Fundamental Power

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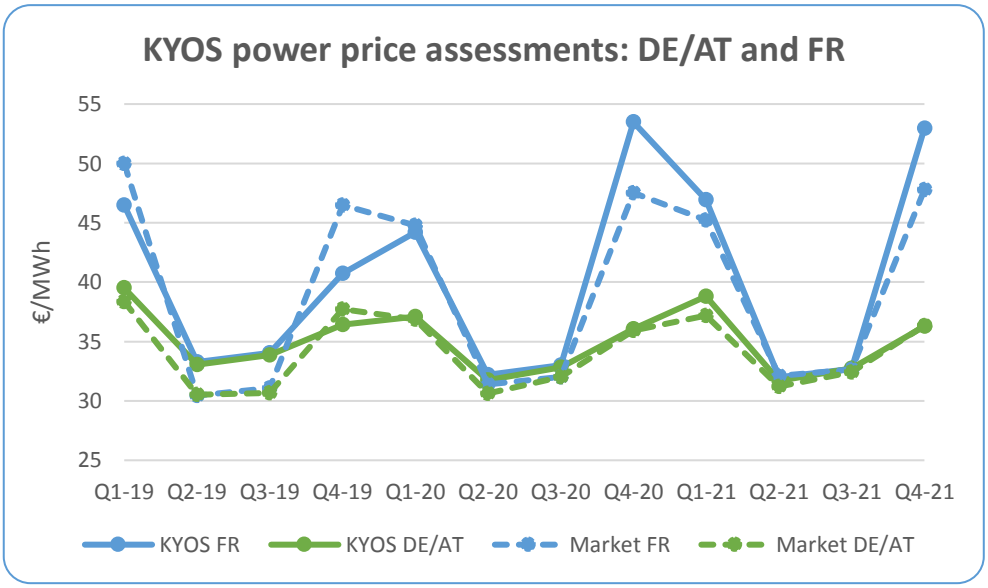
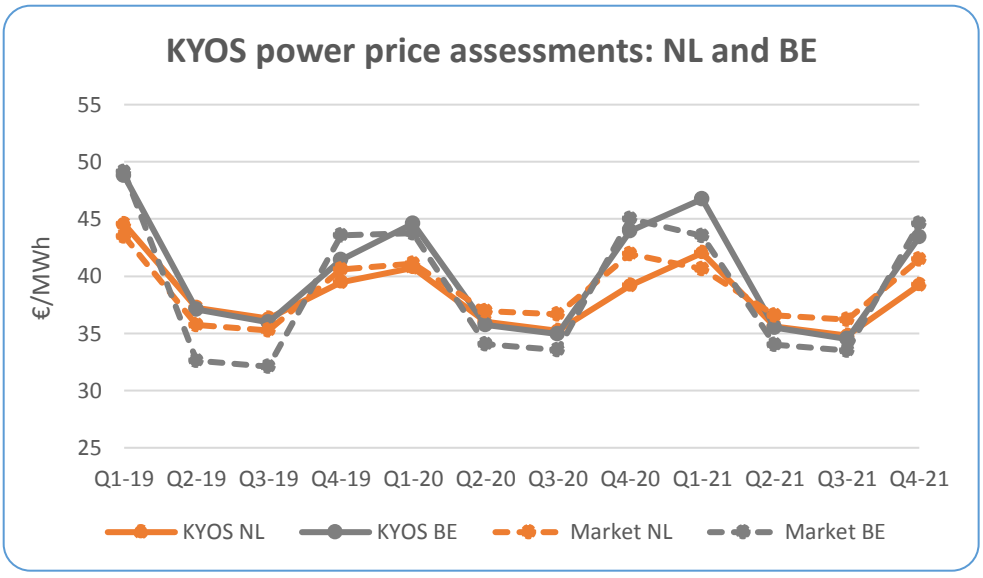
KYOS Fundamental Power Market Analysis

Power price assessments:





Remarks:

The trading date of the analysis is 20 March 2018. End-of-day closing prices from the relevant exchanges were used for all market prices. The KYOS power price assessments have been calculated with the fundamental power market model, KyPF.

This model allows for a very detailed hourly optimization of all individual power plants in the market, including gas, coal, lignite, nuclear and hydro power stations. The true flexibility of the assets is captured, optimizing between minimum and maximum load, using efficiency curves, and taking into account start costs.

