Form B
Connection Impact Assessment Application Form
Distribution System

This Application Form is for Generators applying for Connection Impact Assessment ("CIA") and for Generators with project size >10 kW.

This Application Form is required for:

- **New Generators applying for Connection Impact Assessment ("CIA")**
- **Existing Generators to verify information related to current connection to the Hydro One system. It is part of the overall (Distribution) Connection Agreement.**

For generation size ≤ 10 kW, please fill out Form C ("Micro- Generation Connection Application Form").

"Technical Requirements for Generators Connecting to Hydro One's Distribution System" is available from the Hydro One website,
http://www.hydroonenetworks.com/en/customers/generators/generation_connections/FAQs/default.asp

It is important that the Generator provide all of the information requested below. Failure to do so could result in the non-acceptance of this application form by Hydro One Networks Inc. ("Hydro One").

Please return the completed form, fees and other required documents by mail to:

Generation Connections Coordinator
Hydro One Networks Inc.
483 Bay Street, 15th Floor, North Tower
Toronto, Ontario
M5G 2P5

NOTE 1: Applicants are cautioned not to incur major expenses until Hydro One approves to connect the proposed generation facility.

NOTE 2: All technical submissions (Form B, single line diagrams, etc.) must be signed and sealed by a licensed Ontario Professional Engineer (P.Eng.).

Date: 13/06/2008 (dd / mm / yyyy)

1. **Project Name:** Clarington #1

2. **Proposed In- Service Date:** 01/06/2013 (dd / mm / yyyy)

3. **Project Size:**

Number of Units	1	
Nameplate Rating of Each Unit	20,000 kW	
Generator connecting on	☐ single phase	☒ three phases
Existing Total Nameplate Capacity	_____ kW	
Proposed Total Nameplate Capacity	20,000 kW	

4. **Project Location:**

Address	_____
City / Town / Township	Clarington, ON
Lot Number(s)	27
Concession Number(s)	Broken Front (B.F.)

5. Project Information:

Generator Single Point of Contact Person Greg Borchuk

	Generator	Owner	Consultant
Company/Person	Regional Municipality of Durham	Same as Generator	GENIVAR Ontario Inc.
Contact Person	Greg Borchuk		Jasna Sehovic
Mailing Address	605 Rossland Road East, P.O. Box 623 Whiby ON L1N 6A3		600 Cochrane Drive, Suite 500, Markham, ON L3R 5K3
Telephone	(905) 668-7711		(905) 475-7270
Fax	(905) 668-7494		(905) 475-5994
Email	gerg.borchuk@region.durham.on.ca		jasna.sehovic@genivar.com

6. Program Type:

A. Net Metering ☐ ***(Complete all sections)***

B. Net Metering to RESOP Conversion

i) ☐ Existing Net Metering Customer upgrading generation size and/or technology/ fuel type ***(Complete all sections)***

ii) ☐ Existing Net Metering Customer with no upgrades in generation size and/or technology/ fuel type ***(Complete sections 7 and 8 only)***

C. Renewable Energy Standard Offer Program (RESOP) ☐ ***(Complete all sections)***

7. Fuel Type:

A. Existing: ☐ Wind Turbine ☐ Hydraulic Turbine ☐ Steam Turbine ☐ Solar/ Photovoltaic
☐ Diesel Engine ☐ Gas Turbine ☐ Fuel Cell ☐ Biomass
☐ Co-generation/CHP (Combined Heat & Power)
☐ Anaerobic Digester
☐ Other (Please Specify) _____

B. New: ☐ Wind Turbine ☐ Hydraulic Turbine ☒ Steam Turbine ☐ Solar/ Photovoltaic
☐ Diesel Engine ☐ Gas Turbine ☐ Fuel Cell ☐ Biomass
☐ Co-generation/CHP (Combined Heat & Power)
☐ Anaerobic Digester
☐ Other (Please Specify) _____

8. Customer Status:

Existing Hydro One Customer? ☐Yes ☒No

If yes, Hydro One 10-digit Account Number: _____

Customer name registered in this Account: _____

Are you a GST registrant? ☐Yes ☐No

If yes, provide your GST registration number: _____ - _____ RT _____

9. Location and Site Plan:

Provide Site Plan with approximate line routings for connection to nearby Hydro One's facilities. The Site Plan should include roads, concession and lot numbers and nearby power lines.

Drawing / Sketch No. 5123-E-21, Rev. B

10. Connection to Hydro One's Distribution System:

a. Proposed or existing Connection voltage to Hydro One's distribution system: 44 kV
b. Station: WILSON TS
c. Feeder: M15
d. Distance between the connection point on the feeder and the interface transformer: 0.1 km
e. Line tap between generating facility and connection point on Hydro One's feeder:
   Conductor size (e.g. 336): 4/0
   Conductor type (e.g. AL): AL
   Note: Hydro One may request actual impedance for non-standard conductors at a later time.

11. Single Line Diagram ("SLD"):

Provide a SLD of the Generating Facility including the Interface Point/Point of Common Coupling ("PCC") to Hydro One's distribution system.

SLD Drawing Number: 5123-SK-E02, Rev. A

12. Protection Philosophy:

- Provide a document describing the protection philosophy for detecting and clearing:

- Internal faults within the EG facility;
- External phase and ground faults (in Hydro One's distribution system);
- Certain abnormal system conditions such as over / under voltage, over / under frequency, open phase(s);
- Islanding

Document Number: 5123-P-01

- Include a tripping matrix or similar information in the document.

Note: EG shall install utility grade relays for the interface protection. The protection design shall incorporate facilities for testing and calibrating the relays by secondary injection.

13. Generator Characteristics

NOTE: ***Inverter based generating units must not inject DC greater than 0.5% of the full rated output current at the point of connection of the generating units. The generated harmonic levels must not exceed those given in the CAN/CSA-C61000-3-6 Standards***

a. Characteristics of Existing Generators (if applicable):

1. Number of generating unit(s): N/A
2. Manufacturer / Type or Model No: _____ / _____
3. Rated capacity of each unit: _____ kW _____ kVA

If unit outputs are different, please fill in additional sheets to provide the information.

4. Rated frequency: _____ Hz
5. Rotating Machine Type: ☐ Synchronous ☐ Induction ☐ Other (Please Specify) _____

6. Generator connecting on: ☐ single phase ☐ three phases
7. Limits of range of reactive power at the machine output:
Lagging (over-excited) _____ kVAR power factor _____
Leading (under-excited) _____ kVAR power factor _____
8. Limits of range of reactive power at the PCC:
Lagging (over-excited) _____ kVAR power factor _____
Leading (under-excited) _____ kVAR power factor _____
9. Starting inrush current: _____ pu (multiple of full load current)

For Synchronous Units:

i. Nominal machine voltage: _____ kV
ii. Minimum power limit for stable operation: _____ kW
iii. Unsaturated reactances on: _____ kVA base _____ kV base
Direct axis subtransient reactance, Xd'' _____ pu
Direct axis transient reactance, Xd' _____ pu
Direct axis synchronous reactance, Xd _____ pu
Zero sequence reactance, X0 _____ pu
iv. Provide a plot of generator capability curve (MW output vs MVAR)
Document Number: _____, Rev._____

For Induction Units:

i. Nominal machine voltage: _____ kV
ii. Unsaturated reactances on: _____ kVA base _____ kV base
Direct axis subtransient reactance, Xd'' _____ pu
Direct axis transient reactance, Xd' _____ pu
iii. Total power factor correction installed: _____ kVAR
- Number of regulating steps _____
- Power factor correction switched per step _____ kVAR
- Power factor correction capacitors are automatically switched off when generator breaker opens

☐ Yes ☐ No

b. Characteristics of New Generators:

10. Number of generating unit(s): 1
11. Manufacturer / Type or Model No: ABB / WATER COOLED
12. Rated capacity of each unit: 20000 kW 23529 kVA
13. If unit outputs are different, please fill in additional sheets to provide the information.
14. Rated frequency: 60 Hz
15. Rotating Machine Type: ☒ Synchronous ☐ Induction ☐ Other (Please Specify) _____
16. Generator connecting on: ☐ single phase ☒ three phases
17. Limits of range of reactive power at the machine output:
18. Lagging (over-excited) 17646 kVAR power factor _____
19. Leading (under-excited) 20000 kVAR power factor _____
20. Limits of range of reactive power at the PCC:
21. Lagging (over-excited) _____ kVAR power factor _____
22. Leading (under-excited) _____ kVAR power factor _____
23. Starting inrush current: _____ pu (multiple of full load current)

For Synchronous Units:

v. Nominal machine voltage: 13.8 kV
vi. Minimum power limit for stable operation: _____ kW
vii. Unsaturated reactances on: 23529 kV base
Direct axis subtransient reactance, Xd'' 14.2 pu

Direct axis transient reactance, Xd' 21.8 pu
Direct axis synchronous reactance, Xd 118 (+/-15%) pu
Zero sequence reactance, X0 6.2 pu

viii. Provide a plot of generator capability curve (MW output vs MVAR)
Document Number: XYK210094-EGB, Sh. 4, Rev.A

For Induction Units:

iv. Nominal machine voltage: N/A kV
v. Unsaturated reactances on: _____ kVA base _____ kV base
Direct axis subtransient reactance, Xd'' _____ pu
Direct axis transient reactance, Xd' _____ pu
vi. Total power factor correction installed: _____ kVAR
- Number of regulating steps _____
- Power factor correction switched per step _____ kVAR
- Power factor correction capacitors are automatically switched off when generator breaker opens

☐ Yes ☐ No

14. Interface Step-Up Transformer Characteristics:

a. Transformer rating: 15/20/25 kVA
b. Nominal voltage of high voltage winding: 44 kV
c. Nominal voltage of low voltage winding: 13.8 kV
d. Transformer type: ☐ single phase ☒ three phases
e. Impedances on: z=7%
g. High voltage winding connection: ☒ delta ☐ star
Grounding method of star connected high voltage winding neutral:
☐ Solid ☐ Ungrounded ☐ Impedance: R _____ ohms X _____ ohms

h. Low voltage winding connection: ☐ delta ☒ star
Grounding method of star connected high voltage winding neutral:
☒ Solid ☐ Ungrounded ☐ Impedance: R _____ ohms X _____ ohms

Note: The term 'High Voltage' refers to the connection voltage to Hydro One's distribution system, and 'Low Voltage' refers to the generation or any other intermediate voltage.

15. Intermediate Transformer Characteristics (if applicable):

a. Transformer rating: N/A kVA
b. Nominal voltage of high voltage winding: _____ kV
c. Nominal voltage of low voltage winding: _____ kV
d. Transformer type: ☐ single phase ☐ three phases
e. Impedances on: _____ kVA base _____ kV base
R _____ pu X _____ pu

g. High voltage winding connection: ☐ delta ☐ star
Grounding method of star connected high voltage winding neutral:
☐ Solid ☐ Ungrounded ☐ Impedance: R _____ ohms X _____ ohms

h. Low voltage winding connection: ☐ delta ☐ star
Grounding method of star connected high voltage winding neutral:
☐ Solid ☐ Ungrounded ☐ Impedance: R _____ ohms X _____ ohms

Note: The term 'High Voltage' refers to the intermediate voltage that is input to the interface step-up transformer and the 'Low Voltage' refers to the generation voltage.

16. Load information (if known):

a. Maximum load of the facility: _____ kVA _____ kW
b. Maximum load current (referred to the nominal voltage at the connection point to Hydro One system): _____ A
c. Maximum inrush current (referred to the nominal voltage at the connection point to Hydro One system): _____ A

Attached Documents:

Item No.	Description	Reference No.	No. of Pages
1	Technical Details	1. XYK210045-EGB, REV E, sheet #1-9	9
2	Inspection and Test Report	2. XYK215310-EGB	1
3	System and Protective Relays Overview	3. 5123-P-01	4
4	Turbine and Aux. Equipment Information	4. 04457-N25-30S-1000	5
5	Efficiency Curves	5. XYK210094-EGB	5
6			
7			
8			
9			
10			

Attached Drawings:

Item No.	Description	Reference No.	No. of Pages
1	Location and Site Plan	6. Electrical Site Plan 5123-E-21	1
2	Single Line Diagram	7. 5123-SK-E02	1
3			
4			
5			
6			
7			
8			
9			
10			

Item #1

TECHNICAL SPECIFICATION FOR BRUSHLESS SYNCHRONOUS GENERATOR

CLIENT	:	**MHI Nagasaki**
PROJECT	:	**USA Southwest Florida Board of County Commissioners LEE COUNTY WTE PLANT UNIT 3 EXPANSION**
TYPE	:	**AMS 1120SH**
OUR REFERENCE	:	**8000411/200**
DRIVEN BY	:	**Steam Turbine**
DATE	:	**2005-06-08**

SECTION **PAGE**

ENCLOSURE **NUMBER**

INSPECTION PLAN XYK 210 044-EGB

GENERATOR CURVES : XYK 210 094-EGB

PAGE

- EFFICIENCY CURVES 1
- SATURATION CURVES - A 2
- V-CURVES 3
- CAPABILITY DIAGRAM 4

SHORT CIRCUIT EQUATIONS XYK 210 089-EGB

AE041078

Prep. ATAP/MKE P.S 2006-06-09	Technical Specification				No. of sh.
Appr. Tedbrant Jan	Lee County				9
Resp. dept. ATAP/MK	8000411/200				
ABB Automation Technologies	Document number XYK210045-EGB	Lang. en	Rev. ind. E	Sheet 1	

A. RATED DATA
at cooling water temperature 38 °C

Output	kVA	: 23529
Power factor (overexcited)		: 0.85
Power factor (underexcited)		: 0.85
Voltage	V (±5%)	: 13800
Frequency	Hz (±5%)	: 60
Speed	rpm	: 1800 – generator
Current	A	: 984
Exciter type		: GLA 600B
Excitation	V/A	: 96 / 10

