UpWind

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UpWind Workshop Outline

1. European perspective of wind energy research, Thierry d Estaintot, European Commission
2. Update on UpWind, Peter Hjuler Jensen, Risoe National Laboratory, Technical University of Denmark and Jos Beurskens, Energy research Centre of the Netherlands
3. Upscaling: consequences for concepts and design, Ben Hendriks, Energy research Centre of the Netherlands
4. Latest results on Transmission and Conversion, Jan Hemmelmann, GE Energy
5. Rotor structure and materials: strength and fatigue experiments and phenomenological modelling, Rogier Nijssen, WMC

The UpWind Project

- *FP6 Integrated project*
- UpWind got Wind Energy back in the EU 6 Framework Energy Research program
- *Results of EWEA Thematic Network(EU-project):*
  1. EWEA Research Strategy
  2. UpWind
  3. EWEA Strategic Research Agenda
  4. Technology Platform
- **Behind UpWind application were EAWE, EWEA and the partners**
- **UpWind the glue/network and Lighthouse for EU R&D**

The UpWind Project

UpWind subtitle: Integrated Wind Turbine Design

- Start date: 1 March 2006
- Duration: 60 months
- Costs: 22,340,000 EUR
- EC funding: 14,288,000 EUR
- Co-ordinator Risø National Laboratory, Denmark's Technical University

Participants, update

39 participants plus 4

- 11 EU countries
- 10 research institutes
- 11 universities
- 7 turbine & component manufacturers
- 6 consultants & suppliers
- 2 wind farm developers
- 2 standardization bureaus
- 1 branch organisation

- *3 INCO partners (China, India & Ukraine)*
- *CENER*

The UpWind Project

- ***39 partners in UpWind Consortium from start***
- CENER added (+1)
- Risø and DTU merged to DTU and RisøDTU (-1)
- Elsam sold to Dong Energy and Vattenfall (+1)
- INCO call added 3 new partners (+3):
  - ISM: Institute for Superhard Materials of the Nat. Academy of Science, Ukraine
  - IITB: Department of Civil Engineering of the Indian Inst. of Technology Bombay
  - CUMTB: China University of Mining and Technology Beijing
- **43 partners in UpWind Consortium March 2008**
- **Other potential partners: NREL USA**

Objective - 1

Develop and verify substantially improved design models, new concepts and verification methods for wind turbine components, industry needs for future design and manufacture of:

