Small Generator Technical Data Requirements

☐**Appropriately parameterized generic library RMS positive sequence dynamic models** using GE PSLF Formatting[1,2]. IPC uses the WECC approved dynamic models. A list of approved models can be found on the WECC site under the Modeling and Validation Subcommittee.

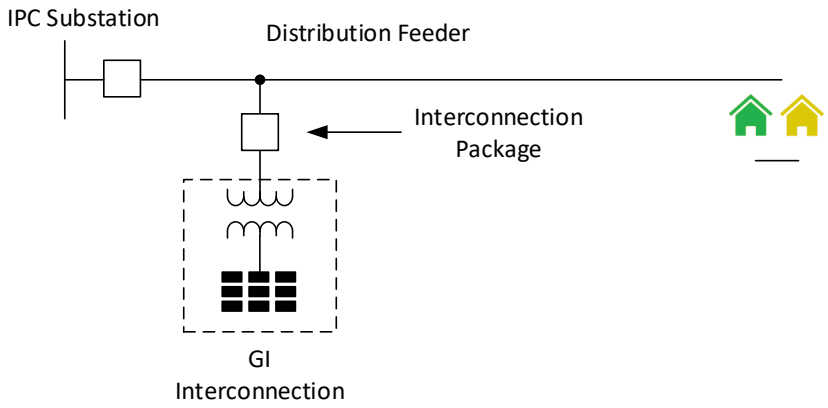
☐ **A validated positive sequence user defined dynamic model (UDM)**[2]. Interconnection Customer (IC) must also demonstrate that the model is validated by providing evidence that the equipment behavior is consistent with the model behavior, (e.g., an attestation from Interconnection Customer that the model accurately represents the entire Large Generating Facility; attestations from each equipment manufacturer that the user defined model accurately represents the component of the Large Generating Facility; or the response obtained by the corresponding generic library models results in similar performance).

☐ **A validated PSCAD electromagnetic transient model** using either an Intel or Fortran compiler.[3,4]

☐ **Steady State Power Flow Models** using .epc, .pwb, or .raw data formats. These models should include:

- An explicit representation of the interconnection transmission or distribution line;
- An explicit representation of all station transformers;
- An equivalent representation of the collector systems;
- An equivalent representation of inverter pad-mounted transformers with a scaled MVA rating;
- An equivalent representation of generators scaled to match the total capacity of the plant; and
- An explicit representation of all plant-level reactive compensation devices either as shunts (fixed or switchable) or as generators (FACTs devices), if applicable.

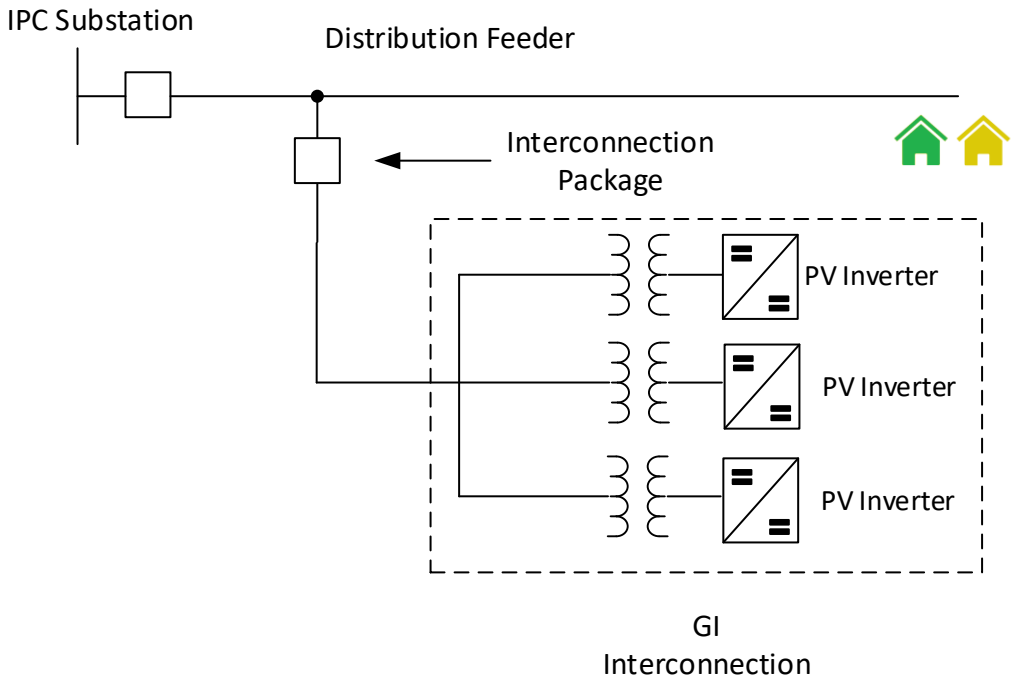
An example of a single-generator equivalent power flow representation for a solar PV power plant connecting to the distribution system is shown here:



