ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

OPG-FORM-0076-R003*

Type 3 Business Case Summary

Final Security Classification of the BCS: **Internal Use Only**

To be used for investments/projects meeting Type 3 criteria in OPG-STD-0076.

Executive Summary and Recommendations					
Project #:	SABP0053 SABP0056	**Title:**	PG3 Overhaul PG3 New Runner Blades		
Phase:	Execution		**Release:**	Full	
Facility:	SAB PGS (NF282)		**Records File:**	08707.021	
Class:	Capital and OMA		**Investment Type:**	Sustaining	

Project Overview

We recommend the release of $9,043 k ($[redacted]base costs plus $[redacted]contingency).

Sir Adam Beck (SAB) Pump Generating Station (PGS) is a six unit reversible pump-turbine plant capable of pumping water from the outlet of the tunnels and canal of the SAB complex, into a storage reservoir, and generating from that reservoir by discharging the stored water back into the SAB Complex head pond.

The primary driver for this project is to mitigate the environmental risk of a potential oil spill from a runner seal failure or oil leakage from the coupling flange between the runner and shaft. Other key drivers are to address reliability issues with major components and the risk of poor runner blade condition. Based on the PG6 overhaul experience, complete overhaul of the unit including replacement of the runner blades is required to reduce the oil leak risk and ensure reliable unit operation for 15 years.

The required funding for this project is broken down as follows:

k$	**2013**	**2014**	**2015**	**Total**
OM&A - SABP0053 Overhaul	1,995	4,347		6,342
Capital - SABP0056 New Runner Blades	424	1,646	631	2,701
Total Project Cost	**2,419**	**5,993**	**631**	**9,043**
BP13-15 OM&A - SABP0036 (Program)	1,200	4,050	4,500	9,750
BP13-15 Capital	0	0	0	0
Variance - OM&A	795	297	(4,500)	(3,408)
Variance - Capital	424	1,646	631	2,701

The unit will be overhauled from September 2013 to July 2014.

The NPG 2013-15 Business Plan BURSA identified PGS unit reliability (forced outage due to oil leakage or generator rotor spider arm cracking) as one of five key business risks for the plant group. The mitigation plan for this risk is to perform the planned overhauls as per the approved work program to address oil leakage issues, and to continue with the established NDE and repair program of the generator rotor.

A spare set of runner blades was purchased in July 2012 as a Capital Spare under project SABP0040 to mitigate the risk of runner blades not being acceptable for use on a unit during the PGS overhaul program. Due to the long lead time to manufacture a set of runner blades (~18 months), the capital spare set will be used on PG3 during this overhaul and the new blades purchased under this project will be put back into inventory as the Capital Spare to protect the remainder of the overhaul program.

[redacted]

Execution of this work will address oil leakage issues, reliability issues with other components, and poor runner blade condition on PG3 and help to refine the scope of work and associated costs for the rest of the units.

*Associated with OPG-STD-0076, Developing and Documenting Business Cases

Type 3 Business Case Summary

Project Cash Flows									
k$	LTD	2013	2014	2015	2016	2017	2018	Future	Total
Currently Released									
Requested Now	-	2,419	5,993	631					9,043
Future Required	-								
Total Project Cost		2,419	5,993	631					9,043
Ongoing Costs	-	0	0	0					0
Grand Total		2,419	5,993	631					9,043

Estimate Class:	Class 3	**Estimate at Completion:**	9,043
NPV:	$ k	**OAR Approval Amount:**	9,043

Additional Information on Project Cash Flows (optional):

The 2013 budget includes funding of $1,200k OM&A for the PGS overhaul program. Changes will be managed within the Plant Group budget envelope.

