HOW CAN GERMANY AVOID THE NEXT ENERGY CRISIS? IMPACT OF AN IMPORT BAN OF RUSSIAN ENERGY SOURCES ON CLIMATE PROTECTION GOALS IN GERMANY

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Overview

Russia is the main supplier for Germany's fossil fuel needs, with more than 50% of its primary energy consumption (Figure 1). Recent events showed, however, that this addiction led to explosive energy prices, which will at one point, the least, lead to an energy crisis. A ban on the import of Russian energy sources to Germany is currently the subject of increasing discussion. We want to support the discussion by showing how the electricity system in Germany can manage in the short term with low energy imports and what measures are necessary to still meet the climate protection goals. In this paper, we examine the impact of a complete stop of Russian fossil fuel imports on the electricity sector in Germany, and how this will affect the climate coals of an earlier coal phase-out and climate neutrality by 2045.

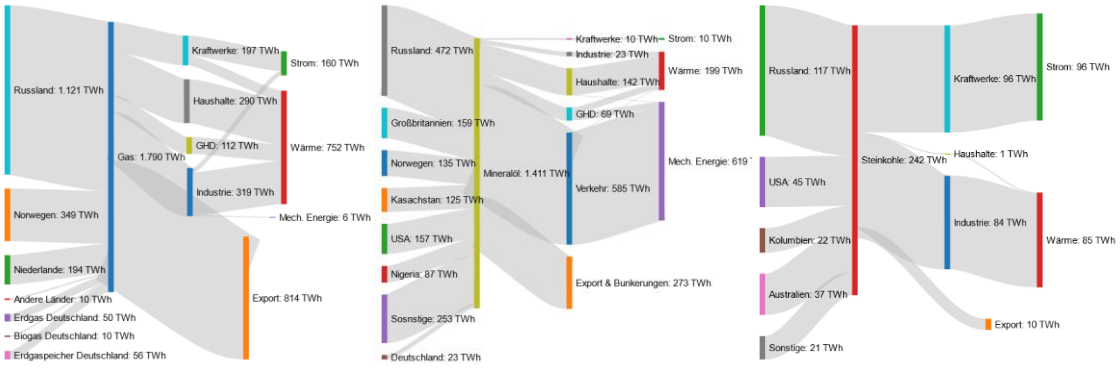

Figure 1: Imports and exports of the energy sources natural gas, mineral oil and hard coal in 2020; the unit TWh indicates the energy content of the respective energy sources.

Methods

Four scenarios are studied. The main idea is to asses the phase-out of coal from the electricity sector while addressing the current energy crisis by comparing the previous 2037 phase-out with the newly 2030 coal phase-out. The assumption that fuel imports from Russia are stopped at the end of 2022 is applied to all scenarios. As the imports and exports of the energy sources show (Figure 1), an import stop will, by default, mean that the fossil fuel demand in at least one of the demand sectors have to be reduced. We want to investigate how the electricity sector ("power sector") can compensate for a sudden abandonment of energy source imports from Russia (cf. Figure 2). With a priority given to heat supply, both oil and gas will be unavailable in the electricity sector in 2023, and only 50% hard coal will be available with reference to 2020 values. After the establishment of new contacts for energy imports with other suppliers, it is assumed that hard coal and oil will have increasing availability again after 2 years. LNG terminals need to be built to import natural gas. Here it is assumed that after 5 years the availability of natural gas will also increase.

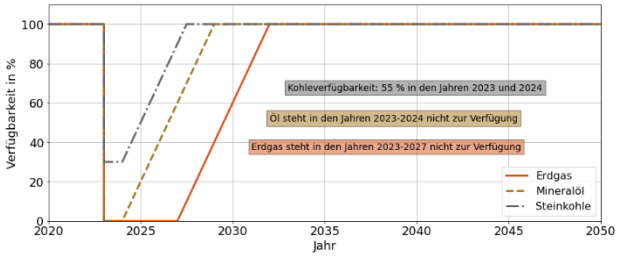

Figure 2: Availability of the energy sources hard coal, oil and gas in Germany's electricity system.

Two different cost assumptions will be followed. In the price shock assumption, fuel costs for natural gas and mineral oil rise sharply in 2022. Thereafter, fuel prices continue to rise moderately. Fuel costs in the price wave assumption will rise sharply in 2022, then fall again in 2028 and follow the original price path of 2020 and 2021.

