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Impacts of DERs on the BPS

Lessons from NERC SPIDERWG

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NARUC NASEO NASUCA Training Session

June 22, 2021

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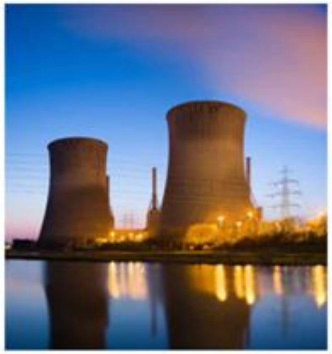
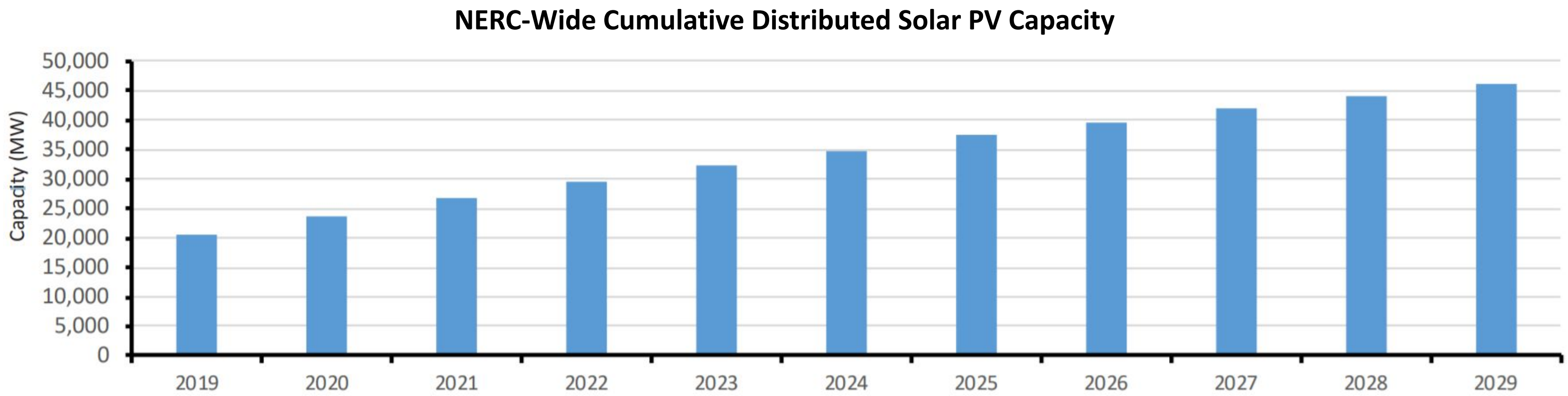


NERC System Planning Impacts of Distributed Energy Resources Working Group (SPIDERWG)

