

2023  
2024



**The best solution to PREVENT  
lightning damages**

 **dinntecospain**  
STOP lightning damages



# DINNTECO

Why just stop a lightning strike when you can prevent it?

Paradoxical though it may seem, the only way to protect yourself from lightning until now was to attract it, to try to “dissipate” its energy to earth or move it away from the place being protected.

Wind turbines are **lightning attractors**. Traditional systems are ALL based on the same concept: dissipating lightning energy via conductors and the actual structure. **Damage from lightning will depend on the intensity of the strike, but will in no case be avoided.**

The cost of damage is millions of euros each year, and may even be a decisive factor when determining the location of wind farms.

**Dinnteco** is a system that acts by **PREVENTING** damage. The **reduction in breakdowns, stoppages, and maintenance costs increases the comparative benefit.**

“  
We at **Dinnteco** have been **PREVENTING LIGHTNING FROM STRIKING** for over 20 years, safeguarding lives and all kinds of facilities on land and sea.

# LIGHTNING AND ELECTROSTATIC CHARGES ON WIND TURBINES

Wind turbines are a natural target for lightning.

Because of the way they operate, wind turbines **generate a high level of electrostatic charge.**

The cost repairing the breakdowns due to the effects of direct lightning strikes and electrostatic discharges are very high.

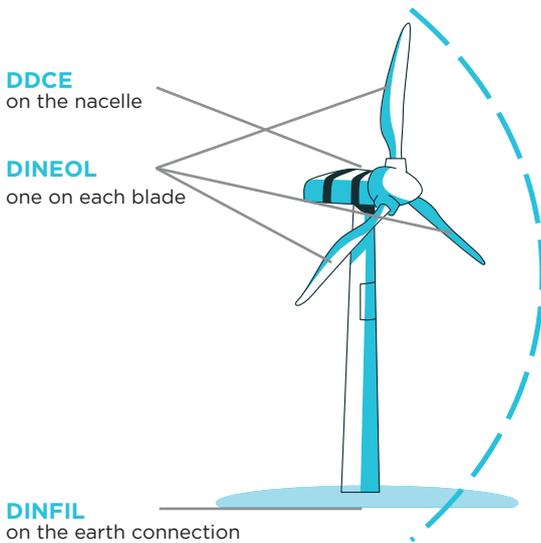
Losses due to production stoppage caused by these breakdowns are also very big.

This forces lightning strike damage coverage policies to be basic, thus increasing their costs.

Conventional LPS **lightning protection systems** are not effective protection systems.



## DINEOL SYSTEM



### Specially designed for Wind Turbines Blades

The **Dineol** system is based on the same operating principle **DDCE**, the difference being that it can be installed on mobile structures such as wind turbine blades.

**Dinnteco** is by Bureau Veritas certifications: UNE EN IEC 62305 1-2-3-4 & UNE EN IEC 61400-24:2119 **LEVEL I** standards, as well as the winter lightning requirements.

## ADVANTAGES

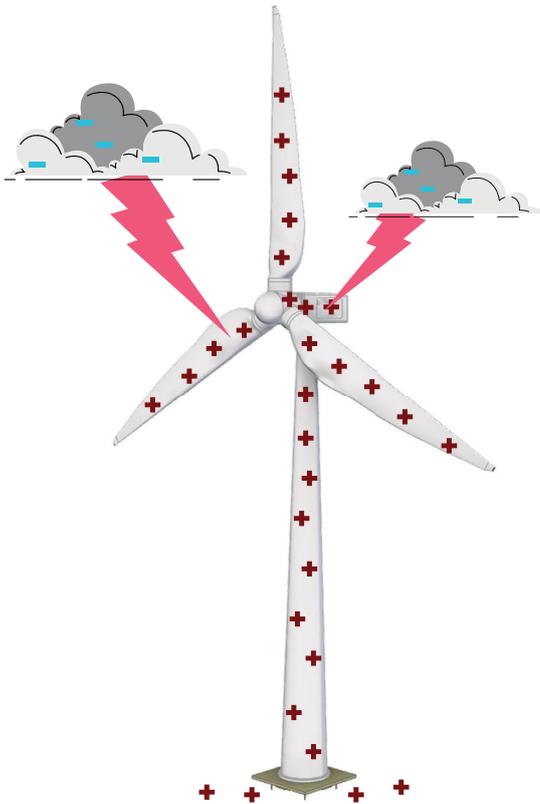
- Prevents the direct impact of lightning on wind turbines.
- Minimises the accumulation of electric charge on the blades and thus the possibility of significant electrostatic discharges.

