Editorial

Sustainable Energy Consumption

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1. Introduction

The Special Issue "Sustainable Energy Consumption" includes 5 papers [1–5]. Energy sustainability is a key challenge for a developed and sustainable world. The use of renewable energy has significantly increased over the past few years, bringing new technical and business challenges to the energy sector.

Consumers are key players in this context, as demand flexibility is crucial to cope with the intermittency of most renewable energy sources, such as wind and sun. Demand active participation is particularly important to ensure the efficient use of the available energy at local and global level.

This Special Issue addresses the different perspectives of energy consumption and demand for ensuring energy sustainability, increased energy efficiency, and reasonable energy costs.

2. Published Papers Highlights

Energy consumption in homes and buildings represent an important part of the consumption of the electrical systems. Maintaining a comfortable level in the indoor environment, namely for heating, cooling, and ventilation, accounts for most of the energy spent in homes and buildings. Other needs for energy consumption in homes and buildings are lights, hot water, and diverse appliances and equipment (refrigerators, washing machines, stove, oven, microwave, TV, computers, etc). The paper of Sakuma & Nishi proposes a thermal performance assessment solution for residential housing [1]. This work is focused on the trends of smart home and house energy management systems. The proposed method enables the assessments of the existing conditions of residential housings. The proposed solution hardware involves a monitoring system of power meters for air conditioner, thermometers, and a bluetooth low energy beacon. The interaction with the proposed solution can be done through a smartphone application. Simulation and experimental data are combined and the analysis of estimation errors and accuracy are performed. The assessments on the experimental data show that the proposed method achieved the average transmission heat transfer coefficient value estimations using a low-cost system.

The huge amount of data we need to store, analyse and protect gave origin to Data Centres, buildings to house computer systems and associated equipment, with redundant and backup components and a infrastructure for power supply to feed computing and cooling devices. Thus, energy efficiency is a very important request for Data Centres, since the energy consumption of a Data Centre is sometimes equivalent to the total consumption of a small town. Besides, there is the need to consider the carbon footprint and the impact on the environment of Data Centres. Renewable energy solutions are being used in Data Centres to cope with these constraints. The paper of Li, Wang, Luo & Pan proposes a thermal-aware workload management method to maximize the utilization of renewable energy sources in Data Centres, considering the power consumption of computing and cooling systems [2]. The proposed method uses the concept of workload shifting, to schedule more delay-tolerant workloads and allocate resources in the Data Centre according to the availability of renewable energy supply and the variation of cooling temperature. Simulation experiments have been performed using the Cloudsim-plus platform and demonstrated that the proposed method could effectively reduce the consumption of brown energy and maximize the use of renewable energy.

Photovoltaic cells convert sun light in electricity. When grouped in a framework, photovoltaic cells constitute Photovoltaic (PV) or Solar Panels. The use of PV Panels is a good way to deal with renewable energy, allowing a distributed solution to produce “green” energy and reduce the carbon footprint and the impact on the environment. Usually placed in building roofs or in other places for a decentralised use, they can be mounted to create photovoltaic power stations as well, allowing the use of photovoltaic systems at the utility level. More recently, there is a trend to place these photovoltaic power stations floating on water, like on artificial lakes. Cao, MO Esangbedo, Bai & CO Esangbedo propose a multi-criteria decision-making approach for contractor selection for the installation of Solar Panel Energy Systems [3], presenting a case-study of a Floating Solar Panel Energy System installation. A combination of stepwise weight analysis ratio assessment with full consistent method weights used with grey relational analysis (GRA) corresponds to the new hybrid method proposed by authors, and the evaluation is based on distance from average solution methods. The used approach allows to increase the decision-makers’ confidence in awarding the installation of the solar panel energy system to the top-ranked contractor.

The importance of Renewable Energy Resources, such as Solar and Wind based, has impacted the generation, and modified the way Electricity is produced and distributed. Since the possibility of production is available in many places the Distributed Generation gained an increased importance. In this scenario new ways to operate in the Electricity marked have appeared, and entities like Virtual Power Players, a kind of aggregator in the coordination of small energy resources, started to make sense. Energy produced by photovoltaic panels or wind turbines vary according to the weather conditions, being much more unpredictable than traditional hydroelectrical and thermoelectrical generation. Thus, the patterns of energy consumption may adapt to the power system’s needs to benefit from price variations in electricity. Demand Response refers to an adaptation in the consumer’s energy consumption to to the needs from the supply side. Silva, Faria & Vale [4] propose a coordinated management of the small resources associated by means of a Virtual Power Player and the participation in the wholesale electricity market as an intermediary in the transactions with the independent system operator. With the communication of this aggregator with small resources, a better clustering approach to create resources’ clusters, and the use of a dynamic remuneration tariff, the authors propose a new classification phase to be joined to the

scheduling phase of energy consumption. In this way the Virtual Power Players will be enabled to operate more efficiently and fairly in the Electricity Market.

Energy performance contracting is defined as a mechanism for organising the energy efficiency financing. At the urban scale the Energy Service Company provides a set of services to obtain energy savings and remunerates consumers that achieve energy savings. This is usual with the public sector and is also emerging in commercial buildings and industrial plants. The goal of Zhang & Yuan is to identify future research trends on Energy Performance Contracting by means of an extensive analysis of 127 journal papers published from 2008 to 2018 [5]. Energy Performance Contracting focused on five main topics on the last decade. These five topics are: the implementation of Energy Performance Contracting projects, the mechanism and business models, the decision-making process, the Energy Service Companies in the projects', and the risk management in Energy Performance Contracting projects. The selection of target scholarly papers started with a set of 1743 papers from the web of science (WoS) in which Energy Performance Contracting topics are referred. Then, conference papers were not considered and the main focus on Energy Performance Contracting was searched, resulting in the 127 selected papers. Most of the analyzed papers have been published in the last 4 years. Eleven future directions for Energy Performance Contracting have been identified and discussed in the paper.

These 5 papers constitute a good and diverse overview of the Sustainable Energy Consumption research area and are of interest for all researchers in the field, namely for those motivated to propose new methods and technologies for the future years.

Conflicts of Interest: The authors declare no conflicts of interest.

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