morgansolar

DC Health Optimization Using In Situ IV Curves

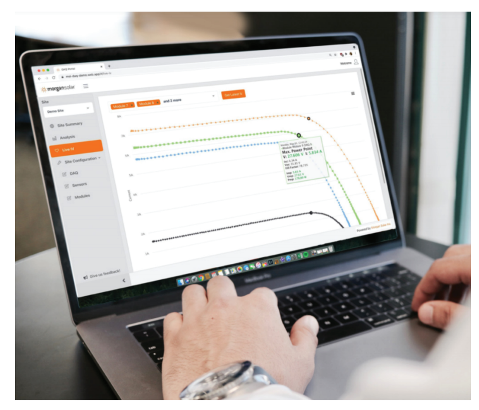
Dr Stefan Myrskog | VP Software & Controls, Morgan Solar Inc.

1 THE OBJECTIVE

QUANTIFY DC LOSSES TO BETER UNDERSTAND PERFORMANCE.

Many performance drivers are modeled but not verified with real world data. A steady stream of new technologies along the value chain introduce further uncertainty.

Performance and revenue forecasts need to be grounded in real-world data.



2 OUR APPROACH

- IV DAQs measure a continuous 'pulse' of solar field health and performance by capturing IV curves every 15 min. (or faster) in-situ, without disrupting energy generation.
- IV DAQs are deployed at a density of 1-5 devices per MW to generate a deep and granular dataset that is designed to integrate with other sensor data.
- This dataset is used by the Analytics Portal to quantify field performance and loss factors, or to validate new technology.
- Rich data & strong analytics inform meaningful cost-benefit decisions and ultimately lead to better predictive models.

