

ARE OWNERS AND OPERATORS ACCURATELY ACCOUNTING FOR ENERGY LOSSES IN A WIND FARM?

PROBLEM

A key challenge for wind turbine owners and operators is understanding the causes of energy loss and the resulting revenue shortfalls. Wind farms can range in size from only a handful of turbines to more than 100. They can also vary in terrain type from flat to very complex. In the last few years, with re-powering of older sites, wind farms with mixed turbine types are also on the rise. It is critical for owners and operators to understand the true energy losses that are occurring and the reasons for these losses. This applies both to self-performing wind farms and those under full-wrap supply agreement.

PAST APPROACHES

The most common method for calculating lost turbine energy is to use the nearest neighbor to calculate the energy loss during downtime. This method provides accurate results under a very narrow set of cases such as a wind farm with flat terrain and significant distance between turbines. For more typical wind farms with wake effects and complex terrain (and recently mixed turbine wind farms), the calculated energy losses using this method can be off by as much as 10%. This affects the customer's bottom line since it affects the calculation of Availability Damages or Availability Bonuses.

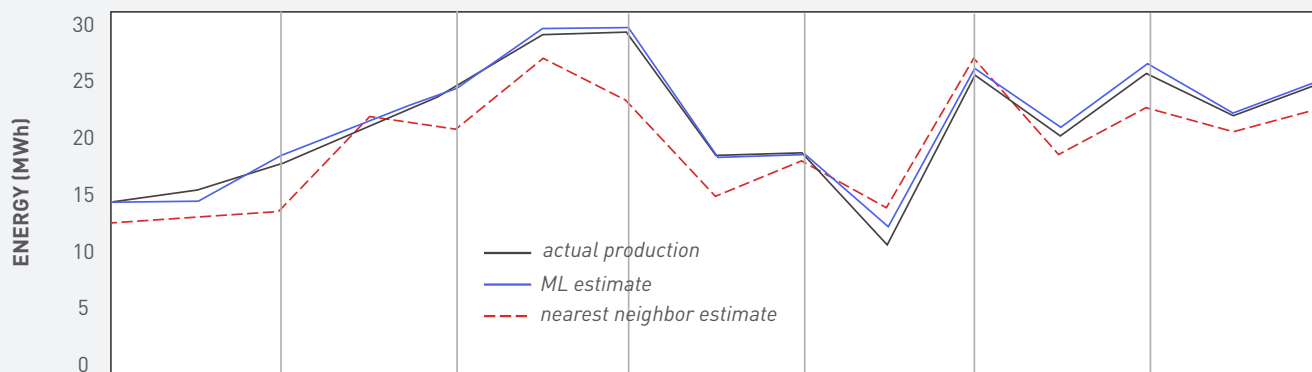
AVATHON'S SOLUTION

Accurate calculations of wind power energy losses are critical for owners with or without an OEM warranty. Fortunately, wind farms are data rich, and physics-informed machine learning approaches provide a framework to calculate these losses much more accurately. One Avathon customer owns and operates more than 1.0 GW of wind assets with wind farms ranging from just a few MW to more than 200 MW. Their fleet also consists of multiple OEMs. The challenge



was to provide a unified view of all their assets and reconcile energy losses provided by different OEMs. In addition, the OEMs were only providing energy loss results for downtime related to turbine unavailability, which leads to a complete lack of visibility into revenue lost due to Balance of Plant (BOP) processes or contractually excluded downtime. The plot below shows how traditional energy loss calculations can result in significant errors and how Avathon Industrial AI platform improves the accuracy of loss calculations (see figure 1).

FIGURE 1: Comparison of Energy Loss Methods



Another use case of Industrial AI platform ML-based energy calculation solution is to calculate energy loss due to BOP issues such as a feeder failure or substation outage. In one instance, a site had a section of the wind farm down for more than a month because of an electrical outage. The OEM did not report the energy loss as it was outside their scope. In addition, there was no SCADA data available for this timeframe for the affected turbines. However, Industrial AI platform was able to calculate the energy loss for the affected section of the project. The energy loss was significantly higher than what the owner's method calculated and reduced the energy-based BOP availability by over 8%. Besides an accurate accounting of the energy loss, this guided the owner's decisions for spare parts inventory planning.

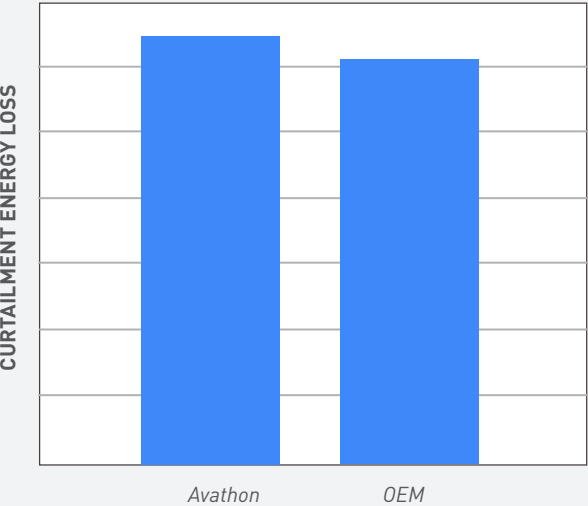
Accurately calculating losses due to grid curtailment is also an important challenge for operators. Wind farms may be curtailed for various reasons with grid curtailment being the most common issue. One wind farm monitored by Avathon is located in an Independent System Operator (ISO) with significant grid curtailment, especially during certain months of the year. Our customer was using the OEM estimate of energy loss. When Avathon reviewed the calculations, the estimate was based on an average wind speed across the site using a single power curve. This wind farm has over 75 turbines, and more importantly, a mix of turbines which meant this calculation methodology was bound to be incorrect. Avathon's data-driven method allowed our customer to accurately calculate the energy loss from curtailment and get the accurate curtailment compensation from the offtaker. The OEM calculation underestimated the losses by nearly 10% over one year (see figure 2).

BENEFITS

More accurate energy loss calculations such as those provided by Avathon Industrial AI platform help operators receive the true value from their O&M contracts. They also help owners understand where energy is being lost, so they can focus their efforts on corrective actions with the highest ROI.

FIGURE 2

Comparison of OEM and Avathon Curtailment Loss Calculations



ABOUT AVATHON

Avathon, a leader in Industrial AI, extends the life of critical infrastructure while advancing the journey toward full autonomy. Avathon's Industrial AI platform empowers commercial and government customers with scalable, secure, and value-driven solutions that enhance efficiency and resilience across heavy industry.

To learn more about how Avathon's AI solutions can unlock the power in your data, visit www.avathon.com.