REFERENCE:

Appendix 7.7 pages 13 to 18.

PREAMBLE TO IR (IF ANY):

Capital Expenditure Plan Table

QUESTION:

a) Identify and group together planned generation, HVDC, T and D sustaining and growth investments by the facility in which the subject assets are located, to provide visibility of the full expected investment in the facility over the planning period. For example:
   - Pointe du Bois; Renewable Energy Project; Unit 16 Turbine Pit Water Leak Refurbishment;
   - Kettle: Units 5, 6 & 10 stator overhauls; U1-4 Generator Terminal Cubicles
   - Grand Rapids: Units 4 Major overhaul; RipRap replacement; Draft Tube Gantry Crane Upgrade; Fish Hatchery Upgrade & Expansion
b) Provide cost benefit analysis or business cases for the proposed total reinvestment in each identified facility where the cumulative investment will exceed $10M over the planning period. In each case, identify if the facility in which investments will be made is intended primarily to ensure reliable service to domestic loads, to serve the export market, both, or for another reason.
c) If all or part of the business rationale justifying the investments at any specific facility relies on export sales revenues, show the cost-effectiveness of the export component of the investment over the service life of the investment (i.e., NPV of the marginal incremental sales revenue enabled by the investment minus the associated capital carrying cost and operating cost).
d) For all facility investments discussed above driven primarily by deteriorated asset condition, map the proposed expenditures against existing asset condition, pre-project risk (probability of failure x consequence) and post-project risk. Ensure that the probability is calculated for the specified consequence, e.g., if the worst-case consequence of a failure at peak system load is used, provide the probability of failure occurring during the peak load period, rather than at a random time during the year.

e) Has the cost-effectiveness of the risk mitigation provided by projects listed in the table been evaluated, quantified and compared to enable appropriate prioritization and scheduling?
   i. If yes, please provide documentation of the evaluation, quantification and comparison process.
   ii. If no, is MH confident that all projects shown in the Capital Expenditure Plan are cost-effective and that they have all been appropriately prioritized and scheduled? Please explain.

f) For each non-mandatory project in the table with expenditures in excess of $10M over the planning period, please identify:
   i. Primary risk driving the project, or which the project is intended to mitigate.
   ii. The consequence of deferring the project for: 2 years; 5 years; 10 years; 20 years.
   iii. The probability that if the project is not implemented, the described consequence will occur in: each of the test years; 5 years; 10 years; 20 years.
   iv. For all projects for which the primary risk involves inability to serve domestic load reliably, please identify the system load condition under which the probability of occurrence for the described consequence was calculated, and the total number of hours this load condition will prevail in: each of the test years; 5 years; 10 years; 20 years.

g) For all projects in the table with expenditures in excess of $10M over the planning period, please identify any alternative project scopes that were evaluated to address the need (either mandated or risk-driven)
   i. Please explain why each non-preferred alternative was eliminated.
   ii. Please provide a cost benefit analysis or business case demonstrating that the preferred alternative is the best choice for ratepayers.
   iii. For all projects for which project deferral or do nothing was not evaluated as an alternative, please explain why not.

h) For each program listed in the table, please map the proposed expenditures against the present assessed asset condition and/or asset health index of the subject asset portfolio.
   i. Has MH quantified the cost-effectiveness of the risk mitigation provided by each of these programs? If yes, please provide documentation. If no, please explain how MH know that each program is cost-effective?

i) Please provide age demographic and asset health rating category rankings for the asset portfolios that are the subject of each program. Describe and quantify the consequences of reducing spending on each program in each test year by: 10%; 20%; 40%.

j) Does MH use a run-to-fail asset management strategy for any of these asset categories? [NTD: perhaps list specific categories for which we would like MH to explain why they don't apply run to fail]

k) For all projects where "Total Project Cost" is greater than "20 Year Total", please explain why.

l) For each capacity project with expenditures greater than $10M over the planning period:
   i. Describe and quantify the triggering system condition and provide the associated load flow studies that demonstrate the need.
   ii. Describe the consequences of deferring the project for 2 years; 5 years; 10 years; 20 years.
   iii. Quantify the number of annual hours during which the described consequence could occur in: each test year; 5 yrs; 10 yrs; 20 yrs.
   iv. Please identify all alternatives to each project that were evaluated, including do nothing or defer.

m) Please list and describe the scope of any individual projects, programs or portfolio adjustments with forecast spending over the planning period greater than $10M in the "Other Projects, Programs & Portfolio Adjustments" line item.

RESPONSE:

a) Please see table below that sorts the investments shown in Appendix 7.7 by facility.
   If an investment is not shown in the table, it is because:
   I. It applies to only one facility, line, location, or customer and is identified in the title of the investment (ex. Court Station Foundation Upgrades)
   II. It applies to many facilities or is a system-wide investment (ex. Generation Security Infrastructure Update, Secondary Network Visibility)

Dorsey Converter Station
Dorsey Synchronous Condenser Refurbishment
Dorsey VG42 High Speed Switch Failure
Grand Rapids GS
Grand Rapids Concrete Restoration

Grand Rapids Day Shift Operating Model Transition
Grand Rapids Draft Tube Gantry Crane Upgrade
Grand Rapids Exciter Replacements
Grand Rapids GS 125V DC Battery Bank Upgrade
Grand Rapids GS PLC Genius 90-70 Replacement
Grand Rapids HVAC Replacement
Grand Rapids Intake Gantry Crane Upgrade
Grand Rapids Rip Rap Replacement
Grand Rapids U1-3 Fire Detection Upgrades
Grand Rapids Unit 1 Overhaul
Grand Rapids Unit 4 Major Overhaul
Grand Rapids Units 1-4 Governor & Protection Replacements
Grand Rapids Utility Storage Replacement
Great Falls GS
Great Falls 11kV Station Service Switchgear Upgrade
Great Falls 250V DC Battery Bank Upgrade
Great Falls Flow Augmentation
Great Falls PLC 90-70 Genius Replacement
Henday Converter Station
Henday Zebra Mussels Mitigation
HVDC (Not Facility Specific)
HVDC - Gapped Arrester Replacement
HVDC Bipole 1 Direct Current Transductor Replacement
HVDC Bipole 1 Disconnect Replacement
HVDC BP2 Valve Hall Wall Bushing Replacement
HVDC Controls & System Replicas Development
HVDC Transformer Marshalling Kiosk Replacement
HVDC Transformer Sustainment
Jenpeg GS
Jenpeg 129V Battery Bank Replacement
Jenpeg Concrete Decks Rehabilitation
Jenpeg Draft Tube Stop Log Gantry Hoist Modernization
Jenpeg Fire Water System Replacement
Jenpeg Intake Stop Log Gantry Hoist Modernization
Jenpeg Oil Interceptor Upgrade
Jenpeg Spare Stator Bar Purchase
Jenpeg Spillway Stoplog Hoist Modernization
Jenpeg Unit 2 Overhauls

Jenpeg Unit Control & Monitoring
Jenpeg Zebra Mussels Mitigation
Kelsey GS
Kelsey GS SS 138kV Breaker Replacement
Kelsey House Units 1 & 2 Refurbishment
Kelsey Intake & Tailrace Joint Seal Replacement
Kelsey Powerhouse Roof Replacement
Kelsey Spillway Emergency Diesel Genset
Kelsey Unit 1-7 Generator Exciter Replacement
Kelsey Zebra Mussels Mitigation
Kettle GS
Kettle 138kV Disconnect Replacements
Kettle Fire Protection System Replacement
Kettle Headgate Platform Fall Protection Replacement
Kettle Intake & Tailrace Deck Seals
Kettle Intake Gate Hydraulic Cylinders Replacement
Kettle Spillway Transformers Replacement
Kettle Station Service Transformers Replacement
Kettle U1-4 Generator Terminal Cubicles
Kettle Unit 10 Stator Overhaul
Kettle Unit 11 Stator Overhaul
Kettle Unit 12 Stator Overhaul
Kettle Unit 1-3,5-8&10-12 Dewater Piping Replacement
Kettle Unit 5 Stator Overhaul
Kettle Unit 6 Stator Overhaul
Kettle Unit 7 Stator Overhaul
Kettle Unit 8 Stator Overhaul
Kettle Unit 9 Stator Overhaul
Kettle Zebra Mussels Mitigation
Laurie River GS
Laurie River Accommodations Replacement
Laurie River Communication Tower & Building
Laurie River Remote Control and Automation
Laurier River Bank 1&2 GSU Transformer Replacement
LR Rip-Rap Slope Protection Addition
Limestone GS
Limestone HVAC Air Handling Replacement
Limestone Unit 1 Overhaul

Limestone Unit 10 Overhaul
Limestone Unit 2 Overhaul
Limestone Unit 3 Overhaul
Limestone Unit 4 Overhaul
Limestone Unit 5 Overhaul
Limestone Unit 6 Overhaul
Limestone Unit 7 Overhaul
Limestone Unit 8 Overhaul
Limestone Unit 9 Overhaul
Limestone Unit Control Monitoring Upgrades
Limestone Units 1-3 & 5-10 Stator Re-Wedge
Limestone Zebra Mussels Mitigation
Long Spruce GS
Long Spruce Fire Water System Replacement
Long Spruce Generator Protection Replacement
Long Spruce GS 230kV Disconnect Replacements
Long Spruce Intake & Tailrace Deck Seals
Long Spruce Powerhouse Actuator Replacement
Long Spruce South Transition Dam Rehabilitation
Long Spruce Unit 10 Overhaul
Long Spruce Unit 1-10 Surface Air Cooler Replacement
Long Spruce Unit 2 Overhaul
Long Spruce Unit 9 Overhaul
Long Spruce Zebra Mussels Mitigation
McArthur Falls GS
McArthur Falls Electrical Components Replacement/Refurbish
McArthur Falls Powerhouse Concrete Roof Deck Rehabilitation
Missi Falls
Missi Falls Diesel Generator Replacement
Missi Falls Sewer & Water Upgrade
Notigi
Notigi Marine Vessel Replace & Infrastructure Improvement
Notigi Sewer & Water Upgrade
Pine Falls GS
Pine Falls Sluiceway Anchoring Upgrade
Pine Falls Units 1, 2, 5 and 6 Upgrades
Pointe du Bois GS
PDB Unit 16 Turbine Pit Water Leak Refurb

Point du Bois Upstream Ice Piers Rehabilitation
Pointe du Bois - Lee River DSC 66kV Line
Pointe du Bois Fire Safety & Employee Egress Install
Pointe Du Bois Generator Transformer Bank 1 Replacement
Pointe du Bois Renewable Energy Project
Pointe du Bois Unit 1 Overhaul
Radisson Converter Station
Radisson BPI Converter Transformer T12A Replacement
Riel Converter Station
Riel Converter Station Fire Water Supply
Riel Storage Facility Construction
Selkirk GS
Selkirk Station Building Heating Source
Selkirk Station Generation Equipment Removal & Decommission
Seven Sisters GS
Seven Sister GS PLC Genius 90-70 Replacement
Seven Sisters Intake Frost Protection
Seven Sisters Powerhouse Roof Replacement
Seven Sisters Stoplog Hoist Replacement
Seven Sisters Transformer Banks 5 and 6 Replacement
Seven Sisters Unit 6 Stator Replacement
Seven Sisters Utility Garage Construction
Slave Falls GS
Slave Falls 7 Bay Sluiceway Pier Anchoring
Slave Falls 7 Bay Sluiceway Upstream Pier Strengthening
Slave Falls Intake & Entrance Area Concrete Rehabilitation
Slave Falls Life Extension
Slave Falls Regulating Sluiceway Gate 1
Slave Falls Tailrace Concrete Rehabilitation
Slave Falls Tailrace Crane Refurbishment
Slave Falls Transformer Banks Replacement
Slave Falls Unit 3-6 Exciter Replacement
Slave Falls Unit 5-8 Stator Spare
Wuskwatim GS
Wuskwatim PCB Remediation
Wuskwatim Water License

b) The facilities in the list in a) are all from the Generation and HVDC systems. These facilities are very expensive to construct and to decommission. It is Manitoba Hydro's experience that if there is significant life left in the facilities there is value in investing in the assets and therefore Manitoba Hydro does not conduct facility level business case reviews. Pointe du Bois is a facility nearing the end of its life. Accordingly, Manitoba Hydro conducted a facility level business case review. Please see response to Coalition/MH I-109.

Manitoba Hydro's Corporate Value Framework is applied to each investment to assess the value and business case for each project.

Details have been itemized below with the project cost and valuation conclusion. For more detail refer to Capital Investment Justification (CIJ) submissions provided in the referenced IRs below and the Attachment to this response.

Sustainment System Renewal Projects

- Pointe du Bois Renewable Energy Project $308.3M
  See CIJ submitted in response to MIPUG-MH I-82 d(i)
- Dorsey Synchronous Condenser Refurbishment $65.4M
  Project was approved prior to implementation of Corporate Value Framework. CPJ and addendums have been provided in COALITION-MH-I-122-b-m Attachment 2 (CPJs)
- System Control Centre Replacement - 820 Taylor $48.2M
  See CIJ submitted in response to MIPUG-MH I-82 d(ii)
- Limestone Units 1-3 & 5-10 Stator Re-Wedge $37.8
  See CIJ submitted in response to MIPUG-MH I-82 d(iii)
- Churchill Weir Rehabilitation $29.4M
  See CIJ submitted in response to MIPUG-MH I-82 d(iv)
- Kettle Unit 5 Stator Overhaul $27.5M
  See CIJ submitted in response to MIPUG-MH I-82 d(v)
- Kettle Unit 9 Stator Overhaul $27.3M
  See CIJ submitted in response to MIPUG-MH I-82 d(v)
- Kettle Unit 7 Stator Overhaul $25.5M
  See CIJ submitted in response to MIPUG-MH I-82 d(v)

- Kettle Unit 11 Stator Overhaul $24.9M
  See CIJ submitted in response to MIPUG-MH I-82 d(v)
- Enterprise PCB Remediation $24.8M
  See CIJ submitted in response to MIPUG-MH I-82 d(viii)
- Kettle Unit 12 Stator Overhaul $24.4M
  See CIJ submitted in response to MIPUG-MH I-82 d(v)
- McArthur Falls Electrical Components Replacement/Refurbish $24.4M
  See CIJ submitted in response to MIPUG-MH I-82 d(vii)
- Kettle Unit 6 Stator Overhaul $23.3M
  See CIJ submitted in response to MIPUG-MH I-82 d(vi)
- Kettle Unit 8 Stator Overhaul $23.1M
  See CIJ submitted in response to MIPUG-MH I-82 d(v)
- Kettle Unit 10 Stator Overhaul $22.9M
  See CIJ submitted in response to MIPUG-MH I-82 d(v)
- Long Spruce Generator Protection Replacement $22.5M
  See COALITION-MH-I-122-b-m Attachment
- Grand Rapids Unit 1 Overhaul $21.2M
  See CIJ submitted in response to MIPUG-MH I-82 d(ix)
- HVDC BP2 Valve Hall Wall Bushing Replacement $19.7M
  Project was approved prior to implementation of Corporate Value Framework. CPJ and addendums have been provided in COALITION-MH-I-122-b-m Attachment 2 (CPJs)
- 13.2kV Shunt Reactor Replacements $19.3M
  See COALITION-MH-I-122-b-m Attachment
- Grand Rapids Unit 4 Major Overhaul $18.2M
  See COALITION-MH-I-122-b-m Attachment
- Kelsey GS SS 138kV Breaker Replacement $18.1M
  See COALITION-MH-I-122-b-m Attachment
- HVDC - Gapped Arrester Replacement $16.1M
  Project was approved prior to implementation of Corporate Value Framework. CPJ and addendums have been provided in COALITION-MH-I-122-b-m Attachment 2 (CPJs)
- Generation Security Infrastructure Update $14.9M

See COALITION-MH-I-122-b-m Attachment

- BP6 & BP7 Permanent Re-Route $12.0M
  A Corporate Value Framework cannot be provided at this time as the project is currently undergoing approvals.
- University Station Switchgear Replacement $10.6M
  See COALITION-MH-I-122-b-m Attachment

System Efficiency Projects

- Jenpeg Unit 2 Overhauls $53.4 M
  See CIJ submitted in response to MIPUG-MH I-82 e(i)
- Station Battery Bank Capacity & System Reliability Increase $45.5M
  Project was approved prior to implementation of Corporate Value Framework. CPJ and addendums have been provided in COALITION-MH-I-122-b-m Attachment 2 (CPJs)
- Long Spruce Unit 10 Overhaul $12.7M
  See CIJ submitted in response to MIPUG-MH I-82 e(ii)

c) Manitoba Hydro operates an integrated system in which all available resources are operated as required to meet the total of the Manitoba load and export obligations on a least cost basis while observing operational limitations. Due to the integrated nature of the system and the range of system water conditions it is not appropriate to determine the export sales value contributing to the justification of each generation project as it operates as a system. For applicable projects, however, lost generation risk is one of the evaluated measures in the corporate value framework. Please refer to COALITION/MH I-108a for additional details regarding generation project evaluations.

d) Manitoba Hydro believes that the application of value-based decision making using the CVF model incorporates condition and risk into the valuation in order to demonstrate prudent decision making and is reflected in the scoring provided in the CIJs filed in the Attachment to part b) of this response. Each valid alternative identified to deal with known potential needs in the CVF, calculates the risk being mitigated by the alternative as compared to the do-nothing option. When the alternative is valued, the probabilities of a worst-case event are considered.

Manitoba Hydro's asset management maturity is not at a level where specific project consequences in relation to peak (or other) loading conditions can be provided.

e) Yes. The cost effectiveness of the risk mitigation (i.e. the selected alternative) is qualified using the Corporate Value Framework. Portfolio optimization (see details in Tab 7) ensures the work is appropriately prioritized and scheduled. Please refer to the response to part b) .

f) Please refer to risk measure quantified by value, as noted in Attachment to the response to b).

Manitoba Hydro utilizes an Optimization Tool (Tab 7, 7.4.3) combined with resource allocation process to evaluate the timing for execution of each project, finding a balance of asset performance, cost and risk. This is an iterative approach that applies different variable constraints and is not specific to a single project. On exception, MH does evaluate specific case by case scenarios for a project where deferral is an alternative.

The consequences of any project deferral are an increase in the risk measures used to value the project in the corporate value framework. For example, deferring a generating station overhaul could increase the probability of realizing the lost generation risk the project intends to mitigate.

Manitoba Hydro does not pre-emptively calculate the consequence, at this time, of deferring all investments, so a more detailed, project specific response cannot be provided.

Manitoba Hydro is unable to produce the level of sensitivity analysis requested. Manitoba Hydro's value based decision making process includes alternatives that consider deferral and lost opportunity costs within the evaluation. All projects will be implemented within our fiscal and resource constraints that impact the start date for execution.

Manitoba Hydro does not calculate project value in the way implied by the question and so cannot provide information in the specified format. As opposed to selecting a specific

load condition and a probability of occurrence, the two approaches below are utilized to evaluate the risks associated with inability to supply domestic load.

With respect to networked transmission system investments, a yearly load profile is projected for a five-year period based on historical data and load forecast. A probabilistic analysis is conducted using the load profile in conjunction with failure events and different system conditions, with consideration given to the likelihood of these states. The analysis is completed for a five-year period, with a representative value from that analysis used to capture the benefits in year 6 and beyond, depending on anticipated load growth.

Projects on the distribution system capture this benefit via the corporate value framework, which accepts inputs such as how many failures per year will be avoided by the project, what the peak lost load is for the failures, and whether the failures result in a customer outage or loss of redundancy. Assumed changes to these inputs over time can be captured through the implementation of the corporate value framework.

g) All valid project alternatives are identified and evaluated using the corporate value framework. The portfolio optimization process is used to select the alternative that will result in the highest value portfolio.

   i. Details on the selected and not-selected alternative(s) for each of the projects, as well as the justification, are included in the Capital Investment Justification provided as part of the response to part b).
   ii. Please refer to the CIJs provided in parts b) and e) above regarding the cost-effectiveness of the project alternatives.
   iii. The “Do nothing” alternative is always considered as a base case against which all other alternatives are compared.

Project deferral is not an evaluated alternative. Deferral occurs only if a higher value/higher risk project forces deferral of a previously planned project, usually due to a fiscal or resource constraint. Please also reference MIPUG/MH I-79 regarding portfolio selection to determine start date after project approval.

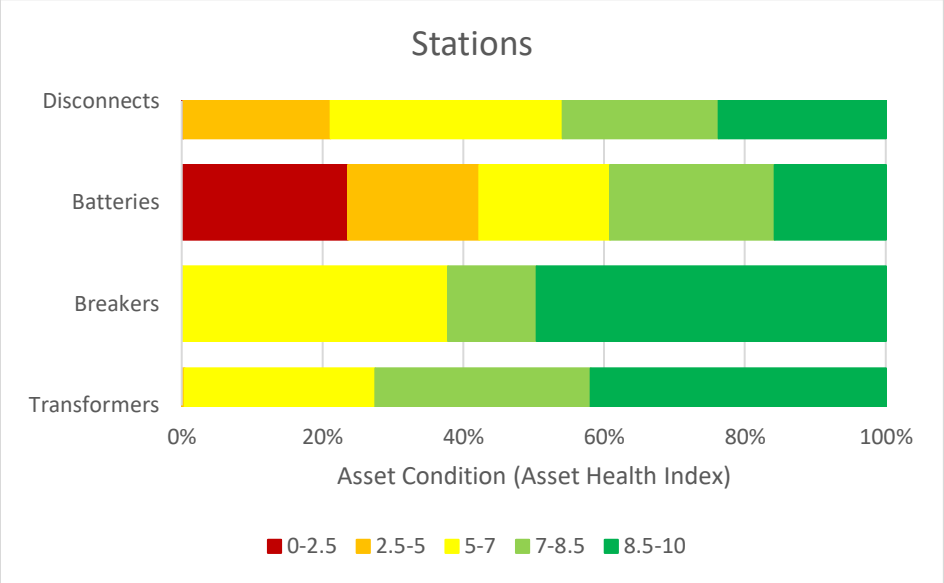
h) Typically, asset health index (AHI) scores are not applied at a program level since programs include multiple asset classes. Therefore, the AHI graphs below show the most prevalent asset applicable to the program.

Manitoba Hydro continues to develop AHIs for additional asset classes. Coalition/MH I-100 shows the asset classes for which AHI methodologies has been established. AHIs are not established for assets applicable to the following programs:

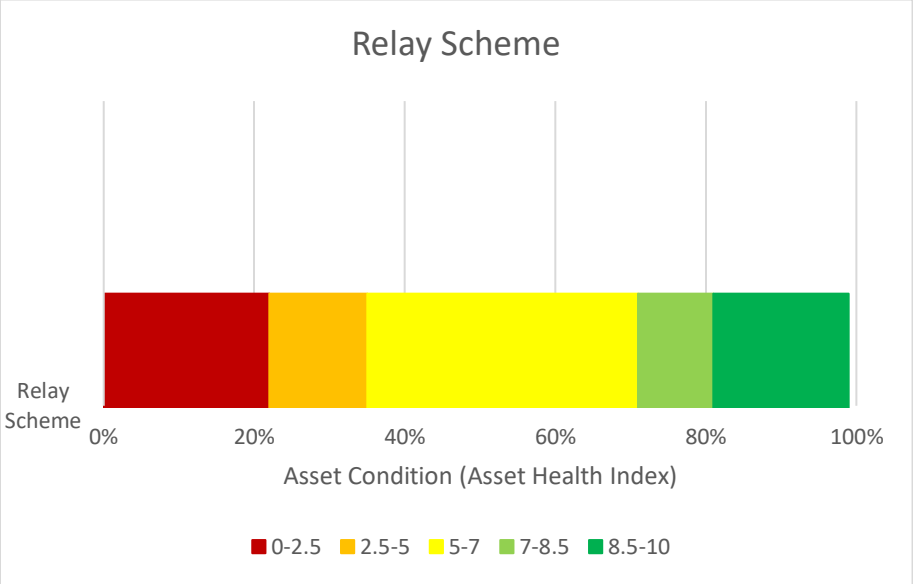
- Overhead – Pole & Feeder Replacements
- Distribution Modifications – Small Scope
- Lighting – Standard, Base & Cable Replacement
- Overhead – IPM Pole Treatment
- Underground – Cable Replacement
- Damaged Plant & Emergency Pole Replacements – Small Scope
- Underground – Cable Injection
- Transmission Line Wood Pole Replacement Program
- Control Centre Technology Infrastructure
- Telecommunication Program
- Underground – Civil Structures
- Distribution Stations Program
- Generation Auxiliary Systems
- Overhead – Right of Way Widening
- Support Infrastructure
- Transmission Line Footing & Anchor Replacement Program
- Overhead – Clearances
- Overhead – Distribution Grounding Replacement
- Underground – Padmount Equipment Replacement
- Station Ground Grid Sustainment Program
- Operational Enhancement & Reliability – Winnipeg

AHIs are established for assets applicable to the following programs with 2022/23-2031/32 10 Year Total Expenditures:

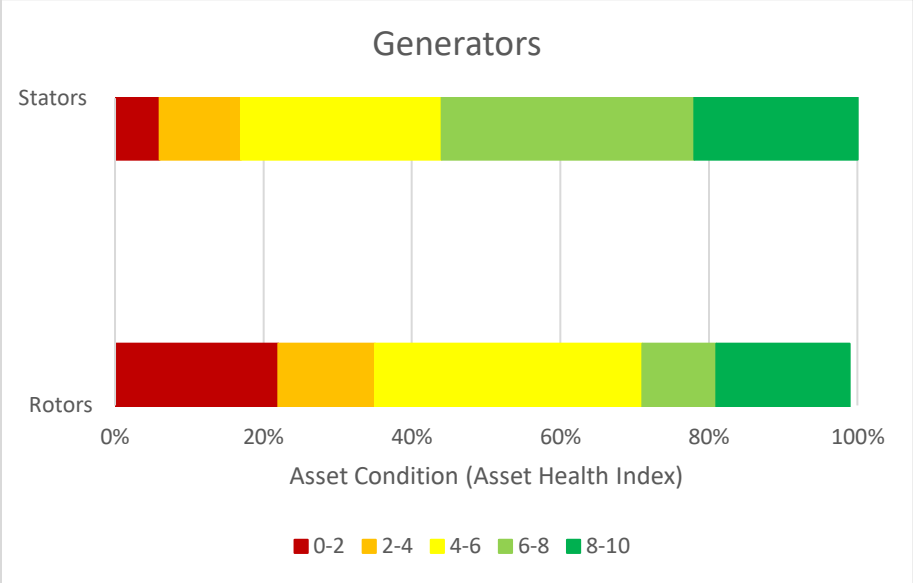
- Station In-Service Equipment Failures: $40.1M
- Transmission Stations Program: $22.4M



- Transmission Protection Relay Replacement Program: $21.2M



- Generation Core Equipment: $14.6M



Some of Manitoba Hydro's programs have been valued using the corporate value framework as described in part e).

Not all programs however have been valued so cost effectiveness is based on:

a) Manitoba Hydro's mandate to serve its customer base for customer driven programs (ex. the Distribution Small Scope Program – see MIPUG-MH I-84),
b) Historical asset needs within the program.

As Manitoba Hydro's asset management maturity increases, it is intended that all programs in the CVF to demonstrate cost-effectiveness.

i) For variable scope projects executed within programs, Manitoba Hydro can compare the alternative that is the most viable compared to the "do nothing" alternative, which will result in realizing the risk if the project is not executed. The positive CVF score indicates cost effectiveness. Manitoba Hydro's asset management continues to develop risk assessment reviews on common scope programs to determine the level of investment on a yearly basis.

Manitoba Hydro does not have the information necessary to quantify the consequences of reducing spending on any program. Please refer to the response to part h) regarding the asset health indices available and applicable to each program. Regarding age

demographics, please refer to Appendix 7.5 Asset Management Sustainment Spending Projection Analysis Sections 1.2 to 1.24.

Manitoba Hydro's asset maturity is not to a point where we are able to provide the specific consequences of reduced spending by specific amounts in the programs.

j) None of the assets listed in the table are identified as having a run-to-failure management strategy. Manitoba Hydro conducts regular inspections of these assets to determine the current state of health for each in order to make the most effective decision as to how to proceed. As such, these assets are managed using condition-base strategies, not run-to-failure.

A run-to-failure strategy on our major asset classes would result in a significant decline in system performance, higher costs to repair/replace after failure, the possibility of collateral damage, and a reduced ability to serve our customers.

k) For any projects in which the "Total Project Cost" is greater than the "20 Year Total", this would be due to expenses incurred prior to 2022/23 which are not reflected in the 20-year timeframe of the financial forecast scenario.

l) Tab 5 Section 5.8 states that using 2022 planning assumptions, Manitoba Hydro's anticipated need date for new resources to serve the Manitoba load and existing export obligations is 2030/31 based on sustained winter peak capacity deficits and sustained annual dependable energy deficits appear starting in 2033/34. These need dates reflect the Manitoba Hydro system capabilities including the capacity and dependable energy provided by the Keeyask, Manitoba-Minnesota Transmission Project and the Pointe du Bois Renewable Energy Projects. Tab 5 Section 5.9 states that to develop the financial scenario, a supply/demand scenario is provided with resources to meet expected demand ("2022 Supply/Demand Scenario"). These resources include refurbishment and capacity increases to Long Spruce and Kettle generating units that are due to be overhauled. As noted throughout the Application, the 2022 Supply/Demand Scenario includes a resource plan that is not fully optimized and is not informed by a developed and complete IRP.

Load flow studies are not used to identify and demonstrate the need for Transmission growth investments. The specific triggering event that resulted in the listed projects can be found within the CIJs provided as part of response b).

i. MH utilizes an Optimization Tool (Tab 7, 7.4.3) combined with resource allocation process to evaluate the appropriate timing for execution of each project, finding the optimal balance of asset performance, cost and risk. This is an iterative approach that applies different variable constraints and is not accomplished specific to a single project.

ii. Consistent with industry practice and NERC Resource Adequacy Assessments, Manitoba Hydro plans its capacity requirements to protect a reserve margin equivalent to 12% of Manitoba Firm demand. This value is confirmed as appropriate based on industry accepted practices (Loss of Load Expectation ("LOLE") Monte Carlo studies) to ensure LOLE is less than 1 day in 10 years.

In their NFAT review, La Capra Associates stated the following regarding Manitoba Hydro's capacity planning: "*A review of capacity reserve margins in other systems demonstrates that MH's reserve margin is no more stringent than typical reserve margins, and at 12%, it is in fact lower than many other systems*."……."*There is no available evidence upon which to conclude that MH's capacity reserve requirement should be any different than the current 12% standard. LCA believes this to be a reasonable assumption for the NFAT analysis*[1]."

Manitoba Hydro does not evaluate the number of hours during which the consequence could occur and therefore cannot provide a response.

iii. All Growth projects >$10M included a do-nothing alternative or include a CVF score that compares the viable alternative(s) to a do-nothing option (see MIPUG/MH I-79b for further explanation of do-nothing alternative).

Refer to CIJ's for each project found in MIPUG/MH I-82 and in response to part b) of this question for details on project alternatives and their CVF score.

