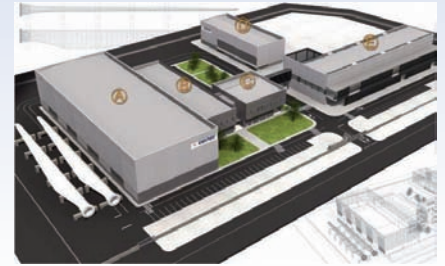


The **National Renewable Energy Centre of Spain -CENER-** is a technology centre specialized in applied research and development as well as the promotion of renewable energies. CENER is divided into six departments: Wind Energy, Photovoltaic Solar Energy, Solar Thermal Energy, Biomass Energy, Bioclimatic Architecture and Renewable Energy Grid Integration.

More info: www.cener.com

The **Wind Turbine Test Laboratory** is an infrastructure required to perform test on wind turbines, encompassing the analysis of individual components to complete wind turbines, in accordance with international standards. These new facilities with a total surface area of 30.000 m² includes the following areas: Blade Test Lab, Power train test Lab and electrical testing, Composite materials and process Lab, Wind turbine field testing, Experimental wind farm & Aerodynamic Wind Tunnel.



BLADE TEST LABORATORY



CENER offers the Wind Energy Sector the possibility to perform tests of WIND TURBINE BLADES.

This laboratory performs structural tests on the blades in accordance to IEC TS-61.400-23 Standard: Characterization of physical properties, Static and Fatigue Tests.

GENERAL INFORMATION:

- **Two Test Bench:**
 - 1 Static & Fatigue Tests: max bending moment 100,000 kNm (Static Tests)
 - 1 Fatigue Tests: max bending moment 50,000 kNm
- Test Hall dimensions: 85m (L) 32m (W) 15m (H)
- Two overhead cranes (2 x 32 Tons). One crane with a trolley and the second crane with two trolleys.
- Root diameter: 4,6 meters.
- **Effective blade length of up to 75 meters.**
- **Static tests on sections of blade with a nominal length of 100 meters.**

CENER BLADE TEST LABORATORY

is accredited to carry out the following tests:

- Determination of natural frequencies
- Modal Analysis
- Static Tests
- Fatigue Tests
- Post-Fatigue Tests
- Collapse Tests



CENER has tested many blades for some of the largest blade manufacturers.

(www.enac.es)

CENER is accredited by ENAC-Spanish National Accreditation Body. UNE-EN ISO/IEC 17025. Exp n°bc: 355/LE803.

STATIC BLADE TESTS



Static blade tests are performed in order to determine the structural properties of a blade including stiffness data and strain distribution. Strain gauges are applied to the internal and external blade structure in correspondence to the client Test Plan.

Flapwise & Edgewise Tests:

- Determination of basic properties: mass, centre of gravity and moments of inertia.
- Determination of stiffness on bending and torsion.
- Ultimate load resistance.

Blade component testing: Box girders, Bolted joints, ...

Maximum tip deflection: 20m

EQUIPMENT:

- 8 Electric Winches:
400 KN x 1
300 KN x 2
200 KN x 2
150 kn x 3
- HPU Hydraulic System
400l/min
210 bar
- Instrumentation



DYNAMIC BLADE TEST



Fatigue blade tests are performed in order to determine the fatigue properties of a blade.

Fatigue Tests:

- Modal analysis
- Endurance test with fatigue loads

Vertical test direction

Resonant mass system

Lower energy requirement

EQUIPMENT:

Two Actuators: 100KN (600-3,000Kg) and 30 KN (218-718Kg).

Both actuators have 3 adjustable parameters to obtain the necessary load level: mass, strokentang, ...

Maximum tip deflection: 26m (tip-to-tip or range).

The reported data enables certifying bodies to compare measured data to the calculated data of the design criteria.



CENER provides these services under strict client confidentiality conditions.