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Agora Energiewende

BACKGROUND PAPER

LNG, Climate and Energy Security: Towards a Comprehensive Approach for Europe

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Executive Summary

Europe, and Germany in particular, have quickly ramped up liquefied natural gas (LNG) imports to partially offset the loss of Russian pipeline gas deliveries. While many observers rightly applaud this historical achievement, there are also concerns that LNG decisions taken in the face of the crisis can lead to new, risky path dependencies incompatible with climate safeguards.

This paper seeks to build bridges and inform more nuanced deliberations. It does so by exploring in detail relevant aspects along the LNG supply chain, guided by the principal assumption that both climate goals and energy security must be achieved. It has been informed by extensive stakeholder engagement, including a workshop bringing together different experts.

We find that the development of new LNG export terminals that have not yet reached a final investment decision poses the biggest risk of violating climate targets. In contrast, European import terminals can act as back-up capacities for crisis times. For this, their use needs to be restricted during non-crisis periods. In terms of LNG market balancing, large new export projects currently under development are already set to enter operation before 2027, significantly easing currently tight markets. Additional export capacity beyond this cannot contribute to easing the current supply crunch at scale given long development times and risks ending up as stranded assets.

Europe should therefore refrain from supporting new upstream projects, including through long-term contracts that enable such projects, and instead focus contracting efforts on the growing amount of uncontracted volumes from expiring legacy contracts, portfolio players, and from export projects that have already reached final investment decisions. Short- and medium-term contracts could decrease uncertainties resulting from excessive spot market exposure while limiting climate risks. There may be a role for governments to enable such contracts.

Lastly, there are two no-regret strategies. In the short term, tackling methane emissions can deliver significant climate and energy security benefits. In the long term, only phasing out natural gas by transitioning to efficient renewable energy systems ultimately reconciles energy and climate security.

#LNG
#ENERGY SECURITY
#CLIMATE

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LNG, Climate and Energy Security: Towards a Comprehensive Approach for Europe – Ten Theses

LNG Supply

Thesis 1: Global LNG supply projects currently under construction are likely to resolve the current supply shortfall by 2027. New projects launched now cannot significantly increase supply in the short term, given long development times.

Thesis 2: Additional global LNG supply projects beyond those currently under construction are not required unless demand after 2030 strongly deviates from climate-compatible pathways or unexpected gas supply disruptions occur.

Thesis 3: The construction of new LNG export capacities is the element of the LNG supply chain most at risk of locking in climate-incompatible gas demand.

LNG contracts

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Thesis 9: Developing some LNG import overcapacity as a security back-up in Europe is sensible, but utilisation should be restricted during non-crisis times.

Thesis 10: The only strategy that can ultimately achieve the twin goals of climate and energy security is to eliminate today's dependence on natural gas by replacing its use with renewables and efficiency gains.

1. Introduction and key takeaways

Liquefied natural gas (LNG) has become one of the most debated topics in climate and energy. In 2022, European countries raced to increase their LNG imports to offset the loss of Russian piped gas imports in the wake of Russia's invasion of Ukraine, fast-tracking the construction of new import facilities and increasing imports by 63 percent. Prices spiked, with the value of global LNG trade doubling to an all-time high of $450 billion[3], while traded volumes only increased by six percent (IEA 2023a).

European policymakers face conflicting demands when deliberating LNG decisions. On the one hand, parts of the existing energy systems in countries such as Germany still rely significantly on natural gas. Therefore, gas supply security and price stability matter greatly, in particular in times of rising global geopolitical tensions. On the other hand, today's natural gas use must be phased out to meet climate targets.

The challenge, therefore, is to make decisions now that will ensure a reliable and economic supply of gas for as long as it is needed, without jeopardising the transition to a clean and efficient energy system in line with the Paris Agreement, in Europe and globally. This paper seeks to inform the important deliberations on how to approach LNG decisions building on the principal belief that both priorities – energy security and climate security – need to be achieved by decision-makers.

The publication is based on expert interviews and a workshop with senior stakeholders, as well as extensive desk research, and we are grateful to all the experts and decision-makers who have shared their views with us. In this paper, we propose ten theses to inform debates on LNG choices, particularly in Europe. In contrast to previous discussions in Europe, which have mainly focused on LNG import issues, we look at the entire LNG value chain and propose theses on LNG supply, contracting, demand and import infrastructure. The key findings are as follows:

1. **LNG supply:** Increased European demand for LNG following Russia's invasion of Ukraine is currently putting global LNG markets under pressure. However, launching new LNG supply projects now does not help resolve this short-term crisis given the long development times of almost all new export projects. Crucially, LNG supply will have increased by around a third of existing capacity by 2027 as export projects *already under construction* come online. Additional supply is not required to balance global markets unless future LNG consumption deviates significantly from climate-compatible pathways or further unexpected severe gas supply disruptions occur, which cannot be ruled out in the light of current geopolitical tensions. Crucially, the construction of new LNG export capacities is the element of the LNG supply chain most at risk of locking in climate-incompatible gas demand. Furthermore, additional LNG demand reductions in third countries relative to current market expectations are equivalent to additional supply from a short-term energy security perspective while also reducing fossil energy use and associated emissions.
2. **LNG contracting:** European buyers have so far been largely reluctant to sign long-term contracts for deliveries to Europe, indicating that they see a significant likelihood of the energy transition reducing the demand for gas imports. In the coming years, a significant number of global legacy contracts will expire and new export projects with yet to be contracted capacities will come online, providing further supply options. In all likely scenarios European buyers will be able to purchase large quantities of LNG on the spot market, including from portfolio players. If governments view relying solely on spot markets as

3 Measured as the costs of LNG procurement for importers.

overly risky, short- and medium-term contracts could increase economic security and provide insurance against volatile spot markets. Those contracts may not be commercially viable and are often not the contracting option preferred by suppliers and hence potentially require government support. A key factor in assessing the climate impact of contracting decisions is whether they enable final investment decisions on new supply projects, thereby creating a much higher risk of locking in additional emissions in violation of Paris-compatible transition pathways.

3. **LNG demand and import infrastructure:** European countries, especially Germany, are developing some reserve capacity of LNG import infrastructure to ensure energy security in the case of further unexpected supply disruptions. To also ensure that climate goals will be reached, utilisation of such back-up infrastructure should be restricted during non-crisis times. Also, the availability of import capacity for bookings by private actors should be linked to more effective regulatory provisions linking capacity bookings to maximum contract durations in line with climate targets. Crucially, public investments into reserve capacity should not be required to generate a financial return. To ensure that such back-up infrastructure does not lock in increased fossil fuel usage in the future, its development must not directly or indirectly enable final investment decisions on new LNG export infrastructure. Wherever possible, flexible floating storage and regasification units (FSRUs) should be used, especially as planned natural gas import terminals are not immediately ready to import hydrogen or its derivatives. Ultimately, the only strategy that can achieve the twin goals of climate and energy security is to eliminate today's dependence on natural gas by replacing its use with renewables and efficiency gains.

