Appendix A – Technical Information Required to Assess an Application for Generator Interconnection

	CONFIDENTIAL INFORMATION					
1.	**CHARACTERISTICS OF GENERATOR EQUIPMENT (data in p.u. based on equipment rating in MVA)**					
a.	**SYNCHRONOUS GENERATORS:**					
	Type (smooth pole/salient pole):					
	Damper windings (connection method):					
	Design ambient temperature (°C):					
	Temperature rise at rated power (°C):					
	Coolant temperature (°C):					
	Rated power:					
	Rated voltage:					
	Rated power factor in over-excited mode:					
	Rated power factor in under-excited mode:					
			DIRECT AXIS			**QUADRATURE AXIS**
	Synchronous reactance – unsaturated:	X_{di}			X_{qi}	
	Transient reactance – saturated:	X'_{dv}			X'_{qv}	
	Transient reactance – unsaturated:	X'_{di}			X'_{qi}	
	Sub-transient – saturated:	X''_{dv}			X''_{qv}	
	Sub-transient – unsaturated:	X''_{di}			X''_{qi}	
	Positive Sequence Leakage Reactance:	X_l				
	Negative Sequence reactance:	X_2				
	Open Circuit Time Constant (direct axis):	T'_{do}		sec		°C
	Open Circuit Time Constant (quadrature axis):	T'_{qo}		sec		°C
	Open Circuit Sub-transient Time Constant (direct axis):	T''_{do}		sec		°C
	Open Circuit Sub-transient Time Constant (quadrature axis):	T''_{qo}		sec		°C
	Armature Resistance (by phase)	R_a		Ω		°C
	Stator Forward Resistance at 60 Hz	R_1		Ω		°C
	Attach copy of saturation curve to this form.					
	Saturation coefficients:	$S_{(1.0)}$			$S_{(1.2)}$	

	Inertia constant H (provide for each generating unit, with turbine):						kWsec/kVA	
	Inertia constant H (provide for each generating unit, without turbine):						kWsec/kVA	
b.	**ASYNCHRONOUS GENERATORS:**							
	Design ambient temperature (°C):							
	Temperature rise at rated capacity (°C):							
	Coolant temperature (°C) (where applicable):							
	Rated capacity:							
	Rated voltage:							
	Power factor at 100%, 75% and 50% of rated capacity:			100%		75%		50%
	Stator leakage reactance:	X_S						
	Stator resistance:	R_S						
	Rotor leakage reactance:	X_r						
	Rotor resistance:	R_r						
	Magnetizing reactance:	X_m						
	Locked rotor reactance:	X_{lr}						
	Open circuit reactance:	X_o						
	Open Circuit Time Constant (direct axis):	T'_{do}						
	Inertia constant H (provide for each generating unit):					kWsec/kVA		
	Attach copy of Torque-slip curve to this form.							
	Slip at rated capacity:							

2. **VOLTAGE REGULATOR, EXCITATION SYSTEM AND STABILIZER**

Provide detailed model and parameters based on a standard IEEE model (IEEE 421.5 IEEE Recommended Practice for Excitation System Models for Power System Stability Studies)

Or

Provide a model with associated parameters that can be used by the NLSO in its dynamic simulation studies with the Siemens PTI PSS®E (Power System Simulator) software package

3. **TURBINE AND SPEED GOVERNOR**

Provide detailed model and parameters based on a standard IEEE model:

- "Dynamic Models for Combined Cycle Plants in Power System Studies", IEEE 94 WM 185-9 PWRS, Working Group on Prime Mover and Energy Supply Models for System Dynamic Performance Studies;
- "Dynamic Models for Steam and Hydro Turbines in Power System Studies", IEEE Transaction on Power Apparatus and System, Vol. PAS-92, pp. 1904-1915, 1973;
- "Hydraulic Turbine and Turbine Control Models for System Dynamic Studies", IEEE Transactions on Power Systems, Vol. 7, No. 1, pp. 167-179, Feb 1992; or
- A model with associated parameters that can be used by the NLSO in its dynamic simulation studies with the Siemens PTI PSS®E (Power System Simulator) software package.

