Inter Station Transfer Bus Capacity Increase Project 13 - 49270

Full Release Business Case Summary NA44 - BCS - 54130 - 00003 – R000

1/ RECOMMENDATION:

We recommend the approval of a Full release of $19.4M (Capital including contingency) to complete the Pickering A Inter Station Transfer Bus (ISTB) Capacity Increase Project. The business objectives of this project are to:

- Design and install a permanent solution for the ISTB to meet regulatory commitments to the Canadian Nuclear Safety Commission (CNSC) under A/R 28082139
- Ensure the permanent solution for power supply to the ISTB meets design and reliability requirements
- Remove operational constraints imposed by the existing Temporary Modification (TMOD) design

During the resolution of a Technical Operability Evaluation on the Pickering A Steam Barrier, testing revealed that the ISTB did not meet Design Requirements for Voltage Drop. As a result, units 1 and 4 were out of service for approximately three months during the summer of 2007. A TMOD under Engineering Change Package EC95373 was installed in August, 2007 as an interim solution to return the Units back to service. A permanent modification is required to ensure availability of the Inter Station Transfer Bus system through the design life of the station.

An option using Class III 4KV Circuit Breakers CB8A/B (in Pickering B) through new Transfer Switches (TS) and transformers was adopted by the Pickering Joint Senior Management Board (SMB) in March 25, 2008 and a Partial Release Business Case Summary (BCS) was subsequently approved in May 2008. The objective was to comply with the September 2007 CNSC request (NA44-CORR-00531-05595) to install a permanent solution within approximately 18 months by completing the tie ins during two 10 day Pickering A (PNGSA) outages starting in April 2009.

Due to a six month delay to resolve legacy loading and equipment supplier concerns, the tie ins are now scheduled to be completed in the 2 unit PNGSA outage planned during the 2010 Vacuum Building Outage (VBO). This strategy will avoid approximately $10M of revenue losses associated with the original schedule. This benefit is partially negated by approximately $7M (without contingency) of projected additional project cost resulting from increased engineering and support effort, firmed up material and installation costs. Pickering B (PNGS-B) unit outages will not be required and commissioning is expected to be completed shortly after the VBO. As this is a large expedited project, some Integrated Operational Plan (IOP) and Outage Governance milestones will not be met. The risk associated with this strategy is outlined in detail in the proposal and Risk Section of this BCS.

As required, we have been providing the CNSC with quarterly updates on our progress. Our latest communication on Nov 15, 2008 indicates that the installation is planned to be available for service in the 2nd quarter of 2010. This schedule is based on the condition that the modification has to be commissioned with the units shutdown in order to complete all testing required to confirm that the design requirements have been met, as well as, timely procurement and delivery of materials from our suppliers.

$M (incl contingency)	Type	LTD 2008	2009	2010	2011	2012	2013	Later	Total
Currently Released	Partial	2.8	1.6						4.4
Requested Now	Full	(1.4)	11.6	4.7	0.2				15.0
Future Funding Req'd									0.0
Total Project Costs		1.4	13.2	4.7	0.2	0.0	0.0	0.0	19.4
Non Project Costs	Spare Parts			1.0					1.0
Grand Total		1.4	13.2	5.7	0.2	0.0	0.0	0.0	20.4
Investment Type Regulatory		Class Capital		NPV (14.0)		IRR N/A		Discounted Payback N/A	

Submitted By:

T. Mitchell — Date: 1 April 09
Chief Nuclear Officer

Finance Approval:

D. Hanbidge — Date:
S.V.P. & Chief Financial Officer

Line Approval (Per OAR Element 1.1 Project In Budget):

J. Hankinson — Date: May 15/09
President & Chief Executive Officer

2/ BACKGROUND & ISSUES

System Impact & Issues:

The Regulator has requested (NA44-CORR-00531-05595) that Ontario Power Generation (OPG) design, implement and install a permanent solution to the Inter Station Transfer Bus (ISTB). The schedule for completion of the installation must consider the expectation that the TMOD will be removed as soon as practical with commitments captured under NA44-CORR-00531-05718.

During resolution of a Technical Operability Evaluation (NA44-TOE-54000-00001) on the Pickering A Steam Barrier, it was discovered that actions in 2005 taken under NA44-TOE-54230-00002 were less than adequate, and that the ISTB did not meet Design Requirements for Voltage Drop. Units 1 and 4 had been out of service since June 2007. A TMOD under Engineering Change Package EC95373 was installed in August, 2007 as an interim solution to return the Units back to service. However, the TMOD has given rise to some new risks, associated with configuration, redundancy and voltage drop issues that need to be addressed by a Permanent Modification.

Under the current configuration, PB cannot complete different kinds of Class III (CLIII) and Class IV (CLIV) maintenance on Units 5 and 6 without putting PNGSA on a shutdown clock. This makes outage work more difficult to plan as alternate supplies and heat sink arrangements are required to support the work.

The 540V threshold is the minimum voltage that the Class II (CLII) battery rectifiers require to operate. In the event of insufficient voltage, ISTB will be unable to supply backup power to CLII for a Main Steam Line Break (MLSB) or provide power to critical Heating, Ventilation, and Air Conditioning (HVAC) loads used to maintain mild conditions in the Control Room and the CLIII Motor Control Centers MCC101/102 enclosures. Other equipment will be affected as well.

