ONTARIO POWER GENERATION	Project Number Project Title	SAB10050 G10 Upgrade – New Runner & Generator Rewind SCI: 08707.021	Page: 1 of 4 Rev. 1

NIAGARA PLANT GROUP
BUSINESS CASE SUMMARY

Project No.: SAB10050
Project Title: G10 Upgrade
Facility Name: Sir Adam Beck 1

Expenditure Type:	☐ OM&A Project	☒ Capital Project		
Release Type:	☒ Developmental	☐ Partial	☐ Full	☐ Superseding
Work Category:	☒ Sustaining	☒ Value Enhancing		☐ Regulatory

Prepared by: Mark Armstrong, Cost & Schedule Analyst

1. RECOMMENDATION

Approval is recommended for the release of 600k$ CAP to fund the preliminary engineering work necessary to identify the SAB1 G10 Upgrade preferred alternative which will be developed in the Definition Phase. This work will include a detailed equipment condition assessment, engineering analysis and a detailed report.

This course of action will address the business needs of this project as outlined in the Niagara Plant Group's Business Plan of sustaining our generating resources and is consistent with the strategic plan for Sir Adam Beck 1 Generating Station (SAB1) and OPG's mandate to increase its portfolio of hydroelectric generating capacity.

(k$)	2011	2012	2013	2014	2015	Total
Cash Flows For This Release	600					**600**
Future Funding (Full Release)		1,700	15,253	12,153		**29,106**
Total Project Cost	**600**	**1,700**	**15,253**	**12,153**		**29,706**
Business Plan (BP2011-15)	400	1700	15253	12153		29,506
Business Plan Variance	200	0	0	0		200

Funding:
This project includes removal costs of $1,500k OM&A in 2013 which has been included in the full release amount.

2. SIGNATURES

Submitted by:

Nov/30/10
Robby Sohi — Date
Asset & Technical Services Manager

Finance Approval:

Nov 30/10
Cynthia Domjancic — Date
Site Controller

Approval by:

1 DEC 10
Mike Martelli — Date
Plant Group Manager

3. BACKGROUND & ISSUES

Sir Adam Beck (SAB) 1 GS is a ten unit station located on the Niagara River. The units were placed in service during the years 1921 to 1930. Two of the units (G1 and G2) are 25 Hz generators and were decommissioned in 2009. Analysis and modelling work for SAB1 considered the water available to the station, including that provided by the 3rd Niagara Tunnel, and concluded that an eight unit configuration will optimize the water available to the station. An orderly program of unit rehabilitation involving G7, G9, G3 and G10 was proposed going forward as the strategic plan for the station.

SAB1 G10 has not had a major rehabilitation since 1986. Hydroelectric units of this type normally require overhauls on a 25-30 year cycle to ensure reliable continued operation. A degraded unit condition, due to end of life, will lead to increasing unreliability, lost production and lost revenue. Since Hydroelectric generation is a renewable source of energy, the loss of a hydroelectric generating unit will increase the environmental impact of meeting Ontario's electricity demands. This will necessitate the supply of energy from other less environmentally friendly sources or generators external to Ontario.

While the G10 unit is being rehabilitated, there is an opportunity to replace the existing runner with a higher capacity and more efficient runner allowing maximum utilization of the Niagara River flows during peak generation hours and increasing the turbine output by approximately 8-10 MW.

Business Need

Complete a comprehensive unit condition assessment and conduct preliminary engineering and analysis to clearly identify the scope of work for the SAB1 G10 Upgrade Project. This will minimize project risk by better identifying the necessary project scope to achieve the overall project business needs identified in the Initiation Phase Project Charter.

4. ALTERNATIVES and ECONOMIC ANALYSIS

Base Case **Status Quo (Not Recommended)** - This alternative is not recommended as it does not address the stated business need of minimizing risk and may result in unnecessary financial exposure. A comprehensive equipment condition assessment is needed to determine which unit components need to be replaced or overhauled and which components can be repaired and reused in addition to those components that are still capable of 25 to 30 years of reliable service.

Alternative 1 **Perform Initiation Phase Assessment Work (Recommended) -** carry out the preliminary engineering work necessary to clearly define the scope of work for SAB1 G10 Upgrade and identify the preferred project alternative prior to proceeding with the Definition Phase. A detailed equipment condition assessment is the preferred way to minimize overall project cost by replacing only those components that cannot be repaired or rehabilitated to achieve the expected unit service life as indicated in the Business Needs in the Initiation Phase project charter.