Approvals			
	Signature	**Comments**	**Date**
This BCS represents the best option to meet the validated business need in a cost effective manner.			
Recommended by: Al Reid Plant Group Manager, Niagara Plant Group Project Sponsor	Al Reid		May 10/13
I concur with the business decision as documented in this BCS.			
Finance Approval: Don Power VP Investment Planning			May 14/2013
I confirm this project will address the business need, is of sufficient priority to proceed, and provides value for money.			
Approved by: Frank Chiarotto SVP HTO, per OAR 1.2			May 15, 2013

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

OPG-FORM-0076-R003*

Type 3 Business Case Summary

Final Security Classification of the BCS: **Internal Use Only**

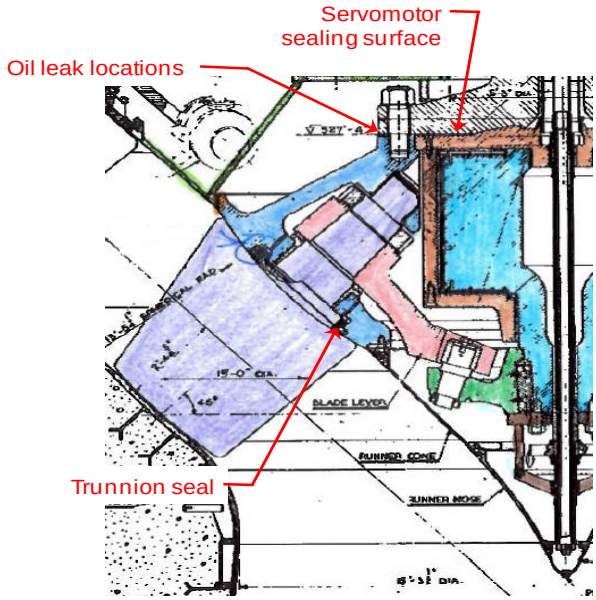
Business Case Summary

Part A: Business Need

Business Need:

The primary driver for this project is to mitigate the environmental risk of a potential oil spill from a runner seal (trunnion seal) failure or oil leakage from the coupling flange between the runner and shaft. Other key drivers are to address reliability issues with major components and the risk of poor runner blade condition.

The following sketch is a section through the runner hub showing key runner components and leak locations. Refer to Appendix E for a full drawing of a PGS unit and the location of the runner assembly in relation to the entire unit.



Additional benefits to be gained from this project are:

- ensure reliable unit operation for 15 years
- opportunity to improve thrust bearing performance
- opportunity to improve the shaft seal on PG3

PG3 was selected as the first unit to be overhauled for the following reasons:

- long time since last overhaul (~15 years at 2013)
- worst internal oil leakage based on governor pump recycle time
- worst blade cavitation damage and blade profile
- still has the original 1957 design vulcanized trunnion seals

In accordance with the OPG standard investment management program, the Life Cycle Plan for the PGS is under development. Early assessment of the LCP indicates that it is favorable to invest in the overhaul on PG3. This does not commit OPG to investment in the remaining units until the LCP is approved.

SAB PGS is a six unit reversible pump-turbine plant capable of pumping water from the outlet of the tunnels and canal of the SAB complex, into a storage reservoir, and generating (174 MW capacity) from that reservoir by discharging the stored water back into the SAB Complex head pond. The station produces an average of 120 GWh/year. Also, there are a number of unique benefits that result from PGS operation which include:

1. Ability to pump water into storage at times of low demand, so that it can be later released for generation at times of high demand (peaking capability).
2. Level control for SAB1 and SAB2 head pond which allows the level to be adjusted for better unit efficiency.
3. Additional water that can be used for peaking at SAB1 and SAB2 - each PGS unit contributes up to 4,500 cfs to the SAB head pond when operating at maximum efficiency.

This unique operational profile results in more stops and starts than a conventional generating station as the units switch between pump and generation modes. In addition, units at the PGS are required to change blade pitch (often several times per minute) in response to the cross-over level controller, which contributes significantly to increased component wear. Because of the unique nature and operating characteristics of the PGS, the expected runner overhaul period is more frequent than conventional hydro units.

The original equipment manufacturer of the PGS vertical Deriaz runners was the English Electric Co. whose assets were purchased by Alstom. Alstom is now the only company which has access to the OEM construction drawings, specifications and procedures.

In 2008, PG6 was removed from service (only 9 years from its previous overhaul) due to oil seepage through the coupling flange between the runner and shaft. Attempts made to repair the leak without dismantling the unit were not successful. A complete overhaul of the unit was required to correct the deficiencies, which necessitated shipping the runner to the OEM. Key observations were made on the physical condition of a number of critical runner components during the PG6 overhaul and recommendations were made by Alstom, under the guidance of OPG's Technical Engineer.

