Energiewirtschaftliches Institut
an der Universität zu Köln

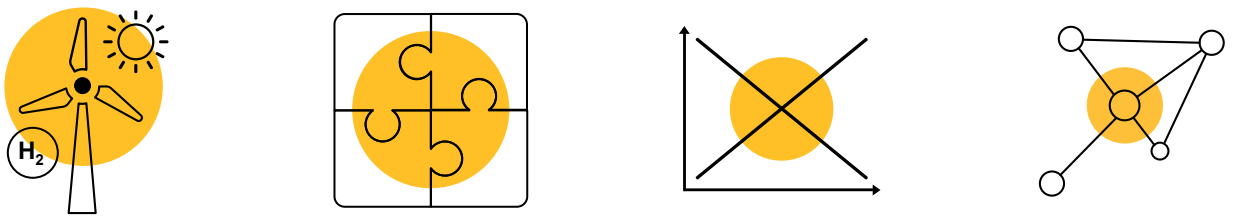
EWI-STUDY

Scenarios for the Price Development of Energy Commodities

English summary

On behalf of the academy project „Energiesysteme der Zukunft“ (ESYS)

July 2022



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Summary

The war in Ukraine and the resulting geopolitical upheavals are fundamentally changing the framework for energy supply in Germany and Europe. Germany is highly dependent on Russian energy imports of natural gas, oil and hard coal. The combined share of energy sources in Germany's primary energy consumption was around 68% in 2021.

In the report, "*Scenarios for the Price Development of Energy Commodities*", the Institute of Energy Economics at the University of Cologne (EWI) examines the medium-term development of prices for the energy carriers natural gas, oil, hard coal and electricity. The possible price developments are analysed for the years 2026 and 2030.

Together with a report by Fraunhofer IEG, Fraunhofer SCAI and TU Berlin on European gas supply security, it forms the basis for an impulse paper by the National Academy of Sciences Leopoldina, acatech and the Union of the German Academies of Sciences and Humanities "Welche Auswirkungen hat der Ukrainekrieg auf die Energiepreise und Versorgungssicherheit in Europa?".

The medium-term price development of energy sources is characterized by significant uncertainties. Therefore, scenarios were developed for the analysis that consider three key uncertainties:

Gas and electricity demand: the driving variables for the development are the ambition level of greenhouse gas reduction and, consequently, the degree of electrification of end-use sectors. In addition, efficiency gains, such as energy-efficient building refurbishment, also play a role. In the case of moderate electrification (mEL), a slight increase in national electricity demand and roughly constant European natural gas demand is assumed. In the case of high electrification (hEL), a strong increase in national electricity demand and a decrease in European gas demand are assumed.

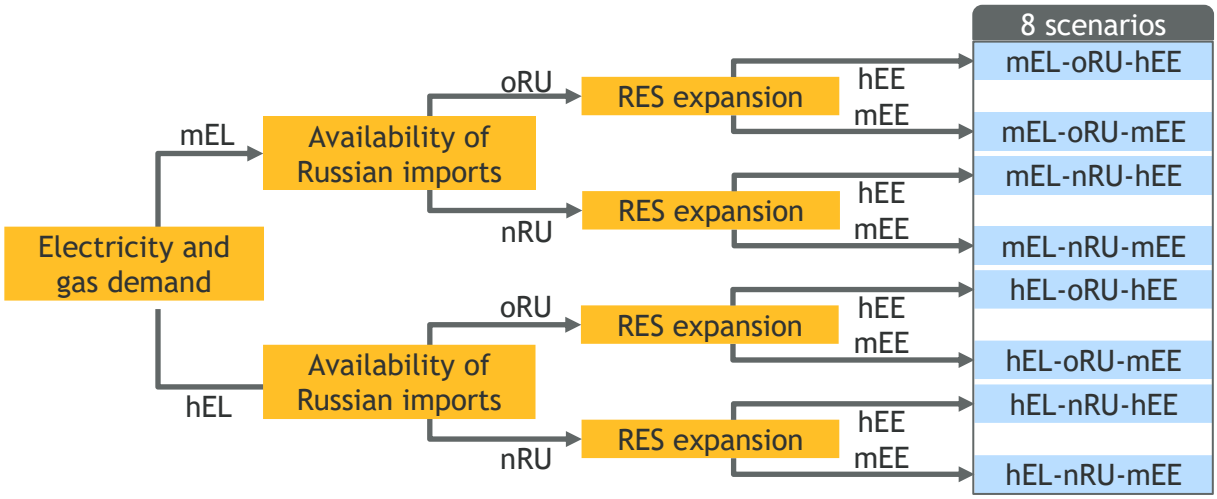
Availability of Russian energy sources: On the supply side, there is significant uncertainty in the level of energy imports from Russia. Concerning the supply of natural gas, coal and oil, one scenario assumes that Europe meets its energy needs without Russian energy sources (oRU). The alternative considers a case with low availability of Russian energy sources (nRU). In this case, Russian imports are assumed to be roughly halved compared with 2021.

