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## *Grid Code Proposals*

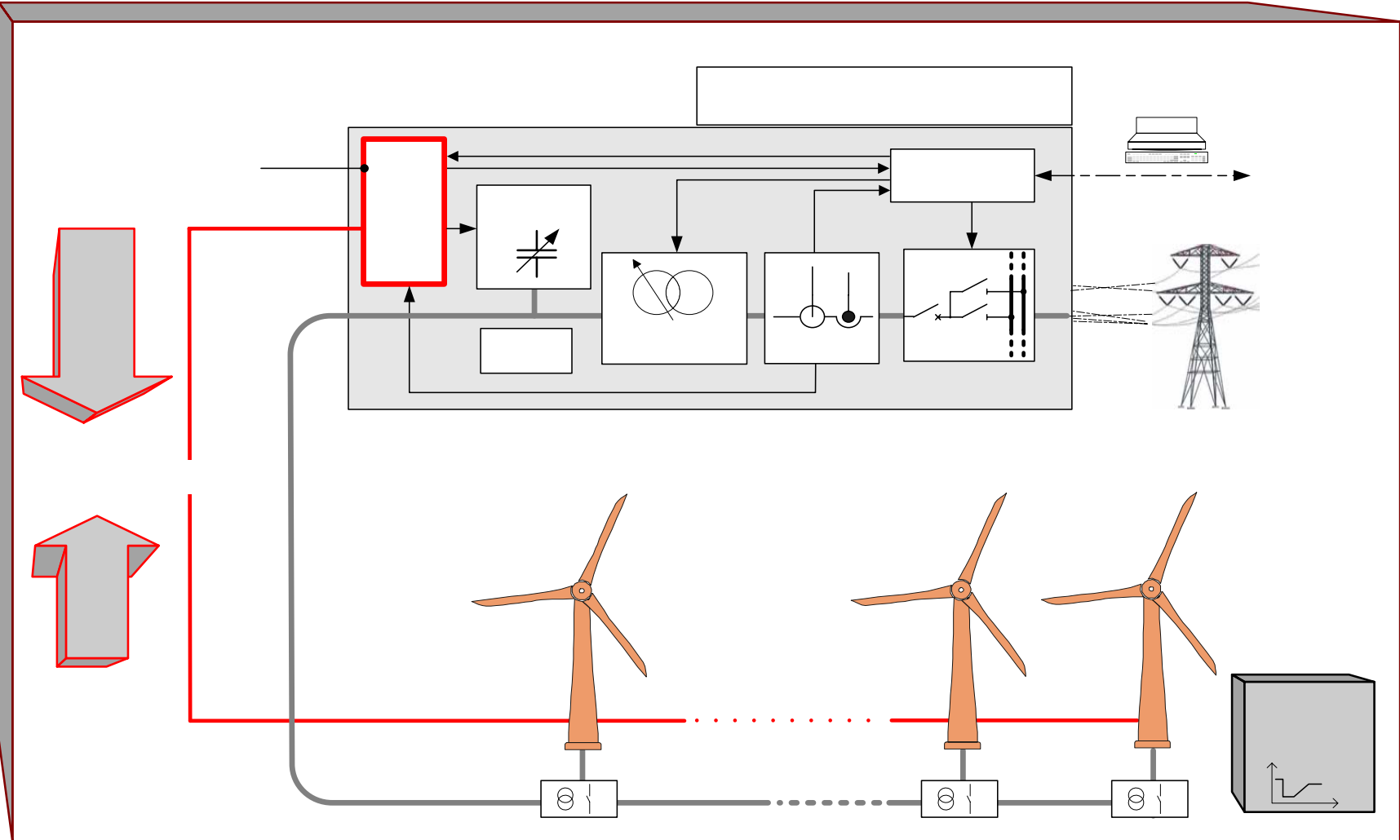
### Background

- **The Grid Code requirements present particular technical challenges for all WindTurbine manufacturers.**
- **DeWind has a programme in place to provide solutions where possible for the emerging Grid Codes in all markets.**
- **DeWind is part of the German FGW, Wind Energy Development Association, which has agreed Modelling methods for wind turbines.**
- **DeWind has been working with EON, VDN & Vattenfall Grid Code requirements in Germany.**
- **Harmonised UK Grid Codes?**

## *Enhanced Grid Codes - Technical Issues*

- **1: Wind Park Control System**
  - Co-ordinates operation of all wind turbines.
  - Adjusts total active & reactive power supply at the Point of Common Coupling (PCC)
  - Integration of wind park into Grid frequency, voltage regulation and protection requirements.
- **2: Wind Turbine Control System**
  - Master control for blade pitch & converter control.
  - Controls turbine speed and energy capture from the wind.
- **3: Generator / Converter System**
  - Independent adjustment of active & reactive power output of a single wind turbine according to wind speed and park control demands.
  - ride through capability: tolerance against grid faults where possible.
  - protection of power electronics and generator.

