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Briefing

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Summary

Germany's planned LNG[1] import terminals are not necessarily required to compensate for the loss for pipeline imports from Russia, when considering what is necessary to meet the country's climate targets. The construction and operation of all currently planned LNG terminals would not only be in conflict with Germany's national climate targets, it would also constitute a breach of national legislation and international commitments under the Paris Agreement.

Gas consumption in Germany in 2022 is estimated to be 83 bcm, around 12% lower than in 2021. The decrease in gas consumption is primarily the result of energy efficiency measures and mild temperatures. German gas consumption must steadily fall for the country to reach its goal of climate neutrality by 2045 - by around a fifth from current levels by 2030, by half by 2035, and to almost zero by 2045.

If imports from neighbouring countries remain at the same level as in recent months, Germany could draw on pipeline imports of around 86 bcm per year. In combination with continued energy efficiency measures to reduce demand for gas, no new LNG terminals would be needed. Germany could seek agreements with its neighbours to maintain high exports in the short term. At the same time, Germany could strengthen energy efficiency measures to meet its self-imposed reduction target, or better yet, a more stringent 1.5°C compatible reduction target.

However, Germany's current strategy points in a different direction: the country is planning LNG terminals with a total capacity of about 73 bcm per year, with capacity equal to 50% more imported gas than it sourced from Russia before the war (46 bcm per year).

Additional LNG import capacity would minimize the risk of gas shortages but would mostly not be required to match shrinking demand. Even if net pipeline imports are assumed to decline (75 bcm in 2023, declining subsequently by 3% per year), demand exceeds imports by no more than 15 bcm per year until 2035, with a declining trend from 2030 onward. This gap could be covered either by more ambitious reductions or by three floating terminals (FSRUs). After 2035, they also would no longer be needed.

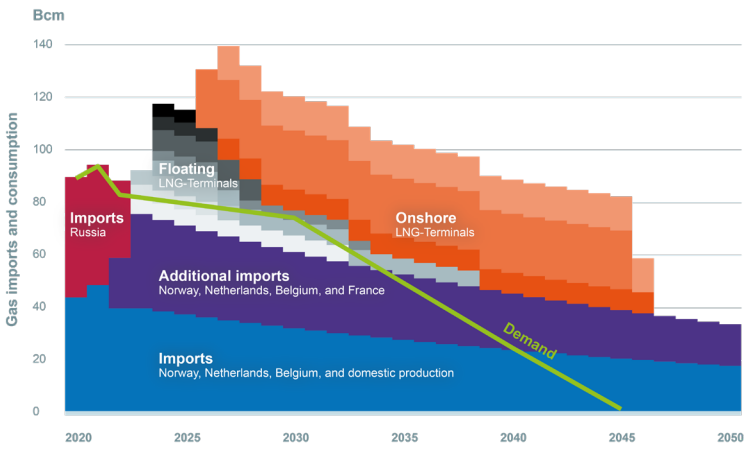

Figure 1: Fossil gas import capacity versus consumption and trajectory towards climate neutrality in 2045.

[1] Liquefied Natural Gas (LNG) is fossil gas that is stored in liquefied form at low temperatures, making it suitable for marine transport.

Even in the unlikely event that both domestic production and imports from the Netherlands, Belgium, and France were to cease, the planned floating terminals would be sufficient to meet demand together with continued imported gas from Norway. In this case, the stationary terminals would only represent reserve capacity.

Stranded assets are likely if all LNG terminals are built. Since a large part of the LNG terminals is supported by federal funding, taxpayers carry a share of resulting costs. With all planned terminals fully operational, Germany would be able to import nearly two-thirds more fossil gas via land and sea than it currently consumes. Pipeline gas is likely to be preferred to LNG imports because of its significantly lower cost. Terminal operators appear to be deliberately accepting stranded asset risks, presumably with the goal of securing their market share by bidding for larger contracts.

