



June 9, 2004

Mr. Gord Haines

Section Manager  
Technical Compliance  
Ontario Power Generation Inc. (OPG)  
700 University Avenue  
Toronto, Ontario, M5G 1X6

Dear Mr. Haines:

***Cameron Falls GS – Units G5, G6 Upgrading***  
***Notification of Approval of Connection Proposal for G5 – Revised***  
***CAA ID Number: 2003-EX179***

Thank you for the detailed information that you provided on OPG's proposal to upgrade units G5 and G6 at Cameron Falls GS.

The assessment concluded that the proposed project would not have a negative impact on the reliability of the IMO-controlled grid.

The connection assessment that you requested is now complete and the IMO is pleased to grant **conditional approval** of your proposed unit G5 upgrading, subject to the full implementation of the IMO's requirements as detailed in the attached Expedited System Impact Assessment Report. Any material changes to your proposal may require a re-assessment by the IMO in accordance with Market Manual 2.10, and may nullify your conditional approval. .

**Final approval** to connect to the IMO-controlled grid and to participate in the IMO-administered markets will be granted upon successful completion of the IMO Facility Registration process. During facility registration you will be expected to demonstrate that you have fulfilled the requirements in your System Impact Assessment and that the project you have installed is materially unchanged from the proposal assessed by the IMO. Contact [facility.registration@theIMO.com](mailto:facility.registration@theIMO.com) if you have not received a Facility Registration Summary package within the next 10 days.

For further information, please contact the undersigned.

Yours truly,

Bob Gibbons  
Manager - Long Term Forecasts & Assessments  
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cc: IMO Records

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All information submitted in this process will be used by the IMO solely in support of its obligations under the *Electricity Act, 1998*, the *Ontario Energy Board Act, 1998*, the *Market Rules* and associated policies, standards and procedures and in accordance with its licence. All information submitted will be assigned the appropriate confidentiality level upon receipt.

**Expedited System Impact Assessment Report – Revised**  
**Cameron Falls CAA ID 2003-EX179**  
**June 9, 2004**

**1.0 Project Description**

Ontario Power Generation Inc. (OPG) has submitted a connection assessment application for work related to the upgrading of units G5 and G6 at Cameron Falls GS.

The proposed work includes:

- Replacing the runners,
- Rewinding the generators,
- Replacing the rotating exciters with GE2100 full-static exciters (type: IEEE ST4B) and power system stabilizers (type: IEEE PSS2A dual-input),
- Replacing the cables running from the generators to the switchyard, and
- Replacing the split phase CT's at the generators.

At the time of the original application, OPG had indicated that this proposed work would increase the maximum output of each generator from 10 MW to 11.2 MW. Subsequently, OPG has indicated that each generator may have a maximum output capability of 12.5 MW.

**2.0 Assessment**

The IMO has assessed the effect of the proposed modifications on the reliability of IMO-controlled grid. This proposal is not expected to result in a material impact on the IMO-controlled grid and therefore was subject to the Expedited System Impact Assessment Process.

OPG has already received final approval from the IMO on February 13, 2004 to replace the exciter on unit G6.

The purpose of this report is to establish the effect of the increased output of both units on the thermal loading of the local system, to assess the overall transient stability performance of both units, and to grant approval for unit G5.

*Local Impact*

Cameron Falls units G5 and G6 are radially connected to a 115 kV single circuit line, C3A, via a three-single-phase step-up transformer, T3. The proposed work will result in a maximum output of 25.0 MW per unit. This translates into a maximum output of 27.8 MVA for both units.

The thermal capability of the three single-phase step-up transformer T3 is:

- summer continuous rating: 51 MVA
- summer 10-Day limited time rating (LTR): 51 MVA

The summer continuous rating of the 115 kV single circuit line which connects G5 and G6 to Alexander SS is 470 A or 96 MVA (calculated at 118 kV).

The upgraded capacity of units G5 and G6 is well under the thermal capacity of transformer T3 and circuit C3A.

### *Transient Stability*

Dynamic simulations were performed to verify that the transient response of the new excitation systems and power system stabilizers meet market rules requirements. The modeling data for the new exciter systems and power system stabilizers were provided by OPG. In particular, the final models for unit G6 were used and preliminary models for G5 were used. Appendix A and B list the PTI/PSSE modeling data for G5 and G6, respectively.

The results of the simulations indicate that the proposed changes for units G5 and G6 meet the market rule requirements.

The results of the open circuit step response test is displayed in Figure 1. Examination of this plot indicates that:

- the exciter field voltage reaches 95% of the excitation ceiling voltage in less than 50 ms, and
- the proposed exciters and power system stabilizers provides adequate damping of system oscillations.

