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REGULATORY BARRIERS TO ACTIVE DEMAND RESPONSE BY RESIDENTIAL ELECTRICITY CONSUMERS

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Abstract. Despite its benefits for various market participants, and the growing importance of distribution grids in light of the integration of renewables, active demand response (DR) for residential consumers is making a rather slow progression. While some of the obstacles are techno-economic in nature, there also exist barriers related to market regulation. The objective of this paper is to analyze the current regulatory framework surrounding DR in distribution systems, with a special focus on the Flanders region in Belgium. Additionally, the principal barriers to implementation are identified.

Keywords: Demand Response, Distribution Grid, Flexibility, Regulation

CONTEXT

Historically, European electricity markets were characterized by a top-down organization, with the production side typically balancing the power system. Nowadays, the demand side is increasingly participating in the market. When active demand response (DR) is implemented, it is primarily by large consumers, connected to the transmission grid, who offer their flexibility on the wholesale market. In the current state of affairs, these larger (often industrial) companies can sign a contract allowing their offtake capacity to fluctuate either between predefined boundaries, or in response to a signal by the grid operator. Hence, when demand is peaking, some pumps or other machinery can be turned off. As an alternative for electricity storage, DR is likely to play an important role in mitigating balancing issues and in dealing with network congestion.

PROBLEM STATEMENT

On the distribution system level, the aforementioned dynamic is almost entirely absent. Although residential consumers possess ample flexibility, the current market model does not allow for it to be exploited. In Flanders, for instance, the contractual options for these consumers are limited to a choice between a fixed pricing scheme versus day and night tariffs. The latter constitute a weak form of demand response where end-users are motivated to consume more during the off-peak period. However, these tariffs are still quite rigid, providing little cost-reflectiveness and therefore limiting price responsiveness. At the same time, the importance of distribution grids is growing steadily, because of the emergence of distributed generation technologies (wind turbines, PV, CHP), as well as new demand applications (electric vehicles, heat pumps). Nevertheless, a major share of the available residential flexibility is currently not being captured, despite the significant benefits for numerous market participants. The question now arises why residential DR is not yet in place, and how it can be enabled. Although there undoubtedly exist techno-economic difficulties, a great deal of the current stagnation can be explained by obstacles related to market regulation. The current regulatory framework often limits the development of new services and technologies.

OBJECTIVE AND METHODOLOGY

The objective of this paper is to analyze the current regulatory framework surrounding DR in distribution systems, with a special focus on the Flanders region in Belgium. Additionally, the aim is to identify different regulatory barriers to implementation. This research is framed within LINEAR (Local Intelligent Networks and Energy Active Regions), a breakthrough project studying and implementing innovative smart-grid technologies on a larger scale in Flemish households. The focus of this project lies on automated active demand technologies in the distribution grid, comprising a field trial involving around 250 end-users. In order to capture possible future market structures, four different Business Cases (BCs) are explored. Portfolio management, wind balancing, load pattern control and transformer lifetime. In the portfolio management BC, residential consumers help operating the power system by responding to dynamic electricity prices, i.e. Time-of-Use tariffs, and shifting their consumption to lower price periods. In the wind balancing BC, real-time imbalances due to deviations from wind power production are dealt with by controlling flexible loads at residential premises. In the load pattern control BC, DSOs optimize the voltage profile on LV feeders by controlling real-time flexible energy resources at the household level, so as to defer or decrease network investments. Lastly, in the transformer lifetime BC, DSOs decrease the peak load of distribution transformers by controlling real-time flexible energy resources at the consumers premises. All four cases are currently being tested in a field trial. Although technical feasibility is a prerequisite to integration of DR, it is also crucial to examine whether true economic value is created, and whether the current juridical and regulatory model support the different business cases. Therefore, LINEAR combines technological research with an economic and regulatory assessment. This paper in particular is part of the latter analysis. In a first part of the study, a concise overview is given of the current regulatory state of affairs in Flanders with respect to DR. It comprises different themes (smart meters, privacy and consumer protection, data handling, roles and responsibilities, incentive schemes,..) and the ongoing developments. Furthermore, different policy levels are analyzed: European, national and regional. To this end, existing academic literature, reports by Belgian research institutions and regulators, and legislative documents are studied in close detail. A second part then identifies and further elaborates on the associated regulatory obstacles.

PRELIMINARY RESULTS

In the current E-market regulations, there still does not exist a clear division of roles and responsibilities with respect to the roll-out of smart meters and associated data management. Moreover, distribution grid operators (DSOs) are usually not incentivized to invest in R&D, since they are often regulated on the basis of cost-efficiency. Consequently, electricity meters, which in Flanders fall under the responsibility of the DSO, are not being modernized. Instead, net operators often choose to cut in their R&D expenses, in order to comply with KPIs and benchmarks set by the regulator. Yet, improved metering infrastructure is a crucial element in the facilitation of DR and the development of smarter electricity grids. In the same context, the issue of consumer privacy inevitably arises. Detailed consumption data on a 15 minute or even real-time basis can be useful for certain regulated or commercial activities. For instance, it can help network operators to better perform their tasks related to grid planning and balancing. Additionally, it may solve a lot of the current problems related to inaccurate billing. However, the Belgian Privacy Law only authorizes the processing of personal data when either there is explicit permission by the consumer, or when it is justified by the associated objectives. Of course, this leaves a lot of room for interpretation. Without additional transparency in sector-specific law, user involvement may be limited due to privacy concerns. Furthermore, many of the benefits from infrastructural investments are shared throughout the value chain, while it is still unclear who should be responsible for the investments, and whether or not the extra expenses can be averted towards the end-user. Clearly, the alignment of split industry incentives and the engagement of consumers for active market participation are significant challenges faced by the present electricity sector.

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