[1] LCA NFAT Review, Technical Appendix 1 Resource Planning, Page 1-10, January 24, 2014

"Deferral" is not considered as a discrete project alternative. The need to defer a project would be identified during portfolio optimization (see Tab 7).

m) The "Other Projects, Programs & Portfolio Adjustments" line items, in the Capital Expenditure Plan provided in Appendix 7.7, do not include any specific projects or programs greater than $10M. The portfolio adjustments capture future anticipated capital expenditures related to business operations capital over the 20-year forecast period and also balance the capital plan sum of all projects to high level targets set for capital spend in each year (i.e. capital global budget or envelope as described in MIPUG/MH I-79 a). Please see Coalition/MH I-91 c) for a breakdown of the Other Projects, Programs and Adjustments line, which includes line items with portfolio adjustments greater than $10M.

C55-CIJ-PROJ

CAPITAL INVESTMENT JUSTIFICATION FOR

Long Spruce Generator Protection Replacement

Investment Type (Project)

BUDGET:	$10,814
CONTRIBUTIONS:	$0
NET BUDGET:	$10,814
(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:** 111,091
	Value/$K: 12.95

DATE PREPARED: 2018/01/04

EC/MHEB APPROVAL MINUTE & DATE:

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
MIDFORD, LORNE	VP GENERATION & WHOLESALE		VP Generation & Wholesale	2018/01/25
TURNER, HAL	DIRECTOR GENERATION ASSET MANAGEMENT		Director - Generation Asset Management	2018/01/22
KREML, JOHN	DIRECTOR GENERATION NORTH		Director - Generation North	2018/01/22
GAREAU, JULES	GENERATION MTCE & OPS SUPPORT DEPT MGR		Generation Maintenance and Oper Support	2018/01/20
MUZYCZKA, ALEX	GILLAM GEN PERFORMANCE GROUP TEAM LEADER	On behalf Of SYLVESTRE, JORDAN (jsylvestre).	Generation Maintenance and Oper Support	2018/01/19
MILLER, SANDY	GENERATION PROJECT MANAGEMENT DEPT MGR		Generation Project Management	2018/01/19
PAWLUK, JAMES	PROJECT MANAGEMENT SECTION HEAD		Generation Project Management	2018/01/19
BORTOLUZZI, LINDSEY	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2018/01/19
EDWARDS, ALAINA	PROJECT CONTROL & REPORTING OFFICER		Generation Project Management	2018/01/09
ALLARD, KATHLEEN	ASSET INVESTMENT PLANNING SECTION HEAD		Generation Asset Strategy and Performanc	2018/01/04

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Generation & Wholesale	**REQUESTING OPERATING/CORPORATE GROUP:**	Generation & Wholesale
RESPONSIBLE DIVISION:	Generation Asset Management	**REQUESTING DIVISION:**	Generation North
RESPONSIBLE DEPARTMENT:	Generation Project Management	**ISD: (YYYY/MM/DD)**	
I.M. NODE NUMBER:	2.1.20.15.08.8	**W.B.S. NUMBERs:**	P:26543
C55 INVESTMENT CODE:	10321		
SAP PROJECT TYPE:	24 - BOC-VP & Management	**C55 INVESTMENT SUB-CATEGORY**:	Single WBS
CORPORATE INVESTMENT CATEGORIES:	(Level 1) C3 / Sustainment (Level 2) CM / System Renewal		

CONTACTS			
PREPARED BY:	EDWARDS, ALAINA PROJECT CONTROL & REPORTING OFFICER 51460	**REQUESTOR:**	SYLVESTRE, JORDAN (jsylvestre)
PROJECT MANAGER:	FRIESEN, MARK PROJECT ENGINEER 51460		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION
Long Spruce Generator Protection Replacement

RECOMMENDATION

Approve a budget of $10.8M to replace the Generator and Transformer Protection and Synchronization Systems for Units 1 to 10 at the Long Spruce Generating Station.

SCOPE

Project Scope:

- Replace existing non-redundant protection scheme with a redundant protection scheme for the:
  - Generator protection
  - Generator Step Up (GSU) Transformer protection
  - Station Service Transformer (SST) protection
- Replace bearing and stator winding temperature probes and resistance temperature detectors (RTD);
- Modify existing direct current (DC) distribution system to add redundant DC zone boxes per unit;
- Install new power, communication, and control cables to interface the new protection systems with other systems;
- Install new communication equipment for remote engineering access for the protection relays;
- Install new protection cubicles to house the protective relays and associated equipment;
- Install new cable trays and trenches;
- Add 120V AC utility supply for protection cubicles;
- Install new transient fault recorder for every two units including new cubicle, input modules and associated wiring and interconnection replacement; and
- Replace synchronizer including new cubicle, associated equipment and wiring and interconnection

Not in Scope:

- Replacement of instrument transformers – voltage & current transformers;
- Upgrade remote terminal units (RTU);
- Upgrade excitation system protection and control;
- Upgrade governor system controls;
- Upgrade switching station metering;
- Upgrade unit control & monitoring system (UCMS)
- Upgrade control room equipment

BACKGROUND

The generator and transformer protection systems have been operational since 1978 and are at the end of their useable life. The relays are experiencing failures and require replacement in order to ensure reliability of power generation.

The Protection Maintenance Engineering Department condition assessment report dated May 18, 2016 indicated that there has been multiple failures of the protection which resulted in extended outages of the units at Long Spruce.

As part of the scope development phase of the project, an emergency protection system was developed using spare relays to mitigate the risk of online failure while the project scope was being finalized. It was identified that having an emergency protection system in place would directly impact the overall project design and construction strategy

BACKGROUND

as well as the risk mitigation strategy.

The Generation Design Department was engaged to develop a Conceptual Design Report (CDR) to develop conceptual design, design delivery strategy, budget estimate and high-level schedule. The CDR reviewed two alternatives:

1. Replace the existing protection with digital relays configured as 'A' and 'B' redundant scheme
2. A like-for-like functional replacement of the existing protection with digital relays to provide an 'A' single contingency coverage scheme for the assets

Manitoba Hydro has adopted the 'A' and 'B' redundant schemes at Kettle, Seven Sisters, Wuskwatim, Great Falls, Keeyask, Jenpeg, Kelsey and Pine Falls Stations. Stations still operating with a single scheme include Grand Rapids, Limestone, McArthur Falls, Slave Falls and Pointe du Bois.

A goal of the project will be to produce a set of standard panel design drawings that can be reused (with minimal to no modification required) for either redundant (A+B) or non-redundant (A) applications for other capital projects at our generating stations moving forward.

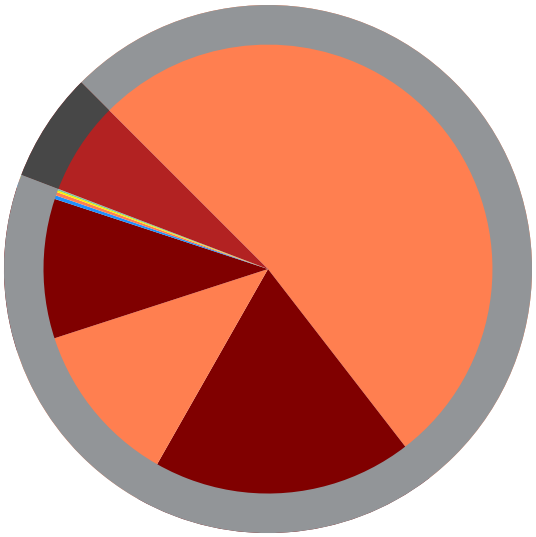
JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):

JUSTIFICATION

The current systems are no longer supported by the manufacturer and cannot be maintained. There are minimal spares available to support future failures. A new protection system provides value by reducing the risk of lost generation and the cost of repairing equipment by protecting the equipment from internal or external faults, abnormal operational conditions, and faults on the connected transmission lines system.

Alternative 1 is recommended to replace the existing protection with digital relays configured as 'A' and 'B' redundant scheme as it returns greater total value within the Corporate Value Framework. The 'A' and 'B' redundant scheme is a best practice widely used in the power industry to improve system reliability and reduce the frequency and duration of equipment outages. The redundant system provides protection against faults and abnormal operational conditions which ultimately reduces the probability of serious equipment damage and the lost revenue associated with it. It also provides the flexibility to take out of service one or the other with no impact on dependability and security of the protection system.

CORPORATE VALUE FRAMEWORK



Value Measure	Value Points	% of Value
Lost Generation Risk	82,151	64.06%
Financial Risk	36,865	28.75%
Safety Risk	366	0.29%
O&M Financial Benefits	176	0.14%
Environmental Risk	110	0.09%
Total Cost	-8,577	6.69%
Total Value	**111,091**	
Value/$K	**12.95**	

ANALYSIS OF ALTERNATIVES:

ECONOMIC ANALYSIS		
Discount Rate	**For current corporate rates see P911 6.25%**	

Active Option	NPV Benefits/(Costs)	CVF Score	Value/$K
Replace Generator Protection with Redundant System		111,091	12.95

Other Alternatives	NPV Benefits/(Costs)	CVF Score	Value/$K
Replace Generator Protection with Like for Like		96,220	14.59

INVESTMENT RISK ANALYSIS

$1.0M of contingency has been included in the budget to mitigate the following:
• Market variability at the time of supply of associated contracts and materials
• Electrical Construction resources are unavailable to complete the installation and the construction has to be tendered to an external contractor
• Additional internal resource efforts are required including design, construction and commissioning

Schedule Risk: As the installation must be completed during outages, there is a risk of not obtaining outages as per

INVESTMENT RISK ANALYSIS

the project schedule resulting in additional labour costs. Construction risks during an outage will be mitigated by predetermining interconnections, offsite fabrication prior to the construction period and having the components available through an early procurement strategy to account for long lead time items.

Scope Risk: Future inspections may reveal unforeseen changes or requirements which may result in additional work that was not originally estimated. Additional project scope items add complexity and may increase the risk of extending the project schedule and increasing the cost.

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

Fiscal Year	Budget	Contributions	Net Budget
Prev. Actuals	$153	$0	$153
2017/2018	$252	$0	$252
2018/2019	$1,181	$0	$1,181
2019/2020	$3,585	$0	$3,585
2020/2021	$1,394	$0	$1,394
2021/2022	$1,294	$0	$1,294
2022/2023+	$2,955	$0	$2,955
Total	**$10,814**	**$0**	**$10,814**

Please see Attachment “Financial Chart LS Generator Protection CIJ.xlsx” for financial chart of changes.

IMPACT ON O&A COSTS

Operating and administrative costs are expected to decrease resulting from the modernization and advanced troubleshooting capability.

PROPOSED SCHEDULE

Concept Design Report – May 2017 (completed)
Detailed Design Complete - January 2019
Components Received – August 2019
Install Unit 1 - November 2019
Install Unit 2 - May 2020
Install Unit 3 - November 2020
Install Unit 4 - May 2021
Install Unit 5 - November 2021
Install Unit 6 - May 2022
Install Unit 7 - November 2022
Install Unit 8 - May 2023
Install Unit 9 - November 2023
Install Unit 10 - May 2024

RELATED INVESTMENTS
None

OTHER ALTERNATIVES CONSIDERED
Replacing half of the units' relays and using the salvaged relays as spares was discounted as the relays are at the end of their maximum useful life and the probability of failure would remain high with the salvaged relays.

REFERENCE DOCUMENTS
DAD_PRE-CONST LS GENERATOR PROT REPL.docm
Financial Chart LS Generator Protection CIJ.xlsx

C55-CIJ-PROJ-AD

CAPITAL INVESTMENT JUSTIFICATION ADDENDUM FOR

Long Spruce Generator Protection Replacement

Investment Type (Project)

Addendum Number 1

	PREVIOUSLY APPROVED	REVISED	INCREASE/ (DECREASE)
BUDGET:	$10,814	$22,406	$11,592
CONTRIBUTIONS:	$0	$0	$0
NET BUDGET:	$10,814	$22,406	$11,592
		(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:** 111,091 **Value/$K:** 12.95	**Value:** 152,563 **Value/$K:** 9.97	

DATE PREPARED: 2021-09-27

EC/MHEB APPROVAL MINUTE & DATE: Approved by Aurel Tess, CFO November 5, 2021

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
Midford, Lorne	VP ASSET PLANNING & DELIVERY		VP Asset Planning & Delivery	2021-10-05
Turner, Hal	DIRECTOR ASSET MANAGEMENT		Director - Asset Management	2021-10-04
Halayko, Krista	ASSET MGMT STRATEGY & PLANNING DEPT MGR		Asset Management Strategy & Planning	2021-10-04
Pawluk, James	GENERATION PROJECT MANAGEMENT DEPT MGR		Generation Projects	2021-10-04
Austman, Jordan	PROJECT MANAGEMENT SECTION HEAD		Generation Projects	2021-10-04
Johnson, Erin	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2021-10-04
Edwards, Alaina	FINANCIAL SERVICES LEAD - GEN PROJECTS		Generation Projects	2021-09-27
Allard, Kathleen	PORTFOLIO PLANNER		Asset Management Strategy & Planning	2021-09-27

ADDENDUM NUMBER	DATE	REVISION (Summary of change)
CIJ	2018-01-25	Approve a budget of $10.8M to replace the Generator and Transformer Protection and Synchronization Systems for Units 1 to 10 at the Long Spruce Generating Station.

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Asset Planning & Delivery	**REQUESTING OPERATING/CORPORATE GROUP:**	Operations
RESPONSIBLE DIVISION:	Project Management	**REQUESTING DIVISION:**	Generation Operations and Maintenance
RESPONSIBLE DEPARTMENT:	Asset Management Strategy & Planning	**ISD: (YYYY/MM/DD)**	2025/12/30
I.M. NODE NUMBER:	2.1.20.15.08.8	**W.B.S. NUMBERs:**	P:26543
C55 INVESTMENT CODE:	10321		
SAP PROJECT TYPE:	24 - BOC-VP & Management	**C55 INVESTMENT SUB-CATEGORY**:	Single WBS
CORPORATE INVESTMENT CATEGORIZATION:	(Level 1) C3 / Sustainment (Level 2) CM / System Renewal		

CONTACTS			
PREPARED BY:	Edwards, Alaina FINANCIAL SERVICES LEAD - GEN PROJECTS 51460	**REQUESTOR:**	SYLVESTRE, JORDAN (jsylvestre)
PROJECT MANAGER:	McMillan, Meagan PROJECTS ENGINEER 51460		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
Long Spruce Generator Protection Replacement

RECOMMENDATION

Approve an increase of $11.6M to $22.4M from a previously approved amount of $10.8M resulting from an increase in scope, underestimated labour hours and material costs.

SCOPE

Level of effort required to successfully complete the work due to the complexity resulted in 85% of the increase.

Added Project Scope:
- Upgrade remote terminal units (RTU)
- Alarms to RTU and unit control & monitoring system (UCMS)
- Arc Flash hazard analysis
- Update of Long Spruce Station Arc Flash Study to revised Institute of Electrical and Electronics Engineers (IEEE) standard calculation methods
- Required spare parts

Removed Project Scope:
- Install new trenches
- Replace synchronizer including new cubicle, associated equipment and wiring and interconnection

BACKGROUND

The generator and transformer protection systems are at the end of their useable life and require upgrades in order to ensure reliability of power generation.

Following completion of the first two unit protection upgrades, additional scope items were discovered. The labour and materials required to complete the work were determined to be significantly underestimated. This resulted in longer outages, contracts and internal labour dedication than planned; 13 and 15 weeks compared to 8 weeks planned for the first two units.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):

JUSTIFICATION

Additional effort and scope of work is required to realize the value of the original justification reducing the risk of lost generation and the cost of repairing equipment by protecting the equipment from internal or external faults, abnormal operational conditions, and faults on the connected transmission lines system. The current systems are no longer supported by the manufacturer and cannot be maintained. There are minimal spares available to support future failures.

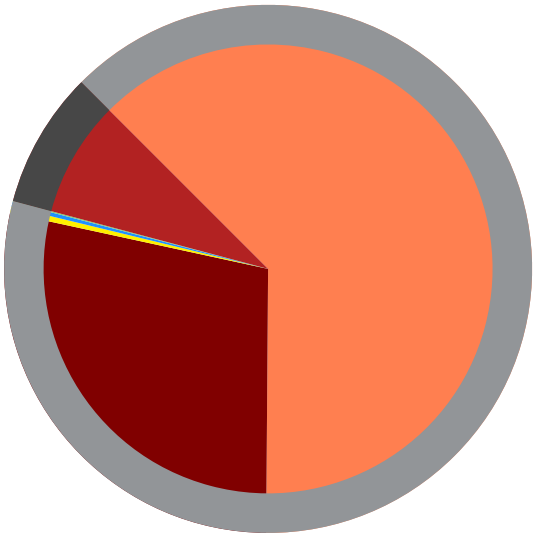
The new protection system will improve system reliability and reduce the frequency and duration of equipment outages. A redundant protection system provides protection against faults and abnormal operational conditions

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):

which ultimately reduces the probability of serious equipment damage and the lost revenue associated with it. It also provides the flexibility to take out of service one or the other with no impact on dependability and security of the protection system.

The graph of the Corporate Value Framework measures below reflects total value projected, sunk costs are not measured, only the future costs are considered.

CORPORATE VALUE FRAMEWORK (REVISED)



Value Measure	Value Points	% of Value
Lost Generation Risk	114,703	62.62%
Financial Risk	51,809	28.28%
O&M Financial Benefits	714	0.39%
Safety Risk	497	0.27%
Environmental Risk	149	0.08%
Total Cost	-15,309	8.36%
Total Value	**152,563**	
Value/$K	**9.97**	

ANALYSIS OF ALTERNATIVES:

ECONOMIC ANALYSIS		
Discount Rate	**For current corporate rates see P911** **5.5%**	

Active Option	**NPV Benefits/(Costs)**	**CVF Score**	**Value/$K**
Replace Generator Protection with Redundency		152,563	9.97

INVESTMENT RISK ANALYSIS

The $1.0M of contingency has been retained from the original CIJ to mitigate the following:
Market Variability: There is a medium risk of further commodity volatility due to the Covid-19 pandemic that may impact the cost and availability of materials and subsequently impact current supply contracts.

Resource Risk: There is a medium risk Electrical Construction resources are unavailable to complete the installation and the construction must be tendered to an external contractor. Additional external drafting resources were recently procured, but there remains a high risk that additional internal design resources are required to complete the construction packages per the project schedule.

Schedule Risk: As the installation must be completed during outages, there is a medium/low risk of not obtaining outages as per the project schedule resulting in additional level of effort. Construction risks during an outage will be mitigated by a three month pre-outage installation period made possible by completing design and procurement activities with consideration for long lead time items.

Scope Risk: There is a medium risk that additional lessons learned items from the first two unit upgrades will become additional project scope items, which may increase the risk of extending the project schedule and increasing the cost.

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
Long Spruce Generator Protection Replacement

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

	PREVIOUSLY APPROVED			PROPOSED			INCREASE / (DECREASE)		
Fiscal Year	**Budget**	**Contributions**	**Net Budget**	**Budget**	**Contributions**	**Net Budget**	**Budget**	**Contributions**	**Net Budget**
Prev. Actuals	$6,564	$0	$6,564	$5,075	$0	$5,075	($1,490)	$0	($1,490)
2021/2022	$1,294	$0	$1,294	$3,921	$0	$3,921	$2,627	$0	$2,627
2022/2023	$1,312	$0	$1,312	$3,876	$0	$3,876	$2,564	$0	$2,564
2023/2024	$1,290	$0	$1,290	$3,899	$0	$3,899	$2,609	$0	$2,609
2024/2025	$353	$0	$353	$3,479	$0	$3,479	$3,126	$0	$3,126
2025/2026	$0	$0	$0	$2,156	$0	$2,156	$2,156	$0	$2,156
2026/2027+	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	**$10,814**	**$0**	**$10,814**	**$22,406**	**$0**	**$22,406**	**$11,592**	**$0**	**$11,592**

IMPACT ON O&A COSTS

There is no change to the O&A cost impacts identified as a result of this addendum.

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
Long Spruce Generator Protection Replacement

PROPOSED SCHEDULE

Completed Installations:
Unit 2 - Sep 2020 to Nov 2020
Unit 9 - May 2021 to Aug 2021

Remaining Installations:
Unit 2 (deficiency resolution): Nov 2021
Unit 10: Mar 2022
Unit 3: Sep 2022
Unit 4: Mar 2023
Unit 8: Sep 2023
Unit 6: Mar 2024
Unit 1: Sep 2024
Unit 5: Mar 2025
Unit 7: Sep 2025

RELATED INVESTMENTS

N/A

OTHER ALTERNATIVES CONSIDERED

There are no other alternatives considered with this addendum.

REFERENCE DOCUMENTS

DAD_PRE-CONST LS GENERATOR PROT REPL.docm

Financial Chart LS Generator Protection CIJ.xlsx

10321_CIJ_LS Generator Protection Replac.docx

FW 26543 RE LSGS prot replacement-NW257734 Telecom SAP entries.msg

LS Generator Protection CIJa1 Financial Chart Sept 2021.xlsx

D1876(A)

REVIEWED BY EXECUTIVE COMMITTEE
MINUTE # 1277.03

DATE: 2009 08 25
Corporate Budget Services

CAPITAL PROJECT JUSTIFICATION
FOR

13.2kV Shunt Reactor Replacements

REVIEWED BY: DR
(Owning Dept Manager)

NOTED BY:
(if applicable)

Coordinating Div.:

Constructing Div.:

Financial: Brewenburg 2009.06.12

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.: 09.06.23

BUDGET $: (Total Net Cost)	$33,036,000
START DATE: (1st Cost Flow)	2009 07
IN-SERVICE DATE: (Indicate "Mult" if more than 1)	Mult - 2018 10
RISK MATRIX/ BUSINESS CASE TIER:	Tier 2 (900 pts)
INVESTMENT REASON: (Category and % Split)	Aging Infrastructure – 60% Employee Safety – 20% Public Safety – 20%

OWNING DIVISION: Apparatus Maintenance

I.M. NODE NUMBER: 1.1.2.3.43.1

W.B.S. NUMBERs: P:15313, P:15451-P:15456

MAJOR ITEM ☒ **DOMESTIC ITEM** ☐

PREPARED BY: D. Reiter / G. Duthie

DATE PREPARED: 2009 02 18

REPORT NUMBER:

FILE NUMBER (Optional):

Project Name
13.2kV Shunt Reactor Replacements.

Recommendation
To purchase a total of fifteen 13.2kV shunt reactors as a direct replacement of all the Ferranti Packard positions currently in the system. The total net cost is $33,036,000 for a staged in-service ending in October 2018.

Project Scope
Purchase and installation of fifteen 13.2kV, 20MVA oil-type shunt reactors for the following stations: - Two at Cornwallis Station (Designation R11and R21) - Six at Rosser Station (Designation R21, R22, R31, R32, R41 and R42) - Two at Raven Lake Station (Designation RB31 and RB 32) - Two at Overflow River Station (Designation R11 and R12) - Two at Mystery Lake Station (Designation R91 and R92) - One at Laverendrye Station (Designation RB 21)

Background
Ferranti Packard reactors are installed at six stations throughout the Manitoba Hydro system, as indicated in the scope section. These reactors are 45 years old, as compared with a useful life of approximately 30 years. They are monitored yearly by taking Dissolved Gas Samples (DGA). The analysis of the results indicates they are producing large amounts of gas, some of which are explosive. The DGA results for a reactor at Cornwallis Station identified a higher level than what is typical. The reactor was sent to the Waverley Service Center facility for inspection which revealed several internal problems. The Waverley Service Center Hi-bay staff said this was typical of these reactors. Documentation on these reactors dating back more than 10 years supported these comments. The Cornwallis Station reactor was scrapped because the winding problems could not be fixed, which, in combination with other issues, led to the conclusion that repairs would not be worth the time and money.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals
The Ferranti Packard reactors have reached the end of their life as seen by the internal inspections and dissolved gas analysis. If we continue to operate this apparatus it will likely fail catastrophically unless caught in time by dissolved gas analysis. We would not have anything with which to replace a failed reactor, which would affect system operation. Currently Cornwallis is operating with minus one reactor which is fine during the winter and summer heavy loading; however, if the 30MVAr reactor were to fail it would have a serious impact to the station bus voltage. It would create voltage levels that would exceed acceptable ranges for both distribution equipment and customer-owned equipment. A shunt reactor essentially provides inductive reactance between the line and the load and does not carry load current though the design considers this possibility. The risk of catastrophic failure is considered high however the consequence of the failure is difficult to predict and would depend on the weakest mechanical containment point of the oil vessel and the integrity of the associated protection scheme. This situation

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals

would present a serious safety hazard to both employees and the public as the potential for an oil pressure rupture with or without fire and bushing explosion are all possible. The historical fact that these oil filled apparatus are producing gas within the insulating oil medium is considered a risk with serious consequences for human life, equipment and our environment.

The choice of air core type reactors was considered, but the stations have limited space where the original oil type reactors are located. The air core type takes enormous space to construct a 20MVAr reactor. The true cost of a new air core type installation is unknown and would be a guess. An oil filled reactor would be a direct replacement with no unknowns except for the manufacturing costs.

Capital Investment Categorization:

Driver	Category	Sub-category	Split	Amount
Reliability-Outage Related	Aging Infrastructure	Asset Sustainment	60%	$19,822,000
Safety	Employee Safety	Asset Sustainment	20%	$ 6,607,000
Safety	Public Safety	Asset Sustainment	20%	$ 6,607,000
				$33,036,000

ANALYSIS OF ALTERNATIVES:

Economic Analysis

Discount Rate	6.10%	For current corporate rates see G911 For clarification on hurdle rates, contact the Economic Analysis Department

Recommended Option	NPV (= PV of BENEFITS - PV of COSTS)
Purchase and install 15 oil type 13.2kV, 20MVA shunt reactors	-$18,079,000

Other Alternatives Considered	NPV (= PV of BENEFITS - PV of COSTS)
Do nothing and risk catastrophic failures with no spares available.	Not costed
Replace with air core type shunt reactors. The larger footprint will present engineering challenges, require extensive civil work and result in a longer replacement program.	Not costed

Risk Analysis

The special risks associated with this project are:
- Initially, the engineering specification for this now obsolete apparatus. It may be difficult to get a Vendor to supply due to uniqueness.
- Secondly, a potentially higher-than-normal delay for the manufacture of oil-filled reactive equipment, again due to their uniqueness.
- Finally, there will be risks associated with outage availability to put the new equipment into service.

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements

The estimated resource requirements are as follows:

Department/ Section	Cost Centre	Hours
Haulage Services	53140	2,840
Apparatus Mtce Wpg North-West	52990	1,950
Apparatus Mtce Shop	53100	1,696
Apparatus Mtce West	53040	1,300
Apparatus Mtce North	53060	1,300
Apparatus Mtce Wpg	53000	650
Station Design-Apparatus QC	52340	640
Station Design-SEG	52280	128
Apparatus Mtce-Technical Support Serv.	53080	128
Other	various	0
Total Resource Requirements		**10,632**

Total Budget

The program calls for two replacements per year to mitigate the impact both in terms of annual financial requirements and system reliability/outages.

The annual net budget requirements are as follows (in thousands of dollars):

Fiscal Year	Proposed Budget	
Prev. Actuals	$	-
2009/10	$	13
2010/11	$	17
2011/12	$	4,103
2012/13	$	4,183
2013/14	$	4,267
2014/15	$	4,352
2015/16	$	4,448
2016/17	$	4,550
2017/18	$	4,628
2018/19	$	2,475
Total	$	33,036

Proposed Schedule

The replacements are scheduled as follows:
- Two at Cornwallis Station for Oct 2011
- Six at Rosser Station, two each for Oct 2012, Oct 2013 and Oct 2014
- Two at Raven Lake Station for Oct 2015
- Two at Overflow River Station for Oct 2016
- Two at Mystery Lake Station for Oct 2017
- One at Laverendrye Station for Oct 2018

Related Projects

None.

Reference Documents

None.

(IN THOUSANDS OF DOLLARS)

Title	Investment Management Node:
13.2KV SHUNT REACTORS-VA...OUS STATIONS	1.1.2.3.43.1
Owning Division: APPARATUS MAINTENANCE	Coordinating Division: APPARATUS MAINTENANCE
	ProjectNumber: P:15313 - P:15456

DESCRIPTION:
Purchase and installation of fifteen 13.2kV, 20MVA oil-type shunt reactors for the following stations:
- Two at Cornwallis Station (Designation R11and R21)
- Six at Rosser Station (Designation R21, R22, R31, R32, R41 and R42)
- Two at Raven Lake Station (Designation RB31 and RB 32)
- Two at Overflow River Station (Designation R11 and R12)
- Two at Mystery Lake Station (Designation R91 and R92)
- One at Laverendrye Station (Designation RB 21)

JUSTIFICATION:
The Ferranti Packard reactors have reached the end of their life as seen by the internal inspections and dissolved gas analysis. If we continue to operate this apparatus it will likely fail catastrophically unless caught in time by dissolved gas analysis. We would not have anything with which to replace a failed reactor, which would affect system operation.

The risk of catastrophic failure is considered high however the consequence of the failure is difficult to predict and would depend on the weakest mechanical containment point of the oil vessel and the integrity of the associated protection scheme. This situation would present a serious safety hazard to both employees and the public as the potential for an oil pressure rupture with or without fire and bushing explosion are all possible. The historical fact that these oil filled apparatus are producing gas within the insulating oil medium is considered a risk with serious consequences for human life, equipment and our environment.

CAPITAL INVESTMENT CATEGORIZATION:
Reliability-Outage Related, Aging Infrastructure, Asset Sustainment, 60%
Safety, Employee, Asset Sustainment, 20%
Safety, Public, Asset Sustainment, 20%

REVISION:
New Item for CEF09

Contingency: $3809

IN SERVICE DATES				Base estimate 2009/04/01 CLASS 2
2011/10/31	4116	2015/10/31	4448	
2012/10/31	4201	2016/10/31	4550	Work start date 2009/07/01
2013/10/31	4267	2017/10/31	4628	
2014/10/31	4352	2018/10/31	2475	

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-HAP TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2009/10	12		1			13
Req: 2010/11	15		2			17
2011/12	3876	186	42			4104
2012/13	3873	266	44			4183
2013/14	3873	349	44			4266
2014/15	3873	434	46			4353
2015/16	3881	521	46			4448
2016/17	3892	610	48			4550
2017/18	3881	699	48			4628
2018/19	2035	415	25			2475
V-HLD TOTAL	29211	3480	346			33037

Prepared by ST	yy mm dd 09 06 11	Approved by OWNING DIVISION	yy mm dd 09 06 11	Approved by COORDINATING DIVISION	yy mm dd 09 06 11	Approved by VICE-PRESIDENT	yy mm dd

2009/06/11 08:14AM

(IN THOUSANDS OF DOLLARS)

FORECAST HISTORY

ProjectNumber P:15313 - P:15456

Approved yy mm	TOTAL AMOUNT	COMMENTS

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2009/10 Apr							
May							
Jun						4	4
Jul	4					7	11
Aug	7					1	12
Sep	1						12
Oct							12
Nov							12
Dec							12
Jan							12
Feb							13
Mar			1			1	13
TOTAL	12		1			13	13
2010/11 Apr							
May							
Jun						4	4
Jul	4					8	12
Aug	8					3	15
Sep	3						15
Oct							15
Nov							15
Dec							15
Jan							15
Feb							17
Mar			2			2	17
TOTAL	15		2			17	17

TRANSMISSION & DISTRIBUTION CAPITAL BUDGET RANKING TOOL

Matrix Scoring Sheet

See the CAPITAL BUDGET RANKING TOOL DOCUMENTATION for instructions and definitions.

