximately 9 km from the Happy Valley Terminal Station.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		70.0	0.0	0.0	70.0
Labour		30.0	0.0	0.0	30.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		4.0	0.0	0.0	4.0
O/H, AFUDC & Escalation		12.7	0.0	0.0	12.7
Contingency		<u>5.2</u>	<u>0.0</u>	<u>0.0</u>	<u>5.2</u>
Total		<u>121.9</u>	<u>0.0</u>	<u>0.0</u>	<u>121.9</u>

Operating Experience:

This is a new installation.

Project Justification:

Due to steadily increasing load on this feeder in recent years and specifically, a new school opening in Sheshatshui in September 2006, voltage levels at customer service entrances will drop below CSA standards during peak demand periods, with the existing system. The addition of a second voltage regulator bank will remedy this problem beyond the forecast period. Other alternatives considered included: the opportunity for a demand side management to defer the expenditure which was determined not to be viable (see attached); and reconductoring or building a second feeder which are an order of magnitude greater in cost and thus it was not pursued further.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS

Demand Side Management Analysis for Capital Budget Proposal						
Project Title: Sheshatshui Voltage Regulator						
Description: Install new voltage regulator bank on HVY-L7 in 2006						
Overview: NLH views DSM as an opportunity to defer or postpone capital costs. The deferral can be evaluated in economic terms as the difference in the present value of the utility revenue requirement under varying commencement years for the investment. The difference represents a DSM budget constraint and is the maximum amount of money that can be expended in order to defer the investment. The analysis proceeds by determining the necessary demand or energy savings required to defer the investment and then evaluates whether the DSM budget constraint can achieve the required saving. This DSM review represents a preliminary screening to ensure there are no obvious DSM opportunities missed.						
Conclusion : DSM is not a viable option for deferring or displacing the voltage regulator required as a result of load growth in the Sheshatshui area.						
<u>Load Forecast (HR OPLF Fall 2004)</u>		<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
Peak Demand Forecast (kW) L7		8,510	9,825	9,957	10055	10,136
Domestic Customers - # L7		486	486	486	486	486
Existing Planning Capacity		8,500	kW			
Capital Budget Proposal for Voltage Regulator		\$121,900	2006\$			
		<u>1 Yr</u>	<u>2 Yr</u>	<u>3 Yr</u>	<u>4 Yr</u>	<u>5 Yr</u>
<u>Required Demand Savings for Capital Deferral (kW)</u>		NA	1,325	1,457	1,555	1,636
(Difference of forecast peak demand and peak demand target at capacity)						
<u>DSM Budget Calculation</u> (Calculated assuming 2% inflation and 8.4% corporate cost of capital)						
Capital Budget Deferral Factors*		5.9%	11.5%	16.7%	21.6%	26.2%
Total DSM Deferral Budget (1yr discount)		\$6,639	\$12,887	\$18,765	\$24,297	\$29,501
DSM Budget Per Required Demand Savings kW		NA	\$10	\$13	\$16	\$18
* Percentage of capital cost that can be incurred to defer project for 1 to 5 years, and still be indifferent in economic terms.						
<u>DSM Supply Cost - \$ per kW Achieved</u>		<u>\$/kW*</u>				
Domestic Hot Water Load Control (DLC)		\$355				
* includes provision for distribution losses.						
<u>Maximum Achievable Winter Peak Demand Reduction</u>		<u>1 Yr</u>	<u>2 Yr</u>	<u>3 Yr</u>	<u>4 Yr</u>	<u>5 Yr</u>
(Max kW reduction at lowest DSM supply cost and full DSM deferral budget)						
DHW - kW		19	36	53	68	83
<u>Achievable DSM Less Required DSM Savings-kW</u>		NA	(1,289)	(1,404)	(1,487)	(1,553)

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Construction of New Diesel Plant
Location: St. Lewis - Labrador
Division: Transmission & Rural Operations
Category: Rural Operations
Type: Clustered
Classification: Normal

Project Description:

This project consists of the construction of a new three-unit diesel plant on Hydro's fenced property, in proximity to the existing tank farm. The plant building will be a pre-engineered metal building. Two new gensets, a 450kW unit and a 350kW unit, and their associated systems, will be purchased and installed in the new plant. A third genset, Unit No. 2015, a 250kW unit, will be removed from the old plant and installed in the new plant. The other two gensets presently in service in the plant will be retired. The existing plant will remain in operation until construction of the new plant is complete.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		684.5	0.0	0.0	684.5
Labour		387.4	0.0	0.0	387.4
Consultant		10.0	0.0	0.0	10.0
Contract Work		675.0	0.0	0.0	675.0
Other Direct Costs		64.4	0.0	0.0	64.4
O/H, AFUDC & Escalation		223.0	0.0	0.0	223.0
Contingency		182.2	0.0	0.0	182.2
Total		2,226.5	0.0	0.0	2,226.5

Operating Experience:

The existing plant equipment operates satisfactorily, and meets system demand. However, maintenance and operating activities are severely limited and hampered by the lack of space and the condition of the building.

The plant is a 35 year old, wood frame, plywood clad building with a concrete floor. It is in a deteriorated condition and does not have the floor space around or the clearance above the gensets to permit the safe performance of operating and maintenance tasks. The plant is cluttered and there is no free wall space to facilitate adding any new equipment.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Construction of New Diesel Plant (cont'd.)

Operating Experience: (cont'd.)

At present there are three generators installed in the plant building and a fourth mobile generating unit installed outside. Unit No. 292 at St. Lewis was purchased in 1984 and has 91,236 accumulated operating hours and has been overhauled five times. It has accumulated 16,236 operating hours since the last major overhaul and is due for replacement. Unit No. 200 at St. Lewis was purchased in 1982 and has 106,182 accumulated operating hours and has been overhauled five times. It has accumulated 18,741 operating hours since the last major overhaul and is due for replacement.

Further details on the condition of the plant and replacement alternatives considered are contained in the report "St. Lewis Diesel Plant - Condition Assessment Report and Investigation of Replacement Alternatives - June 17, 2005" attached in Section H, Tab 5.

Project Justification:

The plant is cluttered and lacking in space, both around equipment and in headroom above the gensets. Maintenance and operating tasks must be performed in close proximity to operating equipment without adequate maneuvering room to do so efficiently and safely. There is no free wall space to facilitate adding any new equipment and this has led to disorganized equipment installation and concerns with respect to operating efficiencies. The low headroom in the engine hall causes problems with heat buildup in the summertime and subsequently reduces the capacity of the units to carry rated loads. In addition, there is no capability to provide secondary containment should there be an oil spill inside the plant.

The replacement of the two diesel units (No. 292 and No. 200) is proposed given their age and extensive operating hours. As well, both have undergone at least five overhauls and are not considered capable of providing reliable capacity to address customer firm load. Experience has shown that it is generally not practical or effective to overhaul the engine more than five times. In addition to the initial savings on maintenance and overhaul costs, new units will provide greater fuel efficiency and reduced emissions. The additional capacity provided by the new units will not increase the firm capacity of the plant as the current requirement for the mobile diesel at this location will be eliminated.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Construction of New Diesel Plant (cont'd.)

Project Justification: (cont'd.)

It is important to note that the diesel replacements have been included with the construction of the new diesel plant as they would logically be undertaken together, however, Hydro believes the unit replacement, which based on separate justification, should be approved and proceed whether or not approval is given for construction of the new diesel plant.

A number of alternatives to the plant's replacement were investigated and are outlined in the attached report (please refer to section H, Tab 5). The construction of a new plant on the existing property was the preferred alternative.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Installation of Fall Protection Systems
Location: Various Locations
Division: Transmission & Rural Operations
Category: Transmission
Type: Pooled
Classification: Mandatory

Project Description:

This project consists of the design, supply and installation of fall protection equipment, where required, at all Hydro locations. These locations include fuel storage tanks, powerhouses, office buildings, terminal station control buildings, accommodation trailers, water control structures, power transformers and any auxiliary buildings. There are approximately 310 locations affected, and installations will be prioritized upon approval to proceed.

In Hydro's 2005 Capital Budget Application, a 4-year fall protection budget was proposed. The concept was to prepare and prioritize a list of all facilities which required a fall protection system and in 2005, install systems on those with the highest priority. Details on the progress of this program is contained in the report titled "The Installation of Fall Protection Systems for TRO and Production Divisions - June 22, 2005" in Section H, Tab 6.

Project Cost:	<i>(\$ x1,000)</i>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>Total</u>
Material Supply		30.0	30.0	30.0	90.0
Labour		65.0	40.0	28.0	133.0
Consultant		5.0	3.0	3.0	11.0
Contract Work		140.0	130.0	80.0	350.0
Other Direct Costs		6.0	6.0	6.0	18.0
O/H, AFUDC & Escalation		22.1	41.9	63.8	127.8
Contingency		<u>0.0</u>	<u>0.0</u>	<u>60.2</u>	<u>60.2</u>
Total		<u>268.1</u>	<u>250.9</u>	<u>271.0</u>	<u>790.0</u>

Operating Experience:

There is no fall protection equipment at these locations at present. When work is undertaken, temporary fall protection equipment is used.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Installation of Fall Protection Systems (cont'd.)

