GRID SIMULATOR TESTING OF WTG

Carlos Garcia de Cortazar

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1. LEA – Wind Turbine Test Laboratory
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3. 5 MW in a Grid Simulator Experience
1. CENER LEA
WTG Test Laboratory
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

- 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.)

POWER TRAIN Facilities

3. LEA – WTG Test Laboratory
TEST BENCHES Configuration

3. CENER LEA – WTG TEST LABORATORY
3. LEA – WTG Test Laboratory

**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, overspeed, 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
2. BEG
Electrical Generator Test Bench
BEG
Electrical Generator Test Bench Overview
Advantages

- 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
3. Grid Simulator Test Experience
5 MW full converter generator Test
Grid Simulator Test Experience

3. Hardware involved equipments
Grid Simulator Test Experience

3. Electrical Configuration
Grid Simulator Test Experience

2. Conclusions

 Proposal for Discussion

- Laboratory Tests accepted for certification

- Bidirectional influence in Grid Simulator Tests