4. **WIND POWER PLANTS**

Provide a detailed model of the wind power plant based upon IEEE models including relevant generator and converter parameters. The models must be compatible with the Siemens PTI PSS®E (Power System Simulator) software package.

If an IEEE model is not available, the generation owner must:

- Provide a manufacturer written/black-box model including:
  - Relevant technical information/documentation
  - Block diagrams
  - Data
  - Parameters
- This model must:
  - Allow all wind generators to be represented as a single generator and must function across the entire range of real and reactive power;
  - Be compatible with the Siemens PTI PSS®E (Power System Simulator) software package; and
  - Be able to work with a time step exceeding [TBD]ms.
- If voltage regulation of the wind power plant is achieved using additional compensation equipment in the ac station, the generator owner must provide detailed models and associated parameters of that equipment based upon standard IEEE models compatible with the Siemens PTI PSS®E (Power System Simulator) software package.
- If the generator owner provides a black-box model and the actual wind generator behaviour does not conform with the black-box model, the generator owner must pay any additional expense that may be incurred to connect the wind power plant to the transmission system.

5. **GENERATOR STEP-UP TRANSFORMERS (as provided by generation owner)**

Number of units:						
Rated power:						
Rated voltage (kV):						
Power with corresponding cooling method:						
Positive sequence impedances (Z_1):		%		X/R		
Zero sequence impedances (Z_0):		%		X/R		
Winding resistance:						
Winding connection:		H.V.		L.V.		T.V.
Number of taps:						
Tap regulating range:						
Location of taps:						
Exciting current (at 80% - 115% of rated voltage):						
Attach copy of saturation curve(s) to this form.						

6. **STATION TRANSFORMERS**

Number of units:	

	Rated power:						
	Rated voltage (kV):						
	Power with corresponding cooling method:						
	Positive sequence impedances (Z_1):		%		X/R		
	Zero sequence impedances (Z_0):		%		X/R		
	Winding resistance:						
	Winding connection:		H.V.		L.V.		T.V.
	Number of taps:						
	Tap regulating range:						
	Location of taps:						
	Exciting current (at 80% - 115% of rated voltage):						
	Attach copy of saturation curve(s) to this form.						

7. **CIRCUIT BREAKERS AND DISCONNECTS**

a.	Operating voltage:	
b.	**CIRCUIT BREAKERS:**	
	Rated voltage (kV):	
	BIL (kV):	
	SIL:	
	Rated Current (A):	
	Rated Short Circuit Current (kA):	
	Make:	
	Model:	
c.	**DISCONNECT SWITCHES:**	
	Rated voltage (kV):	
	BIL (kV):	
	SIL:	
	Rated Current (A):	
	Make:	
	Model:	

8. **SHUNT CAPACITOR BANK OR FILTERS**

Location:	
Power:	
Voltage:	
Inrush/outrush reactor rating:	
Harmonic filters:	
Provide layout of RLC components:	
Operating strategy:	

9. **SURGE ARRESTERS**

Type:	
Ratings:	

	Protection characteristics:				
10.	**CHARACTERISTICS OF HVDC CONVERTER UNIT AND RELATED EQUIPMENT**				
a.	Number of units:				
b.	Type of unit(s):				
c.	Unit topology:				
d.	Unit operating modes:				
e.	Rated active power (MW):				
f.	Rated reactive power (MVar):				
g.	Rated voltage (kV):				
h.	Power with corresponding cooling method:				
i.	Planned runback and automatic controls:				
j.	**CONVERTER TRANSFORMER DATA:**				
	Parameter	**Rectifier**	**Inverter**	**Unit**	
	Winding arrangement:				
	Vector group:				
	Rated power (6-pulse, 3 phase):			MVA	
	Maximum continuous power (6-pulse, 3 phase):			MVA	
	Rated line voltage:			kV_{RMS}	
	Rated valve winding voltage:			kV_{RMS}	
	Maximum valve winding voltage:			kV_{pk}	
	Extreme negative tap:			%	
	Extreme positive tap:			%	
	Tap step:			%	
	Positive sequence impedances (Z_1):			%	
	Zero sequence impedances (Z_0):			%	
	Transformer impedance				
	Impedance (V_{wye} or V_{delta} leg)			%	
	Base MVA			MVA	
	Base Voltage			kV_{RMS}	
k.	**CHARACTERISTICS OF SHUNT REACTIVE COMPENSATION AND FILTERING EQUIPMENT:**				
	Provide details as applicable.				
l.	**CHARACTERISTICS OF THE DC LINK:**				
	Overhead line:				
	Submarine cable:				
	Electrode lines:				
	Electrode sites:				
	Total resistance values used for modeling Bipole mode:				
	Total resistance values used for modeling Monopole mode Ground Return:				
	Total resistance values used for modeling Monopole mode Metallic Return:				