B. STANDARDS

Applicable standards	: NEMA
Insulation class stator and exciter	: F
Insulation class main rotor	: H
Temperature rise, stator within class	: B
Temperature rise, rotor within class	: B

C. OTHER PERFORMANCE DATA

Efficiency at P.F. 0.85 and 100 / 75 / 50 / 25 % load	%	: 97.84	97.53	96.76	94.23
Efficiency at P.F. 1.00 and 100 / 75 / 50 / 25 % load	%	: 98.25	97.98	97.32	95.14

Reactances:

- X_d	(±15%) %	: 118	
- X_q unsat /sat	%	: 65/61	C
- X_d' unsat/sat	" %	: 21.8 / 18.7	
- X_d'' unsat/sat	" %	: 14.2 / 12.5	
- X_0	%	: 6.2	
- X_2	%	: 15.4	

Time constants:

- T_d'	s	: 0.82
- T_d''	s	: 0.022
- T_{d0}'	s	: 6.08
- T_a	s	: 0.13

Excitation main machine:

- voltage no load	V	: 64
- voltage full load	V	: 118
- current no load	A	: 288
- current full load	A	: 534

FL

Mitsubishi → steam Turbine c/w gear reducer from (3600 rpm to 1800)

Sudden short circuit current (peak)	kA : 22	
Short circuit ratio	% : 90	
Max. field forcing for 10 seconds (percentage of rated excitation)	% : 160	
Sustained short circuit, stator current for 10 seconds at symetrical conditions	% : 276	
Max. permissible overspeed	rpm : 2160	
Max. continuous negative sequence current	% : 8	
Fault condition capability $(I_2/I_N)^2t$	s : 20	
Stator winding capacitance per phase	micro farad : 0,11	C

D. SITE CONDITIONS

Ambient temperature range	°C : 0 - 40	°F : 32 - 104
Altitude	m : < 1000	ft : < 3280
Location	: Indoors	
Water temperature range	°C : 10 - 38	°F : 50 - 100
Hazardous area classification	: Non hazardous area	

F. INSTALLATION DATA

Protection form and cooling form			: TEWAC		
Cooler location/No of coolers			: Top / 2		
Water cooling:					
- Cold air temperature	°C	:	46		
- Required cooling water flow	m^3/h	:	50.0	gpm	: 220
- Cooling water temperature max.	°C	:	38	°F	: 100
- Temperature rise cooling water	K	:	7.1	°F	: 12.8
- Pressure drop cooling water	kPa	:	73	psi	: 10.6
- Fouling factor	$m^2°C/W$	:	0.0000900	$hr\text{-}ft^2\text{-}°F/Btu$	: 0.000511
- Cooling water type			: Customer water analysis required		
Heat losses:					
- Cooling water	kW	:	421 (at rated load)		
- Lubrication oil	kW	:	23.8		
Arrangement form			: IM 1001		
Sleeve bearings:					
- Max. axial play towards D-end	mm	:	12	in	: 0.473
- Max. axial play towards N-end	mm	:	12	in	: 0.473
- Max. permissible axial thrust	kN	:	0	lbf	: 0
- Min. barring speed	rpm	:	30		
- Required oil flow to bearings (Total)	l/min	:	35.2	gpm	: 9.3
- Oil temperature range to bearings	°C	:	40 - 65	°F	: 104 - 149
- Required oil pressure at 40 °C	kPa	:	89	psi	: 12.9
At higher pressure an orifice should be used.					
- Supply oil pressure			: 14,5 psi		A
- Type of oil			: ISO VG 32		A
- Degree of purity for oil			: 17/15/12 acc. to ISO 4406:1999		
Weights:					
- Total (complete machine, excluding terminal box)	kg	:	39600	lb	: 87300
- Stator	kg	:	18900	lb	: 41700
- Rotor	kg	:	13700	lb	: 30200
- Terminal box	kg	:	1730	lb	: 3810
Rotor inertia	kgm^2	:	1734	$lb\text{-}ft^2$	: 41155
Direction of rotation (at drive end, facing shaft end)			: COUNTER CLOCKWISE		A
First lateral critical speed (based on stiff foundation)	rpm	:	2453		
Noise level (at 1m acc.to ISO 3744)	dB(A)	:	82 , Tol. +3 dB(A)		
Static force on each machine foot	kN	:	49	lbf	: 10917
Dynamic force on each machine foot	kN	:	± 237	lbf	: ± 53368
Auxiliary equipment power supply:					
- Anticondensation heaters in the main machine	W	:	1600		
- Anticondensation heater in the exciter	W	:	400		
- Anticondensation heater in main terminal box	W	:	400		

G. INCLUDED ACCESSORIES

Cooling arrangement IC8 A1W7
Self circulated inner-air circuit cooled by built-on water-air heat exchanger.

Protection form IP54.

The cooler has following material:

Tube material	:	Cu 90%/Ni 10%
Tube end plates	:	Muntz metal
Water box	:	Rilsan coated steel
Plate fins	:	Aluminium
Customer connection flange	:	ANSI B16.5 Cl.150
Flange location	:	Left hand
Design pressure	:	0.6 MPa
Test pressure	:	0.9 MPa

Exciter
Main brushless exciter type GLA for DC excitation complete with diode bridge, thyristors, RC-circuits and control box.

Exciter no load field voltage	50 V	C
Exciter no load field current	4,8 A	C
Exciter full load voltage at rated powerfactor	96 V	C
Exciter full load current at at rated power factor	10 A	C
Exciter field resistance at 25 °C	8,15 ohm	C
Exciter field time constant	0,32 sec	C

Pilot Exciter (PMG) single phase type.
MCB - PMG over current protection: 20 A.

Rated voltage	222 V	C
Frequency	300Hz	C
No load voltage	250V	C
Full load voltage at field forsing for 10sec	208V	C
kVa rating	3,0 kVA	C

Mounting arrangement IM 1001
Horizontal machine with two bearings, one shaft extension.

DE shaft end cylindrical with key. B

Coupling half and shaft end details
Coupling half to be supplied by others.
Finish boring of coupling by ABB.
Mounting by ABB.

Rotor balanced with half key. B

Foundation details
Machine provided with 8 feet.

Short sole plate kit for grouting with non-shrinking grout including:
Foundation plates (4 pcs), anchoring bolts, holding down bolts,
mounting shims, dowel pins and horizontal machine jacking bolts.

No alignment or grouting included in ABB scope of supply.

Jacking bolts vertical adjustment.
Bearings
Sleeve bearings suitable for flood oil lubrication
provided by others.
Connection at common point at left side of machine.

An oil drain pressure of 200-1000 Pa lower than
the bearing ambient is recommended.

Customer connection flange acc. to ANSI B16.5 Cl.150.

Inlet pipe in stainless steel. B
Outlet pipe in stainless steel. B

Orifice for pressure reduction.

Main terminal
Heaters in HV terminal box.
Large stator terminal box, right side.
Complies with IEEE/ANSI.

Stator terminal box protection IP54 with all 6
ends brought out and neutral point terminated
inside the box. Connection from underneath.
Grounding clamps inside and outside.

The main terminal box is delivered as a loose item,
assembly on site is not included in ABB's scope of supply.

The main terminal box needs to be supported from beneath.
Supports are not included in ABB's scope of supply.
For terminal box weight see section F.

Line side

3 - Surge capacitors
3 - Lightning arrestors
3 - Current transformers with single core for metering. 1200/5A, B-0.5
3 - Current transformers with single core for protection: 1200/5A, C200

IRIS Coupling capacitors

Neutral side

3 - Current transformers with single core for protection: 1200/5A, C200
3 - Current transformers with single core for metering and protection: 1200/5A, C200

1 - Neutral grounding transformer with secondary resistor, 10A for 30 sec.

C

Anticondensation heaters
Standard 1 phase elements for 3 phase supply.

In both main machine, exciter and terminal box.

Termination in separate boxes (normally opposite main supply side).

The anticondensation heaters should always be connected during stand still.

Measurement and control
Resistance temperature detectors type PT100 (3 wire model) ANSI.

12 In the stator winding
1 In each bearing
2 In cold air
1 In hot air

D

Dial thermometer with 2 electrical contacts scale -20 - +200 °C and scale 0 - +400 °F.
1 In each bearing
1 In each oil outlet

E

Dial thermometer CSA approved.

Water leakage detector with electrical contact for external mounting and connection
1 detector CSA approved

Vibration control proximity type in two radial planes, 90° apart
2 probes per bearing mounted outboard the bearing centerline
2 proximitors per bearing
Including mounting and intercables.
Acceptance test for shaft run-out measurement is made in V-blocks.

Burnishing surface for proximity type of vibration probes, maximum combined electrical and mechanical run out 22 µm (0.87 mils) peak-to-peak.

Rotor ground fault brush and slipring.

Shaft grounding brush.

Magnetic center indicator A

Surface treatment
Standard industrial coating

Primer coating - modified epoxy[1]	: 60 µm	2.4 mils
Top coating - modified epoxy[1]	: 60 µm	2.4 mils
[1]The binder is an acid cured epoxidized oil.		
Standard colour	: Blue	NCS 4822-B05G

H. WORKSHOP TESTS

ABB Automation Technologies standard procedure is to perform a type test for a single machine order. If two or more identical machines are ordered, then a type test is performed on the first machine and routine tests on the remaining machines.

Proposed workshop tests according to enclosed **INSPECTION PLAN** are part of our manufacturing program and are part of the quoted price of the machine.

Witnessing of testing

Participation in a test specially arranged, time to be agreed between ABB Automation Technologies and customer, three weeks advance notice. The performance calculations are carried out and presented to customer during his visit.

REVISION

Rev. ind.	Page (P) Chapt.(C)	Description	Date Dept./Init.
A	4/F	Oil supply pressure added	2005-12-01 JT
A	4/F	Type of oil was ISO VG 46	2005-12-01 JT
A	4/F	Direction of rotation was clockwise	2005-12-01 JT
A	7/G	Magnetic center indicator added	2005-12-01 JT
B	5/G	DE shaft was without key	2006-01-10 JT
B	5/G	Balanced without key	2006-01-10 JT
B	6/G	Material was carbon steel	2006-01-10 JT
C	2/C	X_q added	2006-01-31 JT
C	3/C	Stator winding capacitance per phase added	2006-01-31 JT
C	5/G	Exciter date added	2006-01-31 JT
C	5/G	Data for PMG added	2006-01-31 JT
C	7/G	Was 10 sec	2006-01-31 JT
D	7/G	RTD in oil outlet added	2006-04-07 JT
E	7/G	RTD in oil outlet replaced by Dial Thermometer	2006-07-20 AL

ABB Automation Technologies | Cold resistance measurement

Customer: Lee County
Type: AMS 1120 SH
Order no : 8000411-A1
Serial no : 8267 355
Exciter : GLA 600B

Synchronous generator 4-pole
Ratings: 13800 V 984 A
23529 kVA P.F=0,85
1800 rpm 3 ph 60Hz
NEMA

Cold resistance measurement of windings and RTD´s

Object	Between terminals	Volts V dc	Amps A dc	Resist. Ω	Temp. °C
Stator winding	T1 - T2	0,7439	20,00	0,03720	22,7
Stator winding	T1 - T3	0,7454	20,00	0,03727	22,7
Stator winding	T2 - T3	0,7443	20,00	0,03722	22,7
Rotor winding		3,195	20,00	0,1598	22,7
Exciter stator winding	F1-F2	8,285	1,00	8,285	22,7
Exciter rotor winding	R - S	0,08392	20,00	0,004196	22,7
Exciter rotor winding	R - T	0,08392	20,00	0,004196	22,7
Exciter rotor winding	S - T	0,08392	20,00	0,004196	22,7
PMG stator winding	A1 -A2	0,1276	1,00	0,1276	22,7

RTD´s type PT 100 (ANSI)		Measured Resitance Ω	Calc. Temp. °C
In stator winding	501-502	0,44	
In stator winding	502-503	109,81	23,7
In stator winding	504-505	0,35	
In stator winding	505-506	109,25	22,5
In stator winding	507-508	0,36	
In stator winding	508-509	109,45	23,0
In stator winding	511-512	0,45	
In stator winding	512-513	109,21	22,1
In stator winding	514-515	0,25	
In stator winding	515-516	109,05	22,2
In stator winding	517-518	0,49	
In stator winding	518-519	109,23	22,1
In stator winding	521-522	0,30	
In stator winding	522-523	109,11	22,3
In stator winding	524-525	0,40	
In stator winding	525-526	109,32	22,6
In stator winding	527-528	0,26	
In stator winding	528-529	109,12	22,4
In stator winding	531-532	0,30	
In stator winding	532-533	109,25	22,6
In stator winding	534-535	0,55	
In stator winding	535-536	109,42	22,4
In stator winding	537-538	0,39	
In stator winding	538-539	109,35	22,7

REVIEWED/REVIEWED
MALCOLM JONES

ABB Automation Technologies AB
Automation Products
Machines 2006-06-09

Carried out : Anders Svensson
ABB ATAP/MP 7 Västerås Sweden Date: 06-06-07

Witnessed by : .....
Date :

Date : 06-06-06
☐ Witnessed:
☒ Reviewed:
MGI NGA QA Department

Item #3

Durham/York Residual Waste Project

Clarington #1

System and Protective Relays Overview

Prepared by:
GENIVAR Ontario Inc.

Document No. 5123-P-01
Revision: A, June 30, 2008

1. General

This document provides an overview of the system and protective relaying for a residual waste facility project to be located in Lot #7, Courtice, Ontario.

The Proposed Courtice #01 Generator Station will consist of one steam turbine with 20MW generating capacity. The steam turbine will be ABB model XYK210045-EGB.