Aggregate Impacts of Distribution-Connected Energy Resources

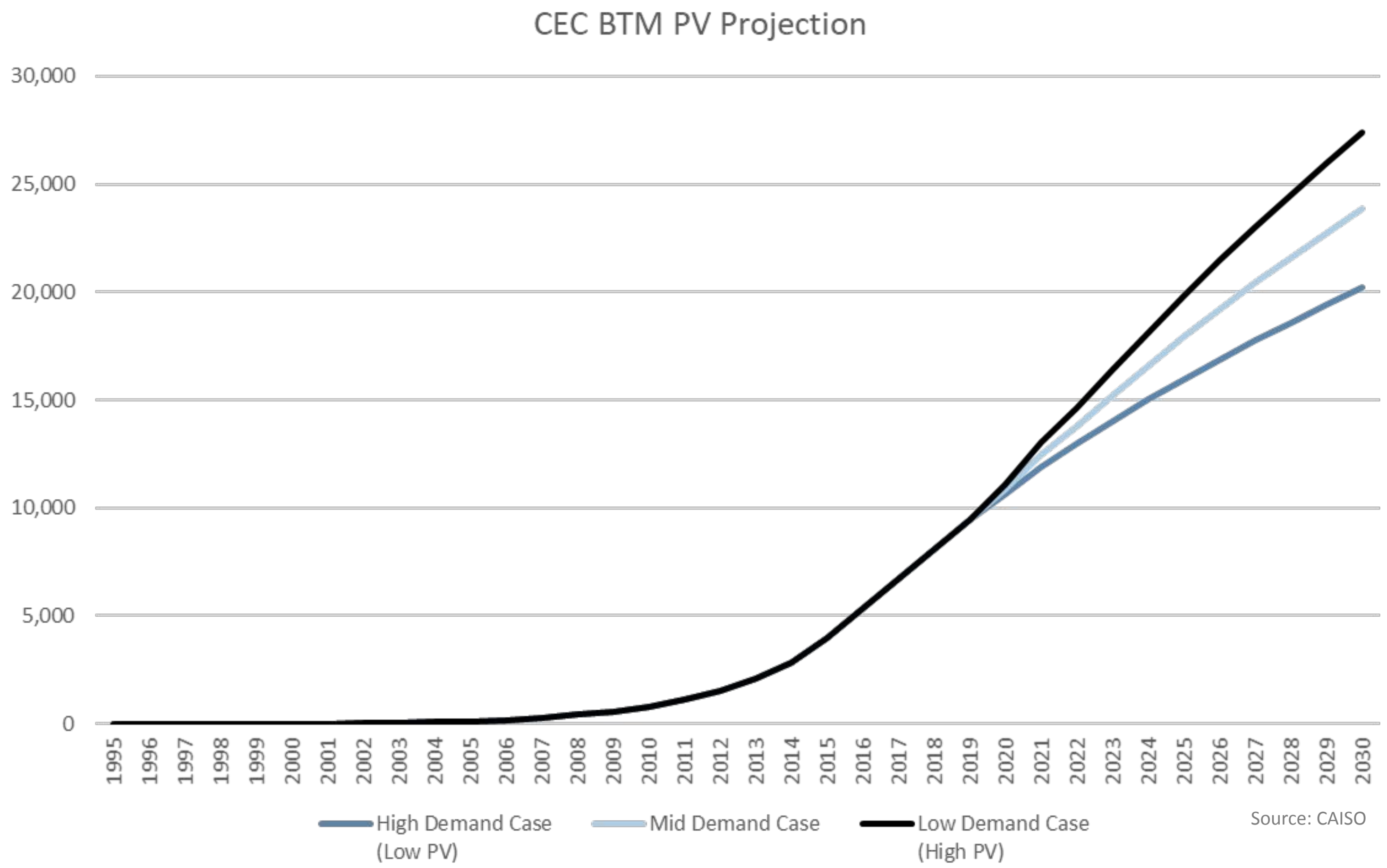
Continuing Trends in DERs



DER penetrations are growing.

Mostly solar PV. Batteries likely to follow.

DER Growth in Context



DER penetrations are growing quickly and steadily.

DER Growth in Context

Mar. 2021 | Summary | Net Load | Pricing | VER Curtailment | Reliability Metrics

Source: CAISO

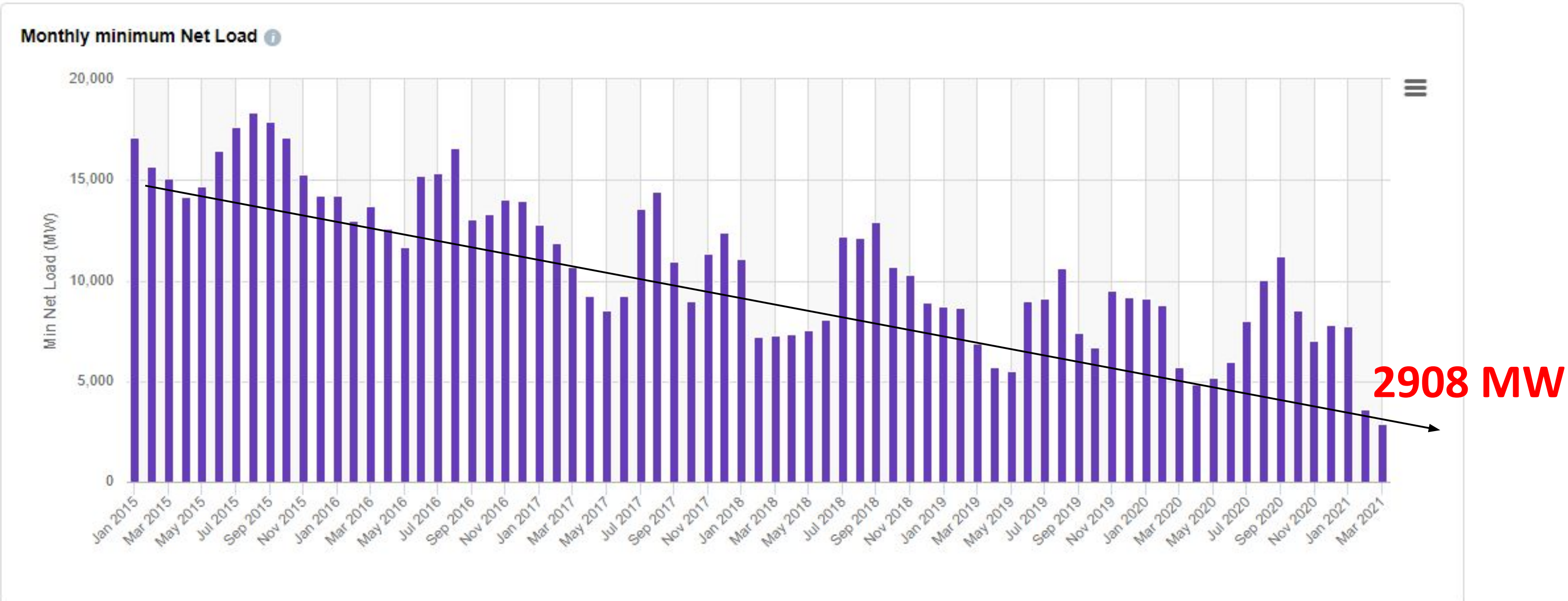
Summary

34.82% Mar Average Renewable Serving Load	**30.14%** Year to Date Average Renewable Serving Load	**92.52%** Max 5 min. Renewable Serving Load All-time	**5.772TWh** Mar Metered Renewable Generation
12913MW Mar Max Solar Production	**12913MW** Year to Date Max Solar Production	**12913MW** All-time Max Solar Production	**323580MWh** Mar Solar Energy Curtailed
5497MW Mar Max Wind Production	**5497MW** Year to Date Max Wind Production	**5497MW** All-time Max Wind Production	**18390MWh** Mar Wind Energy Curtailed
17101MW/3hr Mar Max 3 Hour Net Load Ramp	**7.299%** Percent of 5-min Intervals with Negative Prices	**133.5%** Mar Average Control Performance Standard (CPS1)	**341970MWh** Mar Wind and Solar Energy Curtailed

