NEWFOUNDLAND AND LABRADOR HYDRO

2006 CAPITAL BUDGET

SUBMISSION TO PUBLIC UTILITIES BOARD

HYDRO
THE POWER OF COMMITMENT

NEWFOUNDLAND AND LABRADOR HYDRO
2006 CAPITAL BUDGET

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APPLICATION

IN THE MATTER OF the *Public Utilities Act*, (the "Act"); and

IN THE MATTER OF an Application by Newfoundland and Labrador Hydro for an Order approving: (1) its 2006 capital budget pursuant to s.41(1) of the Act; (2) its 2006 capital purchases, and construction projects in excess of $50,000 pursuant to s.41 (3) (a) of the Act; (3) its leases in excess of $5,000 pursuant to s. 41 (3) (b) of the Act; and (4) its estimated contributions in aid of construction for 2005 pursuant to s.41 (5) of the Act and for an Order pursuant to s. 78 of the Act fixing and determining its average rate base for 2004.

TO: The Board of Commissioners of Public Utilities ("the Board")

THE APPLICATION of Newfoundland and Labrador Hydro ("Hydro") ("the Applicant") states that:

1. The Applicant is a corporation continued and existing under the *Hydro Corporation Act*, is a public utility within the meaning of the Act and is subject to the provisions of the *Electrical Power Control Act, 1994.*

2. Section A to this Application is Hydro's proposed 2006 Capital Budget in the amount of approximately $42.6 million prepared in accordance with the guidelines and conditions outlined in Order No. P.U. 7 (2002-2003) and the Provisional Capital Budget Application Guidelines dated June 2, 2005 (the "Provisional Guidelines").

3. Section B to this Application is a list of the proposed 2006 Construction Projects and Capital Purchases in excess of $50,000 prepared in accordance with Order No. P.U. 7 (2002-2003) and the Provisional Guidelines.

4. Section C to this Application summarizes Hydro's proposed 2006 capital projects by definitions, by classification and by materiality as required by the Provisional Guidelines.

5. There are no new Leases in excess of $5,000 per year for 2006 listed in Section D.

6. Section E to this Application is a Schedule of Hydro's Capital Expenditures for the period 2000 to 2009.

7. Section F to this Application is a report on the status of the 2005 capital expenditures including those approved by Orders Nos. P.U. 53 (2004), P.U. 3 (2005), P.U. 11 (2005), P.U. 12 (2005) and P.U. 14 (2005), projects under $50,000 not included in these Orders, and the 2004 capital expenditures carried forward to 2005.

8. Section G to this Application is a report on the ten year Plan of Maintenance Expenditures for the Holyrood Generating Station required to be filed by Order No. P.U. 14 (2004).

9. Section H to this Application contains the supplementary reports referred to in various capital budget proposals.

10. Section I to this Application shows Hydro's actual average rate base for 2004 of $1,476,724,000.

11. The proposed capital expenditures for 2006 as set out in this Application are required to allow Hydro to continue to provide service and facilities for its customers which are reasonably safe, adequate and reliable as required by section 37 of the Act.

12. The Applicant has estimated the total of contributions in aid of construction for 2006 to be approximately $300,000. The information contained in the 2006 Capital Budget (Section A) takes into account this estimate of the contributions in aid of construction to be received from customers. All contributions to be recovered from customers shall be calculated in accordance with the relevant policies as approved by the Board.

13. Communications with respect to this Application should be forwarded to Maureen P. Greene, Q.C., Vice-President and General Counsel, P.O. Box 12400, St. John's, Newfoundland and Labrador, A1B 4K7, Telephone: (709) 737-1465.

The Applicant requests that the Board make an Order as follows:

(1) Approving Hydro's 2006 Capital Budget as set out in Section A hereto, pursuant to section 41 (1) of the Act;

(2) Approving 2006 Capital Purchases and Construction Projects in excess of $50,000 as set out in Section B hereto, pursuant to section 41 (3) (a) of the Act;

(3) Approving the proposed estimated contributions in aid of construction as set out in paragraph 11 hereof for 2006 as required by section 41 (5) of the Act, with all such contributions to be calculated in accordance with the policies approved by the Board; and

(4) Fixing and determining Hydro's average rate base for 2004 in the amount of $1,476,724,000, pursuant to section 78 of the Act.

DATED at St. John's, Newfoundland, this first day of August, 2005.

NEWFOUNDLAND AND LABRADOR HYDRO

Maureen P. Greene

Maureen P. Greene
Vice-President and General Counsel

Newfoundland and Labrador Hydro
P.O. Box 12400
500 Columbus Drive
St. John's, Newfoundland and Labrador
A1B 4K7
Telephone: (709) 737-1465

IN THE MATTER OF the *Public Utilities Act*, (the "Act"); and

IN THE MATTER OF an Application by Newfoundland and Labrador Hydro for an Order approving: (1) its 2006 capital budget pursuant to s.41(1) of the Act; (2) its 2006 capital purchases, and construction projects in excess of $50,000 pursuant to s.41 (3) (a) of the Act; (3) its leases in excess of $5,000 pursuant to s. 41 (3) (b) of the Act; and (4) its estimated contributions in aid of construction for 2006 pursuant to s.41 (5) of the Act and for an Order pursuant to s. 78 of the Act fixing and determining its average rate base for 2004.

TO: The Board of Commissioners of Public Utilities ("the Board")

AFFIDAVIT

I, James R. Haynes, Professional Engineer, make oath and say as follows:

1. That I am the Vice-President of Production of Hydro and as such I have knowledge of the matters arising in the within matter.

2. That I have read the contents of the attached Application and those contents are correct and true to the best of my knowledge, information and belief.

SWORN TO in the)
City of St. John's, in the)
Province of Newfoundland and Labrador)
this 15 day of August, 2005,)
before me:)

Maureen P Greene

Maureen P. Greene
Barrister (Nfld.)

James R. Haynes

SECTION A

NEWFOUNDLAND & LABRADOR HYDRO

2006 CAPITAL BUDGET - OVERVIEW

($,000)

	Exp To 2005	2006	Future Years	Total
GENERATION	3,624	9,245	4,530	17,399
TRANSMISSION & RURAL OPERATIONS	0	17,404	522	17,926
GENERAL PROPERTIES	5,975	14,987	220	21,182
ALLOWANCE FOR UNFORESEEN EVENTS	0	1,000	0	1,000
TOTAL CAPITAL BUDGET	9,599	42,636	5,272	57,507

NEWFOUNDLAND & LABRADOR HYDRO

2006 CAPITAL BUDGET - SUMMARY BY CATEGORY

($,000)

	Exp To 2005	2006	Future Years	Total
GENERATION				
NEW GENERATION SOURCE				
Feasibility Studies	0	1,937	33	1,970
HYDRO PLANTS				
Construction Projects	496	2,829	0	3,325
Tools & Equipment	0	39	0	39
THERMAL PLANT				
Construction Projects	3,128	3,866	4,497	11,491
Property Additions	0	275	0	275
Tools & Equipment	0	57	0	57
GAS TURBINES				
Construction Projects	0	242	0	242
TOTAL GENERATION	3,624	9,245	4,530	17,399
TRANSMISSION & RURAL OPERATIONS				
TRANSMISSION	0	3,837	0	3,837
SYSTEM PERFORMANCE & PROTECTION	0	292	0	292
TERMINALS	0	858	0	858
DISTRIBUTION	0	7,406	0	7,406
GENERATION	0	3,467	522	3,989
GENERAL				
Metering	0	114	0	114
Properties	0	134	0	134
Tools & Equipment	0	1,296	0	1,296
TOTAL TRANSMISSION & RURAL OPERATIONS	0	17,404	522	17,926

NEWFOUNDLAND & LABRADOR HYDRO

2006 CAPITAL BUDGET - SUMMARY BY CATEGORY

($,000)

	Exp To 2005	2006	Future Years	Total
GENERAL PROPERTIES				
INFORMATION SYSTEMS & TELECOMMUNICATIONS	5,975	12,492	220	18,687
TRANSPORTATION	0	1,733	0	1,733
ADMINISTRATIVE	0	762	0	762
TOTAL GENERAL PROPERTIES	5,975	14,987	220	21,182
ALLOWANCE FOR UNFORESEEN EVENTS	0	1,000	0	1,000
TOTAL CAPITAL BUDGET	9,599	42,636	5,272	57,507

NEWFOUNDLAND & LABRADOR HYDRO
GENERATION
2006 CAPITAL BUDGET - DETAIL

($,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
NEW GENERATION SOURCE						
GENERATION PROJECTS						
Island Pond Development - Feasibility Update		998		998	Nov. 06	B-5
Portland Creek Development - Final Feasibility Study		796		796	Nov. 06	B-7
Wind Generation Inventory Study		143	33	176	Jul. 07	B-9
TOTAL GENERATION PROJECTS	0	1,937	33	1,970		
HYDRO PLANTS						
CONSTRUCTION PROJECTS						
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 Tank - 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
TOTAL CONSTRUCTION PROJECTS	496	2,829	0	3,325		
TOOLS & EQUIPMENT						
Purchase & Replace T & E Less than $ 50,000		39		39		
TOTAL TOOLS & EQUIPMENT	0	39	0	39		

NEWFOUNDLAND & LABRADOR HYDRO
GENERATION
2006 CAPITAL BUDGET - DETAIL
($,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
THERMAL PLANT						
CONSTRUCTION PROJECTS						
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 Steam Coil - Holyrood		602		602	Sep. 06	B-25
HVAC Replacements - 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
TOTAL CONSTRUCTION PROJECTS	3,128	3,866	4,497	11,491		
PROPERTY ADDITIONS						
Replacement of Paging System - Holyrood		275		275	Oct. 06	B-36
TOTAL PROPERTY ADDITIONS	0	275	0	275		
TOOLS & EQUIPMENT						
Purchase & Replace Tools & Equipment Less than $ 50,000	0	57	0	57		
TOTAL TOOLS & EQUIPMENT	0	57	0	57		
GAS TURBINES						
CONSTRUCTION PROJECTS						
Replace Automatic Voltage Regulator - Hardwoods		242		242	Nov. 06	B-38
TOTAL CONSTRUCTION PROJECTS	0	242	0	242		
TOTAL GENERATION	3,624	9,245	4,530	17,399		

NEWFOUNDLAND & LABRADOR HYDRO
TRANSMISSION & RURAL OPERATIONS
2006 CAPITAL BUDGET - DETAIL
($,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
TRANSMISSION						
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
TOTAL TRANSMISSION	0	3,837	0	3,837		
SYSTEM PERFORMANCE & PROTECTION						
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
Install Feeder Backup Protection - Happy Valley		48		48	Oct. 06	
Install Feeder MW Telemetry - Happy Valley		40		40	Oct. 06	
Upgrade Breaker Controls - BDE/BUC Terminal Station		39		39	Aug, 06	
TOTAL SYSTEM PERFORMANCE & PROTECTION	0	292	0	292		
TERMINALS						
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 Air Compressor and Dryer - Grand Falls Frequency Converter Stn		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
Install RIGD (Remote Ice Growth Detection) Beam - Various Stations		28		28	Dec. 08	
TOTAL TERMINALS	0	858	0	858		

NEWFOUNDLAND & LABRADOR HYDRO
TRANSMISSION & RURAL OPERATIONS
2006 CAPITAL BUDGET - DETAIL
($,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
DISTRIBUTION						
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	Oct. 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
Install Substation P.T. - Mary's Harbour		19		19	Nov. 06	
TOTAL DISTRIBUTION	0	7,406	0	7,406		
GENERATION						
Construct New Diesel Plant - St. Lewis		2,227		2,227	Oct. 06	B-78
Installation of Fall Arrest Euipment - Various Locations		268	522	790	Dec. 06	B-81
Replace Diesel Generation 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
TOTAL GENERATION	0	3,467	522	3,989		

NEWFOUNDLAND & LABRADOR HYDRO
TRANSMISSION & RURAL OPERATIONS
2006 CAPITAL BUDGET - DETAIL
($,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
GENERAL						
METERING						
Purchase Meters & Equipment - All Service Areas		93		93	Dec. 06	B-88
Purchase Metering Spares		21		21	Dec. 06	
TOTAL METERING	0	114	0	114		
PROPERTIES						
Legal Survey of Distribution Line Right-of-Ways - Various Sites		50		50	Oct. 06	B-89
Replace Waste Oil Storage Tank - Ramea		29		29	Oct. 06	
Construct Line Material Storage Shed - Black Tickle		28		28	Oct. 06	
Construct Sewage Disposal Field - Charlottetown		17		17	Oct. 06	
Construct Storage Ramp - L'Anse au Loup		10		10	Oct. 06	
TOTAL PROPERTIES	0	134	0	134		
TOOLS & EQUIPMENT						
Replace Off Road Track Vehicles - Various Locations		636		636	Apr. 06	B-91
Purchase & Replace Tools & Equipment Less than $ 50,000	0	386		386		
Replace Light Duty Mobile Equipment Less than $ 50,000		274		274		
TOTAL TOOLS & EQUIPMENT	0	1,296	0	1,296		
TOTAL GENERAL	0	1,544	0	1,544		
TOTAL TRANSMISSION & RURAL OPERATIONS	0	17,404	522	17,926		

NEWFOUNDLAND & LABRADOR HYDRO
GENERAL PROPERTIES
2006 CAPITAL BUDGET - DETAIL
($,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
INFORMATION SYSTEMS & TELECOMMUNICATIONS						
SOFTWARE APPLICATIONS						
Infrastructure Replacement						
Replace Energy Management System - Energy Control Centre	4,856	5,382		10,238	Jul. 06	B-120 (5)
New Infrastructure						
Applications Enhancements		946		946	Dec. 06	B-93
Cost Recovery CF(L)Co		(165)		(165)		
Upgrade of Technology						
Corporate Applications Environment		592		592	Dec. 06	B-96
Cost Recovery CF(L)Co		(36)		(36)		
Network Management Tools		48		48		
TOTAL SOFTWARE APPLICATIONS	4,856	6,767	0	11,623		
COMPUTER OPERATIONS						
New Infrastructure						
Peripheral Infrastructure Replacement		199		199	Dec. 06	B-99
Security - Personal Firewalls		47		47	Dec. 06	
Cost Recovery CF(L)Co		(9)		(9)		
Security - Scan, Block & Quarantine		46		46	Dec. 06	
Cost Recovery CF(L)Co		(9)		(9)		
TOTAL COMPUTER OPERATIONS	0	274	0	274		

NEWFOUNDLAND & LABRADOR HYDRO
GENERAL PROPERTIES
2006 CAPITAL BUDGET - DETAIL
($,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
INFORMATION SYSTEMS & TELECOMMUNICATIONS						
NETWORK SERVICES						
Infrastructure Replacement						
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
Video Conferencing for Regional Offices - H Valley , P Saunders & Holyrood		49		49	Dec. 06	
Network Infrastructure						
Communications Network Technology		97		97	Dec. 06	B-110
Upgrade of Technology						
Upgrade Site Facilities		45		45	Sep. 06	
TOTAL NETWORK SERVICES	1,119	5,451	220	6,790		
TOTAL INFORMATION SYSTEMS & TELECOMMUNICATIONS	5,975	12,492	220	18,687		

NEWFOUNDLAND & LABRADOR HYDRO
GENERAL PROPERTIES
2006 CAPITAL BUDGET - DETAIL
($,000)

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Explanation Page Ref.
ADMINISTRATIVE						
Vehicles						
Replace Vehicles - Various Locations		1,733		1,733	Aug. 06	B-112
ADMINISTRATION						
Construct New Warehouse - Port Saunders		431		431	Oct. 06	B-114
Replace Storage Ramps - Bishop's Falls		159		159	Sep. 06	B-117
Purchase & Replace Admin Office Equipment Less than $50,000		172		172		
TOTAL ADMINISTRATIVE	0	2,495	0	2,495		
TOTAL GENERAL PROPERTIES	5,975	14,987	220	21,182		

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
TOTAL CAPITAL BUDGET	9,599	41,212	5,272	56,083

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		

NEWFOUNDLAND & LABRADOR HYDRO
TRANSMISSION & RURAL OPERATIONS
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.
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 2005	2006	Future Years	Total	In-Ser Date	Explanation 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)*	**2006**	**2007**	**Beyond**	**Total**
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	**998.0**	**0.0**	**0.0**	**998.0**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	**796.0**	**0.0**	**0.0**	**796.0**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	0.0	13.6	0.0	13.6
Total	**143.2**	**33.3**	**0.0**	**176.5**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	**199.5**	**0.0**	**0.0**	**199.5**

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)*	2006	2007	Beyond	Total
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	**106.8**	**0.0**	**0.0**	**106.8**

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 Mm^3 of water was contributed to compensate the creek, while an analysis indicated that 23.7 Mm^3 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

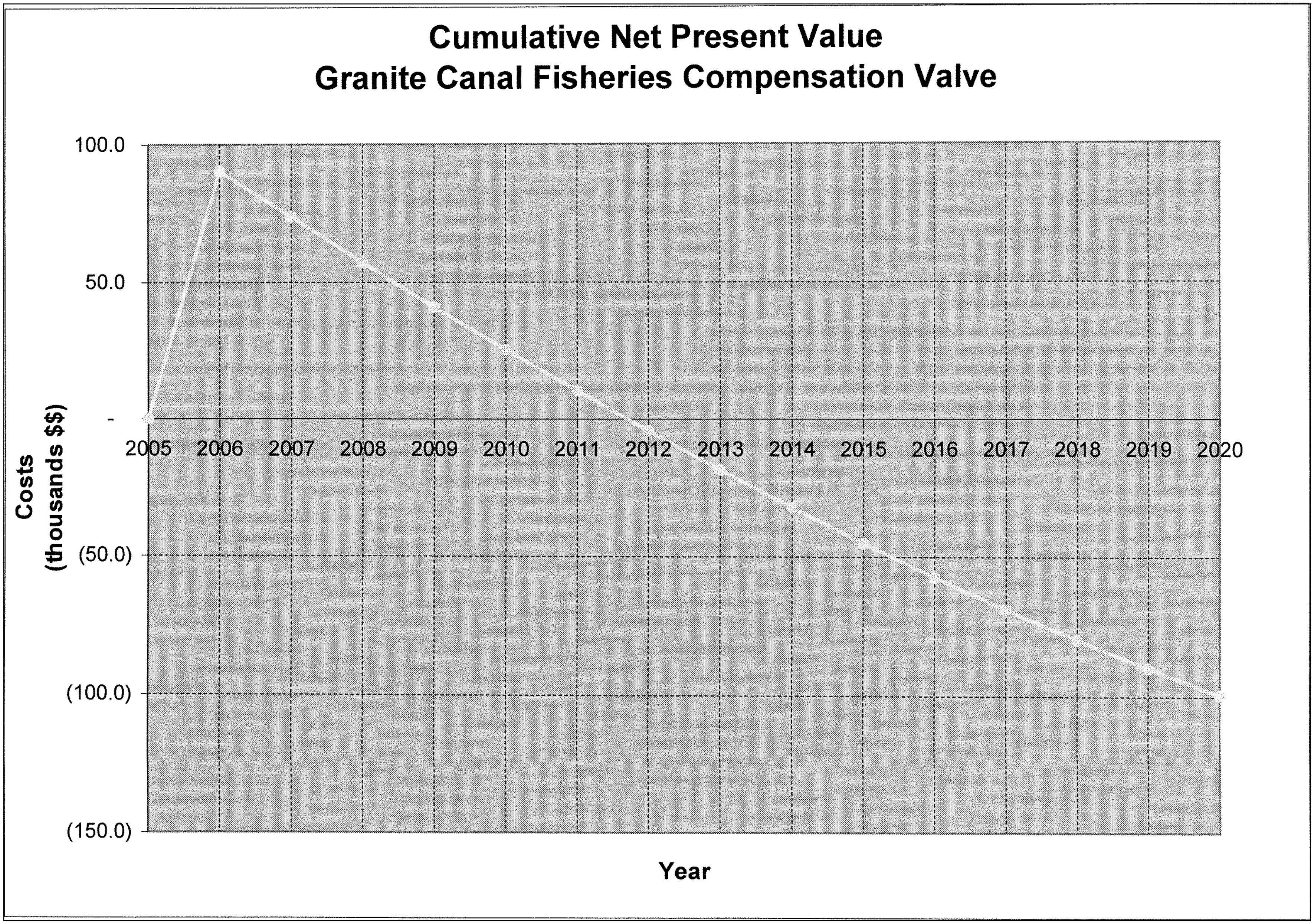
Note: Costs are shown as positive values;Benefits as negative values

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 ***after*** 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)
						-			-	-	-
						-			-	-	-
						-			-	-	-
						-			-	-	-
						-			-	-	-
						-			-	-	-
						-			-	-	-
						-			-	-	-

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


Cumulative Net Present Value
Granite Canal Fisheries Compensation Valve
100.0
50.0
-
(50.0)
(100.0)
(150.0)
Costs
(thousands $$)
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Year

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)*	**2006**	**2007**	**Beyond**	**Total**
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	**82.4**	**0.0**	**0.0**	**82.4**

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	0.0	251.0	0.0	251.0
Total	**318.7**	**2,817.9**	**0.0**	**3,136.6**

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 plattens in the upper section and five of the 31 plattens 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)*	**2006**	**2007**	**Beyond**	**Total**
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	49.2	0.0	0.0	49.2
Total	601.7	0.0	0.0	601.7

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.

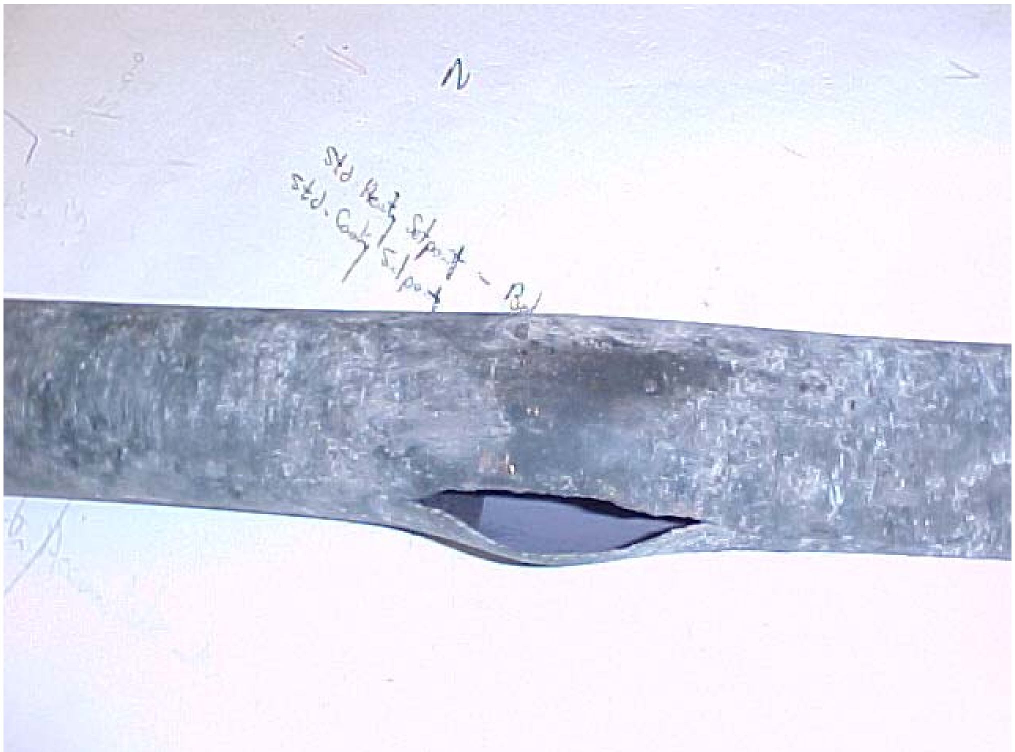
2006 CAPITAL PROJECTS OVER $50,000
EXPLANATIONS

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

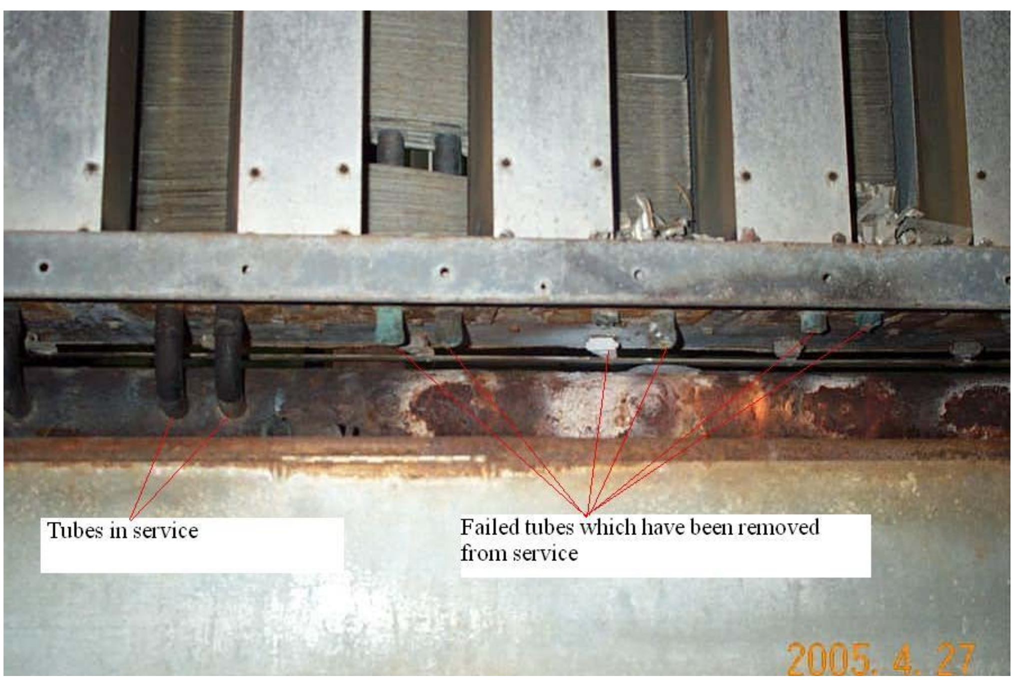
Steam coil with one ruptured tube removed and its connection capped

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)*	2006	2007	Beyond	Total
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	**565.4**	**0.0**	**0.0**	**565.4**

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.

[redacted]

Black & McDonald

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 his 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 his 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)*	**2006**	**2007**	**Beyond**	**Total**
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	15.2	0.0	0.0	15.2
Total	**172.2**	**0.0**	**0.0**	**172.2**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	9.5	0.0	0.0	9.5
Total	**116.6**	**0.0**	**0.0**	**116.6**

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)*	2006	2007	Beyond	Total
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	22.2	0.0	0.0	22.2
Total	274.5	0.0	0.0	274.5

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)*	**2006**	**2007**	**Beyond**	**Total**
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	**241.5**	**0.0**	**0.0**	**241.5**

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	2,302.6	0.0	0.0	2,302.6

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)*	**2006**	**2007**	**Beyond**	**Total**
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	**916.6**	**0.0**	**0.0**	**916.6**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	8.9	0.0	0.0	8.9
Total	**108.9**	**0.0**	**0.0**	**108.9**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	4.5	0.0	0.0	4.5
Total	**56.0**	**0.0**	**0.0**	**56.0**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	**306.8**	**0.0**	**0.0**	**306.8**

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)*	2006	2007	Beyond	Total
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	7.4	0.0	0.0	7.4
Total	89.7	0.0	0.0	89.7

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)*	**2006**	**2007**	**Beyond**	**Total**
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	6.6	0.0	0.0	6.6
Total	79.7	0.0	0.0	79.7

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)*	**2006**	**2007**	**Beyond**	**Total**
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	6.7	0.0	0.0	6.7
Total	**79.9**	**0.0**	**0.0**	**79.9**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	6.5	0.0	0.0	6.5
Total	78.4	0.0	0.0	78.4

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)*	**2006**	**2007**	**Beyond**	**Total**
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	**71.6**	**0.0**	**0.0**	**71.6**

Operating Experience:

The station batteries proposed for replacement are approaching or beyond the normal expected service live. 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)*	**2006**	**2007**	**Beyond**	**Total**
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	4.3	0.0	0.0	4.3
Total	**52.6**	**0.0**	**0.0**	**52.6**

Operating Experience:

The unit transformer at Upper Salmon is consistently operating at 8 - 10 ºC 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)*	**2006**	**2007**	**Beyond**	**Total**
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	2,017.4	0.0	0.0	2,017.4

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

Project Cost: *($ x1,000)*	**St.Anthony L6**	**Bear Cove L6**	**Hawkes Bay L1 & L3**	**Black Tickle**
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	778.3	577.7	379.6	281.8

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)*	**2006**	**2007**	**Beyond**	**Total**
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	180.0	0.0	0.0	180.0
Total	1,984.0	0.0	0.0	1,984.0

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)*	2006	2007	Beyond	Total
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	175.0	0.0	0.0	175.0
Total	1,912.0	0.0	0.0	1,912.0

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)*	**2006**	**2007**	**Beyond**	**Total**
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	14.2	0.0	0.0	14.2
Total	**331.8**	**0.0**	**0.0**	**331.8**

The breakdown of costs for each system is:

Project Cost: *($ x1,000)*	**Nain**	**Bottom Waters**
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	7.7	6.5
Total	**179.4**	**152.4**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	5.2	0.0	0.0	5.2
Total	**121.9**	**0.0**	**0.0**	**121.9**

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 determing 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.

	Load Forecast (HR OPLF Fall 2004)	**2005**	**2006**	**2007**	**2008**	**2009**
1	Peak Demand Forecast (kW) L7	8,510	9,825	9,957	10055	10,136
2	Domestic Customers - # L7	486	486	486	486	486
3	Existing Planning Capacity	8,500	kW			
4	Capital Budget Proposal for Voltage Regulator	$121,900	2006$			
		1 Yr	2 Yr	3 Yr	4 Yr	5 Yr
5=1-8500	Required Demand Savings for Capital Deferral (kW) (Difference of forecast peak demand and peak demand target at capacity)	NA	1,325	1,457	1,555	1,636
	DSM Budget Calculation (Calculated assuming 2% inflation and 8.4% corporate cost of capital)					
6	Capital Budget Deferral Factors*	5.9%	11.5%	16.7%	21.6%	26.2%
7=6*4	Total DSM Deferral Budget (1yr discount)	$6,639	$12,887	$18,765	$24,297	$29,501
8=7/5	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.					
	DSM Supply Cost - $ per kW Achieved	$/kW*				
9	Domestic Hot Water Load Control (DLC) * includes provision for distribution losses.	$355				
	Maximum Achievable Winter Peak Demand Reduction (Max kW reduction at lowest DSM supply cost and full DSM deferral budget)	1 Yr	2 Yr	3 Yr	4 Yr	5 Yr
10=7/9	DHW - kW	19	36	53	68	83
11=10-5	Achievable DSM Less Required DSM Savings-kW	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: *($ x1,000)*	2006	2007	2008	Total
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	0.0	0.0	60.2	60.2
Total	268.1	250.9	271.0	790.0

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)*	**2006**	**2007**	**Beyond**	**Total**
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	8.7	0.0	0.0	8.7
Total	**106.3**	**0.0**	**0.0**	**106.3**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	92.5	0.0	0.0	92.5

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: *($ x1,000)*	**2006**	**2007**	**Beyond**	**Total**
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 Falls**	**Whitbourne**	**Springdale**	**Bay 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	23.0	11.0	11.0	11.0
Total	**259.2**	**125.6**	**125.6**	**125.6**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	47.6	0.0	0.0	47.6
Sub-Total	591.5	0.0	0.0	591.5
Cost Recoveries	(35.7)	0.0	0.0	(35.7)
Total	**555.8**	**0.0**	**0.0**	**555.8**

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: *($ x1,000)*	**2006**	**2007**	**Beyond**	**Total**
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)*	**2006**	**2007**	**Beyond**	**Total**
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	**407.3**	**0.0**	**0.0**	**407.3**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	32.6	0.0	0.0	32.6
Total	**403.6**	**0.0**	**0.0**	**403.6**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	28.1	0.0	0.0	28.1
Total	350.9	0.0	0.0	350.9

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)*	**2006**	**2007**	**Beyond**	**Total**
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	4.6	0.0	0.0	4.6
Total	57.3	0.0	0.0	57.3

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)*	**2006**	**2007**	**Beyond**	**Total**
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	7.8	0.0	0.0	7.8
Total	**96.7**	**0.0**	**0.0**	**96.7**

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)*	**2006**	**2007**	**Beyond**	**Total**
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	1,733.0	0.0	0.0	1,733.0

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.

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.

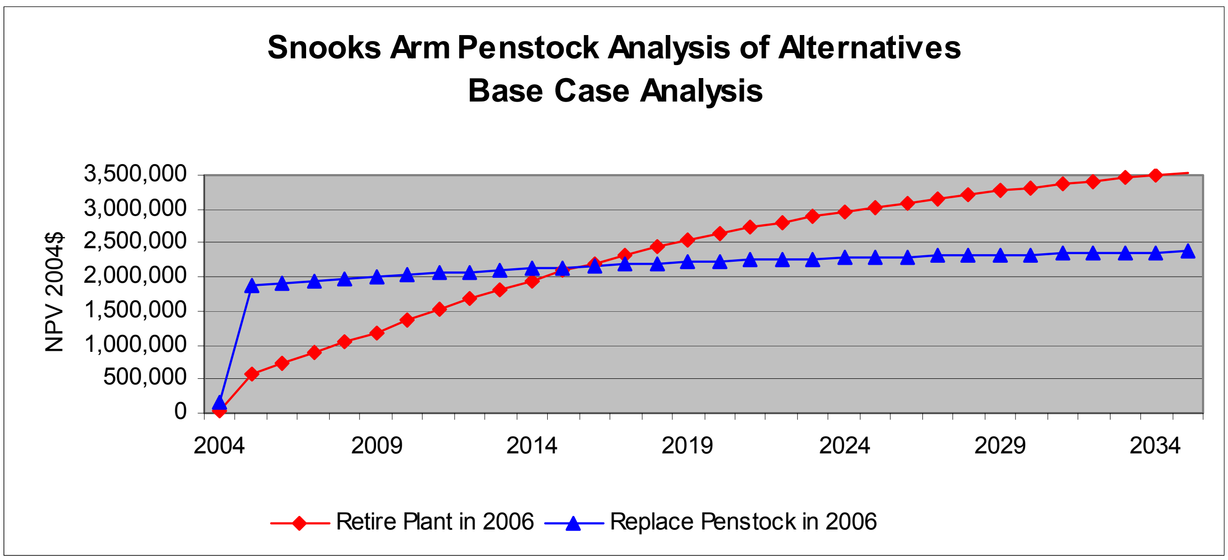
Summary

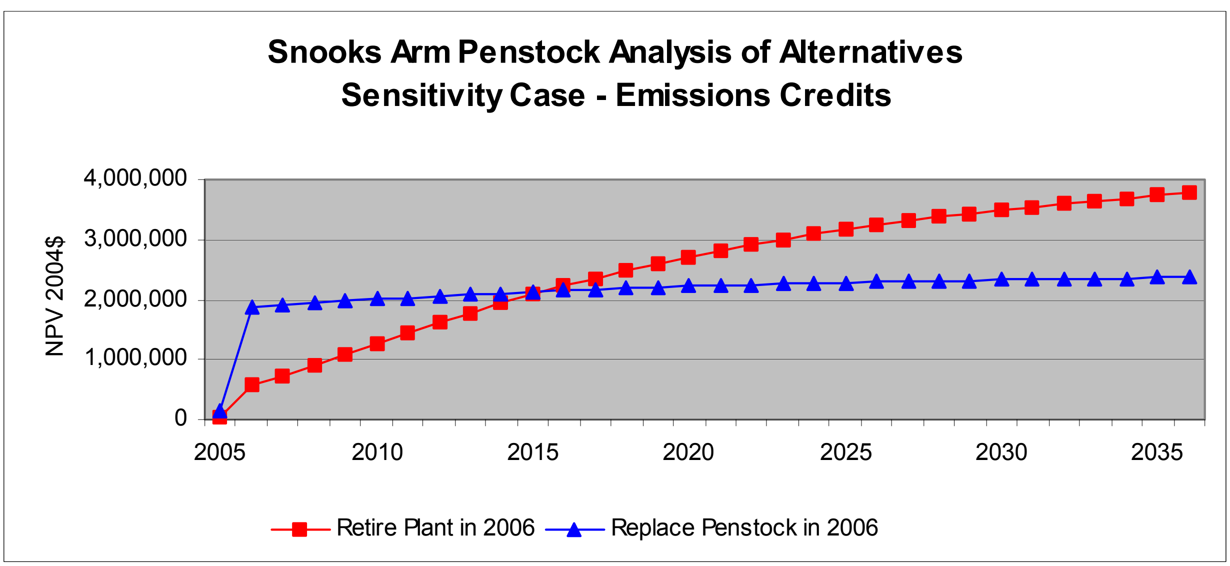
In addition to the increase in the estimated capital cost of the project, a number of other analysis inputs have also changed since the original report was filed with the Board in 2004. All changes are summarized below:

- 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

	Replace Penstock in 2006					Retire Plant in 2006							Difference	
			Runner &											
	Capital	Plant	Penstock	Sub-total		Capital			Holyrood		Sub-total		TOTAL	
Year	Cost	O&M	Maint.	Current$	CPW 2004$	Cost	Operator	Capacity	Var O&M	Fuel	Current$	CPW 2004$	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

	Replace Penstock in 2006					Retire Plant in 2006								Difference	
			Runner &												
	Capital	Plant	Penstock	Sub-total		Capital			CO_2	Holyrood		Sub-total		TOTAL	
Year	Cost	O&M	Maint.	Current$	CPW 2004$	Cost	Operator	Capacity	Emissions**	Var O&M	Fuel	Current$	CPW 2004$	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 CO_2 @ $10/tonne annually

SECTION C

NEWFOUNDLAND & LABRADOR HYDRO

2006 CAPITAL BUDGET - PROJECTS OVER $500,000

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date	Type	Explanation Page Ref.
MANDATORY PROJECTS							
Addition of Disconnecting Means to 600 Volt MCC Branch Feeders -Holyrood	613	859	749	2,221	Dec. 07	Other	B-119 (4)
Replace Superheater Unit 2 - Holyrood		319	2,818	3,137	Oct. 07	Other	B-20
Installation of Fall Arrest Equipment - Various Locations		268	522	790	Dec. 06	Pooled	B-81
TOTAL MANDATORY PROJECTS	613	1,446	4,089	6,148			
NORMAL PROJECTS							
Replace Energy Management System - Energy Control Centre	4,856	5,382		10,238	Jul. 06	Other	B-120 (5)
Upgrade Control Systems - Holyrood	2,515	316		2,831	Dec. 06	Other	B-119 (3)
Replace VHF Mobile Radio System	2,915	5,473		8,388	Dec. 06	Other	B-120 (6)
Cost Recovery - Department of Transportation and Works	(1,796)	(1,796)		(3,592)			
Replace Unit 1 Governor Controls - Cat Arm	378	311		689	Dec. 06	Other	B-119 (2)
Upgrade Corner Brook Frequency Converter		617		617	Nov. 08	Clustered	B-43
Wood Pole Line Management - Various Sites		2,303		2,303	Dec. 06	Pooled	B-39
Construct New Diesel Plant - St. Lewis		2,227		2,227	Oct. 06	Clustered	B-78
Upgrade Distribution Feeders - Various Locations		2,017		2,017	Oct. 06	Pooled	B-65
Provide Service Extensions		1,984		1,984	Dec. 06	Pooled	B-68
Upgrade Distribution Systems		1,912		1,912	Dec. 06	Pooled	B-70
Fire Protection Upgrades - Holyrood		916	930	1,846	Dec. 07	Other	B-23
Replace Vehicles - Various Locations		1,733		1,733	Aug. 06	Pooled	B-112
Replace Insulators - Various Locations		1,020		1,020	Oct. 06	Pooled	B-72
Island Pond Development - Feasibility Update		998		998	Nov. 06	Other	B-5
Applications Enhancements		946		946	Dec. 06	Pooled	B-93
Cost Recovery CF(L)Co		(165)		(165)			
Replace Insulators TL231 - (230kV Bay d'Espoir - Stoney Brook)		917		917	Sep. 06	Other	B-41
Portland Creek Development - Final Feasibility Study		796		796	Nov. 06	Other	B-7
Replace Diesel Generation Units - Various Locations		663		663	Oct. 06	Pooled	B-83
Replace Off Road Track Vehicles - Various Locations		636		636	Apr. 06	Pooled	B-91
Replace Warm Air Make-Up Steam Coil - Holyrood		602		602	Sep. 06	Other	B-25
Corporate Applications Environment		592		592	Dec. 06	Pooled	B-96
Cost Recovery CF(L)Co		(36)		(36)			
HVAC Replacements - Relay, Control & Exciter Rms - Holyrood		565		565	Oct. 06	Other	B-29
TOTAL NORMAL PROJECTS	8,868	30,929	930	40,727			
JUSTIFIABLE PROJECTS							
Replace Penstock - Snook's Arm Generating Station	118	1,992		2,110	Nov. 06	Other	B-119 (1)
TOTAL JUSTIFIABLE PROJECTS	118	1,992	0	2,110			

NEWFOUNDLAND & LABRADOR HYDRO

2006 CAPITAL BUDGET - PROJECTS OVER $200,000 BUT LESS THAN $500,000

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date		Explanation Page Ref.
MANDATORY PROJECTS							
Replacement of Paging System - Holyrood		275		275	Oct. 06	Other	B-36
TOTAL MANDATORY PROJECTS	18,585	68,150	9,289	96,024			
NORMAL PROJECTS							
Construct New Warehouse - Port Saunders		431		431	Oct. 06	Other	B-114
Microwave Site Refurbishing - Bay d'Espoir Hill and Blue Grass Hill		407		407	Dec. 06	Pooled	B-101
Replace Battery System - Multiple Sites		404		404	Dec. 06	Pooled	B-103
Replace Remote Terminal Units - Various Sites		351		351	Dec. 06	Pooled	B-105
Replace Power Line Carrier TL240 - Happy Valley - Churchill Falls		189	220	409	Oct. 07	Other	B-100
Replace Insulators - Various Stations		307		307	Oct. 06	Pooled	B-49
Replace Poles - Various Locations		332		332	Oct. 06	Pooled	B-74
Replace Automatic Voltage Regulator - Hardwoods		242		242	Nov. 06	Other	B-38
TOTAL NORMAL PROJECTS	0	2,663	220	2,883			

NEWFOUNDLAND & LABRADOR HYDRO

2006 CAPITAL BUDGET - PROJECTS OVER $50,000 BUT LESS THAN $200,000

PROJECT DESCRIPTION	Exp To 2005	2006	Future Years	Total	In-Ser Date		Explanation Page Ref.
MANDATORY PROJECTS							
Study Regeneration Waste Treatment - Holyrood		172		172	Aug. 06	Other	B-32
Replace Underground Fuel Tank - Cat Arm Powerhouse		137		137	Nov. 06	Other	B-13
Install NOx Monitor - Little Bay Islands		106		106	Aug. 06	Other	B-86
Install Waste Oil Holding Tanks - BDE, USL, HLK & PRV		82		82	Oct. 06	Pooled	B-19
Replace Telephone Isolation Equipment - Happy Valley		57		57	Dec. 06	Other	B-109
TOTAL MANDATORY PROJECTS	0	554	0	554			
NORMAL PROJECTS							
West Coast Communications Study - Engineering Design		175		175	Dec. 06	Other	B-107
Replace Storage Ramps - Bishop's Falls		159		159	Sep. 06	Other	B-117
Wind Generation Inventory Study		143	33	176	Jul. 07	Other	B-9
Replace Control Panel - Rigolet		135		135	Nov. 06	Other	B-85
Purchase and Install Voltage Regulator L7 - Happy Valley		122		122	Oct. 06	Other	B-76
Modify Boiler Protection and Control - Holyrood		117		117	Nov. 06	Other	B-34
Upgrade 138 kV and 66 kV Protection Systems - Bottom Brook		109		109	Oct. 06	Other	B-45
Communications Network Technology		97		97	Dec. 06	Pooled	B-110
Purchase Meters & Equipment - All Service Areas		93		93	Dec. 06	Pooled	B-88
Replace Battery Chargers - Various Stations (BDE, DLK, GFC & WAV)		90		90	Oct. 06	Pooled	B-51
Replace Air Compressor and Dryer - Grand Falls Frequency Converter Stn		80		80	Aug. 06	Other	B-53
Replace Air Compressors - Holyrood Terminal Station		80		80	Aug. 06	Other	B-55
Replace Battery Bank - Various Stations (GBK,IRV,BDE)		72		72	Sep. 06	Pooled	B-59
Replace Surge Arrestors - Various Stations		70		70	Nov. 06	Pooled	B-61
Replace Instrument Transformers - Various Stations		78		78	Nov. 06	Pooled	B-57
Replace Generating Unit Breakers - Francois,Grey River, Little Bay Islands		68		68	Nov. 06	Pooled	B-87
Replace Data Collection and Monitoring System - Hawke Hill		56		56	Dec. 06	Other	B-47
Install Transformer Oil Monitoring System - Upper Salmon		53		53	Oct. 06	Other	B-63
Legal Survey of Distribution Line Right-of-Ways - Various Sites		50		50	Oct. 06	Other	B-89
Upgrade Controls Spherical Valve #6 - Bay d'Espoir		200		200	Jul. 06	Other	B-11
Peripheral Infrastructure Replacement		199		199	Dec. 06	Pooled	B-99
TOTAL NORMAL PROJECTS	0	7,087	473	7,560			
JUSTIFIABLE PROJECTS							
Remote Operation of Fisheries Comp. By-Pass Valve - Granite Canal		107		107	Aug. 06	Other	B-15
TOTAL JUSTIFIABLE PROJECTS	0	107	0	107			
TOTALS	28,184	112,928	15,001	156,113			

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

Type	No.	($,000)
Clustered	2	$2,844
Pooled	25	17,045
Other	35	35,194
Total	62	$55,083

*Includes all multi-year projects

SECTION D

NEWFOUNDLAND & LABRADOR HYDRO

2006 LEASING COSTS

THERE ARE NO ITEMS FOR THIS SECTION

SECTION E

NEWFOUNDLAND & LABRADOR HYDRO

Capital Expenditures/Budgets 2000 - 2009

($000)

	ACTUALS 2000	ACTUALS 2001	ACTUALS 2002	ACTUALS 2003	ACTUALS 2004	BUDGET 2005	BUDGET 2006	BUDGET 2007	BUDGET 2008	BUDGET 2009
GENERATION[1]	3,463	3,956	5,233	5,572	4,139	9,136	9,390	12,301	34,720	78,855
TRANSMISSION & RURAL OPERATIONS	28,658	28,929	29,560	9,961	14,419	20,875	17,986	18,130	16,612	13,681
GENERAL PROPERTIES	6,442	14,616	5,424	16,973	9,426	13,048	15,260	11,048	21,539	8,539
TOTAL CAPITAL EXPENDITURES	38,563	47,501	40,217	32,506	27,984	43,059	42,636	41,479	72,871	101,075

[1] A provision has been made in the years 2007-2009 for a new generation source.

