



LASSIE

Your Lightning Surveillance System



What is LASSIE?

**Understanding
Lightning Risk**

**Controlling
Lightning Risk**

**Value
Propositions**

Testimonials

Use Case

What is LASSIE?

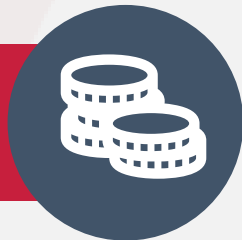
Lightning Analysis Subscription Service Including Expertise

Wind Power LAB's lightning subscription service – LASSIE – offers the wind energy market a new option for managing lightning risk. Lightning will strike turbines, what can be done about this? Understanding exactly which turbines to inspect, when, and how is key. Wind Power LAB's experts have created an automatic rule-based notice system and dashboard that pairs lightning and blade knowledge for actionable insights. Market-leading remote sensing data drives the system backed by intelligence and development from the WPL Team.

Early detection of potential damages



Save damage progression costs



Loss-production days reduced



Lightning Surveillance Service

Controlling lightning risk

LASSIE offers major cost savings due to early detection of potential lightning damages, avoiding unnecessary labour, material, and rental cost.

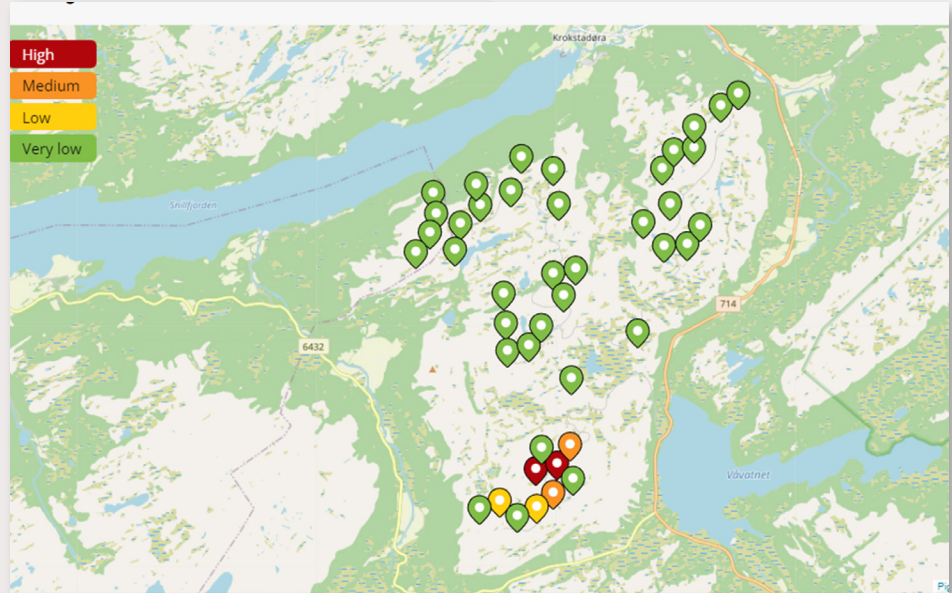
Significant cost savings in excess of 40% can be seen in the instance where LASSIE solutions are used, because repairs are detected earlier than expected through the use of such a solution.

Additionally, cost savings are made by reducing lost production days and avoided inspections. LASSIE adds value to every wind park owner by reducing lost production days by an average of 43%. With growing severity of a damage, more production days are lost, making LASSIE an increasingly valuable solution.

LASSIE adds value to every wind farm in the client portfolio given the number of lightning strikes reported.

Lightning Surveillance Service

Manage lightning risk with the rules-based notifications and dashboard



WIND POWER LAB
Global Blade Experts

LASSIE

Portfolio > Great Western

Great Western

Latest data acquisition: 22 hours ago

LAST TWO WEEKS	TURBINE MODELS	LATEST LIGHTNING ACTIVITY
0 strikes	V100-2.0 Mk 10B, V117-3.3 Mk 2C, V100-2.0 Mk 7H, V100-2.0 Mk 10C	14 days ago