Date Scored: 4/3/2009
I.M. # 1.1.2.3.43.1
WBS # (if Domestic)

NAME OF PROJECT: 13.2 kV Shunt Reactor Replacements

Enter scores in grey cells = Weight X Probability points X Consequence points

Weight	TRANSMISSION & DISTRIBUTION GOAL - Factor	Level 1 (=10 points)	Level 2 (=7 points)	Level 3 (=5 points)	Level 4 (=2 points)	Level 5 (=0 points)	GOAL SCORES	COMMENTS / RATIONALE (Required) (do not split cells; press {Alt}{Enter} to start a new line / paragraph)
10	**SAFETY**						350	Considering the content of the oil samples presently being analysised the probability for catastrophic failure has to be medium high as the majority of the samples contain acetolyene and hydrogen. While the consequence of these failures could be high a medium rank was chosen based on the functioning protection schemes.
	Probability of risk to public or employee safety	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
	Consequence of risk to public or employee safety	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
10	**SERVICE & RELIABILITY**						500	Certain probability was selected as we have already had a failure at Cornwallis Station. Medium consequence selected based on an assumption that 20 MVAR is the same as 20 MVA.
	Probability of:							
	- event affecting service to a customer **OR**	CERTAIN	HIGH	MEDIUM	LOW	does not apply		
	- event affecting reliability of the transmission or distribution system	CERTAIN	HIGH	MEDIUM	LOW	does not apply		
	Consequence of:							
	- event affecting service to a customer, **OR**	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
	- event affecting reliability of the transmission or distribution system, **OR**	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
	- event affecting reliability of the communications system	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
5	**FINANCIAL IMPACT**							High level estimate on the mtce dollars saved by this project - Estimated in today's dollars each unit refurbishment costs would be about $50k. All 15 units have been through WSC for refurbisment and the frequency for these units is every 10 years. Project driver however is Reliability and Safety.
	Probability of achieving financial impact	CERTAIN		LIKELY		does not apply		
	Consequence:							
	- Net Present Value, **OR**	> $1,000k	> $100k and ≤ $1,000k	> $0 and ≤ $100k		≤ $0		
	- Average avoided cost per year	> $250k	> $100k and ≤ $250k	> $30k and ≤ $100k	> $0 and ≤ $30k	does not apply		
5	**TRANSFER CAPABILITY**							
	Probability of impact to transfer capability			ALL PROJECTS		does not apply		
	Consequence of increase to or prevent loss of transfer capability	> 50MW	>10MW and ≤ 50MW	> 0MW and ≤ 10MW	PREVENT LOSS	does not apply		
5	**ENVIRONMENT**						50	Each Reator contains about 7000 liters of transformer insulating oil that has a low probability of leakage from an in-service failure but the impact of this leakage into the environment would be negative especially in a site without oil containment or near a river.
	Probability of negative or positive impact	HIGH		MEDIUM	LOW	does not apply		
	Consequence of negative or positive impact	HIGH		MEDIUM	LOW	does not apply		

Tier 1 ≥ 1,200; Tier 2 = 850-1,199; Tier 3 = 550-849; Tier 4 = 200-549 & Tier 5 < 200

MATRIX SCORE: 900 **Tier 2**

Template Revision Date: 2008 08 20

C55-CIJ-PROJ-AD

CAPITAL INVESTMENT JUSTIFICATION ADDENDUM FOR

13.2kV Shunt Reactor Replacements

Investment Type (Project)

Addendum Number 2

	PREVIOUSLY APPROVED	REVISED	INCREASE/ (DECREASE)
BUDGET:	$15,916	$18,049	$2,133
CONTRIBUTIONS:	$0	$0	$0
NET BUDGET:	$15,916	$18,049	$2,133
		(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:**	**Value:** -2,352	
	Value/$K:	**Value/$K:** (0.53)	

DATE PREPARED: 2019/10/17

EC/MHEB APPROVAL MINUTE & DATE:

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
Mailey, Shane	VP TRANSMISSION		VP Transmission	2019/12/11
Penner, Glenn	DIRECTOR TRANSMISSION CONST & LINE MTCE		Director - Trans Const & Line Mtc	2019/12/11
Neufeld, Gerald	DIRECTOR TRANSMISSION PLANNING & DESIGN		Director - Trans Planning & Design	2019/12/11
Neufeld, Maria	TRANSMISSION ASSET MANAGEMENT DEPT MGR		Transmission Asset Management	2019/12/10
Adamkowicz, Mark	TRANSMISSION PROJECTS DEPARTMENT MGR		Transmission Project Management	2019/12/09
Killen, Mike	CAPITAL/BUSINESS ANALYST OFFICER		Director - Trans Stations Ops & Mtce	2019/12/09
Long, Krista	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2019/12/09
Akhi, Taohida	PROJECT ENGINEER		Transmission Project Management	2019/12/09
Bell, Christine	PORTFOLIO ACCOUNTANT		Transmission Asset Management	2019/10/17

ADDENDUM NUMBER	DATE	REVISION (Summary of change)
1	2012/07/11	Decrease the project budget by $16,375 due to lower estimated costs for the 15 reactors.
Original	2009/08/25	New item.

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Transmission	**REQUESTING OPERATING/CORPORATE GROUP:**	Transmission
RESPONSIBLE DIVISION:	Transmission Construction & Line Mtce	**REQUESTING DIVISION:**	Transmission Stations Operations &
RESPONSIBLE DEPARTMENT:	Transmission Projects Department	**ISD: (YYYY/MM/DD)**	**2021/08/30**
I.M. NODE NUMBER:	2.1.30.15.02.32	**W.B.S. NUMBERs:**	P:15313, P:15451, P:15452, P:15453,
C55 INVESTMENT CODE:	13701		
SAP PROJECT TYPE:	24 - BOC-VP & Management	**C55 INVESTMENT SUB-CATEGORY**:	Shell
CORPORATE INVESTMENT CATEGORIZATION:	(Level 1) C3 / Sustainment (Level 2) CM / System Renewal		

CONTACTS			
PREPARED BY:	Killen, Mike CAPITAL/BUSINESS ANALYST OFFICER 52960	**REQUESTOR:**	Mike Killen, Transmission Stns Ops & Mtce Division
PROJECT MANAGER:	Akhi, Taohida PROJECT ENGINEER 52710		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
13.2kV Shunt Reactor Replacements

RECOMMENDATION

Increase the project budget by $2.2 million compared to Addendum #01 approved in 2012 to a revised total of $18.1 million as a result of:

1. An increase in material costs associated with the purchase of foundation material, conductor, risers, grounding and miscellaneous hardware material.
2. Additional labour requirements for design, construction and commissioning.

SCOPE

The scope of the project includes purchase and installation of 15 shunt reactors currently in the system. The remaining six reactors will be installed over the next 2 years. The overall scope of the project has not changed; increased costs for material and additional labour requirements for design, construction and commissioning.

The work currently underway involve the installation of reactors at the following stations:

- Two at Raven Lake Station (Designation RB31 and RB 32)
- One at Overflowing River Station (Designation R12)
- Two at Mystery Lake Station (Designation R91 and R92)
- One at Laverendrye Station (Designation RB 21)

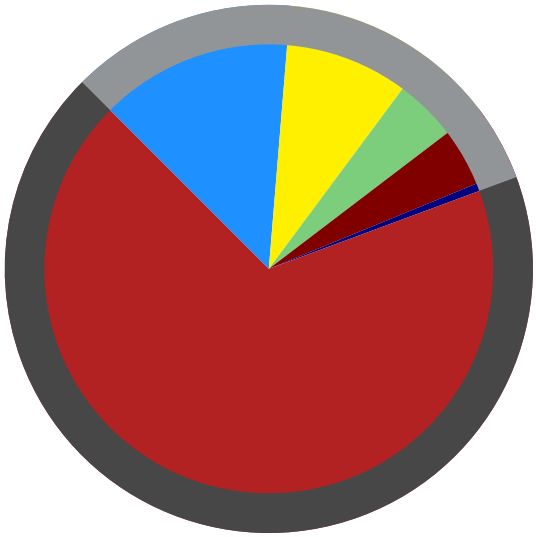
BACKGROUND

The original project budget of $33.0 million was approved in 2009 for the reactors' replacement. The budget was reduced to $15.9 million as result of lower estimated cost for the reactors as part of addendum #01 approved in 2012.

Ferranti Packard reactors are installed at six stations throughout the Manitoba Hydro system, as indicated in the scope section. These reactors are 45 years old, as compared with a useful life of approximately 30 years. They are monitored yearly by taking Dissolved Gas Samples (DGA). The analysis of the results indicates they are producing large amounts of gas, some of which are explosive. The DGA results for a reactor at Cornwallis Station identified a higher level than what is typical. The reactor was sent to the Waverley Service Center facility for inspection which revealed several internal problems. The Waverley Service Center Hi-bay staff said this was typical of these reactors. Documentation on these reactors dating back more than 10 years supported these comments. The Cornwallis Station reactor was scrapped because the winding problems could not be fixed, which, in combination with other issues, led to the conclusion that repairs would not be worth the time and money.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):
JUSTIFICATION
Due to portfolio prioritization this project was deferred 3 years. As a result of the deferral, material and labour costs increased over the period. The Ferranti Packard reactors have reached the end of their life as seen by the internal inspections and dissolved gas analysis; the apparatus could fail catastrophically presenting a safety hazard to employees and affecting system operation.

CORPORATE VALUE FRAMEWORK (REVISED)



Value Measure	Value Points	% of Value
Safety Risk	895	13.8%
O&M Financial Benefits	574	8.86%
Environmental Risk	290	4.48%
Financial Risk	269	4.16%
Blackstart Delay Risk	36	0.56%
Total Cost	-4,416	68.14%
Total Value	**-2,352**	
Value/$K	**(0.53)**	

ANALYSIS OF ALTERNATIVES:

ECONOMIC ANALYSIS		
Discount Rate	**For current corporate rates see P911** **6%**	

Active Option	**NPV Benefits/(Costs)**	**CVF Score**	**Value/$K**
Preferred		-2,352	(0.53)

INVESTMENT RISK ANALYSIS
The risk associated with this project is: - Outage availability to put the new equipment into service.

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
13.2kV Shunt Reactor Replacements

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

	PREVIOUSLY APPROVED			PROPOSED			INCREASE / (DECREASE)		
Fiscal Year	**Budget**	**Contributions**	**Net Budget**	**Budget**	**Contributions**	**Net Budget**	**Budget**	**Contributions**	**Net Budget**
Prev. Actuals	$15,916	$0	$15,916	$13,140	$0	$13,140	($2,775)	$0	($2,775)
2019/2020	$0	$0	$0	$620	$0	$620	$620	$0	$620
2020/2021	$0	$0	$0	$1,866	$0	$1,866	$1,866	$0	$1,866
2021/2022	$0	$0	$0	$2,422	$0	$2,422	$2,422	$0	$2,422
2022/2023	$0	$0	$0	$0	$0	$0	$0	$0	$0
2023/2024	$0	$0	$0	$0	$0	$0	$0	$0	$0
2024/2025+	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	**$15,916**	**$0**	**$15,916**	**$18,049**	**$0**	**$18,049**	**$2,133**	**$0**	**$2,133**

IMPACT ON O&A COSTS

This project will reduce annual maintenance costs and has been factored in to the Corporate Value Framework score.

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
13.2kV Shunt Reactor Replacements

PROPOSED SCHEDULE

The shunt reactor replacements are scheduled as follows:

- One at Overflowing River Station for October 2020 deferred from September 2018
- Two at Raven Lake Station for July 2021 deferred from September 2018
- Two at Mystery Lake Station for August 2021 deferred from November 2018
- One at Laverendrye Station for August 2021 deferred from September 2019

RELATED INVESTMENTS

None.

OTHER ALTERNATIVES CONSIDERED

The alternative to do nothing is not an option due to high risk of catastrophic failure.

REFERENCE DOCUMENTS

CPJA#1

CPJ

C55-CIJ-PROJ

CAPITAL INVESTMENT JUSTIFICATION FOR

Grand Rapids Unit 4 Major Overhaul

Investment Type (Project)

BUDGET:	$18,629
CONTRIBUTIONS:	$0
NET BUDGET:	$18,629
(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:** 111,025
	Value/$K: 8.46

DATE PREPARED: 2020-11-06

EC/MHEB APPROVAL MINUTE & DATE:

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
Midford, Lorne	VP ASSET PLANNING & DELIVERY		VP Asset Planning & Delivery	2020-11-09
Turner, Hal	DIRECTOR ASSET MANAGEMENT		Director - Asset Management	2020-11-09
Bishop, Gary	GEN ASSET STRATEGY & PERF DEPT MANAGER		Generation Asset Strategy and Performanc	2020-11-09
Pawluk, James	GENERATION PROJECT MANAGEMENT DEPT MGR		Generation Project Management	2020-11-09
Orellana, Cristian	PROJECT MANAGEMENT SECTION HEAD		Generation Project Management	2020-11-09
Johnson, Erin	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2020-11-06
Edwards, Alaina	PROJECT CONTROL & REPORTING OFFICER		Generation Project Management	2020-11-06
Allard, Kathleen	PORTFOLIO PLANNER		Generation Asset Strategy and Performanc	2020-11-06

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Asset Planning & Delivery	**REQUESTING OPERATING/CORPORATE GROUP:**	Generation & Wholesale
RESPONSIBLE DIVISION:	Asset Management	**REQUESTING DIVISION:**	Generation Operations and Maintenance
RESPONSIBLE DEPARTMENT:	Generation Project Management	**ISD: (YYYY/MM/DD)**	2026/03/30
I.M. NODE NUMBER:	2.1.20.15.02.69	**W.B.S. NUMBERs:**	P:28747, P:30679
C55 INVESTMENT CODE:	11587		
SAP PROJECT TYPE:	23 - BOC-Corporate Asset Management Executive Committee	**C55 INVESTMENT SUB-CATEGORY**:	Shell
CORPORATE INVESTMENT CATEGORIES:	(Level 1) C3 / Sustainment (Level 2) CM / System Renewal		

CONTACTS			
PREPARED BY:	Harber, Kristina CAPITAL PLANNING ANALYST 51455	**REQUESTOR:**	Kevin Penner
PROJECT MANAGER:	Maloney, Rick PROJECT OFFICER 51460		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION
Grand Rapids Unit 4 Major Overhaul

RECOMMENDATION

Approve a budget of $18.6M to complete major overhaul on Unit 4 at Grand Rapids Generating Station to extend its useful life.

SCOPE

The scope of work includes:

- Turbine – Provide new turbine runner with a stainless-steel construction; refurbish turbine shaft, servo motors and perform cavitation repairs and anchoring on turbine embedments.
- Generator – Reinsulate rotor poles and perform cleaning, re-wedge and clean stator, and replace surface air coolers.
- Electrical Auxiliary –Replace generator line disconnect switch.
- Intake Gates – Replace gate seals and rollers as required.

The scope of work excludes work to the exciter, governor and protection, unit control and monitoring system (UCMS), and generator step up (GSU) transformers.

BACKGROUND

Grand Rapids Unit 4 was installed in 1968 by GE Canada. For the last 10 years the original runner has been experiencing fatigue cracks on the turbine blades that require complex repairs to prevent catastrophic failure. The increased frequency of these cracks indicate that the blades have reached the end of their usable life. Moreover, the original runner is carbon steel construction making it prone to cavitation which also must be repaired by welding. Modern runners of stainless-steel construction have increased cavitation resistance and therefore longevity. In addition, blade jacking test data indicated that the runner blade bushing clearances are no longer within design tolerances. This will eventually result in seal failure which will cause water to leak into the runner hub. The current asset health index score of the turbine is 1.6/10.

As found in recent inspections, the rotor field bus bar pole sections have experienced deterioration and have been recommended to perform a life extension so that they last until the next overhaul cycle. The current rotor asset health index score is 3.5/10.

The stator was re-wedged approximately 30 years ago and based on similar assets within the fleet it is highly unlikely that the current wedging would last until the next overhaul cycle. The major outage required for the unit work provides the opportunity to re-wedge the stator.

It is more than 30 years since the intake gates have been inspected. The gates at Grand Rapids require a mobile crane for their complete removal from the water passage for an inspection. The major outage required for the unit work provides the opportunity to remove the gates for proper inspection and refurbishment as required.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):

JUSTIFICATION

The investment will mitigate Lost Generation Risk associated with prolonged forced outages caused by the turbine runner, the rotor, the surface air coolers, turbine embedments, the stator wedging system, and the generator line switch.

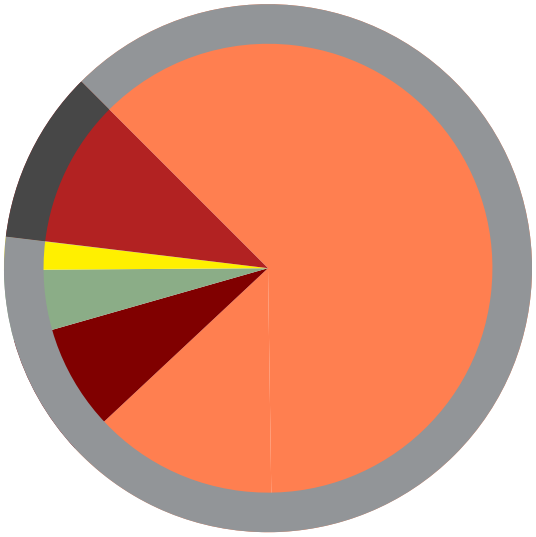
The investment will mitigate Financial Risk associated with repairing damage caused by failure of the stator wedging system, the turbine runner blades, and the generator line switch.

The investment is expected to reduce operating and maintenance costs associated with welding repairs of the cracked turbine runner blades, cavitation repairs of the existing steel runner blades, and the damaged turbine embedments, replacing the runner hub trunnion seals and processing governor oil.

The investment will mitigate Environment Risk associated with a release of governor oil into the Saskatchewan River from the turbine runner hub.

CORPORATE VALUE FRAMEWORK

Value Measure	Value Points	% of Value
Lost Generation Risk	104,865	75.53%
Financial Risk	10,478	7.55%
Generation Revenue Benefit	6,001	4.32%
O&M Financial Benefits	2,783	2%
Environmental Risk	21	0.02%
Safety Risk	0	0%
Total Cost	-13,123	10.59%
Total Value	**111,025**	
Value/$K	**8.46**	



ANALYSIS OF ALTERNATIVES:

ECONOMIC ANALYSIS		
Discount Rate	**For current corporate rates see P911 6.5%**	

Active Option	**NPV Benefits/(Costs)**	**CVF Score**	**Value/$K**
Active		111,025	8.46

Other Alternatives	**NPV Benefits/(Costs)**	**CVF Score**	**Value/$K**
Replace Runner Blades and Refurbish Hub		108,526	8.74
Up-rate Runner and Generator		85,338	2.67

INVESTMENT RISK ANALYSIS

Scope:

- There is a small risk that the existing turbine embedments will affect the performance of the new turbine runner. This risk won't be realized until measurements are taken and factored into the runner design. $1.1M of contingency has been carried in the event re-machining of the embedments is required to assure proper runner performance.
- During disassembly, there are several minor scope items which have uncertain condition and will be inspected and tested during the outage. Testing has been carried in the budget and schedule. $100k of contingency has been carried in the event that some of these assets are required to be refurbished or replaced.

Schedule:

- There is a risk that multiple existing components including embedments, stator, and rotor may have unforeseen condition which will require some level of refurbishment which could extend the construction schedule.
- There is a risk that more than anticipated hazardous materials are required to be abated during the disassembly and reassembly stage which could extend the construction schedule.

Budget:

- The value of these design, fabrication and construction contracts can be affected by the global demand for resources and commodity pricing. The current budget reflects the best information available and includes recent Original Equipment Manufacturer (OEM) input. A contingency of $500k is included in the budget for this risk.

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

Fiscal Year	Budget	Contributions	Net Budget
Prev. Actuals	$218	$0	$218
2020/2021	$47	$0	$47
2021/2022	$372	$0	$372
2022/2023	$2,438	$0	$2,438
2023/2024	$3,143	$0	$3,143
2024/2025	$7,143	$0	$7,143
2025/2026+	$5,269	$0	$5,269
Total	**$18,629**	**$0**	**$18,629**

IMPACT ON O&A COSTS

The investment is expected to reduce operating and administration costs associated with welding repairs on the turbine blades for fatigue cracking and cavitation, and issues related to the turbine blade trunnion seals being in poor condition (oil processing, seal replacement).

PROPOSED SCHEDULE

April 2021 – Commence Project Execution
April 2022 – Award Runner Supply Contract
December 2024 – Design and Fabrication of new runner
January 2025 – Outage Start Date
October 2025 – Unit 4 ISD

RELATED INVESTMENTS

N/A

OTHER ALTERNATIVES CONSIDERED

The following alternatives were considered during the Scope Development stage:

- Refurbish the runner hub and replace the blades – This alternative has slightly less total value than the selected alternative and also presents uncertain project execution risks associated with installing new blades in a used hub. It was therefore not selected.
- Uprate runner and generator - This alternative would present a generating revenue benefit opportunity with a minor improvement in the turbine's capacity and efficiency but the incremental cost to execute dismisses this alternative.

REFERENCE DOCUMENTS
11587_CIC_GR Unit 4 Turbine Runner Repla.docx
GR Unit 4 Major Overhaul Financial Chart CIJ.xlsx

C55-CIJ-PROJ

CAPITAL INVESTMENT JUSTIFICATION FOR

Kelsey SS 138kV Breaker Replacements

Investment Type (Project)

BUDGET:	$18,447
CONTRIBUTIONS:	$0
NET BUDGET:	$18,447
(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:** 35,034
	Value/$K: 2.44

DATE PREPARED: 2022-03-18

EC/MHEB APPROVAL MINUTE & DATE: Approved by Aurel Tess, CFO on April 26, 2022

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
Turner, Hal	VP ASSET PLANNING & DELIVERY		VP Asset Planning & Delivery	2022-03-25
Pawluk, James	DIRECTOR ASSET MANAGEMENT		Director - Asset Management	2022-03-23
Bowen, Dave	DIRECTOR PROJECT MANAGEMENT		Director Project Management	2022-03-22
Halayko, Krista	ASSET MGMT STRATEGY & PLANNING DEPT MGR		Asset Management Strategy & Planning	2022-03-21
Wowryk, Nicole	TRANS & DIST PROJECTS DEPT MANAGER		Transmission & Distribution Projects	2022-03-18
Penner, Kevin	ASSET LIFECYCLE MANAGEMENT DEPT MANAGER		Asset Lifecycle Management	2022-03-18
Aikens, Mark	SENIOR INVESTMENT STRATEGY ENGINEER		Asset Lifecycle Management	2022-03-18
Long, Krista	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2022-03-18
Waddell, Ryan	PROJECT ENGINEER		Transmission & Distribution Projects	2022-03-18
Bell, Christine	PORTFOLIO ACCOUNTANT		Asset Management Strategy & Planning	2022-03-18

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Asset Planning & Delivery	**REQUESTING OPERATING/CORPORATE GROUP:**	Operations
RESPONSIBLE DIVISION:	Project Management	**REQUESTING DIVISION:**	Asset Management
RESPONSIBLE DEPARTMENT:	Transmission & Distribution Projects	**ISD: (YYYY/MM/DD)**	**2026/11/30**
I.M. NODE NUMBER:	2.1.30.15.02.53	**W.B.S. NUMBERs:**	P:24390, P:27498, P:30932
C55 INVESTMENT CODE:	13776		
SAP PROJECT TYPE:	22 - BOC-Executive Committee	**C55 INVESTMENT SUB-CATEGORY**:	Shell
CORPORATE INVESTMENT CATEGORIES:	(Level 1) C3 / Sustainment (Level 2) CM / System Renewal		

CONTACTS			
PREPARED BY:	Waddell, Ryan PROJECT ENGINEER 52710	**REQUESTOR:**	Mark Aikens, Transmission Asset Management Dept
PROJECT MANAGER:	Waddell, Ryan PROJECT ENGINEER 52710		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION
Kelsey SS 138kV Breaker Replacements

RECOMMENDATION

Approve a budget of $18.5M to remove and replace eleven 138kV DCVF air blast breakers due to technical obsolescence, reliability issues and high operating costs, and remove and replace ten potential transformers due to PCB contamination.

SCOPE

This project is to replace obsolete circuit breakers and supporting equipment that have very high operating costs and significant reliability issues as well as specific PCB contaminated assets at Kelsey Generating Station.

The scope of work consists of:
• Removing eleven (11) Brown Boveri DCVF, 3phase, 138kV, live tank, air blast circuit breakers and replace with dead tank breakers c/w current transformers.
• Remove nine (9) 138kV voltage transformers and replace with nine (9) new Capacitive Voltage Transformers (CVT) that are currently on site at Kelsey GS.
• Replace one (1) 230kV Capacitive Voltage Transformer (CVT) which is located in the 230kV yard.
• Salvage the existing site spare ES-138 Wire Wound Potential Transformer.
• Removal of the air blast circuit breaker air compressors and associated equipment such as logic controllers*, air dryer(s), etc, and replace with off-the-shelf screw compressor(s) and refrigerant air dryer system for the unit governors air supply.
*The logic controllers (if PLC based) should be kept for spare parts to support other site installations.

BACKGROUND

The ABB DCVF 138kV air blast breakers were built in 1967. These breakers belong to the BRK003 equipment family. This type of high voltage circuit breaker is the most expensive to operate and one of the poorest performing breakers in Manitoba Hydro. The air blast interruption technology is outdated and relies on a central high pressure air compression, drying, and distribution system to each breaker. Failure of the air system results in all air blast breakers at Kelsey being inoperable.

Due to decreased reliability of these air blast circuit breakers, operating restrictions are in place to only operate these breakers when ambient temperatures are above -25 C. Operation of these circuit breakers below -25C is reserved for emergencies or protection operations only. Modern circuit breakers are rated to -50 C.

Recently, a series of events occurred which necessitated emergency breaker operation in cold weather temperatures below the recommended ambient temperature of -25C. This resulted in an outage of five air-blast breakers and three of five generating units (only enough water for five units) being taken offline until the breakers could be repaired.

The OM&A costs associated with these air blast breakers and the supporting air system components are significant. Repair time for these breakers is considered to be high as catastrophic failure can result in significant time (~6 weeks) required to rebuild the breaker, and cold weather failure (such as the one noted above) requires warmer

BACKGROUND

weather before repairs can be made.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):

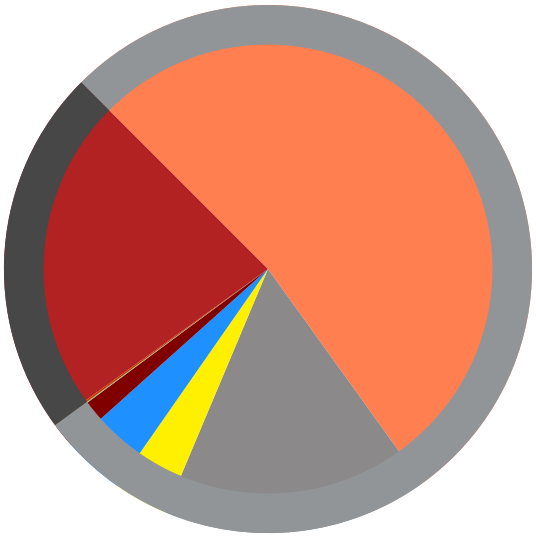
JUSTIFICATION

The most significant drivers for replacement of the air blast breakers at Kelsey Generating Station are:

Lost Generation Risk
The 2020 Breaker Reliability Study indicates that this equipment family of breakers (BRK003) are one of the poorest performing and exceeds a target combined forced and functional failure rate of 10%. Exceeding this failure rate elevates repair costs, significantly heightens the risk of lost generation, and increases the risk for catastrophic failures due to a cascading effect wherein a failed critical component within an asset may impact its other operating components. Additionally, these air blast breakers are also dependent on a high-pressure central air system consisting of at least two air compressors, an air dryer, pressure vessels, piping and controls which are difficult and costly to maintain.

Safety Risk & Compliance
All the Potential Transformers in-scope of this project require replacement in order to meet the Federal Government's PCB Regulations 50R12008-273 by December 31, 2025.
The six wire-wound PTs in-service and the site spare that are in scope for replacement are of a variant identified in Corporate Safety Alert as a hazard to employees in the vicinity due to risk of catastrophic failure.

CORPORATE VALUE FRAMEWORK



Value Measure	Value Points	% of Value
Lost Generation Risk	33,577	52.08%
Compliance Risk	10,386	16.11%
Safety Risk	2,358	3.66%
O&M Financial Benefits	2,130	3.3%
Financial Risk	954	1.48%
Environmental Risk	42	0.06%
O&M Costs	-84	0.13%
Total Cost	-14,329	22.22%
Total Value	**35,034**	
Value/$K	**2.44**	

ANALYSIS OF ALTERNATIVES:

ECONOMIC ANALYSIS		
Discount Rate	**For current corporate rates see P911** **6%**	

Active Option	**NPV Benefits/(Costs)**	**CVF Score**	**Value/$K**
Preferred Alternative		35,034	2.44

Other Alternatives	**NPV Benefits/(Costs)**	**CVF Score**	**Value/$K**

INVESTMENT RISK ANALYSIS

This project is carrying a contingency of $2.6M which is primarily accounted for by the below scope and schedule risks.

Scope:
• The condition of the roof structure which was damaged during a fire in the past. Proper care and design must be considered when moving breakers across the roof during salvage and construction to ensure that weight loads are not exceeded at any time, which could result in catastrophic failure of the roof, injury to workers and damage to switch yard and generation equipment.

Schedule:
• Winter work is restricted due to snow loading on the roof. At this time assumptions as to when snow will impact construction are being made when scheduling, but early snowfall or late melts could delay construction.
• Kelsey Generation Station is a fly in access station with additional rail access, there are no roads to the station, which will restrict access for contractors and equipment. This will likely cause difficulties scheduling the project and could lead to standby extras during the life of the project.

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

Fiscal Year	Budget	Contributions	Net Budget
Prev. Actuals	$473	$0	$473
2021/2022	$11	$0	$11
2022/2023	$391	$0	$391
2023/2024	$4,383	$0	$4,383
2024/2025	$4,406	$0	$4,406
2025/2026	$3,321	$0	$3,321
2026/2027+	$5,462	$0	$5,462
Total	**$18,447**	**$0**	**$18,447**

IMPACT ON O&A COSTS

There are significant OM&A cost savings if the existing air blast breakers at Kelsey Generating Station are replaced with modern SF6 gas breakers.
The net average OM&A saving to Manitoba Hydro would be approximately $150k per year which includes a reduction in field technical support services.

