Introduction – Devansh Patel

- 6 years of experience within renewable energy domain doing wind, solar and battery performance analytics.
- Background in Electrical engineering and MS in Applied Energy from University of North Carolina.
- Experience in building analytical framework from ground up.
- Worked at EPRI as a Scientist doing wind performance and health monitoring
- Worked at NextEra Energy as an operations engineer focusing on solar, wind and storage.
- Currently at RWE, As a Manager of Performance Analytics I focus on building production level automated performance monitoring framework and tools for Solar and Wind performance monitoring.

RWE

Solar Performance Analytics at RWE

Impulsion fan temperature derate

Devansh Patel

Manager, Performance Analysis

04/18/2024

Introduction to RWECE

RWECE, a subsidiary of RWE group

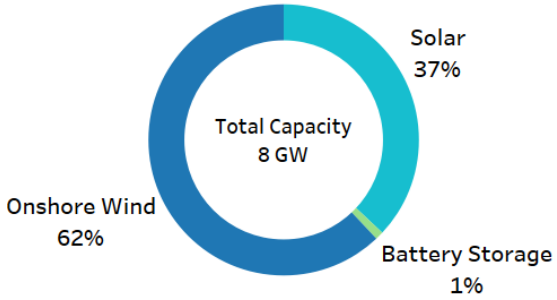
15 years+ in the U.S. renewables business.

Expertise in asset development, construction, operations, and management.

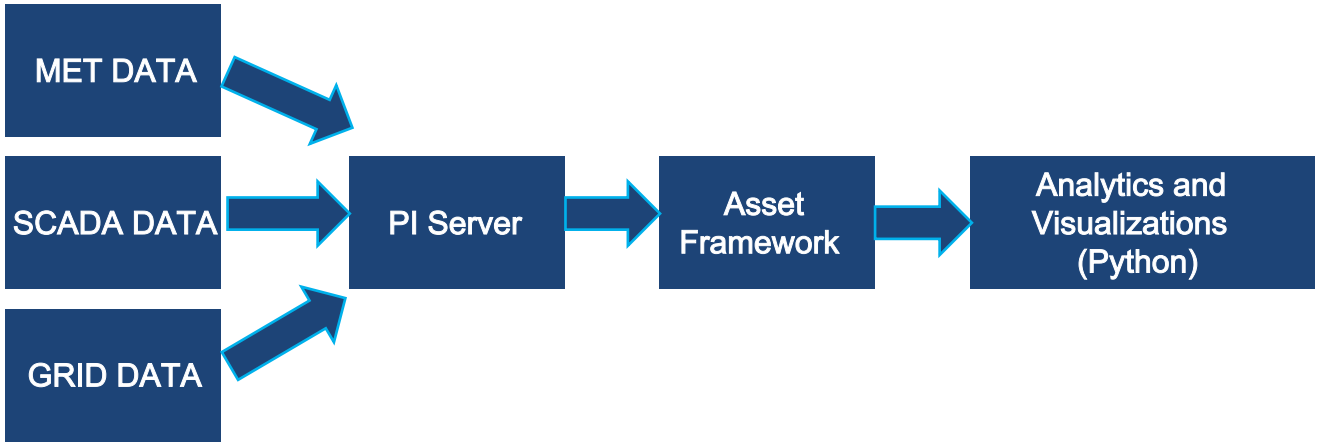
1500 U.S. team contributing to North America clean energy transition.

8GW installed capacity of onshore wind, solar, and battery storage.

24GW clean energy project pipeline.