Project Justification:

In 1999, the Provincial Government passed legislation requiring that fall protection systems be used by all workers when accessing an elevated surface which is 3 m above the next lower level. Personnel need to access building roofs, fuel storage tank tops, water control structures and elevated equipment to perform operational and maintenance tasks. Many of these tasks, such as measuring depth of fuel via a tank top vent for fuel reconciliation purposes, are required by legislation.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

Please refer to the attached report in Section H, Tab 6.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Diesel Generation Units
Location: Various Locations
Division: Transmission & Rural Operations
Category: Rural Operations
Type: Pooled
Classification: Normal

Project Description:

This project consists of the replacement of diesel generating Unit No. 289 at Black Tickle and Unit No. 223 at Rigolet. These generating units will be replaced with equivalent sized units because there is no requirement to meet an increased demand at either of these sites.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		357.5	0.0	0.0	357.5
Labour		155.5	0.0	0.0	155.5
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		31.0	0.0	0.0	31.0
O/H, AFUDC & Escalation		64.7	0.0	0.0	64.7
Contingency		54.5	0.0	0.0	54.5
Total		663.2	0.0	0.0	663.2

The breakdown of these costs at each site are as follows:

Project Cost:	(\$ x1,000)	Black Tickle	Rigolet
Material Supply		178.0	179.5
Labour		78.0	77.5
Consultant		0.0	0.0
Contract Work		0.0	0.0
Other Direct Costs		15.5	15.5
O/H, AFUDC & Escalation		32.3	32.4
Contingency		27.2	27.3
Total		331.0	332.2

Operating Experience:

Unit 289 at Black Tickle was purchased in 1978 and has 83,348 cumulative operating hours. It has had five major overhauls and 13,573 operating hours has accumulated since the last major overhaul.

Unit 223 at Rigolet was purchased in 1978 and has 81,400 accumulated operating hours. It has had five major overhauls and 17,361 operating hours has accumulated since the last major overhaul.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Diesel Generation Units (cont'd.)

Project Justification:

Replacement of all units is justified on the basis of age of the units, accumulated operating hours and number of major overhauls. All units have in excess of 90,000 hours, and five major overhauls. Experience has shown that it is generally not practical or effective to overhaul the engine more than five times. In addition to the initial savings on maintenance and overhaul costs, new units will provide greater fuel efficiency and reduced emissions.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Control Panel
Location: Rigolet Diesel Plant
Division: Transmission & Rural Operations
Category: Rural Operations
Type: Other
Classification: Normal

Project Description:

This project consists of the purchase and installation of a replacement 600 volt, 800-amp diesel control panel complete with a draw out type breaker. As well, it includes the purchase and installation of analog sensors on the diesel unit.

Project Cost: (\$ x1,000)	2006	2007	Beyond	Total
Material Supply	68.0	0.0	0.0	68.0
Labour	35.5	0.0	0.0	35.5
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	7.0	0.0	0.0	7.0
O/H, AFUDC & Escalation	13.6	0.0	0.0	13.6
Contingency	11.1	0.0	0.0	11.1
Total	135.2	0.0	0.0	135.2

Operating Experience:

The control panel to be replaced was installed in the 1970's and is now obsolete. It is used on the diesel generating unit for load and fault interruption and manual synchronizing. Improper synchronizing has, in the past, resulted in damage to the generator exciter and voltage regulator.

Project Justification:

The existing generating unit control panel with a fixed molded case breaker has no draw out or lockable features to provide a safety isolation point, and therefore requires a total plant outage for maintenance checks and emergency repairs. The current standard for a generating unit breaker is a draw out design which allows for removal and isolation of the breaker without any power interruption. A modern electrically operated breaker will provide faster breaker action during synchronizing, and include a synchronizing check capability which ensures proper synchronizing thus eliminating potential damage to generator and associated equipment.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Install NOx Monitor
Location: Little Bay Islands
Division: Transmission & Rural Operations
Category: Rural Operations
Type: Other
Classification: Mandatory

Project Description:

This project consists of the installation of an ambient Nitrous Oxide (NOx) monitor within the community of Little Bay Islands to allow for measurement of ambient NOx levels associated with the operation of the diesel plant. The exact location of the monitor will be selected based on dispersion modeling and in consultation with the Provincial Department of Environment and Conservation.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	52.7	0.0	0.0	52.7
Labour	24.7	0.0	0.0	24.7
Consultant	5.0	0.0	0.0	5.0
Contract Work	3.5	0.0	0.0	3.5
Other Direct Costs	1.5	0.0	0.0	1.5
O/H, AFUDC & Escalation	10.2	0.0	0.0	10.2
Contingency	<u>8.7</u>	<u>0.0</u>	<u>0.0</u>	<u>8.7</u>
Total	<u>106.3</u>	<u>0.0</u>	<u>0.0</u>	<u>106.3</u>

Operating Experience:

This is a new equipment installation. Nitrous oxides (NOx) are produced in the emissions of diesel plant exhaust.

Project Justification:

This project is being completed at the direction of the Provincial Department of Environment and Conservation and is related to requirements of a Certificate of Approval and Compliance Agreements for isolated diesel systems.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Generating Unit Breakers
Location: Various Sites
Division: Transmission & Rural Operations
Category: Rural Operations
Type: Pooled
Classification: Normal

Project Description:

The project consists of the purchase and installation of 600 volt, 400 amp draw out type breakers with solid-state over-current relay and test switch to replace the fixed molded case breakers on diesel generating units at Francois (1), Grey River (1) and Little Bay Islands (3). As well, it includes the replacement of 600V power and control cables as required and the purchase of one spare breaker.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		25.0	0.0	0.0	25.0
Labour		25.6	0.0	0.0	25.6
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		5.0	0.0	0.0	5.0
O/H, AFUDC & Escalation		6.8	0.0	0.0	6.8
Contingency		5.5	0.0	0.0	5.5
Total		67.9	0.0	0.0	67.9

Operating Experience:

The molded case breakers proposed to be replaced are of 1970/80's vintage and are used on diesel generating units for load/fault interruption. Since the breakers are a fixed design they require a total diesel plant outage for maintenance checks and emergency repairs, and only provide for manual synchronizing.

Project Justification:

The appropriate modern design for a diesel unit breaker is a draw out type which allows for removal of the breaker for maintenance and emergency repair without a power interruption, and includes electrical closing for fast breaker action during synchronizing of diesel units. This current standard breaker design also includes a synchronizing check capability which ensures proper synchronizing thus eliminating the potential for damage to the generator and associated equipment.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Purchase Meters and Equipment
Location: All Service Areas
Division: Transmission & Rural Operations
Category: Transmission
Type: Pooled
Classification: Normal

Project Description:

This project consists of the purchase of demand/energy meters, current and potential transformers, metering cable and associated hardware for use throughout Hydro's system.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		90.0	0.0	0.0	90.0
Labour		0.0	0.0	0.0	0.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		2.5	0.0	0.0	2.5
Contingency		0.0	0.0	0.0	0.0
Total		<u>92.5</u>	<u>0.0</u>	<u>0.0</u>	<u>92.5</u>

Operating Experience:

Revenue meters and associated equipment are required for new customer services and the replacement of old, worn, damaged or vandalized meters.

Project Justification:

Demand/Energy meters are expected to last a minimum of twenty years. Each meter is evaluated after that time for condition and either retired from service or refurbished and returned to service. Failure to supply metering equipment as required could result in customer connection delays.

To ensure that the project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials.

Future Plans:

This is an annual allotment which will be adjusted from year to year depending on historical information.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Legal Survey of Distribution Line Right-of-Ways
Location: Various Sites
Division: Transmission & Rural Operations
Category: Distribution
Type: Other
Classification: Normal

Project Description:

This project consists of the completion of legal surveys and the preparation of documentation to acquire Crown Lands easement rights for approximately 600 km of distribution line right-of-ways across Hydro's system.

Project Cost: (\$ x1,000)	2006	2007	Beyond	Total
Material Supply	0.0	0.0	0.0	0.0
Labour	35.0	0.0	0.0	35.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	5.0	0.0	0.0	5.0
O/H, AFUDC & Escalation	5.9	0.0	0.0	5.9
Contingency	4.0	0.0	0.0	4.0
Total	49.9	0.0	0.0	49.9

Operating Experience:

Prior to 1985, it was Hydro's practice to construct and operate transmission and distribution lines without obtaining easement rights over Crown Land as Hydro was an agent of the Crown. In 1985, it was decided to obtain easement rights for all property underlying newly constructed lines and to obtain easement rights for property for the pre-1985 lines. To-date, the easement rights to all property associated with transmission lines have been obtained and there is approximately 1,900 km of distribution lines left without easement rights.

