# JOINT UTILITIES
## OF NEW YORK

## Considerations for Evaluating Flicker for Photovoltaic Inverter Based Generation

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# Background

Screen H: Voltage Flicker Test

- Developed by the ITWG in the spring of 2018 & introduced into the SIR in the April 2018 version.

- This Screen is exclusive to solar photovoltaic interconnections only

- Included as part 1 of the screen, is a calculation for determining emission limit based on the IEEE 1453-2015 Recommended Practice for the Analysis of Fluctuating Installations on Power Systems as expressed below.

$$ P_{st} = \frac{\Delta S}{S_{SC}} \times \frac{\text{Shape Factor}}{\text{Curve Value}} \quad ; \quad \text{where } d \approx \frac{\Delta V}{V} \approx \frac{\Delta S}{S_{SC}} $$

Variables:
$P_{st}$ is short term flicker emission limit for the customer installation (typically based on a 10 minute time frame)
$d$ is Relative voltage change caused by the DER at the PCC
$d_{pst}$ is 1 (curve value) is the relative voltage change that yields a Pst value of unity when voltage fluctuations are rectangular standardized as 2.56% for use in Screen H.
Shape Factor is shape factor related to the shape of expected voltage fluctuation standardized at 0.2 for use in Screen H.
$\Delta S$ is the power variation output of the PV system
$S_{SC}$ is Short circuit current available at PCC of PV site. This is the short circuit current at the PCC due to a three phase symmetrical fault.

# Observations & Efforts

Screen H: Voltage Flicker Test

- The change seemed to drive more conservative results for solar photovoltaic projects than utility previously employed methods.

- Pterra suggested revisiting the IEEE 1453 substitution equivalent of $d = \frac{R_L \text{x} \Delta P + X_L \text{x} \Delta P}{V^2}$ for X/R ratios of less than 5.

- The JU evaluated the impact of utilizing X/R values and found no significant issue with employing this change.

- EPRI provided the JU with research to further support the validity of utilizing the X/R approach.

# Utility Position

Screen H: Voltage Flicker Test

- The Joint Utilities concur that employing the IEEE 1453 recommended method of calculating the relative voltage change where the X/R ratio is less than 5.

- For screening the formula should be revised as follows:

$$P_{st} = d \times \frac{.2}{0.0256}$$

Where $d = \frac{\Delta S}{S_{SC}}$ *for X/R values above 5, and*

$d = \frac{R_L \text{x} \Delta P + X_L \text{x} \Delta P}{V^2}$ for X/R ratios 5 and below as described in IEEE 1453-2015

- The Joint Utilities recommend at a minimum that the above equations be utilized for flicker screening analysis during CESIR evaluations. Other methods of evaluation may be trialed or piloted by individual utilities allowing for greater penetration, although no further methods are recommended to be standardized at this time.

- The practice to request an additional detailed flicker evaluation should remain as an option upon failure of screen outlined above.