

# **CONNECTION ASSESSMENT & APPROVAL PROCESS**

**Expedited System Impact Assessment**

**Applicant: ACHLP**

**Project: Kenora GS - Excitation system and Governor upgrade**

**CAA ID: 2010-EX510**

Final Report

Market Facilitation Department

June 20, 2011

## KENORA GS – EXCITATION SYSTEM AND GOVERNOR UPGRADE PROJECT IESO EXPEDITED SYSTEM IMPACT ASSESSMENT – 2010-EX510

### 1. Project Description

Kenora GS is a self-scheduling generation facility owned by ACHLP. The facility contains 10 hydraulic generation units rated at 1 MW each and operated at 0.65 MW and unity power factor. The generation units are more than 90 years old and were part of Kenora Mill which was decommissioned in June 6, 2007.

Recently, ACH LP has performed the following upgrades to improve the performance of the generation units:

- 1- Installation of electronic excitation control comprising a Basler Digital Excitation Controller feeding a turbine-driven rotating exciter to replace the manually-controlled rheostat that was used to feed direct current excitation voltage to the rotating exciter.
- 2- Installation of high-pressure hydraulic servo and a Powerbase PID electro-hydraulic governor to replace the low-pressure, centrifugal ball-governor used to control the turbine wicket gates.
- 3- Installation of generator/turbine protection system, comprising high-speed protective relaying for electrical disturbances and mechanical failures through temperature, pressure, vibration sensing.

This System Impact Assessment examines the impacts of the upgrades on the reliability of the IESO-Controlled Grid.

### 2. Data Verification

#### a. Excitation System Model

The connection applicant has provided the model for the AC8B Alternator-Rectifier Excitation System shown in Figure 1 and Table 1.

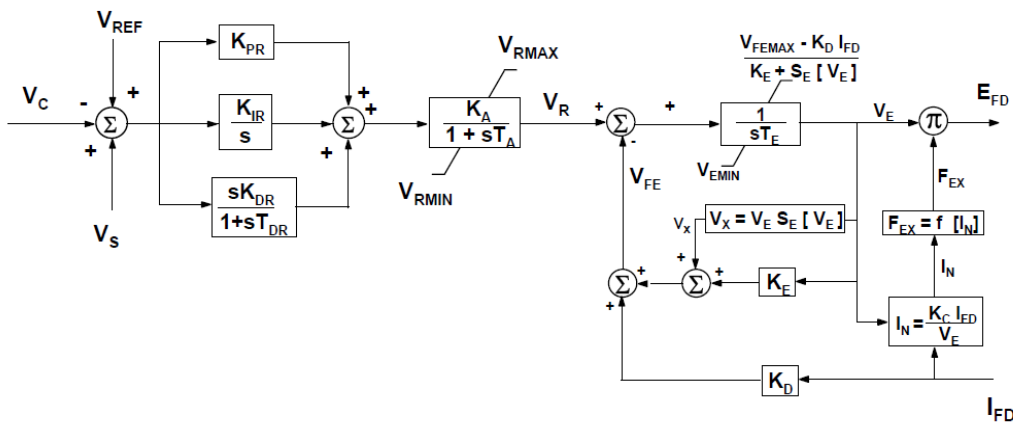


Figure 1 Type AC8B Alternator-Rectifier Excitation System

Table 1 Model parameters for the AC8B Alternator-Rectifier Excitation System

Description	Parameter	Value	Unit
Voltage Regulator Proportional Gain	$K_{PR}$	80	p.u.
Voltage Regulator Integral Gain	$K_{IR}$	20	p.u.
Voltage Regulator Derivative Gain	$K_{DR}$	10	p.u.
Voltage Regulator Derivative Filter Time Constant	$T_{DR}$	0.01	Sec
Regulator output gain	$K_A$	1	p.u.
Regulator output time constant	$T_A$	0.004	Sec
Max Control Output	$V_{RMAX}$	2.7	p.u.
Min Control Output	$V_{RMIN}$	0.0	p.u.
Exciter field proportional constant	$K_E$	1.0	p.u.
Exciter field time constant	$T_E$	1.2	p.u.
commutating reactance constant	$K_C$	0.55	p.u.
demagnetization constant	$K_D$	1.1	p.u.
Max Excitation Voltage	$V_{FEMAX}$	9.3	p.u.
Saturation factor at E1	$SE_{(E1)}$	0.3	p.u.
Exciter flux at SE1	$E_1$	6.5	p.u.
Saturation factor at E2	$SE_{(E2)}$	3.0	p.u.
Exciter flux at SE2	$E_2$	9.0	p.u.

### 3. Assessments

#### a. Excitation System Assessment

The connection applicant confirmed that the upgrade for the excitation system involves installing an AVR for the existing rotating excitation system without changing the main components of the excitation system. This upgrade is considered a non-major change in the existing excitation system. Thus, the excitation system will maintain the same, or better, performance of the original equipment.

The connection applicant shall ensure that after the upgrades, the excitation system will have at least the same performance (or better) as compared to the old excitation system.

#### b. Governor System Assessments

Appendix 4.2 of the Market Rules specifies the performance requirements for generation facilities that are directly connected to the IESO-Controlled Grid as in the case of Kenora GS. Specifically, Appendix 4.2 requires the generation facility to have the capability to:

- 1- Operate continuously between 59.4 Hz and 60.6 Hz and for a limited period of time in the region above straight lines on a log-linear scale defined by the points (0.0 s, 57.0 Hz), (3.3 s, 57.0 Hz), and (300 s, 59.0 Hz).
- 2- Regulate speed with an average droop based on maximum active power adjustable between 3% and 7% and set at 4% unless otherwise specified by the IESO. Regulation deadband shall

not be wider than  $\pm 0.06\%$ . Speed shall be controlled in a stable fashion in both interconnected and island operation. A sustained 10% change of rated active power after 10 s in response to a constant rate of change of speed of 0.1%/s during interconnected operation shall be achievable. Due consideration will be given to inherent limitations such as mill points and gate limits when evaluating active power changes. Control systems that inhibit governor response shall not be enabled without IESO approval.

The connection applicant confirmed that the generation units have frequency protections which trip the units only in the event that the grid frequency exceeds the normal operating range specified in Appendix 4.2, which satisfies the first requirement.

A commissioning guide and acceptance report is provided by the applicant for the Kenora GS upgrades.

The document shows that the governor droop is set to 0.05 pu/pu (5% droop). The applicant has confirmed that the droop setting has been changed to 4% to meet the market rules.

The performance of the governor after the upgrades meets the requirements mentioned in the Appendix 4.2 of the Market Rules.

#### **4. IESO requirements**

The applicant shall ensure that the control systems that inhibit the governor response at Kenora GS are not enabled without approval from the IESO.

#### **5. Conclusions**

The upgrades related to the excitation system are non-major, and thus, the excitation system should have a similar or better performance as compared to the performance of the original equipment that was approved for connection.

The performance of the governor system after the upgrades meet the requirements mentioned in the Appendix 4.2 of the Market Rules.

#### **6. Notification of Conditional Approval**

It is recommended that a Notification of Conditional Approval of the upgrades be issued to the applicant subject to the requirements identified in this assessment.