Improving solar PV performance with meteorological monitoring

In an interview with PES, Alondra Anacleto, North America Team Lead for the solar vertical at OTT HydroMet, discusses how meteorological measurement and monitoring technology optimizes solar PV performance. Now, with the right solutions, operators can optimize energy output, reduce downtime, and improve profitability by accurately measuring key environmental parameters.

PES: It's great to have you with us today, Alondra! Let's start with the basics. Why does meteorology intersect with solar PV?

Alondra Anacleto: Thanks for having me. To keep it at the basic level, for any PV site to succeed environmental data must be considered. From site prospecting for installation, energy forecasting, and plant maintenance, meteorological data and factors plays a critical role. Present and historical weather conditions and patterns directly influence a plant's performance and success.

Within my Sales and Account Management roles for our solar vertical., I've successfully partnered with major EPCs and SCADA integrators on utility scale PV projects throughout North America. It's been exciting to see the growth of where our solutions and products have been integrated. If you want to learn more about our PV projects in North America, the range of our integrated solutions, and how we've supported sites like yours, you can book a meeting with me at RE+ 24.

PES: On the topic of performance, how does meteorological monitoring help solar plant operators distinguish between weather related performance issues and potential hardware problems?

AA: Meteorological monitoring is crucial for accurately calculating and reporting solar PV plant performance. By measuring key parameters like solar irradiance, temperature, precipitation, and wind speed, you can create a baseline for expected energy output under various weather conditions.

When production deviates, operators can leverage the site's meteorological data to determine if drops in performance are due to weather or hardware. Identifying recoverable and unrecoverable losses is critical for optimal energy production, to reduce maintenance costs, for site performance reports relative to the site forecast during development.

PES: At what stages of a PV plant's life cycle is meteorological monitoring most relevant?

AA: Meteorological monitoring is valuable throughout the entire life cycle of a PV plant. During the site assessment and planning phase, it helps developers choose the best plant location and design efficient layouts. During construction and commissioning, it provides raw data to calculate performance and ensure the site was correctly and completely installed.

Once operational, continuous monitoring is required for production forecasting, performance assessment, maintenance scheduling, and long term optimization for environmental impacts such as module soiling. Even during decommissioning, historical weather data can inform future projects in similar climates.

PES: How does your meteorological station contribute to improved plant efficiency and profitability?

AA: OTT HydroMet builds research grade meteorological stations to provide plant operators with accurate, real time data needed to report performance and make informed maintenance decisions. By correlating weather conditions with energy output, operators can optimize panel tilt, cleaning schedules, and maintenance timing. These adjustments increase energy production, reduce downtime, and help keep O&M teams within budget. Site efficiency improvements of 2 to 5% are common, which translates to significant profitability gains over the cycle of a PV plant.

Alondra Anacleto

PES: Can you walk us through the key weather parameters your station monitors and how they impact solar PV performance?

AA: Our station also monitors air temperature, in combination with module temperature. This data is critical to track as it impacts panel performance. As temperatures

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rise, panels heat up. When panels heat up they lose efficiency. Our solutions also track wind speed and direction because of their influence in panel cooling. These parameters can also impact structural integrity of PV sites in extreme conditions.

By monitoring these factors, site operators can then stow modules for high winds reducing damage and therefore safeguarding production uptime. Finally, humidity is used to calculate vapor pressure to calculate spectral shift factor for CdTe cells. All the weather parameters our Met Station monitors all serve to provide the insights required to ensure PV sites are performing optimally.

PES: Let's talk about the Lufft WS600 All in One Weather Sensor. How does it integrate with other monitoring systems?

AA: The Lufft WS600 is designed for seamless integration. It uses the Modbus RTU communication protocols, easily connecting with most SCADA systems and data loggers. Despite its compact design, the Lufft WS600 actually combines multiple weather sensors in one unit. This simplifies installation, reduces maintenance costs, and reduces potential points of failure.

PES: How do the active ventilation and integrated heating in the WS600 contribute to measurement accuracy?

AA: Active ventilation and integrated heating are critical features that contribute to maintaining data accuracy and uptime in varying conditions. This is especially true as solar sites move north to colder weather. The active ventilation ensures that temperature and humidity sensors always measure ambient conditions, not localized heat buildup, which occurs even inside naturally aspirated, white, multi plate shields when the wind speed is less than 3 m/s. The integrated heating prevents snow and ice accumulation, ensuring year round operation.

PES: During site assessment, how does your meteorological station help determine optimal panel placement?