Project Justification:

As the right-of-ways for the distribution lines occupy Crown Land contrary to the Crown Lands Act, the lack of easement rights presents a significant risk to Hydro operations should competing requirements for the land arise. It is important that appropriate easement rights be acquired to permit proper maintenance and upgrading of the lines.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Legal Survey of Distribution Line Right-of-Ways (**cont'd.**)

Future Plans:

This is an annual program which began in 2004 and easement rights for the whole distribution system are planned to be in place by the end of 2008.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Off Road Track Vehicles
Location: Various Locations
Division: Transmission & Rural Operations
Category: General Properties - Transportation
Type: Pooled
Classification: Normal

Project Description:

This project consists of the replacement of the following off-road tracked vehicles and equipment:

1. Unit V7631, a 1985 model crew-cab/backhoe combination at Bishop's Falls will be replaced with a muskeg/boom/dump configured unit;
2. Unit V7633, a 1985 model muskeg/backhoe/boom unit currently in service at Whitbourne will be replaced with an excavator;
3. Unit V7647, a 1988 model muskeg/backhoe/boom unit currently in service at Springdale will be replaced with an excavator; and,
4. Unit V7725, a 1990 model muskeg/backhoe/boom unit currently in service at Bay d'Espoir will be replaced with an excavator.

Project Cost:	2006	2007	Beyond	Total
(\$ x1,000)				
Material Supply	560.0	0.0	0.0	560.0
Labour	0.0	0.0	0.0	0.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	20.0	0.0	0.0	20.0
Contingency	56.0	0.0	0.0	56.0
Total	636.0	0.0	0.0	636.0

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Off Road Track Vehicles (cont'd.)

The breakdown of replacement costs for equipment at each location is:

Project Cost:	(\$ x1,000)	Bishops	Bay		
		Falls	Whitbourne	Springdale	d'Espoir
Material Supply		230.0	110.0	110.0	110.0
Labour		0.0	0.0	0.0	0.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		6.2	4.6	4.6	4.6
Contingency		<u>23.0</u>	<u>11.0</u>	<u>11.0</u>	<u>11.0</u>
Total		<u>259.2</u>	<u>125.6</u>	<u>125.6</u>	<u>125.6</u>

Operating Experience:

The units at Bishops Falls and Whitbourne will be 21 years old at the time of replacement. The unit at Springdale and the unit at Bay d'Espoir will be 18 and 16 years old respectively at the time of replacement.

Project Justification:

Hydro's replacement criteria for heavy-duty off-road tracked equipment with respect to age is 15 - 20 years, combined with its operating condition, the extent of repairs needed and its level of compliance with current safety and health standards. Technological improvements in cab design have reduced noise and heat levels, and there are improvements to seat design steering mechanisms and operator controls. Transmission line maintenance crews should be equipped with a crew-cab/backhoe combination units and distribution crews be equipped with muskegs and excavator units. These options are believed to provide the most appropriate alternative where these crews need transport capability as well as excavating capability. The primary use for this equipment is to facilitate distribution and transmission line maintenance and for emergency repair.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Application Enhancements
Location: St. John's
Division: Production
Category: Information Systems & Telecommunications
Type: Pooled
Classification: Normal

Project Description:

The application enhancement projects proposed are as follows:

- Minor enhancements to applications in response to unforeseen requirements such as legislative and changing business requirements;
- Revisions to the Capital Asset Projection and Depreciation Modeling application used by Rates and Financial Planning;
- Enhancements to the Capital and Operating Process Applications. This project supports enhancements to existing applications to improve business efficiencies as well as to meet requirements of the Board for improvements in information presentation and justification;
- IT Management Tool to support Release Management Process; and,
- Enhancement of the Enterprise Reporting System. This project proposes the acquisition and implementation of an additional module in the existing Showcase toolset in order to enhance the reporting of information from the business applications.

Project Cost:	(\$ x1,000)	2006	2007	Beyond	Total
Material Supply		196.0	0.0	0.0	196.0
Labour		289.2	0.0	0.0	289.2
Consultant		0.0	0.0	0.0	0.0
Contract Work		275.4	0.0	0.0	275.4
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		109.2	0.0	0.0	109.2
Contingency		76.0	0.0	0.0	76.0
Sub-Total		945.8	0.0	0.0	945.8
Cost Recoveries		(165.3)	0.0	0.0	(165.3)
Total		780.5	0.0	0.0	780.5

Operating Experience:

In order to maintain and improve efficiency Hydro must continue to leverage its applications portfolio. The applications allow Hydro to achieve operating efficiencies and improve customer service. When Hydro selects application enhancement projects it uses the following criteria:

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Application Enhancements (cont'd.)

Operating Experience: (cont'd.)

(1) existing solutions and services will be considered first before seeking alternatives; and (2) if business needs are not adequately satisfied, purchased solutions and services will be evaluated before building solutions or services unless there is a compelling business reason to do so.

Project Justification:

1) Minor Enhancements

Total: \$149,219 CF(L)Co: \$28,352 Net: \$120,867

Minor enhancements are justified on the basis of meeting business requirements during the year. The focus of these enhancements is to increase operational efficiencies and improve customer service. This project has been used in the past to create enhancements to safety, environmental compliance and audit applications as well as to fulfill Board directed initiatives such as full time equivalent reporting and equalized billing.

2) Capital Asset Projection and Depreciation Modeling

Total: \$75,853

This project is to investigate and make changes to the process and application that Hydro currently uses for its capital asset projection and depreciation model. The current application used is separate from JDE and interfaces with it to extract data. The application provides projection and scenario models as well as version control and analysis capability.

3) Enhancements to the Capital and Operating Process Applications

Total: \$472,776 CF(L)Co: \$89,827 Net: \$382,948

This project is to make changes to the applications that Hydro currently uses for its capital and operating work management processes. This will allow for the streamlining of the budget preparation and approval process, workforce allocation planning, and outage management planning.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Application Enhancements (cont'd.)

Project Justification: (cont'd.)

4) IT Infrastructure Management Tool

Total: \$62,175 CF(L)Co: \$11,813 Net: \$50,361

In order to continue to focus on efficiency and reliability of service for Hydro's growing and complex portfolio of IT infrastructure the continued implementation of standard IT processes and supporting tools are essential. This project proposes to add another module to an existing tool to support the Release Management process which will be implemented in 2006. Typical IT services impacted by Release Management in a utility environment are end user computing, applications such as JD Edwards that impact the business and Hydro's customers, Energy Management functions including the EMS and RTU's and power system teleprotection devices. IS&T is currently working with Hydro Generation to implement the processes and tools to support non traditional IT infrastructure such as programmable logic controllers, etc.

From a cost benefit perspective when outputs from a Release Management process are not well defined and managed, faulty versions of changes are released into the system causing downtime for the various users of our systems including Hydro's customers and increased workload for the Service (Help) Desk.

5) Enterprise Reporting Enhancement

Total: \$185,778 CF(L)Co: \$35,298 Net: \$150,480

This will allow Hydro employees to access reports from the JD Edwards system in a more efficient manner. Reports will be run on a scheduled basis without human intervention and placed in a centralized repository. The software will allow Hydro employees to access the reports using a standard web browser, thereby ensuring information is available in a more timely and efficient manner.

A financial analysis of the costs and benefits associated with this project, as directed by the Board in Order P.U. 53 (2004) page 57 is attached in Section H, Tab 7. The analysis indicate a positive net present value benefit with the proposed enhancements.

Future Plans:

Application enhancements are a continuing requirement in order for Hydro to ensure efficiencies.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Corporate Application Environment
Location: St. John's
Division: Production
Category: Information Systems & Telecommunications
Type: Pooled
Classification: Normal

Project Description:

The projects which are pooled under this proposal are:

- Enterprise Resource Technology Review. This proposes a review of the current JD Edwards implementation, an assessment of how it can be further leveraged and development of a detailed roadmap for the application for the next five years;
- Upgrade to the existing industrial billing software used to interrogate our industrial customers' meters;
- Upgrade to the existing Diesel Plant Automation systems;
- Upgrade to the existing Aspen Relay setting database; and,
- Upgrade of ShowCase Strategy Application.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	260.0	0.0	0.0	260.0
Labour	100.5	0.0	0.0	100.5
Consultant	0.0	0.0	0.0	0.0
Contract Work	105.0	0.0	0.0	105.0
Other Direct Costs	10.0	0.0	0.0	10.0
O/H, AFUDC & Escalation	68.4	0.0	0.0	68.4
Contingency	<u>47.6</u>	<u>0.0</u>	<u>0.0</u>	<u>47.6</u>
Sub-Total	591.5	0.0	0.0	591.5
Cost Recoveries	<u>(35.7)</u>	<u>0.0</u>	<u>0.0</u>	<u>(35.7)</u>
Total	<u><u>555.8</u></u>	<u><u>0.0</u></u>	<u><u>0.0</u></u>	<u><u>555.8</u></u>

Operating Experience:

There are approximately 43 applications and supporting systems that enable Hydro to operate and provide least cost and reliable power to customers. In order to accomplish this, upgrades to application environments through their life cycle is a normal and necessary requirement. Each year, Hydro reviews its application portfolio and uses two main criteria to determine if an upgrade to an environment is warranted. First, the status of vendor support for all applications is reviewed. Next, any functionality improvements are reviewed in the context of providing business value either in terms of efficiencies gained through improved functionality or improvements in service.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS****Project Title:** Corporate Application Environment (cont'd.)**Project Justification:****1) JDE Enterprise Resource Planning (ERP) Technology Review****Total: \$44,782 CF(L)Co: \$8,509 Net: \$36,274**

The recent acquisition of JD Edwards by PeopleSoft, followed by its acquisition by Oracle, leaves uncertainty regarding the future direction of a major piece of Hydro's technology infrastructure. Hydro needs a clear strategy for how it will deploy and evolve applications to support its business processes and build a solid foundation for the future. Also, the latest release of JD Edwards will no longer support the Utility Customer Information System (UCIS) application and the existing user interface technology. All these issues will be addressed through the review, allowing Hydro to plan future enhancements of the application based on business needs and vendor support limitations.