Current Operational Constraints:

The loss of redundancy reduces the ability of ISTB to deliver as required for a design basis MSLB event. Although a loss of redundancy still meets the minimum requirements to start the units back up, any unavailability needs to be tracked and reported to the CNSC. Moreover, there is an Operating Principles & Procedures OP&P requirement that testing and maintenance be performed without entering into a "does not meet intent" mode. In addition to loss of redundancy, the existing TMOD has placed several operational constraints on Pickering B as follows:

- Single bus operation can not be performed under the split configuration due to severe voltage drop
- Back up power supply to Motor Control Center MCC935 no longer provided by the ISTB. In order to meet Voltage Drop requirements, the TMOD removed the back up power supply (to MCC935) from the ISTB and placed it on CLIV power, therefore, it does not meet reliability requirements.
- No annunciation received on loss of back up control power to MCC935
- Extensive coordination required between Independent Electrical System Operator (IESO), PNGS-A, and PNGS-B operations when grid voltage for unit supplying Site Electrical System (SES) dips below 242 kV
- Procedures are required to ensure Make-Before-Break (MBB) transfer of CLII 600 V buses due to the fact that a Break-Before-Make (BBM) transfer will cause a transient voltage of the ISTB to dip below 480V.
- Voltage drop reduction achieved by the TMOD was marginally acceptable.

PMOD options:

A permanent solution is required that provides adequate system redundancy, ensure adequate and robust supplies are available to the ISTB loads and is relatively transparent in both mission and standby operation modes to Pickering B. To reduce the exposure of both Pickering A and B to the inherent risks of the existing TMOD, installation of the permanent modification is required to be performed on the most expedient schedule possible within reason.

The value engineering process, with third party review, was followed to select the preferred option that avoided $7M extra cost. Some of the options evaluated were:

- PNGS-B option (recommended in this report).
- PNGS-A option using Units 2/3 (U2/3) Station Service Transformers (SSTs) in conjunction with the P-A Standby Generators (SGs).
- PNGS-A option using U2/3 SSTs in conjunction with new diesel generators.

Project Expectations

The proposed installation is based on the expectations outlined in the project charter NA44-PCH-54130-00001 and initiated by ECR#11435.The primary objective is to increase the bus capacity so that ISTB can meet the design basis for current and voltage difference. Critical success factors of this project are:

- Improve voltage and current capability of the MCC incoming supply by appropriate design.
- Ease of installation and testing provision for new ISTB system.
- Remove current TMOD operational and design constraints

Current Status of Project

- SMB approved PNGS-B Option March 25, 2008
- Conceptual Design completed May 30, 2008.
- Preliminary Engineering completed January 21, 2009
- Detailed Design to be completed by August 2009
- Installation and Commissioning to be completed by June 2010

3/ ALTERNATIVES AND ECONOMIC ANALYSIS

$ 000's	Base Case	Alt 1 (Recommended) Full Cost	Alt 1 (Recommended) Incremental Cost	Alt 2 Delay	Alt 3 PNGSA SSTs/SGs	Alt 4 PNGSA Diesel	Alt 5
Revenue					(34,271)	(22,848)	
OM&A							
Capital		(18,696)	(17,330)		(20,268)	(27,918)	
Present Value (PV)		(15,115)	(13,951)	N/A	(36,309)	(35,007)	
Net Present Value (NPV)	**N/A**	(15,115)	(13,951)	N/A	(36,309)	(35,007)	
Internal Rate of Return (IRR) %	N/A	N/A	N/A	N/A	N/A	N/A	
Discounted Payback (Yrs)	N/A	N/A	N/A	N/A	N/A	N/A	

Base Case: Not Recommended - Status Quo

The TMOD installed in August 2007 cannot be left in place indefinitely as the design was not based on a permanent platform. Operational constraints as follows:

- Challenges to maintenance planning and operational flexibility.
- Lack of redundancy in the TMOD configuration (Buss EE (BUEE) fed from unit 5 (U5) and Buss FF (BUFF) from unit 6 (U6)). Units 7 and 8 not used due to high voltage drops.
- MCC935 supply from CLIV (Not from ISTB) – Does not meet reliability requirements
- Requires extensive monitoring of grid voltage by IESO and extensive coordination between IESO and PNGS-A and PNGS-B operations if grid voltage drops below 240kV
- Split configuration of buses BUEE and BUFF challenges single bus operation, parallel operation of BUEE and BUFF required to meet system design requirements.
- Voltage drop reduction achieved by the TMOD was marginally acceptable with respect to meeting Design Requirements
- May result in forced outages
- There is a regulatory commitment to install a permanent solution

Alt. 1: Recommended - Modified Option 7a (Value Engineering Report); PNGS B Solution

This option includes installation of four 4kV/600V dedicated transformers at Pickering A to supply the ISTB. The transformers will receive power from the Pickering B 4kV Class III CB8A/B breakers through a new transfer switch, and will be situated in PNGS-A to supply the new 600V ISTB system. Tie-in of the ISTB buses will require a 2-unit PNGS-A outage (VBO). However, supply side tie-ins can be accomplished independently of Pickering B Unit conditions.

