NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Technical Rationale

Project 2023-01 EOP-004 IBR Event Reporting

Reliability Standard EOP-004-5 – Event Reporting | February 2024

Introduction

This document is the technical rationale and justification for Reliability Standard EOP-004-5 and includes the rationale for changes in the current proposed version, as well as previous versions of the standard. It is intended to provide stakeholders and the ERO Enterprise with an understanding of the revisions, technology and technical concepts of Reliability Standard EOP-004-5. This is not a Reliability Standard and should not be considered mandatory and enforceable.

Background

The Standard Authorization Request (SAR) proposes enhancements to EOP-004-4 (EOP-004) focused on ensuring timely reporting by industry to the Electric Reliability Organization (ERO) Enterprise through reporting of events involving inverter-based resources (IBRs). The project will address the issue that reporting of generation loss events, per the current EOP-004, uses relatively large size thresholds more suitable for synchronous generation. However, NERC and the Regional Entities have analyzed multiple widespread solar PV loss events (some also involving other generation losses as well) across a large number of resources that did not meet the EOP-004 criteria. These events have highlighted systemic reliability risks posed by IBRs that should be reported by applicable entities. This project will modify the existing generation loss criteria so it is more suitable and appropriate for reporting IBR events and so it aligns with past large-scale disturbances analyzed by the ERO. Without these improvements, the ERO must lean on ad hoc reporting per the NERC Event Analysis Process, which is voluntary in nature and involves significantly longer reporting timelines. The EOP-004 standard should be aligned with this process from a reporting size criteria perspective. As reported in numerous ERO disturbance reports, access to data useful for event analysis and risk mitigation following large-scale disturbances has been challenging for IBRs. This has resulted in data unavailability and overwriting by affected facilities since the ERO Enterprise is unable to send requests for information in a timely manner (i.e., must wait for the brief report to be submitted by the associated Reliability Coordinator first). Improved reporting will enable quicker response to widespread IBR loss events and ultimately lead to improved performance of the generation fleet through more detailed analysis and coordination with affected entities, where applicable.

Rationale for Attachment 1

The purpose of the EOP-004-5 is to improve the reliability of the Bulk Electric System (BES) by requiring the reporting of events by Responsible Entities. The event reporting thresholds of Attachment 1 require updating for IBRs as discussed in the background section.

Section 1: IBR generation loss threshold

IBR definition

- **The definition for Inverter-Based Resource as proposed by Project 2020-06 as of December 8, 2023 is as follows:**
  - **Inverter-Based Resource (IBR):** A source (or sink in the case of a charging battery energy storage system (BESS)) of electric power that is connected to the electric power system (transmission, sub-transmission, or distribution system), and that consists of one or more IBR Unit(s) operated as a single resource at a common point of interconnection. IBRs include solar photovoltaic (PV), Type 3 and Type 4 wind, BESS, and fuel cell.
- Based on the definition, the Drafting Team (DT) considers the following IBR generation examples to include, type 3 wind, type 4 wind, solar photovoltaic, battery energy storage, and fuel cell resources.
- The proposed EOP-004-5 will not move forward to final ballot until the IBR Glossary of Terms is finalized by Project 2020-06.

Rationale for exemptions to reporting

- The DT added multiple exemptions for reporting the threshold in Attachment 1. If the entity is aware that one of those exemptions are met, then they are not required to report the IBR generation loss event.

Rationale for "aggregated generation loss of ≥ 500 MW threshold"

- The term "loss" includes instances the IBR unit(s) trips offline, or there is a full or partial reduction of active power output (MW).
- The DT determined the 500 MW threshold from the ERO Event Analysis Process (Category 1i) should be utilized for consistency.
- The number of IBR facilities affected by IBR generation loss could be one or multiple. The number of affected facilities is not included in the threshold, because the BA may not know the exact number or which facilities were affected within the reporting time requirement.
- Using the 500 MW threshold for Category 1i events, there have been approximately 11 events reported from January 2020 to June 2023 via the ERO Event Analysis Process, meaning there have been 11 reported IBR generation loss events over 3.5 years, or about 3 events per year across North America. The DT believes this is not an over-reporting of events, and the 500 MW threshold seems reasonable for EOP-004-5. A list of events with links to the event reports is provided below.
- The DT considered, and decided against, using a percentage threshold based on the Balancing Authority (BA) generation capacity in the BA's footprint. For example, a 25,000 MW IBR generation capacity with 2% threshold would equate to a 500 MW IBR generation loss. Using a percentage

threshold would need to be recalculated on a reoccurring basis by the BA as new IBR facilities come online.