## BENEFITS

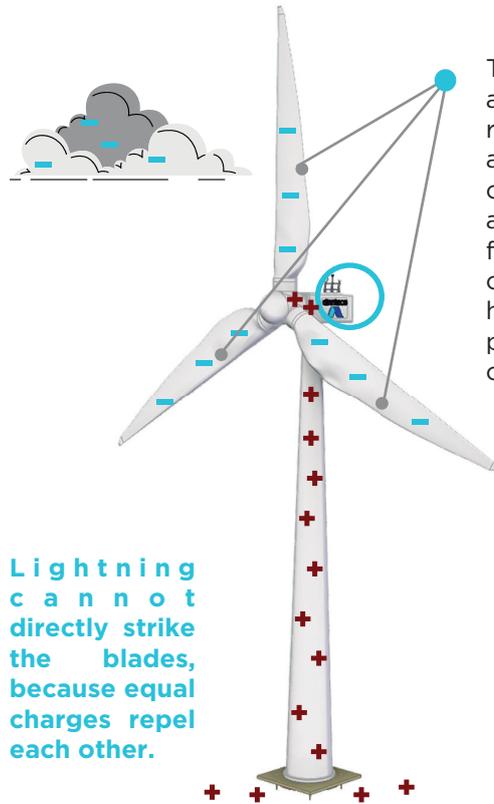
- Significantly reduced cost of repairs due to lightning strikes or electrostatic discharges.
- Reduced costs due to production stoppages.
- Bearing protection measures aimed at improving energy efficiency.

# HOW DOES IT WORK?

## WITHOUT Dinnteco



## WITH Dinnteco

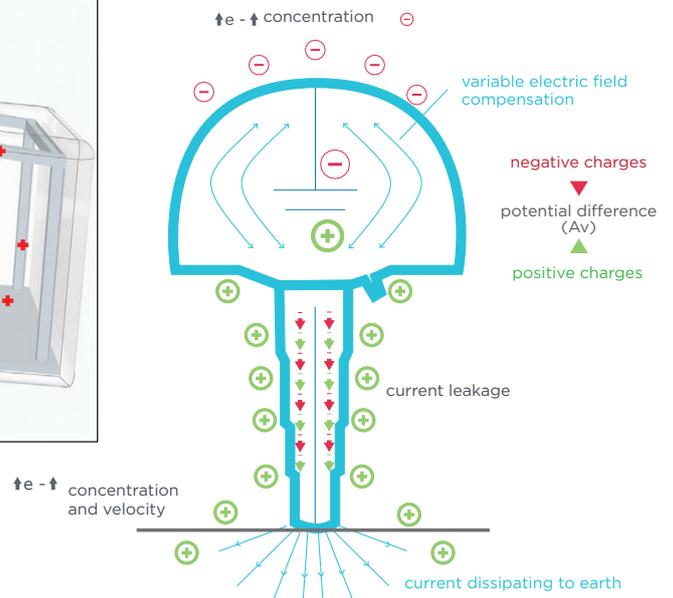
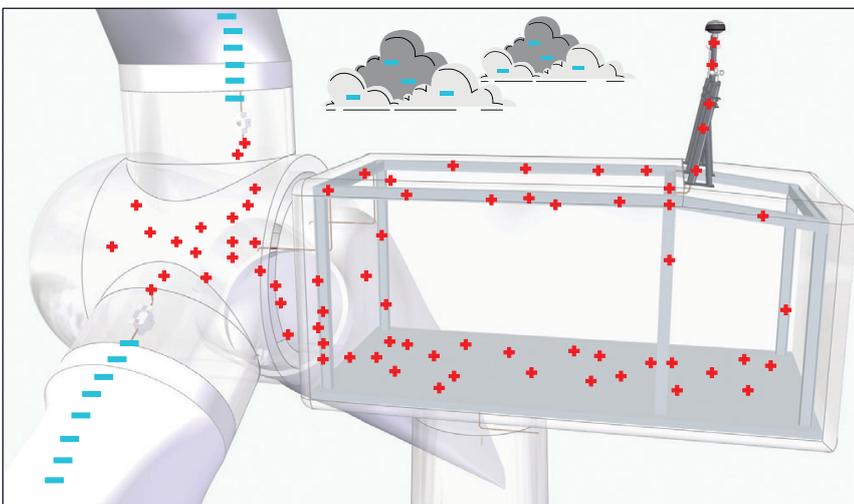


