



Reference Number : \_\_\_\_\_

## FORM A - ESTIMATED EQUIPMENT DATA WIND TURBINE GENERATOR

### A. BASIC INFORMATION

GRID USER	
1. Power Plant Name	
2. Company Name	
3. Office Address	
4. Main Contact Person	
5. Position	
6. Contact Numbers	
7. Email Address	
8. Power Plant Location	
a. Street	
b. Sitio	
c. Barangay	
d. Province	
e. Location Map	<i>Please attach a geographic map showing the coordinates of the power plant site.</i>

### B. POWER REQUIREMENT

YEAR					
A. Load Forecast (MW) During Construction					
B. Load Forecast (MW) for Station Use					
C. Feedback Power Requirement (MW):					

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## C. GENERATOR / MACHINE DATA

STANDARD PLANNING DATA	VALUE
1. In-Service Date (Commissioning)	
2. Manufacturer:	
3. Wind Farm Capacity	
a. Total Installed Capacity	
b. Number of Units and Unit size	
4. Wind Farm Type	
a. Type of Wind Turbine (fixed speed or variable speed)	
b. Type of Wind Farm Operation (continuous or seasonal)	
5. Total Plant Capability	
a. Total VRE Installed Capacity	
b. Number of units and unit size	
c. Rated power of each wind turbine (kW)	
4. Wind Turbine Generator Type	
5. Individual Plant Rated Capability (MVA)	
a. Rated Apparent Power (kVA)	
b. Rated Frequency (Hz)	
c. Frequency tolerance range (Hz)	
d. Rated wind speed (m/s)	
e. Cut-in wind speed (m/s)	
f. Cut-off wind speed (m/s)	
g. Rated voltage (Volt)	
h. Rated current (Ampere)	
i. Short circuit ratio	
j. Synchronous speed (rpm)	
k. Normal station service consumption	

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6. Rated Terminal Voltage (kV)	
7. Frequency Withstand Capability (Hz)	

<b>DETAILED PLANNING DATA</b>			
<i>Check below the corresponding machine model. If other models are to be used, please provide corresponding Machine Data.</i>			
<b>Generator</b>	<b>Electrical</b>	<b>Pitch Control</b>	<b>Aerodynamic</b>
<input type="checkbox"/> WT1G1 <input type="checkbox"/> WT2G1 <input type="checkbox"/> WT3G1 <input type="checkbox"/> WT3G2U <input type="checkbox"/> WT4G1 <input type="checkbox"/> W4G2U <input type="checkbox"/> Other Model:  <hr/> <p align="center"><i>(please specify)</i></p>	<input type="checkbox"/> WT2E1 <input type="checkbox"/> WT3E1 <input type="checkbox"/> WT4E1 <input type="checkbox"/> W4E2U: <input type="checkbox"/> Other Model:  <hr/> <p align="center"><i>(please specify)</i></p>	<input type="checkbox"/> WT3P1 <input type="checkbox"/> Other Model:  <hr/> <p align="center"><i>(please specify)</i></p>	<input type="checkbox"/> WT12A1 <input type="checkbox"/> Other Model:  <hr/> <p align="center"><i>(please specify)</i></p>

<b>GENERATING UNIT PARAMETERS</b>	<b>VALUE</b>
<i>From the above-checked generator model, fill-out the corresponding machine data as applicable. Please provide per unit value. Put n.a. if not applicable.</i>	
1. Wind Farm Detailed Generator Data	
2. Additional information for each wind farm	
a. Dynamic Model	*.dyr
b. Reactive Compensation	
c. Wind Turbine Transformer Data	
d. Transformer Data	
3. Wind Turbine Generating Unit of Wind Farm	
a. Magnetizing Reactance of Generator	
b. Stator leakage reactance	
c. Stator reactance	
d. Rotor leakage reactance	