Expansion of renewable energies: The third key uncertainty is the expansion path of renewables in German power generation. While one scenario assumes a high expansion of renewables (hEE), the other considers a moderate expansion (mEE). The higher expansion path for photovoltaics and wind power is based on the current targets of the German government, which are set out in the draft law for the EEG2023.

The combinations of the three uncertainties result in scenarios for which the price development of energy sources and further implications for the energy sector are subsequently examined. This concerns, for example, the future development of gas import structures or achieving the sectoral

climate target in 2030. Based on the resulting prices, the possible effects of the additional costs for energy carriers on private households and the energy-intensive industry are finally discussed.

The characteristics of the scenarios are summarized in the following scenario tree:



Central uncertainty	Characteristic	Description
Electricity and gas demand	mEL	moderate electrification, constant gas demand
	hEL	high electrification, declining gas demand
Availability of Russian imports	oRU	without availability of Russian imports
	nRU	low availability of Russian imports
RES expansion	hEE	high expansion rate of renewable energies
	mEE	moderate expansion rate of renewable nergies

Figure 1: Scenario tree on the basis of central uncertainties

Source: own presentation

Development of international gas markets and gas prices in Europe

Figure 2 shows the possible developments of gas prices in Northwest Europe in the considered four scenarios for the years 2026 and 2030. The annual average prices of the Dutch Title Transfer Facility (TTF) trading point, the most important reference price for natural gas in the European Union, are shown for comparison.

Since the development of LNG infrastructure is subject to uncertainty, a price range is plotted for each scenario depending on the expansion of global LNG capacity. In particular, the rate and amount of investment in gas liquefaction capacity in the U.S. significantly impact the price in Northwest Europe.

In the scenarios with decreasing gas demand (hEL), gas prices in 2030 are comparable to the price level of the 2018 TTF, which formed approximately the annual average price in the years up to 2018. However, in the short term until 2026, the gas price in the scenario without Russian energy

sources (hEL-oRU) is about 70% higher (+18 EUR/MWh) at 43 EUR/MWh than in the scenario with low availability of Russian raw materials (hEL-nRU).

