

Wind power Energy Activities

What cener is?

■ **The Spain's National Renewable Energy Centre (CENER)** is a national technological centre dedicated to the research, development and promotion of renewable energies in Spain.

It is a modern Centre of Research and Technology, adapted to the needs of businesses, public organisms and institutions, specialized in research and its direct applications, Research and Development and Innovation (R&D&I), which provides a high added value to its clients.

■ **It operates in five main areas:** wind power, solar energy, biomass, bioclimatic architecture and power electronics/hydrogen power. It is equipped with modern facilities for all of these areas, making CENER a point of reference for all of Europe.

CENER participates in key lines of R&D, offers services in cutting-edge technology, provides training and is a member of Standardization Committees.

Wind Energy Department

The main aim of the Wind Energy Department of CENER is to perform applied research activities and services within the field of wind energy, providing services to all the stakeholders in the sector: developers, manufacturers, certifying bodies and financial entities, users, associations and public administrations.



Wind Energy Activities

- a) Wind Turbine Analysis and Design (ADA)
- b) Wind Resource Assessment and Forecasting (EPR)
- c) Wind Turbine Test Laboratory (LEA)

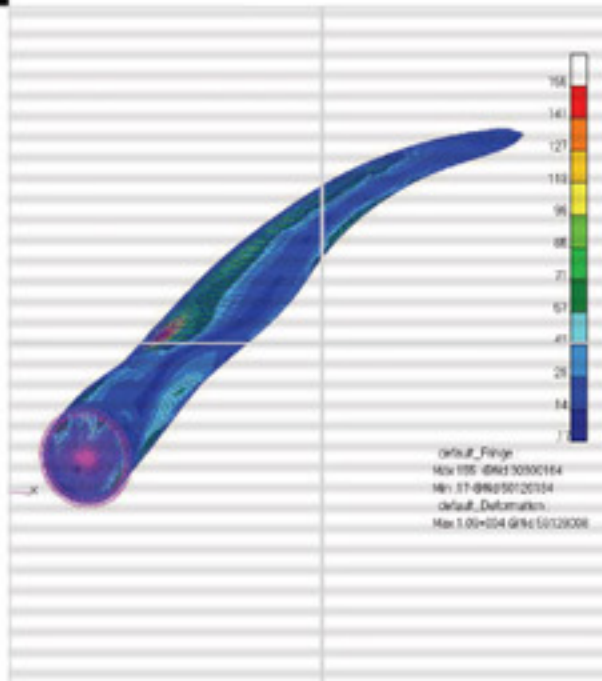
CENER participates in both national and international associations as well as in groups of experts, such as the European Academy of Wind Energy (EAWE) and MEASNET, holding the vice-presidency of this latter association. Furthermore, it contributes actively in the standardisation activities of the IEC (TC 88) as well as in some of the IEA groups (annex XX and XXIII).



a) Wind Turbine Analysis and Design (ADA)

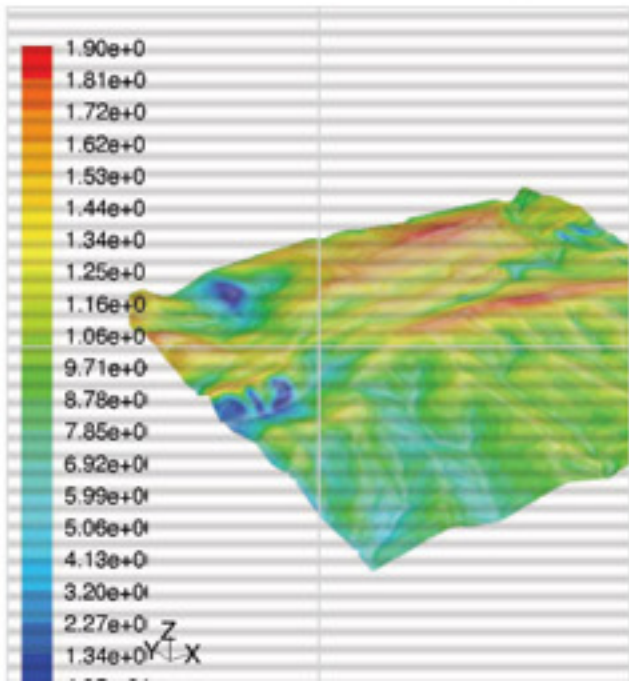
Mainly focused on technologies and services related to wind turbines, from the viewpoint of design, certification and follow-up during operation phase.

- Certification of wind turbines (in agreement with DNV for certification according to IEC standard WT01)
- Development of wind turbine design tools and methodology
- Design of wind turbines and components
- Design of controllers for wind turbines
- Development and optimisation of manufacturing processes for wind turbine components made of composite materials



In that respect CENER employs qualified staff and disposes of specialised software in the following technical areas:

- Aerodynamics and aeroelasticity
- Structural Mechanics
- Control and dynamic systems
- Materials and manufacturing processes



b) Wind Resource Assessment and Forecasting (EPR)

• Assessment:

Estimation of the energy potential of a location with the purpose of estimating the long-term planned production, including measurements, data processing, simulation, analysis, optimisation, uncertainty analysis and class assessment. In order to achieve this, and in addition to the studies using traditional WASP methodology, CENER has developed its own methodology based on CFD and advanced measurement equipment, such as LIDAR, to improve the quality and precision of the results in complex terrain. Furthermore, CENER disposes of methodology and experience to elaborate regional wind resource maps.