SECTION F

NEWFOUNDLAND & LABRADOR HYDRO

2005 CAPITAL EXPENDITURES - OVERVIEW

FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures
GENERATION	1,714	7,769	1,129	6,803	7,932	163
TRANSMISSION & RURAL OPERATIONS	178	19,753	4,380	15,192	19,615	(138)
GENERAL PROPERTIES	2,709	16,913	2,571	8,890	11,461	(5,452)
ALLOWANCE FOR UNFORESEEN EVENTS	0	1,000	0	0	1,000	0
PROJECTS APPROVED BY PUB	214	2,919	657	2,262	2,919	0
NEW PROJECTS LESS THAN $50,000 APPROVED BY HYDRO	0	132	22	110	132	0
TOTAL CAPITAL BUDGET	4,815	48,486	8,759	33,257	43,059	(5,427)

Approved P.U. 53 (2004)	42,431
Approved P.U. 3 (2005)/P.U. 14(2005)	5,826
Approved P.U. 3 (2005)/P.U. 14(2005)	(5,826)
Carryover Projects 2004 to 2005	1,778
Approved P.U. 11 (2005)	3,154
Approved P.U. 14 (2005)	991
New Projects under $50,000 Approved by Hydro	132
TOTAL APPROVED CAPITAL BUDGET	48,486

NEWFOUNDLAND & LABRADOR HYDRO

2005 CAPITAL EXPENDITURES - OVERVIEW

FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures
GENERATION						
HYDRO PLANTS						
Construction Projects	207	3,204	357	2,957	3,314	110
Property Additions	0	0	0	0	0	0
Tools & Equipment	0	294	73	221	294	0
THERMAL PLANT						
Construction Projects	1,499	1,854	566	1,288	1,854	0
Property Additions	8	2,072	75	1,997	2,072	0
Tools & Equipment	0	16	19	0	19	3
GAS TURBINES						
Construction Projects	0	329	39	340	379	50
TOTAL GENERATION	1,714	7,769	1,129	6,803	7,932	163
TRANSMISSION & RURAL OPERATIONS						
TRANSMISSION	0	3,590	687	2,787	3,474	(116)
SYSTEM PERFORMANCE & PROTECTION	0	468	141	382	523	55
TERMINALS	0	598	80	518	598	0
DISTRIBUTION	0	9,559	2,942	6,574	9,559	0
GENERATION	178	2,401	139	2,185	2,324	(77)
GENERAL						
Metering	0	192	57	135	192	0
Properties	0	1,023	153	870	1,023	0
Tools & Equipment	0	1,922	181	1,741	1,922	0
TOTAL TRANSMISSION & RURAL OPERATION!	178	19,753	4,380	15,192	19,615	(138)
GENERAL PROPERTIES						
INFORMATION SYSTEMS & TELECOMMUNICATIONS	1,796	14,705	1,621	7,632	9,253	(5,452)
ADMINISTRATIVE	913	2,208	950	1,258	2,208	0
TOTAL GENERAL PROPERTIES	2,709	16,913	2,571	8,890	11,461	(5,452)
ALLOWANCE FOR UNFORESEEN EVENTS	0	1,000	0	0	1,000	0
PROJECTS APPROVED BY PUB	214	2,919	657	2,262	2,919	0
PROJECTS APPROVED FOR LESS THAN $50,000	0	132	22	110	132	0
TOTAL CAPITAL BUDGET	4,815	48,486	8,759	33,257	43,059	(5,427)

NEWFOUNDLAND & LABRADOR HYDRO
GENERATION
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
HYDRO PLANTS							
CONSTRUCTION PROJECTS							
Upgrade Slope Stabilization - Upper Salmon Power Canal	207	2,566	190	2,483	2,673	107	
Replace Underground Fuel Tanks - Upper Salmon Generating Facility		327	16	311	327	0	
Upgrade Controls Spherical Valve No. 6 - Bay d'Espoir		196	148	48	196	0	
Replace Penstock - Snook's Arm Generating Station		115	3	115	118	3	
TOTAL CONSTRUCTION PROJECTS	207	3,204	357	2,957	3,314	110	
PROPERTY ADDITIONS							
TOTAL PROPERTY ADDITIONS	0	0	0	0	0	0	
TOOLS & EQUIPMENT							
Purchase Dry Ice Cleaning System - BDE		59	0	59	59	0	
Replace Doble F2000 Relay Test Equipment - BDE		96	0	96	96	0	
Purchase Wedge Tightness Detector - BDE		49	28	21	49	0	
Purchase & Replace Tools & Equipment Less than $50,000	0	90	45	45	90	0	
TOTAL TOOLS & EQUIPMENT	0	294	73	221	294	0	

NEWFOUNDLAND & LABRADOR HYDRO
GENERATION
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
THERMAL PLANT							
CONSTRUCTION PROJECTS							
Upgrade Control System - Holyrood	1,499	1,088	562	526	1,088	0	
Purch/Inst Anti-Fouling System for Cooling Water Systems - Holyrood		705	4	701	705	0	
Purch/Inst Fire Protection System - Microwave Radio Room - Holyrood		61	0	61	61	0	
TOTAL CONSTRUCTION PROJECTS	1,499	1,854	566	1,288	1,854	0	
PROPERTY ADDITIONS							
Upgrade Civil Structures	8	2,072	75	1,997	2,072	0	
TOTAL PROPERTY ADDITIONS	8	2,072	75	1,997	2,072	0	
TOOLS & EQUIPMENT							
Purchase & Replace Tools & Equipment Less than $50,000	0	16	19	0	19	3	
TOTAL TOOLS & EQUIPMENT	0	16	19	0	19	3	
TOTAL THERMAL PLANTS	1,507	3,942	660	3,285	3,945	3	
GAS TURBINES							
CONSTRUCTION PROJECTS							
Install Main Fuel Line Valve - Hardwoods		91	30	61	91	0	
Install Transferred Diesel Generating Set - Stephenville		87	3	84	87	0	
Replace Battery Bank - Hardwoods		58	2	56	58	0	
Purchase/Install Reconciliation Flow Meters - Stephenville		26	0	26	26	0	
Purchase/Install Reconciliation Flow Meters - Hardwoods		24	1	23	24	0	
Replace Control Module HVAC Unit - Hardwoods		24	2	22	24	0	
Automate Diesel Backup System - Hardwoods		19	1	68	69	50	
TOTAL CONSTRUCTION PROJECTS	0	329	39	340	379	50	
TOTAL THERMAL PLANTS	0	658	20	68	88	53	
TOTAL GENERATION	1,714	8,098	1,110	6,531	7,553	166	

NEWFOUNDLAND & LABRADOR HYDRO
TRANSMISSION & RURAL OPERATIONS
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
TRANSMISSION							
Replace Wood Poles - Transmission		2,588	615	1,973	2,588	0	
Upgrade TL221 - (69kV Peter's Barren - Hawkes Bay)		774	0	658	658	(116)	1
Replace Insulators TL243 - (138kV Hinds Lake - Howley)		228	72	156	228	0	
TOTAL TRANSMISSION	0	3,590	687	2,787	3,474	(116)	
SYSTEM PERFORMANCE & PROTECTION							
Provide Remote Control - Farewell Head Terminal Station		127	12	170	182	55	
Purch/Install Digital Fault Recorder - Bottom Brook		122	59	63	122	0	
Purch/Install 66Kv Breaker Fail Protection Addition - Massey Drive TS		81	15	66	81	0	
Upgrade Protection 66Kv Lines - Peter's Barren , Daniel's Harbour		78	33	45	78	0	
Upgrade Breaker Controls - BBK/MDR Terminal Station		33	4	29	33	0	
Purch/Install 66Kv Breaker Protection Upgrade - Bay d'Espoir		27	18	9	27	0	
TOTAL SYSTEM PERFORMANCE & PROTECTION	0	468	141	382	523	55	
TERMINALS							
Install Motor Drive Mechanisms on Disconnect Switches - East Coast		183	9	174	183	0	
Replace Battery Banks		166	17	149	166	0	
Replace Instrument Transformers		75	9	66	75	0	
Replace Surge Arrestors		68	22	46	68	0	
Purch/Install Conduit and Cable - (Bay d'Espoir TS - Powerhouse)		61	19	42	61	0	
Construct Yard Extension - Conne River Substation		45	4	41	45	0	
TOTAL TERMINALS	0	598	80	518	598	0	

NEWFOUNDLAND & LABRADOR HYDRO
TRANSMISSION & RURAL OPERATIONS
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
DISTRIBUTION							
Interconnect - Rencontre East		3,250	765	2,485	3,250	0	
Service Extensions		1,728	673	1,055	1,728	0	
Distribution Upgrades		1,601	901	700	1,601	0	
Insulator Replacements		971	199	772	971	0	
Upgrade Distribution Line - Cook's Harbour		718	245	473	718	0	
Upgrade Distribution Line - L'Anse au Loup L1 & L2		636	37	599	636	0	
Relocate Substation- Roberts Arm/Triton		319	79	240	319	0	
Distribution Line Pole Replacements		168	40	128	168	0	
Purchase and Install Reclosers - Makkovik & Hopedale		125	3	122	125	0	
Relocate Regulator Bank - Happy Valley		43	0	43	43	0	
TOTAL DISTRIBUTION	0	9,559	2,942	6,574	9,559	0	
GENERATION							
Upgrade Generator Relaying - Happy Valley North Plant	178	29	54	0	54	25	
Increase Generation - L'Anse au Loup		392	10	382	392	0	
Replace Diesel Generating Unit No. 266 - Williams Hr.		304	10	294	304	0	
Replace Dam - Roddickton Mini Hydro		232	23	107	130	(102)	2
Installation of Fall Arrest Equipment - Hydro facilities		206	3	203	206	0	
Install Shut-Off Valves - Diesel Plants		165	0	165	165	0	
Install Fuel Storage Tanks - Hopedale & Paradise River		152	6	146	152	0	
Replacement of Circuit Breakers - Hawkes Bay Diesel		111	6	105	111	0	
Upgrade Cooling System - Black Tickle		107	1	106	107	0	
Install Day Tank and Fuel Meter - Ramea		106	17	89	106	0	
Upgrade Building System North Plant - Goose Bay		99	4	95	99	0	
Raise Stack Heights - St. Brendan's, Black Tickle, Cartwright		96	0	96	96	0	
Purch.& Inst. Digital Metering - Francois, McCallum, Grey River, Little Bay Isl		90	4	86	90	0	
Upgrade Diesel Plant - Black Tickle		85	0	85	85	0	
Purchase Data Acquisition Software - Diesel Plants		70	0	70	70	0	
Install Intermediate Fuel Storage Tank - Charlottetown		66	0	66	66	0	
Modify Heating System - Hopedale		54	0	54	54	0	
Replace Battery Banks - L'Anse au Loup & Hawkes Bay		37	1	36	37	0	
TOTAL GENERATION	178	2,401	139	2,185	2,324	(77)	

NEWFOUNDLAND & LABRADOR HYDRO
TRANSMISSION & RURAL OPERATIONS
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
GENERAL							
METERING							
Purchase Meters & Equipment - Rural System		159	55	104	159	0	
Purchase Metering Spares - Bulk Electrical System		33	2	31	33	0	
TOTAL METERING	0	192	57	135	192	0	
PROPERTIES							
Install Central Air Conditioning - Whitbourne & Stephenville		289	13	276	289	0	
Warehouse Renovations - St. Anthony		147	70	77	147	0	
Upgrade Line Depot/Storage Shed - Baie Verte, Sop's Arm & Bay d'Espoir		151	0	151	151	0	
Replace Line Depot Building - Mary's Harbour		74	5	69	74	0	
Purchase Global Positioning System		57	41	16	57	0	
Replace Fence Daniels Harbour Terminal Station		52	2	50	52	0	
Construct PCB Storage Building - Wabush		52	3	49	52	0	
Legal Survey of Distribution Line Right-of-Ways		50	0	50	50	0	
Extend Fence - Quartzite Terminal Station		49	3	46	49	0	
Provide Security System - Port Saunders Office		43	13	30	43	0	
Construct Storage Ramp - Stephenville & Whitbourne		36	3	33	36	0	
Replace Wooden Gantry Crane - Salvage Stores		16	0	16	16	0	
Construct Lube Oil Storage Ramp - Williams Harbour		7	0	7	7	0	
TOTAL PROPERTIES	0	1,023	153	870	1,023	0	
TOOLS & EQUIPMENT							
Replace Nodwell V7600 & Boom V6067 - Stephenville		798	0	798	798	0	
Purchase Mobile Oil Reclaimation Unit		531	14	517	531	0	
Replace Doble F2000 Relay Test Equipment - BFL, WBN, STV & BDE		266	0	266	266	0	
Purchase & Replace Tools & Equipment Less than $ 50,000	0	67	32	35	67	0	
Replace Light Duty Mobile Equipment Less than $50,000		260	135	125	260	0	
TOTAL TOOLS & EQUIPMENT	0	1,922	181	1,741	1,922	0	
TOTAL GENERAL	0	3,137	391	2,746	3,137	0	
TOTAL TRANSMISSION & RURAL OPERTIONS	178	19,753	4,380	15,192	19,615	(138)	

NEWFOUNDLAND & LABRADOR HYDRO
GENERAL PROPERTIES
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
INFORMATION SYSTEMS & TELECOMMUNICATIONS							
SOFTWARE APPLICATIONS							
INFRASTRUCTURE REPLACEMENT							
Replace Energy Management System - Energy Control Centre	1796	6,836	778	2,282	3,060	(3,776)	3
NEW INFRASTRUCTURE							
Applications Enhancements		311	38	360	398	87	
Security Program - Secure Remote Access		76	0	76	76	0	
Upgrade of Technology							
Corporate Application Environment - 2005		274	28	246	274	0	
Cost Recovery CF(L)Co		(52)	(26)	(26)	(52)	0	
TOTAL SOFTWARE APPLICATIONS	1,796	7,445	818	2,938	3,756	(3,689)	
COMPUTER OPERATIONS							
INFRASTRUCTURE REPLACEMENT							
iSeries Replacement		1,398	133	1,265	1,398	0	
Cost Recovery CF(L)Co		(266)	(133)	(133)	(266)	0	
End User Infrastructure Evergreen Program - 2005		711	387	324	711	0	
NEW INFRASTRUCTURE							
Peripheral Infrastructure Replacement - 2005		118	67	51	118	0	
Security Strategy Deployment - 2005		99	4	95	99	0	
Cost Recovery CF(L)Co		(19)	(10)	(9)	(19)	0	
UPGRADE OF TECHNOLOGY							
Server & Operating Systems Evergreen Program - 2005		212	10	202	212	0	
TOTAL COMPUTER OPERATIONS	0	2,253	458	1,795	2,253	0	

NEWFOUNDLAND & LABRADOR HYDRO
GENERAL PROPERTIES
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
INFORMATION SYSTEMS & TELECOMMUNICATIONS							
NETWORK SERVICES							
INFRASTRUCTURE REPLACEMENT							
Replace VHF Mobile Radio System		2,915	218	2,697	2,915	0	
Cost Recovery - Department of Transportation and Works		0	0	(1,796)	(1,796)	(1,796)	4
Replace Battery System - Multiple Sites - 2005		364	15	349	364	0	
Microwave Site Refurbishing - 2005		294	13	281	294	0	
Replace Remote Terminal Unit for Hydro - Phase 6		150	1	182	183	33	
Replace Air Conditioners - Stoney Brook & Hardwoods		55	5	50	55	0	
Replace Voice and Data Communications - Berry Hill		15	2	13	15	0	
UPGRADE OF TECHNOLOGY							
Replacement of Operational Data & Voice Network - Phase II	0	1,166	71	1,095	1166	0	
Upgrade Site Grounding - 2005		48	20	28	48	0	
TOTAL NETWORK SERVICES	0	5,007	345	2,899	3,244	(1,763)	
TOTAL INFORMATION SYSTEMS & TELECOMMUNICATIONS	1,796	14,705	1,621	7,632	9,253	(5,452)	

NEWFOUNDLAND & LABRADOR HYDRO
GENERAL PROPERTIES
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
ADMINISTRATIVE							
VEHICLES							
Replace Vehicles - Hydro System - 2004	877	505	48	457	505	0	
Replace Vehicles - Hydro System - 2005		878	649	229	878	0	
ADMINISTRATION							
Electronic Metering Reading	36	224	0	224	224	0	
Replace Chiller - Hydro Place		213	201	12	213	0	
Security Assessment of System Operations		110	0	110	110	0	
Upgrade Standby Diesel Fuel System - Hydro Place		91	1	90	91	0	
Re-Construct Storage Ramps - Bishop's Falls		73	0	73	73	0	
Purchase & Replace Admin Office Equip less than $50,000		114	51	63	114	0	
TOTAL ADMINISTRATIVE	913	2,208	950	1,258	2,208	0	
TOTAL GENERAL PROPERTIES	2,709	16,913	2,571	8,890	11,461	(5,452)	

NEWFOUNDLAND & LABRADOR HYDRO
OTHER APPROVED FUNDS
2005 CAPITAL EXPENDITURES - DETAIL
FOR THE QUARTER ENDING JUNE 30, 2005
($,000)

PROJECT DESCRIPTION	Expenditures Prior To 2005	PUB Approved Budget 2005	2005 Expenditures To June 30	Expected Remaining Expenditures 2005	Expected Total Expenditures 2005	Var. from Approved to Expected Expenditures	Variance Explanation Reference
ALLOCATION FOR UNFORESEEN EVENTS							
Allocation for Unforeseen Events			0	0		0	
TOTAL ALLOCATION FOR UNFORESEEN EVE	0	0	0	0	0	0	
PROJECTS APPROVED BY PUB							
CARRYOVER							
Replacement of Diesel Unit - Hopedale		258	4	254	258	0	
Increase Generation - Port Hope Simpson	132	171	125	46	171	0	
Relocate Mobile Diesel Unit - Roddickton to St. Anthony	82	13	11	2	13	0	
NEW							
Transmission Interconnection - Duck Pond Mine Site		5,826	592	5,234	5,826	0	
Contribution		(5,826)	(81)	(5,745)	(5,826)	0	
Cat Arm Road - Rehabilitation		1,260	5	1,255	1,260	0	
Replace Diesel Engine # 2046, Ramea		226	0	226	226	0	
Cat Arm Unit 1 Governor Controls Replacement		378	0	378	378	0	
Disconnecting Means to 600 Volt MCC Branch Feeders		613	1	612	613	0	
TOTAL PROJECTS APPROVED BY PUB	214	2,919	657	2,262	2,919	0	
Ebbegunbaeg Water Level Station		42	0	42	42	0	
Remote Monitoring System - Granite Canal		26	0	26	26	0	
Electrical Arc Flash Personal Protection Equipment		42	0	42	42	0	
Purchase Hydraulic Operated Drill		2	2	0	2	0	
Replace Broken Poles - TL# 239		10	10	0	10	0	
Portland Creek, Application for Water Use License		10	10	0	10	0	
NEW PROJECTS LESS THAN $50,000 APPROVED BY HYDRO							
TOTAL PROJECTS LESS THAN $50,000 APPROVED B	0	132	22	110	132	0	

1. **Upgrade TL221 (69 kV Peter's Barren - Hawkes Bay)**

   The most recent forecast to completion is $658,000 as compared to $774,000 in Hydro's 2005 Capital Budget Application. The scope of this project as proposed in the 2005 capital budget was to replace the post insulators on a 27 km section of the line with a new 'RG Glazed' insulator manufactured by NGK Insulators of Japan. NGK have since advised that the new 'RG Glazed' insulator which they had promoted in 2004 was now not available. As an alternative, it was decided to coat the existing insulators with a high voltage insulated coating (HVIC). This coating is specially designed for heavily contaminated environments such as coastal marine and heavy industrial areas. The revised scope of work consists of removing the insulators from the line, coating them in a controlled operation at site and re-installing them. Some new insulators will be purchased to permit the coating program to be completed within the construction schedule allowed. The generation at Hawkes Bay will be used to service the customers during the outages on the line.

2. **Replace Dam - Roddickton Mini Hydro**

   The scope of the project as proposed in the 2005 capital budget was to completely replace the rock filled timber crib dam with a new structure. During the detailed design stage, further investigations of the structure were completed and it was determined that an alternate means could be executed to extend the life of the existing dam, rather than replace it. This revised scope of work involves the addition of an upstream liner and additional upstream face sheathing and on the downstream side, selected timbers will be reinforced. This remedial work is expected to extend the life of the existing structure by approximately 5 -7 years. This is believed to be a more prudent approach than a complete replacement at this time resulting in a forecast cost to completion of $130,000 as compared to $232,000 in Hydro's 2005 Capital Budget Application.

3. **Replace Energy Management System - Energy Control Centre**

   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.

4. **Replace VHF Mobile Radio System**

   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 forecast contribution by the Department of Transportation and Works towards the replacement of this system is estimated at $3,592,000 with 50% to be collected in 2005 and 50% in 2006.

SECTION G

Plan of Projected Operating

Maintenance Expenditures

2006 - 2015

For Holyrood Generating Station

Newfoundland & Labrador Hydro

July 2005

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INTRODUCTION

In the Decision and Order No. P. U.14 (2004) of the Board of Commissioners of Public Utilities ("the Board"), dated May 4,2004, (the 'Order) Newfoundland and Labrador Hydro ("Hydro") is required to **"file a ten year plan of maintenance expenditures for the Holyrood Generating Station with its annual capital budget application, until otherwise directed by the Board**" (p. 64 and Paragraph 12, p. 166 of the Order).

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

This report addresses the identified and expected maintenance expenditures for the years 2006 to 2015 inclusive. With respect to these expenditures it must be noted that Unit No's. 1 and 2, as well as two of the main fuel storage tanks and other associated ancillary equipment, are in excess of thirty (30) years old. Unit No. 3 is in excess of twenty (20) years old, along with its associated equipment, including the other two main fuel storage tanks. While many components of this equipment have been replaced and additional items added through the maintenance and capital program over the years, numerous pieces of equipment and components are original.

An accurate ten (10) year plan of system equipment maintenance is difficult to complete given the harsh operating environment, varied production requirements and the age of the units. This report, however, outlines for the next ten (10) years, maintenance items that are anticipated at this time. This plan, of course, will change as time progresses. The operating condition of the equipment will be continuously reviewed and, undoubtedly, events will occur that are not foreseen at this time, which will require changes in the currently anticipated annual maintenance. As can be seen from this report, there must be variation in annual operating costs for the Holyrood Thermal plant. It is not possible to "levelize" the cost of maintaining a plant such as Holyrood where there are numerous components and systems integrated together to form a fossil fired thermal electric generating system.

MAINTENANCE PHILOSOPHY

The Board, in its Order as related to the Holyrood Thermal Plant, noted at p. 64 that **"The Board will require NLH's10 year plan of maintenance expenditures for the Holyrood Generating Station to be updated annually to reflect changing operating circumstances."**

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

1) **Preventive Maintenance**

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

Preventive maintenance, in its specific sense, comprises routine inspections, checks and component replacement at specific time intervals, to prevent failures known, or reasonably expected, to occur within a definable time or operating hour interval during the life of the equipment, e.g. generator brush wear, air and oil filter replacements, etc. This also includes discarding equipment or components rather than repairing them when it is less expensive to do so.

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

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

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

In 2003, a study was undertaken by Hartford Steam Boiler Insurance Company, using their proprietary program called Turbine Overhaul Optimization Program (TOOP). This assesses the causes of failure, the risk of failure and the maintenance history of the Turbines, and then proposes the optimum frequency between major overhauls. This assessment concluded that the Turbine major overhaul interval could be extended to 9 years from the major overhaul of Unit #1 in 2003, the major overhaul of Unit #2 in 2005 and the major overhaul of Unit #3 in 2007, providing that certain upgrades of internal components are made. These recommendations have been accepted and provision for the required upgrades have been incorporated into this updated 10 year plan, see Appendix 4, 2007, Unit 3 TOOP Project.

Turbine valve overhauls are carried out at three-year intervals, between major overhauls. This has been found necessary, due to the critical nature of the safety and reliability aspects of these valves to the turbine operation and integrity, and will continue to be maintained on this three-year interval between major overhauls.

2) Corrective Maintenance

In addition to the predictive maintenance tactics outlined above, there are also corrective maintenance requirements. These include repairs to equipment as it fails or reaches the point where preventive maintenance has identified that the equipment is approaching the end of its useful service life. E.g. wear and tear on pumps, pipes and valves in the main and auxiliary systems, motor rewinds due to failed or deteriorated winding insulation, or as a result of adverse conditions (humidity, salt laden atmosphere, etc), replacement of corroded piping equipment and boiler tube failure repairs etc. In 2003, Unit #2 suffered 3 Superheater Tube failures and their analysis indicated a common tube failure problem had developed. However, at this stage, no provision had been made for additional tube failure repairs, but future capital refurbishment, has been incorporated in the 2006 Capital Budget.

3) Projects

Operating projects are those major cost repairs and inspections that are required to return structures and equipment to their original or near original condition to maintain structural integrity, possibly extend plant life, improve efficiency, improve availability and prevent or reduce environmental risks. Such projects include repairs to building structural steel, roof repairs/replacement, fuel oil tank and pipeline inspection and coating, replacement of equipment or components no longer supported by the original manufacturer. A major Asbestos Abatement program commenced in 2005 and will be completed over a three-year period. Due to the significant cost (approaching $9M), Hydro was given approval to treat this as an extraordinary repair, which will mean an annual cost will be recovered over an additional five years, bringing the total cash flow period to eight years, 2005 to 2012.

COST VARIABILITY

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

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

Unit	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
No. 1	Minor			Minor			Major			Minor
No. 2			Minor			Minor			Major	
No. 3		Major			Minor			Minor		
General Cost	↓	↑	↓				↑	↓	↑	↓

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

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

DETAILED ANALYSIS

Attached are Appendices 1 to 9, which set out the ten-year maintenance plan for the Holyrood Thermal plant, as requested by the Board. Appendix 1 is a summary and indicates the expected expenditures in each of the major equipment groupings containing system equipment maintenance (SEM) costs for the years 2006 to 2015. Appendices 2 to 9, inclusive, show the expected SEM costs categorized according to Preventive, Corrective, Overhauls and Major Operating Projects for each of the major equipment groupings containing SEM costs.

This plan was prepared using the 2006 preventive, corrective and overhaul data and the current 2006 to 2010 operating project lists from Hydro's five-year plan for the Holyrood Thermal Plant as the base data. Considerable judgment of plant personnel had to be used to prepare a ten-year plan.

Hydro does not normally use any escalation in its five-year operating plan at the Plant or regional level. This five-year plan is primarily used for internal purposes and generation of work plans rather than detailed financial planning. However, in the attached ten-year plan, an escalation factor has been used, consistent with the series used for capital project estimates. A single escalation rate was used in this exercise and assumed a 50% weighting of Labour escalation and 50% of Material escalation, and is as follows:-

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
%	2.0	2.0	2.2	2.2	2.2	2.2	2.3	2.2	2.1

Appendices 2 to 9 list the categories of SEM costs for the years 2006 to 2015 in each of the major equipment groupings containing SEM. The categories listed are:

Preventive – Annual	Routine preventive maintenance activities carried out every year
Corrective	Typical but unknown breakdown/ emergency repairs carried out during the year
Turbine – Major	Major overhauls now planned every nine (9) years
Turbine – Minor	Major valve overhauls currently carried out every three (3) years, between major overhauls.
Boiler – Annual	Boiler overhauls carried out annually
Operating Projects	Non-capitalized projects, justified on the basis of Reliability, Safety, Environment or Cost Benefit Analyses.

Appendices 2, 3 and 4 (for Unit No's. 1, 2 and 3 respectively) use all of the foregoing categories. Appendices 5 to 9 are for the remaining equipment groupings of Common Equipment, Building and Grounds, Water Treatment Plant, Waste Water Treatment Plant & Environmental Monitoring and use only Preventive, Corrective and Major Operating Projects.

It must be noted that the Appendices do not itemize preventive and corrective items. The preventive maintenance program consists of approximately 1000 PM's performed on plant equipment annually. Corrective items include a large number of low cost jobs, the majority of which are largely unknown until they happen; thus, it is not practical to provide a breakout of the costs. Projects included in the headings of Operating Projects, Turbine - Major and Turbine - Minor work have been itemized in the year that the work is planned for execution.

Hydro's normal five-year plan identifies specific projects up to 2010. For the period 2011 to 2015, Hydro used an average per unit of the project budgets for the three units over the years 2006 to 2010 with escalation. This approach was taken, as it is not practical or possible to determine specific work items, which are essentially unknown for the period of 2011 to 2015.

SUMMARY

This Plan presents the best available information at this time for a ten-year forecast of the maintenance projects for the Holyrood Plant and is based on the 2006 system equipment maintenance budget. As with any forecast, it is subject to change depending on the operating demands of the plant, the results of inspections and assessments of changing equipment conditions.

The Plan takes into account up-to-date maintenance tactics and known restoration and inspection work. As can be seen from the Plans, fluctuations in the annual cost cannot be eliminated due to the 9-year Turbine Overhauls and 3-year Valve Overhauls, as well as the large but infrequent Major Operating projects, such as Fuel Oil Storage Tank painting and inspection.

APPENDIX 1

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

	($000)									
	Base Year 2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
UNIT #1 Total SEM	1,956	1,265	1,332	1,671	1,348	1,555	3,121	1,626	1,661	2,097
UNIT #2 Total SEM	1,248	1,428	1,947	1,319	1,348	1,923	1,589	1,626	3,263	1,696
UNIT #3 Total SEM	1,260	4,065	1,602	1,319	1,707	1,555	1,589	2,010	1,661	1,696
Common Equipment Total SEM	2,404	2,260	2,579	4,284	4,081	1,642	1,678	1,716	1,754	1,791
Buildings and Grounds Total SEM	894	692	581	615	498	687	702	718	734	750
WT Plant Total SEM	241	161	164	240	297	231	237	242	247	253
WWT Plant Total SEM	18	5	43	19	6	19	19	19	20	20
Environmental Monitoring Total SEM	171	175	178	182	186	180	184	188	192	196
Total Holyrood SEM	8,192	10,051	8,426	9,648	9,469	7,791	9,119	8,145	9,534	8,499
Total Operating Projects	2,806	3,517	2,822	3,920	3,615	1,809	1,848	1,891	1,933	1,973

Total [1] SEM – System Equipment Maintenance

APPENDIX 2

HOLYROOD 10 YEAR MAINTENANCE PLAN

	($000)										
Unit No. 1	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Preventive – Yearly	150	153	156	159	163	167	170	174	178	182	
Corrective	290	296	302	308	315	322	329	337	344	351	
Turbine Major Overhaul							1,532				
Turbine Valve Overhaul	331			352						401	
Boiler Annual Overhaul	800	816	832	851	869	888	908	929	949	969	
Auxiliary Equipment Annual Overhaul											
Operating Projects											
Air Heater Cold End Repairs	160										
Breeching Floor Refractory	40										
Breeching Pant Leg Roof	35										
Upgrade #1 Turbine Emerg. Trip Device	150										
Boiler Feed Pump East			42								
Projects – Lump Sum for Future Years						178	182	186	190	194	
Total - Unit No. 1	**1,956**	**1,265**	**1,332**	**1,671**	**1,348**	**1,555**	**3,121**	**1,626**	**1,661**	**2,097**	
Total Operating Projects Unit 1	385		42			178	182	186	190	194	

[1] 178 - Average Project Cost Per Unit 2006 to 2010 (plus escalation)

APPENDIX 3											
	($000)										
Unit No. 2	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Preventive – Yearly	150	153	156	160	163	167	170	174	178	182	
Corrective	290	296	302	308	315	322	329	337	344	351	
Turbine Major Overhaul									1,602		
Turbine Valve Overhaul			344			368					
Boiler Annual Overhaul	800	816	832	851	869	888	908	929	949	969	
Auxiliary Equipment Annual Overhaul											
Operating Projects											
Unit 2 Vacuum Pump South	8										
Air Heater Cold End Repairs		163									
Replace Unit 2 Main Boiler Stop Valve			156								
Upgrade Turbine Emerg Trip Device			156								
Projects - Lump Sum for Future Years						178	182	186	190	194	
Total - Unit No. 2	**1,248**	**1,428**	**1,947**	**1,319**	**1,348**	**1,923**	**1,589**	**1,626**	**3,263**	**1,696**	
Total Operating Projects Unit 2	8	163	312			178	182	186	190	194	

[(1)] 178 - Average Project Cost Per Unit 2006 to2010 plus escalation)

APPENDIX 4

	($000)									
Unit No. 3	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Preventive – Yearly	150	153	156	160	163	167	170	174	178	182
Corrective	290	296	302	308	315	322	329	337	344	351
Turbine Major Overhaul		1,377								
Turbine Valve Overhaul					360			384		
Boiler Annual Overhaul	800	816	832	851	869	888	908	929	949	969
Auxiliary Equipment Annual Overhaul										
Operating Projects										
7th Stage Bucket Replacement	1									
HP,IP & N1,2,3 Pkg Ring Replacement	1									
Replacement of UPS Batteries	12									
Sootblower System	2									
Cold Water Line	5									
TOOP Recommendations		255								
7th Stage Bucket Replacement		408								
7th Stage Diaphragm – Major Repairs		255								
Boiler Feed Pump East		41								
HP,IP & N1,2,3 Pkg Ring Replacement		51								
HP/IP Diaphragm Spill Strip Repairs		102								
Nozzle Block Repairs		102								
Inspect/Replace Lower Valve Snout Rings		163								
East Circulating Water (CW)Motor Rewind		46								
Replace Unit 2 Major Boiler Stop Valve			156							
Turbine Emergency Trip Device			156							
Projects – Lump Sums for Future Years						178	182	186	190	194
Total - Unit No. 3	**1,260**	**4,065**	**1,602**	**1,319**	**1,707**	**1,555**	**1,589**	**2,010**	**1,661**	**1,696**
Total Operating Projects Unit 3	20	1,423	312			178	182	186	190	194
Total SEM for all Three Units	**4,464**	**6,758**	**4,881**	**4,308**	**4,402**	**5,032**	**6,300**	**5,261**	**6,586**	**5,490**
Total Project Work for Three Units	413	1,586	666			533	545	557	569	581

(1) 178 - Average Project Cost Per Unit 2006 to 2010 (plus escalation)

APPENDIX 5

					($000)					
Common Equipment	2006	2007	2008	2009	2010	2011	2012	2013	2014		
Preventive – Yearly	225	229	234	239	244	250	255	261	267	272	
Corrective	468	478	487	498	509	520	531	544	556	567	
Operating Projects											
Asbestos Abatement	909	1,487	1,806	1,846	1,589						
FO Storage Tank #2 Inspection & Repair	500										
Ground Fault Protection	20										
Inspection of Seal Pits & Piping	5										
Painting Mechanical Equipment	50										
Pipe Surveillance	50										
Plant Color Coding	15										
Replacement of UPS #4 Batteries	12										
Stack Repairs	150										
Pipe Surveillance		51	52								
Plant Color Coding		15									
Fuel Oil Storage Inspection & Repair				1,701	1,739						
Projects – Lump Sum for Future Years						872	891	912	932	951	
Total Common Equipment	**2,404**	**2,260**	**2,579**	**4,284**	**4,081**	**1,642**	**1,678**	**1,716**	**1,754**	**1,791**	
Total Operating Projects Common Equipment	1,711	1,553	1,858	3,547	3,327	872	891	912	932	951	

[1] *872- Average Project Cost 2006 to 2010 (less Asbestos Removal, plus escalation)*

APPENDIX 6

						($000)				
Buildings Grounds	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Preventive – Yearly	230	235	239	245	250	255	261	267	273	279
Corrective	228	233	237	242	248	253	259	265	271	276
Operating Projects										
Coat Interior Liner Panels	100	102	104							
Coat Powerhouse/warehouse Floors	66									
Luminaire Replacement	20									
Repair & Repaint Structural Steel	70	92								
Roof Replacement & Restoration	180									
Marine Terminal Fender Repairs		31								
Coat Int. Liner Panels, Pwhse/CW Pumphouse				128						
Projects - Lump Sum for Future Years						178	182	187	191	195
Total – Buildings and Grounds	**894**	**692**	**581**	**615**	**498**	**687**	**702**	**718**	**734**	**750**
Total Operating Projects Buildings and Grounds	436	224	104	128		178	182	187	191	195

(1) 178 - Average Project Cost 2006 to 2010 (plus escalation)

APPENDIX 7

	($000)										
WT Plant	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Preventive – Yearly	53	54	55	56	57	59	60	61	63	64	
Corrective	105	107	110	112	114	117	119	122	125	128	
Operating Projects											
Replace Acid Lines on Skids	18										
Unit #2 Condensate Polisher Resin	65										
Unit #1 Condensate Polisher Resin				72							
Unit #3 Condensate Polisher Resin					75						
Water Treatment Plant “A” Train Resin					50						
Projects - Lump Sum for Future Years						56	57	59	60	61	
Total WT Plant and Environmental	**241**	**161**	**164**	**240**	**297**	**231**	**237**	**242**	**247**	**253**	
Total Operating Projects WT Plant	83			72	125	56	57	59	60	61	

[1] 56 - Average Project Cost 2006 to 2010 (plus escalation)

APPENDIX 8											
	($000)										
Waste Water Treatment Plant	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Preventive – Yearly	1	1	1	1	1	1	1	1	1	1	
Corrective	4	4	4	4	4	4	5	5	5	5	
Operating Projects											
WWTP Periodic Basin Cleaning & Inspection	13		14	14							
110V AC Power Supply to Landfill			18								
Filter Fabric Replacement-Plat Press			6								
Projects - Lump Sum for Future Years						13	13	13	14	14	
Total WWT Plant	**18**	**5**	**43**	**19**	**6**	**19**	**19**	**19**	**20**	**20**	
Total Operating Projects WWT Plant	13		37	14		13	13	13	14	14	

(1) 13 - Average Project Cost 2006 to 2010 (plus escalation)

APPENDIX 9

	($000)										
Environmental Monitoring	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Preventive – Yearly											
Corrective	21	21	22	22	23	23	24	24	25	25	
Operating Projects											
Emissions Monitoring	150	153	156	159	163						
Projects - Lump Sum for Future Years						156	160	163	167	171	
Total Environmental Monitoring	**171**	**175**	**178**	**182**	**186**	**180**	**184**	**188**	**192**	**196**	
Total Operating Projects Env. Monitoring	150	153	156	159	163	156	160	163	167	171	

[1] 156 - Average Project Cost 2006 to 2010 (plus escalation)

SECTION H

SECTION H
Tab 1

HOLYROOD THERMAL GENERATING STATION

FIRE PROTECTION UPGRADE ASSESSMENT

July, 2005

REGISTERED PROFESSIONAL ENGINEER
J. E. Mallam
SIGNATURE
2005-07-13
PROVINCE OF NEWFOUNDLAND

Prepared By:
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Newfoundland and Labrador Hydro

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Introduction

Stage 1 (Units 1 and 2) of the Holyrood Thermal Generating Station commenced in 1967. Stage 2 (Unit 3) construction started in 1977. NLH has been fortunate in that it has not experienced a fire which resulted in a significant loss of equipment or buildings. The fire protection equipment provided at the facility was designed to the standards in effect at the time of construction and has been augmented at intervals. However, the present extent of protection does not comply with modern standards.

Plant's Role in Power System

The annual production at the Holyrood Generating Station varies from year to year, as it is used to supplement energy from Hydro's hydraulic assets. It is a significant part of the Hydro generation and in a typical year will produce 20 % of the island system's energy production. The loss of the plant, or one of the units, would seriously limit Hydro's ability to serve the needs of Hydro's customers.

Background

When originally constructed, the Holyrood Generating Station was equipped with fire protection considered to be state of the art at that time. Over the years, standards for fire protection have evolved to require greater coverage and Hydro has from time to time upgraded protection in various areas of the facility. Such upgrades have been driven by legislation, revision of design standards and research performed by such organizations as National Fire Protection Association and Factory Mutual (FM).

For a number of years concern has been expressed about the vulnerability of power plants to spray and pool fires which could develop following the rupture of lubrication oil tanks or piping. Standards have existed for some time for the protection of assets from such fires and the Holyrood Generating Station is equipped with fire protection equipment to address such fires, designed in accordance with standards which existed at the time of installation. In recent years some major losses have occurred as a result of oil system fires in power plants, which caused FM to reconsider the adequacy of fire protection stipulated in existing standards. To test the efficacy of the designs required by these standards, FM constructed a mock up of a turbine-generator set and lubricating oil system and performed a number of fire tests using a test sprinkler system which provided various sprinkler water densities. The tests revealed that the sprinkler water densities stated in existing standards were woefully inadequate to control or suppress an oil system fire. FM continued testing with increasing sprinkler water densities until a density was reached which was adequate to control the fire. Appendix I contains photographs taken during these tests. FM issued recommendations for the modification of existing fire protection systems in the form of a memorandum, which is contained in Appendix II.

Fire Protection Review

A review of Holyrood's fire protection was undertaken with the assistance of our insurer and FM, to identify shortcomings as identified in the tests performed by FM and in general plant fire protection. A number of deficiencies were found and solutions identified:

1. Administration office block – no sprinkler protection provided at present

2. Maintenance shops (mechanical, electrical, instrumentation) and associated offices washrooms and sub-compartments. – no sprinkler protection provided at present

3. Unit 3 mezzanine area below turbine generator – no sprinkler protection provided at present

4. Unit 3 ground level floor below turbine generator – inadequate sprinkler protection provided at present – inadequate sprinkler protection provided at present

5. Unit 3 hydraulic oil connections to east and west main steam valves, east and west intercept valves, and blow down valve.

6. Main lube oil filter bank No. 1 – no sprinkler protection provided at present

7. Main lube oil filter bank No.2 – no sprinkler protection provided at present

8. Unit 1 seal oil skid – no sprinkler protection provided at present

9. Unit 2 seal oil skid – no sprinkler protection provided at present

10. Unit 3 seal oil skid – no sprinkler protection provided at present

11. Unit 1 light and heavy oil pump sets – inadequate sprinkler protection provided at present

12. Unit 2 light and heavy oil pump sets – inadequate sprinkler protection provided at present

13. Unit 3 light and heavy oil pump sets – inadequate sprinkler protection provided at present

14. Gas turbine generator building – no sprinkler protection provided at present

    For Items 1 through 14, sprinkler protection will be provided as the acceptable solution.

15. Risk of oil sprays in the event of failure in a threaded pipe joint, flanged connection, or seal associated with the pressurized oil pipes inside enclosures. To address this risk, non-combustible enclosures will be constructed around areas identified by items 5,6,7,8,9, and 10,

16. Risk of spray leaks which will not be contained by new metal enclosures as noted in item 15. To address this risk, fire resistant boots will be installed at all flanged and threaded pipe joints in piping systems that contain mineral oil at pressures above 50 psig.

17. In the event of a plant emergency requiring quick release of the explosive hydrogen gas from the generators, operators must walk beside potentially dangerous equipment to reach the control valves. To address this risk, the hydrogen and carbon dioxide manual valve stations, presently located below the generators, will be relocated to an area immediately outside the control room. In the event of a plant emergency requiring quick release of the explosive hydrogen gas from the generators, this modification will allow a more rapid response by operating personal. This action can then take place without operators having to walk beside potentially dangerous equipment.

18. The existing fire emergency response plan needs to be reviewed and plant personnel require training in emergency procedures. Hydro proposes to engage a fire prevention consultant to prepare operating procedures and devise a detailed and comprehensive training program for operators who must respond to a large fire emergency.

Cost

The total cost to implement these recommended fire protection enhancements is $ 1,846,300.

Implementation

The deficiencies identified occur in many areas of the plant, making it impractical to fully implement the above solutions in a single year without causing major disruptions to other plant maintenance activities. It is therefore recommended that the modifications be performed over a two year period.

Recommendations

1. Improve fire protection provisions to bring the level of protection to an acceptable level, as outlined above.

2. Implement the improvements over a period of two years.

APPENDIX I

FACTORY MUTUAL FIRE TEST PHOTOGRAPHS

Test facility. The object at left represents a lubricating oil tank, the pedestals at centre represent the turbine/generator support structure and the cylindrical object on top of the pedestal represents the turbine/generator.

Fire test, mimicking the failure of an oil line, with burning oil flowing down from the turbine/generator to the plant floor

Spray fire test, mimicking a stream of burning oil from a pressurized lubricating oil pipe.

Pool fire test, mimicking burning oil which would collect on the ground floor of a plant during an oil system fire.

APPENDIX II

FACTORY MUTUAL MEMORANDUM DATED 2004-08-20

Memorandum

RECOMMENDATIONS IN ENGINEERING BULLETIN 06-04
Reference with Data Sheets 7-79 and 7-101

TO: Distribution **AT:** FM Global

FROM: Paul Dobson, Glenn Mahnken **AT:** Engineering Hazards

SUBJECT: Turbine Building Fire Protection **DATE: August 20, 2004**

1.0 SCOPE

This memorandum contains the recommendations from Engineering Bulletin 06-04 (Revision 1 dated August 5, 2004) which will be incorporated into future revisions of FM Global Data Sheet 7-79 (Fire Protection for Gas Turbine Installations) and Data Sheet 7-101 (Fire Protection for Steam Turbines and Electric Generators). In the interim period until those Data Sheets are revised, this memorandum is intended to assist FM Global engineers to convey the recommendations to FM Global insureds that are involved in design and construction of new plants or are making upgrades to fire protection in existing power plants.

Engineering Bulletin 06-04 addresses protection criteria for lubricating and control oil fire hazards in steam and gas turbine buildings without a "full area operating floor", ie without a solid operating floor that extends the length and width of the building footprint. In this type of building design (referred to as "**turbine building"** in this bulletin), the turbines and auxiliary oil equipment are mounted on mezzanines or pedestals and much of the building is open from the ground floor to the roof. In many countries, this type of turbine building commonly houses modern indoor combined cycle power generating units, as well as steam or gas turbine units associated with cogeneration plants. In Canada and other areas of the world, a standard indoor plant design for conventional utility steam turbines also lacks a "full area operating floor" and therefore comes within the scope of this bulletin. In plants with mixed construction (i.e. having partially solid operating floors and partially open from the ground to the roof), protect open areas in accordance with this bulletin if there is a potential for oil fire in the open area.

1.1 Hazard

The hazard includes direct heat damage to the roof and crane, the turbine, and other building contents from a fire involving flammable (mineral type) lube oil, hydrogen seal oil or control oil. Also, in the case of combustible roof construction, collapse of roof steel has caused additional damage to turbine components. If the overhead crane is damaged and requires replacement, the outage will likely be extended. If emergency drainage and containment for oil releases is inadequate, a fire could occur outside the locally protected area, the fire protection system will not be activated and fire discovery will likely be delayed. Over 50% of the fires reported in turbine buildings are oil spray fires. A large oil spray fire could quickly result in severe local damage to structural steel and equipment that the fire impinges on. It is expected that a bearing lube oil release on the turbine pedestal will be at low pressure, which should not result in a significant oil spray fire, if any. Depending on the spill rate and path, oil flowing off the turbine or generator pedestal could result in a severe 3-dimensional spill fire accompanied by a pool fire on the ground floor.

2.0 RECOMMENDATIONS

2.1 Eliminate/Mitigate Unenclosed Oil Fire Hazards

1. When purchasing new equipment, encourage the equipment manufacturers to avoid or reduce the use of flammable (mineral type) oil for control oil systems; instead use FM Approved industrial fluids. Also, encourage the use of Approved fluids for lubricating systems.

2. Where feasible, enclose equipment inside fire-rated or noncombustible enclosures with adequate automatic fire protection, as well as oil spill containment and drainage provisions. See OS 7-79 for protection guidelines for enclosed equipment.

