

# Diagnosis and performance improvement of wind generation plants



CIRCE provides a diagnosis service oriented to the wind generation performance improvement, which allows to know in detail the operation of assets. improving up to 3% the global performance of the plant.

A diagnosis of the situation of a windfarm allows to know the plant performance at any moment, optimizing the response time before performance lost and the time between malfunctions. It also increases the overall performance efficiency, without using additional equipment.

Through this diagnosis it is possible to adapt policies of maintenance to the actual behaviour of the machine in each location, thus establishing new operating strategies that increase the durability of the components and allowing to extend the useful lifetime of the facility.

In addition to the overall improvement of the efficiency performance of the windfarm, it also helps to make accurate economic estimations, for both rating refinancing and new investments.

## Diagnostic service

CIRCE makes detailed diagnostic studies to achieve improvements in the performance of assets:

- ✓ Performance analysis of each wind turbine. Efficiency and performance KPI's analysis.
- ✓ Historical behaviour Reference of each turbine.
- ✓ Comparative analysis in terms of time, space and references of each machine.
- ✓ Site evaluation of the suitability of the wind turbine model.
- ✓ Analysis of alarms and malfunctions. Evaluation of losses due to wind turbine stops.
- ✓ Comparative with historical failure matrixes. Analysis of root cause of faults in each turbine.
- ✓ Aggregate studies by facility, by technologies, etc.
- ✓ Asset health ratio; estimation of hours performing out of design conditions, number of starts, etc.

### KEY FIGURES



**450 Plants** analysed each month

+50 audits of windfarms

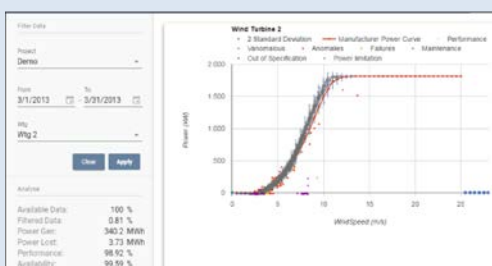


**15 years** experience  
15 experts

+40 countries

### Own visualization tools

CIRCE offers a tool that enables to see and check remotely all the results of the plant.



### Methodology integration with other tools

CIRCE also integrates the methodology developing performance ad-hoc in third parties tools.

- ✓ IDBOX
- ✓ Power BI de Microsoft

- ✓ Quick added value information.
- ✓ Weekly, biweekly monthly access.



## Benefits

### General Benefits:

- 1 Early detection of failures and inefficiency, improving up to 3% the global efficiency of the plant.
- 2 Support to maintenance, proposing improvements and adequate prevents.
- 3 Information to make accurate economic estimation, necessary for refinancing, or making new investments in the plant.
- 4 Improvement of reliability models of the components of the assets, adjusting in a better way the budget forecasts to carry out maintenance or modifications.

## Application for PV plants

- Application of knowledge and tools developed for windfarms.
- Experience in solar plants from 1 MW up to 50MW.
- Performance tracking of the plant. Energy, operation and maintenance indicators.
- Predictive maintenance algorithms development.

### Tools

- ✓ Developed software: WindSEPE, WebSEPE y WindAsT (analysis of parameters IEC 61400-1)
- ✓ Commercial software: WAsP, Windfarmer, Windsim, Meteodym, WindPRO, Windographer...
- ✓ Data base management: PostgreSQL, MySQL, etc.

## Work references

CIRCE has the satisfaction of more than 10 international customers that have improved the power performance efficiency of their generation assets thanks to this technological service in more than 40 countries. Some of them are:



## Other studies

### WIND RESOURCE ASSESMENT

- Wind resource parameters: Turbulence intensity, direction changes vs high (wind veer), end values, in-flow angle, vertical profile, production estimation, uncertainty, production studies: real vs estimated, etc.

### FIELD TESTS

- Power performance curve on wind turbines according to IEC 61400-12-1:2005, IEC 61400-12-1:2017, e IEC 61400-12-2:2013 under ENAC y MEASNET accreditations.
- Acoustic noise measurement and duration test according to IEC 61400-2:2013 and IEC 61400-11:2011

### R&D

- Reliability models of wind turbines based on real operating conditions.
- Predictive maintenance algorithms.
- Optimal management O&M according to weather conditions, electric market.

### Who is it for?

- To owners of renewable generation facilities that would like to take an active part in the operation of their plants.
- To maintenance companies that want to expand their service with studies and analysis.
- To any operator interested in knowing the status of their assets.

In addition, CIRCE coordinates R&D projects in this field that allow improving the service provided.

- **AWESOME** – (H2020 program – research excellence program). The project pursues the development of the knowledge on the Operation and Maintenance field (O&M), thus allowing to maximize revenues and optimize maintenance.

## CONTACT

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