m.	**CHARACTERISTICS OF PROTECTION SYSTEMS:**	
	3 phase AC fault clearing time (in cycles):	
	AC LG fault clearing time in cycles and for Single Pole Reclosing:	
	Near end breaker open time (in cycles):	
	Far end breaker open time (in cycles):	
	Delay time (in cycles) to trip all breakers if fault remains in 3 cycles:	
	Location of breaker used to test line:	
	Delay time (in cycles) to close open breaker if fault is cleared:	
	Station location of breaker used to test line:	
	DC fault clearing time:	
	Curtailment of DC power for power frequency over-voltages of _____ p.u. for a maximum duration of _____ ms.	
n.	**CHARACTERISTICS OF HVDC SPECIAL CONTROL FUNCTIONS:**	
	AC voltage regulation:	
	Active/reactive power control:	
	Frequency control:	
	Load frequency control system:	
	Power limiter system:	
	Black start control:	
	Other special functions:	
o.	**CHARACTERISTICS OF HVDC CONTROL SYSTEM DISTURBANCE UNDER DISTURBANCE CONDITIONS:**	
	Time to restore after a 100% drop in commutation bus voltage:	
	OVRT:	
	LVRT:	
11.	**PLANNED TRANSMISSION LINES (including collector system for wind power plants)**	
a.	Number of lines:	
b.	Type of lines (e.g. single or double circuit):	
c.	Line length:	
d.	Line voltage:	
e.	Power, with corresponding cooling method:	
f.	Ampacity:	
g.	**CONDUCTOR AND OVERHEAD GROUND WIRE CHARACTERISTICS**	
	Phase conductor size and type:	
	Ground wire size and type:	
	Phase conductor configuration:	
	Phase conductor phase spacing (m):	

	Phase conductor maximum attachment height (m):	
	Phase conductor minimum attachment height (m):	
	Phase conductor minimum ground clearance (m):	
	Overhead ground wire attachment height (m):	
	OPGW/OHGW to OPGW/OHGW separation:	
	Protection angle (deg):	
	Centre line separation distance (m):	
	Typical span (m):	
	Soil resistivity:	
h.	**CABLE CHARACTERISTICS**	
	Voltage:	
	Type:	
	Length:	
	Size:	
	Ampacity:	
i.	**PROTECTIONS**	
	Type of protections:	
	Type of remote protections:	
	Setting parameters:	
j.	**SPECIAL PROTECTION SCHEMES INTEGRATED TO GENERATING/TRANSMISSION STATIONS**	
	Type:	
	Setting parameters:	
12.	**SINGLE LINE DIAGRAMS OF NEW GENERATING STATION AND/OR TRANSMISSION SYSTEM**	
	Attach a schematic diagram which includes the following: • Power transformers • Position of switchgear • Operating mode of switchgear (NO/NC) • Position of instrument transformers • Position of surge arrestors • Position of circuit breakers	
	Attach a preliminary control and protection schematic.	
13.	**OPERATING STRATEGY AND ANNUAL GENERATION PROFILE (attach separate sheets as needed)**	
a.	Provide description of intended operating strategy (power flow):	

b.	Provide description of operating modes under normal conditions:	
c.	Provide description of operating modes under degraded conditions:	
d.	Provide description of operating modes under emergency conditions:	
e.	Provide description of operation of the planned special protection schemes:	
f.	Capacity factor of the new generating station:	

g. **TYPICAL MEAN MONTHLY VALUES:**

Typical Annual Production			
	Average on Peak MW	**Average off Peak MW**	**GWh**
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			