



CITIES

Centre for IT Intelligent Energy Systems

Performance monitoring of renewable production assets

Objective

The project is concerned with performance monitoring of renewable production assets, considering wind farms as an example. For such assets it is standard procedure to monitor the overall performance by comparing actual production to estimates of potential production estimates. Traditionally, such estimates are compared on e.g. weekly, monthly, quarterly and yearly basis. The project studies such estimates and consider more proactive approaches where the aim is to discover and correct issues in real time.

Background

Renewable production assets, such as wind farms, ideally produce energy following a static mapping from weather to energy. Reasons why this may not be true includes

- Some of the energy-producing units are out for maintenance: E.g. for larger wind farms it is quite expected that some wind turbines are shut down for maintenance during daytime. If this can be planned on days with low wind, it can be done with little loss of production.
- Export restrictions prevent full energy production: In some situations, the grid operator may not be able to transport all energy produced. This can be due to e.g. a general system failure on the export cable, due to grid restrictions or because the produced energy cannot be sold on the market. Depending on contractual agreements, in some of these situations, the wind farm owner may be entitled to compensation for such curtailment of the production. The compensation will be based on estimates of the potential production.
- Wear and tear or system upgrades has caused the mapping to change: For a wind farm this includes wear and tear in the main components or in sensors used by the control system. The wear and tear may result in a gradual deterioration or in a sudden breakdown of components. In either case, this is unlikely to result in a complete loss of production and the situation may not be noticed instantly. It should be noticed that system upgrades (mechanical as well as software upgrades) may also cause the mapping to change, presumably in a favourable direction.

Project description

To support the periodic performance monitoring where actual production is compared to various estimates and summarized for periods such as week, months, quarters and years, the project considers estimates of power for both the case of active wind turbines as well as the case where all turbines are assumed to be active. In order to support various loss of measurements, the estimates are formed both based on wind speed measurements performed at the wind turbines, secondary wind speed measurements (e.g. performed at the offshore platform), and when using numerical weather prediction data instead actual measurements. The estimates are compared for precision.

Based on the estimates the loss, if any, is separated into loss due to curtailment, loss due to availability, and unexplained loss.

To support more proactive monitoring a framework for monitoring e.g. unexplained loss will be developed. The framework will be based on statistical control charts.

Connection with CITIES WP's

WP2: Energy Supply, Transmission, Storage and Conversion

WP5: Forecasting and state-estimation

Time schedule

The main development will take place during 2015-2016.

Partners

DONG Energy

ENFOR