2. LNG supply

Thesis 1: Global LNG supply projects currently under construction are likely to resolve the current global supply shortfall by 2027. New projects launched now cannot significantly increase supply in the short term, given long development times.

The sudden increase in LNG demand from Europe in 2022 has put LNG markets under pressure. Europe's willingness and ability to pay high prices for LNG imports amid the sudden increase in its LNG demand tightened global LNG markets and led to extraordinary price spikes. Vulnerable consumers such as Pakistan and Bangladesh were partially priced out of the market, with severe social consequences and resulting in gas-to-coal switches (Reuters 2023a).

Until 2026, LNG markets are likely to remain tight (BloombergNEF 2022). As only few new export projects will come online in the near future, the prospects for market balancing primarily depend on demand-side developments, with Chinese LNG demand a crucial factor (IEA 2023a). However, additional export projects that have not yet reached a final investment decision cannot contribute to resolving the near-term supply shortfall at scale, as the construction of onshore export terminals alone takes three to five years (Merlin Advisors 2019, Global Energy Monitor 2022).

For example, the Port Arthur LNG project in the United States, which reached a final investment decision in March 2023, will only begin commercial operations in 2027, reaching full capacity in 2028 (Sempra 2023). Floating LNG (FLNG) units that can be deployed more quickly may represent limited exceptions to this, even though high hopes regarding the prospects for FLNG have failed to materialise in the past (Westwood Global Energy Group 2023, Eni 2022).

However, LNG supply on global markets is set to greatly expand until the end of 2027 given a very significant pipeline of post-FID projects already under development (figure 1). By then, global export capacities will grow by around 35 percent over current levels once projects that have already reached final investment decisions will have come online. Most of these capacity additions will come from export projects in the United States and Qatar.

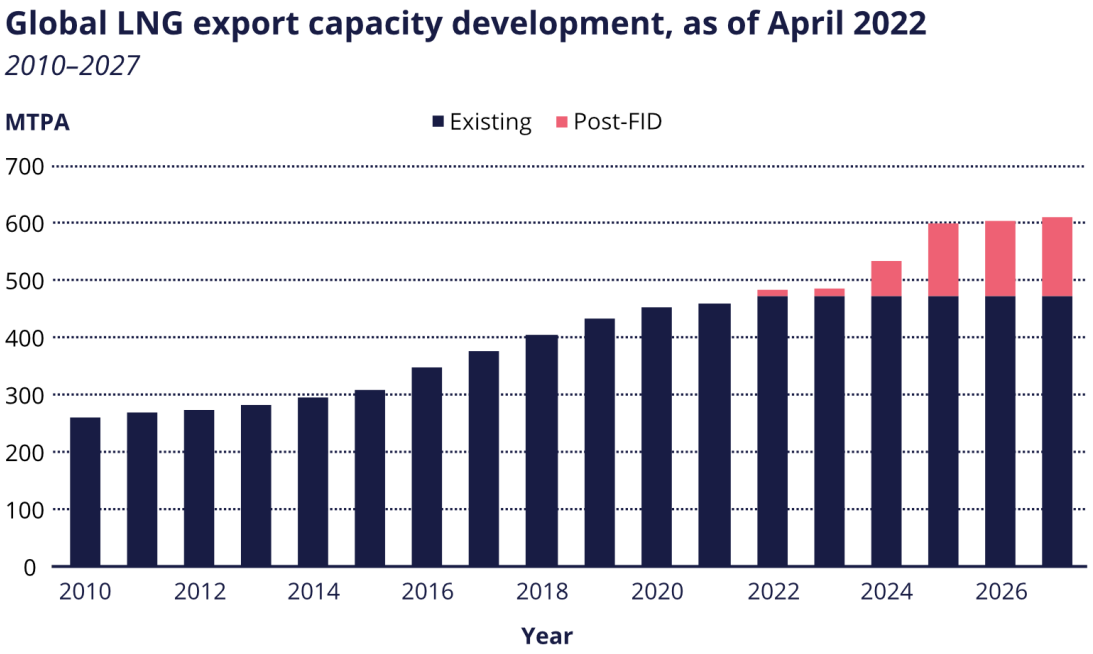


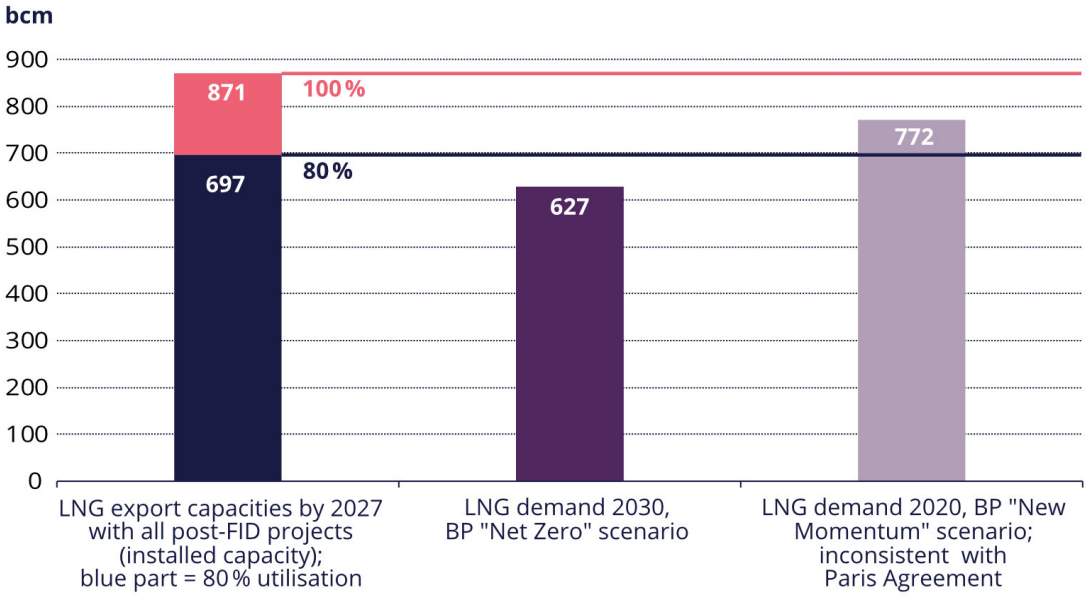
Figure 1: Global LNG export capacity development, as of April 2022; **Source:** adapted from IGU 2022[4]

Notably, total LNG export capacities will significantly exceed the capacities needed by 2030 if demand develops in line with a climate-compatible pathway once the projects that have reached final investment decisions and are currently under development are operational by the end of 2027 (figure 2). Various analyses have independently come to the same conclusion: additional projects beyond those that have already reached a final investment decision will only be needed if LNG demand increases significantly beyond climate-compatible pathways, already taking into account the substantial loss of Russian piped gas exports to Europe (e.g. Enervus 2023, EWI 2023).

Therefore, any new LNG export project approved now can only be profitable if future gas consumption significantly exceeds climate-compatible pathways. For this reason, new LNG export projects launched now face a very high risk of becoming stranded assets if climate targets are met. Consequences of the energy crisis, such as additional, targeted gas demand reduction measures and high LNG prices, as well as climate policies more generally, further increase the likelihood of an accelerated decline in LNG demand in the coming years (IEEFA 2023).

