REACHING THE SMART GRID'S POTENTIAL: DEFINING LOCAL MARKETS FOR FLEXIBILITY

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Overview

Electricity markets are undergoing a harmonization in economic terms with wider areas of price coupling and trading. In physical terms, more renewable power generation is being integrated into local distribution grids causing the need to micro-manage the network. The economic layer of electricity markets and the physical layer are moving in opposite directions. Corrective actions are often needed at a particular place in the grid. Wholesale market solutions at the moment do not provide location specific solutions. In order to deal with local issues system operators can take several actions such as grid reconfigurations, re-dispatching of units, curtailment, grid reinforcements or balancing actions. So far, system operators in distribution have had little involvement in market actions to balance the network or relieve congestion.

This paper defines the economic conditions necessary to develop a local market in terms of temporal, spatial, contractual, and price clearing conditions. Possible market power issues are posed depending on the sensitivity of the network to participants in the relevant market. Finally, two main approaches to contracting flexibility are described depending on the possibility of market power. One is a regulated local flexibility market approach and the second is a flexibility pool approach.

Methods

The relevance of the issue is examined through a literature review highlighting the wide range of industry led projects for contracting flexibility. Additional literature, such as the THINK report from the Florence School of Regulation (Perez-Arriaga, Ruester, Schwenen, Batlle, & Glachant, 2013) and EDSO (EDSO, 2013) recognize the need for a market that allows local balancing actions to take place at the DSO level. Current wholesale markets are taken as a starting point to understand each aspect of market design and then apply it to the particular case of a local flexibility market Next the issue of market power is addressed through the definition of the smallest relevant market where a hypothetical monopolist could profitably sustain a small and significant non transitory increase in prices (Belleflamme & Peitz, 2010). Theoretically, the optimal local market design depends on the sensitivity of the network to parties offering flexibility at specific places in the network.

Results

Based on the analysis of the relevant market and the criteria of market design, local flexibility markets are defined as: '*long or short term trading actions for flexibility in a specific location given by grid conditions or balancing needs, where participants in a relevant market can be aggregated to provide flexibility services'*. In addition, the objective of a local market could serve several purposes beyond balancing and congestion relief, such as grid losses minimization, component life extension, and postponement of grid reinforcements. Flexibility services can be a tool to minimize the operation costs of DSOs. Two main design options are proposed depending on the sensitivity of the network to market power as defined by the relevant market.

The first option is a regulated local flexibility market approach, where the system operator procures resources in the best interests of the network. Flexibility could be contracted either by the DSO directly for aggregated resources in its grid, or by the TSO even when resources are in the DSO grid. In the latter case the DSO should have a view on the availability and activation schedules of controllable resources connected to its network. Organizing a regulated market becomes an issue of hidden information, since -as of now- shifting costs for demand response are mostly undefined. As in all regulated markets the SO has the option of regulating either price or quantity A clear market signal will attract competitive market participants that wish to offer flexibility.

The second option is a flexibility exchange when the relevant market can be extended enough to mitigate the sensitivity of the network toward a single area/participant, and enough liquidity is available. The design of the exchange can mirror the wholesale market in temporal, contractual, and price clearing dimensions, but it has a specific spatial component. A local flexibility exchange could exist as a platform run by the DSO, the TSO, or an independent party.

Conclusions

Starting a local market for flexibility poses several challenges to market players. First, the rules for selling and buying must be clear to all parties in order to guarantee a stable market place. Second, aggregators must reach a critical mass of users before they can meet the minimum quantity requirements to sell flexibility. This poses a barrier to the creation of effective flexibility markets, since it is difficult for an emerging business to obtain enough market share from the start. Third, market power can be an issue if the relevant local market for flexibility is too limited and does not count with enough participants. In order to counteract these barriers, it is prudent to first start local flexibility contracting in a regulated market where prices or quantities are set by the SO. A premature pool structure might not attract enough participants if it is set up too soon and market players do not yet know the valuation and availability of flexibility resources. Once the market grows and enough participants are available, a transfer to a pool or exchange structure could be possible.

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