This option is recommended due to the following:

- Voltage profile enhanced by positioning transformers in PNGS-A
- Even and Odd supplies will provide power to the ISTB (U5/6 to BUEE & U7/8 to BUFF), therefore increasing system redundancy/reliability and remove the constraints imposed by the TMOD
- Adding Transfer Switches (remotely operated from Main Control Room (MCR) or local manual) do not require PNGS-B unit outages
- New ISTB design supports single bus operation.
- MCC935 ISTB supply restored
- Minimal impacts to existing station CL III distribution system

However, similar to the original ISTB design, the recommended Permanent Modification (PMOD) is PNGS-B dependent, and hence work coordination is required between the two stations, as well as impairments review.

Alt. 2: Not Recommended - Delay Project

This option is not recommended because it will result in leaving the TMOD installed over an extended period of time, resulting in PNGS-A forced unit outages in the event of loss of power to ISTB from units 5 and 6 (due to lack of redundancy from units 7&8). In addition, delaying the project would mean not meeting a regulatory commitment to the CNSC.

Alt. 3: Not Recommended - Option 19 (Value Engineering Report)- PNGS-A Option Using SSTs/SGs

This option includes the installation of 2 dedicated transformers at Pickering A to supply the ISTB. This option provides a PNGS-A independent solution, and hence, requires no work coordination with PNGS-B (unlike the original design). Power will be received from U2/3 SSTs in conjunction with PNGS-A SGs as follows:

- One transformer (feeds BUEE) from U2 SST secondary side and one PA SG bank
- Other transformer (feeds BUFF) from U3 SST secondary side and the other SG bank
- The transformers to be situated in PNGS-A; and step down the 4kV supply to the new 600V ISTB system.

This option is NOT recommended due to the following:

- Licensing issues due to the fact that the CLIII SG Switch gear and SST will not survive an MSLB event under current configuration. CLIII distribution system would require re-defining/re-classifying/& re-licensing in order for this option to be viable. There are no guarantees that the regulator would sanction such re-licensing.
- Power to the steam protected room fans will be interrupted for 3 minutes while an SG starts, which would result in CLII equipment failure. Other provisions would be required for power during these 3 minutes such as a stand alone Uninterruptible Power Supply (UPS) to supply power to fans until SGs pick up. This is a complex and expensive modification.
- Only one transformer supplying ISTB, and hence, less reliable compared to PNGS-B option.
- Requires all 3 PNGS-A SG's down in order to complete modifications (OP&P violation)
- Extensive modifications to the PNGS-A MCR

Alt 4: Not Recommended - PNGS-A Option with Diesel Generators

This option is similar to alternative 3; however, involves the addition of 2-4 Diesel Generators in place of the PNGS-A SGs in order to remove the alternative 3 technical deficiencies. As in alternative 3, this option provides a PNGS-A independent solution, and hence, requires no work coordination with PNGS-B (unlike the original design).

This option is NOT recommended due to the following:

- Although the use of fast start Diesels together with U2/U3 SST would be technically possible, it will be prohibitively expensive. The arrangement would require 2-4 generators, and additional breakers to protect the SST.
- Environmental Assessment would be required
- Only one transformer supplying ISTB, and hence, less reliable compared to PNGS-B option. Probability of failure of one ISTB bus is 2e-3
- Complex additions to the PNGS-A MCR would be required
- Added infrastructure, maintenance personnel and complexities

Alt. 5: Not Recommended - Other Options Listed in Value Engineering Report

Other options outlined in the Value Engineering (VE) report (NA44-REP-54130-00016) were discounted during the Engineering Decision Making (EDM) meeting held on March 19, 2008

Filed: 2013-09-27
EB-2013-0321
Ex. D2-1-3
Attachment 1 Tab 9

4/ THE PROPOSAL

We recommend the approval of a Full release of $15,006K ($19,420K total project estimate) Capital funding to complete the Detailed Engineering, installation and close-out for the Pickering A Inter Station Transfer Bus (ISTB) Capacity Increase Project. The project is currently funded through a Partial Release approved May 26, 2008.

The tight project schedule allows for adherence to some on-line (IOP) and outage work management milestones; however, design issuance and assessing milestones will not follow IOP and VBO outage governance defined milestones. Given the CNSC requirement to expeditiously remove the existing TMOD supply, and the economic advantages of utilizing the planned PNGS-A outages we recommend this approach. The risks of this planned strategy will be mitigated by performing some work at risk (WARR), as per the signed modification outline package, starting in May 2009. Tie-ins will be performed during the VBO PNGS-A 2-unit outage. A PNGS-B outage will not be required to perform tie-ins to the PNGS-B supplies.

Full **Release BCS major project deliverables** are:

- Project Execution Plan
- Issue Design Packages
- Work at Risk Release (WARR) Work Plans and Field Engineering Packages
- Pre-outage (IOP) Work Plans and Field Engineering Packages for U7/8 TS tie-ins
- Outage Work Plans and Field Engineering Packages
- New and/or revised Operating and Maintenance Procedures
- Installation of new equipment and cable runs and commissioning of new ISTB system
- Post-outage Work Plans and Field Engineering Packages for U5 Transfer Switch (TS) tie-in and U8 load test
- ISTB TMOD removal and close out
- Training for Operations, Maintenance, and Performance Engineering staff
- Revised Design Packages (as required)
- Design and Project Close-out
- Post Implementation Review, Lessons Learned

This BCS assumes the abandonment in place of the majority of the TMOD and legacy installations. Only necessary removals will be performed, as part of the installation cost, to accommodate for the Permanent Modification (PMOD) installations.

