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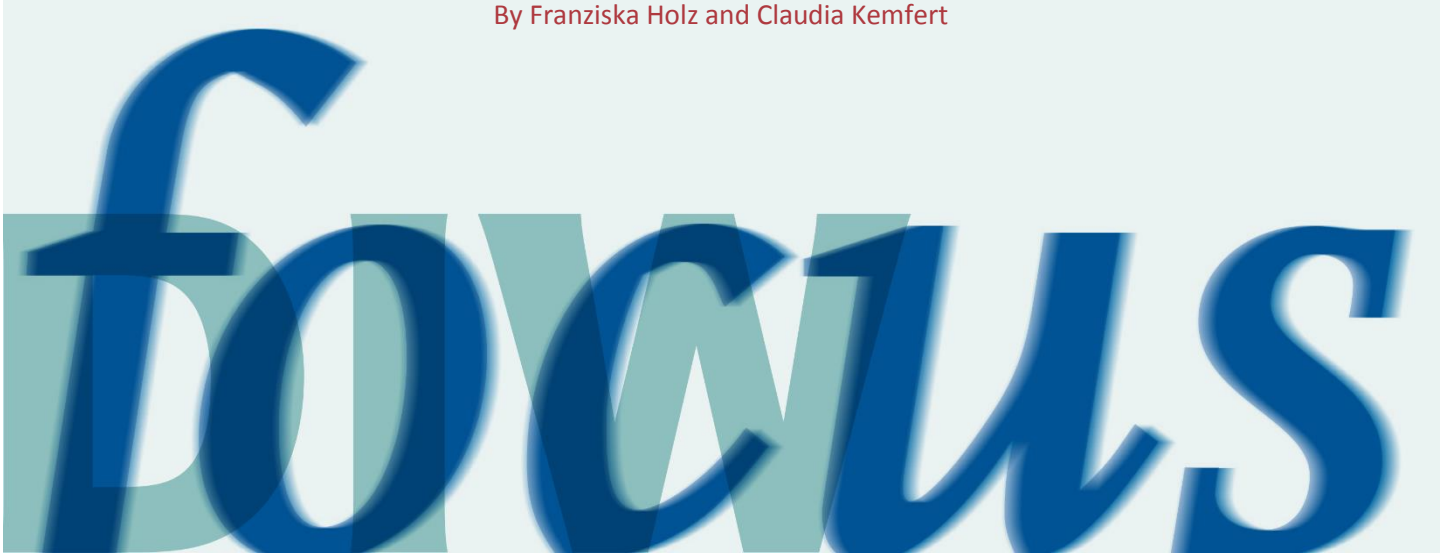
No need for new natural gas pipelines and LNG terminals in Europe

By Franziska Holz and Claudia Kemfert



Natural gas could play an increasing role in the German energy system following the coal exit decided in July 2020 by the German parliament. However, natural gas has no climate benefit compared to coal. What is more, Europe risks to become a battleground for the conflict between Russia and the United States. The construction of the Baltic Sea pipeline Nordstream 2 has set in motion a downward spiral of sanctions and counter-sanctions. US liquefied natural gas (LNG) exports compete with Russian gas exports to Europe. While German and European policy makers debate about an appropriate reaction to the US sanctions, we ask which role will US LNG be able to play in the European natural gas market. Model results by DIW Berlin provide first answers. In the long run, however, the European climate policy commitments will lead to a phase-out of fossil natural gas in the wake of the energy transition in the next decades.

As In the last decades, natural gas has become a fully-fledged alternative to mineral oil and coal, in particular for heat generation. However, in the long-run, fossil fuels will have to be phased out to comply with the climate targets of the Paris Agreement. Notwithstanding, natural gas may receive further support in Germany in the wake of the recently decided coal exit.[1] Moreover, Germany – and other European countries – support further expansions of the natural gas infrastructure, both pipelines and terminals for liquefied natural gas (LNG)

[1] See an overview of the coal exit legislation in English provided by Clean Energy Wire here.

imports. This support is often rooted in strategic and geopolitical concerns, but it contradicts the climate policy commitments.

Main share of natural gas imports comes from Russia

The European Unions consumes around 400 billion cubic meters (bcm) of natural gas per year. More than 85 percent come from external sources outside the European Union.[2] Around half of the EU's imports come from Russia, about a third from Norway, and around ten percent from Algeria. Germany consumes about 80 to 90 bcm per year which are mainly imported from Russia and Norway. EU imports are predominantly de-livered by pipeline (ca. 85 percent) and a relatively small share of about 15 percent arrives as LNG (Figure 1).

