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German Energy Transition

Targets, current status, chances and
challenges of an ambitious pathway

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With the 'Energiewende', the German term for the transformation of the national energy system, the German government pursues ambitious goals, primarily but not only to reflect the climate change challenge and to react to the risks associated with the use of nuclear power plants. After launching the energy concept in mid-2011, which describes the 'Energiewende' goals, Germany was perceived as an international pioneer in energy transition for many years and has been acknowledged for its braveness to combine ambitious greenhouse gas (GHG) mitigation targets with a phase out program for nuclear power plants. In this context, this article asks where Germany's energy transition currently stands, what is planned next and how far the set targets have been achieved or where more action is required to stick to this pathway.

Stony roads to energy transition

Over the last years, it became obvious that the intended transformation is a complex and challenging process, requiring so far unprecedented efforts. The challenges comprise technological aspects, but also infrastructure, economic, social, cultural, political and institutional obstacles. Moreover, the transformation process has to be implemented in a very dynamic system environment triggered amongst others by digitization and characterized by manifold uncertainties. As such, it might not be a surprise that implementation of the 'Energiewende' is not a smooth and straight forward-oriented process. One of its most important setbacks was the governmental confession that the intermediate GHG mitigation target for 2020 cannot be achieved. Until then, GHG emissions were supposed to be reduced by 40% in comparison to 1990. Most likely the country will end up with a reduction rate of only 32 or 33%. In other words, there is a strong need for improvement action to close the gap.

Various reasons are responsible why Germany will not be able to stick to the 2020 goal: First and foremost, lignite (brown coal) steadily contributes to the electricity generation mix. Since 1995, lignite-based electricity generation is more or less stable, although in the same time period the share of renewable energy in the electricity system rocketed from 5% to almost 40% at the end of 2018. Backed by comparable low CO₂-prices in the EU Emissions Trading System (ETS), Germany became a net-exporter of electricity over the last years, allowing a stable positioning of lignite in the market. Another important factor is that the energy efficiency goals set in the energy concept were not met, particularly in the transport sector - the only sector that has not been able to reduce associated GHG emissions since 1990.

Energiewende – Success stories to be proud of?

Besides all problems, there are many positive trends and success stories to talk about regarding the German 'Energiewende'. This is not only that two-fifth of the electricity produced in Germany in 2020 is based on renewables, but that this is the case without jeopardizing grid stability and security of energy (electricity) supply. Some indicators like the System Average Interruption Duration Index (SAIDI), describing the quality of the electricity system, are currently even better than 10-15 years before. Of course, this was not part of a self-dynamic process; it required substantial investments in the distribution and transport grid. Another success story is related to participation. The 'Energiewende' is not only a top-down driven process by the government, but also supported by a huge and powerful bottom-up movement. For example: more than 130 communities declared themselves as 100% renewable energy-communities and aim for achieving that goal already within the next one or two decades. As those communities are often located in rural areas and have preferable conditions, it is remarkable that also big cities like Munich, Frankfurt and Freiburg have announced quite ambitious goals. Munich aims to be the first city (in 2025) where public utility shifts to a completely renewable energy-based electricity system. Last but not least, the 'Energiewende' creates new jobs in the energy business sector, drives innovation and helps companies to set up promising export markets.

How to continue - A pathway to 2030

Having understood that the 2020 target is out of reach, the German government is now focusing on the goal for 2030. Until then, following a pathway that is compatible with the Paris Agreement, GHG emissions should be 55% lower than 1990. That roughly means doubling the mitigation target (compared to the current level), but in contrast to the time frame from 1990 until today, in half of the time. How is Germany trying to achieve that goal? Various measures will be necessary to do so: e.g. further increase of renewable energies in the supply system and at end-use level (e.g. buildings, industry), increasing the share of electricity in the final energy mix (via electric vehicles, heat pumps, electrode boilers: sector coupling), implementation offensive to improve insulation of buildings, boost attractiveness of public transport and improvement of infrastructure for bicycles and pedestrians.

Two specific measures are worth to be mentioned: firstly, a phase-out program for coal production and electricity generation in coal-fired power plants and secondly, the development and implementation of a climate protection law that is promised for 2019. For finding an appropriate way to phase out coal, a stakeholder commission called "Wealth, Structural Change and Employment" (or in short just the Coal Commission) was established by the government in mid of 2018, dedicated to cut a kind of Gordian Knot. Bringing together 31 stakeholders representing the broad spectrum of actors in the energy system, it was a big success that the commission presented a consensus proposal in an area that was characterised by intensive and controversial debates for decades after only half a year of discussion.

The commission fulfilled its mandate by squaring the circle and described a plan of how to phase out coal-fired electricity

Photo in printed edition available

generation without jeopardizing grid stability, with limited impacts on the electricity tariffs reflecting social concerns and competitiveness, providing ideas how to maintain economic viability of the coal regions via proactive structural change measures and securing a substantial contribution to GHG mitigation. Until 2038, coal power generation shall be terminated including the shutdown of about half of all coal power plants already until 2030. Even if a faster phase-out of coal use would be more favourable from a climate protection point of view, the consensus proposal made by the commission sets an important tone: coal exit starts now. However, in practice, the speed of the process among other things depends on how fast it is possible to get involved with alternatives, in particular expansion of renewable energies, improvement of energy efficiency and providing the necessary framework conditions for doing so (e.g. through extension of grid infrastructure, provision of energy storage options and load management).