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e. Rotor reactance	
f. Magnitude of inrush current	
g. Time duration of inrush currents	
4. Open circuit transient time constant, T (>0) (sec)	
5. Open circuit subtransient time constant, T'' (>0) (sec) If T'' = 0, single cage	
6. Synchronous reactance, X (p.u.)	
7. Transient reactance, X' (p.u.)	
8. Subtransient reactance, X'' (p.u.) (>0) If X'' = 0, single cage	
9. Leakage reactance, Xl (p.u.)	
10. First saturation coordinate, E1	
11. First Saturation factor, S(E1)	
12. Second saturation coordinate, E2	
13. Second saturation coordinate factor, S(E2)	
14. Stator reactance, XA (p.u.)	
15. Magnetizing reactance, XM (p.u.)	
16. Rotor reactance, X1 (p.u.)	
17. Rotor resistance, R_ROT_MACH (p.u.)	
18. A sum of R_ROT_MACH and total external resistance, R_ROT_MAX (p.u.)	
19. First of 5 coordinate pairs of the power-slip curve, POWER_REF_1	
20. POWER_REF_2	
21. POWER_REF_3	
22. POWER_REF_4	
23. POWER_REF_5	
24. SLIP_1	
25. SLIP_2	
26. SLIP_3	

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27. SLIP_4	
28. SLIP_5	
29. Equivalent reactance of current injection, $X_{eq}$ (p.u.)	
30. PLL first integration gain, $K_{pll}$	
31. PLL second integration gain, $K_{ipll}$	
32. PLL maximum limit, $P_{lmax}$	
33. Turbine MW rating, $P_{rated}$	
34. Converter time constant for IQcmd, $T_{iqcmd}$	
35. Converter time constant for IPcmd, $T_{ipcmd}$	
36. LVPL voltage 1 low voltage power logic, $V_{LVPL1}$	
37. LVPL voltage 2, $V_{LVPL2}$	
38. LVPL gain, $G_{LVPL}$	
39. High voltage reactive current (HVRC) logic, $V_{HVRCR}$ (p.u.) voltage	
40. HVRC logic current, $CUR_{HVRCR}$ (p.u.)	
41. Rate of active current change, $R_{ip\_LVPL}$	
42. Voltage sensor for LVPL, $T_{LVPL}$ (sec)	

<b>WIND ELECTRICAL DATA PARAMETERS</b> <i>From the above-checked model, fill-out the corresponding wind pitch control data as applicable. Please provide per unit value. Put n.a. if not applicable.</i>	<b>VALUE</b>
1. Rotor speed filter time constant, $T_{SP}$ (sec)	
2. Power filter time constant, $T_{PE}$ (sec)	
3. PI-controller integrator time constant, $T_i$ (sec)	
4. PI-controller proportional gain, $K_P$ (p.u.)	
5. Output MAX limit, $ROTRV\_MAX$	
6. Output MIN limit, $ROTRV\_MIN$	
7. Filter time constant in voltage regulator, $T_{fv}$ (sec)	
8. Proportional gain in voltage regulator, $K_{PV}$ (p.u.)	
9. Integrator gain in voltage regulator, $K_{IV}$ (p.u.)	
10. Line drop compensation reactance, $X_c$ (p.u.)	
11. Filter time constant in torque regulator, $T_{FP}$ (sec)	

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12. Proportional gain in torque regulator, $K_{PP}$ (p.u.)	
13. Integrator gain in torque regulator, $K_{IP}$ (p.u.)	
14. Max. limit in torque regulator, $P_{MX}$ (p.u.)	
15. Min. limit in torque regulator, $P_{MN}$ (p.u.)	
16. Max. limit in voltage regulator, $Q_{MX}$ (p.u.)	
17. Min. limit in voltage regulator, $Q_{MN}$ (p.u.)	
18. Max. active current limit, $IP_{MAX}$	
19. Voltage sensor time constant, $T_{RV}$	
20. Max. power order derivative, $RP_{MX}$	
21. Min. power order derivative $RP_{MN}$	
22. Power filter time constant, $T_{Power}$	
23. MVAR/Voltage gain, $K_{qi}$	
24. Min. Voltage limit, $V_{MINCL}$	
25. Max. Voltage limit, $V_{MAXCL}$	
26. Voltage/MVAR gain, $K_{qv}$	
27. $XIQ_{min}$	
28. $XIQ_{max}$	
29. Lag time constant in WindVar controller, $T_v$	
30. $P_{elec}$ filter in fast PF controller, $T_P$	
31. A portion of online wind turbines, $F_n$	
32. Shaft speed at $P_{min}$ , (p.u)	
33. Shaft speed at 20% rated power, $wP_{20}$ (p.u.)	
34. Shaft speed at 40% rated power, $wP_{40}$ (p.u.)	
35. Shaft speed at 60% rated power, $wP_{60}$ (p.u.)	
36. Minimum power for operating at $wP_{100}$ speed (p.u.)	
37. Shaft speed at 100% rated power, $wP_{100}$ (p.u.)	