There is the potential during the unit overhauls to find that the runner blades are not acceptable for use, either due to damage (cavitation, corrosion, cracking) or excessive deviation in blade profile. If the existing blades cannot be used, the unit would be forced out for 18+ months while a new set of blades are manufactured. To mitigate this risk, a set of blades was purchased for $2.8M as a Capital Spare under project SABP0040.

The current condition of the PG3 runner blades is not fully known. However, based on anecdotal history of blade damage, blade profile, and operational issues, the Engineering judgement is that the blades will not be acceptable for use. Therefore, the project is planning to replace the PG3 runner blades with the Capital Spare blades during the overhaul, and the new set of blades purchased under this project will be put back into inventory as the Capital Spare to protect the remainder of the overhaul program.

A Periodic Facility Condition Assessment (PFCA) for the PGS was completed in November 2010. Recommendations from the PFCA are being incorporated into the scope of work for this project and include:

1. Turbine - Inspect and correct all fits between the blade assembly and the servomotor assembly (PG6 scope).
2. Generator - Continue current program of NDT to monitor for cracks in the rotor and install telltales to monitor tightness of rims and effectiveness of the rim shrinks. Stator winding dog bones should be lashed.

The NPG 2013-15 Business Plan BURSA identified PGS unit reliability (forced outage due to oil leakage or generator rotor spider arm cracking) as one of five key business risks for the plant group. The mitigation plan for this risk is to perform the planned overhauls as per the approved business plan to address oil leakage issues, and to continue with the established NDE and repair program of the generator rotor.

The procurement strategy for the PG1-5 runner assemblies is to sole source the overhauls to Alstom with a scope of work similar to that performed for PG6. Included with the sole source justification is the supply and installation of new blades on each unit if required. The contract with Alstom will be structured to perform the overhaul on PG3, with options for overhaul of each of the remaining units. [redacted]

The Trades Work Assignment for the remaining project work was completed January 22, 2013. Disassembly, repairs to mechanical/electrical equipment and systems, installation of a PTFE thrust bearing, assembly, alignment, and commissioning was assigned to the PWU. The NPG Production department has committed to fully resourcing this work with PWU staff.

The BTU was assigned the installation of a new Fugesco seal, replacement of bearing cooling water piping, and installation of ultrasonic flow meters, an oil mist eliminator, and a kidney loop filtration system. The procurement strategy for the BTU assigned work is to competitively bid the work to general contractors approved by OPG. The contract will be structured to perform the work for PG3, with options for each of the remaining units.

A Project Definition Rating Index (PDRI) assessment was completed Mar.19, 2013. The result was a normalized PDRI score of 328 (out of 1000) which was desirable at this stage in the project life cycle. The team scored well on the basis of project decision but identified the basis of design as requiring additional definition. Finalization of the Tech Spec for the design and supply of the PTFE bearing, kidney loop filters, and oil mist removal system will address many of the less defined items.

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

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Type 3 Business Case Summary

Part B: Preferred Alternative

Description of Preferred Alternative: Rehabilitate PG3

Rehabilitate the existing PG3 runner, including repairing the servomotor, modify and/or replace seals and sealing surfaces, and other minor runner repairs as required. Install new runner blades. Complete other work on the unit that is consistent with a major overhaul and work consistent with the PFCA results.

The existing servomotor is not at end of life, is in acceptable condition, and can continue to be maintained.

The current condition of the existing runner blades is not fully known. However, based on anecdotal history of blade damage, blade profile, and operational issues, the Engineering judgement is that the blades will not be acceptable for use. Therefore, they will be replaced with new runner blades during the overhaul. If the blades are not replaced, the unit would require another long duration outage in approximately 7 years to fully disassemble the unit, inspect the runner blades, and re-assemble.

The existing generator rotor spider arms are not at end of life, are in acceptable condition, and can continue to be maintained.

The unit will be overhauled from September 2013 to July 2014.

This alternative will address the potential oil leak issue that currently exists on PG3, provide reliable unit operation for 15 years, and has the lowest estimated project cost.

