Editorial

Demanding decarbonisation and nuclear power phase-out objectives on an international and especially European basis (like the 20-20-20 aims) require concepts for a sustainable energy supply system. In this context, renewable energy has taken a prominent role in recent discussions. Due to its political effort and the concrete implementations and actions, Germany is the most apparent example. The German concept for a sustainable energy supply system is called the 'Energiewende'. This term was coined by the Federal Environment Ministry in Germany. Due to its positive sense – promising improved circumstances without blaming existing conditions – the term is said to be hardly translatable. Attempts include *energy turnaround* or *energy u-turn*. The 'Energiewende' describes a comprehensive sustainable energy supply system including the sectors electricity, heat and mobility – with electricity building the most important/largest part.

The German roadmap for increasing the share of renewable energy sources for electricity generation (RES-E) is laid down in the Erneuerbare Energien Gesetz (EEG) and schedules Germany to reach thresholds of 35% and 80% RES-E by 2020 and 2050, respectively. Realisation of these goals is based on three factors: the nuclear power phase-out, reduction of energy production from fossil fuels and development, and promotion of renewable energy.

In 2011, after the nuclear catastrophe in Fukushima, the lifetime expansion of German nuclear power plants was cancelled. Eight nuclear power plants had to stop their operations immediately and the remaining nine nuclear power plants are scheduled to be shut down until 2022. According to the Atomgesetz, the nuclear power phase-out will be completed by 2022. The use of fossil fuels for the production of electricity is not restricted by law but economically disadvantaged through the European Union Emission Trading System (EU ETS). Enacted in 2003, the EU ETS has already completed two trading periods, which helped to gain experience and to establish the necessary infrastructure. The third trading period started in 2013, although full auctioning was postponed and is still discussed. The ETS creates an additional cost factor for power plants using fossil fuels and diminishes its cost advantages in comparison to renewable energy. The EEG includes several rules for promoting renewable energies. First of all, grid operators are obliged to connect renewable energy power plants (costs of connection are born by the power plant operator) and to take the electricity produced there with priority. As a consequence, grid operators have to upgrade grids to the state of the art and to extend them if necessary – all costs incurred are born by the grid operator. Furthermore, the EEG schedules a fixed-price feed-in compensation for renewable energy independent of recent market prices for elec-

tricity. This German feed-in tariff model has been adopted by more than two thirds of EU member states by now.[1]

The Swiss Federal Council enacted an Energy Strategy 2050 aiming at a nuclear power phase-out in the medium term. All five existing nuclear power plants in Switzerland are allowed to operate until their specific lifetime expiration and will be shut down subsequently. No further lifetime expansion will be granted. To maintain Switzerland's high level of electricity supply security, the Energy Strategy 2050 focuses on increased energy efficiency, the expansion of hydropower and new renewable energy, and, where necessary, on fossil-fuel-based electricity production (combined heat and power plants, gas-fired combined cycle power plants) and imports.

The far-reaching restructuring of the European energy sector brings along severe challenges for power grids, with the management of unstable power flows, decentralised production and the connection of massive wind power production in the north with storage power plants in the south as a few examples. Consequently, the expansion of electricity grids without delay and investments in energy research are distinct aims in most countries. Moreover, with Directives 96/92/EC, 2003/54/EC and 2009/72/EC, the EU energy sector underwent severe regulatory reforms. The main purpose of these reforms was to liberalise the market, privatise state-owned monopolies, create competition and to improve firm efficiency and the quality of service.

Due to their importance across sectors and countries, sustainable energy supply concepts and especially the German 'Energiewende' have been the subject of intense and detailed research. In particular the spontaneous nuclear power phase-out raised massive concerns regarding the 'Energiewende'. Most often, increasing CO_2 emissions, power supply shortages and the potential need for Germany to become a net importer of electricity were mentioned and examined in research[2]. Most of these concerns could be answered by Germany's intense promotion of renewables and the resulting increase in respective installed capacities. The development of necessary feed-in tariffs and renewable surcharges are part of recent discussions in light of the affordability of energy.

This special issue provides articles on different challenges of the 'Energiewende' from an economic perspective starting from a more macro-orientated view. The first paper explains the main topic by analyzing energy relevant forecasts and policy targets. This is followed by a paper focusing on the decarbonisation objective. Two articles and a statement from the industry are dedicated to the pros and cons of capacity markets. Finally, challenges and opportunities are analysed from a business-model innovation standpoint.

The first paper, "Energy Reference Forecasts and Energy Policy Targets by Germany" by *Christian Lutz, Dietmar Lindenberger, Michael Schlesinger, and Christian Tode* summarizes and analyzes results from studies covering forecasts of probable energy industry development up to the year 2030 complemented by a trend scenario to the year 2050 considering the 'Energiewende'. The authors conclude – for the most parts – the goals for the German government's Energy Concept will not be achieved, unless additional measures are taken.

1 *Sühlsen/Hisschemöller* (2014): Lobbying the Energiewende. Assessing the effectiveness of strategies to promote the renewable energy business in Germany, in: Energy Policy, Vol. 69, p. 316-325.