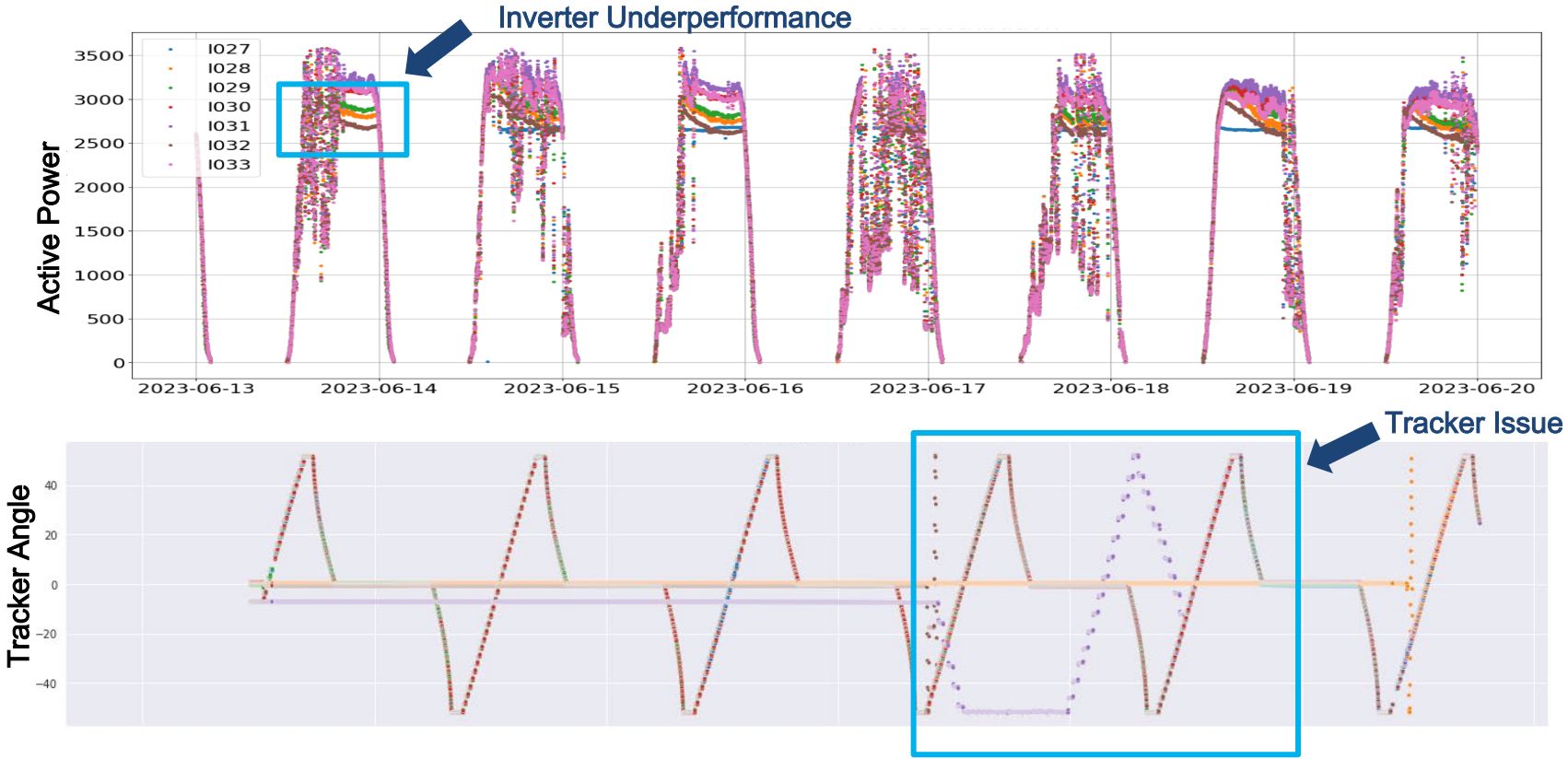


Solar Data – RWE Framework

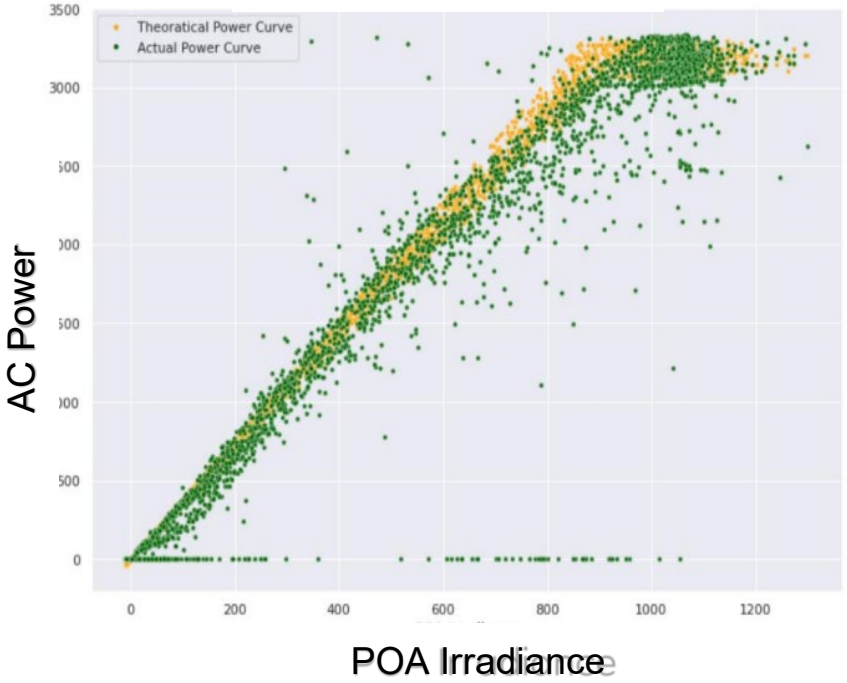


- We import 5min Avg, Min, Max and Std values from PI for SCADA inverter, MET tower and grid data.
- The tags are processed and calculated fields are calculated in the Asset Framework
- Data is aggregated in the SQL and imported into python environment where it is used for advanced detections and visualizations.