The plans are oversized, even if there are intentions to eventually repurpose the terminals to import green hydrogen or ammonia. Developers would need to consider the technical measures necessary for conversion to hydrogen already in the planning and construction phase of the terminals, and likely face higher costs. Moreover, the demand for imported hydrogen in a climate-neutral Germany will likely be much smaller than the current gas demand.

The new LNG terminals would undermine the energy transition. Their construction would tie up resources and attention that would then not be available for energy efficiency measures and the expansion of renewable energy.

Achieving Germany's climate targets with full operation of the planned terminals would be nearly impossible. If Germany were to use 100% of the eleven LNG terminals, CO_2 emissions from the combustion of the imported gas would account for one third of the greenhouse gas emissions permissible under the target path in 2030. This does not include CO_2 and fugitive methane emissions from production and transport.

Germany has enshrined its climate targets internationally in the Paris Agreement and in national climate legislation. To remain credible and set a positive international example, Germany would have to make good on its commitments and strengthen them instead of massively jeopardizing their implementation. Maintaining credibility is particularly important vis-à-vis countries with which climate partnerships are being negotiated.

Introduction

Germany faces major energy policy challenges following the Russian invasion of Ukraine. Germany must replace its imports of Russian gas, which amounted to 46 bcm in 2021[2], around half of Germany's annual consumption (BMWK, 2022).

With the help of the LNG Acceleration Act (*LNG-Beschleunigungsgesetz*), the German government aims to secure alternative gas supplies independent of Russia. The country intends to build additional import capacity through new terminals that can receive and regasify liquefied fossil gas (LNG).

This briefing examines the extent to which the scale of the planned capacity expansions is justified against the backdrop of Germany's legally binding target to become climate neutral by 2045, which requires almost a complete reduction in gas consumption.

To answer this question, we compare the following variables:

- gas demand in Germany until 2045, taking into account the goal of achieving climate neutrality by then;
- expansion plans for German LNG terminals;
- current import sources for fossil gas and domestic production and their possible future course.

Gas demand in Germany on a climate neutral pathway

Germany's Climate Change Act (*Klimaschutzgesetz*) enshrines the goal of becoming climate-neutral by 2045 in national law. Achieving this goal requires an almost complete phase out of coal, oil, and gas. Compatible pathways imply that gas consumption must already fall significantly in the short term. Various scenarios that achieve climate neutrality by 2045 calculate gas consumption in 2030 to be 20% to 30% below pre-war levels (Prognos et al., 2021; Sterchele et al., 2020). By 2035, gas demand must drop by half from current levels, by four-fifths by 2040, and to nearly zero by 2045, in order to achieve Germany's agreed-upon goal of climate neutrality by 2045 (Prognos et al., 2021).

We assume that this path remains realistic, even though the scenarios on which it is based do not yet account for an earlier coal phase-out in 2030, which may lead to higher gas demand. We assume that increased efficiency measures to reduce gas demand, as the result of the Russian invasion of Ukraine, will endure, which will likely offset higher gas demand stemming from the earlier coal phase-out.

Germany's climate targets are still insufficient: Germany needs to adhere to its pathway to climate neutrality in 2045, which it has enshrined in its Climate Change Act. Otherwise, it would not represent a fair contribution to the 1.5°C temperature limit of the Paris Climate Agreement (CAT, 2022; Höhne et al., 2019, 2020; German Council of Environmental Experts, 2022). To meet the targets of the Paris Agreement and respond to the calls of the COP26 in Glasgow and COP27 in Sharm El Sheikh, Germany needs to raise the ambition of its 2030 target and reduce gas consumption even faster than mentioned above.

Expected German gas consumption in 2022 is estimated to amount to 83 bcm, which is about 12% lower than in 2021 (Bundesnetzagentur, 2022 and own estimate for November and December). In 2021, German gas consumption amounted to 94 bcm (AG Energiebilanzen, 2022). Gas price inflation, gas savings, and mild temperatures contributed to the reduction.

