PV Performance Analysis Using Digital Twins:

Understand, Improve and Validate

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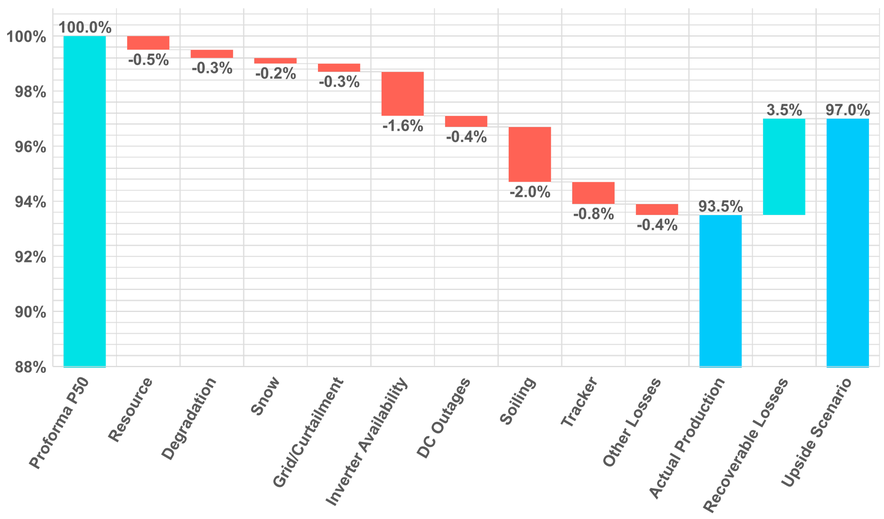
Industry-Wide Solar Production Performance Gap

In 2020, kWh Analytics reported a performance gap of 6.3%. When compared to industry-wide modeled estimates, UL Solutions also identified a gap of about 6% in weather-corrected performance.

Addressable Operational Underperformance

UL Solutions estimates that 3-4% of energy lost to addressable issues is recoverable as illustrated in the generic loss waterfall below.

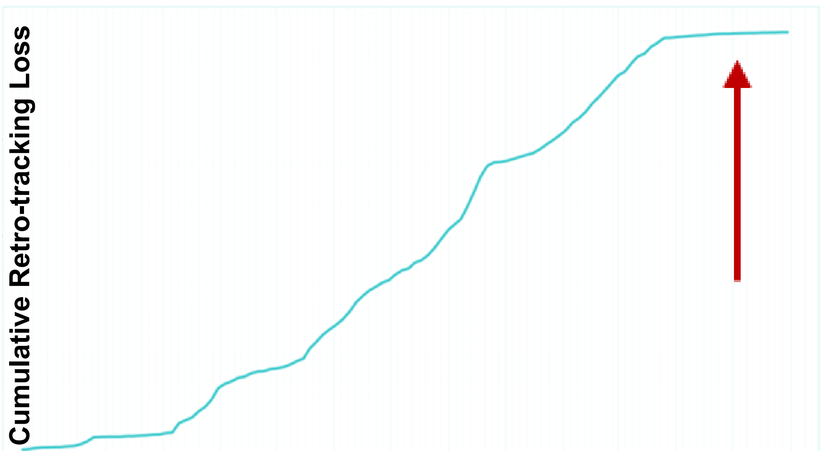


Case Study

Performance analysis using a digital twin identified addressable causes of underperformance including loss due to shading during the retro-tracking period.

Identified sources of underperformance

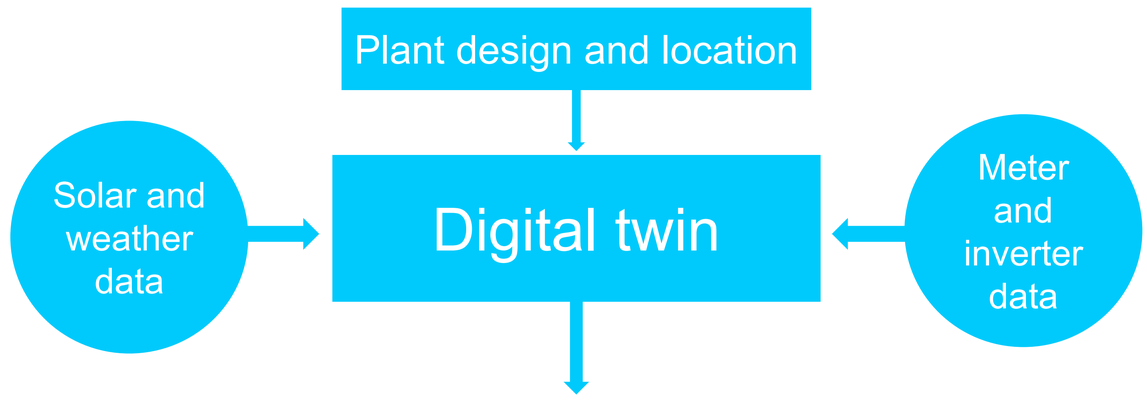
Performance analysis using digital twin also validated the operational remediation of the loss mechanism.