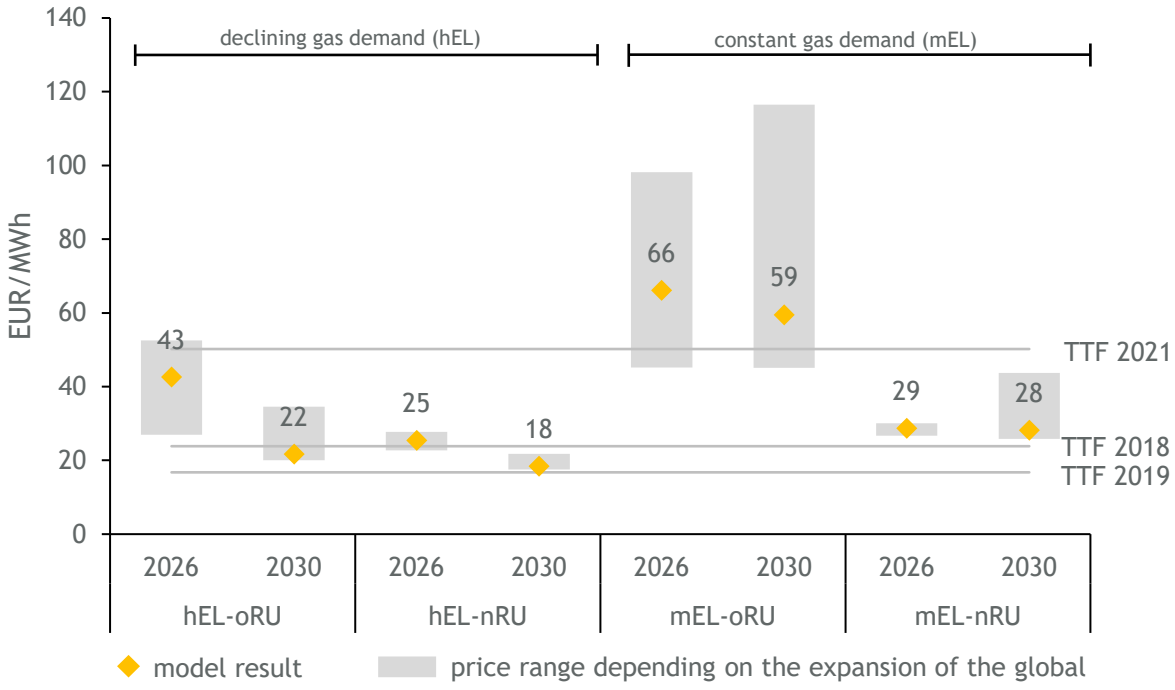


Figure 2: Possible development of gas prices in Europe

Source: historical values based on Rystad Energy, 2022

In the scenarios with constant gas demand (mEL), the influence of the availability of Russian imports is also significantly greater in the long term. In the scenario without Russian energy sources (mEL-oRU), the gas price will remain at a very high level until 2030. In this case, even the high price level of the 2021 TTF would only be achievable with significant investments in LNG infrastructure. In the case that Russian energy sources are available in low volumes (mEL-nRU), prices that are approximately 5 EUR/MWh above the price level of the 2018 TTF are simulated.

In all scenarios, Russian gas imports to the EU27+UK decrease significantly, as assumed. In the case of low availability of Russian energy sources (nRU), Russian gas supplies fall to 75 bcm in 2026, roughly halving Russian imports compared to 2021. By 2030, imports will fall further to 59 bcm. The reduction in Russian gas imports can be partially offset by the assumed decline in gas demand and a significant increase in LNG imports. The USA plays a key role here, as it is there that production and liquefaction capacities are being expanded the most worldwide. In the scenarios without Russian feedstock availability, LNG from the US accounts for up to 35% of total gas imports to the EU27+UK. This leaves the US as the largest LNG supplier to the EU27+UK, followed by Qatar. It should be noted that the current dependence on Russia is thus partly replaced by a growing dependence on the US. In addition to increasing LNG production, major investments in regasification terminals are taking place in Northwest Europe until 2026, with Germany accounting for about half of the added liquefaction capacity with a total capacity of 25 bcm/a (FSRUs), followed by the Netherlands.

Russia can only partially compensate for a loss of exports to the European market in terms of volume by expanding its exports to the Asian market. In each scenario, total Russian gas exports

are down from 2021 levels. In the scenarios without Russian imports for Europe (oRU), exports decline by up to 55% by 2030, and by up to 33% in the scenarios with low availability of Russian imports.

Development of international oil and hard coal markets and prices in Europe

Figure 3 shows the possible development of prices for oil and hard coal in Europe for the years 2026 and 2030. In contrast to gas prices, the price developments for oil and hard coal are less dependent on the development of demand in Europe. The main drivers are the production decisions of OPEC+ (oil) and economic developments in Asia. In contrast to the procedure for gas, only the availability of imports from Russia is varied in the scenarios. In addition, with regard to oil, the scenarios are based on gas oil, a precursor of energy sources such as diesel and heating oil, rather than crude oil.