• Energy Production Forecasting:

CENER is capable of forecasting precisely the production of wind farms on a short - term range required for the management of electrical transmission and distribution systems. To achieve this, CENER owns proprietary methodology and software, whose development is constantly ongoing. A large number of wind farms on the Spanish market are using CENER real time power predictions to minimize their and the system's power deviation costs as stated by the Spanish transmission system operator. On top of it CENER participates regularly in public financed R&D forecasting projects (ANEMOS, UPWIND, POWWOW).

c) Wind Turbine Test Laboratory (Sangüesa)

CENER is currently executing several test infrastructures with cutting-edge technology, which will become an international reference. These infrastructures include:

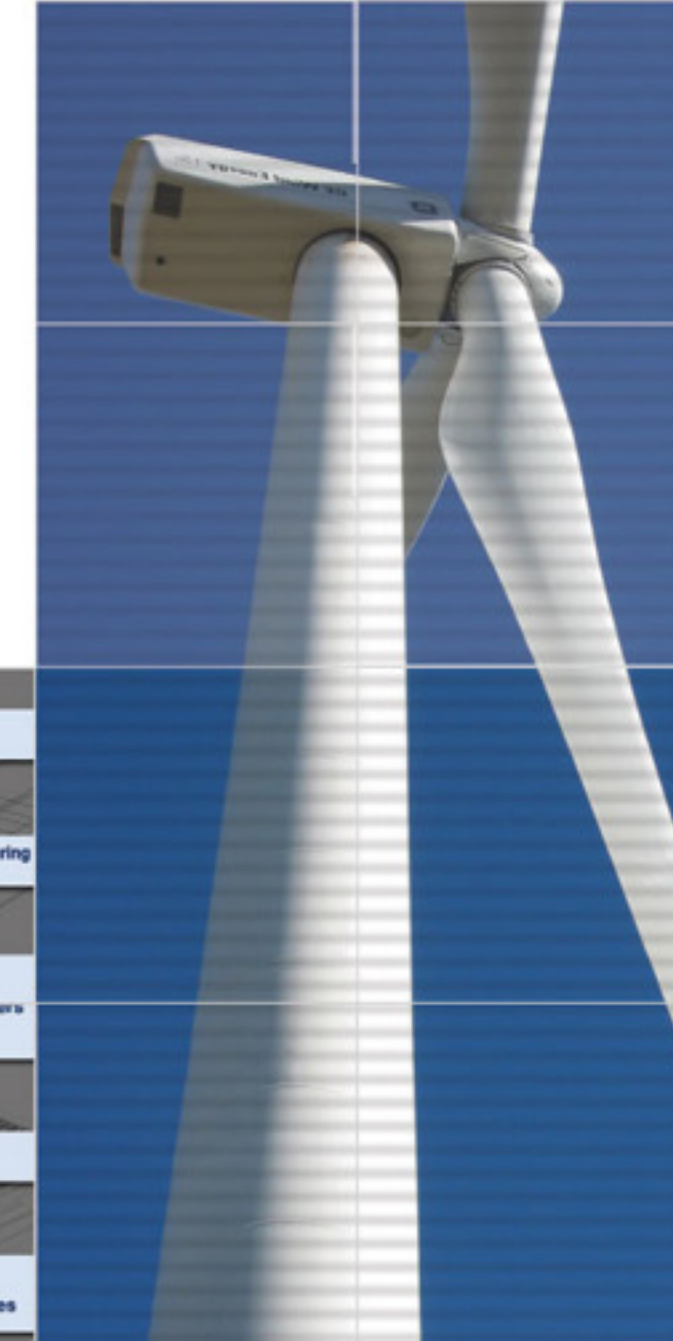
- **Blade Test Laboratory.** In order to perform tests in agreement with Standard 61400-23 (Full-scale structural testing of rotor blades). It will have two test positions for blades up to 75 m long.
- **Powertrain test bench.** To perform mechanical tests on the powertrain of wind turbines up to 5 MW.
- **Electrical test bench.** To perform tests on generators and power electronics equipment.
- **Nacelle test bench.** To perform functional tests on the complete nacelle, tests on tooling and to train personnel for assembly and maintenance processes.
- **Wind tunnel.** For characterisation of aerodynamic airfoil performance.
- **Manufacturing laboratory.** To optimise manufacturing processes with composite materials, characterise process control variables, etc.
- **Experimental wind farm.** To perform field tests on prototypes and for certification of wind turbines. It will have 5 calibrated positions up to 5 MW each one.



The following activities are currently carried out:

- Power curve tests
- Noise tests
- Energy quality tests
- Mechanical resistance tests

Tests are accredited by ENAC (file number 355 LE/803) and performed according to IEC Standards as well as to MEASNET guidelines. All field tests, except for mechanical loads test, are accredited MEASNET.



ENERGÍA EÓLICA