DATE: February 28, 2018

TO: Jason Pause, Electric Distribution Systems,
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Department of Public Service
3 Empire State Plaza, Albany, NY 12223

FROM: Joint Utilities of New York – Interconnection Technical Working Group

RE: 1/31/2018 ITWG Meeting Follow-Up – Voltage Questions

Introduction

Pursuant to your request, the Joint Utilities of New York ("JU") submit this brief memo as a follow-up from the 1/31/2018 Interconnection Technical Working Group ("ITWG") meeting ("recent ITWG meeting") regarding the four items on voltage variation and flicker.

Item #1 – Ratio Applied to Screen F

The Staff Proposed Standardized Interconnections Requirements filed on December 20, 2017 ("Staff SIR") suggested screen:

> Is the feeder available short circuit capacity at the medium voltage PCC, divided by the rating of the individual DER greater than 25 [PCC stiffness ratio]? Is the feeder available short circuit capacity at the substation divided by the capacity all aggregate DER on the feeder, greater than 25 [substation stiffness ratio]?

The JU continue to support this screen. At the recent ITWG meeting, an alternative was proposed to multiply the stiffness ratio by the Z/R ratio and screen for a result greater than 50. The JU opposes this change for the following reasons:

(1) It is impossible to apply at the substation level. Because the resistance at the substation can be very low, with the resistive component of the impedance quickly increasing as you move away from the substation, particularly with overhead conductor. In addition, it does not account for the impact of where Distribution Energy Resources (DER) are specifically located. Therefore, it is an inaccurate predictor of the impacts a high penetration of facilities located away from the substation may have on

the utility system. As noted in the Duke Energy - CSR (Circuit Stiffness Ratio) Report[1] and supported by the National Renewable Energy Lab, the aggregate impact at the substation must be considered.

(2) Because the short circuit capacity is calculated based on system impedance, it is already related to the Z/R ratio. Therefore, multiplying the Z/R ratio by the stiffness factor is redundant and provides no additional benefit.

(3) As proposed in the Staff SIR, this screen cannot be automated, but it can be readily calculated by an Engineering Technician. Adding a Z/R ratio that is not as easily obtained will delay the screening process.

(4) The JU have not found an application of the Z/R ratio in other jurisdictions, but have found that Duke Energy[2] and NERC[3] applied the stiffness ratio.

Item #2 – Percentage Output Change Applied to Voltage Variation Calculations in Screen H

At the recent ITWG meeting, the industry gave a presentation that suggested that an output change of 75% be applied to the screens for solar photovoltaics (PV). Although there are times where a sudden change from 100% output to 0% output occur, the Joint Utilities are willing to assume that risk since it is rare. That said, in the EPRI data, there were 7 days where the output changed by more than 75%. The EPRI data also indicated that during the hours of 10am-3pm, the PV panel operated at 20% or less of its rated output for approximately 19% of the year, so a change in output of 80% or more is expected. Therefore, the JU recommend using an 80% change in output.

Item #3 – ΔV Limitations for Screen H

The JU understanding after the recent ITWG meeting was that in addition to applying the Pterra IEEE 1453 screens, there was consensus to screen aggregate DER for voltage limitations of 3% at the Point of Interconnection[4], 5% at any location on the feeder, and half the bandwidth of any the voltage regulating device setpoint at any voltage regulating device. The JU would apply the 80% change in output to determine the calculation for exceeding half the bandwidth of any regulating device, as described in Item #2. In addition, voltage excursions outside of the ANSI C84.1 Range A should also be considered as failures of this screen.

[1] "Duke Energy - CSR (Circuit Stiffness Ratio) Report", Stiffness factor evaluation: background & technical basis, August 2016, pages 1-2.

[2] Ibid.

[3] "Integrating Inverter-Based Resources into Weak Power Systems", Reliability Guideline, North American Electric Reliability Corporation, June 2017.

[4] Supported by the Rapid Voltage Change limits in the proposed IEEE 1547 Standard revision.

In addition to these rapid voltage change limitations, the JU support the application of the Pterra IEEE 1453 screen as detailed in the Staff SIR for solar PV, with adjustments as needed for other technologies. This screen applies the full ΔS of the proposed system.

Item #4 – Voltage Variation and Flicker Studies with the CESIR

Regarding flicker calculations in the CESIR, there were 2 items discussed at the 1/31/2018 ITWG meeting: (1) the application of calculated ΔV/V data in the CESIR study, and (2) upon failure that ΔV/V screen, the ability to complete a voltage time series analysis study after the CESIR results are provided to the developer.

For the purpose of voltage flicker analysis, the JU support applying Screen H rather than the calculated ΔV/V data in the CESIR study. Using the assumptions provide by Pterra during the September 2017 workshop (F = 0.2, $d_{pst=1}$ = 2.568%) at the IEEE 1547 emissions limit of 0.35, a ΔV/V of approximately 4.5% is allowed. Pterra limits the analysis to the Point of Common Coupling, but even if evaluating the maximum ΔV/V for all DER on a feeder or substation bus, this limitation is concerning for the following reasons:

(1) This far exceeds the 3% voltage change allowed in the 2017 proposed IEEE 1547 Standard.
(2) If the voltage is greater than 100.5% of nominal voltage just prior to a facility coming online, the voltage will exceed ANSI C84.1 limitations.
(3) No capacity will remain on the feeder for residential or small commercial DERs. These smaller projects will not undergo the same level of study and cannot bear the costs of significant upgrades due to voltage variation or flicker.

The JU support the completion of a voltage time series analysis study outside of the CESIR time period. Depending upon its staffing, software capabilities, and volume of voltage studies requested in a period of time, each utility will either complete the analysis internally or contract with vendors of its choice to complete the analysis using the parameters it defines. Completion time will depend upon availability of internal and external resources.

Summary

The JU appreciate the opportunity to provide input on these items, and find we are very close to consensus with the industry community on these items.