FP7 ClusterDesign
Cluster Controller RWEI

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Agenda

1. **Aims of Wind Cluster Control**
2. **RWEI's Role in Cluster Design**
3. **Wind Cluster Control Concept**
4. **Wind Cluster Controller Overview**
5. **Wind Cluster Controller Insight**
6. **Questions and Discussion**

- Lower the cost/MW of offshore wind generated power by:

  - Increasing the power output of a given wind cluster.
    - Results in an increase in revenue from the sale of electricity.

  - Reducing the WTG loads per MW power generated.
    - Results in:
      - possible life extension and additional revenue
      - leaner structural and drive train design at lower cost
      - lower maintenance requirements

Aims of Wind Cluster Control II

- Enable the cost effective provision of auxiliary grid support services:

    - optimal generation of reactive power in wind farm to:
        - compensate for reactive power sources and sinks in the offshore network, thereby reducing losses.
        - meet grid power factor demand at PCC.

    - Active power delivery options for frequency control including:
        - Active power curtailment for overfrequency
        - Holding a constant active power reserve for underfrequency
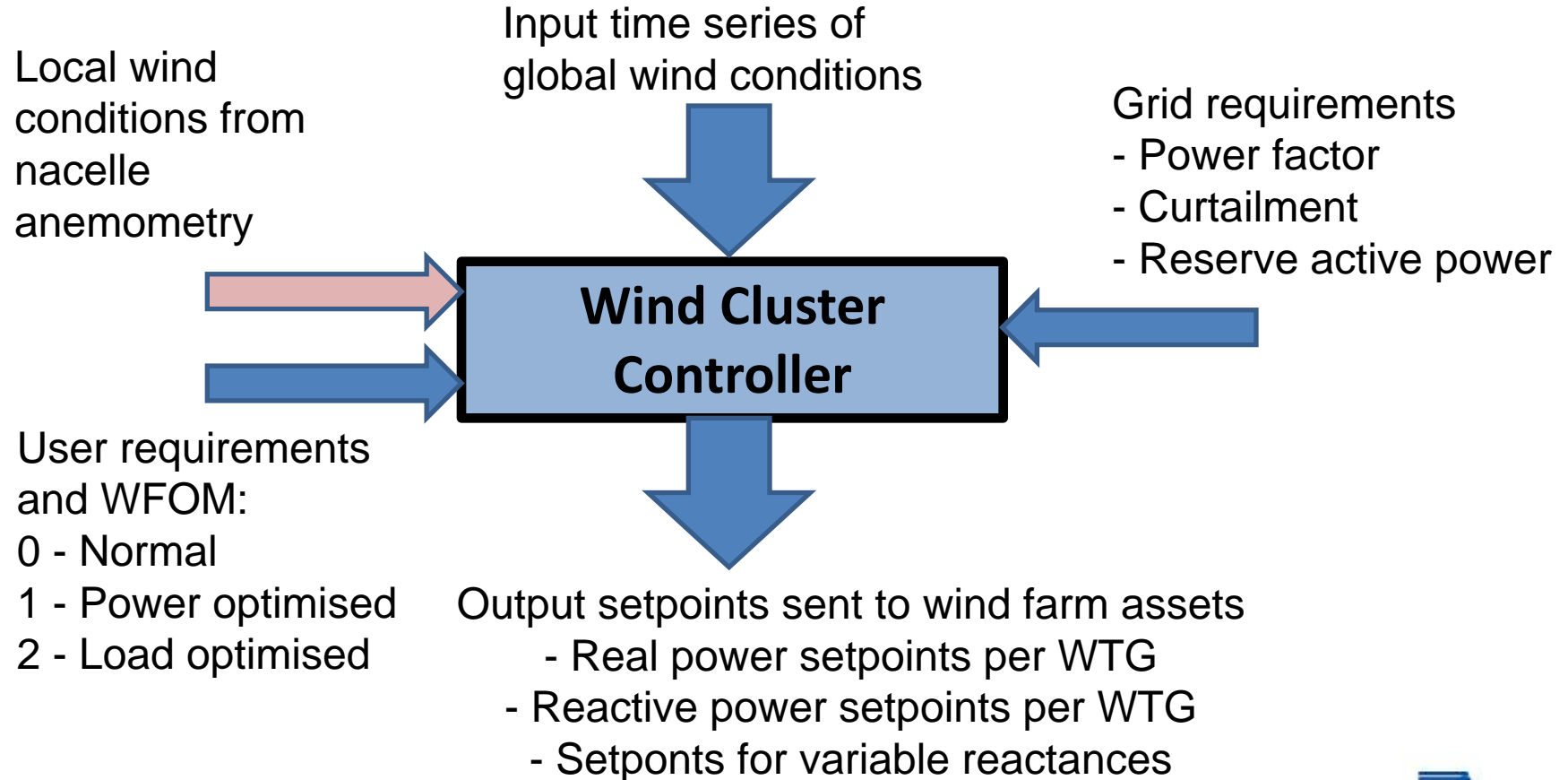
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RWEI's Role in ClusterDesign

- WP4 Cluster Control Modelling (RWEI Lead Partner)
- RWEI is responsible for:
  - Specifying the requirements for a Wind Cluster Control System
  - Designing and programming the Wind Cluster Controller
  - Defining and running verification scenarios with ECN

- WP8 Cluster Control Testing (RWEI Lead Partner)
- RWEI is responsible for:
  - Preparing the test strategy and test plan
  - Consenting and approvals for the field testing
  - Executing the field tests

- Participation in other work packages.

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Wind Cluster Control Concept

- WTGs & Power Management Unit
  - Safe WTG control
  - Meeting dynamic grid code requirements
- Wind Farm Management System (WFMS)
  - Integration of SCADA systems from assets within one wind farm (WTGs, substations, met masts, etc)
- Wind Cluster Controller (WCC)
  - Communication between one wind farm and others in the wind cluster owned by different operators.
  - Optimal distribution of setpoints to wind farm assets to maximise production, minimise loads and meet PCC grid and user requirements.
  - Optimal provision of auxiliary grid support services (active and reactive power) to the PCC over 10min time periods or longer.

Wind Cluster Controller Overview

Input time series of global wind conditions

Local wind conditions from nacelle anemometry

Grid requirements
- Power factor
- Curtailment
- Reserve active power

Wind Cluster Controller

User requirements and WFOM:
0 - Normal
1 - Power optimised
2 - Load optimised

Output setpoints sent to wind farm assets
- Real power setpoints per WTG
- Reactive power setpoints per WTG
- Setponts for variable reactances

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SEVENTH FRAMEWORK PROGRAMME

Wind Cluster Controller Insight

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Global wind condition table
(synthesized data or data from a site met. mast)

Wind Flow Model
(Farmflow – ECN)
(FLaP ForWind)

Local wind condition table for each WTG in the field incorporating wake effects

Active power production table for all possible global wind conditions for WFOM 0,1,2

Wind Flow Model
(Farmflow – ECN)
(FLaP ForWind)

Calculations with optimisation algorithms for:
- WFOM 1 Power optimisation
- WFOM 2 Load optimisation

Electrical Model
(powerfactory)

Optimal WTG operational mode table for power and load optimized modes

Optimal reactive power table for all possible global wind conditions for WFOM 0,1,2

Thank you for your attention.
Are there any questions?