PROPOSED SCHEDULE

Activity	Start	Finish
Kick-Off	April 2022	
Design	April 2022	July 2023
Procurement	July 2022	Nov. 2023
Construction	April 2024	Nov. 2026
ISD	Nov. 2026	

*PCB containing apparatus would be planned to be replaced in year one of construction in order to meet the PCB removal deadline of December 2025.

RELATED INVESTMENTS

None

OTHER ALTERNATIVES CONSIDERED

Run the circuit breakers to failure.

OTHER ALTERNATIVES CONSIDERED
This alternative is not viable because of the proven poor reliability of these circuit breakers that cause significant lost generation, bottled energy, high OM&A costs, safety and operational inflexibility for the System Control Center. Replacing a circuit breaker after it fails at Kelsey would incur significant incremental reactive replacement costs due to Kelsey's location as well as require outages and work at periods of high system loading and/or extreme cold temperatures.

REFERENCE DOCUMENTS
13776_CIC_Kelsey SS 138kV Breaker Replac.docx

C55-CIJ-PROJ

CAPITAL INVESTMENT JUSTIFICATION FOR

Generation & Wholesale Security Infrastructure Update

Investment Type (Project)

BUDGET:	$14,881
CONTRIBUTIONS:	$0
NET BUDGET:	$14,881
(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:** 2,186
	Value/$K: 0.17

DATE PREPARED: 2019/04/30

EC/MHEB APPROVAL MINUTE & DATE:

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
MIDFORD, LORNE	VP GENERATION & WHOLESALE		VP Generation & Wholesale	2019/05/10
TURNER, HAL	DIRECTOR GENERATION ASSET MANAGEMENT		Director - Generation Asset Management	2019/05/09
Kreml, John	DIRECTOR GENERATION OPERATIONS & MTCE		Director - Generation Ops & Maintenance	2019/05/09
BISHOP, GARY	GEN ASSET STRATEGY & PERF DEPT MANAGER		Generation Asset Strategy and Performanc	2019/05/04
PAWLUK, JAMES	PROJECT MANAGEMENT SECTION HEAD	On behalf Of MILLER, SANDY (sgmiller).	Generation Project Management	2019/05/03
PAWLUK, JAMES	PROJECT MANAGEMENT SECTION HEAD		Generation Project Management	2019/05/03
Johnson, Erin	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2019/05/03
EDWARDS, ALAINA	PROJECT CONTROL & REPORTING OFFICER		Generation Project Management	2019/05/01
ALLARD, KATHLEEN	PORTFOLIO PLANNER		Generation Asset Strategy and Performanc	2019/04/30

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Generation & Wholesale	**REQUESTING OPERATING/CORPORATE GROUP:**	Generation & Wholesale
RESPONSIBLE DIVISION:	Generation Asset Management	**REQUESTING DIVISION:**	Generation Asset Management
RESPONSIBLE DEPARTMENT:	Generation Project Management	**ISD: (YYYY/MM/DD)**	Multiple 2024/03/31
I.M. NODE NUMBER:	2.1.20.15.09.36	**W.B.S. NUMBERs:**	P:28398, P:30694
C55 INVESTMENT CODE:	11573		
SAP PROJECT TYPE:	24 - BOC-VP & Management	**C55 INVESTMENT SUB-CATEGORY**:	Shell
CORPORATE INVESTMENT CATEGORIES:	(Level 1) C6 / Business Operations Support (Level 2) CT / Corporate Infrastructure Sustainment		

CONTACTS			
PREPARED BY:	KJARTANSON, DERRICK STAFF OFFICER 51460	**REQUESTOR:**	HAY, BRADLEY (brhay)
PROJECT MANAGER:	PAWLUK, JAMES PROJECT MANAGEMENT SECTION HEAD 51460		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION
Generation & Wholesale Security Infrastructure Update

RECOMMENDATION

Approve a budget of $14.9M to update security infrastructure at all Generation & Wholesale Generating Facilities.

SCOPE

Project Scope includes the following security integration which will be determined on a station by station basis per the assessment requirement to:

- Detect unauthorized entry;
- Respond to alarms to assess cause as soon as possible;
- Deter, Detect, Delay, Deny and Respond to forced malevolent acts; and
- Prevent Entry and/or secure asset from loss.

Threat Risk Analysis' will be conducted on a station-by-station basis and reviewed by Manitoba Hydro's Physical Security Subject Matter Expert and Station representative to ensure that the site is fully secured to Manitoba Hydro Corporate Security Standards.

Not In Scope:

- Grand Rapids – work is being completed under the transition to a day shift operating model;
- Wuskwatim - work will be completed as a separate project to accommodate partnership requirements;
- Keeyask – work is being completed as part of construction;
- Inside lighting upgrades;
- Parking lot upgrades;
- Access road upgrades; and
- IT server capacity.

BACKGROUND

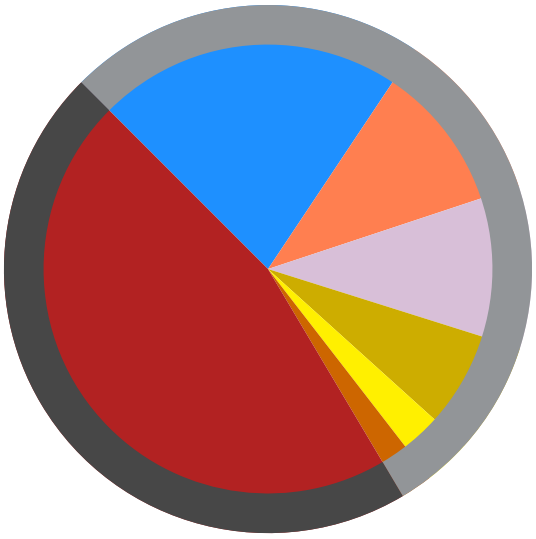
Manitoba Hydro has recently completed security access control upgrades related to regulatory requirements from the North American Electrical Reliability Council (NERC) with the Physical Security Upgrade Project. This work focused on upgrading the Physical Access Control System (PACS) to meet the minimum requirements as identified in Critical Infrastructure Protection standard version 5 (CIPv5), during which other security gaps were identified within the existing security infrastructure at all of the Generating Stations.

Manitoba Hydro engaged Stantec to perform a gap analysis between the Physical Security Road Map report completed in 2008, Manitoba Hydro Corporate Security Policy requirements, Public Water Safety Around Dams infrastructure, as well as current industry best practices regarding security standards. The gap analysis report provided Manitoba Hydro with an understanding of what physical security requirements are currently not being met or implemented along with an estimated cost to upgrade to meet these requirements.

The report provided Manitoba Hydro with a road map with recommended measures that should be implemented to bridge the gap with the above mentioned reference documents and industry best practices.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):
JUSTIFICATION
This alternative reflects the minimum Manitoba Hydro needs to provide an adequate level of security at Generation and Wholesale Generating Facilities and meets the needs of all stakeholders. No other alternatives were considered. Safety Risk – Without proper security and visual deterrents, people will continue to violate limits of approach, steal material, and place themselves near extremely dangerous high-energy equipment. Stakeholder Perception Risk – Failing to provide secure facilities will create the public perception that Manitoba Hydro is not exercising due diligence in the protection of the public, staff and assets. Additionally, lack of proper demarcation of property can lead to confusion in dealing with people on Manitoba Hydro property.

CORPORATE VALUE FRAMEWORK



Value Measure	Value Points	% of Value
Safety Risk	6,017	21.86%
Lost Generation Risk	2,901	10.54%
Stakeholder Perception Risk	2,740	9.96%
Security Risk	1,880	6.83%
O&M Financial Benefits	778	2.83%
Working Conditions Benefit	537	1.95%
Total Cost	-12,667	46.03%
Total Value	**2,186**	
Value/$K	**0.17**	

INVESTMENT RISK ANALYSIS

Scope Risk: There is a risk that new regulations will arise during the course of this work requiring more stringent security measures.

Schedule Risk: There is a risk that throughout the course of the work, emergency or priority items will be identified that require immediate execution. This may potentially impact other items or sites currently scheduled to be completed.

Budget Risk: There is a risk that market variability at the time of contract tender may result in higher than anticipated contract costs.

Contingency of $500k has been included in the project budget to mitigate the impact of the above noted risks, should any be realized.

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

Fiscal Year	Budget	Contributions	Net Budget
Prev. Actuals	$122	$0	$122
2019/2020	$245	$0	$245
2020/2021	$4,530	$0	$4,530
2021/2022	$4,051	$0	$4,051
2022/2023	$3,789	$0	$3,789
2023/2024	$2,144	$0	$2,144
2024/2025+	$0	$0	$0
Total	**$14,881**	**$0**	**$14,881**

IMPACT ON O&A COSTS

No significant impact on operating and administration costs.

PROPOSED SCHEDULE

- Jenpeg Generating Station – FY2021
- Great Falls Generating Station – FY2021
- Pine Falls Generating Station – FY2021
- Kettle Generating Station – FY 2022
- Long Spruce Generating Station – FY2022
- Limestone Generating Station – FY2022
- Seven Sisters Generating Station – FY2022
- McArthur Generating Station – FY2022
- Kelsey Generating Station – FY2023
- Pointe du Bois Generating Station – FY2023

PROPOSED SCHEDULE
• Slave Falls Generating Station – FY2023 • Churchill River Diversion – FY2024 • Selkirk Generating Station – FY2024 • Brandon Generating Station – FY2024

RELATED INVESTMENTS
GW Public Water Safety Around Dams (P:15729) Generation South Physical Security Project Upgrades (P:11300) Generation North Physical Security Project Upgrades (P:11302) Grand Rapids Day Shift Transition (P:28711)

OTHER ALTERNATIVES CONSIDERED
N/A

REFERENCE DOCUMENTS
Project Initiation Template GO Security Infrastructure Design Rev.docm 11573_CIC_GW Security Infrastructure Upd.docx Financial Chart P30694 GW Security April 2019.xlsx

C55-CIJ-PROJ-AD

CAPITAL INVESTMENT JUSTIFICATION ADDENDUM FOR

Generation Security Infrastructure Update

Investment Type (Project)

Addendum Number 1

	PREVIOUSLY APPROVED	REVISED	INCREASE/ (DECREASE)
BUDGET:	$14,881	$15,978	$1,097
CONTRIBUTIONS:	$0	$0	$0
NET BUDGET:	$14,881	$15,978	$1,097
		(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:** 2,186 **Value/$K:** 0.17	**Value:** 3,400 **Value/$K:** 0.25	

DATE PREPARED: 2021-09-29

EC/MHEB APPROVAL MINUTE & DATE: Approved by Aurel Tess, CFO November 5, 2021

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
Midford, Lorne	VP ASSET PLANNING & DELIVERY		VP Asset Planning & Delivery	2021-10-01
Turner, Hal	DIRECTOR ASSET MANAGEMENT		Director - Asset Management	2021-10-01
Halayko, Krista	ASSET MGMT STRATEGY & PLANNING DEPT MGR		Asset Management Strategy & Planning	2021-09-30
Pawluk, James	GENERATION PROJECT MANAGEMENT DEPT MGR		Generation Projects	2021-09-30
Austman, Jordan	PROJECT MANAGEMENT SECTION HEAD		Generation Projects	2021-09-29
Johnson, Erin	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2021-09-29
Edwards, Alaina	FINANCIAL SERVICES LEAD - GEN PROJECTS		Generation Projects	2021-09-29
Allard, Kathleen	PORTFOLIO PLANNER		Asset Management Strategy & Planning	2021-09-29

ADDENDUM NUMBER	DATE	REVISION (Summary of change)
CIJ	2019/05/10	Approve a budget of $14.9M to update security infrastructure at all Generating Facilities.

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Asset Planning & Delivery	**REQUESTING OPERATING/CORPORATE GROUP:**	Asset Planning & Delivery
RESPONSIBLE DIVISION:	Asset Management	**REQUESTING DIVISION:**	Asset Management
RESPONSIBLE DEPARTMENT:	Asset Management Strategy & Planning	**ISD: (YYYY/MM/DD)**	2025/03/31
I.M. NODE NUMBER:	2.1.20.15.09.36	**W.B.S. NUMBERs:**	P:28398, P:30694
C55 INVESTMENT CODE:	11573		
SAP PROJECT TYPE:	24 - BOC-VP & Management	**C55 INVESTMENT SUB-CATEGORY**:	Shell
CORPORATE INVESTMENT CATEGORIZATION:	(Level 1) C6 / Business Operations Support (Level 2) CV / Corporate Facilities		

CONTACTS			
PREPARED BY:	Edwards, Alaina STAFF OFFICER	**REQUESTOR:**	HAY, BRADLEY (brhay)
PROJECT MANAGER:	Duyile, Latoya PROJECT ENGINEER 51460		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
Generation Security Infrastructure Update

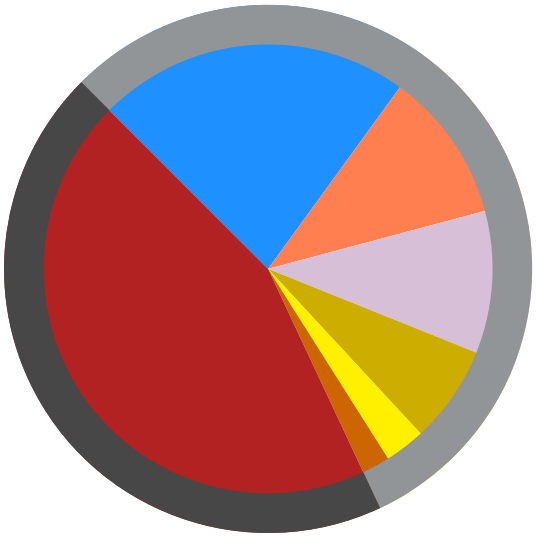
RECOMMENDATION
Increase the budget by $1.1M to $16.0M from $14.9M to account for additional costs including project management, contract administration, consulting services, support from generation design, corporate security, telecommunications and an increase in contingency.

SCOPE
The original scope remains unchanged.

BACKGROUND
The financial structure was arranged earlier this year to increase granularity and visibility of cost details. The new structure allocates a network to each site and standard activity numbers to accurately capture project costs and improve management of the budget. Review of the estimate in the new structure highlighted that the original estimate prepared by Manitoba Hydro underestimated labour, expenses and contingency costs.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):
JUSTIFICATION
The justification for this investment remains unchanged.

CORPORATE VALUE FRAMEWORK (REVISED)



Value Measure	Value Points	% of Value
Safety Risk	6,906	22.49%
Lost Generation Risk	3,330	10.85%
Stakeholder Perception Risk	3,145	10.24%
Security Risk	2,158	7.03%
O&M Financial Benefits	893	2.91%
Working Conditions Benefit	617	2.01%
Total Cost	-13,650	44.46%
Total Value	**3,400**	
Value/$K	**0.25**	

ANALYSIS OF ALTERNATIVES:

ECONOMIC ANALYSIS		
Discount Rate	**For current corporate rates see P911** **5.5%**	

Active Option	**NPV Benefits/(Costs)**	**CVF Score**	**Value/$K**
Security Infrastructure Update		3,400	0.25

INVESTMENT RISK ANALYSIS
There are no changes to the risks for this investment. The contingency increase of $150k to $650k from $500k is a better reflection of the risks of proceeding and improves ability to manage execution risks. This increase is included in the additional funding requested.

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
Generation Security Infrastructure Update

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

	PREVIOUSLY APPROVED			PROPOSED			INCREASE / (DECREASE)		
Fiscal Year	**Budget**	**Contributions**	**Net Budget**	**Budget**	**Contributions**	**Net Budget**	**Budget**	**Contributions**	**Net Budget**
Prev. Actuals	$4,897	$0	$4,897	$776	$0	$776	($4,121)	$0	($4,121)
2021/2022	$4,051	$0	$4,051	$4,214	$0	$4,214	$163	$0	$163
2022/2023	$3,789	$0	$3,789	$4,742	$0	$4,742	$952	$0	$952
2023/2024	$2,144	$0	$2,144	$3,045	$0	$3,045	$901	$0	$901
2024/2025	$0	$0	$0	$3,202	$0	$3,202	$3,202	$0	$3,202
2025/2026	$0	$0	$0	$0	$0	$0	$0	$0	$0
2026/2027+	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	**$14,881**	**$0**	**$14,881**	**$15,978**	**$0**	**$15,978**	**$1,097**	**$0**	**$1,097**

IMPACT ON O&A COSTS

There is no significant impact on operating and administration costs.

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
Generation Security Infrastructure Update

PROPOSED SCHEDULE

- Jenpeg Generating Station – FY2022
- Great Falls Generating Station – FY2022
- Pine Falls Generating Station – FY2022
- Kettle Generating Station – FY 2023
- Long Spruce Generating Station – FY2023
- Limestone Generating Station – FY2023
- Seven Sisters Generating Station – FY2023
- McArthur Generating Station – FY2023
- Kelsey Generating Station – FY2024
- Pointe du Bois Generating Station – FY2024
- Slave Falls Generating Station – FY2024
- Notigi Control Structure - FY2024
- Missi Falls Control Structure - FY2024
- Laurie River 1 & 2 Generating Stations - FY2025
- Selkirk Generating Station – FY2025
- Brandon Generating Station – FY2025

RELATED INVESTMENTS

GW Public Water Safety Around Dams (P:15729)
Generation South Physical Security Project Upgrades (P:11300)
Generation North Physical Security Project Upgrades (P:11302)
Grand Rapids Day Shift Transition (P:28711)

OTHER ALTERNATIVES CONSIDERED

N/A

REFERENCE DOCUMENTS

Project Initiation Template GO Security Infrastructure Design Rev.docm

11573_CIC_GW Security Infrastructure Upd.docx

Financial Chart P30694 GW Security April 2019.xlsx

11573_CIJ_GW Security Infrastructure Upd.docx

Financial Chart P30694 GW Security CIJa1 Sept 2021.xlsx

C55-CIJ-PROJ

CAPITAL INVESTMENT JUSTIFICATION FOR

University Station Replacement

Investment Type (Project)

BUDGET:	$7,564
CONTRIBUTIONS:	$0
NET BUDGET:	$7,564
(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:** 49,892
	Value/$K: 7.87

DATE PREPARED: 2017/08/04

EC/MHEB APPROVAL MINUTE & DATE:

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
Vinish, Siobhan	VP MARKETING & CUSTOMER SERVICE		VP Marketing & Customer Service	2018/01/24
Isaac, Rob	DISTRIBUTION CAPITAL & RISK MGMT ADVISOR	On behalf Of Prydun, Mark (maprydun).	Planning, Protection & Asset Strategy	2018/01/24
Steele, Chuck	DIRECTOR OF ENGINEERING & CONSTRUCTION		Director - Engineering & Construction	2018/01/24
Braid, Kristin	DISTRIBUTION ASSET MANAGEMENT DEPT MGR		Planning, Protection & Asset Strategy	2018/01/24
Sawhney, Harinder	WINNIPEG PLANNING SECTION HEAD		Planning, Protection & Asset Strategy	2018/01/23
Kong, Jiasi	CAPACITY PLANNING ENGINEER		Planning, Protection & Asset Strategy	2018/01/23
Waddell, Jared	DISTRIBUTION PORTFOLIO SERVICES DEPT MGR		Dist. Contract, Program & Project Mgmt	2018/01/23
DESSERRE, ALLAN	STATION & PROGRAM PROJECT MGMT SECT HEAD		Dist. Contract, Program & Project Mgmt	2018/01/22
Caron, Nicki	PROJECTS OFFICER		Dist. Contract, Program & Project Mgmt	2018/01/22
LAWRIE, SARAH	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2018/01/22
Colatruglio, Angelo	TECHNICAL OFFICER		Planning, Protection & Asset Strategy	2017/09/06
Sawhney, Harinder	WINNIPEG PLANNING SECTION HEAD	On behalf Of Braid, Kristin (kbraid).	Planning, Protection & Asset Strategy	2017/08/04

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Marketing & Customer Service	**REQUESTING OPERATING/CORPORATE GROUP:**	Marketing & Customer Service
RESPONSIBLE DIVISION:	Engineering & Construction	**REQUESTING DIVISION:**	Engineering & Construction
RESPONSIBLE DEPARTMENT:	Distribution Engineering - Winnipeg		
I.M. NODE NUMBER:	2.1.40.15.06.24	**W.B.S. NUMBERs:**	P:19444, P:24551
C55 INVESTMENT CODE:	13692		
SAP PROJECT TYPE:	24 - BOC-VP & Management	**C55 INVESTMENT SUB-CATEGORY**:	Shell
CORPORATE INVESTMENT CATEGORIES:	(Level 1) C3 / Sustainment (Level 2) CM / System Renewal		

CONTACTS			
PREPARED BY:	Colatruglio, Angelo TECHNICAL OFFICER 52465	**REQUESTOR:**	Kong, Jiasi
PROJECT MANAGER:	Caron, Nicki PROJECTS OFFICER 52610		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION
University Station Replacement

RECOMMENDATION

Construct a new interchange transformer site, located on the green space adjacent to the east side of the existing University Station, to address capacity, reliability and aging asset concerns with the current University Station. Residential customers currently supplied from University Station 4kV feeders will be transferred to Bayridge Station.

The estimated cost of the project is $7.6M, with an in-service date of March 2020.

SCOPE

The recommended scope, which forms the basis for the budget and schedule for this project includes:

Interchange Transformer Site:

- Includes the installation of seven 24KV/4.16KV 4MVA interchange transformers which each connect to a three-phase 548A regulator, a manual 4-way Vista Gear, and two feeder positions.
- Designed with control and automation on the 24kV supply.

24kV Feeders:

- Install a new 24kV feeder (X101) from Mohawk Station, using a portion of an existing feeder (X99) to extend to the interchange transformer site.
- Re-route a 24kV feeder from Mohawk Station (X94) with underground cable from Bayridge Station to the interchange transformer site.
- Re-terminate two 24kV feeders from Mohawk Station (X94 and X95) at the interchange transformer site.

4kV Feeders

- Transfer two University Station Bank 2 feeders (U140 and U141) to Bayridge Station, with feeder reconfiguration and regulator installations.

When re-termination is complete, all electrical assets in University Station will be salvaged. The University of Manitoba will re-terminate their customer-owned thirteen feeders to the new interchange transformer site.

BACKGROUND

University Station was built in 1960 to supply load for the University of Manitoba Fort Garry Campus, and the neighboring residential area. After 57 years in service, this station has numerous safety, operating and maintenance concerns. The following hazards will continue to exist until all of the old equipment is removed from service:

- Leaking roofs in switchgear cubicles
- Deterioration of ground grid
- Underrated protection equipment
- Oil leaking from transformers
- Lack of switchgear spare parts
- Arc flash hazard
- Asbestos exposure

BACKGROUND

University Station load has exceeded firm capacity during summer peak since 2012. Under these conditions, the station bus auto load transfer is also blocked. The University of Manitoba is continually renovating and redeveloping their Fort Garry Campus. The current station does not have sufficient capacity to support this load growth.

The two existing Mohawk 24kV feeders (X94 and X95) are installed on a common wood pole line. In the event ofa contingency situation, such as a pole fire or vehicle collision, both circuits would be removed from service, interrupting supply to University and Bayridge Stations for an extended period. Neither station have nearby 24kV feeders that can be easily connected to provide emergency supply. Furthermore, one of Mohawk Station's 24kV feeders (X94) does not have viable feeder ties during peak seasons. A viable feeder tie is required to execute load transfer during contingency situations. As a result, in the event of a feeder fault during peak season, customers on this feeder will experience an extensive outage until the fault is cleared and service restored.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):

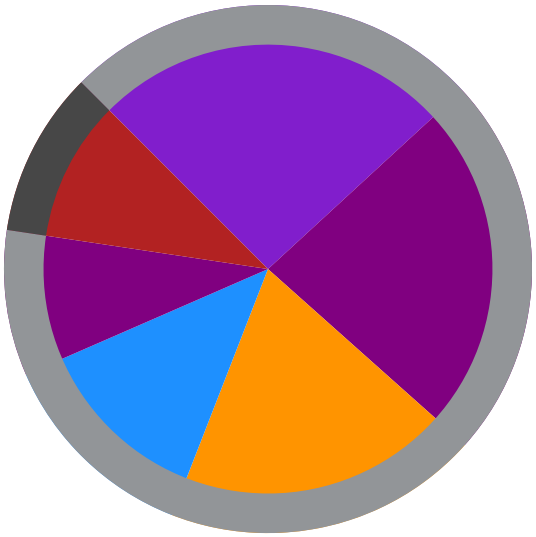
JUSTIFICATION

University Station does not have firm capacity and the 24kV supply feeder (X94) does not have viable feeder ties which are both violations of Distribution Planning Standard-Urban DPS-2010. The interchange transformer site will have sufficient capacity to meet existing load and future development plans at the University of Manitoba's Fort Garry Campus. Constructing a new interchange transformer site also eliminates the noted safety, operating and maintenance concerns as the site can be constructed in a timely manner to replace the aged University Station.

The extension of a new 24kV feeder (X101) from Mohawk Station will alleviate loading concerns on the two existing feeders (X94 and X95), and also restores viable feeder ties. Distribution automation will be applied to the three noted 24kV feeders to mitigate outages.

Transferring residential load to Bayridge Station will allow the electric assets at University Station to be salvaged. Salvaging the 4kV equipment will address maintenance and operational concerns with the 4kV switchgear.

CORPORATE VALUE FRAMEWORK



Value Measure	Value Points	% of Value
Electrical Delivery Capacity Risk	16,056	25.66%
Outage Recovery Benefit	20,234	32.34%
Distribution Reliability Benefit	12,090	19.32%
Safety Risk	7,849	12.55%
Total Cost	-6,336	10.13%
Total Value	**49,892**	
Value/$K	**7.87**	

ANALYSIS OF ALTERNATIVES:

ECONOMIC ANALYSIS		
Discount Rate	**For current corporate rates see P911 6.25%**	

Active Option	CVF Score	Value/$K
Recommended	49,892	7.87

Other Alternatives	CVF Score	Value/$K

INVESTMENT RISK ANALYSIS

Acquisition of a property easement from the University of Manitoba is critical to proceed with this project as scoped in this CIJ. The U of M is withholding their approval on the easement pending completion of their consultant's report. There is risk the consultant will recommend an alternative approach to servicing the site. Although much of the infrastructure and property included in the project's current scope will not change regardless of the alternative recommended, the location and ownership of some of the assets may be altered which could materially affect budget, and delay schedule and in service date.

Completion of the Mohawk Station Bank Addition project could affect the in service date as the energization of a new Mohawk 24kV feeder (X101) is required for this project.

The recommended project may compete with other similar projects for the same planning, design and construction resources. The project may demand similar timelines of implementation, resulting in conflicts, and possible deferral of the in service date.

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

Fiscal Year	Budget	Contributions	Net Budget
Prev. Actuals	$233	$0	$233
2017/2018	$80	$0	$80
2018/2019	$1,000	$0	$1,000
2019/2020	$5,862	$0	$5,862
2020/2021	$389	$0	$389
2021/2022	$0	$0	$0
2022/2023+	$0	$0	$0
Total	**$7,564**	**$0**	**$7,564**

IMPACT ON O&A COSTS	
Minimal.	

PROPOSED SCHEDULE

24kV Feeders:

- Design Completion: January 2019
- Construction Completion/In Service: September 2019

Interchange Transformer Site:

- Design Completion: January 2019
- Construction Completion/ In Service: March 2020

RELATED INVESTMENTS

P:19914 - Mohawk Station Bank and Feeder Addition

OTHER ALTERNATIVES CONSIDERED

University Station Restoration:
The total estimated cost of this option is $13.0M. However, this alternative was not selected because it does not provide the most cost effective solution and would involve significant logistical challenges to install new equipment without affecting the existing Station's underground infrastructure. Even with a comprehensive work staging plan, longer than normal outage times would be required that would be difficult, or near impossible, for the University of Manitoba to manage.

REFERENCE DOCUMENTS

Planning study DEW-W16-08

C55-CIJ-PROJ-AD

CAPITAL INVESTMENT JUSTIFICATION ADDENDUM FOR

University Station Switchgear Replacement

Investment Type (Project)

Addendum Number 1

	PREVIOUSLY APPROVED	REVISED	INCREASE/ (DECREASE)
BUDGET:	$7,564	$10,258	$2,694
CONTRIBUTIONS:	$0	$0	$0
NET BUDGET:	$7,564	$10,258	$2,694
		(values listed above are in thousands of dollars)	
CORPORATE VALUE FRAMEWORK SCORE:	**Value:** 49,892	**Value:** 19,057	
	Value/$K: 7.87	**Value/$K:** 2.38	

DATE PREPARED: 2020-04-21

EC/MHEB APPROVAL MINUTE & DATE:

APPROVER	APPROVER TITLE	COMMENT	ORGANIZATIONAL UNIT	APPROVAL DATE
Midford, Lorne	VP ASSET PLANNING & DELIVERY		VP Asset Planning & Delivery	2020-05-20
Turner, Hal	DIRECTOR ASSET MANAGEMENT		Director - Asset Management	2020-05-19
Braid, Kristin	DISTRIBUTION ASSET MANAGEMENT DEPT MGR		Planning, Protection & Asset Strategy	2020-05-01
Sawhney, Harinder	WINNIPEG PLANNING SECTION HEAD		Planning, Protection & Asset Strategy	2020-04-30
Lawrie, Sarah	CHARTERED PROFESSIONAL ACCOUNTANT		Financial Advisory Services	2020-04-28
Hunter, Lindsay	PROJECTS ENGINEER		Dist. Contract, Program & Project Mgmt	2020-04-27
Sawhney, Harinder	WINNIPEG PLANNING SECTION HEAD		Planning, Protection & Asset Strategy	2020-04-21

ADDENDUM NUMBER	DATE	REVISION (Summary of change)
	January 24, 2018	Original CIJ, titled University Station Replacement, approved for $7.6M to construct a new interchange transformer site, located on the green space adjacent to the east side of the existing University Station, to address capacity, reliability and aging asset concerns with the current, with an in-service date of March 2020.

CAPITAL INVESTMENT MASTER DATA			
RESPONSIBLE OPERATING/CORPORATE GROUP:	Marketing & Customer Service	**REQUESTING OPERATING/CORPORATE GROUP:**	Marketing & Customer Service
RESPONSIBLE DIVISION:	Engineering & Construction	**REQUESTING DIVISION:**	Engineering & Construction
RESPONSIBLE DEPARTMENT:	Distribution Asset Management	**ISD: (YYYY/MM/DD)**	**2023/03/31**
I.M. NODE NUMBER:	2.1.40.15.06.24	**W.B.S. NUMBERs:**	P:19444, P:24551, P:30068, P:31023, P:31382, P:33583
C55 INVESTMENT CODE:	13692		
SAP PROJECT TYPE:	24 - BOC-VP & Management	**C55 INVESTMENT SUB-CATEGORY**:	Shell
CORPORATE INVESTMENT CATEGORIZATION:	(Level 1) C3 / Sustainment (Level 2) CM / System Renewal		

CONTACTS			
PREPARED BY:	Hunter, Lindsay PROJECTS ENGINEER 52610	**REQUESTOR:**	Kong, Jiasi
PROJECT MANAGER:	Hunter, Lindsay PROJECTS ENGINEER 52610		

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
University Station Switchgear Replacement

RECOMMENDATION

Approve a $2.7M increase to the budget from $7.6M to $10.3M to replace existing switchgear with two new metalclad outdoor switchgear units, rather than the previously approved interchange transformer site solution. The in-service date is being deferred from March 2020 to March 2023.

