

VAISALA

Lightning and the wind energy life cycle

Solutions Brochure



The lightning factor

Lightning is among the most under-addressed risks in wind energy. The risk of putting large, conductive structures in the middle of open spaces or the ocean is easy to understand – but lightning's effects throughout the entire wind energy life cycle are more nuanced and complex than that.

From the moment a site is evaluated, or wind resources assessed, work crews and equipment are exposed. Operational continuity is impacted not just by lightning damage, but by inefficient stopping and starting of wind turbines due to poor storm awareness. Furthermore, crucial construction and turbine selection decisions are affected by a site's long-term lightning patterns – which, if misunderstood, can result in significant inefficiency and extra costs even if not a single lightning strike ever takes place while the wind farm is operational.

Modern data, modern operations

Fortunately, modern data-as-a-service lightning solutions are cost-effective, low-risk ways to improve weather awareness and project success. They are available immediately, with little or no capital costs, construction, or permitting, and the gains they provide can readily offset the investment it takes to use them.

Vaisala's lightning solutions are unique in the world because they are rooted in our proprietary ground-based network data, Global Lightning Dataset (GLD360) and National Lightning Detection Network (NLDN). No other lightning detection networks are as reliable, cover the entire globe with such resolution and accuracy, offer



the same consistent level of performance, or can be seamlessly integrated to improve so many other technologies.

This guide walks you through a typical scenario where lightning awareness is critical, and it introduces Vaisala's core lightning solutions for wind energy. By the end, you'll better understand lightning's implications for your project and the options immediately available to you.

Lightning and the life cycle

A theoretical wind farm case study

The site is assessed

- The developer establishes a precise, data-driven understanding of the site's unique lightning patterns and history – which can vary significantly from nearby locales.
- This enables changes to the proposed maintenance budget, turbine layout, and turbine choice.
- Financing is secured and planning is optimized. Confidence is gained.

Vaisala solutions: GLD360 or NLDN, Lightning Integrator, plus our free interactive global lightning density map

Construction begins

- People and equipment remain safe with enhanced 24/7 weather awareness specific to this site.
- A storm passes. Crews are held back for safety but resume promptly due to accurate 24/7 storm data, keeping the project on track and avoiding unnecessary downtime.
- Throughout construction and commissioning, teams act with objective data and notifications, keeping people and equipment safe with no guesswork.

Vaisala solutions: GLD360 or NLDN, Thunderstorm Manager, Lightning Threat Zone

Into operations and maintenance

- Safety is maintained as storms come and go. Operators occasionally shut down turbines or advise maintenance personnel to get to a safe place, to proactively reduce the risk of injury or strike damage.
- Power production is optimized through precise, decisive adjustments when needed.
- Estimates made earlier during development are met.

Vaisala solutions: GLD360 or NLDN, Thunderstorm Manager, Lightning Threat Zone



Lightning strike!

- A lightning strike takes place nearby. Operators predicted it and can determine if a turbine was hit, the severity of the potential damage, or if the strike was near the wind farm but unlikely to have caused damage.
- With Vaisala solutions, they understand the type of lightning, its impact in the area, and the likelihood of damage.
- Fully informed, the operators avoid wasting resources on unnecessary site inspection visits. Power production continues uninterrupted.
- They also know that in case of future strikes, they can take the necessary measures to carefully evaluate and mitigate damage before it gets worse.

Vaisala solutions: GLD360 or NLDN, Strike Damage Potential, Lightning Exporter, Lightning Integrator

Striking accuracy: Vaisala lightning solutions at a glance

Vaisala's lightning solutions are optimized for the most important needs and use cases in wind energy. They rely on the best lightning detection networks anywhere, and each is easy to integrate into existing systems for quick, reliable value.

These solutions are the ideal ways to augment your situational awareness over the whole life span of your projects. Read on to see how to get started.

Step 1 Subscribe to a Vaisala lightning detection data network

Global Lightning Dataset (GLD360) and National Lightning Detection Network (NLDN)

There are no lightning detection networks on the planet quite like Vaisala's GLD360 and NLDN. Unmatched in their coverage, accuracy, and availability, they inform countless technologies and applications. They are trusted by the world's leading weather authorities, including the U.S. National Weather Service, FAA, and armed forces.

Developed and managed by Vaisala, these networks are incredible strategic assets for many renewable energy applications, including wind energy, where they enable operators to monitor asset availability, receive trustworthy alerts, and stay ahead of hazardous storms.

Key benefits:

- Decisive lightning and storm alerts around wind farms.
- Unrivaled accuracy, even beyond the range of radars and satellites. This provides truly global coverage for users anywhere (GLD360) and unrivaled awareness for North American users (NLDN).
- Smarter decisions and improved safety across many applications and operations, as well as reliable early warning capabilities to reduce downtime.
- Data feeds boast greater than 99.99% uptime, short latency up to only ~12-seconds, and are delivered over a variety of real-time methods, file types, and APIs to fit various forecasting, alerting, reporting, and analytical needs.
- Historical lightning data can also be easily accessed and analyzed.
- Available as convenient data services immediately, with no capital costs required.