Solar Data Visualization – Time Series Plots

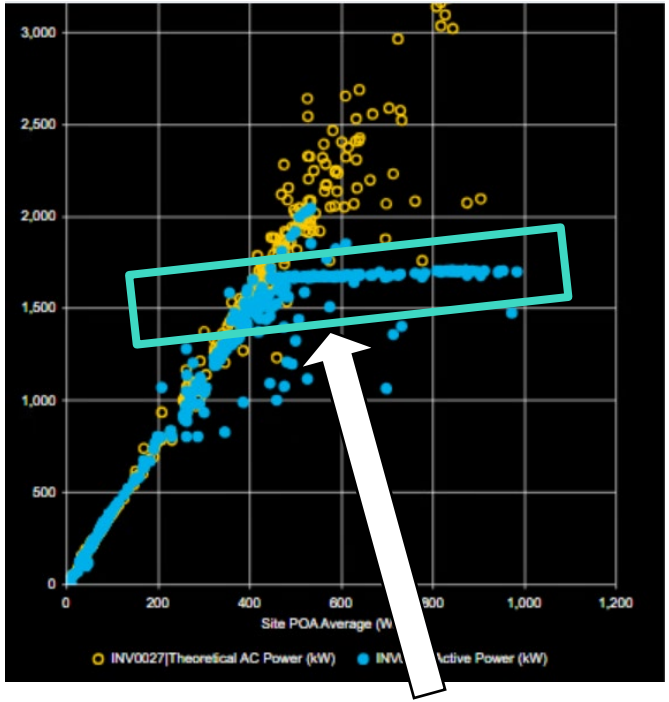


Solar Data Visualization – Power Curves



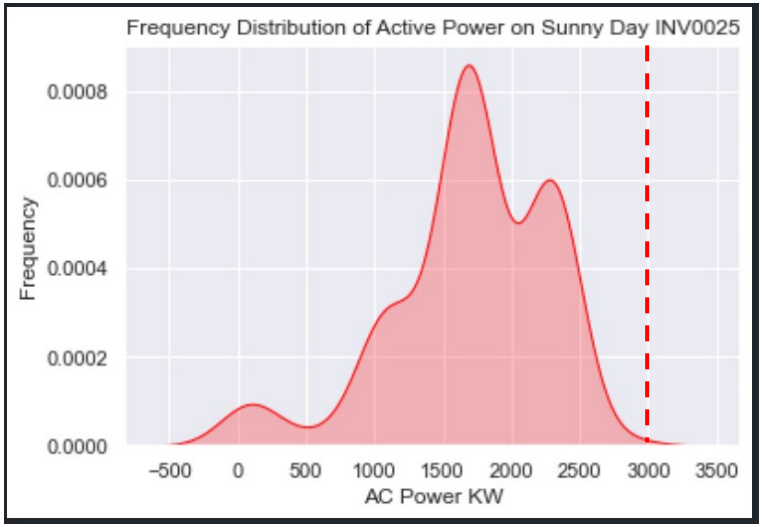
Solar Inverter Impulsion Fan Issue

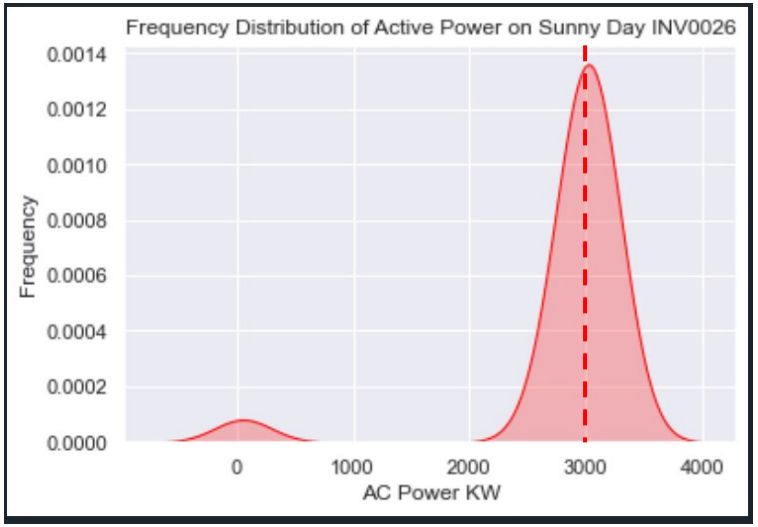
- Blown out impulsion fan increases the cabinet temperature of the inverter and hence the underperformance due to derating.
- Inverter Scada has a tag “Impulsion fan status” which is a binary tag, which can be used to track the status of the impulsion fan.
- A ticket is then opened for the site to take immediate action.
- As per ERCOT’s guidance on infrastructure and reliability for weather emergency preparedness, for the summer checks it is vitality important to detect these derates and get these fans fixed as soon as possible.
- As a summer preparedness check, before **June 1st** all hot weather critical components are monitored, and maintenance is performed on this components if required.



Blown out impulsion fan causes the inverter to derate due to high cabinet temperature