The electrical system consists of a 13.8/44kV substation within the plant and one 44kV cable segment for connection to HONI system.

Main system electrical components:

- 44/13.8 kV interface transformer at steam turbine substation.
- 44kV circuit breaker, disconnect switches, revenue metering voltage and current transformers, lightning arresters and auxiliaries located in substation for connection to existing Hydro One 44 kV distribution line.
- Steam turbine package.
- Protective relaying.
- Fiber optics cables.
- SCADA / communications system

2. Steam Turbine Generator

Steam turbine generator will be a self-contained package, capable of automatic operation under remote supervisory control. Generator will be rated 13,800 volts, 20,000 kW and will be capable of operating at variable power factor with default value of 1.0

The generators will be Direct Drive Synchronous type.

Interconnection between the generator and 13.8/44kV substation will be made through 13.8kV switchgear.

3. 13.8/44kV Substation

The 13.8/44kV interface transformer will be of liquid type (mineral oil), tamper proof with two stage of natural and fan cooling depending on loading condition.

Multi-function microprocessor type protective relays similar to Multilin T35 (UR transformer management relay) is proposed for 44/13.8 kV interface transformer protection.

The substation also comprises of potential transformers and bushing current transformers utilized for protection of 44/13.8 kV interface transformer, as shown on the single line diagram.

Control and protective relaying, SCADA control & communication devices, batteries and charger, and auxiliary power supplies will be housed inside a weather proof enclosure.

The substation surface area will be covered with crushed stone for keeping the step/touch voltage within the tolerable limits and spill containment as per the Electrical Safety Code. The substation will be protected by fence and barbed wire per the Electrical Safety Code requirements

4. Protective Relaying

4.1 General

The Protective Relays function to protect the following system components:

- Associated upstream section of the Hydro One distribution feeder M15.
- 44/13.8 kV interface transformer at substation.

The protection systems outlined in the following paragraphs are intended to describe basic protective functions. Protective schemes may be modified at the detail design stage, once the protective relaying of Wilson TS and other relevant Hydro One facilities have been made available.

4.2 Hydro One Existing 44 kV Distribution Line

Protection for the 44 kV line feeder will be coordinated with the protection of Hydro One upstream existing 44 kV distribution line at Wilson TS.

In general, protection will be provided, utilizing GE-multilin, multi-function feeder protective relay similar to F60, envisaged for this purpose. Protection will include :

- Directional Overcurrent Relay
- Ground Fault Relay
- Instantaneous and Time Delayed Overcurrent Relay
- Under Voltage/Over Voltage Relay
- Under/Over Frequency Relay
- Breaker Failure Relay

It is proposed to provide SCADA equipment and functions at the substation for remote supervisory monitoring and control. This will include two independent data-grade telephone communication lines leased from the local telephone provider, to be used for transfer trip (if required) and other supervisory functions.

SCADA control will permit monitoring of the physical status of stations' equipment such as breaker and disconnect, and electrical status such as currents, voltages and power. It will also provide capability for remote supervisory operation of circuit breaker and other equipment, as may be required for transfer tripping, re-closing and other control functions associated with supervisory control of the stations or the steam turbine.

4.3 Steam Turbine Package

The site will be provided with 13.8kV switchgear complete with draw-out circuit breakers. This switchgear will allow for the turbine connection to be connected to the interface transformer substation and HONI grid.

The turbine generator will be connected via 15kV shielded cable to a generator circuit breaker in the 13.8kV switchgear. Surge protection equipment will be located at the generator terminals. Potential transformers for voltage regulator sensing and protective relaying will be located in the 13.8kV switchgear.

The protective relay system for the steam turbine will form a part of the steam turbine equipment package that will be purchased from the steam turbine vendor. Governor and voltage regulator controls will be located in a local turbine control panel provided with the unit. Generator protection will be provided per the recommendations of IEEE C37.102 and will include both primary and backup protective relays.

SCADA capability will be provided for remote supervisory monitoring and control of a steam turbine package.

5. Revenue Metering

Revenue metering will be provided at the Substation. This metering will follow the relevant requirements for current transformers, potential transformers, meters, and communications. A telephone line will be provided for metering purposes.

6. Communications

A fibre-optic network will interconnect the steam turbine with the substation and extends to the junction station, using fibre-optic cables as appropriate. Leased telephone lines will link the substation with Hydro One Wilson TS.

7. Control Philosophy

Control Philosophy will be in accordance with all applicable IEEE Standards and recommended practices.

VAR compensation may be required. This will be coordinated by Hydro One during design stage and provided as required.

A SCADA system will permit monitoring and control of the steam turbine from a central point located at the substation or remote station. The SCADA system will be extended to provide monitoring of key operating parameters at Wilson TS. SCADA features provided to Hydro One will include status indication and control of the 44 kV circuit breaker at the junction station.

A key element of the SCADA system extended to Hydro One will be transfer trip "lock-out" of the 44 kV breaker through Hydro One control systems.

In the event of disconnection from the external grid the SCADA control system will shut down the steam turbine to prevent "islanding".

CHAPTER 1. TURBINE AND AUX. EQUIPMENT PARTICULARS

1. STEAM TURBINE

Type	Mitsubishi, multi-stage, single cylinder with single flow, impulse and reaction type extraction, condensing turbine with reduction gear
Number of unit	1 set
Generator output	MCR : 17,740 kW VWO : 19,960 kW
Turbine rated speed	4,135 rpm
Generator rated speed	1,800 rpm
Turbine rotating direction (viewed from steam inlet side)	Clockwise
Main steam condition (at main stop valve inlet)	865psia x 825degF (5.96MPaA x 440.6degC)
Turbine exhaust pressure	2.3inHgA (7.79kPaA)
No. of stages	10 stages
Last stage dimension	
Blade height	15.7 inches (399 mm)
Base diameter of stage	38 inches (965.2 mm)
Radial bearing	Sleeve type
Thrust bearing	Tilting pads type

Max allowable seam pressure (at main stop valve inlet)

1) In normal operation

Average over any 12 months operating period	850.3 psig (100% of Max.)
Max. press. during the operating period	935.3 psig (110% of Max.)

2) During abnormal operation

Max. press. during a momentary swing	1,020 psig (120% of Max.)

(The total duration of such swings must never exceed 12 hours over any 12 months operating period.)

Max. allowable steam temperature (at main stop valve inlet)

1) In normal operation

Average over any 12 months operating period	825 degF (Max.)
Max. temp. during the operating period	840 degF (Max. + 15 degF)

2) During abnormal operation

Max. temp. during a momentary swing	850 degF (Max. + 25degF)

(The total duration of such swings must never exceed 400 hours over any 12 months operating period.)

875 degF (Max. + 50degF)

(The total duration of such swings must never exceed 80 hours over any 12 months operating period.)

2. REDUCTION GEAR

Type	Double helical single reduction gear with forced lubrication and turning device
Module	8
Number of teeth	
Pinion	37
Wheel	85
Gear ratio	2.297
Pitch circle diameter	
Pinion	13.324 inches (338.433 mm)
Wheel	30.610 inches (777.481 mm)
Center distance	22.047 inches (560 mm)

3. GENERATOR

Rating	Continuous/
	23,529kVA, 20,000kW, 4P-13.8kV, 60Hz, 984A,
PF0.85	
Excitation system	Brushless type with AC exciter and PMG
Type of rotor	Cylindrical type
Winding connection	Star
Number of pole	4
Rated speed	1,800 rpm
Number and type bearing	Two, sleeve
Insulation class	F
Temp. rise limit of winding	B
Cooling method	TEWAC
Lubrication	Forced lubrication

4. GOVERNOR

Type	WOODWARD 505
Design standard	NEMA class "D"
Adjustable speed range	90%~106 % of rated speed

5. TURNING DEVICE

Type	Motor driven automatically engaged/disengaged
Turbine turning speed	34 rpm (on low speed shaft)
Motor	37 kW x 1,800 rpm

6. OIL UNIT

6-1 L.O. COOLER

Type		Horizontal, Shell and tube type
Quantity		Two(2) sets
Surface area		1025 sq.ft
Lube oil	Quantity :	237.8gpm
	Temp. :	139.98/113.0degF (in/out)
Cooling water	Quantity :	370gpm (Max.440)
	Temp. :	100.0/107.08 degF (in/out)
Tube		90/10 CuNi, Lo- fin tube

6-2 LUBE OIL PUMP

Type	AC motor driven screw pump
Quantity	Two(2) sets
Capacity	264.2gpm
Discharge press.	227.6psig
Motor	75HP(55kW) x 1,800 rpm

6-3 EMERGENCY OIL PUMP

Type	DC motor driven screw pump
Quantity	One(1) set
Capacity	132gpm
Discharge press.	42.7psig
Motor	15HP(11kW) x 1,800 rpm

6-4 OIL RESERVOIR

Capacity	1321 gallons
Retention time	5 min (at normal operation)

6-5 OIL STRAINER

For lube oil	50micron, Duplex type
For control oil	20micron, Duplex type
For emergency oil pump discharge line	50micron, Simplex type

6-6 VAPOR EXTRACTOR FAN

Type	Centrifugal type
Volume	634gal/min
Motor	2.0HP(1.5kW) x 1,800 rpm

6-7 OIL PURIFIER

Type	Coalescing filter type
Feed pump	7gpm x 3/4HP(0.55kW) x 1,800 rpm
Heater	41HP(30kW)

6-8 OIL HEATER

Type	Electrical type with thermostat
Source	20HP(15kW)

6-9 OTHERS

Oil press. control valve for L.O.		Set : 232psig
Oil press. control valve for C.O.		Set : 29psig
Oil temp. control valve		Wax type, Set : 113degF
Accumulator	L.O. :	26gallon, piston type
	C.O. :	4gallon, piston type

7. GLAND CONDENSER

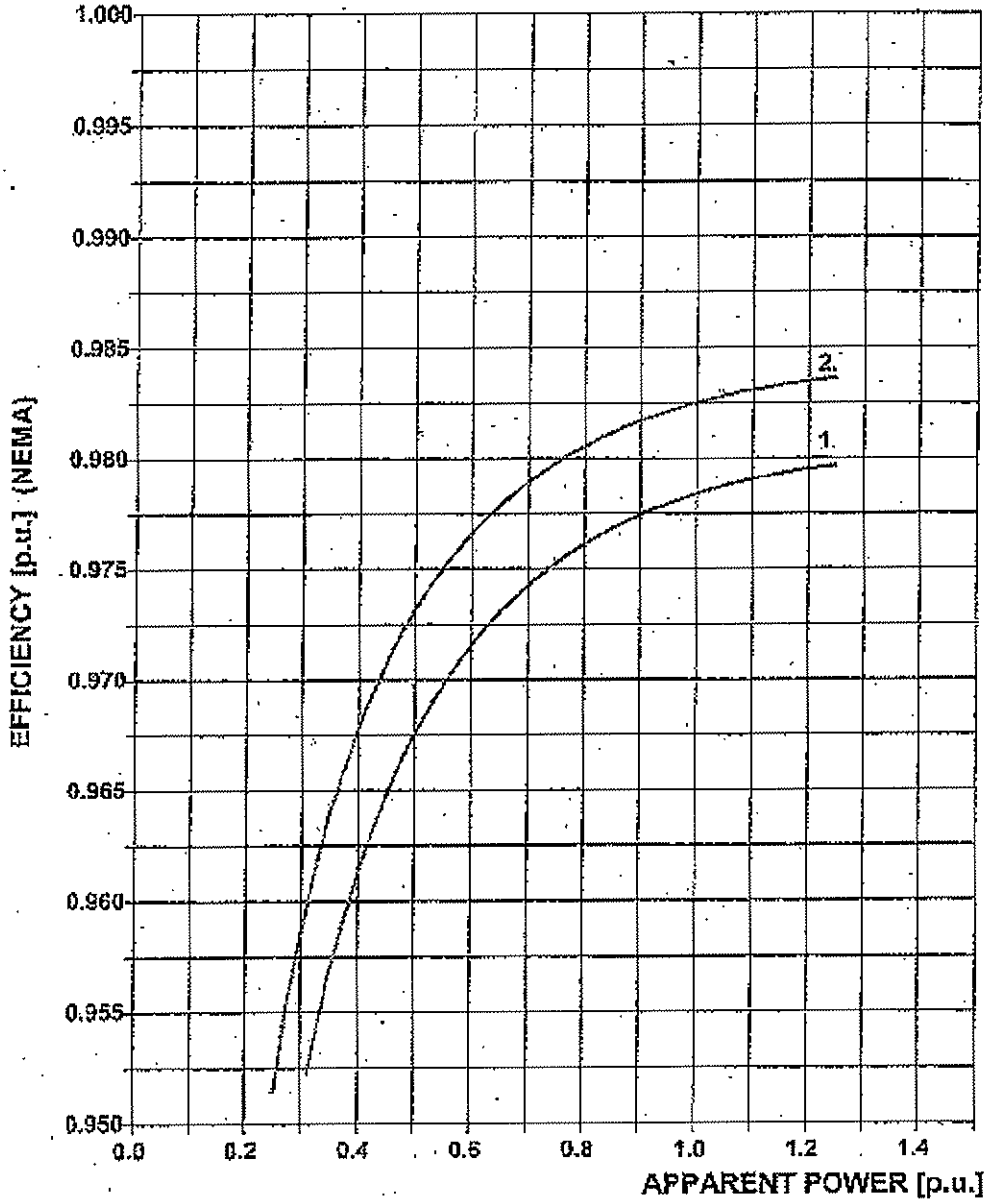
Type		Horizontal, Shell and tube type
Surface area		53.8 sq.ft
Cooling water	Quantity :	262gpm
	Temp. :	100.0/107.2 degF (in/out)
Tube		A249-TP304, O.D.19.05mm x t1.24mm
Fan		Suction press. : -200mmAq
Motor		5HP(3.7kW) x 3,505 rpm

