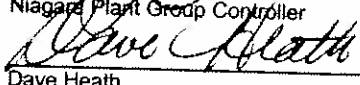


<b>ONTARIO POWER GENERATION</b>	Project: SAB10032	Review Routing Slip
	SIR ADAM BECK 1 - GS Unit 7 FREQUENCY CONVERSION FROM 25Hz TO 60Hz	

Niagara Plant Group Review:

  
Craig Smallman  
Niagara Plant Group Controller

May 9/07  
Date

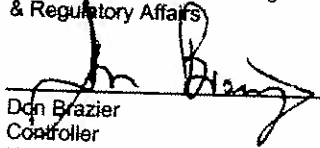
  
Dave Heath  
Niagara Plant Group Manager

May 9/07  
Date

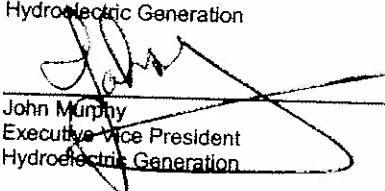
Hydroelectric Generation Review

  
Mario Mazza  
Manager Hydroelectric Programming  
& Regulatory Affairs

May 11/07  
Date

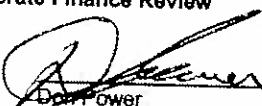
  
Don Brazier  
Controller  
Hydroelectric Generation

May 10/07  
Date

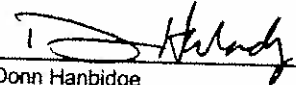
  
John Murphy  
Executive Vice President  
Hydroelectric Generation

May 22/2007  
Date

Corporate Finance Review


  
Don Power  
Vice President  
Corporate Investment Planning

June 4/07  
Date

  
Donn Hanbidge  
Senior Vice President and  
Chief Financial Officer

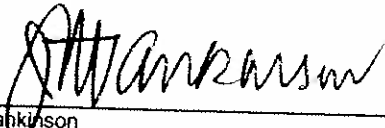
June 7/07  
Date

Recommended by:

  
Pierre Charlebois  
Senior Vice President and  
Chief Operating Officer

June 8/07  
Date

Line Approval:

  
Jim Hapkinson  
President and CEO

11/6/07  
Date

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**SIR ADAM BECK 1 GS UNIT 7**

**G7 GENERATOR FREQUENCY CONVERSION FROM 25HZ TO 60HZ**

**Project Number: SAB10032**

**Niagara Plant Group**

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	SIR ADAM BECK 1 – GS Unit 7 G7 FREQUENCY CONVERSION FROM 25Hz TO 60Hz		

## SIR ADAM BECK 1 GS UNIT 7

### **G7 GENERATOR FREQUENCY CONVERSION FROM 25HZ TO 60HZ**

**SAB10032**

#### RECOMMENDATION

Approve the release of \$ 33.4 M for the conversion of the 25 Hz G7 unit to a new 60 Hz unit. This will return G7 to service and increase the installed capacity of Sir Adam Beck 1 GS (SAB 1) by 68.5 MVA. (61.5 MW). G7 will optimize energy production by efficiently utilizing the water available to the Sir Adam Beck Complex, including water availability from the Niagara Tunnel. This generation will be incremental to the 1.6 TWh of generation identified in the Niagara Tunnel Project Business Case in July 2005.

The energy generation from G7 will be possible by increased use of the Pump Generating Station (PGS) to shift energy from off-peak to on-peak, increasing capacity output of the SAB facility.

This project is consistent with OPG's objective of continuing to optimize production from its existing hydroelectric generating assets. The unit is expected to produce an incremental 99 GWh annually.

With equipment upgrades, it is expected that current technology and materials can provide improvements in efficiency. Competitive bids have been obtained for the installation of a new 68.5 MVA, 60 Hz generator. The upgraded G7 is scheduled to be commissioned and placed into service by March 2009.

This project is identified in the current approved business plan with cash flows in 2007 and 2008. A developmental release of \$1.8M has been approved. The total project cost will be \$35.2M.