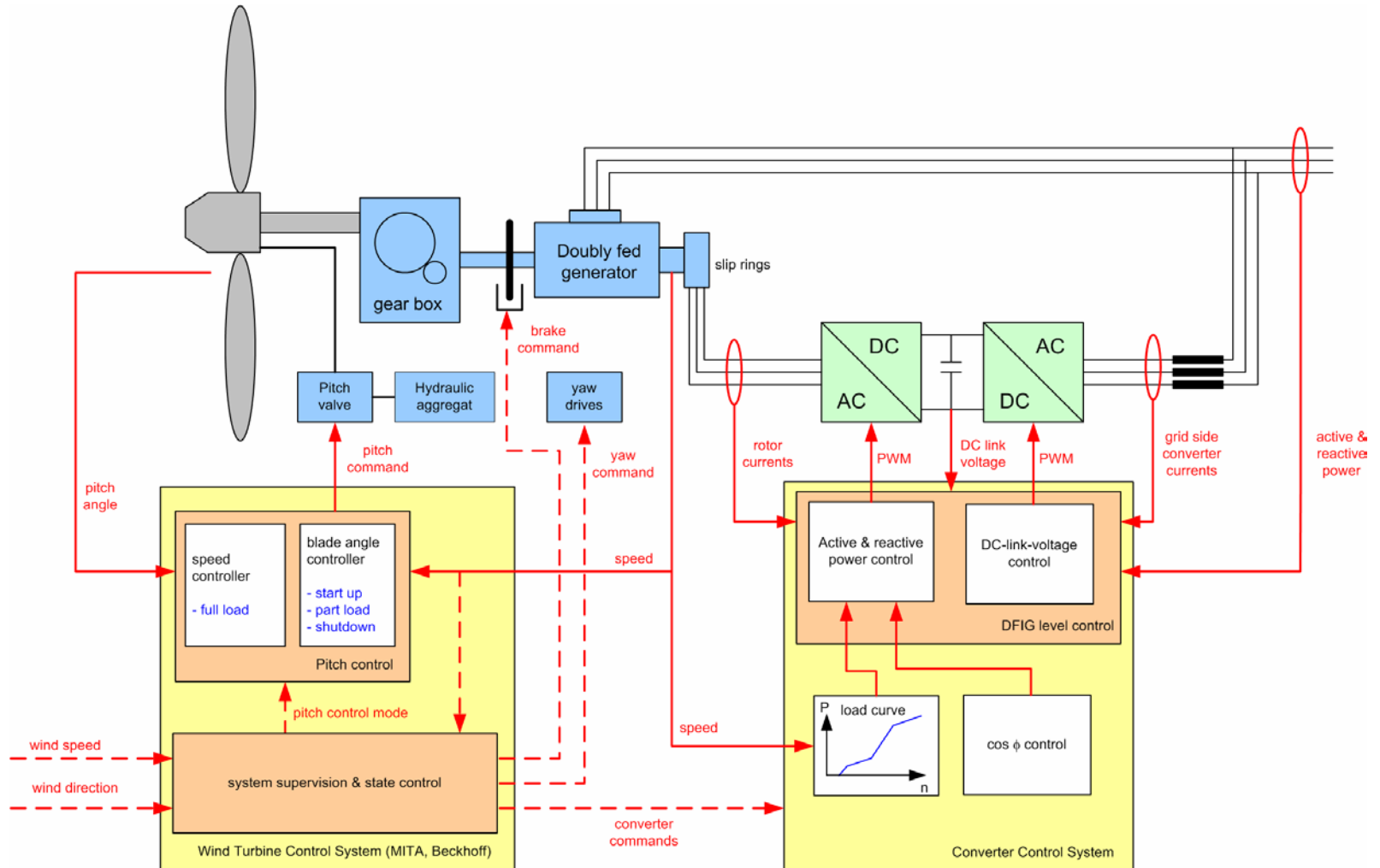
## Park Control System & Infrastructure



## Park Control System - functionality:

- **Provides voltage and power measurements at PCC .**
- **Interface to grid control system.**
- **Active contribution to grid stability.**
  - **Limited power gradient during wind park start-up.**
  - **Frequency control:**      **Reduction of active power at high frequencies.**  
**Short term increase of active power at low frequencies possible at full load (high wind speeds).**
  - **Voltage control:**      **Reactive power supply according to voltage level at PCC.**

# Wind Turbine & Converter Control



## **Turbine Control System functionality:**

- **Interface between park control and converter control.**
- **Limits energy capture from the wind to the maximum active power value defined by park control.**
- **Allows for continued turbine operation during grid faults.**
- **Keeps generator speed within the operational range at sudden load changes ( wind gusts, grid faults ...)**

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## *Converter System*

DeWind is using the Alstom ProWind Converter for our D8 2MW Turbine

- Increased tolerance against system voltage and frequency deviations,
- Increased tolerance against grid transient voltage dips,
- Supply of reactive power is possible during grid faults,
- Fast stator breaker trip & resynchronisation sequence possible to avoid reactive power consumption at voltage recovery (due to crowbar activation).





DeWind, as part of FKI Energy Technology has the resources to provide solutions for individual Wind Turbines and Wind Parks meeting the various Grid Code requirements.