2) Upgrade to Industrial Customer Billing Software**Total: \$155,494**

This project proposes upgrading to the latest version supported by the vendor. The Industrial Customer Billing software has been in place since January 2000 and is the primary bulk meter interrogation and billing application. Changes in metering technologies and system configurations have been well accommodated within the current version of the application. The current version of the software used to interrogate the meters monitoring the energy and demand usage of our industrial customers requires an operating system which is no longer supported by the vendor. This project as proposed will ensure the integrity and accuracy of billing information for our industrial customers.

3) Upgrade to the existing Diesel Plant Automation systems**Total: \$217,070**

This project proposes the upgrade of the existing software used in nine of Hydro's automated diesel generating plants. The existing version is no longer supported by the manufacturer and this upgrade will ensure that Hydro generation facilities for its remote customers perform in an efficient and reliable manner.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Corporate Application Environment (cont'd.)

Project Justification: (cont'd.)

4) Upgrade of the Aspen Relay Database Application

Total: \$31,099

The existing database application is no longer supported by the vendor. This project proposes an upgrade to the current version supported by the vendor. The application is used to store power system relay protection information. It is necessary that this data be secure and accurate to ensure Hydro is able to deliver power to customers in a least cost and reliable manner.

5) Upgrade of ShowCase Strategy Application

Total: \$143,055 CF(L)Co: \$27,180 Net: \$115,874

This is a lifecycle upgrade to keep the ShowCase application current with the vendor upgrade program. Software must be regularly upgraded to maintain the benefits of vendor advancements in system functionality.

Future Plans:

Application enhancements and upgrades are an ongoing life cycle based on business demands and vendor support levels.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Peripheral Infrastructure Replacement
Location: Hydro Place
Division: Production
Category: Information Systems & Telecommunications
Type: Pooled
Classification: Normal

Project Description:

Project Description:

This project consists of the replacement of three Multi-Function Devices and the purchase of one new Multi-Function Device for the Stephenville office.

Project Cost: (\$ x1,000)	2006	2007	Beyond	Total
Material Supply	154.0	0.0	0.0	154.0
Labour	4.0	0.0	0.0	4.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	25.3	0.0	0.0	25.3
Contingency	15.8	0.0	0.0	15.8
Total	199.1	0.0	0.0	199.1

Operating Experience:

The units scheduled for replacement have been in service for five to six years and have exceeded 500,000 copies with an average volume of 20,000 copies per month. As the devices reach and exceed their rated capacity, they require more maintenance and service time resulting in loss of reliability and productivity. The typical service life for a peripheral device is five years.

Project Justification:

This is the continuation of the evergreen program to replace peripheral devices as they reach the end of their useful life. Hydro's infrastructure is supported by the manufacturer's maintenance agreement that covers the cost of consumables, except paper, and maintenance based on a monthly price per page. The additional multi-functional device is a replacement for a standalone analog copier which was installed in 1999.

Future Plans:

The ongoing plan involves a coordinated effort to keep Hydro's peripheral infrastructure in good working order and using current technologies.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Power Line Carrier - TL240
Location: Happy Valley - Churchill Falls
Division: Production
Category: Information Systems & Telecommunications
Type: Other
Classification: Normal

Project Description:

The Powerline Carrier on TL240 carries power system protection circuits as well as operational voice and data in support of the Energy Control Centre. This project consists of the design, supply, installation and commissioning of a Powerline Carrier (PLC) to replace the existing system and associated equipment on TL240 between Churchill Falls and Happy Valley Terminal Station.

Project Cost:	2006	2007	Beyond	Total
<i>(\$ x1,000)</i>				
Material Supply	137.5	117.3	0.0	254.8
Labour	31.2	31.7	0.0	62.9
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	19.9	39.4	0.0	59.3
Contingency	0.0	31.8	0.0	31.8
Total	188.6	220.20	0.0	408.8

Operating Experience:

This Powerline Carrier is 28 years old. Reliability is an issue due a lack of replacement parts, manufacturer support and repair services.

Project Justification:

The equipment has been in service for over 28 years and is now obsolete. The manufacturer no longer supports the product, and has discontinued the manufacture and sale of replacement components. In addition, there is no known third-party that provides repair services for defective modules. Therefore continued utilization of this equipment poses a risk of failure and hence loss of communications required for the protection and control of the power system and to provide uninterrupted service to customers.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Microwave Site Refurbishing
Location: Bay d'Espoir Hill and Blue Grass Hill
Division: Production
Category: Information Systems & Telecommunications
Type: Pooled
Classification: Normal

Project Description:

This project involves the refurbishing of two West Coast microwave sites located at Blue Grass Hill and Bay d'Espoir Hill, including:

- galvanizing and structural member replacement;
- guy wire replacement; and,
- building foundation replacement.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	0.0	0.0	0.0	0.0
Labour	21.3	0.0	0.0	21.3
Consultant	19.0	0.0	0.0	19.0
Contract Work	283.8	0.0	0.0	283.8
Other Direct Costs	5.4	0.0	0.0	5.4
O/H, AFUDC & Escalation	44.9	0.0	0.0	44.9
Contingency	32.9	0.0	0.0	32.9
Total	<u><u>407.3</u></u>	<u><u>0.0</u></u>	<u><u>0.0</u></u>	<u><u>407.3</u></u>

Operating Experience:

These microwave sites have been in operation since 1979 with no major refurbishing done and minor maintenance completed annually. The towers and guy wires are showing signs of rusting and oxidation. The buildings are experiencing shifting foundations and other similar indications of deterioration.

The microwave system is a part of Hydro's critical infrastructure, supporting power system protection signaling, as well as other functions related to the monitoring and control of the Corporation's generation, transmission and distribution assets. The microwave system is critical to Hydro in order to operate the power system and provide least cost and reliable power to customers. This program will extend the useful life of these sites.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Microwave Site Refurbishing (cont'd.)

Project Justification:

These microwave sites are major components of the power system and are required to provide the reliable generation and transmission of electricity across the Province. Without refurbishing, these microwave sites will deteriorate to a level where catastrophic structural failure would happen. This would result in direct loss of control of the grid for the Energy Control Center (ECC) and therefore extended power outages. As well, the loss of teleprotection on the transmission lines could cause severe damage to equipment and extend outages even longer.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

This project is part of an IS&T program to refurbish the West Coast Microwave site infrastructure. Other locations will be submitted as identified through inspection.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Battery System
Location: Multiple Sites
Division: Production
Category: Information Systems & Telecommunications
Type: Pooled
Classification: Normal

Project Description:

This project proposes: the replacement of DC battery systems at Daniel's Harbour Terminal Station, Hawke's Bay Terminal Station, St. Anthony Airport Terminal Station and St. Anthony Diesel Plant; the replacement of DC power plants at two sites: Deer Lake Terminal Station and Hinds Lake Generating Station; and the replacement of both battery and power plant at the Burnt Dam and Godaleich Hill Microwave sites.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	155.7	0.0	0.0	155.7
Labour	154.3	0.0	0.0	154.3
Consultant	0.0	0.0	0.0	0.0
Contract Work	10.0	0.0	0.0	10.0
Other Direct Costs	6.0	0.0	0.0	6.0
O/H, AFUDC & Escalation	45.0	0.0	0.0	45.0
Contingency	<u>32.6</u>	<u>0.0</u>	<u>0.0</u>	<u>32.6</u>
Total	<u>403.6</u>	<u>0.0</u>	<u>0.0</u>	<u>403.6</u>

Operating Experience:

This project is a continuation of a program to replace aging stationary battery systems and DC power plants. The decision to replace a battery system is based on a combination of age, observation and testing. The accepted guideline for the replacement of stationary battery system is to replace when the capacity falls below 80%. Based on our experience, the battery systems are at the end of their useful life. The DC power plants being replaced are all more than 20 years old and have reached the end of their useful lives.

The flooded cell battery bank being proposed for replacement was installed in 1983. The Valve Regulated Lead Acid (VRLA) battery banks being proposed for replacement are ten or more years old. Yearly capacity and conductive tests confirm the natural, expected degradation with time for these types of batteries.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Battery System (cont'd.)