[2] In this briefing, we represent gas consumption and import volumes in bcm for better comparability. This simplification ignores the fact that fossil gas can have a different energy content for the same volume.

All scenarios for a climate neutral Germany in 2045 project hydrogen to only partially replace fossil gas as an energy carrier. Green hydrogen will replace fossil gas only in specific sub-sectors and for certain industrial applications due to higher cost compared to alternatives, i.e. energy efficiency measures and electrification.

Future hydrogen demand, as scenarios show, will likely be much lower compared to today's gas consumption. A study with medium hydrogen demand puts the total demand for hydrogen at about 265 TWh in 2045 (Prognos et al., 2021). This is roughly equivalent to the energy content of 27 bcm of fossil gas. Based on this study, only about two thirds of the hydrogen will be imported. Accordingly, only one fifth of the energy volume provided by gas today would be replaced by imported hydrogen. Even scenarios with an assumed high consumption of hydrogen (Gunnar Luderer (ed.) et al., 2021) put the demand in 2045 at only about 500 TWh per year, which is roughly equivalent to the energy content of 51 bcm of fossil gas, of which, again, only a share would be sourced through imports. Even in this high consumption scenario, only one third of the energy demand currently met by gas would be met with imported hydrogen.

Planned LNG import terminals in Germany

For this briefing, we have summarized plans for the construction and operation of LNG terminals in Germany. Specifically, we tabulate planned capacities, start year and planned duration (Table 1). Our analysis is based on a comprehensive review of official application documents, compiled by the Deutsche Umwelthilfe. We supplemented information drawn from these application documents with other data from public media reports. Information on construction and operation of the terminals is subject to some uncertainty since planning details are not centrally available and sometimes are based on incomplete press releases and other public documents.

The general order of magnitude of assumed or reported capacities and lifetimes, however, should be robust. The planned LNG import capacity (eleven terminals with a total capacity of about 73 bcm per year, Table 1) could allow the import of about 50% more gas than was purchased from Russia before the war (46 bcm per year).

Our estimate of the total capacity represents a conservative figure: We assume that three floating terminals will be decommissioned as soon as respective fixed terminals, operated by the same company, become available at the same location. This assumption is not in line with charter contracts and permit applications, which imply longer operational timelines. In addition, we have omitted a fourth (publicly subsidised) terminal in Lubmin, which has not yet been approved, as well as a private terminal in Wilhelmshaven, where implementation planning is less certain. If these and all other terminals were operated in parallel, we would arrive at a total capacity of over 100 bcm per year, more than twice as much as was sourced from Russia before the war (46 bcm per year).

Table 1. Planned LNG import terminals in Germany

	Location	Type*	Operator	State support	Capacity per year, bcm		Start	Lifetime	Comment
					Min	Max			
1	Brunsbüttel	FSRU	RWE	X	5	5	2022	4	Chartered for 10 years
2	Wilhelmshaven	FSRU	Uniper	X	5	7,5	2022	10	Application for permanent operation
3	Lubmin	FSRU	Deutsche ReGas		4.5	6,5	2022	5	Application for permanent operation
4	Wilhelmshaven	FSRU	Tree Energy Solutions	X	5	5	2023	2	Chartered for 5 years
5	Lubmin	FSRU	RWE/Stena Power	X	5	7	2023	15	
6	Lubmin	FSRU	Deutsche ReGas		7	9	2023	5	Duration of charter unknown, conservative estimate
7	Stade	FSRU	Hanseatic Energy Hub	X	5	5	2023	3	Chartered for 15 years
8	Hamburg	FSRU	Hamburger Energiewerke	X	3.2	4	2023	10	
9	Wilhelmshaven	Onshore	Tree Energy Solutions		20	25	2025	20	
10	Brunsbüttel	Onshore	RWE/Gasunie	X	8	8	2026	20	
11	Stade	Onshore	Hanseatic Energy Hub	X	13	13	2026	20	
The maximum total capacity will be reached at the end of 2026. The sum of the average of the minimum and maximum capacity of the plants operating at that time is around 73 bcm.									