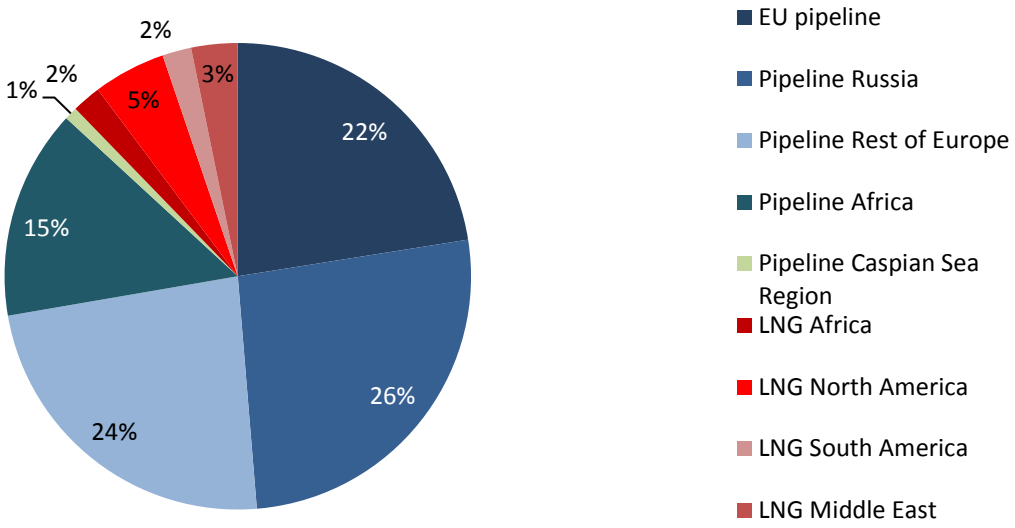
In the latent conflict situation with Ukraine, Russia decided already well before the Crimea crisis to con-struct the first Baltic Sea pipeline Nordstream which started operations in 2011 (capacity: 55 bcm per year). With the Nordstream 2 pipeline that is currently under construction (planned capacity: 55 bcm) as well as the simultaneously constructed Black Sea pipeline TurkStream to Turkey and Southeast Europe (planned capacity: 31,5 bcm), Russia could completely avoid using the Ukraine transit.

But the long-term need for this natural gas and the additional pipeline infrastructure is questionable. If natural gas demand in Europe were to stay stable at the current level, the import shares of Russia and Norway in Europe and Germany will hardly vary. This is the result of calculations with the Global Gas Model that is regularly used for investigating scenarios for the long-term development of the European natural gas market. [3] Domestic natural gas production in the European Union continues to decrease and will be compensated by larger imports from North Africa and of LNG. In other words, new large pipeline infrastructure such as Nordstream 2 or TurkStream is actually unnecessary.

In addition, the Paris Climate Change Agreement questions a stable demand trend for natural gas in the coming decades.[4] The climate protection goals can only be achieved if the whole of Europe becomes climate-neutral. This means abandoning fossil fuels such as natural gas.[5] The "gas exit" will also make new pipelines superfluous.[6]

[2] Data from BP Statistical Review of World Energy 2019 (available online) and IEA Natural Gas Information 2019 (available online).
[3] Also see Anne Neumann et al. (2018): Natural Gas Supply: No Need for Another Baltic Sea Pipeline. DIW Weekly Report Nr. 27, 241, Figure 5 (available online).
[4] Cf. Karlo Hainsch et al (2020): European Green Deal: Using Ambitious Climate Targets and Renewable Energy to Climb out of the Economic Crisis. DIW Weekly Report No. 28-29, 303-310 (available online).
[5] Greenhouse gas-compensating technologies such as CCS have not yet achieved the promised and necessary cost reduction. The continued little use of this technology, coupled with the continued deployment and cost reduction of renewable technologies, leads us to expect that CCS will not play a significant role in achieving greenhouse gas neutrality in the future, at least not in the energy sector.
[6] Also see Ruud Egging et al. (2019): The Role of Natural Gas in an Electrifying Europe. SET-Nav Issue Paper (available online).