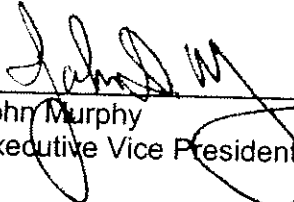
\$000s	2007	2008	2009	Total
Currently Released	1,800			1,800
Requested Now (Full Release)	6,100	23,364	3,946	33,410
Total Project Costs	7,900	23,364	3,946	35,210
<u>Investment Type</u>	<u>Class</u>	<u>NPV</u>	<u>IRR</u>	<u>Discounted Payback</u>
Value Enhancing	17	7,091 (using SEVs)	11.9% (using SEVs)	21 years (Using SEVs)

**Investment Financial Measure:** The increased energy output resulting from the Project will receive a regulated rate as part of OPG's regulated hydroelectric assets. This project will be included as part of the OPG rate submission to the Ontario Energy board.


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	SIR ADAM BECK 1 - GS Unit 7 G7 FREQUENCY CONVERSION FROM 25Hz TO 60Hz		

2. SIGNATURES

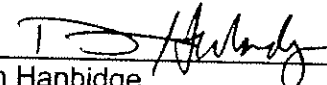
Submitted by:

 22 May 2007.  
\_\_\_\_\_  
John Murphy Date  
Executive Vice President - Hydro


Recommended by:

 Aug 13/07  
\_\_\_\_\_  
Pierre Charlebois Date  
Senior Vice President and  
Chief Operating Officer

Finance approval:

 Aug 17/07  
\_\_\_\_\_  
Donn Hanbidge Date  
Senior Vice President and  
Chief Financial Officer

Line Approval:

  
\_\_\_\_\_  
Jim Hankinson Date  
President and CEO

<b>ONTARIOPOWER</b> <b>GENERATION</b>	Document Number: SAB10032	Revision: REV 6	Page: 4 of 18
	SIR ADAM BECK 1 – GS Unit 7 G7 FREQUENCY CONVERSION FROM 25Hz TO 60Hz		

### 3. BACKGROUND AND ISSUES

Sir Adam Beck 1 GS (SAB 1) is a ten unit station located on the Niagara River. It was placed in service in 1922 and has seven 60 Hz generating units and three 25 Hz generating units. The station currently has a total capacity of 447 MW, an annual energy production of approximately 1,670 GWh and 2005 production revenue of \$55.1 million (at \$33/MWh).

SAB 1 G7 is a 25 Hz unit. In 2005 the Johnson valve that controls the water flow to the G7 turbine failed, and because OPG's obligation to the 25 Hz market could be met by the SAB 1 GS 25 Hz units G1 and G2, G7 was decommissioned. G7 was subsequently deregistered with the IESO.

As of April 2009, the IESO will end the 25 Hz energy market and 25 Hz power will have no market value. There is no future benefit to having G7 available to generate 25 Hz power.

Beginning in 2009, additional water will be supplied to the SAB complex by the new Niagara Tunnel. A new 60 Hz generating unit will make use of this additional water. Deferring this project will mean OPG will not make full use of the water diversion available.

Similar work involving the replacement of a 25 Hz generator with a new 60 Hz generator and associated components was carried out on SAB 1 G6 in 1994/95. Lessons learned and experiences acquired during that project have been incorporated into this project.

A life cycle plan for SAB1 is currently being prepared which will include the conversion of this unit, the plans for the other 9 units and the impact on the transmission system.

### 4. ALTERNATIVES & ECONOMIC ANALYSIS

#### **Base Case (Status Quo): Leave SAB1 G7 Out of Service**

This alternative does not make use of the water available for generation and does not maximize the generation of hydroelectric energy.

- **This alternative is not recommended.**

#### **Alternative 1:**

#### **Install a new 68.5 MVA (61.5 MW capacity) 60 Hz Generator, Transformer, Headgates, Runner, and Upgrade the Turbine**

This alternative brings to service a 61.5 MW capacity hydroelectric generating unit that optimizes the use of the water available. It includes a new generator with new protections and controls, a new exciter and digital governor head, new switchgear, new headgates, a new transformer and removal of the failed internal components of the Johnson valve. It also includes a new efficient runner and a turbine upgrade.