The **Dineol** system acts as a sink, rearranging the +ve and -ve charges by compensating the associated electric field. The sensors on the blades will have the same polarity as the base of the cloud.

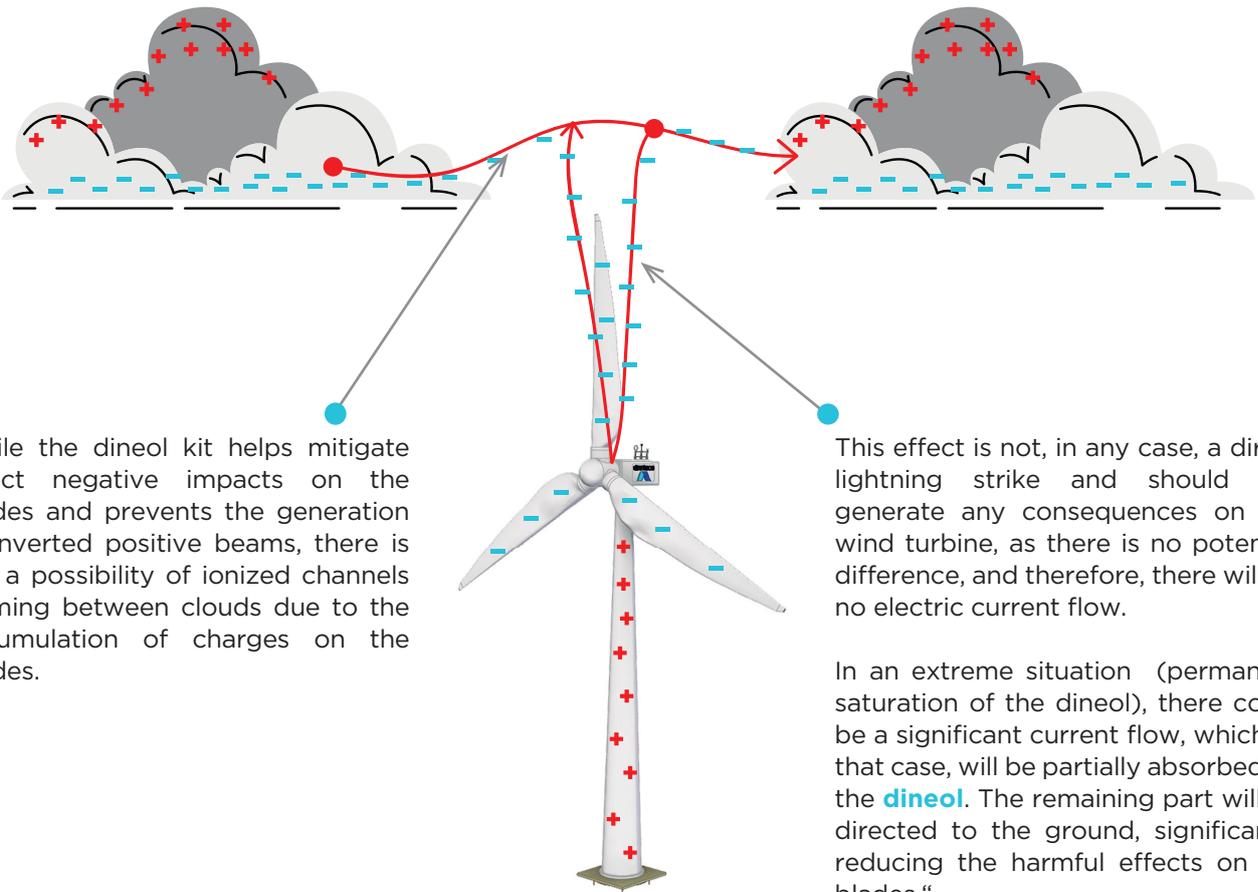
Lightning cannot directly strike the blades, because equal charges repel each other.