Project Justification:

This replacement is necessary to provide emergency power to equipment required for the remote control and monitoring of Hydro's transmission and generation system and to provide reliable power to customers. Failure to replace this equipment is likely to result in a battery bank failure or reduced reliability which could cause or extend customer outages. The flooded battery has exceeded the 20-year design life which is the industry standard life expectancy of large stationary batteries of the flooded cell type. A failure is likely after the battery design life is exceeded.

The VRLA battery will be ten years old in 2005. Non-flooded batteries have demonstrated service life in the range of seven - eight years depending on the conditions in which the battery operates.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans:

None for this phase.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Remote Terminal Units
Location: Various Sites
Division: Production
Category: Information Systems & Telecommunications
Type: Pooled
Classification: Normal

This project proposes the replacement of four Remote Terminal Units (RTUs) at the Holyrood Generating Station, Stephenville Terminal Station, Come-by-Chance Terminal Station and Roddickton Terminal Station. This is phase seven of a nine-phase plan to replace all obsolete RTUs. The spares salvaged will be used to extend the life of the remaining units.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		175.7	0.0	0.0	175.7
Labour		60.3	0.0	0.0	60.3
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		45.0	0.0	0.0	45.0
O/H, AFUDC & Escalation		41.8	0.0	0.0	41.8
Contingency		<u>28.1</u>	<u>0.0</u>	<u>0.0</u>	<u>28.1</u>
Total		<u>350.9</u>	<u>0.0</u>	<u>0.0</u>	<u>350.9</u>

Operating Experience:

The RTUs being replaced are 18 - 20 years old. Each location has had parts replaced in the past due to failures. This is a continuation of a program to replace obsolete Remote Terminal Units (RTUs). The RTUs have been manufacturer discontinued and spare parts and repair services are no longer available. RTUs are critical assets used in conjunction with the Energy Management System (EMS) to control the delivery of power to our customers.

Project Justification:

Failure to replace this equipment may result in an impact on service to our customers. This may result in reduced reliability or extended customer outages. The RTUs being replaced are critical to the operation of the provincial power grid. The Holyrood Generating Station generates 32% of the

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Remote Terminal Units (cont'd.)

Project Justification: (cont'd.)

Island system's total power and is critical to the reliable supply of power on the Avalon Peninsula. Come-by-Chance Terminal Station supplies North Atlantic Refining Ltd., one of Newfoundland and Labrador Hydro's largest industrial customers, which is highly sensitive to outages. As well, the RTU at Come-by-Chance implements an auto restoration process that allows for automated recovery from certain outages on part of the eastern transmission system. The Stephenville Terminal Station RTU provides control and monitoring capability of terminal station facilities at Abitibi Consolidated's Paper Mill. The Roddickton RTU provides monitoring and control and for part of the Great Northern Peninsula.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: West Coast Communications Study
Location: West Coast
Division: Production
Category: Information Systems & Telecommunications
Type: Other
Classification: Normal

Project Description:

This project consists of a study to evaluate all viable communications options including but not limited to, microwave radio, fibre optic cable, leased services, or other technologies that may be suitable for collection and transmission of data gathered at the West Coast 230 kV substations for support of operations, administration and maintenance. A communications plan will be produced and a preliminary engineering design will be prepared on the most cost effective option.

Project Cost: (\$ x1,000)	2006	2007	Beyond	Total
Material Supply	0.0	0.0	0.0	0.0
Labour	35.3	0.0	0.0	35.3
Consultant	100.7	0.0	0.0	100.7
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	4.9	0.0	0.0	4.9
O/H, AFUDC & Escalation	20.1	0.0	0.0	20.1
Contingency	14.1	0.0	0.0	14.1
Total	175.1	0.0	0.0	175.1

Operating Experience:

Telecommunication service to Hydro's West Coast terminal stations (Massey Drive, Bottom Brook, and Stephenville) is presently achieved using Power Line Carrier (PLC) and dial backup facilities. The PLC provides teleprotection, low bandwidth data for Remote Terminal Unit (RTU) communications, and limited voice service. This technology will not be capable of supporting future data requirements for system performance and system operations applications.

Project Justification:

This cost benefit analysis and preliminary engineering design will provide Hydro with the most viable communications solution for the West Coast and ongoing support for core business such as teleprotection, real time system operations and operational voice for the provincial Energy Control Center. It is anticipated that operational data obtained would be used to improve system planning, maintenance and operation of the provincial electrical system to reduce costs and extend the life of the core electrical system assets.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: West Coast Communications Study (cont'd.)

Project Justification: (cont'd.)

To ensure that this project will be completed at the lowest possible cost, Newfoundland and Labrador Hydro will solicit competitive bids for all services.

Future Plans:

Based on the results of this communications plan, Hydro may submit a future capital budget proposal for an improved West Coast Communications System in 2008.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Telephone Isolation Equipment
Location: Happy Valley
Division: Production
Category: Information Systems & Telecommunications
Type: Other
Classification: Mandatory

Project Description:

This project involves the replacement of the existing telephone isolation equipment at the Happy Valley Terminal Station with a fibre optic cable.

Project Cost: (\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply	0.0	0.0	0.0	0.0
Labour	11.3	0.0	0.0	11.3
Consultant	0.0	0.0	0.0	0.0
Contract Work	31.7	0.0	0.0	31.7
Other Direct Costs	3.0	0.0	0.0	3.0
O/H, AFUDC & Escalation	6.7	0.0	0.0	6.7
Contingency	<u>4.6</u>	<u>0.0</u>	<u>0.0</u>	<u>4.6</u>
Total	<u>57.3</u>	<u>0.0</u>	<u>0.0</u>	<u>57.3</u>

Operating Experience:

The existing telephone isolation equipment which was made by Positron will be over 10 years old in 2006. In March 2000, six cards in the Positron shelf required replacement. Of the six cards, four needed to be returned to Positron for modifications and two cards were not working (no dial tone).

Project Justification:

The current installation of the telephone isolation equipment does not meet the distance clearances, as determined by the station's zone of influence, required for safety. A fibre optic system will meet safety requirements and provide improved communications reliability in support of Hydro's bulk transmission terminal stations. This will also provide enhanced protection for personnel and equipment against lightning and power surges.

Isolation equipment is required to be connected to telecommunications cables entering a generating station or terminal station in order to protect the workers outside the station who may be working on this cable when a fault occurs at the station.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Communications Network Technology
Location: Various Locations
Division: Production
Category: Information Systems & Telecommunications
Type: Pooled
Classification: Normal

Project Description:

This project proposes to replace 8 obsolete telecommunication network components as well as provide additional capacity on other network components. In addition, the project includes the installation of facilities required in the future to extend network access and voice connectivity as well as upgrade technology due to unforeseen circumstances. This network technology is used by staff throughout Hydro to obtain access to various applications and operational data, thereby increasing productivity and improving service to our customers.

The communications network is the connected devices and telecommunication facilities that allows employees to perform administrative activities and to connect to required Energy Management System data.

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		60.1	0.0	0.0	60.1
Labour		17.5	0.0	0.0	17.5
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		11.3	0.0	0.0	11.3
Contingency		<u>7.8</u>	<u>0.0</u>	<u>0.0</u>	<u>7.8</u>
Total		<u>96.7</u>	<u>0.0</u>	<u>0.0</u>	<u>96.7</u>

Operating Experience:

The network components being replaced under this project have reached the end of their useful life and are now obsolete. As well, the devices are not able to support desired expanded functionality including security and performance. The switches to be upgraded do not have the capacity to service the ongoing bandwidth enhancement requirements of the business.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Communications Network Technology (**cont'd.**)

Project Justification:

Hydro's refresh life cycle for network devices is eight years. These networking devices are obsolete and do not meet the functionality requirements of the business. The replacement equipment will correct network performance problems and allow traffic management to improve performance without requiring additional operating costs for leased services.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Vehicles
Location: Various Locations
Division: Transmission & Rural Operations
Category: Administration
Type: Pooled
Classification: Normal

Project Description:

This project involves replacing 37 light vehicles (cars, pick-ups and vans) and three medium/heavy vehicles (line trucks and boom trucks).

Project Cost:	(\$ x1,000)	<u>2006</u>	<u>2007</u>	<u>Beyond</u>	<u>Total</u>
Material Supply		1,525.7	0.0	0.0	1,525.7
Labour		0.0	0.0	0.0	0.0
Consultant		0.0	0.0	0.0	0.0
Contract Work		0.0	0.0	0.0	0.0
Other Direct Costs		0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation		54.8	0.0	0.0	54.8
Contingency		152.5	0.0	0.0	152.5
Total		<u>1,733.0</u>	<u>0.0</u>	<u>0.0</u>	<u>1,733.0</u>

Operating Experience:

It has been Hydro's experience that vehicles experience increased downtime and decreased reliability as they reach the replacement criteria outlined below.