Projects will identify the critical spares required for 20 years and will ensure availability prior to the final Available for Service (AFS) meeting. The cost to procure spare parts is not included in the total project capital cost as it will be funded by the inventory OM&A budget (Station OM&A budget will not be charged until parts are drawn from stores). It is estimated that the total cost to procure spare parts is approximately $1M. Cost breakdown as follows:

Item	Quantity	Cost per unit	Total Cost
Transformer (4kV/600V)	4	$100K	$400K
Disconnect Switch (4kV)	2	$35K	$70K
Transfer Switch Pair (4kV)	2 pairs	$36K per pair	$144K
Control Relays	20	$1K	$20K
Switchgear Breakers (600V)	10	$15K	$150K
Protection Relays	10	$5K	$50K
Hand-Switches (Control Room)	20	$500	$10K
Voltage Meters (Control Room)	20	$500	$10K
Indicating Lights (Control Room)	20	$500	$10K
Human Machine Interface (HMI) (Switchgear)	10	$5K	$50K
Heating units (Switchgear)	5	$5K	$25K
Ventilators (Switchgear)	5	$2K	$10K
Air Condition units (Switchgear)	5	$5K	$25K
HVAC Filters	25	$200	$5K
		Total	$979K

This project will procure nine resistive load boxes (400kVA, 600V) for commissioning purposes for a total cost of $200K. These load boxes will also be used for maintenance purposes in the future.

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EB-2013-0321
Ex. D2-1-3
Attachment 1 Tab 9

5/ QUALITATIVE FACTORS

- Removal of operational constraints on Pickering B as a result of the ISTB TMOD.
- Increased redundancy of the ISTB system.
- Single bus operation capability restored.
- MCC935 ISTB supply restored.
- Enhance the voltage profile:

    1. Improve the voltage drop performance against Design Requirements
    2. Provision of adequate voltage to ISTB loads

6/ RISKS (see Attachment D for details)

Low = 1 to 3	Medium = 4 to 9	High = 10 to 25

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Description	Mitigating Activities	Probability x Impact — Before Mitigation									Probability x Impact — After Mitigation								
		Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)	Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)
Potential for rework due to the fact that design issuance and assessing milestones will not meet IOP and outage work management milestones in governance. **$ 103K**	-Implementing WARR strategy to ensure pre-requisites for the VBO are completed. -Working downstream deliverables in parallel. -Support groups working closely with design agency	5	12							**12**	3	9							**9**
Potential for cost increase and schedule delays due to Design packages requiring CNSC approval (VBO may not be met). Approvals need to be fast-tracked to meet IOP schedule. **$ 171K**	Regular communications maintained with the CNSC – Action Tracking AR28084390-2 & 28088132-1. Engage Senior Management and Regulatory Affairs to assist in approvals.	5	12							**12**	3	9							**9**
Cost/schedule impact due to Delayed Equipment Vendor documentation and less than adequate Quality causing assessing re-work. **$ 133K**	Close OPG Design & Supply Chain interface and monitoring of Vendor. Close Design, Project and Field Engineering (FE) integration with Design Agency (DA) required to limit re-work.	5	12							**12**	3	9							**9**
Potential for delays and increased cost to provide additional structural support to Reactor Auxiliary Bay (RAB) and Service Wing Roof caused by less than optimal civil design **$ 163K**	1. Validate structural assumptions 2. Increased oversight of civil design 3. Review existing loads on roof	5	12	15	12	9	3		4	**15**	3	8	8	3	3	1			**8**

Low = 1 to 3	Medium = 4 to 9	High = 10 to 25

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Description	Mitigating Activities	Probability x Impact (Before Mitigation)									Probability x Impact (After Mitigation)								
		Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)	Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)
Portfolio risk: Schedule delays due to changing station conditions and unforeseen issues. **$ 73K**	Projects to minimize work during VBO (or outage) by performing the following: 1. Cable trays/pulls to follow WARR or Job Jar strategy (possible, otherwise IOP) 2. Major equipment installation to follow IOP prior to outage or VBO 3. Only Tie-ins, CB8 logic work, MCR work, and testing to be performed in VBO outage 4. Equipment Removal to be performed as necessary during installation (rest of removals to be completed post outage or VBO) 5. Design reviews performed bi-weekly with the design agency to ensure schedule closely monitored and mitigating actions taken 6. Secure senior management sponsorship and commitment to obtain dedicated resources and establish aligned priorities 7. Work plans, Fabrication and Installation Package Releases (FIPRs), Inspection & Test Plans (ITPs), will be prepared in parallel with design packages, as possible.	5	15							**15**	3	6							**6**