The BPS is dealing with its own challenges regarding the rapid transition toward renewables.

DER Growth in Context CAISO

Net Load



Source: CAISO

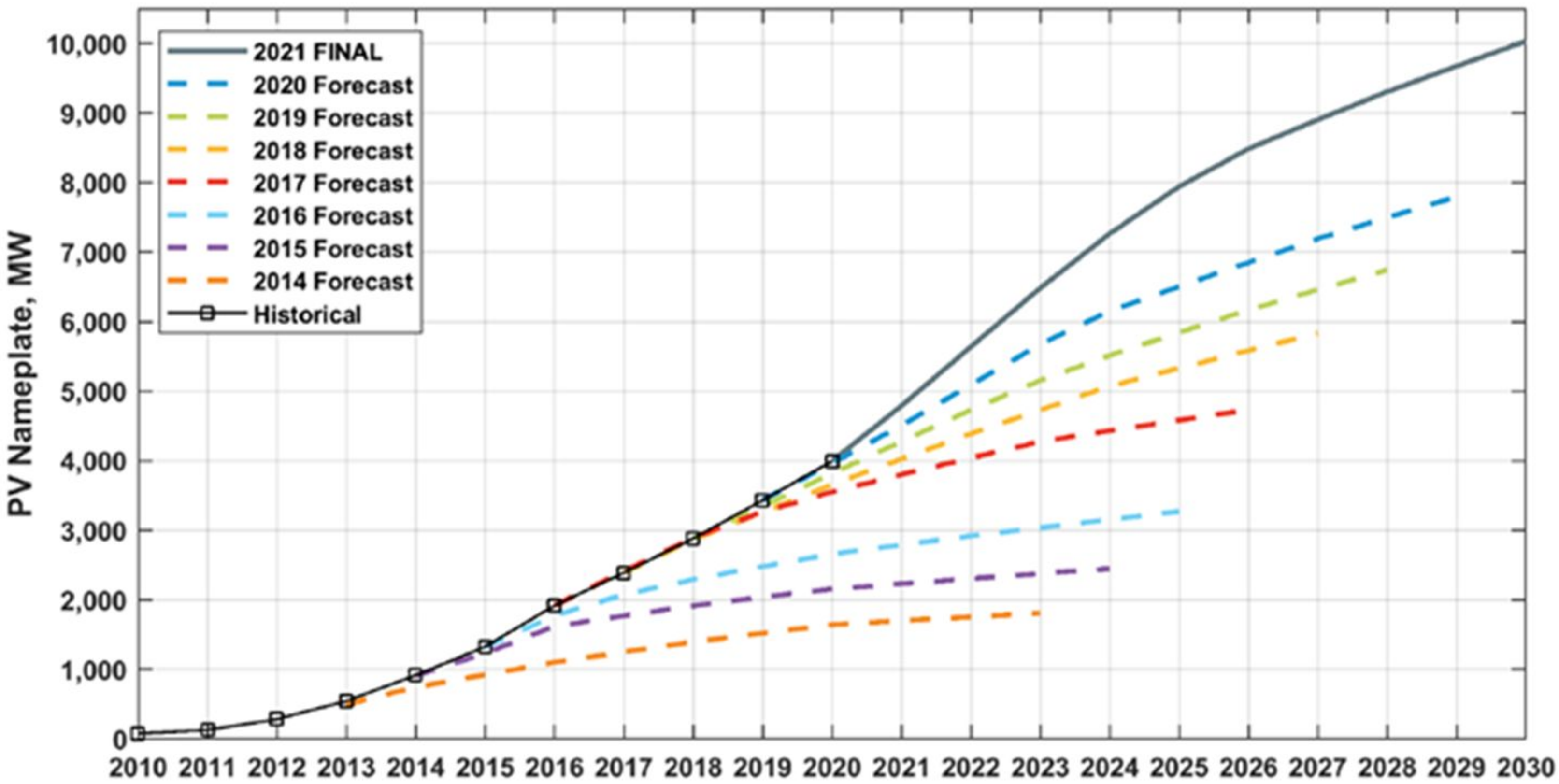
Growing DERs = dropping net demand levels

Lowest net demand levels during off-peak conditions

Coincident with renewables

Will multisector electrification outpace installation of DERs?