## DDCE FUNCTIONING IN STORM PHASE (nacelle)

As it constantly leaks charge to earth, the structure does not generate an upward tracer.



## Critical situations with DINEOL KIT: Blades inside the clouds



While the dineol kit helps mitigate direct negative impacts on the blades and prevents the generation of inverted positive beams, there is still a possibility of ionized channels forming between clouds due to the accumulation of charges on the blades.

This effect is not, in any case, a direct lightning strike and should not generate any consequences on the wind turbine, as there is no potential difference, and therefore, there will be no electric current flow.

In an extreme situation (permanent saturation of the dineol), there could be a significant current flow, which, in that case, will be partially absorbed by the **dineol**. The remaining part will be directed to the ground, significantly reducing the harmful effects on the blades."

## KIT DINEOL EFFECTS

### LIGHTNING ROD

A charge arrangement model significantly reduces the possibility of upward tracer generation by the blades.

Continuous compensation of the generated electric field decreases the probability of field saturation.

Prevents negative and reverse positive lightning strikes generated by the blades.

Ionized channels may form from intercloud lightning strikes when their main path passes very close to the tip of a blade, although this is unlikely and occurs in very critical situations.

### ELECTROSTATIC DISCHARGES

Significantly reduces electric charges present in the blade-collector assembly.

Generates continuous compensation of the electric field, primarily in the dineol desaturation zone rather than the blades.

## TELEMONITORED TURBINES

In 2019, two turbines with a history of continuous breakdowns due to lightning were protected.

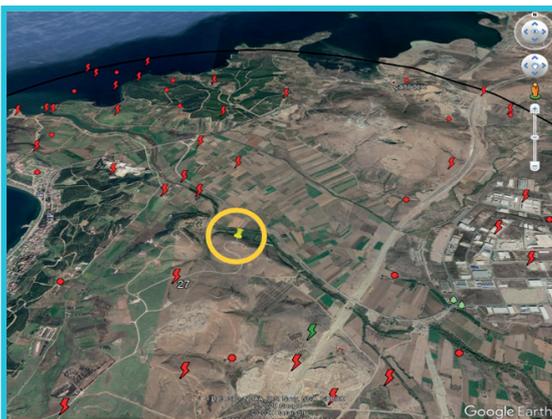
The data comes from two sources: Météorage and measurements in the actual turbine using the LMS system.

Until February 2022, data provided by Météorage as well as measurements from LMS and the client's own data endorse the effectiveness of the system.

### PERCENTAGE OF LIGHTNING STRIKES in a 5 km radius of **PROTECTED TURBINES** September 2019 - February 2022

STRIKES AROUND TURBINES	% STRIKES TURBINE A	% STRIKES TURBINE B
Direct strikes	0%	0%
Strikes 100 m away	0%	0%
Strikes 100-300 m away	0.21%	0.6%
Strikes 300-500 m away	0.21%	3.01%
Strikes 500-900 m away	3.42%	7.23%
Strikes > 900m away	96.16%	89.16%

CONCEPT	TURBINE A	TURBINE B
Number of strikes in a 5 km radius	468	332
Stormy days	16	27
Types of lightning strikes	+ 22	+ 9
	- 252	- 232
	Intracloud 194	Intracloud 91
Maximum current	- 192 kA	- 251 kA
Maximum current	+ 181 kA	+ 167 kA
Closest strike	- 11 kA 200 m	- 33 kA 212 m
Medium intensity	- 18.51 kA	- 25.2 kA
Medium intensity	+ 43.4 kA	+ 100 kA



Wind Turbine No. 16 has historically received the highest number of lightning strikes (compared with turbines No. 17, 18, 19, and 20 in the same area), so it was chosen for the POC. During the storm on 24th, 2022, turbine 16 was the only one NOT struck by lightning.

