

Renewables or Coal?

11 Lessons on Germany's Changing Energy Mix

1. Europe's structural response to the gas crisis has been to focus on renewable energy, energy efficiency, and diversification of gas supply.
2. In this context, Germany has passed the largest package of measures to accelerate the energy transition to renewable energy and is working on additional legislation to further speed up this process and to promote energy efficiency.
3. In the power sector, additional unforeseen events – especially a nuclear power crisis in France - have exacerbated an extraordinary supply crisis.
4. In this emergency, coal will play a role as a short-term alternative to gas in the power sector.
5. Short-term plans for coal include the extension of the lifetime of existing plants for a few months coupled with higher operating hours.
6. The uptick in coal consumption has led to an emissions increase in the electricity sector in 2022 and Germany has missed its domestic climate targets. However, the structural challenges to meet the climate targets lie elsewhere, in the buildings and transport sector.
7. The German government remains committed to its goal to end the use of coal ideally by 2030.
8. The legal date for the end of lignite-based power production in Western Germany was recently moved forward to 2030 from 2038. While it is unclear to what extent this will lead to reduced emissions overall, it provides additional certainty that the age of coal is ending.
9. An anticipated exit from hard coal and from lignite in Eastern Germany is still under discussion.
10. Independent of these domestic legal exit dates, the recent changes to the European Emissions Trading Scheme and the rapid growth of renewables are likely to make coal uneconomical by 2030 in Germany.
11. Overall, the gas crisis is likely to lead to an accelerated energy transition, translating into higher climate ambition. It will be crucial to reduce fossil lock-in in order to avoid stranded asset risks.

Europe's structural response to the gas crisis has been to focus on renewable energy, energy efficiency, and diversification of gas supply.

The year 2022 marked a turning point for European energy policies as the negative impacts of the EU's dependency on Russian fossil fuels – especially gas – were heavily felt. Before, Russia supplied the EU with about 40 per cent of its fossil gas,¹ imported predominantly via Nord Stream I as the main network of gas pipelines running to Germany under the Baltic Sea. That pipeline network is no longer functional, the Russian government has reduced the flow of gas to Europe, and the EU has set itself the objective to stop importing Russian gas. Since the beginning of the conflict, the EU has successfully cut around 10 per cent of fossil gas demand in response to the invasion and in order to reduce dependency on Russian fossil fuels, with an overall reduction of 15 per cent being planned by March 2023.^{2,3}

¹ See Chestney (2022).

² See McWilliams et al. (2022).

³ See Enerdata (2022).

As a response to the energy crisis the European Commission proposed the RePowerEU Plan in May 2022 with its three main objectives of saving energy, accelerating the production of clean energy, and diversifying energy supplies.

1. To save energy, the plan proposes an updated target for energy efficiency, raised from 9 per cent to 13 per cent by 2030, compared to the projections of the 2020 Reference Scenario. Moreover, the Commission proposed a target to reduce overall electricity demand by 10 per cent, as well as an obligation for Member States to reduce demand during peak price hours by and additional 5 per cent.⁴
2. The plan foresees a rapid rollout for renewables, proposing to increase the 2030 target for renewables from 40 per cent to 45 per cent (from 1067 GW to 1236 GW), supported by a faster permitting process for renewable installations and the introduction of the EU Solar Energy Strategy, which intends to double installed solar capacity by 2025 from current levels. The strategy aims to bring more than 320 GW of solar PV online, newly installed by 2025, and almost 600 GW by 2030.⁵
3. Moreover, the EU has taken measures to diversify its gas supply and entered international cooperation with several countries to this end. Next to increasing supply, the EU has also introduced measures to reduce gas demand by adopting the European Gas Demand Reduction plan, including the switch from gas to alternative fuels, incentives for reducing gas consumption, and reducing heating and cooling, to support Member States in reducing their gas demand by 15 per cent.⁶

Germany has supported EU measures on gas reduction and aims to cut its gas consumption by 20 per cent between 1 August 2022 and 31 March 2023. In Germany, the reaction to the energy crisis has also translated into an enhanced focus on diversifying gas supplies, with plans to build a number of fixed onshore LNG terminals and five floating storage and regasification units,⁷ as well as pursuing contracts with additional suppliers. Some parts of the federal German government want support for the exploration of new gas fields abroad, but a number of ministries are trying to prevent this step.⁸ The situation has also led to postponing the deadline for nuclear phase-out by three-and-a-half months, and a temporary uptick in coal consumption.

