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Independent System Operator

DER Impacts for NYISO Reliability Planning Studies

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Agenda

- System Modeling
- Transmission Security
  - Steady-State
  - Stability
- Resource Adequacy
- Other Work

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System Modeling

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NERC Guideline: DER Types

- Utility-Scale DER (U-DER): DERs directly connected to, or closely connected to, the distribution bus or connected to the distribution bus through a dedicated, non-load serving feeder. These resources are typically three-phase interconnections and can range in capacity (e.g., 0.5 to 20 MW).
- Retail-Scale DER (R-DER): DERs that offset customer load, including residential, commercial, and industrial customers. Typically, the residential units are single-phase while the commercial and industrial units can be single- or three-phase facilities.

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NERC Guideline: DER Controls

- U-DERs are typically relatively large, stand-alone installations that may have more complex controls or requirements associated with their interconnection.
- R-DERs represent the truly distributed resources throughout the distribution system whose controls are generally reflective of IEEE Std. 1547 vintages or other relevant requirements for the region in which they are being interconnected.

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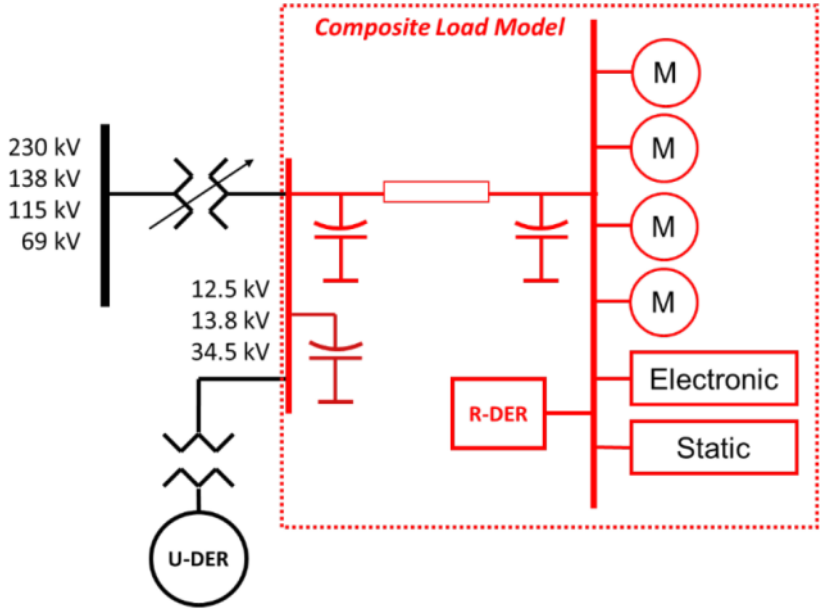
U-DER, R-DER, and Composite Load Model



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System Models - Current

- Steady-State models are Developed each year for the FERC-715 Filing
- Dynamic cases are developed as part of an annual database update
- DER that goes through the NYISO Interconnection process (U-DER) is already modeled explicitly using the information provided in that process
- Behind-the-meter DER (R-DER) is netted with Forecasted Load consistent with the Gold Book
- The components of R-DER are detailed in the Gold Book by Zone
  - Solar
  - Non-Solar Distributed Generation
  - Storage

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Steady-State Models - Future

- **U-DER will be explicitly modeled using the information provided in the interconnection process**
- **In 2020, the NYISO will develop test cases where R-DER is explicitly modeled**
  - For solar, the NYISO will use a triangulation methodology using NYSERDA location information to estimate the PSS/e buses where the solar DER is located. The NYISO will coordinate with Transmission Owners to confirm or update the locations.
  - For non-Solar DER and storage, the NYISO will work with the Transmission Owners to identify the PSS/e buses where DER is located.
  - For DER participating in the NYISO DER program, the appropriate modeling information and location is to be supplied by the responsible entity.