REPLACEMENT CRITERIA			
VEHICLES			
Category	Description	REPLACEMENT CRITERIA	
		Age	Other
1000	Cars/Mini-vans	5-7 yrs.	>150,000 kms, maintenance cost, condition
2000	Pick-ups/Service Vans	5-7 yrs.	>150,000 kms, maintenance cost, condition
3000	Light Trucks	6-8 yrs.	>180,000 kms, maintenance cost, condition
4000	Medium/Heavy Trucks	7-9 yrs.	>200,000 kms, maintenance cost, condition

Category 1000 and 2000 vehicles being replaced will generally have an average age of six years and 190,000 km, while category 4000 will have an average age of nine years and 198,000 km.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Vehicles - 2006 (cont'd.)

Project Justification:

New vehicle replacements are required in order to ensure maximum reliability with minimum equipment downtime. Having work crews equipped with reliable and technologically current work vehicles, ensures their safety while at the same time enhancing efficient delivery of services. Operating vehicles beyond their economical life cycle will result in delays for work crews and have a negative impact on customer service.

Vehicles are screened against the replacement criteria before being identified for replacement. When a unit has met the age or kilometer criteria, the unit is further evaluated for its condition and maintenance history.

The budget allocations for each class of vehicle is shown below.

Vehicle Class	Budget Amount
1000 (Cars/Mini-vans)	\$ 232,000
2000 (Pick-up/ Service Vans)	791,500
3000 (Light Trucks)	0
4000 (Medium/Heavy Trucks)	557,000
Contingency	152,500
Total	1,733,000

New vehicles are acquired through competitive tendering with a lease/purchase analysis used to determine the least cost alternative.

Future Plans:

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Construct New Warehouse
Location: Port Saunders
Division: General Properties
Category: Administration
Type: Other
Classification: Normal

Project Description:

The project consists of the construction of a 280 square meter pre-engineered metal building, one story in height and equipped with shelving and laydown areas suitable for inventory storage, materials handling for operating and capital work projects for the Northern regional operations.

Project Cost: (\$ x1,000)	2006	2007	Beyond	Total
Material Supply	0.0	0.0	0.0	0.0
Labour	52.0	0.0	0.0	52.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	301.0	0.0	0.0	301.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	42.6	0.0	0.0	42.6
Contingency	35.3	0.0	0.0	35.3
Total	430.9	0.0	0.0	430.9

Operating Experience:

Prior to the interconnection of the Great Northern Peninsula in 1996, Hydro's operations on the Northern Peninsula and Southern Labrador was centered in two regional offices, at Port Saunders and in St. Anthony. The St. Anthony office was responsible for all diesel and associated distribution operations from St. Anthony to Norman Bay in Labrador. The majority of this activity was related to diesel plant systems, particularly the main plant at St. Anthony. The Port Saunders office was responsible for distribution operations from Deer Lake to Bear Cove and Roddickton, Main Brook and Englee. The Stephenville regional office was responsible for all transmission systems on the peninsula. This resulted in a limited sized inventory and materials handling facility at Port Saunders for distribution materials, only. At St. Anthony, the main materials handling requirements centered around the required inventory for diesel plants, particularly the St. Anthony plant. All transmission materials for the peninsula were processed through regional operations in Stephenville and Bishop Falls.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Construct New Warehouse (cont'd.)

Operating Experience: (cont'd.)

The interconnection of the GNP in 1996, provided Hydro with the opportunity to restructure its operations on the Northern Peninsula and in Southern Labrador. The interconnection resulted in the St Anthony diesel plant being changed to stand by status, and thus a downsizing in operational requirements for that part of the region. At the same time, the responsibilities for the transmission systems were transferred to the Port Saunders region. Overall, across Hydro, the six regional offices were reduced to three and the operational center for the Northern Peninsula and Southern Labrador was more appropriately relocated to Port Saunders.

As these structural reorganizations were underway, Hydro was also reviewing and modifying its Goods and Services and Work Execution processes. These modifications took the form of reducing inventory levels and entering into long-term partnerships with suppliers. For the work execution process, materials would be 'kitted' for preplanned work one - two weeks in advance, rather than having trades people requisitioning materials for projects as they were assigned. These revisions to the business processes, changed the nature and space requirements of the materials handling facilities. The Port Saunders site, is now the central control point for the regional operations and for the materials distribution throughout the Northern regional operations area.

Project Justification:

The size of the existing warehouse at Port Saunders is 150 square meters. This space was sufficient for the limited requirements of distribution materials management which was the limit of the operations previously performed by the Port Saunders office. Since the interconnection of the GNP, the corporate reorganizations and the revisions to the Goods and Services process, this facility is no longer adequate. Port Saunders is now the operational center for Hydro operations from Deer Lake on the Island to Norman Bay on the Labrador coast. The focus now is on both transmission and distribution operations from this site. This requires that all materials for diesel, distribution and transmission work be processed, handled and transhipped from Port Saunders.

The nature and quantity of the materials being processed requires an increase in space to approximately 280 square meters. As the existing space at Port Saunders is an open bay area at

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Construct New Warehouse (cont'd.)

Project Justification: (cont'd.)

the end of the office space an extension of this space to the required 280 square meters was not deemed practical. It is proposed to construct a separate building to house the materials management operation. The existing space in the office building will be used for line maintenance personnel and their tools and equipment that require indoor storage. As well, the space will be used for the pre-assembly of hardware and laydown area needed for planned activities.

To ensure that this project will be completed at the lowest possible cost, Hydro will solicit competitive bids for all materials and external labour.

Future Plans

None.

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Project Title: Replace Storage Ramps
Location: Bishop's Falls
Division: Human Resources & Legal
Category: Administration
Type: Other
Classification: Normal

Project Description:

The project consists of the replacement of storage ramps, No. 66, No. 67 and No. 116 at the Bishops Falls Control Stores facility. The new ramps will be constructed of steel posts, with supporting steel beams and decked with treated timber platforms. Ramp No. 116 will be strengthened by the addition of mid span beams.

Project Cost: (\$ x1,000)	2006	2007	Beyond	Total
Material Supply	65.0	0.0	0.0	65.0
Labour	65.0	0.0	0.0	65.0
Consultant	0.0	0.0	0.0	0.0
Contract Work	0.0	0.0	0.0	0.0
Other Direct Costs	0.0	0.0	0.0	0.0
O/H, AFUDC & Escalation	15.9	0.0	0.0	15.9
Contingency	13.0	0.0	0.0	13.0
Total	158.9	0.0	0.0	158.9

Operating Experience:

These ramps are located in the Bishop's Falls Central Stores yard and used for the outside storage of transformers and related distribution and transmission hardware. In August 2004, Storage Ramp No. 65 collapsed while distribution transformers were being removed by a forklift. The potential for serious injury to employees and major loss to stored equipment was extremely high.

A subsequent condition assessment of the storage ramps identified design shortcomings and recommended replacement of all identically constructed ramps. The five ramps identified were No. 64, No. 65, No. 66, No. 67 and No. 72. Ramp No. 64 and No. 65 are being replaced in 2005. and ramps No. 66 and No. 67 are proposed for replacement in 2006 while the replacement of ramp No. 72 will be proposed in Hydro's 2007 Capital Budget.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Project Title: Replace Storage Ramps (cont'd.)

Project Justification:

The existing ramps are approximately 20 to 25 years old and in a deteriorated condition. A condition assessment recommended these ramps be replaced. Materials stored on these ramps are both heavy and expensive to replace. Given the deteriorated condition, there are concerns for personal safety and the protection of stored assets.

Future Plans:

Ramp No. 72 will be proposed in the 2007 Capital Budget.

MULTI-YEAR PROJECTS

2006 CAPITAL PROJECTS OVER \$50,000 EXPLANATIONS

Multi-Year Projects

The following projects are multi-year projects and have been reviewed by the Board at previous Capital Budget Applications. The projects are underway and have not had a material change in either scope, nature or forecast cost of the project from that contained in the original approval (as defined on Page 7 of the Provisional Capital Budget Application Guidelines - June 2, 2005).

1. **Replace Penstock - Snook's Arm Generating Station**

This project was included in Hydro's 2005 Capital Application, (please refer to Section B, page B-13) and received the Board's approval in Order No. P.U. 53 (2004). The most recent cost estimate to completion is \$2,110,000 as compared to \$1,930,000 in Hydro's 2005 Capital Budget Application. An updated economic analysis (attached) indicates a net present value benefit of \$1,161,092 to \$1,398,735 at the end of a 30-year analysis with a pay back in 10 to 11 years. The analysis reviewed as part of the 2005 Capital Budget Application indicated a pay back in 13 years.

2. **Replace Unit No. 1 Governor Controls - Cat Arm**

This project was included in an application filed with the Board on May 2, 2005 and which the Board approved in Order No. P.U. 14 (2005). The project is on schedule with no change in scope or forecast costs, with the installation planned during a scheduled outage in 2006.

3. **Upgrade Control System - Holyrood**

This project was included in Hydro's 2005 Capital Budget Application (please refer to Section B, page B-16) and received the Board's approval in Order No. P.U. 53 (2004). The most recent forecast cost to completion is \$2,831,469 as compared to \$2,586,700 in Hydro's 2005 Capital Budget Application. Units No. 1 and No. 2 were completed in 2004 and Unit No. 3 was planned for 2005. However the plant station service portion could not proceed as system conditions and the ongoing asbestos abatement project would not permit an extended plant outage as was required. This portion of the project is now planned for completion during 2006.