Deliverables:	Associated Milestones (if any):	Target Date:
Contract with Alstom finalized	P.O. issued to Alstom	May 24, 2013
RFP process for general Contractor complete	P.O. issued to Contractor	Aug. 30, 2013
PG3 taken out of service	Outage start	Sept. 17, 2013
Overhaul work complete	PG3 RTS	July 15, 2014

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

OPG-FORM-0076-R003*

Type 3 Business Case Summary

Part C: Other Alternatives

Base Case: Status Quo – No Project

Continue to execute the existing LEM program for unit maintenance which does not include any unit disassembly. Maintenance costs will increase each year as the unit continues to wear.

This alternative is not acceptable as it does not address the runner seal issues and may lead to oil leakage or reduced pump/generator availability.

Alternative 2: Rehabilitate PG3 including Replacement of Major Components

Rehabilitate the existing PG3 runner by replacing the aging servomotor, replacing runner blades, and replacing/ modifying seals, sealing components and related surfaces. Replace the generator rotor spider. Complete other work on the unit that is consistent with a major overhaul and work consistent with the PFCA results.

The existing servomotor is not at end of life, is in acceptable condition, and can continue to be maintained. A like-for like replacement would provide no additional benefit.

The existing generator rotor spider arms are not at end of life, are in acceptable condition, and can continue to be maintained. Replacement with a new design that doesn't have the cracking issues would reduce maintenance but the high cost cannot be justified.

This alternative will address the potential oil leak issues that currently exist on PG3 and will provide a more efficient unit. However, the incremental efficiency benefit to be gained does not justify the higher project cost.

Alternative 3: Replace Existing PG3 Runner, Overhaul Generator

Complete runner, including servomotors and blades, would be replaced with a modern high efficiency unit. The efficiency increases gained would allow longer PG3 operation with existing generator and reservoir configuration.

This alternative requires a complete redesign of the PGS units and would take an estimated 2 years to redesign and another 1 to 2 years to install on the first unit. This will continue to leave the PGS at a high risk of a potential oil spill or oil leakage for at least 3-4 additional years.

Some design issues to consider are:

- shaft and rotor may be inadequate to handle higher stresses due to increased loading
- stator may not be able to handle the increased power from the unit
- major modifications may be required to install wicket gates

The estimated cost for this alternative is $15-20M per unit. This alternative is not recommended due to the high project cost.

Alternative 4:

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

OPG-FORM-0076-R003*

Type 3 Business Case Summary

Part D: Project Cash Flows

k$	LTD	2013	2014	2015	2016	2017	2018	Future	Total
Currently Released									
Requested Now	-	2,419	5,993	631					9,043
Future Required	-								
Total Project Cost		2,419	5,993	631					9,043
Ongoing Costs	-	0	0	0					0
Grand Total		2,419	5,993	631					9,043

Estimate Class:	Class 3	**Estimate at Completion:**	9,043	**OAR Approval Amount:**	9,043

Additional Information on Project Cash Flows (optional):

The 2013 budget includes funding of $1,200k OM&A for the PGS overhaul program. Changes will be managed within the Plant Group budget envelope.

Part E: Financial Evaluation

k$	Rehabilitate PG3	Status Quo	Rehabilitate PG3 incl. Replace Major Components	Replace PG3 Runner, O/H Generator	
Project Cost	9,043	N/A	14,000	20,000	
NPV (after tax)					
Other					

Summary of Financial Model Key Assumptions (see Guidance on this Type 3 BCS Form):

A Financial Evaluation was not completed for this project since this is sustaining work that was similarly performed on PG6.

Note that a Financial Evaluation of the PGS was performed as part of the PGS Reservoir Refurbishment project which is being managed by Hydro Development Engineering. In the Definition Phase BCS, the economic assessment showed that there is approximately a $470M net present value to the Ontario electricity system based on evaluation of capacity value and the peaking energy value of the ongoing operation of PGS compared to shutdown of the facility. This economic analysis was over a 50 year period and included overhauls of PG1-5.

