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# An automated energy management system in a Smart Grid context

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The ongoing transformation of electric grids into smart grids provides the technological basis to implement demand-sensitive pricing strategies aimed at using the electric power infrastructure more efficiently. These strategies, also designated by demand response [1], already proved to be effective in altering patterns of electricity usage [2-6], and create benefits not only for end users (by lowering their electricity bill without degrading comfort levels), but also for the utilities (by managing the peak, flattening the aggregate demand curve, and meeting supply with demand) and the environment (by avoiding, or delaying, building new generation units and other network infrastructures). In fact, demand-sensitive pricing of electricity is expected to become the standard pricing mechanism in smart grids [3, 7, 8] and is considered essential to accelerate the deployment of variable renewable generation while maintaining electric system security and reliability at least cost [9].

However, the increased complexity in smarter grids associated with dynamic pricing schemes, decentralized generation and storage may represent a significant burden for small consumers. Deciding whether using, storing or selling electricity back to the grid in face of dynamic variables such as the price of electricity, weather conditions, comfort requirements, and electricity availability from decentralized renewable sources, is a very challenging decision process that will require some form of automated support [10]. Accordingly, enabling technologies often referred to as key elements to provide information and control capabilities to users [9] will be of utmost importance also as decision support tools, namely if endowed with adequate algorithms.

However, recent experiences highlighted several behavioral barriers that may compromise the deployment of such technologies, such as the lack of understanding about demand response programs [11], the high costs of technologies, the exhausting and costly process of seeking dynamic pricing information and reprogramming electric appliances accordingly, and the inertia associated with habitual behaviors [1]. Nevertheless, users do respond to prices and change how they use electricity, but the magnitude of that response varies

depending on several factors including the presence of enabling technologies [3, 4].

In this context, this poster presents the main features of an R&D project leading to such an enabling technology, consisting of an automated energy management decision support system (EMDSS) that coordinates and optimizes, in an autonomous manner, the management of electricity use, storage and selling back to the grid for small consumers of electricity in the residential and small services/industrial sectors. This system consists of a hardware device and algorithms that may be incorporated in existing energy management solutions, or added as a new system. It integrates two decision levels: the local (in-house/building) and the interaction with the grid and other EMDSSs.

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