This alternative assesses the condition of the existing generator, turbine and associated unit components. Project alternatives will be developed for the optimum rehabilitation and upgrade of the unit, consistent with the strategic plan for the station. Alternatives will consider:

- The installation of a new generator,
- The re-wind of the existing generator,
- The installation of new equipment to optimize the unit output,
- The optimal use of the available water.

Alternative 2 **Proceed to Definition Phase Immediately (Not Recommended) –** this alternative is not recommended as there are uncertainties relating to the exact work scope and optimal equipment configuration that need to be resolved. Proceeding directly to Definition Phase work may result in the approval of an inappropriate scope of work with a higher degree of uncertainty, risk and overall project cost.

5. PROPOSAL

Results to Be Delivered

The overall objective of this project is to provide 25 to 30 years of reliable operation of G10 in the most cost effective manner possible. In addition, replace or introduce new components to improve both efficiency and unit output where it is economically advantageous to do so. This developmental release will be used to deliver the following results:

- Accurately identify the scope of work required to meet the stated business needs and objectives.
- Minimize financial risk by identifying a clear and well defined scope of work, allowing a higher degree of control over cost & schedule.
- Ensure the project plan is achievable from a practicality and resourcing point of view.
- Recommend the preferred alternative to be developed in the Definition Phase.
- Critically examine capacity and efficiency improvements to ensure that they are economically sound investments

Proposal Overview

The work to be done in this stage will include preliminary engineering work necessary to clearly identify the scope of work for the Definition phase and recommend the preferred alternative consistent with the strategic plan for SAB1.

6. QUALITATIVE FACTORS

Sustainable Development

Since Hydroelectric generation is a renewable source of energy, the loss of a hydroelectric generating unit will increase the environmental impact of meeting Ontario's electricity demands. This will necessitate the supply of energy from other less environmentally friendly sources; therefore, an increase in the reliability and production of G10 unit will reduce the environmental impact of meeting Ontario's electricity demands.

Technical Considerations

Upgrading and rehabilitation of the G10 unit and its components will increase its reliability over the next 30 years. Unplanned maintenance due to aging equipment is expected to be reduced following rehabilitation or replacement of the existing equipment with new equipment.

7. RISK ANALYSIS

This risk analysis only addresses the Definition Phase work for this project.

Risk Category	Description of Risk	Description of Consequence	Risk Before Mitigation	Mitigating Activity	Risk After Mitigation
Cost	Final Initiation Phase cost higher then estimated.	Release funding insufficient to complete work.	Medium.	Preliminary price quotes have been obtained from known suppliers for external resources in an effort to develop accurate cost estimates. The risk of over expenditure is low because the field work has been done in a satisfactory fashion before by the staff involved. A contingency allowance is included in the estimate.	Low.
Scope	Poor Definition of Scope of Work.	Increased Cost.	Medium.	Detailed scope provided for Initiation Phase work based on equipment condition, maintenance records as well as previous experience with other similar projects.	Low.
Schedule	Delay in completion of outage work will result in lost generation revenue.	Reduced revenue.	Low.	Scheduled outage provides a float and is longer than what is needed to do the Initiation Phase site work because this outage is also being utilized to install G10 Governor Control Head which should have no impact on this work.	Very Low.
Resources	No available resources to do the work.	Delays in schedule. Work not getting done.	Medium.	Based on earlier discussions, Internal and external resources have been committed from OPG and service providers for the work. The project engineer will coordinate project resourcing.	Low.
Regulatory	Delays in obtaining outage approval.	Delay in start of outage inspection work.	High.	Prior approval has been obtained for the outage.	Very Low.
Environmental	Spill.	Reportable Spill.	Low.	NPG Environmental policies will be followed.	Very Low.
Health &Safety	Risk of Injury to workers.	Worker Injury.	Low.	NPG Safety policies will be followed.	Very Low.

8. POST IMPLEMENTATION REVIEW

A simplified Post Implementation Review Report will not be needed for this Initiation Phase. A comprehensive Post Implementation Review Report will be submitted within twelve months of the date of the completion of Execution Phase work, which is projected to be 2014.