This leads to a realistic behavior of the individual power plants, very close to real market behavior. The model also optimizes the interconnection flows between the countries.

KyPowerFundamentals (KyPF)

With KyPF you can create hourly power price forecasts and analyze a range of scenarios. It is provided with relevant data sets and integrated in our web-based Analytical Platform for ease of use. Let these forecasts assess the impact of policy changes, assist you with strategic investment decisions your trading activities. KyPF has the unique feature of integrating Monte Carlo simulations into fundamental power market modelling. This provides a much broader perspective on potential future developments than in the traditional deterministic fundamental market models.

For more information about the analysis, please contact us on info@kyos.com.

KYOS

Case Study: Germany – Coal Phase-Out

A new coalition government

The coalition between Germany's Social Democratic party (SPD) and the Christian Democrats (CDU/CSU), will face major challenges in energy policies. One of the fiercely debated political issues is the path towards decarbonization. Closing down coal plants will certainly be featured on the agenda, but don't hold your breath on when these will happen.

The new government's climate policy agenda is ambitious, but will it be enough to meet the emissions reductions targets? For 2020 a target of 40% reduction is set, and it is uncertain if Germany will meet this figure. By 2030, binding targets of 55% reduction must be met (with 1990 as baseline, over all sectors).

Emission reduction initiatives

To achieve this, we know the government plans to invest heavily in renewable energy with its program *Energiewende (energy transition)*. By 2020 at least 4 GW of new solar PV and 4 GW of on- and offshore wind parks will be realized. Another measure is phasing-out nuclear capacity by 2022.

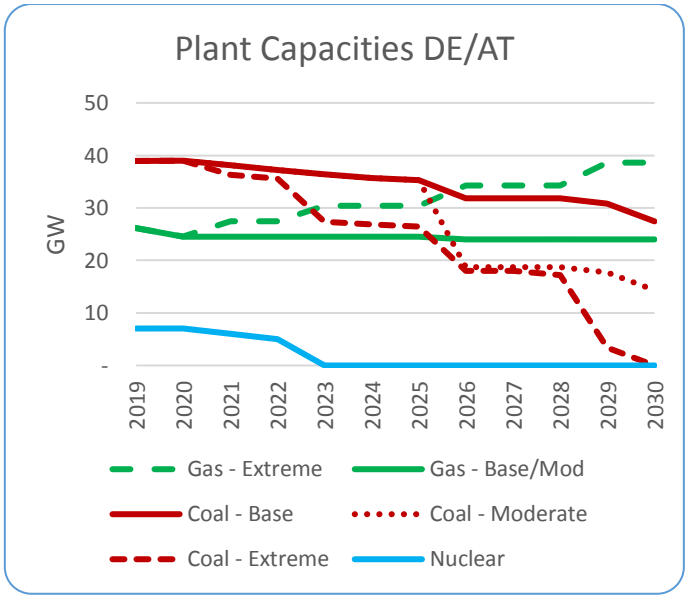
However, more drastic actions are called for - the climate targets cannot be met without some phase-out of coal. One working paper from the CSU-Bavarian party suggested a shutdown of 12 of the oldest coal plants by 2020. Earlier this year, the German minister for the Environment, Barbara said that "we have to organise a way out of coal", but so far, no fixed date has been set to start decommissioning Germany's coal assets.

How to avoid black-outs from a coal phase-out?

Keeping those renewable targets in mind, leave these unanswered coal questions to the KYOS fundamental model, KyPF. With the model we can analyse a set of scenarios to help better understand what different pathways to coal (including lignite) shutdowns will do to emissions, production patterns, and the power price. Note that the forced closure of coal (and lignite) plants can be an alternative or coincide with measures to support carbon emission price levels, a topic we analysed in our previous report.

Base
In this report the Base scenario moderately shuts down older coal plants for general economic reasons. This reduces the combined German (including Austrian) coal and lignite capacities from around 39 GW in 2019 to 35.5 GW in 2025 and then to 27.5 GW in 2030. At the same time, in all scenarios the German nuclear plants will all be closed by the end of 2022.

Moderate
The Moderate scenario assumes 17 GW of German coal shutdowns in 2025, and then some more gradual closures until 2030, leaving around 14 GW in the market.