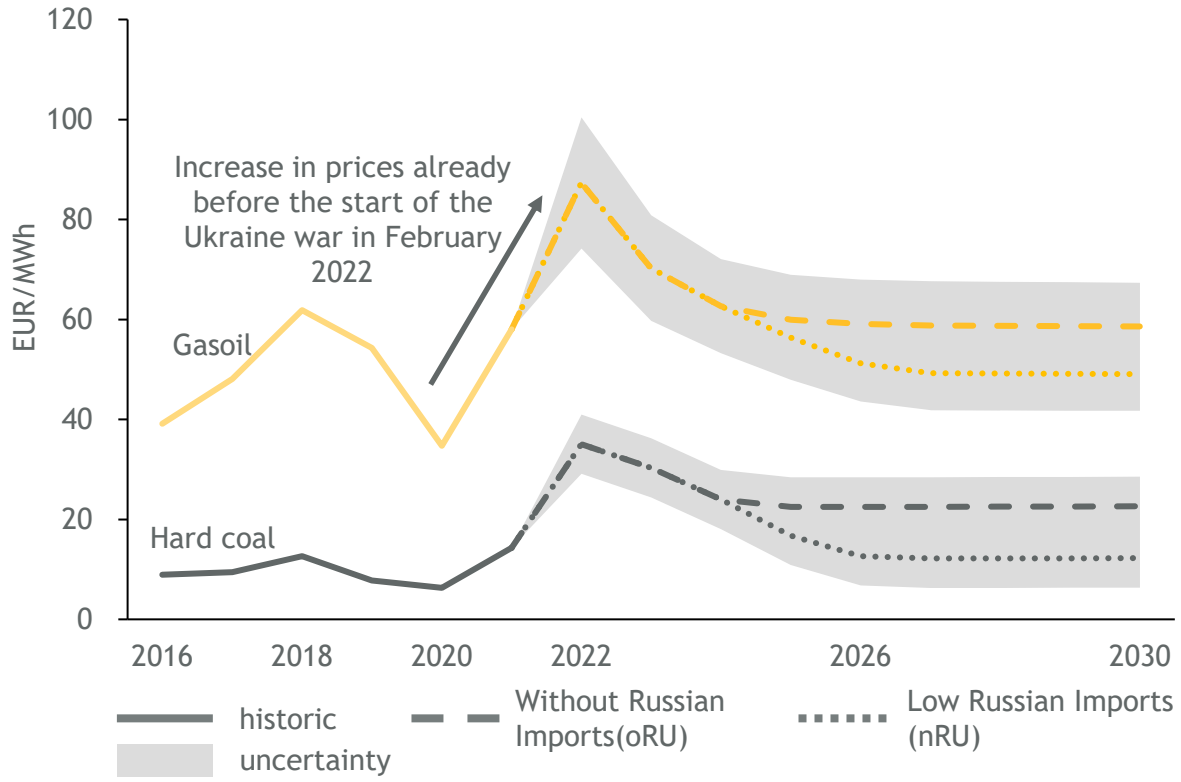


Figure 3: Possible development of oil and hard coal prices in Europe

Source: historical values based on Rystad Energy, 2022; development based on Investing, 2022a & Investing, 2022b

It is assumed that current futures prices already approximate a scenario in which no more oil or hard coal is imported from Russia in the medium term (oRU). This follows the assumption that the embargo decided by the EU is already priced in both cases. Accordingly, after a price peak in 2022, market players assume that gas oil prices will fall. The price drops to a level in the upper range of the historical values of the years 2016 to 2021. Possible reasons for this decline are the lower import volumes from Russia compared to gas and hard coal, which means that the necessary adjustment of the import structure will be lower. Furthermore, OPEC has already announced that it will increase production capacities. In the event of low availability of Russian oil imports (nRU), the price level falls to around the average value of the last five years.

With regard to the possible development of hard coal prices, a decline is also assumed. However, provided there are no more imports from Russia in the medium term (oRU), a price level is established, which is above the historical price level of the years 2016 to 2021. This is due, among other things, to the increase in transport distances from, for example, the USA, Colombia and South Africa. A partial availability of Russian coal imports (nRU) leads to a price drop in the scenario accordingly. In this case, the price falls to a level in the upper range of the historical values for the years 2016 to 2021.

Development of the national electricity market and wholesale electricity prices

The range of possible price developments, especially of gas and hard coal, change the generation costs of power plants and affect wholesale electricity prices. The scenarios without availability of Russian imports (oRU) show higher fuel prices than the scenarios with low availability (nRU). Accordingly, average electricity prices are higher in these scenarios. In addition, the level of renewable energy addition is decisive. A higher expansion (hEE) leads to a lower use of conventional power plants compared to a moderate expansion (mEE), so that the average wholesale electricity prices decrease. Furthermore, the level of electricity demand is of crucial importance. A strong increase in demand (hEL) leads to a greater use of conventional power plants with higher generation costs compared to a moderate increase (mEL), causing electricity prices to rise.