Item #5

1/5

EFFICIENCY CURVES

AMS 1120SH 23529 kVA 60 Hz 0.85 PF 13800 V 984 A 1800 rpm



1. PF = 0.85 U = 1.00 OUTPUT 1 p.u. = 23529 kVA
2. PF = 1.00 U = 1.00

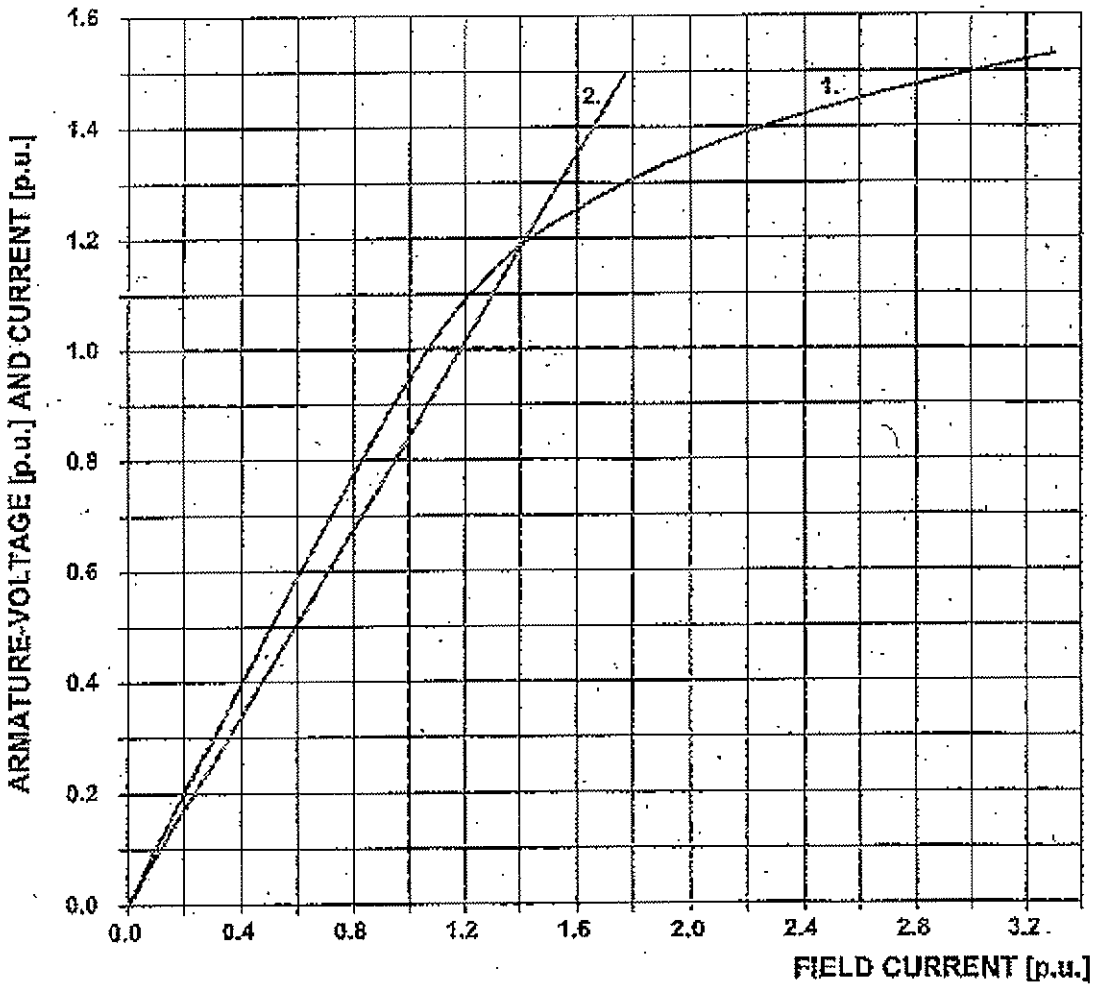
AE041078

Prep. ATAP/MKE P.S 2005-06-08	Generator Curves				No. of sh.
Appr. Sandin Per 2005/06/14	Lee County				6
Resp. dept. ATAP/MK	800041 1/200				
ABB Automation Technologies	Document number XYK210094-EGB	Lang. en	Rev. ind. A	Sheet 1	

TEMPLATE: NORMAL.DOT; PRINTDATE: 2005/06/22 14:00; SAVEDATE: 2005/06/14 11:26; OSKAR VERSION: 3.2f (2005-02-10)

SATURATION CURVES - A

AMS 1120SH 23529 kVA 60 Hz 0.85 PF 13800 V 984 A 1800 rpm

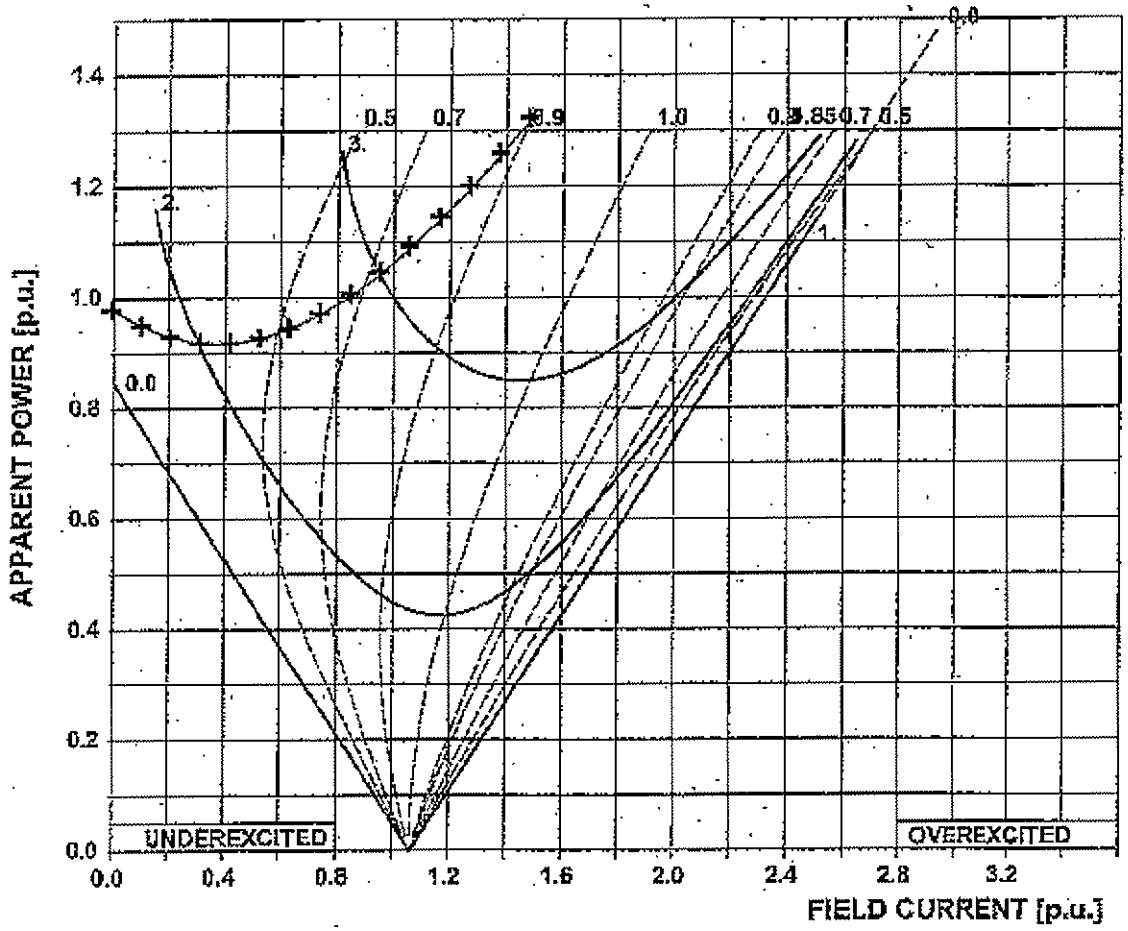


1. OPEN -CIRCUIT SATURATION
2. SHORT-CIRCUIT SATURATION

ARMATURE VOLTAGE	1 p.u. =	13800 V
ARMATURE CURRENT	1 p.u. =	984 A
FIELD CURRENT	1 p.u. =	251 A

V-CURVES

AMS 1120SH 23529 kVA 60 Hz 0.85 PF 13800 V 984 A 1800 rpm



1. ACTIVE OUTPUT [p.u.] = 0.00
2. ACTIVE OUTPUT [p.u.] = 0.43
3. ACTIVE OUTPUT [p.u.] = 0.85

GENERATOR OUTPUT	1 p.u. = 23529	kVA
FIELD CURRENT	1 p.u. = 251	A

+++ PRACTICAL STABILITY LIMIT
- - - POWER FACTOR
—— ACTIVE OUTPUT

NOTE: $\frac{P}{P_N}$ = 1 IS EQUAL TO p.u. = 0.85

P_N = Nominal active output

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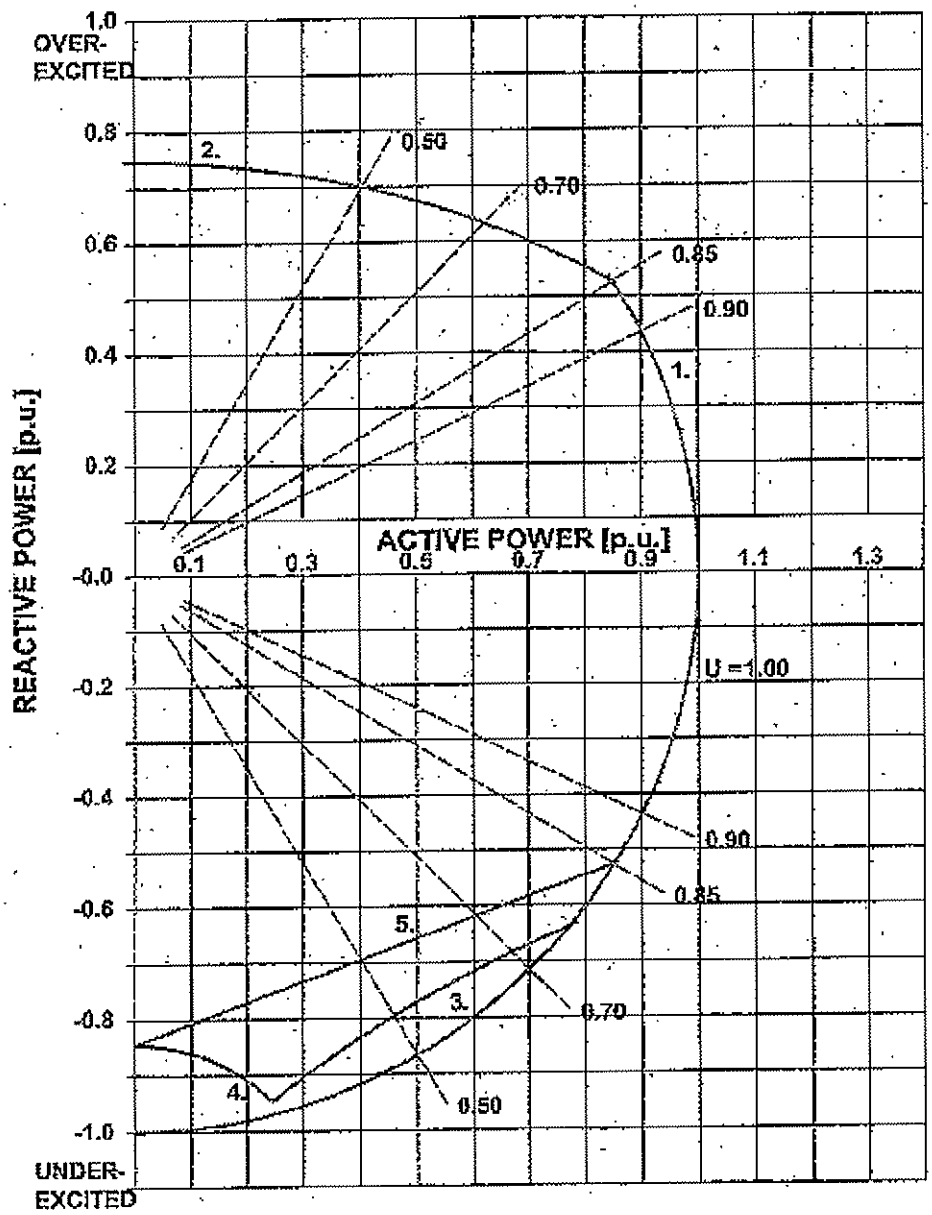
CAPABILITY DIAGRAM AT COOLING WATER TEMPERATURE OF 38.0°C