SCOPE

Scope Revisions:

Additions:

- Two metalclad outdoor enclosed switchgear units to replace existing units at end of life, including required station site expansion and ducts for underground bus expansion
- Feeder egress provisions to 1m outside the station fence
- Reconfiguration of 24kV Line X94 terminations into the station
- Salvage of transformer Bank 2
- Salvage of existing switchgear units once the University of Manitoba (the 'customer') owned feeders are terminated to the new switchgear

Exclusions:

- Reconnection of customer owned feeders to the new switchgear
- Underground infrastructure requirements to re-route customer owned feeders to the new switchgear location

Removals:

- Pad mount transformer interchange site
- Salvage the entire University Station

The following items remained unchanged from the original approved scope:

- 24kV feeder work, including X101 from Mohawk Station, re-route of X94 to underground
- 4kV feeder offload (U140 and U 141) to bring University Station below firm capacity

BACKGROUND

During detailed design of the pad mount transformer interchange site, it was identified the customer revenue meters for the university should be installed on each 4kV feeder position rather than the 24kV station supplies. This change resulted in requirements to include disconnect switches at each feeder position to address operational concerns and meet Canadian Electrical Code requirements. In addition to the extra equipment requirements, unforeseen clearance and underground congestion issues were encountered. The interchange site design was expanded to address these issues, which included new manholes and ductlines to route 24kV and 4kV cables around the congestion. However, this additional scope increased the work staging complexities and budget, as well as added risk to meeting the original in-service date. Ultimately, the complexity of the proposed pad mount transformer interchange site was deemed not feasible due to the extra equipment required, site congestion, escalating costs, and execution risks.

BACKGROUND

Easements have been obtained on the land adjacent to University Station, which will be used for the required station expansion to install the two new metalclad outdoor switchgear units. As well, construction has started on the first stage of feeder X101, the X94/X95 reconfigurations, and the 4kV feeder offload to bring University Station below firm capacity.

In 2016 when the transformer banks at University Station were assessed, a few operational concerns were brought forward including the need to replace Banks 1 and 2. In 2018/19, the remaining service life of the banks were reassessed under various operating scenarios assuming completion of regular future maintenance. Bank 2 was confirmed to be at end of life, Bank 1's expected remaining service life was determined to be 15 years if operated as a spare, and Banks 3 and 4 expected remaining service life was 15-20 years.

Over the last several years, there have been multiple faults on the customer owned cables, which have resulted in damage to Manitoba Hydro's switchgear breakers. To date, the damage has been repaired, or spare equipment salvaged from Manitoba Hydro stations utilized; however, replacement parts on an ongoing basis are no longer available.

The customer provided a signed a letter of intent, indicating they will work with Manitoba Hydro to move towards multiple points of 24kV delivery as they address their own aging electrical infrastructure by converting 4kV to 24kV service. As the customer's proposal is a long-term replacement for University Station, reliable power is still required for the interim.

The original objective of the project to address capacity, safety, operating and maintenance issues associated with equipment and infrastructure at University Station remains unchanged, such as:

- University Station has been operating over firm capacity since 2012.
- Several pieces of equipment in the station have multiple operation and maintenance concerns. Of most concern is the metalclad outdoor switchgear units, which have recently sustained catastrophic failures due to deterioration, can no longer be properly maintained and serviced, do not meet current arc flash requirements, and no longer have any replacement parts.
- A lack of feeder ties on the 24kV feeder X94 limit load transfer during a contingency situation.
- 24kV feeders X94 and X95 are built on the same pole line; a catastrophic event along the line will interrupt service to University Station, and there are no other nearby 24kV feeders to quickly refeed the station.

In service date delays reflect significant time to:

- Redesign required to accommodate the additional equipment and unforeseen underground conditions into the original pad mount transformer interchange solution.
- Fully understand the customer's long-term intentions to best align Manitoba Hydro's solution.
- Re-scope the project and restart preliminary design.
- Plan the complexity of the outage coordination with the customer.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):

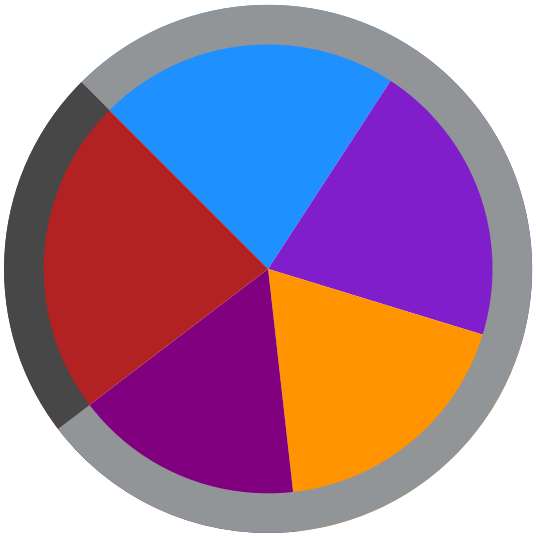
JUSTIFICATION

Altering the project scope is the best option to address reliability and infrastructure issues at the current station, while both maintaining control of capital costs to Manitoba Hydro and minimizing execution risks. With a signed letter of intent with the customer, the project is now refocused to address existing station issues and deliver reliable power for an interim period, rather than being focused on a long-term, full station replacement solution.

JUSTIFICATION – BUSINESS CASE ANALYSIS (SUMMARY):

The switchgear solution requires a smaller station expansion, fewer ductlines, and a simpler customer metering scheme. Adhering to and completing recommended maintenance schedules for the remaining Banks is expected to maintain their service life over the interim period. The revised scope addresses imminent station issues and sufficiently extends the current station equipment's life expectancy to provide reliable power to the customer while they implement a longer-term goal of converting their service from 4kV to 24kV.

CORPORATE VALUE FRAMEWORK (REVISED)



Value Measure	Value Points	% of Value
Safety Risk	7,613	21.69%
Electrical Delivery Capacity Risk	7,212	20.54%
Distribution Reliability Benefit	6,491	18.49%
Outage Recovery Benefit	5,765	16.42%
Total Cost	-8,023	22.86%
Total Value	**19,057**	
Value/$K	**2.38**	

ANALYSIS OF ALTERNATIVES:

ECONOMIC ANALYSIS		
Discount Rate	**For current corporate rates see P911 6.5%**	

Active Option	**NPV Benefits/(Costs)**	**CVF Score**	**Value/$K**
Recommended		19,057	2.38

INVESTMENT RISK ANALYSIS

Scope:
Manitoba Hydro may be required to install certain infrastructure requirements to best accommodate the customer to re-route their feeders to the new switchgear location. This scope would be limited to what would interfere with the existing or expanded station, including the ground grid. Further discussion with the customer is required.

Schedule:
Generally, any risk that impacts the in-service date puts University Station at further risk of experiencing a catastrophic failure that ultimately risks the ability to provide reliable power to the customer.

Switchgear procurement is on the critical path. Metalclad outdoor switchgear has not been procured by Manitoba Hydro in recent history. As well, much of the detailed design requires specific technical information from the eventual manufacturer. To mitigate this risk, completion of the technical specifications and procurement documents have started.

There is a requirement to keep the existing switchgear energized until the customer transfers their feeders to the new switchgear. Because both sets of switchgear need to be energized and any energized underground infrastructure must be maintained during this period, a non-standard design solution is required. This requirement introduces design and construction complexities that may result in delays to the in-service date.

Discussion and decisions are required from the customer to finalize certain aspects of the project scope. Though much of the project execution has been established to eliminate any need for customer information and/or decisions, if there are delays obtaining information relating to remaining critical decisions, it may impact the in-service date or require design revision/construction modifications.

Outage requirements to safely complete construction need to be coordinated with the customer. Delays coordinating these outages with the customer, or an inability to align them effectively with project deliverables may impact the schedule.

Budget:
A significant portion of the revised budget is for the metalclad outdoor switchgear units. However, when the customer eventually converts their load to 24kV and removes the load from the switchgear units, Manitoba Hydro will be able to repurpose the units for other projects.

Only budget pricing for the new metalclad outdoor switchgear is currently available. Since Manitoba Hydro has not

INVESTMENT RISK ANALYSIS
recently procured this equipment, comparable actual project costs do not exist and will be reflective of market conditions. Contingency of $1.3M has been budgeted to cover costs associated with project risks discussed above.

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
University Station Switchgear Replacement

ESTIMATED COST FLOW

The annual projected cost flows are as follows (in thousands of dollars):

	PREVIOUSLY APPROVED			PROPOSED			INCREASE / (DECREASE)		
Fiscal Year	**Budget**	**Contributions**	**Net Budget**	**Budget**	**Contributions**	**Net Budget**	**Budget**	**Contributions**	**Net Budget**
Prev. Actuals	$7,175	$0	$7,175	$1,275	$0	$1,275	($5,900)	$0	($5,900)
2020/2021	$389	$0	$389	$1,601	$0	$1,601	$1,212	$0	$1,212
2021/2022	$0	$0	$0	$3,046	$0	$3,046	$3,046	$0	$3,046
2022/2023	$0	$0	$0	$3,822	$0	$3,822	$3,822	$0	$3,822
2023/2024	$0	$0	$0	$513	$0	$513	$513	$0	$513
2024/2025	$0	$0	$0	$0	$0	$0	$0	$0	$0
2025/2026+	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	**$7,564**	**$0**	**$7,564**	**$10,258**	**$0**	**$10,258**	**$2,694**	**$0**	**$2,694**

IMPACT ON O&A COSTS

Minimal.

MANITOBA HYDRO
CAPITAL INVESTMENT JUSTIFICATION ADDENDUM
University Station Switchgear Replacement

PROPOSED SCHEDULE

24kV Feeders and 4kV Offload
Construction complete – May 2020

New Metalclad Outdoor Switchgear
Design and Equipment procurement start – May 2020
Construction start – April 2022
In Service – March 2023

RELATED INVESTMENTS

None.

OTHER ALTERNATIVES CONSIDERED

Forego station improvements in place of three Mohawk Station 24kV feeders
The opportunity to work with the customer on their 4kV to 24kV service conversion was considered. This alternative entails replacement of University Station with multiple 24kV points of delivery, foregoing addressing any of the required improvements at the station. However, the 24kV service conversion is a long-term goal for the customer, and presently they have not committed to a specific timeline. With no spare parts or economical way to extend the existing equipment service life in University Station, this alternative is not recommended as it risks Manitoba Hydro's ability to provide reliable power to the customer.

REFERENCE DOCUMENTS

Original Approved CIJ

University Station Replacement Planning Study DEW-W16-08

Addendum Memo University Station 2020 02 18 (002)

Financial Chart - University Station CIJ Addendum 1

CAPITAL PROJECT JUSTIFICATION ADDENDUM
FOR

Dorsey Synchronous Condensers
Major Refurbishment
Addendum Number 1

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Designing Division:

Constructing Division:

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.:

03 06 25

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$7,609,000
REVISED BUDGET $: (Total Net Cost)	$8,375,000
START DATE: (1st Cost Flow)	2003/01
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	2008/10/31
REVISED ISD: (Last Major In-service Date)	2008/10/31
RISK MATRIX/ BUSINESS CASE TIER:	Unacceptable
INVESTMENT REASON:	C3.08 Reliability – Transmission
OWNING DIVISION:	HVDC
I.M. NODE NUMBER:	1.1.1.2.14.1
W.B.S. NUMBER:	P:00446
MAJOR ITEM X	**DOMESTIC ITEM**
PREPARED BY:	T. Ta
DATE PREPARED:	2003 06 19
REPORT NUMBER:	HVDC 99-02CR1
FILE NUMBER (Optional):	

ADDENDUM NUMBER	DATE (yyyy mm dd)	REVISION	REVISED BY	APPROVED BY
1	2003 06 23	Removed SC22Y and Revised Cash Flow	L. Recksiedler	

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CAPITAL EXPENDITURE REVISION
(IN THOUSANDS OF DOLLARS)

Title	Investment Management Node:
03008376-DORSEY SYNC'S REFURBISHMENT	1.1.1.2.14.1
Owning Division: HVDC / Coordinating Division: HVDC	ProjectNumber: P:00446

DESCRIPTION:
For the major inspection and overhaul of synchronous condensers SC7Y, SC8Y, SC9Y, SC21Y, and SC23Y.

JUSTIFICATION:
The synchronous condensers are critical for the proper operation of the HVDC system voltage regulation of the southern AC system and provide reactive power for export of power to the USA. A major inspection and overhaul of each machine is necessary to prevent catastrophic failure, involving the rotors and rotor bolts as indicated by the failures of SC12Y in 1987 and SC11Y in 1988. The cost of repairing a failure when combined with our inability to export power exceeds the cost of major inspection and overhaul.

REFERENCE:
Report HVDC 99-02, Dorsey Station Synchronous Condenser Major Refurbishment
Report HVDC 99-02CR1, Dorsey Synchronous Condenser Major Refurbishment Addendum #1

REVISION:
The refurbishment of SC22Y has been removed. The repair of corrosion fretting problems on MIL Sync's SC7Y, SC8Y and SC9Y has been added and their respective ISDs have been deferred one year. Estimate based date revised to 2003.

CONTINGENCY: $219,000

IN SERVICE DATES				Base estimate 2003/04/01 CLASS 3
2003/12/31	53	2007/10/31	1263	Work start date 2002/04/01
2004/11/30	1883	2008/10/31	1295	
2005/10/31	1912			
2006/10/31	1950			

	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
PREV.AUTHORITY	1					1
Actual cost to date:	610	3	5			618
(Over)under expend:	568	2	17			587
2003/04	1168	31	36			1235
2004/05	1770	94	42			1906
2005/06	579	37	17			633
2006/07	1170	105	39			1314
2007/08	1175	131	40			1346
2008/09						
V-A02 TOTAL	7041	403	196			7640
REV. AMOUNTS:						
Actual cost to date:	1					1
(Over)under expend:	51		1			52
Auth 2003/04	1808	30	44			1882
Req: 2004/05	1808	65	43			1916
2005/06	1808	103	55			1966
2006/07	1147	80	36			1263
2007/08	1153	105	37			1295
2008/09						
V-SEL TOTAL	7776	383	216			8375

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
GB	03 06 24	OWNING DIVISION	03 06 24	COORDINATING DIVISION		VICE-PRESIDENT	03 06 25

2003/06/24 10:05AM

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CAPITAL EXPENDITURE REVISION

FORECAST HISTORY (in thousands of do

ProjectNumber
P:00446

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2003/04 Apr	1					1	1
May	6					6	7
Jun	6					6	13
Jul	6					6	19
Aug	6					6	25
Sep	6					6	31
Oct	7					7	38
Nov	6					6	44
Dec	7					7	51
Jan							51
Feb							51
Mar			1			1	52
TOTAL	51		1			52	52
2004/05 Apr	142	2				144	144
May	246	3	1			250	394
Jun	260	4	3			267	661
Jul	261	4	4			269	930
Aug	261	5	6			272	1202
Sep	244	6	8			257	1459
Oct	240	5	10			255	1714
Nov	141	3	12			156	1870
Dec	4					4	1874
Jan	4					4	1878
Feb	3					3	1881
Mar	2	-1				1	1882
TOTAL	1808	30	44			1882	1882

2003/06/24 10:05AM

CAPITAL PROJECT JUSTIFICATION ADDENDUM FOR

Dorsey Synchronous Condensers Major Refurbishment Addendum Number 1

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Designing Division:

Constructing Division:

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.:

03 06 25

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$7,609,000
REVISED BUDGET $: (Total Net Cost)	$8,375,000
START DATE: (1st Cost Flow)	2003/04
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	2008/10/31
REVISED ISD: (Last Major In-service Date)	2008/10/31
RISK MATRIX/ BUSINESS CASE TIER:	Unacceptable
INVESTMENT REASON:	C3.08 Reliability – Transmission

OWNING DIVISION: HVDC

I.M. NODE NUMBER: 1.1.1.2.14.1

W.B.S. NUMBER: P:00446

MAJOR ITEM X **DOMESTIC ITEM**

PREPARED BY: T. Ta

DATE PREPARED: 2003 06 19

REPORT NUMBER: HVDC 99-02CR1

FILE NUMBER (Optional):

1	2003 06 23	Removed SC22Y and Revised Cash Flow	L. Recksiedler	
ADDENDUM NUMBER	**DATE** (yyyy mm dd)	**REVISION**	**REVISED BY**	**APPROVED BY**

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION ADDENDUM

Project Name

Dorsey Synchronous Condensers Major Refurbishment

Recommendation

Remove the refurbishment of Dorsey Synchronous Condenser SC22Y from this project and defer the refurbishment of SC8Y, SC7Y and SC9Y one year.

Project Scope

The project scope has been revised to include the repair of corrosion fretting problems on MIL Synchronous Condensers SC7Y, SC8Y and SC9Y and to remove SC22Y.

Background

Synchronous Condenser SC22Y was damaged when it was synchronized out of phase. Inspection and testing revealed that the winding had been severely damaged. As a result, the repair and refurbishment of SC22Y has been advanced from 2006 to 2003/04 and will be carried out as a System Emergency, instead of as a part of this project.

Advancement of SC22Y has resulted in the deferral of the refurbishment of SC8Y, SC7Y and SC9Y approximately one year, respectively. Fretting corrosion problems on these three synchronous condensers have increased the cost of refurbishment by approximately $1,966,000. An overall increase of approximately $766,000 to the budget is required when the increased cost of refurbishment is combined with the reduction of approximately $1,200,000 from the removal of SC22Y.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals (This section is be filled out only if there is a change to the recommended alternative).

N/A

ANALYSIS OF ALTERNATIVES: (This section is be filled out only if there is a change to which alternative is being recommended).

Economic Analysis		
Discount Rate	For current corporate rates see G911 %	For clarification on hurdle rates, contact Economic Analysis Department

Recommended Option	NPV (= PV of BENEFITS - PV of COSTS)
No Change	N/A

Other Alternatives Considered	NPV (= PV of BENEFITS - PV of COSTS)
No Change	N/A

Risk Analysis - (This section is be filled out only if there is a change to the project risk)

No Change

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements (This section is be filled out only if there is a change to the resource requirements)

N/A

Total Budget - (This section is required for all Addendums)

$8,351,000 as per the attached CER.

The impact on annual budget requirements is as follows (in thousands of dollars):

Fiscal Year	Approved CPJ Budget	Current CEF Budget	Revised CPJ Budget	CPJ Increase (Decrease)	CEF / Revised CPJ Increase (Decrease)
Prev. Actuals	1	1	1	0	0
2003/04	1,278	1,278	52	(1,226)	(1,266)
2004/05	1,133	1,133	1,882	749	749
2005/06	1,156	1,156	1,916	760	760
2006/07	1,179	1,179	1,966	787	787
2007/08	1,416	1,416	1,263	(153)	(153)
2008/09	1,446	1,446	1,295	(151)	(151)
Total	**7,609**	**7,609**	**8,375**	**766**	**766**

Proposed Schedule (This section is be filled out only if there is a change to the project schedule)

SC8Y ISD 2004 11 16 (was 2003 09 30); SC7Y ISD 2005 10 31 (was 2004 10 31); SC9Y ISD 2006 10 31 (was 2005 10 31); SC21Y ISD 2007 10 31 (no change); SC23Y ISD 2008 10 31 (no change).

Related Projects (This section is be filled out only if changed)

Dorsey SC22Y Synchronous Condenser Failure

Reference Documents (This section is be filled out only if changed)

CPJ HVDC 99-02 entitled "Dorsey Converter Station Synchronous Condensers Major Refurbishment"
Report # HVDC 03 09C entitled "Dorsey SC22Y Synchronous Condenser Failure"

D1876(A)

Attachment #2

4

CAPITAL PROJECT JUSTIFICATION ADDENDUM FOR

Dorsey Synchronous Condensers
Major Refurbishment
Addendum Number 2

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Designing Division:

Constructing Division:

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.

04 06 10

REVIEWED BY EXECUTIVE COMMITTEE
MINUTE # 1039.03

DATE: 2004 08 04
MANAGEMENT SERVICES

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$8,375,000
REVISED BUDGET $: (Total Net Cost)	$11,738,000
START DATE: (1st Cost Flow)	2002/05
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	2008/10/31
REVISED ISD: (Last Major In-service Date)	2008/10/31
RISK MATRIX/ BUSINESS CASE TIER:	Unacceptable
INVESTMENT REASON:	C3.08 Reliability – Transmission
OWNING DIVISION:	HVDC
I.M. NODE NUMBER:	1.1.1.2.14.1
W.B.S. NUMBER:	P:00446
MAJOR ITEM X	**DOMESTIC ITEM**
PREPARED BY:	T. Ta
DATE PREPARED:	2004 03 31
REPORT NUMBER:	HVDC 99-02CR2
FILE NUMBER (Optional):	

ADDENDUM NUMBER	DATE (yyyy mm dd)	REVISION	REVISED BY	APPROVED BY
1	2003 06 23	Removed SC22Y and Revised Cash Flow	L. Recksiedler	EC 990.03

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION ADDENDUM

Project Name

Dorsey Synchronous Condensers Major Refurbishment

Recommendation

Increase the estimate to cover the cost for re-wedging of SC8Y, SC7Y, SC9Y, SC21Y and SC23Y, and for GEM80 PLC replacements for MIL Syncs SC7Y, SC8Y and SC9Y.

Project Scope

The project scope has been revised to include re-wedging of SC8Y, SC7Y, SC9Y, SC21Y and SC23Y, and replacement of GEM80 PLCs for MIL Syncs SC7Y, SC8Y and SC9Y.

Background

Replacement of the stator wedges is a normal requirement during a major overhaul of a synchronous condenser. It is highly unlikely the stator wedges will last until the next scheduled major overhaul some 12 to 15 years later. A review of the original estimate indicated that no monies had been allocated for re-wedging. Fretting corrosion between the rotor fan blades and the stub shaft was dicovered during inspection on all three MIL units SC7Y, SC8Y and SC9Y. Alstom Power has analyzed the problem and has come up with a design fix for this problem

The three Dorsey MIL synchronous condensers SC7Y, SC8Y and SC9y are the largest units on site, providing up to 360 MVARs each of reactive power. Reactive power is a vital component in the conversion from dc to ac, and for support of the AC system. Monitoring and control PLCs are required for starting, stopping, protecting and in service monitoring of the machines. The existing monitoring and control PLCs are over 12 years old and rapidly approaching their end of life. Component failure rate is increasing and new spare parts are no longer available.

Reliability of MIL synchronous condenser monitoring and control PLCs impacts the overall reliability of the HVDC Transmission System. Failure of one of these control systems could result in a reduction of 400 MW of HVDC capabililty due to the loss of service of a synchronous condenser. Coordinating replacement of the PLCs with the major refurbishment of the synchronous condensers minimizes the risk of an unplanned outage with its extra costs and its impact on system power requirements.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals (This section is be filled out only if there is a change to the recommended alternative)

No Change

Capital Project Justification Addendum

ANALYSIS OF ALTERNATIVES: (This section is be filled out only if there is a change to which alternative is being recommended).

Economic Analysis		
Discount Rate	5.98%	For clarification on hurdle rates, contact Economic Analysis Department

Recommended Option	NPV (= PV of BENEFITS - PV of COSTS)
No Change	N/A

Other Alternatives Considered	NPV (= PV of BENEFITS - PV of COSTS)
No Change	N/A

Risk Analysis: (This section is be filled out only if there is a change to the project risk)

There is a high risk that rotor pole repairs will be required on SC8Y, based on external resistance measurements taken recently, and no funds have been estimated. There is also a risk that SC7Y and SC9Y will require similar repairs because they have similar designs.

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements (This section is be filled out only if there is a change to the resource requirements)

Manitoba Hydro Labour			Material / Contract	
HVDC Engineering/Admin	2025	hrs	Material	$1,236,430
Insulation Testing	2554	hrs	Consulting Services	$463,750
Dorsey Site Labour	41,825	hrs	Refurbishment Contracts	$4,292,165
			Equipment	$20,000
			Contingency	$570,000
Total	46,904	hrs	Total	$6,582,345

* Reflects resource requirements for the entire project.

Capital Project Justification Addendum

Total Budget (This section is required on all Addendums)

$11,738,000 as per the attached CER.

The impact on annual budget requirements is as follows (in thousands of dollars):

Fiscal Year	Approved CPJ Budget	Current CEF Budget	Revised CPJ Budget	CPJ Increase (Decrease)	CEF / Revised CPJ Increase (Decrease)
Prev. Actuals	$60	$60	$60	$0	$0
2004/05	$1,875	$1,875	$3,181	$1,306	$1,306
2005/06	$1,916	$1,916	$2,862	$ 946	$ 946
2006/07	$1,966	$1,966	$2,686	$ 720	$ 720
2007/08	$1,263	$1,263	$1,458	$ 195	$ 195
2008/09	$1,295	$1,295	$1,491	$ 196	$ 196
Total	**$8,375**	**$8,375**	**$11,738**	**$3,363**	**$3,363**

Proposed Schedule (This section is be filled out only if there is a change to the project schedule)

No change

Related Projects (This section is be filled out only if changed)

No Change

Reference Documents (This section is be filled out only if changed)

CPJ HVDC 99-02 entitled "Dorsey Converter Station Synchronous Condensers Major Refurbishment"
Report # HVDC 03 09C entitled "Dorsey SC22Y Synchronous Condenser Failure"
CPJ HVDC 99-02CR1 entitled "Dorsey Converter Station Synchronous Condensers Major Refurbishment Addendum Number 1"
"Fretting Corrosion Engineering Analysis – Dorsey Station Synchronous Condensers SC7Y, SC8Y, SC9Y" Revision 1, dated 2004-03-10, prepared by ALSTOM Canada Inc.

D1876(A) Attachment #2

CAPITAL PROJECT JUSTIFICATION ADDENDUM FOR

Dorsey Synchronous Condensers
Major Refurbishment
Addendum Number 3

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Designing Division:

Constructing Division:

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.:

REVIEWED BY EXECUTIVE COMMITTEE
MINUTE # 1080.04

DATE: 2005 06 21
Capital Plans, Corp Budget Services

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$11,738,000
REVISED BUDGET $: (Total Net Cost)	$16,725,000
START DATE: (1st Cost Flow)	2002/05
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	2008/10/31
REVISED ISD: (Last Major In-service Date)	2009/04/30
RISK MATRIX/ BUSINESS CASE TIER:	Unacceptable
INVESTMENT REASON:	C3.08 Reliability – Transmission
OWNING DIVISION:	HVDC
I.M. NODE NUMBER:	1.1.1.2.14.1
W.B.S. NUMBER:	P:00446
MAJOR ITEM X	**DOMESTIC ITEM**
PREPARED BY:	T. Kolesar
DATE PREPARED:	2005 05 04
REPORT NUMBER:	HVDC 99-02CR3
FILE NUMBER (Optional):	

ADDENDUM NUMBER	DATE (yyyy mm dd)	REVISION	REVISED BY	APPROVED BY
3	2005 05 24	Estimate increased and ISDs Deferred	T. Kolesar	
2	2004 03 31	Added Re-Wedging to SC7,8,9,21& 23 & GEM80 PLC Replacements to SC7Y,SC8Y & SC9Y	T. Ta	EC 1039.04
1	2003 06 23	Removed SC22Y and Revised Cash Flow	L. Recksiedler	EC 990.03

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION ADDENDUM

Project Name

Dorsey Synchronous Condensers Major Refurbishment

Recommendation

The recommendation is to increase the estimate to cover a modification to the 600V transfer scheme to SC8Y, SC7Y and SC9Y. Estimate increases have also been made to all remaining synchronous condenser refurbishments (SC7Y, SC9Y, SC21Y and SC23Y) to reflect actual costs incurred in the refurbishment of SC8Y. The final in service date for the complex has been deferred six months to 2009 04 30.

Project Scope

The project scope has been revised to include a modification to the 600V transfer scheme to SC8Y, SC7Y & SC9Y.

Background

A major system fault caused an interruption in pump operation and a corresponding trip of two MIL synchronous condenser. Depending on loading conditions, the loss of an MIL synchronous condenser could result in a reduction of up to 400 MW of HVDC capabililty. The problem can be corrected by a modification to the 600V transfer scheme. This will help to maintain system capacity and improve reliability of the HVDC system.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals (This section is be filled out only if there is a change to the recommended alternative)

No Change

ANALYSIS OF ALTERNATIVES: (This section is be filled out only if there is a change to which alternative is being recommended).

Economic Analysis		
Discount Rate	6%	For clarification on hurdle rates, contact Economic Analysis Department

Recommended Option	NPV (=PV of BENEFITS - PV of COSTS)
No Change	N/A

Risk Analysis (This section is be filled out only if there is a change to the project risk)

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements (This section is be filled out only if there is a change to the resource requirements)

Manitoba Hydro Labour			Material / Contract	
HVDC Engineering/Admin	9,807	hrs	Material	$1,693,000
HVDC Drafting	710	hrs	Consulting Services	$380,000
Electrical Construction	2,240	hrs	Refurbishment Contracts	$4,063,000
Insulation Testing	2,224	hrs	Equipment	$20,000
Dorsey Site Labour	37,657	hrs	Contingency	$585,850
Total	52,638	hrs	Total	$6,741,850

* Reflects resource requirements for 2005/06 to the end of the project.

Total Budget - (This section is required for all Addendums)

$16,725,000 as per the attached CER.

The impact on annual budget requirements is as follows (in thousands of dollars):

Fiscal Year	Approved CPJ Budget	Current CEF Budget	Revised CPJ Budget	CPJ Increase (Decrease)	CEF / Revised CPJ Increase (Decrease)
Prev. Actuals	$2,748	$2,748	$2,748	$0	$0
2005/06	$3,355	$3,356	$3,477	$122	$121
2006/07	$2,686	$2,686	$4,929	$2,243	$2,243
2007/08	$1,458	$1,458	$2,197	$739	$739
2008/09	$1,491	$1,491	$3,228	$1,737	$1,737
2009/10	$0	$0	$146	$146	$146
Total	**$11,738**	**$11,739**	**$16,725**	**$4,987**	**$4,986**

Proposed Schedule (This section is be filled out only if there is a change to the project schedule)

The last in service date of the project has been deferred 6 months to 2009 04 30 to coordinate the final 600V transfer scheme modifications with a scheduled major maintenance outage.

Related Projects (This section is be filled out only if changed)

No Change

Reference Documents (This section is be filled out only if changed)

CPJ HVDC 99-02CR2 entitled "Dorsey Converter Station Synchronous Condensers Major Refurbishment Addendum Number 1"
"BP2 MIL Sync. Condensers Reliability Investigation" dated 2004 01 20.

