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PREFACE

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Nowadays, the electric grid faces different requirements and challenges, in relation to the past. The deployment of renewable distributed generation has been leading to new challenges in the electric grid operation, due to the intermittent character of most renewable resources. At the same time, there are also new resources available for the grid management, such as energy storage technologies (including electric vehicles) with increasing efficiency and reliability, as well as decreasing costs. However, the main change is in the paradigm of the electric grid management, which is moving from an approach where the generation must always follow the load to a new approach where the load is also considered a manageable resource, which can be controlled to follow the available generation, using demand-side management and demand response programs.

To deal with such challenges and take advantage of the new resources, new monitoring, control, and communications technologies have been developed and deployed. The new developments in information and communications technology allow sharing the information in real-time, between all grid points. Smart meters have been deployed ensuring the exchange of information (for instance consumption and tariffs) between consumers and utilities. New low cost and user-friendly monitoring and control systems that provide appliance monitoring and control are already available.

Due to the fast technology evolution and adoption, smart grids are no longer just a future vision but are already a reality. A high number of implemented projects and pilots have been proving the impacts of smart grids which can ensure multiple benefits, not only to the utilities but also to the users and society, due to the increased reliability, lower operation costs, and lower environmental impacts. One of the most important impacts is the achieved savings on energy consumption and peak load. Smart grids can ensure energy savings due to the monitoring and remote control capabilities, which increases the users' awareness by providing information about consumption and costs, as well as provide to the users automated control over those loads. At the same time, such monitoring and control services can ensure the implementation of demand-side management and demand response programs to enhance such impacts and align it with the grid needs. Therefore, smart grids will have a major role to achieve energy efficiency goals in a cost-effective way.

The objective of the special issue "Smart Grids and Energy Efficiency" is to present the state-of-the-art the impact of smart grids on energy efficiency. The focus is on case studies with the implementation of smart grid technologies.

As an introduction to the topic, "The Role of Smart Grids to Foster Energy Efficiency" (Moura et al.) presents an overview on the main requirements and features of smart grids, on the work done and to be done, on the enabler technologies, as well as on the expected impacts and the main potential benefits it will bring.

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After this introduction paper, seven additional papers are included in this issue—two dealing with the residential sector, four addressing the tertiary/commercial sectors, and the final paper analyzing the overall impacts of smart grids.

"The Effects of Combining Dynamic Pricing, AC Load Control, and Real-Time Energy Feedback: SMUD'S 2011 Residential Summer Solutions Study" (Herter et al.) assesses the hourly load effects of three different real-time information treatments (no real-time data, real-time whole-house information, and real-time whole-house and appliance information) and two program options (dynamic time-of-use rate and a load control incentive program) for residential customers.

"Constructing Users in the Smart Grid—Insights from the Danish eFlex Project" (Nyborg and Røpke) reports on one smart grid project for residential customers in which consumer aspects have been central and in which the potential for flexible electricity consumption has been tested using home automation energy management systems and hourly pricing.

"Field Demonstration of Automated Demand Response for Both Winter and Summer Events in Large Buildings in the Pacific Northwest" (Piette et al.) summarizes the results of a series of field test of automated demand response systems in large buildings, with the objective to evaluate the use demand response automation technologies and control strategies that could change the electric load shape in both winter and summer conditions.

"Smart Grid as Advanced Technology Enabler of Demand Response" (Gellings and Samotyj) is focused on the smart grid functionalities which are going to facilitate the ever growing need for enhanced demand response and load control, evaluated in a new office building with the implementation of dynamic energy management technologies and strategies.

"Renewable Generation and Demand Response Integration in Micro-grids: Development of a New Energy Management and Control System" (Álvarez et al.) presents a new management and control system which uses demand response to control a micro-grid based on the use of renewable generation and demand resources, successfully implemented with a pilot in an university campus.

"Energy Saving in Existing Buildings by an Intelligent Use of Interoperable ICTs" (Osello et al.) reports a methodology aimed at exploiting ICT monitoring and control services to reduce energy usage and CO_2 footprint in existing buildings, based on commercial-off-the-shelf devices with case studies in public buildings.

"Potential Carbon Impacts of Smart Grid Development in Six European Countries" (Darby et al.) presents a methodology for estimating the potential impact of smart grids on carbon emissions, used to model the impact of smart grid functionalities by 2020 for six representative EU markets (Austria, France, Germany, Great Britain, Portugal, and Spain), using a detailed pan-European market model and a high-level ancillary services model.