NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

This is a Compliance Monitoring and Enforcement Program (CMEP) Practice Guide. It is developed exclusively by the ERO Enterprise under its obligations for independence and objectivity. This CMEP Practice Guide is intended for use by ERO Enterprise Staff to support consistency as they perform CMEP activities. This CMEP Practice Guide is posted publicly solely to provide transparency.

ERO Enterprise CMEP Practice Guide

Modeling and Studies Involving Distributed Energy Resources

October 13, 2022

Preface

In support of successful implementation of and compliance with the North American Electric Reliability Corporation (NERC) Reliability Standards, the Electric Reliability Organization (ERO) Enterprise[1] adopted the Compliance Guidance Policy.[2] The Compliance Guidance Policy outlines the purpose, development, use, and maintenance of guidance for implementing Reliability Standards. According to the Compliance Guidance Policy, Compliance Guidance includes two types of guidance – Implementation Guidance and Compliance Monitoring and Enforcement Program (CMEP) Practice Guides.[3]

Purpose

CMEP Practice Guides are developed solely by the ERO Enterprise to reflect the independent, objective professional judgment of ERO Enterprise CMEP staff and, at times, may be initiated following policy discussions with industry stakeholders. Approved Practice Guides are posted for transparency on the NERC website. Certain aspects of this Practice Guide may assist CMEP staff directly in determining compliance; while other aspects may assist CMEP staff in understanding the processes and controls, the entity has in place to reduce risks to the bulk power system (BPS).

The purpose of this Practice Guide is to provide areas of focus that CMEP Staff may consider in acquiring an understanding of how the registered entity has accounted for mitigating the aggregate impacts of distributed energy resources (DERs) in relation to certain Reliability Standards. In all cases, the determinations of compliance with Reliability Standards are to be made in light of the facts and circumstances of the individual registered entities and the language of the requirements.

Background

North America is experiencing a rapid growth in distributed energy resources that will have a significant impact on how registered entities plan, design, and operate the BPS (see Figure 1).[4] The projected levels of DERs across North America are growing rapidly and are expected to continue increasing at different rates across multiple geographic footprints. Some year-over-year DER projections have been underestimated,[5] further emphasizing the rapid growth of resources connecting to the distribution system and offsetting BPS

[1] The ERO Enterprise consists of NERC and the Regional Entities.

[2] The ERO Enterprise Compliance Guidance Policy is located on the NERC website at: http://www.nerc.com/pa/comp/Resources/ResourcesDL/Compliance_Guidance_Policy_FINAL_Board_Accepted_Nov_5_2015.pdf.

[3] Implementation Guidance provides a means for registered entities to develop examples or approaches to illustrate how registered entities could comply with a Standard that are vetted by industry and endorsed by the ERO Enterprise. CMEP Practice Guides differ from Implementation Guidance in that they address how ERO Enterprise CMEP staff executes compliance monitoring and enforcement activities, rather than examples of how to implement the Standard.

[4] https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2021.pdf

[5] *See* https://www.iso-ne.com/static-assets/documents/2021/04/final_2021_pv_forecast.pdf at pg. 11 of 67.

generation. In general, near-term growth projections are more accurate, while longer-term projections have usually been underestimated and can be significantly different than actual values.