Low = 1 to 3	Medium = 4 to 9	High = 10 to 25

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Description	Mitigating Activities	Before Mitigation: Probability x Impact									After Mitigation: Probability x Impact								
		Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)	Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)
Potential for PNGSA forced outage (beyond VBO), schedule delays, and cost increase due to the recommended alternative not meeting business objectives (design does not meet Design intent for Voltage Drop, or other installation / commissioning issues). **$ 350K**	1. Design validated through extensive and rigorous technical reviews and Constructability, Operability, Maintenance, and Safety (COMS). 2. Factory Acceptance Test (FAT) completed for all equipment prior to shipping to ensure specs are met. 3. Comprehensive Design Requirement (DR) (Load List finalized) & Scope of Work (SOW) issued to DA. 4. P-2008-13330 findings (Unexpected low ISTB volts) incorporated in design. 5. Grid voltage requirements incorporated in design. 6. As-found Emergency Lighting loads incorporated in design; 7. Extensive analysis for transients using the Electrical Transient Analysis Program (ETAP) has shown that the recommended alternative will provide adequate power to the ISTB and meets design requirements. 8. Several load challenge reviews	10	16	15	4	6				**16**	5	**9**	3	1	2				**9**
Potential for schedule delays and cost increase due to uncertainty surrounding scope of TMOD removal. **$ 174K**	1. Projects to set up meeting with stakeholders to determine scope of TMOD removal 2. Review scope of removal with OPS during Detailed Design 3. Perform walk down to determine required scope 4. This BCS assumes substantial abandon in place of the TMOD and legacy PMOD installations	5	12							**12**	3	3							

Low = 1 to 3	Medium = 4 to 9	High = 10 to 25

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Description	Mitigating Activities	Before Mitigation: Probability x Impact									After Mitigation: Probability x Impact								
		Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)	Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)
Potential schedule delays and cost increase due to constructability issues discovered during detailed design. **$ 158K**	1. Lessons Learned and Operational Experience (OPEX) from the ISTB TMOD incorporated. 2. Extensive involvement of Field Engineers in Design Process.	5	16							**16**	3	3							3
Potential schedule delays and cost increases due to discovery issues during installation. **$ 103K**	1. Stakeholders engaged early through COMS and walk downs. 2. Several challenge reviews were held.	5	6							**6**	3	2							3
Potential schedule delay due to unavailability of spare parts at Available for Service (AFS) meeting stemming from less than optimal spares Procurement process. **$ 50K**	1. B-2 Joint Projects and Modifications (P&M) / Supply Chain initiative underway to ensure spare parts are available at AFS for projects 2. Spare parts to be manually procured up front (along with Materials)	5	16						6	**16**	3	3						3	3
Potential schedule delay and cost increase due to internal resource unavailability (ISTB project **not** part of original VBO schedule). Some milestones not met **$ 14K**	1. Projects to coordinate and integrate with VBO team. 2. Work Orders W/Os added to VBO scope 3. Recovery plan for milestone non-compliance completed and will be closely monitored by management team	5	12							**12**	3	2							3
Potential for schedule delays due to insufficient room to lay down equipment in a common area. **$ 56K**	1. Apply early for Space Allocation Permits. 2. Coordinate with Single Point of Contact (SPOC) regarding lay down areas	5	12				6			**12**	3	1				2			

Low = 1 to 3	Medium = 4 to 9	High = 10 to 25

Probability \ Impact	1	2	3	4	5
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
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Risk Description	Mitigating Activities	Probability x Impact: Before Mitigation									Probability x Impact: After Mitigation								
		Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)	Finance	Schedule	Quality	Corporate Reputation	Regulatory	Health & Safety	Environment	Nuclear Safety	Risk Rating (1 to 25)
Potential schedule delays due to permitry issues. **$ 112K**	1. Develop permitry strategy well in advance (Follow VBO integrated strategy)	5	12							**12**	3	3							**3**
Potential for schedule delays and cost increases due to conflict between Transformer T5 outage & ongoing VBO or other outage maintenance requiring T5 in service (eg. Conflicts with U7 outage and needs for T5). **$ 19K**	1. Coordinate with the System Window Coordinator (SWC) and integrate with station plans	5	12				4		6	**12**	3	3				1		3	**3**

Note: The table above shows the major risks associated with this project. See the Risk Management Plan (NA44-PLAN-54130-0260750) for a full list of the risks. The specific contingency numbers in this BCS include all risks and not just the contingencies in this table.

7/ POST IMPLEMENTATION REVIEW PLAN

Type of PIR:	Targeted Final AFS Date:	Targeted PIR Approval Date:	PIR Responsibility (Sponsor Title)
Simplified	Jun 2010	Dec 2010	Performance Engineering

	Measurable Parameter	Current Baseline	Targeted Result	How will it be measured?	Who will measure it? (person / group)
1.	CNSC requested actions under A/R 28082139 completed	Not satisfied	Satisfy CNSC commitment	Communication of results accepted by CNSC	Project Manager/ Design Projects
2.	Voltage drop and bus capability	Needs improvement to restore required design margins	Improve voltage and current capability of the bus by appropriate design	Commissioning results accepted by design and stakeholders and meet Mod Design Requirements	Design Responsible Engineer/ Plant Design
3.	Restored design margins, redundancy and reliability	Doesn't meet required design margins, redundancy and reliability	Satisfies design margins, redundancy and reliability	Commissioning results demonstrate compliance with Mod Design Requirements	Design Responsible Engineer/ Plant Design
4.	TMOD operation and design	Existing TMOD operational constraints	Remove existing constraints	Electrical Removal of TMOD	Project Manager/ Design Projects

