Hourly Modeling Corrections for PV Energy Assessments

Introduction

Most bankable PV models use hourly irradiance data. In areas that experience intra-hour irradiance variability, the use of this hourly data can over-predict energy yield predominantly due to subhourly DC power above or below inverter rated power, underpredicting inverter clipping losses. DNV implemented a machine learning model to correct for these underpredictions. The hourly modeling correction seen in the US for utility-scale plants is typically around 1.0% and increases with DC:AC ratios above 1.0.

Methods

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<th>Training</th>
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<tr>
<td>SURFRAD: 1 min irradiance data</td>
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<tr>
<td>Array MPP data</td>
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<tr>
<td>Site specific data and hourly TMY</td>
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pvlb model calculates:

Features:
- GHI
- POA
- POA velocity
- Clearsky GHI
- Clearsky POA
- POA difference
- Cell temperature

Predict:

Site specific data and hourly TMY

PVsys output including:
- GHI, POA, cell temperature

Calculate clearsky GHI, clearsky POA, POA velocity, POA difference

Target:
- Hourly vs 1-min model AC power difference

Train: random forest model

Predict: random forest model

Convert hourly to monthly corrections

Apply spatial and temporal correction factors

Apply to point of interconnection 8760

*First order difference of the POA time series

- Random forest machine learning model adapted from K. Anderson and K. Perry, 2020
- Times considered are filtered for GHI and POA > 200 W/m²
- Spatial factor uses wavelet variability model to account for plant size
- Temporal factor accounts for sampling rate of constituent TMY data

References