4 Since April 2022, there have been additional FIDs for further LNG export projects, most notably for Port Arthur (18.6 bcm/y) and Plaquemines Phase 1 and Phase 2 (27.6 bcm/y) in the United States. These are not included in figure 1, but in the calculations in the text and in figure 2.

LNG export capacities after 2027 with projects in development (post-FID) and demand range



Reading example: By 2027, installed export capacities exceed 870 billion cubic metres per year once all projects currently under construction have come online. At a typical utilisation rate of 80 percent, this equates to around 700 billion cubic meters per year of LNG supply, well above LNG demand in a net-zero scenario. The highest projected 2030 demand in a climate-incompatible scenario of 772 billion cubic meters lies between installed export capacity and capacity at 80 percent utilisation.

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Figure 2: LNG export capacities after 2027 with projects in development (post-FID) and demand range; **Sources:** adapted from IGU 2022, BP 2023, Shell 2023[5]

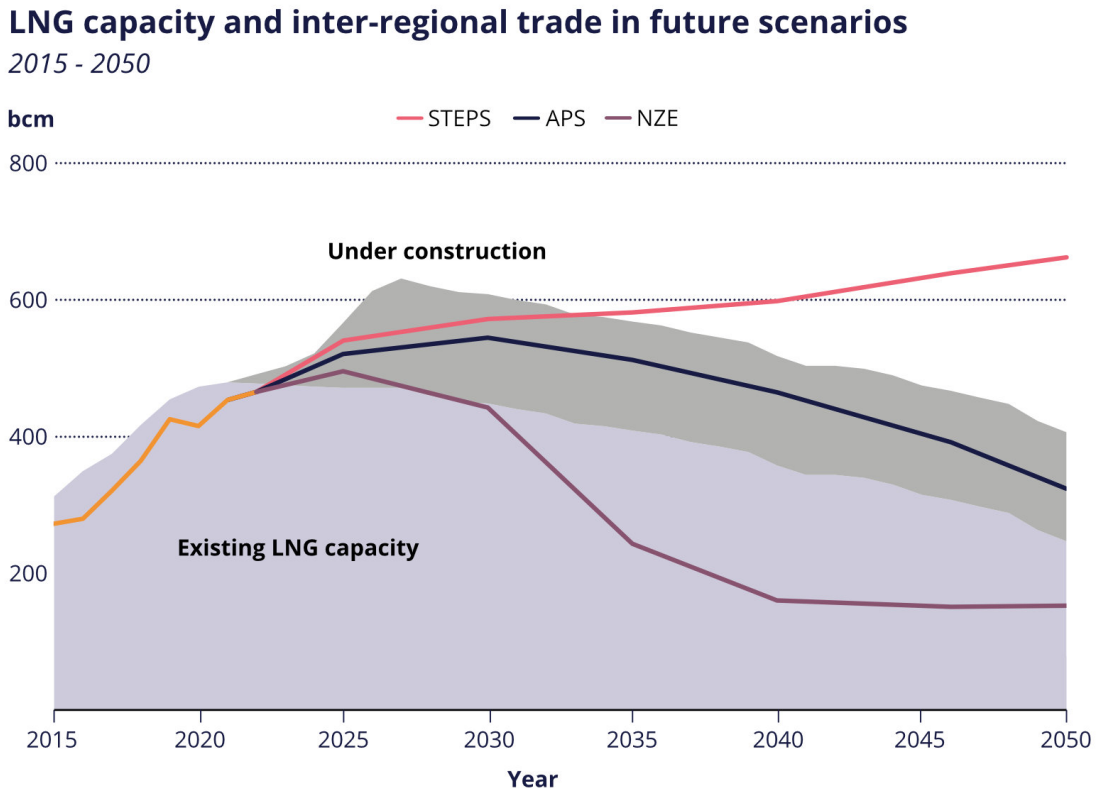
Furthermore, it should be noted that additional demand reductions for LNG outside of Europe relative to current market expectations are equivalent to additional upstream supply from a short-term energy security perspective. However, they have the substantial advantage of reducing fossil energy use, associated emissions and thus contribute to both short- and long-term energy security.

European countries are in a privileged position to facilitate an accelerated deployment of renewable energy and energy efficiency solutions in developing and emerging economies. Indeed, a deal struck between Germany, the United States and Egypt follows this logic: accelerating renewables and thereby freeing additional LNG to substitute for the loss of Russian imports (Climate Home News 2022a). This approach could be more widely implemented as part of North-South partnerships for an accelerated global energy transition. They may also allow to reach additional objectives linked to geopolitical considerations and establishing resilient clean-energy supply chains.

5 Future export capacity data based on IGU (2022) (see Figure 1) with the Port Arthur and Plaquemines export terminals, which reached final investment decisions afterwards, added.

Thesis 2: Additional global LNG supply projects beyond those currently under construction are not required unless demand after 2030 strongly deviates from climate-compatible pathways or unexpected gas supply disruptions occur.

If global climate targets are to be met, LNG demand will have to begin to fall in the coming years, both for staying within the 1.5°C limit (NZE scenario) and also given the currently less ambitious climate pledges by governments (APS scenario) (figure 3)[5]. In these cases, and assuming no unexpected supply disruptions occur, such as those resulting from the Russian war, existing LNG export capacities (including those under construction) can reliably ensure security of supply once projects currently under construction are finalised.



Reading example: LNG consumption starts to decline around 2025 in a net zero scenario (NZE) and around 2030 given announced climate pledges (APS). Thanks to significant new export capacities entering operation in the second half of the 2020s, further export capacities are only required to meet demand under current policies (STEPS) after ca. 2035.

Note: The figure shows LNG capacity adjusted to reflect inter-regional trade and de-rated to 80% of nameplate capacity. For these reasons, the numbers are lower than those shown in figure 2.

Adapted from IEA World Energy Outlook 2022 figure 8.8, p. 383

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Figure 3: LNG capacity and inter-regional trade in future secnarios; **Source:** adapted from IEA 2022a

6 This is based on the International Energy Agency's World Energy Outlook. The Net Zero Emissions by 2050 (NZE) Scenario is developed based on specific targets, notably limiting global warming to 1.5°C. The Announced Pledges Scenario (APS) assumes that current government targets are met. The Stated Policies Scenario (STEPS) is based on current policy settings (IEA 2022a).

Notably, the project pipeline of potential additional LNG export capacity is very significant. Capacities currently under consideration that have not yet reached a final investment decision could triple global capacities in the unlikely case that they are all realised (IGU 2022). Key decisions will be made in the near future, shaping future pathways for global LNG supply: more than 260 billion cubic metres of projects are targeting final investment decisions in 2023 and 2024, equal to over 40 percent of already existing capacities (Wood Mackenzie 2023).

