Gen Model One-Line Definitions

Please note – Common definitions used for all applicable Gen Model related generators. "Synchronous Generators" (Nuclear, Combined Cycle, Hydro Generators, etc.) and "Wind Farm/Inverter Based Generators" will have slightly different reference "measurement points" to accommodate their respective one-line diagrams.

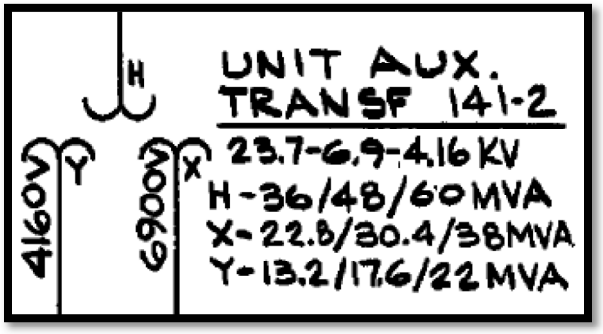
Low Side Gross Output - The maximum capacity the generator can sustain over a specified period when not restricted by ambient conditions or de-ratings. To establish this capability, a formal demonstration of the MFO is required. No standard demonstration test method or test duration exists at this time, but many of the NERC Regions have their own criteria that all operating companies in those Regions follow. This value should change only because of permanent unit modifications. This term is defined as "Gross Maximum Capacity (GMC)" in the NERC GADS DRI. This measurement point is shown as "Point A" on the Synchronous Generator One-Line Diagram. This measurement point is shown as "Point J" on the Inverter Based Generator and Wind Farm Generator One-Line Diagrams.

Auxiliary Transformer - (e.g., unit auxiliary transformer (UAT) - A transformer that is intended primarily to supply all or a portion of the generating unit auxiliary loads. This transformer is supplied from the main generator [low side of the generator step-up transformer (GSU)], typically through Isolated Phase Bus Ducts with the high side winding voltage same as the generator terminal voltage. This type of transformer may also be referred to as a unit station service transformer (USST), etc. The auxiliary transformer typically supplies auxiliary load, but may not always be the case (i.e., tertiary winding of step of transformer). ***This transformer would not be in service when the generator is offline.*** This measurement point is shown as "Point B" on the Synchronous Generator One-Line Diagram. For most inverter-based generators and wind farms, auxiliary loading is negligible and not considered for Gen Model.

Low-Side Net Output – It shall be determined as the gross output of the unit (Point A for Synchronous) less power used for unit auxiliaries (Point B for Synchronous Only) required for electrical generation and any power required to serve host process load. This measurement point is shown as "Point C" on the Synchronous Generator One-Line Diagram.

Tertiary Transformer Load (Winding) - An additional winding in a transformer that can be connected to a synchronous condenser, a reactor, an auxiliary circuit, etc. For transformers with wye-connected primary and secondary windings, it may also serve load. A tertiary winding may also serve auxiliary load (IEEE Std C57.12.80). For the purpose of MOD-032, transformer containing three windings (for example, 25 kV high side with X winding of 4.16 kV and Y winding of 6.9 kV) is considered as containing both the secondary and a tertiary winding. The Tertiary Winding information is necessary and needs to be provided s as it factors into the overall modeling and needs to be accounted for. This measurement point is shown as "Point D" on the Synchronous Generator One-Line Diagram. This measurement point is shown as "Point P" on the Inverter Based Generator and Wind Farm Generator One-Line Diagrams.

Example:



Stabilizing Winding – A delta-connected auxiliary winding used particularly in wye-connected three-phase transformers. Terminals of a stabilizing winding are not brought out for connection to an external circuit. However, one corner point of the delta can be brought out for grounding and field testing (IEEE Std C57.12.80). A stabilizing winding does not serve load and should not be considered a "tertiary winding" for purposes of MOD-032-1/TPL-007-3. A stabilizing winding in this case only function is to stabilize neutral point voltage and protect against third-harmonic voltages in the line.

High-Side Net Output - It shall be determined as the gross output of the unit (Point A for Synchronous Generators and Point I for Wind/Inverter Based Generators) less power used for unit auxiliaries (Point B for Synchronous Generators Only) and tertiary loads (Point D for Synchronous Generators Only) required for electrical generation and any power required to serve host process load measured at the high side voltage of a generator step up transformer. **For Synchronous Generators only** - this output value can be the same as the Net Plant Output value where there is no additional "High Side Connected Transformer", additional generators, and any "Remotely Connected Transformer" loads required for generation. This measurement point is shown as "Point E" on the Synchronous Generator One-Line Diagram.