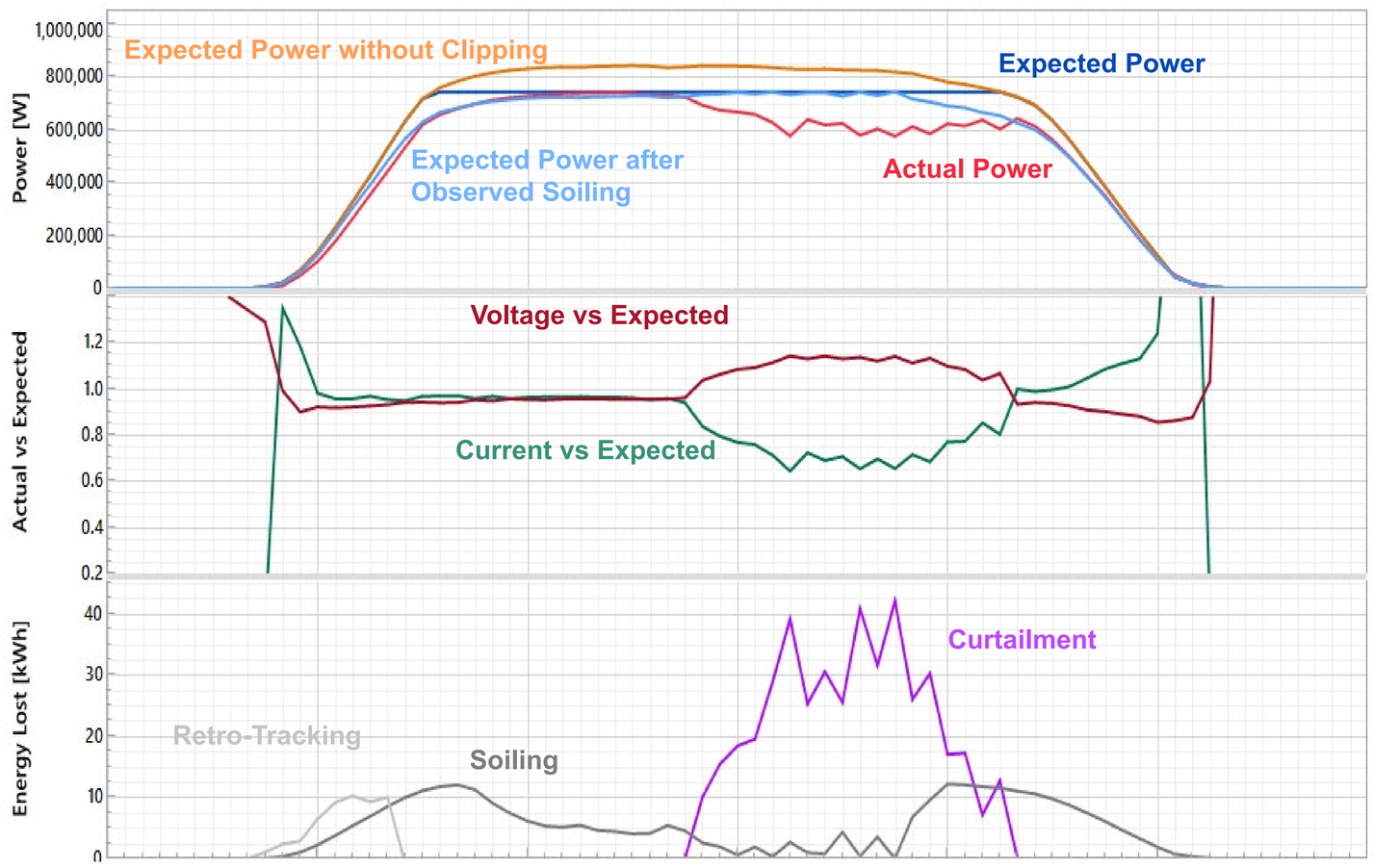


Digital Twins for Performance Analysis of Operational Plants

Physics-based digital twin models of solar plants are used to generate an expectation for power, current and voltage output using on-site insolation/weather data and compared against measured outputs at inverters, utilizing data extracted from SCADA systems.

Algorithmic curation of data quality issues, including validation and repair, is critical. Losses are algorithmically identified and quantified with a defined hierarchy.





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