At the same time, restricting fossil fuel provision is essential for staying within climate safeguards. Projected emissions from existing fossil fuel infrastructure already exceed the emission budget for limiting global warming to 1.5°C, and almost 40 percent of already developed fossil fuel reserves would have to remain unextracted to stay within a 1.5°C-compatible emissions budget (IPCC 2023, Trout et al. 2022). Accordingly, the International Energy Agency has identified an immediate halt to all new gas exploration projects as a crucial milestone for achieving net-zero emissions in line with the 1.5°C limit (IEA 2021).

Thesis 3: The construction of new LNG export capacities is the element of the LNG supply chain most at risk of locking in climate-incompatible gas demand.

The development of liquefaction terminals for exports is the most costly and complicated part of the LNG supply chain. It is responsible for approximately three quarters of the total investment needs of the supply chain from liquefaction to regasification (figure 4).

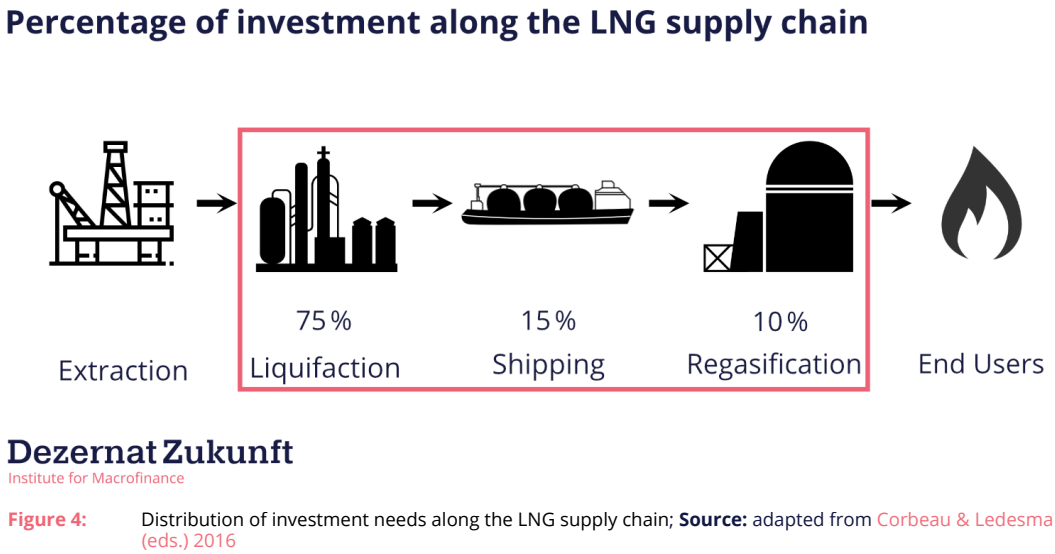


Figure 4: Distribution of investment needs along the LNG supply chain; **Source:** adapted from Corbeau & Ledesma (eds.) 2016

Developing the capital-intensive upstream and midstream export infrastructure usually requires the conclusion of long-term supply contracts to secure a viable business case and financing. At least 70 percent, and up to 80 percent, of the expected production and export amounts must be sold under unconditional long-term offtake contracts for an export project to go ahead (Steuer 2019, US Department of Energy & United States Energy Association 2017), with limited exceptions, most notably in Qatar thanks to significant government involvement. The development of gas export and that of extraction infrastructure are also usually directly linked, with the US market after the fracking boom as one notable exception.

New LNG export projects, once built, are highly likely to lead to increased gas consumption, and hence emissions. First, new projects secured via long-term contracts lock in future gas consumption as buyers will always seek to market the contracted amounts, either in the original target market or through reselling. This is also true if the contracts are not with final buyers but with portfolio players. Such actors can either resell purchased quantities through long-term contracts to final buyers or keep them in their portfolios to be able to arbitrage between spot markets.

Second, capacities that are not secured via long-term contracts also incentivise higher future gas demand: once initial investments into export projects are made and costs sunk, infrastructure owners have an incentive to sell produced amounts as long as prices for LNG sold through spot markets exceed marginal export costs. This also applies to projects with long-term contracts that have expired if the assets can still be used.

Additional supply infrastructure, with or without long-term contracts, is therefore likely to lead to lower LNG prices. The lower the price, the harder it will be to reduce global gas consumption as required for climate targets to be achieved, and the presence of abundant cheap gas would make the switch to clean energy solutions less attractive.

One may argue that in light of today's energy security concerns this is a secondary issue that can be addressed in the future. However, it is entirely unclear how this problem could be addressed: raising the price of a globally-traded good would require establishing a mechanism like a global CO2 price, which seems highly unlikely. Alternatively, one would have to reduce the volume of LNG available to the global market. Short of paying for LNG to be left underground, this seems close to impossible given how easily LNG cargoes can be redirected. Thus, there is no simple solution to the problem of markets awash with a cheap fossil fuel whose use should be phased out.

3. LNG contracts

LNG is mostly sold through long-term contracts with "take-or-pay" clauses, requiring buyers to take and pay for contracted LNG quantities, or alternatively pay a certain price for LNG amounts not taken (Herbert Smith Freehills 2020). This contracting structure plays a crucial role in derisking the development of new, capital-intensive LNG production and export projects (*see LNG supply section above*). In 2021, around two thirds of global LNG cargoes were sold through long-term contracts, with a volume-weighted average duration of over 15 years (GIIGNL 2022).

Long-term contracts do contain some flexibility elements. First, prices are usually indexed to some factor. Traditionally, most long-term LNG contracts have been indexed to oil prices, but this has started to change over the past decade with the emergence of, initially, US LNG indexed to Henry Hub spot prices and then a broader shift to gas-to-gas indexation as oil and gas prices began to diverge (GaffneyCline 2022, S&P Global 2023). In addition, contracts typically include reopener clauses, which allow buyers and sellers to respond to unexpected developments. However, the application of these clauses is often subject to legal disputes. Overall, confidentiality in long-term LNG contracts makes it difficult to fully understand how prices are set and how they can be renegotiated (Norton Rose Fullbright 2017).

Thesis 4: To prevent fossil fuel lock-ins and reduce the risk of stranded cargoes, Europe should abstain from new long-term contracts that directly or indirectly enable new upstream export projects.

As elaborated in the previous section on supply-side decisions, the construction of new LNG export projects beyond those that have already reached final investment decisions is incompatible with climate safeguards. With regard to the long-term emission impact of long-term contracts, there is hence a crucial distinction between long-term contracts that enable new LNG production projects to come on stream, thereby increasing the cumulative supply of LNG to world markets; and contracts fed by existing projects.