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Stability Models - Future

- **U-DER will be explicitly modeled using the information provided in the interconnection process**
- **Similar to steady-state models, in 2020 the NYISO will develop test cases where R-DER is explicitly modeled**
  - Will use explicit models for Utility-Scale DER (U-DER) NYISO project that go through the NYISO Interconnection process and when available.
  - Will use the DER_A model for Retail-Scale DER (R-DER) and for U-DER when an explicit model is not available
  - The parameters will be set consistent with the NERC Reliability Guideline-Parameterization of the DER_A Model

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DER_A Dynamic Model

- Is a stand-alone model that is also incorporated into the dynamic load model (CMDL)
- Incorporates the parameters of IEEE-1547
- The NERC Reliability Guideline on Parameterization of the DER_A Model provides default values for IEEE-1547 including default values when there is a blend of older and newer version of IEEE-1547

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IEEE 1547

- IEEE 1547-2018 was published in April 2018 and significantly enhances the performance and functional capability of DERs connecting specifically to the distribution system.
- This latest version expands the scope of prior IEEE 1547 standards by considering BPS issues, such as ride-through requirements, as well as distribution issues.

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DER_A model - Partial Tripping

- **Voltage Recovery Fraction (Vrfrac) is the setting for the ratio of DERs that restore output upon voltage recovery and should be set to:**
  - 0 for legacy DERs (i.e., no DER restore output following a ride-through event)
  - 1.0 for modern DERs (i.e., all DERs restore output following a ride-through event)
  - Some value in between for a mix of a legacy and modern DERs based on the assumed vintage of the DER deployed.
  - A value of Vrfrac = 0 is a conservative assumption and should be used if no detailed DER information is available. Since IEEE Std. 1547-2018 is a relatively new standard, for now, Vrfrac can be set at or near 0.

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Transmission Security

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Steady-State Transmission Security

- **Historically, for a relatively small amount of DER, netting with load provides a good model in steady-state analysis since:**
  - Transmission Security analysis typically focuses on a snapshot of Summer and Winter Peak load conditions and
  - Summer and Winter Peak load conditions are the conditions forecasted in the Gold Book
- **Going forward, when the system models have explicitly modeled the components of DER**
  - For those DER facilities that will be dispatchable under the NYISO DER program, they will be dispatchable in the Transmission Security analysis consistent with the capabilities of the aggregation
  - If the DER facilities are not dispatchable, then the dispatch will be consistent with the methodology in Gold Book

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Stability Transmission Security

- **Going forward, the modeling will break out the components of DER**
  - Will use explicit models for Utility-Scale DER (U-DER) NYISO project that go through the NYISO Interconnection process when available.
  - Will use the DER_A model for R-DER and for U-DER when an explicit model is not available
    - The parameters will be set consistent with the NERC Reliability Guideline-Parameterization of the DER_A Model

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Considerations when modeling a significant amount of DER

- **For steady-state, summer peak may no longer be the most stressed case for the electric system**
  - Light load cases where there are areas that have excess DER could load lines and send the power to other areas
- **For stability, Peak/Light load cases may no longer be the most stressed cases**
  - Shoulder period cases, where DER could be a significant resource and loads are reasonably high could be the most stressed cases

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IEEE 1547-2018 Performance Categories

- IEEE 1547-2018 provides three categories that would be assigned to specific (groups of) DERs and the coordination of regional voltage and frequency trip settings across the transmission and distribution (T&D) interface.
- The specification of these regional functional settings will need to balance bulk system reliability and distribution concerns.

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NERC Reliability Process - Bulk Power System Reliability Perspectives on the Adoption of IEEE 1547-2018

- Category II performance covers minimum BPS reliability needs, and coordinates with NERC Reliability Standard PRC-024-2, which was developed to avoid adverse tripping of BPS generators during system disturbances.
- IEEE standards are voluntary in nature, so state regulators, local distribution utilities, or other applicable governing bodies throughout North America must adopt them. The FERC Small Generator Interconnection Procedures and Energy Policy Act of 2005 reference IEEE 1547 and any updates to the standard, so DER interconnections that are subject to FERC jurisdiction are likely subject to the requirements of IEEE 1547-2018. Similarly, Authorities Governing Interconnection Requirements (AGIRs) should ensure appropriate adoption and implementation of IEEE 1547-2018 in interconnection requirements for all other DERs not subject to FERC jurisdiction. In many cases, interconnection requirements for DERs may need to be modified to accommodate the new standard.