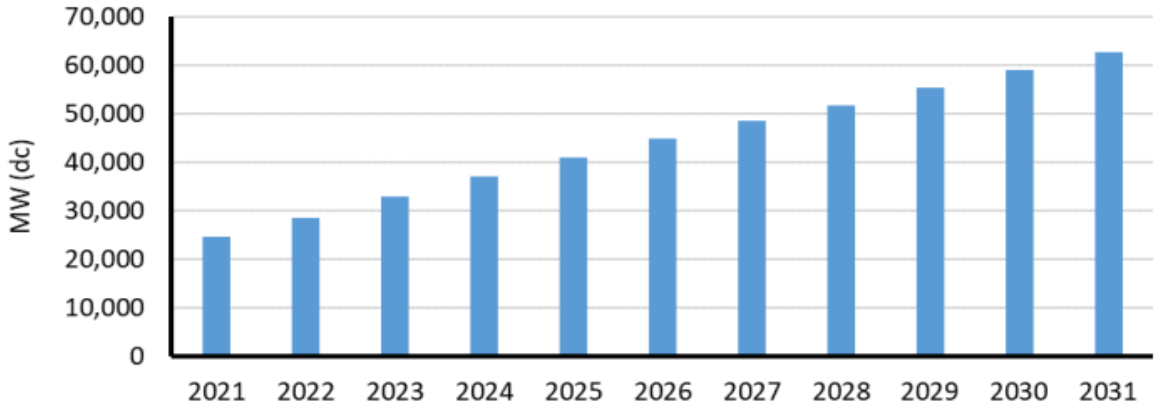

Figure 1: NERC-Wide Cumulative Distributed Solar PV Capacity — 2021 through 2031

DERs have impacted BPS performance in a number of major disturbances in North America and around the world including, but not limited to, the following:

- In August 2019, the United Kingdom experienced a grid disturbance that unexpectedly triggered underfrequency load shedding (UFLS). One of the contributing factors to the UFLS operation was a significant unexpected power reduction of DERs in addition to the other BPS generation losses. The Office of Gas and Electricity Markets (Ofgem) estimates that at least 1,300 MW of DERs were tripped and that "there is a significant possibility that this volume is in excess of the transmission-connected generation lost during the event." Further, Ofgem highlights that "understanding the role of distributed generation in the energy mix and the control of the electricity system" is of paramount importance moving forward.[6]
- In April and May 2018, CAISO experienced two fault events (the Angeles Forest and Palmdale Roost disturbances) that resulted in approximately 130 MW and 100 MW of DERs tripping, respectively.
- In July 2020, CAISO experienced a fault event in the San Fernando Valley that caused approximately 80 MW of DER tripping.[7]

The 2019 NERC Risk Priorities Report also highlighted grid transformation as an overarching risk area.[8] Within that area, coordination of behind-the-meter DERs with the BPS was highlighted as a "potential challenge to the BPS from a planning and forecasting perspective." Furthermore, the 2021 NERC Risk Priorities Report also recognized "emerging risks emanating from different areas of the grid (e.g., resources like DERs that are not located or directly connected to the BPS)." These examples highlight the growing impact that DERs are having on grid performance today. It is critical to note, however, that DERs can and

[6] https://www.ofgem.gov.uk/system/files/docs/2020/01/9_august_2019_power_outage_report.pdf
[7] https://www.nerc.com/pa/rrm/ea/Pages/Major-Event-Reports.aspx
[8] https://www.nerc.com/comm/RISC/Documents/RISC%20ERO%20Priorities%20Report_Third_Draft_September_2019_CLEAN.pdf

will impact BPS planning and operations modeling, studies, and analysis much earlier than any actual grid disturbances that involve abnormal performance of these resources during contingency events. CMEP staff considers how registered entities account for DERs in planning and operational assessments to ensure registered entities identify and mitigate BPS reliability risks. A recent NERC initiative shows a consolidated list of ERO Enterprise work for use by registered entities as a quick reference guide on DERs.[9]

Approach to Evaluating Modeling and Studies Involving DERs

The following sections provide guidance for CMEP staff to consider during CMEP activities to evaluate the registered entity's consideration of DER aggregate impacts in relation to certain Reliability Standards. The considerations are grouped by risk categories and then Reliability Standard to identify areas of potential risk associated with growing levels of DERs. While facts and circumstances ultimately shape CMEP determinations, CMEP staff may use the practices identified below to gain a better understanding of how the entity considers the impact of DERs associated with the specific standards.