T79 ▲ At risk

Distance: 120 m Peak: -9.5 kA Date: 2023-08-14 01:50:51

Mark for Inspection
Ignore Risk

WIND POWER LAB
Global Blade Experts

LASSIE

winddiagnostics.com/lassie/windfarm/411/complete-turbine-list

Turbine Model	Name	Model	Comment	Overall probability (?)	Closest lightning	Outside cert
<input type="checkbox"/>	T79	V100-2.0 Mk 7H		94%	120 m	Show less -
	Distance	Major axis	Peak current	Hit probability	Timestamp	
<input type="checkbox"/>	T43	V100-2.0 Mk 10C		85%	110 m	Show more +
<input type="checkbox"/>	T20	V117-3.3 Mk 2C		65%	350 m	Show more +
<input type="checkbox"/>	T16	V100-2.0 Mk 10C		46%	430 m	Show more +
<input type="checkbox"/>	T34	V100-2.0 Mk 10C		40%	460 m	Show more +
<input type="checkbox"/>	T18	V117-3.3 Mk 2C		40%	430 m	Show more +
<input type="checkbox"/>	T27	V117-3.3 Mk 2C		14%	1070 m	Show more +
<input type="checkbox"/>	T21	V117-3.3 Mk 2C		7%	770 m	Show more +
<input type="checkbox"/>	T22	V117-3.3 Mk 2C		6%	1060 m	Show more +
<input type="checkbox"/>	T24	V117-3.3 Mk 2C		5%	1570 m	Show more +
<input type="checkbox"/>	T25	V117-3.3 Mk 2C		3%	740 m	Show more +
<input type="checkbox"/>	T02	V117-3.3 Mk 2C		3%	750 m	Show more +
<input type="checkbox"/>	T58	V100-2.0 Mk 10C		2%	1430 m	Show more +
<input type="checkbox"/>	T29	V117-3.3 Mk 2C		2%	760 m	Show more +

Selected turbines:

Comment or note

When was the inspection performed?



Understanding Lightning Risk

The impact of lightning strikes

Understanding lightning risk is key to mitigating potential wind turbine damage and foreseeing lightning risk events.

LASSIE supports wind turbine owners and asset managers in developing the prudent operator mindset required to ensure efficient repairs, quick responses and reduce lost production days.

Client Reference Case

78 Turbines under surveillance over 2 months:

Lightning events

- **1,557** lightning strikes this year within 1 km of a turbine
- **828** lightning strikes within 3x hub height(IEC) covering **78** turbines during the surveillance period
- **10.62** incident rate of strikes per turbine aggregated over the turbines under surveillance

Further WTG analysis

- Number of turbines potentially impacted by lightning strike = **78** (according to the IEC standard)
- Number of turbines with no impact activity = **0**
- % of turbines under surveillance impacted = **100%**
- Number of turbines subject to 1 strike only = **3 WTG's**
- Number of turbines subject to >1 strike = **75 WTG's** with risk of lightning damages

In a portfolio of **78 wind turbine generators**, the yearly cost savings are estimated to be **EUR 260k/year** based on the model assumptions.

Model assumptions include:

- 2x scenarios covering split tip repair and external delamination (classified as Cat 3 only)
- Estimated annual repair cost **without LASSIE** of **EUR 621k** from propagating lightning related blade damage across the **75** turbines under surveillance that have been potentially hit more than six times - a cost of **EUR 3,378k** per WTG on average.
- Client mitigates an estimated total cost of **EUR 3,378k per WTG** (including the cost of LASSIE) across all of the **78** turbines under surveillance.
- **With LASSIE, a yearly cost saving of EUR 260k** is achieved (not including production loss) through the early intervention of repairing the damage caused by lightning strike based on the model assumptions above.

Under LASSIE surveillance:

Assumes **2.5 days** repair time for split tip and **3.7 days** for delamination

- **Without LASSIE surveillance** and factoring the deterioration of the damage causing a greater repair time:

Assumes **4.3 days** repair time for split tip and **6.3 days** for delamination

- Does not account for the potential cost of any catastrophic blade failures from a lightning strike or production loss as a result from blade repairs

ROI model independently developed by industry consultants Brinckmann Group (see <https://brinckmanngroup.com/>)