3. Install spray guards, shields, barriers, or spray hoods for pressurized oil equipment such as lubricating and control oil pumps, control devices and flanged or screwed fittings in order to deflect potential high pressure sprays of combustible lubricating and control oil. If removable metal flange shields are used they should be installed so that the perimeter of the flange is covered and an overlap is provided which extends down on both sides of the flange. The shield may be held in place with a band or with screws (Ramco Manufacturing Co., Inc; Kenilworth, NJ 07033, manufactures flange shields for maritime applications. There are no FM Approved flange shields). Inspect and maintain spray guards, shields, barriers and hoods as follows:

a. Itemize, tag and inspect all spray guards, barriers, and hoods on a monthly recorded basis.

b. Establish a spray guard supervision program and documentation system to ensure proper replacement of all shields, guards, barriers, etc. that are removed for maintenance activities. Supervision of such programs should be equivalent to or included in the plant's lock-out tag-out program.

c. Provide periodic training of maintenance and operations personnel on the purpose of the barriers and their proper maintenance.

4. Conduct a thorough, documented, oil fire risk assessment for all flammable lubricating and control oil systems to identify potential release scenarios, sources of large leaks, and determine the specific conditions necessary that would permit the safe shutdown of lube oil, seal oil and control oil systems. Include the following in the assessment:

a. Determine the various conditions that would permit the safe shutdown of the lube oil, seal oil, or control oil systems.

b. Determine potential flow paths for the released oil, from leak source to pooling areas and drains.

c. Ensure that all floor areas that oil can flow to, especially via pedestal openings, are locally sprinklered and provided with adequate containment and emergency drainage.

d. Identify pressurized flammable oil systems and potential oil spray sources, including the operating pressure, quantity of the connected oil supply, and potential spray "targets."

5. Ensure that oil fire prevention is addressed through on-going appropriate plant programs and procedures, such as:

a. Appropriate maintenance procedures-to minimize the potential for accidental releases of oil during and following maintenance activities

b. Oil fire awareness training programs for operators and maintenance personnel

c. Emergency response plans for oil release situations

d. The facility's "managing change" program

e. Self-audits

2.2 Ceiling Sprinkler Protection

1**.** Install automatic sprinkler area protection at the roof level of turbine buildings if the roof is combustible (including Class 2 steel deck).

2. Design ceiling protection in accordance with the criteria provided in Table 2.1:

Table 2.1 Ceiling sprinkler design criteria for turbine buildings with combustible roof construction

Type of Sprinkler System	Sprinkler Temperature Rating	Density gpm/ ft^2 (mm/min)	Area of Demand ft^2 (m^2)
Wet	High	0.20 (8)	5000 (465)
Dry			8000 (740)
Hose stream demand: 750 gpm (2840 l/min) Duration: 60 min (Water supply duration may need to be increased when local conditions exist that could delay fire fighting efforts - such as lack of drainage, inaccessible areas, etc.)			

The criteria in Table 2.1 are for protection of the roof only. Due to excessive clearances, ceiling sprinklers will have minimal if any impact on control of oil fires in typical turbine buildings. If local protection is inadequate, large spray or pool fires could develop and will likely result in operating areas that significantly exceed the ceiling sprinkler demand areas indicated in Table 2.1.

2.3 Local Deluge/Sprinkler Protection for Unenclosed Oil Fire Hazards

Apply the recommendations below retroactively. These recommendations have been developed based on engineering judgment taking into account the findings of a series of large-scale pool and spray fire demonstration tests conducted by FM Global in 2004. It is expected that most turbine building fires will be adequately controlled by the local protection criteria recommended below, if installed in combination with appropriate drainage/containment and effective emergency shutdown procedures.

1. Provide local automatic deluge (preferred) or closed head sprinkler protection for equipment and areas that present pool or three-dimensional spill fire hazards, including under the turbine pedestal, under any walkways around the pedestal, under spray guards, shields, barriers, or hoods and all floor areas that released oil can flow to. Such areas should be identified by an oil fire risk assessment (see 2.1 [4] above). Where oil releases could accumulate in pools on top of the pedestal or solid mezzanines as a result of containment areas formed by curbs, kick-plates, etc., provide appropriate drainage or a local protection system for the pooling area on the pedestal.

See Figures 2.1 and 2.2 for a general conceptual layout of local protection, containment, and drainage.

Among the potential oil release sources that could result in pool fires are pipe flanges, oil pumps, filters, gauges, threaded joints and fittings, sight glasses, indoor oil coolers, bearings, and rubber hoses. Rupture of welded pipe should not be considered a potential release source. Welded pipe often will be located above floor areas that need local protection because oil could flow to them from any of the previously mentioned leak sources.

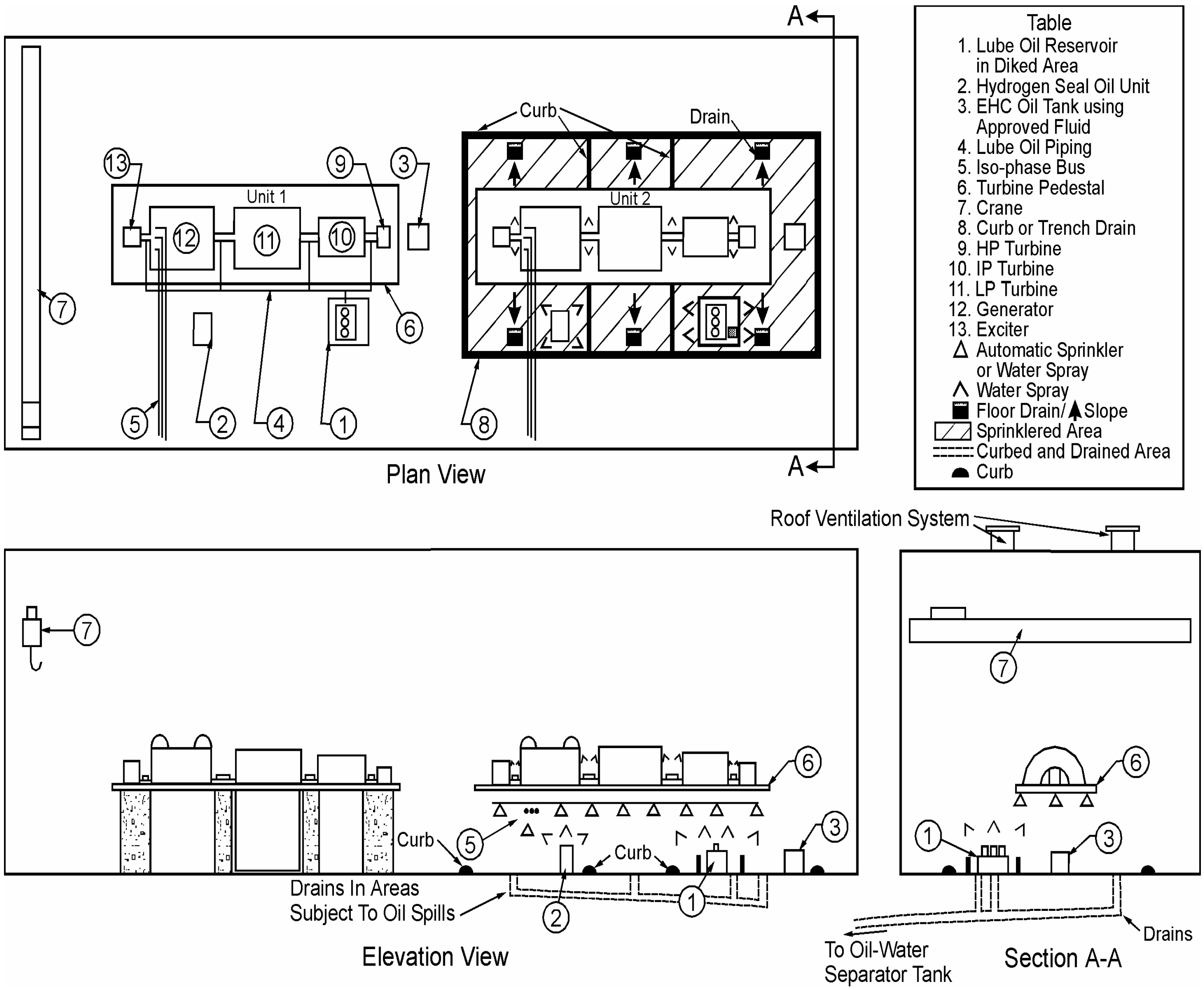


Figure 2.1 Local protection layout for unenclosed steam turbines and generators

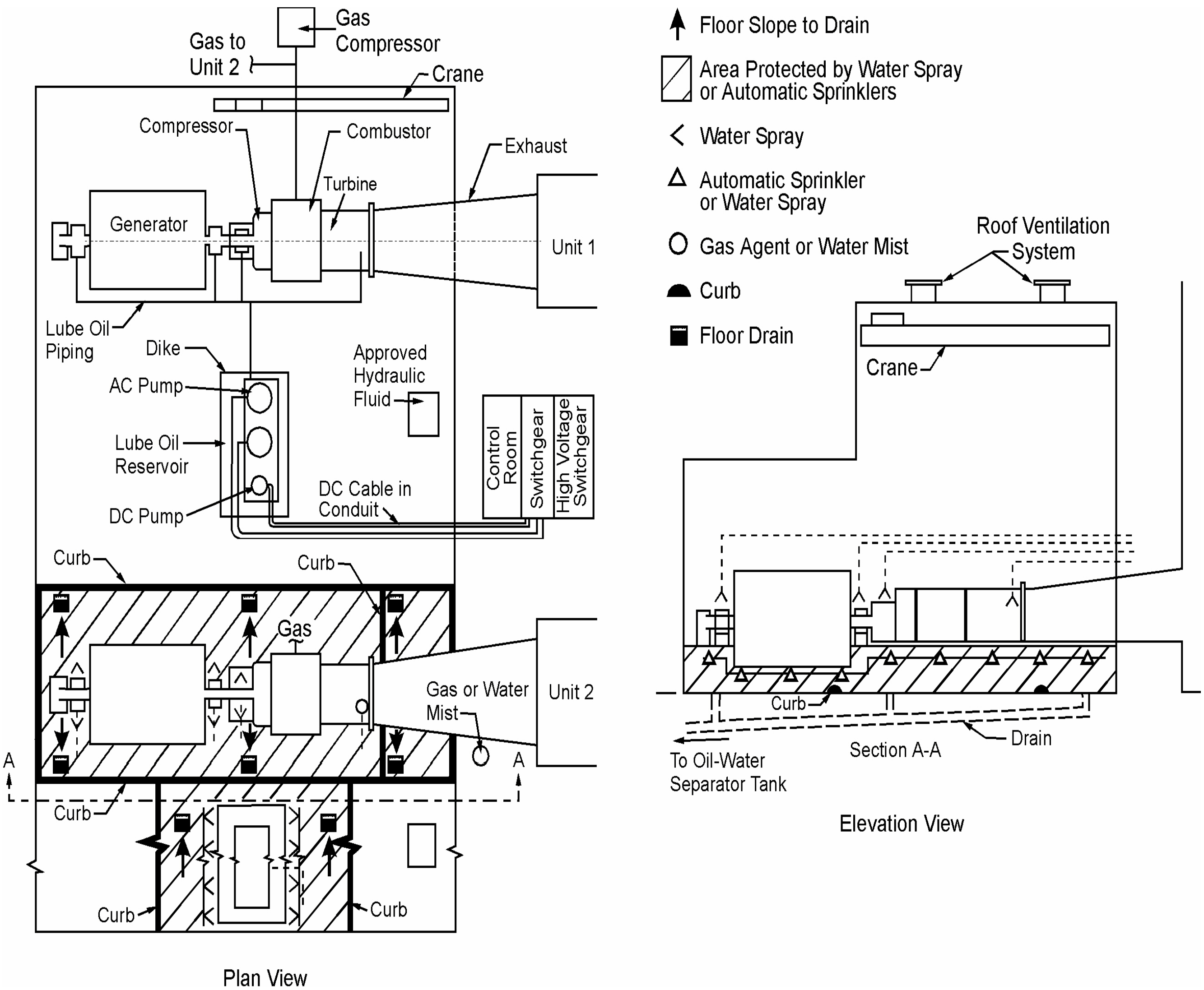


Figure 2.2 Local protection layout for unenclosed combustion turbines and generators

2. Design local protection against pool and three-dimensional spill fires as follows:

a. Provide a maximum 15 ft (4.5 m) clearance from the floor to the sprinklers. Install open (preferred) or closed sprinklers over the entire oil containment area, on maximum 10 x 10 ft (3 x 3 m) spacing. Provide sprinklers with a K-factor = 8.0 (115) and a design density = 0.30 gpm/ft^2 (12 mm/min). The demand area is 5000 ft^2 (465 m^2) if the closed sprinklers are directly under a solid deck or ceiling. If sprinklers are not directly under a solid deck or ceiling, design a demand area of 5000 ft^2 (465 m^2) or the containment area, whichever is less. Use 165°F (74 °C) in areas where local pool fire protection is present without a solid "ceiling". If sprinklers are located under a solid deck or ceiling, use 286°F (141 °C).

Note: k = 5.6 (81) sprinklers are acceptable in existing locations as long as the provided density is fully adequate.

b. For greater than 15 ft (4.5 m) up to 30 ft (9 m) clearance from floor to sprinklers, design as in part a) above, but provide a minimum density of 0.40 gpm/ft^2 (16 mm/min) and K-factor = 11.2 (161).

c. If adequate emergency drainage is not provided for containment areas subject to pool fires, then install either of the above protection options along with containment and/or curbing to hold sprinkler discharge inside the sprinklered area for 20 minutes or the rundown time of the turbine generator unit, whichever is greater. Provide local protection for all areas that sprinkler discharge may overflow to after the defined hold-up time.

d. As an option to either a. or b. above, for protection of areas subject to pool fires, provide an FM Approved foam-water sprinkler system designed for a density of at least 0.20 gpm/sqft (8 mm/min) or the minimum required density in the Approval listing, whichever is greater. Design for a demand area as in part 2a. above. Provide enough foam concentrate to last at least 20 minutes or the rundown time of the unit, whichever is greater. If adequate drainage is not available, design containment as in part 2c. above.

3. Use close-spaced (5 x 5 ft [1.5 x 1.5 m]) pendent deluge sprinklers, with orifice coefficient K = 8.0 (115) to protect against unenclosed oil spray fire sources. Provide a minimum end head pressure of 50 psig (3.9 barg). Locate these open sprinklers with approximately 6 ft (1.8 m) vertical clearance above the potential oil spray source and provide a minimum of nine heads on 5 x 5 ft (1.5 x 1.5 m) spacing. If multiple oil spray sources are present in the same general area, provide additional close-spaced heads as needed in order to provide a sprinkler grid that extends at least 5 ft (1.5 m) beyond each spray source. Preferably, provide a fire-rated spray barrier or hood above the deluge sprinklers. If a spray hood (see appendix A.7) is provided, sprinklers located under the hood may be closed head type (although open heads are preferred).

A spray fire source for the purposes of this recommendation is any unenclosed flange, threaded fitting, or hydraulic control device that provides containment for pressurized flammable oil at 50 psig (3.9 barg) or greater and could release at least 200 gallons of oil into the fire before the suction to the source oil pump runs dry. (If the largest possible oil release size is less than 200 gallons, provide close-spaced deluge sprinklers or, alternatively, provide a spray barrier above the source, with sprinklers designed as in part 2. above). Flanges on lube oil supply piping inside a gravity type return oil pipe are not considered spray sources for the purposes of this recommendation. Sprays can develop at pressures as low as 20-30 psig, but the heat release rate for such sprays is expected to be significantly reduced. Hydrogen seal oil systems on large generators may deliver oil to the seals at pressures in excess of 50 psig (3.9 barg).

Shields, barriers and hoods may be given credit for eliminating the spray fire hazard for the purposes of this recommendation if the conditions in par 2.1 [3] are met.

Close-spaced pendent heads in the arrangement recommended above were used in testing conducted by FM Global. The spray fire was not extinguished, but the measured ceiling temperatures and heat release rate of a 40 MW spray fire were significantly reduced.

Only K=8.0 (115) sprinklers can be used for this protection scheme. Larger and smaller K-factors were tried and found to be ineffective with the same close spacing arrangement.

There were no obstructions present between the open heads and the spray source. Pendent heads may be more effective than uprights against pool fires accompanying the spray fire, if there are no obstructions to sprinkler discharge. Upright heads may be more effective if there are obstructions to the sprinkler discharge, but obstructions should be avoided where possible.

4. Activate spray fire deluge systems automatically by an FM Approved line type heat detection or flame detection system. Pool fire deluge systems may be operated by pilot sprinklers, line type heat detection, or flame detection. Also provide remote manual (“push-button”) activation of deluge systems from the control room or other accessible location outside the turbine building.

5. Provide water supplies to simultaneously feed all local systems which may be expected to operate simultaneously in the worst credible case scenario for the site, plus 750 gpm hose stream. Determine the duration based on the fire scenario or 60 minutes, whichever is greater.

2.4 Spill Containment and Emergency Drainage

1. Provide an engineered spill containment and emergency drainage system that will “contain and drain” any oil spills originating from turbine generator bearings, control equipment, piping flanges, pumps, or control equipment.

2. Consider subdividing large containment areas by use of additional curbing or drain trenches, where feasible, to limit the potential pool size (see Figs. 2.1 and 2.2).

3. Design emergency drainage capacities and floor pitch (to drains) per OS 7-83, or per equivalent engineering design criteria, to provide a discharge flow rate equal to the combined water spray and sprinkler demand plus 750 gpm (2850 l/min) hose stream.

2.5 Structural Steel Protection

1. Provide automatic water spray or apply fireproofing rated for hydrocarbon pool fire exposures to any exposed steel columns supporting the building, crane rails, or other major equipment, if these columns are located within areas where pool fires may occur.

2. Arrange water spray for column protection in accordance with OS 7-93, including the following:

a. Provide a minimum 0.25 gpm/ft^2 (10 mm/min) over the wetted area of the columns. ("Wetted area" is the surface area on the three sides of the reentrant space formed by the column web and flanges).

b. Locate water spray nozzles spaced on 10 ft (3 m) centers on alternate sides of "H" columns.

2.6 Emergency Shutdown Plan

1. Develop a documented emergency plan with appropriate posted procedures to secure the turbine generator unit and achieve lube and control oil pump shutdown as quickly and safely as possible, recognizing that under some circumstances, it may be better to shut off the pumps rather than continue to supply oil to a fire.

While a posted procedure is preferred, a documented procedure that is routinely reviewed and well known to all operators is also acceptable. Generally the DC pump cannot be shut off from the control room. The posted procedure should include where and how to shut off all pumps. If the only existing pump shut off is in an area that would not be not accessible during a fire, provide the capability to shut off the pump from the control room or another accessible area.

2. Clearly establish and document the authorization for designated personnel to make critical decisions regarding lube oil shutdowns during fire emergencies. Periodic training sessions should be held to give responsible on-site personnel the opportunity to deal with the decision-making issues involved in exercising this authority.

3. Locate the control room in a separate building. When the control room is located in the turbine building, do the following:

a. Isolate the room from the remainder of the turbine building with minimum one hour fire rated walls, roof and floor. Provide wired glass or rolling steel fire rated shutters or an automatic water spray protection system for any windows facing the interior of the turbine building.

b. Provide an independent air supply capable of pressurizing the room to maintain acceptable habitability during a fire event.

c. Seal penetrations between the control, cable spreading and relay rooms with a FM Approved fire stop system.

d. Ensure that equipment needed to safely shutdown the turbine such as actuation solenoid valves to break vacuum and shutdown controls for the a.c. and d.c. lube oil pumps are arranged for remote operation from the control room.

If operators cannot be expected to remain in the control room during a fire, make alternate provisions for emergency shutdown from an accessible location.

4. Keep a copy of the complete documentation available in the control room.

5. Conduct drills for all personnel who are designated to perform emergency shutdown functions.

SECTION H
Tab 2

HYDRO
THE POWER OF
COMMITMENT

Wood Pole Line Management Program
Executive Summary Report

REGISTERED PROFESSIONAL ENGINEER
G. J. HOLDEN
SIGNATURE
June 24, 2005
DATE
PROVINCE OF NEWFOUNDLAND

Prepared By: **Gordon Holden P.Eng.**
Engineering Design Department
Transmission & Rural Operations Division
June 24, 2005

Background

Hydro maintains approximately 2400 km of wood pole transmission lines operating at 69, 138 and 230 kV. These lines consist of approximately 26,000 transmission size poles of varying ages, with the maximum age being 39 years. Almost two-thirds of transmission pole plant assets fall into two age categories; approximately 34% are at or over 30 years, and another 31% are 20 to 30 years old. The remaining asset age is less than 20 years old.

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 tests raised concerns regarding the general preservative retention levels in wood poles. It is well known in the industry that poles become susceptible to fungi and/or insect attack as the preservative levels deplete.

Between 1998 and 2003, Hydro undertook additional coring and preservative testing. This testing confirmed that there were a significant number of poles, which had a preservative level below what was required to maintain the required design criteria. 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 the analysis of the data confirmed that a more rigorous wood pole line management program was required.

Hydro first initiated the Wood Pole Line Management program as a pilot study in 2003. This pilot, lead to the recommendation that the program continue as a long-term asset management and life extension program. The program was presented to the Board of Commissioners of Public Utilities in 2004 as part of Hydro's capital program and was titled "Replace Wood Poles – Transmission". The proposal was supported in the application by the Hydro internal report titled "Wood Pole Line management Using RCM Principles" by Dr. Asim Haldar, Ph.D, P.Eng.

The Board found that "This approach (by Hydro) is a more strategic method of managing wood poles and conductors and associated equipment and is persuaded that the new WPLM Program, based on RCM principles, will lead to an extension of the life of the assets, as well as a more reliable method of determining the residual life of each asset. One of the obvious benefits of RCM will be to defer the replacement of these assets thereby resulting in a direct benefit to the ratepayers".

The Board found that the project was justified and prudent and approved the expenditures as submitted in the 2005 Capital Budget. (Ref; Board Order P.U. 53(2004).

As part of its 2005 Capital Budget application process, Hydro committed to provide the Board with an update of the 2004 program work, a progress report of the 2005 work and a forecast of the program objectives for 2006 and beyond. This report would be provided with the 2006 Capital Budget Application.

The Program

The Wood Pole Line Management (WPLM) program is a condition-based program, which uses basic Reliability Centered Maintenance principles and strategies. Under the program, line inspection data in each year is analyzed and appropriate recommendations are made for necessary refurbishment and/or replacement of line components (poles/structures, hardware, conductor, etc) in the subsequent year. The inspection data and any refurbishment and/or replacement of assets are recorded in a centralized database for easy access and future tracking.

The program is aimed at early detection and treatment of the wood pole before the integrity of the structures is jeopardized. If the deterioration of the structure is not detected early enough then the reliability of the structure will affect the reliability of the line and the system as a whole. It may also create safety issues and hazards for the Hydro personnel and for the general public.

Update of 2004 Work

The first objective of the 2004 program was to inspect, test and treat at least 3200 poles and associated line components. The program is built on the strategy of focusing on the older lines first and working towards the newer lines. The following table summarizes the inspection accomplishments for 2004.

Regions	Line Name	Year In Service	Voltage Level	Target Number of Poles Inspected	Complete	Inspection rate (poles per week)
Eastern	TL 201	1966	230kV	283	80%	30
	TL 203	1965	230kV	437	100%	
Central	TL 222	1967	138kV	553	100%	51
	TL 223	1966	138kV	177	50%	
	TL 224	1968	138kV	151	100%	
Western	TL 233	1973	230kV	511	100%	36
	TL 245	1969	138kV	239	100%	
	TL 250	1987	138kV	110	9%	
Northern	TL 221	1970	69kV	250	100%	42
	TL 226	1970	69kV	250	50%	
	TL 227	1970	69kV	330	35%	
Total				3291		

The second objective of the 2004 program was to develop and implement an electronic data collection system to facilitate the field data collection and subsequent data analysis.

This objective was started by first developing a definition of the requirements of the electronic data collection system, and the storage database. The intent is to be able to archive the WPLM Inspection data in such a way that it can be easily retrieved and analyzed.

The basic requirements for the hardware were that it be ‘Windows’ compliant, compatible with a ‘ Pocket PC’ type device with a ‘portrait’ oriented input screen and allow for a minimum of one week’s worth of data storage.

For the software the general requirements were that it be configurable with the paper forms already in use, be uploadable from remote locations, provide import/export capabilities to other Microsoft products, allow for the tracking of data and corrective action histories and be connectable with Hydro’s JDE business applications.

ESRI Canada was chosen as the contractor to select the hardware and to develop the electronic data collection software. Some of the hardware units evaluated were Allegro by Juniper systems (currently in use by R Whitewoods Inc.), Panasonic CF-P1, Hewlett Packard Ipaq, and Dolphin 9500. The model selected that best met all these requirements was the Dolphin 9500. Therefore, four units, including spare battery and charger base unit, were purchased.

Once the data collection software was developed, a training session was held with the field personnel. The line crew and supervisors were given training on how to use the new software to collect the inspection data electronically. The training sessions included a field trip to TL 232 to provide hands on use of the program.

The second phase of the program was the development of an Access based database, which stores all of the electronic data for archival and query purposes. A database modeling workshop was held, in which it was determined that the primary requirement for the database is to extract relevant information for further analysis and to provide interaction with other external programs such as EXCEL. From this workshop, the database was created and subsequent training session on the ArcMap software was held. The software and database were installed on Hydro’s network. From this point, all electronic data collected were uploaded to the database. Also, all 2003 and 2004 inspection data, contained in an Excel spreadsheet, were imported to the database. Database query and reporting tools are currently under development.

The fourth objective of the 2004 work was to develop a methodology to assess the consequences of a specific failure mode with particular reference to strength deterioration with increasing line age.

Hydro engineering staff developed the reliability analysis methodology based on the premise that the strength as well as the effects of all loads on the line or on its components can be defined by their respective probabilistic distributions. The respective distribution is based on the sample test data set from Hydro systems or from published data of similar pole age groups and exposures.

The methodology is based on the concept of the transmission line studied as a “series” system where the failure likelihood is primarily controlled by the “weakest link” component. As the component’s strength deteriorates over time the failure consequence must be evaluated by assessing individual failure mode. For example a suspension structure subjected to transverse wind load is likely to fail by pole bending below the cross brace point. Therefore it is important to have sufficient fiber strength and section modulus to withstand this load effect. Under vertical loading, the same pole will likely fail by buckling. Therefore it is necessary to ensure that sufficient material left in the cross sectional area to yield the adequate capacity.

Conclusion

In conclusion, the three major objectives for the 2004 program were fully achieved. This included collection of inspection data for 3200 poles and other associated line components, development of an electronic data collector system, and an electronic database to process the data and the development of a sound reliability based methodology to assess and analyze the pole inspection data.

The major thrust of the 2004 program was also to develop a full electronic data collection system as well as an electronic database to manage effectively 26000 poles as well as other line component information. The database is now operating successfully and engineering is analyzing the pole data for further reporting. It is envisaged that all 2005 data will be collected electronically, thus eliminating the paper forms.

A framework for systematically analyzing a large volume of wood pole transmission line inspection data has been developed using the reliability based analysis technique. The method uses a hybrid approach where the uncertainties in load and strength values and the strength deterioration due to aging are taken into account in combination with the condition rating of each pole. This information is then developed into a condition matrix table.

This matrix table provides four possible outcomes for future mitigations. The method is developed only for one failure mode “pole bending” at this time. It is equally applicable to other failure mode scenarios such as vertical failure mode of the cross arm or buckling failure mode of the angle and/or dead end structures. Work is underway in developing the reliability based methodology for these other failure modes and eventually all failure modes will be evaluated using the matrix table. Failure modes will be coordinated with the field inspection data to provide specific mitigation actions for each line component. The ultimate objective is that all failure modes will be evaluated using the “Condition Matrix” table. Figure 1 shows a typical plot for the reliability versus condition matrix for TL 209.

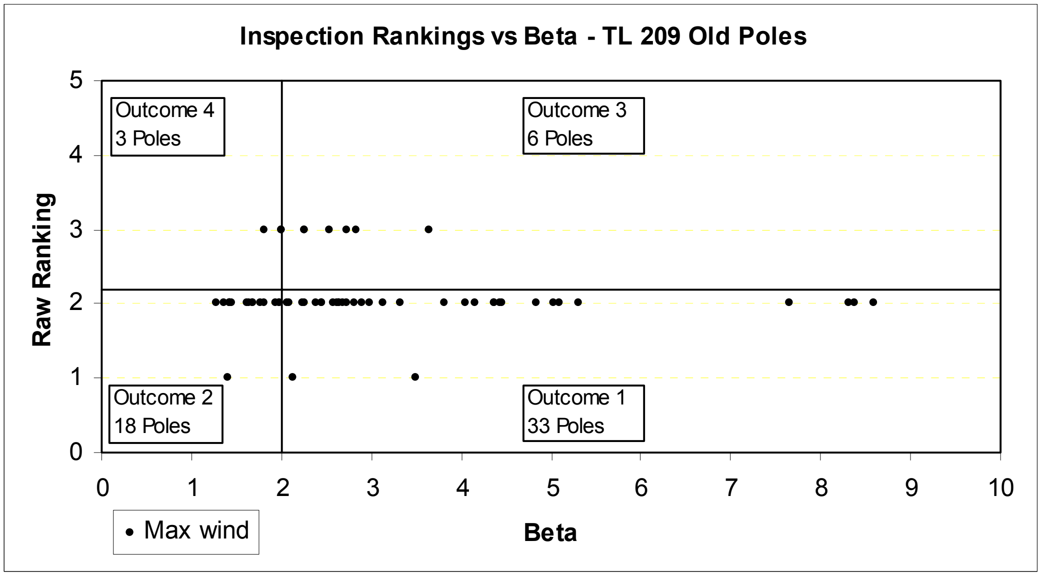


Fig. 1 Summary Plot For Suspension Structures (Pole Bending) –Beta Values Versus Condition Ranking

2005 Work Plans

The inspection and treatment work plan for 2005 is shown summarized in the following table.

Regions	Line Name	Year In Service	Voltage Levels	Number of Poles to be Inspected	Remarks
Eastern	TL 201	1966	230kV	158	
	TL 218	1983	230kV	223	
	TL 212	1866	138kV	156	
	TL 219	1990	138kV	263	
Central	TL 210	1969	138kV	455	
	TL 223	1966	138kV	88	
	TL 234	1981	230kV	245	
Western	TL 243	1978	138kV	159	
	TL 250	1987	138kV	578	
Northern	TL 226	1970	69kV	268	
	TL 227	1970	69kV	298	
	TL 239	1982	138kV	100	
	TL 241	1983	138kV	152	
Labrador	TL 240	1976	138kV	792	
Total				3935	

As well, in 2005, the corrective action work resulting form the analysis of the 2003/2004 inspection data is summarized in the table below.

Total Poles Inspected	Rejections after analysis	Poles to Monitor	Estimated Cost for all 2005 refurbishment
5284	**116**	**421**	**$1,300,000**

The estimated costs for the 2005 refurbishments are within 10% of what was forecasted in the 2005 Capital Budget. At the time of this report about 25% of this work has been completed. The majority of the refurbishments are on the eastern end of the system, and because of outage restrictions, these will be done in the fall of 2005. All refurbishments planned for 2005 will be completed in 2005.

The inspection and treatment plan for the years 2006 and beyond are shown in general terms in the table below. The total pole asset consists of 26000 poles approximately.

	2006	2007	2008	2009	2010
Number of poles	3600	3200	2500	1600	1600
Percent of asset	13.8%	12.3%	9.6%	6.2%	6.2%

This table summarizes the inspection and treatment plan for the years 2006 and beyond. This is stated in general terms only, and is based on the statistical information. Should the inspections reveal some unforeseen conditions, then this inspection and treatment plan may be adjusted. The overriding premise of the whole WPLM program is that it is ‘condition based’. That is, the inspections, treatments and corrective actions are all executed on the condition of the equipment.

Attached, for additional general information is a sample inspection sheet for TL 223. This is presented here as a typical example of the type of information that is collected for each of the lines. It is provided to give an extra measure of information and understanding of the type and content of information that is being processed in this program.

SAMPLE INSPECTION SHEET

Inspection Report – TL 223

Report Coverage: 2004 inspection year

Report Issued April 25, 2005

General Line Description:

- Construction Type: Wood Pole H-Frame
- Operating Line Voltage: 138kV
- Geographic Location: Springdale Substation to Indian River Substation
- Year of Construction: 1966
- Line Length: 29.8km
- Basic Line Loading, Original Design:
  - 1" Radial Glaze
  - 110MPh Gust Wind
  - 0.5" Ice / 55MPh Wind

Construction Summary:

- Total Wood Poles: 351
- Pole Size: CL3 (100%)
- Suspension: 92%
- Angles and Deadends: 8%
- Species (based on inspection data)
  - Douglas Fir 0%
  - Southern Pine 98%
  - Western Red Cedar 2%

Pole Length Breakdown (Percent):

45'	50'	55'
31	59	10

Past Performance:

- Significant Line Failures:
  - No significant line failures recorded
- Line Upgrades:
  - No line upgrades recorded
- Previous Inspections:
  - Standard preventive maintenance inspections (20% annually) until 2002. No major pole replacements. Cross arm replacement has been an issue over the last few years with approximately 35 replaced in 2002/2003.

Current Inspection (covered by this report)

- 175 poles (50% of total) inspected
- 7 poles (4%) recorded as possible rejections by field crew
- 1 pole (0.5%) scheduled for replacement after analysis
- Major pole issue: checking
- Minor pole issues: shell separation
- Rotten cross arms are prominent on this line with 10 replacements (13%) in 2005, and 23 (30%) to monitor
- 12 poles after 2005 replacement program will require periodic monitoring
- Preservative retention: average 0.133pcf (minimum required 0.18pcf)

Future Work

- 2005
  - Replace 1 pole, 10 cross arms, and other noted defects in 2005 using existing WPLM CJC
  - Inspect another 90 poles in 2005
- After 2005
  - Periodically monitor 12 poles, cross arms and numerous other wood items
  - Schedule next major inspection for 2014

SECTION H
Tab 3

Engineering Condition Assessment
of the
Corner Brook Frequency Converter

Prepared by: Paul Nolan, P.Eng.
TRO Engineering Department
Newfoundland and Labrador Hydro

April 7, 2005

ENGINEERING CONDITION ASSESSMENT

CORNER BROOK FREQUENCY CONVERTER

APRIL 7, 2005

Contents

A. EXECUTIVE SUMMARY

Site inspections of the Corner Brook frequency converter were carried out on October 25th and 26th, 2004 and March 24th, 2005. The purpose of these inspections was to review the general condition of the converter and the facility along with area personnel and to compare the present condition of the unit and facility to the "Condition Assessment of 50/60 Cycle Frequency Final Report", which was submitted to Hydro in September of 1998 by Acres International Limited.

The key observations and recommendations are:

- The condition of the insulation of the rotors (especially the 50 Hz rotor) was identified by Acres as very low. This issue has not been addressed. The 50 Hz rotor should be rewound as soon as possible. (A thorough assessment of the Grand Falls unit should be performed in order to explore the option of rewinding this unit as a replacement to the Corner Brook unit. This would decrease the length of the outage.) During this rewind, a thorough assessment of the other rotating equipment should be conducted.

- Transformer T1 is nearing the end of its service life. This unit should be rewound or replaced as soon as possible.

- The pedestal bearing was identified by Acres as being partially wiped. This issue has not been addressed. This bearing should be replaced or repaired as soon as possible.

- Acres identified that the oil spill containment and drainage around the main transformers and transformer doors require improvement in order to contain a spill and to eliminate a fire hazard. No deluge system exists for the transformers. These issues should be addressed as soon as possible.

- The ventilation system does not provide adequate cooling for the converter and the transformers. The air being brought into the facility is poorly filtered which is a significant contributor to the accumulation of dust and dirt. The fire doors separating the transformers from the converter must be left open during the summer to prevent overheating. These problems were identified by Acres but have not been corrected. The ventilation system should be upgraded as soon as possible.

- The upgrade of the ventilation system should include an alternate method of bringing air into the facility. This would permit opening of the transformer area to the outdoors.

- Portions of the compressed air system's piping should be replaced. The air receiver should have an inspection opening installed and be inspected for corrosion. If the tank is in good condition, a pressure gauge and automatic water release valve should be installed. These problems were identified by Acres but have not been addressed.

- The existing control system is outdated and, due to the failure of the auto-synchronizer, it is sometimes difficult to synchronize the 50 Hz and 60 Hz systems together. The auto-synchronizer should be replaced.

- There is a Pyrotronics model 302A fire alarm control panel inside the facility. These panels are normally inspected on an annual basis, but there is no evidence of this being done. The control panel, smoke / heat detectors, sirens, and horns should be inspected by a qualified and licensed fire alarm system technician. Annual inspections should be performed in the future.

- The voltage regulator's design is obsolete and has been the source of many maintenance difficulties over the years. Maintaining this system on a long-term basis may be problematic. Installation of a new voltage regulation system, which can be maintained over the long term, should be done within the next couple of years.

- The design of the speed control for the starting motor includes a liquid rheostat, which is a rudimentary and outdated method of varying the resistance of the rotor circuit. Maintaining this system on a long-term basis may be problematic. Installation of a new speed control system (suitable for automatic startup and synchronizing), which can be maintained over the long term, should be done within the next couple of years.

- Replacement of the battery bank should proceed as planned in 2005.

- Painting of the take-off towers and replacement of the 66 kV pin cap and suspension insulators should proceed as planned in 2005.

- Replacement of the entrance insulators should proceed as soon as possible.

- The main lube oil pump is nearing the end of its service life. The cost of replacing this pump is estimated to be $7,000. This work should be budgeted and completed within the next couple of years.

- The facility should be cleaned and painted, but this work should not begin until the ventilation problems are addressed.

- An assessment of the Grand Falls converter should be done. Also, a listing of usable spare parts from the Grand Falls frequency converter should be created. Spare part requirements for the Corner Brook unit should be identified and compared to spare parts available. Any deficiencies should be addressed.

- The condition of numerous components and subsystems (i.e.: compressors, protection relays, battery charger, etc.) should be evaluated. If spare components are available from the Grand Falls unit, they should be in shipped to Corner Brook.

The following table summarizes significant repairs / replacements which should be completed over the next couple of years. These cost estimates are derived from several sources, including the original Acres report and recent discussions with local companies and suppliers. Estimates based upon the Acres report have been indexed to the appropriate year using the Gross Domestic Product (GDP) Implicit Price Deflator, which is included in the Appendix. It is likely that during the bidding process for this work, the tendered prices will be less than these estimates.

TASK	COST ESTIMATE	YEAR
Rewind or Replace Transformer T1	$480,000 (**)	2006
Ventilation System Upgrade	$120,000 (***)	2006
Transformer Area Modifications	$6,000 (**)	2006
Replace Pedestal Bearing	$6,000 (***)	2006
Address Compressed Air System Deficiencies	$12,000 (***)	2006
Rewind 50 Hz Rotor	$600,000 (***)	2007
Evaluate Condition of Rotating Equipment	$50,000 (**)	2007
Oil Spill Containment	$412,000 (***)	2007
Replace Auto-Synchronizer	$20,000 (**)	2007
Replace Lube Oil Pump	$7,000 (**)	2007
Replace / Repair Doors	$12,000 (**)	2007
Repair Concrete and Masonry Walls	$5,000 (**)	2007
Clean / Paint Walls and Roof Trusses	$40,000 (**)	2007
Replace Voltage Regulators	$200,000 (**)	2008
Replace Starting System (Liquid Rheostat)	$200,000 (**)	2008
Rewind 60 Hz Rotor (*)	$610,000 (***)	2008

(*) – dependant upon evaluation
(**) – new estimate
(***) – estimate based upon Acres report, escalated to project year and rounded

B. INTRODUCTION

1.0 Corner Brook Frequency Converter Site Inspections

An on site inspection of the Corner Brook frequency converter was carried out on October 25^{th} and 26^{th}, 2004. During this site inspection, discussions were held with area Operations personnel.

The purpose of this inspection was to review the general condition of the converter and the facility along with area personnel and to compare the present condition of the unit and facility to the "Condition Assessment of 50/60 Cycle Frequency Final Report", which was submitted to Hydro in September of 1998 by Acres International Limited.

An additional site inspection was carried out on March 24^{th}, 2005.

2.0 Grand Falls Frequency Converter Site Inspection

An on site inspection of the Grand Falls frequency converter was carried out on October 27^{th}, 2004. During this site inspection, discussions were held with area Operations personnel.

The purpose of this inspection was to review the general condition of the converter and the facility along with area personnel. Since this unit is no longer in service, discussions centered on its use as a source of spare parts and components for the Corner Brook unit.

C. ACRES REPORT UPDATE

The following observations and recommendations were obtained from the executive summary of the Acres report. These observations and recommendations are followed by TRO Engineering comments *(in italics)*.

1.0 Dust and Dirt Within the Facility

The entire facility is covered with dust and dirt and accumulated residue from the pulp mill operation. The ventilation system is faulty and the building shell has numerous cracks, which allow penetration of debris. The entire facility requires cleaning, particularly the converter itself. The ventilation system should also be brought up to current standards.

Dust and dirt continue to be a problem at the facility. This has been alleviated by some degree due to the paving of the dirt road immediately adjacent to the converter, but the problem persists. The facility has been cleaned, but dust and dirt quickly reaccumulates. There have been no improvements to the ventilation system.
The ventilation system requires upgrading such that properly filtered air enters the facility ($120,000 estimate).
The facility should be cleaned and painted once the ventilation system improvements are completed ($40,000 estimate).

2.0 Rotor Windings

The insulation resistance value of the rotor windings is very low, in the order of 300 kohms. These low values are indicative of a failure within the next few years, but the failure could occur at any time. The rotors should therefore be rewound. Because the existing windings are asbestos insulated, the rewind will cost more than usual.

This issue has not been addressed.
Readings of the insulation values of the 50 Hz rotor since 1998 remain very low (approximately 200 to 300 kohms.) The readings for the 60 Hz rotor, unlike the 50 Hz rotor, improved after cleaning.
The Acres report included a budget estimate of $500,000 to rewind each rotor.
The existing equipment was supplied by Westinghouse.

Figure 1 – 50 Hz Rotor (2005)

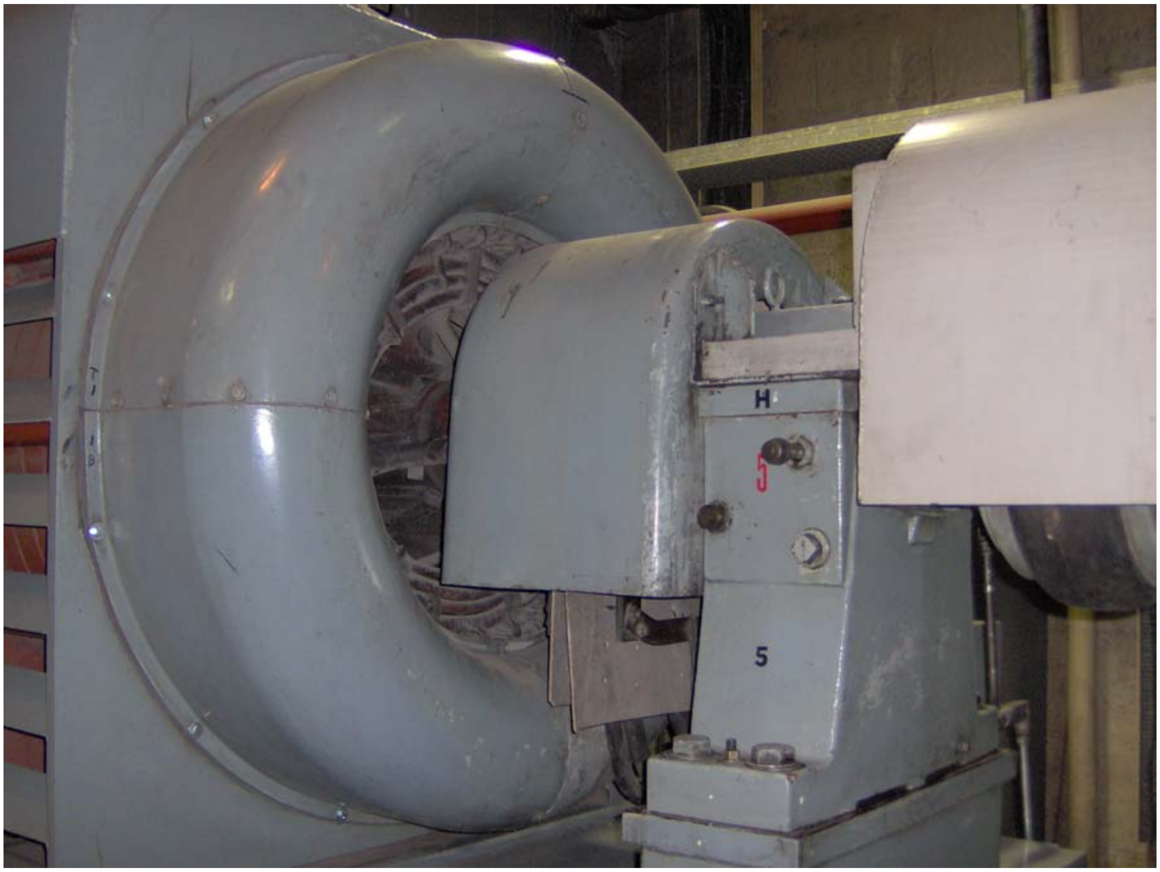


Figure 2 – 60 Hz Rotor (2005)

3.0 Oil Spill Containment

The oil spill containment and drainage around the main transformers and the transformer doors require improvement to contain any spill and to eliminate any fire hazard.

This issue has not been addressed.
Acres estimated that the cost of installing an oil spill containment system and fire protection system for the transformer area is $345,000.
At present, there are large oil filled transformers contained inside a building with no fire protection system and no way to remove oil should a problem occur.
There is a Pyrotronics model 302A fire alarm control panel inside the facility. These panels are normally inspected on an annual basis, but there is no evidence (certificate or sticker from a certified fire alarm system technician) of this being done. The batteries inside the control panel appear to have been installed in 1984. TRO Engineering has asked for details and is awaiting a response from Corner Brook Pulp and Paper.
The control panel, smoke / heat detectors, sirens, and horns should be inspected by a qualified and licensed fire alarm system technician. Annual inspections should be performed in the future.

4.0 Cooling System Water Leak

The cooling system associated with the voltage regulator (starting motor) has a water leak that occurs only on shut down or startup. This is known to the maintenance forces and they routinely drain the accumulated water after a shut down or startup. The water level after a shut down or startup is, however, only slightly below the main incoming leads, which are bare. Although it is unlikely, the potential exists for a short to occur. The leak should be fixed or static voltage regulators, which have a relatively low cost and greater flexibility, should be installed.

The cooling system leak has been repaired.

5.0 Pedestal Bearing

The pedestal bearing has been wiped and should be replaced.

This issue has not been addressed.
It is incorrect to state that this bearing has been wiped. This bearing has been partially wiped. A wiped bearing would likely cause damage due to contact between the shaft and the bearing shell. A machine cannot be operated with a wiped bearing.
The bearing should be replaced as soon as possible. It is running at higher than normal temperatures, as evidenced by the condition of the oil, and bearing failure is possible. This could cause shaft damage and a lengthy outage.

