WINDBALANCE

Balancing wind energy in the grid: an overall, techno-economic and coordinated approach

DURATION OF THE PROJECT
Phase 1: 15/12/2006 – 31/01/2009
Phase 2: 01/02/2009 – 31/01/2011

BUDGET
789.067 €

KEYWORDS
Wind energy, Balancing arrangements, Wind prediction, Intra day trading, Reserve power

CONTEXT

Wind energy can make an important contribution to reaching the Belgian target for renewable energy sources (RES) imposed by the European Commission (Directive 2001/77/EC). However, the participation of wind energy in markets must always assure security of supply (Proposal for a Directive COM(2003)740). Finally, wind energy support must be compatible with the Internal Market (Directive 2003/54/EC).

With current market rules wind power can difficultly enter the markets. However, the capacity of wind that can be installed in the Belgian grid is limited due to such market barriers but also technical limitations. It is the objective of this project to identify these barriers and to analyze how they could be removed. With the results of this project, Belgian policy makers will be able to take the necessary actions to increase the potential of wind energy.

PROJECT DESCRIPTION

Objectives

Wind can best be integrated in the power system if it becomes integrated in the market environment. Since the market as it exists today has emerged in the period of a concentrated market (with central power plants in largely public or regulated ownership) it is not adapted to decentralized generation. With current market rules wind power can difficultly enter these markets as they are today. Since a large share of wind energy is supposed to become integrated in the future, benign conditions for wind power are necessary for its participation in the market. In recent years, several initiatives were taken to develop offshore wind farms in the Belgian area of the North Sea. However, the capacity of wind that can be installed in the Belgian grid, as in other countries, is limited due to such market barriers but also technical limitations. It is the objective of this project to identify these barriers limiting the wind potential in Belgium, and to analyze how they could be removed. Consequently, with the results of this project, Belgian policy makers will be able to take the necessary actions to increase the potential of wind energy.

Methodology

The methodology proposes to approach the problem from two sides: In Module 1, wind energy as a decentralised power source with variable output is modelled for a single wind farm. This way, the value of wind power in energy markets can be modelled and the behaviour of wind power producers as a response to market prices can be estimated with different applicable market rules. The chosen approach in Module 1 is from the bottom up. In Module 2, the power system is modelled as a whole. Unit commitment in the centralised, hence, dispatchable fraction of the Belgian power generation park is modelled yielding the status of the power generation system and the network as a whole. The chosen approach in Module 2 is top down, taking into consideration the models for wind power generation from Module 1.

Finally, in Module 3, the economic possibilities to integrate wind energy (behaving as described in Module 1) into the global system (Module 2) are analysed. Firstly, additional measures in order to facilitate the integration of wind energy are described and, secondly, a sensitivity analysis is carried out in order to identify the degree to which market rules, boundary conditions, technical constraints and additional measures affect the feasibility to integrate wind energy into the power system.

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EXPECTED RESULTS

Results Year 1 (Module 1):

- Market inventory and description of market rules
- Stochastic description of wind power output and its prediction error for different time scales. These will serve as a basis for generating synthetic time series of wind power output and prediction errors.
- Stochastic description of markets outcomes. These will serve for generating synthetic time series of market prices.
- Market simulation tool for single wind farms.

Results Year 2 (Module 2):

- Report on technical upper limit for wind in ideal conditions.
- Report on technical upper limit for wind considering network constraints.

Results Years 3 and 4 (Module 3):

- Technical parameters of potential technologies for additional balancing measures.
- Set of proposed market mechanisms for procuring these services.
- General evaluation of different market scenarios.

PARTNERS

R & D organisation	Relevant core competences & know-how
KULeuven-ELECTA	Distributed Energy Resources, Power Electronics, Electrical power transport and grid operation
3E	Energy in buildings, Solar thermal energy, Photovoltaics, Biomass and Policy studies
KULeuven-TME	fluid mechanics and heat transfer, combustion, energy and environment and industrial safety
ULB	operation, monitoring and protection of power systems

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Follow-up Committee

For the complete and most up-to-date composition of the Follow-up Committee, please consult our Federal Research Actions Database (FEDRA) by visiting http://www.belspo.be/fedra or http://www.belspo.be/ssd

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