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IFIP was founded in 1960 under the auspices of UNESCO, following the first World Computer Congress held in Paris the previous year. A federation for societies working in information processing, IFIP's aim is two-fold: to support information processing in the countries of its members and to encourage technology transfer to developing nations. As its mission statement clearly states:

> *IFIP is the global non-profit federation of societies of ICT professionals that aims at achieving a worldwide professional and socially responsible development and application of information and communication technologies.*

IFIP is a non-profit-making organization, run almost solely by 2500 volunteers. It operates through a number of technical committees and working groups, which organize events and publications. IFIP's events range from large international open conferences to working conferences and local seminars.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is generally smaller and occasionally by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is also rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

IFIP distinguishes three types of institutional membership: Country Representative Members, Members at Large, and Associate Members. The type of organization that can apply for membership is a wide variety and includes national or international societies of individual computer scientists/ICT professionals, associations or federations of such societies, government institutions/government related organizations, national or international research institutes or consortia, universities, academies of sciences, companies, national or international associations or federations of companies.

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Christian Derksen · Christoph Weber (Eds.)

Smart Energy Research

At the Crossroads of Engineering, Economics, and Computer Science

3rd and 4th IFIP TC 12 International Conferences
SmartER Europe 2016 and 2017
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Revised Selected Papers

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Preface

The transformation process of the European energy system faces major challenges. Information technologies and computer systems are perceived as a key enabler for future sustainable production and consumption patterns. Multiple issues are awaiting clarification – besides technical and economic solutions, social and political as well as organizational and juridical aspects have to be considered. In particular, the complex and manifold interdependencies between involved technologies, numerous and internationally inconsistent regulations, and the lack of convincing business cases require attention. Furthermore, the ongoing transformation of the energy sector warrants consideration of both long-term solutions and concepts with perceptible short- to mid-term benefits.

New solutions are needed to maintain or even increase the reliability and the security of energy supply in more decentralized systems. Additionally, newly designed energy markets should enable an efficient and transparent matching of supply and demand for energy and ancillary services in large-scale networks. This requires the handling and analysis of great amounts of data as well as advanced algorithms for forecasting, operation, and matching, especially for distributed generation and consumption. The resulting overall system is thus going to be significantly more complex and interlinked. Considering these conditions, decentralized and autonomous agents may enable a robust high-performance system operation. Yet, the interactions between the market level and the technical system operation have to be dealt with carefully.

Although significant efforts and investments have already been made for developing smart grids and smart markets, important research questions need to be answered before smart grids become a reality. Particularly, sector coupling and hybrid energy infrastructures, considering not only electricity but also other grid-based energy carriers like natural gas and heat, become increasingly important. Additional flexibility and additional complexity are gained when these networks interact in order to meet the requirements of a decentralized, diversified, secured, sustainable, and stable future energy supply.

Regardless of how the energy system is designed and operated in the future, it is obvious that a key enabler for a successful transformation of the energy supply will be a purposefully designed and used ICT infrastructure. However, new solutions will consolidate and represent the combined knowledge of different disciplines such as engineering, business management, and economics as well as computer science. These new solutions will contribute significantly to an efficient energy supply and to the economic success of the companies involved. The IT backbone for such solutions is likely to comprise distributed, collaborative, autonomous and intelligent software packages for simulation, monitoring, control, and optimization as well as appropriate data and business models, reporting systems, and perhaps also mobile solutions.

The SmartER-Europe Conference aims at providing an interdisciplinary forum for presenting and discussing recent advances and experiences in building and using new

IT-based solutions for smart grids and smart markets. For this, the conference provides a forum for different scientific disciplines. Furthermore, it enables an industrially relevant exchange of knowledge and experience.

Both, SmartER Europe 2016 and 2017 were held in conjunction with "E-world energy & water" in Essen (Germany), which is one of the leading trade fairs for energy markets and energy management. The quality and practical relevance of the scientific contributions presented here were underlined by the participation of and discussion with industry; practical presentations of industrial projects rounded off the SmartER Europe program. The articles in this book were invited and reviewed after being selected from the conference presentations.

The contributions reflect the versatility and the complexity of the transformation process in the energy sector. At the same time, they also show the great need for research that is required to achieve the high targets for a digitized and sustainable energy landscape.

Special thanks go to the organizers of E-world energy & water, who have made possible the exchange between industry and science. Further, we would also like to take this opportunity to thank the members of the Steering and Program Committee, who were able to improve the quality of the contributions through their valuable advice.

February 2016

Christian Derksen
Christoph Weber

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