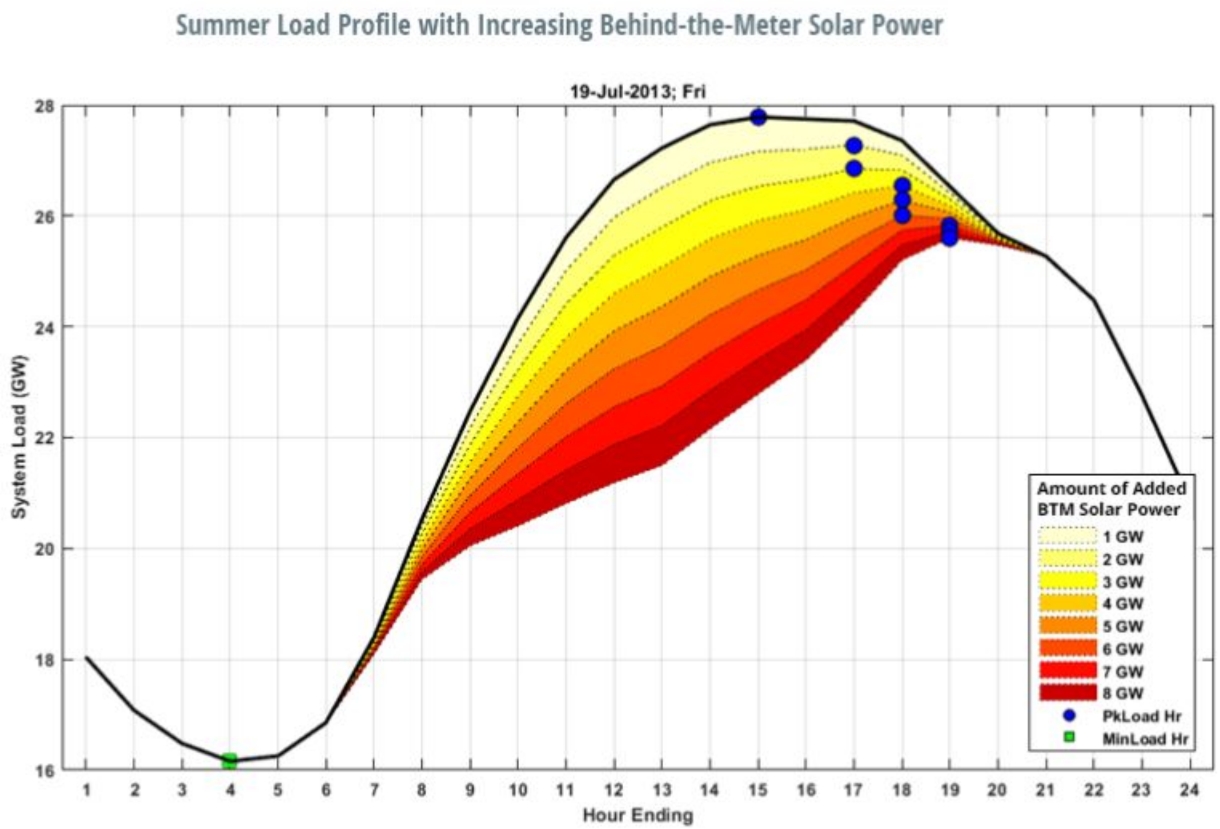
DER Growth in Context
ISO-NE



Source: ISO-NE

It's not just a California issue
Your forecast is definitely wrong (they always are).
And likely underestimated.

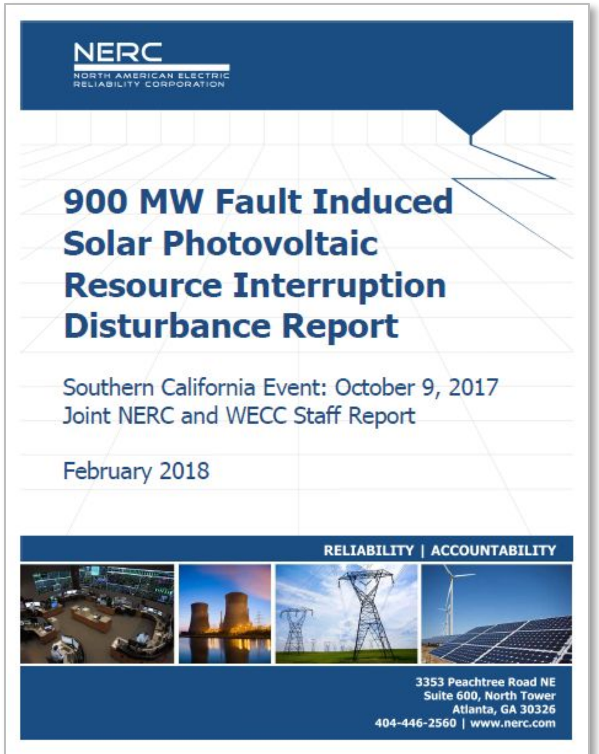
DER Growth in Context ISO-NE



Source: ISO New England

Growing DERs are shifting peak load hour.
Affects modeling and studies.
Information sharing is key.