4. **Addition of Disconnecting Means to 600 Volt MCC Branch Feeders**

This project was included in an application filed with the Board on May 2, 2005 and which the Board approved in Order No. P.U. 14 (2005). This project is proceeding as planned with no change in scope, nature or forecast cost.

**2006 CAPITAL PROJECTS OVER \$50,000
EXPLANATIONS**

Multi-Year Projects (cont'd.)

5. Replace Energy Management System - Energy Control Centre

This project was included in Hydro's 2005 Budget Application (please refer to Section B, page B-114) and received the Board's approval in Order No. P.U. 53 (2004). The most recent forecast cost to completion is \$10,238,000 as compared to \$12,278,100 in Hydro's 2005 Capital Budget Application. This revision resulted from a higher Canadian dollar exchange rate with the US dollar and a decision to manage some of the work internally rather than to contract to an outside party.

6. Replace VHF Mobile Radio System

This project was included in Hydro's 2005 Budget Application (please refer to Section B, page B-137) and received the Board's approval in Order No. P.U. 53 (2004). This project is proceeding as planned with no change in scope, nature or forecast. Currently Hydro is in the process of tendering the system. The current estimate for the contribution of the Department of Transportation and Works to this project is \$3,592,000.

2006 CAPITAL PROJECTS OVER \$50,000

EXPLANATIONS

Newfoundland and Labrador Hydro

Report Addendum

Snook's Arm Wood Stave Penstock

Update of Economic Analysis

July 14, 2005

Introduction

As part of its 2005 Capital Budget, Hydro submitted and the Board approved a proposal to “Replace Penstock – Snook’s Arm Generation Station”. Final engineering commenced in 2005 with the bulk of the construction activities planned for completion in 2006. Due to a worldwide increase in the price of steel, the overall project estimate has increased from \$1.93 million to \$2.11 million. The following presents an update to the analysis of the economic viability of the proposed project.

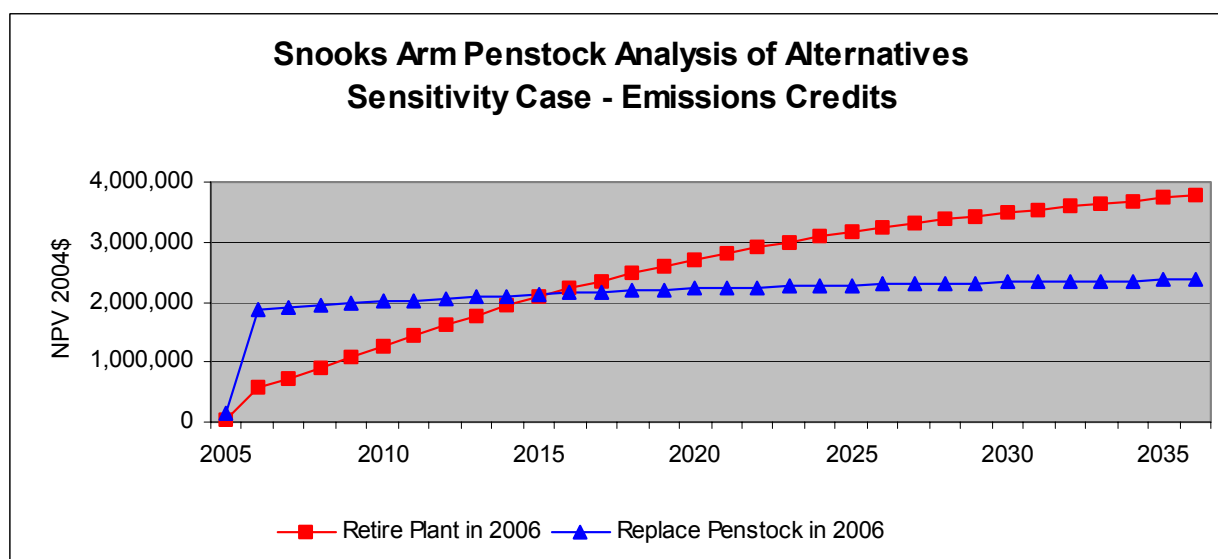
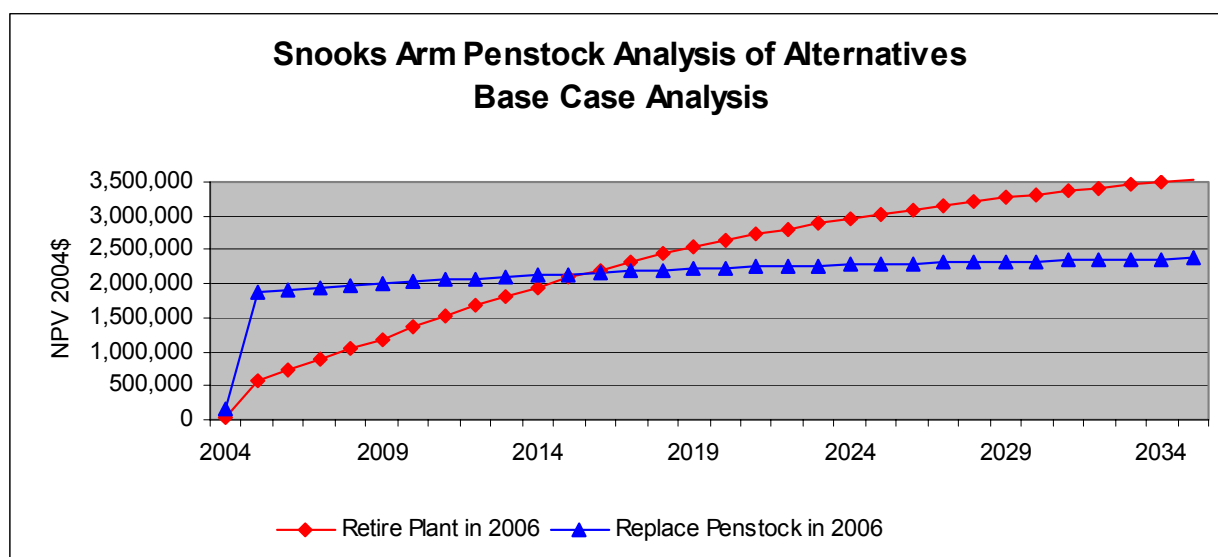
Summary

In addition to the increase in the estimated capital cost of the project, a number of other analysis inputs have also changed since the original report was filed with the Board in 2004. All changes are summarized below:

- Capital cost changed to \$2,110,000
- Holyrood conversion efficiency changed to 630 kWh/bbl
- Holyrood variable O&M has been changed to 1.16 mills/kWh (2004\$); and
- Forecast of fuel prices at Holyrood have been updated to reflect Hydro’s latest estimates.

A summary of the detailed economic analysis (attached) is presented in the following table and graphs. Note that while the capital cost has increased, there has been a significant increase in the value of avoided fuel at Holyrood that has the overall effect of increasing the economic viability of the penstock replacement project.

Snook's Arm Penstock Replacement Comparison of Alternatives		
	CPW Preference Against Plant Retirement Alternative	
	CPW (2004\$)	Payback Period
Base Case:		
Full Replacement in 2006	\$1,161,092	11 Years
Sensitivity Case – Emissions Costs:		
Full Replacement in 2006	\$1,398,735	10 Years



Snooks Arm Penstock Replacement

Option 1 - Full Replacement in 2005/6

Assumptions			
Annual Escalation:	2.0%	Engineering (2005):	117,600
Discount Rate:	8.4%	Construction (2006):	1,992,400
Installed Capacity:	590 kW		
Annual Energy:	3,500,000 kWh		
Holyrood Conversion:	630 kWh/BBL	Operator + O&M (2003\$):	40,000
Holyrood Var O&M:	1.16 mills/kWh 2004\$	Runner Maintenance (2003\$):	7,500
Fuel Forecast:	Spring 2005 mills/kWh	Upper Penstock Maintenance (2003\$)	20,000
Capacity Value (CT equiv.):	100 \$/kW/yr 2004\$	Retire Plant in 2006:	500,000