Automatic Inverter Underperformance Detection – KDE Plots

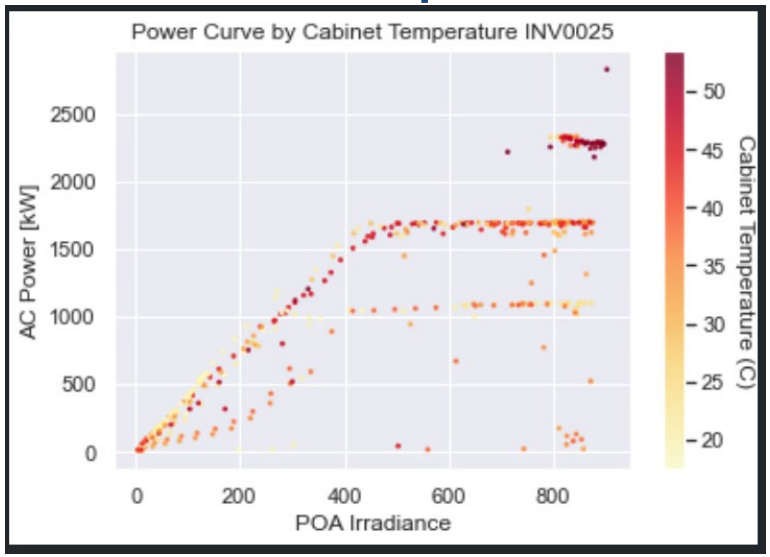


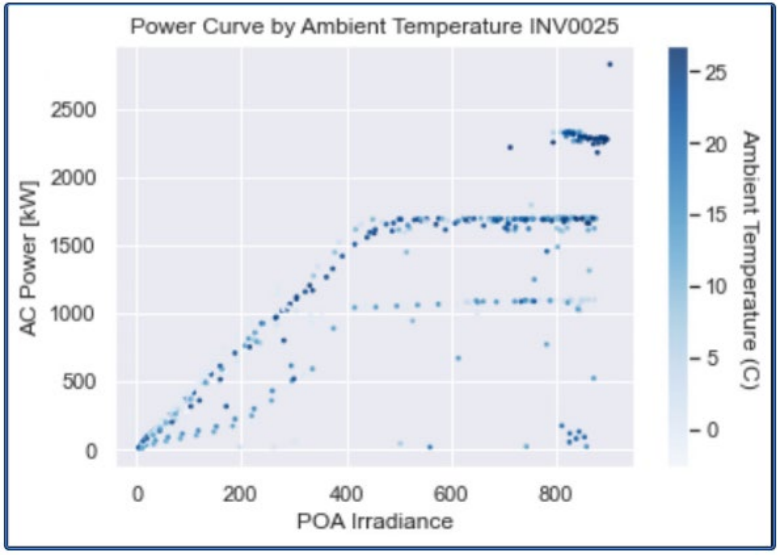


Macro level analysis consists of Kernel Density Estimate (KDE) plots. A kernel density estimate plot is a method for visualizing the distribution of observations in a dataset, analogous to a histogram. KDE represents the data using a continuous probability density curve in one or more dimensions.

The expectation would be to see a peak around rated power of the inverter. Any deviation elsewhere is usually a sign of underperformance.

