

# **GRID SIMULATOR TESTING OF WTG**

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# índice

- 1. LEA Wind Turbine Test Laboratory
- BEG Electrical Generator Test Bench
- 3. 5 MW in a Grid Simulator Experience









# Wind Turbine Test Facility











#### Overview

## **LEA – WTG Test Laboratory**

- Complements the research work of CENER in wind energy Dedicated to Tests of components, subsystems & full systems
- Activities
  - Blade tests
  - Experimental Windfarm
  - Power Train tests and Electrical Testing









### **BLADE TEST PLANT**

# 1. LEA – WTG Test Laboratory











# **BLADE TEST PLANT Capabilities**

# 1. LEA – WTG Test Laboratory

Perform structural tests on WTG blades							
☐ IEC TS-61400-23 standard / GL Guidelines							
□ Static/Fatigue							
☐ Up to 75 m blade full length							
Sections of up to 100m blades							
Static Tests							
Mass, COG, moments of inertia							
□ Stiffness bending/torsion							
Ultimate strength							
Fatigue Tests							
Modal analysis							
☐ Endurance/fatigue							
☐ Biaxial + Multipoint (UREX, GREX)							









### **EXPERIMENTAL WINDPARK**

## 2. CENER LEA – WTG TEST LABORATORY











#### EXPERIMENTAL WINDPARK

#### 2. CENER LEA – WTG TEST LABORATORY

- 6 calibrated positions
  - WTG prototypes for up to 30 MW evacuation capacity
  - Field tests on complex terrain (Wind Classes IA, IIA)
  - Fully CFD Characterised
- Wind Park features
  - 120 m high Met Masts instrumented at 5 different heights & Lidar
  - Field Offices & Redundant communications
  - Substation 20KV/66KV
- Technical Services
  - IEC Certification tests (Power Curve, Noise, PQ, Mechanical Loads)
  - Verification of response to voltage dips (LVRT)
  - Others (design, optimization, validation, etc.)
- Energy Production Income RD661/2007



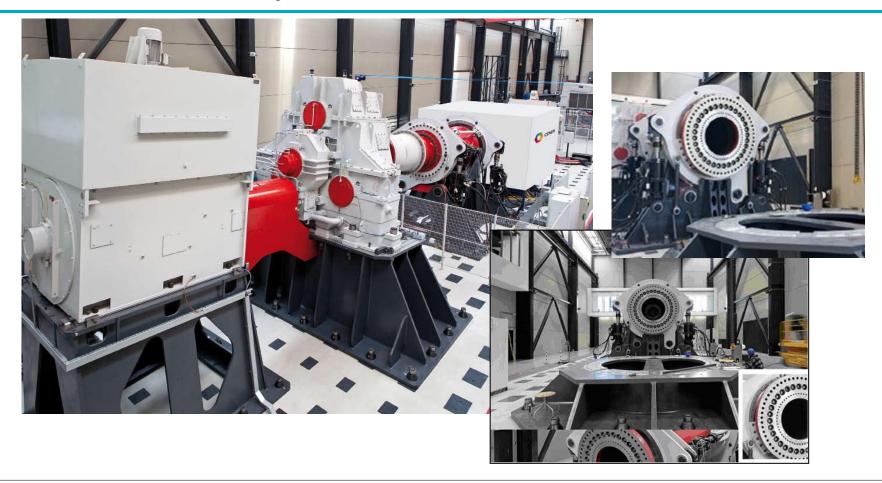






### **POWER TRAIN Facilities**

# 3. LEA – WTG Test Laboratory





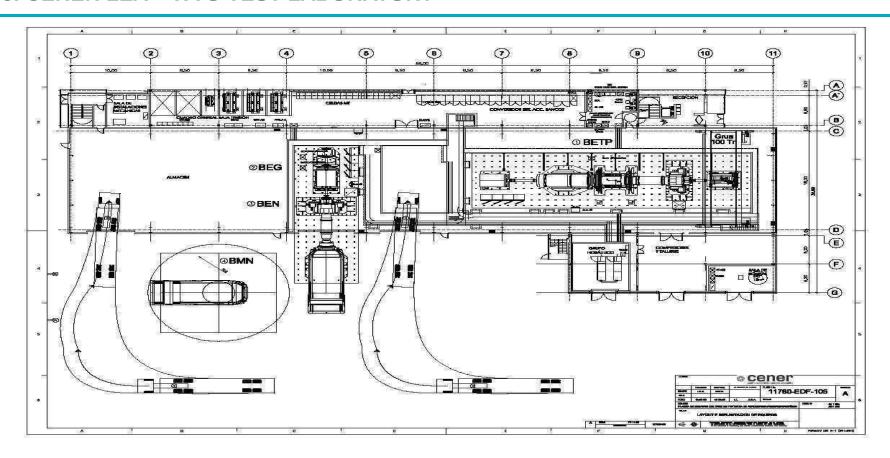






## **TEST BENCHES Configuration**

#### 3. CENER LEA – WTG TEST LABORATORY





CENTRO NACIONAL DE ENERGÍAS RENOVABLES







### TEST BENCHES Capabilities

### 3. LEA – WTG Test Laboratory

#### S Power Train test bench

- ☐ Test of WTG power train up to 8MW
- ☐ Functional tests on mechanical parts
- ☐ Functional/load test of brake/coupling at high speed shaft HSS
- □ Concentrated life test and HALT
  - bearings in the main shaft (LSS)
  - gears and bearings in the gearbox

#### Generator test bench

- > Functional test of generator and power electronics
- Electrical transient simulation (voltage dips)
- > Functional tests, vibration, acoustic noise, heating, etc.
- Overspeed tests and transients surges









### TEST BENCHES Capabilities

### 3. LEA – WTG Test Laboratory

### Nacelle test bench

functional,	, emergency	stop,	overs	beed, (	climatic	conditions,	etc.