Entity Coordination by Reliability Standard

EOP-005-3

- CMEP staff considers what the Transmission Operator (TOP) and Reliability Coordinator (RC) do to ensure accurate and validated Load data, including possible connections of DERs, as part of their system restoration plans.
  - CMEP staff may seek additional follow-up to consider DER capability differences such as available power versus total aggregate maximum capacity and how this can impact TOP and RC system restoration plans.
- CMEP staff considers how the RC coordinates DER settings across different state or other jurisdictional boundaries where settings may differ.

Risk Category - Entity Coordination
Coordination among entities, both internally and externally, as well as 3rd party suppliers and contractors, is necessary prior to making changes to the system or taking any actions that has a potential to impact another entity and in turn may impact the reliability and security of the BPS. Coordination should address risk associated with operating horizon, planning horizons and during emergencies. Failure to coordinate may result in impact to the reliability and security of the BPS.

- CMEP staff considers how the RC coordinates to ensure that each TOP is appropriately accounting for and maintaining awareness of the operational impacts of DERs (e.g., reconnection, ramp rates, etc.) on system restoration, including the establishment of a Cranking Path and the impacts to voltage and frequency conditions during restoration.
  - CMEP staff may focus on this the RC restoration plans review required by EOP-005-3 of the TOPs within the RC area under EOP-006-3 R5 and 5.1.

[9] https://www.nerc.com/pa/Documents/DER_Quick%20Reference%20Guide.pdf

MOD-031-3

- CMEP staff considers how the Planning Coordinator (PC) and Balancing Authority (BA) are quantifying necessary information regarding the variability and uncertainty of renewable-based DERs for both historic and forecast quantities.
- CMEP staff considers the PC and BA processes to obtain and review data. This may include gathering data in the correct and suitable formats as well as gathering data that is sufficiently accurate and inclusive of DER forecasts.
- CMEP staff considers how the PC and BA are considering all DER output in peak Demand and Net Energy for Load.

MOD-032-1

- CMEP staff considers if the Transmission Planner (TP) and PC are gathering suitable DER data to create steady-state base cases representative of aggregate DERs and dynamics models to represent the aggregate performance of these DERs during simulated BPS disturbances. CMEP staff may seek additional follow-up, including:
  - How model parameters are being selected to represent expected DER performance during BPS disturbances (including tripping, momentary cessation, etc.).
  - What assessments, analysis, or considerations have been given to determining the extent to which DER data is to be collected per NERC MOD-032-1 activities?
  - What entities are providing aggregate DER data to the PC for accurate modeling in planning assessments, and whether the TPs or PCs experiencing any difficulties gathering this information.
  - What situations exist where the appropriate entity has not provided necessary aggregate DER information and may be introducing gaps in the data collection process based on the procedures established and data requests administered.
- CMEP staff considers: 1) how the PC or TP have used data quality checks to ensure the data provided by applicable entities is accurate; and 2) the processes the PC or TP have implemented to notify entities of technical concerns with the data submitted. CMEP staff may seek additional follow-up, including:
  - How the PC or TP have formulated a technical basis for the accuracy of all data used in their planning base cases and reliability studies, inclusive of aggregate DER representation.
  - How the PC or TP have documented any technical concerns with the data provided and sought updates from the applicable entities, and whether the applicable entities have provided suitable data corrections in response to those requests.
  - How the PC or TP responded to any disagreement in the technical concerns between the PC or TP and the applicable entity, particularly with representation of aggregate DER information (e.g., a revolving 90-day period where the same technical concerns are circulated).

Emergency Operations Planning by Reliability Standard

EOP-005-3

- CMEP staff considers how the TOP is accounting for DERs in the analysis, simulations, or testing to verify the Blackstart Resources' active and reactive power, the magnitude of loads that impact voltage and frequency, and other generating resources required to control system voltages and frequency.
  - CMEP staff may place emphasis on R6.1 in verifying the capability of Blackstart Resources to meet the Real and Reactive Power requirements of the Cranking paths and the dynamic capability to supply initial loads.

Risk Category - Emergency Operations Planning
Entities must have the necessary facilities, tools, processes and procedures in place to prevent or respond to system events, emergencies or unexpected conditions. Failure to develop adequate plans may result in gaps of processes, procedures and tools, which may lead to compromise the integrity and reliability of the BPS.