Appendix "A" Glossary (acronyms, codes, technical terms)

- ANO – Authorized Nuclear Operator
- AR - Action Request
- AFS – Available for Service
- BUEE – Bus EE
- BUFF – Bus FF
- BTU – Building Trade Union
- BBM – Break before make
- BCS – Business Case Summary
- CLII/III/IV – Electrical Class 2/3/4
- CMO – Contract Management Office
- COMS – Constructability, Operability, Maintenance, Safety
- CB – Circuit Breaker
- CNSC – Canadian Nuclear Safety Commission
- DTL – Design Team Leader
- DR – Design Requirement
- DA – Design Agency
- ETAP – Electrical Transient Analysis Program
- EDM – Engineering Decision Making
- FIPR – Fabrication and Installation Package Release
- FAT – Factory Acceptance Test
- FEP – Front End Planning
- HVAC – Heating, Ventilation, Air Conditioning
- HFE – Human Factor Engineering
- ISTB – Inter Station Transfer Bus
- ITP – Inspection and Test Plan
- IESO – Independent Electrical System Operator
- IEV – Impact on Economic Value
- IRR – Internal Rate of Return
- IOP – Integrated Operational Plan
- IOPX – Code for work performed online
- MSLB – Main Steam Line Break
- MBB – Make before break
- MCC – Motor Control Centre
- MCR – Main control Room
- NPV – Net Present Value
- OPEX – Operational Experience
- OAR – Organizational Authority Register
- OT – Overtime
- OP&P – Operating Principles and Procedures
- PIR – Project Implementation Review
- PVBO – Code for work performed during vacuum Building Outage
- POST – Code for work performed post vacuum Building Outage
- P&M – Projects and Modifications
- PMOD – Permanent Modification
- PEP – Project Execution Plan
- RAB – Reactor Auxiliary Bay
- RC – Resource Centre
- RFP – Request for Proposal
- SMB – Site Management Board
- SOW – Scope of Work
- SSF – Secondary Side Failure
- SES – Site Electrical System

- SRE/SE – System responsible Engineer
- SG – Standby Generator
- SQA – Software Qualification Assessment
- SPOC – Single Point of Contact
- SST – Station Service Transformer
- SWC – System Window Coordinator
- SCR – Station Condition Record
- S/W – Software
- T5 – Transformer 5
- T&M – Time & Materials
- TPAR – Technical Procedure Action Request
- TS – Transfer Switch
- TMOD – Temporary Modification
- TOE – Technical Operability Evaluation
- UPS – Uninterruptible Power Supply
- VD – Voltage Drop
- VE – Value Engineering
- VBO – Vacuum Building Outage
- WBS – Work Breakdown Structure
- WARR – Work at Risk Release
- W/O – Work Order

Appendix "B" Project Funding History

$ 000's		All Existing and Planned Releases (incl contingency) Cumulative Values									
Release Type	Month	Year	2007	2008	2009	2010	2011	2012	2013	Later	Total
Partial	Mar	2008	132	2,678	1,604						4,414
Full	Feb	2009	132	1,258	13,197	4,682	151				19,420
											0
											0
											0
											0
											0
											0
											0
LTD Spent	Dec	2008	1,390								1,390

Comments:

Appendix "C" Financial Model – Assumptions

Financial Assumptions:

Discount Rate	7%	Cost Escalation (yr)	3%	SR & D Opportunity	No
Progress Payments	No	Foreign Currency	N/A	Retainer Fee	No
Income Tax Rate	Generation	PST	No	Interest Rate (Capital)	6%
Depreciation Rate (Capital)	Generating Equipment 8%	Leasing	No	Indexed Priced Contract	No

Comments:

Project Cost Estimate:

Design Complete	Up to - 40%	Quality of Estimate	Budget + 30% to - 15%	3rd Party Estimate	Yes
Reviewed by Sponsor	Yes	OPEX used	Yes	Lessons Learned	Yes
Similar Projects	Yes	Budgetary Quote(s)	Yes	First Unit Actual Used	N/A
Cost Sharing	No	Contracts in place	Some in place	Competitive Bid	Yes
Fixed Price Contract	Yes	Fee for Service		Firm Vendor Proposal	Yes

Comments:

Contracts:

Engineering Services: Fixed price Contract in place.
SQA contract: Time & Materials (T&M).
Construction: T&M.

Budgetary Quotes:

-Construction quotes obtained from the Contract Management Office (CMO) and Field Engineering and validated by Third Party.
-Engineered Materials quotes/bids received from Vendors.

Generation Plan Assumptions:

Station	Unit	EOL		MW	Capacity	Planned Outages for Project Work (eg P1071)						
Pickering A	1	Mar	2020	5t3	85%	Pt09t						
	4	Mar	2020			Pt0Bt						
Pickering B	5	Mar	2018	5t6	85%							
	6	Mar	2018									
	7	Mar	2018									
	8	Mar	2020									
Darlington	1	N/A	N/A	N/A	N/A							
	2	N/A	N/A									
	3	N/A	N/A									
	4	N/A	N/A									

Comments:

-Major equipment (No tie-ins) will be installed IOP (or Job Jar).
-PNGSA outage required for tie-ins. Tie-ins to be performed during VBO 2010.
-PNGSB outage NOT required for Transfer Switch tie-ins.