Extreme
In the Extreme scenario, the coal closures start earlier and gradually lead to a total coal phase-out by the end of 2030. In combination with the nuclear phase-out, this would lead to many black-outs in Germany. Therefore, we believe this Extreme scenario can only happen with a (maybe short-term) revival of natural gas fired plants. They are not only needed for short-term balancing, but also needed to avoid longer periods of supply shortages, especially in winter. Whereas the Base and Moderate scenarios have just below 25 GW of gas-fired plants, in the Extreme scenario this gradually increases to almost 39 GW. Part of the capacity additions may be de-mothballed plants, but also new builds are needed. For example, gas engines can be operational relatively quickly, and may even have a second life if they are no longer economical in Germany after 2035 or so. Of course, other scenarios which fill the supply gap are imaginable too, e.g. with a bigger role for biomass or energy storage, but we believe the gas revival is quite probable.

Coal phase-out leads to gas revival

The 3 different scenarios have different impacts on the cross-border flows. In particular, when the (cheap) coal and lignite are phased-out, it is more likely that Germany becomes a net importer of power, especially from France in the summer, and from other countries in the winter. Therefore, the market analysis is performed for Germany (including Austria) in combination with France, Belgium and the Netherlands. France and the Netherlands have some coal plants too, some of them very new, and we assume that they keep operating at least until 2030. The same holds for the nuclear plants in Belgium and France, to which we assume no major capacity reductions. Even though in Belgium the government's ambition is to close all nuclear (producing half of the country's electricity) by 2025, our analysis shows that this is not realistic without a major investment in other forms of generation and higher emission levels, or large-scale black-outs.

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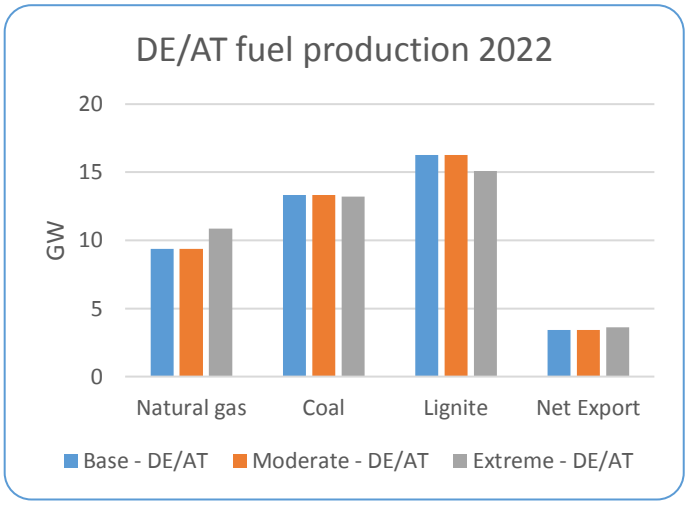