- DT agreed that the 500 MW criteria should be based on aggregate IBR output instead of the number of individual units lost. This is due to time constraints of submitting the EOP Event Reporting Form, or DOE OE-417 form. The BA may not know the exact number of facilities or which facilities were included in the IBR generation loss in the 24-hour (or next business day) reporting window. To comply with EOP-004, the BA need only report the basic information required in EOP-004 Attachment 2, and can report the available information when threshold was exceeded and within the time requirement. The BA, respective GOs, and ERO can later determine which IBR generators experienced generation loss as part of the subsequent ERO Event Analysis Process.

Rationale for "30 second period"

- DT reduced the duration from one minute for traditional generation loss to 30 seconds for IBR events. The reasoning is that the calculation from traditional generation loss is usually based on breaker openings and resources disconnecting from the BES. However, this calculation method requires analyzing aggregated Telemetering data for IBR MW output and deriving maximum loss over a shorter period of time.
- A one minute duration could lead to more events detected that are a result of normal IBR output fluctuation due to change in wind, cloud cover, irradiance, ramping due to curtailment, etc. These are non-events and we should be focused on events that have a quicker drop in output due to a system disturbance.
- Allowing at least 30 seconds allows for multiple Telemetering data samples to occur and accounts for delay in Telemetering data.

Rationale for "Telemetering data"

- The BA can only monitor what it has visibility to via its Telemetering data.
- The BA will use "Telemetering data from IBR generators within its Balancing Authority Area (including, at a minimum, BES-connected IBRs, and BPS-connected IBRs for which the BA has Telemetering data)."
- By utilizing Telemetering data (e.g. SCADA tags), the aggregated IBR generation loss value does not distinguish between BES and BPS resources, and does not distinguish between the MW capability values of each Facility. Meaning if the BA has Telemetering data for a 50 MVA facility connected to the BPS, which is less than the current BES 75 MVA threshold, then it should be included in the aggregate total.
- EOP-004-5 does not require the BA to obtain additional or new Telemetering data. The BA would already have Telemetering data for all BES facilities with TOP-003 or IRO-010 (for Generator Owners), and some BPS connected facilities through interconnection agreement(s) (for GO-IBR).
- As the BA gains additional Telemetering data for a BPS connected facility (GO-IBR) at a future date, via TOP-003 or interconnection agreement, then the facility would be included in the aggregate IBR generation total.

Consequential/non-consequential interruption (generation loss)

- The BA may not be able to distinguish between consequential and non-consequential generation loss within a 24-hour reporting window. Therefore, this delineation was not included in the requirement language. The determination of consequential/non-consequential generation loss would therefore be determined in the Event Analysis Process.
- Non-consequential interruption (generation loss) is described in the Event Analysis Process as, "the interruption of resources caused by action of control systems on the resources in response to perturbations in voltage and/or frequency on the Interconnection, not including the control actions of a RAS".
- Failure of Telemetering data from IBR units triggering the reporting threshold may be excluded from reporting requirement.

Section 2: DC Tie Line loss threshold

- DT determined the 500 MW threshold from the Event Analysis Process (Category 1j) should remain for consistency.

Examples of IBR Loss Event Reports:

- April 2023 Southwest Utah Disturbance Report: loss of 921 MW PV generation

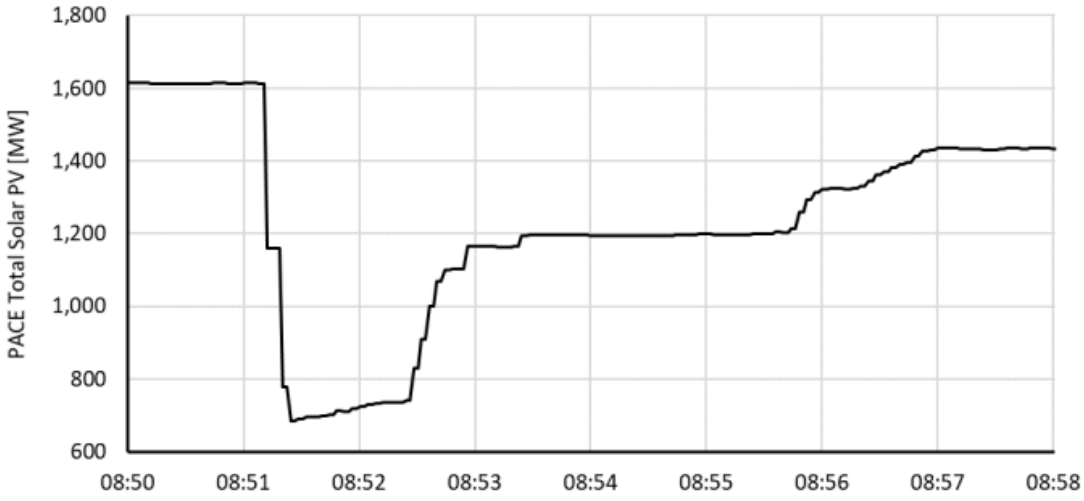

Figure I.2: PACE BPS-Connected Solar PV during Disturbance

- June 2022 Odessa Disturbance Report 1,711 MW of inverter-based resources

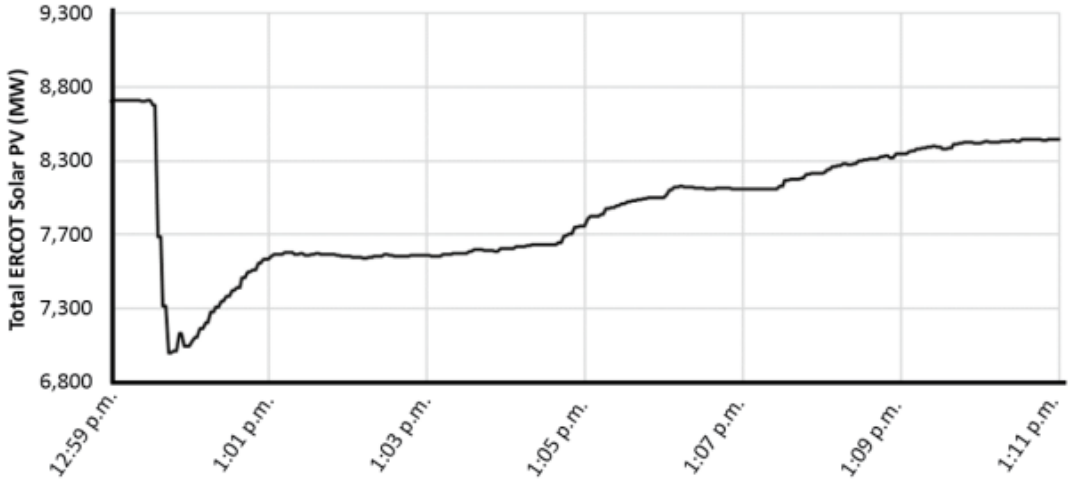

Figure I.4: ERCOT BPS-Connected Solar PV Generation during Disturbance [Source: ERCOT]

- March 2022 Panhandle Wind Disturbance Report Loss of 765 MW of wind resources (10 facilities)

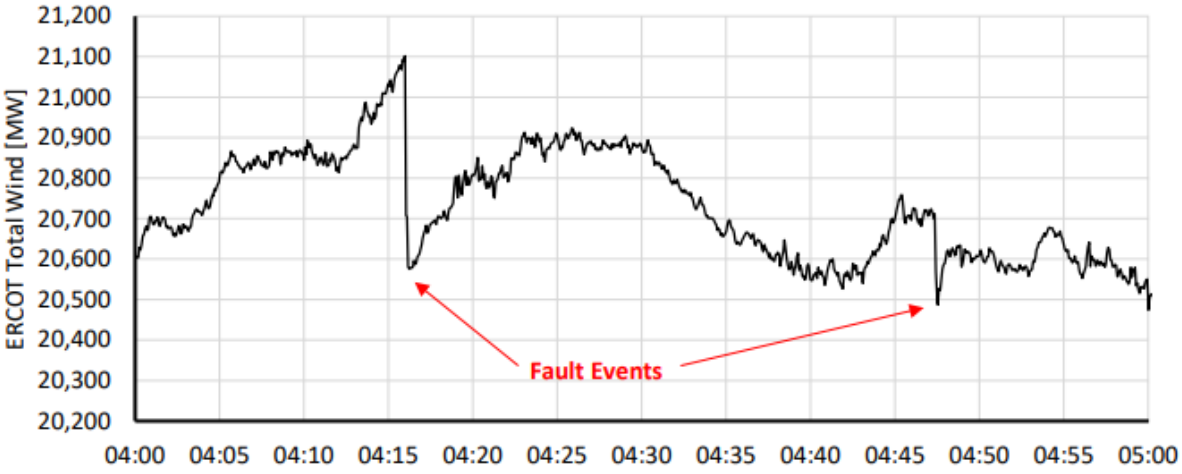

Figure I.5: ERCOT Wind Output during Disturbances

- June-August 2021 CAISO Solar PV Disturbance Report: All 4 days listed on page 2 met the 500 MW threshold (730 MW, 605MW, 511MW, 583 MW).