2 See e.g. *Lechtenböhmer/Samadi* (2013): Blown by the wind. Replacing nuclear power in German electricity generation, in: Environmental science and policy, Vol. 25, p. 234-241.

The second paper, "The Impact of EU ETS Price Variations on Germany's Electricity Production Mix" by *Francisca Bremberger, Stephan Gasser, Thomas Kremser and Margarethe Rammerstorfer*, analyses the detailed effects of the EU ETS on the German electricity production mix and puts emphasis on the achievement of postulated renewable energy shares. The authors find that the ability of EUAs to influence the production mix starts at EUA price levels around €25-35/ton and that in order to reach Germany's future RES-E target shares, EUA price levels of €40 (2020) and €45 (2030) are sufficiently high enough.

The next article, "Risk Assessment of Investments in Energy-only and Capacity Markets" by *Christian Growitsch, Burkhard Pedell, and Lisa Schaupp,* addresses the pros and cons of capacity markets from an economic viewpoint. The government wants utilities to keep gas- and coal-fired plants open to ensure power supply when there is a lull in variable wind or solar energy. Subsidies have fuelled rapid expansion in renewable energy in Germany, hurting conventional power stations. Accordingly, utilities lose money and have called for the creation of a so-called "capacity market", which would involve the government raising funds to pay operators to keep such sites open. The German Economics Minister *Sigmar Gabriel* just recently announced a first round of energy reforms and signaled he would hold talks with utilities regarding a capacity market in the second half of 2014. However, there should be no "social welfare benefit" for old power stations ".[3]

The authors of the third paper identify two counterparties. The one side argues in favor of the performance of energy-only markets and the occurrence of sufficient price spikes. The other side states that to ensure security of supply the current market design has to be complemented by a capacity market which guarantees generation investments' long run profitability by compensating generating capacities through fixed payments, irrespective of whether capacity is used or not. Analyzing related research, economic theory and empirics have not yet finally provided answers on the necessity of a capacity mechanism. In order to provide a sound economic base for the consistent design of capacity markets, the paper outlines the economic theory of the missing money problem. The authors conduct a risk assessment of different market designs. They conclude that both market and regulatory risks are important issues of the discussion – and that capacity markets suffer from the risk of wrong design but can be a device for regulatory commitment and, thus, reduce regulatory risk for investors.

The example of Germany is prominent but bears the risk to distract from other important effects that should be considered in analyzing potential welfare effects and regulatory risk of capacity markets and mechanisms. *Urs Meister* in his paper on „Grenzüberschreitende Effekte von Kapazitätsmechanismen" highlights externalities for smaller economies stemming from neighboring markets. This is especially true for small-scale electricity markets with relatively high trading volumes such as Switzerland or Austria. *Meister* shows in his analysis that wholesale energy prices are factually heteronomous and therefore capacity mechanisms should not be implemented unilaterally. In any case it would be inefficient for the small market because the domestic consumer pays the costs of the mechanism without profiting from lower wholesale prices or the absence of price peaks. Vice versa, it seems to be difficult to ignore the implementation of capacity mechanisms in neighboring

3 …"ein "Hartz IV" für alte Kraftwerke werde es nicht geben…." (Verhandlungen über Kapazitätsmarkt noch dieses Jahr, in: Energate Messenger, available at http://www.energate-messenger.de/news/143627/Gabriel-Verhandlungen-%FCber-Kapazit%E4tsmarkt-noch-dieses-Jahr (last access May 27, 2014)).

markets. Consumers might profit from lower prices but investment incentives for domestic utilities are low so that regulatory action might be necessary to ensure the long-term security of supply. He concludes that only the coordination with the neighbors offers efficient solutions. Stand-alone-mechanisms would suffer from the administrative burden, the lack of liquidity and insufficient competition of the supply side.

The industry perspective – provided by the Verbund, an Austrian utility – sees capacity markets as "a measure of last resort". First the energy-only market should be reformed. At least, capacity mechanisms must follow certain principles such as European harmonization, technological neutrality, market orientation and decentralization.

Last but not least, there is another aspect of the 'Energiewende' that keeps both research and practice busy: how do these changes impact the development of business models? We now have a management or micro view on the impact of all those changes on the industry. The paper by *Wolfgang Marko,* "Small-scale, Big Impact – Utilities' New Business Models for 'Energiewende'", analyses the impact of the rising diffusion of renewable energy generation, particularly small-scale distributed renewable energy generation (DREG), on business-model innovation. This paper addresses the major challenges for utilities concerning the 'Energiewende' and presents five new utility business models for small-scale DREG focusing on optimized energy. Marko develops a generic approach for developing business models based on distributed, renewable energy technologies (business model morphology). In particular, utilities could extend their classic business model, activate their role as energy partners, get closer to the customer, and consequently encourage customer loyalty. Thus, the author suggests alternative approaches to providing customer benefit with services around the optimization of their individual energy system and DREG-plants.

This issue provides an amazing bundle of ideas how the 'Energiewende' affects economy and industry. We hope that the results and arguments will receive attention and enrich current discussions.

Sincerely yours Anne d'Arcy and Francisca Bremberger

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