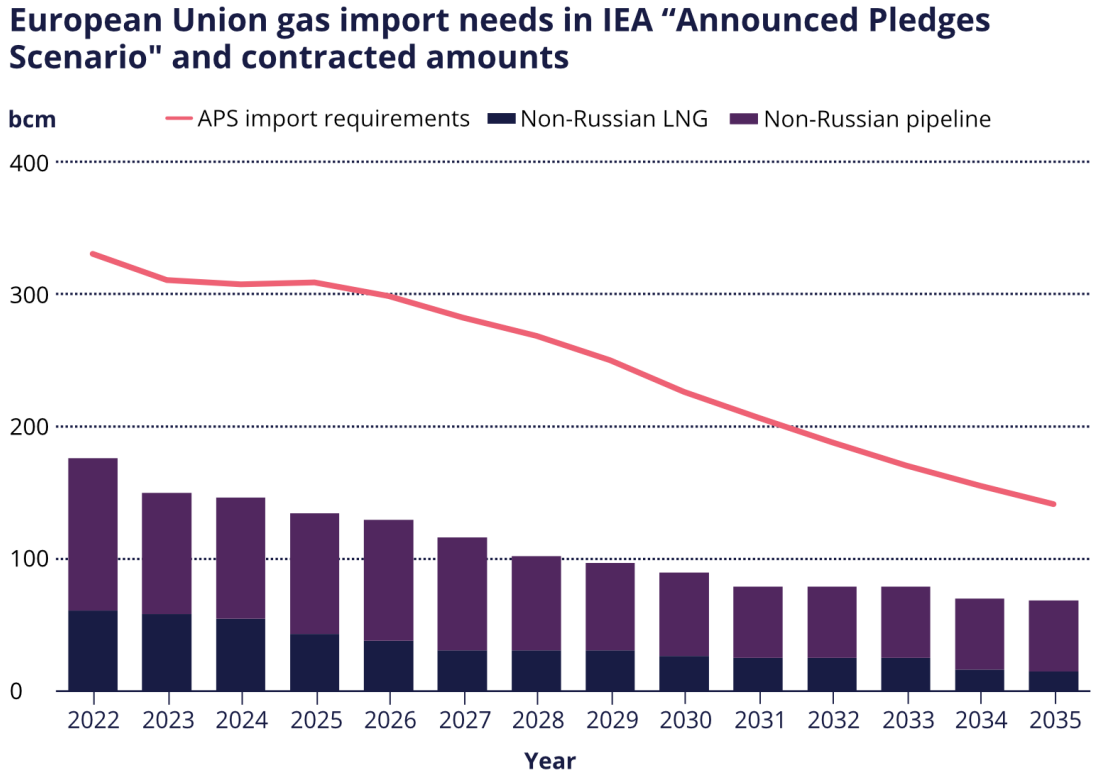
Contracts that enable final investment decisions on new supply projects are significantly more likely to create path dependencies for higher emissions from gas consumption in the future (*see thesis 3 above*). Therefore, Europe must, and can, abstain from concluding or encouraging long-term contracts that enable final investment decisions on new export projects.

In more general terms, extensive long-term contracting can be characterised as a bet on and insurance against future global gas demand not falling as required for climate targets to be met. Notably, extensive long-term contracting could turn out to be a self-fulfilling prophecy: first, it may reduce confidence in the probability of energy transition targets being reached, thereby making it less likely that investment decisions are aligned with climate-compatible pathways. Second, in the case of FID-enabling contracts, long-term contracting increases the overall supply of LNG, thereby lowering gas prices and incentivising higher gas consumption. This risk increases with the volume of long-term contracts concluded.

Fortunately, there are alternatives to long-term contracts that can enable importing states to secure required gas supplies until natural gas use is phased out without locking in climate-incompatible longer-term path dependencies. In particular, shorter-term LNG contracts based on uncontracted volumes that will become available on the global market in the coming years, including from portfolio players, offer viable and preferable alternatives (see thesis 5 below).

Steering clear of especially FID-enabling long-term contracts is also a prudent strategy from a macro-financial perspective, as it reduces the risk of exposure to stranded cargoes in the future. To illustrate: the European Union faces a supply gap of up to 170 billion cubic metres of natural gas between non-Russian firm delivery contracts and demand given announced energy transition targets in the years up to 2030. However, this gap quickly shrinks by more than half to 70 billion cubic metres by 2035 (figure 5). Closing the entire existing supply gap through LNG long-term delivery contracts with fixed delivery volumes could hence create a strong mismatch between future deliveries and expected demand.

In this scenario, (European) importers would be exposed to stranded cargoes with potentially limited reselling options in the globally oversupplied market that is likely to emerge if governments accelerate climate policy implementation worldwide. This outcome is made more likely by the fact that other import markets such as China are already stepping up their own long-term contracting, further limiting future reselling opportunities (Bloomberg 2023). Long-term contracts therefore transfer a significant share of the risk of final gas demand not materialising from producers and exporters to buyers, as opposed to spot market transactions.



Note: The figure shows LNG capacity adjusted to reflect inter-regional trade and de-rated to 80% of nameplate capacity. For these reasons, the numbers are lower than those shown in figure 2.

Reading example: Import requirements given announced pledges (APS) decline rapidly from 2025 onwards. As contracted volumes decline at a slower rate, the gap between contracted deliveries and demand shrinks over time.

Adapted from IEA World Energy Outlook 2022 figure 8.14, p. 391

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Figure 5: European Union gas import needs in IEA "Announced Pledges Scenario" and contracted amounts; **Source:** adapted from IEA 2022a

Private sector players in Europe are recognising the limited scope for long-term gas supply and the risks of stranded cargoes in the event of too high long-term contracting and have so far only shown limited appetite for new long-term supply contracts (McKinsey 2022). In 2022, around 15 billion cubic metres worth of long-term LNG supply clearly destined for Europe were signed by private actors, less than one third of the capacity of the Nord Stream 1 pipelines (Holleaux 2023). This compares to four billion cubic metres of LNG contracted by European buyers in 2021 (IEA 2022b). At the same time, the limited long-term contracting by German energy companies did already contribute to final investment decisions on two LNG export projects in the United States, the Plaquemines Phase Two project with bookings from EnBW, and the Port Arthur project with bookings from RWE (Venture Global 2023, Sempra 2023), illustrating the relevance of these deliberations.