NERC Disturbance Reports and Alerts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900 MW Fault Induced Solar Photovoltaic Resource Interruption Disturbance Report

Southern California Event: October 9, 2017
Joint NERC and WECC Staff Report

February 2018

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April and May 2018 Fault Induced Solar Photovoltaic Resource Interruption Disturbances Report

Southern California Events: April 20, 2018 and May 11, 2018
Joint NERC and WECC Staff Report

January 2019

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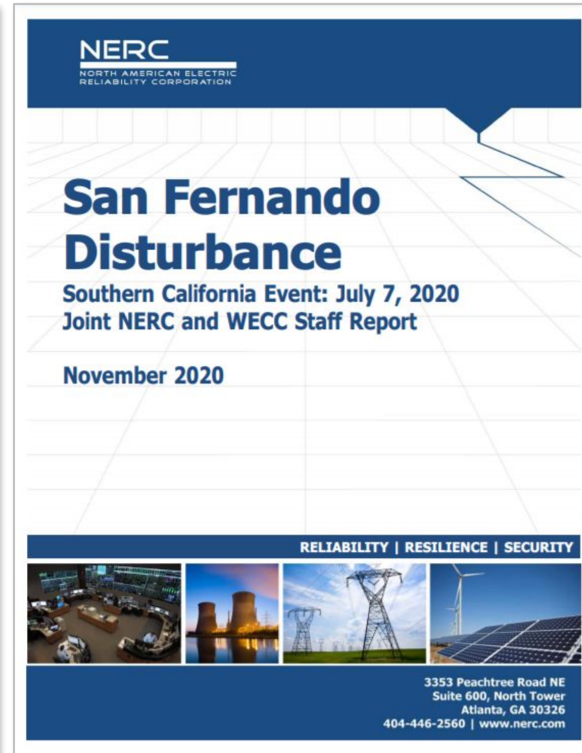
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San Fernando Disturbance

Southern California Event: July 7, 2020
Joint NERC and WECC Staff Report

November 2020

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These events all involved DER tripping caused by transmission-level fault events

9 August 2019 UK Disturbance

Overview

3.30. Our lower bound for total estimated distributed generation lost across the event is 1,300MW, and the loss could be as high as 1,500MW. There is a significant possibility that this volume is in excess of the transmission connected generation lost during the event. This underscores the changes that Great Britain's electricity system is facing and the importance of understanding the role of distributed generation in the energy mix and the control of the electricity system. Our findings on the causes of the distributed generation losses also highlight the importance of compliance with the Distribution Code, and the need to strengthen and clarify the regulatory framework for these generators to meet current and future electricity system needs.

Significant DER tripping – frequency and ROCOF protection.
Not expected or well-studied previously.

ofgem
Making a positive difference
for energy consumers

9 August 2019 power outage report

Publication date:	3 January 2020	**Contact:**	Simon Wilde
		Team:	Systems and Networks
		Tel:	020 7901 1834
		Email:	August2019PowerOutage@ofgem.gov.uk

This report sets out the key findings to date, outcomes and next steps from our investigation into the power outage that occurred on 9 August.

In the report we:

- identify the circumstances and causes of the outage;
- set out our assessment of the key issues, and the outcomes of our investigation into certain licensed parties' compliance with their obligations;
- identify the lessons to be learned by the energy sector to improve the resilience of Great Britain's electricity network; and
- recommend actions to implement the lessons learned.

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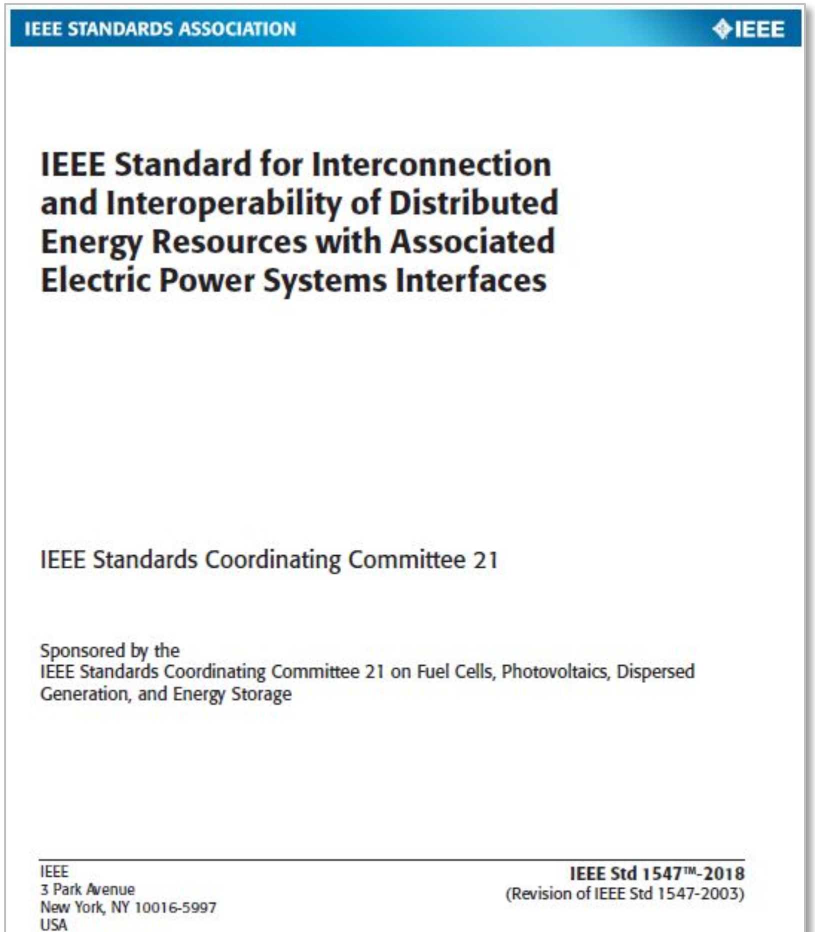
IEEE 1547-2018 and BPS Reliability Perspectives