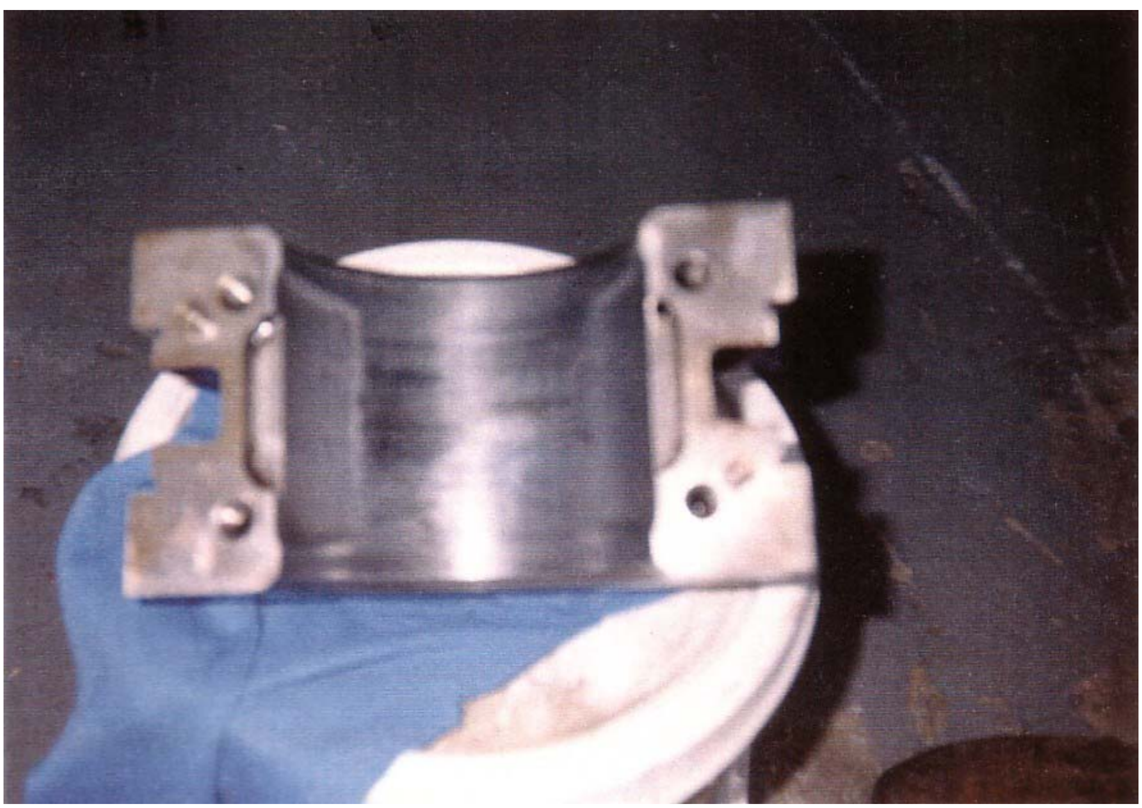


Figure 3 – Top Half of the Pedestal Bearing (1998)

6.0 Building Repairs

The building requires repair. Concrete and bricks have fallen from the roof and building sides and damaged the bushings and post insulators. Building cracks have allowed entrance of the wood debris associated with operation of the paper mill. The ceiling in the stairwell is temporarily repaired using a sheet of plywood. This should be permanently repaired.

Repairs have been made to the roof and stairwell ceiling. Caulking has been applied to building cracks when possible to decrease the ingress of dirt and dust. The overall condition of the building remains poor.
Repairs to the concrete and masonry ($5,000 estimate) should be done as soon as possible.

Figure 4 – Example of Crack in Wall (2005)

Figure 5 – Example of Crack in Wall (2005)

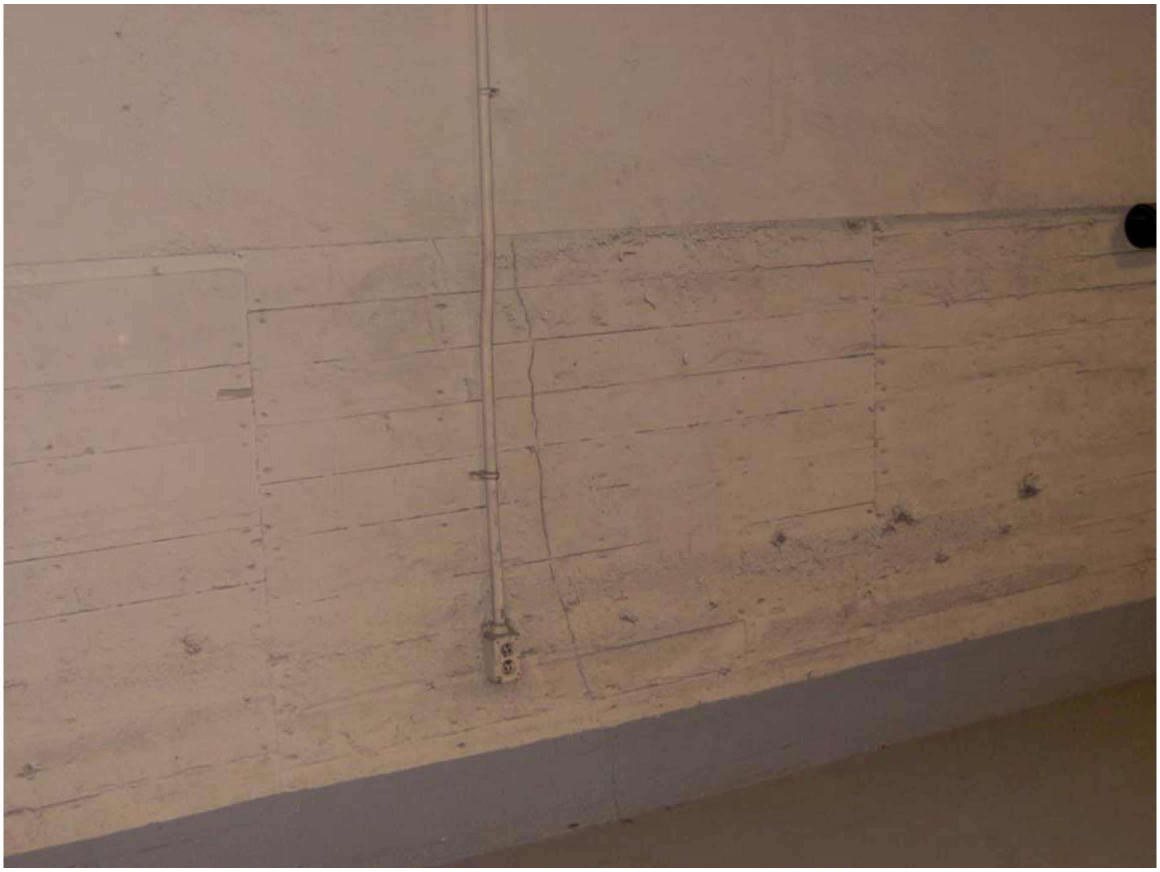


Figure 6 – Example of Crack in Wall (2005)

7.0 Neutral Grounding Transformers

The neutral grounding transformers are oil insulated and should be replaced by dry type transformers.

This issue has not been addressed.
The risk of an oil leak from these transformers is small. A dry type transformer would be more susceptible to problems caused by the accumulation of dust and dirt.

Figure 7 – Neutral Grounding Transformer (2005)

8.0 Lighting

The lighting in the building, particularly the emergency lighting, should be upgraded.

There have been significant improvements, including the addition of a new AC distribution panel and several HID (high intensity discharge) fixtures. Operations personnel indicate that the present lighting levels are adequate.
Emergency lighting should be installed in the transformer vaults, the converter area, the switchgear area, and the stairway.

9.0 Batteries

The batteries should be enclosed and measures taken to control and exhaust hydrogen gases.

An overhead shield and lighting has been installed. The hydrogen gases from the bank are not being exhausted. The battery bank is scheduled for replacement in 2005 under a capital project ("Replace Battery Banks – Various Stations and Lines"), which also includes the replacement of several other battery banks. The total project cost is $165,700. The cost of replacing the Corner Brook frequency converter's battery bank is roughly $40,000. The building's ventilation system, in addition to providing cooling air for the transformers and converter, exhausts hydrogen gases from the battery bank.

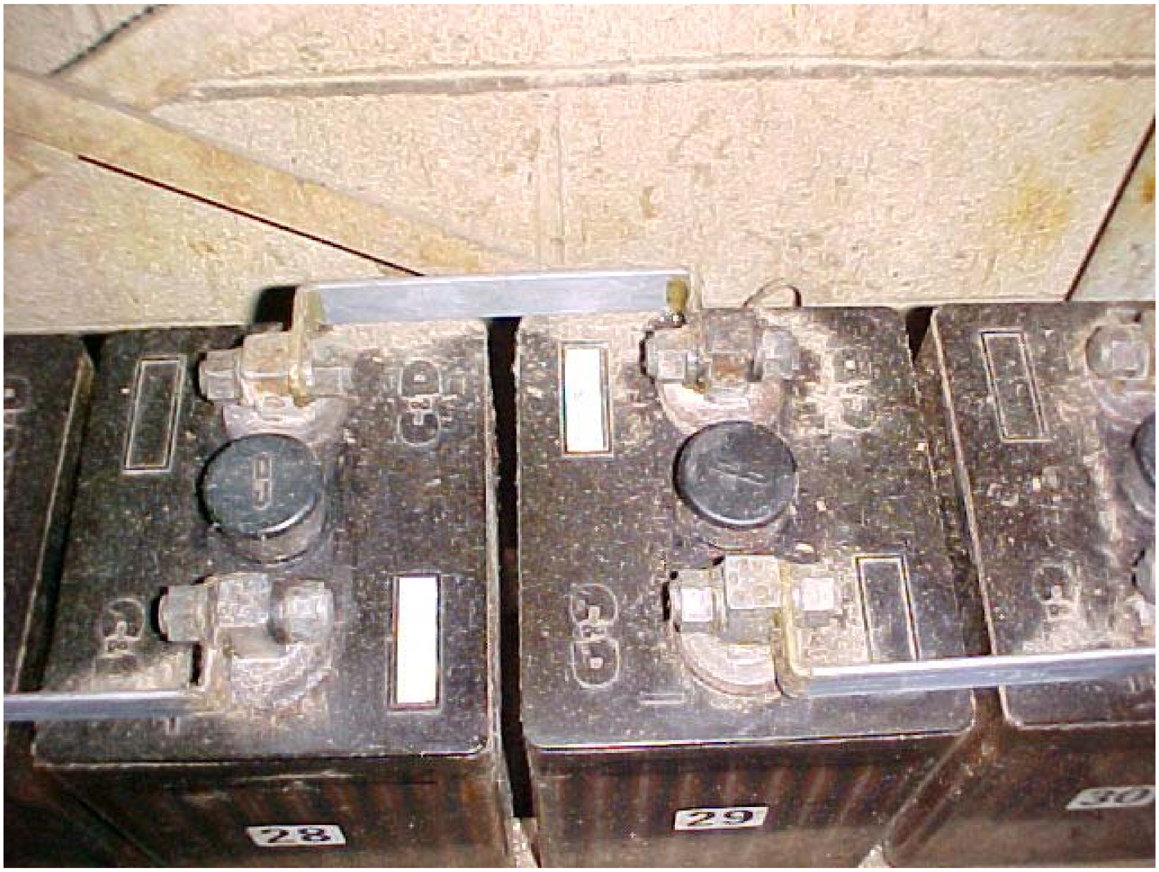


Figure 8 - Close-up of Battery Bank (2001)

Figure 9 – Battery Charger & DC Panel (2005)

Figure 10 – Battery Bank {Scheduled For Replacement} (2005)

10.0 Building Insulation – Asbestos

The building insulation contains asbestos fiber. Whereas this asbestos does not seem to be friable, it would be best to remove it, if only to allow personnel entering the building freedom from wearing respirators.

The building and piping asbestos insulation has been removed. The chamber of the liquid rheostat is asbestos lined and is still in service.
This site has been identified under Hydro's Asbestos Abatement Program and is scheduled to be inspected this summer. The results of the inspection will determine the course of action required by Hydro.

Figure 11 – Liquid Rheostat (2005)

Figure 12 – Liquid Rheostat Asbestos Warning Sign (2005)

D. DEVELOPMENTS SINCE THE 1998 ACRES REPORT

1.0 Transformer T2 Failure and Rewind

On February 20th, 2002 transformer T2 experienced an internal fault. The unit was removed, shipped to Burlington, rewound and reinstalled. The cost of these repairs was approximately $266,287. The total cost of the project for Hydro due to the failure of the transformer was approximately $467,000.

Transformer T2 was rewound such that it could be used on the 50 Hz side of the frequency converter (i.e.: it could replace transformer T1 if necessary). The Corner Brook mill has a spare transformer that could subsequently replace T2.

2.0 Transformer T1

During the replacement of transformer T2, it was decided to replace the oil in transformer T1 in order to extend the life of this unit and to reduce the risk of failure. At the time, the oil was in very poor condition (poorer condition than T2 which failed) and it was recognized that replacing the oil would provide a low cost extension of the life for the unit.

Replacement of the oil was a life extension plan, not a life renewal measure. Transformer T1 is nearing the end of its service life. The high acidity has quite possibly allowed the formation of sludge inside the unit. This would lead to reduced cooling of the windings. Furan levels indicate severe paper degradation. There is also a strong possibility that because of the overheating and insulation breakdown the coils may be loose. Loose coils may lead to mechanical failure particularly during startup.

Test results (dissolved gas analysis, transformer condition assessment and insulating fluid evaluation) for transformer T1 indicate that heating and arcing are present and that the condition of the paper insulation has been reduced.

It is recommended that transformer T1 be rewound (coils and new insulation) as soon as possible. Rebuilding this unit will ensure that the physical requirements (connections to the existing bus, etc.) are suitable for this particular application.

The cost of rewinding transformer T1 would be approximately $480,000.

The latest transformer oil test results for T1 and T2 are attached as an appendix.

3.0 Towers and Insulators

Operations are beginning to address the condition of the steel take-off towers and insulators this year. The take-off towers will be painted (cost estimate = $6400) and the 66 kV pin cap and suspension insulators will be replaced (cost estimate = $19,450).

The entrance bushings for the 500 mcm conductor to transformer T2 are damaged and should also be replaced (cost estimate = $12,200 for each of the twelve bushings). These bushings are not scheduled for replacement this year.
TRO Operations authored a report on the equipment on top of the frequency converter building. This report is attached as an appendix.

Figure 13 – Towers and External 66 kV Bus (2005)

4.0 Potential Relocation of the Grand Falls Frequency Converter to Corner Brook

In an April 2000 memo, TRO Engineering estimated that the cost to relocate the Grand Falls frequency converter to Corner Brook would be approximately $360,200. This estimate covered off-loading only and installation costs were not included. This estimate was accurate to within 25%.

A suitable location to store the Grand Falls unit in Corner Brook would have to be determined.

A copy of the memo is attached as an appendix.

5.0 Additional Issues

In addition to the items identified in previous sections of this report, various other components and systems throughout the facility require repair and improvements. TRO Engineering has prioritized these additional issues and categorized them as either "Top Priority", "Secondary Priority", or "Further Investigation / Information Required".

5.1 Top Priority

- No deluge system exists for the transformer vaults. The fire protection doors are kept open during the summer to prevent overheating of the facility. An alternate method of providing intake air should be provided as part of the ventilation system upgrade. Subsequently, the transformer area's outside wall and filter could be removed which would permit normal cooling of the transformers. The exisiting fire doors could be removed and replaced by concrete block. The fire rating of the remaining walls of the transformer vaults would be verified. It is estimated these modifications would cost $6,000. These modifications should not proceed until the ventilation system improvements are completed.
- The voltage regulator's design is obsolete and has been the source of maintenance difficulties over the years. Maintaining this system on a long-term basis may be problematic. Installation of a new voltage regulation system, which can be maintained over the long term, should be done within the next couple of years. It is estimated that replacement of the voltage regulation system would cost roughly $200,000. A detailed estimate should be generated and the work would proceed, if justified.
- The design of the speed control for the starting motor includes a liquid rheostat, which is a rudimentary and outdated method of varying the resistance of the rotor circuit. Maintaining this system on a long-term basis may be problematic. Installation of a new speed control system (suitable for automatic startup and synchronizing), which can be maintained over the long term, should be done within the next couple of years. It is estimated that a variable speed drive to replace the liquid rheostat would cost roughly $200,000. A detailed estimate should be generated and the work would proceed, if justified.
- The bearing on the starting motor has an oil leak. This should be investigated and replaced if necessary.
- The emergency exit door from the upstairs switchgear area was damaged during a fire and should be repaired.
- The main lube oil pump is nearing the end of its service life. The cost of replacing this pump is estimated to be $7,000. This work should be budgeted and completed within the next couple of years.
- Due to the age of the unit, operating problems with components (like the auto-synchronizer), and the retirement of key Operations personnel, the operating instructions should be reviewed and updated.

Figure 14– Emergency Exit from Switchgear Floor (2005)

Figure 15– Main Lube Oil Pump (2005)

Figure 16 – Frequency Converter Switchgear (2005)

Figure 17 – Frequency Converter Switchgear (2005)

Figure 18 – Frequency Converter Switchgear (2005)

Figure 19 – Frequency Converter Switchgear (2005)

Figure 20 – Frequency Converter Switchgear (2005)

5.2 Secondary Priority

- A listing of usable spare parts from the Grand Falls frequency converter should be created. Spare part requirements for the Corner Brook unit should be identified and compared to spare parts available. Any deficiencies should be addressed.
- The main door to the converter area is in poor condition and should be replaced (budget estimate is $5,000). The four personnel doors are in poor condition and should also be replaced (budget estimate is $4,000). The existing fireproof transformer doors require upgrading (budget estimate is $2,000).
- It is estimated that the cost of installing washroom facilities would be $10,000. This work should proceed, if justified.
- It is estimated that the cost of installing permanent electrical backup heating would be $30,000. This work should proceed, if justified.
- The existing battery charger is nearing the end of its service life. The cost of replacing this unit is approximately $10,000. This work should proceed, if justified.
- Annunciation and remote annunciation requirements should be reviewed.
- Voice communications are difficult throughout the facility due to the noise levels.

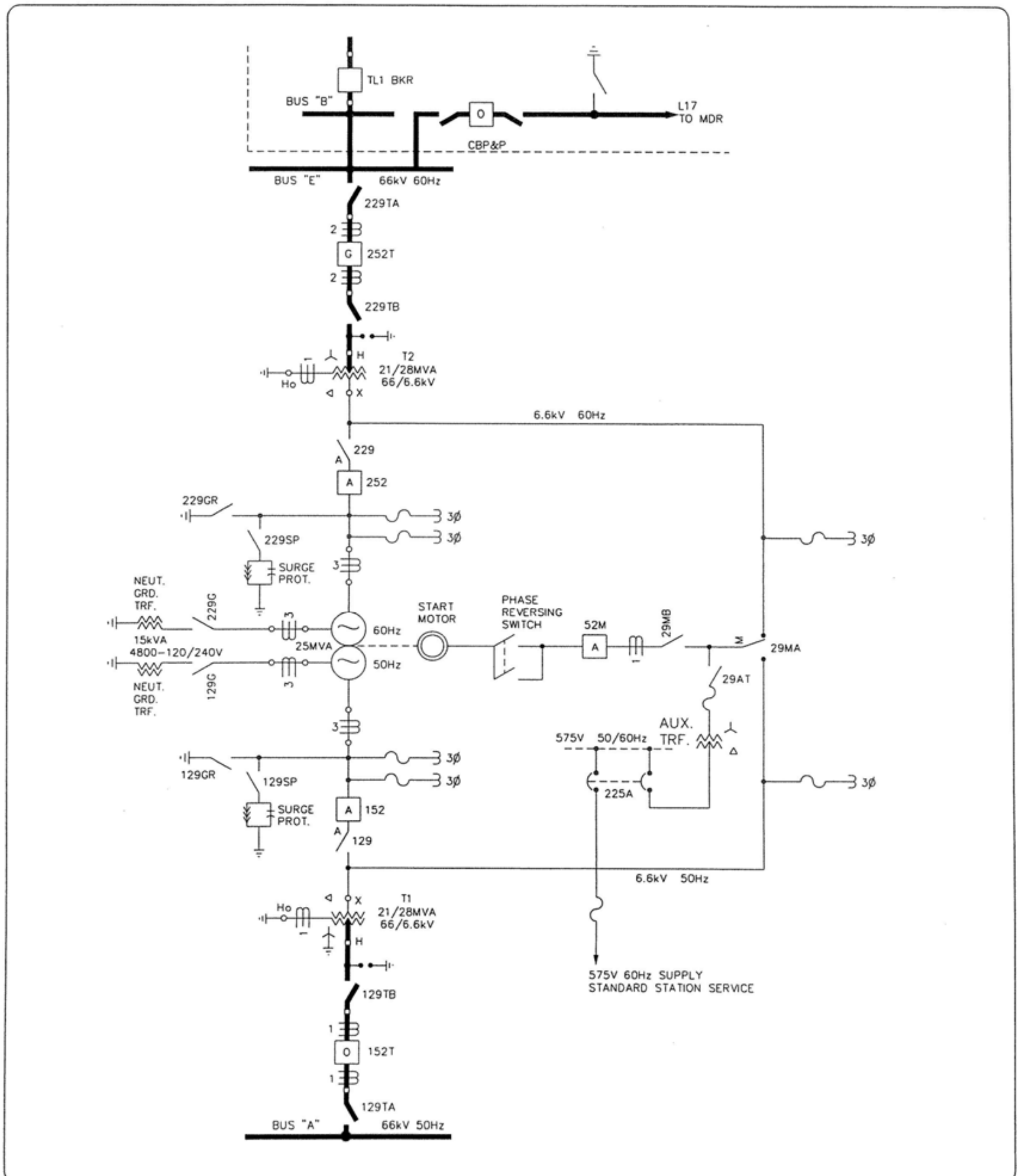
Figure 21 – Main Door To Converter Area (2005)

5.3 Further Investigation / Information Required

- The existing control system is for the most part manual. The auto-synchronizer is out of service, is not repairable, and should be replaced. It is estimated that modernization of the entire control system would cost roughly $600,000. This estimate is based upon replacement of most of the protection and control equipment, including the regulators, synchronizer, and additional monitoring equipment for load, winding temperatures, etc. There are options available, dependant upon various factors, especially the expected life cycle of the converter. The estimate of $600,000 is based upon the installation of a reasonable and modern protection and control system, which would be acceptable for the next 20 years or so. If necessary, cost estimates for different alternatives can be explored.
- Modernization of the control system such that automatic (and possibly remote) startup and shutdown of the converter by Deer Lake Power or Corner Brook Pulp and Paper would permit the customer to operate the unit as required and contact Hydro only if a problem occurs. Cost estimates should be generated (this work would likely include modernization of some or all of the control system) and the work would proceed, if justified.
- The condition of the air operated disconnect switches should be reviewed. Overhauls of the operating mechanisms may be required due to recurring air leaks.
- Isolation of breakers 129, 229 and 29 MB is not adequate. The supply and drain valves for 229 are located inside the door of 252. In order to make 229 a guaranteed device the individual performing the switching is exposed to 6.9 kV and the pneumatic controls inside the breaker switchgear enclosure. Work procedures are in place to address these inadequacies. This situation should be reviewed and an estimate to modify the air control system created.
- The condition of breaker 152T (a 69 kV OCB which is about 39 years old) should be reviewed.
- The operating solenoid of disconnect 129SP is not operational. An estimate for repair should be completed.
- Disconnects 129SP and 229SP contain PCB filled capacitors.

E. APPENDICES

1.0 System Operating Diagram - Corner Brook Frequency Converter



DRAWN BY TT	NEWFOUNDLAND AND LABRADOR HYDRO	DWG NO
APPROVED BY WR	SYSTEM OPERATING DIAGRAM CORNER BROOK FREQUENCY CONVERTER	REV NO 4
DATE 02-09-23		

2.0 Transformer Oil Test Results

Dissolved Gas Analysis

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ANALYTICAL SERVICES INCORPORATED

David Hicks
Newfoundland Labrador Hydro

P.O. Box 12400
St John's, NF A1B 4K7
P.O. Number: 52675-000 OP

Equipment Type :	Transformer	Equip Desc. :	CBF-T1
Location :	CB CONVERTER	Manufacturer :	Moloney
Mfg. Date:	01/01/1966	Serial Number :	230815
MVA :	66000	Equipment ID :	230815
Fluid type :	Mineral Oil	kV:	66
Breathing :		Fluid Volume :	1880
Analysis Date:	5/19/04	Cooling :	
Report Print Date:	5/20/2004	Report Number:	5005911

	Sample Date :	04/20/2004	03/25/2003	02/28/2002
	Laboratory No. :	5005911	5003701	5001787
	Container No. :	TJC 099	TJC 354	TJC 569
	Sample Point :	BOT MAIN		
	Sampled By :	Rex Cook		
	Temperature :	60	4	10
H2	Hydrogen (ppm) :	24	33	29
CH4	Methane (ppm) :	9	12	161
C2H6	Ethane (ppm) :	7	7	126
C2H4	Ethylene (ppm) :	11	4	64
C2H2	Acetylene (ppm) :	0	0	2
CO	Carbon monoxide (ppm) :	940	801	1849
CO2	Carbon dioxide (ppm) :	11418	7521	11117
N2	Nitrogen (ppm) :	78249	95687	99886
[illegible]	Oxygen (ppm) :	17906	23921	5546
	Total (ppm) :	108563	127984	118780
	TDCG (ppm) :	991	856	2230
	TDCG Rate (ppm/day) :	0.3	-3.5	0.0
	CH4 / H2 :	0.37	0.36	5.60
	C2H2 / C2H4 :	0.00	0.00	0.03
	C2H2 / CH4 :	0.00	0.00	0.01
	C2H6 / C2H2 :	9999.99	9999.99	70.69
	C2H4 / C2H6 :	1.64	0.54	0.50
	CO2 / CO :	12.15	9.39	6.01
	C2H2 / H2 :	0.00	0.00	0.07
	H2 / C2H6 :	3.43	4.71	0.23
	C2H4 / C2H2 :	9999.99	9999.99	32.00

Dissolved Gas Diagnostics

Key Gas Method : Possible Cellulose Decomposition,
Doernenburg Ratios : Not in table
Rodgers Ratios (3) : Not in table
Rodgers Ratios (4) : General Conductor Overheating
CO2 / CO :
IEEE Std. C57.104 -1991 Condition : 2
Sampling Interval : Quarterly
Operating Procedure : Exercise caution. Analyze for individual gases. Determine load dependence.

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Transformer T1 – Dissolved Gas Analysis

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INCORPORATED

Insulating Fluid Evaluation

David Hicks
Newfoundland Labrador Hydro

P.O. Box 12400
St John's, NF A1B 4K7
P.O. Number: 52675-000 OP

Equipment Type :	Transformer	Equip Desc. :	CBF-T1
Location :	CB CONVERTER	Manufacturer :	Moloney
Mfg. Date:	01/01/1966	Serial Number :	230815
MVA :	66000	Equipment ID :	230815
Fluid type :	Mineral Oil	kV :	66
Breathing :		Fluid Volume :	1880
Analysis Date :	5/19/04	Cooling :	
Report Print Date :	5/20/2004	Report Number:	5005911

	Sample Date :		04/20/2004	03/25/2003	02/28/2002
	Laboratory No. :		5005911	5003701	5001787
	Container No. :		TJC 099	TJC 354	TJC 569
	Sample Point :		BOT MAIN		
	Sampled By :		Rex Cook		
	Temperature :		60	4	10
D1533	Moisture/Water Content	(ppm) :	15	8	8
D971	Interfacial Tension	(dynes/cm) :	32.0	28.3	24.4
D974	Acid Number	(mg KOH/g) :	0.050	0.030	0.197
D1500	Color Number	:	2.5	<3.0	<7.5
D1524	Visual Examination	:	Clear & Bright	Clear & Bright	Clear & Bright
D877	Dielectric BV	(kV) :			
D1816	Dielectric BV	(kV) :	26@1mm	25	28
D924	Power Factor	(% at 25 C) :	0.122	0.088	0.758
D924	Power Factor	(% at 100 C) :			
D2668	Oxidation Inhibitor	(%) :			0.068
	Specific Gravity	:			
D88	Viscosity	(SUS) :			
D97	Pour Point	(C) :			
D92	Flash Point	(C) :			
D92	Fire Point	(C) :			
D1807	Refractive Index	:			
D1275	Corrrosive Sulfur	:			

Insulating Fluid Diagnostics

	New Oil	ASTM D3487	IEEE Group I	<69	>69<288	>345	IEEE Group II		IEEE Group III	
Moisture :	Acceptable	35 max	Acceptable	35 max	25 max	20 max				
Interfacial Tension :	Warning	40 min	Acceptable	24 min	26 min	30 min	Acceptable	24 min	Acceptable	16 min
Acid Number :	Warning	0.03 max	Acceptable	0.2 max	0.2 max	0.1 max	Acceptable	0.2 max	Acceptable	0.5 max
Color Number :	Warning	0.5 max								
Visual Examination :	Acceptable	clear & bright								
Dielectric BV D877 :		30 min		26 min	26 min	26 min				
Dielectric BV D1816 :	Warning	28 min	Acceptable	23 min	26 min	26 min				
Power Factor @ 25 C :	Warning	0.05 max								
Power Factor @ 100 C :		0.30 max								
Oxidation Inhibitor :		0.3 max								
Specific Gravity :		0.91 max								
Viscosity @ 40 C :		66 max								
Pour Point :		-40 max								
Flash Point :		145 min								
Fire Point :										
Refractive Index :										
Corrosive Sulfur :		noncorrosive								
Comments :										

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Transformer T1 – Insulating Fluid Evaluation

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ANALYTICAL SERVICES INCORPORATED

Transformer Condition Assessment TCA™

David Hicks
Newfoundland Labrador Hydro

P.O. Box 12400St.
St John's, NF A1B 4K7

Location :	Corner Brook
Bank & Phase :	Bottom- T1
Serial Number :	230816
Manufacturer :	Moloney
Date Mfgd :	07/01/1966
Size (kVA) :	28000
Rating kV:	66

Date :	03-08-2002
Report Number :	5001787
Fluid volume :	1880
Fluid type :	Mineral Oil
Preservation :	
Cooling :	
Core & coil wt. :	
Impedance :	

		Sample Date :	02/28/2002
		Laboratory No. :	5001787
		Container No. :	TJC 569
		Temperature :	10
H2	Hydrogen	(ppm) :	29
CH4	Methane	(ppm) :	161
C2H6	Ethane	(ppm) :	126
C2H4	Ethylene	(ppm) :	64
C2H2	Acetylene	(ppm) :	2
CO	Carbon monoxide	(ppm) :	1849
CO2	Carbon dioxide	(ppm) :	11117
N2	Nitrogen	(ppm) :	99886
O2	Oxygen	(ppm) :	5546
		Total (ppm) :	118780
		TDCG (ppm) :	2231
		SHL (%) :	11.10
		ETCG (% in blanket) :	1.37
Particles		5 to 15 um :	3626865
Particles		15 to 25 um :	681470
Particles		25 to 50 um :	246825
Particles		50 to 100 um :	4900
Particles		> 100 um :	100
D1533	Moisture	(ppm) :	8
D1816	Dielectric BV	(kV) :	28
D974	Acid Number	(mg KOH/g) :	0.197
D971	Interfacial Tension	(dynes/cm) :	24.4
D1500	Color Number	:	<7.5
D924	Power Factor	:	0.758
D2668	Oxidation Inhibitor	(%) :	0.068
5 HMF	5 hydroxymethyl-2-furaldehyde	(ppm) :	0.028
2 FAL	2 furaldehyde	(ppm) :	0.521
2 ACF	2 acetylfuran	(ppm) :	0.468
5 MEF	5 methyl-2-furaldehyde	(ppm) :	<0.010
2 FOL	2 furfurol	(ppm) :	<0.010
	Estimated DP	:	429-512

Following information will help us to evaluate in-depth TCA

1. Load Dependency
2. Previous DGA preferably with loading
3. System event
4. Maintenance Activity
5. Operational Activity

Transformer Condition Assessment Diagnostic Evaluation

TCA Assessment : Potential 3
Sampling Interval : Retest in three months. Establish trends and confirm condition.
Operating Procedure : *Consider treatment to remove oxidation products.*
Comments : Heating and arcing are indicated. Cellulose may be involved.
Field Comments : Fluid oxidation is advancing. Paper condition is reduced to approximately 53% tensile strength.

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Transformer T1 – Transformer Condition Analysis

TJ | H 2 b

Dissolved Gas Analysis

David Hicks
Newfoundland Labrador Hydro

P.O. Box 12400St.
St John's, NF A1B 4K7
P.O. Number: 37293-000 OP

Equipment Type :	Transformer	Equip Desc. :	T2
Location :	CBF	Manufacturer :	Moloney
Mfg. Date:	01/01/1966	Serial Number :	230814
MVA :	66000	Equipment ID :	230814
Fluid type :	Mineral Oil	kV:	66
Breathing :		Fluid Volume :	1600
Analysis Date:	8/13/2002	Cooling :	OA/FA/FOA
Report Print Date:	8/23/2002	Report Number:	5002808

	Sample Date :	08/07/2002
	Laboratory No. :	5002808
	Container No. :	TJC 827
	Sample Point :	Main TK
	Sampled By :	T K
	Temperature :	25
H2	Hydrogen (ppm) :	0
CH4	Methane (ppm) :	1
C2H6	Ethane (ppm) :	1
C2H4	Ethylene (ppm) :	1
C2H2	Acetylene (ppm) :	0
CO	Carbon monoxide (ppm) :	10
CO2	Carbon dioxide (ppm) :	231
N2	Nitrogen (ppm) :	38959
O2	Oxygen (ppm) :	14721
	Total (ppm) :	53924
	TDCG (ppm) :	13
	TDCG Rate (ppm/day) :	0.0
	CH4 / H2 :	9999.99
	C2H2 / C2H4 :	0.00
	C2H2 / CH4 :	0.00
	C2H6 / C2H2 :	9999.99
	C2H4 / C2H6 :	1.62
	CO2 / CO :	22.34
	C2H2 / H2 :	9999.99
	H2 / C2H6 :	0.00
	C2H4 / C2H2 :	9999.99

Dissolved Gas Diagnostics

Key Gas Method : All gases are within normal limits
Doernenburg Ratios : Not in table
Rodgers Ratios (3) : Not in table
Rodgers Ratios (4) : Not in table
CO2 / CO :
IEEE Std. C57.104 -1991 Condition : 1
Sampling Interval :
Operating Procedure : Transformer is operating satisfactorily

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Transformer T2 – Dissolved Gas Analysis

TJ | H 2 b

Insulating Fluid Evaluation

Equipment Type :	Transformer	Equip Desc. :	T2
Location :	CBF	Manufacturer :	Moloney
Mfg. Date:	01/01/1966	Serial Number :	230814
MVA :	66000	Equipment ID :	230814
Fluid type :	Mineral Oil	kV :	66
Breathing :		Fluid Volume :	1600
Analysis Date :	8/13/2002	Cooling :	OA/FA/FOA
Report Print Date :	8/23/2002	Report Number:	5002808

David Hicks
Newfoundland Labrador Hydro

P.O. Box 12400St.
St John's, NF A1B 4K7
P.O. Number: 37293-000 OP

Sample Date :	08/07/2002
Laboratory No. :	5002808
Container No. :	TJC 827
Sample Point :	Main TK
Sampled By :	T K
Temperature :	25

D1533	Moisture/Water Content	(ppm) :	6
D971	Interfacial Tension	(dynes/cm) :	29.3
D974	Acid Number	(mg KOH/g) :	0.019
D1500	Color Number	:	<1.5
D1524	Visual Examination	:	Clear w/ part.
D877	Dielectric BV	(kV) :	
D1816	Dielectric BV	(kV) :	19
D924	Power Factor	(% at 25 C) :	0.087
D924	Power Factor	(% at 100 C) :	
D2668	Oxidation Inhibitor	(%) :	0.139
D129	Specific Gravity	:	
D88	Viscosity	(SUS) :	
D97	Pour Point	(C) :	
D92	Flash Point	(C) :	
D92	Fire Point	(C) :	
D1807	Refractive Index	:	
D1275	Corrrosive Sulfur	:	

Insulating Fluid Diagnostics

		ASTM D3487	IEEE Group I	<69	>69<288	>345	IEEE Group II		IEEE Group III	
Moisture :	Acceptable	35 max	Acceptable	35 max	25 max	20 max				
Interfacial Tension :	Warning	40 min	Acceptable	24 min	26 min	30 min	Acceptable	24 min	Acceptable	16 min
Acid Number :	Acceptable	0.03 max	Acceptable	0.2 max	0.2 max	0.1 max	Acceptable	0.2 max	Acceptable	0.5 max
Color Number :	Acceptable	0.5 max								
Visual Examination :	Warning	clear & bright								
Dielectric BV D877 :		30 min		26 min	26 min	26 min				
Dielectric BV D1816 :	Warning	28 min	Warning	23 min	26 min	26 min				
Power Factor @ 25 C :	Warning	0.05 max								
Power Factor @ 100 C :		0.30 max								
Oxidation Inhibitor :	Acceptable	0.3 max								
Specific Gravity :		0.91 max								
Viscosity @ 40 C :		66 max								
Pour Point :		-40 max								
Flash Point :		145 min								
Fire Point :										
Refractive Index :										
Corrosive Sulfur :		noncorrosive								
Comments :										

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Transformer T2 – Insulating Fluid Evaluation

3.0 Memo – Relocation of Grand Falls Unit to Corner Brook

HYDRO

INTER-OFFICE MEMORANDUM

G.J.H.
00-04-10

TO:	G. J. Holden
FROM:	G. O'Keefe
DATE:	April 10, 2000
SUBJECT:	Grand Falls Frequency Converter – Relocation to Corner Brook

In response to your request, following is an estimate of the cost to relocate the GFFC & Control to Corner Brook. Costs at Corner Brook cover off-loading only, and no installation costs are included.

The Direct "order of magnitude" costs are cash flowed over a one-year period to give the total estimated cost. The summary of these costs presented in the same form as the budget proposal format is:

Construction/Service Contracts		$189,000
Materials Supply		$ 10,000
Construction/Internal		$ 10,000
Engineering		$ 15,000
Project Management		$ 29,000
Corporate Overheads		$ 27,800
Interest During Construction		$ 700
Contingency (25%)		$ 63,000
Escalation		$ 11,900
	Total	$ 360,200

These are "order of magnitude" estimates based on file information, photos, and telephone information from our field staff. There is no detailed breakdown of these estimates. If detailed estimates are required, then much more extensive engineering work (including field investigations) would be required. This would require 2-3 weeks to complete. This is not in our work plan now.

These estimates are accurate to within 25%. The information should be used for internal resource material, only. More detailed and extensive information would be prepared for outside distribution.

Glenn O'Keefe
Glenn O'Keefe
Supervising Electrical Engineer (Acting)

GOK/rh

A:\Memo G. Holden - Grand Falls Frequency Converter.doc

4.0 Corner Brook Frequency Converter Annual Operating Costs

Corner Brook Frequency Converter Work Order Direct Cost - 2000 to 2005						
	2004	**2003**	**2002**	**2001**	**2000**	**Annual 5 Yr Ave**
CBFTS	$29,800.00	$8,240.00	$79,388.00	$6,847.00	$14,374.00	$27,729.80
CBFCS	$36,455.00	$48,263.00	$61,430.00	$34,437.00	$100,173.00	$56,151.60
Total	$66,255.00	$56,503.00	$140,818.00	$41,284.00	$114,547.00	$83,881.40

5.0 Electric Utility Project Escalation Indexes

TABLE 1

ELECTRIC UTILITY PROJECT ESCALATION INDEXES

(1997 = 1.000)

	GDP Implicit Price Deflator [2]	Canadian CPI [2]	Newfoundland & Labrador CPI [2]	Hydraulic & Thermal Plant Construction [1]	Distribution & Transmission Construction [1]	Operating & Maintenance (O&M) [2]	
						Materials ~75% Labour ~25%	Materials ~50% Labour ~50%
1990	0.8885	0.867	0.861	0.858	0.847	0.904	0.919
1991	0.9147	0.915	0.915	0.871	0.835	0.924	0.933
1992	0.9267	0.929	0.924	0.891	0.840	0.933	0.939
1993	0.9401	0.946	0.940	0.908	0.865	0.943	0.946
1994	0.9508	0.948	0.951	0.935	0.911	0.951	0.951
1995	0.9720	0.968	0.965	0.961	0.972	0.967	0.962
1996	0.9880	0.984	0.980	0.980	0.982	0.985	0.982
1997	1.0000	1.000	1.000	1.000	1.000	1.000	1.000
1998	0.9960	1.009	1.002	1.022	1.041	1.002	1.007
1999	1.0130	1.027	1.017	1.038	1.061	1.020	1.027
2000	1.0540	1.055	1.047	1.063	1.086	1.056	1.059
2001	1.0650	1.082	1.058	1.084	1.094	1.078	1.091
2002	1.0750	1.106	1.084	1.105	1.109	1.097	1.120
2003	1.1120	1.137	1.116	1.143	1.147	1.140	1.168
2004	1.1265	1.158	1.134	1.160	1.167	1.164	1.203
2005	1.1490	1.183	1.156	1.185	1.192	1.189	1.230
2006	1.1697	1.206	1.178	1.208	1.217	1.212	1.255
2007	1.1896	1.230	1.199	1.230	1.241	1.234	1.281
2008	1.2098	1.255	1.221	1.253	1.265	1.257	1.306
2009	1.2303	1.280	1.248	1.277	1.293	1.282	1.335
2010	1.2513	1.306	1.275	1.302	1.320	1.307	1.364
2011	1.2725		1.303	1.328	1.349	1.332	1.394
2012	1.2942		1.332	1.354	1.378	1.358	1.425
2013	1.3162		1.362	1.380	1.408	1.385	1.457
2014	1.3385		1.391	1.407	1.438	1.412	1.488
2020	1.4942		1.580	1.589	1.639	1.594	1.701
2025	1.6416		1.747	1.759	1.826	1.765	1.897

Note: 1. 2003 is forecast.
2. 2004 is 1st forecast year.

Source: Statistics Canada
Conference Board of Canada
Gov't of Nfld & Labrador Dept. of Finance

Mar-04
C:\paustrea\ESCL\EUCPI\[EUCPI_Forecast for Spring 2004.xls]Table1
Economic Analysis Section, System Planning Dept.

[redacted]

6.0 M. Zaichkowsky Report – Towers / Insulators

Engineering Assessment of Steel Take-Off Towers and Miscellaneous Equipment on top of the Frequency Converter Building at Corner Brook Pulp and Paper Ltd.

1. TAKE – OFF TOWERS.

There are currently 2 steel towers on top of the Frequency Converter Building that support conductors between the Frequency Converter and No. 1 Substation. Each tower is approximately 25' high x 18' wide x 6' deep, and is fabricated from steel angle, plate, and tower bolts. All of these components are hot dip galvanized.

Take Off Towers and External 66 kv Bus associated with the Frequency Converter at Corner Brook Pulp and Paper.

Both towers are in good condition, including the bolted connections and leg anchors. Approximately 80 percent of the surface area of both towers is lightly corroded with some signs of mild pitting. Although maintenance of these steel towers is not urgent, it is recommended that a protective coating be applied to prevent any further deterioration of the structural steel. A two to three year delay in carrying out this maintenance would be acceptable.

Take Off Tower for T1, bolted connection, leg to horizontal brace, light corrosion.

Take Off Tower for T2, leg anchor, light corrosion and mild pitting.

As a protective coating, it is recommended that a good quality zinc or aluminium rich self priming paint be used. Surface preparation shall be in accordance with the SSPC-SP-2 standard (hand tool cleaning). Hydro currently stocks a high quality product that would be suitable for use on the towers. This product is Galvacon GC-243 cold galvanizing compound, however, it is quite expensive at $232.00 per gallon.

2. PROTECTIVE STRUCTURE – 66 KV BUS LEADING TO T2

Last year, in order to facilitate the removal of T2 from the Frequency Converter Building, part of the protective structure that prevents the incidental contact between the 66 kv Bus and Mill Personnel/Equipment was removed. For safety reasons it is recommended that this structure be reinstated to its original condition as soon as possible. See drawing No. 401-S-16-Rev. 2.

Protective Structure for T2 External 66 kv Bus, steel frame and wire mesh removed.

3. ENTRANCE INSULATORS FOR 500 MCM CONDUCTOR LEADING TO T2.

Both A and C phase entrance insulators for the 500 MCM Conductor leading to T2 have sustained considerable physical damage, resulting in reduced leakage distances and an increased probability of flashover. It is recommended that both A and C phase insulators be replaced as soon as a suitable substitute can be found. The existing insulators are vintage 1966, Canadian Porcelain, 69 kv, 350 BIL, catalogue No. 1216. Dave Hicks of TRO Engineering has been contacted for assistance in locating the replacement insulator.

Damaged A phase entrance insulator.

Damaged C phase entrance insulator.

4. PINCAP AND SUSPENSION INSULATORS.

The current 66 kv Bus arrangement on the frequency converter building is supported by C.O.B. pincap and suspension insulators. These types and make of insulators have been failing at an ever increasing rate in many of our terminal stations, distribution, and transmission lines. Therefore, it would be prudent to consider changing out these insulators within the next several years. The pincap insulators are vintage 1966, C.O.B., catalogue No. 37769 (double units), 36 units would require replacement. The suspension insulators are vintage 1966, C.O.B., ball and socket type, catalogue No. 32436. 12 strings of 5 units would require replacement. Hydro currently stocks suitable station post and suspension type insulators for this work.

C.O.B. pincap insulators, 66 kv Bus CBPPL frequency converter building.

Mike Zaichkowsky
09/10/03

7.0 Acres International – Condition Assessment of (Corner Brook) 50/60 Cycle Frequency Converter Final Report

Newfoundland and Labrador Hydro
P.O. Box 12400
Hydro Place, Columbus Drive
St. John's, Newfoundland A1B 4K7

Condition Assessment of 50/60 Cycle Frequency Converter Final Report

September 1998

P12869.00

Acres International Limited
St. John's Newfoundland

ACRES

October 6, 1998
P12869.00

Newfoundland and Labrador Hydro
P.O. Box 12400
Hydro Place, Columbus Drive
St John's, Newfoundland. A1B 4K7

Attention: Mr. David Hicks, P.Eng.

Dear Mr. Hicks: **Frequency Converter Condition Assessment**

We are pleased to forward four copies of our final report of the above project. This report, which reflects your review of our draft reports, presents the findings of our site inspections and recommendations for rehabilitation of the converter and associated facilities. Our estimate of the cost to refurbish the facility is approximately $2.6 million. Almost one-half of this cost is due to rewinds of the converter rotors, and the accuracy of the estimate is therefore strongly affected by the accuracy of this cost component. While we have made efforts to achieve an accuracy of 10 percent in our overall estimate, we believe that the influence of this component will more reasonably result in an accuracy of 15 percent overall since the associated cost is based on a supplier budget quote. It is likely that during the bidding process for this work, the tendered price will be less than this estimate.

We are pleased to have had the opportunity to carry out this work and would be available to assist you in implementation of the refurbishment if required.