- CMEP staff considers how the TOP assesses expected DER automatic return to service[10] settings and performance (particularly relevant to inverter-based DERs) that may affect system restoration activities. These settings may be dictated in equipment standards such as IEEE 1547[11] or distribution interconnection requirements. Legacy DERs may automatically reconnect within minutes of detecting a grid voltage, and CMEP staff will examine whether these effects on BPS performance are quantified.
  - CMEP staff may emphasize this during the review of restoration plans and discussion with entities on their understanding and impacts of DER within their operating footprint.
- CMEP staff considers how the TOP assesses DER effects on Loads selected as part of the Cranking Path. For instance, does the TOP have an understanding of the penetration level of DERs on each Load (e.g., distribution feeders or substations) selected in the Cranking Path? How does the TOP ensure adequate identification of Distribution Provider DER data collection processes and integration of that data?

[10] DERs may include pre-determined and programmed automatic return to service settings that will attempt reconnection to the grid (likely with a timer) as soon as they detect acceptable terminal voltage and frequency conditions.
[11] https://standards.ieee.org/standard/1547-2018.html

Modeling Data by Reliability Standard

MOD-031-3

- CMEP staff considers how the PC and BA incorporate DERs in their definition of Total Internal Demand, Net Energy for Load, and Demand Side Management data; specifically, CMEP staff considers how the inclusion of DERs affects gross load quantities and demand side management activities.
  - CMEP staff may seek additional follow-up to consider how the PC or BA are requesting actual data for Demand, Net Energy for Load, and Demand Side Management, and how those requests account for aggregate DER penetrations.
- CMEP staff considers how the PC and BA have incorporated DER data collection into data requests per MOD-031 explicitly, if applicable. If they have not, CMEP staff seeks to understand the cause or reason.
  - CMEP staff may seek additional follow-up to consider how any requests for summary explanations are accounting for aggregate DER penetrations.

Risk Category - Modeling Data
Simulation tools are mathematical models of individual components and their control systems, when applicable. These models form the building blocks of power system studies performed in the planning and operations horizons. Models that entities have verified to be accurate are critical to a range of reliability studies including transmission planning assessments and establishing SOLs and IROLs, as well as state estimation used for Real-time Assessments (RTA) and Operation Planning Assessments (OPA). The validity of those assessments is dependent on modeling data which includes, but is not limited to, correct Facility Ratings, verified generator real and reactive capability, and knowing how control systems respond to dynamic system conditions. Failure by appropriate entities to provide that data in a timely manner and at intervals that will assure model accuracy during retirements and new construction, may compromise the integrity and reliability of the BPS.

MOD-032-1

- CMEP staff considers how the registered entity has incorporated findings from NERC reliability guidelines and disturbance reports involving DER tripping into modeling requirements and procedures.
- CMEP staff considers how the PC and each of its TPs jointly developed or updated their steady-state and dynamic data requirements to be inclusive of DER data.
  - CMEP staff may seek additional follow-up to consider MOD-032-1 Attachment 1, steady-state column, Item 9 and dynamics column, Item 10 to gather data "necessary for modeling purposes."
- CMEP staff considers the specific specifications for gathering DER data established in the jointly developed modeling requirements, including data format, level of detail, and case types and scenarios to be modeled.

- CMEP staff may seek additional follow-up to consider how the registered entity establishes data collection requirements for different aggregate DER types, and how time, weather, or other variability factors are incorporated into the requirements, as needed.