AA: By deploying multiple stations at proposed sites, developers can use the data from our stations to map variations in solar resources, wind patterns, temperature gradients, precipitation patterns, etc. This data helps choose the highest resource location and design the most efficient layout, considering factors like natural cooling from prevailing winds or avoiding areas prone to shading.

PES: What sets your data acquisition process apart in terms of accuracy and ease of use?

AA: We prioritize both accuracy and usability in our data acquisition systems. Our sensors undergo rigorous calibration and strict quality control checks during production, with a mean time between failure rates typically greater than 10 years. For ease of use, we collect feedback from our customers to improve designs, we provide user friendly software interfaces, and support various data export formats. We also offer cloud based data access, including APIs for customers who want to integrate our data directly into their own analytics platform(s).

PES: The Kipp & Zonen SMP12 pyranometer is known for its accuracy. How does it compare to other options on the market?

AA: The SMP12 is indeed a top tier pyranometer. Its key advantages are its excellent stability, fast response time, and built in heating that mitigates dew and frost formation that causes over reporting of irradiance, which leads to false reports of energy losses. Compared to lower cost silicon cell pyranometers, the SMP12 offers superior accuracy across the entire shortwave irradiance spectrum and has much better long term stability.

While a Class A heated pyranometer is a higher initial investment, significantly lower uncertainty tolerances in performance ratios lead to better decision making and optimization, clearly justifying the upfront cost over the life of the plant.

PES: Let's discuss module soiling. How does your DustIQ Soiling Monitoring Solution help optimize cleaning schedules?

AA: The DustIQ provides continuous, real time measurements of soiling levels on PV panels. This allows operators to move from calendar based cleaning to data driven cleaning. By understanding how quickly soiling

is accumulating on the modules and its impact on performance, operators can schedule cleaning only when the cost to clean will be recovered by an increase in production. This may result in fewer cleanings, savings cost of cleaning, or more cleanings, generating additional energy and therefore revenue.

In addition, the DustIQ responds to nighttime dew formation as well as water and snow on the modules, which can aid in deciding to dry or wet brush during cleaning, improving module lifetime.

PES: How do you ensure the durability and accuracy of your sensors in harsh environments?

AA: Durability is a key focus in our design process. We use high grade materials resistant to UV degradation and corrosion. To increase data reliability many of our sensors eliminate moving parts, such as the SMP12 with solid state heating, and the WS600 wind measurement that uses sonic anemometry instead of rotating cups for wind speed.

We also employ protective housing and coatings to shield sensitive components. For accuracy, we use advanced calibration techniques and often include self diagnostic features in our sensors, such as internal humidity and tilt measurements. While sensors can operate for years without it, we recommend regular maintenance and recalibration schedules to ensure longer term accuracy, which we support through our global service network.

PES: How do your meteorological stations contribute to reducing CO_2 emissions in solar projects?

AA: While our stations don't directly reduce emissions, they play a crucial role in maximizing the efficiency of solar plants, producing more energy with the same infrastructure, which in turn displaces fossil fuel generated electricity. Additionally, by optimizing maintenance schedules, we reduce the need for vehicle trips to remote solar sites, further cutting emissions.

PES: Can you discuss the integration of your stations with SCADA systems and how this benefits plant operators?

AA: Integration with SCADA systems is a key feature of our meteorological stations and sensors. This integration allows for centralized monitoring and control, combining weather data with other plant metrics in a single interface. Operators can set up automated alerts based on weather conditions, correlate weather events with plant performance in real time, and even automate certain plant operations based on meteorological data. This level of integration enhances overall plant intelligence, enabling more responsive and efficient operations.

PES: Would you like to add anything else about environmental monitoring our readers should know about?

AA: We are seeing a growing demand for environmental resource monitoring solutions for PV plants across the globe. Only a few teams, like ours, have an in house portfolio of instruments that measure the parameters required to have a complete meteorological station.

That's why at RE+ 24, we are showcasing our comprehensive meteorological station, similar to those used in active PV sites. With our extensive portfolio, attendees will experience the benefits of collaborating with a team that can act as a one-stop solution for all their PV measurement and monitoring requirements. Visit us in Hall E, Booth 16030.

You can book a meeting with Alondra at RE+ 24.

www.otthydromet.com

About Alondra Anacleto

I'm the North America Team Lead for the solar vertical at OTT HydroMet. I began my career at Lufft, now part of OTT HydroMet, always within sales.

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We will be in Hall E Booth #16030