AMS 1120SH 23529 kVA 60 Hz 0.85 PF 13800 V 984 A 1800 rpm

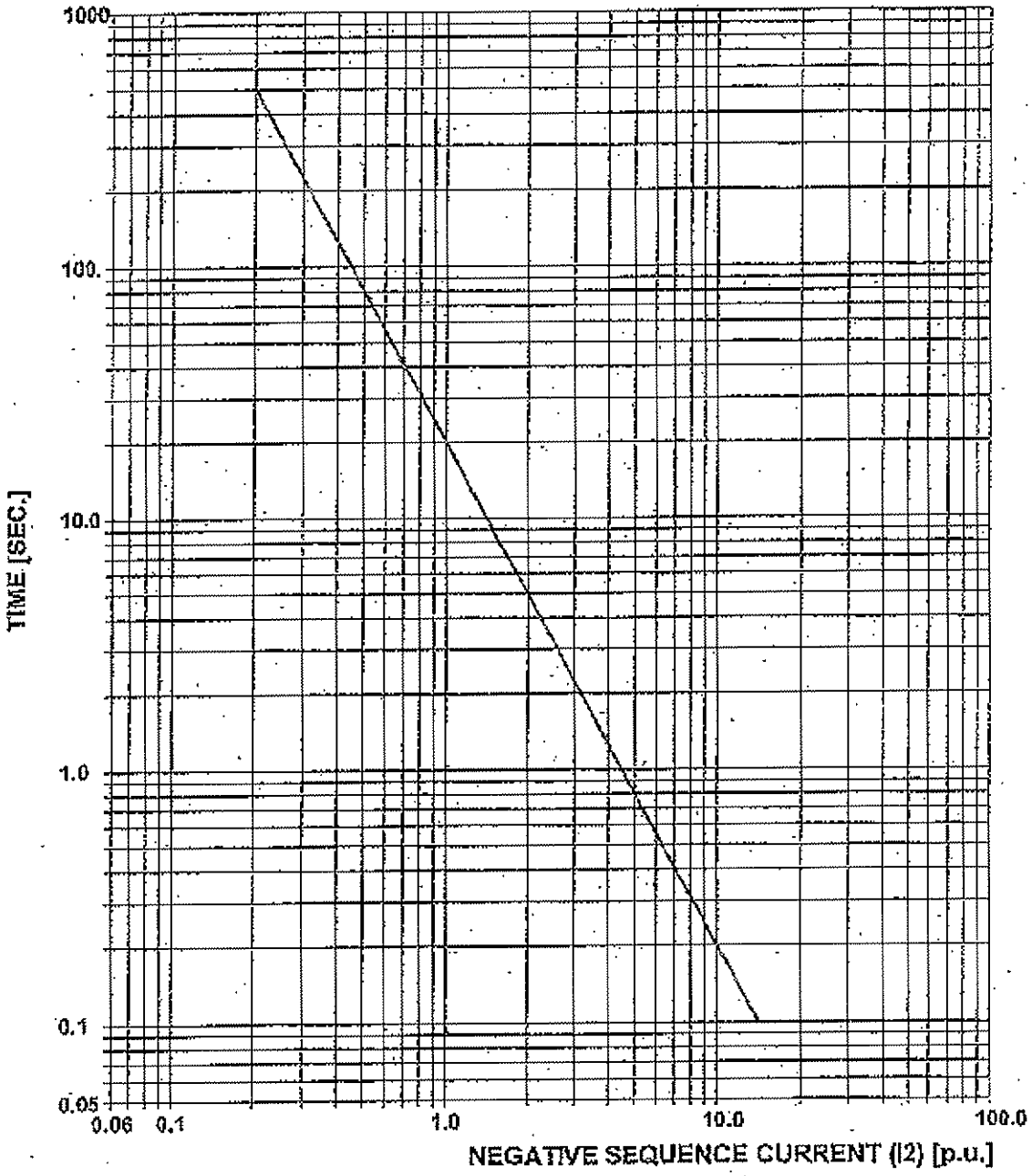


BASE APPARENT POWER 1 p.u. = 23529 kVA

1. STATOR HEATING LIMIT
2. ROTOR HEATING LIMIT
3. PRACTICAL STABILITY LIMIT
4. ZERO FIELD-CURRENT LIMIT
5. CORE END HEATING LIMIT

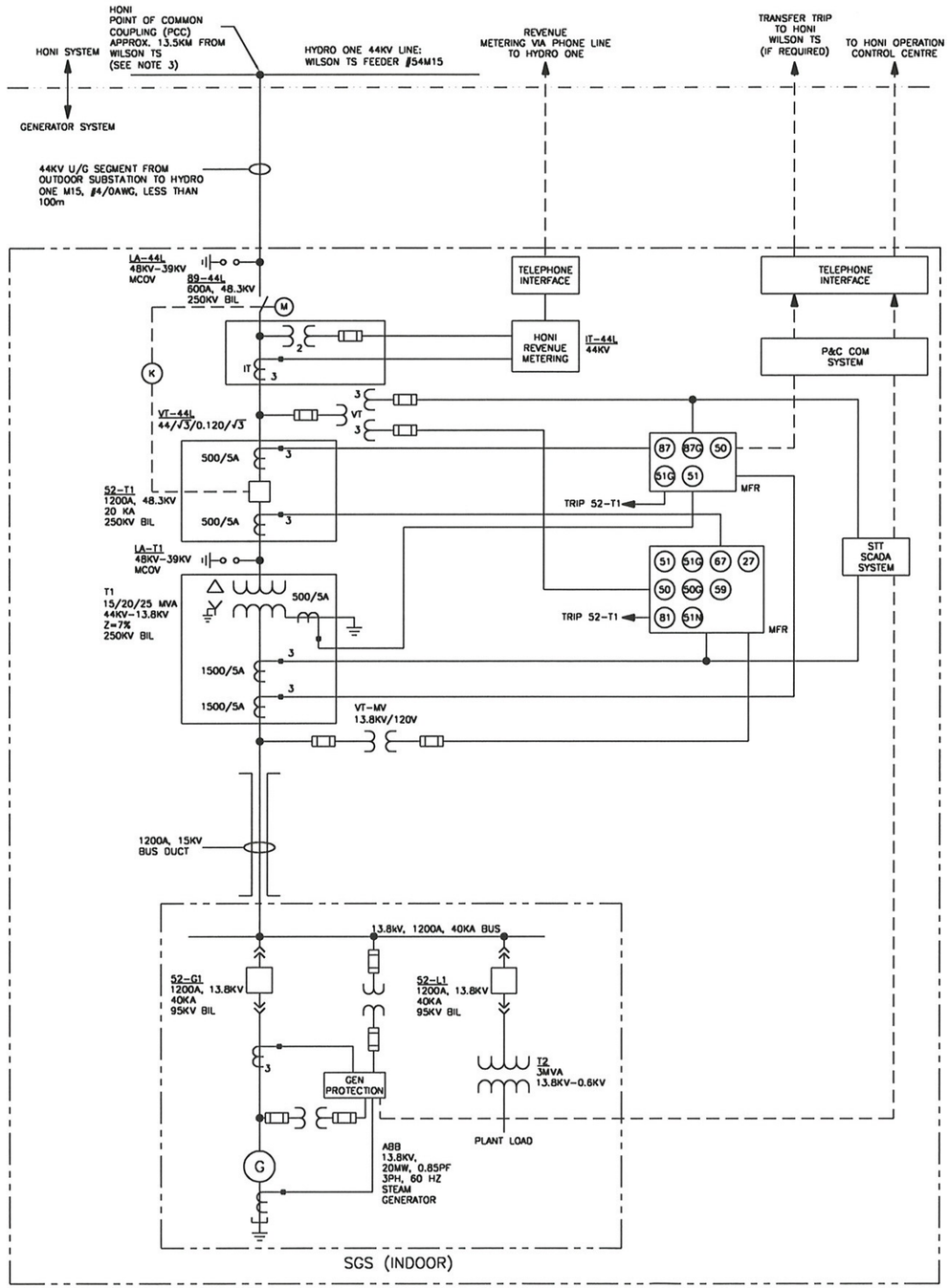
NEGATIVE SEQUENCE CURRENT CAPABILITY CURVE

AMS 1120SH 23529 kVA 60 Hz 0.85 PF 13800 V 984 A 1800 rpm



$(I_2/I_N)^2 \times t = 20.0s$ $I_N = 984$ A

ABB	ABB Automation Technologies	Document number XYK210094-EGB	Lang. en	Rev. ind. A	Sheet 5



LICENSED PROFESSIONAL ENGINEER
J. SEHOVIC
100101797
July 16/08
PROVINCE OF ONTARIO

NOTES:

1. MFR DENOTES "MULTI-FUNCTION RELAY".
2. PROTECTION AND CONTROL SCHEME WILL BE IN ACCORDANCE WITH "DISTRIBUTION SYSTEM CODE" AND "TECHNICAL REQUIREMENTS FOR GENERATORS CONNECTING TO HYDRO ONE DISTRIBUTION SYSTEM", VERSION AUGUST 2007 AND WILL BE COORDINATED WITH EXISTING PROTECTION AND CONTROL SCHEMES AT WILSON TS.
3. FINAL TERMINATIONS BY HYDRO ONE.

LEGEND

- DISCONNECT SWITCH
- MOTOR OPERATED LOAD BREAK SWITCH
- POWER TRANSFORMER
- POTENTIAL TRANSFORMER WITH TWO SECONDARY WINDINGS
- POTENTIAL TRANSFORMER WITH ONE SECONDARY WINDINGS
- CURRENT TRANSFORMER
- HIGH & MEDIUM VOLTAGE CIRCUIT BREAKER
- FUSE-LOAD BREAK SWITCH
- SURGE ARRESTER
- SGS STEAM GENERATOR STATION

No.	REVISIONS	DATE	INTLS
A	ISSUED WITH FORM "B" APPLICATION	JUNE 2008	

DESIGNED BY J.S.
DRAWN BY J.S.
CHECKED BY
APPROVED BY

STAMP

GENIVAR

DURHAM/YORK RESIDUAL WASTE STUDY

ELECTRICAL
SINGLE LINE DIAGRAM (13.8KV/44KV)
CLARINGTON #01

DATE : JUNE 2008
SCALE: N.T.S.
FILE No.: 5123-SK-E02
CONTRACT No.:
DRAWING No.: 5123-SK-E02

FRAME SIZE 566x801mm
DRAWING SIZE A1(595x841mm)
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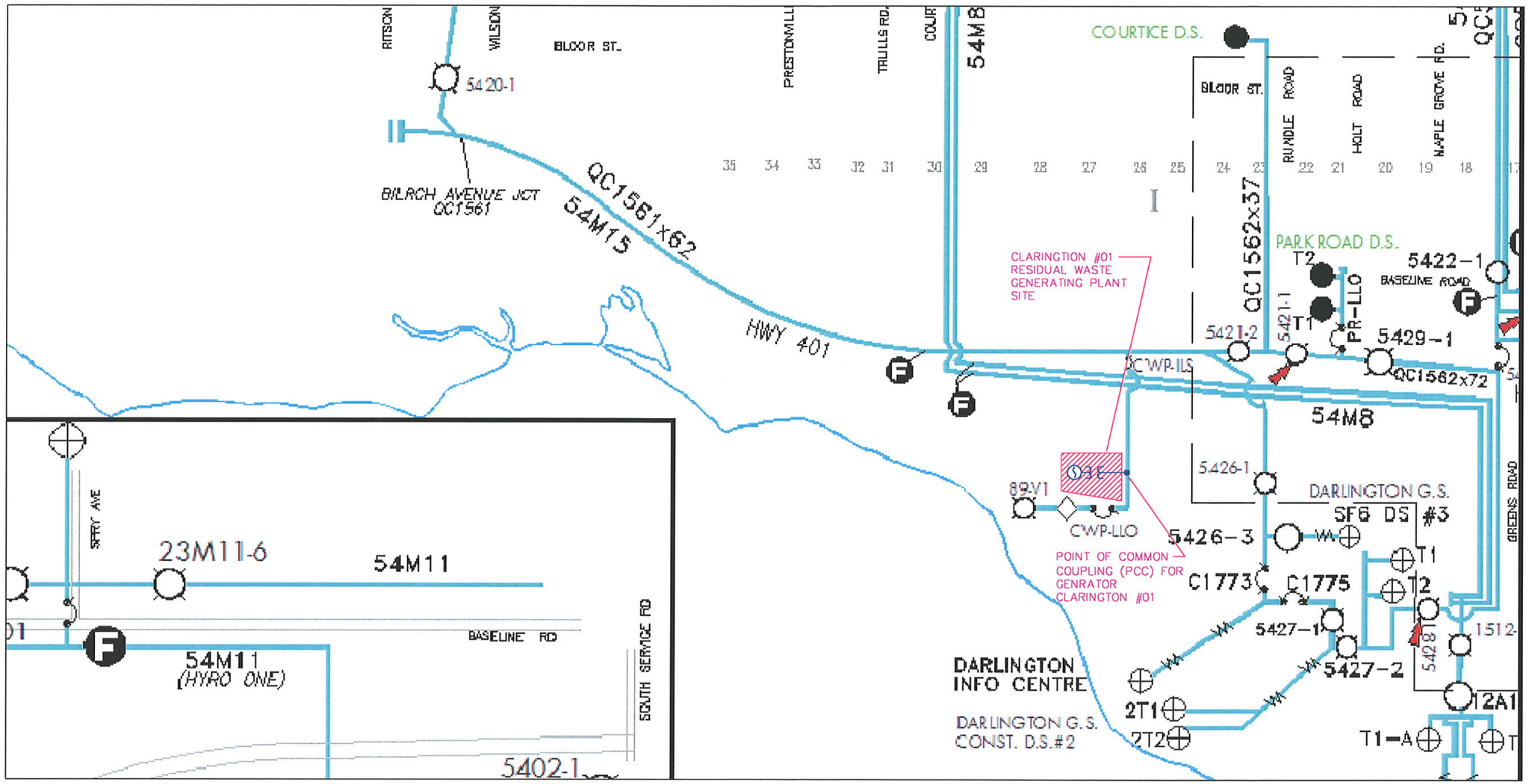
PLOT DATE: Jul 16, 2008-3:19pm BY:(psms sehovic)



No.	REVISIONS	DATE	INTLS
B	ISSUED WITH FORM "B" APPLICATION	JUNE 2008	
A	ISSUED WITH FORM "A" APPLICATION	AUG. 2007	

DESIGNED BY J.S.
DRAWN BY J.S.
CHECKED BY J.S.
APPROVED BY

STAMP

GENIVAR

DURHAM/YORK RESIDUAL WASTE STUDY

ELECTRICAL SITE PLAN
CLARINGTION #01
44kV GRID CONNECTION

DATE : JUNE 2008
SCALE: N.T.S.
FILE No.: 5123-E21
CONTRACT No.:
DRAWING No.: 5123-E-21

FRAME SIZE 566x801mm
DRAWING SIZE A1(595x841mm)
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PLOT DATE: Jun 09, 2008 - 2:55pm BY: (josna.sehovic)

CLARINGTON #1

THIS STUDY AGREEMENT made in duplicate as of the _____day of ____ month, 2008 between Hydro One Networks Inc. ("Networks") and THE REGIONAL MUNICIPALITY OF DURHAM (the "Generator")

WHEREAS:

A. the Generator intends to build a generating facility described as CLARINGTON #1, LOT#27, CLARINGTON, ON (the "Generating Facility") that would be connected to Networks' distribution system through the Generator's electrical system (the "Proposed Project");

B. the Generator has requested and Networks has agreed to conduct the Work with respect to the Proposed Project.

C. the Generator has requested and Networks has agreed to conduct the Work with respect to the Proposed Project; and

D. Networks has entered or will enter into an agreement with the Independent Electricity System Operator (the "IESO") to have the IESO prepare a Connection Assessment ("CA") under the IESO's Connection Assessment and Approval Process ("CAA").