Client Reference Case

Return On Investment

78 WTGs

EUR 260k

in yearly cost savings

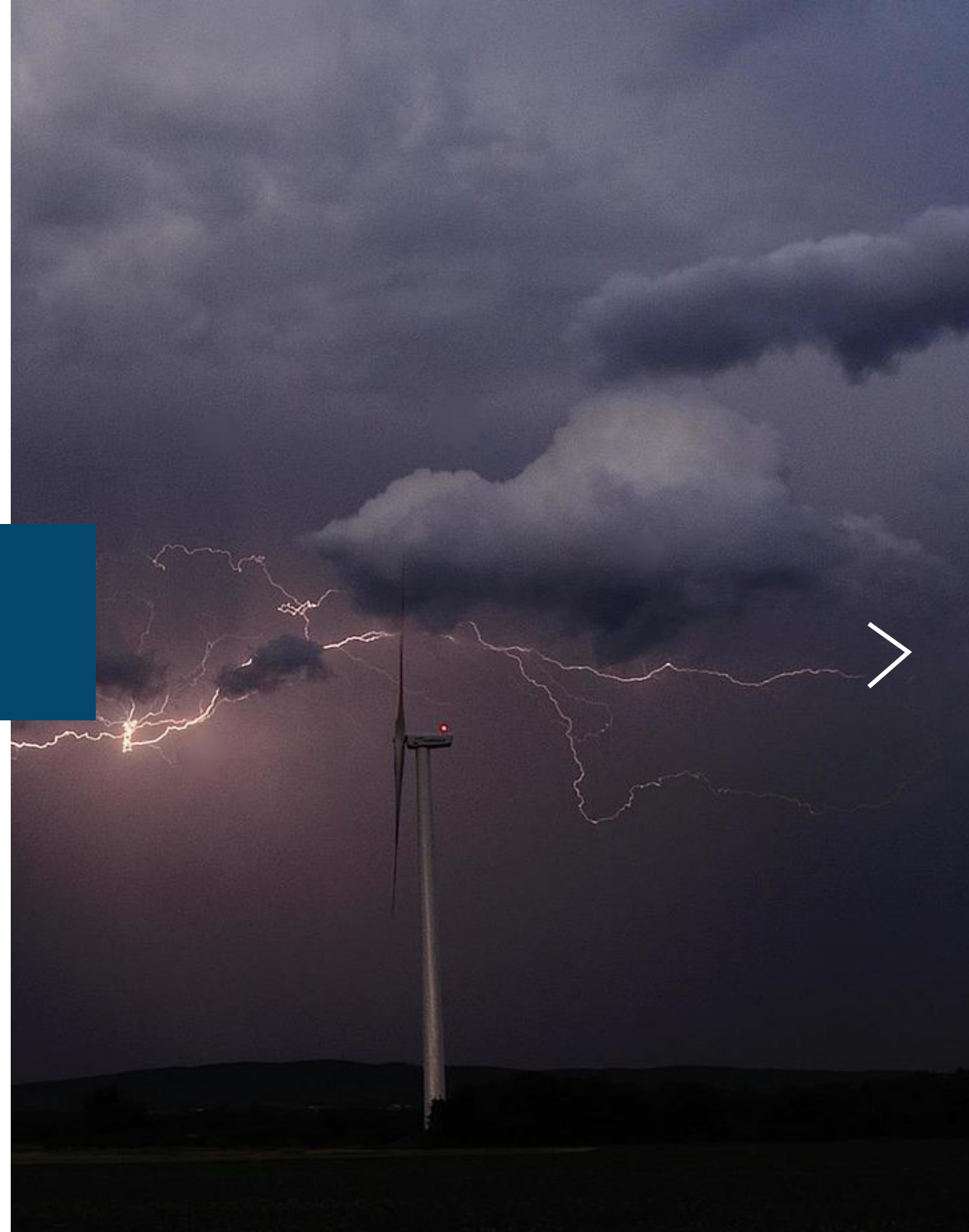
LASSIE is simply priced at **EUR 1 per day per WTG** over a minimum **3-year agreement term**.

For a **EUR 365** investment per annum per turbine, this investment would save a potential cost of **EUR 3,378k** (not including loss of production) per wind turbine.

ROI calculation of EUR 3,378k / EUR 365 = 9.14

The cost of LASSIE represents a **9x** return on investment in reducing the potential cost of repair works by alerting EDF to the lightning event and likelihood of damage.

***The client has confirmed 9 actual lightning damages over the last two months, based on LASSIE motivated inspections.**



Understanding Lightning Risk

The impact of lightning strikes

The situation

- Lightning strikes to a wind turbine blade can create severe damages, even with a lightning protection system(LPS) installed.
- Lightning can jump from down conductor cables to structural components of a blade internally and cause flashovers with severe impact on blade integrity.
- Response time to a lightning strike is crucial to avoid catastrophic blade failure.

