

An Intelligent Approach to Assessing Wind Turbine Lightning Damage

Look Back to Move Forward

Lightning often challenges wind farm assets and affects operations, especially if your assets are in a lightning-prone area. Blade damage due to lightning strikes can result in a significant amount of time for inspection and repair, not to mention the cost to repair or replace a blade. Access to detailed information about a lightning event gives you the power to make smart decisions, save time, money, and even improve your process to better manage your operational budget and exceed performance expectations. Pattern Energy, a leading independent power company with wind power operations in the U.S., Canada, and Chile, is making smart decisions when it comes to adding lightning information to its data infrastructure and turbine blade-inspection program.

Pattern Energy was already working on establishing a new data system, which is a great time to assess an organization's requirements and where improvements can be made. Pattern Energy knew that access to information would help them determine if a turbine was affected by lightning and when, saving time and improving their inspection and claims processes. Ben Rice, Operations Engineering Manager, at Pattern Energy adds, "Before we didn't have any insight into historical lightning data, or a good way of assessing lightning damage." They needed to be able to look back in time – with historical data – to make decisions and move forward.

With previous experience and knowledge about the availability of Vaisala lightning information, Pattern Energy decided to implement lightning information as part of its data system, and in particular, historical lightning information. This would allow Pattern Energy to conduct assessments of blade damage, and send detailed insurance or warranty-based claims.



The Gulf Wind Project in Texas, one of many Pattern Energy projects impacted by lightning.

Challenge

- Pattern Energy needed to assess and confirm the risk of lightning to its operational fleet
- Previously, it had no insight into historical lightning information across its portfolio
- Pattern Energy also had no way to correlate blade damage with lightning activity

Solution

- Vaisala provided the lightning data and software that Pattern Energy needed to assess its risks
- FALLS software provided access to historical lightning information
- Pattern Energy was able to overlay its assets on a map and correlate lightning strikes with blade damage

Benefits

- Pattern Energy has direct access to the source of real-time and historical lightning information
- Vaisala has the longest and richest lightning database in the world
- Pattern Energy is able to correlate lightning strikes with blade damage
- Pattern Energy can be more selective during the inspection process, saving time and money
- Identifying damage early reduces operations and maintenance costs (blade replacements are 10 times more expensive than repairs)

Evaluating the Risk

Before Pattern Energy implemented a long-term contract for lightning information, it first evaluated risk across its operational portfolios. Working with Vaisala, Pattern Energy learned that a substantial part of its fleet was susceptible to lightning. Pattern Energy already understood how lightning affects its operations and why it was critical to verify its occurrence. Lightning strikes to wind turbines can result in a large amount of damage each year. The blades are particularly vulnerable, causing turbines, and therefore wind projects, to underperform while driving up operations and maintenance costs. Additionally, lightning can increase the risk of future failures due to residual effects. Thus, it is important to quickly identify wind turbines that have suffered a strike in order to reduce the probability of further losses and damage.

With ten wind turbine sites between central Canada and Texas, Pattern Energy's operations are in a prime area of lightning activity. After receiving a few detailed reports from Vaisala about lightning risks and reviewing the density of lightning in its operating area, Pattern Energy could clearly see the value of accessing Vaisala's full historical lightning database and incorporating it into its reporting and data infrastructure programs.

Implementing the Solution

Pattern Energy began with a three-year contract for the Vaisala FALLS (Fault Analysis Lightning Location System) for all of its sites in lightning-impacted areas. FALLS software allows wind farm operators to access historical lightning data and analyze past exposure to assets. Pattern Energy uses FALLS to overlay infrastructure with the

correlating lightning activity. This is a proactive approach to determine which turbines and corresponding projects have the highest risk, or potential, of being affected by a lightning event.

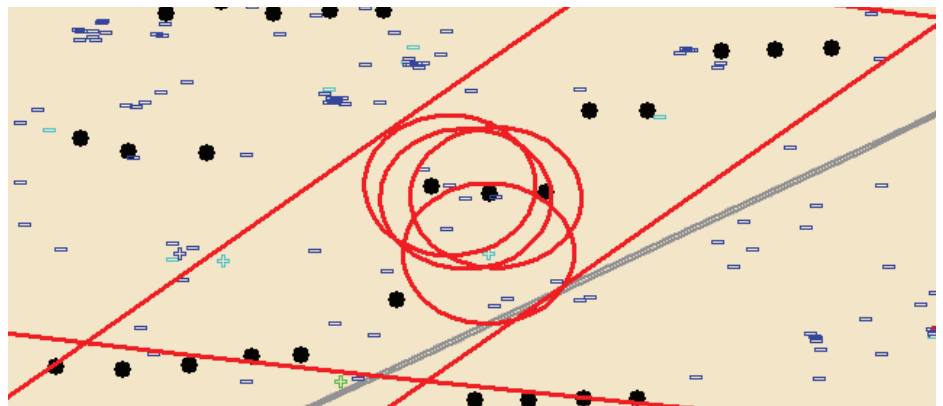
For Pattern Energy's sites in the U.S. and central Canada, FALLS software utilizes lightning data from the North American Lightning Detection Network (NALDN), which is owned and operated by Vaisala. The NALDN provides the amperage of a lightning event, polarity, timing to the millisecond, and a median location accuracy between 150–250 meters. Having this data greatly increases Pattern Energy's chances of determining exactly which turbines were affected, and how extensive the damage may be.

Rice commented, "We wanted to go straight to the source for lightning data." While other vendors can provide lightning information, most of these solutions are based on Vaisala's network, which has the richest lightning database in the world, and Vaisala has the most experience in lightning detection technologies. "In general, [FALLS] has helped us look back and assess turbine damage, enabling us to determine whether lightning truly caused damage and exactly when that damage occurred."

Using the Vaisala FALLS software means Pattern Energy can spot damage early, reduce inspection and repair costs, and potentially reduce downtime. Blade damage may progress if it is not identified early. "The repair cost for a blade is tens of thousands of dollars, while replacement is in the hundreds of thousands. By comparison, the annual cost for Vaisala's data across our entire wind fleet is less than 5% of a single blade replacement, so it clearly pays for itself and is well worth the investment," Rice added.

While there is no way to remove the risk of lightning, knowing an asset was affected saves cost and up to half the inspection time compared to not having any insight into the cause of damage or where lightning might have occurred.

Further, Pattern Energy plans to use Vaisala's lightning information to build a better blade inspection and maintenance program. Knowing lightning is the cause means it can mobilize inspection and repairs quickly, assess where future lightning damage is mostly likely to occur, and reduce the number of times inspections are needed.



Pattern Energy FALLS Demo Snapshot

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