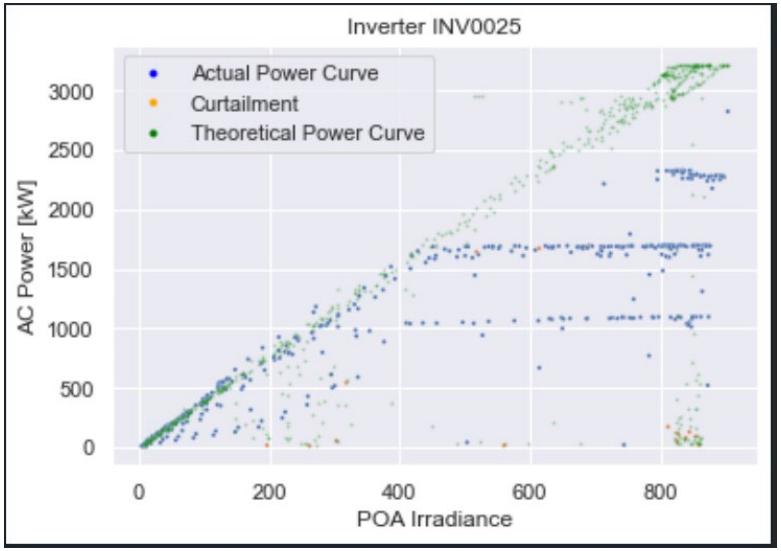
Automatic Inverter Underperformance Detection – Ambient and Cabinet Temperature





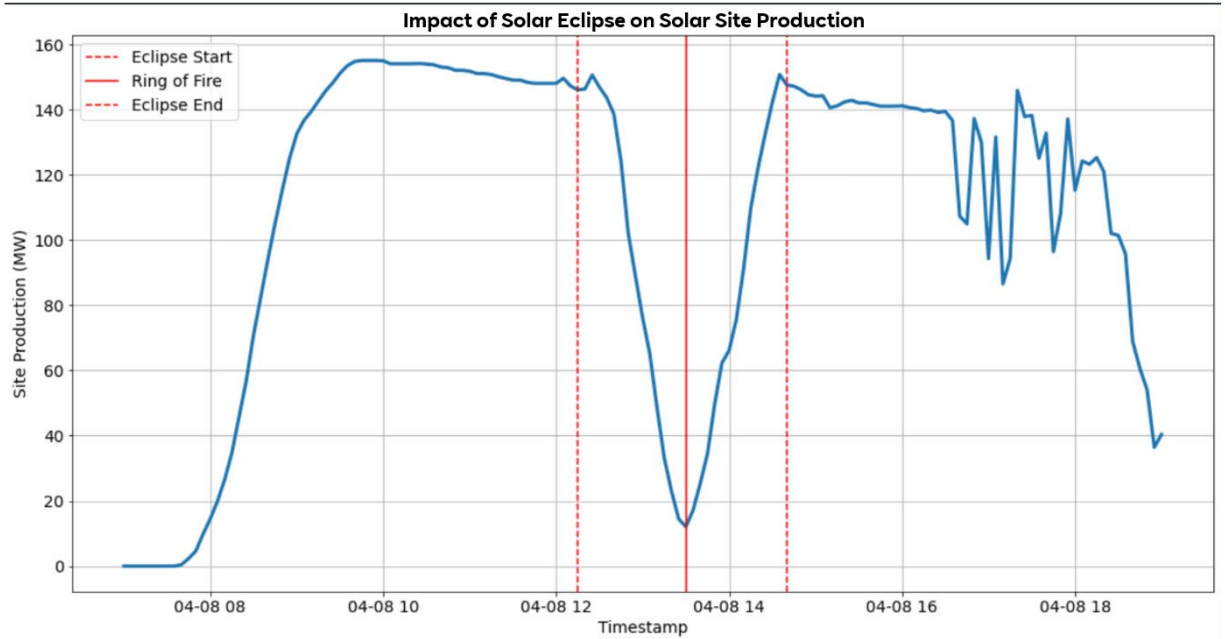
Traditional Power curves do provide insights on the underperformance of inverters but usually overlook the impact of ambient and cabinet temperature. Power Curves colored by cabinet temperature and ambient temperature give a good idea on how inverter is behaving under certain weather conditions