Yours very truly,

R.J. Gill, P.Eng.
Vice President, Atlantic Region

RJG:sjc

Enclosure

cc R. Bustrean

ACRES INTERNATIONAL LIMITED
4th Floor, Beothuck Building, 20 Crosbie Place, St. John's, Newfoundland, Canada A1B 3Y8
Telephone 709-754-1710 Facsimile 709-754-2717

Vancouver, Calgary, Winnipeg, Niagara Falls, Toronto, Halifax, Sydney

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Executive Summary

Executive Summary

Acres International was retained by Newfoundland and Labrador Hydro (NLH) to carry out a condition assessment of NLH's 50/60 Hz frequency converter at Corner Brook Pulp and Paper Limited. A site inspection was carried out during the week of August 16 to 22, 1998, a review of available maintenance records and drawings was conducted, and discussions were held with other frequency converter users.

The main observations and recommendations arising from the work are:

- The entire facility is covered with dust and dirt and accumulated residue from the pulp mill operation. The ventilation system is faulty and the building shell has numerous cracks, which allow penetration of debris. The entire facility requires cleaning, particularly the converter itself. The ventilation system should also be brought up to current standards.

- The insulation resistance value of the rotor windings is very low, in the order of 300-kohms. These low values are indicative of a failure within the next few years, but the failure could occur at any time. The rotors should therefore be rewound. Because the existing windings are asbestos insulated, the rewind will cost more than normal.

- The oil spill containment and drainage around the main transformers and the transformer doors require improvement to contain any spill and to eliminate any fire hazard.

- The cooling system associated with the voltage regulator (starting motor) has a water leak that occurs only on shut down or startup. This is known to the maintenance forces and they routinely drain the accumulated water after a shut down or startup. The water level after a shut down or start up is, however, only slightly below the main incoming leads, which are bare. Although it is unlikely, the potential exists for a short to occur. The leak should be fixed or static voltage regulators, which have a relatively low cost and greater flexibility, should be installed.

- The pedestal bearing has been wiped and should be replaced.

- The building requires repair. Concrete and bricks have fallen from the roof and building sides and damaged the bushings and post insulators. Building cracks have allowed entrance of the wood debris associated with operation of the paper mill. The ceiling in the stairwell is temporarily repaired using a sheet of plywood. This should be permanently repaired.

- The neutral grounding transformers are oil insulated and should be replaced by dry type transformers.

- The lighting in the building, particularly the emergency lighting, should be upgraded.

- The batteries should be enclosed and measures taken to control and exhaust hydrogen gases.

- The building insulation contains asbestos fiber. Whereas this asbestos does not seem to be friable, it would be best to remove it, if only to allow personnel entering the building freedom from wearing respirators.

- A number of minor repair items, such as replacement of relay case covers, should be carried out.

The recommended sequence of execution of these recommendations is as follows:

1. Remove the building insulation asbestos.

2. Improve building lighting.

3. Repair the building, improve the drains and replace the insulators as required

4. Clean the converter facility thoroughly, particularly the converter itself.

5. Make necessary converter improvements, including rewinding the rotors, monitoring of the coupling and replacement of the bearings as necessary.

6. Make necessary improvements to the facility including the ventilation system, the compressed air system, the oil lubrication system, the fire control system and the oil spill containment system.

7. Make other repairs and improvements as necessary including those to the voltage regulator, the switchgear, and auxiliary transformer replacement.

It is believed that the work, if properly planned and expedited, should be completed within a two to three month period. The major item of work would be the rotor rewind, which would require the rotors be removed from site to a suitable workshop.

The estimated cost to carry out the full rehabilitation is $2.6 million, almost 50 percent of which is attributable to the rewind of the rotors. The level of accuracy of the estimate overall is ±15 percent.

Once refurbished, the facility should be maintained appropriately and a suitable level of spare parts should be kept in inventory.

Introduction

1 Introduction

In August, 1998, Newfoundland and Labrador Hydro (NLH) retained Acres International Limited to carry out a condition assessment of NLH's 50/60 cycle frequency converter located at Corner Brook Pulp and Paper.

The work included a review of the maintenance records at NLH's Stephenville office in addition to the inspection of the converter facility at Corner Brook. This report presents the findings of the assessment and costs to upgrade the facility.

Methodology

2 Methodology

2.1 Data Acquisition

Prior to any machine inspections or other work, maintenance records, relevant drawings and other data believed pertinent was obtained from NLH offices in St. John's and Stephenville. The latter office is responsible for maintenance of the Corner Brook converter. This data was examined before the machine inspection and testing took place.

In addition to obtaining data and drawings showing the machine and structural and mechanical systems, discussions were held with owners of other rotating converters regarding their experience with their converters. Further discussions were held with suppliers of thyristor static converters and with service companies to determine costs of repair and rehabilitation.

2.2 Machine Inspection and Observations

The machine was shut down for the period of August 18 to August 21, 1998. During that period, the condition of the machine stators and rotors was assessed to the extent possible without removal of the rotors. The electrical machine inspection consisted of visually examining the windings and the ties to ensure the windings and insulation were in adequate condition. In addition, the windings were meggared to determine their insulation resistance to ground. The machine bearings and condition of the bearing oil were inspected.

In addition to the above the condition of the switchgear, the relays and meters and the AC and DC auxiliary systems were inspected and noted. The air filtration systems were observed along with the environmental control systems, such as transformer oil spill containment and asbestos in the building ceilings.

The structural condition of the building was also assessed. The findings in each case are recorded in Section 3 of this report.

2.3 Analysis

After the machine inspection, the readings obtained and the observations made were compiled and analyzed. Where necessary, prices were obtained from outside parties for possible rehabilitative services. These budgetary prices, and estimated costs obtained through Acres own internal sources, were added together to provide estimates for the necessary rehabilitation of various options for repair or rehabilitation of the machine, the building in which it housed and any of the ancillary mechanical systems.

In addition to the above, the samples of residue obtained from the machine during the inspection were sent out for laboratory analysis. The results are discussed in Section 4 of this report.

Also in this section, the typical life spans of equipment similar to that at the frequency converter facility at Corner Brook are presented on the basis of statistical data compiled on equipment that undergoes normal operation and maintenance procedures.

2.4 Operations and Maintenance

Discussions were held with two owner operators of rotating frequency converter. The information obtained is discussed in Section 5.

2.5 Conclusions

Section 6 makes a recommendation for the manner in which NLH should proceed if it wishes to rehabilitate the facility in order to continue to operate the facility for a further 10 years at a minimum.

Observations

3 Observations

3.1 Summary of Review of Maintenance Records

3.1.1 Brown Boveri Metalclad Circuit Breakers

Maintenance records show that these breakers and the metalclad switchgear have not caused any problems; however, this gear is old and planning for replacement should be periodically reviewed to ensure replacement is planned on a timely basis.

The values obtained in the tests performed on the breakers, ductor tests, and anecdotal evidence of interruption severity were reviewed. Apparently nothing untoward has happened to the gear as far as can be obtained from questioning the maintenance staff or reviewing the records. However, the records are scanty, particularly for the early years of use, and none of the present maintenance staff remembers all the incidents that happened with the gear.

3.1.2 Exciter and Pilot Exciter

No specific maintenance problems have been observed with this equipment. The equipment is, however, old and planning for replacement should be started.

3.1.3 Starting Motor

There appear to be no specific references to the starting motor in the maintenance records.

3.1.4 Voltage Regulator

A number of problems have occurred and continue to occur with the voltage regulator. Specifically, the major problems noted in review of the maintenance records are listed below.

- A June 2, 1981 memo describes a fault that occurred and includes a Brown Boveri recommendation that a major overhaul be performed every five years.

- There are numerous references to oil and water leaks and the resultant repairs. It is estimated that two barrels of water are discharged during each startup and shutdown due to a leak in the water coolers.
- There seems to be no record of periodic maintenance in any recognizable program format.

3.1.5 Transformers

- T1 maintenance records show routine maintenance and no sign of problems.
- T2 records show an incident in 1990 with gas buildup and loose connections found during the resultant trip. No other significant problems were observed. Routine maintenance is performed.

3.1.6 Batteries

Batteries appear to be serviced regularly and records show charge in excess of two volts. The current set of batteries was installed in 1981, replacing the original set, for which records still exist. No problems have been noted with the batteries. It is noted, however, the recommended yearly deep discharge does not appear to have been performed at any time.

3.1.7 50/60 Hz Converter

Numerous maintenance records detail problems that have occurred with various parts of the converter. In particular, problems have been observed with the following components.

- High temperatures and oil problems with bearings
- Uneven wear and pitting of slip rings
- Failure of louvers to operate
- Shorts, flashovers and high incidence of brush failures
- Low rotor field winding insulation strength

The stator winding insulation strength does not seem to have deteriorated significantly over time as is the case with the field winding insulation strength.

A number of major cleaning exercises have occurred. Montreal Armature cleaned the converter in 1975, Westinghouse did the same in 1984 and a third cleaning was handled by NLH staff in 1989. In all cases failure to correct the root cause of the contamination meant the dirt continued to accumulate after the cleaning was completed and thus required repetition of the cleaning. It is probable, however that, without the cleaning the machine would not now be operating.

The maintenance records highlight the poor environment in which the machine operates and the particle deposits that exist on all the equipment.

3.2 Electrical Observations During Inspection Shutdown

3.2.1 Emergency Lighting

Ground Floor

1. No emergency lighting exists in the transformer vaults or the voltage regulator vault.

2. In the converter area, three unprotected light bulbs are attached to the cable tray on the left side; none were found on the right side (as viewed from the pilot exciter).

3. None were observed elsewhere.

Stairway and Stair Landings

Emergency lighting appeared to need augmentation by being better oriented and also by having an additional light at the bottom of the stairway.

Switchgear Floor

1. Two lights were observed in each of the front and back of the duplex panels.
2. Two lights were observed in the duplex panel corridor.
3. No other emergency lights were observed anywhere else on the second floor.

3.2.2 Main Lighting

Ground Floor

Lighting levels were not measured but were found to be inadequate for most tasks; for inspection of the converter a flashlight had to be used.

Stairway and Landings

Lighting appeared adequate.

Switchgear Floor

Lighting levels were not measured but appeared somewhat low, probably because some bulbs needed replacement.

3.2.3 Transformer Vaults

1. No deluge system exists for the transformers; none was required at the time of the installation, unlike current requirements.

2. Drains in both vaults are blocked. This was apparently done to stop water from backing up into the vault area from outside.

3. Fire protection doors do not close easily and seem not to be a fabricated fit. No system was found to automatically close the doors in case of a fire. This is a potential hazard, and would not be acceptable under current design practice.

4. The air intake seems inadequate, and the intake filters are partially clogged and need cleaning. The air intake filters are adjacent to a dirt road which provides plant access.

5. The vault area needs to be cleaned of dust and dirt.

6. The air intake for converter cooling is drawn past the transformers and, now heated, into the converter area. No separate air supply system for the converter is available.

3.2.4 Voltage Regulator

1. Panel and equipment appear to be in reasonable operating order, but the equipment design is antiquated.

2. The regulation equipment is water cooled. A leak exists in the equipment on startup and shut down. During the inspection, a water pool was found in the center of the unit at a point just below the main three phase lead connections (bare). A flashover would almost certainly have occurred if the equipment had been started before the water was drained.

3. Water, probably from the above leak, also appeared in the cable ducts from the units to the right hand wall.

3.2.5 Bus Duct

60 Hz Side

1. The micarta bus insulation (sleeving) is cracked on the vertical sections and also on the horizontal section under the switchgear room floor.

2. A mild steel nut is installed on the left hand connection; an extra long bolt is installed on the right hand connection.

3. Minor conductor bird caging was observed off the center phase flexible connection, probably due to bus and converter loads being at different heights and different centers.

4. Flexible connectors do not exhibit evidence of fraying or separation.

5. Supports and bracing appear adequate.

50 Hz Side

Micarta insulation shows evidence of cracking similar to the 60 Hz insulation. All other findings on the 50 Hz portion of the bus duct are the same as for the 60 Hz portion except for the nut and bolt problem.

3.2.6 Pilot Exciter

1. No visible damage or defect is apparent.

2. Wear on the commutator and brushes appears even.

3. No visible access was available to the stator or rotors for all motors and exciters, except what could be seen with the brushgear covers removed. The condition of most of the windings could not be directly observed.

4. The machine is covered in dust and dirt.

3.2.7 60 Hz Exciter

No visible damage or defect was observed nor is there any problem apparent with the brushes or commutator. Again the exciter could not be directly observed for the most part. It also is dust and dirt encrusted.

3.2.8 60 Hz Motor

1. All leads are dirt encrusted. Insulation however does not show signs of distress, fraying or other problems.

2. There was indication of burning and flashover between the center and right phase, when looking directly at the brush rings. The right hand connection is incorrectly located on the inside position between phases.

3. Bolts should be shorter.

4. Machine is covered in dust and dirt.

5. The machine windings could not be properly inspected due to the lack of access.

3.2.9 50 Hz Exciter

1. No visible signs of damage or problems; however, the lack of access to the windings is the same as for the other machines.

2. The machine and leads are covered with dust and dirt and require a good cleaning.

3.2.10 50 Hz Motor

There are no obvious sign of problems, except for the dust and dirt covering motor and leads, similar to the condition of the 60 Hz motor.

3.2.11 60 Hz Converter

1. Insulation on the leads appears satisfactory as does the bracing.

2. Inter-turn coil connections are free of fretting and fraying and are without visible damage.

3. Stator wedges, as far as they could be observed, are tight

4. Laminations show signs of top varnish becoming worn and embrittled. Signs of varnish peeling exist.

5. The machine in general and the rotor poles are heavily covered with dust and dirt, baked on.

6. Collector bar insulation to pole connection leads is bared and becoming embrittled as well.

7. A white deposit on three pole bases exists at the base plate to winding corner, opposite the drive end. Samples were taken and chemically analyzed and found to be composed of cellulose and water.

8. Despite a lack of access because the rotor could not be removed during the limited inspection period available, the stator and poles showed no signs of distress, other than dirt encrustation. No visible indication, nor odor, of burning existed. The machine, except for the dirt encrustation, appeared sound.

The following test values were obtained when the 60 Hz machine stator insulation was meggared using a 5000-V meggar.

Phase	1 Minute	10 Minutes
Phase A	350 Mohms	425 Mohms
Phase B	350 Mohms	415 Mohms
Phase C	320 Mohms	370 Mohms

The above values compare well with the maintenance records and are within the acceptable range.

The rotor was also meggared from the slip rings and the value obtained was 300 Kohms. This value is not satisfactory and is suggestive of a failure within a few years.

Photo number 1 illustrates the dirt on the machine windings and rotor. This photo is typical of the state of the machine and surroundings.

3.2.12 50 Hz Converter

1. All of the observations made concerning the 60 Hz machine hold true for the 50 Hz machine.

2. The poles of this machine are even more heavily encrusted with dirt than the 60 Hz machine.

3. The pole connections exhibit cracked and embrittled insulation.

4. One anomaly stood out on the left hand side when viewed from the 60 Hz machine. At the 8:00 o'clock position, two laminations are connected by a substance, which runs over the winding wedges and which has the appearance and consistency of a metal. It could not be chipped with a fingernail. It appears to be a tear drop or melt but no incidence of high temperature or burning is exhibited on the machine.

The following test values were obtained when the 50 Hz stator insulation was meggared.

Phase	1 Minute	10 Minutes
Phase A	650 Mohms	1475 Mohms
Phase B	880 Mohms	1475 Mohms
Phase C	900 Mohms	1900 Mohms

The above values again compare well with the maintenance records and are within the acceptable range for such a machine.

The 50 Hz machine rotor was meggared at the slip rings and the value found was 200 Kohms. Again this value is indicative of a failure within a few years.

3.2.13 Neutral Cabinet Current Transformers

1. The neutral lead at the top of the panel on the 60 Hz cabinet has been cut approximately from the connecting clamp and the insulation removed. This should be rectified.

2. On the 50 Hz cabinet the neutral lead exhibits evidence of burning for a distance of 4 cm from the connecting clamp. It is apparent that at some time in the past, excessive current was passed through this wire for a prolonged period. This is possibly due to a wiring error that caused neutral current from more than one circuit to pass through the wire; alternatively a wrong ratio setting may have been used on one or more relays. In any case the reason for this anomaly should be researched and the problem rectified if necessary.

3.2.14 Bearing Pump Disconnect Switch Boxes, Bearings 1, 2, 3 and 4

Each box shows evidence of oil tracking across the mechanical protective sheath of the cable, entering at the top of the panel, running down wire and staining the panel bottom. The wire insulation is not of a type subject to petroleum deterioration. Deterioration is visible at No. 4 and to a lesser degree at No. 2 and No. 3. All the cabinets require cleaning. The oil in these panels should be removed and care should be taken to ensure oil is not reintroduced into the panel by tracking down the source of the oil contamination and correcting the problem.

3.2.15 Neutral Grounding Panels

1. Both cabinets require cleaning as they are covered inside and out with dust and dirt.

2. The transformers are oil filled and may contain PCBs. The units do not have nameplates, thus the insulant composition is not known. Present day practice is to use dry type transformers indoors. It is understood NLH plan to sample the oil in the transformers.

3.2.16 Switchgear

60 Hz and 50 Hz Regulator Panels
Oil is leaking from the top cover. The technician responsible for the converter unit advised that the panel operates suitably. The source of the oil leaks should be traced and repaired. Such leaks are minor and cost little to repair.

Auxiliary Panel
The load break switch exhibits no visible evidence of burning or arcing on either the fixed or moving portions. The insulation on top of the transformer requires replacement. Air ducts appear to be free of obstruction.

50/60 Hz Phase Reversing Switch
No pitting, burn marks or arc marks are apparent.

60 Hz Frequency Converter, Breaker No. 252
The auxiliary relay in the upper front of the cell requires a new cover; glass is missing from the cover fittings. The NLH maintenance crew did not have the applicable instruction book and neither this breaker nor the 50 Hz breaker (No. 252) was withdrawn for inspection.

50 Hz Frequency Converter, Breaker No. 152
No defects were visible.

Converter Ground Switch
The left-hand phase, when viewed from the front of the panel, shows signs of arcing. Insulator is broken and requires replacement. The moving portion of the switch shows damage due to arcing. Similarly, the center phase shows signs of burning at the incoming bus joint. The right hand phase shows slight damage, with a burn mark at the fixed contact.

Photo number 3 illustrates the arcing and burning found in this cubicle.

Auxiliary Transformer Primary Fused Load Break Switch
The upper chamber, containing the load break switch, shows heavy dirt and dust deposits on the insulators and fuse holders.

60 Hz Load Break Switch
The pivot point of the load break switch shows minor burn marks. Insulators of phases 1 and 3 have a stain, possibly oil, on the upper segments. A short bolt is installed on the main bus riser joint of phase 3.

50/60 Hz Starting Motor Breaker
The auxiliary relay cover requires replacement, as the existing cover glass is missing.

50 Hz Auxiliary Standby Supply
The 3 phase molded case circuit breaker requires replacement. Only two poles of the breaker will positively close when the handle is operated. The third pole will eventually close when the handle is fiddled sufficiently.

General Switchgear Comments
The panels all require cleaning to remove dirt and dust. None of the relays checked showed signs of pitting or burning. All the relays, meters and controls are of the old electro-mechanical type that is two generations older than the current standard. There are burn marks on and in some of the panels, and some relay covers are broken and not replaced. The relay's condition can deteriorate and eventually fail under such circumstances.

3.2.17 Battery and Battery Charger

1. The battery charger panel requires cleaning.

2. The terminals at cells 57 and 58 are staring to corrode.

3. The stand appears to be sound.

4. The batteries are about 17 years old. Normally batteries are replaced at between 20 to 25 years of age. Scheduling for battery replacement should be considered at this time.

3.2.18 High Voltage Bus from Transformers to Mill Switchyard

1. Phases 1 and 3 60 Hz exit bushings are damaged and require replacement.

2. Similarly, the 50 Hz exit center and right phase bushings are damaged and require replacement. According to the NLH personnel on site, the damage was caused by concrete falling from the converter building side and roof.

3. Support structures at the wall exit have minor corrosion, but the structure at the roof lines appear to be heavily corroded.

4. The standoff insulators appear in suitable condition, without chipping or damage.

5. Phase 3 of the 50 and 60 Hz wall bushing entries into the mill building are damaged and require replacement.

6. Phase 2 of the same group of wall entry bushings has been repaired and probably should be replaced.

Photo number 3 illustrates the damaged bushings outside the converter building.

3.3 Mechanical Observations

3.3.1 Bearings

1. The machine has five journal type bearings which are numbered on the exterior of the housings. All bearings are split babbitt type with oil lubrication. Bearings 1 to 4 are the main bearings and are connected to a recirculating oil filtering and cooling system. Bearing 5 is a pedestal bearing located between the exciter and the induction motor uses a self contained oil bath for lubrication.

2. The housings for bearing 2, 4 and 5 were removed and the top half of the bearings lifted to expose the shaft and top half bearing surface.

3. The bearings and shaft for both main bearings were found to be in excellent condition. There were no significant score marks on the bearing surface or the shaft, the oil color was good and there was no evidence of sludge or dirt of any kind around the bearing, shaft or housing.

4. Bearing 5 was found to be in poor condition. The top half of the bearing was scored, the oil was black and sludge had built up around the housing. The

shaft was jacked and the bottom half of the bearing removed. The bottom half was found to be in worse condition than the top. The bearing was partially wiped with sludge deposits caked to the surface.

5. Measurements of the shaft journal surface were taken with a micrometer by CBPP personnel and recorded as 4.995 (+ 0.004 on induction motor side).

6. The metal labyrinth seal was worn and leaking. Measurements were taken of the seal diameter and recorded as 6.250 + 0.008 at 0° and + 0.032 at 90°.

7. There was a very small amount of scoring on the shaft journal surface.

8. The bearings are monitored for alarm conditions only.

Photo number 4 shows the scoring that has occurred on the failed bearing number 5.

3.3.2 Flexible Shaft Couplings

1. The main shaft couplings are Dodge Para Flex PX200.

2. There are side wall cracks both circumferential and radial on both sides of the two couplings.

3.3.3 Oil Lubrication System

1. The existing oil lubrication system is located in a concrete sump adjacent to the converter. The oil is contained in a single rectangular steel reservoir which supports the pumps, heat exchanger and piping. A small turbine pump is located in the concrete sump which is connected to the drainage system.

2. Only a visual inspection of the components was performed. There is evidence of corrosion on the cold water supply to the heat exchanger. The top of the oil reservoir is damp with oil. The floor of the sump was damp with water. The pressure switch on the cold water line did not appear to be working

3. There are two pumps, one driven with an AC motor and the other driven with a DC motor. A temporary AC driven pump is currently installed awaiting replacement.

3.3.4 Fire Protection System

1. The existing fire protection system is connected to a 6 inch fire main inside CBPP. There is not a separate fire department connection at the converter building.

2. The system in the converter building is connected to two manual shut off valves. The valve handles are located in the unheated stair well and the pipes and valve bodies which are located on the opposite side of the wall are heat traced but are not insulated.

3. There is a single fire hose reel and the hose is in poor condition.

4. The converter is connected to the fire water lines but the transformer rooms are not sprinklered.

5. There is a separate nitrogen extinguisher system on a wheeled cart.

3.3.5 Compressed Air System

1. The existing compressed air system is located in an open room adjacent to the fire protection valves. The system consists of two compressors, one after cooler, one air receiver, a control panel and associated piping.

2. The existing piping system does not meet current standards for pressure piping systems.

3. All the major equipment is original except one of the compressors. The maintenance personnel were pleased with the equipments operation and stated it worked better than some of the newer systems that have been purchased recently.

4. The air receiver does not have an automatic water release valve or inspection opening.

3.3.6 Ventilation System

1. The cooling and general ventilation air is delivered to the converter building from the adjacent CBPP building via ductwork. The air is exhausted from the

building using a forced air fan mounted inside a duct located above the main entrance. Large screened openings are located in the walls behind each transformer.

2. As the building is under negative pressure, there is a buildup of dust and dirt inside the converter building and a large build up of dirt and wood fiber collecting around cracks in the exterior walls, especially in the adjoining Wood Room.

3. The intake air screens in the transformer areas are clogged with debris.

3.3.7 Roof and Floor Drains

1. Roof drain down pipes are located in the two transformer areas. The piping near transformer T1 is the original malleable iron.

2. In the converter area there are two floor drains.

3. The drainage system is blocked causing water to back up and flood the floor under the transformers and converter. When flooding occurs, water travels across the floor and enters the concrete sump where the lubrication oil reservoir is located.

4. Freezing of the roof drains has caused the failure of the down pipes near transformer T1.

5. The piping for transformer T2 was replaced with plastic. The drain lines from both the roof drains and the voltage regulators are connected to drainage piping located under the concrete floor.

3.4 Structural Observations

1. The building housing the converter is part of the paper mill buildings and was renovated in 1966 for that purpose. Two of the walls adjoin the paper mill, one of which is the Woodroom, and the other two are exterior walls. There is an interior metal staircase connecting the converter level with the upper floor where the switchgear is located.

2. The masonry walls are cracked in numerous locations which allow debris to enter the building. These cracks appear old and probably occurred when the building originally settled. The steel structure is in good condition except the column in the stairwell. This column is corroding because of the damp atmosphere and failure of the steel surface treatment. There is also spalling of the concrete in this area due to corrosion of the rebar.

3. In addition to the structural steel and concrete problems, in the stairwell, the metal stair is in poor condition. Some of the welds connecting the stair pans were repaired and many more are corroded and failing.

4. The exterior walls are weathered and have small areas of missing concrete and holes.

5. The exterior door to the stairwell is not working properly.

6. The flat roof does not appear to be leaking but is covered with patches of moss.

7. The steel beams supporting the second floor are coated in an asbestos based fire retardant.

8. The overhead crane rail connection to the roof truss has only two bolts in the connection. The crane trolley is attached to a 4 ton chain hoist but there is no safe working load marked on the crane.

Photo number 5 is indicative of the type of structural deterioration inside the building.

3.5 Environmental Observations

From an environmental viewpoint, the most important defects in the facility are the suspected PCB contaminated auxiliary transformers, the lack of oil spill containment for the main transformers, the batteries and asbestos fire retardants.

3.5.1 Auxiliary Transformers

Two small neutral grounded auxiliary transformers are believed to contain oil with PCB's. It is understood that NLH is checking these units and may replace them. Under current standards, the use of oil filled transformers inside a building would be considered unacceptable. These transformers should be replaced with dry or silicon type transformers if the facility is to be retained for any significant period.

3.5.2 Main Transformers

The main transformers illustrate a number of environmental problems.

1. The fire doors appear not to operate properly; they seem not to seal completely.

2. The spill containment and drainage system needs improvement to meet current standards.

3. The existing floor drains are blocked preventing water drainage.

4. There is no fire extinguishing system in the transformer area; nor is there an oil-water separator to separate the oil from the water in the case of a spill.

5. Should a major fault occur within a transformer, the likely resulting fire would be difficult to control.

These defects in the plant design should be remedied soon to ensure environmental compliance and also to remedy a serious fire hazard. The system as it stands is an insurance liability as there are large oil filled transformers contained inside a building with no fire protection system and no way to remove oil should a problem occur.

The cooling air circulation problem should be remedied at the same time. It would be best to provide a new cooling air system for the transformers and the converter. In this manner, the cooling would be more efficient and the transformer vaults could be sealed so that if a fault occurred, oil and/or fire would not leak into the adjoining converter hall.

3.5.3 Batteries

The batteries are not separated from the remainder of the equipment on the switchgear floor creating two hazards. Firstly the problem of hydrogen generation by the batteries is not handled separately; and, secondly if a battery were to explode, a remote but real possibility, there is nothing to prevent the acid from damaging nearby equipment or possibly injuring personnel. Normally batteries are installed in their own separate enclosures so as to isolate the hydrogen and explosive hazards from the remainder of the building.

3.5.4 Building Asbestos Insulation

The building contains asbestos fire retardant on the underside of the switchgear floor. At the present, personnel entering the building are required to wear respirators while working in the converter area. Samples of the dirt contaminants on the converter were laboratory tested and no trace of asbestos was found in the samples, however. (The building asbestos insulation is entirely separate and not related to the asbestos insulation found on the rotor wire insulation. The latter asbestos was an integrated insulation compound that was occasionally used on high grade insulation compounds before 1970.)

Assessment of the Facility

4 Assessment of the Facility

4.1 Overview of the Problems Observed

The problems observed with the frequency converter facility may be summarized as follows.

The Converter
The main problems with the converter are dirt and dust contaminated windings, low insulation resistance of the rotor windings, and a failing pedestal bearing, bearing number 5, near the exciter.

The Transformers
Problems with the transformer relate to the fact that the transformers are oil filled and are situated within a building without a proper fire control (sprinkler) system and suitable oil spill containment system.

The Voltage Regulator
The voltage regulator has a water leak and should be repaired or the regulator replaced.

The Ventilation System
The problem with the ventilation system is that the air filters are inadequate to prevent dust and debris from entering the converter facility and thus contaminating the entire facility. Converter cooling air has already been drawn past the transformers and thus been partially heated; hence, the full cooling effect of the air is not available.

Lighting
The emergency lighting system needs improvement so that adequate lighting is available in all areas during a power failure. The main lighting system also is not adequate in all areas, in particular around the converter itself.

The Structure
The building is old and, while not failing structurally, suffers from loose concrete and debris falling from the roof edge and the walls, especially in the unheated stairwell. There are also a number of cracks in the walls that require repair, if only to reduce the amount of dust and debris entering the building. Plywood is also temporarily attached to the stairwell ceiling; permanent repairs should be carried out.

The Battery

The batteries are not properly shielded from the surrounding equipment. A battery explosion could seriously damage surrounding equipment. In addition, no separate facility for evacuating hydrogen evolved from the batteries is in place.

Oil Lubrication System

There appears to be corrosion in the system, on the cold water supply to the heat exchanger. The ac driven pump is awaiting replacement and is temporarily replaced. The pressure switch on the line should be replaced.

Fire Protection System

The water system is not to current standards and does not extend to the transformer area. The fire reel hoses are in poor condition.

Compressed Air System

The compressed air piping system does not meet current standards. No automatic water release valve or inspection opening is provided.

Roof and Floor Drains

The drainage system is blocked thus allowing water to flood the floor. Water also enters the sump where the lubrication oil reservoir is located. Freezing of the roof drains has caused a failure of one of the down pipes.

Other Problems

Numerous other problems exist in the converter facility. They include the necessity to repair relay covers and to make minor repairs to equipment, and the need to clean the facility throughout so as to remove the dust and dirt that covers the entire facility and is a contaminant to the converter equipment in particular. Normally, if the equipment were to be installed today, a modern programmable relay, metering and control system would be installed; but, as the existing system has worked satisfactorily for many years, it does not seem necessary to replace the existing system if the remainder of the equipment is not also planned for replacement.

Year 2000 Problem

Since the facility was constructed before the advent of microprocessors, all the equipment would be of the electro-mechanical type and thus would not be expected to have any so-called Y2K problems. However, this study does not cover the SCADA control system terminal which could have such problems.

4.2 Assessment Detail and Estimate

4.2.1 Converter

Except for the bearing problem, it appears that all other problems with the converter are the result of poor ventilation. It is recommended that the ventilation system be upgraded and then the machine be repaired, in that order. It is believed the minimum repairs to the machine are to clean all parts including the 50 and 60 Hz main portions of the machine, the 50 and 60 Hz exciters and the pilot exciter. Given the low winding resistance of the 50 and 60 Hz rotors, they should be rewound.

In addition to cleaning the main portions of the machine, it is recommended that the exciters, the induction motors and the pilot exciter also be cleaned as the exciters and the motors could not be meggared during the inspection. Other problems may be found when the exciters and motors are tested after cleaning. From their general appearance, however, it is likely this would not be the case.

The main bearings are in excellent condition; further inspection of bearings 1 and 3 is not necessary. Bearing 5 needs to be replaced soon. NLH noted that a similar bearing is in inventory at NLH's Bishop's Falls maintenance facility; however, there is some doubt as to whether the bearing will fit properly. This should be carefully checked before proceeding with the replacement. If the bearing is suitable, it is recommended that it be cleaned and polished and bearing housing flushed clean and new filtered oil installed prior to machine startup. Actual bearing temperatures should be monitored and recorded.

The work involved in installing and running a new bearing in is not trivial. Firstly, the bearing may have to be made to fit, if it is slightly out of tolerance. Secondly, the bearing must then be run in for a significant period, while the temperature is monitored closely to ensure a bearing wipe is not underway. This can take a period of days.

An oil sample was taken of the faulty bearing during the inspection; however, since the bearing will be replaced, it will not be necessary to test the oil.

It is expected that the costs for these modifications and improvements would be as follows.

Rewind both rotors	$1,365,000
Clean the facility*	$ 75,000
Install 2 dry type transformers	$ 45,000
Replace faulty bearing	$5,000**
Oil testing and bearing temperature monitoring	$ 10,000
TOTAL	**$1,500,000**

* The cleaning is to cover the entire facility and not just the converter and associated machines

** The low cost for this work is based on the assumption that a replacement bearing exists in NLH's inventory. There will be lost revenue for down time while the bearing is being replaced and run in; but, the only direct cost at this time will be for the labor of replacement, which is minimal.

These costs and all other costs estimates include an allowance for engineering, and contingency. Further details of the estimates are provided in an appendix to this report.

4.2.2 Transformers

No known problems exist with the transformers themselves. Instead the problems are associated with the lack of fire protection and spill containment for the transformer. An estimate of the cost to provide spill containment and a fire protection/sprinkler system is provided below.

Despite the fact that no known problems exist with the transformers, power transformers normally have a 40 year life which is within the 10 year horizon that this report covers. Given the fact that the transformer maintenance records show no serious incidents and that they are presently more than 30 years of age, it is expected the transformers will last for the ten year period.

Cost of fire protection system (using existing water supply)	$120,000
Cost of spill containment with oil/water separator	$225,000
TOTAL	**$345,000**

4.2.3 Voltage Regulator

The voltage regulator problem is a water leak in the cooling circuit. The leak should not be difficult to fix; however, it would require study to find the cause which occurs on startup and shut down only. The cost of engineering analysis to resolve the problem could be significant; thus no estimate to repair the unit is provided. However, the cost of not fixing the leak could be prohibitive; if the maintenance crews forget to drain the water after shut down or start up, a flashover will occur if the water level rises high enough to contact the main leads.

As an alternative to providing a cost for repair, a cost for replacement of what is an antiquated voltage control system is provided instead. This system would use two static AVRs, suitably switched as required depending on which machine was driving or driven. This system would replace the present voltage regulator and drivers.

Cost for supply and installation of two new AVRs	$150,000
Cost of removal of existing equipment	$ 50,000
TOTAL	**$200,000**

4.2.4 Ventilation System

A separate ventilation system should be installed so that only clean, dry air is brought into the facility supplying sufficient air to the converter and the transformers. If the transformers were kept in sealed compartments, a lower standard of cleanliness could be allowed for the transformers than for the converter. In any case, some structural modifications would be required to supply air for the transformers and the converter. Estimated costs to provide for this are provided below.

Cost of new air handling system	$ 50,000
Cost of structural modifications	$ 50,000
TOTAL	**$100,000**

4.2.5 Lighting

The lighting system in the converter facility, including both the main and emergency systems, is not adequate. Augmentation of both systems is required in certain areas, particularly the stairwells and the converter area. The cost of bringing the system up to proper standards is estimated to be $20,000. It is assumed that no new ac main supply panel board augmentation is required to carry out the improvement in lighting.

4.2.6 Structural Requirements

The structure appears to be basically sound. However, the structure has numerous superficial deficiencies, including cracks in the walls and loose mortar and bricks that fall from the roof and walls. These deficiencies can be repaired without excessive costs. Because of the loose mortar and bricks that have fallen from the walls and the roof, significant damage has been caused to the insulators and wall bushings of the converter building. The wall bushings and standoff insulators should all be replaced.

In the stairwell the steel column should be sand blasted and painted, the concrete wall repaired and the metal stair replaced. Immediate repairs are required to the stair pans to ensure safety. The door to the stairwell should be replaced and the stairwell should be ventilated and heated to avoid deterioration due to moisture buildup. The crane and the support structure should be inspected and the safe working load established.

In addition to the above, the mill building has also had some problems and some of the wall bushings and associated insulators have been similarly damaged. Estimated costs for the repair of this work are also included below. It should be noted, however, that both buildings belong to CBPP and any damage to NLH equipment due to building deficiencies or failures should presumably be the responsibility of the paper mill.

Repair of converter building structural steel and concrete	$ 15,000
Stair replacement	$ 10,000
Door replacement	$ 1,000
Heating and ventilation in stairwell	$ 4,000
Stairwell roof repairs	$ 8,000

Crane inspection	$ 5,000
Replace NLH insulators (converter building)	$100,000
Repair of mill building	$ 30,000
Replace NLH insulators (mill building)	$ 60,000
TOTAL	**$233,000**

4.2.7 The Battery

The battery is about 17 years of age and should be replaced within the next 10 years. An estimated cost for a new battery is included. In addition, a vented enclosure should be placed around the batteries to protect personnel and associated equipment from the effects of a faulted battery cell.

New battery	$25,000
Battery enclosure	$10,000
TOTAL	**$35,000**

4.2.8 Oil Lubrication System

The oil reservoir should be removed and inspected for pitting and corrosion. Replacement may be required as the sump has been filled with water on several occasions and the area is generally damp. The sump should be made water tight and an oil water separator installed on the discharge from the sump pump. All leaking fittings and valves should be repaired or replaced and the pressure transducer on the cold water line should be replaced. Corroded piping should be cleaned and painted or replaced.

The estimated cost to carry out this work is as outlined below:

Rehabilitate or replace existing tank	$15,000
Repair or replace mechanical equipment	$ 3,000
Line concrete sump, and repair piping	$ 4,000
TOTAL	**$22,000**

4.2.9 Compressed Air System

The piping should be upgraded in particular the copper piping should be removed. The air receiver should have an inspection opening installed and be inspected for internal and external corrosion. If the tank is found to be in good condition a pressure gauge and automatic water release valve should be installed.

The estimated cost for carrying out this work is estimated below.

Upgrade piping	$ 5,000
Modify air receiver	$ 5,000
TOTAL	**$10,000**

4.2.10 Roof and Floor Drains

New floor drains are required to remove the water from the building. Water from floor drains and cooling water systems should be separated from roof drains and sent through an oil water separator before discharge to the sewer. Freezing of roof drains should be monitored and the down pipes heat traced and insulated if the problem persists.

The estimated cost of making these modifications is $30,000.

4.2.11 Other Problems

Numerous other small problems exist within the facility and the switchgear. These, however, should not require individually a significant amount to repair. It is not expected for instance to replace the protection or control systems at this time, although repair to many of the cubicles is required along with replacement of some relay case doors.

Allowance for repairs to remainder of electrical gear $105,000

4.2.12 Total Estimate

The total estimated cost to repair the facility is $2.6 million. Some of these costs, such as the expected replacement to the battery, may be deferred for a period. Others, particularly the cost of the building repairs and associated replacement of insulators, should be borne by the paper mill. An argument could also be made for the paper mill to carry some of the cost of cleanup.

The estimated cost of replacement of the frequency converter with similar technology is $10 million; however, this estimate is somewhat misleading because it is highly unlikely a rotating frequency converter would ever be built today. Frequency converter requirements are presently fulfilled by using thyristor based technology, similar to the high voltage ac to dc converters used for long distance transmission facilities, such as the Nelson river lines in Manitoba. At the time of writing, an estimate for such a facility was still being awaited from ABB.

4.2.13 Accuracy of Estimate

The Terms of Reference for this work stipulated a target accuracy in the estimates of ±10 percent. Since the single major item in the estimates is the rewind of the rotors, the accuracy in the budget quote for this work would have a significant effect on the overall accuracy of the total estimate. It is believed that the accuracy of the estimate for the rewind is ±15 percent although experience suggests that the eventual bid price is usually lower than the budget quote. A more likely level of the accuracy for this part of the estimate is therefore plus 10 percent minus 15 percent.

The accuracy of the estimate for the remaining items of work ranges from 10 to 20 percent; therefore, a reasonable overall accuracy in the total estimate is considered to be ±15 percent.

4.3 Repair Sequence

In order to effectively rehabilitate the converter facility, the following sequence should be followed.

1. Remove the building asbestos.

2. Improve building lighting.

3. Repair the building, improve the drains and replace the insulators as required.

4. Clean the converter facility thoroughly.

5. Make necessary converter improvements, including rewinding the rotors, monitoring of the coupling and replacement of the bearings as necessary.

6. Make necessary improvements to the facility including the ventilation system, the compressed air system, the oil lubrication system, the fire control system and the oil spill containment system.

7. Make other repairs and improvements as necessary including those to the voltage regulator, the switchgear, and auxiliary transformer replacement, etc.

The program outlined below is a minimum program that must be carried out to ensure the complete rehabilitation of the converter facility. Any restricted program will not ensure the complete rehabilitation of the facility and will probably lead to early higher costs again. Undoubtedly some items such as lighting rehabilitation may be considered not completely essential to continued operation of the converter; but such an understanding would be erroneous because the poor lighting in the facility can lead to errors that can mean incorrect operation and severe damage.

It is believed that this work could be completed in about 45 days, assuming suitable shift work as necessary to get the most intensive portions of the work done as expeditiously as possible.

The estimate provided here does not allow for unforeseen circumstances, such as the machines being in worse condition than they appeared to be. As noted previously, the machines were inspected only as far as possible without the rotors being removed. Other problems may exist which could not be detected during the inspection, but which could for instance require a stator restacking or rewind at an increase in estimated cost of approximately $1,000,000. Given the meggar test results, however, such an additional cost would be unlikely.

4.4 Estimated Repair Times

If some component of the converter were to fail, the facility would have to be shut down for varying periods of time while the component was repaired or some way of operating the facility without the failed component was found. Table 4.1 contains a listing of the possible failures, some of the consequences of the failure and an estimate of the time to repair the faulty component.

As may be understood from examining this table, the range of possible consequences for each type of failure and the possible range of failures are so wide as to be make it difficult to state exactly the extent of any failure and thus the range of consequences. From our examination of the facility, the most likely serious electrical problem would be a rotor winding failure. The consequences of such a failure are difficult to predict because a simple failure may not be of serious concern. The faulted turn could possibly be bypassed and the machine operated almost normally until the machine could be rewound. Acres does strongly recommend that the machine rotors be rewound as soon as possible as the meggar tests show very low rotor insulation resistance and incipient failure. From a mechanical viewpoint it is recommended that the pedestal bearing be replaced before total bearing failure occurs and the machine cannot be operated.

4.5 Remaining Life Evaluation

4.5.1 Description of the Application of Iowa Curves

An estimate of the remaining life that might be expected for similar equipment to that at Corner Brook was prepared using comparative data published by the US Bureau of Reclamation and industry accepted generic survivor curves as published by the University of Iowa.

Studies by the University of Iowa have defined a number of basic mortality curves for various types of capital plant. The curves have three basic shapes defined as L, S and R types. The significance of these curve shapes is that in comparing them to a standard Bell curve, S curves are Bell curves, i.e. symmetrical, which means that items of a particular type of plant expire at the same rate on each side of the peak (average) expiry age. L curves are skewed to the left and R curves are skewed to the right, which means in practical terms that L rated items of equipment mostly expire early, with some long lived items making up the balance. For R rated items, very few items of plant expire early,

Table 4.1

Estimated Repair Times

Component	Replacement Component	Procurement Time	Component Cost (000s)	Installation Time*	Failure Consequence	Time to Repair
Rotor winding	Rotor windings	4-5 mths	$500	2 wks	Machine inoperative and damaged	1 wk - 3 mths
Rotor structure	Rotor	4-6 mths	$600	2 wks	Machine inoperative and damaged	1 wk - 2 mths
Stator winding	Stator windings Stator	3-4 mths 3-4 mths	$400 $1000	2 mths 3 mths	Machine inoperative and damaged	1 wk - 3 mths
Stator lamination failure	Stator restack	2-3 mths	$500	3 mths	High losses and arcing	2 wks - 3 mths
Exciter failure	Exciter	3 mths	$100	1 wk	Machine inoperative	1 mth
Starter motor	Motor	1 mth	$50	3 days	Cannot start converter	2 wks
Voltage regulator	Regulator	1 mth	$75	3 days	Cannot regulate voltage	1 mth
Relay failure	1 Relay All relays	2 mths 4 mths	$15 $200	2 days 2 wks	Inconsequential to total immobilization	Up to 1 mth
Switchgear failure	1 breaker All cells	2 mths 6-8 mths	$30 $800	3 days 1 mth	Inconsequential to total failure	Up to 4 mth
Main transformer	Transformer	10 mths	$500 each	2 wks	Facility inoperative	1 wk to 10 mths
Auxiliary transformer	Transformer	3 mths	$25	3 days	Probably inconsequential	3 mths to replace
Converter bearing	Bearing	1-2 mths	$30	1 wk	Inconsequential to inoperative	Up to 2 mths

Notes:

* It is believed the installation times are minimum and assume that forces are made ready in advance for the required work.

1. The timings given in column Procurement Time and Time to Repair are generally different. The Time to Repair column assumes that some time is available to arrange a repair contract before the component fails completely. The Procurement Time column assumes the worst possible delays and no pre warning of possible failure.

but there is a mass die off shortly after the average date is attained. To complicate matters, there is a number of each curve type noted above, for instance R0, R1, R2, etc. The significance of this number is that it defines the slope of the curve, the higher the number the steeper the curve slope. In practical, terms this would mean the death rate would be spread out over a longer time for a lower rated curve than for a higher rated curve..

Typical Iowa curve designations are composed of 3 parts, the first being the average lifetime, e.g. 40 standing for 40 years and the second being the basic curve shape, e.g. R for right skewed. The last part is representative of the degree of spreading the curve base has, i.e. a 1 curve is much wider than a 3 curve. A typical curve could be designated 40 R2, which means an item which has an average life of 40 years and a right skewed mortality rate, i.e. the item tends to expire slowly at first but at a sharper rate after the average lifetime is reached.

The other part of the analysis consists of matching a utility's observed mortality rate for an item of equipment to one of the curve shapes and to define an average life. Except for the very largest organizations, such an exercise is meaningless because in order for the observations to have statistical meaning the population must be large, in the order of 1000 as a minimum. For this analysis, we will apply curve shapes and life data found to be reasonable by the US Bureau of Reclamation and the Western Area Power Administration. It is understood that similar information is available from other utility organizations.

4.5.2 Application to NLH Corner Brook Facility

The following table lists the equipment items for which analyses have been done and the curves used to evaluate the remaining life expectancies and the forecast future life of each item under normal plant operating and maintenance conditions.

Item	Curve Number	Present Age	Life at Mortality	Predicted Additional Life
Stator	50L0	30	65	35
Rotors	50S1	30	56	26
Exciters	45S2	30	49	19
Transformers	40R3	30	48	18
Switchgear	35R4	30	38	8

Item	Curve Number	Present Age	Life at Mortality	Predicted Additional Life
Building	50S1	30	56	26
Building Roof	20L1	30	36.5	6.5
CM&R Panel	35S0	30	46	16
Station Service Transformer	35R3	30	39.5	9.5
Surge Arrestors	25R4	30	32	2
Battery Charger	20S3	30	31.2	1.2
Battery	25S2	10	25	15

It must be emphasized the above analyses are strictly on a statistical basis. In effect, the equipment is treated statistically as if it were a part of the USBR plant. Experience with individual items of equipment may be longer or shorter than the above expectations given the operating environment and maintenance history. Given the levels of maintenance and the poor performance of the filters and air leaks in the building shell, the life expectancies of the equipment in the Corner Brook facility are lower than the above predictions. In addition, some anomalies exist in the curves used in the above table. Some items of equipment have artificially low life expectancies. Among such items are the surge arrestors and battery chargers. The life expectancies of the surge arrestors are lower than expected because USBR companies tend to change out arrestors with better arrestors having been placed on the market. Battery chargers in the USBR tend to get changed out early along with batteries; thus their true life expectancies are not reflected herein. Conversely the CM&R panel life expectancies do not reflect change outs of relays for the more modern relays now on the market. The life expectancy only reflects the probable life of the panels and not the equipment in them.