Appendix "C"

Financial Model – Assumptions
Impact on Operations

Impact on Revenue

$000's	Present	2009	2010	2011	2012	2013	2014	2015	Later	Total
Rate KWH										
Probability	0	0	0	0	0	0	0	0	0	0.0%
Consequence	0	0	0	0	0	0	0	0	0	0
Risk	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0
Base Case	0	0	0	0	0	0	0	0	0	0
Probability	0	0	0	0	0	0	0	0	0	0.0%
Consequence	0	0	0	0	0	0	0	0	0	0
Risk	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0
Recommendation	0	0	0	0	0	0	0	0	0	0
Net Impact	0	0	0	0	0	0	0	0	0	0

Comments:

This is a Regulatory Project. The Base Case is assumed to be Zero. There will be no impact on Revenue as the tie ins are not critical path work for the 2 unit PNGSA outage planned during the 2010 VBO.

Impact on OM&A

$000's	Present	2009	2010	2011	2012	2013	2014	2015	Later	Total
Base OM&A	0	0	0	0	0	0	0	0	0	0
Outage OM&A	0	0	0	0	0	0	0	0	0	0
Project OM&A	0	0	0	0	0	0	0	0	0	0
Base Case	0	0	0	0	0	0	0	0	0	0
Base OM&A	0	0	0	0	0	0	0	0	0	0
Outage OM&A	0	0	0	0	0	0	0	0	0	0
Project OM&A	0	0	0	0	0	0	0	0	0	0
Recommendation	0	0	0	0	0	0	0	0	0	0
Net Impact	0	0	0	0	0	0	0	0	0	0

Comments:

This is a Capital Project. No incremental impact on OM&A due to routine testing post installation.

Notes for Attachment A (Next Page):

-Spare Parts not included in total project cost.
-Removal cost included in installation.

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EB-2013-0321
Ex. D2-1-3
Attachment 1 Tab 9

Inter Station Transfer Bus Capacity Increase Project 13 - 49270

Full Release Business Case Summary NA44 - BCS - 54130 - 00003 – R000

Attachment "A" **Project Cost Summary**

	$000's Capital	LTD 2008	2009	2010	2011	2012	2013	2014	Later	Total
Scores Basis	Project Mgmnt & Support	199	1,452	643	78					2,373
	Engineering	1,039	1,931	468	51					3,489
	Procurement	47	3,989	4	-					4,040
	Construction	80	3,634	1,524	21					5,259
	Other									-
										-
										-
										-
										-
	Interest (Capital Project Only)	24	313	387	-					724
	Project Costs	**1,390**	**11,319**	**3,025**	**151**	**-**	**-**	**-**	**-**	**15,885**
	General Contingency		882	795						1,677
	Specific Contingency		996	862						1,858
	Project Costs	**1,390**	**13,197**	**4,682**	**151**	**-**	**-**	**-**	**-**	**19,420**
Cash	**Adjust to Cash Basis + / -**								-	-
	Project Costs	**1,390**	**13,197**	**4,682**	**151**	**-**	**-**	**-**	**-**	**19,420**
Funding	**Current Release**	2,810	1,604							4,414
	This Release	(1,420)	11,593	4,682	151					15,006
	Future Release								0	0
	Project Cost	**1,390**	**13,197**	**4,682**	**151**	**-**	**-**	**-**	**0**	**19,420**

Note: Scores Basis = Cash Basis = Funding Basis (Timing differences only)

Budget	**2009-2013 Business Plan**	1,964	7,651	406	-					10,021
	Variance to Business Plan	**(574)**	**3,668**	**2,619**	**151**	**-**	**-**	**-**	**-**	**5,864**

Other	**Removal Costs included above**									-
	Inventory to be written off									-
	Spare Parts in Inventory			**1,000**						1,000

The estimated variance(s) to the **2009-2013 Business Plan** will be addressed through the portfolio management process.
A PCRAF **is not required** .

Reviewed By: (Kuttemjee, Mar 13, 2009) (for JANE CLEMO)
Jane Clemo
Project Manager (acting) Date:

Approved By:
George Makdessi
Strat IV Manager (acting) 13 Mar 09 Date:

