Dynamic Energy Management Method with Demand Response Interaction Applied in an Office Building

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Abstract The intelligent management systems of the end consumers are endowed with advanced functions being one of them the interaction with external entities through the automatic participation in demand response programs. The development of the intelligent management systems is to reduce the energy consumption based on internal information and on the interaction with an external entity. Moreover, the management approaches results in an active participation of the consumers in the operation of the smart grids and microgrids concepts. The paper developed presents the application of a dynamic priority method in SCADA Office Intelligent Context Awareness Management system to manage the energy resources installed in an office building. The intelligent management method allows the dynamic active participation of the office building in the DR events considering the real data of consumption and generation of one building in Polytechnic of Porto. The main goal of the methodology is to obtain a dynamic

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scheduling for all energy resources with little interference in the comfort of users. The results of dynamic management model in office building are discussed for the participation in 8 hours demand response event. The power limit of the scenario depends on the consumption and micro-generation power of an October day.

Keywords Demand Response · Dynamic priority method · Energy management · Office building · Energy resources

1 Introduction

Several approaches have been proposed to the consumers in view of an active participation in the operation of the Smart Grids (SG) and Microgrids (MG) with capability to manage their own energy consumption, generation and storage systems [1]. The main cause for the faster SG development requirement is the high penetration of the distributed energy resources, making the energy management decision more decentralized, allowing the means for coordinating a wide range of players [2]. The players aggregated in small areas represent the MG that allows the management of several consumers, distributed generation and the connection with main grid [3].

With development of the SG and MG, it emerged the development of other systems: the smart meter, the smart home or smart buildings [4]. The smart home can be defined as a house which comprises a network communication between all devices of the house allowing the control, monitoring and remote access of all application and services of the management system. The management system should include advanced functions, such as, the management of electric vehicles and the interface with external operators, among others [5], [6]. A smart home include the internal communication network, intelligent control systems and home automation [7].

The advanced functions should be integrated on the House Management Systems (HMS) or on the Building Automation Systems (BAS) allowing the interaction with external entities through the automatic participation in Demand Response (DR) events [8], [9]. The HMS and BAS systems need to reduce the energy consumption based on internal information and on the interaction with an external entity according with DR events [10]. The development of sophisticated management systems has become the main goal of modern intelligent houses/buildings [9]. The actual developments of the HMS and BAS consider the management of the consumption, generation, electric vehicles and DR programs [11]. With this programs, it is possible to obtain a reduction of the electricity consumption without a substantial change in the comfort levels [12].The comfort level in the management of the HMS and BAS systems is so important and depends of each context, the minimum energy consumption and operation costs [13]. To the better management, the ability to autonomously acquire knowledge about the user's behavior adjusting the consumer's preferences arises as an essential role [14].