DEPLOYMENT OF INDUSTRY-FLEXIBILITY FOR TSO-DSO COORDINATED REDISPATCH IN AUSTRIA

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Overview

The dynamic developments of the national and European electricity markets, especially due to the integration of fluctuating renewable generation and the progressing integration of the European electricity grids, result in increasing grid loads and growing demand for redispatch. In some European countries, redispatch procurement is done either in a market-based way via advanced platforms ([1], [2]), or through the utilisation of either producers and/or consumers above a certain plant/unit size which are obliged to provide their flexibility for flexibility services and receive a cost-based remuneration ([3],[4]).The project Industry4Redispatch (I4RD) [5] analyses to what extent new flexibilities, such as demand response potentials provided by industry, can support redispatch provision in the future. Among other things, the regulatory framework and the currently insufficient flexibilization of industrial plants must be examined and solutions evaluated. Another area of complexity is that industrial flexibility is often located in the distribution system, which requires efficient coordination between transmission system operators (TSOs), distribution system operators (DSOs), and industrial units. The project will investigate all necessary technical, regulatory, economic, and organizational requirements for the implementation of redispatch of industrial units, as well as the necessary DSO-TSO interaction. The project I4RD is funded by the Climate and Energy Fund and is carried out within the framework of the NEFI showcase region program.

Methods

The-goal of I4RD is to enable the provision of flexibility from industrial plants for redispatch. To this end, various use cases were developed in the first year of the project that depict the interaction between all the stakeholders involved. These use cases will be validated and evaluated for various stakeholders through simulations and/or demonstrations during the course of the project. The use cases include a reference scenario representing the current state of the art, as well as additional scenarios for the participation of industry units at spot- and balancing markets or the provision of their flexibility for DSO congestion management and/or for TSO redispatch purposes. I4RD will test the integrated redispatch concept through several demonstrations at various industrial facilities located in the distribution grid to efficiently address industrial customers with varying levels of automation system maturity. This will lay the foundation for future engagement of a wide range of industrial sectors. I4RD will develop enhancements to existing redispatch processes, as well as identify the necessary data and technical constraints for exchange between the TSO and the DSOs and develop additional tools as necessary. A cost-benefit analysis will determine the economic viability for each stakeholder and selected use case. The results will then be extrapolated and a possible large-scale roll-out in Austria will be analysed. A scalability analysis will identify the impact on the distribution system caused by large-scale demand-side and supply-side redispatch management in the transmission system and specify the required information flow between TSOs and DSOs. Finally, a step-by-step guide for transforming a conventional, existing industrial power system into a more flexible, de-carbonized, optimally operated system will be provided, highlighting the relevant aspects for the TSO-DSO coordination process.

Results

The central planned use case of the project is the use of flexibility bids for redispatch and congestion management in the day-ahead time frame, as shown in Figure 1. In the first step, the industry units purchase energy at the day-ahead spot markets, considering the variable prices throughout the day as well as their own needs. Thereafter, the amount of remaining flexibility is assessed, and this can be offered in the form of standardized bids for redispatch. In order to enable the use of flexibility bids from the redispatch platform by both TSO and DSOs without causing $n-0$ or $n-1$ violations in either network, grid security calculations are required that determine the bids that can be called. Each grid operator performs an individual capacity calculation in its own supply area. Thereafter, both network congestions and free capacities in the individual DSO supply areas are communicated. The redispatch platform serves as a data exchange platform with the additional feature to filter out bids according to the available grid capacity by TSO/DSOs.

Only bids which do not exceed grid capacities can be selected, thus ensuring that no action by a TSO/DSO has a negative effect on the grid of another TSO/DSO. The platform shall also contain a mechanism for the coordination of redispatch bid selection between TSO and DSOs.