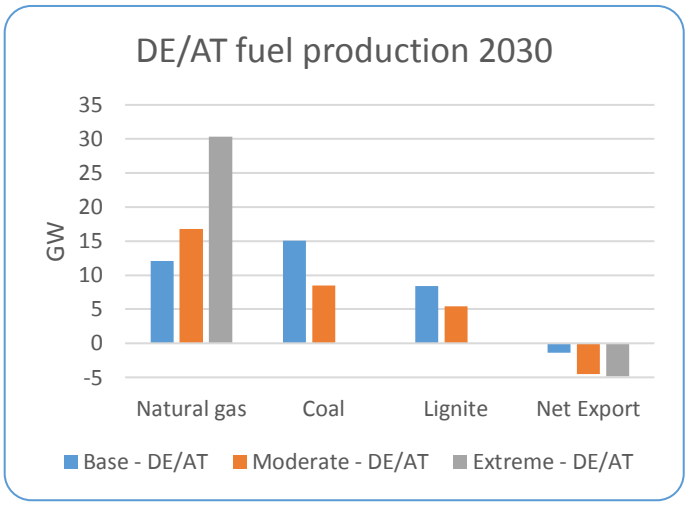

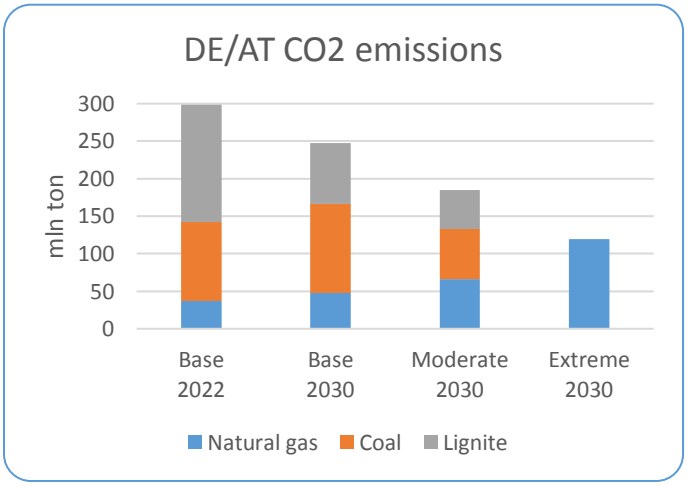

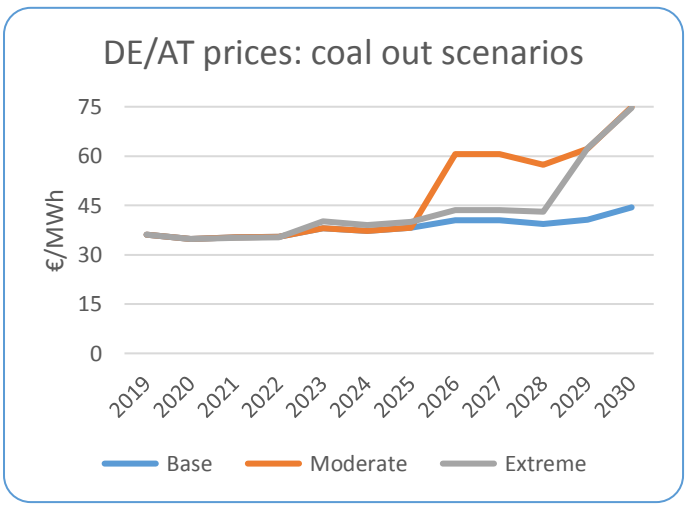

Coal phase-out reduces emissions drastically

Up to about 2022 the differences between the scenarios are rather small, but in 2030 the differences manifest themselves in the production mixes, emission levels and market prices.

Comparing 2030 with 2022, in the Extreme scenario the coal and lignite fired power production drops from an average 28 GW to zero. This is compensated by about 20 GW extra gas fired production and a switch from 3 GW export to 5 GW import. In the Moderate scenario, the average coal and lignite fired production stays at about 50% of what it was in 2022, at an average output level of 14 GW. To absorb this loss, just as in the Extreme scenario, the market has to make a considerable U-turn as well, leading to 9 GW more gas-fired production and a similar switch from export to import.

Our analysis shows that the Moderate scenario seems still feasible without any significant capacity additions of gas-fired generation, even though the supply-demand balance is extremely tight and could lead to supply shortages in individual hours.

Natural gas plants have much lower carbon emission levels than coal- and lignite plants. In the Base scenario, from an original level of almost 300 million ton the carbon emissions between 2022 and 2030 drop by ‘just’ about 51 million ton. In the Moderate scenario, this doubles to 112 million ton, and in the Extreme scenario more than triples to 179 million ton annually.

The reduction in emissions does not come for free: it will raise power prices. In the Moderate and Extreme scenarios, in 2030 they reach 75 €/MWh, i.e. 30 €/MWh above the Base scenario. Because the Moderate scenario assumes no new investments in gas-fired generation, we see a more extreme impact on prices in 2026-2028. This also shows more generally how vulnerable power prices can be to a tight supply-demand balance. Tightening that balance further, can easily lead to power prices rising further.

Decarbonization comes at a cost

Adhering to the Paris Agreement is a challenge for Germany. The investments in renewable energy sources are likely not enough to reach the set targets. A reduction in coal-fired generation is needed too.

We have analysed two different scenarios of coal phase-out, an Extreme scenario requiring significant new gas fired plants, and a Moderate scenario where this is not needed. The good news is that a coal phase-out will significantly contribute to the decarbonization of the electricity sector. The bad news is that it comes at a price… It seems inevitable that German citizens and industries will have to pay more for their power consumption. How much more the energy bill will rise is very susceptible to the speed of coal plant closures and the scale by which potentially new or de-mothballed gas-fired plants compensate the reduction in supply.

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