FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426

OFFICE OF ENERGY MARKET REGULATION

In Reply Refer To:
California Independent System Operator Corporation
Docket No. ER19-1153-000

Issued: April 18, 2019

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California Independent System Operator Corporation
250 Outcropping Way
Folsom, CA 95630

Reference: Deficiency Letter

On February 28, 2019, the California Independent System Operator Corporation (CAISO) filed tariff revisions to mitigate reliability issues caused by the temporary losses of inverter-based generators. CAISO states that the proposed tariff revisions are a part of CAISO's effort to maintain grid reliability and resilience given the rapidly changing resource mix and operating condition on its system. CAISO explains that the volume of inverter-based generators interconnecting in CAISO's balancing authority area has increased substantially in recent years; and, that inverter-based generators are programmed to trip/go offline and stop injecting current into the grid when they detect certain transmission conditions that might harm them. CAISO asserts that the sudden loss of inverter-based generators' energy has been a significant reliability challenge.[1]

CAISO states that its proposed tariff revisions, consistent with North American Electric Reliability Corporation's (NERC) recommendations, aim to eliminate unnecessary momentary cessation for inverters during the clearing of a transmission line fault; eliminate inverter tripping for momentary loss of synchronism; and require coordination of the plant controller with the inverter control systems to help with reconnection following a trip. CAISO also proposes requiring asynchronous generating facilities greater than 20 MW to install

[1] CAISO Transmittal at 2.

diagnostic equipment to monitor such events and record transient data.

Please be advised that additional information is necessary to process the filing. Please provide complete responses to the following:

1) In its transmittal CAISO states that "[t]he inverter must produce full rating reactive current when the AC voltage at the inverter terminals drops to a level of 0.50 per unit, and must continue to operate and attempt to maintain voltage for transient voltage conditions between 1.10 and 1.20 per unit." CAISO further notes in its transmittal that it "anticipates that inverter-based resources will read voltage at their generator terminals, but will often be under the control of a central plant controller that will maintain voltage at the high side of the generator substation."[2] CAISO's proposed tariff language in section A.i.3 of Appendix H requires that for transient low voltage conditions, the inverters will inject reactive current based on the voltage at the inverter AC terminals.

   NERC Reliability standard PRC-024-2 ensures that generator owners set their generator protective relays such that generating units remain connected during voltage excursions at the point of interconnection (for excursions that remain within the no-trip zone), and states that "for the purposes of this standard, point of interconnection means the transmission (high voltage) side of the generator step-up or collector transformer."

   If inverters will react based on the voltage that is measured at the inverter AC terminals, which can differ from voltage at the high side of the generator step-up transformer (e.g., an inverter AC terminal reads 1.25 per unit and the generator high-side terminal reads 1.15 per unit which is inside the no trip zone), please explain how the proposed voltage ride-through requirements will ensure that inverters perform in accordance with NERC Reliability Standard PRC-024-2.

2) In its transmittal, CAISO explains that its proposal prohibits unnecessary "…momentary cessation - ceasing to inject current during a fault…"[3] and requires generators to remain online and provide reactive current only within the existing "no trip" zone. CAISO states that its proposal does not preclude active current injection during a fault. CAISO further states that "[a]fter first meeting the voltage control need, current can be used to produce active output at the same

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[2] CAISO Transmittal at 18, n.72.

[3] *Id.* at 17.

time."[4] However, CAISO's proposed tariff language in section A.i.3 of Appendix H only specifies the following requirements for reactive current injection: "[F]or transient low voltage conditions, the Asynchronous Generating Facility's inverters will inject reactive current. The level of this reactive current must be directionally proportional to the decrease in per unit voltage at the inverter AC terminals."[5]

Please explain if CAISO has any expectations or requirements around active current injection during transient low voltage situations in the no trip zone and, if so, what they are and where they are stated (e.g., if any such requirements are not included in the tariff, whether these details would be included in the relevant business practice manual). Specifically, what are the active power expectations, if any, for inverters during the fault conditions for voltages from 0.9 per unit to 0.5 per unit, and from 0.5 per unit to 0.0 per unit?

This letter is issued pursuant to delegated authority, 18 C.F.R. § 375.307 (a) (1)(v) and is interlocutory. This letter is not subject to rehearing pursuant to 18 C.F.R. § 385.713. CAISO must respond to this letter within 30 days of the date of this letter by making an amendment filing in accordance with the Commission's electronic tariff requirements.[6]

The filing requested in this letter will constitute an amendment to the filing, and a new filing date will be established, pursuant to *Duke Power Company*, 57 FERC ¶ 61,215 (1991), upon receipt of CAISO's electronic tariff filing. A notice of amendment will be issued upon receipt of the response.

Failure to respond to this deficiency letter within the time period specified, and in the manner directed above, may result in an order rejecting the filing. Until receipt of the amendment filing, a new filing date will not be assigned to this case.

Issued by: Carlos D. Clay, Acting Director - Division of Electric Power Regulation – West

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[4] *Id.* at 22.

[5] CAISO Tariff, Appendix H of Appendix EE, Proposed § A.i.3; Attachment 7 of Appendix FF, Proposed § A.i.3.

[6] *Electronic Tariff Filings*, 130 FERC ¶ 61,047, at P 3-8 (2010) (an amendment filing must include at least one tariff record even though a tariff revision might not otherwise be needed). The response must be filed using Type of Filing Code 180 – Deficiency Filing. If there are no changes to tariff records, CAISO can attach a single tariff record with no changes.