

Western Electricity Coordinating Council

Generating Facility Data Requirements

1. Principal one-line electrical diagram of the generating facility

Provide a principal one-line diagram of the generating facility, identifying individual generating units, transformers (main step-up, unit auxiliaries, excitation source), transmission lines associated with the generation facility, station service loads, and any other relevant electrical equipment (e.g. power-factor capacitors, static var compensators).

2. Generating Unit Data

Label the generating unit number or identifier in the plant diagram

2.1. Synchronous Generator Data

Provide synchronous generator nameplate data, including rated MVA, kV, stator Amps, power factor, RPM, exciter voltage, rotor Amps.

Provide synchronous generator parameters:

Impedance Data in per unit on machine rated MVA and kV		
Synchronous direct axis reactance – unsaturated	X _{di}	
Synchronous quadrature axis reactance– unsaturated	X _{qi}	
Transient direct axis reactance – unsaturated	X' _{di}	
Transient quadrature axis reactance – unsaturated (*)	X' _{qi}	
Subtransient direct axis reactance – unsaturated	X'' _{di}	
Subtransient quadrature axis reactance – unsaturated (*)	X'' _{qi}	
Leakage reactance	X _l	
Positive sequence resistance	R _a	
Field Time Constants		
Open circuit transient time constant – direct axis	T' _{do}	
Open circuit transient time constant – quadrature axis (*)	T' _{qo}	
Open circuit subtransient time constant – direct axis	T'' _{do}	
Open circuit subtransient time constant– quadrature axis	T'' _{qo}	
Combined Turbine-Generator(-Exciter) Inertia		
Inertia Constant	H	
Open-Circuit Saturation		
Saturation at 1.0 pu generator voltage	S _{1.0}	
Saturation at 1.2 pu generator voltage	S _{1.2}	

(*) not required for salient pole generators

Provide generator open circuit saturation curve with air-gap line.

Air gap field current at rated generator voltage _____ Amps

Measured field winding resistance _____ Ohms

Field winding temperature or generator hot air/gas temperature at which the field winding resistance was measured _____ C

2.2. Excitation System Data

2.2.1. Exciter and Voltage Regulator

Excitation system type (static, ac rotating, brushless, dc generator, etc) and manufacturer: _____

Provide nameplate information on excitation equipment (such as excitation transformer in static exciters, dc generator and amplidyne in dc rotating exciters, main and pilot ac generators in ac rotating exciters)

Voltage regulator type and manufacturer (e.g., GE EX 2100, ABB Unitrol-F, etc)

Provide a block diagram and completed data forms for the corresponding WECC-approved model (document "WECC Approved Models").

2.2.2. Line Drop Compensation/Reactive Current Compensation

Indicate whether the voltage regulator has a line drop compensation or reactive current compensation, and provide settings in per unit on machine rated MVA and kV.

2.2.3. Power System Stabilizer

PSS type and manufacturer (e.g., GE EX2000, Basler)

Provide a block diagram and completed data forms for the corresponding WECC-approved model (document "WECC Approved Models").

2.2.4. Over-Excitation Limiter (OEL)

Provide fullest available information on OEL.

Indicate OEL type and manufacturer (e.g. Westinghouse MXL/OXP).

Describe OEL time characteristic (definite time, inverse time).

Provide pickup vs. time characteristic curve

Describe OEL actions (e.g., reduce field current below continuous current rating, trip voltage regulator into manual field current control, trip the generator.)

2.2.5. Under-Excitation Limiter (UEL)

Provide fullest available information on UEL.

UEL type (conventional or voltage sensitive, PQ-limiter, etc).

Describe UEL actions.

Provide limit settings as a curve of real and reactive power.

2.2.6. Stator Current Limiter

Is a stator current limiter incorporated into the excitation system?

Provide fullest available information on stator current limiter

2.2.7. High Voltage Bus Controllers, VAR limiters and Power factor controllers

Provide fullest available information on these controllers.

Indicate which of these controllers are active in normal operation.

2.3. Generator Reactive Capability Curves

Continuous field current rating _____ Amps

For hydrogen-cooled generators, indicate hydrogen pressure during normal operating conditions _____ psi.

Provide machine reactive capability curves at rated voltage and nominal hydrogen pressure).

Superimpose generator control, limiter and protection curves on the machine reactive capability curve.

Define the operating reactive capability of the generator.

Provide information on reactive power limits implemented by plant or unit supervisory controls (e.g. plant DCS, GE Mark V/ Mark VI / Ovation, GDACS).