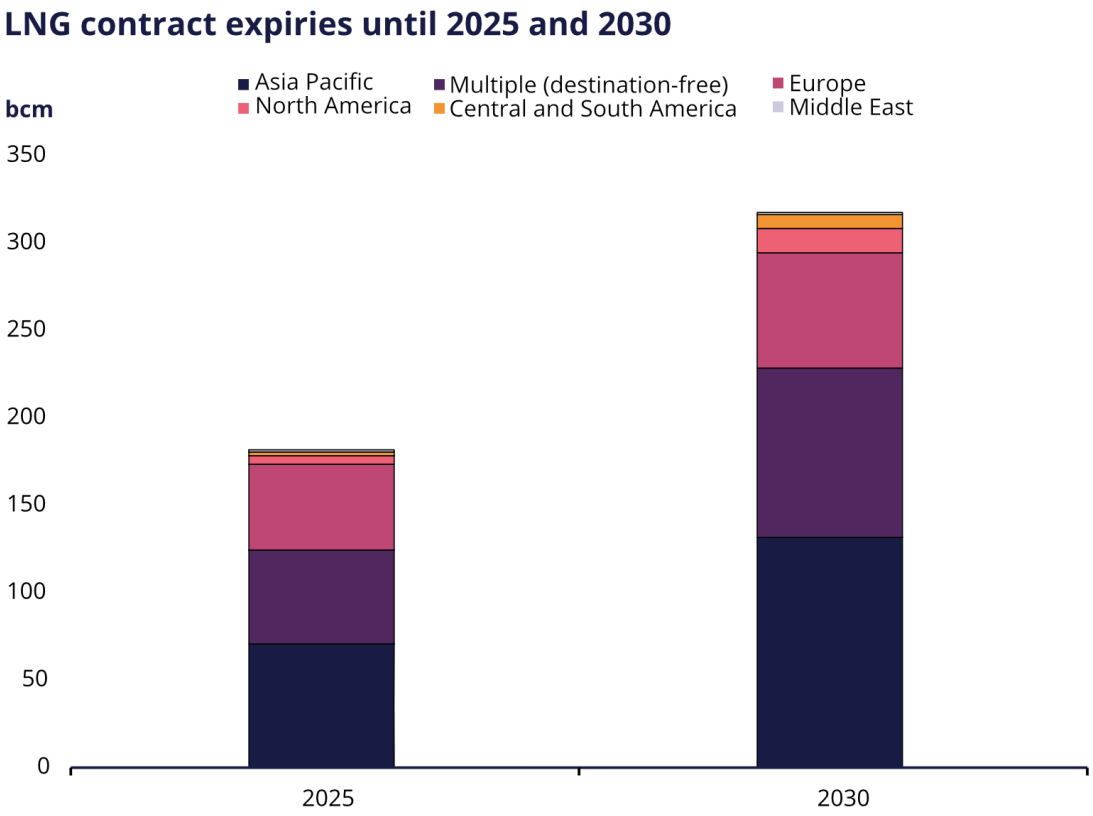
Thesis 5: Short- and medium-term contracts could decrease uncertainties resulting from excessive spot market exposure while limiting climate risks. There may be a role for governments to enable such contracts.

As outlined above, long-term contracts that enable new upstream export projects are incompatible with climate safeguards, even if they may seem desirable from an energy security perspective focussed on gas supply. Fortunately, European buyers have access to other supply routes. These include spot market purchases, purchases from portfolio players such as Shell or BP and short- and medium-term contracts. Europe's ability to attract significant additional LNG cargoes at short notice in 2022 is testament to this, although it came at a significant price premium that led to some demand destruction.

Relying entirely on spot market purchases would be a risky strategy. In the possible scenario of future geopolitical events that impact Europe's access to gas supplies, or if gas demand deviates strongly from climate-compatible pathways, energy security may not be ensured via spot markets, and the possibility of exposure to significant price spikes cannot be ruled out. In this context, short- and medium-term contracts can be a way of reducing price volatility and improving planning certainty, although even these contracts are subject to some price volatility due to price indexation. The public debate in importing countries such as Germany so far largely focusses on long-term contracts with durations of at least 15 to 20 years, but there are important nuances in this field.

First, in the future, the expiry of legacy contracts will increase the availability of uncontracted LNG volumes. According to the International Energy Agency, 180 billion cubic meters worth of legacy contracts will expire by 2025, followed by an additional amount of 135 billion cubic meters by 2030, shifting the focus of contracting activities from new supply to the recontracting of legacy volumes (figure 6). Furthermore, a significant portion of Qatar's large LNG export capacities that are already under construction is not yet contracted out, further increasing the amount of future uncontracted LNG volumes in addition to existing contract expiries (CGEP 2023).

Focussing contracting activities on recontracting volumes from expiring legacy contracts thus allows reducing spot market exposure while avoiding the additional emissions that would be locked in by long-term contracts for supplies from export projects that have not yet reached a final investment decision and rely on such contracts to move forward.



Reading example: Until 2025, 180 billion cubic meters of LNG delivery contracts expire, and 315 billion cubic meters will have expired in total by 2030.

Adapted from IEA Gas Market Report, Q4-2022, p. 47

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Figure 6: LNG contract expiries unteil 2025 and 2030; **Source:** adapted from IEA 2022b

Second, it is important to note that direct contracting from producers to importers is not the only route: portfolio players and traders who purchase LNG from various sources and resell them to importers provide important flexibility by acting as intermediaries in the market. Their important role in global markets is sometimes overlooked in political discussions: more than half of the contracts signed in 2022 were signed by portfolio players and traders (Wood Mackenzie 2023), and around half of the over 300 billion cubic metres contracted by portfolio players through to 2025 are not yet sold, bringing significant flexibility to the market (IEA 2022b).

In 2021 (the last year for which comprehensive data is available), portfolio players such as BP signed several medium-term supply contracts with a duration of five to ten years (GIIGNL 2022). More recently, other portfolio players including Shell have begun offering supply contracts with clauses that allow changes to contract terms and destinations at predefined points during the contract period (Reuters 2023b). Such options can play a crucial role in reconciling the two goals of supply security and price stability while avoiding long-term fossil fuel path dependencies.

Notably, the reluctance of wealthy importers, especially in Europe, to sign conventional contracts on a large scale can motivate exporters and portfolio players to offer more dynamic contracting arrangements if they cannot find buyers on conventional terms. This effect can be particularly important given exporters' initial opposition to move away from traditional long-term contracts.

If governments conclude that future gas supply needs, even in net-zero scenarios, are not sufficiently covered by contracting decisions made by private-sector players, and that this could lead to an economically problematic exposure to the spot market, they may be inclined to support contracts with medium lengths (up to ten years) to reduce spot market exposure without generating long-term lock-ins. This could happen indirectly or directly through state-owned energy companies (e.g., the nationalised energy companies Uniper and SEFE in Germany).

In doing so, governments must avoid supporting contracts that enable final investment decisions on new export projects, which are not required in climate-aligned scenarios and would with a high certainty lock in additional emissions. If the increased costs of contracts with shorter durations are the decisive hurdle for private actors in the conclusion of these contracts, governments may explore mechanisms that allow limited public support for these.

An innovative solution with dual benefits for energy security and emission reductions would be to combine the conclusion of medium-term contracts with efforts to reduce gas consumption outside of Europe via additional measures by European governments. Under such a scheme, European countries would invest in renewables and efficiency measures, freeing up LNG volumes that would have otherwise been consumed in those countries (*see thesis 1 above*). New medium-term contracts, especially those with portfolio players as intermediaries, could already include provisions for such cases, creating an incentive for both European buyers and intermediaries to use such options. Buyers could be encouraged by lower prices under the contract, intermediary companies receive an option to buy such volumes at a very low price. Doing so would also address the risk that even medium-term contracts could ultimately trigger new upstream investments, if intermediaries can recover such costs in a shorter time period via elevated prices for medium-term contracts.

Thesis 6: Inflexible delivery ex-ship (DES) contracts can lead to regional gas lock-ins, but destination-flexible deliveries may pose greater risks of locking in higher global gas consumption.