Germany has passed the largest package of measures to accelerate the energy transition to renewable energy, and is developing further laws to speed up this process.

In spring of 2022, Germany announced its “Easter Package”, which included the most amendments to energy policies that Germany has seen in decades. The five laws⁹ that were amended in July 2022 all target the rapid expansion of renewable energies, ranging from an increase in renewable capacity expansion, faster permitting processes and grid expansion for an improved integration of renewable energies.¹⁰ The update of the country’s Renewable Energy Act (EEG), for example, included new targets for renewable energies. The share of wind, solar, and hydropower in electricity consumption is set to increase to at least 80 per cent by 2030. Due to the new level of priority allocated to renewable energies, the planning and permitting processes of installation projects will be accelerated. This is especially important to speed up the expansion of onshore wind energy, which had been negatively affected by bureaucratic delays in the

⁴ See European Commission (n.a.).

⁵ See European Commission (2022).

⁶ See European Commission (n.a.).

⁷ See Kyllmann (2022).

⁸ See Schauenberg (2022).

⁹ The Renewable Energy Act, the offshore Wind Act, the Onshore Wind Act, the federal Nature Conservation Act and the Energy Industry Act.

¹⁰ See Geres et al. (2022).

past.¹¹ Wind power provided the largest contribution to electricity generation in 2021 (2021: 114.6 bn kWh; 2020: 132.1 bn kWh), yet its installed capacity has been growing only slowly (2021: +1.632 MW; 2020: +1.227 MW).¹² In comparison to the slow expansion of installed wind power capacity, installed solar power capacity was expanded continuously: From 2016 to 2021, total installed capacity grew by 46 per cent from 40.700 MW to 59.400 MW.¹³ 2022 saw yet another increase in the rolling out of solar power, as net solar PV additions are estimated to have risen by 26 per cent, increasing the cumulative installed capacity to over 65 GW.¹⁴

In addition, targets for offshore wind have also increased significantly with the Offshore Wind Act and the Offshore Realisation Agreement: Offshore wind capacity will be expanded from the current 8 GW to 40 GW by 2035 and 70 GW by 2045 (previous target: 20 GW by 2030; 40 GW by 2040).¹⁵

In 2022, the share of renewables in German power consumption reached a new high, as renewables accounted for almost 46.9 per cent, an increase of 4.9 percentage points from 2021.¹⁶

While renewables are widely considered to have the highest priority in the debate about energy security, energy savings and efficiency have been somewhat less prominent but no less crucial. A study by E3G found that investments in building efficiency alone could help Germany to save more gas than would be imported via any of the planned LNG terminals, saving EUR 200bn of gas imports.¹⁷ Germany introduced clear measures tackling energy efficiency and savings on the demand-side by approving two energy conservation ordinances in August 2022.¹⁸ The ordinances include enhancing the energy efficiency in public, private, and corporate buildings, e.g. by optimising of heating systems, as well as energy savings in companies, for which companies with an annual energy consumption of 10 GWh or more are required to implement energy efficiency measures.¹⁹ Moreover, Germany is working on two ambitious energy efficiency laws. So far, concrete legal targets include a reduction of final energy consumption by 500 TWh by 2030. Starting in 2024, the federal government is required to reach final energy savings of 45 TWh per year, while the German states must save 5 TWh annually.²⁰

At the end of January, due to the described measures and relatively mild temperatures, gas storage facilities are still full, prices have come down, and the problem of a gas crunch seems unlikely for the current winter season. However, next winter may still be a challenge, as – contrary to the first part of 2022 – no gas from Russia will be imported, China might export less gas due to stronger domestic demand, and mild temperatures are not guaranteed.