# STUDIES in electrostatic & radiofrequency fields

## MIJAS TOWER

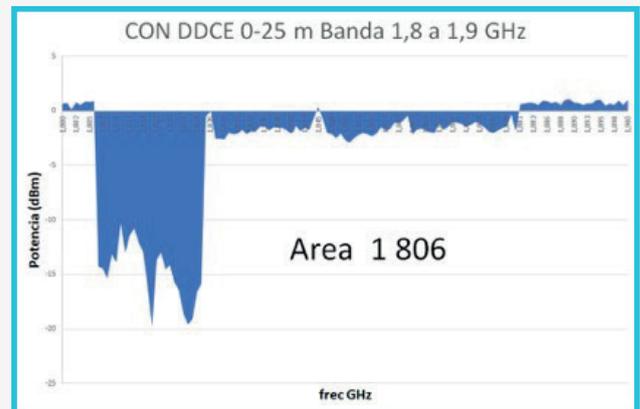
- **Measurement dates:** Nov 2020-Nov 2021
- **Place:** Mijas, Spain
- **Object:** Measurement of charge and potential With and Without **dineol**
- **Design of protection:** One **DDCE** 100 Plus, three **dineol**

Measurement in good weather with a light wind. **Sum of areas with positive potential**

WITHOUT Dinnteco



WITH Dinnteco



Measures demonstrate that there is a Reduction of electrostatic charge and radio-frequency impact

## REFERENCES

### GAMESA G90 WIND TURBINES



#### CASE:

Following the detection of a serious problem of breakdowns due to atmospheric discharges, Enel hired Météorage to carry out a study. At the same time, ENEL commissioned Dinnteco to protect six wind turbines in Spain.

#### ACTION:

The integration of the **dineol** system was jointly studied. The installation carried out with no problems.

#### CONCLUSIONS:

Due to the results , ENEL has decided to homologate and continue with the implementation of Dinnteco System on 2024.



# INSTALLED REFERENCES

customer	location	n° wind turbines	study period	comments
<b>ENEL Green Power</b>	Spain	6	27 months	<ul style="list-style-type: none"> <li>• no direct lightning strikes</li> <li>• no incidence on the bearings between the blades and the hub</li> </ul>
<b>Molinos del Ebro</b>	Spain	2	21 months	<ul style="list-style-type: none"> <li>• no direct lightning strikes</li> <li>• no incidence on the bearings between the blades and the hub</li> </ul>
<b>Energy Eurus</b>	Japan	2	22 months	<ul style="list-style-type: none"> <li>• no direct lightning strikes</li> <li>• appearance of an ionized channel on a blade without any consequence on the blade (Radowsky coil has not detected anything. It is detected to be a lightning strike between clouds)</li> <li>• no impact on the bearings between the blades and the hub</li> <li>• 2 records have been detected in Radowsky coil without any incidence (arcs coming from zone 3)</li> </ul>
<b>confidential</b>	Europe	2	20 months	<ul style="list-style-type: none"> <li>• no direct lightning strikes</li> <li>• no impact on the bearings between the blades and the hub</li> <li>• LMS coil recording on a day without thunderstorm (electrostatic discharge absorbed by dineol). discharge absorbed by dineol</li> </ul>
<b>Innergex</b>	USA	6	0 months	<ul style="list-style-type: none"> <li>• April 24 : 6 Wind turbines protected with DINEOL KIT</li> <li>• POC: comparison of the 6 Turbines protected Vr 6 turbines without protection</li> <li>• Measurement system: LMS Phoenix Contact</li> </ul>



[sales@dinntecospain.com](mailto:sales@dinntecospain.com)  
(+34) 932.389.080  
[dinntecospain.com](http://dinntecospain.com)