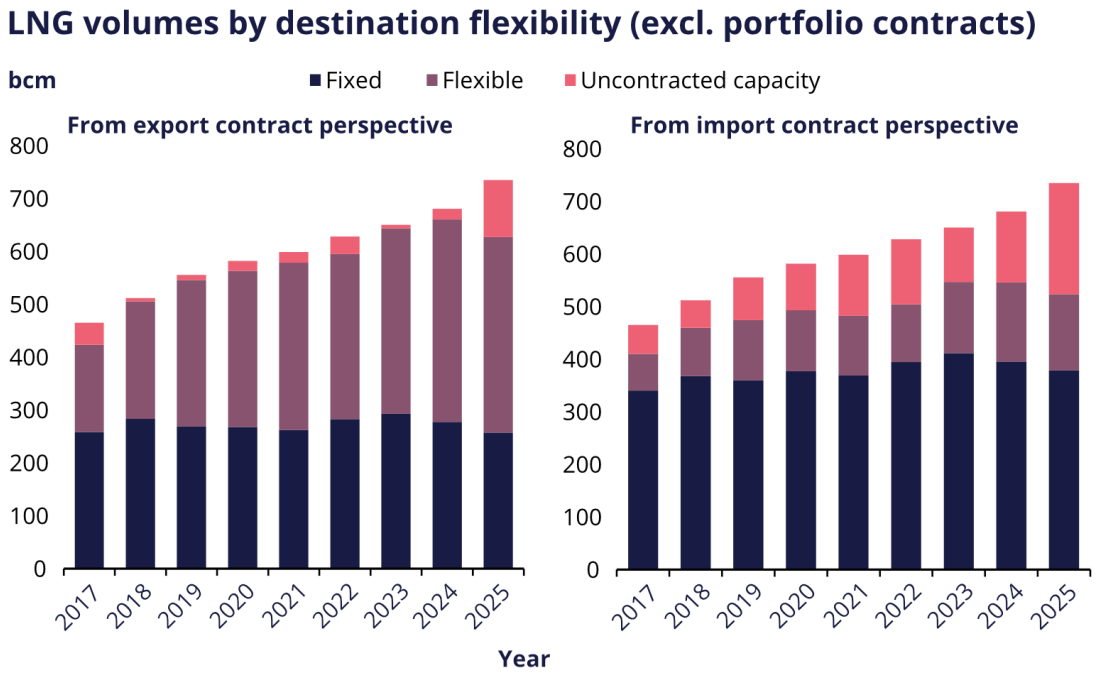
There are two principal types of delivery contracts for LNG: in free on board (FOB) contracts, the ownership of the LNG is transferred to the buyer once the LNG is loaded onto the transport ship. In delivery ex-ship (DES) contracts, LNG ownership is only transferred when the LNG is unloaded at the import terminal. In the case of DES contracts, delivery contracts usually specify destination ports to which the LNG must be delivered, decreasing flexibility. Notably, these contracts tend to contain reopener clauses including the possibility of changing destination ports.

At the same time, so-called "destination clauses", which prohibit any reselling of LNG deliveries, as well as mandatory profit sharing mechanisms if cargoes are rerouted, have been deemed anticompetitive by regulators in key LNG import markets such as the European Union and Japan (Thomson Reuters 2019, Stephenson Harwood 2019). In these markets, possible regional supply lock-ins would thus only arise through delivery ex-ship contracts.

However, long-term delivery ex-ship contracts with accompanying territorial restrictions could indeed undermine regional climate neutrality targets when they commit importers to accept LNG deliveries at import terminals in regions where there is no longer a need for these gas volumes, and incentivise importers to sell such cargoes at a discount. This is also true if contracts contain reopener clauses, in case the associated costs from a renegotiation exceed the discounts at which deliveries could still be sold in the original target market.

Overall, however, global LNG supply is becoming more destination-flexible, in particular because of the provision of additional US LNG supply with a tendency for destination-flexible free on board contracting as well as the expiry of legacy contracts. By 2025, almost 60 percent of all primary LNG export volumes are expected to be destination-flexible, excluding volumes sold by portfolio players, which provide further flexibility (figure 7).

Notably, destination-flexible LNG contracts are not more aligned with the global climate transition than destination-inflexible contracts. In fact, the opposite may be true, as destination-flexible contracts allow the companies involved to more easily redirect volumes to areas of the world where demand remains, while potentially incentivising higher consumption through lower prices as described above.



Adapted from IEA Gas Market Report, Q4-2022, p. 42

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Figure 7: LNG volumes by destination felxibility (excl. Portfolie contracts); **Source:** adapted from IEA 2022b

4. LNG demand and import infrastructure

Thesis 7: Most LNG demand is and will be outside of Europe, but Europe plays a crucial role in setting global expectations.

The stark drop in Russian pipeline gas deliveries to the European Union led to a strong increase in European LNG imports: in 2022, Europe's LNG imports increased by 63 percent to a record level of 132 billion cubic meters. While European imports (including the United Kingdom and Turkey) still only represented around one third of global LNG trade, the sudden surge of European demand drove LNG prices to record highs (IEA 2023a, Shell 2023, GIS 2023).

In the future, Europe's relative size in the LNG import market will further decline: BP's Energy Outlook expects European LNG imports to fall in relative terms to 15 percent in 2030 and eight percent in 2050 in a net-zero scenario, and to 24 percent of global LNG trade in 2030 and 20 percent in 2050 in a future energy world that continues to rely on fossil fuels (BP 2023). The majority of LNG demand is and will be from Asian countries such as China, South Korea, and Japan.

At the same time, European energy and climate policies more broadly play an important role in guiding future global LNG demand. The signals European leaders and companies sent with regards to expected future LNG demand, for example through contract conclusions or the development of import terminals, are closely observed. These are particularly impactful given the significant gaps between possible future LNG trajectories depending on the extent to which climate targets are met. For instance, high levels of long-term contracting by European buyers could easily be interpreted as a vote of no confidence in the prospects for the global energy transition.

European governments (especially Germany and Italy) also played an instrumental role in driving the G7's 2022 statement calling for additional upstream gas investments (Climate Home News 2022b, Financial Times 2022). On the other hand, European governments in 2023 pushed back against demands for a more LNG-friendly statement from Japan, again highlighting their crucial role, with a different outcome (Axios 2023, Reuters 2023c).

More broadly, the extent to which Europe succeeds in meeting its climate transition targets under the *European Green Deal* and its gas demand reduction targets under the *REPowerEU* plan will have important consequences for the global climate transition, with very significant implications for possible future gas consumption pathways. In addition, international cooperation mechanisms and measures by the European Union and its member states, working with international partners for instance in the context of *Just Energy Transition Partnerships*, can greatly support the global shift away from natural gas and fossil fuels, thereby also improving energy supply security.

Thesis 8: Natural gas venting and flaring as well as leakages cause significant losses of gas resources. Addressing these losses benefits climate and energy security and should be a short-term priority.

Large amounts of natural gas continue to be lost due to leakages in gas infrastructure, as well as to the intentional venting or flaring of gas. The International Energy Agency estimates that 210 billion cubic meters of natural gas could be additionally provided to global markets if measures to tackle flaring and methane leakage were taken. If implemented in countries that currently export gas to Europe, 45 billion additional cubic meters of natural gas could be provided per year, almost one third of Europe's gas imports from Russia in 2021 (IEA 2022c).

