Simulation of regional cross border activation of secondary control reserves within the FutureFlow project

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SUMMARY

FutureFlow research and innovation project aims to design, prototype and pilot test a regional cross-border techno-economic cooperation scheme for the trading of aFRR ancillary service (automatically Activated Frequency Restoration Reserve, formerly called "secondary control") between four European TSOs: ELES (Slovenia), APG (Austria), MAVIR (Hungary) and TRANSELECTRICA (Romania). Such cooperation scheme of cross-border integration of national balancing markets strives to increase competition, reduce risks to security of supply and reduce high balancing costs. This regional balancing platform can roughly be split into three blocks:

- A common bid selection and activation function (CAF) that receives aFRR bids (their capacity and price from balancing units. It then accepts or declines bids based on market criteria and available cross-zonal capacities. The selected aFRR bids are then set for activation.
- TSOs' specific functionalities such as bid forwarding to CAF, cross-border capacity management and TSO bid to real-time unit management with passing bids for activation.
- Data warehouse which gathers messages and exchanged data and uses this information for operational reports and ex-post analytics.

For the pilot testing a real-time demonstration platform was developed. An important part of the platform is the common real-time processing function. The function is developed to simulate each TSO operating environment and to reproduce it in pilot test process. As such it provides the link between the TSO cloud and the real-time environment of the TSOs. The real-time processing function firstly collects input from the TSO cross-border capacity management and inputs from TSOs' aFRR controllers. The inputs from the bids selection from CAF are also collected and sent to this function. Based on simulated controllers' responses to the input signals and based on selected bids from CAF, the unit control processing is performed. As a result of new units' responses, a feedback loop is produced and used in the next simulation step. Also the output signals from CAF are calculated and used for the next time step of the processing function. A simulation environment of the real-time processing function called DEMOX

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is designed within MATLAB/Simulink software and is described in detail in this paper. The simulation environment enables us to assess the behaviour of the platform and evaluate the efficiency of different integration approaches. Under CAF design two main options are being considered: CD (control demand) and CT (control target) options. Since for the simulations the real time ACE (area control error) signals are not provided (all simulations are done off-line) we use open loop ACE of all four TSOs as input for simulations (open loop ACE represents the system ACE when no secondary control is active). Additionally, input bids sent by all four TSOs are used. In case of two TSOs these bids represent real bids from historical data, while for other two TSOs that currently use pro rata activation, we used hypothetical bids. Regarding the cross zonal capacities two approaches were used in simulations: the ATC (available transfer capacity) and the FB (flow based) approaches. The whole system is modelled as connected Simulink blocks where each block represents a certain TSO. Next, simulations are performed for longer periods of time and the results are evaluated. The evaluation of results determines which integration approach (control demand or control target) is preferable.

KEYWORDS

Balancing market, ancillary services, aFRR, cross-border, simulation model

1. REFERENCES

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