3. Turbine-Governor Data

3.1 Hydro-turbine generators

Hydraulic Turbine

Turbine type (e.g., Francis, Kaplan, Pelton) _____

Nominal head _____ ft Typical range of operating heads _____ ft

Turbine capacity at full gate opening, nominal head _____ MW

Provide the “Power versus Gate Position” characteristic at expected operating heads (for Kaplan turbines with blade on the cam). For Kaplan turbines, provide the “Blade angle versus Gate Position” characteristic at expected operating heads.

Provide contact information for a person for reference regarding hydraulic profile of the plant.

Water inertia starting time T_w _____ sec

Hydro Governor

Hydro governor type (e.g. Asea analog electronic, Woodward dash-pot, Woodward 505H, Voest Alpine electronic) _____

Provide a block diagram and completed data forms for the WECC-approved models (document “WECC Approved Models”).

For Kaplan turbines, provide block diagram with relevant data for a blade controller.

3.2 Steam-Turbine

Boiler type (drum-type or once through) _____

Normal fuel type (coal, oil, gas, other) _____

Indicate whether the turbine is tandem-compound or cross-compound

Turbine capacity at rated steam throttle pressure, full valve opening
_____ MW

Rated steam pressure (HP) _____ psi

Governor type and manufacturer _____

Boiler controller type and manufacturer _____

Describe the normal turbine control and operating practice (base loaded, turbine follow, boiler follow, coordinated controller, sliding pressure, etc)

Provide a block diagram and completed data forms for the WECC-approved models (document "WECC Approved Models").

3.3. Gas Turbines

Gas turbine type and manufacturer (e.g. GE Frame 7, W-501, GE LM6000, etc)

Provide the maximum generator output as a function of ambient temperature.

For combined cycle plants,

If the plant has a steam cycle, describe how steam is used from a heat recovery steam generator (HRSG), e.g.

- all steam is used by a steam-turbine generator, or
- 40% of steam is for industrial use, or
- the project is using supplementary duct firing, all steam is used by a steam-turbine generator

Provide a block diagram and completed data forms for the WECC-approved models (document "WECC Approved Models.").

4. Power Plant Controls (e.g. GE Mark V, Ovation,)

4.1. Load or MW controller

Indicate whether the plant has an active load controller (e.g. Process Coordinated Controller).

Describe load controller functions:

- Does it keep the MW output of the plant at a specified set-point?
- Does it have a frequency bias and dead-band?

Provide recordings of plant response to system frequency excursions, if available.

Provide information on AGC capability, ramp rates (up and down), and ranges (low and high). Provide ramp rate recordings, if available.

4.2. Reactive Power Controller

Indicate whether the plant has any reactive power controller (high-side voltage controller, reactive power balancing among units, etc).

Describe the reactive power controller functions:

- Does the controller balance reactive power among generators in the plant?
- Does the controller perform high-side voltage control automatically and how fast it starts and completes response?
- Does the controller limit generator terminal voltage (e.g. +/- 5% of nominal)?

Provide SCADA recordings of plant response to system voltage deviations, if available, showing the effect of the plant reactive power controller.

5. Transformers

Provide the following information for each of the transformers identified in the principal one-line diagram of the generating facility.

Application (GSU/CSU/LT): _____

Number of Windings (2 or 3): _____

Indicate whether the unit is an autotransformer: _____

Note: Subsequent data in rows identified with asterisk (*) are required only for 3-winding transformers

Winding Data

Winding	Nominal [kV]	Configuration [Δ, Y, YG]	Nameplate MVA Ratings		
			FA	FO	FOA
Primary – H					
Secondary – X					
(*) Tertiary – Y					

Impedance Data (base MVA= _____ base kV= _____) :

Windings	R1	X1	R0	X0
H to X				
(*) H to Y				
(*) X to Y				

Tap Changer

Tap Changer	Tap Position [kV or Percent]			
	Operating	Min	Max	Step
Winding (H, X, or Y)				

For on-load tap changers, specify the following:

- Regulated voltage: _____ percent, or Volts
- Controlled bus: _____
- Dead-band: _____ percent, or Volts
- Tap changer time constant: _____ sec

6. Line Data

Provide the following data for each of the lines and feeders identified in the principal one-line diagram of the generating facility:

Nominal operating voltage, kV	
Line length, mi	
Positive sequence line resistance, Ω	
Positive sequence line reactance, Ω	

Please indicate whether the line is overhead or underground.

7. Auxiliary Load

Provide auxiliary load MW and MVAR at minimum stable and maximum power output.

Auxiliary load may be identified as any load at utilization voltage less than the transmission system interconnection voltage, including station service load and unit service load.