At the same time, methane – the main component of natural gas – reaches the atmosphere through leakages or venting of natural gas and is a very powerful greenhouse gas, with a warming effect 84 times as powerful as that of CO2 over a 20-year time period (IPCC 2013).

Notably, many of the measures that reduce methane emissions, such as leak detection and repairs, can be implemented at net-zero costs: based on pre-crisis gas prices, around half of the possible response measures could be implemented without net costs, and doing so would cut methane emissions from the oil and gas industry by 40 percent. With the record gas prices of 2022, the share of measures that can be implemented without net costs rises to 80 percent, with a resulting reduction in methane emissions of more than 60 percent (IEA 2023b).

Effective measures that tackle venting and flaring of natural gas as well as leakages thus provide a crucial win-win for energy security and climate protection. Emerging regulatory efforts in the United States and Europe as well as initiatives such as the Global Methane Pledge or the Oil & Gas Methane Partnership 2.0 provide promising avenues for progress on these matters, but a timely realisation of real-world progress beyond monitoring mechanisms will be crucial (CSIS 2023).

Thesis 9: Developing some LNG import overcapacity as a security back-up in Europe is sensible, but utilisation must be restricted during non-crisis times.

In countries that seek LNG imports, the LNG debate has largely centred on the effects of constructing LNG import terminals. As shown in the preceding sections, LNG supply decisions, often made possible via long-term contracts, are the choices most directly at risk of locking in higher gas consumption and hence emissions, or of generating stranded assets. Import infrastructure is different because it is, in principle, possible to construct and operate import terminals at a low utilisation rate, i.e., with only a weak link to gas consumption.

Given Germany's particular exposure to the cessation of Russian pipeline gas supplies and the government's subsequent push to increase LNG imports, it is worth examining the German case in more detail. The government plans to charter up to five floating storage and regasification units (FSRUs), two of which are already operational, in addition to one privately operated FSRU. Furthermore, the government is envisioning the construction of three fixed LNG import terminals (BMWK 2023).

Notably, the German government officially plans for a significant share of the future LNG import infrastructure to be unutilised in normal times. A very high share of more than 75 percent of import capacities by 2030 are designated as reserve capacities, i.e., as insurance against other supply disruptions (42.5 billion cubic metres – including a ten percent risk premium – out of 54 billion cubic metres, BMWK 2023).

However, for this insurance function to be realised, regulatory restrictions for utilisation must be in place. This requires clarity that these import capacities will not be utilised in non-crisis times, including the necessary corresponding legal obligations and financing restrictions. Notably, the current regulatory provisions for the terminals are at odds with the intended reserve nature of the terminals. Germany's LNG regulation from November 2022 allows terminal operators to market 90 percent of their import capacity on a long-term basis, 80 percent of which for more than 15 years (LNGV 2022). The national regulatory agency has allowed long-term contracting of this share for the next 20 years in Lubmin and Brunsbüttel and 25 years in Stade (Bundesnetzagentur 2023).

At the same time, the German government is heavily supporting the development of new LNG import infrastructure. In addition to generous regulatory support for LNG import projects, the state is directly financially involved in LNG import infrastructure in five ways. First, the government has allocated €9.8 billion between 2022 and 2038 for the chartering and operation of five floating storage and regasification units (FSRUs) and for the construction of the required infrastructure, and will operate these terminals through a state-owned company (BMWK 2023). Second, the public development bank KfW holds a 50 percent stake in the German LNG Terminal company, which is developing a fixed LNG import terminal in Brunsbüttel, with public spending of €744 million (Bundesregierung 2023). Third, the state-owned energy company SEFE has signed a 20-year contract for import capacities at the planned Stade LNG terminal (HHE 2023). Fourth, at least €400 million in public funding have been made available for port construction works in relation to the planned terminal in Stade (Niedersachsen Ports 2023, Energate 2022). Lastly, gas consumers are financing the construction of the required onshore pipeline connections from the new terminals to the existing gas grid through grid fees.

Since there is a public interest in energy security and climate change mitigation, but not in high utilisation of LNG import terminals as an end in itself, governments that decide to get involved in import projects should follow three principles: first, public involvement in such projects should be seen as an investment in energy security that does not need to generate a direct financial return that would require the infrastructure to be utilised. This should be reflected in budgetary planning.

Second, to the extent that import terminals are developed and operated by private actors, their utilisation should be restricted. Reserve capacity should not be available for long-term bookings and utilisation by private actors. Instead, reserve capacities should be reserved and paid for by governments as a crisis insurance mechanism. In general terms, reserve capacity is the capacity that is not needed to meet future gas import demand, including to ensure storage refilling, in line with a climate-compatible gas consumption pathway, if other supply routes are not disrupted.

Third, the availability of import capacity for bookings by private actors should be linked to more effective regulatory provisions linking capacity bookings to maximum contract durations in line with climate targets. Current regulations show that this is possible in principle, but this lever is not effectively used. Therefore, long-term capacity bookings that exceed future gas import needs in climate-compatible scenarios should be limited. Over time, the maximum duration threshold should be reduced in line with the progressive phase-out of natural gas.

Given that the supply crisis is primarily a short- to medium-term crisis, and that demand-side and clean energy solutions can help to significantly reduce gas dependency in the medium to long term, governments should also fully assess the potential of floating LNG import facilities (FSRUs) to provide the necessary import capacity – not as a bridge to the construction of fixed terminals, but as a bridge to a clean energy system where no (or at least fewer) natural gas import capacities are needed.

This is particularly relevant given the serious doubts about whether terminals that are constructed for LNG imports can be repurposed for imports of hydrogen or hydrogen derivatives (Riemer et al. 2022). Hence, to the extent possible, FSRUs should be used for importing LNG. Instead of building large-scale fixed LNG import terminals, one could then transition directly to terminals built for importing hydrogen products such as ammonia.

Thesis 10: The only strategy that can ultimately achieve the twin goals of climate and energy security is to eliminate today's dependence on natural gas by replacing its use with renewables and efficiency gains.

The preceding sections have shown the complexity of LNG-related decisions in the short term. While there is no way to avoid this complexity in the short and medium term, the transition to a more efficient energy system based on renewables is the only way to ultimately achieve both energy security and climate change mitigation goals. If governments and companies increasingly succeed in realising this pathway to clean, efficient energy systems, LNG-related decisions will become less complex as the reduced future demand for LNG becomes more certain.

The measures necessary for this have been repeatedly and consistently identified. They include accelerating the deployment of wind, solar and other renewable energy generation, replacing fossil-fuel appliances such as gas heating systems in households and industrial plants with electricity-run alternatives, and improving energy efficiency across the economy (see, for example, IEA 2022d, European Commission 2022, and Agora Energiewende 2022). Importantly, the complexity of LNG choices should not detract from the urgency and benefits of advancing the energy transition. On the contrary, it should be seen as a further argument for realising the transition to efficient, clean energy systems as soon as possible.

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