An automated energy management system in a smart grid context

Citation

As Published
http://dx.doi.org/10.1109/ISSST.2012.6227983

Publisher
Institute of Electrical and Electronics Engineers (IEEE)

Version
Author's final manuscript

Accessed
Mon Mar 11 03:26:51 EDT 2019

Citable Link
http://hdl.handle.net/1721.1/82546

Terms of Use
Creative Commons Attribution-Noncommercial-Share Alike 3.0

Detailed Terms
http://creativecommons.org/licenses/by-nc-sa/3.0/
An automated energy management system in a Smart Grid context

M. Lopes\textsuperscript{1}, C. H. Antunes\textsuperscript{1}, A. R. Soares\textsuperscript{1}, A. Carreiro\textsuperscript{1}, F. Rodrigues\textsuperscript{1}, D. Livengood\textsuperscript{2}, L. Neves\textsuperscript{1}, H. Jorge\textsuperscript{1}, A. Gomes\textsuperscript{1}, A. G. Martins\textsuperscript{1}, L. Dias\textsuperscript{1}, P. Pereirinha\textsuperscript{1}, J. P. Trovão\textsuperscript{1}, R. Larson\textsuperscript{2}, W. L. Leow\textsuperscript{2}, A. Mônica\textsuperscript{1}, M. Oliveira\textsuperscript{3}, S. J. Breda\textsuperscript{3}, R. Viegas\textsuperscript{3}, P. Peixoto\textsuperscript{4}

\textsuperscript{1} INESC Coimbra, Rua Antero de Quental 199, 3000-033 Coimbra, Portugal
\textsuperscript{2} Center for Engineering Systems Fundamentals - Engineering Systems Division, MIT, Cambridge, Massachusetts 02139 USA
\textsuperscript{3} IPCDVS - Universidade de Coimbra, Rua do Colégio Novo, Apartado 6153, 3001-802 Coimbra, Portugal
\textsuperscript{4} CES - Universidade de Coimbra, Colégio de São Jerónimo, Apartado 3087, 3000-995 Coimbra, Portugal

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], are not only 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.

ACKNOWLEDGMENT

This work has been framed under the Energy for Sustainability Initiative of the University of Coimbra, and partially supported by Fundação para a Ciência e a Tecnologia (FCT) under grant SFRH/BD/51104/2010 - MIT Portugal Program, and projects grants MIT/SET/0018/2009 and PEst-C/EEI/UI0308/2011.

REFERENCES