- □ electrical transient simulation "Voltage dips"
- ☐ EMC and acoustic test
- ☐ Reactive power measurements

## Nacelle assembly bench

- WTG erection and nacelle setup procedures
- Use of auxiliary assembly cranes
- Simulation of maintenance exercises, including major corrections
- Staff training in the assembly and maintenance of WTG
- Training in evacuation and security operations in WTG











BEG

Electrical Generator Test Bench Overview











#### **BEG**

#### 2. Electrical Generator Test Bench

## Adavantages

- ☐ Not depending on Wind conditions: maximum productivity
- □ Development laboratory conditions: measurement devices, communication, working conditions, etc.
- ☐ Easily different working points reproducibility

### Disadvantages

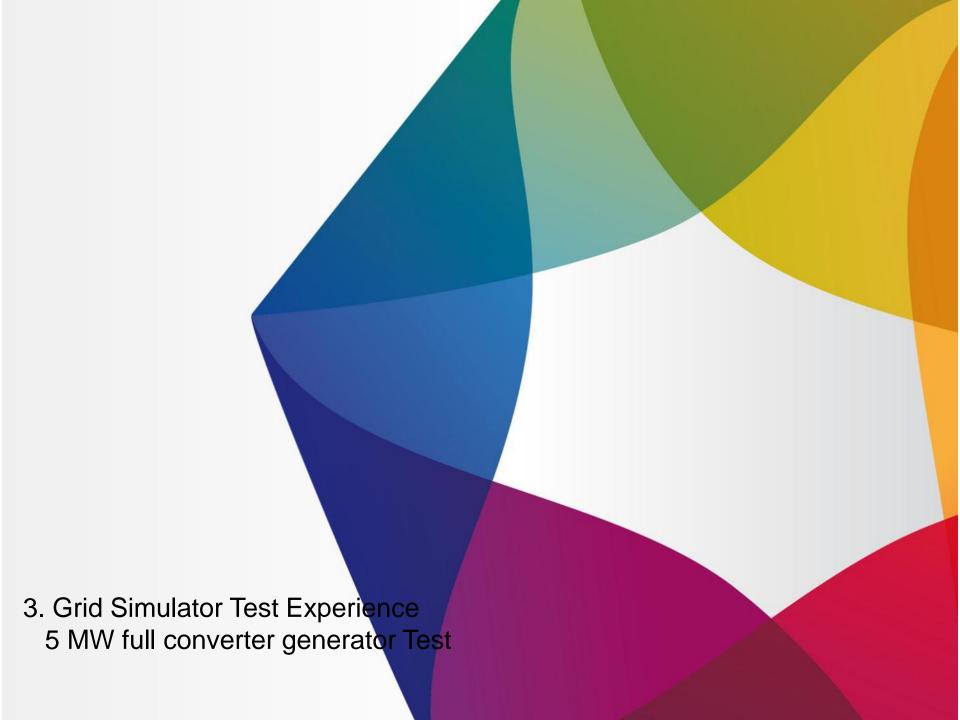
- High frequency wind and mechanical forces not considered
- On the field certification still required











## Grid Simulator Test Experience

# 3. Hardware involved equipments





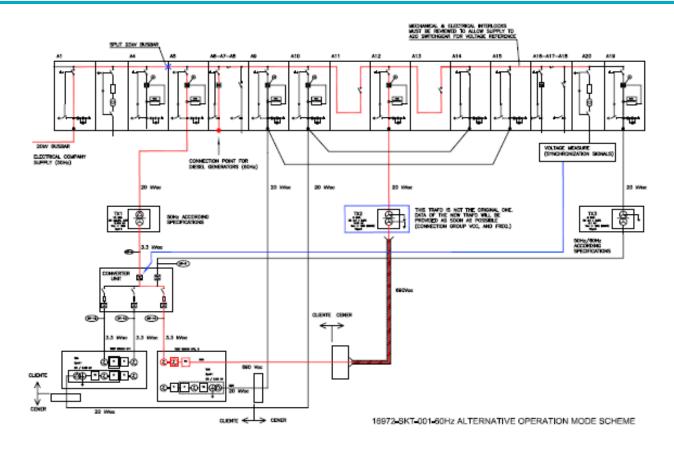






## **Grid Simulator Test Experience**

## 3. Electrical Configuration











## Grid Simulator Test Experience

### 2. Conclussions

Proposal for Discussion

☐ Laboratory Tests accepted for certification

☐ Bidirectional influence in Grid Simulator Tests