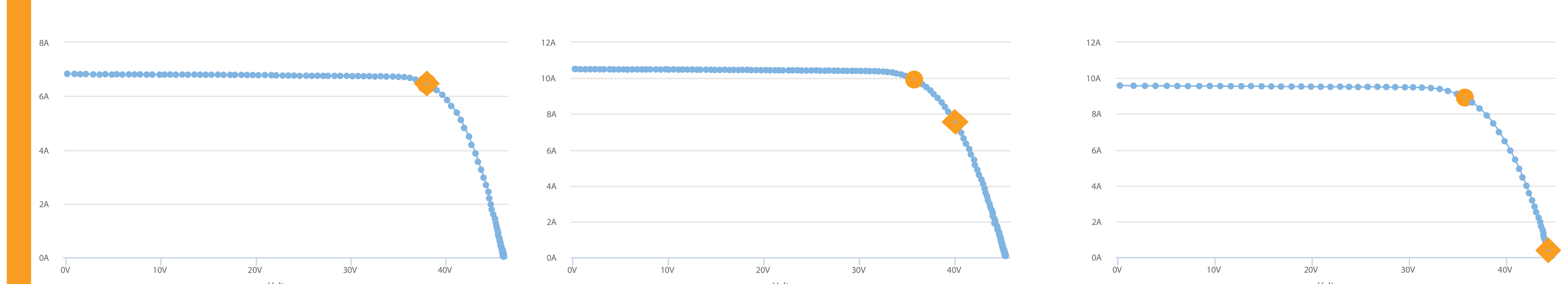
3 CASE STUDIES

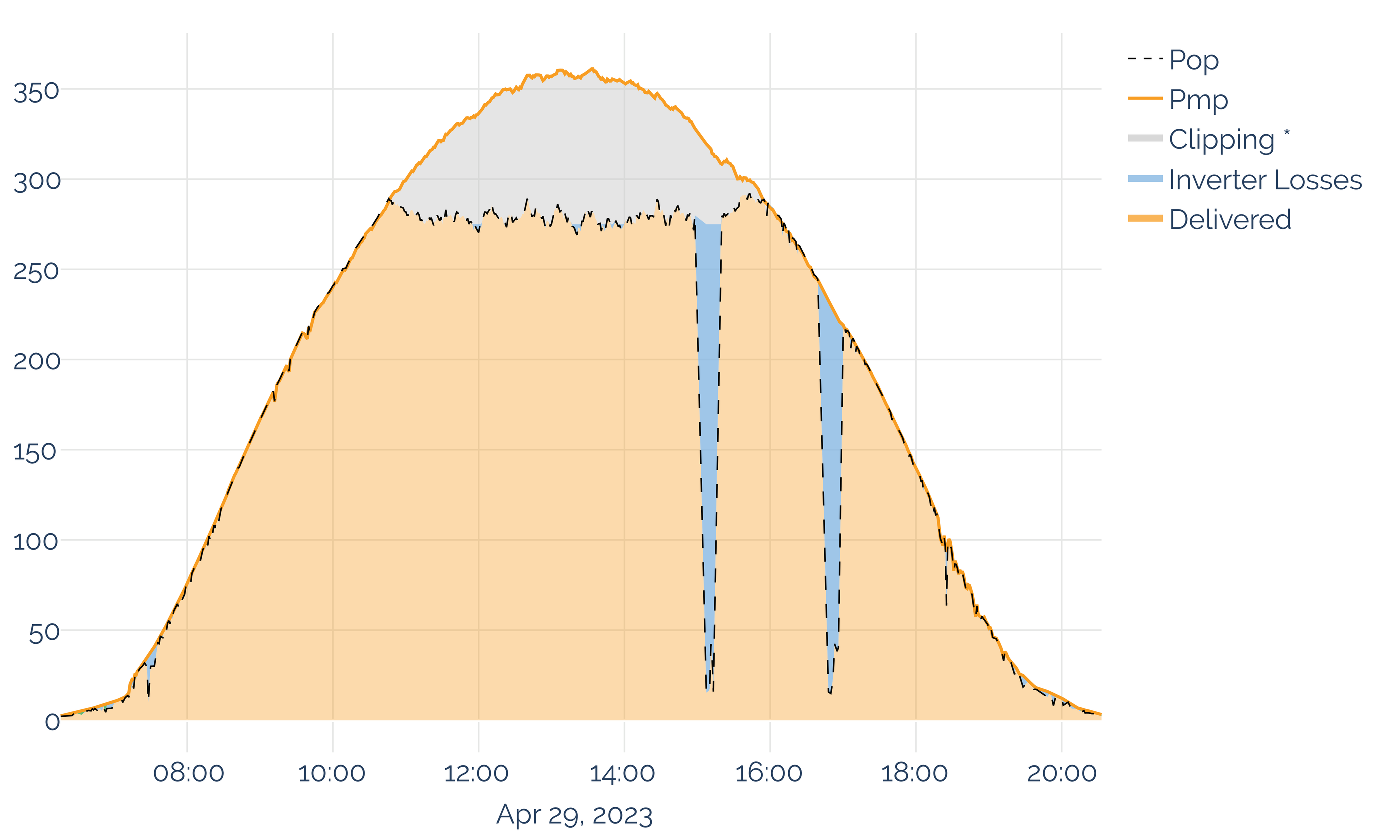
Plant Efficiency

Evaluated **plant inefficiencies** by tracking the module max power vs the inverter set point.

Results

Maximum Power Point (Pmp) and Operating Power Point (Pop) differentiate between what a module **can** do and what it **is** doing. Measuring the variance between Pmp and Pop across a site over time lets us assess loss factors and inform actions.