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CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

Title		Investment Management Node:
03008376-DORSEY SYNC'S REFURBISHMENT		1.1.1.2.14.1
Owning Division: HVDC	Coordinating Division: HVDC	ProjectNumber: P:00446

DESCRIPTION:

For the major inspection and overhaul of synchronous condensers SC7Y, SC8Y, SC9Y, SC21Y, and SC23Y.

JUSTIFICATION:

The synchronous condensers are critical for the proper operation of the HVDC system voltage regulation of the southern AC system and provide reactive power for export of power to the USA. A major inspection and overhaul of each machine is necessary to prevent catastrophic failure, involving the rotors and rotor bolts as indicated by the failures of SC12Y in 1987 and SC11Y in 1988. The cost of repairing a failure when combined with our inability to export power exceeds the cost of major inspection and overhaul.

REFERENCE:

Report HVDC 99-02, Dorsey Station Synchronous Condenser Major Refurbishment
Report HVDC 99-02CR1, Dorsey Synchronous Condenser Major Refurbishment Addendum #1
Report HVDC 99-02CR2, Dorsey Synchronous Condensers Major Refurbishments Addendum Number 2

REVISION:

The estimate has been increased to cover the cost of 600V transfer scheme modifications to SC8Y, SC7Y and SC9Y. All remaining synchronous condenser refurbishments (SC7Y, SC9Y, SC21Y and SC23Y) have been increased to reflect actual costs incurred in the refurbishment of SC8Y. The final ISD has been deferred 6 months to 2009 04 30. Contingency has been increased. The estimate base date has been changed to 2005.

Contingency: $585,850

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2004/03/31	54	2007/10/31	2117	
2005/05/31	3266	2008/10/31	2166	Work start date 2001/01/01
2006/03/31	4015	2009/04/30	1153	
2007/03/31	3953			

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:	2704		44			2748
(Over)under expend:	489	18	-13			494
2005/06	2772	63	37			2862
2006/07	2555	93	38			2686
2007/08	1359	59	40			1458
2008/09	1364	87	40			1491
V-A04 TOTAL	11243	310	186			11739
REV. AMOUNTS:						
Actual cost to date:	2704		44			2748
(Over)under expend:						
Auth 2005/06	3390	24	63			3477
Req: 2006/07	4751	114	64			4929
2007/08	2060	68	49			2197
2008/09	2969	168	91			3228
2009/10	132	8	6			146
V-H&D TOTAL	16026	382	317			16725

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
GMB	05 05 13	OWNING DIVISION	05 05 26	COORDINATING DIVISION		VICE-PRESIDENT	05 06 03

2005/05/12 6:21PM

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CAPITAL EXPENDITURE REVISION

FORECAST HISTORY (in thousands of do.

ProjectNumber
P:00446

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr	168		14			182	182
May	338		15			353	535
Jun	22					22	557
Jul	33					33	590
Aug	42					42	632
Sep	46					46	678
Oct	283	2	1			286	964
Nov	242	1	2			245	1209
Dec	495	4	3			502	1711
Jan	463	4	6			473	2184
Feb	563	6	9			578	2762
Mar	695	7	13			715	3477
TOTAL	3390	24	63			3477	3477
2006/07 Apr	1031	18				1049	1049
May	135	3				138	1187
Jun	221	5	1			227	1414
Jul	196	5	2			203	1617
Aug	241	6	3			250	1867
Sep	165	4	4			173	2040
Oct	209	4	5			218	2258
Nov	318	5	7			330	2588
Dec	224	3	8			235	2823
Jan	248	4	10			262	3085
Feb	248	4	11			263	3348
Mar	1515	63	13			1581	4929
TOTAL	4751	114	64			4929	4929

D1876(A)

CAPITAL PROJECT JUSTIFICATION ADDENDUM FOR

Dorsey Synchronous Condensers Major Refurbishment Addendum Number 4

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Coordinating Division:

Constructing Division:

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.:

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$16,726,000
REVISED BUDGET $: (Total Net Cost)	$28,477,000
START DATE: (1st Cost Flow)	2002 05
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	2009 04
REVISED ISD: (Last Major In-service Date)	2012 03
RISK MATRIX/ BUSINESS CASE TIER:	Unacceptable
INVESTMENT REASON:	C3.08 Reliability – Transmission

OWNING DIVISION: HVDC

I.M. NODE NUMBER: 1.1.1.2.14.1

W.B.S. NUMBERs: P:00446

MAJOR ITEM X **DOMESTIC ITEM** ☐

PREPARED BY: P. Tan

DATE PREPARED: 2006 06 13

REPORT NUMBER: HVDC 99-02CR4

FILE NUMBER (Optional):

ADDENDUM NUMBER	DATE (yyyy mm dd)	REVISION	REVISED BY	APPROVED BY
3	2005 05 24	Estimate increased and ISDs Deferred	T. Kolesar	EC 1080.04
2	2004 03 31	Added Re-Wedging to SC7,8,9,21& 23 & GEM80 PLC Replacements to SC7Y,SC8Y & SC9Y	T. Ta	EC 1039.04
1	2003 06 23	Removed SC22Y and Revised Cash Flow	L. Recksiedler	EC 990.03

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION ADDENDUM

Project Name
Dorsey Synchronous Condensers Major Refurbishment

Recommendation
Increase the estimate to cover the refurbishment of SC11Y, SC12Y and SC13Y synchronous condensers. Increase the estimate to cover the upgrade of the vibration monitoring equipment on all nine (9) synchronous condensers at Dorsey Station, plus the purchase of one spare monitor. Increase the estimate to cover upgrade of controls on SC7Y, SC8Y , SC9Y, SC21Y, SC22Y and SC23Y.

Project Scope
The project scope has been revised to include: • refurbishment of SC11Y, SC12Y and SC13Y synchronous condensers • vibration monitoring equipment upgrades on all nine (9) syncrhonous condensers, plus the purchase of one spare monitor • controls upgrades on SC7Y, SC8Y , SC9Y, SC21Y, SC22Y and SC23Y

Background
SC11Y, SC12Y and SC13Y synchronous condensers were installed in the early 1970s and must be refurbished to maintain system capacity and ensure reliability of the HVDC system. Two of these synchronous condensers suffered rotor bolt failures which damaged the stator windings, resulting in stator re-coring and rewinding work. The existing vibration monitoring systems are old, failing and inaccurate. There is a risk of catastrophic damage to a synchronous condenser should the vibration system fail to detect excessive vibration. The existing protection systems are experiencing problems.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals
No change.

ANALYSIS OF ALTERNATIVES:

Economic Analysis		
Discount Rate	6%	For clarification on hurdle rates, contact Economic Analysis Department

Recommended Option	NPV (= PV of BENEFITS - PV of COSTS)
No change	Not applicable

Risk Analysis -

There is a high risk that the proposed schedule will be revised, affecting the cashflow of several fiscal years' proposed budgets. This is due to the possibility that sufficient labour resources will not be available to proceed with SC9Y refurbishment in fall 2006. If SC9Y is deferred, the schedule of all subsequent refurbishments will be affected.

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements

The impact on resource requirements is as follows:

Department/ Section	Cost Centre	Prev. Approved CPJ/Addendum	Proposed CPJ Addendum	Increase (Decrease)
Dorsey Site Labour	51160	37,657	73,414	35,757
HVDC Engineering	51220	10,517	22,335	11,818
Insulation Testing	51430	2,224	5,730	3,506
Other	various	2,240	11,826	9,586
Total Internal Resources (hrs)		**52,638**	**113,305**	**60,667**
Material / Contracts	**Cost Element**			
Material	710120/710130	1,693,000	4,400,000	2,707,000
Consulting Services	750010	380,000	835,000	455,000
Contracts	750020/750060	4,063,000	7,030,000	2,967,000
Equipment	750060	20,000	200,000	180,000
Contingency	790100	585,850	890,200	304,350
Total Primary Costs ($)		**6,741,850**	**13,355,200**	**6,613,350**

Total Budget -

The impact on annual budget requirements is as follows (in thousands of dollars):

Fiscal Year	Prev. Approved CPJ/Addendum	Proposed CPJ Addendum	Increase (Decrease)
Prev. Actuals	$ 6,702	$ 6,702	$ -
2006/07	$ 4,453	$ 5,318	$ 865
2007/08	$ 2,197	$ 4,015	$ 1,818
2008/09	$ 3,228	$ 3,687	$ 459
2009/10	$ 146	$ 2,663	$ 2,517
2010/11	$ -	$ 2,539	$ 2,539
2011/12	$ -	$ 3,553	$ 3,553
Total	$ 16,726	$ 28,477	$ 11,751

Proposed Schedule

SC9Y Refurbishment – ISD 2007 06 30
SC8Y 600V Transfer Scheme & Vibration Monitoring – ISD 2007 06 30
SC21Y Refurbishment / Controls Upgrade – ISD 2007 10 31
SC23Y Refurbishment / Controls Upgrade – ISD 2008 10 31
SC7Y 600V Transfer Scheme & Vibration Monitoring – ISD 2008 10 31
SC11Y Refurbishment – ISD 2010 03 31
SC12Y Refurbishment – ISD 2011 03 31
SC22Y Vibration Monitoring / Controls Upgrade – ISD 2012 03 31
SC13Y Refurbishment – ISD 2012 03 31

SC7Y and SC8Y refurbishments have been completed.

Related Projects

No Change

Reference Documents

CPJ HVDC 99-02CR3 entitled "Dorsey Synchronous Condensers Major Refurbishment Addendum Number 3.

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CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

Title		Investment Management Node:
DORSEY SYNC'S REFURBISHMENT		1.1.1.2.14.1
Owning Division: HVDC	Coordinating Division: HVDC	ProjectNumber: P:00446

DESCRIPTION:

For the major inspection and overhaul of synchronous condensers SC7Y, SC8Y, SC9Y, SC11Y, SC12Y, SC13Y, SC21Y AND SC23Y.

JUSTIFICATION:

The synchronous condensers are critical for the proper operation of the HVDC system voltage regulation of the southern AC system and provide reactive power for export of power to the USA. A major inspection and overhaul of each machine is necessary to prevent catastrophic failure, involving the rotors and rotor bolts as indicated by the failures of SC12Y in 1987 and SC11Y in 1988. The cost of repairing a failure when combined with our inability to export power exceeds the cost of major inspection and overhaul.

REFERENCE:

Report HVDC 99-02, Dorsey Station Synchronous Condenser Major Refurbishment
Report HVDC 99-02CR1, Dorsey Synchronous Condenser Major Refurbishment Addendum #1
Report HVDC 99-02CR2, Dorsey Synchronous Condensers Major Refurbishments Addendum Number 2
Report HVDC 99-02CR3, Dorsey Synchronous Condensers Major Refurbishment Addendum No. 3
Report HVDC 99-02CR4, Dorsey Synchronous Condensers Major Refurbishments Addendum No. 4

REVISION:

The refurbishments of SC11Y, SC12Y and SC13Y have been added to the project. The cost of adding vibration monitoring equipment to all synchronous condensers has been added to the project. The cost of controls upgrades on SC7Y, SC8Y, SC9Y, SC21Y, SC22Y & SC23Y has been added to the project. The final ISD has been deferred 3 years to 2012 03 31. Contingency has been increased. The estimate base date has been changed to 2006.

Contingency: $890,200

IN SERVICE DATES						Base estimate 2006/04/01 CLASS 3
2004/03/31	53	2007/10/31	4737	2012/03/31	3552	
2005/06/30	3138	2008/10/31	3870			Work start date 2001/01/01
2006/06/30	3941	2010/03/31	2490			
2007/06/30	4156	2011/03/31	2640			

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:	6557		145			6702
(Over)under expend:	-462	24	-38			-476
2006/07	4751	114	64			4929
2007/08	2080	68	49			2197
2008/09	2969	168	91			3228
2009/10	132	8	6			146
V-A05 TOTAL	16027	382	317			16726
REV. AMOUNTS:						
Actual cost to date:	6557		145			6702
(Over)under expend:						
Auth 2006/07	5121	27	170			5318
Req: 2007/08	3791	83	141			4015
2008/09	3496	144	47			3687
2009/10	2460	155	48			2663
2010/11	2294	196	49			2539
2011/12	3134	340	79			3553
V-HLD TOTAL	26853	945	679			28477

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
GMB	06 06 27	OWNING DIVISION	06 07 04	COORDINATING DIVISION		VICE PRESIDENT	06 07 07

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

FORECAST HISTORY (in thousands of dolla

ProjectNumber
P:00446

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2006/07 Apr	340		19			359	359
May	443		22			465	824
Jun	283	1	22			306	1130
Jul	515	2	2			519	1649
Aug	596	4	5			605	2254
Sep	256	2	8			266	2520
Oct	354	2	10			366	2886
Nov	418	1	12			431	3317
Dec	283		15			298	3615
Jan	307		16			323	3938
Feb	301		17			318	4256
Mar	1025	15	22			1062	5318
TOTAL	5121	27	170			5318	5318
2007/08 Apr	62	1	26			89	89
May	115	2	28			145	234
Jun	162	3	28			193	427
Jul	202	4	6			212	639
Aug	443	11	7			461	1100
Sep	677	14	10			701	1801
Oct	779	17	14			810	2611
Nov	769	18	4			791	3402
Dec	527	12	5			544	3946
Jan	20		6			25	3971
Feb	18		4			22	3993
Mar	17	1	4			22	4015
TOTAL	3791	83	141			4015	4015

D1876(A)

CAPITAL PROJECT JUSTIFICATION ADDENDUM FOR

Dorsey Synchronous Condensers
Major Refurbishment
Addendum Number 5

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Coordinating Division:

Constructing Division:

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.:

07 06 25

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$28,477,000
REVISED BUDGET $: (Total Net Cost)	$32,330,000
START DATE: (1st Cost Flow)	2002 05
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	2012 03
REVISED ISD: (Last Major In-service Date)	2015 03
RISK MATRIX/ BUSINESS CASE TIER:	Unacceptable
INVESTMENT REASON:	C3.08 Reliability – Transmission
OWNING DIVISION:	HVDC
I.M. NODE NUMBER:	1.1.1.2.14.1
W.B.S. NUMBERs:	P:00446
MAJOR ITEM X	**DOMESTIC ITEM** ☐
PREPARED BY:	P. Tan
DATE PREPARED:	2007 04 13
REPORT NUMBER:	HVDC 99-02CR5
FILE NUMBER (Optional):	

ADDENDUM NUMBER	DATE (yyyy mm dd)	REVISION	REVISED BY	APPROVED BY
4	2007/03/13	**Estimate Increase and ISD Deferred**	T Kolesar	Ec 1160.05
3	2005 05 24	Estimate increased and ISDs Deferred	T. Kolesar	EC 1080.04
2	2004 03 31	Added Re-Wedging to SC7,8,9,21& 23 & GEM80 PLC Replacements to SC7Y,SC8Y & SC9Y	T. Ta	EC 1039.04
1	2003 06 23	Removed SC22Y and Revised Cash Flow	L. Recksiedler	EC 990.03

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION ADDENDUM

Project Name
Dorsey Synchronous Condensers Major Refurbishment

Recommendation
To defer in-service dates from 2012 03 to 2015 03 as well as to reflect increase in costs due to resolving the excessive brush wearing problems with refurbished synchronous condenser units SC7 and SC8. The project was deferred until the excessive brush wearing problems with refurbished synchronous condenser units SC7 and SC8 were resolved. This problem has been corrected and the work is commencing on refurbishing the synchronous condensers this fall.

Project Scope
The project scope has been revised to include the work to resolve the deficiencies associated with the brush wearing problems. The work to resolve the brush wear problems involved revised procedures developed by [redacted] on line machining by [redacted] and modifications to the slip ring enclosure for humidity control. The same work will be required on SC9Y. 1a, 2b

Background
During the final testing of SC7 and SC8 overhauls it was determined that excessive brush wear was occurring. This project was haulted until the brush wear problem was resolved. In addition to the scope changes, delays in this project have resulted in increased interest and escalation costs.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals
No change.

ANALYSIS OF ALTERNATIVES:

Economic Analysis		
Discount Rate	6%	For clarification on hurdle rates, contact Economic Analysis Department

Recommended Option	NPV (= PV of BENEFITS - PV of COSTS)
No change	

Risk Analysis -

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements

The impact on resource requirements is as follows:

Department/ Section	Cost Centre	Prev. Approved CPJ/Addendum	Proposed CPJ Addendum	Increase (Decrease)
Dorsey Site Labour	51160	73,414	73,414	0
HVDC Engineering	51220	22,335	22,486	151
Insulation Testing	51430	5,730	5,730	0
Other	various	11,826	11,756	-70
Total Internal Resources (hrs)		**113,305**	**113,385**	**80**
Material / Contracts	**Cost Element**			
Material	710120/710130	4,400,000	4,620,000	220,000
Consulting Services	750010	835,000	835,000	0
Contracts	750020/750060	7,230,000	9,445,000	2,215,000
Contingency	790100	890,200	1,041,660	151,460
Total Primary Costs ($)		**13,355,200**	**15,941,660**	**2,586,460**

Total Budget -

The impact on annual budget requirements is as follows (in thousands of dollars):

Fiscal Year	Prev. Approved CPJ/Addendum	Proposed CPJ Addendum	Increase (Decrease)
Prev. Actuals	$ 8,352	$ 8,352	$ 0
2007/08	$ 7,683	$ 2,501	$ (5,182)
2008/09	$ 3,687	$ 1,995	$ (1,692)
2009/10	$ 2,663	$ 3,997	$ 1,334
2010/11	$ 2,539	$ 2,998	$ 459
2011/12	$ 3,553	$ 3,952	$ 399
2012/13		$ 2,742	$ 2,742
2013/14	$ -	$ 2,794	$ 2,794
2014/15	$ -	$ 2,999	$ 2,999
Total	$ 28,477	$ 32,330	$ 3,853

Proposed Schedule

SC9Y Refurbishment – ISD 2010 05 31
SC8Y 600V Transfer Scheme & Vibration Monitoring – ISD 2008 06 30
SC21Y Refurbishment / Controls Upgrade – ISD 2011 05 31
SC23Y Refurbishment / Controls Upgrade – ISD 2012 03 31
SC7Y 600V Transfer Scheme & Vibration Monitoring – ISD 2008 11 30
SC11Y Refurbishment – ISD 2013 03 31
SC12Y Refurbishment – ISD 2014 03 31
SC22Y Vibration Monitoring / Controls Upgrade – ISD 2009 01 31
SC13Y Refurbishment – ISD 2015 03 31

Related Projects

No Change

Reference Documents

CPJ HVDC 99-02CR4 entitled "Dorsey Synchronous Condensers Major Refurbishment Addendum Number 4".
CPJ HVDC 99-02CR3 entitled "Dorsey Synchronous Condensers Major Refurbishment Addendum Number 3".

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CAPITAL EXPENDITURE REVISIC

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
DORSEY SYNCH COND MAJOR REFURBISHMENT		1.1.1.2.14.1
Owning Division: HVDC	Coordinating Division: HVDC	ProjectNumber: P:00446

DESCRIPTION:

For the major inspection and overhaul of synchronous condensers SC7Y, SC8Y, SC9Y, SC11Y, SC12Y, SC13Y, SC21Y AND SC23Y and resolve the brush wearing problems on SC7 and SC8.

JUSTIFICATION:

The synchronous condensers are critical for the proper operation of the HVDC system voltage regulation of the southern AC system and provide reactive power for export of power to the USA. A major inspection and overhaul of each machine is necessary to prevent catastrophic failure, involving the rotors and rotor bolts as indicated by the failures of SC12Y in 1987 and SC11Y in 1988. The cost of repairing a failure when combined with our inability to export power exceeds the cost of major inspection and overhaul.

REFERENCE:

Report HVDC 99-02, Dorsey Station Synchronous Condenser Major Refurbishment
Report HVDC 99-02CR1, Dorsey Synchronous Condenser Major Refurbishment Addendum #1
Report HVDC 99-02CR2, Dorsey Synchronous Condensers Major Refurbishments Addendum Number 2
Report HVDC 99-02CR3, Dorsey Synchronous Condensers Major Refurbishment Addendum No. 3
Report HVDC 99-02CR4, Dorsey Synchronous Condensers Major Refurbishments Addendum No. 4
Report HVDC 99-02CR5, Dorsey Synchronous Condensers Major Refurbishment Addendum Number 5

REVISION:

Increase in the costs for this project is mainly deficiencies due to resolving the brush wearing problems. This problem has also resulted in deferring the in service dates from 2012 03 to 2015 03. Contingency has been increased. The estimate base date has been changed to 2007.

Contingency: $1,041,660

IN SERVICE DATES						Base estimate
2004/03/31	53	2008/10/31	1443	2011/05/31	3217	2007/04/01 CLASS 3
2005/06/30	3138	2008/11/30	412	2012/03/31	3277	Work start date
2006/06/30	3772	2009/01/31	747	2013/03/31	2742	2001/01/01
2008/06/30	3257	2010/05/31	4477	And on	6793	

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:	8096		256			8352
(Over)under expend:	3582	27	59			3668
2007/08	3791	83	141			4015
2008/09	3496	144	47			3687
2009/10	2460	155	48			2663
2010/11	2294	196	49			2539
2011/12	3134	340	79			3553
V-A06 TOTAL	26853	945	679			28477
REV. AMOUNTS:						
Actual cost to date: (Over)under expend:	8096		256			8352
Auth 2007/08	2328	17	156			2501
Req: 2008/09	1829	45	121			1995
2009/10	3771	171	55			3997
2010/11	2719	168	111			2998
2011/12	3527	292	133			3952
2012/13	2426	258	58			2742
2013/14	2426	312	56			2794
2014/15	2566	390	53			2999
V-HLD TOTAL	29678	1653	999			32330

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
BMB	07 06 15	OWNING DIVISION	07 06 15	COORDINATING DIVISION		VICE PRESIDENT	07 06 25

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CAPITAL EXPENDITURE REVISIC

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:00446

Approved yy mm	TOTAL AMOUNT	COMMENTS
2007 03	28477.00	he refurbishments of SC11Y, SC12Y and SC13Y have been added to the project. The cost of adding vibration monitoring equipment to all synchronous condensers has been added to the project. The cost of controls upgrades on SC7Y, SC8Y, SC9Y, SC21Y, SC22Y & SC23Y has been added to the project. The final ISD has been deferred 3 years to 2012 03 31. Contingency has been increased.

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2007/08 Apr	152		8			160	160
May	177		8			185	345
Jun	116		8			124	469
Jul	116	1	9			126	595
Aug	131	1	10			142	737
Sep	231	1	11			243	980
Oct	421	4	12			437	1417
Nov	433	4	14			451	1868
Dec	197	2	17			216	2084
Jan	177	2	19			198	2282
Feb	94	1	18			113	2395
Mar	83	1	22			106	2501
TOTAL	2328	17	156			2501	2501
2008/09 Apr	238	5	21			264	264
May	274	6	24			304	568
Jun	181	4	25			210	778
Jul	107	2	9			118	896
Aug	98	2	10			110	1006
Sep	266	7	10			283	1289
Oct	164	4	12			180	1469
Nov	108	3	4			115	1584
Dec	70	2	2			74	1658
Jan	44	1	3			48	1706
Feb	184	6				190	1896
Mar	95	3	1			99	1995
TOTAL	1829	45	121			1995	1995

D1876(A)

REVIEWED BY EXECUTIVE COMMITTEE
MINUTE # 1350.04

DATE: 2011 04 19
Financial Planning

CAPITAL PROJECT JUSTIFICA
FOR

Dorsey Synchronous Condensers
Major Refurbishment
Addendum Number 6

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Coordinating Division:

Constructing Division:

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.:

10 07 20

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$32,330,000
REVISED BUDGET $: (Total Net Cost)	$78,307,000
START DATE: (1st Cost Flow)	2002 05
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	2015 03
REVISED ISD: (Last Major In-service Date)	2018 03
RISK MATRIX/ BUSINESS CASE TIER:	Unacceptable
INVESTMENT REASON:	C3.08 Reliability
OWNING DIVISION:	HVDC
I.M. NODE NUMBER:	1.1.1.2.14.1
W.B.S. NUMBERs:	P:00446
MAJOR ITEM ☒	**DOMESTIC ITEM** ☐
PREPARED BY:	Stan Matwyczuk
DATE PREPARED:	2010 06 21
REPORT NUMBER:	HVDC 99-02CR6
FILE NUMBER (Optional):	

5	2007/04/13	Estimate Increase for Brush wear issues and Defer ISD	Philip Tan	EC 1183.03
4	2006/06/13	Estimate Increase and Defer ISD	Tom Kolesar	EC 1160.05
3	2005/05/24	Estimate Increase and Defer ISD	Tom Kolesar	EC 1080.04
2	2004/03/31	Added Re-Wedging to SC7, 8, 9, 21, &23 & GEM80 PLC Repl to SCY7, 8, &9	T Ta	EC 1039.04
1	2003/06/23	Removed SC22Y and Revised Cashflow	Les Recksiedler	EC 990.03
ADDENDUM NUMBER	**DATE** (yyyy mm dd)	**REVISION**	**REVISED BY**	**APPROVED BY**

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION ADDENDUM

Project Name

Dorsey Synchronous Condensers Major Refurbishment

Recommendation

That the scope and estimates of the Dorsey Synchronous Condensers Refurbishment program be expanded to include:

- Increased components for MIL Synch overhauls (SC7Y, SC8Y, SC9Y) required to resolve/repair the premature brush wear and bolt fretting issues, and overall longer overhaul process ($10.9M);
- Increased components for EE Synch overhauls (SC11Y, SC12Y, SC13Y) required ($6.3M);
- Increased components for Asea Synch overhauls (SC21Y, SC22Y, SC23Y) required ($20.7M);
- Reflect required overhaul for SC22Y ($2.7M);
- Increase in interest/escalation cost reflecting current in-service dates ($4.4M)

Project Scope

The scope of this project was adjusted to include the major overhaul of Synchronous Condenser 22, and other components for the other synchronous condensers (7, 8, 9, 11, 12, 13, 21, & 23). Below is a schedule of the new items and existing items that require additional funding:

#	Components	Impacts Syncs	Approved Plan	Proposed Plan	(Incr) / Decr
1	Controls, Protection & Cabling	21, 22, 23	1,008	11,301	(10,293)
2	Exciter Replacement	21, 22, 23	0	5,375	(5,375)
3	H2 Ventillation & H2 and CO2 Detection	All Syncs	0	4,410	(4,410)
4	Stub Shaft Bolt Replacement	7 & 8	0	3,295	(3,295)
5	Pony Motor Brushgear	11, 12, 13, 21, 22, 23	0	2,555	(2,555)
6	H2 Cooler Replacement	21, 22, 23	0	1,221	(1,221)
7	Power Supply Upgrade	11, 12, 13	0	1,233	(1,233)
8	Mixing Valve Replacement	11, 12, 13, 21, 22, 23	0	1,000	(1,000)
9	Breaking Cubicle Disconnects	21, 22, 23	0	672	(672)
10	Temperature Monitoring Replacement	12, 13	0	614	(614)
11	IPB Refurbishment	11, 12, 13, 21, 22, 23	0	820	(820)
12	Previously Approved/Other	Various	26,983	32,563	(5,580)
13	Interest & Escalation	All nine Syncs	2,652	7,933	(5,281)
14	Vibration Detection	All nine Syncs	1,687	2,615	(928)
15	Overhaul Sync 22	22	0	2,700	(2,700)
			32,330	78,307	(45,977)

Background

The Synchronous Condenser overhaul project originally included Synchronous Condensers 7, 8, 9, 21, 22 and 23, and was planned to start overhauling condensers in 2000 with the last overhaul being completed by 2005. Due to resourcing constraints and an emergency overhaul of Synchronous Condenser 22, the overhaul of the other condensers were deferred to 2005. Synchronous condensers 11, 12 and 13 were added to this project in 2006 (Addendum #4).

The major overhaul of Synchronous Condenser 8 was mainly completed by the end of 2005 and Synchronous Condenser 7 by the end of 2007. An inspection of Synchronous Condenser 8, in 2007, revealed that the brushes were prematurely deteriorating, further delaying the overhaul project for approximately one year, while the cause of the premature brush wear was investigated and a solution put in place. The overhaul project also experienced "bolt fretting" issues, which resulted in approximately 6 months of delays for investigation and implementation of a solution. Other delays were due to resourcing issues and scheduling outages.

With the start of this project being delayed almost six years, combined with delays while overhauling Synchronous Condensers 7, 8 & 9, the overhaul project is almost ten years later than planned. The manufactures of the Synchronous Condensers have recommended that the condensers be overhauled every seven years, but Manitoba Hydro is comfortable with and has targeted ten years. Even with Manitoba Hydro's comfort level we are already behind by one overhaul on several machines. Mechanical inspections have been completed and will continue to ensure that our plan appropriately identifies issues and prioritizes overhauls.

The current overhaul project is scheduled to be completed by 2018, resulting is some of the condensers operating from 15 to 20 years without a major overhaul. Most of the equipment that has been added to this addendum is original equipment that is approaching 30 to 40 years old, which will be well beyond their life expectancies at the time of the planned overhaul. If this project had proceeded as originally planned, a new project would have been created, including the equipment that is identified in this addendum.

To take advantage of the scheduled outages for the Synchronous Condenser refurbishment project, additional items that have been identified as requiring replacement have been added to the scope of this project. To accommodate the additional planning and design work associated with these new items, the outages scheduled for Synchronous Condensers 21 and 22 have been deferred while advancing Synchronous Condensers 11 and 12. Also, some of the items that are currently included in the scope of the project are experiencing higher material and labour costs than originally anticipated.

The overhaul of Synchronous Condenser 22 was originally included in the CPJ, but removed (in Addendum #1); because of damages incurred to the winding while as a result of being synchronized out of phase. At that time, this unit was taken out of service to repair the damage to the winding.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals
To take advantage of the current scheduled outages for refurbishing the Synchronous Condensers: the components identified in the above schedule are being included in the scope of the project because they are approaching thirty plus years and reaching the end of their useful lives. If theses items are not included at this time: there is a good possibility that one or more of them may fail in the future (before the next major overhaul program commences), resulting in forced outage. There would also be a need to plan additional outages over the next ten years to repair or overhaul these items. Repairing or overhauling any of these items at a later date will result in significant cost increases, because the Synchronous Condenser will have to be dismantled to execute the repair/overhaul, or extended outages will be required to complete the work.

ANALYSIS OF ALTERNATIVES:

Economic Analysis		
Discount Rate	6.1%	For clarification on hurdle rates, contact Economic Analysis Department

Recommended Option	NPV Benefits/(Costs)

Other Alternatives Considered	NPV Benefits/(Costs)

Risk Analysis -
Scheduled outages may have to be extended to perform the required overhauls. There is also a possibility that planning and designing the work required to overhaul a Synchronous Condenser may take longer than currently planned, resulting in deferring the project.