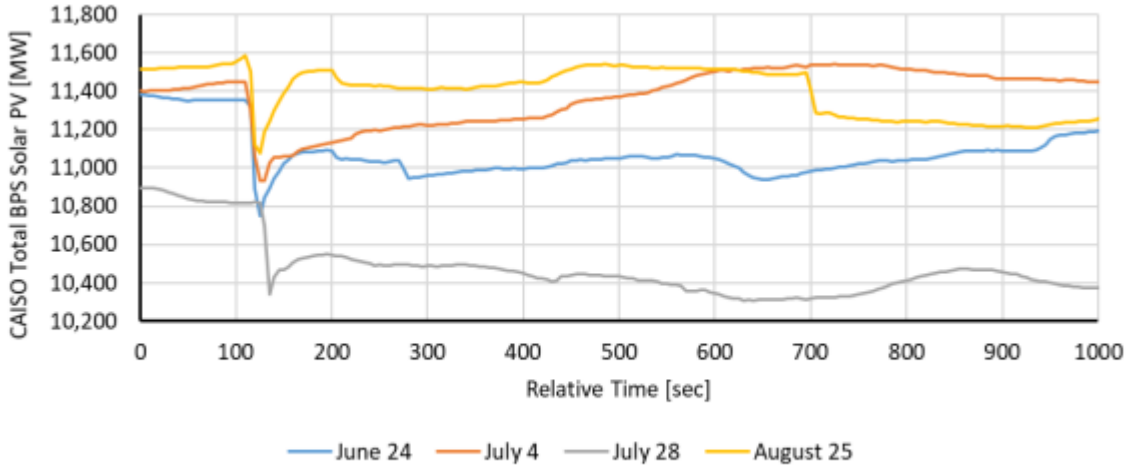

Figure 1.2: CAISO BPS-Connected Solar PV during Disturbance

- May/June 2021 Odessa Disturbance Report: 1,112 MW reduction

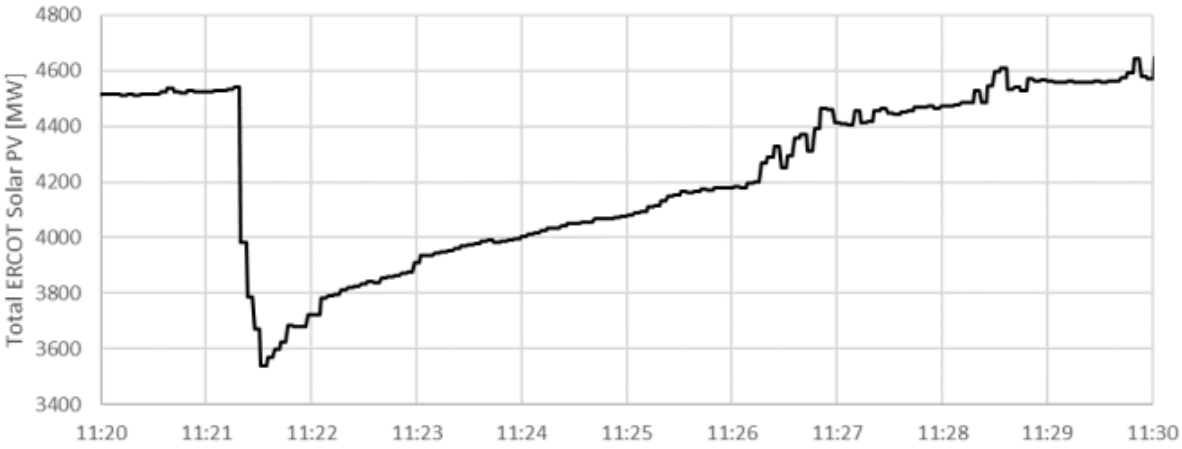

Figure I.5: ERCOT BPS-Connected Solar PV during Disturbance [Source: ERCOT]

- July 2020 San Fernando Solar PV Reduction Disturbance Report: IBR generation loss was 901 MW with CA-ISO.