Figure 1: **Composition of EU natural gas imports**
In percent, model calculation for the year 2020



Source: Own calculations.

Diversification of European natural gas imports through liquefied natural gas (LNG)

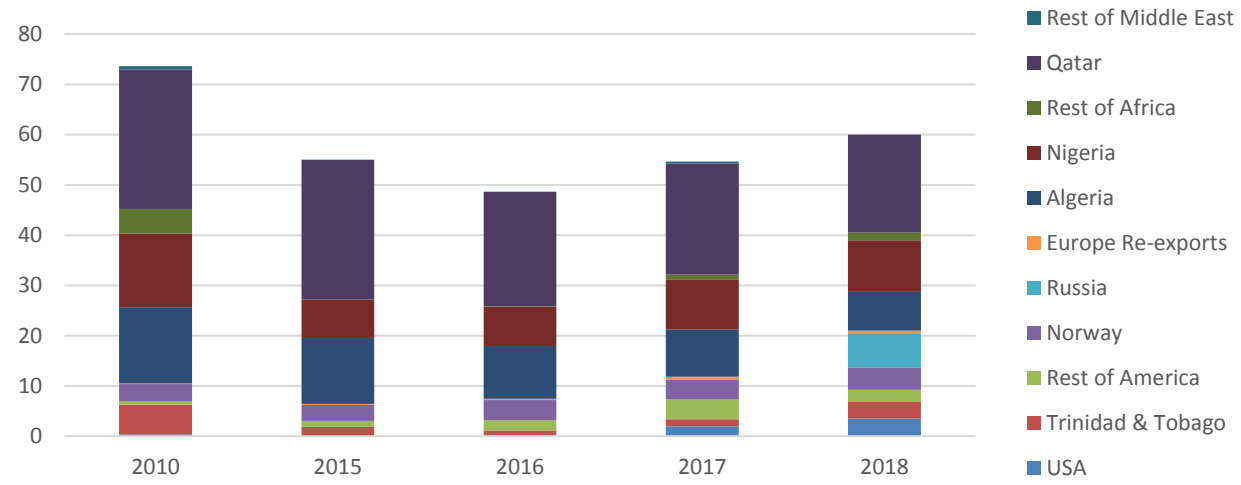
In addition to Russian natural gas, LNG has also increasingly entered the European market. At around 165 bcm per year, Europe's import capacities (regasification terminals) correspond to just over a third of the annual natural gas consumption in the EU (including UK). Traditionally, LNG has been imported into Southern Europe (since 1968), more recently also into Eastern Europe (Poland since 2016, Lithuania since 2014), which wants to become less dependent on Russian imports.

LNG contributes significantly to the diversification of natural gas supply in Europe (Figure 2). The number of LNG suppliers on the European market is twice as high as the number of pipeline suppliers.[7] Europe receives LNG mainly from the Middle East (Qatar), Africa (Nigeria) and the Americas (Trinidad & Tobago, more recently the USA). The major pipeline suppliers in the European market also supply small quantities of LNG to Europe (Algeria since 1964, Norway since 2007, Russia since 2016).

For many years, European regasification capacities have only been used to a fraction of their full capacity: [8] on average less than 25 percent between 2012 and the beginning of 2019, partly due to the lack of (cross-border) pipeline capacities for onward transport to other markets with higher demand, as gas consumption in countries with LNG facilities was lower than expected. On the other hand, LNG prices have traditionally been higher than the prices for pipeline imports, so that LNG was only imported when no adequate pipeline supply was available.

[7] IEA Natural Gas Information 2019
[8] See also: Transparency Platform (available online) and the evaluation by Food and Water Europe (2019): The Insanity of European LNG Utilization Rates (available online).

Figure 2: **European liquefied natural gas (LNG) imports by origin**
In billion cubic metres (bcm) per year



Sources: BP Statistical Review 2011, 2016–2019.

LNG exports from the USA since 2015 have changed the situation on the global and European natural gas market. The extensive production of shale gas by means of fracking - and its lax environmental regulation – offers US LNG suppliers the opportunity to purchase natural gas on the US wholesale markets at very low prices.