System Protection by Reliability Standard

PRC-006-5

- CMEP staff considers how the PC is applying recommendations and other guidance materials related to DER tripping during BPS disturbances.
- CMEP staff considers that the PC has a strong technical basis (backed by study results, historical events, etc.) for the selection of either gross load or net load in the imbalance equation cited in PRC-006-5.
- CMEP staff considers how PCs are incorporating the aggregate impacts of DERs into UFLS program design, specifically around how DERs are represented in UFLS studies. CMEP staff may seek additional follow-up to determine:
  - How PCs have considered the recommended practices outlined in NERC Reliability Guideline: Recommended Approaches for UFLS Program Design with Increasing Penetrations of DERs.[12]
  - How PCs are determining the level of detail and modeling assumptions used for aggregate DER representation in UFLS studies.
  - How each PC has considered DERs in their determining portions of the BES that may form islands.
  - How the PC has considered historical events and system studies (involving DER) in their considerations.
  - How the aggregate DER models used in UFLS studies are parameterized, particularly for underfrequency and rate-of-change-of-frequency (ROCOF) tripping, based on known information such as vintage of IEEE 1547, historical events, or other relevant factors.

Risk Category - System Protection

Reliability of the BPS requires that adequate generation supplies meet the existing load during steady-state and expected dynamic conditions. When faults or failures occur, the system must respond in a manner that isolates the problem, but maintains integrity of the BPS as is possible. To accomplish such a complex goal, the protection systems must be capable of identifying the location of the problem, the type of problem, and isolating the appropriate part of the BPS while minimizing the disturbance to the remainder of the system. This requires the Protection Systems associated with the generation, transmission, and load to accurately detect system properties and respond appropriately to unsafe conditions. Protection System settings must allow control systems to provide a full range of control and allow the system to "ride-through" expected transients. Owners of interconnecting BPS devices and systems must coordinate the settings of their systems with the neighboring systems to ensure they interact in a manner to achieve the desired outcome and prevent unnecessary disconnection of equipment. The Protection System must also be prepared in a manner that will respond to Misoperations of the primary protection. Entities must identify and correct the source of those operational failures.

[12] https://www.nerc.com/comm/Pages/Reliability-and-Security-Guidelines.aspx

  - How PCs are accounting for the impacts that adjacent feeders (especially those with high DER penetration) have on the UFLS studies.
- CMEP staff considers how UFLS entities are accounting for DER penetration levels in the selection of feeders used for UFLS arming. CMEP staff may seek additional follow-up to determine:
  - How gross versus net load is being used to calculate imbalance levels in the UFLS studies, and how DER penetration levels were accounted for in that determination.
  - How DERs are affecting the UFLS entities' ability to arm and trip a suitable amount of Load that is determined by the PC in their UFLS program.
  - How PCs and UFLS entities are ensuring that any changes to DER penetrations are not having an adverse impact on UFLS program design and operation, particularly if these changes can compromise the effectiveness of the UFLS program.

Long-term Studies/Assessments by Reliability Standard

TPL-001-4[13]

- CMEP staff considers: 1) how the TP and PC gather necessary information about the aggregate levels of DERs in their planning area; and 2) how that information translates into planning base case assumptions, model selection and parameterization, and BPS performance criteria (if applicable).
- CMEP staff considers how DER penetrations have affected planning base case assumptions, particularly around how registered entities use Peak versus Off-Peak operating conditions in planning studies. CMEP staff may seek additional follow-up, including:
  - What methodology is used to modify dispatch of BPS-connected resources to account for growing levels of DERs?
  - How TPs and PCs are considering tripping of generators, including aggregate DERs, where voltage conditions show the possibility of DER tripping for known voltage limitations.
  - What analysis was conducted by the TP and PC to quantify the difference between gross and net Peak Load levels for Years 1, 2, and 5, and what technical basis is used to select which case(s) are appropriate to use for planning assessments.

Risk Category - Long-term Studies/Assessments
Long-term studies and assessments in the planning horizon are used to evaluate whether the system can reliably operate in Real-time. This includes the correct identification and protection of transmission and generation assets, properly designed plans for System Restoration from Blackstart Resources, impact studies for new and revised facilities, correct methodologies to determine and communicate SOLs and transfer capabilities, analysis of disturbances and misoperations, proper design of UFLS and UVLS programs and response to GMD events. Failure to do so will likely result in gaps and may compromise the integrity and reliability of the BPS.