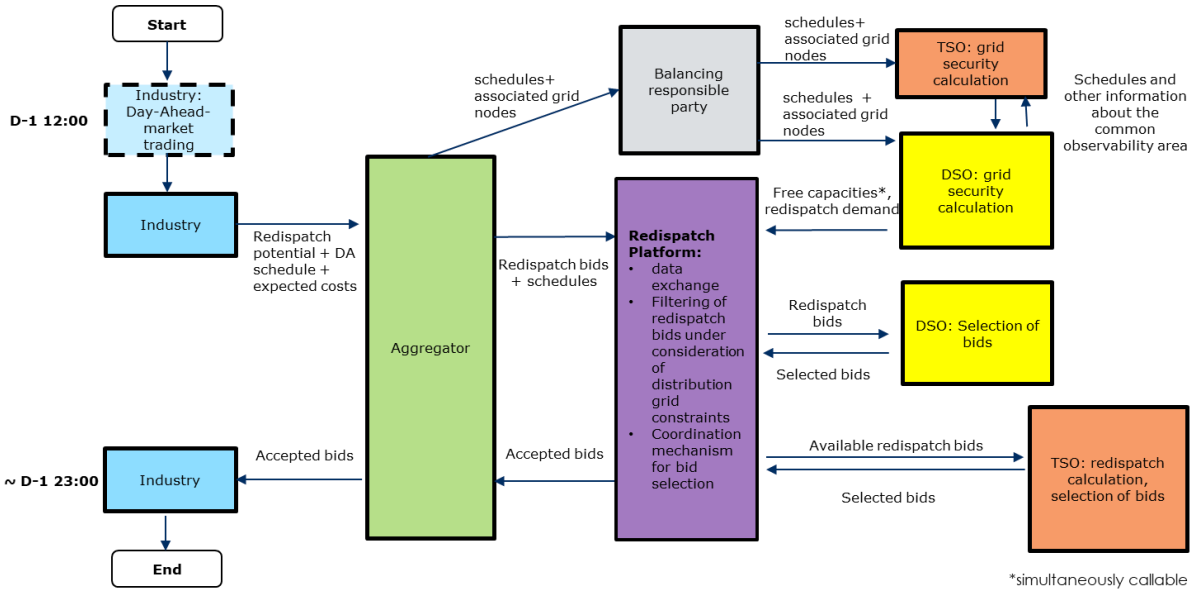

Figure 1 Schematic overview of stakeholder interaction in I4RD's central use case. Based on the day-ahead-market schedules, the industry units provide information on possible redispatch provisions to the aggregator. The aggregator provides aggregated redispatch bids to the redispatch platform. Moreover, schedules are exchanged between the balancing responsible party and DSOs and TSOs via the platform, which are then used to perform grid security calculations.

Basic requirements for participation in redispatch provision have been defined for the planned implementation, which simultaneously need to consider the industry as well as system operator requirements. At the current state, the minimum bid size is defined as 1 MW to ensure observability. The product length is defined as 15 minutes, similar to spot market bids. To enable the participation of smaller plants, technical units can be aggregated by third parties within their role as service providers. Observability, reliability, as well as the quality of forecast schedules and monitoring are a necessary requirement for participants. For this purpose, a prequalification process for participation in the flexibility platform and a standardized data-exchange will be mandatory. The actual activation of flexibility is validated starting from a baseline, similar to which exists for balancing reserve activation. Trading on other electricity markets should still be possible after the submission of redispatch bids with the limitation that no downward bids at these markets are allowed if the redispatch bid points into the upward direction and vice versa. Moreover, capacity limits must be fulfilled by the technical unit at each timestep. In most industrial processes, the energy made available for redispatch is consumed at an earlier or later time, referred to as preliminary/catch-up effects. These catch-up effects, however, could result in a shift of the grid congestion and thus it is imperative that such conditions are adequately managed or avoided.

Conclusions

In workshops between research facilities, Industry, aggregator, TSO, and DSOs, use cases were developed which detail the integration of industrial units in the existing TSO redispatch process. These use cases enable comparisons between the current market participation of industrial units, current redispatch procedures and a future redispatch provision. Gaps between current procedures and future redispatch provision show where additional data exchange and an adaption of processes is required. In addition, standardized requirements were developed to enable offering redispatch in the form of bids to a common platform. An evaluation of these processes and the feasibility of the requirements is to be performed in subsequent implementation and demonstration work.

References

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