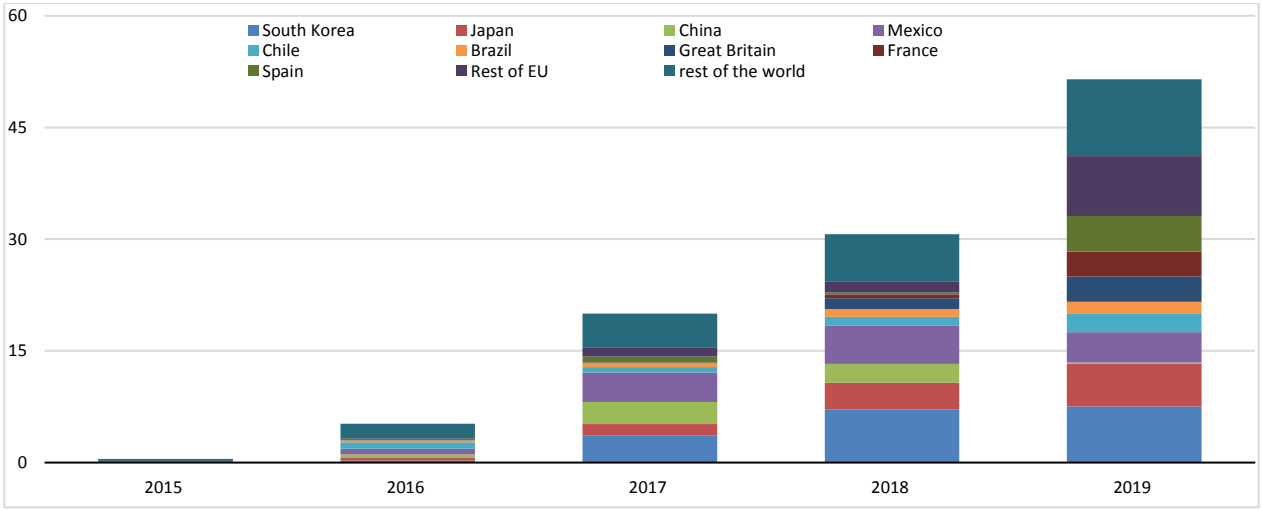
US LNG exports are structurally different from other supply in the global LNG market, which is usually done through long-term contracts or within corporate value chains. US LNG suppliers purchase the gas on the US wholesale market) at the market price, bear the cost of liquefaction and then offer it either in longer but flexible contracts (for example with a low minimum purchase quantity) or even "spot" (in the short-term market) for immediate purchase to the buyer offering the highest price.

US LNG exports are therefore much more flexible than the traditional LNG offer and have only limited assurance of having a stable buyer who cannot withdraw from the purchase. They reflect the competitive character of the US natural gas market and contribute to creating more competition in the global natural gas market.

Long-term prospects for US LNG deliveries to Europe

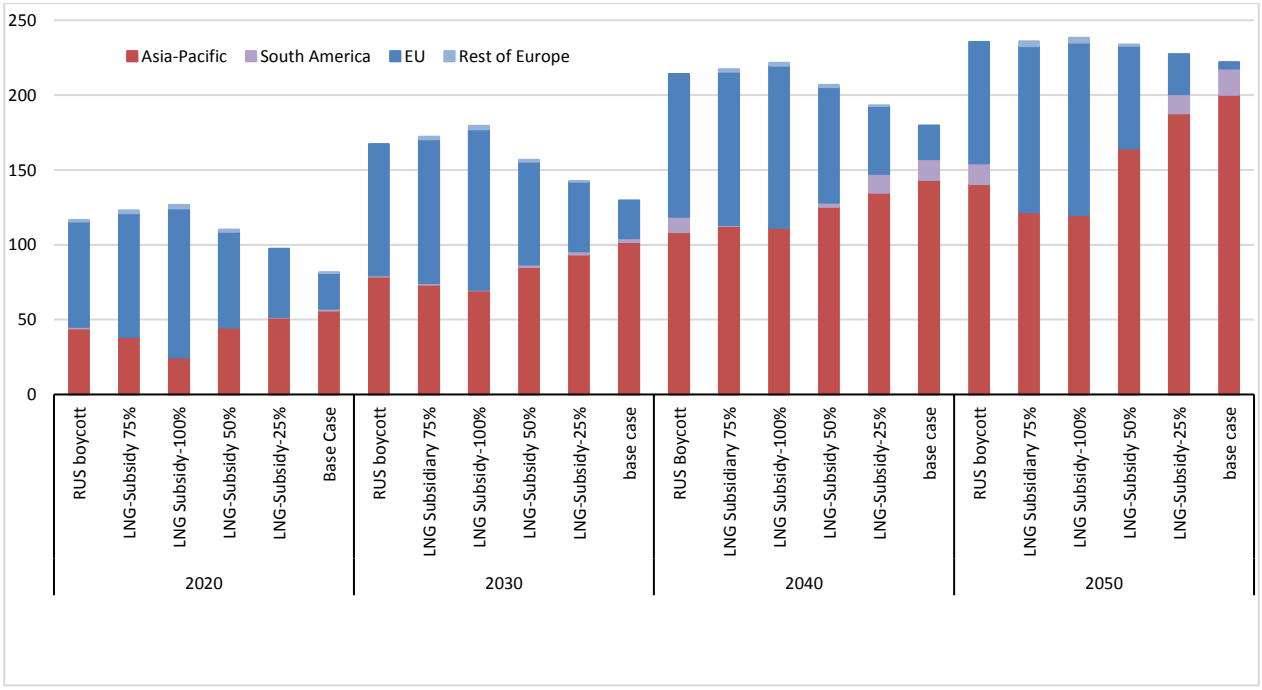
The Europe is not the primary target destination for US LNG; only 12 percent of US LNG deliveries went to Europe in 2018. Although this share increased last year and this year, Asia (due to usually higher prices) and South America (because of the lower transport costs resulting from the short distances involved) remain more interesting destinations (Figure 3).