- **This is the recommended alternative**

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## Alternative 2:

### **Install a 56.7 MVA (51 MW Capacity) 60 Hz Generator, Transformer, Headgates, Upgrade the Turbine and Re-use the Existing 70-year-old Runner**

This alternative is rejected because it does not optimize the use of the water available. Re-using the existing runner, which has an output of approximately 51 MW, limits the size of the new generator to 51 MW, well below the optimal size.

- **This alternative is not recommended.**

## Financial Analysis:

\$ Million's	Base Case	Alt 1 (recommended)	Alt 2
Project Cost	0	35.2	34.0
NPV (after tax)	0	7.1	2.5
Impact on Economic Value	0	7.1	2.5
IRR %	0	11.9	10.7
Discounted Payback (Yrs)	n/a	21	31

The NPV calculations are conservative as they exclude some potential benefits.

Additional generation available at the Beck Complex is considered to have a capacity benefit, as it would likely displace other more expensive generation at peak times. However, due to the variety of operational parameters and water constraints during peak months of the Beck Complex, it is very difficult to quantify the capacity benefit with a high degree of precision. They have therefore been excluded to be conservative. To put this into context, a conservative estimate of 5 MW would increase the NVP to \$8.8M, and a capacity benefit of 20 MW would increase the NPV to \$14.0M.

The Beck Complex is often operated for operating reserve and paid through an operating reserve revenue stream. The NPV calculations do not include that benefit as this value is determined at the time of operation depending on system requirements, and how the units are required to operate.

In a rate regulated environment, OPG will receive market prices for any generation exceeding 1,900 MW from the regulated hydroelectric fleet. The addition of G7 will allow generation above 1,900 MW on a more frequent basis. Because this level of generation can not be assured, a conservative approach has been taken and the quantitative benefit has not been included.

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The breakeven levelized Unit Energy Cost (LUEC) for this project over a 50 year period is \$43.32/MWh. This is lower than the recent OPA contracts that are > \$70/MWh.

The Sir Adam Beck facilities are part of OPG's regulated hydroelectric fleet. A Power Purchase Agreement cannot be obtained for this generation. This project will be included in the OPG rate regulation submission. The impact on regulated rates required to recover the costs of this project is expected to be approximately 0.07%

## 5. THE PROPOSAL

### Results to be delivered:

Construct a new SAB1 G7 generator to supply 60 Hz power to the Hydro One connection point. The generator is scheduled to be commissioned by the end of March 2009. The resulting generation capacity will provide an average of 99GWh annually and increase the Beck Complex's ability to provide operating reserve as well as provide assistance with EBG on the system.

This project includes the removal of the existing 54 MVA, 25 Hz, G7 generator and the supply and installation of a new generator, a new transformer, new headgates and a new runner and the upgrade of the turbine and the remaining associated unit components.

### Runner

The existing runner dates from 1936. It was last inspected in 2001 and reported to be in good condition but with some cavitation and pinholes in the stainless steel overlay.

Preliminary engineering analysis indicates that power available through the G7 water conveying structures is in excess of 58 MW. The existing runner is rated to produce only approximately 51 MW of power. The existing runner is, therefore, unable to fully utilize the available water.

A contract has been awarded for runner design, runner model development and model testing for new runners for SAB 1 GS. Preliminary engineering indicates that a new runner with an efficiency of approximately 90% and a corresponding output of 58 MW, at efficiency, can be supplied by the runner manufacturer as part of the purchase option OPG has retained.

### Generator:

A new 68.5 MVA (61.5 MW capacity), 60 Hz generator can be installed to match the maximum power output of a new runner.

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With a new generator and new runner, G7 will have a high efficiency and will generally be the first unit on / last unit off at the station to maximize generation. The expected annual energy production for SAB 1 will increase by 99 GWh annually on average.

#### Transformer

The replacement of the 25 Hz generator with a 60 Hz generator necessitates the replacement of the three existing 25 Hz transformers. The existing transformers are in fair condition and the best one will be kept as a spare for Units 1 and 2.

The existing transformer will be replaced with a new 60 Hz, three phase, water-cooled transformer.

