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Ancillary services from a renewable-sourced virtual power plant: the REstable project

REstable is a collaborative project with a European dimension aimed at demonstrating the feasibility of providing ancillary service by renewable plants. There are several reasons why this is important for renewable producers: the provision of ancillary services can represent an additional revenue stream and remove a technical barrier to the penetration of renewable energy into the system, currently implemented through curtailment.

The project is based on the following assumptions: 1) Due to intermittency and forecast errors in renewable production, it is not possible for an individual renewable wind or photovoltaic plant to provide ancillary services in the same way as a dispatchable thermal plant. 2) A solution "virtual power plant" (VPP) is therefore used. Weather conditions that are unfavorable to renewable production in a given region (cloud or no wind) may be offset by more favorable conditions in another region. This effect is amplified by the geographical dispersion of the plants controlled by the VPP. 3) Thanks to the centralized aggregation and control carried out by the VPP, it is possible to have at all times a small production that can be mobilized for the provision of system services. This production is generally of the order of a few percent of the sum of the peak powers of the power stations of the VPP. This value must be related to the size of the (primary) reserve in Europe, which represents about 1% of the peak installed power.

Several actions are carried out within the project to remove technological barriers and allow the feasibility of the proposed solution: 1) Advanced forecasts are developed for the prediction of aggregated and individual production of power stations. These forecasts are probabilistic in nature and improved to obtain a better definition (0.1%) for the highest forecast reliability levels (> 99%). These forecasts are used to define the quantity of production to be used for providing system services. 2) An auction tool is being developed to assist VPP operators in the sale of energy and system services on European markets.. 3) A VPP control system is responsible for displaying the status and production of the connected plants and sending individual set-points to all the plants in order to obtain the total amount of power output desired at the VPP level. The dispatch is based on a merit order built taking into account the relative activation costs for each plant, and the measurement of the available active power, the active power that would be produced by each plant in the absence of capping. 4) An improved dispatch algorithm establishes a dynamic order of merit, based on the speed of response of each machine. The goal is to smooth the response of the VPP and cope with power variations of the order of a second.

Developments are associated with tests on a virtual power plant built with the help of renewable producers. The virtual plant is composed of 4 photovoltaic plants for a total of 8 MW and 13 wind power plants for a total of 264 MW. The plants were chosen for their dispersion over several climates. The VPP is used to test the following ancillary services: i) Frequency Containment Reserve, ii) Frequency Restoration Reserve, iii) Replacement Reserve, iv) Voltage Support

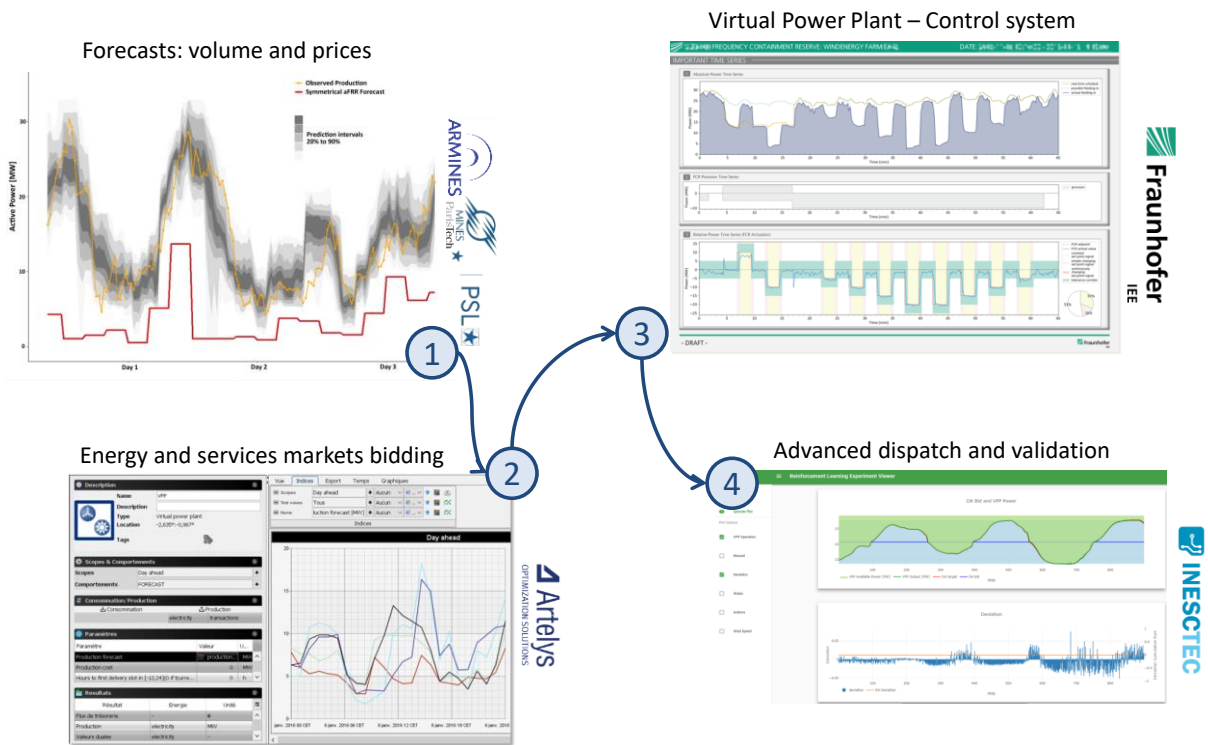


Figure 1: Examples of the developments for each technological barrier and their interaction



Figure 2: Results from a test for FCR and FRR with 4 power plants in Germany and France.