NOW THEREFORE in consideration of the mutual covenants, agreements, terms and conditions herein and other good and valuable consideration, the receipt and sufficiency of which is hereby irrevocably acknowledged, the parties agree as follows:

1. In this Agreement, unless there is something in the subject matter or context inconsistent therewith, the following words shall have the following meanings:

"Actual Cost" means Networks' charge for equipment, labour and materials at Networks' standard rates plus Networks' standard overheads and interest thereon.

"Agreement" means this agreement together with Schedules "A", "B" and "C" attached hereto.

"Applicable Laws" means any and all applicable laws, including environmental laws, statutes, codes, licensing requirements, treaties, directives, rules, regulations, protocols, policies, by-laws, orders, injunctions, rulings, awards, judgments or decrees or any requirement or decision or agreement with or by any governmental or governmental department, commission board, court authority or agency.

"Good Utility Practice" means any of the practices, methods and acts engaged in or approved by a significant portion of the electrical utility industry in North America during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgement in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to optimum practice, method or act to the exclusion of all others, but rather to include all practices, methods or acts generally accepted in North America.

"Work" means the work to be conducted in accordance with the Scope of Work attached hereto as Schedule "A" and in accordance with the terms and conditions of this Agreement.

2. The recitals in this agreement are acknowledged as true and correct in substance and in fact and are hereby incorporated into and form part of this Agreement.

3. The Generator and Networks shall perform their respective obligations outlined in this Agreement in a manner consistent with Good Utility Practice and in compliance with all Applicable Laws.

4. In order for Networks to conduct the Work, the Generator, at its own cost and expense, shall provide Networks with the following information with respect to the Proposed Project:

(a) site Location Map(s) with suitable details of the Generating Facility, line routing and the proposed connection to Network's distribution facilities;
(b) the information listed in Schedule "B"; and
(c) any other information as may be required and requested by Networks in order to conduct the Work.

5. Networks shall complete the Work by no later than 90 calendar days after the latter of: (a) the Generator executing this Agreement; (b) the Generator paying Hydro One the amount specified in Section 7; and (c) the Generator providing the information described in Section 4. Should the Generator make any changes to the information provided in accordance with Section 4 above after Networks has commenced the Work, and those changes result in an increase in the cost of or the time required for Networks performance of the terms of this Agreement or otherwise affect any other provision of this Agreement, Networks may make an equitable adjustment to Networks' compensation under Section 7 and any other provision of this Agreement which is thereby affected. The Generator agrees to pay Networks any amounts invoiced in accordance with this Section 7 by no later than 30 days following receipt of the invoice.

6. The Generator acknowledges and agrees that:

a. the Generator is responsible for contacting the IESO to have them conduct a System Impact Assessment (SIA). Furthermore, the Generator is responsible for any resulting

requirements that come from the IESO's review of the dynamic studies that were not part of the IESO System Impact Assessment including, but not limited to any changes required to be made to the Work as a consequence of such review;

b. should the Proposed Project proceed, an agreement must be executed by the Generator and Networks to address the terms and conditions (which may include capital contribution and revenue guarantee requirements) of Networks performing the work required in order to provide for the connection of the Generating Facility prior to Networks initiating any modifications to Networks' facilities or purchasing any equipment;

c. the Generator will be responsible for ensuring that the Generating Facility and the Proposed Project complies with all Applicable Laws;

d. all right, title and interest, including copyright ownership, to all information and material of any kind whatsoever (including, but not limited to the work product developed as part of the Work) that may be developed, conceived and/or produced by Networks during the performance of this Agreement is the property of Networks and the Generator shall not do any act that may compromise or diminish Networks' interest as aforesaid;

e. the Generator will be responsible to rectify at its expense, any negative impacts that the connection of the Generating Facility and operation of the Generating Facility following connection may have on Networks' distribution system (the "Distribution System") in accordance to the satisfaction of Networks;

The negative impacts can include, but is not limited to the impacts on safety, reliability, efficiency, power factor and power quality (voltage disturbances, voltage flicker, or objectionable harmonics on the Distribution System or on other distribution connected customers' electrical and communication systems).

f. the Generator will also be responsible to rectify at its own expense any negative impacts that the connection of the Generating Facility and operation of the Generating Facility following connection may have on the IESO-controlled grid (as that term is defined in the *Electricity Act, 1998 (Ontario)*;

g. the Generator is responsible for obtaining all applicable approvals required by the IESO for the connection of the Generating Facility to Networks' distribution system;

h. that Networks will not normally change its feeder operating, protection and reclosing practice to accommodate the connection of the Generating Facility, since this would be detrimental to the existing customers connected to these feeders; and

i. the Generator agrees that it will provide a deposit to the IESO for the IESO studies in relation to the Proposed Project. In the event that the IESO refunds part of the deposit to Networks, Networks will refund such funds to the Generator within 30 days of receipt by Networks. In the event that the IESO studies cost more than the deposit, the Generator agrees that it will pay the additional costs of such studies as invoiced by the IESO; and

j. Networks performs the Work based on the system conditions at the time the Work is performed, should there be any changes to system conditions between the time that Networks completes the Work and when the Generator proposes to connect the Proposed Project, the Work may have to be revised at the Generator's expense at that time.

k. although there may be one or more other proposed generation connection projects that are ahead of the Proposed Project in the queue for connection at the Proposed Connection Point, the Generator has requested that Hydro One perform the Work as if there is available capacity at the Proposed Connection Point. If one or more of the other proposed projects ahead of the Proposed Project in the queue use the remaining capacity available at the Proposed Connection Point, the Generator acknowledges and agrees that the Work will have to be re-performed at the Generator's expense once the Generator selects another connection point.

7(a). The Generator shall provide Networks the sum of $6,000.00 (plus GST) for the Work upon the execution of this Agreement.

(b) Invoiced amounts are due 30 days after invoice issuance. All overdue amounts, including but not limited to, amounts that are not invoiced but required under the terms of this Agreement to be paid in a specified time period, shall bear interest at 1.5% per month compounded monthly (19.56 percent per year) for the time they remain unpaid.

8. Except as provided herein, Networks makes no representation or warranty, express, implied, statutory or otherwise, including, but not limited to, any representation or warranty as to the merchantability or fitness of the Work or any part thereof for a particular purpose.

9. Networks shall only be liable to the Generator for damages that arise directly out of the negligence or the willful misconduct of Networks in meeting its obligations under this Agreement.

Notwithstanding the foregoing, Networks shall not be liable under any circumstances whatsoever for any loss of profits or revenues, business interruption losses, loss of contract or loss of goodwill, or for any indirect,

consequential, incidental or special damages, including but not limited to punitive or exemplary damages, whether any of the said liability, loss or damages arise in contract, tort or otherwise.

In any event, the total liability of Networks to the Generator for any claim for damages will not exceed the amounts paid by the Generator under the terms of this Agreement.

This Section 9 shall survive the termination of this Agreement.

10. Neither party shall be considered to be in default in the performance of its obligations under this Agreement, except obligations to make payments with respect to amounts already accrued, to the extent that performance of any such obligation is prevented or delayed by any cause, existing or future, which is beyond the reasonable control of, and not a result of the fault or negligence of, the affected party ("Force Majeure") and includes, but is not limited to, strikes, lockouts and any other labour disturbances.

If a party is prevented or delayed in the performance of any such obligation by Force Majeure, such party shall immediately provide notice to the other party of the circumstances preventing or delaying performance and the expected duration thereof. Such notice shall be confirmed in writing as soon as reasonably possible. The party so affected by the Force Majeure shall endeavour to remove the obstacles which prevent performance and shall resume performance of its obligations as soon as reasonably practicable, except that there shall be no obligation on the party so affected by the Force Majeure where the event of Force Majeure is a strike, lockout or other labour disturbance.

11. Each party agrees that no portion of this Agreement shall be interpreted less favourably to either party because that party or its counsel was primarily responsible for the drafting of that portion.

12. No amendment, modification or supplement to this Agreement or any waiver shall be valid or binding unless set out in writing and executed by the parties with the same degree of formality as the execution of this Agreement.

13. This Agreement shall be construed and enforced in accordance with, and the rights of the parties shall be governed by, the laws of the Province of Ontario and the laws of Canada applicable therein, and the courts of Ontario shall have exclusive jurisdiction to determine all disputes arising out of this Agreement.

14. This Agreement may be executed in counterparts, including facsimile counterparts, each of which shall be deemed an original, but all of which shall together constitute one and the same agreement.

15. Notwithstanding the terms of Schedule "C", the Generator acknowledges and agrees that Networks may publish on its web site for public viewing, the following information:

- Queue Position #;
- Date of Connection and Cost Recovery Agreement used for Queue Position or OPA contract date;
- Your Name
- Location (TS & Feeder) of the Proposed Project
- Proposed Size (MW)
- In-service Date (Q,Yr)
- Status of this Agreement or CCRA status (Active or complete)

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by the signatures of their proper officers, as of the day and year first written above.

HYDRO ONE NETWORKS INC.

_____

Bob Singh
Manager – Generator Connections
I have the authority to bind the corporation

INSERT CORPORATE NAME OF THE GENERATOR
THE REGIONAL MUNICIPALITY OF DURHAM

_____

Name: **CLIFF CURTIS**
Title: **COMMISSIONER OF PUBLIC WORKS**
I have the authority to bind the corporation

CLARINGTON #1

SCHEDULE "A": Scope of Work

General Description:

Networks will prepare a Connection Impact Assessment for the connection of the proposed generation project and review the feasibility of the proposed connection arrangement.

Specific Requirements:

1.0 Connection Impact Assessment

1.1 Networks will conduct and provide a Connection Impact Assessment to determine the feasibility of connecting the Generating Facility to Networks' distribution system. The Connection Impact Assessment will review the impact of the Proposed Project on Networks' Distribution facilities and Networks' Transmission System.

1.2 Networks will review the Generator's detailed Single Line Diagram (SLD) and provide comments with regard to interface connection items.

Note: The purpose of Networks review of the Generator's SLD and other information is to establish that the Generator's electrical interface design meets Networks' minimum requirements to permit the initial connection of the Generating Facility to Networks' distribution system. It is Generator's responsibility to ensure that its Generating Facility causes no negative impacts to Networks' distribution system or other customers of Networks.

1.3 Networks will advise the Generator of site specific requirements, for each of the alternative connections that are identified by the Connection Impact Assessment.

1.4 Networks will describe the necessary modifications to Networks' Transmission System and distribution facilities based on Networks' review of the Proposed Project in order to permit the connection of the Generating Facility to Networks' distribution system.

SCHEDULE "B":

The Generator must complete Networks' information package (Form B or equivalent).

The Generator must submit this information before Networks can begin the Connection Impact Assessment.

The completed **Networks' information package (Form B or equivalent)** must be signed by a Professional Engineer licensed in Ontario.

SCHEDULE "C":

CONFIDENTIALITY TERMS

1. For the purposes of this Schedule "C", the following definitions will apply:

a) "Confidential Information" means all information whether transmitted orally, electronically or in written form, relating to the Proposed Project which a party or its Representatives may receive or have received in the course of the Work and which contain or otherwise disclose information which the other party reasonably claims as confidential or proprietary, including, but not limited to, Networks' distribution system or transmission system design and system specifications. For further clarity, all requests for information made by a party to the other party are Confidential Information.

b) "Person" shall include individuals, trusts, partnerships, firms and corporation or any other legal entity.

c) "Representative" means (i) a person controlling or controlled by or under common control of a party and each of the respective directors, officers, employees and independent contractors of a party and such party's Representative, (ii) any consultants, agents or legal, financial or professional advisors of a party or such party's Representative and (iii) in the case of Generator, any institution providing or considering providing financing for the Generating Facility, including such institutions directors, officers, employees and independent contractors or its consultants, agents or legal, financial or professional advisors.

2. **Disclosure of Confidential Information**

Pursuant to the terms and conditions contained herein, a party may disclose Confidential Information to the other party solely for the purpose of the Proposed Project or the Work. Notwithstanding such disclosure the Confidential Information shall remain the sole and exclusive property of the disclosing party and as such shall be maintained in confidence by the receiving party using the same care and discretion to avoid disclosure as the receiving party uses with its own similar information that it does not wish to disclose. The receiving party may disclose Confidential Information to its Representatives pursuant to Section 4 below but may not use or disclose it to others without the disclosing party's prior written consent. Notwithstanding the generality of the foregoing, all intellectual property rights which may subsist in the Confidential Information shall remain with the disclosing party. The receiving party shall not use the confidential information for any purposes other than the Proposed Project or the Work without the disclosing party's prior written consent.