#### Turbine Upgrade

The last significant amount of work on the G7 turbine was carried out in 1975. The normal interval between such work is 25 to 30 years. The turbine upgrade will be performed while the unit is dismantled for the installation of the new runner and new generator. The scope will include the modification of the discharge ring and the installation of greaseless bushings.

#### Johnson Valve and Headgates

Each generating unit at SAB 1 generating station was built with a Johnson valve to control water flow to the unit. Following the SAB 1 G4 Johnson valve failure in 1999, an engineering study concluded that the Johnson valves had reached the end of their service life and could no longer be relied on to control water flow to the units. A program to remove the internal parts of the Johnson valves and to replace the functionality of the Johnson valves with headgates was initiated. To date, the other 9 units at the station have had this work done.

#### Other Major Items In Scope

The existing governor control head is at the end of its service life. Replacement parts are not available. The governor head will be replaced with a new digital control head.

A new exciter will be supplied for the new generator.

New switchgear will be supplied for the new generator.

Upgrades to the generator output buswork and to the electrical connections to the Hydro One system are required.

Assessments by both Hydro One and the IESO are required prior to connecting new generation to the Ontario Grid. Agreements have been made with both parties, and



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funding provided in the developmental release to carry out the studies in order to maintain the project schedule.

#### Ongoing Operational and Maintenance Cost Impacts

Ongoing operation of the converted unit will be absorbed in the existing operation and support infrastructure of the facility. Non standard maintenance costs of \$5k per year, ½ of maintenance FTE as well as a future unit overhaul have been included in the project NPV calculations. These costs will be included in future Niagara Plant Group Business Plans and budgets.

#### Qualitative factors

Trades work has been reviewed under the Chestnut Park Accord Addendum, and has been awarded to the Building Trade Unions (BTU).

Project activities will be conducted in accordance with Niagara Plant Group Environment, Health and Safety (EH&S) Management System

#### Project management

A Project Execution Plan identifying scope, schedule and cost has been developed for this project

The project will be executed by the Niagara Plant Group Project Management Department

#### Post Implementation Review (PIR)

A comprehensive Post Implementation Review will be conducted within 12 months of the date of the return to service of the unit.

The following unit performance parameters will be measured:

Turbine/ generator output: The Niagara Plant Group Production Department will verify that the generator output is 61.5 MW. Revenue metering equipment will be used to measure the output.

Runner performance: The runner performance with respect to cavitation will be assessed by the Niagara Plant Group Production Department and Hydro Engineering by making an inspection of the runner in accordance with the runner warranty details.

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The Project Department will review the project by comparing the planned cost and schedule milestones as outlined in the Project Execution Plan to the actual cost and schedule milestones.

## 6. QUALITATIVE BENEFITS

### Qualitative Factors & Sustainable Energy Development

- Installation of headgates at the top of the penstock provides increased level of safety for the powerhouse, staff, and environment in the event of a penstock failure.
- Combining the generator replacement, runner replacement, headgate installation, and turbine upgrade into one outage reduces total outage time, avoids repetitive dismantling and assembly of the unit.
- Increased production of renewable hydroelectric energy (61.5 MW, 99GWh annually).
- Increased efficiency of water use due to the upgraded runner.
- Environmentally friendly generation with virtually no additional environmental impact which will displace more costly and higher emitting fossil fueled facilities.

## 7. RISK ANALYSIS

See Appendix 2 for Risk Management Table.

### Cost Risk:

There is a high level of confidence in the cost estimate for this project. Over 50% of the project estimate is based on quotes or budget estimates from suppliers and past purchase experience.

- The risk of over expenditure on the headgate work (\$2.7M) is low because the work has been done in a satisfactory fashion nine times before by the same contractor.
- The generator design/ supply/ install, the largest single component of the project is a firm bid quotation.
- Preliminary price quotes have been obtained from known suppliers in an effort to develop accurate cost estimates.
- A contingency of [REDACTED] is included in the project cost estimate. The overall contingency has been prepared by adjusting contingencies by major item based on its unique risk characteristics.