IEEE STANDARDS ASSOCIATION ◆IEEE

IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

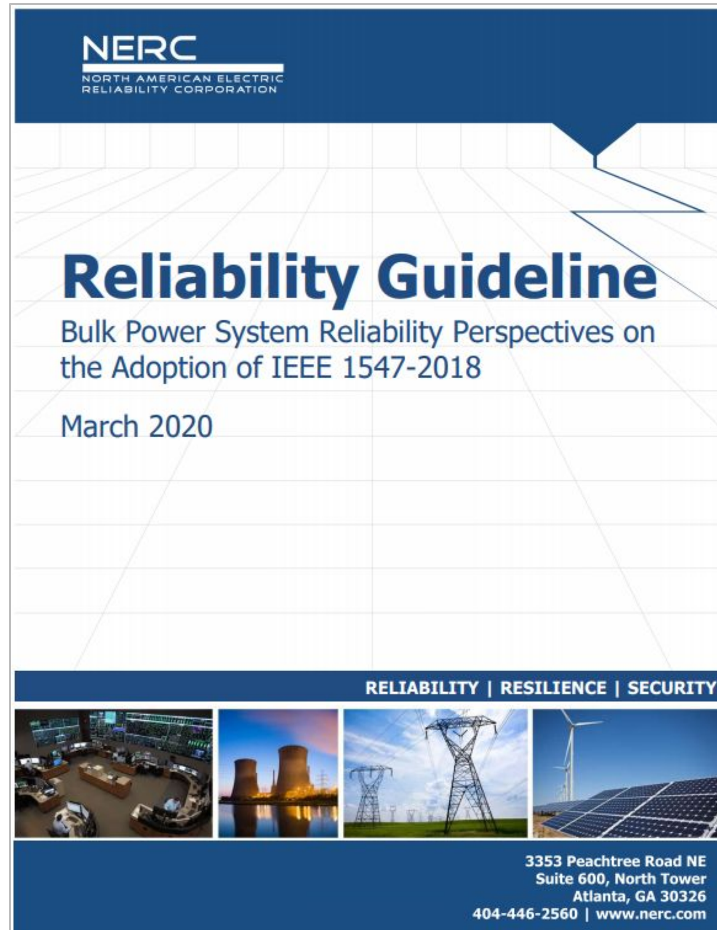
IEEE Standards Coordinating Committee 21

Sponsored by the
IEEE Standards Coordinating Committee 21 on Fuel Cells, Photovoltaics, Dispersed Generation, and Energy Storage

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

IEEE Std 1547™-2018
(Revision of IEEE Std 1547-2003)

Source: IEEE SA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Reliability Guideline