TIP: See GLD360 and NLDN in action with our free interactive global lightning density map.

Step 2 Unleash your data with Vaisala's leading lightning and storm detection software

Thunderstorm Manager

Thunderstorm Manager, part of our Xweather family of subscription based products, is the ideal comprehensive lightning detection and mitigation software system. It makes GLD360/NLDN insights available through a convenient user interface, improving situational awareness and helping customers stay efficient, informed, and ready for anything.

Key benefits:

- Web-based interface provides real-time tracking and visualizations from any device, flexible display options for different lightning types and parameters, and playback from the previous 7 days.
- Provides various alert types and levels, based on specific project needs.
- Includes Lightning Threat Zone (see below) to track specific storms' trajectory, cell velocities, speed, and direction.



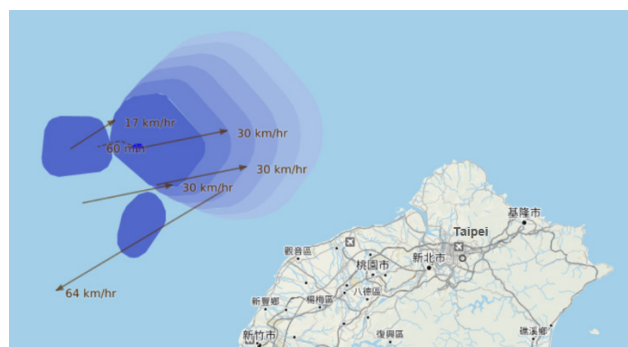
Step 3 Add other Vaisala lightning data to augment Thunderstorm Manager, or access the data separately to integrate into existing systems

Lightning Threat Zone

Included with Thunderstorm Manager, Lightning Threat Zone provides lightning nowcast data for anywhere in the world. Or, through an easily integrated API, the data populates customers' existing weather tracking tools with the exact information needed for better situational awareness of thunderstorm and lightning risks.

Key benefits:

- Single-source, real-time access with 99.99% uptime, making the best data available to any user, anywhere.
- Includes an additional information layer with forecast polygons and velocity vector data for each identified storm.
- Highly localized, early detection of all relevant storms, enabling earlier planning for real threats and avoidance of unnecessary operational disruptions for nonproblematic storms.



Lightning Integrator and Lightning Exporter

Lightning Integrator, part of our Xweather family of subscription based products, provides quick and easy access to Vaisala's high-quality, accurate historical lightning data through an API or an easy-to-use web interface. This enables robust, data-driven safety and planning practices, as well as advanced risk assessments and incident reporting – all informed by the best lightning data on the planet.

Lightning Exporter, also part of our Xweather family of subscription based products, provides an easy-to-use web interface that lets users download and compile the exact lightning data they need from hazardous weather events near facilities or assets. It enhances report credibility for management, legal teams, unions, or external audiences, and it often eliminates the need to purchase, install, or maintain any lightning detection sensors.

Key benefits:

- Reduced downtime through near-real-time storm analysis, even when a wind asset(s) might have been compromised. Teams make better decisions to maximize productivity.
- Confident, objective evaluations derived from the largest, most sophisticated, most accurate lightning detection networks in the world (see GLD360/NLDN).
- Ultimate asset management and storm visibility, no matter where wind operations are located onshore or offshore.
- Improved asset reliability and liability protection resulting from informed emergency, maintenance, and management practices.

Strike Damage Potential

Accessible through Lightning Integrator or Lightning Exporter, Strike Damage Potential, part of our Xweather family of subscription based products, enables intelligent analysis of lightning strikes, reliably distinguishing between low-risk



strikes and those with greater potential to cause wind turbine damage. This revolutionary offering creates substantial efficiency and allows wind stakeholders to plan decisively and quickly.

Key benefits:

- Enables fast, critical lightning insights by simplifying lightning data into strike points and showing the precise location of strikes – both near-real time and historical – that are most likely to have started a fire or caused damage.
- Unrivaled accuracy around the globe, with actionable insights derived from GLD360 and NLDN data.
- Enables earlier interventions that require less time and fewer resources for repairs or wildfire containment.

Lightning doesn't need to be a game of chance

Lightning awareness improves safety and business outcomes across the entire wind energy life cycle. Vaisala solutions are easy to deploy, trusted around the globe, and immediately available. We're ready anytime to talk with you about your specific needs.



Why Vaisala?

We are innovators, scientists, and discoverers who are helping fundamentally change how the world is powered. Vaisala elevates wind and solar customers around the globe so they can meet the greatest energy challenges of our time. Our pioneering approach reflects our priorities of thoughtful evolution in a time of change and extending our legacy of leadership.

Vaisala is the only company to offer 360° of weather intelligence for smarter renewable energy, nearly anywhere on the planet. Every solution benefits from our 85+ years of experience, deployments in 170+ countries, and unrivaled thought leadership.

Our innovation story, like the renewable energy story, continues.

