



*SUPERGEN Wind*  
***Wind Energy Technology***

Theme 4

Bill Leithead

General Assembly, Durham

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# Research Programme 2010-2012



- Organisation of work programme
  - Theme 1: *The Farm*
  - Theme 2: *The Turbine*
  - Theme 3: *The Connection*



# Theme 1: The Farm

## Co-ordinator – Simon Watson

- The offshore wind resource.
- Wakes and aerodynamics
- Radar and the environment
- Optimisation of farm performance.



# Theme 2: The Turbine

## Co-ordinator – Geoff Dutton

- Drive-train dynamics.
- Rotor wind-field interaction
- Turbine blade and tower materials
- Multiple wake interaction on the machines
- Fault detection
- Subsea turbine foundations



# Theme 3: The Connection

## Co-ordinator – Peter Tavner/Mike Barnes

- Achieving reliability, maintainability and cost effectiveness for large offshore wind farms via connection and control schemes
- Wind turbine installation
- Wind farm control schemes
- Connection to shore.



# Mid-Term Review

- Detailed programme detailed in proposal for 2010 – 2012
- Outline programmed only for 2012 - 2014
- EPSRC required mid-term review
  - To firm up programme for 2012 – 2014
  - To revise programme to match changing circumstances
  - To merge three themes into one to strengthen collaboration
- Programme review by Themes and PMB
- Programme plan for unified Theme 4 devised
- To be proposed to CSC for approval



# Theme 4: The Wind Farm as a Power Station Co-ordinator – Bill Leithead

Towards an “Integrated, Cost-effective , Reliable & Available  
Offshore Wind Power Station”

- Array performance
- Wind farm control
- Operation as a power station
- Integrated monitoring
- Operations research for the farm
- Integrate wind farm economics



# Research Programme

Tasks	Theme 4 Competencies		
	A	B	C
	Design	Operation	Sustainability and Economics
1 Offshore Wind Resource	LU	LU	LU
2 Array Performance	LU SuU+IC	LU SuU+IC	MU(AB) LU
3 Foundations		MMU	
4 Materials	MU(PH)	RAL MU(PH)	MU(PH) MU(PH)
5 Connection (Reliability/Costs)	DU	DU RAL	RAL RAL
6 Wind Farm Control	MU(MB) StU(OAL) StU	MU(MB) StU StU RAL+IC	
7 Operation as a Power Station (Scaling/Costs)	MU(MB) StU	MU(MB) StU	
8 Integrated Monitoring (Reliability/Costs)	MU StU DU	MU StU DU LU	LU LU
9 Operations Research for the Farm (Reliability/Costs)		DU	
10 Assessment of Economic Resource	RAL LU	RAL LU	MU(AB) RAL LU
11 System-wide Economics of Offshore Wind Energy			StU(Ec)





# Theme 4: Deliverables

- Deliverable D4.1: Offshore Connection

Mike Barnes

- Deliverable D4.2: Economics and Performance

Simon Watson

- Deliverable D4.3: Asset Management

Simon Hogg

- Deliverable D4.4: Dynamic Loading and Structures

Geoff Dutton



# Deliverable D4.1

## Offshore Connection

Academic Partners: DU, MU, STFC, StU

### Objective

To address technical barriers to the connection of offshore wind farms, singly and collectively, to the onshore electrical grid and the *interaction* between the two.



# Deliverable D4.1

## Offshore Connection

Academic Partners: DU, MU, STFC, StU

- System performance evaluation – Reliability/Connection
- Offshore control schemes – Connection
- Connection to Shore – Connection
- Integration of storage – Cost/Connection



# Deliverable D4.2

## Economics and Performance

Academic Partners: LU, SuU(IC), MU, STFC, StU

### Objective

To produce tools that may be used to optimise the position and layout of a proposed offshore wind farm and give an indication of the optimised cost of energy for the site.



# Deliverable D4.2

## Economics and Performance

Academic Partners: LU, SuU(IC), MU, STFC, StU

- Estimate of site specific wind resource
- Prediction of large array wake losses
- Multiple Wake Radar Modelling
- System wide economics/cost benefit analysis
- Software Site Optimisation Tool



# Deliverable D4.3 Asset Management

Academic Partners: DU, LU, MU, StU

## Objective

To develop a single condition monitoring and fault identification strategy for the electrical and mechanical drivetrain systems, appropriate for large offshore wind turbine designs.



# Deliverable D4.3

## Asset Management

Academic Partners: DU, LU, MU, StU

- End-user requirements for health monitoring of offshore turbines
- Improving wind turbine reliability through better detection and identification of faults
- Improving the prognosis of developing faults



# Deliverable D4.4

## Dynamic Loading and Structure

Academic Partners: MU, MMU(LaU), STFC, StU, SuU(IC)

### Objective

To address the materials and (dynamic) loading of blades, tower and foundations and their implications, with regard to both design and operation, for cost and potential up-scaling of the offshore wind farm.





# Deliverable D4.4

## Dynamic Loading and Structure

Academic Partners: MU, MMU(LaU), STFC, StU, SuU(IC)

- Wave interaction with structures
- Design strategies of materials for off-shore wind turbine blades
- Structural implications of wind farm control strategies



**Thank you!**



**Consortium**