Multi-megawatt electrical drivetrain testing laboratory
Testing grid code compliance and performance

Wind turbine converters play a central role in the turbine's grid code compliance. In order to ensure the wind turbine will comply with the grid codes, the right sized converter needs to be selected. But selecting the right size wind turbine converter can be difficult because it's not always known where the turbine will ultimately be installed.

Grid codes are diverse and are still evolving to meet the regional needs of utilities and governments. Turbine manufactures can use the converter's software and hardware configuration to support the wind turbine's grid code compliance.

However, diversity and frequent changes in grid codes affect the ability of turbine manufactures to accurately estimate the needed converter sizing.

Improperly sized converters reduce the capability to fulfill grid code requirements, add direct costs and reduce drivetrain efficiency. In order to help prevent this and keep a competitive edge, turbine manufacturers can take advantage of laboratory simulation and testing when possible.

Not all laboratory testing is the same

In order to get a realistic idea of the electrical performance of wind turbine, it is necessary that the testing laboratory is capable of conducting full scale tests during development.

For wind turbines, the IEC standard 61400-21 2nd edition has been developed which defines realistic testing methodology for full power testing at multi-megawatt levels. Proper testing needs to follow this standard and use a full scale configuration (full scale transformer, voltage divider, generator and converter). This methodology gives customers a very good estimation of the real dynamic performance of the wind turbine equipped with the pre-tested wind turbine converter.

ABB's drivetrain testing laboratory

The drivetrain testing laboratory, located at ABB's factory in Helsinki, Finland, enables multi-megawatt testing of doubly-fed and full converter wind turbine concepts. The lab is built according to the IEC61400-21 (2nd edition) standard as well as other relevant standards. It is connected to the local power system operator's medium voltage distribution network. This ensures our customers have an ideal and realistic testing environment for multi-megawatt and full power drivetrain testing.

The drivetrain testing laboratory serves four primary functions:

- Electrical drivetrain dynamic performance requirement fulfillment evaluation (as related to grid codes)
- Electrical drivetrain optimization (modeling and converter dimensioning)
- Validation of simulation models against full power testing
- Electrical drivetrain technology development for ABB converters and generators

Cost advantages

Our laboratory testing results are used to select the converter to meet the turbine's requirements and relevant standards. In addition, we take advantage of our signature converter control technology, DTC, to configure the converter to help meet the requirements of the turbine. The main cost benefit when using pre-tested components for the wind turbine is the minimized need for unnecessary changes to the wind turbine design.

ABB's drivetrain testing laboratory capabilities

- Fault ride-through testing that includes:
  - Balanced and unbalanced faults
  - Short term single-phase and three-phase interruptions
  - Any combination of interruptions and faults with fast closing and re-closing operations
- Power quality tests
  - Harmonic distortion evaluation with different short circuit ratios at the point of connection
  - Continuous and temporary power supply unbalanced operation testing
- The direct connection to the distribution power system in connection with a serial reactor allows a wide short circuit power range at the point of connection. This is not limited by the nominal power of a grid emulator.
- Control of the prime mover speed and torque in order to emulate wind turbine behavior during change of wind speed.
- An optional large synchronous generator can be used to supply the testing configuration
  - Any frequency can be emulated to test the response of the drive system to grid-side frequency changes (eg, 50 or 60 Hz testing).
  - Clean power supply to evaluate injected harmonic distortion levels

Active participation for real results

ABB is active in several grid code working groups. We also use the drivetrain testing laboratory to test proposed grid codes and provide analysis and feedback to stakeholder groups that are focused on grid code harmonization within Europe, such as the EWEA working group on grid code harmonization, and it's representation to ENSTO-E European pilot code drafting committee. We interact with the standardization of wind turbine simulation models (IEC T88-27) and IEC standardization on harmonic requirements. Our testing lab is important because we can provide full scale results for input and development of these standards.

This involvement and expertise is used when we work with our customers throughout turbine development and converter selection.

For more information contact your local ABB representative or visit:

www.abb.com/windpower

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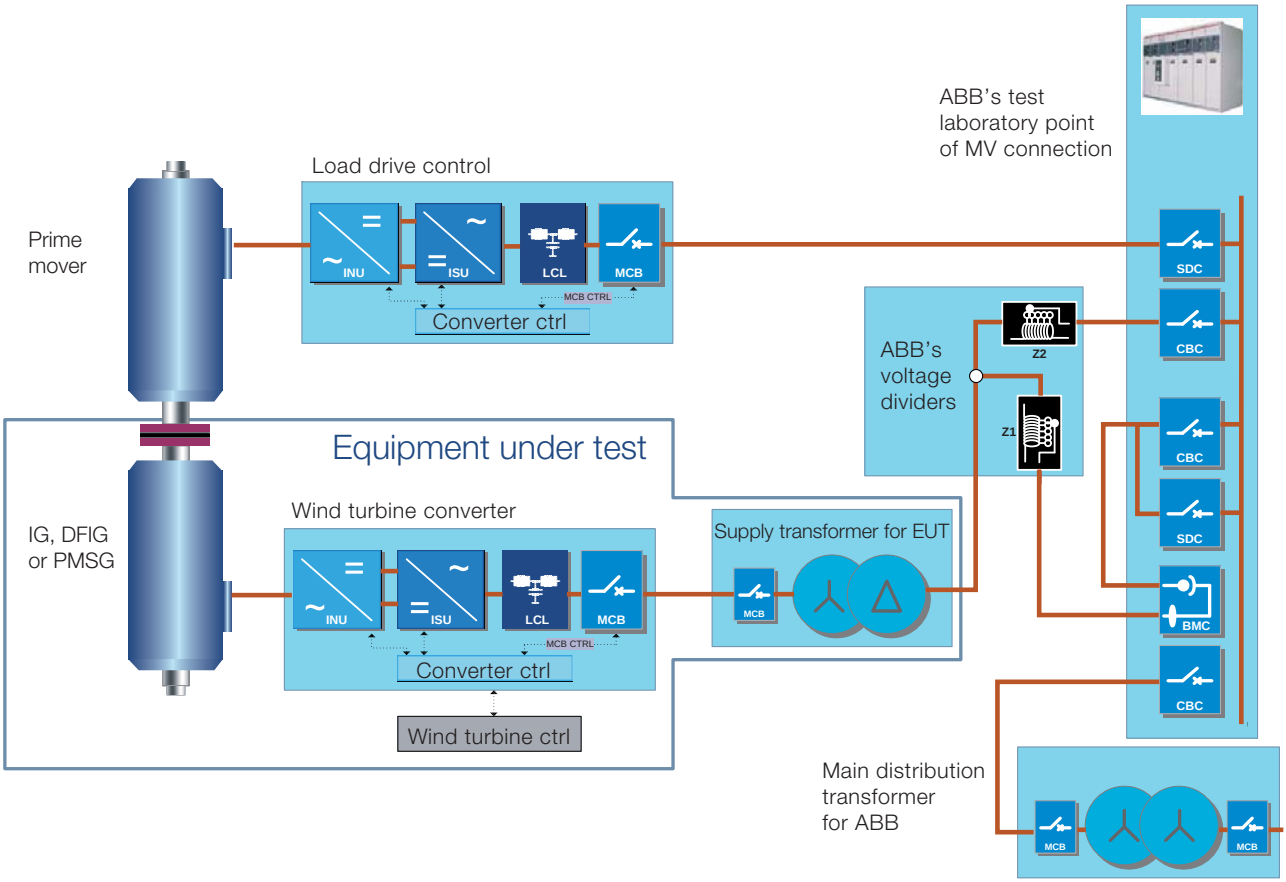

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