Inter Station Transfer Bus Capacity Increase Project 13 - 49270

Full Release Business Case Summary NA44 - BCS - 54130 - 00003 – R000

Attachment "B" **Project Variance Analysis**

	Capital	LTD Dec 2008	Total Project: Last BCS Mar 2008	Total Project: This BCS Feb 2009	Variance	Comments
Scores Basis	Project Mgmnt & Support	199	638	2,373	1,735	Project duration streched by one year due to changed strategy to use VBO outage for installation tie-in's. Front End Planning (FEP) Work Breakdown Structure (WBS) for Project Mgmnt includes all field preparation efforts by FE and CMO as well (unlike original estimate).
	Engineering	1,039	2,386	3,489	1,103	Finalized design requirements available for this release, detailed project scope is developed and as a result, design agency original estimate increased.
	Procurement	47	1,852	4,040	2,188	Finalized design requirements led to material quantity and cost changes. Original estimate included budget quotes from a supplier no longer on Approved Supplier List (ASL)
	Construction	80	3,861	5,259	1,398	Scope and strategy of installation was not finalized in original Partial Release estimate
	Other				-	
					-	
					-	
					-	
					-	
	Interest (Capital Project Only)	24	337	724	387	Project duration streched by one year due to the changed strategy of utilizing VBO outage installation.
	Project Costs (Scores Basis)	**1,390**	**9,074**	**15,885**	**6,811**	
	General Contingency		1,553	1,677	124	
	Specific Contingency		1,130	1,858	728	
	Project Costs (Scores Basis)	**1,390**	**11,757**	**19,420**	**7,663**	
Cash	**Adjust to Cash Basis + / -**	**N/A**			-	
	Project Costs	**N/A**	**11,757**	**19,420**	**7,663**	
Funding	**Current Release**	**N/A**		**4,414**	4,414	
	This Release	**N/A**	**4,414**	**15,006**	10,592	
	Future Release	**N/A**	7,343		(7,343)	
	Project Cost	**N/A**	**11,757**	**19,420**	**7,663**	

Note: Scores Basis = Cash Basis = Funding Basis (Timing differences only)

Other	**Removal Costs included above**				0	
	Inventory to be written off				0	
	Spare Parts in Inventory				0	

Comments:

Attachment "C" **Milestones and In Service Declarations**

Key Milestones

Completion Date			Description
Day	Mth	Yr	
18	Feb	09	AISC Disposition Full Release Business Case Summary
26	Feb	09	Long Lead Time Material Contracts Awarded
15	Apr	09	Project Execution Plan Approved
17	Apr	09	Full Funding Release Approved
30	Apr	09	Installation Labour Contracts Awarded
31	Aug	09	Design Documents Approved and Issued -EC Approval
29	Oct	09	IOPX Remaining Equipment or Material Staged
15	Jan	10	PVBO Work Plans Issued
29	Jan	10	PVBO and POST Work Package Assessment Completed
3	May	10	Start of Installation VBO
20	May	10	Partial AFS U7 BUFF
25	May	10	Partial AFS U6 BUEE
25	Jun	10	Available for Service Final for U5 and U8
30	Aug	11	Project Complete Milestone

A Project Execution Plan (PEP) **will be approved by Feb 2009**

In Service Declarations: (Capital Only)

Month	Year	Description	$ 000's	%
Jun	2010	Available for Service Final for U5 and U8	15,220	100%
Aug	2011	Project Closure	665	

Attachment "D"

Risk Probabilities Chart

Likelihood	Improbable	Unlikely	Possible	Likely	Probable
Probability	<= 1 in 1000	About 1 in 100	About 1 in 10	About 1 in 5	>= 3 in 4
Rank	1	2	3	4	5

Risk Impact Chart

Impact Rating	Financial	Project Schedule (12 months)	Quality	Corporate Reputation	Regulatory / Legal	Health & Safety	Environment	Nuclear Safety
5	>80% of Total Project $	> 90 day delay	Significant, unacceptable non-conformance requiring extensive rework	National and international adverse coverage or impacts	Non-compliance with potential for significant implications for personnel, potentially large damages or Criminal Charges **OR** Potential loss of operating licenses	Potential for fatality(s)	Spill or release causing immediate and extended impact with off-site impacts, e.g.: Clean-up costs > $15M Cat. A spill (>55 pts)	Loss or serious degradation of a safety system
4	30% - 80% of Total Project $	30 - 90 day delay	Unacceptable non-conformance requiring some rework, but not major	Long-term local or national impact	Legislative non-compliance with potential for fines, charges, and damages **OR** Major degradation of reputation with regulatory bodies	Potential for life-threatening critical injury or permanent total disability, including occupational disease	Exceedances resulting in charges or Director's Order Cat. A spill (45 - 55 pts) Public complaints with OPG implications Explosion and/or major fire	Reduced effectiveness of a safety system
3	15% - 30% of Total Project $	10 - 30 day delay	Non-conformance bordering design tolerances, potential to require rework	Major local impact or minor national impact. Minor local damage	Systematic non-compliance with potential for fines OR Potential to cause strained relationship with regulator, increased surveillance and/or regulations	Potential for less serious critical injuries (e.g. fractures), permanent partial disabilities and temporary total disabilities of a significant nature	Cat. B spills Emission in exceedance of regulatory or legal limits Field orders or AMP's Public complaints with OPG implications Danger to health, life, or property	Reduced effectiveness of redundant safety system components
2	5% - 15% of Total Project $	3 - 10 day delay	Acceptable non-conformance, within design tolerances, no rework required	Complaints from local officials / politicians	Systematic non-compliance with impacts to project schedule OR Possibility of regulatory / legal implications	Potential for less serious temporary disabilities and injuries requiring off-site medical attention other than first-aid. Complete recovery by worker.	Cat. C spills - reportable Administrative infractions Public Complaints with plant level implications	Impact on a safety support or safety related system
1	<5% of Total Project $	< 3 day delay	Minimal impact on quality Routine non-conformance, can be easily dispositioned	Complaints from local public	Isolated non-compliance OR Routine approval / notification	No medical attention beyond first aid, no impairment to worker or complete recovery of worker.	Administrative, non-reportable events Cat. C spills non-reportable and spills resulting from Acts of God	