

# Overview of State Distributed Generation Interconnection Rules

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# What an Interconnection Rule Does & Does Not Do

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➤ Does:

- Provide a process for developers and customers to follow when seeking to operate DG in grid-synchronous manner
- Provide for fast-track treatment based on:
  - Characteristics of equipment
  - System context for installation
- Provide for operational requirements
- Provide standardized forms, fees and agreements for DG interconnection

➤ Does not:

- Generally touch on the underlying economics of installation (e.g. does not set prices for output or govern net metering economics)
- Specify how a specific DG unit should be engineered or designed



# Scope and Applicability

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- Most state rules to date have used a maximum size (usually 10 or 20 MW) for applicability of rule
  - Better approach: Cover all “jurisdictional” interconnections
    - Assures no conflict with FERC jurisdiction
    - Assures no jurisdictional gap



# Technical Standard

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- The technical standard to be used in evaluating all Applications, unless otherwise provided for in the SGIR, is IEEE 1547.
- Utility must seek and be granted wavier from Commission to utilize standards other than IEEE standard 1547
- Applicant must construct, own, operate, and maintain its Small Generator Facility and associated Interconnection Facilities in accordance with:
  - IEEE Standard 1547 and
  - Other safety and reliability standards required by the Commission



# Fast Track & Full Study Tiers

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- Three Fast Track “Tiers”
  - Each uses a set of largely engineering-based “screens”
  - If Facility passes screens, Utility must interconnect
  - If Facility fails screens, Customer may pay additional fees and move to another tier or utility can deem safe and interconnect anyway
- One “Full Study Tier” – Tier 4
  - Uses series of optional studies to determine if Facility can be interconnected
  - Much more intricate and expensive than Fast Track treatment



# Tier 1: Overview

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- Procedures in Section 10
- Capacity rating is 25 kW or less,
- Interconnection equipment is inverter based
- The Small Generator Facility is “Lab Tested”
- Not connecting to a transmission line
- Fastest timeline: usually < 20 days total



# Tier 1 Evaluation and Screening Criteria

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- If on a radial distribution circuit aggregate existing generation plus that of generators with a higher Queue Position, must not exceed 15 percent of Line Section annual peak load
- If on the load side of Spot Network protectors aggregate generation must not exceed the lesser of five percent of a Spot Network's maximum load or 50 kW
- If on a single-phase shared secondary service line aggregate generation capacity on the shared secondary must not exceed 20 kW.
- If Facility is single-phase and is to be interconnected on a center tap neutral of a 240 volt service line must not create a current imbalance between the two sides of the 240 volt service of more than 20 percent of the nameplate rating of the service transformer
- The proposed interconnection must use existing Public Utility facilities (i.e. not require construction or upgrades to existing facilities)



## Tier 2: Overview

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- Capacity is 2 MW or less
- Proposed connection is to a radial distribution circuit, or to a Spot Network that is serving one premise
- Facility is either Lab Tested Equipment or Field Tested Equipment
- The Application does not qualify for a Tier 1 review



# Tier 2: Field Tested Equipment

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- Designed to allow for certification via utility study process
- To gain Field Tested Equipment status, the Applicant must provide:
  - All the documentation of the prior Tier 4 study, review and approval
  - Any interconnection studies, and
  - Certificates of Completion




# Tier 2: Evaluation and Screening Criteria

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- If connecting to a radial distribution circuit aggregate generation on circuit must not exceed 15 percent of Line Section annual peak load (same as Tier 1)
- If connecting to the load side of Spot Network protectors aggregate must not exceed the lesser of five percent of a Spot Network's maximum load or 50 kW (same as Tier 1)
- Facility, in aggregation with other generation on circuit, must not contribute more than 10% to circuit's maximum Fault Current at point on primary voltage line nearest Point of Interconnection
- Facility, in aggregate with other generation must not expose distribution protective devices and equipment (e.g. substation breakers, fuse cutouts, and line reclosers), or other Utility equipment to Fault Currents exceeding 90 percent of the short circuit interrupting capability; and
- Point of Interconnection must not be located on a circuit that already exceeds 90 percent of the short circuit interrupting capability (same as Tier 1)

# Tier 2: Evaluation & Screening (cont'd)



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- Point of Interconnection must not be on Transmission Line
- Facility, in aggregate with other generation interconnected to distribution side of substation transformer feeding interconnected circuit must not exceed 10 MW where there are known, or posted, transient stability limitations to generating units located in the general electrical vicinity (e.g., three or four distribution busses from the point of interconnection)
- If the proposed Small Generator Facility interconnection is to Primary Line, interconnection must be according to the screening criteria below, depending on the type of electrical service provided by the Utility:
  - If the Small Generator Facility is 3-phase or single-phase and is to be connected to a 3-phase 3 wire Primary Line, it must be connected phase-to-phase.
  - If the Small Generator Facility is 3-phase or single-phase and is to be connected to a 3-phase 4-wire Primary Line, it must be connected line to neutral and effectively grounded.
- If to be interconnected on single-phase shared service line, aggregate generation capacity on the shared secondary line, including the proposed Small Generator Facility, must not exceed 20 kW (same as Tier 1)