### Assumed Benefits (Generation) Risk:

In order to determine the energy generation potential of G7, historic Niagara River flows were reviewed. The amount of water available at the plant for G7, incorporating water from the new Niagara Tunnel, was determined and the seasonal peak/ off-peak timing of

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this water was predicted. Historic water usage at the SAB Complex was extrapolated into the future and the amount of water available for G7 was determined. In order to optimize the water diversion, the Pump Generating station (PGS) was also optimized.

Schedule Risk:

The schedule is aggressive and there will be numerous contractors on site, raising the possibility of interference. This concern will be managed by closely scheduling and coordinating site work.

Supply/ Procurement/ Quality Assurance Risk:

The potential generator suppliers have been pre-qualified to reduce the risk of unsatisfactory contract performance.

Possible manufacture of runner and generator components overseas presents quality risks. Inspection and test plans are being utilized to monitor the product quality through the manufacturing process.

Graphical Representation of Risk using a Tornado Diagram:

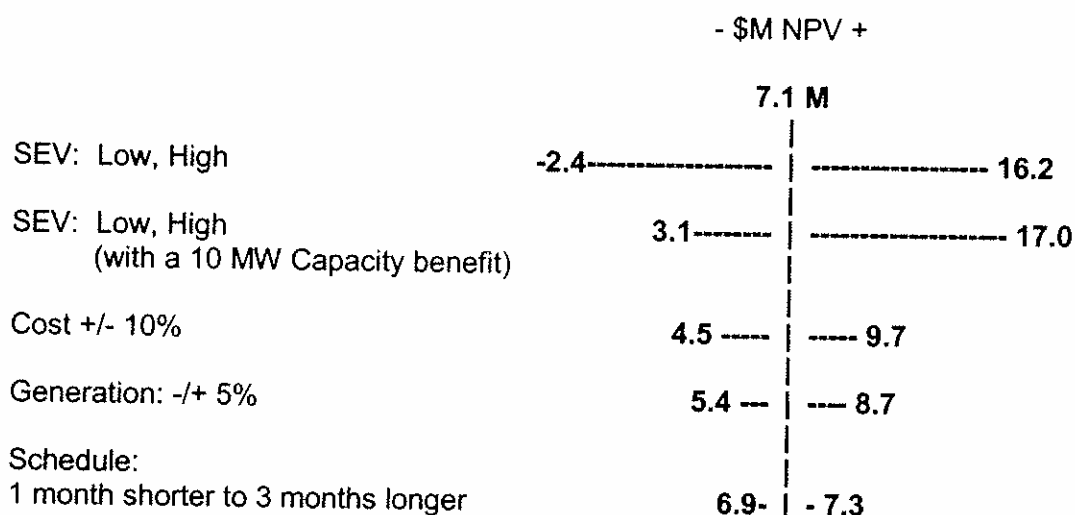
The project is considered to be sensitive to the following variables:

- SEV
- Project cost
- Generation
- Project in-service date (project schedule)

A Tornado diagram has been constructed to assess the project NPV with the following variables and changes:

- Change to SEV: High and Low values
- Change to SEV: High and Low values, also including a capacity benefit in the NPV calculations equal to 20MW
- Project cost: + / - 10%
- Generation: - / + 5%
- In-service date: schedule shortened by 1 month / extended by 3 months

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Schedule has relatively little impact on the NPV due to the seasonal characteristics of the generation from the unit and the timing of the scheduled in-service. Generation also does not have a large impact. The project cost also directly affects the NPV.

The project NPV is most sensitive to a variation in the SEV (market energy price). If a conservative capacity benefit of 20MW is included in the NPV calculation, the impact of low SEV's is greatly reduced, and will result in a positive NPV.

