THE TRIPLE-C METHOD FOR CORRECTLY SIMULATING PV CLIPPING LOSS

Tim Townsend, P.E., Davis, CA

Kenneth J. Sauer, Bodo Littmann, and Brian Grenko, VDE Americas

CLIPPING: IT'S WORSE THAN WE'VE THOUGHT HOURLY-BASED MODELS ARE "BLIND" TO SUB-HOURLY CLIPPING TRIPLE-C - <u>C</u>LOUDS, <u>C</u>APACITY, AND <u>C</u>LIPPING - "SEES" SUB-HOURLY CLIPPING

Annual overprediction modeling error caused by unrecognized subhourly clipping. From L to R, markers correspond to ILRs of 1.1, 1.2, 1.35, 1.5, and 1.65, as connected by the smoothed lines.

5% 5% 8 4% <<< Hourly-based simulation models overlook the minute-by-minute clipping that happens on most modern PV systems. Annual bias errors of 0-4% are shown at left. The graph is based on comparing minutely vs. hourly modeled results for 100 fixed and tracking systems in 10 climates from the Tropics to Tennessee.



The Triple-C correlation reduces ac capacity by an amount that is based on inverter loading ratio (ILR) and site insolation characteristics so that any hourly model will more accurately capture clipping losses. With Triple-C, annual clipping errors are reduced to a -1% to +1% range. >>> Residual modeling error after applying the Triple-C capacity multiplier. Line markers correspond to ILRs of 1.1, 1.2, 1.35, 1.5, and 1.65.



Predicted (y-axis) vs. Actual (x-axis) clipping loss for 100 cases at 10 diverse locations. Improved prediction is achieved by running simulations using a reduced ac capacity using the Triple-C multiplier.



<<< Without the Triple-C correction, we found that conventional simulations only capture ≈81% of the true clipping losses. Using the Triple-C method, our production estimates capture >99% of it. The graph at left shows that for the 100 systems we analyzed, mean bias error (MBE) was reduced by 99% and mean absolute error (MAE) was reduced by 69%.

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