4.5.3 Conclusions of Remaining Life Predictions

The above predictions are, as noted, of a statistical nature only. The facility components should, if they had been operated and maintained in a manner commensurate with standard practices, reach the ages predicted. However, the facility has been operated without adequate filtering, which has allowed accumulation of dust and dirt over the entire frequency converter facility. This means the life expectancy of the machines should be less than the above predictions. Implementation of the remedial program outlined in this report should, however, lead to a significant improvement in this life expectancy.

Operations and Maintenance

5 Operations and Maintenance

In order to compare the operating and maintenance practices associated with the converter facility at Corner Brook, Acres staff contacted two companies that own and operate rotating frequency converters. These are Ontario Hydro, which operates a major facility near its Sir Adam Beck II hydro plant to convert between 25 Hz and 60 Hz and Elkem, which operates a small converter, rated at 6-MVA, 2 phase 62.5 Hz to 3 phase 25 Hz in Ohio. The practices followed by each company are described below.

5.1 Ontario Hydro

The Ontario Hydro converter, rated at 54-MVA, situated near the Beck II station in Niagara Falls, has been operating for a number of decades. Prior to being located at the Beck II site, it had been located elsewhere on the Ontario Hydro system. When questioned about their operating experience, Ontario Hydro advised they maintained the facility as they would if it were a thermal generator. The machine operates continuously as the demand for power on the 25 and 60-Hz systems exists all the time. There is generation throughout the province for 60 Hz power. For 25 Hz power generation exists both in the south at Beck and at some nearby small plants as well as in the north at Abitibi Canyon. The converter operates almost all the time except for periodic maintenance shut downs according to their regular maintenance schedule.

5.2 Elkem

Elkem operates its converter almost 100 percent of the time to convert whatever power it can generate at 62.5 Hz to 25 Hz power, which it uses in its silicon smelters. According to Elkem it does virtually no maintenance on any of the generators it owns and operates. It is difficult to describe the Elkem system. Basically it operates about 235-MVA of hydro and thermal generation, mostly at 25 Hz except for a maximum of 6-MVA at 62.5 Hz, in and around Gauley Junction in West Virginia. It is also tied to Allegheny Power and operates a static frequency converter from 60 Hz to 25 Hz at the same time. It uses mostly 25 Hz power in its silicon production process but also has furnaces that operate at 60 Hz.

It is Elkem's practice to operate its power system until components either fail or show immanent signs of doing so. Elkem has stated that it almost never does maintenance on the rotating converter and appears not worried if the converter should fail. The generating plants supplying power to the converter are themselves more than 80 years old and in questionable health, given their lack of maintenance. The power that Elkem uses because of the furnaces has a high harmonic content (up to 30%); and again, because the furnace power demand varies considerably over time the level of generation required at any one time fluctuates dramatically. The fact that the rotating converter (as well as other equipment) has operated satisfactorily on this type of system for decades is a tribute to the original equipment builders.

5.3 NLH Recommended Operation

Given the two examples of rotating frequency converter operation, it is not recommended that NLH emulate the practices of Elkem. Even Elkem personnel are becoming concerned over their method of maintaining their increasingly aged plant, and, they plan to institute a maintenance program in the near future, to the extent that they can remove machines from service given the almost incessant demand for steadily more power in their system.

Ontario Hydro operates and maintains its converter in a more intelligent fashion given the long term requirements for 25 and 60 Hz power in the system. It is noted, however, that Ontario Hydro has the luxury of having sufficient generation available at both the 25 and 60 Hz level to meet power requirement at either frequency.

It is understood that NLH also uses its thermal generator maintenance program as a model for the maintenance program followed for the frequency converter. It is recommended that this practice continue. The maintenance sequences required for the converter facility have been reviewed and are considered adequate. The addition of monitoring equipment such as partial discharge monitors could help in the overall operation of the facility, but, it is more important to repair the facility so that the conditions under which the converter machinery operates are conducive to prolonged life.

It is noted, however, that not all the repairs that would have been expected to be completed, such as replacement of relay covers, seem to be carried out in a timely manner. It is suggested that the performance of the maintenance forces be audited occasionally to ensure that such "run of the mill" repairs are carried out more expeditiously.

5.4 Non Destructive Testing and Monitoring

The frequency converter facility has not been fitted with any of the more modern test or monitoring facilities. Chief among such test and monitoring facilities now available in the market are:

- Transformer incipient fault monitoring.
- Machine air gap monitoring.
- Machine partial discharge measurement facilities.
- Vibration monitoring facilities.

Of the above facilities, the second the air gap monitor is unlikely to be used as it is more commonly used on water wheel generators, particularly where there is concern about the stator going out of round due to concrete alkaline aggregate reaction. No cost estimates have been obtained for such equipment, but it is understood that each can be purchased from more than one supplier at present, generally speaking, for prices in the order of $10,000 to $30,000 per unit.

In addition to the above, it is suggested that a modern generator protection package be purchased for both portions of the converter. Such packages are available from numerous suppliers including ABB and Alsthom. The cost for such packages can vary widely but is in the order of $50,000 each.

5.5 Spare Parts Inventory

As far as could be determined, there is no spare parts inventory for the frequency converter. Apart from the spare bearing that apparently exists in stores at Bishop's Falls, virtually nothing exists that could be put to use in an emergency. The use of this bearing is also questionable because of some uncertainty over its dimensions. As a minimum, the following spare parts should exist for both frequency converters. Not all of these spares need be dedicated to the converters; some could be system spares to be used anywhere in the system. Such system wide spares could include relays and breakers for the metalclad switchgear.

- Spare rotor coil
- Spare stator winding and end pieces
- Spare metalclad breaker, truck mounted
- Spare CT suitable for installation into metalclad gear
- Spare relays of each type used in facility

- Tape, clamps, cable, bus materials, repair materials
- Spare bearings of each type used

If the voltage regulator is replaced, spare cards for the new voltage regulators should be obtained as recommended by the eventual supplier. Similarly, spare parts should be obtained from any supplier of replacement equipment.

As the existing equipment has all been supplied by Westinghouse, it is believed that Westinghouse Service would be the best supplier of spare parts. As is well known, Westinghouse Service is now part of Siemens Corporation, and it is understood that Siemens has all the records to which Westinghouse Service originally had access.

The switchgear was supplied by Brown Boveri Company, now part of ABB. It is our understanding that ABB can supply any spare parts required for gear it may have supplied in past years. However, ABB has closed its only switchgear manufacturing facility in Canada and some of the equipment and parts formerly relatively readily obtainable from the facility are now difficult to obtain.

5.6 Unit Rating and Capability

It is understood the converter unit is not presently run at its nameplate capacity. In discussing the problem with maintenance personnel, it was found that the stator air cooling ducts are partially blocked thus reducing the cooling effect of the available air. It is believed that a thorough cleaning including flushing of the debris from the ducts will allow the machine to operate at its design rating. The expected cost for this work is included in the cost estimate provided for the cleaning of the facility. However, without a significant effort to repair the building and the ventilation/filtration system, nothing that is done in the way of cleaning will have a lasting effect.

The converter unit is presently operating at approximately 20 MVA maximum output, about 2/3 of its rating. It is understood that this output is the maximum available if the machine is to stay within its operating temperature range. It is believed the machine should be able to operate up to its rating of 28 MVA if it were cleaned. No further action should be required other than to ensure a sufficient flow of clean cooling air at adequate temperatures by rehabilitating the filters and ventilation system.

Conclusions

6 Conclusions

This report has detailed the deficiencies found in the converter facility at Corner Brook. A program has been recommended, with associated estimated costs, to carry out the rehabilitation of the facility. It is believed the option of replacing the entire facility with a static converter or another rotating converter is not attractive as long as the existing facility has significant life remaining. The recommended steps to rehabilitate the facility are:

1. Remove the building insulation asbestos. (It is understood that NLH is proceeding to do this)

2. Improve building lighting.

3. Repair the building, improve the drains and replace the insulators as required.

4. Clean the converter facility thoroughly, particularly the converter itself.

5. Make necessary converter improvements, including rewinding the rotors, monitoring of the coupling and replacement of the bearings as necessary.

6. Make necessary improvements to the facility including the ventilation system, the compressed air system, the oil lubrication system, the fire control system and the oil spill containment system.

7. Make other repairs and improvements as necessary including those to the voltage regulator, the switchgear, and auxiliary transformer.

These steps are repeated in Table 6.1 along with associated costs and estimated time to repair.

Table 6.1
Recommended Repairs, Costs and Repair Times

Step Number	Action	Associated Costs	Required Time
1	Remove building asbestos	$75,000 (not in estimate)	2 weeks
2	Improve building lighting	$20,000	2 weeks (concurrent)
3	Repair building, drains, insulators	$263,000	3 weeks (concurrent)
4	Clean facility	$75,000	3 weeks (concurrent)
5	Make converter repairs	$1,445,000	2-3 months
6	Improve ventilation, compressed air and fire control systems, etc.	$467,000	2 months (concurrent)
7	Other repairs and improvements	$330,000	2 months (concurrent)
TOTAL		**$2,675,000**	**2-3 months**

It must be emphasized that the above program is a minimum program. Deletions or omissions of any part of the program will mean the entire program is compromised.

It is believed that the work should, if properly planned and expedited, be completed within a two to three month period. The major item of work would be the rotor rewind, which would require the rotors be removed from site to a suitable workshop. Once repaired, the facility should be maintained appropriately and a suitable level of spare parts should be kept on hand.

Appendix A
Cost Estimate Details

Converter Improvements

Items	Unit Cost	Number	Totals
Rewind both rotors	500000	2	1000000
Associated NLH Labor	25000	2	50000
Clean facility	50000	1	50000
New bearing	3000	1	3000
Dry type transformers	15000	2	30000
Oil test and monitor new bearing	6000	1	6000
Subtotal			1139000
Engineering			91120
Project Management			56950
Owner Administration			28475
Interest during construction			34170
Subtotal			1349715
Contingency			161965.8
Total			**1511681**
Rounded			**1,500,000**

Transformer Area Improvements

Items	Unit Cost	Number	Totals
Fire protection system	60000	1	60000
Oil - water separator	100000	1	100000
Concrete works	33000	1	33000
Labor associated	50000	1	50000
Subtotal			243000
Engineering			19440
Project Management			12150
Owner Administration			6075
Interest during construction			7290
Subtotal			287955
Contingency			57591
Total			**345546**
Rounded			**345,000**

New Automatic Voltage Regulators

Items	Unit Cost	Number	Totals
New AVRs	50000	2	100000
Labor to install	5000	2	10000
Remove Existing Volt Reg	32000	1	32000
Subtotal			142000
Engineering			11360
Project Management			7100
Owner Administration			3550
Interest during construction			4260
Subtotal			168270
Contingency			33654
Total			**201924**
Rounded			**200,000**

Ventilation System Improvements

Items	Unit Cost	Number	Totals
New filter system	25000	1	25000
Labor to install	10000	1	10000
Structural Modifications	35000	1	35000
Subtotal			70000
Engineering			5600
Project Management			3500
Owner Administration			1750
Interest during construction			2100
Subtotal			82950
Contingency			16590
Total			**99540**
Rounded			**100,000**

Lighting System

Items	Unit Cost	Number	Totals
New Lights	4000	1	4000
Labor to install	10000	1	10000
Subtotal			14000
Engineering			1120
Project Management			700
Owner Administration			350
Interest during construction			420
Subtotal			16590
Contingency			3318
Total			**19908**
Rounded			**20,000**

Structural Improvements

Items	Unit Cost	Number	Totals
Repair converter structure	10000	1	10000
Stair replacement	7000	1	7000
Door replacement	1000	1	1000
Heating and Ventilation in Stairs	3000	1	3000
Stairwell roof repairs	6000	1	6000
Crane Inspection	3000	1	3000
Replace insulators, converter bld	60000	1	60000
Repair mill building	10000	1	10000
Replace insulators, mill bld	45000	1	45000
Associated labor	31000	1	31000
Subtotal			176000
Engineering			14080
Project Management			8800
Owner Administration			4400
Interest during construction			5280
Subtotal			208560
Contingency			25027.2
Total			**233587.2**
Rounded			**233,000**

Battery System

Items	Unit Cost	Number	Totals
New battery	15000	1	15000
Labor to install	3000	1	3000
Battery screen	6500	1	6500
Subtotal			24500
Engineering			1960
Project Management			1225
Owner Administration			612.5
Interest during construction			735
Subtotal			29032.5
Contingency			5806.5
Total			**34839**
Rounded			**35,000**

Oil System Improvements

Items	Unit Cost	Number	Totals
Rehabilitate tank	5000	1	5000
Repair/replace mech equip	1000	1	1000
Line concrete sump	2500	1	2500
Labor associated	7000	1	7000
Subtotal			15500
Engineering			1240
Project Management			775
Owner Administration			387.5
Interest during construction			465
Subtotal			18367.5
Contingency			3673.5
Total			**22041**
Rounded			**22,000**

Compressed Air System

Items	Unit Cost	Number	Totals
Upgrade piping	2000	1	2000
Modify air receiver	2000	1	2000
Associated labor	3000	1	3000
Subtotal			7000
Engineering			560
Project Management			350
Owner Administration			175
Interest during construction			210
Subtotal			8295
Contingency			1659
Total			**9954**
Rounded			**10,000**

Roof/Floor Drains

Items	Unit Cost	Number	Totals
Drain Materials	10000	1	10000
Labor to install	11000	1	11000
Subtotal			21000
Engineering			1680
Project Management			1050
Owner Administration			525
Interest during construction			630
Subtotal			24885
Contingency			4977
Total			**29862**
Rounded			**30,000**

Other Areas

Items	Unit Cost	Number	Totals
Repair/replace swtgear comps	35000	1	35000
Misc repairs	15000	1	15000
Associated labor	24000	1	24000
Subtotal			74000
Engineering			5920
Project Management			3700
Owner Administration			1850
Interest during construction			2220
Subtotal			87690
Contingency			17538
Total			**105228**
Rounded			**105,000**

Appendix B
Photographs

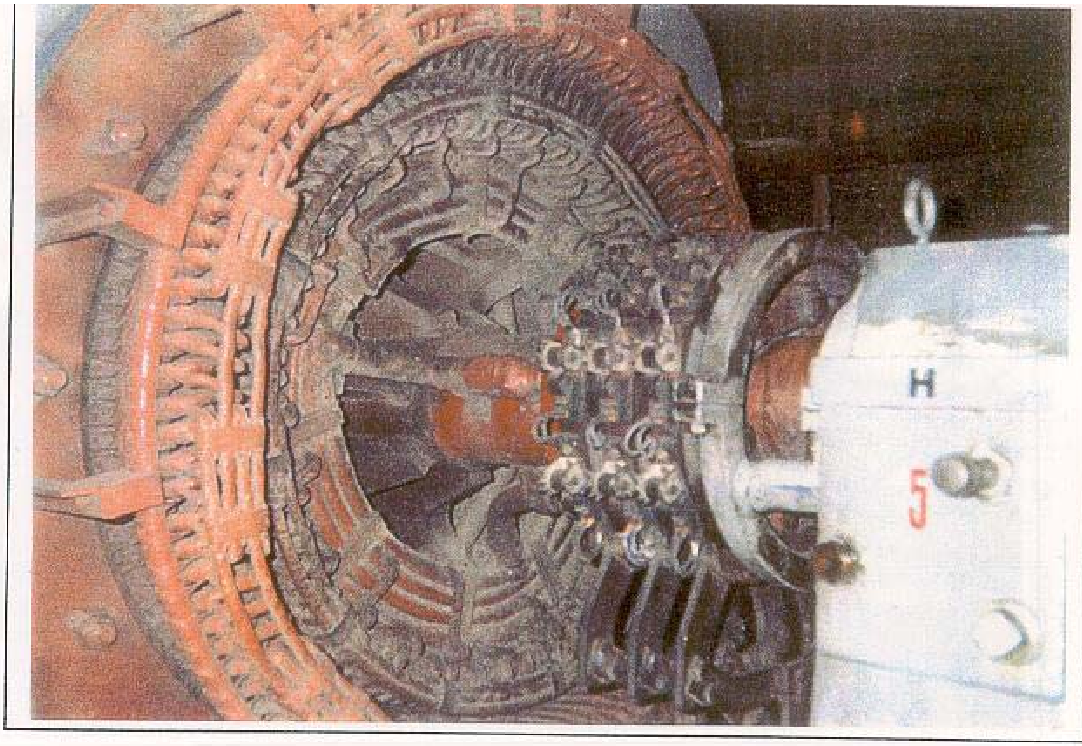


Photo 1: Dust and dirt on the machine windings and rotor - August 19, 1998

Photo 2: Arcing and burning found in cubicle - August 19, 1998

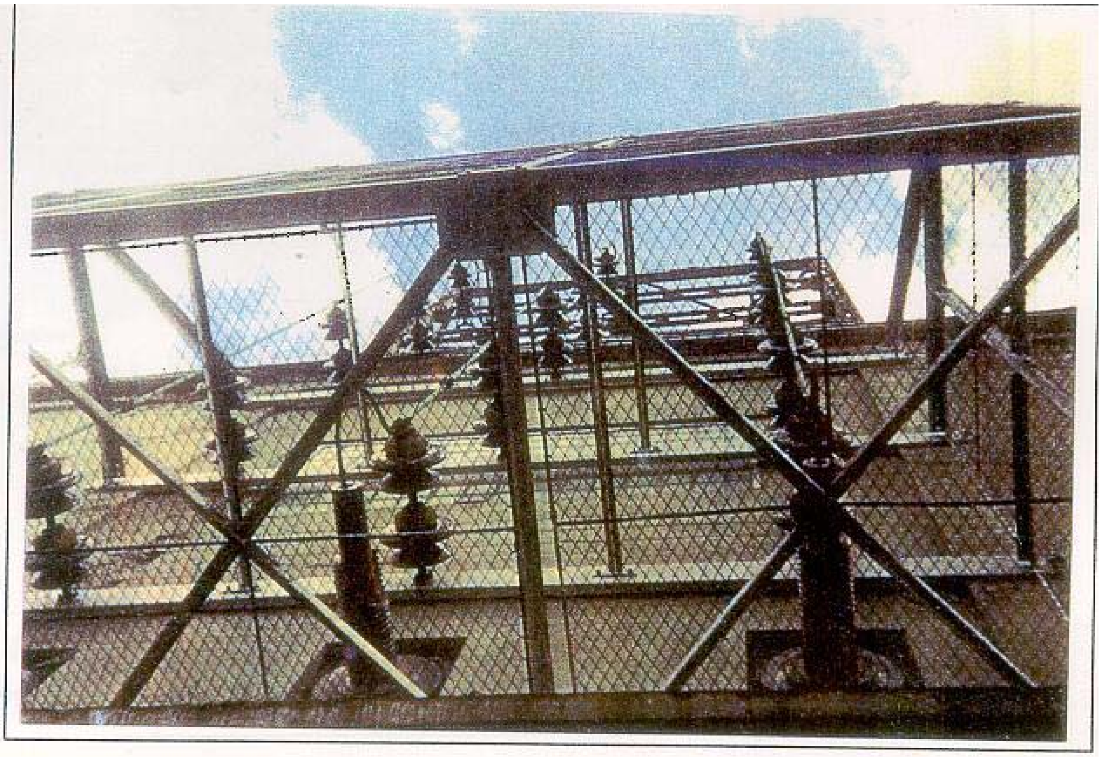


Photo 3: Damaged bushings outside the converter building - August 19, 1998

Photo 4: Shows scoring that has occurred on the pedestal bearing which has failed
- August 19, 1998

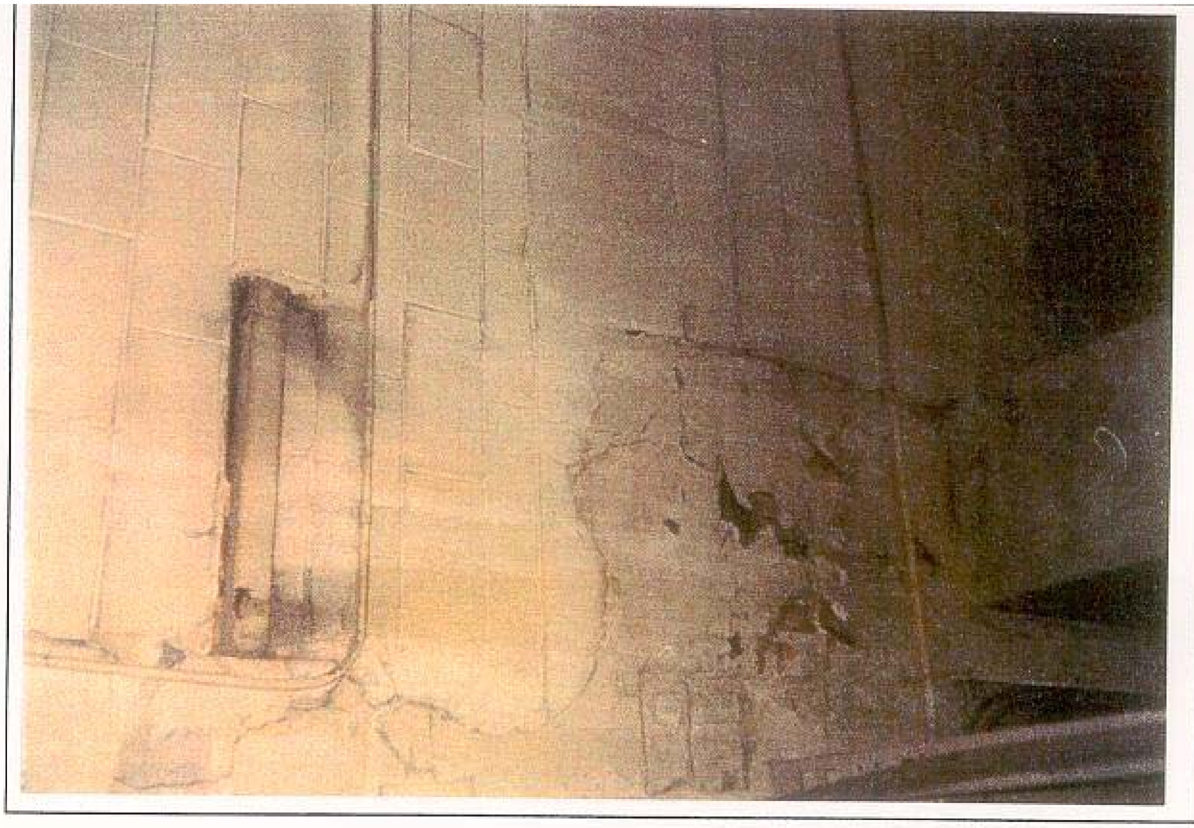


Photo 5: Type of structural deterioration in the building - August 19, 1998

Appendix C
Laboratory Analysis

Laboratory Report

Client:	**ACRES Analytical Ltd.** 360 York Road - Units 1 & 2 Niagara-on-the-Lake, ONT L0S 1J0	Laboratory Project #	ON808358
		Project Manager:	Paul Chopra
		Start Date:	8/27/98
Attention:	Marie Tabaka	Report Date:	8/31/98
Project Ref #	# GNGH & AIL	Analysis Type:	**Bulk Asbestos Analysis by Polarized Light Microscopy**
Purchase Order #			
Project:	**Bulk Sample Analysis**		

Authorized Signature ______________________

☐ Daniel Miller, Senior Microscopist

☐ Paul S. Chopra, Laboratory Manager

Analysis Results Table

Client Sample	CLI Sample # Sample Location / Description *Material Description(s)*	*Asbestos Content*	Analyst Comment *Non-Asbestos Content*	Analyst - Date
The following 3 samples were submitted by ACRES Analytical Ltd. on 8/27/98 and analyzed in accordance with PLM - EPA/600/R-93/116				
1	393187			JR 8/29/98
	100% Black dust	*No Asbestos Detected using PLM*	*54% Cellulose 46% Non-Fibrous Material*	
No asbestos detected in sample				
2	393188			JR 8/29/98
	100% Black dust	*No Asbestos Detected using PLM*	*20% Cellulose 80% Non-Fibrous Material*	
No asbestos detected in sample				
3	393189			JR 8/29/98
	100% Black dust	*No Asbestos Detected using PLM*	*10% Cellulose 90% Non-Fibrous Material*	
No asbestos detected in sample				

Analysis Results Table

Client Sample	CLI Sample #	Sample Location / Description		Analyst Comment	Analyst - Date
		Material Description(s)	*Asbestos Content*	*Non-Asbestos Content*	

Additional testing is recommended for any material which contains <1% asbestos or NOB (non-friable organically bound) bulk materials which are negative or <1% asbestos. Analysis by Polarized Light Microscopy (PLM) has a degree of uncertainty that is dependent on the sample matrix, non-asbestos minerals present, size of the asbestos present, the sample homogeneity and analyst variability. PLM coefficients of variance range from approx. 1.8, at the quantitation limit of 1%, to 0.1 at high fiber concentrations. All PLM analyses must be reviewed with these factors taken into consideration.

CHOPRA-LEE
Incorporated

1815 Love Road
Grand Island, NY 14072
716-773-7625 FAX 716-773-7624

NIST NVLAP Lab # 1208-01

NYS DOH ELAP Lab # 10954

SECTION H
Tab 4

A Performance Target Methodology for the Distribution Feeders of the Newfoundland and Labrador Hydro Electrical System

Prepared by: Ernest Buglar, P.Eng.
System Performance and Protection
TRO Engineering Department
Newfoundland and Labrador Hydro
June 15, 2005

Introduction

A review of the Newfoundland and Labrador Hydro (NLH) isolated and interconnected distribution feeders was compiled in order to identify areas of the electrical system which should be targeted for reliability improvement, and to prioritize and justify capital spending beginning in 2006.

This review of system performance, using the Canadian Electricity Association (CEA) defined indices SAIFI and SAIDI, focused on the feeders of both the interconnected and isolated systems of NLH.

The evaluation identifies poor performers by analyzing the 5-year trends for the feeders in question with reference to the 5-year average performance of the NLH system. Minimum performance benchmarks or targets for the identified poor performers were developed using the outlined methodology.

An extensive compilation of performance indices (SAIFI, SAIDI) for all feeders was completed and served as the foundation for all further analysis. Included in this compilation is the decomposition of all indices into their components (defective equipment, adverse weather, etc) using both five-year averages and specific years of interest.

Performance Analysis Methodology

One of the objectives of the system review was to improve system performance for the greatest number of customers and therefore, a SAIFI index normalized to 500 customers was used for the calculation of feeder rankings. The effect of the normalization is to skew the index towards those feeders with a greater number of customers and is intended to quantify continuity of electrical service. This normalization was used only for the purposes of generating feeder rankings and all other references to a SAIFI or SAIDI index refer to indices calculated in the conventional fashion. The worst performing feeders were then analyzed further for outage trends using conventional indices.

The determination of what constitutes a poorly performing feeder was made through a consideration of the SAIFI index and continuity of electrical service. Although the SAIDI index was not used explicitly in the determination of worst performers, it was considered implicitly, and a ranking using the SAIDI index would have given similar results with respect to the identification of the worst performing feeders.

The SAIFI and SAIDI indices were decomposed into their constituents: Defective Equipment, Loss of Supply, Adverse Weather, Adverse Environment, Other, Planned, Foreign Interference, Lightning, and Human Error. This breakdown was done to facilitate a thorough investigation of feeder performance based on all aspects of the performance indicators reported to the CEA. Any component of the SAIFI or SAIDI index that was anomalous, that is, an unusually high index value for a specific cause (i.e. defective equipment), would then be examined further to identify possible performance improvement strategies.

In general, the failure modes of the feeders were distinctive and could not be identified through use of a composite SAIFI and SAIDI. One such anomaly is the Bear Cove system that has a high outage incidence due to adverse weather. For example, the five year average (1999 to 2003) SAIDI for Bear Cove (line 4) was 9.24 and 5.84 was attributed to adverse weather (approximately 63%). Investigation of a composite index would not have revealed this trend.

Feeder performance indices vary annually in accordance with weather conditions or other factors. This variability makes the data derived from the 5-year averages useful in that it is representative of a feeder's performance over time and will reveal the "character of the feeder", that is, proximity to salt water, typical weather conditions, or common failure modes. For example, poor performance based on weather related causes does not necessarily indicate a below standard feeder since either a new feeder or an old feeder will likely respond in a similar manner to heavy salt contamination or a lightning storm. This is the primary reason for using 5-year averages in the derivation of the performance targets since they are not subject to the same variability as indices based on a single year.

The calculation of the projections for a specific year include a consideration of whether or not there has been maintenance planned for a feeder in either of the years under consideration and for which projections have been constructed (2004, 2005, or 2006). For example, if it is intended to replace 500 insulators on a given line and there are 2000 insulators on that line, then clearly 25% of the insulators are new and free from defect. This being the case, it is reasonable that the performance of the line will improve and outages due to defective equipment related to insulators on the line in question should also decrease. The assumption would then be to decrease the SAIFI and SAIDI defective equipment component by a corresponding 25%. Similarly, there will also be an increase in the planned portion of the index for the year under consideration. These adjustments are approximations and are subject to a margin of error although every effort was made to make reasonable predictions.

It has been assumed that in the quantification of feeder performance, the only equipment on the distribution feeder contributing to failure are the insulators. This is provisionally true as there are also other components (i.e. distribution transformers, poles, cutouts, conductors, etc.), which may contribute to a feeder failure. However, in general, failures to insulators have the potential to cause an outage to an entire line and will affect more customers than failures to the other types of equipment mentioned. Since the objective is to attempt to quantify the performance of the distribution line, it is reasonable to assume that outages (to the line) caused by defective equipment are primarily related to insulator failure, even though, this is an approximation it is considered to be correct for a high percentage of cases.

Conclusion

The performance indices for all feeders comprising the NLH system were examined and the worst performers identified through consideration of a ranking based on the SAIFI index. Performance targets for the identified poor performers were then established based upon 5 – year averages for the individual feeder and the NLH system indices while also giving due consideration to the length of a particular feeder.

The identification and improvement of the least acceptable performers through the establishment of performance benchmarks will, in addition to improving the feeder in question, also improve the system performance. This analysis is an iterative process, which is expected to be repeated in subsequent years and will identify and minimize the effects of poor performers on the system indices.

The SAIFI and SAIDI indices, although indicative of feeder performance, should not be used to impose minimum levels of performance on a given feeder without due consideration for factors external to the actual condition of the equipment involved. Other issues, such as recent or planned maintenance, sleet storms or operational histories are also considered when determining which areas will derive the maximum benefit from any new capital expenditure.

Although the performance indices are the measures used to compare feeders, they are not the only indicator of the condition of a feeder. Therefore, prior to designating a new capital improvement initiative for a specific feeder, all factors affecting system performance should be assessed in conjunction with the performance indicators. Such factors would include and consider the experience of line personnel with first hand experience of the condition of the line. This experience would lead to replacement of only those components that have exhibited operational problems.

The Program

Subsequent to the analysis of feeder performance, the feeder rankings may determine when, in the 5-year plan, the upgrades will be executed. The timing and scheduling of the work is developed with due consideration to whether or not a group of feeders occupy a similar geographical area and are all poor performers. In this case, the selected feeders will be grouped together in the interests of economy and be upgraded at the same time. The rationale is that it is more cost effective to perform maintenance on a group of feeders that are in close geographical proximity, if they are scheduled for maintenance based on their performance, than a grouping of feeders that is widely dispersed.

The bar charts in Appendices 1 and 2 show the performance ranking of the feeders for the interconnected and isolated systems respectively and indicate, with an asterisk, the feeders targeted for upgrades in 2006. The feeders selected for upgrades need not necessarily be at the lower end of the performance spectrum with respect to the evaluation in Appendices 1 and 2. For example, the two worst performing feeders (i.e. EHW1 and HVY7), have both received extensive maintenance over the past few years and it is expected that their respective rankings will improve as the effect of this maintenance manifests itself with improved performance in the calculation of the five-year averages. The feeders selected for maintenance are relatively poor performers and will benefit from the upgrade.

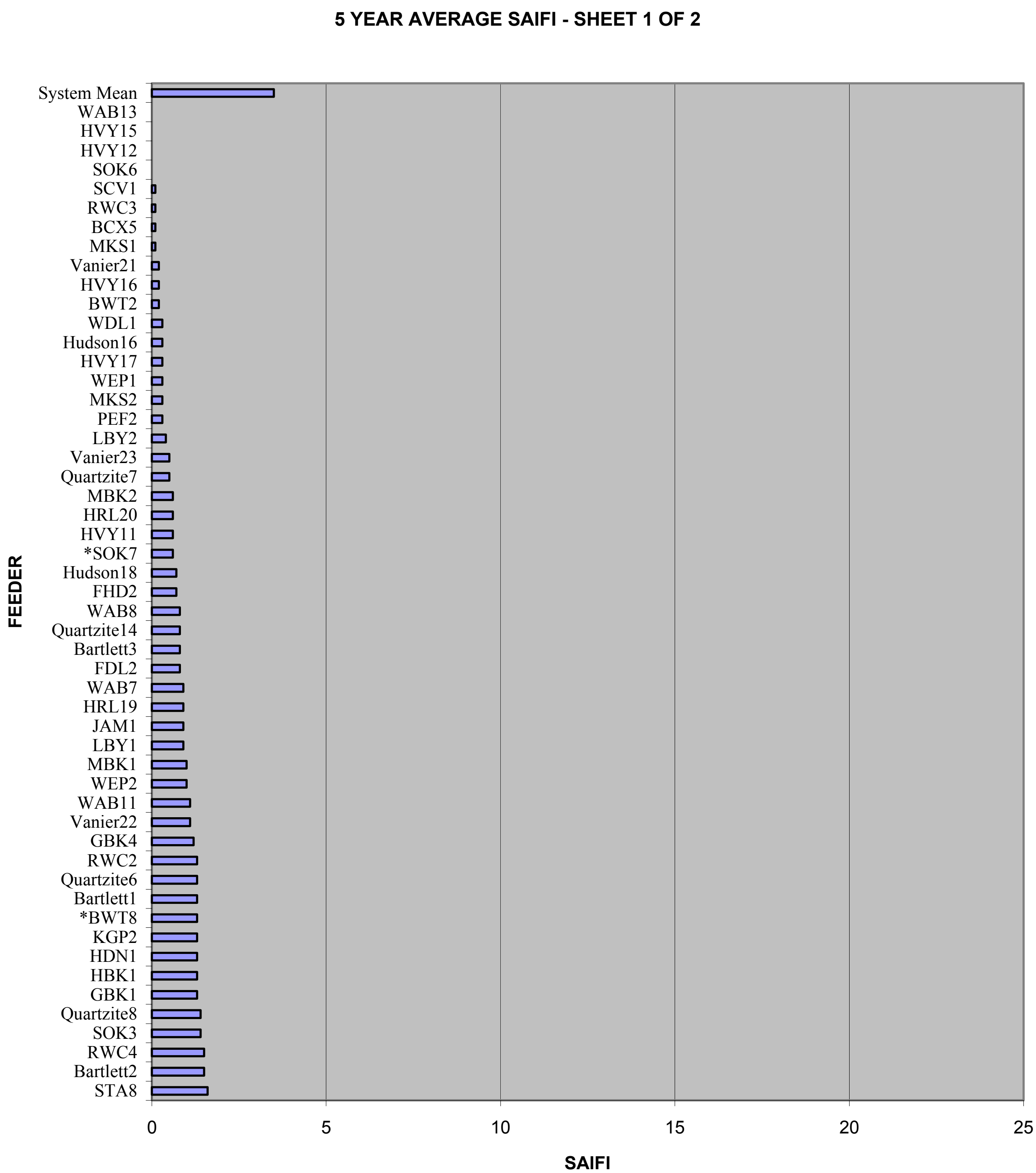
Appendix 3 shows the SAIFI and SAIDI statistics for the individual feeders chosen for upgrades in 2006. The choice of whether or not to perform maintenance on a given feeder may be based on past feeder performance but may also be justified by known operational issues. Notice that in some cases, the 5-year average index may be less than the target developed for the chosen feeder; an example of this can be seen in the statistics for Hawke's Bay Feeder (#20101). The procedure for generating the feeder targets is based upon projections using 5-year averages and comparisons with the performance indices of the NLH electrical system. This methodology is a long-term strategy for system improvement and will admit some variation in results when the performance of a specific feeder is close to that of the system or vice versa. Ultimately, the generation of feeder targets are mechanisms which will respond to the areas of optimum system performance and will be required to decrease to better that performance and thereby that of the system. This phenomenon should be kept in mind when studying these statistics.

Appendix 4 shows the proposed plan for distribution upgrades for the next five years. Associated with this performance upgrade plan, is the routine pole replacement program. The timing of pole replacements is adjusted and aligned with the performance upgrades to take full advantage of contract packaging and construction logistic opportunities. Note that the order and scheduling for these upgrades may change from year to year as the indices are updated and re-evaluated on an annual basis.

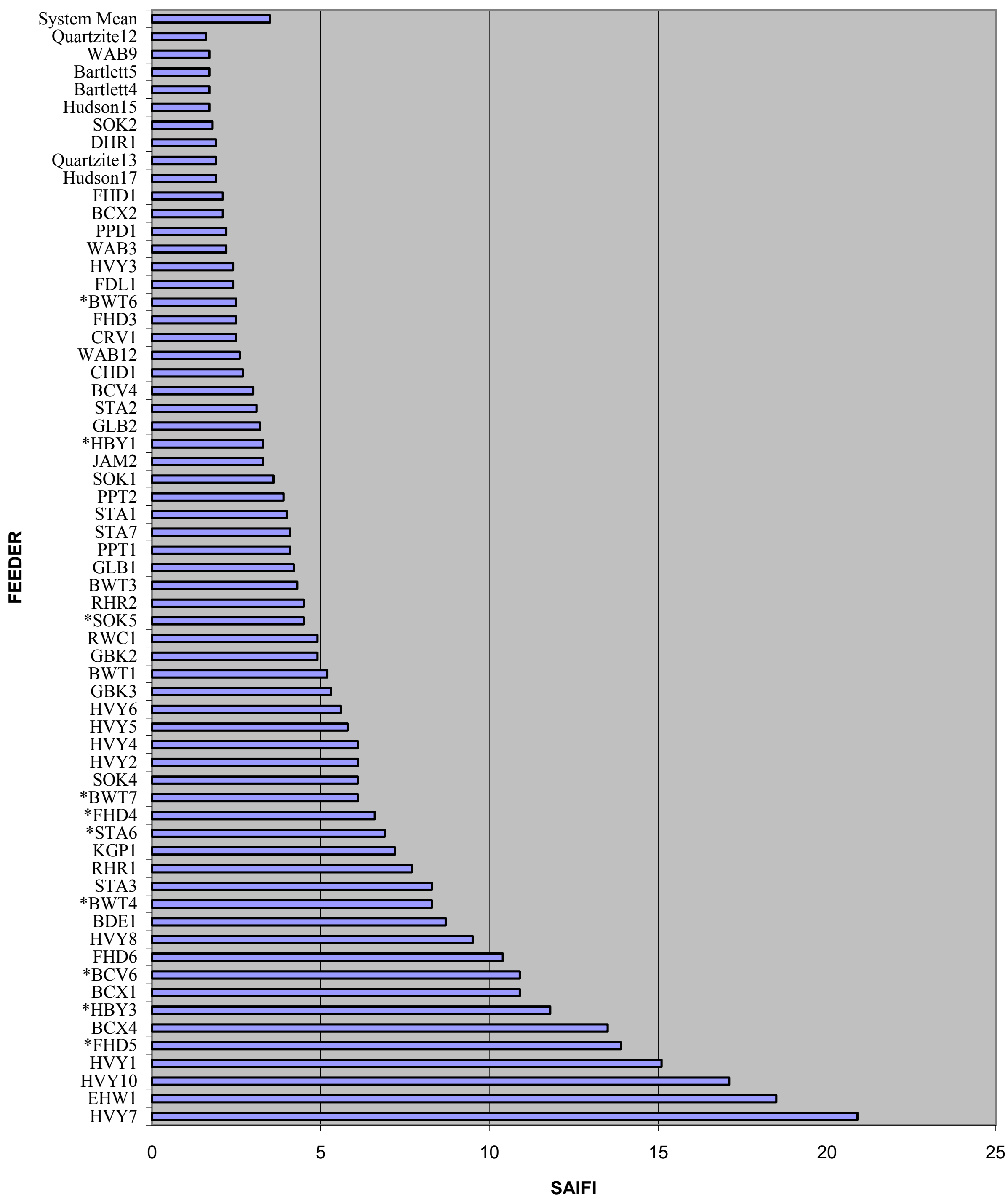
Appendix 1

Appendix 1

5-Year Average Normalized SAIFI (1999 to 2003) – Interconnected Systems



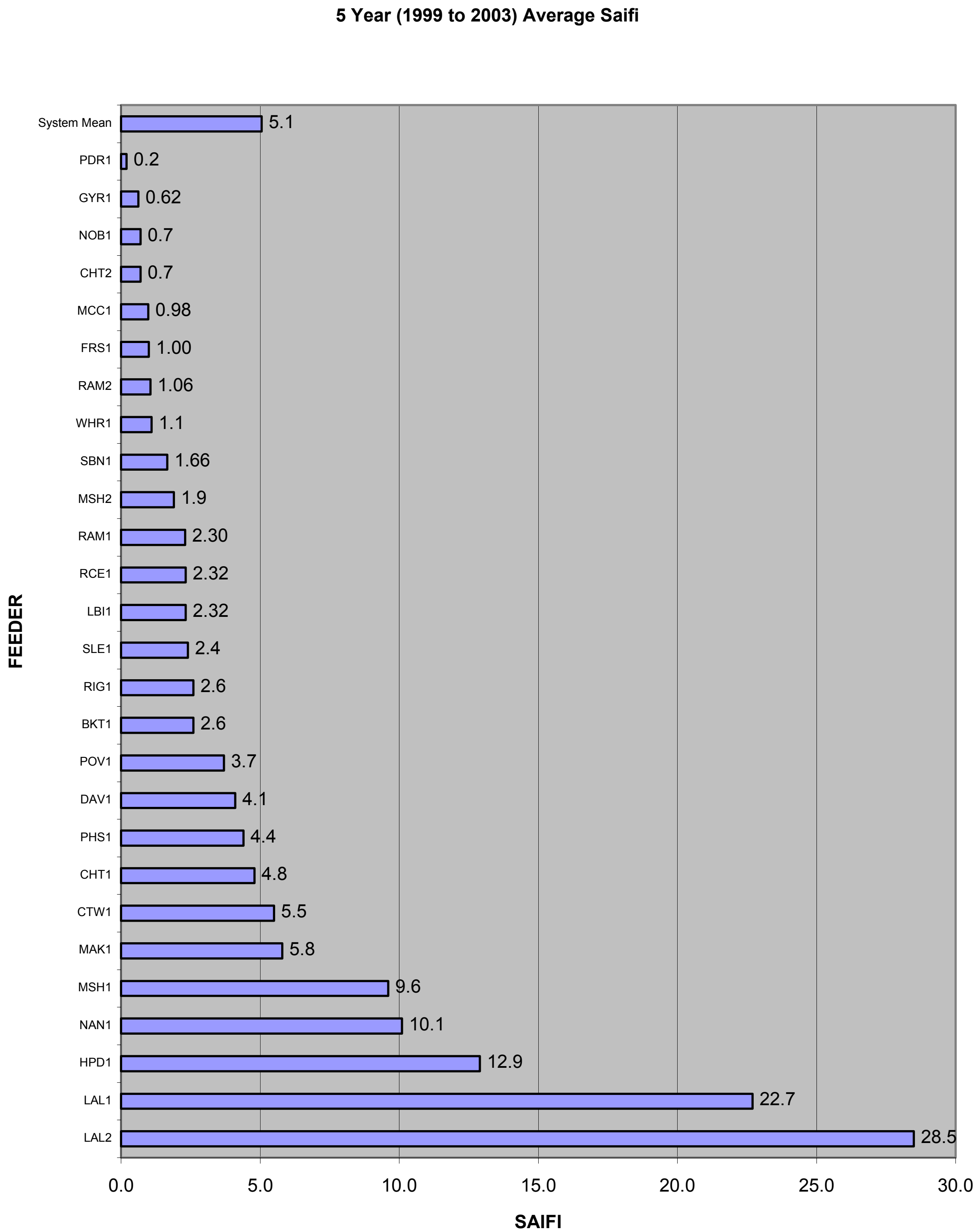
5 YEAR AVERAGE SAIFI - SHEET 2 OF 2



Appendix 2

Appendix 2

5-Year Average Normalized SAIFI (1999 to 2003) – Isolated Systems



Appendix 3

Appendix 3

The following is a tabular compilation of SAIFI and SAIDI data for the feeders proposed in the 2006 capital budget. (All indices are current as of December 31, 2004).