High-Side Connected Transformer (Collector Bus Connected Transformer Load) - It shall be determined as either a start-up or station service transformer (also known as Station Auxiliary Transformer or Reserve Auxiliary Transformer) that is electrically connected to the generator collector bus (i.e., the high side voltage of a generator step up transformer or switchyard) required for electrical generation. If applicable, this transformer load should have be included in the MFO calculation identified in the interconnection agreement. This measurement point is shown as "Point F" on the Synchronous Generator One-Line Diagram. This measurement point is shown as "Point L" on the Inverter Based Generator and Wind Farm Generator One-Line Diagrams.

Station Service Transformer – (IEEE terminology - station service (startup) transformer (SST)) - A transformer that supplies power from a station high-voltage bus to the station auxiliaries and to the generating unit auxiliary loads during unit startup and shutdown and/or when the unit auxiliary transformer (UAT) is not available. "Station Service transformers" are common to the overall facility and functions regardless of the individual generation unit(s) in operation. It includes facility lighting, security, and any buildings/heat which may house control rooms. The buildings may also house multiple generators. In the case of Inverter-Based DER (IBR), the building may house multiple central inverters for portions of the facility, which can produce energy independently. This type of transformer may also be referred to as a "system auxiliary transformer (SAT)", "common station service transformer (CSST)", or "reserve auxiliary transformer (RAT)".

Remotely Connected Transformer Load - It shall either be determined as a start-up or station service transformer that is electrically connected independently to the transmission (or distribution) system and required for electrical generation. If applicable, this transformer load should have be included in the MFO calculation identified in the interconnection agreement. This measurement point is shown as "Point G" on the Synchronous Generator One-Line Diagram. This measurement point is shown as "Point M" on the Inverter Based Generator and Wind Farm Generator One-Line Diagrams.

Net Plant Output - The amount of megawatts (MW) of electric power which can be delivered by a generator **without restriction** by the owner under the conditions and criteria specified herein and shall be determined as the gross output of the unit (Point A for Synchronous Generators, Point J for Wind/Inverter Based Generators) less power used for unit auxiliaries and other station use required for electrical generation and any power required to serve host process load (Points B, D, F, and G as applicable for Synchronous, Points L, and M, and P as applicable for Wind/Inverter Based Generators). In the case where auxiliary load, station use and/or process load is apportioned across multiple units at a plant, the apportioned auxiliary load, station use and/or process load during the test must be commensurate with the apportioned auxiliary load, station use and/or process load during summer and winter conditions. The summer and winter conditions for Gen Model use are fixed values for temperature/humidity/cooling water temp, etc. Net Capability and Net Plant Output (for a single unit plant) should only be equal when the underlying ambient conditions align. Without restriction, means that the values so determined are available for utilization at the request of PJM for supply of operating capability and energy before any operating procedures are placed in effect anticipatory to a voltage reduction on the PJM system. This measurement point is shown as "Point I" on the Synchronous Generator One-Line Diagram. This measurement point is shown as "Point Q" on the Inverter Based Generator and Wind Farm Generator One-Line Diagrams.

Generator Step Up Transformer – (IEEE terminology - generator step-up transformer (GSU)) - A transformer connecting the unit main generator to the transmission system. This type of transformer may also be referred to as a main power transformer (MPT) or unit transformer (UT).

Offsite Power – (IEEE terminology - offsite power) - A power source provided to permit functioning of structures, systems, and components important to nuclear safety. Offsite power includes the transmission system, switchyard(s), and preferred power supply (PPS). "Offsite power" typically is intended for nuclear generators. Inverter-Based DER (IBR) generators do not normally have critical functions to be monitored and controlled when the unit is off-line like nuclear units. Many IBR's can sit out-of-service and unattended for extended periods of time.

Maximum Output Conditions – The GO should provide the maximum net output the facility can produce trying to maximize profit while assuming an extremely high value per MW under identified seasonal considerations. It should be assumed that the generator is under ideal operating conditions (i.e., clean condensers, no steam and air leaks, etc.). Therefore, the output value used for Gen Model, should be the power level (e.g., Emergency Max) that provides the maximum net output configuration. If the GO normally employs capability-enhancing measures such as, but not limited to, compressor inlet cooling, wet compression, peak firing, or boiler overpressure, this should also be assumed when providing output values for the MOD-032 submission. Those same assumptions mentioned above should be used **consistently** when determining the values of Auxiliary loads, Start Up Units, Station Service loads, etc. that may impact the net output of the generator.

Host / Process Load - Host or process load is thermal and/or electrical load consumed by a co-located or nearby facility associated with a co-generator or part of a combined heat and power system. Host/Process Load is essentially a load that is not related to the generating plant "contributing" to its output. Refer to EIA document for more information - https://www.eia.gov/workingpapers/pdf/chp-Industrial_81415.pdf.