Changes in the key assumptions since the Definition BCS was released in Sept 2011 are shown in the following table:

$M	Def BCS	2013 Forecast	Variance
Estimated cost of reservoir refurb project	255	100	(155)
Overhauls (5 units)	25	29.5	4.5
Runner blade replacement (6 units)	15	16.8	1.8
Totals	**285**	**146.3**	**(138.7)**

Based on these changes, the economic assessment in the PGS Reservoir Refurbishment project Definition BCS is still valid.

Part F: Qualitative Factors

Ensure availability of PG3 to preserve the ability to time shift water from off-peak to peak periods.

ONTARIO POWER GENERATION

Records File Information:
See Guidance Section

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Type 3 Business Case Summary

Part G: Risk Assessment

Risk Class	Description of Risk	Risk Management Strategy	Post-Mitigation	
			Probability	Impact
Cost	Costs higher than expected	Allowances have been included in the RQE for known unknowns. This will be relinquished as necessary during the project. Contingency ([redacted]) included.	Low	Low
Scope	Discovery work	The scope was prepared based on PG6 work scope in 2008 and PFCA recommendations. Allowances have been made for repairs based on findings.	Medium	Low
Schedule	Delays to project schedule if PWU crews pulled off project work.	Commitment from Production to provide adequate resources.	Low	Medium
Resources	Maintenance crews pulled off project work to perform other priority work	Commitment from Production to provide adequate resources. A proper resource plan needs to be developed. An overhaul crew will be formed.	Low	Medium
Quality/ Performance	Poor quality of work	An ITP will be developed for testing, start-up, and commissioning.	Low	Low
Technical	Improvements to turbine shaft seal and coupling bolt/stud seals don't work	Changes to match PG6 modifications. Alstom to pressure test servomotor and assembled runner hub to guarantee against leaks for a period of 10 years	Low	Medium
Cost	OM&A costs higher due to repairing instead of replacing runner blades	Accept increased OM&A costs. New PG3 set of blades becomes a spare for the rest of the program.	Low	Low
Schedule	Overhaul work during winter months, delays due to poor weather when hatch covers are open (craning)	There is sufficient time and flexibility in the schedule to manage these delays.	Low	Low
Technical	New design of thrust bearing (using PTFE) does not work or fails	PES prepare tech spec and provide technical assistance during install and commissioning. If it fails, replace with existing design and don't use on other units.	Medium	Low
Technical	Alternate design of trunnion seal by Alstom	If a new seal cannot be designed, all seals will be replaced with the design used on PG6. If a new design can be provided, it is to be guaranteed for 10 years. OPG will have to decide if this is a risk we want to accept.	Medium	Medium
Environment	Oil spills during the overhaul	Use NPG approved instructions.	Low	Low

Additional Risk Analysis:

Part H: Post Implementation Review (PIR) Plan				
Type of PIR	**Target Project In Service Date**		**Target PIR Completion Date**	
Simplified	July 15, 2014		December 30, 2015	
Measurable Parameter	**Current Baseline**	**Target Result**	**How will it be measured?**	**Who will measure it? (person/group)**
Runner assembly oil leakage	< 300 mL/day	0 mL/day	Pressure test at Alstom facility	NPG & PES Tech Support Engineers
Unit internal oil leakage	49 gal/min	< 25 gal/min	Readings per PGS Leakage Assess	NPG Tech Support Engineer
Correct fabrication of set of runner blades and transfer to Cap. Spare asset class	N/A	As per drawings and tech specifications	Inspections as per QA/QC programs	PES Tech Support, Asset Engineer

Part I: Definitions and Acronyms

ITP - Inspection & Test Plan
LCP - Life Cycle Plan
LEM - Leading Edge Maintenance
NDE - Non-Destructive Examination
NDT - Non-Destructive Test
NPG - Niagara Plant Group
PES - Plant Engineering Services
PFCA - Periodic Facility Condition Assessment
PGS - Pump Generating Station
PTFE - Polytetrafluoroethylene - a synthetic fluoropolymer of tetrafluoroethylene that finds numerous applications. The best known brand name of PTFE is Teflon.
RQE - Release Quality Estimate
SAB - Sir Adam Beck