Source: Own research based on data obtained from the Deutschen Umwelthilfe and other sources.[3]

* Floating Storage Regasification Unit (FSRU)

The German state supports the majority of the planned LNG terminals through federal funding (Table 1). These funds have been increased in part because initial calculations underestimated total costs.[4]

Terminal operators are currently in the process of signing LNG supply contracts. These contracts are usually tied to specific terminals. Some of the supply contracts will likely run until 2044 and beyond, which contradicts the operating life of the fossil gas terminals (end of 2043) as well as the German goal of climate neutrality by 2045.[5] Furthermore, there is talk of helping African countries to develop new gas deposits and to supply gas as LNG to Germany.[6] This would be a breach of Germany's commitment made at the COP26 in Glasgow not to finance fossil fuel infrastructure abroad. We have not yet been able to compile a comprehensive overview of all supply contracts, as this information is mostly not publicly available.

It is currently unclear whether the LNG import infrastructure planned in Germany can be used for hydrogen or ammonia in the future. Operators must account for future repurposing already during the planning and construction phases. Repurposing also requires additional investments, and it is currently uncertain whether required modification would be economical (Schreiner & Riemer, 2022). For operators, it is unclear whether pre-fitting for potential import of hydrogen or ammonia is worthwhile,

[3] https://www.focus.de/finanzen/news/beispiellose-geschwindigkeit-deutschland-stellt-erste-lng-terminals-fertig-aber-wer-liefert-jetzt-das-gas_id_179875917.html; https://www.abendblatt.de/wirtschaft/article236946949/hafen-hamburg-lng-terminal-bekommen-moorburg-gaskrise-habeck-kerstan.html;

[4] https://www.sueddeutsche.de/wirtschaft/gasversorgung-lng-terminals-3-5-milliarden-teurer-als-geplant-1.5699739

[5] https://www.chemietechnik.de/energie-utilities/ineos-schliesst-vertrag-ueber-lng-lieferungen-aus-den-usa-41-806.html

[6] https://www.tagesschau.de/ausland/afrika/scholz-besuch-senegal-erdgas-101.html

since the future demand for hydrogen or ammonia cannot accurately be quantified today, and as such robust assumptions of potential start dates are difficult to make. Also, not all technologies needed in the future are available on an industrial scale today, such as for the processing of ammonia back into hydrogen (Schreiner & Riemer, 2022). Repurposing is also only worthwhile if the environment can structurally accommodate the alternative energy carrier, e.g., through direct customers, options for onward transport, or low-carbon energy supply for further processing (Schreiner & Riemer, 2022).

It is unlikely that the new LNG infrastructure will help other EU countries procure gas. For one thing, new excess capacity is also planned in other EU states (Aitken et al., 2022). For another, these states also need to significantly reduce their gas consumption to meet their climate targets.

The new LNG terminals would undermine the German energy transition. Once the terminals are built, operators will also seek to use them for as long as possible so as to recoup their costs and generate as much profit as possible. The construction and operation of these terminals ties up resources and attention, where instead Germany should rather focus on energy efficiency measures and the expansion of renewable energy.

Climate targets are also at risk. If Germany was to use 100% of the eleven LNG terminals, CO_2 emissions from the combustion of the imported gas would account for one third of the greenhouse gas emissions permissible under the country's targeted emissions pathway in 2030. This does not include CO_2 and fugitive methane emissions from production and transport. Full operation of the planned import capacity would push Germany's climate targets out of reach.[7]

Imports and exports via pipelines

Before the Russian invasion of Ukraine, Russia supplied about half of Germany's gas demand. Norway, the Netherlands, Belgium, as well as domestic production, provided the rest. At the same time, Germany supplied gas to the Czech Republic, Austria and, to a lesser extent, Poland, Denmark, France, and Switzerland.