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

March 2020

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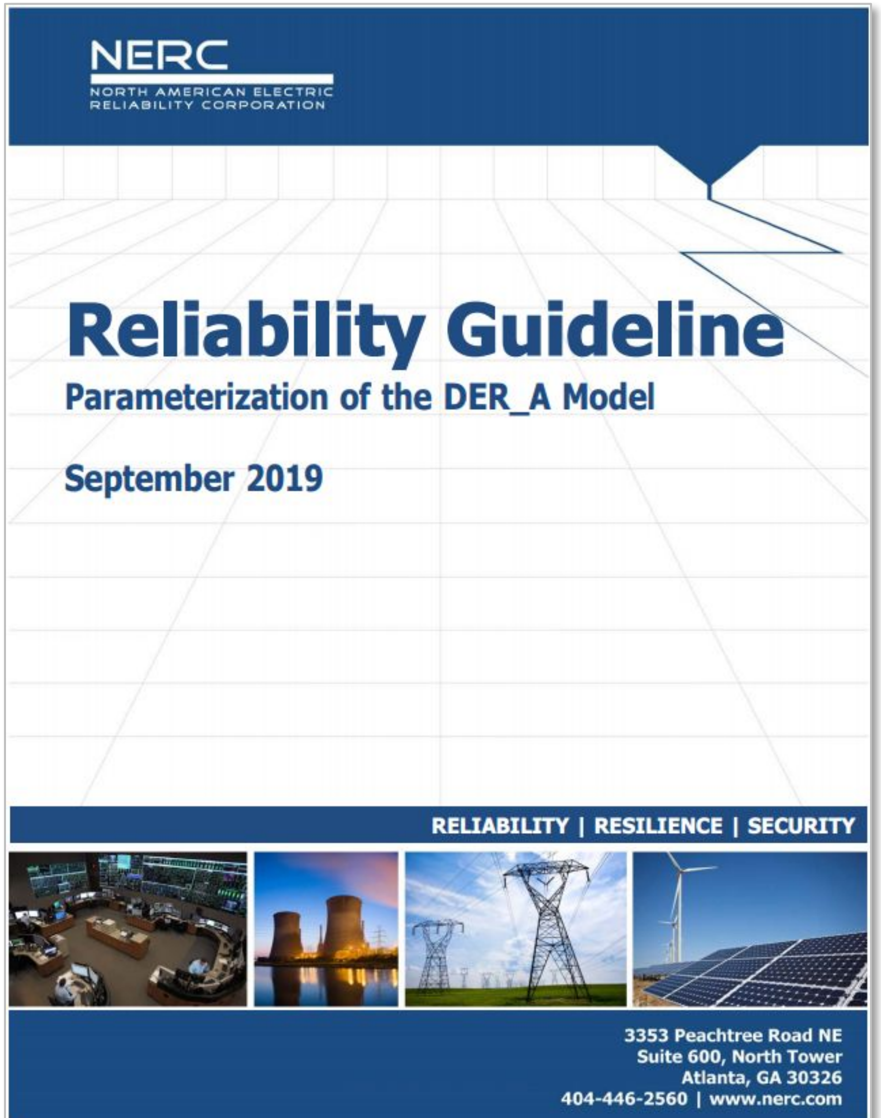
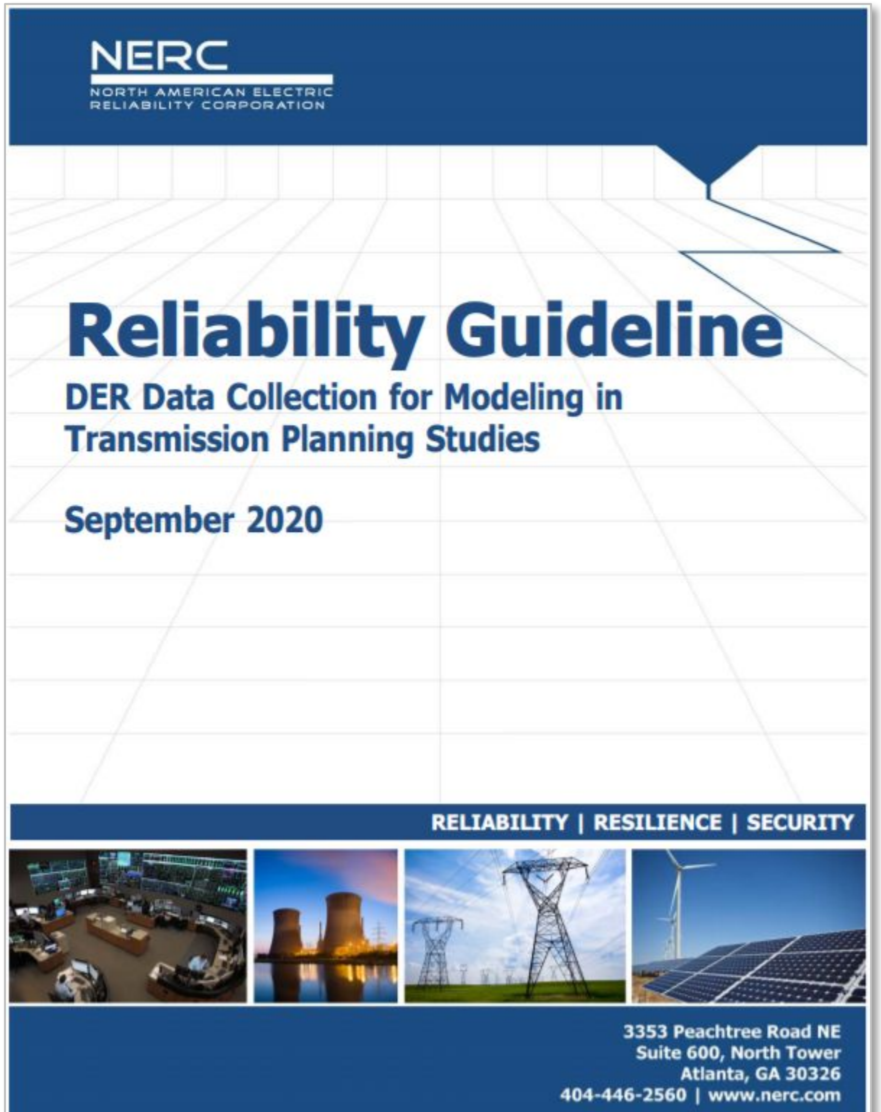
Implementation of 1547-2018 is paramount.