SAIFI Feeder Performance Targets for 2006									
	St. Anthony Feeder: 30106					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.16	0.01	0.16	0.19	0.19	0.52	0.33	0.23	0.26
Planned	2.00	2.81	2.25	2.05	1.54	1.54	1.49	0.35	0.25
Loss of Supply	1.25	0.00	1.25	1.28	1.28	2.69	2.61	0.67	0.84
Tree Contact	0.60	0.00	0.60	0.72	0.05	0.05	0.03	0.26	0.30
Lightning	0.02	0.00	0.02	0.01	0.01	0.53	0.82	0.15	0.08
Defective Equipment	1.35	0.21	2.85	1.27	1.27	1.12	1.49	0.50	0.54
Adverse Weather	1.33	0.04	1.33	0.97	0.78	0.78	0.75	0.26	0.37
Adverse Environment	0.17	0.51	0.17	0.20	0.14	0.14	0.18	0.08	0.10
Human Error	0.22	0.00	0.22	0.26	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.03	0.00	0.03	0.01	0.01	0.13	0.08	0.19	0.22
Total	7.13	3.58	8.88	6.96	5.37	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	St. Anthony Feeder: 30106					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.26	0.02	0.26	0.28	0.28	0.73	0.68	0.24	0.34
Planned	3.15	2.25	3.94	3.22	3.06	3.16	2.60	0.48	0.53
Loss of Supply	0.30	0.00	0.30	0.24	0.24	2.65	2.87	1.40	4.99
Tree Contact	2.15	0.00	2.15	2.57	0.12	0.12	0.05	0.86	1.24
Lightning	0.23	0.00	0.23	0.10	0.10	0.38	0.25	0.29	0.16
Defective Equipment	4.07	0.47	2.85	3.28	2.03	2.03	2.85	0.72	0.81
Adverse Weather	4.22	0.40	4.22	3.57	2.23	2.23	1.97	1.07	2.47
Adverse Environment	1.54	6.22	1.54	1.85	0.48	0.48	0.47	0.11	0.14
Human Error	0.06	0.00	0.06	0.07	0.07	0.08	0.03	0.04	0.07
Foreign Interference	0.03	0.00	0.03	0.01	0.01	0.24	0.14	0.27	0.34
Total	16.01	9.35	15.58	15.20	8.62	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Bear Cove Feeder: 20806					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.83	0.02	0.83	0.99	0.52	0.52	0.33	0.23	0.26
Planned	1.11	0.50	1.11	0.90	0.90	1.54	1.49	0.35	0.25
Loss of Supply	1.20	0.00	1.20	1.24	1.24	2.69	2.61	0.67	0.84
Tree Contact	0.00	0.00	0.00	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.14	0.00	0.14	0.03	0.03	0.53	0.82	0.15	0.08
Defective Equipment	0.62	1.05	0.62	0.69	0.69	1.12	1.49	0.50	0.54
Adverse Weather	4.02	2.97	4.02	4.47	0.78	0.78	0.75	0.26	0.37
Adverse Environment	0.44	1.02	0.44	0.52	0.14	0.14	0.18	0.08	0.10
Human Error	0.00	0.00	0.00	0.00	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.20	0.00	0.20	0.24	0.13	0.13	0.08	0.19	0.22
Total	8.56	5.56	8.56	9.08	4.59	7.58	7.86	2.47	2.67

	Bear Cove Feeder: 20806					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	1.34	0.03	1.34	1.60	0.73	0.73	0.68	0.24	0.34
Planned	2.11	0.52	2.11	1.38	1.38	3.16	2.60	0.48	0.53
Loss of Supply	0.85	0.00	0.85	0.91	0.91	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.26	0.00	0.26	0.08	0.08	0.38	0.25	0.29	0.16
Defective Equipment	1.14	1.45	1.14	1.25	1.25	2.03	2.85	0.72	0.81
Adverse Weather	7.99	9.71	7.99	9.35	2.23	2.23	1.97	1.07	2.47
Adverse Environment	0.50	1.82	0.50	0.58	0.48	0.48	0.47	0.11	0.14
Human Error	0.01	0.00	0.01	0.01	0.01	0.08	0.03	0.04	0.07
Foreign Interference	0.07	0.00	0.07	0.09	0.09	0.24	0.14	0.27	0.34
Total	14.27	13.54	14.27	15.25	7.28	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Hawke's Bay Feeder: 20101					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.01	0.02	0.01	0.01	0.01	0.52	0.33	0.23	0.26
Planned	0.32	0.27	0.32	0.38	0.38	1.54	1.49	0.35	0.25
Loss of Supply	1.19	0.00	1.19	1.24	1.24	2.69	2.61	0.67	0.84
Tree Contact	0.00	0.00	0.00	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.28	0.00	0.28	0.33	0.33	0.53	0.82	0.15	0.08
Defective Equipment	0.60	0.00	0.60	0.71	0.71	1.12	1.49	0.50	0.54
Adverse Weather	0.04	0.01	0.04	0.03	0.03	0.78	0.75	0.26	0.37
Adverse Environment	0.01	0.00	0.01	0.01	0.01	0.14	0.18	0.08	0.10
Human Error	0.20	0.00	0.20	0.24	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.03	0.15	0.03	0.04	0.04	0.13	0.08	0.19	0.22
Total	2.68	0.46	2.68	2.99	2.91	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	Hawke's Bay Feeder: 20101					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.06	0.03	0.06	0.03	0.03	0.73	0.68	0.24	0.34
Planned	1.08	0.22	1.08	1.30	1.30	3.16	2.60	0.48	0.53
Loss of Supply	1.02	0.00	1.02	1.12	1.12	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.84	0.00	0.84	0.94	0.38	0.38	0.25	0.29	0.16
Defective Equipment	1.49	0.00	1.49	1.79	1.79	2.03	2.85	0.72	0.81
Adverse Weather	0.07	0.01	0.07	0.04	0.04	2.23	1.97	1.07	2.47
Adverse Environment	0.06	0.00	0.06	0.04	0.04	0.48	0.47	0.11	0.14
Human Error	0.03	0.00	0.03	0.03	0.03	0.08	0.03	0.04	0.07
Foreign Interference	0.09	0.45	0.09	0.11	0.11	0.24	0.14	0.27	0.34
Total	4.74	0.71	4.74	5.39	4.96	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Hawke's Bay Feeder: 20103					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.46	0.01	0.46	0.33	0.33	0.52	0.33	0.23	0.26
Planned	0.97	0.10	1.46	1.14	1.14	1.54	1.49	0.35	0.25
Loss of Supply	1.20	0.00	1.20	1.24	1.24	2.69	2.61	0.67	0.84
Tree Contact	0.00	0.00	0.00	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.26	0.00	0.26	0.30	0.30	0.53	0.82	0.15	0.08
Defective Equipment	1.89	0.01	1.89	2.07	1.12	1.12	1.49	0.50	0.54
Adverse Weather	0.40	0.01	0.40	0.34	0.34	0.78	0.75	0.26	0.37
Adverse Environment	0.04	0.07	0.04	0.04	0.04	0.14	0.18	0.08	0.10
Human Error	0.20	0.00	0.20	0.24	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.33	0.00	0.33	0.07	0.07	0.13	0.08	0.19	0.22
Total	5.75	0.20	6.24	5.76	4.73	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	Hawke's Bay Feeder: 20103					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	1.00	0.03	1.34	1.60	0.73	0.73	0.68	0.24	0.34
Planned	2.49	0.18	3.74	2.91	2.91	3.16	2.60	0.48	0.53
Loss of Supply	0.80	0.00	0.80	0.85	0.85	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.37	0.00	0.37	0.36	0.36	0.38	0.25	0.29	0.16
Defective Equipment	3.46	0.01	2.60	3.53	2.03	2.03	2.85	0.72	0.81
Adverse Weather	0.66	0.01	0.66	0.67	0.67	2.23	1.97	1.07	2.47
Adverse Environment	0.07	0.12	0.05	0.06	0.06	0.48	0.47	0.11	0.14
Human Error	0.02	0.00	0.02	0.02	0.02	0.08	0.03	0.04	0.07
Foreign Interference	0.64	0.01	0.64	0.13	0.13	0.24	0.14	0.27	0.34
Total	9.51	0.36	10.22	10.13	7.88	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	South Brook Feeder: 10105					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.25	0.20	0.25	0.29	0.29	0.52	0.33	0.23	0.26
Planned	1.23	0.00	1.23	1.38	1.38	1.54	1.49	0.35	0.25
Loss of Supply	0.96	0.00	0.96	1.16	1.16	2.69	2.61	0.67	0.84
Tree Contact	0.35	1.74	0.35	0.42	0.05	0.05	0.03	0.26	0.30
Lightning	0.00	0.00	0.00	0.01	0.01	0.53	0.82	0.15	0.08
Defective Equipment	0.33	0.19	0.33	0.39	0.39	1.12	1.49	0.50	0.54
Adverse Weather	0.35	0.74	0.35	0.37	0.37	0.78	0.75	0.26	0.37
Adverse Environment	0.11	0.09	0.11	0.13	0.13	0.14	0.18	0.08	0.10
Human Error	0.00	0.00	0.00	0.00	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.01	0.02	0.01	0.01	0.01	0.13	0.08	0.19	0.22
Total	3.59	2.96	3.59	4.16	3.90	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	South Brook Feeder: 10105					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.39	0.21	0.39	0.45	0.45	0.73	0.68	0.24	0.34
Planned	3.20	0.00	3.20	3.66	3.16	3.16	2.60	0.48	0.53
Loss of Supply	2.31	0.00	2.31	2.78	2.65	2.65	2.87	1.40	4.99
Tree Contact	0.37	1.86	0.37	0.45	0.12	0.12	0.05	0.86	1.24
Lightning	0.02	0.00	0.02	0.03	0.03	0.38	0.25	0.29	0.16
Defective Equipment	2.51	1.02	2.51	3.00	2.03	2.03	2.85	0.72	0.81
Adverse Weather	2.17	1.84	2.17	1.95	1.95	2.23	1.97	1.07	2.47
Adverse Environment	0.15	0.08	0.15	0.17	0.17	0.48	0.47	0.11	0.14
Human Error	0.00	0.00	0.00	0.00	0.08	0.08	0.03	0.04	0.07
Foreign Interference	0.03	0.13	0.03	0.04	0.04	0.24	0.14	0.27	0.34
Total	11.15	5.14	11.15	12.51	10.67	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	South Brook Feeder: 10107					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.25	0.02	0.25	0.29	0.29	0.52	0.33	0.23	0.26
Planned	1.21	0.00	1.21	1.04	1.04	1.54	1.49	0.35	0.25
Loss of Supply	0.46	0.00	0.46	0.55	0.55	2.69	2.61	0.67	0.84
Tree Contact	0.20	1.01	0.20	0.24	0.05	0.05	0.03	0.26	0.30
Lightning	0.01	0.01	0.01	0.02	0.02	0.53	0.82	0.15	0.08
Defective Equipment	0.45	1.00	0.45	0.54	0.54	1.12	1.49	0.50	0.54
Adverse Weather	0.00	0.00	0.00	0.00	0.78	0.78	0.75	0.26	0.37
Adverse Environment	0.00	0.00	0.00	0.00	0.14	0.14	0.18	0.08	0.10
Human Error	0.43	0.00	0.43	0.31	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.00	0.01	0.00	0.00	0.13	0.13	0.08	0.19	0.22
Total	3.02	2.06	3.02	2.99	3.64	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	South Brook Feeder: 10107					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.46	0.05	0.46	0.51	0.51	0.73	0.68	0.24	0.34
Planned	3.14	0.00	3.14	2.33	2.33	3.16	2.60	0.48	0.53
Loss of Supply	2.75	0.00	2.75	3.30	2.65	2.65	2.87	1.40	4.99
Tree Contact	0.34	1.69	0.34	0.40	0.12	0.12	0.05	0.86	1.24
Lightning	0.08	0.02	0.08	0.08	0.08	0.38	0.25	0.29	0.16
Defective Equipment	1.41	2.08	1.41	1.69	1.69	2.03	2.85	0.72	0.81
Adverse Weather	0.00	0.00	0.00	0.00	2.23	2.23	1.97	1.07	2.47
Adverse Environment	0.00	0.00	0.00	0.00	0.48	0.48	0.47	0.11	0.14
Human Error	0.13	0.00	0.13	0.04	0.04	0.08	0.03	0.04	0.07
Foreign Interference	0.00	0.02	0.00	0.00	0.24	0.24	0.14	0.27	0.34
Total	8.32	3.86	8.32	8.37	10.38	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Farewell Head Feeder: 11004					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.02	0.00	0.02	0.02	0.02	0.52	0.33	0.23	0.26
Planned	1.51	1.01	1.51	1.08	1.08	1.54	1.49	0.35	0.25
Loss of Supply	2.86	2.00	2.86	2.17	2.17	2.69	2.61	0.67	0.84
Tree Contact	0.00	0.00	0.00	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.21	0.00	0.21	0.25	0.25	0.53	0.82	0.15	0.08
Defective Equipment	1.54	0.02	1.54	1.12	1.12	1.12	1.49	0.50	0.54
Adverse Weather	1.07	1.04	1.07	1.28	0.78	0.78	0.75	0.26	0.37
Adverse Environment	0.26	0.03	0.26	0.27	0.14	0.14	0.18	0.08	0.10
Human Error	0.00	0.00	0.00	0.00	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.38	0.00	0.38	0.28	0.13	0.13	0.08	0.19	0.22
Total	7.86	4.11	7.86	6.47	5.85	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	Farewell Head Feeder: 11004					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.02	0.00	1.34	1.60	0.73	0.73	0.68	0.24	0.34
Planned	4.44	2.69	5.78	3.32	3.16	3.16	2.60	0.48	0.53
Loss of Supply	6.14	4.09	6.14	3.62	2.65	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.21	0.00	0.21	0.25	0.25	0.38	0.25	0.29	0.16
Defective Equipment	7.23	0.01	3.30	3.84	2.03	2.03	2.85	0.72	0.81
Adverse Weather	6.34	4.80	6.34	7.41	2.23	2.23	1.97	1.07	2.47
Adverse Environment	0.70	0.02	0.87	0.63	0.48	0.48	0.47	0.11	0.14
Human Error	0.00	0.00	0.00	0.00	0.08	0.08	0.03	0.04	0.07
Foreign Interference	0.21	0.00	0.21	0.16	0.16	0.24	0.14	0.27	0.34
Total	25.29	11.61	24.19	20.83	11.89	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Farewell Head Feeder: 11005					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.24	0.00	0.24	0.29	0.29	0.52	0.33	0.23	0.26
Planned	1.67	1.18	1.67	1.20	1.20	1.54	1.49	0.35	0.25
Loss of Supply	3.40	2.00	3.40	2.28	2.28	2.69	2.61	0.67	0.84
Tree Contact	0.00	0.00	0.00	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.41	0.00	0.41	0.29	0.29	0.53	0.82	0.15	0.08
Defective Equipment	1.55	1.24	1.55	1.61	1.12	1.12	1.49	0.50	0.54
Adverse Weather	2.73	1.80	2.73	2.85	0.78	0.78	0.75	0.26	0.37
Adverse Environment	0.67	1.00	0.67	0.80	0.14	0.14	0.18	0.08	0.10
Human Error	0.20	0.00	0.20	0.24	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.40	0.00	0.40	0.28	0.13	0.13	0.08	0.19	0.22
Total	11.27	7.23	11.27	9.84	6.38	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	Farewell Head Feeder: 11005					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	1.34	0.03	1.34	1.60	0.73	0.73	0.68	0.24	0.34
Planned	3.85	4.23	5.78	3.05	3.05	3.16	2.60	0.48	0.53
Loss of Supply	8.18	4.07	8.18	4.02	2.65	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.49	0.00	0.49	0.38	0.38	0.38	0.25	0.29	0.16
Defective Equipment	4.18	2.52	3.30	4.57	2.03	2.03	2.85	0.72	0.81
Adverse Weather	10.89	7.12	10.89	11.87	2.23	2.23	1.97	1.07	2.47
Adverse Environment	1.10	0.76	0.87	1.12	0.48	0.48	0.47	0.11	0.14
Human Error	0.42	0.00	0.42	0.51	0.08	0.08	0.03	0.04	0.07
Foreign Interference	0.64	0.00	0.64	0.49	0.24	0.24	0.14	0.27	0.34
Total	31.09	18.73	31.91	27.60	11.99	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Bottom Waters Feeder: 10204					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.69	1.36	0.69	0.62	0.52	0.52	0.33	0.23	0.26
Planned	3.79	1.05	3.79	3.74	1.54	1.54	1.49	0.35	0.25
Loss of Supply	1.21	0.00	1.21	0.85	0.85	2.69	2.61	0.67	0.84
Tree Contact	0.00	0.00	0.00	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.02	0.00	0.02	0.02	0.02	0.53	0.82	0.15	0.08
Defective Equipment	2.32	0.00	2.32	2.58	1.12	1.12	1.49	0.50	0.54
Adverse Weather	0.40	1.00	0.40	0.28	0.28	0.78	0.75	0.26	0.37
Adverse Environment	0.00	0.00	0.00	0.00	0.14	0.14	0.18	0.08	0.10
Human Error	0.00	0.00	0.00	0.00	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.01	0.00	0.01	0.01	0.01	0.13	0.08	0.19	0.22
Total	8.43	3.41	8.43	8.11	4.64	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	Bottom Waters Feeder: 10204					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.84	1.27	0.84	0.74	0.73	0.73	0.68	0.24	0.34
Planned	11.45	4.08	11.45	11.67	3.16	3.16	2.60	0.48	0.53
Loss of Supply	2.78	0.00	2.78	2.32	2.32	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.14	0.00	0.14	0.17	0.17	0.38	0.25	0.29	0.16
Defective Equipment	4.93	0.00	4.93	5.25	2.03	2.03	2.85	0.72	0.81
Adverse Weather	4.20	1.00	4.20	1.04	1.04	2.23	1.97	1.07	2.47
Adverse Environment	0.00	0.00	0.00	0.00	0.48	0.48	0.47	0.11	0.14
Human Error	0.00	0.00	0.00	0.00	0.08	0.08	0.03	0.04	0.07
Foreign Interference	0.03	0.00	0.03	0.04	0.04	0.24	0.14	0.27	0.34
Total	24.38	6.35	24.38	21.22	10.17	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Bottom Waters Feeder: 10206					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.45	1.02	0.45	0.53	0.52	0.52	0.33	0.23	0.26
Planned	2.45	3.99	2.45	2.24	1.54	1.54	1.49	0.35	0.25
Loss of Supply	1.00	0.00	1.00	0.60	0.60	2.69	2.61	0.67	0.84
Tree Contact	0.00	0.00	0.00	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.00	0.00	0.00	0.00	0.53	0.53	0.82	0.15	0.08
Defective Equipment	2.07	2.28	2.07	2.37	1.12	1.12	1.49	0.50	0.54
Adverse Weather	1.24	1.01	1.24	1.49	0.78	0.78	0.75	0.26	0.37
Adverse Environment	0.41	2.02	0.41	0.49	0.14	0.14	0.18	0.08	0.10
Human Error	0.00	0.00	0.00	0.00	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.40	1.00	0.40	0.48	0.13	0.13	0.08	0.19	0.22
Total	8.03	11.33	8.03	8.21	5.52	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	Bottom Waters Feeder: 10206					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.51	1.03	0.51	0.60	0.60	0.73	0.68	0.24	0.34
Planned	5.68	11.06	5.68	4.54	3.16	3.16	2.60	0.48	0.53
Loss of Supply	3.47	0.00	3.47	2.24	2.24	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.00	0.00	0.00	0.00	0.38	0.38	0.25	0.29	0.16
Defective Equipment	3.67	2.49	3.67	4.03	2.03	2.03	2.85	0.72	0.81
Adverse Weather	3.63	4.66	3.63	4.36	2.23	2.23	1.97	1.07	2.47
Adverse Environment	0.38	1.80	0.38	0.44	0.44	0.48	0.47	0.11	0.14
Human Error	0.00	0.00	0.00	0.00	0.08	0.08	0.03	0.04	0.07
Foreign Interference	1.46	7.00	1.46	1.75	0.24	0.24	0.14	0.27	0.34
Total	18.80	28.03	18.80	17.96	11.52	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Bottom Waters Feeder: 10207					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.61	2.03	0.61	0.74	0.52	0.52	0.33	0.23	0.26
Planned	2.61	2.08	2.61	2.91	1.54	1.54	1.49	0.35	0.25
Loss of Supply	1.40	0.00	1.40	0.69	0.69	2.69	2.61	0.67	0.84
Tree Contact	0.01	0.00	0.01	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.00	0.00	0.00	0.00	0.53	0.53	0.82	0.15	0.08
Defective Equipment	1.05	1.23	1.05	1.26	1.12	1.12	1.49	0.50	0.54
Adverse Weather	1.11	0.00	1.11	1.30	0.78	0.78	0.75	0.26	0.37
Adverse Environment	0.41	2.03	0.41	0.49	0.14	0.14	0.18	0.08	0.10
Human Error	0.00	0.00	0.00	0.00	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.41	1.02	0.41	0.49	0.13	0.13	0.08	0.19	0.22
Total	7.62	8.39	7.62	7.89	5.61	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	Bottom Waters Feeder: 10207					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	1.08	4.31	1.08	1.30	0.73	0.73	0.68	0.24	0.34
Planned	3.35	5.78	3.35	3.32	3.16	3.16	2.60	0.48	0.53
Loss of Supply	4.51	0.00	4.51	2.46	2.46	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.00	0.00	0.00	0.00	0.38	0.38	0.25	0.29	0.16
Defective Equipment	2.34	2.39	2.34	2.81	2.03	2.03	2.85	0.72	0.81
Adverse Weather	3.03	0.00	3.03	3.58	2.23	2.23	1.97	1.07	2.47
Adverse Environment	0.37	1.80	0.37	0.44	0.44	0.48	0.47	0.11	0.14
Human Error	0.00	0.00	0.00	0.00	0.08	0.08	0.03	0.04	0.07
Foreign Interference	1.47	7.02	1.47	1.76	0.24	0.24	0.14	0.27	0.34
Total	16.17	21.31	16.17	15.66	11.87	12.09	11.91	5.18	10.65

SAIFI Feeder Performance Targets for 2006									
	Bottom Waters Feeder: 10208					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.28	0.05	0.28	0.33	0.33	0.52	0.33	0.23	0.26
Planned	2.53	1.14	2.53	2.56	1.54	1.54	1.49	0.35	0.25
Loss of Supply	1.60	0.00	1.60	0.93	0.93	2.69	2.61	0.67	0.84
Tree Contact	0.00	0.00	0.00	0.00	0.05	0.05	0.03	0.26	0.30
Lightning	0.00	0.00	0.00	0.00	0.53	0.53	0.82	0.15	0.08
Defective Equipment	1.98	0.12	1.98	2.17	1.12	1.12	1.49	0.50	0.54
Adverse Weather	0.54	0.33	0.54	0.18	0.18	0.78	0.75	0.26	0.37
Adverse Environment	0.00	0.00	0.00	0.00	0.14	0.14	0.18	0.08	0.10
Human Error	0.20	0.00	0.20	0.25	0.11	0.11	0.10	0.06	0.10
Foreign Interference	0.02	0.05	0.02	0.02	0.02	0.13	0.08	0.19	0.22
Total	7.15	1.70	7.15	6.44	4.95	7.58	7.86	2.47	2.67

SAIDI Feeder Performance Targets for 2006									
	Bottom Waters Feeder: 10208					NLH and CEA			
CAUSE	5 Year Average 2000 to 2004	2004	2005 Projection	2006 Projection	Future Target	NLH 5 year Average 1999 to 2003	NLH 2003	CEA 5 Year Average 1999 to 2003	CEA 2003
Unknown	0.34	0.10	0.34	0.40	0.40	0.73	0.68	0.24	0.34
Planned	7.49	4.35	7.49	7.26	3.16	3.16	2.60	0.48	0.53
Loss of Supply	4.66	0.00	4.66	2.67	2.65	2.65	2.87	1.40	4.99
Tree Contact	0.00	0.00	0.00	0.00	0.12	0.12	0.05	0.86	1.24
Lightning	0.00	0.00	0.00	0.00	0.38	0.38	0.25	0.29	0.16
Defective Equipment	4.91	0.74	4.91	5.23	2.03	2.03	2.85	0.72	0.81
Adverse Weather	1.34	0.89	1.34	0.47	0.47	2.23	1.97	1.07	2.47
Adverse Environment	0.00	0.00	0.00	0.00	0.48	0.48	0.47	0.11	0.14
Human Error	0.09	0.00	0.09	0.11	0.08	0.08	0.03	0.04	0.07
Foreign Interference	0.17	0.28	0.17	0.21	0.21	0.24	0.14	0.27	0.34
Total	19.01	6.36	19.01	16.35	9.98	12.09	11.91	5.18	10.65

Appendix 4

Appendix 4

RURAL SYSTEMS
2006 CAPITAL BUDGET & 5 YEAR PLAN – DISTRIBUTION FEEDER UPGRADES
($,000)

PROJECT DESCRIPTION	2006	2007	2008	2009	2010	Total
CENTRAL REGION - DISTRIBUTION						
Replace Insulators - South Brook Distribution System	441					441
Replace Insulators - L4 & L5 - Farewell Head Distribution System	261					261
Replace Insulators - L4 & L6 Bottom Waters Distribution System	198					198
Replace Poles L1- Bottom Waters Distribution System	152					152
Replace Insulators - L7 & L8 Bottom Waters Distribution System	121					121
Replace Distribution Line - Seal Cove to Pass Island		536				536
Upgrade Distribution System - L2 & L3 Farewell Head		277				277
Replace Poles - Barachoix Distribution System		225				225
Replace Poles L2 & L3 - Farewell Head Distribution System		225				225
Replace Distribution Line - Brighton		189				189
Replace Poles - St. Brendan's Distribution System		156				156
Replace Insulators - L4 Barachoix Distribution System		117				117
Replace Insulators - L1 & L2 Jacksons Arm - L1 Hampden			496			496
Replace Poles - South Brook Distribution System			324			324
Replace Poles - Bay D'Espoir Distribution System			229			229
Install Remote Control Unit - Change Islands			217			217
Replace Insulators - L2 Westport Distribution System			82			82
Replace Insulators - Upper Salmon Distribution System				229		229
Replace Insulators - L1 Hind's Lake				167		167
Replace Insulators - Coney Arm Distribution System				119		119
Replace Insulators - L2 Little Bay Distribution System				83		83
NORTHERN REGION - DISTRIBUTION						
Upgrade Distribution System - L6 St. Anthony	778					778
Upgrade Distribution System - L6 Bear Cove	578					578
Upgrade Distribution System - L1 & L3 Hawkes Bay	380					380
Install Substation P.T. - Mary's Harbour	19					19
Upgrade Distribution System - L1 & L2 Rocky Harbour		514				514
Upgrade Distribution System - L1 & L2 St. Anthony		364				364
Upgrade Distribution System - Mary's Harbour			227			227
Upgrade Distribution System - Port Hope Simpson			176			176
Upgrade Distribution System - L4 Bear Cove			143			143
Upgrade Distribution System - L7 St. Anthony				400		400
Upgrade Distribution System - L1 Cow Head				362		362
Upgrade Distribution System - L1 Parson's Pond				251		251
Upgrade Distribution System - Charlottetown				174		174
Upgrade Distribution System - L1 Glenburnie				496		496
Upgrade Distribution System - L1 Plum Point				896		896
Upgrade Distribution System - L2 Glenburnie					711	711
Upgrade Distribution System - L2 Plum Point					913	913
LABRADOR REGION - DISTRIBUTION						
Purchase and Install Voltage Regulator L7 - Happy Valley	122					122
Rebuild Distribution System - Black Tickle	282					282
Replace Poles (Hebron Section) - Nain	179					179
Upgrade Distribution Line - Aliant VOR Site - Wabush			96			96
TOTAL	3,511	2,603	1,990	3,177	1,624	12,905

SECTION H
Tab 5

ST. LEWIS DIESEL PLANT

CONDITION ASSESSMENT
AND
INVESTIGATION OF REPLACEMENT ALTERNATIVES

Prepared by: **G.W. Lundrigan, P. Eng.**
Engineering Design Department
Transmission & Rural Operations Division
June 17, 2005

Table of Contents

1.0 SUMMARY

The existing plant has three diesel units installed inside the diesel hall and a mobile diesel unit installed outside the building. This mobile diesel was put in place in 1997 to meet growing power requirements and, due to inadequate space inside the building, was set up outside adjacent to the substation.

The existing plant building which is of wood framed construction with plywood cladding is 35 years old, and is in a deteriorated condition. The floor area, wall area and ceiling height are completely inadequate for the installation and operation of equipment necessary in a power plant of this capacity. The existing congested conditions are a result of increased energy requirements of the community over the years requiring the installation of larger units and auxiliary equipment. As well, the design criteria for diesel plants have changed significantly since this plant was built.

The lack of space results in operational and maintenance tasks being performed in close proximity to operating equipment which exposes workers to unsafe conditions. Noise and ventilation conditions are also substandard.

Alternatives considered were 1) upgrade of existing plant, 2) re-build of existing plant while it continued to operate, 3)interconnection to either Port Hope Simpson or Mary's Harbour or 4) construct a new plant on the existing property.

The recommendation is that a new plant be constructed on the existing property and that the old plant remain in operation during the construction period. One engine would be moved from the old plant to be installed in the new plant with the two new units. The plant would be designed in early 2006, with a construction contract tender and award in the spring of 2006 with an in-service date of October 2006.

2.0 GENERAL

The main areas of concern with the existing plant can be summarized under the following headings:

- Structural / Cladding
- Inadequate Floor Area
- Inadequate Wall Area
- Lack of Separate Control Room
- Inadequate Ceiling Height
- Inadequate Ventilation
- Inadequate Insulation
- Noise Issues
- Inadequate Storage
- Fire Prevention
- Environment
- Safety

3.0 EXISTING PLANT DEFICIENCIES

3.1 Structural / Cladding

Although there are no major concerns with respect to the structural strength of the building, the plywood cladding is in a deteriorated condition and would need replacement or covering by metal siding. Doors and windows need to be replaced. The roof leaks. The walls and roof are penetrated in a number of areas to accommodate fuel piping, exhausts, ventilation fans and electrical wiring and it is very difficult to seal these areas against snow and rain. Other openings which were used in the past and which have since being abandoned are patched but are also difficult to seal.

3.2 Inadequate Floor Area

The floor area of the existing diesel hall is approximately 65 m^2 as compared to the current design criteria of 140 m^2 for a similar capacity plant. This has resulted in the units having inadequate spacing such that operational and maintenance tasks must be performed in close proximity to operating equipment giving rise to safety concerns. The minimum distance of : 0.9 meters between front of units and the plant walls or auxiliary systems mounted on walls; 1.7 meters between the gensets; and 3.1 meters between rear of units and plant wall for laydown areas during major overhauls are not available in St Lewis.

3.3 Inadequate Wall Area

The wall area is insufficient for the amount of equipment /panels which need to be mounted. Over the years, the necessity to make use of any bare wall space has resulted in an unorganized, cluttered installation of equipment with a resulting spider web of pipes and wiring. At present there is no available wall space to install any new equipment. New modern switchgear cannot be installed as it is larger and requires more space both for installation and maintenance.

The wall area in the existing diesel hall is approximately 82 m^2 as compared to the existing design criteria of 175 m^2 for a similar capacity plant

3.4 Lack of Separate Control Room

Hydro's standard is to have unit switchgear installed in a separate control room both as a safety measure and to provide a clean environment for the equipment. In St Lewis the switchgear is located in the diesel hall and in the case of an emergency such as a fire in the diesel hall, the plant operator would have to enter the diesel hall to shut down the plant. Also, the mobile unit controls are mounted at the mobile and remote from the operators.

3.5 Inadequate Ceiling Height

The ceiling height in the existing plant is 2.43 m as compared to the design criteria of 3.6 m. The inadequate floor area and ceiling height prevents the installation of overhead lifting devices suitable to perform the heavy lifts of engine parts during maintenance and major overhauls. This results in personnel using improvised lifting devices and exposing themselves to unsafe conditions which could result in damage to equipment or injury. Normal design criteria is that a lifting device capable of lifting the heaviest of the dismantled parts of a genset be installed in each diesel plant. This capability cannot be accommodated in the existing plant.

3.6 Inadequate Ventilation

The size of the engine hall does not permit the installation of an adequate ventilation system to obtain the number of air exchanges necessary to adequately cool the units under warm summer conditions. This results in overheating of the units and a subsequent derating and reduction in maximum power they can produce. In the summer, plant doors are kept open in an attempt to obtain cooling air. The volume of the St Lewis diesel hall is approximately 160 cubic meters as compared to the design criteria of approximately 510 cubic meters.

3.7 Inadequate Insulation

In the winter when the mobile unit is running and the units inside the plant are idle, it is impossible to retain heat in the plant. This is due to inadequate insulation and the difficulty of sealing of areas where the roof and walls are penetrated to accommodate equipment and piping. This creates startup problems when engines inside the plant become very cold. Admittedly, this is an unusual situation and would only happen if the units inside the plant had to be taken offline due to a significant problem.

3.8 Noise Issues

The existing plant's office and workshop areas are add-ons and are not adequately constructed to meet the noise criteria standard of 65 dBA.

3.9 Inadequate Storage

The storage room is too small to adequately store the plant supplies such as engine filters, etc. In addition, rain and snow infiltrates the structure and supplies get wet.

3.10 Fire Protection

The plant's structural members and siding, have become tinder dry, due to excessive build up of heat in the engine hall, and this combined with the congestion of electrical equipment and inadequately spaced gensets operating at elevated temperatures results in conditions condusive to a catastrophic fire.

3.11 Environment

The existing plant foundation is not constructed to contain fuel within the building should there be a spill, nor can it be modified to do so. This secondary containment feature which consists of a curb constructed on the foundation and which provides adequate sealing of all foundation openings is a requirement of all new plants. A fuel spill inside the existing plant could get outside the building. There are no spill containment capabilities in the existing plant.

3.12 Safety

Safety issues are addressed under other headings in this section and as such will not be discussed further.

4.0 GENERATION --- ALTERNATIVES INVESTIGATED

The generation alternatives investigated are:

- Upgrade of existing plant
- Rebuild of existing plant while it continues to operate
- Interconnection to Port Hope Simpson or Mary's Harbour
- Construct new plant on existing property.

The upgrade of the existing plant was eliminated as the existing structure is in a deteriorated condition and the floor area, wall area and ceiling heights are inadequate such that no amount of adjustment would produce any significant improvement.

The rebuilding of the old plant while it continued to operate was eliminated as past experience at other sites have highlighted the safety and schedule issues connected with this type of construction. The safety precautions required while constructing over and around operating equipment made for very slow progress and hence significantly increased the duration of the construction period and costs of the project. The Grey River plant was constructed in this manner as there was no other site available in the community. This is not the case in St Lewis as a new site is readily available on the existing property.

The alternative of removing the existing plant and supplying the St Lewis Distribution System from either Port Hope Simpson or Mary's Harbour via a new distribution was studied. Over a thirty (30) year study period, it was not cost effective when compared to the construction and operation of a new diesel plant.. Major costs in the interconnection scenario were the construction of the distribution line and the expansion of generating capacity at either Port Hope Simpson or Mary's Harbour to carry the increase load demand by St Lewis. Please refer to Appendix 1 the Port Hope Simpson Interconnection, Economic Analysis.

The fourth alternative investigated was to build a new diesel plant within the boundaries of Hydro's existing fenced property, in close proximity to the existing tank farm. This would be a pre-engineered building to house three units with space to add a fourth unit with a control room, a washroom, an office, a workshop and a kitchen/lunchroom.

5.0 Conclusions and Recommendations

The existing plant falls well below Hydro's present operating standards and design criteria and there is no practical method of upgrading it to meet them. This combined with the requirement for two of the existing units to be replaced with larger units only exasperates the situation.

The interconnection to Mary's Harbour or Port Hope Simpson is not cost effective over a thirty year study period when compared to the construction of a new plant; hence, the recommendation is that a new plant be constructed on the existing fenced property to coincide with the proposed replacement of two diesel gensets in 2006.

The construction of a new plant is proposed for within the fenced area of our existing property, adjacent to the existing tank farm. The proposed site is expected to meet the approval of the St. Lewis Council. Preliminary discussions with the Council will start in 2005. If project costs increase significantly due to unforeseen Council requirements, then the project proposal for the new plant will be re-estimated and re-evaluated against the other alternatives.

6.0 Photos

Photo # 1—St Lewis Diesel Plant Site showing a) Plant (Blue Bldg to the right with Mobile Unit (White Bldg. in front of Plant), b) Hydro Fuel Storage Tank Farm (6 Horizontal Tanks to the left).

The Blue Building and Three Vertical Tanks in the foreground are owned by the Canadian Coast Guard.

Photo #2---St Lewis Diesel Plant ---Note Extensions a) Office to the right and b) Storage Room to the left and rear.

Photo #3—St Lewis Plant—Front View

Photo #4—St Lewis Plant—Rear View Showing Deterioration of Siding

Photo #5—St Lewis Plant—Rear View Showing Wall Penetrations

Photo #6—St Lewis Plant—Rear View

Photo #7—St Lewis Plant—Rear View Showing Office & Kitchen Extensions

Photo #8—St Lewis Plant—Mobile Unit & Line Storage Building

Photo #9—St Lewis Plant—Interior View Showing Wooden Trusses

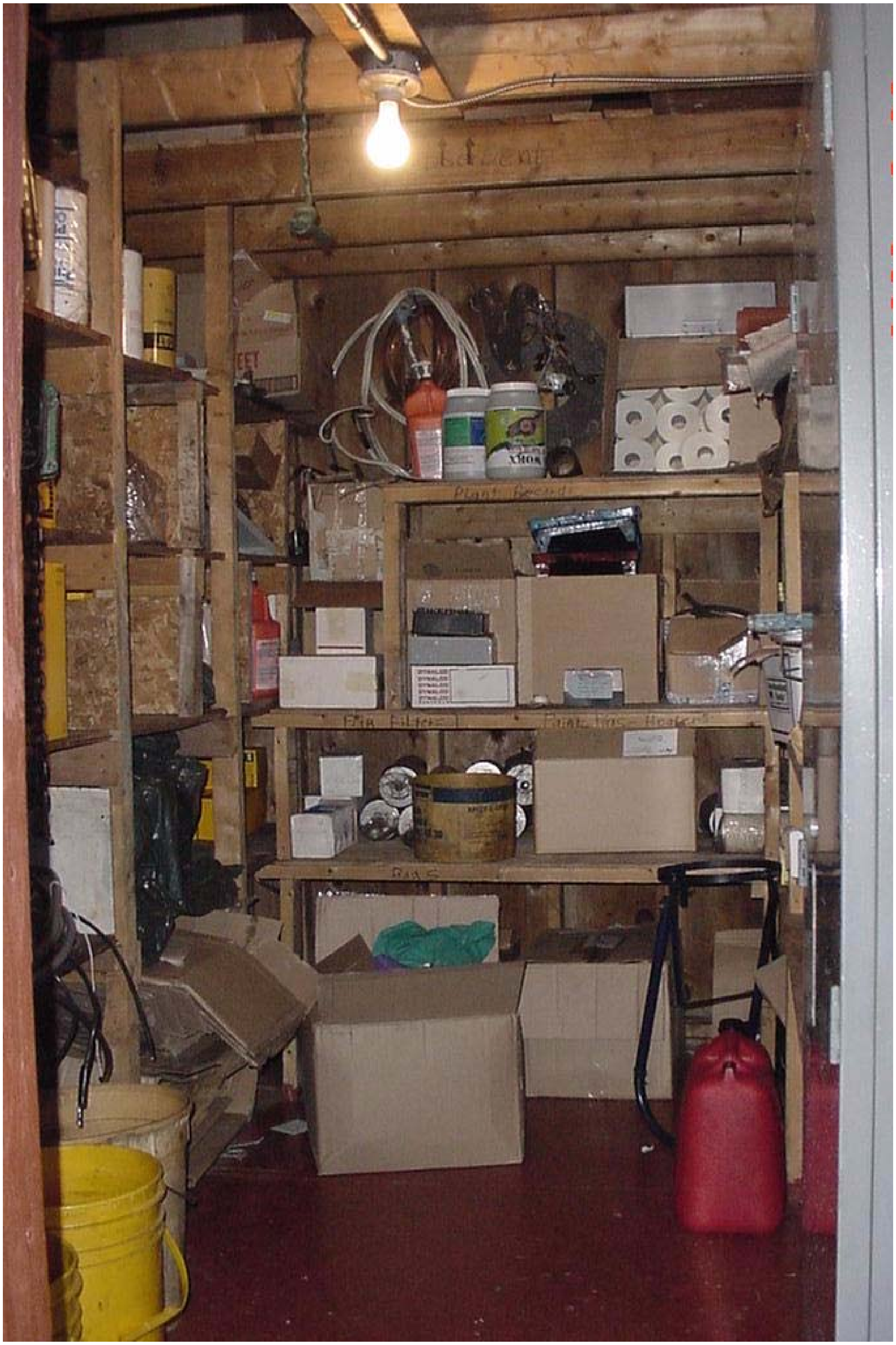


Photo #10—St Lewis Plant—Storage Room

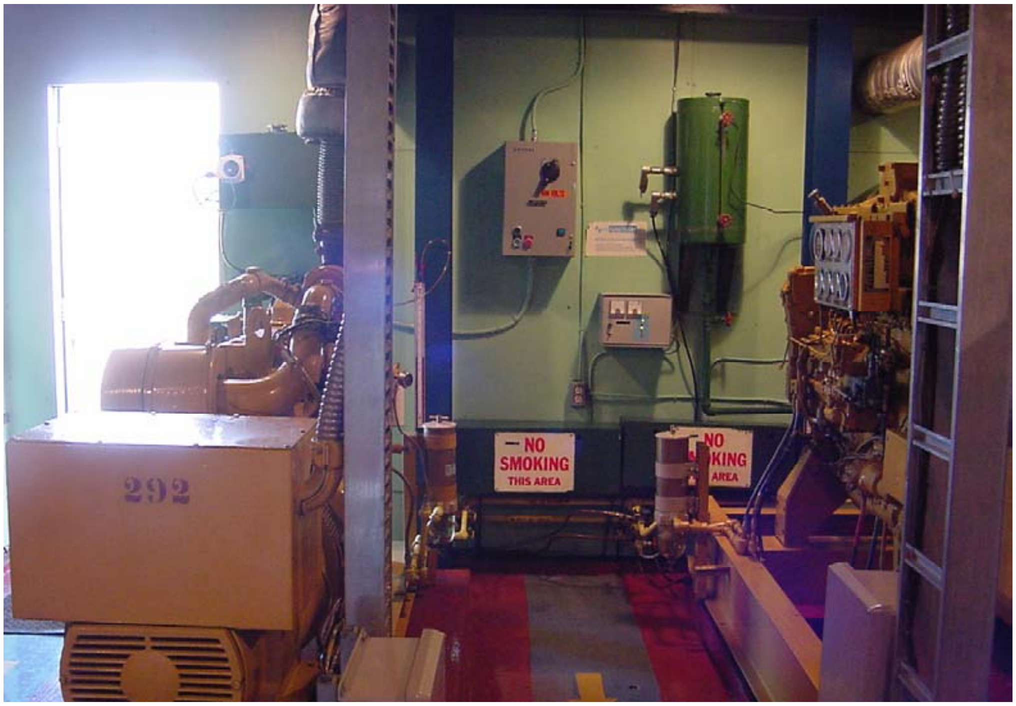


Photo #11—St Lewis Plant—Interior View Showing Space Between Units

Photo #12—St Lewis Plant—Interior View Showing Three (3) Units

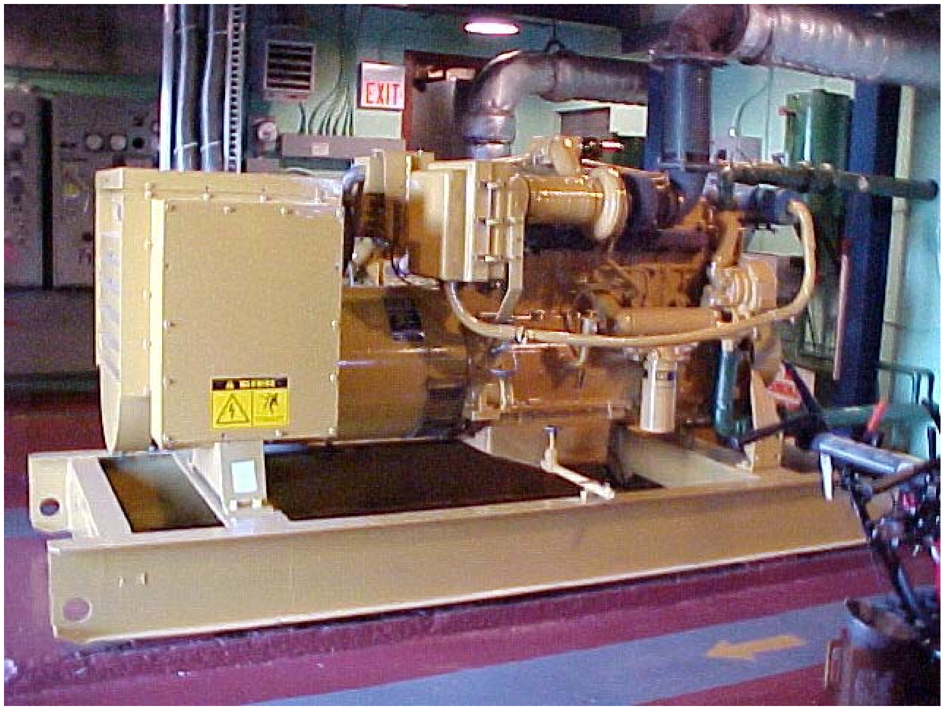


Photo #13—St Lewis Plant—Interior View Showing Single Unit

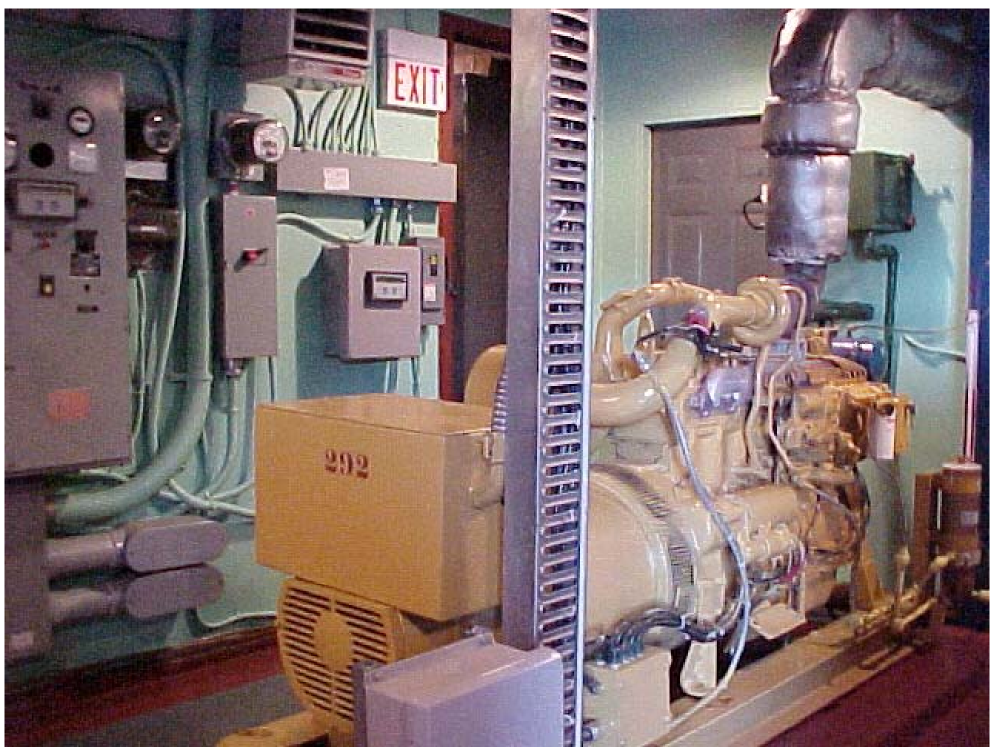


Photo #14—St Lewis Plant—Interior View Showing Single Unit

Photo #15—St Lewis Plant—Interior View Showing Congestion

Photo #16—St Lewis Plant—Interior View Showing Congestion

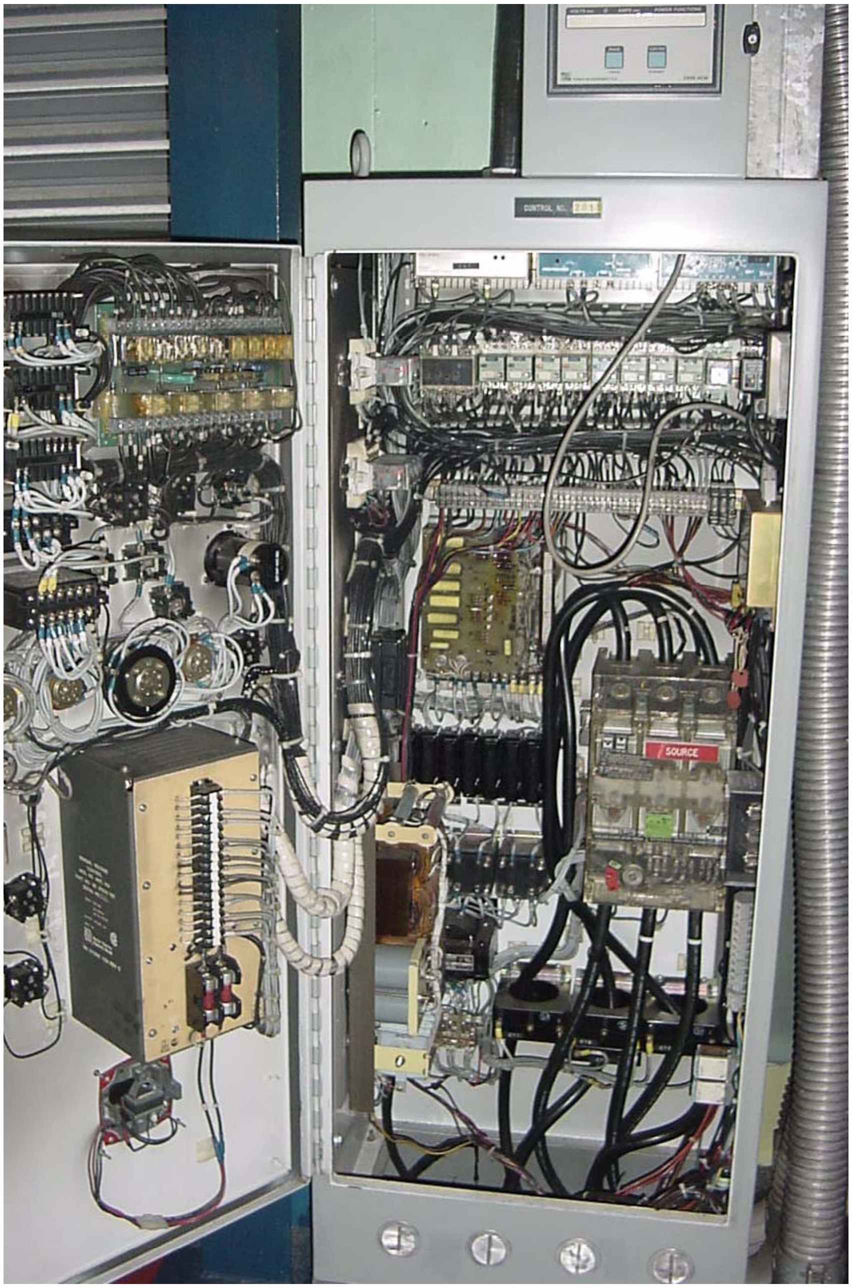


Photo #17—St Lewis Plant—Interior of Switchgear

APPENDIX 1

Newfoundland and Labrador Hydro

Construction of New Diesel Plant – St. Lewis

New Diesel Plant versus St. Lewis – Port Hope Simpson Interconnection

Economic Analysis

System Planning

June 2005

Introduction

An alternative to the construction of a new diesel plant at St. Lewis is to expend $3,400,000 to interconnect the St. Lewis Distribution System to the Port Hope Simpson Diesel Plant via a 50 km distribution line. This cost includes $400,000 for additional generation in the Port Hope Simpson Diesel Plant. This interconnection would enable the St. Lewis Diesel Plant to be shut down and taken out of service. An interconnection between St. Lewis and Mary's Harbour was also considered, but as the interconnection would be 6 km longer than from St. Lewis to Port Hope Simpson, the capital cost would be proportionately higher so it was decided to complete that analysis only if the St. Lewis – Port Hope Simpson interconnection showed promise.