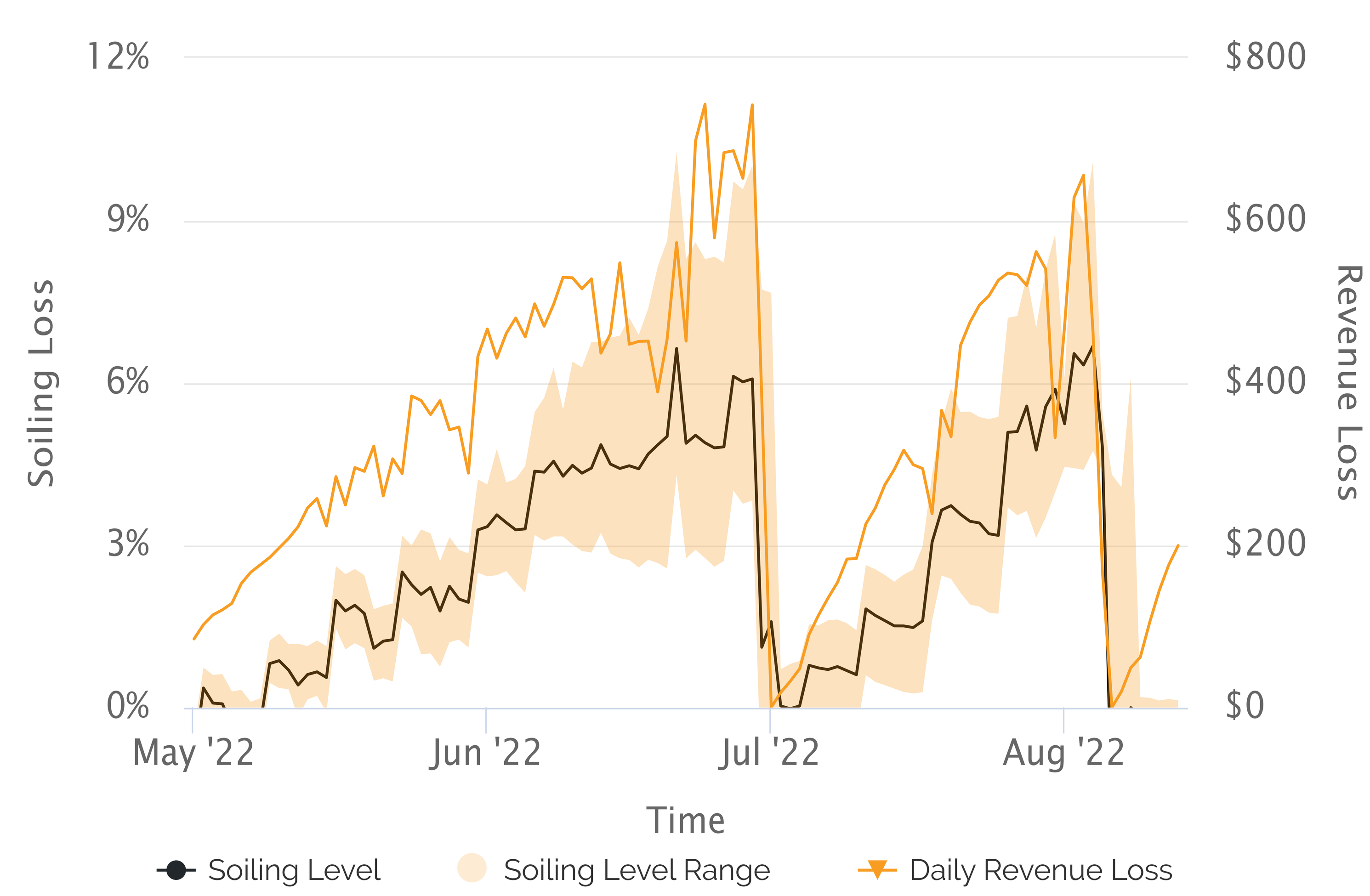
Observing Variance in Pmp & Pop from strategically placed IV DAQ units throughout a field can inform troubleshooters about loss factor causes. Ex. Analyze variance in inverter Mpp tracking performance.

Loss Analysis

Analyzed & quantified losses impacting O&M costs, like **soiling**, by using modules as distributed sensors.

Results

Placing IV DAQs across a field to measure performance against a cleaned control module allowed us to isolate the real-time soiling from other loss factors.



Extraction of module-level soiling information is a necessary step to generating more complex degradation and predictive performance models, such as:

- Soiling variations over a field to inform O&M cost and action
- Module performance models
- Degradation over time (aging, LID, PID)

4 CONCLUSION & NEXT STEPS

- High frequency IV curve data generates robust correlations that quantify loss factors and significantly improve performance forecast accuracy.
- IV DAQs deployed across a wide range of technologies around the globe is creating the world's largest weather-correlated, IV curve database.
- Training AI and machine learning algorithms on the collective data sets will enable development of an enhanced Digital Twin to optimize solar farm design and operation.

More Information

The full poster abstract describing the study can be found here.

More detailed information on each of the case studies can be found here.

Industry Partners

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