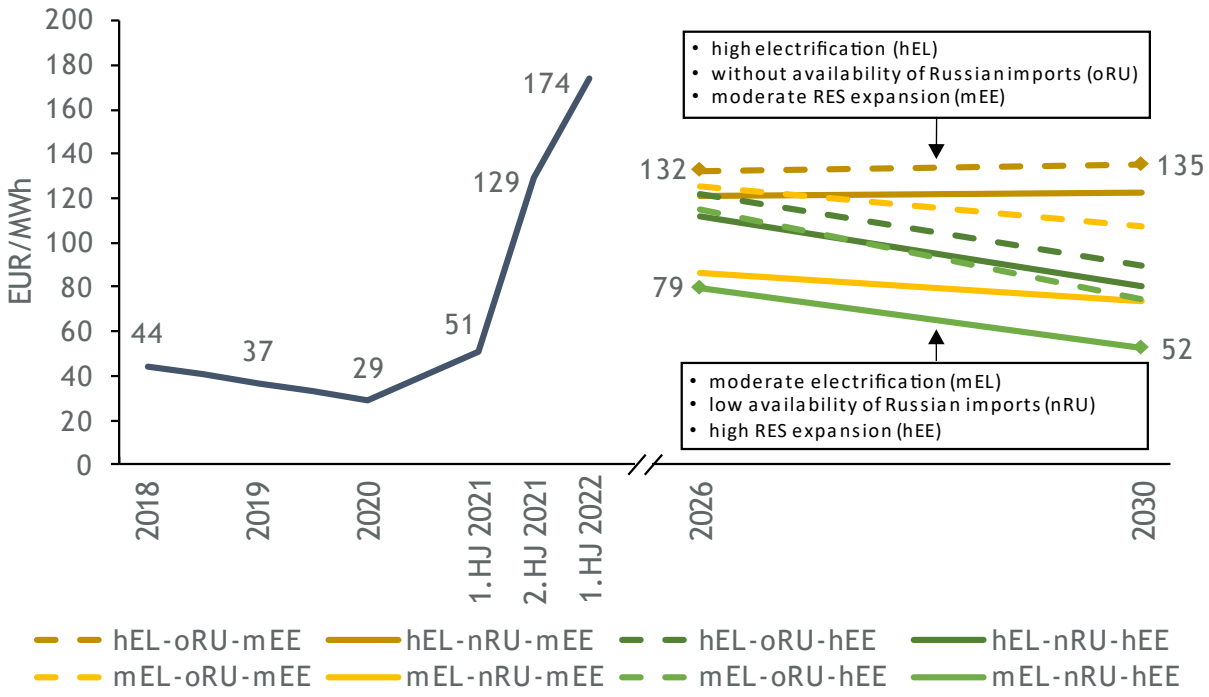


Figure 4: Possible development of wholesale electricity prices in Germany

Source: historical values according to own calculations based on BNetzA, 2022

Concerning wholesale electricity prices, there is a significant increase in the price level compared to the long-term historical prices in all scenarios considered. However, comparing these with the high prices since mid-2021 shows a significant decline. The highest prices with annual average prices of up to 132 EUR/MWh (2026) and 135 EUR/MWh (2030) result in the scenarios in which

price-increasing effects such as high electricity demand, no availability of Russian energy commodity imports and a moderate expansion of renewable energies (scenario hEL-oRU-mEE) overlap. The reason for the higher prices is the increased use of conventional power plants.

The lowest prices of 79 EUR/MWh (2026) and 52 EUR/MWh (2030) occur in the opposite case, i.e. with moderate electricity demand, low availability of Russian energy commodity imports and high expansion of renewable energies (mEL-nRU-hEE). The expansion of renewable energies is a key instrument for the reduction of wholesale electricity prices.

Impact of rising energy prices on households and industry

Energy is an essential commodity for the German economy that can only be substituted to a limited extent. Price increases have a correspondingly critical impact on various players such as (low-income) households and (energy-intensive) industries that need energy commodities to meet their demand for electricity, heat and mobility.

On the industry side, it is primarily sectors from the basic materials industry that are affected by rising energy prices. In the medium term, high energy prices in Europe could create competitive disadvantages compared with other regions such as Asia or the USA, where the rise in energy prices is lower. The analysis shows that, for example, the competitive position of gas-intensive basic industries such as the fertilizer industry in Germany could deteriorate compared with Asia and, above all, the USA. In the medium term, this poses a major threat to Germany as an industrial location. Energy-intensive industries will have an incentive to relocate their production sites unless they succeed in counteracting the development with appropriate political decisions.

On the household side, the analysis shows that low-income households, particularly, are strongly affected by the rise in energy prices. This is due, for example, to the rising share of energy costs in disposable income or low adjustment options through investments in efficient heating technologies, PV systems or building renovation. Overall, the importance of the social compatibility of energy policy decisions complementing the energy policy targets consisting of environmental compatibility, economic efficiency and security of supply continues to increase.