<b>WIND PITCH CONTROL DATA PARAMETERS</b> <i>From the above-checked model, fill-out the corresponding wind pitch control data as applicable. Please provide per unit value. Put n.a. if not applicable.</i>	<b>VALUE</b>
1. Blade response time constant, $T_p$	
2. Proportional gain of PI regulator, $K_{pp}$ (p.u.)	
3. Integrator gain of PI regulator, $K_{ip}$ (p.u.)	

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4. Proportional gain of the compensator, Kpc (p.u.)	
5. Integrator gain of the compensator, Kic (p.u.)	
6. Lower pitch angle limit, TetaMin (degrees)	
7. Upper pitch angle limit, TetaMax (degrees)	
8. Upper pitch angle rate limit, RTetaMax (degress/sec)	
9. Power reference, P <sub>MX</sub> (p.u.) on MBASE	

<b>WIND AERODYNAMIC DATA PARAMETERS</b> <i>From the above-checked model, fill-out the corresponding wind aerodynamic data as applicable. Please provide per unit value. Put n.a. if not applicable.</i>	<b>VALUE</b>
1. Droop	
2. Proportional gain, Kp (p.u.)	
3. Integrator time constant, Ti (sec)	
4. Output filter 1 time constant, T1 (sec)	
5. Output filter 2 time constant, T2 (sec)	
6. Power filter time constant, Tp (sec)	
7. Maximum output limit, Lim <sub>max</sub>	
8. Minimum output limit, Lim <sub>min</sub>	

Generator Model	<p><i>Insert equivalent standard model that represents the generator model</i></p> <p><input type="checkbox"/> User Written Model</p> <p><input type="checkbox"/> Other Standard Model</p> <p><i>Provide a block diagram suitable for stability studies or an IEEE standard model type with all in-service parameter values for the generator.</i></p>
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<b>FLICKER COEFFICIENT WITH THE WIND TURBINE IN OPERATION, <math>c(\Psi_k, v_a)</math></b>				
Average wind speed, $v_a$ (m/s)	Network impedance phase angle, $\Psi_k$ (degrees)			
	30	50	70	85
6				
7.5				
8.5				
10.0				

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<b>VOLTAGE CHANGES AND FLICKER CAUSED BY SWITCHING OPERATIONS</b>				
<b>Case of switching operation</b>	Start-up at cut-in wind speed			
<b>Max. number of switching operation for ten minutes, N<sub>10</sub></b>				
<b>Max. number of switching operation for two hours, N<sub>120</sub></b>				
	<b>Network impedance phase angle, <math>\Psi_k</math> (degrees)</b>			
	<b>30</b>	<b>50</b>	<b>70</b>	<b>85</b>
Flicker step factor, $k_f$ ( $\Psi_k$ )				
Voltage change factor, $k_u$ ( $\Psi_k$ )				
<b>Case of switching operation</b>	Start-up at rated wind speed			
<b>Max. number of switching operation for ten minutes, N<sub>10</sub></b>				
<b>Max. number of switching operation for two hours, N<sub>120</sub></b>				
	<b>Network impedance phase angle, <math>\Psi_k</math> (degrees)</b>			
	<b>30</b>	<b>50</b>	<b>70</b>	<b>85</b>
Flicker step factor, $k_f$ ( $\Psi_k$ )				
Voltage change factor, $k_u$ ( $\Psi_k$ )				
<b>Case of switching operation</b>	Worst case switching between generators or windings			
<b>Max. number of switching operation for ten minutes, N<sub>10</sub></b>				
<b>Max. number of switching operation for two hours, N<sub>120</sub></b>				
	<b>Network impedance phase angle, <math>\Psi_k</math> (degrees)</b>			
	<b>30</b>	<b>50</b>	<b>70</b>	<b>85</b>
Flicker step factor, $k_f$ ( $\Psi_k$ )				
Voltage change factor, $k_u$ ( $\Psi_k$ )				

<b>HARMONICS AND WAVEFORM DISTORTION</b>					
<i>This table shall only be filled in for wind turbines equipped with an electronic power inverter.</i>					
<b>ORDER</b>	<b>OUTPUT POWER (kW)</b>	<b>Harmonic Current (% of I<sub>rated</sub> power)</b>	<b>ORDER</b>	<b>OUTPUT POWER (kW)</b>	<b>Harmonic Current (% of I<sub>rated</sub> power)</b>
2			3		
4			5		
6			7		
8			9		
10			11		
12			13		
14			15		