If a plant has different makes of the inverters installed and these inverters have different reactive capability, control setup, or protection setup, a multi-generator representation is fitting. The determination of single or multiple generator equivalence should take into account the number of the main substation transformers, the collector system behind each main substation transformer, the placement of different makes of inverters behind the main substation transformers, the setting difference among inverters, and the mix of different inverters.

- Each substation transformer is explicitly represented in the power flow model.
- If the same inverters are installed behind the substation transformer, represent the inverters with one equivalent collector circuit, one equivalent pad-mounted transformer, and one equivalent generator.
- If different inverters with the same control and protection setting are installed behind one substation transformer, represent all inverters by one equivalent collector circuit, one equivalent pad-mounted transformer, and one equivalent generator.
- If inverters with different settings are installed behind the same substation transformer, model each type of inverter that has at least 10 MVA installed capacity by one equivalent generator with its own equivalent pad-mounted transformer. The type of inverters less than 10 MVA installed capacity may be aggregated with another type of inverter in one equivalent generator.

An example of a multi-generator equivalent power flow representation for a solar PV power plant is shown here:



☐ **Single Line Diagram** this diagram must be signed and stamped by a licensed Professional Engineer if the Small Generating Facility is larger than 50 kW

☐ **Map with proposed interconnection transmission line route from collector substation to the POI**

☐ **Project/Inverter Data Sheets** to include PQ capability curve (see notes in Projects with Energy Storage Components)

☐ **Other Applicable data** as outlined in the Small Generation Interconnection Application

☐ **Projects with Energy Storage Components:**

☐**Project/Inverter Data Sheets** are provided in Exhibit A to the Energy Storage System Process.

☐**The requested operating assumptions** (i.e., whether the Generating Facility will or will not charge at peak load) to be used by IPC that reflect the proposed charging behavior of the Generating Facility

☐ **A description of any control technologies** (software and/or hardware) that will limit the operation of the Generating Facility to the operating assumptions submitted

Important Notes:

1. The default parameters listed in the library model software manuals are provided only as a starting point to prevent model initialization issues. Those parameters are not suitable replacements for site-specific parameters. Documentation showing how the library model was parameterized and compared to inverter and plant-level controller settings should be provided.

2. While finalized plant settings are not available at this stage of the interconnection process, the models should be parameterized with control modes and parameters that are as reflective of the intended final design as possible. Models should be compatible with PowerWorld.

3. NERC Supporting Paper: *EMT Models in NERC MOD, TPL, and FAC Standards*, NERC Inverter-Based Resource Performance Subcommittee (IRPS), April 2022 "Industry has also recognized that the collection of EMT models during the interconnection process is the most effective means of gathering these models for newly connecting facilities. Requiring EMT models after interconnection presents some challenges for the TP, PC, GO, and equipment manufacturers. As more inverter-based resources are connected to the BPS without collecting high quality EMT models for these facilities, the risk of future BPS reliability challenges increases."

4. EMT Models may be required as early as the System Impact Study Phase.

5. Important references include: Idaho Power Facility Interconnection Requirements, NERC Dynamic Modeling Recommendations, WECC Solar PV Plant Modeling and Validation Guideline.