[13] Guidance for TPL-001-4 to apply for TPL-001-5.1 when version 5.1 becomes effective on 7/1/2023

  - How the Peak load hour is determined if the operating hour shift between the gross versus net Peak Load and Off-Peak Load cases. If significant DER penetrations are causing differences between Peak and Off-Peak operating conditions, how are TPL SMEs conducting, short-circuit studies and maintaining an effective feedback loop for proper relay coordination under those operating conditions?

- CMEP staff considers how the registered entity models aggregate DERs in the steady-state planning cases, particularly post-contingency. CMEP staff may seek to understand the technical basis for configurations in which the aggregate DER models are providing essential reliability services such as voltage control.
- CMEP staff considers how the dynamic performance of aggregate DERs (particularly the possibility of DER tripping) is affecting BPS performance in TP or PC studies, particularly in areas with high penetrations of DERs or rapid DER growth. CMEP staff may seek additional follow-up, including:
  - How the TP and PC apply stability criteria to aggregate DER generating resources in the stability studies, including possible tripping, momentary cessation, or other control actions.
  - How possible generator tripping during stability studies is considered by TPs and PCs, including aggregate DERs, where voltage conditions show the possibility of DER tripping for known voltage limitations.
- CMEP staff considers how DER forecasts are used to create sensitivity cases, particularly the aggregate effects (e.g., possibly tripping, reduction of power output, or other protection and controls) that different DER forecast levels and DER vintages could have on BPS dynamic performance. CMEP staff may seek additional follow-up, including:
  - How forecast uncertainty (based on historical data or future projections) has been used to determine reasonable bounds on DER penetration, particularly in the long-term planning horizon, and how are those bounds used to create sensitivity cases and studies.
  - What analysis was conducted to quantify the impacts of forecast uncertainty, particularly in areas with rapid DER growth?
- CMEP staff considers how DERs are assessed in short-circuit analyses, such as breaker duty studies, particularly in the determination of the case assumptions, as well as what determines how to model the aggregate DERs in those studies.
- CMEP staff considers how any use of Non-Consequential Load Loss considered the effects of DERs on those Load elements.
- CMEP staff considers how TPs and PCs coordinate DER modeling and performance information with neighboring TPs or PCs, particularly for studies that affect neighboring footprints or studies near TP or PC boundaries. CMEP staff may seek additional follow-up, including:
  - How aggregate DERs are represented in steady-state and dynamic simulations in neighboring TP or PC footprints, particularly when those areas have notable penetration of DERs.
  - How TPs and PCs develop system models, particularly for real and reactive Load forecasts, and how DERs are accounted for in those forecasts.

- CMEP staff considers how the registered entity parameterizes and configures aggregate DER dynamic models, and whether those models provide dynamic control of electrical system quantities (e.g., bus frequency, inverter terminal voltage, remote bus voltage, etc.) during disturbance events.
  - CMEP staff may seek additional follow-up around possible tripping or other performance issues of DERs in neighboring areas considered in the TP or PC planning assessments.
- CMEP staff considers how the registered entity parameterizes aggregate DER dynamic models by the TP, PC, or other applicable entity submitting the data, to represent the expected performance of aggregate DERs. CMEP staff may seek additional follow-up, including:
  - How aggregate DER models differentiate between the performance of DERs and end-use load components that may have different performance during grid disturbances.
  - How TPs and PCs are representing "projected System conditions," inclusive of the representation of aggregate DERs in the TP or PC planning area.
- CMEP staff considers how TPs and PCs are assessing "demand-side resources required for Load," which is inclusive of DERs represented in planning assessments.
  - CMEP staff may seek additional follow-up regarding how aggregate levels of DERs are represented in planning study models both in steady-state and dynamic base cases.
- CMEP staff considers how the expected dynamic behavior of aggregate Loads are (including induction motor Loads) modeled and represented explicitly separate[14] from the expected dynamic behavior of aggregate DERs. CMEP staff may seek additional follow-up, including:
  - How the TP and PC have considered the performance of aggregate DERs in establishing BPS performance criteria.
  - How the BPS performance criteria align with known DER performance criteria such as IEEE 1547 (varying versions based on installation time).