Figure 3: **LNG exports from the USA with destinations**
In billion cubic metres per year



Source: Energy Information Administration of the US Department of Energy

Figure 4: **US LNG exports by destination region in different scenarios**
In billion cubic metres per year



Comments: In the RUS boycott scenario, natural gas supplies from Russia are missing in the European market; in the LNG subsidy scenarios, transport costs are subsidised proportionally according to the percentage. Base case corresponds to the current situation.
Source: Own calculations.

In the long term, too, strong growth of demand in Asia is expected which means that prices there will generally exceed European prices, making Asia the more attractive market for US LNG supplies. This is also confirmed

by our model calculations.9 They show that Europe's share of LNG imports will decrease in the long term from around 30 percent in 2020 to 20 percent in 2030 and 12 percent and 2 percent in 2040 and 2050, respectively ("base case" Figure 4).

The US government's hope that US LNG - which has occasionally been advertised as "Freedom Gas" - could become a substitute for Russian natural gas will therefore not be fulfilled. US LNG exports to Europe will only be higher under certain conditions, which DIW Berlin has examined using hypothetical and rather drastic scenarios. On the one hand, this would be the case if LNG transportation from the USA to Europe were to be subsidized (scenarios "LNG-Subsidy").[10] Subsidizing 25 percent of the transport costs could lead to a doubling of US LNG exports to Europe. If transport costs were subsidized completely, US LNG deliveries could even increase up to fivefold.

On the other hand, US LNG exports to Europe would be significantly higher if large quantities of natural gas were lacking on the European market. We have modelled this, as an example, with a hypothetical complete disruption of Russian supplies (scenario "RUS boycott"). In this case, three to four times as much US LNG as in the base case would help to compensate for a large part of the shortfall.

Together with other suppliers, most of them also LNG, the USA would thus help to reduce the impact of the disruption to at most a 10 percent drop in consumption and correspondingly small price increases. US LNG thus not only leads to a greater diversification of the natural gas supply in Europe, but can also serve as "contingency insurance" with its flexible and price-sensitive offer.

However, even in the worst-case scenario, the existing LNG import capacities in Europe will be sufficient. The plans of some European countries, including Germany, to build additional LNG terminals will therefore be just as unnecessary as building new pipelines.

High US LNG imports in 2019 and 2020 were an exception

The structural relationships described above already point to the high flexibility of liquefied natural gas supplies from the USA and other sources, which has been clearly manifested recently. Last year and the current year were and are exceptional years that directly intertwined: 2019 because of the impending end of Ukrainian transit, 2020 because of the Corona crisis, which has reduced global energy demand.

In 2019, the impending end of Ukrainian transit for Russian natural gas supplies, which was only resolved late in December 2019 with a new transit agreement for the next five years, for a long time fueled fears of supply shortfalls from January 2020. Europe reacted with its own precautionary mechanisms and also resorted to the international market and especially US LNG imports.