Total Budget -

The impact on annual budget requirements is as follows (in thousands of dollars):

Fiscal Year	Prev. Approved CPJ/Addendum	Proposed CPJ Addendum	Increase (Decrease)
Prev. Actuals	$ 8,352	$ 8,352	$ -
2007/08	$ 2,501	$ 1,576	$ (925)
2008/09	$ 1,995	$ 5,409	$ 3,414
2009/10	$ 3,997	$ 4,534	$ 537
2010/11	$ 2,998	$ 2,454	$ (544)
2011/12	$ 3,952	$ 4,483	$ 531
2012/13	$ 2,742	$ 4,393	$ 1,651
2013/14	$ 2,794	$ 5,135	$ 2,341
2014/15	$ 2,999	$ 8,040	$ 5,041
2015/16	$ -	$ 12,928	$ 12,928
2016/17	$ -	$ 12,341	$ 12,341
2017/18	$ -	$ 8,662	$ 8,662
Total	$ 32,330	$ 78,307	$ 45,977

Proposed Schedule

SC7Y Refurbishment March 31, 2012
SC8Y Refurbishment June 30, 2011
SC21Y Refurbishment March 31, 2017
SC22Y Refurbishment March 31, 2018
SC23Y Refurbishment February 24, 2016
SC11Y Refurbishment June 30, 2013
SC12Y Refurbishment June 30, 2014
SC13Y Refurbishment March 31, 2015

Related Projects

None.

Reference Documents

None.

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CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
DORSEY SYNCH COND MAJOR REFURBISHMENT		1.1.1.2.14.1
Owning Division: HVDC	Coordinating Division: HVDC	ProjectNumber: P:00446

DESCRIPTION:

For the major inspection and overhaul of Synchronous Condensers 7, 8, 9, 11, 12, 13, 21, 22, and 23 which would also include the replacement of Controls, Protection & Cabling, Exciter Replacement, Stub Shaft Bolt Repl, H2 Ventilation & H2 and CO2 Detection, H2 Cooler Repl, Mixing Valve Repl, and Temperature Monitoring Repl.

JUSTIFICATION:

Many of the items listed above are approaching thirty years and have reached the end of their useful life. If these items are not replaced during the upcoming scheduled outage, there is a good possibility that in the future one or more of them may fail, resulting in a forced outage. Repairing or overhauling any of these items at a later date will result in significant cost increases, because the Synchronous Condenser will have to be dismantled to execute the repair/overhaul.

REFERENCE:

Report HVDC 99-02, Dorsey Station Synchronous Condenser Major Refurbishment
Report HVDC 99-02CR1, Dorsey Synchronous Condenser Major Refurbishment Addendum #1
Report HVDC 99-02CR2, Dorsey Synchronous Condensers Major Refurbishments Addendum Number 2
Report HVDC 99-02CR3, Dorsey Synchronous Condensers Major Refurbishment Addendum No. 3
Report HVDC 99-02CR4, Dorsey Synchronous Condensers Major Refurbishments Addendum No. 4
Report HVDC 99-02CR5, Dorsey Synchronous Condensers Major Refurbishment Addendum Number 5
Report HVDC99-02CR6, Dorsey Synchronous Condenser Major Refurbishment Addendum #6

REVISION:

Increase the cost of this project from $32.3m to 78.3m, due to increasing the scope of this project for items that were not included in the CPJ or subsequent CPJ Addendums; and reflect cost increases for items that were overhauled at higher costs then estimated (resolve/repair the premature brush wear and bolt fretting issues, and in general the overhauls are taking longer than originally anticipated). The final ISD is March 31, 2018.

Contingency $4,314

IN SERVICE DATES						Base estimate 2010/04/01 CLASS 3
2004/03/31	53	2008/11/30	1658	2011/06/30	4612	
2005/06/30	3138	2009/07/31	6875	2012/03/31	3593	
2006/06/30	3772	2009/09/30	100	2013/03/31	1231	Work start date 2001/01/01
2008/06/30	2420	2010/06/30	423	And on	50429	

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:	19189		682			19871
(Over)under expend:	-3165	233	-94			-3026
2010/11	2719	168	111			2998
2011/12	3527	292	133			3952
2012/13	2426	258	58			2742
2013/14	2426	312	56			2794
2014/15	2556	390	53			2999
V-CPJ TOTAL	29678	1653	999			32330
REV. AMOUNTS:						
Actual cost to date:	19189		682			19871
(Over)under expend:						
Auth 2010/11	2257	10	187			2454
Req: 2011/12	4230	97	156			4483
2012/13	4082	187	124			4393
2013/14	4672	305	158			5135
2014/15	7154	624	262			8040
2015/16	11294	1314	320			12928
2016/17	10443	1425	473			12341
2017/18	7052	1147	463			8662
V-HLD TOTAL	70373	5109	2825			78307

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
		OWNING DIVISION	10 07 16	COORDINATING DIVISION		VICE PRESIDENT	10 07 20

2010/07/15 11:08AM

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CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dol

ProjectNumber
P:00446

Approved yy mm	TOTAL AMOUNT	COMMENTS
2009 08	33048.00	The estimate base date has been changed to 2009 04
2008 06	31689.00	The estimate base date has been changed to 2008.
		Contingency: $358
2007 06	32330.00	Increase in the costs for this project is mainly deficiencies due to resolving the brush wearing problems. This problem has also resulted in deferring the in service dates from 2012 03 to 2015 03. Contingency has been increased. The estimate base date has been changed to 2007.
2007 03	28477.00	hc refurbishments of SC11Y, SC12Y and SC13Y have been added to the project. The cost of adding vibration monitoring equipment to all synchronous condensers has been added to the project. The cost of controls upgrades on SC7Y, SC8Y, SC9Y, SC21Y, SC22Y & SC23Y has been added to the project. The final ISD has been deferred 3 years to 2012 03 31. Contingency has been increased.

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2010/11 Apr	191		10			201	201
May	274		11			285	486
Jun	305		13			318	804
Jul	202		12			214	1018
Aug	192	1	14			207	1225
Sep	212	1	14			227	1452
Oct	234	1	16			251	1703
Nov	249	2	17			268	1971
Dec	231	2	19			252	2223
Jan	62	1	20			83	2306
Feb	62	1	19			82	2388
Mar	43	1	22			66	2454
TOTAL	2257	10	187			2454	2454
2011/12 Apr	183	3	23			209	209
May	273	4	25			302	511
Jun	111	2	25			138	649
Jul	102	2	3			107	756
Aug	108	3	4			115	871
Sep	308	4	4			316	1187
Oct	448	9	5			462	1649
Nov	592	13	7			612	2261
Dec	533	13	11			557	2818
Jan	562	15	14			591	3409
Feb	562	16	16			594	4003
Mar	448	13	19			480	4483
TOTAL	4230	97	156			4483	4483

D1876(A)

CAPITAL PROJECT JUSTIFICATION
FOR

HVDC BP2 VALVE HALL
WALL BUSHING REPLACEMENT

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Coordinating Division:

Constructing Division:

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.:

06 06 09

REVIEWED BY EXECUTIVE COMMITTEE
MINUTE # 1128.04

DATE: 2006 06 20
Capital Plans, Corp Budget Services

BUDGET $: (Total Net Cost)	$19 209 000
START DATE: (1st Cost Flow)	2009 07
IN-SERVICE DATE: (Last Major In-service Date)	2013 06
RISK MATRIX/ BUSINESS CASE TIER:	**Not Desirable**
INVESTMENT REASON:	C3.08 – Transmission Reliability
OWNING DIVISION:	HVDC
I.M. NODE NUMBER:	1.1.1.2.37.1
W.B.S. NUMBERs:	P:11169
MAJOR ITEM X	**DOMESTIC ITEM** ☐
PREPARED BY:	T. Aussant
DATE PREPARED:	2006 05 14
REPORT NUMBER:	HVDC 07-08C
FILE NUMBER (Optional):	

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION

Project Name

HVDC BP2 Valve Hall Wall Bushing Replacement

Recommendation

Replace all oil filled bushings with new solid core bushings, or SF6 filled bushings.

Project Scope

An engineering report is required to determine a detailed scope of work. An addendum containing a detailed scope of work, cost analysis and detailed cost estimate will be prepared upon completion of an engineering report. The proposed scope of work would include replacing all oil filled bushings with new solid core bushings, or SF6 filled bushings.

Background

The Bipole 2 bushings have been in service between 21 and 29 years. The oil filled bushings in Bipole 1 were under replacement as early as 1997. The reason for the Bipole 1 replacement was the diminishing supply of viable spares, gassing, fire and overheating. This is a general concern for Bipole 2 as these bushings are of similar age, and construction as the Bipole 1 bushings when they were beginning the replacement.

We are proposing to develop a totally dry type 500 KV Wall Bushing over the next two years and develop the capability to retrofit the existing SF6 filled wall bushings in the future as SF6 is now a reportable gas ozone depletion. Also because of all the problems experienced with the Bipole 1 bushings we want to ensure that this will not be repeated.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals

This will provide reliable operation of the valve group well into the future. Also the bushings in place are nearing the end of their lifespan, and will eventually begin failing.

The valve groups are running at levels elevated beyond the original design criteria of the station. Although the bushings have performed well in these conditions, they weren't meant to run for extended periods beyond their 1800A designs.

The replacement of the oil filled bushings to SF6, or solid core will support the corporate goals of:

1. Improved safety for equipment and personnel. The bushings run directly over the walkways in the valve halls. Should one fail on the valve hall side and burn it will be dropping the burning debris within the valve hall. This could result in extensive damage of the valve hall. Smoke and corrosive by products could damage electronic equipment in adjacent valve halls as was experienced by the Los Angeles Department of Water and Power with a fire on the PIE Project.
2. Maximize export power net revenue- by reducing the number of forced outages associated with this equipment.
3. Be proactive in protecting the environment.

This project supports the goals of Transmission Reliability, Investment Reason C3.08, Employee Safety,

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals
This project supports the goals of Transmission Reliability, Investment Reason C3.08, Employee Safety, Investment Reason C3.14, and Protecting the Environment, Investment Reason C3.15.

ANALYSIS OF ALTERNATIVES:

Economic Analysis	
Discount Rate	6%

Recommended Option	NPV (= PV of BENEFITS - PV of COSTS)
Replace the oil filled with SF6, or solid core bushings	Not applicable at this time

Other Alternatives Considered	NPV (= PV of BENEFITS - PV of COSTS)
Do nothing	Not applicable at this time

Risk Analysis
Further study for suitable replacements may identify alternatives or problems not included in the proposed scope of work.

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements
Not applicable at this time – to be completed with Addendum.

Total Budget

The annual net budget requirements are as follows (in thousands of dollars):

Fiscal Year		Proposed Budget
Prev. Actuals		
2009/10	$	3,454
2010/11	$	4,652
2011/12	$	4,815
2012/13	$	4,893
2013/14	$	1,395
Total	$	19,209

Proposed Schedule

VG41	2010
VG42	2011
VG32	2012
VG31	2013

Related Projects

None

Reference Documents

None

D1876(A)

CAPITAL PROJECT JUSTIFICATION ADDENDUM FOR

HVDC BP2 VALVE HALL WALL BUSHING REPL.

Addendum Number 1

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Coordinating Division:

Constructing Division:

Financial Department:
(if over $1 million)

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$19 209 000
REVISED BUDGET $: (Total Net Cost)	$19 185 874
START DATE: (1st Cost Flow)	2010 03
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	2013 06
REVISED ISD: (Last Major In-service Date)	2017 10

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.:

PRIMARY JUSTIFICATION:
Indicate key project driver(s):

- ☒ Safety
- ☐ System Supply
- ☒ System Reliability
- ☐ Customer Service
- ☐ Efficiency
- ☒ Environmental

NERC COMPLIANCE: ☐ **YES** ☒ **NO**
Determine if the project requires compliance with North American Electric Reliability Corporation (NERC) CIP Cyber Security Standards.

OWNING DIVISION:	G12300 / HVDC
I.M. NODE NUMBER:	1.1.1.2.37.1
W.B.S. NUMBERs:	P:11169
MAJOR ITEM ☒	**DOMESTIC ITEM** ☐
PREPARED BY:	LEE, STEVEN
DATE PREPARED:	2013 07 16
REPORT NUMBER:	2898
FILE NUMBER (Optional):	HVDC 07-08CR1

ADDENDUM NUMBER	DATE (yyyy mm dd)	REVISION	REVISED BY	APPROVED BY

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION ADDENDUM

Project Name
HVDC BP2 Valve Hall Wall Bushing Replacement

Recommendation
Purchase 62 solid core bushings and risers, 52 of these bushings and risers will be installed to replace the remaining oil filled bushings currently in service. The ten (10) remaining bushings will be maintained as spares.

Project Scope
The scope of work includes removing and replacing 52 Bipole 2 porcelain oil filled wall bushings with composite solid core bushings. The risers for these bushings will also be replaced. Two bushing for each voltage class will be purchased for spares, ten spares in total.

Background
The original CPJ was approved as a place holder and requires an addendum to be approved prior to proceeding with the project. In 2010, two solid core bushings were installed as test case to evaluate their operational capabilities. During this testing period the bushings have operated as designed. Of the 62 solid core bushings there are fourteen 500kV, twelve 415kV, twenty 290kV, twelve 165kV, and four 25kV. These figures include two spares for each voltage type.

Justification
The existing bushings are reaching their life expectancy of 35 years old and with them currently operating at levels beyond their original design there is increased risk that they could start experiencing failures in the near future. Past experience in the Bipole 1 valve hall includes this type of bushing catching on fire causing a forced outage to repair the bushing, and significant damage to the valve hall and other equipment. Replacement of the oil filled bushings to solid core supports the corporate goals of: 1. Improved safety for equipment and personnel. The bushings run directly over the walkways in the valve halls. Should one fail on the valve hall side and burn it will be dropping the burning debris within the valve hall. This could result in extensive damage of the valve hall. Smoke and corrosive by-products could damage electronic equipment in adjacent valve halls as was experienced by the Los Angeles Department of Water and Power with a fire on the PIE Project. 2. Maximize export power net revenue- by reducing the number of forced outages associated with this equipment. 3. Be proactive in protecting the environment by removing oil from the equipment.

ANALYSIS OF ALTERNATIVES:

Economic Analysis		
Discount Rate	For current corporate rates see G911 5.4%	For clarification on hurdle rates, contact the Economic Analysis Department

Total Budget –

Fiscal Year	Prev. Approved CPJ/Addendum	Proposed CPJ Addendum	Increase (Decrease)
Prev. Actuals	$ -	$ 568	$ 568
Over/Under Exp			$ -
2009/10	$ 3,454		$ (3,454)
2010/11	$ 4,652		$ (4,652)
2011/12	$ 4,815		$ (4,815)
2012/13	$ 4,893		$ (4,893)
2013/14	$ 1,395	$ 37	$ (1,358)
2014/15	$ -	$ 2,559	$ 2,559
2015/16	$ -	$ 5,407	$ 5,407
2016/17+	$ -	$ 10,615	$ 10,615
Total	$ 19,209	$ 19,186	$ (23)

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

Title		Investment Management Node:
HVDC BP2 VALVE HALL WALL BUSHING REPL.		1.1.1.2.37.1
Owning Division: HVDC	Coordinating Division: HVDC	ProjectNumber: P:11169

DESCRIPTION:

Replace all oil-filled wall bushings in the BP2 valve halls with new solid core bushings or SF6 filled bushings.

JUSTIFICATION:

Existing wall bushings in the BP2 valve halls are over 20 years old and are reaching the end of their service life. The risk of bushing failure, and fire in a valve hall increases as the bushings age. Replacing the bushings will ensure reliable operation of the valve group well into the future, and provide a safer working environment for employees at the converter stations.

REFERENCE:

CPJ Report No. HVDC 07-08C entitled HVDC BP2 Valve Hall Wall Bushing Replacement

REVISION:

Project has passed 2 year testing period, an engineering report has been created, and project has been reforecasted.

Contingency - $1,500

Note: Previous authority on the CPJ $19,142 reflect IFRS changes.

IN SERVICE DATES				Base estimate 2013/04/01 CLASS 3
2010/04/30	415	2016/10/31	4844	
2010/11/30	153	2017/10/31	7961	Work start date 2009/04/01
2014/10/31	1561			
2015/10/31	4251			

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:	565		3			568
(Over)under expend:	15085	1665	496			17246
2013/14	1150	173	72			1395
V-CPJ TOTAL	16800	1838	571			19209
REV. AMOUNTS:						
Actual cost to date:	565		3			568
(Over)under expend:						
Auth 2013/14	36		1			37
Req: 2014/15	2468	58	33			2559
2015/16	5081	224	102			5407
2016/17	4049	263	132			4444
2017/18	5382	466	114			5962
2018/19	191	18				209
V-CEO TOTAL	17772	1029	385			19186

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
		OWNING DIVISION	13 08 27	COORDINATING DIVISION		VICE-PRESIDENT	

2013/08/07 10:18AM

D1876(A)

REVIEWED BY EXECUTIVE COMMITTEE
MINUTE # 1316.04

DATE: 2010 07 20
Corporate Budget Services

CAPITAL PROJECT JUSTIFICATION FOR

HVDC - Gapped Arrester Replacement

REVIEWED BY:
(Owning Dept Manager) / Sorace Mulchand

NOTED BY:
(if applicable)

Coordinating Division: HVDC Division

Constructing Division: HVDC Division

Financial Department:
(if over $1 million)

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager: John McNichol

Business Unit V.P.: Ken Adams

10 06 25

BUDGET $: (Total Net Cost)	$16 318 000
START DATE: (1st Cost Flow)	2010 10
IN-SERVICE DATE: (Last Major In-service Date)	2015 11
RISK MATRIX/ BUSINESS CASE TIER:	**Unacceptable**
INVESTMENT REASON:	C3.08 Transmission Reliability

OWNING DIVISION: HVDC

I.M. NODE NUMBER: ~~1.1.1.2.40.1~~ 1.0.1.2.43.1

W.B.S. NUMBERs: P:16737

MAJOR ITEM X **DOMESTIC ITEM**

PREPARED BY: T. Aussant

DATE PREPARED: 2010 03 18

REPORT NUMBER: HVDC08-17C

FILE NUMBER (Optional):

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION

Project Name
HVDC - Gapped Arrester Replacement

Recommendation
Replace the gapped surge arresters with a polymer gapless Metal Oxide Varistor (MOV) arrester.

Project Scope
Removal of the gapped arresters, porcelain supports, and their associated counters followed by replacement of these arresters with gapless MOV arresters, Silicon Shed supports, and new counters.

Background
The gapped surge arresters were installed during the construction of Bipole I and II, making these surge arresters 30 - 35+ years old. The original life of these surge arresters in approximately 25 years. When the arresters were installed there was no alternative type of arrester available. Even if the switching or lightning transient exceeded the rating of the arrester and destroyed the unit, it still protected the equipment from extensive damage. Gapped arresters can fail in a manner which damages adjacent equipment, and jeopardizes employee safety at time of failure. The post insulators supporting these arresters are cracking and breaking regularly. A broken insulator provides no support, and leaves the arrester hanging from the line, putting additional stresses on adjacent equipment. As a result, the stock of spare porcelain insulators is depleted and needs to be replaced.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals
The gapped surge arresters are over 30 years old and are experiencing more frequent breakdowns. When a gapped surge arrester malfunctions there is a potential for employees to be injured and/or damage to equipment. The new MOV arrester will eliminate the safety issues and adjacent equipment damage associated with failure of a gapped arrester. The silicon shed MOV type arresters do not explode when they fail. These arresters have been in commercial use for 20 years now, and have proven very reliable, and are not prone to degradation with each operation, as the gapped surge arresters are. The silicon sheds do not require cleaning to maintain the voltage withstand capability as the current ones do. The post insulators that will replace the current units use silicon sheds as well, and are not prone to cracking or breaking like our current insulators. Replacement of the counters will ensure accurate surge arrester operations are recorded. This project supports the corporate goals of improving safety in the work environment, improved system reliability and maximizing of export power net revenues.

ANALYSIS OF ALTERNATIVES:

Economic Analysis		
Discount Rate	6.1%	

Recommended Option	NPV (= PV of BENEFITS - PV of COSTS)
Purchase of Polymer MOV surge arresters	($14 581 250)

Other Alternatives Considered	NPV (= PV of BENEFITS - PV of COSTS)
Do nothing (Not Acceptable - because it does not resolve the issues concerning employee safety)	($5 247 148)

Risk Analysis
There is little risk in progressing with this project.

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements

The estimated resource requirements are as follows:

Department/ Section	Cost Centre	Hours
HVDC Engineering	51220	2,290
Dorsey Site Labour	51160	6,019
Radisson Site Labour	51210	7,091
Insulation Testing	51430	897
		0
Total Resource Requirements		16,297

Total Budget

The annual net budget requirements are as follows (in thousands of dollars):

Fiscal Year		Proposed Budget
Prev. Actuals	$	-
2010/11	$	125
2011/12	$	3,755
2012/13	$	3,431
2013/14	$	3,977
2014/15	$	3,466
2015/16	$	1,350
2016/17	$	214
Total	$	16,318

Proposed Schedule

Dorsey:
VG11, VG21, SST1, Pole 3 and Pole 3 DC filters in 2011
VG22, VG32, SST3, FB3, FB4, Pole 1 and Pole 1 DC filters in 2012
VG13, VG23, VG31, SST4, FB2A, Pole 4 and Pole 4 DC filters in 2013
VG12, FB1A, VG41, SST2, Pole 2 and Pole 2 DC filters in 2014
VG42, FB1B, FB2B in 2015

Radisson:
VG11, VG21, SST1, L42R, and FB1A in 2011
VG22, L43R, SST2, Pole 1 and Pole 1 DC filters in 2012
VG13, VG23, and SST3 in 2013
VG12, Pole 2 and Pole 2 DC filters in 2014
L41R in 2015

Henday:
SST3, Pole 3 and Pole 3 DC filters in 2011
VG32, FB1 in 2012
VG31, FB2, Pole 4 and Pole 4 DC filters in 2013
VG41, SST1, FB3 in 2014
VG42, SST2 in 2015

Related Projects

None

Reference Documents

HVDC08-17 Surge Arrester Replacement NPV.XLS
HVDC08-17 Surge Arrester Replacement Est.xls
Forced outage costs due to arrester fail.xls
HVDC08-17E Surge Arrester Replacement.doc

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CAPITAL EXPENDITURE REVISION
(IN THOUSANDS OF DOLLARS)

1.1.1.2.43.1

Title	Investment Management Node:
HVDC - GAPPED ARRESTER REPLACEMENT	~~1.1.1.2.40.1~~
Owning Division: HVDC / Coordinating Division: HVDC	ProjectNumber: P:16737

DESCRIPTION:
Remove the existing gapped arresters, porcelain supports, and their associated counters; and replace them with Metal Oxide Varistor (MOV) arresters, silicon shed supports, and new counters.

JUSTIFICATION:
The gapped surge arresters are over 30 years old and are experiencing more frequent breakdowns. When a gapped surge arrester malfunctions there is a potential for employees to be injured and/or damage to equipment. The new MOV arrester will eliminate the safety issues and adjacent equipment damage associated with failure of a gapped arrester. The silicon shed MOV type arresters do not explode when they fail. These arresters have been in commercial use for 20 years now, and have proven very reliable, and are not prone to degradation with each operation, as the gapped surge arresters are. The silicon sheds do not require cleaning to maintain the voltage withstand capability, as the current ones do. The post insulators that will replace the current units use silicon sheds as well, and are not prone to cracking or breaking like our current insulators. Replacement of the counters will ensure accurate surge arrester operations are recorded.

REFERENCE:
CPJ entitled HVDC 08-17C HVDC Gapped Arrester Replacement

REVISION:
New Item

Contingency $1,390

IN SERVICE DATES				Base estimate 2010/04/01 CLASS 3
2011/11/30	2648	2015/11/30	2687	
2012/11/30	3544			Work start date 2010/10/01
2013/11/30	3820			
2014/11/30	3617			

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-CPJ TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2010/11	121	2	2			125
Req: 2011/12	3586	102	67			3755
2012/13	3161	156	114			3431
2013/14	3602	256	119			3977
2014/15	3060	289	117			3466
2015/16	1150	128	72			1350
2016/17	190	24				214
V-HLD TOTAL	14870	957	491			16318

Prepared by	yy mm dd	Approved by OWNING DIVISION	yy mm dd	Approved by COORDINATING DIVISION	yy mm dd	Approved by VICE-PRESIDENT	yy mm dd
	10 06 21		10 06 22				10 06 25

2010/06/21 1:42PM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

FORECAST HISTORY (in thousands of doll

ProjectNumber
P:16737

Approved yy mm	TOTAL AMOUNT	COMMENTS

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2010/11 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct	20					20	20
Nov	20					20	40
Dec	20					20	60
Jan	19					19	79
Feb	19					19	98
Mar	23	2	2			27	125
TOTAL	121	2	2			125	125
2011/12 Apr	279	5	1			285	285
May	295	6	2			303	588
Jun	326	7	4			337	925
Jul	295	7	6			308	1233
Aug	310	8	8			326	1559
Sep	310	9	10			329	1888
Oct	279	8	12			299	2187
Nov	310	10	13			333	2520
Dec	279	9				288	2808
Jan	295	10	2			307	3115
Feb	295	11	3			309	3424
Mar	313	12	6			331	3755
TOTAL	3586	102	67			3755	3755

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CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

Title		Investment Management Node:
HVDC - GAPPED ARRESTER REPLACEMENT		1.1.2.7.43.1
Respons ble Division	Requesting Division	ProjectNumber:
Transmission Planning & Design	Transmission Stations Operations & Mtce	P:16737

DESCRIPTION:

Remove the existing gapped arresters, porcelain supports, and their associated counters; and replace them with Metal Oxide Varistor (MOV) arresters, silicon shed supports, and new counters.

JUSTIFICATION:

The gapped surge arresters are over 30 years old and are experiencing more frequent breakdowns. When a gapped surge arrester malfunctions there is a potential for employees to be injured and/or damage to equipment. The new MOV arrester will eliminate the safety issues and adjacent equipment damage associated with failure of a gapped arrester. The silicon shed MOV type arresters do not explode when they fail. These arresters have been in commercial use for 20 years now, and have proven very reliable, and are not prone to degradation with each operation, as the gapped surge arresters are. The silicon sheds do not require cleaning to maintain the voltage withstand capability, as the current ones do. The post insulators that will replace the current units use silicon sheds as well, and are not prone to cracking or breaking like our current insulators. Replacement of the counters will ensure accurate surge arrester operations are recorded.

CAPITAL INVESTMENT CATEGORY:
Sustainment - System Renewal - High Voltage Direct Current (HVDC)

REFERENCE:

CPJ entitled HVDC 08-17C HVDC Gapped Arrester Replacement

REVISION:

Adjusted cash flow to reflect delivery of 98 surge arrestors in June 2017 and installation of 58 for fall 2017.
Final ISD has been deferred from November 2015 to November 2021 due to resource constraints.

Contingency $810

IN SERVICE DATES				Base estimate 2017/04/01 CLASS 3
2012/11/30	431	2020/11/30	1515	
2017/09/30	987	2021/11/30	4133	Work start date 2010/04/01
2017/11/30	4335			
2018/11/30	4354			

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:	2244		458			2702
(Over)under expend:	12181	957	33			13171
V-CPJ TOTAL	14425	957	491			15873
REV. AMOUNTS:						
Actual cost to date:	2244		458			2702
(Over)under expend:	1					1
Auth 2017/18	2835	16	133			2984
Req: 2018/19	1289	33	44			1366
2019/20	923	42	29			994
2020/21	1650	108	32			1790
2021/22	5403	460	56			5919
2022/23						
2023/24						
2024/25						
V-CEO TOTAL	14345	659	752			15756

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
		RESPONSIBLE DIVISION		REQUEST NG DIVISION		VICE-PRESIDENT	

2017/06/12 09:08AM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

FORECAST HISTORY (in thousands of dollars) | ProjectNumber P:16737

Approved yy mm	TOTAL AMOUNT	COMMENTS
2016 06	16318	Adjusted cash flow to reflect surge arrestor delivery in 2016 and the first outage in spring 2017. Final ISD has been deferred from November 2015 to November 2021 to help level capital cash flow and internal Project/Engineering resources. Contingency $810
2015 06	16318	Adjusted cash flow to reflect purchase of spares in 2016/17 which will allow us to defer the project one year for a final ISD of November 2019. Also updated for activity and overhead rates, interest and escalation. Contingency $810
2014 06	16318	Adjusted cash flows to reflect resource availability and scheduling, resulting in a deferral of the final ISD from November 2016 to November 2018. Contingency $810
2013 07	16318	Adjusted cash flows and update base date. Contingency $1,390 Note: Previous authority on the CPJ $15,872 reflects IFRS changes.
2012 07	15704	Deferred in-service date one year as planning stage is not yet completed. Contingency $1,075
2011 07	16391	Deferred start date due to resource constraints and manpower availability. Teshmont is currently working on new estimates and scheduling. Contingency $1,125
2010 07	16318	New Item Contingency $1,390

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2017/18 Apr	69		10			79	79
May	81		10			91	170
Jun	1645	5	10			1660	1830
Jul	73		18			91	1921
Aug	75		18			93	2014
Sep	271	2	18			291	2305
Oct	301	3	19			323	2628
Nov	71	1	20			92	2720
Dec	57	1	2			60	2780
Jan	67	1	2			70	2850
Feb	61	1	2			64	2914
Mar	64	2	4			70	2984
TOTAL	2835	16	133			2984	2984
2018/19 Apr	150	3	2			155	155
May	166	4	3			173	328
Jun	151	3	4			158	486
Jul	158	4	4			166	652
Aug	166	4	5			175	827
Sep	135	4	5			144	971
Oct	166	5	6			177	1148
Nov	158	5	6			169	1317
Dec	9		2			11	1328
Jan	10		2			12	1340
Feb	9		2			11	1351
Mar	11	1	3			15	1366
TOTAL	1289	33	44			1366	1366

D1876(A)

CAPITAL PROJECT JUSTIFICATION FOR

Station Battery Bank Capacity & System Reliability Increase

REVIEWED BY:
(Owning Dept Manager)

NOTED BY:
(if applicable)

Designing Division:

Constructing Division:

Financial Department:
(if over $1 million) Brienenburg 2004 07 29

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager:

Business Unit V.P.: 2004 07 30

REVIEWED BY EXECUTIVE COMMITTEE
MINUTE # 1040.06

DATE: 2004 08 10
MANAGEMENT SERVICES

BUDGET $: (Total Net Cost)	$45,526,000
START DATE: (1st Cost Flow)	2005 04
IN-SERVICE DATE: (Last Major In-service Date)	Multi - 2015 03
RISK MATRIX/ BUSINESS CASE TIER:	
INVESTMENT REASON:	System Reliability
OWNING DIVISION:	Apparatus Maintenance
I.M. NODE NUMBER:	1.1.2.10.1.1
W.B.S. NUMBER:	P:08149
MAJOR ITEM ☒	**DOMESTIC ITEM** ☐
PREPARED BY:	D. Phillips & A. Boyd
DATE PREPARED:	2004 07 23
REPORT NUMBER:	
FILE NUMBER (Optional):	

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION

Project Name

Station Battery Bank Capacity & System Reliability Increase

Recommendation

Replace and upgrade station battery bank capacity at 156 substations over the next ten years at an estimated total net cost of $45.526 million.