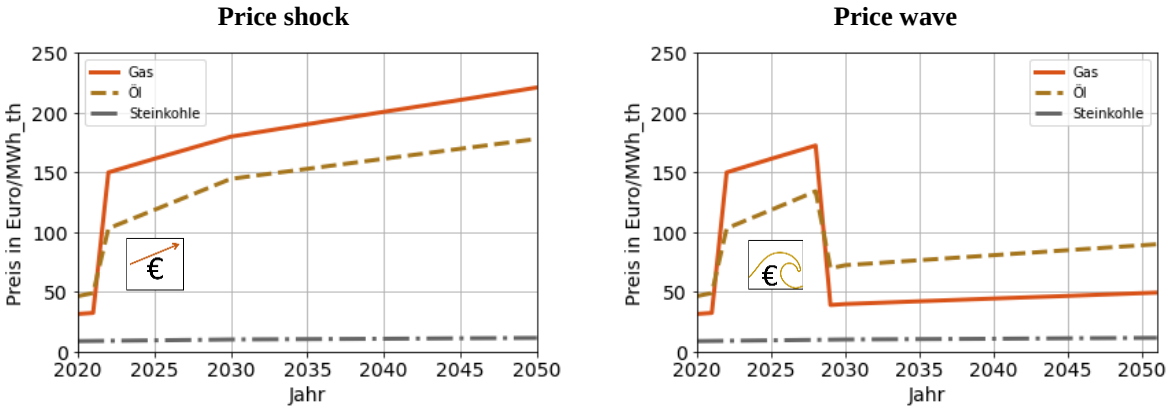

Figure 3: Model Costs assumptions.

Results

It can be summarized that an early phase-out of conventional energy sources and an expansion of renewables pave the way to a low-carbon electricity system. The short-term reduction in fossil fuel imports leads to enormous investments in renewable energy in all scenarios, almost twice as high as the investments in the previous years, in addition to enormous investments in storage. However, many positive aspects can also be taken from the scenarios. For example, the early expansion of storage facilities means that not only in the short term, but also in the medium and long term, there is no need for significant quantities of natural gas in the electricity system. Moreover, the climate targets of the German government are met and, more importantly, the available CO2 budget for the 1.5-degree target in the electricity system is undercut.

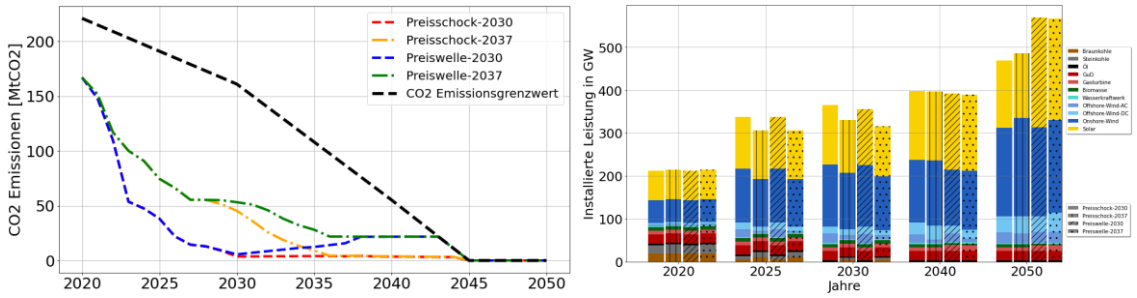

Figure 4: Scenarios emissions and installations comparison.

Conclusions

Using the open-source model MyPyPSA-Ger and following a scenario-based analysis, the results gave a point of view on how much would be needed to completely rely on the scarce non-renewable energy resources in Germany. Huge amounts of investments would be inevitable in order to ensure a secure supply of electricity, in both generation and storage technologies. The results showed that, it would be possible after 2028 to run the electrical system without the gas-fired power plants, meaning that it is more important to focus on higher renewables and storage investments rather than building LNG gasification stations to replace gas pipelines. Stopping the gas, coal and oil imports can be very challenging, but not necessarily impossible. Great obstacles must be resolved in order to develop and achieve a 100% self-sufficient energy strategy.