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OPG-FORM-0076-R003

Type 3 Business Case Summary

Appendix A: Summary of Estimate			
Project Number:	SABP0053 SABP0056	**Facility:**	SAB PGS (NF282)
Project Title:	P-G3 Overhaul / New Runner Blades		

Estimated Cost in k$

	LTD	2013	2014	2015	2016	2017	2018	Future	Total	%
OPG Project Management		68	97						165	1.8
OPG Engineering		16	16						32	0.35
Permanent Materials	[redacted]									
Design and Construction		330	670						1,000	11.1
Consultants										
Other Contracts / Costs	[redacted]									
Interest		5	20	7					32	0.35
Subtotal	[redacted]									
Contingency										
Total		**2,419**	**5,993**	**631**					**9,043**	**1.0**
Removal Costs Included										

Note: All estimates shown in the table are for the combined OM&A and Capital portions. For breakdowns of OM&A and Capital estimates, refer to the individual RQE's.

Notes			
Project Start Date	2013-09-17	**Project Completion or In-Service Date**	2014-07-15
Interest Rate	5%	**Escalation Rate**	0%
Definition Cost Included	$0 k	**Estimate at Completion**	$9,043 k

Prepared by:		Approved by:	
Greg Young Project Officer	2013-04-30	Dan Roorda Section Manager, Projects	2013-04-30

Type 3 Business Case Summary

Appendix B: Comparison of Total Project Estimates										
Phase	**Release**	**Date (YYYY-MM-DD)**	**Total Project Estimate in k$ (by year including contingency)**						**Later**	**Total Project Estimate**
			2012	**2013**	**2014**	**2015**	**2016**	**2017**		

Project Variance Analysis					
Estimated Cost in k$					
k$	**LTD**	**Total Project**		**Variance**	**Comments**
		Last BCS	**This BCS**		
OPG Project Management			165	n/a	This is a new project.
OPG Engineering			32	n/a	All estimates shown in the table are for the combined OM&A and Capital portions. For breakdowns of the OM&A and Capital estimates, refer to the individual RQE's.
Permanent Materials	[redacted]			n/a	
Design and Construction			1,000	n/a	
Consultants					
Other Contracts/Costs	[redacted]			n/a	
Interest			32	n/a	
Subtotal	[redacted]			n/a	
Contingency				n/a	
Total			**9,043**	n/a	
Removal Costs Included					

Type 3 Business Case Summary

Appendix C: Financial Evaluation Assumptions

Key assumptions used in the financial model of the Project are (complete relevant assumptions only):

Project Cost:

(1)
(2)
(3)

Financial:

(1)
(2)
(3)

Project Life:

(1)
(2)
(3)

Energy Production:

(1)
(2)
(3)

Operating Cost:

(1)
(2)
(3)

Other:

(1)
(2)
(3)

Attach further detail as appropriate from the Financial Evaluation spreadsheet.

Refer to SAB PGS Reservoir Refurbishment Definition BCS

Appendix D: References

PGS Periodic Facility Condition Assessment (Report No. R-NF282-01557-0003) dated November 2010

Definition Phase Project Charter for SABP0036 approved December 18, 2012

Business Plan 2013-2015

SAB PGS Reservoir Refurbishment Definition BCS (R-NF282-08707.021-0002) approved September 19, 2011

Release Quality Estimates - OM&A and Capital

Initial Project Execution Plan

Appendix E: PGS Full Unit Drawing

(±½) 39'-9" PIT OPENING

MOTOR GENERATOR DATA

MOTOR / GENERATOR FR 78-350 x 50

SECTIONAL ELEVATION

Generator

Thrust Bearing

Location of sketch in Background

Runner Assembly

SIR ADAM BECK - NIAGARA
PUMPING GENERATING STATION

GENERAL ASSEMBLY OF UNIT

NF 28-f-9336

ONTARIO POWER GENERATION

Niagara Plant Group

RELEASE QUALITY ESTIMATE (RQE)
Summary Sheet (K$)

Date:	11-Apr-13
Estimate #:	

PROJECT CLASSIFICATION: OM&A
PROJECT NUMBER: SABP0053
FACILITY: Pump Generating Station
PROJECT DESCRIPTION: PGS Unit 3 Rehabilitation

Estimated Cost Summary (K$)