One important consideration to note is that this is an interconnection of one diesel system to another and power will still be supplied by diesel generators of similar size. Primarily, the impact of reducing long-term fixed costs is being analyzed, as the interconnection will not lead to significant change in the cost of energy production, which is proportional to fuel cost and usage.

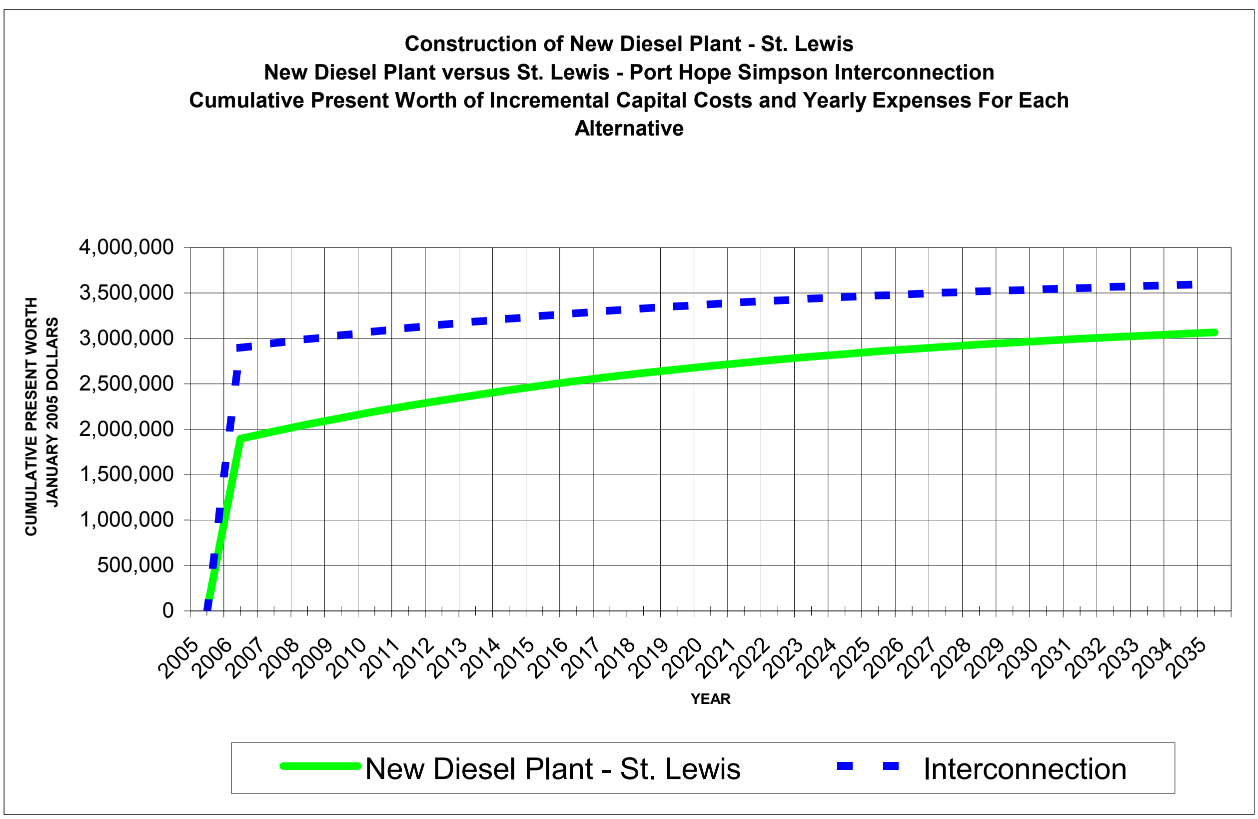
Summary

This study only looked at the incremental costs between the two alternatives:

- As both diesel plants are of similar size and production efficiency, fuel, lube and variable O&M costs were considered to be the same in both cases and therefore were not included;
- An increase in station service costs for the new Diesel Plant alternative was offset by the increase in distribution losses for the Interconnection alternative;
- There would be a savings in fixed O&M costs at the St. Lewis Diesel Plant, if the Interconnection was constructed and the St. Lewis Diesel Plant shut down.

A summary of the detailed economic analysis (attached) is presented in the following table and graph. Over a 30 year period, the new Diesel Plant alternative has a CPW preference of $530,732 and has a positive CPW from the beginning.

New Diesel Plant - St. Lewis versus St. Lewis – Port Hope Simpson Interconnection Comparison of Alternatives		
	CPW Preference of New Diesel Plant Alternative	
	CPW (2005$)	Payback Period
Base Case	$530,732	Immediate



Construction of New Diesel Plant - St. Lewis
Economic Analysis

New Diesel Plant versus St. Lewis - Port Hope Simpson Interconnection

Year	New Diesel Plant Alternative				St. Lewis - Port Hope Simpson Interconnection Alternative				Net Value of New Diesel Plant Over Interconnection		
	ANNUAL	CONSTRUCTION	TOTAL NEW DIESEL $		CONSTRUCTION	ANNUAL	TOTAL INTERCONNECTION $				
	Fixed O&M	New Diesel Plant	$ For Year	CPW Jan-05	Dist. Line & New Unit for PHS	O&M Dist Line	$ For Year	CPW Jan-05	Net $ For Year	Net CPW Jan-05	CPW Jan-05
2005				0				0			
2006	0	2,226,500	2,226,500	1,894,803	3,400,000		3,400,000	2,893,479	1,173,500	998,676	998,676
2007	104,142	0	104,142	1,976,563		62,485	62,485	2,942,535	(41,657)	(32,704)	965,972
2008	106,225	0	106,225	2,053,495		63,735	63,735	2,988,694	(42,490)	(30,773)	935,199
2009	108,562	0	108,562	2,126,027		65,137	65,137	3,032,213	(43,425)	(29,013)	906,186
2010	110,950	0	110,950	2,194,411		66,570	66,570	3,073,244	(44,380)	(27,353)	878,833
2011	113,391	0	113,391	2,258,883		68,035	68,035	3,111,927	(45,356)	(25,789)	853,044
2012	115,886	0	115,886	2,319,668		69,531	69,531	3,148,398	(46,354)	(24,314)	828,730
2013	118,493	0	118,493	2,377,004		71,096	71,096	3,182,800	(47,397)	(22,935)	805,795
2014	121,041	0	121,041	2,431,035		72,624	72,624	3,215,218	(48,416)	(21,612)	784,183
2015	123,583	0	123,583	2,481,925		74,150	74,150	3,245,752	(49,433)	(20,356)	763,827
2016	126,400	0	126,400	2,529,942		75,840	75,840	3,274,563	(50,560)	(19,207)	744,620
2017	129,282	0	129,282	2,575,249		77,569	77,569	3,301,746	(51,713)	(18,122)	726,498
2018	132,230	0	132,230	2,617,997		79,338	79,338	3,327,395	(52,892)	(17,099)	709,398
2019	135,245	0	135,245	2,658,332		81,147	81,147	3,351,596	(54,098)	(16,134)	693,264
2020	138,328	0	138,328	2,696,389		82,997	82,997	3,374,431	(55,331)	(15,223)	678,041
2021	141,385	0	141,385	2,732,274		84,831	84,831	3,395,961	(56,554)	(14,354)	663,688
2022	144,510	0	144,510	2,766,109		86,706	86,706	3,416,263	(57,804)	(13,534)	650,153
2023	147,703	0	147,703	2,798,012		88,622	88,622	3,435,405	(59,081)	(12,761)	637,392
2024	150,968	0	150,968	2,828,094		90,581	90,581	3,453,453	(60,387)	(12,033)	625,360
2025	154,304	0	154,304	2,856,457		92,582	92,582	3,470,472	(61,722)	(11,345)	614,014
2026	157,714	0	157,714	2,883,201		94,629	94,629	3,486,518	(63,086)	(10,698)	603,317
2027	161,200	0	161,200	2,908,418		96,720	96,720	3,501,648	(64,480)	(10,087)	593,230
2028	164,762	0	164,762	2,932,195		98,857	98,857	3,515,914	(65,905)	(9,511)	583,719
2029	168,403	0	168,403	2,954,614		101,042	101,042	3,529,366	(67,361)	(8,968)	574,751
2030	172,125	0	172,125	2,975,753		103,275	103,275	3,542,049	(68,850)	(8,456)	566,296
2031	175,929	0	175,929	2,995,685		105,557	105,557	3,554,008	(70,372)	(7,973)	558,323
2032	179,817	0	179,817	3,014,479		107,890	107,890	3,565,284	(71,927)	(7,517)	550,806
2033	183,791	0	183,791	3,032,199		110,275	110,275	3,575,917	(73,516)	(7,088)	543,717
2034	187,853	0	187,853	3,048,908		112,712	112,712	3,585,942	(75,141)	(6,683)	537,034
2035	192,004	0	192,004	3,064,662		115,203	115,203	3,595,394	(76,802)	(6,302)	530,732
CPW 2005$			**3,064,662**				**3,595,394**				

Discount Rate = 8.4%

CPW New Diesel Plant Cost - Jan 2005	**3,064,662**
CPW Interconnection Cost - Jan 2004	**3,595,394**
Cumulative Present Worth of New Diesel Plant	**530,732**

SECTION H
Tab 6

THE INSTALLATION OF

FALL PROTECTION SYSTEMS

FOR

TRO & PRODUCTION DIVISIONS

Prepared by: G.W. Lundrigan, P. Eng.
Engineering Design Department
Transmission & Rural Operations Divisions
June 22, 2005

Introduction

In 2004 Hydro submitted a Capital Budget Proposal for its 2005 Capital Plan, titled “Install Fall Protection/Travel Restraint Systems for TRO and Production Divisions”. This proposal was the first year of a four-year program, which was estimated at $993,000.00. The portion of the work proposed for 2005 was estimated at $206,200.00. This report is an update on the 2005 work and the status of the whole program.

The requirements for fall protection systems when working at heights of 3.05 meters and greater above the next lower level and when using permanently attached ladders of 6.1 meters or greater in length is addressed respectively by Sections 91 and 90 of the Occupational Health and Safety Regulations. The requirements when using portable ladders are addressed by Section 89. In the late nineties the CSA Standards, to which the Occupational Health and Safety Regulations refer, became more precise with respect to fall protection requirements. Since that time when new structures, such as the Nain and Natuashish Diesel Plants, were built permanent fall protection equipment was installed. Also, when major upgrades were completed to existing structures, such as the Stephenville Gas Turbine Generating Station fuel storage tanks, permanent fall protection equipment was installed. In all other areas access was either deferred or temporary measures were employed.

At the time the 2005 proposal was submitted a preliminary investigation identified approximately three hundred and ten (310) locations where fall protection systems might be required. The understanding was that each location would be evaluated and a decision whether to proceed with installation of a system would be made. The intention was to prioritize the list and first address the locations which needed to be accessed on a regular basis in order to perform routine operational and maintenance tasks. This list would be then further prioritized to address the locations which were considered the most hazardous. Also, it was understood that, in the final analysis, a number of the locations initially identified would not have permanent systems installed as the infrequency of access and the ability to utilize a temporary system when access was required made it unnecessary. Again, it was understood that although accessing certain locations could be considered hazardous they would not be addressed until access was needed as this access may not be until sometime in the distant future.

The locations identified have been categorized under four areas: Hydro Generation, Thermal Generation, TRO and General Facilities.

Status of Work for 2005

Hydro Generation

The majority of the locations addressed will be at the Bay D'Espoir Powerhouses # 1 and #2 and at the three surge tanks. This involves the installation of fall protection climbing devices on existing ladders, ten (10) in Powerhouse #1 and six (6) in Powerhouse #2, as well as upgrading of the surge tank climbing systems. These fall protection systems consist of a rigid rail attached to the access ladder with a locking pawl which attaches to the climber's belt or harness and which slides up and down the rail. Any slip or fall is stopped by the pawl's locking action. The total cost for this work is estimated to be $70,000.

Thermal Generation (Holyrood Generating Plant)

At the Holyrood Generating Plant the existing fixed ladders; one (1) in Pumphouse #1, one (1) in Pumphouse #2, six (6) interior ladders in the main plant and two (2) exterior ladders at the main plant; will be fitted with fall protection systems similar to those been used by Hydro Generation. The total cost for this work is $60,000.

Transmission and Rural Operations (TRO)

The areas to be addressed in 2005 are:

1) Vertical fuel storage tanks where access is required on a weekly basis to complete fuel measurements. These tanks are at Mary's Harbour, Black Tickle, Charlettotown, Makkovik, Rigolet and Nain. All other vertical tanks already have fall protection systems.

2) High buildings with roof mounted equipment such as ventilation fans that have to be accessed for regular maintenance. These include diesel plants located at Black Tickle, Charlottetown and Ramea. The Black Tickle and Ramea work is scheduled to coincide with major upgrades to the plants.

The Charlottetown building is the highest of our continuously operating plants and as such will be one of the first to have a fall protection system installed.

3) The larger power transformers. Three portable pole type fall arrest systems will be purchased. The greater number of larger transformers is in the Central Region and as such this will be the first Region addressed.

The total cost for this work is estimated to be $77,000.

General Facilities

This category is meant to cover locations such as Hydro Place, Bishop's Falls Depot and Regional Offices. There is no work planned for this category in 2005.

Future Plans

The 2005 program for $206,200.00 is the first year of a four-year program. Expenditures budgeted for future years are, $268,100 in 2006, $251,000 in 2007 and $271,000 in 2008 for a total of $992,900.00 for the four years.

Attached is a table entitled "Supply and Install Fall Protection Equipment – 4 Year Plan" wherein is presented a list of locations to be evaluated and, if required, where permanent systems will be installed in future years. Work to be completed in 2005 is also listed.

FALL PROTECTION SYSTEMS
SUPPLY AND INSTALL PROTECTION EQUIPMENT - 4 YEAR PLAN

s n	Division / Site	2005	2006	2007	2008	comments
	TRO-REGIONAL OFFICES					
1	Bishops Falls					Service Bldg, A/C Unit on roof (Warning Line)
2	Bishops Falls					Warehouse roof access requirements to be reviewed
3	Port Saunders					A/C Unit on roof
4	St. Anthony					No roof mounted equip. No fall protection required
5	Stephenville					A/C Unit on roof
6	Whitbourne					A/C Unit on roof
	TRO- CENTRAL					
A	**Diesel Plants & Tanks**					
1	Francois					Low Hor tank, Fall protection to be reviewed
2	Grey River					Low Hor tank, Fall protection to be reviewed
3	Hardwood G T					Rails & Stairs
4	Little Bay Islands					Exist. Rails & Platform
5	McCallum					Complete remaining minor work
6	Ramea					Fall arrest system to be installed for roof mounted exhausts
7	St. Brendan's					High Horizontal tank
8	S'ville Gas Turbine					All vertical Tanks done, G T bldg to review in 2007
B	**Power Transformer**					Install Removable Post Attachment on three (3) larger units
						Purchase three Portable Posts
	TRO- NORTHERN					
A	**Diesel Plants & Tanks**					
1	Charlottetown					Vertical Tank & Plant Exhaust Fans on Roof
2	L'Anse-au-Loup					Low Hor Tanks
3	Mary's Hr					Vertical Tanks and Plant Exhaust Fans on Roof
4	Norman Bay					Low Tanks, Exhaust Fans on Roof, Review in 2008
5	Port Hope Simpson					Low Hor Tanks
6	St. Anthony					To be completed with siding upgrading in 2006
7	St. Lewis					Eye bolts on cat walk for all tanks, Bldg to be reviewed
8	Williams Hr.					Review at time of tank(s) replacement in 2007
B	**Power Transformer**					Access requirements to be reviewed
	TRO - LABRADOR					
A	**Diesel Plants & Tanks**					
1	Black Tickle					All tanks done done, Plant 2005 upgraded. Includes fps
2	Cartwright					Review with Tank Replacement
3	Happy Valet G T					Tanks and G T Bldg
4	Hopedale					Review with New tank installation
5	Makkovik					Vertical & Horizontal in 2005, Plant in 2006
6	Nain					600,000 L tank, Plant has fps installed
7	Natuashish	-	-	-	-	Gated access ladder and Portable system for roof
8	Paradise River					Review requirement with new tanks installation
9	Postville					Eye bolt to cat walk
10	Rootlet					1-vertical tank in 2005,2 Horizontal tanks in 2006
11	North Plant					System installed
B	**Power Transformer**					Access requirements to be reviewed

FALL PROTECTION SYSTEMS						
SUPPLY AND INSTALL PROTECTION EQUIPMENT - 4 YEAR PLAN (Cont'd)						
s n	**Division / Site**	**2005**	**2006**	**2007**	**2008**	**comments**
	GENERATION					
A	**Thermal (Holyrood)**					
1	Fuel Storage Tank					Day tank existing FPS to be reviewed
2	Gas Turbine Building					Roof mounted equipment to be serviced by own forces.
3	Holyrood Plant external					Access ladders to be equipped with safe climbing device
4	Holyrood Plant Internal					Access ladders to be equipped with safe climbing device
5	Pumphouse 1					Access ladders to be equipped with safe climbing device
6	Pumphouse 2					Access ladders to be equipped with safe climbing device
7	Training Room					Access requirement to be reviewed
8	Warehouse					Access requirement to be reviewed
B	**Hydro**					
B1	**Bay D'Espoir**					
1	Intake					Access ladder to be equipped with safe-T- track
2	Main P H external					Access ladder to be equipped with safe-T- track
3	Main P H internal					Access ladder to be equipped with safe-T- track
4	Other buildings					Access requirement to be reviewed
5	Surge Tank					Upgrade existing climbing device
6	Unit 7 P H external					Access ladder to be equipped with safe-T- track
7	Unit 7 P H internal					Access ladder to be equipped with safe-T- track
B2	**Upper Salmon**					
1	P H External					Safe T track to be installed
2	P H Internal					Safe T track to be installed
3	Other Buildings					Requirements to be reviewed
B3	**Hinds Lake**					
1	P H external					Safe T track to be installed
2	P H internal					Safe T track to be installed
3	Other Buildings					Requirements to be reviewed
B4	**Cat Arm**					
1	P H external					Safe T track to be installed
2	P H internal					Safe T track to be installed
3	Other Buildings					Requirements to be reviewed
B5	**Paradise River**					
	P H External					Access requirements to be reviewed
	P H Internal					Access requirements to be reviewed
B6	**Granite Canal**					
1	Power House	-	-	-	-	Fall Protection System installed during construction
	Hydro Place					Requirements to be reviewed

H:\TRO Engineering\GEOLUNED\[Fall Protection System Program --Status Tablet ~4011555.xls]Sheet1

Updated June 21, 2005

Photos

The following are pictures of typical examples of the Fall Protection Systems which will be installed.

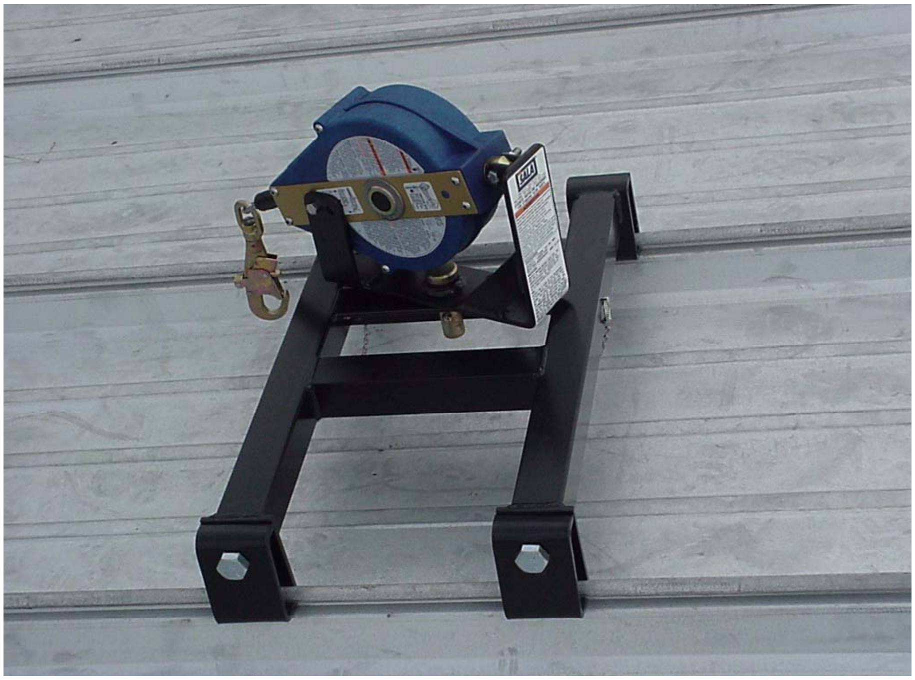


Photo # 1—Natuashish Diesel Plant—Travel Restraint Device attached to Metal Roof's Standing Seam

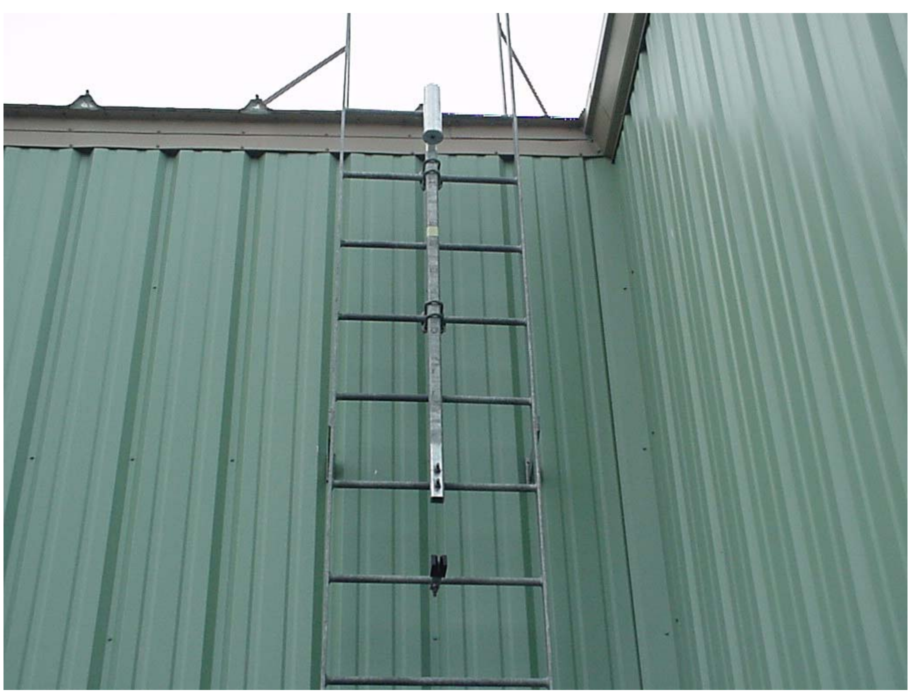


Photo # 2---Natuashish Diesel Plant---T-Rail attached to Building Access Ladder.

Photo # 3—Stephenville Gas Turbine Generating Station (STGTGS)

Fuel Storage Tank with T-Rail Attached to Ladder and Safety Wire Attached to Tank Center Vent

Photo # 4—STGTGS--- Fuel Storage Tank with T-Rail Attached to Ladder

Photo # 5—STGTGS Fuel Storage Tank with Safety Wire Attached to Tank Center Vent

FALL PROTECTION SYSTEM

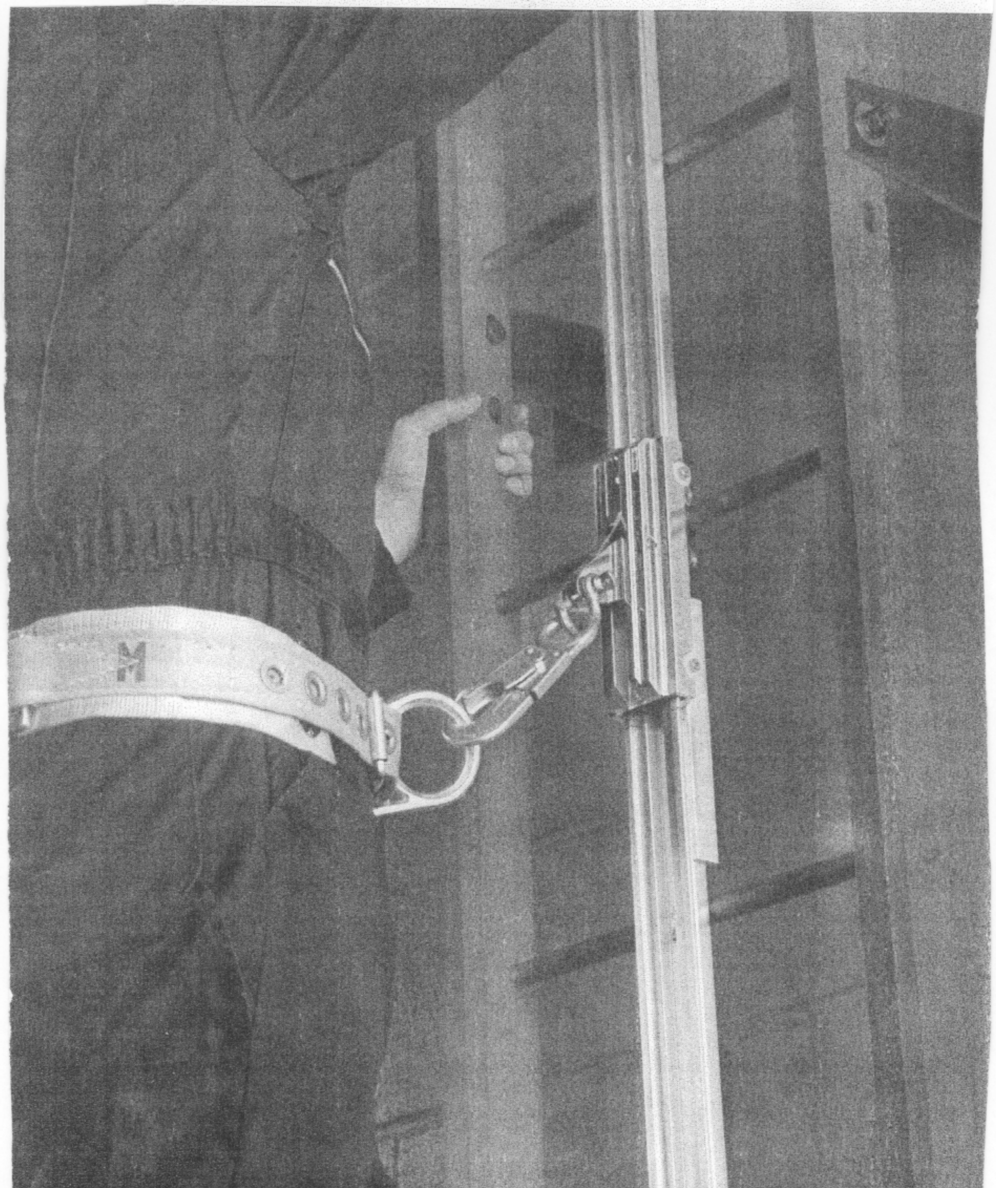
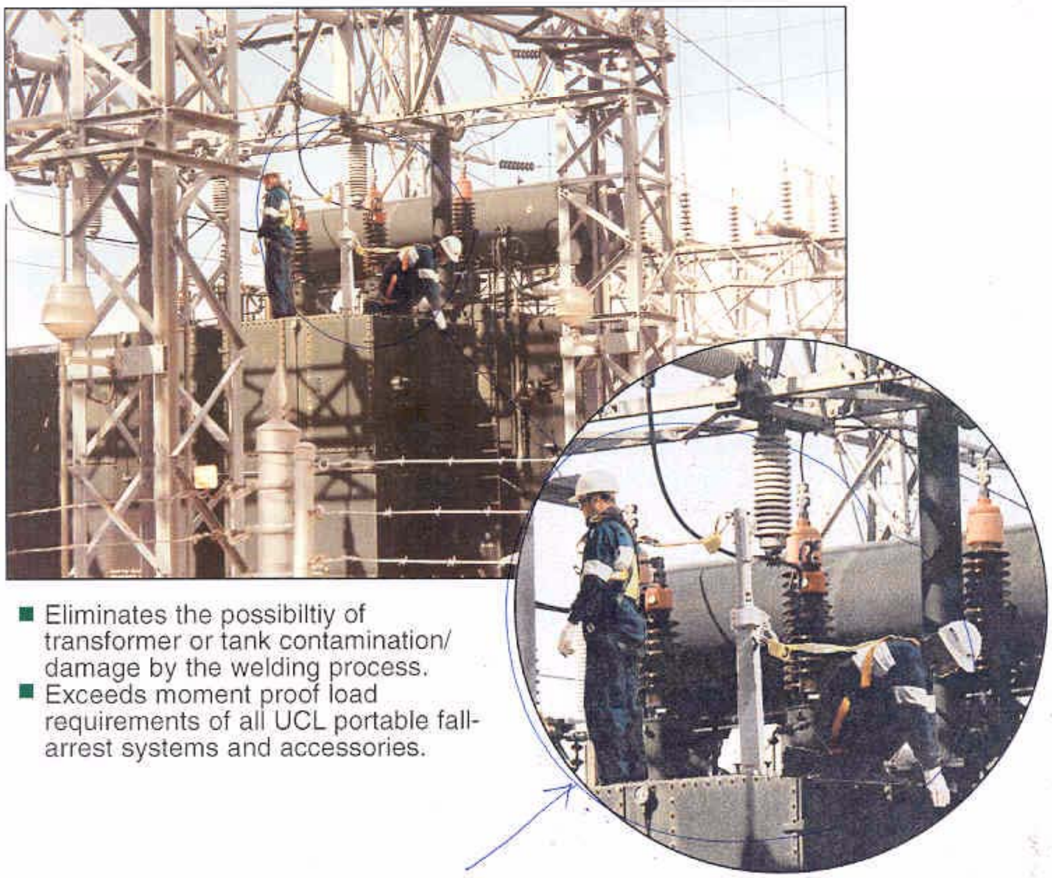


Photo # 6—Typical Arrangement for Worker Attachment to Ladder's T-Rail new from UCL SAFETY SYSTEMS

weldless base

features:

- Using specialized tooling, installs quickly without welding to steel surfaces as thin as 3/8" (9.5mm).
- Hot dipped galvanized steel construction for long life in outdoor installations.



- Eliminates the possibiltiy of transformer or tank contamination/ damage by the welding process.
- Exceeds moment proof load requirements of all UCL portable fall-arrest systems and accessories.

Photo # 7—Showing Workers attached to a Portable Pole which will be Attached to Transformers as required

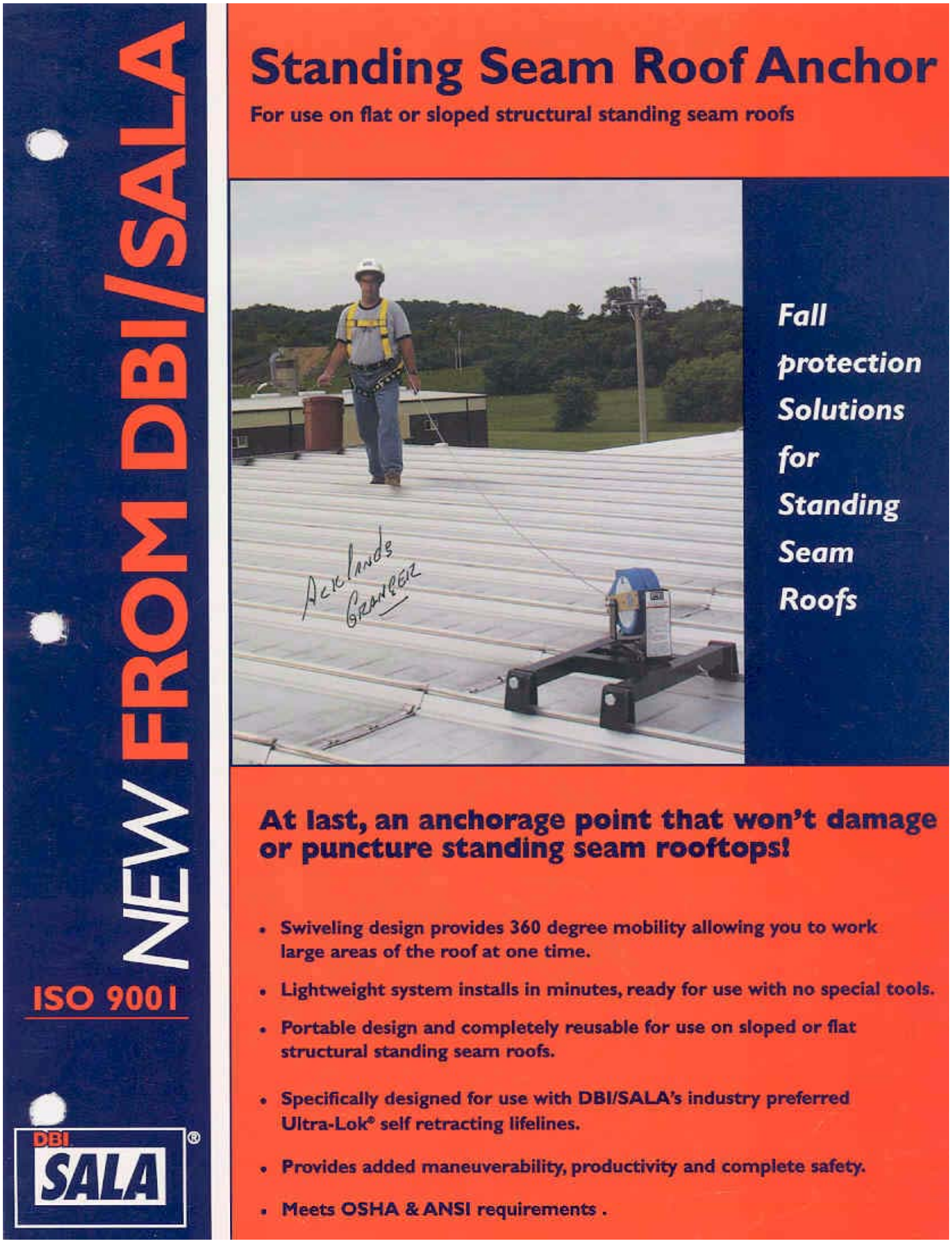


Photo # 8—Standing Seam Roof Anchor Similar to Ones Installed at New Diesel Plants in Nain and Natuashish

SECTION H
Tab 7

Applications Enhancements 2006

Cost/Benefit Analysis

Information Systems and Telecommunications
July 2005

Introduction

The Corporation's 2006 Application Enhancements project is described in Section B of Hydro's 2006 Budget Application. In Order No. P. U. 53(2004) – Reasons for Decision, page 57, the Board stated: "However, the Board would expect that prior to any future Capital Budget Application Hydro will have explored any process by which some quantifications of efficiency to be gained through the implementation of new technology, enhancement or otherwise, may possibly be defined to the best extent possible".

This report provides information on the efficiencies expected from specific projects within the Application Enhancements project as requested in Order No. P.U. 53(2004).

Capital Asset Projection Modeling (CAP/M)

Background

The CAP/M software was developed on a platform of assorted analysis tools, deriving information from a warehouse of data that is built on a monthly or yearly basis from the JD Edwards fixed asset and financial information. The resulting information is analyzed to provide long-term depreciation modeling and asset projections.

Information Technology (IT) support time incurred for CAP/M for the last full year (2004) was 175 hours.

Hydro's Rates and Financial Planning group is the primary user of the information produced by CAP/M; however it is also used by the Fixed Asset group as well as Executive Managers.

Scope

This project will investigate a more cost effective and efficient alternative to determining depreciation. Based on the results of the investigation, enhancements will be made to the application set to achieve the efficiencies anticipated.

Cost/Benefit

A financial Net Present Value calculation attached indicates a payback period of 3.2 years. It is expected that productivity savings will result from a more clearly defined reporting requirement and the integration of a new Work Budgets process.

Assumptions Used in the Analysis

- Internal staff will carry out the investigation with the assistance of external resources as required.
- Enhancements will reduce the frequency and complexity of reports required, resulting in productivity savings.
- Software maintenance fees for the current product will cease resulting in a saving of $22,168 per year plus annual increases of 15%.
- IT support will be reduced.
- All investigation and subsequent enhancements will be completed in 2006.
- A discount rate of 8.4% was used.

Enhancements to Capital and Operating Process Applications

Background

Hydro has recently reviewed and adjusted its Work Management process, a process that underlies all aspects of the Corporation's operating and capital work. A central repository for information is necessary to reduce the duplication of data gathering activities in various geographical centers, allow for more efficient workforce planning and proper utilization of the workforce and ensure the coordination of planned equipment outages so that work initiated from various departments within the organization minimizes the impact on customers.

Scope

This project will identify and enhance existing applications currently used, aligning them to the redesigned process model, eliminating duplication of application functionality and introducing functionality necessary to insure the efficiency and effectiveness of the processes. A job plan repository will be established that will be used to provide a basis for streamlined budget preparation, workforce allocation planning, and outage management planning.

Cost/Benefit

A financial Net Present Value calculation attached indicates a payback period of 3.7 years.

The benefits that will be realized from this project are expected to include:

- A net operating benefit will be realized through efficiency savings;
- Hydro managers will be able to see workforce allocation to prioritized work across the corporation in varying levels of detail;
- Better organization of planned equipment outages across various disciplines within the organization will help minimize equipment outages affecting our customers;
- A central repository for job plans will insure that there is a more efficient method of obtaining and developing future job plans reducing the operating and capital budgeting effort.

Assumptions Used in the Analysis

- There are 100,000 work orders created each year to assist in controlling Hydro's work management and it is expected that 80% of these work orders will be directly impacted by changes to the process applications resulting in time saving for work order entry and management.
- A discount rate of 8.4% was used.

IT Infrastructure Management Tool

Background

Hydro maintains a complex portfolio of software and hardware infrastructure including typical IT related infrastructure as well as energy management and telecommunications systems. As changes are introduced it is critical to insure that they do not negatively impact services in terms of unplanned outages or increased support times. The Release Management process is an industry recognized best practice that takes a holistic view of a change to an IT service and ensures that all aspects of a release, both technical and non-technical, are considered together. The process strives to ensure consistency in the release process, improved historical data concerning releases and reduction of risk from unauthorized or illegal software. Tools are currently in place to support the release management process but are not yet implemented. This project will formalize the Release Management process and implement the tools to monitor and report the effectiveness of the process.

Scope

This project will formalize a consistent and manageable Release Management process across all disciplines within IS&T and implement the supporting monitoring and reporting tools to aid in management of releases.

Cost/Benefit

A financial Net Present Value calculation attached indicates a payback period of 3.7 years. Over time there will be a decline in call volumes related to releases and the business will not be negatively impacted by failed or poorly managed releases.

Assumptions Used in the Analysis

- In 2004 there were in excess of 3,000 software incident related calls registered with the Support (Help) Desk.
- It is anticipated that a 10% reduction in the number of these calls can be achieved with a Release Management process.
- On average the resolution time for these types of calls is 1 hour.
- Adequate software is already in the IT portfolio.
- A discount rate of 8.4% was used.

Enterprise Reporting

Background

Hydro currently obtains reporting and query information from a large number of disparate data sources including but not limited to internal sources such as JD Edwards, Capital Asset Projection and Modeling (CAP/M), IT Management Tools, energy management monitoring, and external sources such as external knowledge databases, supplier websites, governing bodies and environmental monitoring agencies and companies.

Within Hydro there are currently large quantities of both operating reports and queries, and individual ad-hoc reports and queries. These reports and queries access information from many different sources and are presented in many different formats. Although there will always be a requirement for ad-hoc reporting, many standard reports can be accessible at all times, produced from a central store of data and be presented through a standard internet web browser. Getting information in this manner will eliminate the need to “run” a report as they will be scheduled, run and placed in a central repository, without human intervention, for access as needed.

Scope

This project will acquire and implement an Enterprise Reporting system with a browser interface. A data warehouse will be developed to support the requirements of the existing reports and deploy these reports in a secure and accessible manner.

Cost/Benefit

A financial Net Present Value calculation attached indicates a payback period of 4.1 years.

Assumptions Used in the Analysis

- The vast majority of reports currently being run access real-time data.
- Increased software licensing and support fees will be offset by a reduction in current report writing software licensing and support costs.
- 1200 reports are run monthly with an average running time of 20 minutes.
- Each report has on average 2 pages for 24,000 pages per year.
- A discount rate of 8.4% was used.

Capital Asset Projection and Modeling (CAP/M) Application Enhancements

	Year	Capital Cost	Operating & Maintenance Cost	Benefits/ Savings (A.)	Cumulative Incremental Cash Flow	Present Worth	Cumulative Present Worth (C.)
0	2006	($75,700)			($75,700)	($69,834)	($69,834)
1	2007			$32,668 (B.)	($45,500)	$27,801	($42,033)
2	2008			$36,203	($14,940)	$28,422	($13,611)
3	2009			$40,241	$15,988	$29,144	$15,534
4	2010			$44,856	$47,292	$29,969	$45,503

Payback period = 3.2 years

Notes:

(A) Benefits/Savings are derived from increased efficiencies resulting in a productivity and IT support saving. This saving is incremented by 2% per annum.

(B.) Software maintenace savings from licensing will be $22,168 incremented by 15% annually and labour savings of $10,500 escalating at 2% annually.

(C.) Discount Rate used for calculating Present Worth is 8.4%

Capital and Operating Processes Applications

	Year	Capital Cost	Operating & Maintenance Cost (C.)	Benefits/ Savings (A.)	Cumulative Incremental Cash Flow	Present Worth	Cumulative Present Worth (B.)
0	2006	($382,700)			($382,700)	($353,044)	($353,044)
1	2007		($20,000)	$160,000	($242,700)	$119,143	($233,901)
2	2008		($20,000)	$163,200	($99,500)	$112,423	($121,478)
3	2009		($20,000)	$166,464	$46,964	$106,075	($15,403)
4	2010		($20,000)	$169,793	$196,757	$100,079	$84,677

Payback period = 3.7 years

Notes:

(A) Benefits/Savings are derived from increased efficiencies resulting in a productivity saving. This saving is incremented by 2% per annum.

(B.) Discount Rate used for calculating Present Worth is 8.4%

(C.) O/M cost calculated as a 15% software license fee + 5% support fee

IT Management Tool

	Year	Capital Cost	Operating & Maintenance Cost	Benefits/ Savings (A.)	Cumulative Incremental Cash Flow	Present Worth	Cumulative Present Worth (B.)
0	2006	($49,500)			($49,500)	($45,664)	($45,664)
1	2007			$18,000	($31,500)	$15,318	($30,346)
2	2008			$18,360	($13,140)	$14,414	($15,932)
3	2009			$18,727	$5,587	$13,563	($2,369)
4	2010			$19,100	$24,687	$12,761	$10,392

Payback period = 3.7 years

Notes:

(A) Benefits/Savings are derived from increased efficiencies resulting in productivity and IT support saving. This saving is incremented by 2% per annum. Additional benefits will accrue from reduced printing costs.

(B.) Discount Rate used for calculating Present Worth is 8.4%

Enterprise Reporting

	Year	Capital Cost	Operating & Maintenance Cost	Benefits/ Savings (A.)	Cumulative Incremental Cash Flow	Present Worth	Cumulative Present Worth (B.)
0	2006	($152,100)			($152,100)	($140,314)	($140,314)
1	2007			$47,750	($104,350)	$40,636	($99,678)
2	2008			$48,500	($55,850)	$38,076	($61,602)
3	2009			$49,277	($6,573)	$35,688	($25,914)
4	2010			$50,064	$43,491	$33,449	$7,535

Payback period = 4.1 years

Notes:

(A) Benefits/Savings are derived from increased efficiencies resulting in a productivity and IT support saving. This saving is incremented by 2% per annum. Additional benefits will accrue from reduced printing costs.

(B.) Discount Rate used for calculating Present Worth is 8.4%

SECTION I

NEWFOUNDLAND & LABRADOR HYDRO

2004 RATE BASE

($000s)

	2003	2004
Capital Assets	1,904,557	1,922,374
Less:		
Contributions in Aid of Construction	85,055	85,081
Accumulated Depreciation	456,695	481,801
Net Assets not in Service	4	4
Muskrat Falls	2,049	2,149
Net Capital Assets	1,360,754	1,353,339
Balance Previous Year	1,234,420	1,360,754
Average Capital Assets	1,297,587	1,357,047
Working Capital	3,456	2,945
Fuel	18,310	15,611
Supplies Inventory	18,565	18,615
Average Deferred Charges	84,494	82,506
Average Rate Base	1,422,412	1,476,724