



WP2

Demand for energy balancing and storage

This WP will assess cost-efficient storage configurations for various scenarios of renewable and thermal power generation, and how such configurations perform in the context of day-ahead, intra-day and balancing markets. A scheme will be developed to systematically categorize variability and the need for storage for different time horizons in a multiple coupled market environment. This scheme will be used to establish scenarios with different storage options to be further analysed by simulations. As an alternative to storage, the flexibility of the demand should be included on the overall balancing needs assessment. WP2 will:

- Establish data models with sufficient geographical detail and time resolution
- Model and analyse the interaction between different markets
- Assess the need for energy balancing
- Compare alternative technological solutions to cover the need for energy balancing.

Task 2.1 – Establish data models

Establish data models with sufficient spatial and temporal resolution. Variations in generation of wind and solar power are challenging in the time frames from minutes to weeks. Especially for the shorter time frames models with sufficient level of detail are necessary. The focus will be put on principal but as far as possible realistic studies. Reduced geographical models for some time horizons may be used by the PhD-candidate to investigate fundamental issues. Larger scale models may be developed jointly with other work packages.

Task 2.2 – Interaction between markets

Model and analyse the interaction between day-ahead, intra-day and balancing markets. Generally shorter time between gate closing in a market and the implementation will reduce the uncertainty. The modelling of the intraday markets is therefore essential for the efficient handling of the wind and solar forecast errors. Handling 12-36 hour forecast errors for systems with very high share of intermittent renewable generation will be challenging and requires better solutions. Another issue is the coupling that will arise due to the bidding strategy of both markets. How to bid in the day-ahead market to maintain the flexibility of the intra-day and the balancing markets?

Task 2.3 – Assess demand for energy balancing

Assess the need for storage in the time perspective of minutes to weeks, depending on scenarios of thermal and hydro generation capacity and its technical capabilities, particularly ramping speed. The essence is to look at characteristic periods for different scenarios of included intermittent generation (Wind, PV) and identify the flexibility of the thermal generation and system loads to identify the possible technical benefits of combining hydro generation with other storage options. It will be assumed a regional description where major transmission capacities are included to capture the generation and load composition in the different regions.

Task 2.4 – Compare alternative solutions

Compare alternative solutions for storage, both in economic terms and with respect to physical power system related results, considering different scenarios.