On the political track

The German government is now in the process of turning the commission's proposals into specific political action. This does not only apply to the shutdown of power plants, but also and foremost to designing structural change in the regions of coal

extraction. In the first step an investment law for coal-mining regions will be passed by summer of 2019, which regulates in precise terms how assistance for structural change will be provided for the affected regions. Until 2038, 700 million EUR per year will be made available to the regions in order to finance individual projects for implementing structural change. In addition, other governmental funding regimes will enable the realisation of lighthouse projects, foster research initiatives as well as infrastructure measures affecting transport and digitization. These funds are intended to position the regions well for the future, to provide attractive conditions for the creation of new jobs and to curb structural change in a social way (just transition).

For 2019, the development and implementation of a climate protection law is on the agenda. With this law, the German government will underline its willingness to stick to the 2030 climate protection goal with more seriousness than the 2020 target lines. The law will form a legal basis for this ambition and will raise this topic to a higher political level. Taking the 2030 goals more serious also has an economic background. There is a significant difference between the target for 2020 and 2030, due to the fact that the EU imposes huge penalties if the

one for 2030, to which Germany committed itself, is not met. The climate protection law is supposed to build the ground for achieving the goals, especially if it provides reduction targets for each sector (i.e. for the transport and the building sector) as it was stipulated by the Federal Ministry for the Environment.

The discussion about sector specific targets leads back to the development of the climate protection plan in 2016. In this participatory discussion process, the government for the first time was able to break down the national goal. Even if depending on the not fully foreseeable future the exact differentiation of the sectoral targets can be argued about and a certain degree of flexibility will be necessary for shifting emissions rights between the sectors, they provide an important orientation mark for identification and specification of appropriate measures. According to the sector targets, particularly the transport sector, the only one that increased its emissions from 1990 until today, is now under pressure. For it, the climate protection plan proposes to reduce emissions by 40 to 42% until 2030 compared to the 1990 level. With only incremental improvements, this goal cannot be achieved; therefore, a tremendous change of direction will be required. These efforts will certainly be worthwhile, not only for climate protection, but also for improving urban air quality, for triggering a dynamic of innovation and ultimately for supporting the export economy. Worldwide demand on technologies and services for sustainable mobility will increase.

However, the reduction targets from the climate protection plan cannot be met without any additional political interventions. The crucial measures currently being discussed are the introduction of a CO2 tax or the integration of the transport and building sector into the Emissions Trading System (ETS). It is irrelevant in the first place, how an adequate CO2 pricing is achieved as both instruments have their (dis-)advantages. With the ETS for instance, there is on one hand a guarantee to achieve specific mitigation goals, but on the other hand due to the large heterogeneity of the sectors there exists a risk of price distortions for the energy-intensive sectors as the CO2-price is very much determined by the transport sector that has substantially higher CO2-reduction costs. In addition, past experience (such as the implementation of air traffic into the ETS) shows that it may take a long time until Europe-wide solutions can be implemented. In the case of CO2 taxation, the associated price signal is much more transparent, particularly if a clear path for a tax increase in the future is provided when implementing the new measure. However, determining a reasonable price associated to the intended mitigation goal is a substantial challenge, taking into account the various influencing factors and objectives.

By itself, the CO2 price charged is not decisive for its effect on climate protection. It depends on how the ingested funds are used. Reflecting social and economic concerns, it might be reasonable to return the additional income to the population (i.e. like in the Swiss model) and the companies concerned as well as to set aside some money for an innovation fund and the direct implementation of climate protection measures. The latter budget can help to ensure that energy costs (as the product of a specific price * consumption) do not rise despite the tax surcharge by promoting energy efficiency measures.

A transnational joint journey

Regardless of the outstanding position of the state, the implementation of the energy transition is a joint task of politics, business and society. It can only be successful if everyone is aware of his or her responsibilities. Although most societies are traditionally not fond when it comes to transformations, many are ready to be taken on the path forward and to participate in shaping it. But an explanation as well as a consistent and convincing narrative is needed for where the path is heading to and that it is worthwhile to endure until the goal is reached. This applies to climate protection in any case, because we do not have an alternative, we just have this one planet. To continue as before must be prohibited, because of unforeseen consequences and high probability that tremendous costs will be associated with a changing climate.

Without any doubt, Germany already gained a lot of experience on how to shape an energy transition process. Because of this, other countries can learn from successful elements as well as mistakes that have been made so far. In general, more international cooperation is needed, including experience exchange and mutual efforts for technology development, innovation dynamic and fostering market penetration of crucial technologies for climate protection. More intense cooperation between Korea and Germany should be part of this.

Photo in printed edition available

Lignite Power Plant at sunset with cloudy sky in Neurath, Germany

Photo in printed edition available

April 5, 2019: "Fridays for Future" protest in Frankfurt. Participants protesting against climate policy.

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