3. **Information that is not Confidential**

Confidential Information shall not include information which:

(a) is previously known to or lawfully in the possession of the receiving party prior to the date of disclosure as evidenced by the receiving party's written record;
(b) is independently known to or discovered by the receiving party, without any reference to the Confidential Information;
(c) is obtained by the receiving party from an arm's length third party having a bona fide right to disclose same and who was not otherwise under an obligation of confidence or fiduciary duty to the disclosing party or its Representatives;
(d) is or becomes publicly available through no fault or omission of, or breach of this Schedule "C" by, the receiving party or its Representatives;
(e) is disclosed by the disclosing party to another entity without obligation of confidentiality;
(f) is required to be disclosed by the disclosing party in order to comply with any legislative or regulatory requirements including but not limited to, the requirements of the Independent Electricity System Operator; or
(g) is required to be disclosed on a non-confidential basis pursuant to a judicial or governmental order or other legal process as described in Section 6 or as set forth in Section 5.

4. **Disclosure to Representatives**

Confidential Information shall only be disclosed to Representatives who need to know the Confidential Information for the purposes of the Proposed Project or the Work. Except in the case of officers, directors or employees, Confidential Information may only be disclosed to Representatives where the receiving party has an agreement in place with those Representatives sufficient to obligate them to treat the Confidential Information in accordance with the terms hereof. The receiving party hereby specifically acknowledges that it shall be solely responsible to ensure that its Representatives comply with the terms of this Schedule "C" and that the receiving party shall defend, indemnify and hold harmless the disclosing party from and against all suits, actions, damages, claims and costs arising out of any breach of this Schedule "C" by the receiving party or any of its Representatives.

5. **Compelled Disclosure**

In the event that a receiving party, or anyone to whom a receiving party transmits Confidential Information pursuant to this Schedule "C" or otherwise, becomes legally compelled to disclose any Confidential Information, the receiving party will provide the disclosing party with prompt notice so that the disclosing party may seek injunctive relief or other appropriate remedies. In the event that both parties are unable to prevent the further transmission of the Confidential Information, the receiving party will, or will use reasonable efforts to cause such person to whom the receiving party transmitted the Confidential Information to furnish only that portion of the Confidential Information, which the receiving party is advised by written opinion of counsel is legally required to be furnished by the receiving party, to such person and exercise reasonable efforts to obtain assurances that confidential treatment will be afforded to that portion of the Confidential Information so furnished.

6. Records with respect to Confidential Information

The receiving party shall keep all written or electronic confidential information furnished to or created by it. All such Confidential Information, including that portion of the Confidential Information which consists of analyses, compilations, studies or other documents prepared by the receiving party or by its Representatives, is the disclosing party's property and will be returned immediately to the disclosing party or destroyed upon its request and the receiving party agrees not to retain any copies, extracts or other reproductions in whole or in part. If a receiving party does not receive a request to return Confidential Information to the disclosing party within six months of the last communication between the parties concerning the Proposed Project or the Work then the receiving party shall destroy any Confidential Information it holds.

Notwithstanding the foregoing and provided that the Proposed Project is connected to Networks' transmission system, Networks shall have the right to retain such electrical information concerning the Proposed Project that it has received from the Generator or its Representatives for the purpose of Networks making the required calculations and decisions related to the design, operation, and maintenance of Networks' facilities and those for any other person that may connect or is considering connecting to Networks' transmission system that could be impacted by the Proposed Project.

7. Remedies

The receiving party agrees that the disclosing party would be irreparably injured by a breach of this Schedule "C" and that the disclosing party shall be entitled to equitable relief, including a restraining order, injunctive relief, specific performance and/or other relief as may be granted by an court to prevent breaches of this Schedule "C" and to enforce specifically the terms and provision hereof in any action instituted in any court having subject matter jurisdiction, in addition to any other remedy to which the disclosing party may be entitled at law or in equity in the event of any breach of the provisions hereof. Such remedies shall not be deemed to be the exclusive remedies for a breach of this Schedule "C" but shall be in addition to all other remedies available at law or equity.

8. Term

This Agreement shall be effective as of the date of this Agreement and shall remain in force and effect for a period of three (3) years thereafter, unless modified by further written agreement of the parties.

System Impact Assessment Application (IESO)/ Customer Impact Assessment Application (Hydro One) for Generation Facilities

Submit this form by email, courier or fax[1] to the following address:

Independent Electricity System Operator 655 Bay Street, Suite 410 P.O. Box 1 Toronto, ON M5G 2K4 Attn: Connection Assessments Fax number: (905) 855-6372 connection.assessments@ieso.ca	**Hydro One Networks Inc.** 483 Bay Street Toronto, ON M5G 2P5 Attn: Generation Connections Fax number: (416) 345-6029 txgen.connect@hydroone.com

Subject: ***Impact Assessment Application for Generation Facilities***

All information submitted in this process will be used by the Independent Electricity System Operator ("IESO") and Hydro One Networks Inc. ("Hydro One") solely in support of their obligations under the *Electricity Act, 1998*, the *Ontario Energy Board Act, 1998,* the *Market Rules*, the Transmission System Code and associated policies, codes, standards and procedures and their licences. All information submitted will be treated in accordance with the IESO's and Hydro One confidentiality policies. The undersigned consents to the sharing of all such information between the IESO and Hydro One.

Since complete data may not yet be available for this Project, the accompanying data sheets have been modified to identify those data that are essential for the IESO and Hydro One to be able to undertake the Assessment. The data sheets also identify those data for which the IESO or Hydro One will use appropriate values should the Applicant not provide suitable data.

Whenever it is necessary for the IESO or Hydro One to use typical (generally conservative) values for the Assessment of the Connection Application, then it will be the responsibility of the Applicant to ensure that the equipment that is eventually installed meets or exceeds these values.

NOTE: This is not an LDC Connection Impact Assessment application form.

PART 1 – GENERAL INFORMATION

Organization Name (Generator):Regional Municipality of Durham
Organization Short Name: (Maximum 12 keystrokes) Durham
Project Name: Clarington #1
Location of Project: Clarington, ON

[1] A faxed application will only be accepted when the deposit is submitted by electronic wire payment or electronic direct deposit to the *IESO* account.

Generator Customer / Proponent	
Name: Greg Borchuk	
Position/Title: Project Manager	
Company: Regional Municipality of Durham	
Address: 605 Rossland Road East, P.O. Box 623	
City/Town: Whiby	
Province/State: Ontario	
Postal/Zip Code: L1N 6A3	Country: Canada
Fax No.: (905) 668-7494	
Email Address: greg.borchuk@region.durham.on.ca	
Hydro One Account Number: N/A (Only for existing customers intending to install generation for load displacement.)	

Contact (Consultant)	
Name: Jasna Sehovic	
Position/Title: Electrical Engineer	
Company: Genivar	
Address: 600 Cochrane Drive, Suite 500,	
City/Town: Markham,	
Province/State: ON	
Postal/Zip Code: L3R 5K3	Country: Canada
Telephone No.: (905) 475-7270	Fax No.: (905) 475-5994
E-mail Address: jasna.sehovic@genivar.com	

PART 3A – PAYMENT OF $30,000 DEPOSIT TO IESO

Method of Payment (choose one)

☐ Certified cheque payable to the IESO	☐ Attached
☐ Deposit to IESO Account	☐ Receipt Attached
☐ Electronic Wire Payment to IESO Account	☐ Receipt Attached

For direct deposit or electronic wire payments, reference the following IESO account:

TD Bank, Institution ID # 0004, Transit # 10202, Account # 0690-0429444

PART 3B – PAYMENT TO HYDRO ONE

Payment to Hydro One along with the terms and conditions will be outlined in the Study Agreement, which will be discussed with the generator upon receipt of the application form. Cost for the Customer Impact Assessment will be based on generator capacity and connection configuration.

PART 4 – CERTIFICATION

The undersigned hereby declares that the information contained in and submitted in support of this document is, to the best of the connection applicant's knowledge, complete and accurate. By signature the connection applicant agrees that information may be provided to any affected transmitter(s) other than Hydro One and posted on the *IESO* Web site as stipulated in the applicable Market Manual pertaining to connection assessment and approval.

Name (Please Print)	Title
Signature	Date

PART 5 – FOR IESO USE ONLY

Received by:_____	Date Received:_____
Payment Received with Application (Y/N):	CAA ID Number:_____

Generic Information

Bold-Italic	Essential
	Typical values will be assumed if data not provided
	Only required upon request

Facility Type	***Specify if generation facility will be registered as self-scheduled, intermittent or dispatchable.***	TBD
Intent of Generation	***Specify if the facility will be used as load displacement or for sale of electricity.***	**FOR SALE OF ELECTRICITY**
Project Dates	***Start of construction***	**Q2 2010**
	Electrical backfeed (energized stations)	Q1 2013
	In-service dates (first synchronization of each unit)	Q1 2013
	Permanent in-service date	Q2 2013
Protection System Description	***An overview of the protective relaying schemes to be employed together with an explanation of the manner in which they are to be deployed.***	Attach File [1]
Operating Philosophy	***An overview explaining how the facility will be operated outlining possible operating modes. Include details on start-up and maintenance outages.***	Attach File
Detailed Single-Line Diagram(s)	***A detailed single-line diagram showing the equipment and the protection and telemetry points. The locations of the proposed connections on to existing lines, or into existing transformer/ switching stations, are also to be included.*** ***Details are to be included of any existing facilities that are to be replaced or removed from service. Out-of-service dates are to be provided whenever these do not coincide with the in-service dates for the new facilities.*** ***Provide details of LDCs between the generator and the transmission system.***	Attach File [1]
Geographic Map including GPS Coordinates	***A large-scale map or drawing showing the location of the exact point of the proposed interconnection with Hydro One facilities (or other transmitters including lot number and concession number for the project).*** ***Attachments for wind farm projects must include the configuration and grouping of individual units, including GPS coordinates of each turbine, physical dimensions and turbine nomenclature.***	Attach File [1]
Control Schemes	***Describe any control schemes that are to be used to automatically change the tap positions for any of the transformers, or to automatically switch into-service or out-of-service any reactive compensation devices.***	Attach File [1]

1) All files and diagrams provided as attachments are to be signed and sealed by a Professional Engineer.

Generation Facilities

Bold-Italic	Essential
	Typical values will be assumed if data not provided
	Only required upon request

Unit Data **Complete one table for each different type of generator**	***Number and identifier of identical units (e.g., 3 units - G1, G2, G3)***							1 unit G1	
	Manufacturer							ABB	
	Type (e.g. salient pole, round rotor, induction, inverter based, e.g. solar)							ROUND ROTOR	
	Frequency (Hz)							60	
	Speed (RPM)							1800	
	Machine base (MVA)							23.529	
	Rated voltage (kV)							13.8	
	Power Factor							0.85	
	Maximum Continuous Rating (MCR)	***(MW) - summer at 35°C*** [1]						20	
		(MW) - winter at 10°C						20	
	Capability above MCR (MW), sustainability per event (hrs)								
	NERC Unit type	Refer to Table below						ST	
	NERC Status								
	NERC Cooling Water Source								
	NERC Fuel Type (primary, alternate)	Refer to Table below						OT	
	NERC Fuel Transportation (primary, alternate)								
	NERC primary fuel heat rate at full load (BTU/kWhr)								
	Unsaturated reactances in pu based on machine base (Xo required only if unit transformer provides a zero sequence path)								
	Xd	***X'd***	***X''d***	***Xq***	***X'q***	***Xl***	***X_2***	***Xo***	
	118%	21.8%	14.2%	65%			15.4%	6.2%	
	Open circuit time constants (s)								
	T'do	***T''do***	***T'qo***	***T''qo***					
	6.08								
	Station load (MW, Mvar)							2.5MW	
	Minimum power (MW)								
	Normal loading and unloading ramp rates (MW/min)								
	Emergency loading and unloading ramp rates (MW/min)								
	Armature (Ra) and field resistance (Rfd [2]***) (Ohms)***							0.16	
	Total rotational inertia of generator and turbine(s)							41,155lb ft^sq (generator)	
	Saturation at rated voltage (S1.0) and 20% above (S1.2)							attachm.#5	page 2/5
	Damping								
	Base field current (A)							534	
	Base field voltage (volts)							118	
	Losses at 1.0 and 0.9 power factor (MW)								
Characteristics (must be provided for each different type of generator)	***Open circuit saturation curve***							Attach File	
	Short circuit curve							Attach File	
	V curves							Attach File	
	Capability curve							Attach File	

1 If the location of the project is north of the City of Barrie, then provide summer ratings based on 30°C and 4 kph wind speed

2 Field resistance should be specified at 75°C for hydro-electric units and at 100°C for thermal units.

Generation Facilities (continued)

EXCITATION SYSTEM MODEL

A block diagram suitable for stability studies or an IEEE standard model type with all in-service parameter values for the exciter. Models for stabilizers, under-excitation limiters, and over-excitation limiters shall be provided where applicable.	For each unit 10 MVA or larger

GOVERNOR AND PRIME MOVER SYSTEM MODEL

A block diagram suitable for stability studies or an IEEE standard model type with all in service parameters values for the governor and prime mover (turbine). More detailed models would be required if off-nominal frequency or shaft torsional studies are required.	For each unit 10 MVA or larger