# Tier 2: Evaluation and Screening (cont'd)

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- If Facility is single-phase and is to be interconnected on center tap neutral of 240 volt service line, must not create current imbalance between the two sides of the 240 volt service of more than 20 percent of the nameplate rating of the service transformer (same as Tier 1)
- Interconnection must only use existing Public Utility facilities and the Applicant's proposed facilities
- Facility, in aggregate with existing generators and exiting transmission loads must not cause a transmission system circuit to exceed its design capacity on the transmission system circuit directly connected to the distribution circuit where the interconnection is proposed
- If Utility's distribution circuit utilizes high speed reclosing with less than 2 seconds of interruption the proposed generator must not be a synchronous machine



# Tier 3: Overview

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- Procedures in Section 12
- Capacity of 10 MW
- Does not qualify for Tier 1 or Tier 2 review
- Does not export power beyond the Point of Interconnection



# Tier 3 Evaluation & Screening Criteria- Area Networks

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- For interconnection to load side of an Area Network distribution circuit
- Capacity of Facility is 50 kW or less;
- Facility utilizes a Lab Tested, inverter-based equipment package for interconnection;
- Facility utilizes low forward power relays or other protection functions that prevent power flow on to the Area Network;
- Aggregate generation on the Area Network does not exceed the lesser of 5 percent of an Area Network's maximum load or 50 kW; and
- Interconnection must use only existing Public Utility facilities and the Applicant's proposed facilities.



# Tier 3 Evaluation & Screening Criteria -- Not Networked

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- Facility has Capacity of 10 MW or less and;
- Aggregate total of generators on the circuit is 10 MW or less and;
- The Small Generator Facility does not export power beyond the point of interconnection and employs reverse power relays or other protection functions that prevent power flow onto the T&D System and;
- Interconnection must be to a radial distribution circuit and;
- Facility is not served by a shared transformer and;
- Interconnection must use only existing Public Utility facilities and Applicant's proposed facilities and;
- If circuit utilizes high speed reclosing with less than 2 seconds of interruption, proposed generator must not be a synchronous machine



# Tier 4: Overview

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- For all facilities that do not qualify for or have failed either the Tier 1, Tier 2 or Tier 3 interconnection review procedures
- Requires full study process
- Most expensive and time consuming path to interconnection



# Tier 4: Meetings & Studies Overview

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- Scoping Meeting
- Interconnection Feasibility Study
- Interconnection Impact Study
- Interconnection Facilities Study
- Any one or combination can be waived



# Interconnection Agreement

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- Governs how facility can be operated while interconnected
- For a period of up to 20 years at the Applicant's option, unless:
  - Terminated earlier by the default or voluntary termination by the Interconnection Customer or
  - Terminated by action of the Commission
- Existing Interconnection Agreements expire according to their terms



# Other Issues Related to Facilities

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- Utility right of access
- Disconnect/isolation devices
- Study costs
- Interconnection facility costs
- T&D upgrade costs
- Adverse system impact mitigation
- Metering, monitoring & communications standards



# Insurance & Liability

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- Interconnection Customers must either obtain, or are explicitly encouraged to obtain prudent amounts of general liability insurance to protect any person who may be affected by their Small Generator Facility and its operation
- In many states no general liability insurance is required for smallest facilities (up to 200 kW or so)
  - Implicitly relies on homeowner or small business owner insurance, if applicable
- Other states set out graduated insurance limits, based on facility size
- Utilities and customers usually have mutual indemnity agreements



# Notice of Commissioning & Witness Test

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- Applicant must provide Utility advance notice (usually around 5 days notice) of planned commissioning of Facility.
- Utility has option to conduct Witness Test usually within 10+/- business days of scheduled commissioning
- Utility may waive the Witness Test and notify Applicant.
- If Utility does not conduct the Witness Test within allowed time, Witness Test is deemed waived



# Completion of Interconnection

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- Interconnection process is not complete until:
  - Application has passed screening criteria;
  - The Small Generator Facility installation is approved by the electric code inspector with jurisdiction over the interconnection;
  - Witness Test, if conducted by the Public Utility, is successful; and
  - The Parties execute interconnection agreement and a Certificate of Completion



# Stakeholder Participation in Regulatory Proceedings

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- Regulators generally desire input from interested stakeholders
- Options available to regulators are usually limited to matters that are on the record
- If a stakeholder's position is not known, regulators can't and won't adopt it



Thanks for you attention...

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