



**REVIEW OF NERC WHITEPAPER:
DISTRIBUTED ENERGY RESOURCES (DERs)
Reliability Impacts and Recommended Changes**

March 7, 2017

- Executive Summary
- Definitions
- Reliability Considerations
- Data and Modeling
- Characteristics of Nonsynchronous DER
- NERC Reliability Standards

DER whitepaper executive Summary

- Develop a set of guidelines to assist owners/operators of the BPS in modeling DER in the electric system
- Data requirements and information sharing across the transmission-distribution (T-D) interface should also be further evaluated to allow for adequate assessment of future DER deployments
- Simultaneous efforts to improve DER interconnection standards, such as proposed changes to IEEE 1547, will assist in interconnection of DER to electric power systems
- As the penetration level of DER increases, the classical transmission model of distribution system load (netted generation and load) is not valid
- Data for DER modeling and verification purposes must be collected, and the industry should determine the level of granularity which corresponds to the future BPS modeling needs.
- A coordinated effort by transmission and distribution entities is needed to determine the appropriate use of future DER capabilities

Definitions

- **Distributed Energy Resource**

- A **Distributed Energy Resource (DER)** is any resource on the distribution system that produces electricity and is not otherwise included in the formal NERC definition of the Bulk Electric System (BES). -- (Does not include demand response.)
 - **Distribution Generation (DG):** Any non-BES generating unit or multiple generating units at a single location owned and/or operated by 1) the distribution utility, or 2) a merchant entity.
 - **Behind The Meter Generation (BTMG):** A generating unit or multiple generating units at a single location (regardless of ownership), of any nameplate size, on the customer's side of the retail meter that serve all or part of the customer's retail load with electric energy. All electrical equipment from and including the generation set up to the metering point is considered to be behind the meter. This definition does not include BTMG resources that are directly interconnected to BES transmission.
 - **Energy Storage Facility (ES):** An energy storage device or multiple devices at a single location (regardless of ownership), on either the utility side or the customer's side of the retail meter. May be any of various technology types, including electric vehicle (EV) charging stations.

Definitions

- Distributed Energy Resource (contd)
 - **DER aggregation (DERA):** A virtual resource formed by aggregating multiple DG, BTMG, or ES devices at different points of interconnection on the distribution system. The BES may model a DERA as a single resource at its “virtual” point of interconnection at a particular T-D interface even though individual DER comprising the DERA may be located at multiple T-D interfaces.
 - **Micro-grid (MG):** An aggregation of multiple DER types behind the customer meter at a single point of interconnection that has the capability to island. May range in size and complexity from a single “smart” building to a larger system such as a university campus or industrial/commercial park.
 - **Cogeneration:** Production of electricity from steam, heat, or other forms of energy produced as a by-product of another process.
 - **Emergency, Stand-by, or Back-Up generation (BUG):** A generating unit, regardless of size, that serves in times of emergency at locations and by providing the customer or distribution system needs. This definition only applies to resources on the utility side of the customer retail meter.

Reliability Considerations

- Modeling
- Ramping and Variability
- Reactive Power
- Frequency Ride-Through
- System Protection
- Visibility and Control
- Power Flow and State Estimation
- Load and Generation Forecast
- Interconnection Requirements

Data and Modeling for DER

- Collection and sharing of data across the T-D interface
 - Modeling detailed representations may be beyond practical limits.
 - Computational time
 - Operability
 - Data availability
 - Recommended “modular approach”
- Modeling
 - Steady State Power Flow
 - Short Circuit
 - Dynamic Disturbance ride-through
 - Transient Stability studies
- Threshold for modeling
 - Each area to determine threshold for modeling
 - WECC threshold is 10 MVA for single DER / 20 MVA for multiple DER

Characteristics of Nonsynchronous DER

- Existing Inverter based generation complies with IEEE1547-2003
 - Anti-islanding
 - Relatively narrow must-trip conditions
- Future revisions to IEEE-1547 to include:
 - Widened must-trip conditions
 - Voltage regulation
 - Frequency and voltage Ride-through
 - Anti-Islanding
 - Primary frequency Response
 - Communications capability

NERC Reliability Standards

- NERC standards address BES requirements.
- Increased DER penetration impacts BES
 - Transmission line loading
 - Grid voltage
 - System frequency
 - Resource adequacy
 - Demand balancing
- NERC standards provide authority for system planners to collect required information for reliability and encourages collaboration



- Questions?