In the final months of 2022, increased imports from neighbouring countries offset much of the shortfall in imports from Russia (Bundesnetzagentur, 2022). This included increased supplies from Norway and the Netherlands, gas imports from France (previously only exports), and LNG imports via Belgium and the Netherlands.

If Germany manages to maintain the current elevated pipeline imports while exports remain constant, the country could meet its gas demand without new LNG import infrastructure. If imports and exports and domestic production were to stay at current levels, a total supply of 86 bcm per year (based on data from the Federal Network Agency, 2022) would cover estimated consumption of 83 bcm (estimated consumption in 2022).

However, in this case, the reduced buffer would entail higher gas deficit risks, and Germany would find it more difficult to build up reserves. In addition, the Netherlands has already announced that it will curtail gas production, and the Netherlands, Belgium, and France may increasingly use their LNG import capacities to cover their own needs.

Since it is currently impossible to obtain a detailed overview of the mostly non-public import supply contracts, we describe two scenarios:

In the baseline scenario, we assume net pipeline imports at 75 bcm in 2023, decreasing 3% per year in subsequent years. This would mean that 91% of 2022 consumption is covered in 2023. We assume net

[7] Combustion of 73 bcm of gas results in about 140 $MtCO_2$. This is about one-third (32%) of the targeted emissions pathway in 2030 of about 435 $MtCO_2$.

pipeline imports of 75 bcm, which is derived on the basis of estimated import capacities (calculated from 2022 exports and imports) from Norway, the Netherlands, Belgium, and France, as well as domestic production, minus onward transmission commitments to the Czech Republic and Austria. The value also corresponds to the "Realistic Scenario" of the DIW estimate (DIW Berlin, 2022).

We deem this scenario realistic, as we observe both drivers and barriers of pipeline imports, which are likely to cancel each other out: Factors that would still increase the value, but which were not taken yet into account, are the increased feed-in of biogas and the increased imports now taking place (approximately an additional 11 bcm).

However, constant supplies are not guaranteed. Around 20 bcm of the 75 bcm is regasified as LNG in existing plants in the Netherlands, Belgium and France and piped to Germany (DIW Berlin, 2022). In the long term, this capacity could be used by importing countries and no longer be available to Germany.

In an additional extreme scenario, we assume that imports from Dutch production and LNG via the Netherlands, Belgium, and France stop, along with a phase out of domestic production, leaving Germany to rely only on current levels of imports from Norway. These are stable factors that are within Germany's control. In this case, 45 bcm of gas per year would be available from Norway alone, 54% of consumption in 2022.

Capacity exceeds demand

In summary, in the ideal case, i.e., if imports from neighbouring countries remain at the same level as in recent months, no new LNG terminals would be needed (see section 4). Germany could seek assurances from its neighbours to maintain high exports in the short term. At the same time, Germany could do its utmost to further curb gas demand to meet its self-imposed reduction target, or better yet, a more stringent 1.5°C compatible reduction target in line with the Paris Agreement. Investments in energy efficiency measures and renewable energy would be further future-proof solutions. New fossil fuel infrastructure, in contrast, would undermine German efforts to meet its climate targets, and is at risk of turning into stranded assets.

Imports via pipelines from Norway, the Netherlands, Belgium, France, and domestic production, together with planned import capacity from the new LNG terminals, would exceed gas demand by a multiple, even if we assume imports from neighbouring countries decline (Figure 1). With net pipeline imports estimated at 75 bcm in 2023, declining by 3% per year in subsequent years, demand would

exceed imports by no more than 15 bcm per year by 2035. This gap could be covered either by more ambitious demand reductions or by three FSRUs. After 2035, even these will no longer be needed.

