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Local Energy and Flexibility Markets to Foster Demand Response Services within the Energy Community

Authors : Eduardo Rodrigues, Gisela Mendes, José M. Torres, José E. Sousa

Abstract : In the sequence of the liberalisation of the electricity sector a progressive engagement of consumers has been considered and targeted by sector regulatory policies. With the objective of promoting market competition while protecting consumers interests, by transferring some of the upstream benefits to the end users while reaching a fair distribution of system costs, different market models to value consumers' demand flexibility at the energy community level are envisioned. Local Energy and Flexibility Markets (LEFM) involve stakeholders interested in providing or procure local flexibility for community, services and markets' value. Under the scope of DOMINOES, a European research project supported by Horizon 2020, the local market concept developed is expected to: • Enable consumers/prosumers empowerment, by allowing them to value their demand flexibility and Distributed Energy Resources (DER); • Value local liquid flexibility to support innovative distribution grid management, e.g., local balancing and congestion management, voltage control and grid restoration; • Ease the wholesale market uptake of DER, namely small-scale flexible loads aggregation as Virtual Power Plants (VPPs), facilitating Demand Response (DR) service provision; • Optimise the management and local sharing of Renewable Energy Sources (RES) in Medium Voltage (MV) and Low Voltage (LV) grids, trough energy transactions within an energy community; • Enhance the development of energy markets through innovative business models, compatible with ongoing policy developments, that promote the easy access of retailers and other service providers to the local markets, allowing them to take advantage of communities' flexibility to optimise their portfolio and subsequently their participation in external markets. The general concept proposed foresees a flow of market actions, technical validations, subsequent deliveries of energy and/or flexibility and balance settlements. Since the market operation should be dynamic and capable of addressing different requests, either prioritising balancing and prosumer services or system's operation, direct procurement of flexibility within the local market must also be considered. This paper aims to highlight the research on the definition of suitable DR models to be used by the Distribution System Operator (DSO), in case of technical needs, and by the retailer, mainly for portfolio optimisation and solve unbalances. The models to be proposed and implemented within relevant smart distribution grid and microgrid validation environments, are focused on day-ahead and intraday operation scenarios, for predictive management and near-real-time control respectively under the DSO's perspective. At local level, the DSO will be able to procure flexibility in advance to tackle different grid constrains (e.g., demand peaks, forecasted voltage and current problems and maintenance works), or during the operating day-to-day, to answer unpredictable constraints (e.g., outages, frequency deviations and voltage problems). Due to the inherent risks of their active market participation retailers may resort to DR models to manage their portfolio, by optimising their market actions and solve unbalances. The interaction among the market actors involved in the DR activation and in flexibility exchange is explained by a set of sequence diagrams for the DR modes of use from the DSO and the energy provider perspectives. • DR for DSO's predictive management – before the operating day; • DR for DSO's real-time control – during the operating day; • DR for retailer's day-ahead operation; • DR for retailer's intraday operation.

Keywords : demand response, energy communities, flexible demand, local energy and flexibility markets
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