Year	Replace Penstock in 2006				Retire Plant in 2006						Difference	
	Capital Cost	Plant O&M	Penstock Maint.	Sub-total Current\$ CPW 2004\$	Capital Cost	Operator	Capacity	Holyrood Var O&M	Fuel	Sub-total Current\$ CPW 2004\$	TOTAL Current\$ CPW 2004\$	
2004												
2005	117,600	41,616		159,216 146,878		41,616				41,616 38,391	117,600 108,487	
2006	1,992,400	42,448		2,034,848 1,878,582	530,604	21,224		2,112	89,444	643,385 585,926	1,391,464 1,292,655	
2007		43,297		43,297 1,912,573				4,309	189,722	194,031 738,255	-150,733 1,174,318	
2008		44,163		44,163 1,944,558				4,395	211,667	216,061 894,736	-171,898 1,049,822	
2009		45,046		45,046 1,974,654				4,483	221,667	226,149 1,045,830	-181,103 928,824	
2010		45,947	8,615	54,563 2,008,284				4,572	230,000	234,572 1,190,408	-180,010 817,876	
2011		46,866		46,866 2,034,931			45,895	4,664	243,333	293,892 1,357,510	-247,026 677,421	
2012		47,804		47,804 2,060,006			45,895	4,757	254,444	305,096 1,517,541	-257,293 542,465	
2013		48,760		48,760 2,083,599			45,895	4,852	265,694	316,441 1,670,660	-267,682 412,939	
2014		49,735		49,735 2,105,800			45,895	4,949	276,944	327,789 1,816,979	-278,054 288,821	
2015		50,730		50,730 2,126,690			45,895	5,048	287,778	338,721 1,956,462	-287,991 170,228	
2016		51,744		51,744 2,146,347			45,895	5,149	293,750	344,794 2,087,443	-293,050 58,904	
2017		52,779		52,779 2,164,843			45,895	5,252	299,722	350,869 2,210,403	-298,090 -45,560	
2018		53,835		53,835 2,182,247			45,895	5,357	305,833	357,085 2,325,845	-303,251 -143,597	
2019		54,911		54,911 2,198,624			45,895	5,464	312,083	363,443 2,434,236	-308,531 -235,613	
2020		56,010	10,502	66,511 2,216,923			45,895	5,574	318,472	369,941 2,536,017	-303,429 -319,094	
2021		57,130		57,130 2,231,423			45,895	5,685	325,000	376,580 2,631,595	-319,450 -400,172	
2022		58,272		58,272 2,245,067			45,895	5,799	331,806	383,499 2,721,387	-325,227 -476,320	
2023		59,438		59,438 2,257,905			45,895	5,915	338,611	390,421 2,805,716	-330,983 -547,811	
2024		60,627		60,627 2,269,985			45,895	6,033	345,417	397,345 2,884,890	-336,718 -614,904	
2025		61,839		61,839 2,281,352			45,895	6,154	352,500	404,549 2,959,252	-342,709 -677,900	
2026		63,076		63,076 2,292,048			45,895	6,277	359,722	411,894 3,029,098	-348,818 -737,050	
2027		64,337		64,337 2,302,113			45,895	6,402	367,083	419,381 3,094,703	-355,043 -792,590	
2028		65,624		65,624 2,311,583			45,895	6,530	374,722	427,147 3,156,345	-361,523 -844,762	
2029		66,937		66,937 2,320,494			45,895	6,661	382,361	434,917 3,214,244	-367,980 -893,750	
2030		68,275	12,802	81,077 2,330,451			45,895	6,794	390,139	442,828 3,268,629	-361,751 -938,177	
2031		69,641		69,641 2,338,341			45,895	6,930	398,194	451,019 3,319,727	-381,378 -981,385	
2032		71,034		71,034 2,345,765			45,895	7,069	406,389	459,352 3,367,736	-388,319 -1,021,971	
2033		72,454		72,454 2,352,751			45,895	7,210	414,583	467,688 3,412,829	-395,234 -1,060,078	
2034		73,904		73,904 2,359,324			45,895	7,354	423,194	476,444 3,455,206	-402,540 -1,095,882	
2035		75,382		75,382 2,365,510			45,895	7,501	431,806	485,202 3,495,018	-409,820 -1,129,508	
2036		76,889		76,889 2,371,330			45,895	7,651	440,592	494,138 3,532,422	-417,249 -1,161,092	

Snooks Arm Penstock Replacement **Option 1 - Full Replacement in 2005/6 + Emissions Credits**

Assumptions			
Annual Escalation:	2.0%	Engineering (2005):	117,600
Discount Rate:	8.4%	Construction (2006):	1,992,400
Installed Capacity:	590 kW		
Annual Energy:	3,500,000 kWh		
Holyrood Conversion:	630 kWh/BBL	Operator + O&M (2003\$):	40,000
Holyrood Var O&M:	1.16 mills/kWh 2004\$	Runner Maintenance (2003\$):	7,500
Fuel Forecast:	Spring 2005 mills/kWh	Upper Penstock Maintenance (2003\$):	20,000
Capacity Value (CT equiv.):	100 \$/kW/yr 2004\$	Retire Plant in 2006:	500,000

Year	Replace Penstock in 2006				Retire Plant in 2006								Difference	
	Capital Cost	Plant O&M	Penstock Maint.	Sub-total Current\$ CPW 2004\$	Capital Cost	Operator	Capacity	CO ₂ Emissions**	Holyrood Var O&M	Fuel	Sub-total Current\$ CPW 2004\$		TOTAL Current\$ CPW 2004\$	
2004														
2005	117,600	41,616		159,216 146,878		41,616					41,616 38,391		117,600	108,487
2006	1,992,400	42,448		2,034,848 1,878,582	530,604	21,224			2,112	89,444	643,385 585,926		1,391,464	1,292,655
2007		43,297		43,297 1,912,573					4,309	189,722	194,031 738,255		-150,733	1,174,318
2008		44,163		44,163 1,944,558				28,140	4,395	211,667	244,201 915,116		-200,038	1,029,442
2009		45,046		45,046 1,974,654				28,140	4,483	221,667	254,289 1,085,011		-209,243	889,643
2010		45,947	8,615	54,563 2,008,284				28,140	4,572	230,000	262,712 1,246,933		-208,150	761,351
2011		46,866		46,866 2,034,931			45,895	28,140	4,664	243,333	322,032 1,430,035		-275,166	604,896
2012		47,804		47,804 2,060,006			45,895	28,140	4,757	254,444	333,236 1,604,826		-285,433	455,180
2013		48,760		48,760 2,083,599			45,895	28,140	4,852	265,694	344,581 1,771,562		-295,822	312,038
2014		49,735		49,735 2,105,800			45,895	28,140	4,949	276,944	355,929 1,930,442		-306,194	175,358
2015		50,730		50,730 2,126,690			45,895	28,140	5,048	287,778	366,861 2,081,512		-316,131	45,178
2016		51,744		51,744 2,146,347			45,895	28,140	5,149	293,750	372,934 2,223,183		-321,190	-76,836
2017		52,779		52,779 2,164,843			45,895	28,140	5,252	299,722	379,009 2,356,005		-326,230	-191,162
2018		53,835		53,835 2,182,247			45,895	28,140	5,357	305,833	385,225 2,480,544		-331,391	-298,296
2019		54,911		54,911 2,198,624			45,895	28,140	5,464	312,083	391,583 2,597,328		-336,671	-398,704
2020		56,010	10,502	66,511 2,216,923			45,895	28,140	5,574	318,472	398,081 2,706,850		-331,569	-489,927
2021		57,130		57,130 2,231,423			45,895	28,140	5,685	325,000	404,720 2,809,571		-347,590	-578,148
2022		58,272		58,272 2,245,067			45,895	28,140	5,799	331,806	411,639 2,905,951		-353,367	-660,885
2023		59,438		59,438 2,257,905			45,895	28,140	5,915	338,611	418,561 2,996,358		-359,123	-738,453
2024		60,627		60,627 2,269,985			45,895	28,140	6,033	345,417	425,485 3,081,139		-364,858	-811,154
2025		61,839		61,839 2,281,352			45,895	28,140	6,154	352,500	432,689 3,160,675		-370,849	-879,322
2026		63,076		63,076 2,292,048			45,895	28,140	6,277	359,722	440,034 3,235,292		-376,958	-943,244
2027		64,337		64,337 2,302,113			45,895	28,140	6,402	367,083	447,521 3,305,299		-383,183	-1,003,186
2028		65,624		65,624 2,311,583			45,895	28,140	6,530	374,722	455,287 3,371,002		-389,663	-1,059,419
2029		66,937		66,937 2,320,494			45,895	28,140	6,661	382,361	463,057 3,432,647		-396,120	-1,112,153
2030		68,275	12,802	81,077 2,330,451			45,895	28,140	6,794	390,139	470,968 3,490,487		-389,891	-1,160,036
2031		69,641		69,641 2,338,341			45,895	28,140	6,930	398,194	479,159 3,544,774		-409,518	-1,206,432
2032		71,034		71,034 2,345,765			45,895	28,140	7,069	406,389	487,492 3,595,724		-416,459	-1,249,959
2033		72,454		72,454 2,352,751			45,895	28,140	7,210	414,583	495,828 3,643,530		-423,374	-1,290,779
2034		73,904		73,904 2,359,324			45,895	28,140	7,354	423,194	504,584 3,688,410		-430,680	-1,329,086
2035		75,382		75,382 2,365,510			45,895	28,140	7,501	431,806	513,342 3,730,531		-437,960	-1,365,022
2036		76,889		76,889 2,371,330			45,895	28,140	7,651	440,592	522,278 3,770,065		-445,389	-1,398,735

** Assumes value associated with reduction of 2814 tonnes CO₂ @ \$10/tonne annually