The increased injection of natural gas into underground gas storage facilities has safeguarded against a possible disruption in Europe. Since there was no disruption of Russian supplies after the new transit agreement was adopted, the high storage volumes were not needed in the market and storage levels have reached new highs in

9 Ruud Egging, Franziska Holz and Victoria Czempinski: Freedom Gas to Europe? Scenario Analyses with the Global Gas Model (forthcoming). See also earlier analyses: Franziska Holz, Philipp M. Richter and Ruud Egging (2015): A Global Perspective on the Future of Natural Gas: Resources, Trade, and Climate Constraints. Review of Environmental Economics and Policy, Vol. 9 (1), 85-106, as well as Franziska Holz, Philipp M. Richter and Christian von Hirschhausen (2013): Structural Shift in Global Natural Gas Markets: Demand Boom in Asia, Supply Shock in the US. DIW Weekly Report No. 31 (available online).

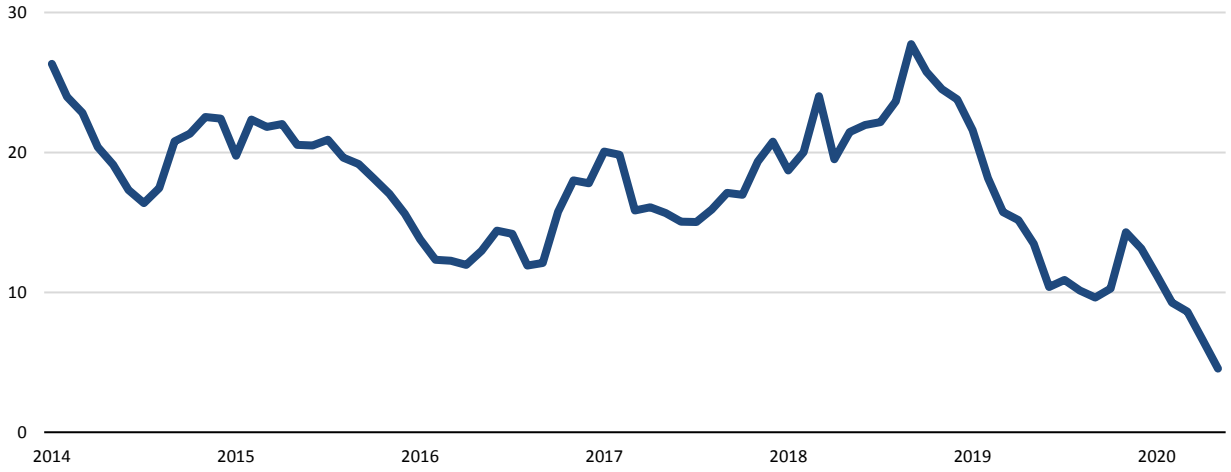
10 In this scenario, a proportional reduction of LNG transport costs between 25 and 100 percent of transatlantic shipping costs is assumed.

2020. Even at the end of the winter (April 2020), the European average did not fall below 50 percent on any day.[11]

The structural flexibility of US deliveries will continue to play a major role in 2020. The Corona crisis has exacerbated the weakness in demand in Asia and largely pushed US LNG volumes out of this market. In the search for buyers, only Europe offers the possibility of using both storage facilities, and also relatively liquid gas trading hubs with a large number of buyers.

As long as the price of gas in Europe can still cover the cost of US LNG (consisting of the US price plus liquefaction costs plus transatlantic transport costs), US LNG suppliers will continue to supply to Europe. However, given the ongoing price decline in Europe (Figure 5), it is questionable how long LNG costs can be covered. For example, the spot price on the Dutch gas exchange TTF in May 2020 was only EUR 4.55 per MWh on monthly average which was one sixth of its peak in September 2018 (EUR 27.74).

Figure 5: **Spot gas price on the TTF**
In euro



Source: Elexys

No new natural gas infrastructure needed despite continued gas use

In the context of the energy transition and climate policy efforts to achieve climate neutrality in Europe by 2050, it is becoming increasingly clear that natural gas will be squeezed out of the energy system in the long term. Studies in recent years have shown that natural gas production is far more harmful to the climate than many people believe.[12] Renewable alternatives are available both in electricity generation and in other areas of demand, and cost reduction has been successfully initiated.