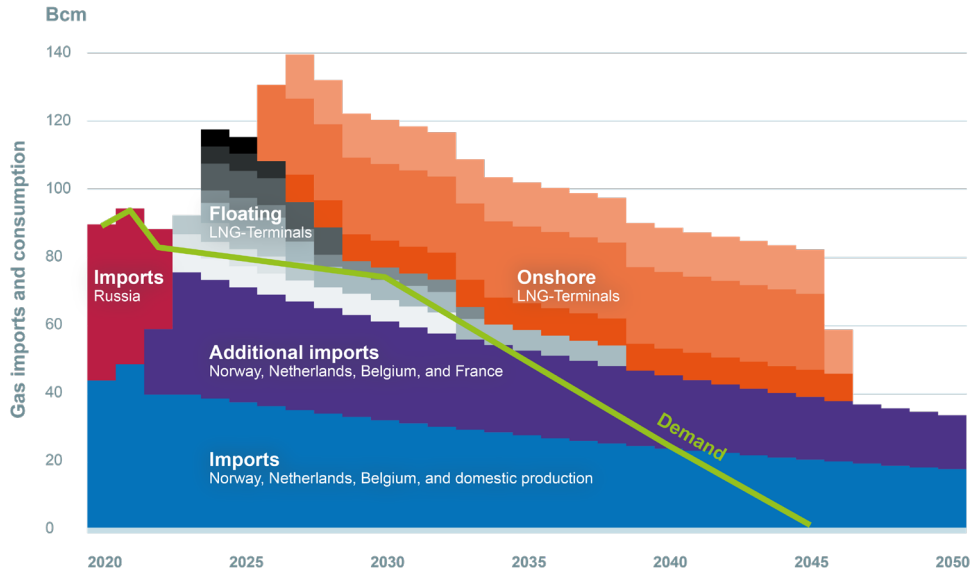

Figure 1: Fossil gas import capacity versus consumption and trajectory towards climate neutrality in 2045.

(Sources: Consumption 2020/21 (AG Energiebilanzen, 2022), Consumption 2022 (estimates based on Bundesnetzagentur, 2022), Consumption 2030, 2035 and 2045 climate neutrality scenario (Prognos et al., 2021), LNG import capacity and imports from neighbouring countries in this study).

Even in the unlikely event that imports from Dutch production and LNG via the Netherlands, Belgium, and France stop, domestic production end completely, and Germany relies only on Norwegian imports (about 45 bcm per year), the planned FSRUs are sufficient (a total of about 44 bcm per year from 2024 and as long as the FSRUs are in operation) to cushion the gap. More ambitious conservation measures would mean shorter periods of operation for FSRUs. The onshore terminals would only represent reserve capacity in this case.

If all LNG plans are implemented, assets are very likely to strand. In such a case, Germany could import almost two thirds more gas via land and sea than is currently consumed. Pipeline gas is likely preferable to direct LNG imports because of its significantly lower cost, leaving the LNG terminals underutilized.

Based on an analysis comparing total import capacity and import gas demand, one gets the impression that companies are planning more terminals than necessary to be able to accommodate larger supply contracts. Terminal operators seem to consciously accept stranded asset risks, presumably with the aim of securing larger market shares. Lack of profitability of underutilized terminals can lead to losses in value and premature write offs, which in part will also have to be borne by the taxpayers.

Conclusion: Germany's planned LNG import terminals are not necessarily needed to meet gas demands aligned with the country's climate targets, even in the absence of pipeline imports from Russia. Additional import capacity would only minimize the risk of undersupply. The planned import infrastructure is also generally oversized for repurposing for green hydrogen imports.

The new LNG terminals would stand in the way of the energy transition. Construction ties up resources and attention that would then not be available for energy efficiency measures and the expansion of renewables.

The construction and operation of all planned LNG terminals would contradict Germany's climate objectives and would thus be a breach of the country's Climate Change Act as well as international commitments under the Paris Agreement.

Germany has internationally enshrined its climate commitments under the Paris Agreement and in national climate protection legislation. To remain credible and set an example, Germany would have to stick to its targets and try to strengthen them instead of massively jeopardizing their implementation. Maintaining credibility is particularly important vis-à-vis countries with which climate partnerships are being negotiated.