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16			17		
18			19		
20			21		
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44			45		
46			47		
48			49		
50					

<b>GENERATOR TRANSFORMER DATA</b>			
1. Substation Name		10. Status	
2. Rated Capacity		11. Model type	
3. Transformation Voltage (kV)		12. Serial Number	
4. Vector Group		13. Rated Frequency	
5. No. of Taps		14. Power Factor	
6. % Adjust per Tap		15. Voltage Ratio	
7. % Impedance at Rated load & Voltage		16. Configuration (e.g. 3 Phase or Three Single Phase)	
8. Manufacturer		17. Temperature Rise (°C)	
9. Year of commissioning		18. Connection for each winding H,X,Y (e.g.	

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				Wye, Delta, Zigzag)					
19. Positive Sequence Impedance	(See IEEE C57.12.90 for measurement techniques)	Positive Sequence Impedance (%)				HX	HY	XY	
		R							
		X							
		Base MVA							
20. Zero Sequence Impedance (Data is 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							
	In-Service Off-Load Tap (kV)								
	Off –Load Taps (kV)								
	On-Load Taps (kV) (Max Tap, Min Tap, Number of Steps)								
	Core and Excitation Losses (kW, kVAr)								

<b>CHARACTERISTIC DATA</b>	
1. Open circuit saturation curve	<i>Attach File</i>
2. Short circuit curve	<i>Attach File</i>
3. V curves	<i>Attach File</i>
4. Reactive Power Capability curve	<i>Attach File</i>
5. Ramping Capability Curve	<i>Attach File</i>
6. Short Circuit and Open Circuit Characteristic Curve	<i>Attach File</i>

<b>PLANT FLEXIBILITY PERFORMANCE DATA (FOR EACH GENERATING PLANTS)</b>	
a. Rate of loading following weekend shutdown (Generating Unit and Generating Plant)	
b. Rate of loading following an overnight shutdown (Generating Unit and Generating Plant)	
c. Block Load following synchronization	

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d. Rate of Load Reduction from normal rated MW	
e. Regulating range	
f. Load rejection capability while still synchronized and able to supply Load.	

<b>AUXILIARY DEMAND DATA</b>	
a. Rated Normal unit-supplied auxiliary Load for each Generating Unit at rated MW output	
b. Each Generating Plant Auxiliary Load other than (a) above and where the station auxiliary Load is supplied from the Grid.	
Please attach the following:	
a. Physical Layout	
b. Electrical Layout	
c. Specifications	
d. Protections	

<b>CONNECTION SCHEME</b>
<i>Provide a single line diagram of the connection scheme showing the details of the main connection facilities:</i>
<ul style="list-style-type: none"> <li>a. NGCP facility where connection of power plant will be made</li> <li>b. Length of the connection line including the type of conductor and structure used</li> <li>c. MVA Rating of the transformers</li> <li>d. MVAR Rating of Shunt Capacitors or Shunt Reactors, if any</li> </ul>

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## D. SUBSTATION AND TRANSMISSION FACILITY

### Line Information

Line Name	Operating Voltage Level (kV)	Length (km)	Type of conductor		Actual Rating (MVA)	R	X	B	Year of Commissioning	Age (Year)	Connected Generator /Load
			No. of Bundles	Conductor size							

*Please add rows as necessary*

### Line Structure Information

Number	Type	Coordinates

*Please add rows as necessary*

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**Power Circuit Breaker**

Substation Name	System Voltage (kV)	Type (Live Tank or Dead Tank)	Continuous Rating (A)	Breaker Interrupting Capacity (kA)	Manufacturer	Year of Commissioning	Age (Year)

*Please add rows as necessary*

**Reactive Compensation Equipment**

Substation Name	Rated Voltage (kV)	Rated Capacity (MVar)	Manufacturer	Year of Commissioning	Age (year)	Status

*Please add rows as necessary*

**ACCOMPLISHED BY:**

**SIGNATURE:** \_\_\_\_\_

**NAME:** \_\_\_\_\_

**POSITION:** \_\_\_\_\_

**DATE:** \_\_\_\_\_