The transient response of the Cameron Falls machines equipped with the new exciters was also verified for a three-phase fault on 115 kV circuit A5A at the Alexander Switching Station. With the unit outputs at 13.8 MW each (capability of 12.5 MW plus a 10% margin to account for modeling errors, metering errors and variations in dispatch), the units remained stable for the fault. Plots of rotor angles and voltages for unit G5 at approximately 13.8 MW are shown in Figure 2.

### **3.0 Conclusions and IMO Requirements**

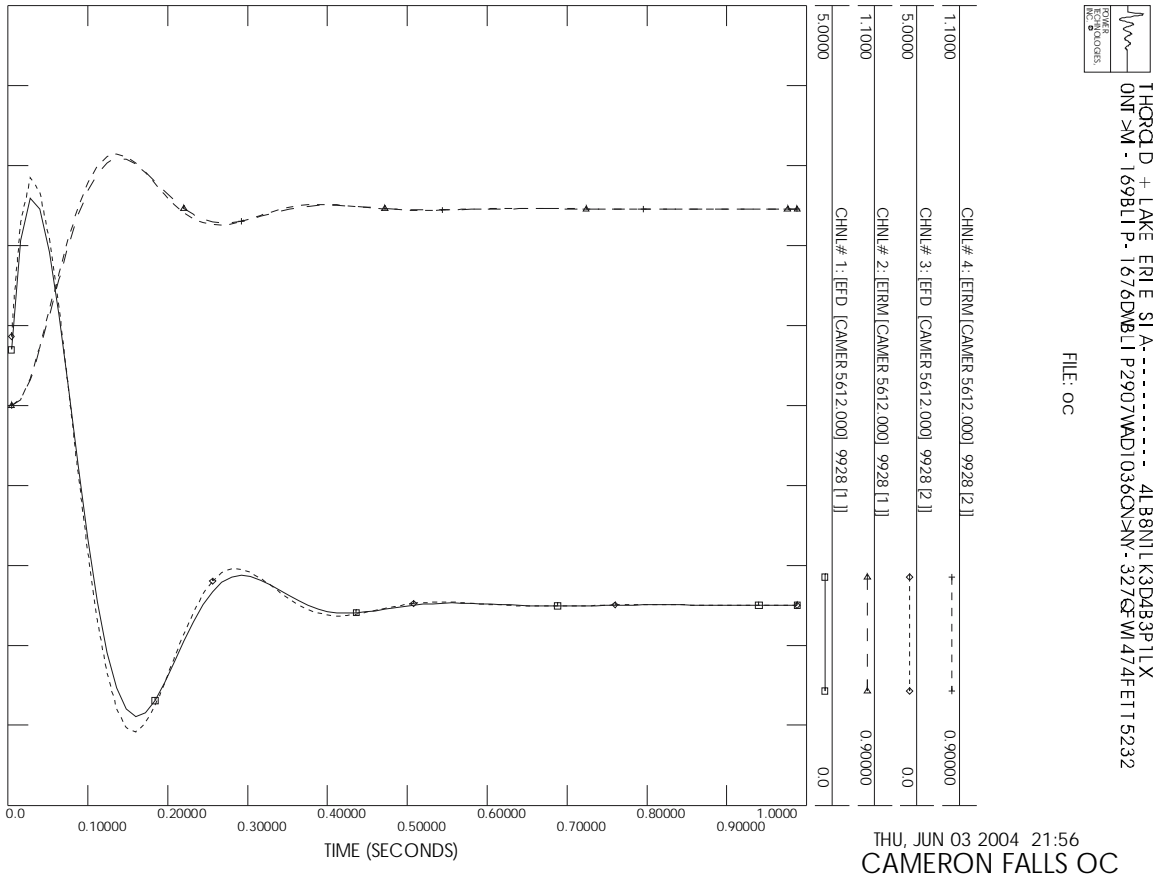
This assessment concluded that the proposed upgrading of Cameron Falls units G5 and G6 will not have any adverse impact on the reliability of the IMO-controlled grid.

It is required that OPG submit to the IMO final test results on the exciter and power system stabilizer for unit G5 after commissioning is completed.