¹¹ See Witsch (2022).

¹² See Amelang (2022).

¹³ See Umweltbundesamt (2022).

¹⁴ See Radowitz (2023).

¹⁵ See Amelang (2022).

¹⁶ See Reuters (2023).

¹⁷ See E3G (2022).

¹⁸ See Rossen (2022).

¹⁹ See BMWK (2022a).

²⁰ See Kersting et al. (2022).

The German Energy Transition

The German Energy Transition (Energiewende) aims at restructuring the German energy system towards renewable energy sources and away from the use of nuclear power by 2023, from coal ideally by 2030, and from oil and fossil gas by 2045. The transition began as early as 2000 with the introduction of the Renewable Energy Act (EEG). Since then, the EEG has been revised several times, including a move from set feed-in tariffs to auctions for renewables. Germany aims to cut all greenhouse gas (GHG) emissions by at least 65 per cent by 2030 compared to 1990 levels, by 88 per cent by 2040, and to achieve GHG neutrality by 2045. Until recently, gas was regarded as a “transition” fuel in the context of the Energy Transition, whereas coal and nuclear were being phased out. Consequently, Germany has shifted away from coal and nuclear energy over the past decade and turned towards renewables - and gas (Myllyvirta 2022).

The German coal phase-out was legally adopted in July 2020 and has been complemented by an Act on Structural Change in Coal Mining Areas to support structural changes in coal-producing regions, as well as plans to boost the expansion of renewable energy, especially wind and solar. The first coal-fired power plants were shut down in 2020 (BMUV n.a.).

In the power sector, additional unforeseen events – especially a nuclear power crisis in France - have exacerbated an extraordinary supply crisis.

Along with the high energy prices as a result of Russia’s invasion of Ukraine, several other factors aggravated the energy crisis. France experienced a power crisis due to the weak nuclear output during much of 2022. By November, a record number of 26 out of 56 reactors was shut down. Moreover, the effects of the exceptional summer drought throughout the EU, which hampered hydropower generation in the South, put additional stress on the EU’s electricity systems.

In this emergency, coal will play a role as a short-term alternative to gas in the power sector.

A particularly effective measure to reduce the total amount of gas consumed lies in curbing its use in electricity generation. However, while investment in renewable energies has been ramped up in Germany and across all of the EU, renewable energy capacities are not yet sufficient to cover for the current supply shortages in gas. It is now widely seen as a mistake that previous governments slowed down the expansion of renewable energy. While Germany used to be a pioneer in solar and wind power, changes to the Renewable Energy Sources Act, which resulted in reduced feed-in tariffs and fewer financial incentives for the industry, as well as additional regulations led to a slowdown in the expansion of installed solar power. More recent obstacles were a lack of skilled technicians and backlogs in the supply chain.²¹ In the case of onshore wind, long permitting procedures, minimum distances, local protests, and ideological blockages in some German states like Bavaria have hampered the expansion of wind infrastructure.²² Another problem is the transmission infrastructure that has not been developed fast enough in the past because of opposition from local municipalities in expanding an electricity line connecting the northern and southern grids. A majority of wind energy generation takes place in northern Germany while southern Germany is responsible for an outsize share of the country’s total electricity demand.²³ Furthermore, Germany has had

²¹ See Rooks (2022).

²² See Witsch (2022).

²³ See Power Technology (2022).

to export large amount of electricity to France in 2022, where a large number of nuclear power stations were unable to run consistently

Because of these shortcomings, coal-fired power plants have been chosen to substitute for fossil gas in the short term and serve as an emergency alternative to gas in the power sector.²⁴

Short-term plans for coal include the extension of the lifetime of existing plants for a few months or years coupled with higher operating hours.