Automatic Inverter Underperformance Detection – Expected Power



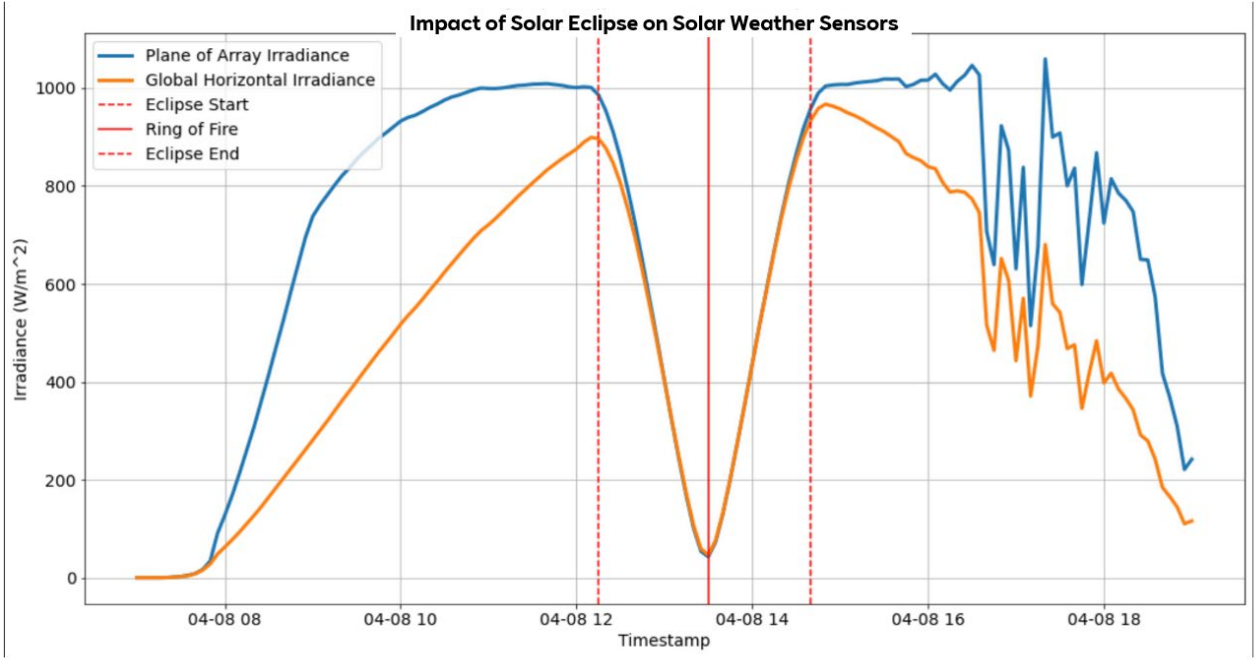
RWE has its own in-house developed theoretical power curve for each inverter which we use as a baseline to detect underperforming inverters. A simple delta between theoretical and actual power can help detect underperformance.

Solar Eclipse – Solar Site Production Impact



The site was performing as per expectation. We expected 90% totality at this site, and we experienced exactly that for the duration of the eclipse.

Solar Eclipse – Solar Site Weather Sensors Impact



It can be observed weather and production sensors are working accurately. Note the perfect overlap between the Plane of Array (POA) sensor and our Global Horizontal Irradiance (GHI) sensor at TX solar site during the time of eclipse on Apr 8 th.

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Thank You