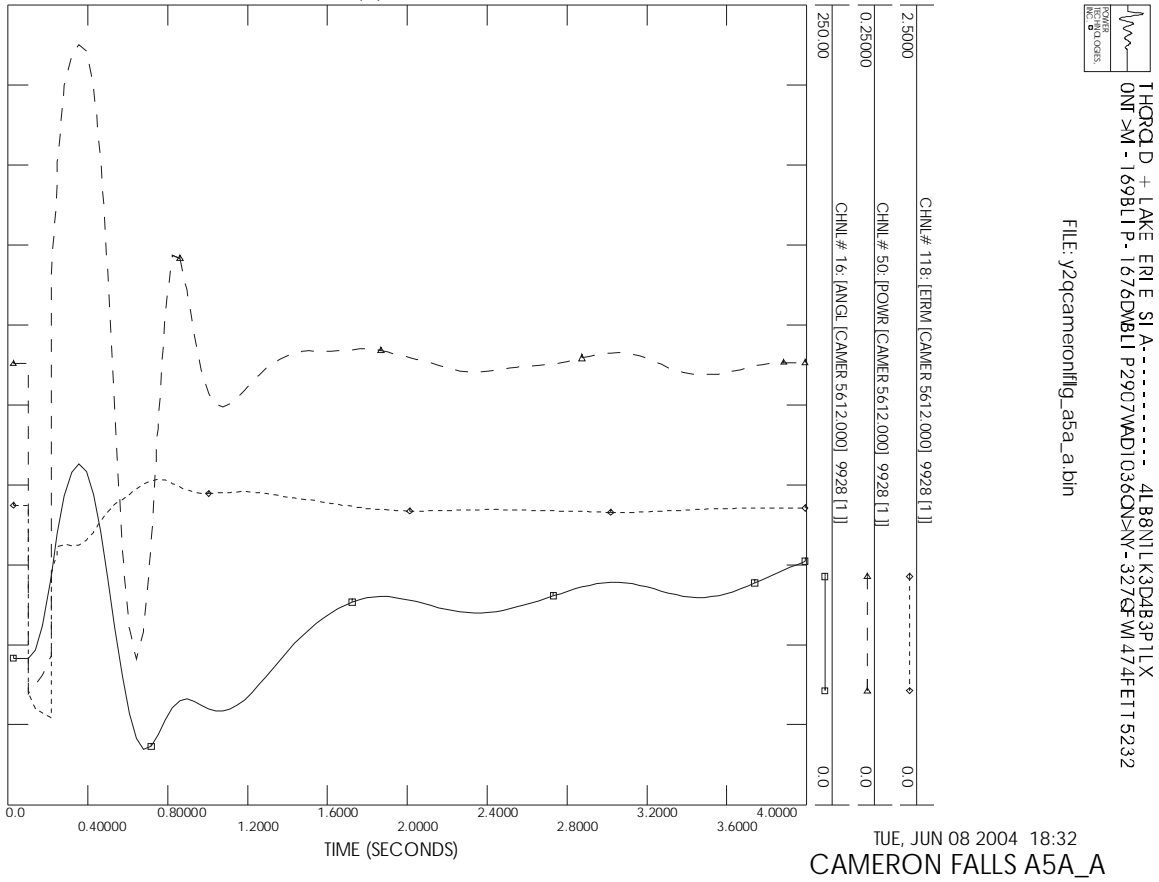
### **4.0 Notification of Approval**

Notification of approval is granted for Cameron Falls unit G5.

**Figure 1 Open Circuit Step Response Test – Cameron Falls G5(1) & G6(2)**



**Figure 2 Transient Response for 3-phase fault on circuit A5A at Alexander Switching Station – Cameron Falls G5(1)**



**Appendix A – PTI/PSSE modeling data for Cameron Falls G5**

**\*\* GENSAE \*\*** BUS NAME BSKV MACH CONS STATES  
 9928 CAMER 56 12.0 1 167414-167425 60188-60192

MBASE Z S O R C E X T R A N G E N T A P  
 13.7 0.00000+J 0.37500 0.00000+J 0.00000 1.00000

T'D0 T"D0 T"Q0 H DAMP XD XQ X'D X"D XL  
 2.760 0.025 0.035 2.04 0.00 1.3950 0.9700 0.5690 0.3750 0.3500

S(1.0) S(1.2)  
 0.1430 0.4430

**\*\* COMP \*\*** BUS NAME BSKV MACH CON XE  
 9928 CAMER 56 12.0 1 167438 0.05000

**\*\* PSS2A \*\*** BUS NAME BSKV MAC CONS STATES VARS ICONS  
 9928 CAMER 56 12.0 1 167440-167456 60198-60213 10159-10162 2231-2236

IC1 REMBUS1 IC2 REMBUS2 M N  
 1 0 3 0 5 1

TW1 TW2 T6 TW3 TW4 T7 KS2 KS3  
 5.000 5.000 0.000 5.000 0.000 5.000 1.220 1.000

T8 T9 KS1 T1 T2 T3 T4 VSTMAX VSTMIN  
 0.500 0.100 5.000 0.130 0.030 0.130 0.030 0.200 -0.050

**\*\* URST4B \*\*** BUS NAME BSKV MACH CONS STATES  
 9928 CAMER 56 12.0 1 167474-167490 60230-60233

TR KPR KIR VRMAX VRMIN TA KPM KIM VMMAX VMMIN  
 0.010 10.000 0.000 999.000-999.000 0.010 1.000 0.000 0.990 -0.950

KG KP KI VBMAX KC XL THETAP  
 0.000 5.720 0.000 999.000 0.051 0.3500 0.000

**\*\* WEHGOV \*\*** BUS NAME BSKV MACH CONS STATES VARS ICON  
 9928 CAMER 56 12.0 1 167508-167556 60238-60244 10167-10170 2243