Project Scope

This project involves the study and replacement of Station Control Battery Banks & Chargers at 156 Transmission & Distribution Stations. For maintenance and reliability purposes stations with system restoration plans will require dual battery banks. Several locations will require AC station service upgrades and building modifications or additions to accommodate increased battery capacity. Battery Bank replacement will be coordinated by changing the banks as they reach end-of-life, to maximize the use of the existing asset.

Background

Manitoba Hydro has designed station battery banks for a maximum 8-hour standard considering supplying all normal DC loads. This standard no longer meets system restoration requirements, and there are additional concerns that many battery banks may no longer meet the 8-hour standard due to the addition of DC loads in the stations and due to age-related deterioration.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals

Transmission System Operations Division has requested that Apparatus Maintenance Division provide T&D stations with a 12-16 hour battery endurance to meet the North American Electric Reliability Council's (NERC's) requirements to have a workable system restoration plan. Stations without system restoration plans will require battery capacity for 16-hour duration. Stations with a restoration plan will require battery capacity for 12 hours and dual battery bank systems, with multiple chargers, where practical. The installation of dual battery bank configurations at critical stations will facilitate safe battery maintenance and reduce the requirement to utilize a temporary battery bank during maintenance work. (Transmission System Operations' guidelines will not allow any maintenance to be performed on in-service single battery bank configurations in stations that have been identified as having system restoration plans.)

System Control has proven, under their simulations, that the present battery sizing standard will inhibit system restoration if a black-start situation should occur. Although not a requirement at this time, the regulatory boards could curtail Manitoba Hydro from exporting power if we don't show due diligence by sizing batteries to meet System Control's/NERC's restoration requirements.

ANALYSIS OF ALTERNATIVES:

Economic Analysis		
Discount Rate	6.00%	For clarification on hurdle rates, contact the Economic Analysis Department

Recommended Option	NPV (= PV of BENEFITS - PV of COSTS)
Replace Battery Banks and Chargers in 156 transmission and Distribution Stations to meet revised battery bank sizing criteria.	-$26,325,000

Other Alternatives Considered	NPV (= PV of BENEFITS - PV of COSTS)
Do nothing – This alternative is not recommended as the existing battery banks are inadequate to withstand minimum system restoration duration.	

Risk Analysis

The system restoration plan has been developed to meet Manitoba Hydro requirements as well as NERC criteria for recovery from a system blackout event. It is a NERC requirement to have a workable system restoration plan. The plan was developed by the System Control Department in coordination with the MAPP (now MISO) Power System Restoration group. Any of the criteria used to develop this system restoration plan are subject to change over the life of this replacement project.

Design margins are factored into battery bank sizing however unforeseen station DC capacity requirements at stations are subject to change as station apparatus and/or technology change.

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements

The high-level estimate of resource requirements is as follows:

Area	Total Hours	In 2005/06	In 2006/07	Per Year Thereafter
T&D Design	15,840	587	1,173	1,760
Civil Construction	28,000	1,037	2,074	3,111
Apparatus Maintenance	48,960	1,813	3,627	5,440
Other	50,400	1,867	3,733	5,600
Total	143,200	5,304	10,607	15,911

Total Budget

The total net cost is estimated as follows (in thousands of dollars):

Fiscal Year	Proposed Budget
2005/06	1,699
2006/07	3,023
2007/08	4,757
2008/09	4,850
2009/10	4,945
2010/11	5,044
2011/12	5,144
2012/13	5,249
2013/14	5,534
2014/15	5,460
Total	$45,526

Note that the Apparatus Maintenance Division presently allots $500,000 of their Domestic Budget to replacement and upgrades of station battery banks. These funds would be freed up upon approval of this program and transferred to Major to help offset the impact of this new complex.

Proposed Schedule

Twenty sites have been identified as requiring immediate action and are scheduled for replacement and upgrades in 2005/06 and 2006/07. The remaining 136 sites must be studied in terms of existing and future dc loading profiles and ac station service capacities and requirements, in order to develop detailed scopes and estimates. These studies should be completed by September 2005, at which time more detailed work plans will be developed for these remaining sites.

Related Projects

None at present

Reference Documents

a) Recommendations from the Technical Review Committee meeting held 2004 06 17.
b) Station Control DC System Criteria Review Report dated 2003 07 21.
c) Electric System Restoration (NERC Operating Committee Reference Document 1993 04 01)

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CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

Title	Investment Management Node:
STN BATT. BNK CAP.&SYS RELIAB. INC HL PL	1.1.2.10.1.1
Owning Division / **Coordinating Division**	**ProjectNumber:**
APPARATUS MAINTENANCE / APPARATUS MAINTENANCE	P:08149

DESCRIPTION: BATTERY BANKS & CHARGERS AT 156 TRANSMISSION & DISTRIBUTION STATIONS. FOR MAINTENANCE AND RELIABILITY PURPOSES STATIONS WITH SYSTEM RESTORATION PLANS WILL REQUIRE DUAL BATTERY BANKS. SEVERAL LOCATIONS WILL REQUIRE AC STATION SERVICE UPGRADES TO ACCOMMODATE INCREASED BATTERY CAPACITY. IF BUILDING EXTENSIONS ARE REQUIRED TO ACCOMMODATE LARGER BATTERY SYSTEMS, THE BUILDING EXTENSION COSTS WILL BE COVERED AS PART OF THIS SCOPE.

JUSTIFICATION:
BATTERY BANK REPLACEMENT WILL BE COORDINATED BY CHANGING THE BANKS AS THEY REACH END OF LIFE TO MAXIMIZE THE USE OF THE EXISTING ASSET. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATING GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM.

IN SERVICE DATES						Base estimate
2006/03/31	1699	2010/03/31	4945	2014/03/31	5354	2004/04/01 CLASS 1
2007/03/31	3023	2011/03/31	5044	2015/03/31	5460	Work start date
2008/03/31	4757	2012/03/31	5144			2005/04/01
2009/03/31	4850	2013/03/31	5249			

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A03 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2004/05						
Req: 2005/06	1600	39	60			1699
2006/07	2800	117	106			3023
2007/08	4325	267	165			4757
2008/09	4325	358	167			4850
2009/10	4325	452	168			4945
2010/11	4325	548	171			5044
2011/12	4325	646	173			5144
2012/13	4325	745	179			5249
2013/14	4325	846	183			5354
2014/15&on	4325	950	185			5460
V-M04 TOTAL	39000	4968	1557			45525

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
	04 07 27	OWNING DIVISION	04 07 28	COORDINATING DIVISION			

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CAPITAL EXPENDITURE REVISION

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:08149

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.		GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2004/05	Apr							
	May							
	Jun							
	Jul							
	Aug							
	Sep							
	Oct							
	Nov							
	Dec							
	Jan							
	Feb							
	Mar							
TOTAL								
2005/06	Apr	130	2				132	132
	May	137	3	1			141	273
	Jun	137	3	2			142	415
	Jul	130	3	3			136	551
	Aug	144	3	4			151	702
	Sep	130	3	5			138	840
	Oct	130	3	6			139	979
	Nov	137	4	6			147	1126
	Dec	124	3	7			134	1260
	Jan	130	4	8			142	1402
	Feb	124	4	9			137	1539
	Mar	147	4	9			160	1699
TOTAL		1600	39	60				

D1876(A)

CAPITAL PROJECT JUSTIFICATION ADDENDUM FOR

Station Battery Bank Capacity & System Reliability Increase Addendum Number 01

REVIEWED BY:
Ron Dacombe

NOTED BY:
(if applicable)

Designing Division:

Constructing Division: 22/05

Financial Department:
(if over $1 million) Quievenbourg 2005 07 26

RECOMMENDED FOR IMPLEMENTATION:

Owning Div. Manager: Ronald F Dacombe
Ron Dacombe July 25/05
Business Unit V.P.: 050726

REVIEWED BY EXECUTIVE COMMITTEE
MINUTE # 1085.07

DATE: 2005 08 02
Capital Plans, Corp Budget Services

PREV. APPROVED BUDGET $: (Use $ value from approved CPJ or last approved CPJ Addendum)	$45,526,000
REVISED BUDGET $: (Total Net Cost)	$46,467,000
START DATE: (1st Cost Flow)	2004 12
PREV. APPROVED ISD: (Use In-service Date from approved CPJ or last approved CPJ Addendum)	Multi - 2015 03
REVISED ISD: (Last Major In-service Date)	Multi - 2015 03
RISK MATRIX/ BUSINESS CASE TIER:	
INVESTMENT REASON:	

OWNING DIVISION:	Apparatus Maintenance
I.M. NODE NUMBER:	1.1.2.10.1.1
W.B.S. NUMBER:	P7951, P7952, P7967, P8149, P8708, P8784, P8785, P8888, P9825, P9948
MAJOR ITEM ☒	**DOMESTIC ITEM** ☐
PREPARED BY:	Garnet Boyd
DATE PREPARED:	2005-07-06
REPORT NUMBER:	
FILE NUMBER (Optional):	

ADDENDUM NUMBER	DATE (yyyy mm dd)	REVISION	REVISED BY	APPROVED BY
-		Original CPJ	D. Phillips & A. Boyd	Executive Committee (Minute #1040.06)

MANITOBA HYDRO
CAPITAL PROJECT JUSTIFICATION ADDENDUM

Project Name (This section is required for all Addendums).

Station Battery Bank Capacity & System Reliability Increase

Recommendation (This section is required for all Addendums).

Increase the scope to include replacement and upgrade of battery banks and chargers at seven stand-alone Communication Sites, between 2007 and 2010 inclusive, at an estimated cost of $150,000 per site. This, along with adjusting the base date and recalculating for rates results in a total net increase of $941,000.

Project Scope (This section is be filled out only if there is a change to the scope).

The scope detailed in the original CPJ was for the study and replacement of Station Control Battery Banks & Chargers at 156 Transmission and Distribution Stations. Included in the original program but not specifically mentioned in the scope, was the replacement of 48V Communications battery banks and chargers at these 156 stations. Not included in the original scope and being added under this Addendum, is the replacement of 48V Communications battery banks and chargers at seven stand-alone Communication Sites.

Background (This section is be filled out only if there is information relevant to the recommendation).

No change.

JUSTIFICATION—BUSINESS CASE ANALYSIS (SUMMARY):

Justification and Link to Corporate/Business Unit Goals (This section is be filled out only if there is a change to the recommended alternative).

The seven stand alone Communication sites are critical to the system restoration, same as the terminal station communication banks, and therefore should have been included with the original scope.

ANALYSIS OF ALTERNATIVES: This section is be filled out only if there is a change to which alternative is being recommended).

Economic Analysis		
Discount Rate	**For current corporate rates see G911** **%**	**For clarification on hurdle rates, contact the Economic Analysis Department**

Recommended Option	**NPV (= PV of BENEFITS - PV of COSTS)**
No change.	

Other Alternatives Considered	**NPV (= PV of BENEFITS - PV of COSTS)**

Risk Analysis - (This section is be filled out only if there is a change to the project risk).

No change.

RESOURCE REQUIREMENTS AND CAPITAL BUDGET ESTIMATE:

Resource Requirements (This section is be filled out only if there is a change to the resource requirements).

No change; the labour is still a high level estimate as per the original CPJ.

Total Budget - (This section is required for all Addendums).

The impact on annual net budget requirements is as follows (in thousands of dollars):

Fiscal Year	Approved CPJ Budget	Current CEF Budget	Revised CPJ Budget	CPJ Increase (Decrease)	CEF Increase (Decrease)
2004/05	$ 0	$ 0	$ 112	$ 112	$ 112
2005/06	$ 1,699	$ 1,699	$ 1,520	($ 179)	($ 179)
2006/07	$ 3,023	$ 3,023	$ 3,196	$ 173	$ 173
2007/08	$ 4,757	$ 4,757	$ 4,953	$ 196	$ 196
2008/09	$ 4,850	$ 4,850	$ 5,057	$ 207	$ 207
2009/10	$ 4,945	$ 4,945	$ 5,155	$ 210	$ 210
2010/11	$ 5,044	$ 5,044	$ 5,084	$ 40	$ 40
2011/12	$ 5,144	$ 5,144	$ 5,189	$ 45	$ 45
2012/13	$ 5,249	$ 5,249	$ 5,294	$ 45	$ 45
2013/14	$ 5,354	$ 5,354	$ 5,400	$ 46	$ 46
2014/15	$ 5,460	$ 5,460	$ 5,507	$ 47	$ 47
Total	$45,526	$45,526	$46,467	$ 941	$ 941

Proposed Schedule (This section is be filled out only if there is a change to the project schedule).

Four communication stand alone sites will be added to the schedule for 2006/07 and the remaining three will be added to the schedule to be completed by 2009/10.

Related Projects (This section is be filled out only if changed).

No change.

Reference Documents (This section is be filled out only if changed).

No change.

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CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
STN BATT. BNK CAP.&SYS RELIAB. INC HL PL		1.1.2.10.1.1
Owning Division	Coordinating Division	ProjectNumber:
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:08149

DESCRIPTION: BATTERY BANKS & CHARGERS AT 156 TRANSMISSION & DISTRIBUTION STATIONS. FOR MAINTENANCE AND RELIABILITY PURPOSES STATIONS WITH SYSTEM RESTORATION PLANS WILL REQUIRE DUAL BATTERY BANKS. SEVERAL LOCATIONS WILL REQUIRE AC STATION SERVICE UPGRADES AND BUILDING MODIFICATIONS OR ADDITIONS TO ACCOMMODATE INCREASED BATTERY CAPACITY. BATTERY BANK REPLACEMENT WILL BE COORDINATED BY CHANGING THE BANKS AS THEY REACH END-OF-LIFE, TO MAXIMIZE THE USE OF THE EXISTING ASSET.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
200K ADVANCE TO FISCAL YEAR 2004/2005 AFTER NOVEMBER CURRENT OUTLOOK MEETING

SCOPE INCREASED TO INCLUDE SEVEN STAND-ALONE COMMUNICATION SITES AT AN AVERAGE COST OF $150K PER YEAR FOR 2007 - 2010.

HIGH LEVEL PLAN REDUCED TO REFLECT THE CREATION OF NEW DETAILED PROJECTS FOR ASHERN STATION (P:07951), ROBLIN STATION (P:07952), UNIVERSITY STATION (P:07967), BURNTWOOD STATION (P:08708), STONEWALL (P:08784), ST. LEON (P:08785), INCO STATION (P:08888), ST. MATTHEWS STATION (P:09825), & TRANSCONA STATION (P:09948)

MATCHED PLAN TO ACTUALS FOR 2005

IN SERVICE DATES						Base estimate 2005/04/01 CLASS 1
2006/03/31	702	2010/03/31	5155	2014/03/31	5400	
2007/03/31	3196	2011/03/31	5084	2015/03/31	5507	
2008/03/31	4954	2012/03/31	5189			Work start date 2004/12/01
2009/03/31	5057	2013/03/31	5294			

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:	108		2			110
(Over)under expend:	-108		-2			-110
2005/06	1600	39	60			1699
2006/07	2800	117	106			3023
2007/08	4325	267	165			4757
2008/09	4325	358	167			4850
2009/10	4325	452	168			4945
2010/11	4325	548	171			5044
2011/12	4325	646	173			5144
2012/13	4325	745	179			5249
2013/14	4325	846	183			5354
2014/15	4325	950	185			5460
V-A04 TOTAL	39000	4968	1557			45525
REV. AMOUNTS:						
Actual cost to date:	108		2			110
(Over)under expend:						
Auth 2005/06	563	5	25			593
Req: 2006/07	3009	88	99			3196
2007/08	4565	227	161			4953
2008/09	4565	323	169			5057
2009/10	4565	421	169			5155
2010/11	4412	504	168			5084
2011/12	4412	602	175			5189
2012/13	4412	702	180			5294
2013/14	4412	804	184			5400
2014/15	4412	909	186			5507
V-HLD TOTAL	39435	4585	1518			45538

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd

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CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber
P:08149

Approved yy mm	TOTAL AMOUNT	COMMENTS
2004 0	45526	NEW ITEM

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr	46		1			47	47
May	48		1			49	96
Jun	48		1			49	145
Jul	46		1			47	192
Aug	51		2			53	245
Sep	46		2			48	293
Oct	46		2			48	341
Nov	48	1	2			51	392
Dec	43	1	3			47	439
Jan	46	1	3			50	489
Feb	43	1	3			47	536
Mar	52	1	4			57	593
TOTAL	563	5	25			593	593
2006/07 Apr	220	4				224	224
May	272	6	1			279	503
Jun	259	6	3			268	771
Jul	246	6	5			257	1028
Aug	272	7	6			285	1313
Sep	233	7	7			247	1560
Oct	259	8	9			276	1836
Nov	272	9	10			291	2127
Dec	220	7	12			239	2366
Jan	259	9	14			282	2648
Feb	233	9	14			256	2904
Mar	264	10	18			292	3196
TOTAL	3009	88	99			3196	3196

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CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
ASHERN STN - BATTERY BANK REPL		1.1.2.10.1.1
Owning Division	Coordinating Division	ProjectNumber:
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:07951

DESCRIPTION:
SALVAGE OLD 129 VOLT BATTERY BANK AND CHARGERS, AND INSTALL NEW 129 VOLT BATTERY BANK, CHARGERS DISCONNECT AND PARALLEL SCHEME.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2005/10/31	104			Work start date 2004/12/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:	2					2
(Over)under expend:	-2					-2
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:	2					2
(Over)under expend:						
Auth 2005/06 Req: 2006/07	98	3	1			102
V-HLD TOTAL	100	3	1			104

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
	05 05 25	OWNING DIVISION	05 05 26	COORDINATING DIVISION		VICE-PRESIDENT	05 07 26

2005/05/25 11:56AM

ER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:07951

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr	6					6	6
May	9					9	15
Jun	9					9	24
Jul	8					8	32
Aug	9					9	41
Sep	8					8	49
Oct	8		1			9	58
Nov	9					9	67
Dec	8					8	75
Jan	8					8	83
Feb	8					8	91
Mar	8	3				11	102
TOTAL	98	3	1			102	102
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

2005/05/25 11:56AM

CERI Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
ROBLIN SOUTH STN BATTERY BANK REPL		1.1.2.10.1.1
Owning Division	Coordinating Division	ProjectNumber:
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:07952

DESCRIPTION:
REPLACE 129 V BATTERY BANK AND CHARGER.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2005/11/30	102			Work start date 2005/05/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2005/06	100	1	1			102
Req.:						
V-HLD TOTAL	100	1	1			102

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
	05 05 25	OWNING DIVISION	05 05 26	COORDINATING DIVISION		VICE-PRESIDENT	05 05 26

2005/05/25 11:58AM

Rev. 97 12

CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:07952

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr							
May	5					5	5
Jun	10					10	15
Jul	9					9	24
Aug	10					10	34
Sep	9					9	43
Oct	9					9	52
Nov	10		1			11	63
Dec	9					9	72
Jan	9					9	81
Feb	9					9	90
Mar	11	1				12	102
TOTAL	100	1	1			102	102
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

2005/05/25 11:56AM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
UNIVERSITY STN-BATTERY BK & CHARGER		1.1.2.10.1.1
Owning Division	Coordinating Division	ProjectNumber:
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:07967

DESCRIPTION:
REPLACEMENT OF 180 A.H. STATION CONTROL BATTERIES & 30 AMP CHARGER & UPGRADE BATTERY ROOM.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2005/10/31	102			Work start date 2005/05/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2005/06 Req.:	100	1	1			102
V-HLD TOTAL	100	1	1			102

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
	05 05 05	Ronald J Ducenko OWNING DIVISION	05 05 26	COORDINATING DIVISION		VICE-PRESIDENT	05 07 26

2005/05/25 11:57AM

GER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:07967

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr							
May	9					9	9
Jun	9					9	18
Jul	9					9	27
Aug	10					10	37
Sep	9					9	46
Oct	9		1			10	56
Nov	9					9	65
Dec	8					8	73
Jan	9					9	82
Feb	8					8	90
Mar	11	1				12	102
TOTAL	100	1	1			102	102
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
BURNTWOOD STN REPLACE 129V BATTERY BANK		1.1.2.10.1.1
Owning Division	Coordinating Division	ProjectNumber:
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:08708

DESCRIPTION:
EXISTING BANK REQUIRES REPLACEMENT DUE TO FAILED CELLS.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2005/05/31	103			Work start date 2005/04/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2005/06 Req.:	100	3				103
V-HLD TOTAL	100	3				103

Prepared by	yy mm dd	Approved by OWNING DIVISION	yy mm dd	Approved by COORDINATING DIVISION	yy mm dd	Approved by VICE-PRESIDENT	yy mm dd
	05 05 25	Ronald Daconte	05 05 26				05 07 26

2005/05/25 11:58AM

ER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:08708

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr	8					8	8
May	9					9	17
Jun	9					9	26
Jul	8					8	34
Aug	9					9	43
Sep	8					8	51
Oct	8					8	59
Nov	9					9	68
Dec	8					8	76
Jan	8					8	84
Feb	8					8	92
Mar	8	3				11	103
TOTAL	100	3				103	103
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

2005/05/25 11:58AM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

Title		Investment Management Node:
STONEWALL STN 130V BATTERY BANK & CHARGE		1.1.2.10.1.1
Owning Division	Coordinating Division	ProjectNumber:
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:08784

DESCRIPTION:
UPGRADE STATION CONTROL BATTERIES- PER MEMO OF A. BOYD/R. RYGIEL FOR NEW BATTERY BANK & CHARGER

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2006/03/31	103			Work start date 2005/04/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2005/06 Req.:	100	1	2			103
V-HLD TOTAL	100	1	2			103

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
	05 06 14	OWNING DIVISION	05 06 16	COORDINATING DIVISION	05 06 15	VICE-PRESIDENT	05 07 26

2005/06/14 08:38AM

ER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:08784

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr	8					8	8
May	9					9	17
Jun	9					9	26
Jul	8					8	34
Aug	9					9	43
Sep	8					8	51
Oct	8					8	59
Nov	9					9	68
Dec	8					8	76
Jan	8					8	84
Feb	8					8	92
Mar	8	1	2			11	103
TOTAL	100	1	2			103	103
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

2005/06/14 08:38AM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

Title		Investment Management Node:
ST LEON STN 130V BATTERY BANK & CHARGERS		1.1.2.10.1.1
Owning Division	Coordinating Division	ProjectNumber:
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:08785

DESCRIPTION:
REPLACE 130V DC BATTERY BANK.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2006/03/31	103			Work start date 2005/04/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2005/06 Req.:	100	1	2			103
V-HLD TOTAL	100	1	2			103

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
	05 07 26	OWNING DIVISION	05 07 26	COORDINATING DIVISION		VICE-PRESIDENT	05 07 26

2005/07/26 08:24AM

Rev. 97 12

CAPITAL EXPENDITURE REVISION

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:08785

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr	8					8	8
May	9					9	17
Jun	9					9	26
Jul	8					8	34
Aug	9					9	43
Sep	8					8	51
Oct	8					8	59
Nov	9					9	68
Dec	8					8	76
Jan	8					8	84
Feb	8					8	92
Mar	8	1	2			11	103
TOTAL	100	1	2			103	103
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
INCO STN REPL STN CONT BATTERY & CHARGER		1.1.2.10.1.1
Owning Division	Coordinating Division	ProjectNumber:
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:08888

DESCRIPTION:
REPLACE INCO HILL STATION CONTROL BATTERIES AND BATTERY CHARGER.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2006/03/31	104			Work start date 2005/05/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2005/06 Req.:	100	1	3			104
V-HLD TOTAL	100	1	3			104

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
	05 05 25	OWNING DIVISION	05 05 26	COORDINATING DIVISION		VICE-PRESIDENT	05 07 26

2005/05/25 11:58AM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:08888

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr							
May	5					5	5
Jun	10					10	15
Jul	9					9	24
Aug	10					10	34
Sep	9					9	43
Oct	9					9	52
Nov	10					10	62
Dec	9					9	71
Jan	9					9	80
Feb	9					9	89
Mar	11	1	3			15	104
TOTAL	100	1	3			104	104
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

2005/05/25 11:58AM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title		Investment Management Node:
ST. MATTHEWS STN BATTERY BANK REPL		1.1.2.10.1.1
Owning Division: APPARATUS MAINTENANCE	Coordinating Division: TRANS CONST & LINE MTCE	ProjectNumber: P:09825

DESCRIPTION:
REPLACE BATTERIES AND CHARGERS AT ST. MATTHEWS STATION AND THE RECONSTRUCTION OF BATTERY ROOM.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate
2006/03/31	104			2005/04/01 CLASS 3
				Work start date 2005/05/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2005/06	100	1	3			104
Req.:						
V-HLD TOTAL	100	1	3			104

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
[signature]	05 05 25	[signature] OWNING DIVISION	05 05 26	[signature] COORDINATING DIVISION		[signature] VICE-PRESIDENT	05 07 20

2005/05/25 11:58AM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:09825

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr							
May	8					8	8
Jun	10					10	18
Jul	9					9	27
Aug	10					10	37
Sep	9					9	46
Oct	9					9	55
Nov	10					10	65
Dec	9					9	74
Jan	9					9	83
Feb	9					9	92
Mar	8	1	3			12	104
TOTAL	100	1	3			104	104
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

2005/05/25 11:58AM

CER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

(IN THOUSANDS OF DOLLARS)

SIMULATED ROLLOVER

Title	Investment Management Node:
TRANSCONA STN BAT BANK REPL&ROOM UPGRADE	1.1.2.10.1.1
Owning Division	**Coordinating Division**	**ProjectNumber:**
APPARATUS MAINTENANCE	TRANS CONST & LINE MTCE	P:09948

DESCRIPTION:
REPLACE BATTERIES AND CHARGERS.

JUSTIFICATION:
TRANSMISSION SYSTEM OPERATIONS DIVISION HAS REQUESTED THAT T&D STATIONS HAVE A 12-16 HOUR BATTERY ENDURANCE TO MEET THE NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL.S (NERC.S) REQUIREMENTS FOR A WORKABLE SYSTEM RESTORATION PLAN. STATIONS WITHOUT SYSTEM RESTORATION PLANS WILL REQUIRE BATTERY CAPACITY FOR 16-HOUR DURATION. STATIONS WITH A RESTORATION PLAN WILL REQUIRE BATTERY CAPACITY FOR 12 HOURS AND DUAL BATTERY BANK SYSTEMS, WITH MULTIPLE CHARGERS, WHERE PRACTICAL. THE INSTALLATION OF DUAL BATTERY BANK CONFIGURATIONS AT CRITICAL STATIONS WILL FACILITATE SAFE BATTERY MAINTENANCE AND REDUCE THE REQUIREMENT TO UTILIZE A TEMPORARY BATTERY BANK DURING MAINTENANCE WORK. (TRANSMISSION SYSTEM OPERATIONS. GUIDELINES WILL NOT ALLOW ANY MAINTENANCE TO BE PERFORMED ON IN-SERVICE SINGLE BATTERY BANK CONFIGURATIONS IN STATIONS THAT HAVE BEEN IDENTIFIED AS HAVING SYSTEM RESTORATION PLANS.)

REVISION:
NEW ITEM, FORMERLY INCLUDED UNDER THE HIGH LEVEL PLAN COVERED BY P:08149.

IN SERVICE DATES				Base estimate 2005/04/01 CLASS 3
2006/03/31	104			Work start date 2005/05/01

PREV.AUTHORITY	GROSS	ESCALATION	INT.CAPITALIZED	SALVAGE	CONTRIBUTION	TOTAL NET COST
Actual cost to date:						
(Over)under expend:						
V-A04 TOTAL						
REV. AMOUNTS:						
Actual cost to date:						
(Over)under expend:						
Auth 2005/06 Req.:	100	1	3			104
V-HLD TOTAL	100	1	3			104

Prepared by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd	Approved by	yy mm dd
	05 05 25	Ronald Dacombe OWNING DIVISION	05 05 26	COORDINATING DIVISION		VICE-PRESIDENT	

2005/05/25 12:00PM

GER(1) Rev. 97 12

CAPITAL EXPENDITURE REVISION

SIMULATED ROLLOVER

FORECAST HISTORY (in thousands of dollars)

ProjectNumber P:09948

Approved yy mm	TOTAL AMOUNT	COMMENTS

ASSOCIATED PROJECTS

Project number	Description

Forecasted Mthly Exp.	GROSS	ESCALATION	INTEREST CAP.	CONTRIBUTION	SALVAGE	TOTAL NET COST	YTD Accumulated
2005/06 Apr							
May	5					5	5
Jun	10					10	15
Jul	9					9	24
Aug	10					10	34
Sep	9					9	43
Oct	9					9	52
Nov	10					10	62
Dec	9					9	71
Jan	9					9	80
Feb	9					9	89
Mar	11	1	3			15	104
TOTAL	100	1	3			104	104
2006/07 Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Jan							
Feb							
Mar							
TOTAL							

2005/05/25 12:00PM

TRANSMISSION & DISTRIBUTION CAPITAL BUDGET RANKING TOOL

Matrix Scoring Sheet

Date:	2006 01 12
I.M. #	1.1.2.10.1.1
WBS # (if Domestic)	

NAME OF PROJECT TO BE RANKED: STATION BATTERY BANK REPLACEMENT PROGRAM

Weight	TRANSMISSION & DISTRIBUTION GOAL - Factor	Level 1 (=10 points)	Level 2 (=7 points)	Level 3 (=5 points)	Level 4 (=2 points)	Level 5 (=0 points)	GOAL SCORES	COMMENTS / RATIONALE
	SAFETY							
4	- Probability of risk to public or employee safety	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
6	- Consequence of risk to public or employee safety	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
	SERVICE & RELIABILITY							
4	- Probability of							
	- event affecting service to a customer, OR	CERTAIN	HIGH	MEDIUM	LOW	does not apply		There is only a single contingency. Justification is for 2nd contingency
	- event affecting system reliability, OR	CERTAIN	HIGH	MEDIUM	LOW	does not apply	28	
	- loss of communications	CERTAIN	HIGH	MEDIUM	LOW	does not apply		
5	- Consequence of:							
	- event affecting service to a customer, OR	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
	- event affecting system reliability, OR	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply	50	
	- loss of communications	HIGH	MEDIUM-HIGH	MEDIUM	LOW	does not apply		
5	**FINANCIAL IMPACT**							
	- Net Present Value, OR	> $1,000k	> $100k and ≤ $1,000k	> $0 and ≤ $100k		≤ $0		Very Conservative-Depending upon which battery bank fails would determine the financial impact (Exports and/or Import)
	- Average avoided cost per year	> $250k	> $100k and ≤ $250k	> $30k and ≤ $100k	> $0 and ≤ $30k	does not apply	10	
7	**TRANSFER CAPABILITY**							
	- Increase or prevent loss of energy transfer capability	> 50MW	>10MW and ≤ 50MW	> 0MW and ≤ 10MW	MAINTAIN	does not apply	14	
	ENVIRONMENT							
2	- Probability of negative or positive impact	HIGH		MEDIUM	LOW	does not apply		
3	- Consequence of negative or positive impact	HIGH		MEDIUM	LOW	does not apply		
2	**ENERGY CONSERVATION**							
	- Energy efficiency	> 10MW	> 5MW and ≤ 10MW	> 1MW and ≤ 5MW	> 0MW and ≤ 1MW	does not contribute		
						MATRIX SCORE:	102	= TIER 2

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