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**ONTARIOPOWER**  
GENERATION

**HYDROELECTRIC**  
**Summary of Estimate**

Date March 14, 2007  
 Project # SAB10032

**Facility Name:** Beck 1 GS  
**Project Title:** G7 Generator Frequency Conversion from 25 Hz to 60 Hz

Years (k\$)	2007	2008	2009	TOTAL	%
Project Mgmt.	446	594	149	1,189	3.4
Engineering	300	400	130	830	2.4
Permanent Materials					
Construction/ Installation					
- Contractors					
Interest	307	1,298	433	2,038	5.8
Contingency					
<b>TOTAL</b>	<b>7,900</b>	<b>23,364</b>	<b>3,946</b>	<b>35,210</b>	<b>100%</b>

- Notes: 1 Schedule Start date: May, 2007  
 In-service dates(s):  
 Headgates, Johnson valve 9 % Jan. 2008  
 Generator, balance of work 91% Mar. 2009
- 2 Interest and Escalation rates are based on current allocation rates provided by Corporate Finance
- 3 Includes Removal Costs of: 750 k\$
- 4 Includes Definition Phase Costs of: 1,800k\$

**Prepared by:**

**Approved by:**

*Torben Frost*

Torben Frost  
 Project Engineer

*John Conlon*

John Conlon  
 Project Manager

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## APPENDIX 1

### Assumptions

#### Financial Model

Following are the key assumptions used during the modeling of the Project:

##### Project Cost Assumptions:

1. Quotes from suppliers of major components were used if available.
2. Costs for other components and labour were based on costs for similar work carried out in the past with appropriate escalators applied.
3. Competitive bids can be received for the work to be contracted out.

##### Financial Assumptions:

4. In a non-regulated scenario, energy produced will provide revenue at the 2006 system energy values (SEVs).
5. The September 2006 Hydro FE Model, was used with a 2007 project start year.

##### Project Life Assumptions:

6. The project can start immediately after approval.
7. The project can be completed in 22 months and the generator can be commissioned in March, 2009.

##### Energy Production Assumptions:

8. Niagara River flow modeling tool accurately models the water available to the Beck plants.
9. Existing outage plans can be followed.
10. Generation at the Beck plants can be maximized while adhering to the market dispatches.
11. Historical forced outage rates will be typical in the future.

##### Operating Cost Assumptions:

12. The new unit will increase OM&A costs by 0.5 FTE (or equivalent cost of work contracted out).
13. On-going Non-Standard costs associated with the new unit will be minimal (5k per year)

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## APPENDIX 2

**Risk Management Table for Full Project Release**

Risk Category	Risk Description	Implications	Mitigation	Risk After Mitigation
Cost	<b>Electrical Systems - Hydro 1 -</b> Extent to which OPG is responsible for changes to the Hydro one equipment	Cost: Uncertain – Costs will be firmed up as Hydro One completes their Customer Impact Assessment in November/ December 2007	Due to the uncertainty, include a [REDACTED] contingency to increase this amount to [REDACTED]	Low
Schedule	<b>Will Hydro One accept 'E' bus?</b> [REDACTED]	Schedule: Preliminary schedule from Hydro One indicates no impact, but this requires Hydro One to dedicate adequate engineering and construction effort	Approach Hydro One to start preliminary work on accelerated schedule	Medium
Schedule	<b>Electrical Systems - Hydro 1</b> to determine what changes they need to make to their system	Schedule: If changes required to Hydro One system are extensive, this may delay in-service date - by several months?	OPG to participate in outage planning and work coordination	Medium
Schedule	<b>IESO System Impact Assessment (SIA) and Hydro One Customer Impact Assessment</b>	Delays in completing the assessments could delay the ability to connect to the Ontario Grid resulting in lost opportunity.	The Developmental release has included funds to start both the IESO and Hydro One assessments	Medium
Schedule	<b>IESO System Impact Assessment (SIA) and Hydro One Customer Impact Assessment results in insufficient transmission Capacity to allow G7 to connect</b>	Should the SIA state that it is not possible to connect new generation to the grid, generation from G7 could be bottled.	SAB 1 has a common bus system. When G7 is completed, G9 will be at the end of its service life. Should capacity not be available on the transmission system, G9 will be taken out of service and not rehabilitated. G7 will be connected to the bus. (See appendix 5 for further discussion)	Low
Cost	<b>Generator removal</b> - costs currently based on G6 costs - current estimate \$535k (not a quote)	Cost: Retaining existing foundation bolts may be challenging	Obtain competitive quotes from contractors Include adequate contingency	Low
Schedule		Schedule: Possible project delay	Schedule work appropriately. The unit is currently not operating, so the removal start is not restricted by outage requirements.	Low
Cost	<b>Generator foundation</b> - more work than what GE has anticipated in proposal	Cost: GE will have cost extras if they cannot use the existing foundation bolts as planned \$[REDACTED] - \$[REDACTED]	Have GE inspect and approve foundation condition as soon as generator is removed Include adequate ( [REDACTED] ) contingency on foundation work cost	Low
Schedule		Schedule: May delay in-service date - 3 weeks?		Low

