Expanding the renewable energy portfolio: Fit for purpose, cost-effective, eco-friendly

The expansion of the renewable energy portfolio is a key component in the decarbonisation of the global energy system. Without a rapid transition to an electricity system based entirely on renewable energies, climate targets will not be reached. The renewables expansion has been a success story thus far; under no circumstances should it be allowed to stagnate.

According to figures from the Working Group on Renewable Energy Statistics (AGEE-Stat), ren*ewables* – solar, wind, etc. – reached approximately 40% of Germany's *gross electricity consumption* in 2018. Fossil fuels, by contrast, are becoming less significant.

More ambitious expansion targets needed

The Renewable Energy Sources Act (EEG), adopted in 2000 and amended several times since then, has been a key driver in increasing renewables-based generation capacity. The guaranteed payments and priority feed-in for green electricity have greatly facilitated forward planning of investment, while mass production has pushed down the costs of renewable energy systems. Today's state-of-the-art wind turbines and freestanding photovoltaic installations can produce electricity for just 5-8 cent/kWh.

Expansion targets, however, are lagging behind these real-world developments. The Renewable Energy Sources Act (EEG), as amended in 2016/2017, aims to increase the proportion of electricity generated from renewables in gross electricity consumption, with a target of 40-45% by 2025. In fact, this goal has already been reached. The Act also states that a 55-60% renewables share in the German energy mix is to be achieved by 2035. The 2018 coalition agreement sets the bar somewhat higher, with renewables to reach a 65% share in electricity consumption by 2030, but this target must be passed into law before it becomes mandatory.

In order to keep global warming well below 2°C, however, there is no option but to make the transition to 100% renewables-generated electricity. This will become an increasingly urgent necessity given that the mobility and heating sectors will be more reliant on electricity as a substitute for fossil fuels in future.

Good for the climate – but who covers the costs?

One criticism frequently levelled at renewable energies, particularly after the various reforms of the Renewable Energy Sources Act (EEG), is that they are too expensive and drive electricity prices sky-high. But is this a fair assessment? Granted, the renewable energy surcharge (EEG surcharge) introduced under the Act increased progressively until 2017. The surcharge covers the gap between the guaranteed payment for feeding in green power and the current market price and is passed on to customers via their electricity bills.

However, the sharp rise in the surcharge was mainly the result of the exemption granted to major consumers, notably industry, leaving domestic consumers and smaller businesses to pay it in full. Another point to bear in mind is that with the expansion of the renewable energy portfolio, electricity market prices have tumbled. The renewable energy surcharge, then, is certainly not an accurate indicator of the costs of transforming our energy system.

A projection of its future trajectory indicates that the surcharge will decrease as more green electricity is fed into the grid. The EEG Calculator developed by the Oeko-Institut for Agora Energiewende shows that even with a steep expansion pathway and an 83% renewables share in 2035, the surcharge would amount to just 3.2 cent/kWh.

As modern renewable energy installations are much cheaper to build and support payments for the older and more expensive systems are to be phased out from 2021, the expansion of the RE portfolio can be expedited at minimal additional cost.

EEG Calculator, developed by the Oeko-Institut (Agora Energiewende website)

Fossil fuels are no cheaper – quite the contrary

Another study by the Oeko-Institut for Agora Energiewende considers four different scenarios for the power system in 2050: two scenarios based on fossil fuels (one on coal and one on natural gas) and two scenarios for systems with a 95% renewables share, which differ in their deployment of storage technology.

The findings clearly show that a renewables-based electricity system is no more expensive than a fossil-based system as the costs associated with the latter depend heavily on future fuel and CO_2 prices. As these costs may be expected to rise, power systems with a 95% renewables share may in fact have lower costs than a fossil-based system in some cases.

Renewables-based power systems are also more stable as they are not exposed to fuel and CO_2 price volatility. And lastly, the expansion of the renewable energy portfolio is a highly efficient climate change mitigation tool: a power system with a 95% share of renewables reduces CO_2 emissions by 96% compared with 1990 levels at CO_2 abatement costs of about 50 euros/t.

Renewables versus fossil fuels – comparing the costs of electricity systems. An analysis for Agora Energiewende by the Oeko-Institut (2017)

Sufficient land is available for renewable energies …

Renewables-based power systems are decentralised systems. Power generation from fossil and nuclear fuels is concentrated at a small number of sites with potentially major impacts, whereas renewable electricity generation is much more widely distributed. A study prepared by the Oeko-

Institut and Prognos for WWF Germany considers land-use demand for a power system that is almost entirely renewables-based by 2050.

Based on two scenarios for German power system development, including a solar focus scenario (i.e. the substantial expansion of photovoltaics), the researchers looked at area demand and various land-use restrictions, taking into account nature and species conservation, distances to human settlements and potential for installation on buildings. It concludes that even from a conservative perspective renewable energies can be expanded in a way that is socially acceptable and compatible with nature.

… but grid infrastructure is still playing catch-up

In order to balance daily and seasonal fluctuations in power generation from renewables (particularly wind energy and photovoltaics), there is an increased demand for grid infrastructure and decentralised storage capacities, with both scenarios clearly demonstrating that large-scale grid expansion will be required. The researchers also look at various energy storage options, including the use of battery systems and the conversion of surplus green electricity into energy forms that are suitable for seasonal storage, such as hydrogen and methane (power-to-gas).

Study: Germany's Electric Future II. Regionalization of renewable power generation. By the Oeko-Institut and Prognos for WWF (2018)

The renewables expansion – what are the barriers?

On behalf of the European Commission, Oeko-Institut researchers analysed the expansion of renewable energies in the EU to 2016 in preparation for the Renewable Energy Package for 2020-2030. In addition to developing models for progress in deployment of renewable energy sources to 2020, the study includes an analysis of non-economic barriers and incentives for more rapid deployment of renewables.

Other barriers to renewables expansion are investigated in a current Oeko-Institut study for the German Environment Agency (UBA). Entitled "Instruments and measures to progress the additional RE expansion required from a climate change mitigation perspective", the researchers aim to identify key barriers, assess their potential impacts and develop viable solutions.

Study on Technical Assistance in Realisation of the 2016 Report on Renewable Energy, in preparation of the Renewable Energy Package for the Period 2020-2030 in the European Union, for the European Commission

Further information

(The EEG surcharge in 2018: more rapid expansion of renewable energies is possible at minimal additional cost. Press release with calculations by the Oeko-Institut (2017))

(How much does green electricity cost? Analysis of the EEG surcharge from 2010 to 2018. Final report for the Federal Ministry for Economic Affairs and Energy in the context of the Progress Report on the Renewable Energy Sources Act (2017))

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