R-GATE R-PE TPE KP KI KD TD TP TDV TG GTMXOP  
 0.040 0.000 1.000 1.780 0.360 0.020 0.100 0.100 0.100 0.400 0.050

GTMXCL GMAX GMIN DTURB TW DBAND DPV DICM  
 -0.120 1.000 0.000 0.000 1.000 0.010 0.000 0.040

FLOW VERSUS GATE TABLE

G1 G2 G3 G4 G5  
 0.000 0.105 0.756 1.000 1.000

F1 F2 F3 F4 F5  
 0.000 0.105 0.756 1.000 1.000

POWER VERSUS FLOW TABLE

F1 F2 F3 F4 F5 F6 F7 F8 F9 F10  
 0.000 0.105 0.756 1.000 1.000 1.000 1.000 1.000 1.000 1.000

P1 P2 P3 P4 P5 P6 P7 P8 P9 P10  
 0.000 0.000 0.912 0.912 0.912 0.912 0.912 0.912 0.912 0.912

ICON(M)= 0; SIGNAL FOR DROOP IS THE GATE SIGNAL

**Appendix B – PTI/PSSE modeling data for Cameron Falls G6**

**\*\* GENSAE \*\*** BUS NAME BSKV MACH CONS STATES  
 9928 CAMER 56 12.0 2 167426-167437 60193-60197

MBASE Z S O R C E X T R A N G E N T A P  
 13.7 0.00000+J 0.37500 0.00000+J 0.00000 1.00000

T'D0 T"D0 T"Q0 H DAMP XD XQ X'D X"D XL  
 2.760 0.025 0.035 2.04 0.00 1.3950 0.9700 0.5690 0.3750 0.3500

S(1.0) S(1.2)  
 0.1430 0.4430

**\*\* COMP \*\*** BUS NAME BSKV MACH CON XE  
 9928 CAMER 56 12.0 2 167439 0.05000

**\*\* PSS2A \*\*** BUS NAME BSKV MAC CONS STATES VARS ICONS  
 9928 CAMER 56 12.0 2 167457-167473 60214-60229 10163-10166 2237-2242

IC1 REMBUS1 IC2 REMBUS2 M N  
 1 0 3 0 5 1

TW1 TW2 T6 TW3 TW4 T7 KS2 KS3  
 5.000 5.000 0.000 5.000 0.000 5.000 1.220 1.000

T8 T9 KS1 T1 T2 T3 T4 VSTMAX VSTMIN  
 0.500 0.100 5.000 0.130 0.030 0.130 0.030 0.200 -0.050

**\*\* URST4B \*\*** BUS NAME BSKV MACH CONS STATES  
 9928 CAMER 56 12.0 2 167491-167507 60234-60237

TR KPR KIR VRMAX VRMIN TA KPM KIM VMMAX VMMIN  
 0.010 10.000 0.000 999.000-999.000 0.010 1.000 0.000 0.990 -0.950

KG KP KI VBMAX KC XL THETAP  
 0.000 6.000 0.000 999.000 0.054 0.3500 0.000

**\*\* WEHGOV \*\*** BUS NAME BSKV MACH CONS STATES VARS ICON  
 9928 CAMER 56 12.0 2 167557-167605 60245-60251 10171-10174 2244

R-GATE R-PE TPE KP KI KD TD TP TDV TG GTMXOP  
 0.040 0.000 1.000 1.780 0.360 0.020 0.100 0.100 0.100 0.400 0.050

GTMXCL GMAX GMIN DTURB TW DBAND DPV DICM  
 -0.120 1.000 0.000 0.000 1.000 0.010 0.000 0.040

FLOW VERSUS GATE TABLE

G1 G2 G3 G4 G5  
 0.000 0.105 0.756 1.000 1.000  
 F1 F2 F3 F4 F5  
 0.000 0.105 0.756 1.000 1.000

POWER VERSUS FLOW TABLE

F1 F2 F3 F4 F5 F6 F7 F8 F9 F10  
 0.000 0.105 0.756 1.000 1.000 1.000 1.000 1.000 1.000 1.000  
 P1 P2 P3 P4 P5 P6 P7 P8 P9 P10  
 0.000 0.000 0.912 0.912 0.912 0.912 0.912 0.912 0.912 0.912

ICON(M)= 0; SIGNAL FOR DROOP IS THE GATE SIGNAL