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### Appendix 3

#### Major Component Cost Estimates

##### Unit Runner

American Hydro has been awarded a contract for runner design, runner model development and model testing for new runners for SAB 1 GS. Preliminary engineering indicates that a new runner with an efficiency of approximately █% and a corresponding output of 58 MW, at efficiency, can be supplied by the runner manufacturer.

OPG has the option to purchase a runner for unit 7 at a cost of \$ █M.

##### New Generator

The design and build of a new generator is on the critical path for the project. Work must start in early 2007. GE was one of three vendors submitting proposals. Bids were evaluated with Supply Chain's involvement, and GE was selected to supply and install the new generator. A developmental release has been approved to allow GE to commit to this work, and to cover their cost incurred (up to \$1M) should the project not proceed. A new generator, supplied and installed, will have a cost of approximately \$12M.

##### Replacement of the existing 25hz Transformer

A new water cooled transformer, will cost \$1.3m based on firm quotes received.

##### Turbine Upgrade

Upgrades to the turbine, to increase the power output, and modifications consistent with a 25 to 30 year maintenance cycle, will cost approximately \$3.1M.

##### Johnson Valves and Head Gates

The removal of the internal components of the Johnson valves and installation of headgates has been completed on the other 9 units resulting in reliable work processes and cost estimates.

The internal components of the G7 Johnson valve will be removed and new headgates will be installed in the G7 headworks at a cost of \$3.2M.

##### Governor Control head

A new governor head, supplied and installed, will cost approximately \$460k.

##### Electrical system and Connection to Hydro One

This work will cost approximately \$5.0M to upgrade electrical system up to the connection to Hydro One. █



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### IESO System Impact Assessment and Hydro One Customer Impact Assessment

The developmental release (approved) includes \$30k funding to have the IESO complete a System Impact Assessment. This assessment is required prior to connecting any new generation to the Ontario Grid. Although G7 is part of the existing SAB1 complex, the unit was deregistered in 2005, and therefore requires this assessment.

In addition, the developmental release (approved) includes \$15k funding for Hydro One to complete a Customer Impact Assessment which is required prior to adding additional generation to the transmission system.

### New Exciter

A new exciter is required for the new generator and is expected to cost \$ [REDACTED] k.

### New unit Switchgear

New switchgear is required for the new generator and is expected to cost \$ [REDACTED] k.

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## Appendix 4

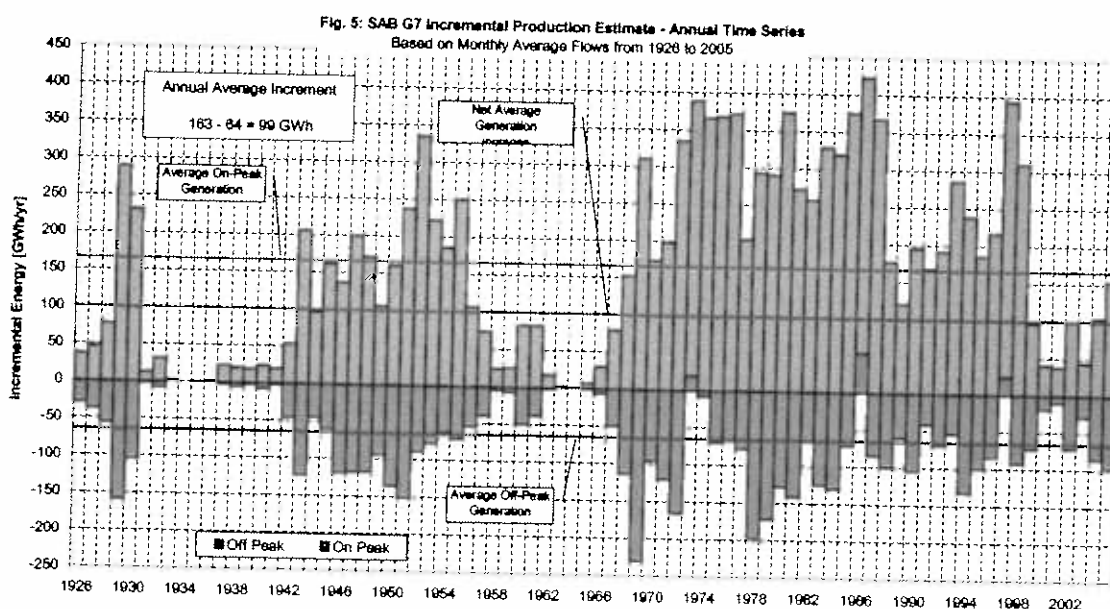
### Impact of Tunnel Water on Generation with and without G7