Not only Germany, but several other EU Member States, such as Austria, France, and the Netherlands, have decided to extend the operation time of their coal-fired power plants, reopened them, or raised caps on operating hours.²⁵ In Germany, the parliament passed the Substitute Power Plant Standby Act (EKBG) in July, which intends to secure energy supply and flexibility for the energy market during the energy crisis. In line with the EKBG, coal-fired power plants will be upgraded in order for them to re-enter production for the energy market at any time but only as a back-up option. The same goes for power plants that initially were supposed to be shut down in either 2022 or 2023, as well as for plants that have - until now - only served as grid reserves, or security reserves, the latter of which are supposed to restart only in extreme emergencies.²⁶ For hard coal-fired power plants, the temporary comeback will apply until the end of March 2024 at the latest. For lignite, it will end even earlier on 30 June 2023.²⁷

The uptick in coal consumption has led to higher emissions in 2022, but the structural challenges for Germany to meet its climate targets lie elsewhere, in the buildings and transport sector.

Calculations by Agora Energiewende show that the reduction in CO₂ emissions required for achieving the German climate targets did not materialise in 2022 as Germany's GHG emissions stagnated at around 761 million tons of CO₂, missing the target of 756 million tons of CO₂. Emission reductions in 2022 compared to the reference year 1990 were only 39 per cent and, thereby, for the second time, lagging behind the 2020 climate target of 40 per cent. Although energy consumption fell to the lowest level measured since the country's reunification in 1990, the increased use of coal and oil nullified the emission reductions that were achieved through energy savings and lowered gas consumption. However, the use of coal in the power generation process was not the problem behind the failure to meet the climate targets, as the emission targets of the power sector were met. Rather, the transport and building sectors failed to meet their targets as the necessary structural changes for deep emissions reductions in those sectors have been delayed for years.²⁸

At the EU level, a study by Ember found that the short-term uptick in coal use will not have negative impacts on EU climate ambitions in the long term. Even if all the coal-fired power plants that are now on reserve across the EU were to operate at 65 per cent of their capacity,²⁹ emissions in 2023 would increase by 30 MtCO₂, equalling 1.3 per cent of the EU's total CO₂ emissions in 2021 and 4 per cent of its annual emissions in the power sector.³⁰

The German government remains committed to its goal to end the use of coal ideally by 2030.

According to the German government, the increased coal use is only seen as a last resort and short-term back up to secure energy supply.³¹ Germany will not add any new coal capacity, and the government

²⁴ See Appunn (2022).

²⁵ See IEA (2022).

²⁶ See Bundesregierung (2022a).

²⁷ See Witsch et al. (2022).

²⁸ See Agora Energiewende (2023).

²⁹ Note that this is the worst-case scenario capacity, in 2021 the average capacity factors for EU power plants were 36% for hard coal and 57% for lignite.

³⁰ See Brown (2022).

³¹ Bundesregierung (2022c).

remains committed to phasing out coal ideally by 2030 and by 2038 at the latest, as mandated by German law.

The legal date for the end of lignite-based power production in Western Germany was recently moved forward to 2030 from 2038. While it is unclear to what extent this will lead to reduced emissions overall, it provides additional certainty that the age of coal is ending.

That Germany remains set on its plans to end coal use and accelerate its energy transition can be seen in the case of Western Germany, where the legal date for the coal exit has been accelerated. In the federal state of North Rhine-Westphalia (NRW), the end date for lignite in the Rhenish mining area has been moved forward by eight years to 2030. Two power plants that were meant to be shut down by the end of 2022 will remain connected to the grid until 31 March 2024, and all other lignite-fired power plants of RWE³² will retire by 2030. The implementation of this understanding between the BMWK, the Ministry of Economic Affairs, Industry, Climate Action and Energy of the State of NRW and RWE was anchored in law by adapting the Coal-fired Power Generation Termination Act. The government estimates that 280 million tons of coal are to remain in the ground as a result, saving up to 280 million tons of CO₂ that could have been emitted with a later phase-out in 2038.³³ However, in a scenario modelled by Aurora Energy Research, which is based on the assumption that generating electricity from lignite would be unprofitable after 2030 - mainly due to the gradual normalisation of gas prices and rising prices in European emissions trading - the early phase-out of coal in the Rhenish mining area in 2030 would not have any meaningful emission-reducing effect.³⁴ While it remains thus unclear to what extent this arrangement will reduce overall emissions, it highlights that the age of coal is ending in Germany.

