Internet of Energy

ICT as a Key Technology for the Energy System of the Future

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Since the appearance of the special focus of "IT in the Utilities Industry" (WI 49) in the journal WIRTSCHAFTSINFORMATIK in autumn 2007, a dynamic development has taken place in the field.

The ongoing effects of liberalization and the accelerated development of renewable energies have driven sustainable market changes leading to a transformation of the industry.

In parallel, the research program E-Energy of the Federal German Government started in 2008. Within this framework, projects in six model regions applied novel concepts and conducted systematic empirical research with extensive field trials. The federal research program in the field of infrastructure and processes for electric mobility also played an important role in the research landscape of the recent years.

But the biggest driver was the political development of the recent months. In fall 2010, the German Federal Government presented its energy strategy. Renewable energy sources played a central role in the approach, but also the use of nuclear energy was laid down as a "bridge technology" for the next two decades. The nuclear disaster in Fukushima triggered a reassessment of the situation, and the amendment to the Atomic Energy Act sealed the decision for an accelerated phase out of nuclear energy. The Bundestag passed the act on 30 June 2011 with a large majority and concluded a discussion which in Germany had become part of the political debate over the last three decades. The related amendment to the Energy Industry Act on 28 July 2011 completed the political decision to change the energy system.

This transformation of the energy system includes a number of factors and parameters. Production, transportation, storage and consumption of energy can be distinguished on the side of the primary technologies. The overall system spans over different scales – from gigawatts in large power plants, high voltage grids and large consumers (such as aluminum plants) over megawatts in generation sites for municipalities and industrial plants down to the kilowatt scale in distribution grids, domestic cogeneration of heat and power, and photovoltaic systems. Consequently, a wide range of devices and infrastructures already exists.

Information and communication technologies have been used for decades to technically operate these systems, to control the equipment, to monitor the technical status and for automated or manual intervention in emergency situations. In addition to the technical IT, information systems have been set up to implement core business processes. They include asset management and maintenance applications for facilities and infrastructures as well as billing engines and systems that enable services rendered by the utility companies. With the changes in the energy system, the ICT stack must be reconsidered to meet the changing requirements of the future.

The open system integration of the energy landscape of tomorrow must be built on an adequate ICT infrastructure. In this context, the term "Internet of Energy" has been proposed. The metaphor states: just as the Internet joins together all computers based on a set of open standards and protocols, all components of the future energy system (producers, grids, storage, and consumers) can be connected on the basis of standardized open architectures. The well-known keyword "Smart Grid" refers to a similar context.

In fact, the mentioned amendment to the Energy Act from summer 2011 contains a number of aspects that have to do directly with this topic. Inter alia, the Energy Act provides a framework for the integration of switchable loads (§ 13 paragraph 4a EnWG-E), mentions secure, efficiency-oriented smart metering (§§ 21b-i EnWG-E) as well as variable tariffs and interruptible consumption devices (§ 40 V, § 14 aEnWG-E), and finally describes an energy information system among grid operators (§ 12 paragraph 4 EnWG-E). Although many of these topics still have to be operationalized and

brought into binding regulations, the Act states a clear direction. The transformation is no longer just the prospect of thought leaders, but has become manifest in a concrete and binding statute.

Given this background, the present issue is of immediate relevance. The contributions show how this transformation can be accompanied scientifically and supported technically. In the article "Methods to manage information sources for software product managers in the energy market", the authors González Vázquez, Sauer, and Appelrath present a reference model catalog for the energy industry, which may act as a support system for product managers to merge information from a broad range of sources. In the model, industry-specific requirements of customers, of the regulator and of the many technical standards are brought together.

The article "Integrated information supply for decision support in grid companies" by Felden and Buder develops a reference model to derive practical guidance for the strategic asset management and validates it through expert interviews. It is the model's aim to integrate the technical and business artifacts that are currently available in distributed data sources, and it intends to offer decision support in business intelligence systems.

The article by Flath, Nicolay, Conte, van Dinther, and Filipova-Neumann, "Cluster Analysis of Smart Metering Data – An Implementation in Practice", shows how new services and improved processes can be developed using data collected in smart metering. Data from temporal consumption behavior is treated with a cluster analysis in the business intelligence system and leads to a refined customer segmentation. The analysis is based on real data collected in a project with a local energy provider.

In the interview, Prof. Dr. Henning Kagermann, Chairman of acatech (the National Academy of Science and Engineering), explains his thoughts on "Smart grids – information and communication technology as a key factor in a future energy system". He also announces that acatech will recommend the creation of a "National Smart Grid Platform" similar to the "National Electric Mobility Platform". The proposal will be presented in early February 2012 in Berlin. According to Kagermann, the proactive coordination of stakeholders is a prerequisite to communicating with policy makers and achieving a well-aligned industrial and research policy.

We hope that this issue brings together solid research with practical topics of relevance and that it can contribute to the development of the matter, which is crucial not only for the energy industry, but also throughout the economy. We hope you enjoy reading it!