References

AG Energiebilanzen. (2022). *Auswertungstabellen zur Energiebilanz Deutschland*. https://ag-energiebilanzen.de/wp-content/uploads/2021/09/awt_2021_d.pdf

Aitken, G., Langenbrunner, B., & Zimmerman, S. (2022). *Europe Gas Tracker Report*. https://globalenergymonitor.org/wp-content/uploads/2022/04/EUGasReport2022_final.pdf

BMWK. (2022). *Zweiter Fortschrittsbericht Energiesicherheit Deutschland reduziert Energieabhängigkeit von Russland in hohem Tempo*. https://www.bmwk.de/Redaktion/DE/Downloads/Energie/0501_fortschrittsbericht_energiesicherheit.html

Bundesnetzagentur. (2022). *Bundesnetzagentur - Aktuelle Lage Gasversorgung - Gasverbrauch in Deutschland 2022 in GWh/Tag, monatlicher Mittelwert*. https://www.bundesnetzagentur.de/DE/Gasversorgung/aktuelle_gasversorgung/_svg/Gasverbrauch_Gesamt_monatlich/Gasverbrauch_Gesamt_M.html?nn=1077982

CAT. (2022). *Country Assessment Germany*. Climate Action Tracker (CAT). https://climateactiontracker.org/countries/germany/

DIW Berlin. (2022). *Energieversorgung in Deutschland auch ohne Erdgas aus Russland gesichert*. https://www.diw.de/de/diw_01.c.838843.de/publikationen/diw_aktuell/2022_0083/energieversorgung_in_deutschland_auch_ohne_erdgas_aus_russland_gesichert.html

Gunnar Luderer (Hrsg.), Christoph Kost (Hrsg.), & Dominika Sörgel (Hrsg.). (2021). *Deutschland auf dem Weg zur Klimaneutralität 2045 Szenarien und Pfade im Modellvergleich*. https://doi.org/10.48485/pik.2021.006

Höhne, N., Emmrich, J., Fekete, H., & Kuramochi, T. (2019). *1,5°C: Was Deutschland tun muss*. NewClimate Insitute / Campact. https://newclimate.org/2019/03/14/15c-what-germany-needs-to-do/

Höhne, N., Hagemann, M., & Fekete, H. (2020). *Zwei neue Klimaschutzziele für Deutschland Kurzstudie*. https://newclimate.org/wp-content/uploads/2020/05/Zwei_neue_Klimaschutzziele_für_Deutschland_5_2020.pdf

Prognos, Öko-Institut, & Wuppertal-Institut. (2021). *Klimaneutrales Deutschland 2045. Wie Deutschland seine Klimaziele schon vor 2050 erreichen kann*. https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021_04_KNDE45/A-EW_209_KNDE2045_Zusammenfassung_DE_WEB.pdf

Sachverständigenrat für Umweltfragen. (2022). *Wie viel CO_2 darf Deutschland maximal noch ausstoßen? Fragen und Antworten zum CO_2-Budget*. https://www.umweltrat.de/SharedDocs/Downloads/DE/04_Stellungnahmen/2020_2024/2022_06

_fragen_und_antworten_zum_co2_budget.html;jsessionid=A9FF3BD2FA054EFE58FF3415C55CA969.intranet231?nn=400658

Schreiner, F., & Riemer, M. (2022). *Conversion of LNG Terminals for Liquid Hydrogen or Ammonia*. https://www.isi.fraunhofer.de/de/presse/2022/presseinfo-25-lng-terminals-wasserstoff-ammoniak.html

Sterchele, P., Julian Brandes, Judith Heilig, Daniel Wrede, Charlotte Senkpiel, Markus Haun, Patrick Jürgens, Christoph Kost, Thomas Schlegl, Andreas Bett, & Hans-Martin Henning. (2020). *Wege zu einem klimaneutralen Energiesystem*. https://www.ise.fraunhofer.de/de/veroeffentlichungen/studien/wege-zu-einem-klimaneutralen-energiesystem.html

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