1 Very Large Wind Turbines

2 More Cost Efficient Wind Turbines

3 Turbines for very large offshore wind farms

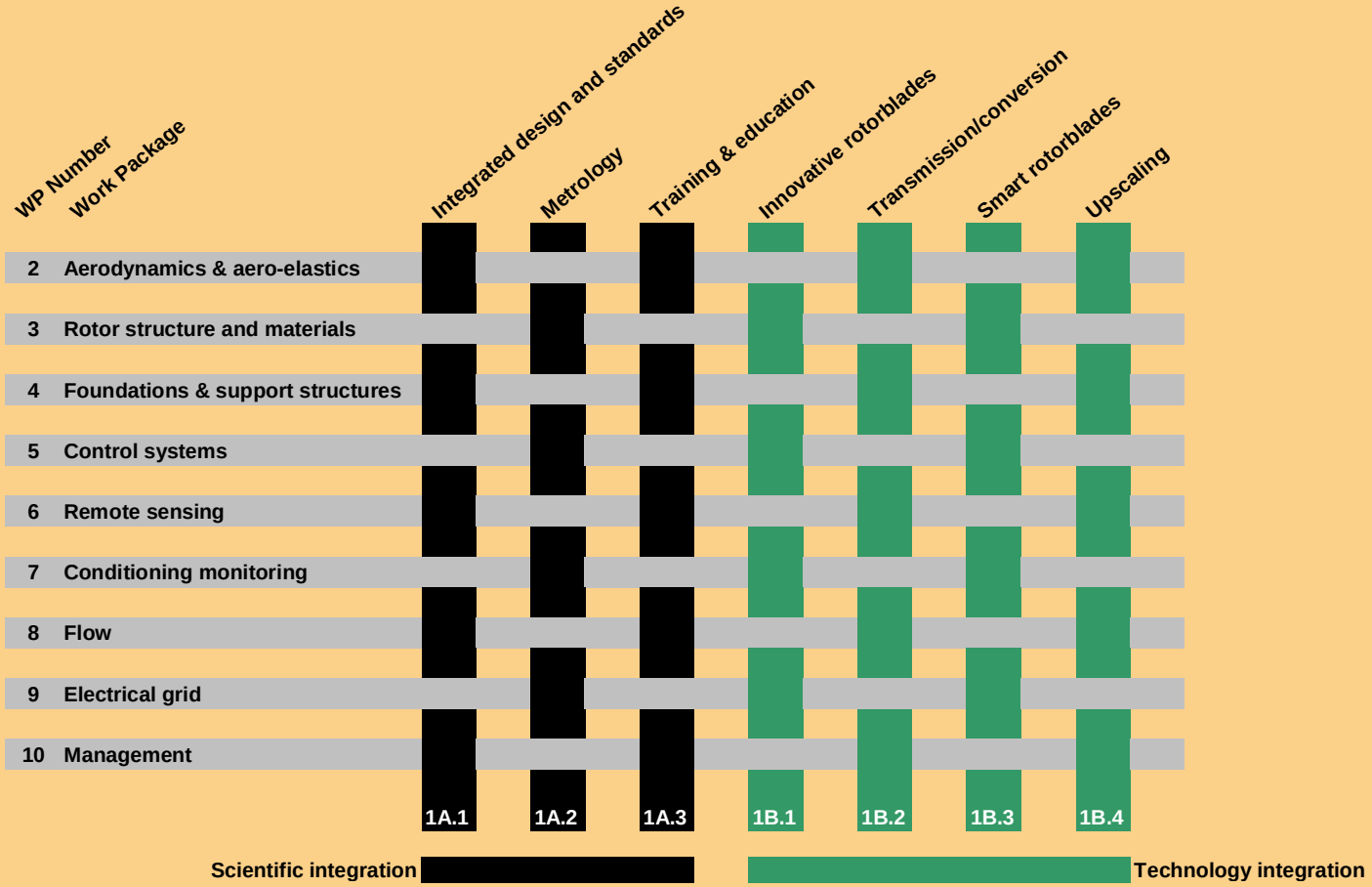
Objective - 2

- Consortium **integrates the disciplines and sectors needed** for the entire development chain of wind turbine technology
- 8 Scientific Work Packages –work programme
- 7 Integration Work Packages –work programme

Upscaling

- Today: WT up to P = 5 MW and D = 120 m
- Future: WT upscaling: P = 10 MW and P = 20 MW
- Develop methods to overcome showstoppers/optimize

Organisation
Classic and integrated research approach
Advanced Flexible Modern Organisation



Selected Results
first two years

WP 1B.4 Upscaling

WP 1B.2 Transmission & Conversion

WP 3 Rotor structures & Materials


Integral design approach and standards
UpWind
UpWind

WP descriptions available

Challenge

Research activities

Results and expectations

Contact data

Participants of WG

THE RESEARCH ACTIVITIES

The main research activities for the integral design approach and standards' work package include:

- Defining and updating a reference wind turbine and a reference technical-economic cost model for benchmarking to be used for communication of the design parameters and design developments and the main economic and dynamic performance parameters for all UpWind project activities;
- Development, application and evaluation of an integral design approach methodology in offshore wind turbine design;
- Development of standards in general and for the application of the integral design approach, including definitions of interfaces between models, including data needs, specifications and protocols;
- Definitions and specifications of experimental data to be condensed into input design parameters for the design models or to verify critical design and performance issues.

In practical terms, the above research activities are sub-divided into 4 tasks.

SUBTASK A: REFERENCE WIND TURBINE AND COST MODEL

The subtask is dedicated at facilitating the integration of the different activities in all the horizontal (and vertical) work packages throughout the project. For this, a reference wind turbine will be defined to provide a basis for communication and comparisons. The design parameters and the main characteristics, including results of parameter sensitivity studies, will be defined and kept up to date. Input data will be provided from the other work packages. The data will be made easily accessible to all partners in the project.

Work Package 1

SUBTASK B: INTEGRAL DESIGN APPROACH METHODOLOGY

Other technology sectors, such as air-transport, have experienced a development similar to wind energy with respect to increasing complexity and focus on specialists. For some of these technologies "Knowledge Based Engineering" (KBE) is investigated as a means to increase productivity of the design teams and to reduce the boundaries between disciplines. KBE tries to model not only properties of a product, but also the knowledge about the product that captures the engineering intent behind the design. KBE can be used in Design and Engineering Engines (DEE), to automate the multi-disciplinary processes. This automation is not intended to replace the design team, but rather to replace routine activities and to improve efficiency and consistency of information exchange. As a result, design teams will have more time for their creative contributions and thus can increase their productivity. Core element of the DEE is a (multi-) model generator in which the parametrical description of the product resides. It gets input from a concept generator and (re)generates the input for the analysis tools: the discipline silos. Typically, the discipline silos are commercial off-the-shelf analysis tools. The Knowledge Based Engineering tools reside in the concept generator.

Thus, the objective of this activity is to assess the feasibility of this approach for wind turbine design and to develop the knowledge needed to generate a DEE for this purpose. It is noted that the analysis tools in the discipline silos are external tools and are not part of the development undertaken in this activity. However, this activity will contribute to and make use of the common formats developed in this task, as these represent the interfaces between the model generator and the analysis tools. The reference turbine will be used as a case study.

Integration and Scientific work packages

SUBTASK C: DEVELOPMENT OF (PRE) STANDARDS FOR THE APPLICATION OF THE INTEGRAL DESIGN APPROACH

This subtask is dedicated to the development and formulation of standards in a broad sense, and for the application of the integral design approach of subtask B. Hence the subtask C aims at integrating the design models, experimental methods and concepts arising from the horizontal work packages.

SUBTASK D: INTEGRATION, REVIEW AND PLANNING WORKSHOPS

This subtask focuses on coordination and cross-cutting activities.

RESULTS AND EXPECTATIONS

So far cost functions for the components of the wind turbine, for which the input from parallel project activities is needed have been developed.

This WP works in close cooperation with the WP Upscaling (1B4).

The final results of the work package include:

- Guidelines for the integral design approach, including guidelines for design models, experimental methods and concepts arising from the scientific WP's;
- Recommendations and pre-standards to be submitted for IEC/ISO and CEN/CENELEC for the revision or development of international standards for design and tests of wind energy systems.

UpWind Workshop

October 9, 2008

Brussels

Questions?