NERC UNIT TYPE

AB	Atmospheric Fluidized Bed Combustion		IG	Integrated Coal Gasification Combined Cycle	
CA	Combined Cycle	Steam Turbine with supplemental firing	JE	Jet Engine	
CC		Total Unit (use only for such units that are in planning stages)	NB	Steam Turbine	Boiling Water Nuclear Reactor
CD	CANDU		NG		Graphite Nuclear Reactor
CE	Compressed Air Energy Storage		NH		High-temperature Gas-Cooled Nuclear Reactor
CH	Steam Turbine		NP		Pressurised Water Nuclear Reactor
CS	Combined Cycle	Single Shaft (gas turbine & steam turbine share a single generator	OC	Ocean Thermal Turbine	
CT		Combustion Turbine Portion	PB	Pressurised Fluidised Bed Combustion	
CW		Steam Turbine – Waste Heat Boiler only	PS	Hydraulic Turbine Reversible – Pumped Storage	
FB	Fluidised Bed Combustion		PV	Photovoltaic	
FC	Fuel Cell – Electrochemical		SS	Steam Turbine	Solar
GE	Steam Turbine – Geothermal		ST		Boiler – Non-nuclear
GT	Combustion Turbine – Gas Turbine		VR	Various Types	
HL	Hydraulic Turbine	Pipeline	WT	Wind Turbine	
HY		Conventional	OT	Other (describe in notes)	
IC	Internal Combustion (diesel, piston)		NA	Unknown at this time	

Generation Facilities (Continued)

NERC FUEL TYPES

ANT	Anthracite	PET	Petroleum - Generic
BFG	Blast-Furnace Gas	PC	Petroleum Coke
BIO	Biomass - Generic	PL	Plutonium
BIT	Bitumous Coal	PRO	Propane
COG	Coke-Oven Gas	REF	Refuse, Bagasse, of Other Non-wood Waste
COL	Coal – Generic	RG	Refinery Gas
COM	Coal-Oil Mixture	RRO	Re-Refined Motor Oil
CWM	Coal-Water Mixture	SNG	Synthetic Natural Gas (Coal Gasification)
CRU	Crude Oil	STM	Steam
FO1	No. 1 Fuel Oil	SUB	Sub-bituminious Coal
FO2	No. 2 Fuel Oil	SUN	Solar
FO3	No. 3 Fuel Oil	TH	Thorium
FO4	No. 4 Fuel Oil	TOP	Topped Crude Oil
FO5	No. 5 Fuel Oil	UR	Uranium
FO6	No. 6 Fuel Oil	WAT	Water
GAS	Gas – Generic	WC	Waste Coal (culm)
GST	Geothermal Steam	WD	Wood & Wood Waste
JF	Jet Fuel	WH	Waste Heat
KER	Kerosene	WND	Wind
LIG	Lignite	OT	Other (describe under 'Notes')
LNG	Liquefied Natural Gas	NA	Not Available
LPG	Liquefied Propane Gas	ZZ	Fuel brought to the plant site that is converted before the combustion process, such as for a coal gasification system. To be identified as Type ZZ, and explained in a footnote
MF	Multi-fuel (two or more fuels burned simultaneously, not as a mixture)		
MTE	Methane		
MTH	Methanol	ZZF	Orimulsion ™ water emulsified bitumen used in New Brunswick Power's Dalhousie units.
NG	Natural Gas		

Connection (Transmission) Facilities

Bold-Italic	Essential
	Typical values will be assumed if data not provided
	Only required upon request

If the connection from the generator to the transmitter consists of different sections, then the applicant must complete a table for each overhead circuit section and for each underground circuit section.

Provide a detailed single line diagram of the connection facilities.

Transmission connection	***Point of connection to IESO controlled grid (circuit operating nomenclature or terminal station name)***			N/A - Distribution Connections		
Overhead circuit section Complete one table for each overhead circuit section	***Identifier (to be provided on drawing)***					
	Voltage (kV)					
	Length (km)					
	Phase conductor size (kcmil)					
	Phase conductor type (ASC,ACSR) [1]					
	Phase conductor stranding (# of Al strands/ # of Steel strands)					
	Phase conductors per bundle and spacing (m)					
	Geometry of all phase and sky wires for each tower type					
	Ground resistivity (ohms)					
	Skywire size (kcmil)					
	Skywire type (Alumoweld, EHS, HS) [1]					
	Skywire stranding (# of Al strands/ # of Steel strands)					
	Skywire number if more than one					
	Positive sequence impedance (R, X, B)					
	Zero sequence impedance (Ro, Xo, Bo)					
	Winter thermal ratings at 10°C and 4 kph wind speed (A)					
	Continuous - *operating temperature of 93°C*	***Long term emergency*** - *127°C or sag temperature, whichever is lower*	***15-Minute*** - *sag temperature*			
	Summer thermal ratings at 35°Cand 4 kph wind speed (A) [2]					
	Continuous - *operating temperature of 93°C*	***Long term emergency*** - *127°C or sag temperature, whichever is lower*	***15-Minute*** - *sag temperature*			

1 If the conductor type is new then additional information may be required.

2 If the location of the project is north of the City of Barrie, then provide summer ratings based on 30°C and 4 kph wind speed

Connection (Transmission) Facilities (cont)

Bold-Italic	Essential
	Typical values will be assumed if data not provided
	Only required upon request

Underground Circuit Section Complete one table for each underground circuit section	***Identifier (to be provided on drawing)***		N/A - Distribution Connections		
	Voltage (kV)				
	Length (km)				
	BIL rating				
	Phase conductor size (kcmil)				
	Phase conductor type [1]				
	Insulation type				
	Semiconductor shield type				
	Shield grounding				
	Metallic sheath type				
	External layer type				
	Geometry of all phases				
	Ground resistivity (ohms)				
	Cable construction				
	Installation type (e.g. direct buried, in duct, etc.)				
	Positive sequence impedance (R, X, B)				
	Zero sequence impedance (Ro, Xo, Bo)				
	Continuous, 15-Minute and 24-Hour thermal ratings (A)	***Winter***			
		Summer			

Main Buses Complete one table for each bus	***Identifier (to be provided on drawing)***	
	Terminal Station	
	Summer continuous (A)	
	Winter continuous (A)	
	Maximum operating temperature (°C)	
	Conductor size (kcmil)	
	Conductor type (ASC,ASCR,Al tube)	

1 If the conductor type is new then additional information may be required.

Connection (Transmission) Facilities (cont)

Bold-Italic	Essential
	Typical values will be assumed if data not provided
	Only required upon request

Transformers Complete one table for each transformer	***Number and Identifier of identical units (e.g., 3 units - T1, T2, T3)***		N/A - Distribution Connections				
	Station						
	Manufacturer						
	Configuration (e.g. 3 phase or three single phase)						
	Cooling types (e.g. ONAN, ONAF, OFAF)						
	Associated Thermal Rating for each cooling type (MVA)						
	Winter (10°C) continuous, 10-Day and 15-Minute thermal ratings	(A)					
		(MVA)					
	Summer (35°C) continuous,10-Day , and 15-Minute thermal ratings [1]	(A)					
		(MVA)					
	Connection for each winding H, X, Y (e.g. wye, delta, zig-zag)						
	Rated voltage for each winding, e.g. HV, LV, tertiary (kV)						
	Rated capability for tertiary winding, if applicable (A, MVA)						
	Impedance to ground for each winding H, X, Y (ohms) Indicate: U – ungrounded or R – Resistance; X – Reactance (e.g. 16 R)						
	Off–load tap positions (kV)						
	On-load taps (max tap (kV), min tap (kV), number of steps)						
	In-service off-load tap position (kV)						
Positive Sequence Impedance	(see IEEE C57.12.90 for measurement techniques)	Positive Sequence Impedance (%)	HX		HY		XY
		R					
		X					
		Base MVA					
Zero Sequence Impedance (only required for transformers with 1 or 2 external neutrals)	H winding energized all others open	Closed Tertiary	H		X	HX	XH
		R					
		X					
		Base MVA					
	H winding energized X winding shorted	Open Tertiary	H		X	HX	XH
		R					
		X					
		Base MVA					

1 If the location of the project is north of the City of Barrie, then provide summer ratings based on 30°C and 4 kph wind speed

Connection (Transmission) Facilities (cont)

Bold-Italic

Essential
Typical values will be assumed if data not provided
Only required upon request

Shunt Capacitors Complete one table for each type of shunt capacitor	***Identifier***	N/A - Distribution Connections
	Station	
	Manufacturer	
	Rated voltage (kV)	
	Rated capability (Mvar)	
	Discharge time (s)	
	Current limiting reactor (mH or Ω)	
	Bank arrangement (e.g. delta, wye, double-wye, etc)	
	Description of automatic switching	Attach File
	Anticipated switching restrictions	Attach File
Shunt Reactors Complete one table for each type of shunt reactor	***Identifier***	
	Station	
	Manufacturer	
	Rated voltage (kV)	
	Rated capability (Mvar)	
	Winding configuration (e.g. delta, wye)	
	Description of automatic switching	Attach File
	Description of anticipated switching restrictions	Attach File

Connection (Transmission) Facilities (cont)

Bold-Italic	Essential
	Typical values will be assumed if data not provided
	Only required upon request

Circuit Breakers Complete one table for each type of circuit breaker	***Identifier***	N/A - Distribution Connections
	Station	
	Manufacturer	
	Maximum continuous rated voltage (kV)	
	Interrupting time (ms)	
	Interrupting media (e.g. air, oil, SF_6)	
	Rated continuous current (A)	
	Rated symmetrical and asymmetrical short circuit capability (kA)	
Circuit Switchers Complete one table for each type of circuit switcher	***Identifier***	
	Station	
	Manufacturer	
	Maximum continuous rated voltage (kV)	
	Interrupting time (ms)	
	Interrupting media (e.g. air, oil, SF_6)	
	Rated continuous current (A)	
	Rated symmetrical short circuit capability (kA)	
Disconnect Switches Complete one table for each type of disconnect switch	Identifier	
	Station	
	Manufacturer	
	Maximum continuous rated voltage (kV)	
	Continuous current rating (amps)	
Wavetraps	Identifier	
	Station	
	Manufacturer	
	Serial number	
	Continuous current rating (amps)	
DC Lines	***Identifier***	
	Complete steady state (loadflow) parameters and dynamic parameters	
FACTS Devices (e.g., dynamic reactive devices, series compensation, etc.)	***Identifier***	
	Complete steady state (loadflow) parameters and dynamic parameters	

LDC Facilities for Embedded Generation

Bold-Italic	Essential
	Typical values will be assumed if data not provided
	Only required upon request

Provide the following information for each LDC existing between the new facility point of connection and the transmitter facilities.

Provide a detailed single line diagram of the connection facilities.

Transmission connection	***Point of connection to Transmitter (circuit operating nomenclature or terminal station name)***	54M15		
Overhead circuit section Complete one table for each section	***Identifier (to be provided on drawing)***			
	Voltage (kV)			
	Length (km)			
	Positive sequence impedance (R, X, B)			
	Zero sequence impedance (Ro, Xo, Bo)			

Underground Circuit Section	***Identifier (to be provided on drawing)***				
Complete one table for each underground circuit section	***Voltage (kV)***		44		
	Length (km)		0.1		
	BIL rating		250		
	Phase conductor size (kcmil)		4/0		
	Phase conductor type [1]		AL		
	Insulation type		XLPE		
	Semiconductor shield type		TAPE SHIELD (COPPER)		
	Shield grounding		BOTH ENDS GROUNDED		
	Metallic sheath type				
	External layer type		PVC JACKET		
	Geometry of all phase				
	Ground resistivity (ohms)				
	Cable construction				
	Installation type (e.g. direct buried, in duct, etc.)		IN DUCT ONE LAYER FLAT		
	Positive sequence impedance (R, X, B)		0.364	0.295	
	Zero sequence impedance (Ro, Xo, Bo)		2.137	0.679	
	Continuous, 15-Minute and 24-Hour thermal ratings (A)	***Winter***	336	268	
		Summer	336	268	

1 If the conductor type is new then additional information may be required.

LDC Facilities for Embedded Generation

Bold-Italic	Essential
	Typical values will be assumed if data not provided
	Only required upon request

Transformers Complete one table for each transformer	***Number and Identifier of identical units (e.g., 3 units - T1, T2, T3)***			T1			
	Station			OUTDOOR SUBSTATION			
	Manufacturer			TBD			
	Configuration (e.g. 3 phase or three single phase)			3-PHASE			
	Cooling types (e.g. ONAN, ONAF, OFAF)			ONAN	ONAF1	ONAF2	
	Associated Thermal Rating for each cooling type (MVA)			15	20	25	
	Winter (10°C) continuous, 10-Day and 15-Minute thermal ratings	(A)		227	292	365	
		(MVA)		17.25	22.25	27.81	
	Summer (35°C) continuous,10-Day , and 15-Minute thermal ratings* [1]	**(A)**		197	263	328	
		(MVA)		15	20	25	
	Connection for each winding H, X, Y (e.g. wye, delta, zig-zag)			H:delta	X:wye		
	Rated voltage for each winding combination (kV) (e.g. HV, LV, tertiary)			HV:44	LV:13.8		
	Rated capability for tertiary winding, if applicable (A, MVA)			N/A			
	Impedance to ground for each winding H, X, Y (ohms) Indicate: U – ungrounded or R – Resistance; X – Reactance (e.g. 16 R)						
	Off-load tap positions (kV)			41.8	42.9	44	45.1	46.4
	On-load taps (max tap (kV), min tap (kV), number of steps)			N/A			
	In-service off-load tap position (kV)			44			
Positive Sequence Impedance	(see IEEE C57.12.90 for measurement techniques)	Positive Sequence Impedance (%)		HX	HY	XY	
		R		0.3179			
		X		6.9928			
		Base MVA		20			
Zero Sequence Impedance (only required for transformers with 1 or 2 external neutrals)	H winding energized all others open	Closed Tertiary		H	X	HX	XH
		R					
		X					
		Base MVA		N/A			
	H winding energized X winding shorted	Open Tertiary		H	X	HX	XH
		R					
		X					
		Base MVA		N/A			