[14]The current positive sequence simulation platform standard model libraries provide the option for a combination of DER and load components in the composite load models. Entities that use the model (and parameterize the components explicitly) can explicitly represent aggregate DERs in addition to gross load dynamic behavior, therefore fully representing the dynamic behavior of both the DERs and the end-use loads.

Summary Guidance by Reliability Standard

EOP-005-3

EOP-005-3 requires that "plans, Facilities, and personnel to enable System restoration from Blackstart Resources to ensure reliability is maintained during restoration and priority is placed on restoring the Interconnection." Restoration plans are intended to ensure that large portions of the Bulk Electric System (BES) can be methodically restored following a widespread outage using designated Blackstart Resources and identified Cranking Paths. These activities must be coordinated between and across TOPs and RCs to ensure, the system can be effectively and expeditiously restored. This requires coordination of system restoration strategies, operating plans, and established system performance requirements to return generation and Load across the Interconnection.

As the penetration of DERs continues to grow, the aggregate impacts of DERs can and will affect system restoration activities and will need to be considered by TOPs and RCs. Large fluctuations in DER output over a relatively short time period will have an elevated impact on BPS voltage and frequency during restoration activities and needs to be considered by the TOP and RC.

MOD-031-3

MOD-031-3 provides "authority for applicable entities to collect Demand, energy and related data to support reliability studies and assessments and to enumerate the responsibilities and obligations of requestors and respondents of that data." TPs and PCs perform reliability studies that require information regarding Demand, energy, and related data for both existing quantities and projections of future conditions. This information is used to create the planning base cases that serve as a foundation for planning assessments and reliability decisions. Having accurate values for Load, inclusive of DERs, is paramount to developing accurate planning models and conducting reliability studies. Further, Resource Planners (RPs) need sufficient information to forecast future years' demand and generation to provide targets for resource procurement as well as assessments of future years' capacity and energy adequacy metrics. The growing penetration of DERs in many areas is affecting Total Internal Demand, Net Energy for Load, Demand Side Management quantities, and data needed to perform reliability assessments.

PRC-006-5

PRC-006-5 establishes "design and documentation requirements for automatic underfrequency load shedding (UFLS) programs to arrest declining frequency, assist recovery of frequency following underfrequency events, and provide last resort system preservation measures." The standard focuses specifically on ensuring that the UFLS programs designed by the PC are able to adequately provide a functional safety net to preserve the Interconnection. This requires accurate modeling and studies of BPS performance during severe underfrequency conditions, including accurate representation of the effects of aggregate DERs. DERs may offset net loading of distribution feeders, some of which may be selected for UFLS arming, and also may have dynamic effects (e.g., tripping) during severe frequency excursions that need to be accounted for in UFLS studies.

TPL-001-4[15]

TPL-001 establishes "Transmission system planning performance requirements within the planning horizon to develop a BES that will operate reliably over a broad spectrum of System conditions and following a wide range of probable Contingencies." Long-term planning assessments use models of the BPS to ensure that system planning performance requirements are met over a broad spectrum of future system conditions and following a wide range of probably contingencies. DERs have a notable impact on BPS performance by changing the steady-state power transfers on the BPS, tripping during BPS fault events, and altering the short-circuit behavior of the BPS. These types of possible reliability impacts need to be accounted for in planning assessments performed by TPs and PCs, inclusive of the impacts of aggregate levels of DERs. Performing planning assessments without due consideration for the impacts of aggregate DERs on the BPS may lead to inappropriate corrective actions, possible reliability gaps in future operating conditions, or BPS performance deficiencies not properly identified in the planning horizon.

[15] Guidance for TPL-001-4 to apply for TPL-001-5.1 when version 5.1 becomes effective on 7/1/2023.

Revision History

Revision #	Revision Date	Revision Details
V1.0	10/13/22	Initial Draft