Reliability Guideline on DER Modeling for Planning Studies



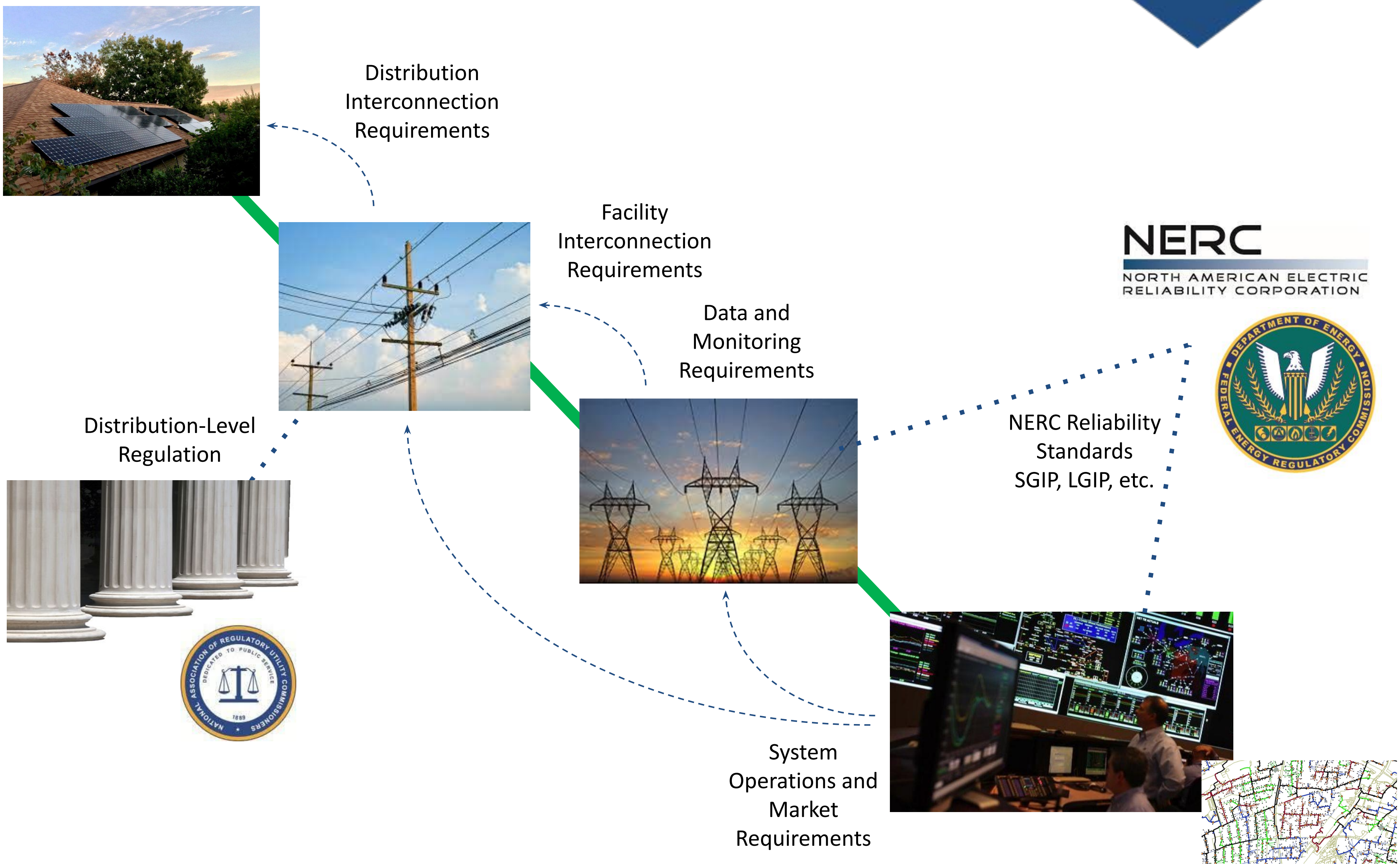
- *Transmission planners perform studies to ensure reliability of the BPS*
  - *Include all models of applicable elements (and aggregate facilities)*
- *Being able to represent the aggregate amount of DERs in a planning study is critically important as penetrations grow.*
- *We have models that are able to do this.*
- *This guideline explains how those models work.*

Reliability Guideline on DER Data Collection for Planning Studies



- *Transmission planners need information and data to be able to populate those models of future penetration levels.*
  - *Aggregate capacity*
  - *Aggregated location information*
  - *Vintage of installation*
    - *Tripping possibility*
    - *Sensitivity analyses*
- *Data flow from distribution to transmission entities – aggregate information*

Requirements Flow



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DER Data Flow

Interconnection Information

In-Service Date
End-of-Service Date
DER Type

DER kW Capacity
Vintage of IEEE 1547

Aggregate DER Data

Installed Capacity by T-D Transformer
Aggregate vintage information
Requirements driving performance
T-D Measurement Points
Utility-Scale DER Measurements

Considerations for Increasing DERs

- Is the flow of DER information clear for your jurisdiction?
  - Is effective T-D coordination taking place to facilitate information sharing?
- Leverage guidance from across industry on DER integration successes, modeling, studies, data collection, etc.
- Planning considerations
  - Modeling aggregate DERs in transmission planning
  - Developing base case assumptions for penetration levels
  - Sensitivity analyses
  - Dispatch assumptions for DERs and aggregators
- Data sharing across regional bodies
- Are you prepared for implications of third-party DER aggregators?

Questions and Answers

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