In the electricity sector, natural gas - just like coal and nuclear power - can be replaced by renewable energies such as wind power and solar energy in the base load, as is already happening to some extent in Germany. The

[11] Cf. data from Gas Infrastructure Europe (available online)
[12] Vgl. Robert W. Howarth (2015): Methane Emissions and Climatic Warming Risk from Hydraulic Fracturing and Shale Gas Development: Implications for Policy. Energy and Emission Control Technologies 3, 45-54 (available online); Robert W. Howarth (2019): Ideas and Perspectives: Is Shale Gas a Major Driver of Recent Increase in Global Atmospheric Methane? Biogeosciences 16 (15), 3033-46 (availble online).

energy industry and research have also already found answers to the important question of "flexibility solutions", i.e. what happens if wind and sun are temporarily unavailable, that work without natural gas. In addition to battery storage, demand management and the extension of electricity grids to connect more and more regions with renewable energies under varying weather conditions, Power-to-X technologies will also be part of the solutions.[13]

Power-to-X refers to the conversion of electricity into other energy sources, for example heat. One much discussed technology is the use of electrolysis to produce hydrogen and possibly further processing to methane (methanization), the main component of natural gas. Both hydrogen and methane can be used as gaseous energy carriers in current applications of natural gas, for example in heat generation in industry and households, in power generation for peak load balancing or as fuels. Biogas - i.e. methane produced from biomass - can also replace fossil natural gas in its applications.

The phase-out of fossil natural gas does, therefore, not have to be accompanied by a complete conversion of applications to renewable electricity. Rather, gas produced from renewable sources will increasingly be part of the energy mix. Much of this gas can be produced locally and close to the consumers - especially when compared to the current distances of many thousands of kilometers between natural gas extraction and consumption. This means that the existing generously dimensioned import infrastructure for natural gas in the form of pipelines and liquefied gas ports will no longer be needed in the climate-neutral energy system. The existing infrastructure is also sufficient in the transition phase. However, it is questionable whether sufficient hydrogen production capacities can be built up in Europe, so that imports may have to be used as a source.

Conclusion: LNG for security of supply in the current market, but not in the future climate-neutral Europe

The Nordstream2 pipeline would not have been necessary to secure natural gas supplies in Europe, as Germany and other European countries already have access to large capacities of import infrastructure and a large number of suppliers. Nevertheless, the Nordstream2 pipeline has been supported by the German federal government. The German government has also promised to build LNG terminals that can be used to import US natural gas.

At present, counter sanctions are being discussed in Germany and the European Union against the (tightened) sanctions imposed by the USA against the construction of Nordstream2. At the European level, however, it is unlikely that the Eastern European countries will support sanctions against US LNG. Poland and Lithuania import US LNG and Estonia also plans to build an LNG terminal to (partly) replace Russian gas supplies. In addition, US LNG can serve as an "insurance" in the event of disruption of other gas suppliers, which is also an important argument for (Eastern European) importers of Russian natural gas. Many coun-tries in the EU have viewed the construction of Nordstream2 critically anyway, so it will be difficult to win a sufficient majority for measures against the US.

However, the discussions on short-term security of supply of natural gas must be embedded in a long-term context. Natural gas will play a diminishing role in the long run due to strict climate targets and the resulting

[13] See Florian Ausfelder and Hanna Ewa Dura (2018): Optionen für ein nachhaltiges Energiesystem mit Power-to-X-Technologien. 1. Roadmap des Kopernikus-Projektes „Power-to-X“: Flexible Nutzung erneuerbarer Ressourcen (P2X). (in German, available online)

need to reduce emissions.[14] In this context, it is surprising that the recently decided coal phase-out law in Germany includes further use of natural gas. The declining demand for natural gas can be covered by the existing infrastructure and the planning of new LNG terminals should be stopped.

It should be examined whether the planned terminals are suitable for hydrogen instead of liquid gas. The repurposing for hydrogen would fit into the National Hydrogen Strategy of the German government, which includes the import of hydrogen.[15] Germany and also Europe need to support the energy transition away from all fossil energies (including fossil natural gas) towards a full supply of renewable energies. Any new energy infrastructure should be geared to the goal of 100 percent renewable energies.

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[14] See German Council of Environmental Advisors (2020): Towards an ambitious environmental policy in Germany and Europe. Environmental Report. May 2020 (Executive Summary available online).
[15] Cf. the explanations on the German hydrogen strategy by Clean Energy Wire.