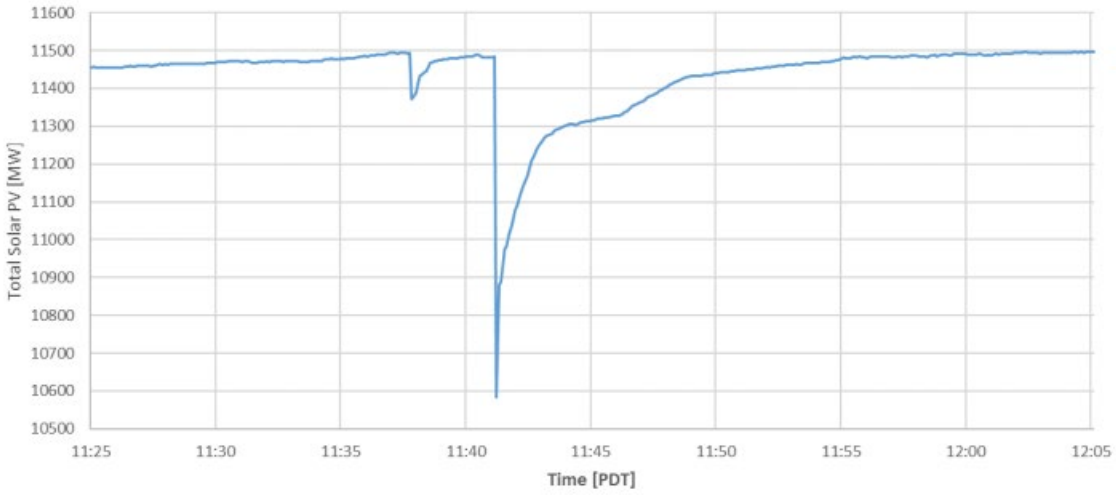

Figure 1.4: CAISO BPS-Connected Solar PV during Disturbance [Source: CAISO]

- Canyon 2 Fire Disturbance report, ~900 MW of solar PV lost as a result of these events

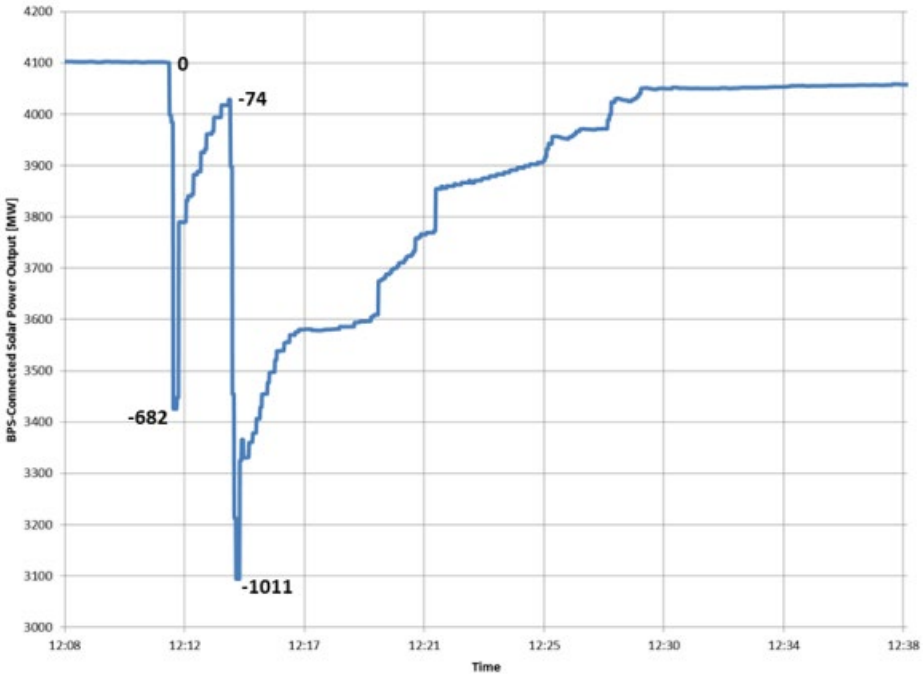

Figure 1.4: Solar PV Response during Canyon 2 Fire [Source: SCE]