GUEST EDITORIAL PREFACE

Special Issue on the Role of Information and Communications Technology in Developing Renewable Energy Processes and Systems

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The world is witnessing a tremendous growth in energy demand that is expected to climb 35% by 2030. This inflicts an enormous pressure on existing conventional energy resources, or fossil fuels (oil, gas and coal), which provide more than 80% of the energy consumed worldwide (REN21, 2013). The world reliance on fossil fuels presents many challenges, including: cost, environmental damage, and lack of sustainability. Currently, looking for sustainable energy is the key priority to address the world's energy, environmental and economic challenges.

One way to maintain energy sustainability is to rely on Renewable Energy (RE), which supplies an estimated 19% of energy consumed worldwide (REN21, 2013), and global demand for RE continued to rise. However, the available scientific, engineering, and technology capabilities are still short from providing cost-effective RE sources, and more extensive research is a necessity.

Information and Communications Technology (ICT) can play a vital role in exploring problems related to RE, such as cost-effectiveness, efficiency, control, monitoring, automation, intelligence, distribution, reliability, security, availability, and simulation. To achieve these objectives, ICT academicians, researchers, and professionals should engage with issues related to renewability and sustainability of energy.

RE sources and systems lifecycle can significantly benefit from the implementation of the latest development in the different fields of ICT. Particularly, ICT can be used to develop powerful computation and simulation applications, smart grids, and efficient resource management and economics for RE resources and systems. For example, Software Engineering methodologies and techniques can play a

big role in developing powerful RE software that is robust and traceable. They can be used to develop high performance applications simulating complicated RE systems, utilizing powerful computational techniques to solve the non-linear and multi-variables related problems, and provide accurate and low-cost solutions.

Smart grids have a significant impact on the propagation of RE systems, and it is necessary to explore the ICT fields necessary for the development of smart grids, such as: communications technologies; internetworking protocols; sensing, monitoring and measuring tools; smart meters; smart control; scheduling techniques; fault tolerance algorithms; security procedures and infrastructure; interoperability, scalability, availability, reliability, etc. Using ICT in developing effective smart systems could help reduce energy consumption in buildings (by 17%), transport and logistics (by 27%), and save 15% in total carbon emissions by 2020 (Renewable Energy Focus, 2010). In general, using ICT can improve energy efficiency in several ways, such as by:

- Developing intelligent and power conservation wireless communication networks.
- Developing low power consumption internetworking components.
- Monitoring and controlling energy used in, and produced by, buildings.
- Optimizing energy and reducing carbon footprint in the logistics industries, in particular transportation and storage requirements.
- Improving production efficiency control, energy distribution, and consumption through smart metering and smart grids. With smart meters in homes, consumers could reduce their energy consumption by as much as 10%.
- Helping consumers to understand better how much energy they consume, how much it costs, and how it varies during the day.

Other ICT fields (such as Computer Information Systems, Management Information Systems, Decision Support Systems, Database/Data Mining Systems, Data Visualization, Knowledge Discovery and Dissemination, Signal Processing, Operating Systems, etc.) can provide valuable support tools and applications enabling efficient and effective management of RE resources. These resources may include knowledge, human, financial resources.

In order to bridge the gap between academicians, researchers, professionals, and decision makers who are working in the areas of IT and RE to disseminate knowledge and interchange information for better future collaboration on developing more cost-effective, efficient, reliable, and automated RE processes and systems, the 1st International Conference on the Applications of Information Technology in Developing Renewable Energy Processes and Systems (IT-DREPS 2103), was held as step in this direction. This special issue of the *International Journal of Information Technology and Web Engineering* (IJITWE) includes extended versions of six of the papers presented at IT-DREPS 2013. These papers summarize the current trends and the roles that can be played by ICT in developing RE sources and systems.

The first paper by Vlasakoudi and Sanduk discusses the requirements and design of a small wind rotor for a small house in Guildford. The second paper by Al-Naima, Ali, and Abid presents the design of a reliable, accurate, and easy to install solar dual axis tracking system. The system utilizes the GPS and astronomical equations for fixing the time, date and location of the sun in terms of longitude and latitude. The third paper by Al-Sarayreh, Meridji, Fayyoumi, and Idwan proposed a novel approach to build a generic model of photovoltaic solar system using sound biometric techniques.

The fourth paper by Abu-Arqoub, Issa, Shubita, and Banna presents a demand-driven algorithm for sharing and distribution of photovoltaic power in a small local area grid. The fifth paper by Bouhafs and Merabti proposes communication architecture for power routing in the smart grid, which opens the road for the introduction of distributed energy resources into the electricity grid at large scale. The last paper by Omar, Mayyas, and Zhou discusses

the implementation of information technology tools; specifically, computerized knowledge based systems, in managing the energy flows, conversions, and expenditures within manufacturing environments; including renewable energy sources (namely, landfill gas). The developed tool also addresses the question "how energy-efficient are renewable energy sources" using a novel simulation platform based on hybrid scheme.

Finally, I would like to express my deep appreciation to the Editors-in-Chief of IJITWE for giving us this opportunity of publishing this special issue; and also I would like to thank the authors for their interest and co-operation throughout preparation of this special issue.

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Hussein Al-Bahadili received his B.Sc degree in Engineering from College of Engineering (University of Baghdad, Iraq) in 1986. He received his M.Sc and PhD degrees in Engineering from Queen Mary College (University of London, UK) in 1988 and 1991, respectively. His field of study was parallel computers. He is currently working as an Associate Professor at Petra University, Jordan. He is a visiting researcher at the Wireless Networks and Communications Centre (WNCC) at the University of Brunel, UK. He is also a visiting researcher at the School of Engineering, University of Surrey, UK. He has published many papers and book chapters in different fields of science and engineering in numerous leading scholarly and practitioner journals, books, and presented at leading world-level scholarly conferences. His research interests include parallel and distributed computing, wireless communications, computer networks, cryptography and network security, data compression, image processing, and artificial intelligence and expert systems.