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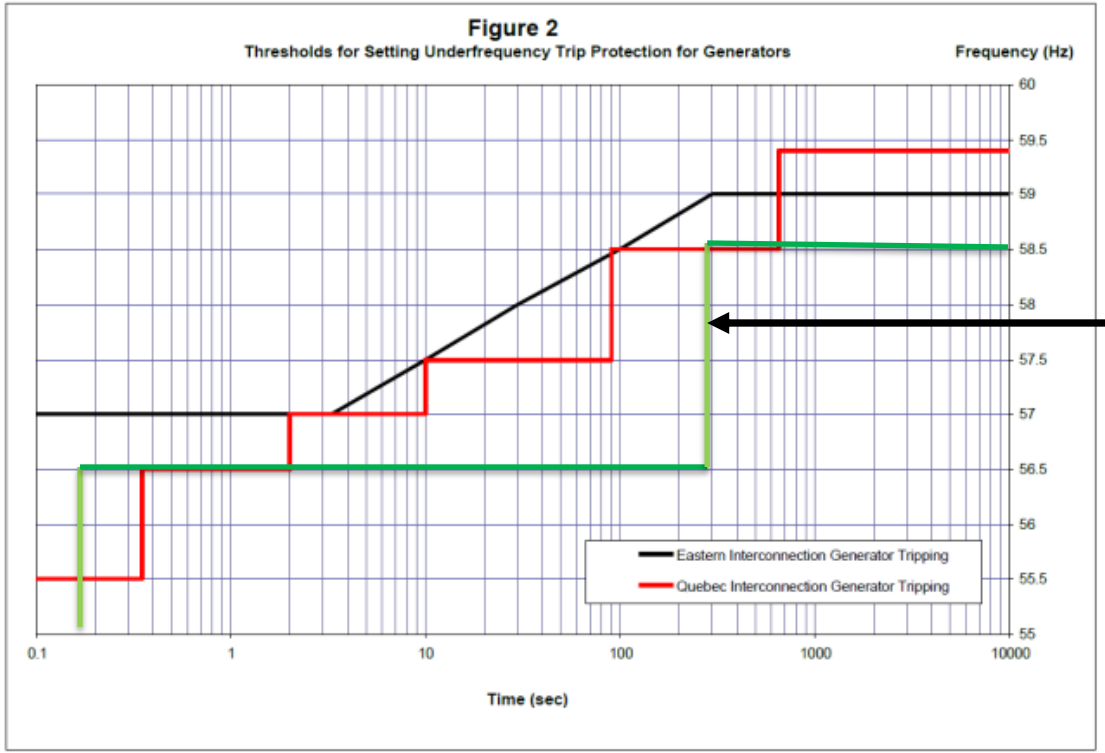
Figure 2
PRC-006-NPCC-2
Underfrequency Load Shedding Program – Thresholds for Setting Underfrequency Trip Protection for Generators



IEEE 1547 – 2018 Default Values

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Resource Adequacy

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Resource Adequacy

- **U-DER**
  - Is modeled explicitly: probabilistic model (GE MARS) chooses from five years of production data output shapes (one shape per replication is randomly selected in Monte Carlo process)
- **Solar- R-DER**
  - The solar impact is backed out from the load forecast, and modeled explicitly (similar to U-DERs)
  - Probabilistic model (GE MARS) chooses from five years of production data output shapes (one shape per replication is randomly selected in Monte Carlo process)
  - Aligns with the method used for wind, utility solar, landfill gas, and run-of-river facilities
- **Non-Solar and Energy Storage-DER**
  - The NYISO is actively investigating the best way to model storage including looking at new MARS features and post-processing tools
  - Non-solar DG, storage, and EV impacts at peak are otherwise currently accounted for in the load forecast components
  - Modeling of DER aggregations will be developed in the future as data becomes available

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Other Work

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System Planning Impacts from Distributed Energy Resources (SPIDER) Working Group

- **NYISO is actively participating on the NERC SPIDERWG**
  - The working group has published a Reliability Guideline: Bulk Power System Reliability Perspectives on the Adoption of IEEE 1547-2018

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Questions?

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Our mission, in collaboration with our stakeholders, is to serve the public interest and provide benefit to consumers by:

- Maintaining and enhancing regional reliability
- Operating open, fair and competitive wholesale electricity markets
- Planning the power system for the future
- Providing factual information to policymakers, stakeholders and investors in the power system

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