Lightning Parameter Certification Limits for LPL 1 IEC Standard IEC 61400:24–2010

Peak current	-100 to 200 kA
Average Steepness	200 kA/ μ s
Specific Energy	10 MJ/ Ω
Total Charge	300 C

The Complications

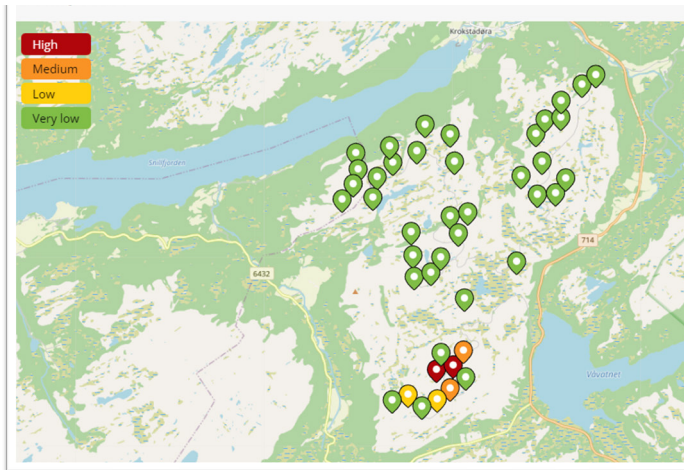
- Smaller lightning strikes have a higher risk of hitting outside LPS receptors, causing possible structural damage to the blade. These events are usually not in scope of Service Agreement blade inspections.
- The IEC standard specifies that 2% of all lightning strikes will cause blade damage independent of peak current and polarity.
- Lightning damage events can cause a blade collapse/ failure within a short timeframe.

Service Agreement (SA) Definition of Actions [Example]

>2km	No inspection
2km <->800m	Inspection on next availability
<800m	Urgent -Inspect ASAP

Controlling Lightning Risk

How LASSIE allows clients to manage risk and make informed decisions



The Solution:

- Understand the risk of lightning damages through data.
- Daily notifications if lightning strikes have occurred in close proximity to a wind turbine.
- Recommended wind turbine operation actions based on characteristics of the lightning strikes.
- Optimised lightning strike inspection planning.
- Verify if a lightning strike is within or outside the certification: IEC 61400:24 2010.
- Trigger Service Agreement blade inspection to mitigate risk of catastrophic blade failures.
- Become a prudent operator by mitigating foreseeable lightning risk events.

Testimonials

The impact on the market

External - Market:



“... We really need your surveillance service in order to be in compliance and to able to deliver best practise Technical Asset Management for our clients ...”



“What you offer is a really useful service for us, providing risk based insights on when and where to inspect. This capability allows us to take extra good care of our wind farm assets”

Internal - Group:



“... We get to deliver blade expertise through a SaaS analytics for the global wind industry market while creating jobs in Europe ...”



“... We get to deliver in field blade repairs in our primary markets, instead of seeing our clients scrapping blades for landfills and then be suffering from supply chain issues ...”

Value Propositions

Benefits

A Prudent Operator mindset among insurance clients on policy can mitigate foreseeable lightning risk events and enables wind turbine owners and asset managers to understand their risk of lightning damages.

- ✓ Reliable electricity production
- ✓ Reduced OPEX cost in operations
- ✓ Reduced business interruption
- ✓ Scaling through SaaS business model

- ✓ Job creation benefits
- ✓ Supply chain benefits
- ✓ Environmental benefits
- ✓ Document performance

Use Case

Saving on damage progression costs



The situation

Ongoing lightning damages across portfolio only found on yearly inspections, costing \$\$\$



The complication

Lightning risk for wind farms across multiple locations, >10GW manually managed by 1 person



The solution

Inspect what is relevant and avoid lightning damage propagation

*Lightning risk managed for multiple wind farms by one person

Use Case

Controlling lightning risk

The LASSIE lightning subscription service enables wind turbine owners and asset managers to better understand their risk of lightning damages.

Step 1 | Alignment with client on lightning risk they want to mitigate and how

Step 2 | Custom creation of rules-based or algorithmic risk warnings

Step 3 | Onboarding of specific wind farms and wind turbines into system

Step 4 | System training and exercise/response alignment for client

Step 5 | Ongoing support of client with system



WE CAN HELP!

Wind Power LAB is a Danish company, founded in 2016 by a passionate group of wind power industry professionals. Our team of experts based in Copenhagen offers market leading expertise related to blade risk management. Our goal is to deliver the best available and robust solutions to empower our clients with the ability to make decisions to optimize their asset performance.

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