Coal use in response to the crisis: Lützerath

Part of the compromise to re-activate two lignite power plants but move the date for coal phase-out forward by RWE has been the decision to destroy the German hamlet Lützerath. In some circles, its fate has taken on a symbolic significance, purportedly indicating whether Germany will act in keeping with the Paris agreement and the 1.5° goal. The hamlet consists of only a few houses and many of its previous residents have long sold their property and moved elsewhere. The ground now belongs to the energy company RWE, and clearing and demolition work started in 2020. Climate activists did occupy the site for about two years until January 2022 to prevent Lützerath's destruction but without success.

An anticipated exit from hard coal and from lignite in Eastern Germany is still under discussion.

Discussions about aiming for an earlier lignite exit in Eastern Germany are ongoing, but are more complicated due to stronger objections from local politicians.³⁵ In January 2023, Germany's Federal Minister for Economic Affairs and Climate Action, Robert Habeck, called on states in the east of the country to follow the agreement between NRW and RWE and move their respective coal exit to 2030 as well, warning that after 2030 coal-fired power generation in Germany will no longer be economically viable.³⁶

While a timely exit from lignite is the bigger challenge, Germany also has remaining hard coal-fired power plants that fully run on imported coal. They will be phased out through a combination of two approaches: Until June 2023, power plant operators can participate in several rounds of auctions to receive a payment from the state to close down their plants by 2026 at the latest. For the remaining plants, a phase out

³² RWE is a multinational energy company headquartered in Germany.

³³ See BMWK (2022b).

³⁴ See Aurora (2022).

³⁵ See Wehrmann (2022).

³⁶ See von Riegen (2023).

schedule will be set by the regulator, following a pathway defined by law. The end date of that pathway is also 2038 at the latest and would have to be brought forward for a complete coal exit by 2030.

The recent changes to the European Emissions Trading Scheme and the rapid growth of renewables are likely to make coal uneconomical by 2030 in Germany.

Overall, the German government has emphasised that emissions will only increase in the short term. In the long term, overall emissions will not surpass any planned targets because the cap on emissions from the power sector under the European Emissions Trading System (ETS) remains unchanged.³⁷ With the recent deal on the European ETS from December 2022 that increases emission reduction targets to 62 per cent (from the current 43 per cent), the European coal phase-out could even be accelerated and take place before 2030, as coal usage becomes more and more unprofitable.³⁸

Overall, the gas crisis is likely to lead to an accelerated energy transition, translating into higher climate ambition. It will be crucial to reduce fossil lock-in in order to avoid stranded asset risks.

There are no relevant political voices that demand a lowering of German - or European - climate targets.³⁹ If anything, ambitions seem to target an even faster transition towards clean energy, now that the problems of a fossil fuel-based energy system dependent on imports have manifested themselves as clearly as they have since the beginning of the war. The German coal exit is unquestioned and likely to be accelerated. The largest risk in the current changes to the German energy mix lies in the potential lock-in of new fossil fuel infrastructure related to LNG imports. Oversized LNG project could quickly turn into stranded assets as renewables expand rapidly, the carbon price increases and the political support for climate neutrality by 2045 in Germany and 2050 in Europe remains very high.

³⁷ See Bundesregierung (2022b).

³⁸ See Wettengel (2022).

³⁹ See Brown (2022).

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