Project Components	TOTAL EST.	2013	2014	2015	2016	2017	Future Years	%
Removal Costs								
Contingency	[redacted]							
Interest								
Development Spending								
Execution Phase (Summary)	[redacted]							
Project Management	153	56	97					2.4%
Engineering	32	16	16					0.5%
Materials	[redacted]							
External Purchase Services	[redacted]							
PWU Charges	1,000	330	670					15.8%
TOTAL	6,342	1,995	4,347					1

SUMMARY: Basis of Estimate

Scope:

Rehabilitate the existing PGS Unit 3 runner, including replacing the runner blades, repairing the servomotor, modify and/or replace seals and sealing surfaces, and other minor runner repairs as required. Complete other work on the unit that is consistent with a major overhaul and work consistent with PFCA results. This scope will address the potential oil leak issues that currently exist and provide reliable unit operation for 10 to 15 years.
This estimate is based on information compiled from the PGS Unit 6 overhaul, project SABP0030 with actuals equaling 4,577K and from experienced personnel who worked on and were involved with the PG6 overhaul. The new runner blades will be provided to the project through project # SABP0056, PG3 New Runner Blades.
This RQE value is more than the PGS 6 Rehabilitation cost due to added [redacted] escalation cost per year, an allowance for parts procurement and contingency.

Conditions/Assumptions:

Allowances have been included in the contingencies for work processes that have changed since PGS U 6 was overhauled and also to accommodate a workforce learning curve with the PWU crew, as most are new.
The schedule relies on the NPG machining facility and Alstom providing the required services as shown on the project schedule.

Schedule:
Start Date: Monday, September 16, 2013
Project In-Service Date: Friday, July 11, 2014

Back up documents attached:

☐ Contractor Quote ☐ Labour Estimate ☐ Other (description) _____
☐ Project Schedule ☐ Shop Services Estimate ☐ Other (description) _____

Prepared by:
Greg Young — April 11/13 — Date
Project Engineer/Officer

Approved by:
Dan Roorda — Apr. 15/13 — Date
Section Manager, Projects

Estimate conforms to AACE - Class 3
OPG Governance applicable to the preparation of this document ETS-PM-STD-006; HY-HD-STD-06; OPG-PROC-0050

ONTARIO POWER GENERATION

Niagara Plant Group

RELEASE QUALITY ESTIMATE (RQE)
Summary Sheet (K$)

Date: 18-Apr-13
Estimate #:

PROJECT CLASSIFICATION: CAPITAL
PROJECT NUMBER: SABP0056 FACILITY: SAB PGS (NF282)
PROJECT DESCRIPTION: PG3 New Runner Blades

Estimated Cost Summary (K$)

Project Components	TOTAL EST.	2012 LTD	2013	2014	2015	2016	Future Years	%
Removal Costs								
Contingency	[redacted]							
Interest	32		5	20	7			1.2%
Development Spending								
Execution Phase (Summary)	[redacted]							
Project Management	12		12					0.4%
Engineering								
Materials	[redacted]							
External Purchase Services	[redacted]							
PWU Charges								
TOTAL	2,701		424	1,646	631			1

SUMMARY: Basis of Estimate

Scope:

Supply of one set of PGS runner blades to replace capital spare installed on PG3.

Conditions/Assumptions:

This estimate is based on a quotation from Alstom (Rev.2) received Jun.14, 2012. The quotation included options for up to 6 additional sets of blades.

Contingency of [redacted] was included for potential price changes.

Schedule:
Start Date: Tuesday, July 02, 2013
Project In-Service Date: Tuesday, March 17, 2015

Back up documents attached:

- ☑ Contractor Quote
- ☐ Project Schedule
- ☐ Labour Estimate
- ☐ Shop Services Estimate
- ☐ Other (description) _____
- ☐ Other (description) _____

Prepared by:
Greg Young — Apr. 30/13 — Date
Project Engineer/Officer

Approved by:
Dan Recorda — Apr. 30/2013 — Date
Section Manager, Projects

Estimate conforms to AACE - Class 3
OPG Governance applicable to the preparation of this document ETS-PM-STD-006; HY-HD-STD-06; OPG-PROC-0050