The Niagara Tunnel project assumed the Beck complex will increase its generation on average by 1.6 TWh as a result of increased water diversion. This generation is derived from additional water delivered and an increased ability to utilize PGS to pump. The additional generation would be generated by all the units across the Beck Complex as the tunnel would increase water throughput for a greater period of time. At the time the Niagara Tunnel BCS was presented, G7 was operating as a 25 Hz unit. The Niagara Tunnel BCS was silent on the retirement of the 25hz system and did not contemplate the conversion of any 25 Hz units to 60 Hz. The additional generation was a function of the additional water at the existing station configuration.

To determine the possible generation advantage from the conversion of G7, the generation from the Beck Complex was modeled. Monthly average Niagara River flows from 1926 to 2005, were used to calculate corresponding average tourist and non-tourist hour diversion flows for future diversion capability conditions according to long-term average seasonal restrictions and a DeCew diversion assumption of 200 cms. The model included the new tunnel water as if it were in service for this period. The model was run with G7 not being in service, and with G7 being converted to 60 Hz operation.

Without the G7 conversion, the average annual generation would have been 12,762Gwh. With G7 rehabbed, the average annual generation is 12,861 GWh, for an average annual increase of 99 GWh. This is made up of 163 GWh of on peak generation, offset by -64 GWh of off peak generation, which is the generation required by PGS for pumping.

The graph below indicates the on peak and off peak generation that would have resulted with G7 in service for each of the years since 1926. The green line is the average Net of off-peak (red line) and On-peak (blue line)



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## Appendix 5

### Risk Mitigation Strategy for Queenston Flow West Transmission Limitation.

The outcome of the IESO System Impact Assessment (SIA) will be known in June 2007 and the outcome of the Hydro One Customer Impact Assessment (CIA) will be known in the fall of 2007. There is a potential risk to the viability of the G7 project if the SIA concludes that the system cannot accept the additional station output provided by G7.

The condition of G9 is an important factor when discussing risks to the viability of the G7 project. G9 is currently operating at a reduced output due to its poor mechanical condition. It is scheduled to be removed from service for major repairs, or to be replaced by a new unit, as soon as G7 is placed into service.

G9 will be taken out of service and G7 can be connected to the station output bus and placed in service. The net effect on the transmission system, by this substitution of G7 for G9, will be minor.

Under the current SAB I unit outage strategy, appreciable capacity is not added to the transmission system until the first quarter of 2010 when SAB I G9 is returned to service. Therefore, there is a 3 year period in which the transmission limitation issue can be resolved. The 25 Hz market will also have ended by that time, and it may be possible to utilize the 25 Hz transmission system to help resolve this issue.

If the transmission system capability issue is not resolved by 2010, the timing of the rehabilitation of G9 will be reassessed and the project will be delayed until the transmission constraints are resolved.

The financial risk to the G7 Conversion Project is reduced to the incremental cost of the G7 project over the cost of the G9 project. This incremental cost is in the range of \$3M to \$10M.