

EU gas storage and LNG capacity as responses to the war in Ukraine

SUMMARY

Russia remains Europe's largest supplier of coal, oil, and gas. This poses a particular difficulty for the EU and its Member States, which are urgently seeking to reduce their energy dependence. This is not only necessary to pressure Russia economically to end its invasion of Ukraine, but also to prevent Russia from weaponising its energy supplies and threatening Europe's energy security in future.

Replacing Russian natural gas will be much more difficult than replacing oil and coal, due to differences in supply infrastructure, transportation and storage. While part of the long-term solution lies in the promotion of renewable energy sources and energy efficiency savings, the EU will nevertheless require large volumes of natural gas imports in the short and medium term.

Since most of Europe's pipeline infrastructure is organised to import Russian gas, alternative supplies will mostly have to come by sea in the form of liquefied natural gas (LNG). To guarantee security of supply, the EU will also need to ensure gas storage levels remain high so Member States can cope with a sudden interruption of gas supplies. However, both LNG terminals and gas storage capacity are unevenly spread across Europe, with important policy implications.

There is a clear need to frontload investment to diversify supplies and fill storage, but uncertainty as to who can or should finance these changes. There is also the question of how to coordinate policy action at EU level, how to buffer against negative social and economic consequences, and how to ensure coherence of security of supply with the 'fit for 55' package and the European Green Deal.



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Current situation

The EU imports 90% of the gas it consumes, with its own production in [secular decline](#). In 2021, 45% of EU natural gas imports came from the Russian Federation. The vast majority of Russian gas is supplied through pipelines via Belarus, Ukraine and Turkey, or the Nord Stream 1 pipeline providing a direct connection to Germany. Gas imports from Russia in 2021 totalled around 155 billion cubic metres (bcm). In addition to its dominant role in gas supply, Russia also accounts for 27% of EU oil imports and 46% of EU coal imports.¹ Whereas the EU has imposed a [partial ban on coal imports from Russia](#) (8 April 2022), and is discussing the feasibility of banning crude oil imports, ending gas imports implies additional difficulties in terms of volume, price, and transportation.

Increasing LNG supplies and ensuring sufficient gas storage are two key policy steps ahead of next winter. It is vital that the EU has sufficiently high volumes of gas in all of its storage sites, so that it can cope with an interruption of Russian gas supplies, whether that is initiated by Russia itself, or forms part of a potential embargo on all energy imports from Russia, as advocated by the European Parliament in [April 2022](#). At least in the short run, a full embargo on all energy imports from Russia might have a considerable macro-economic impact on Member States heavily dependent on Russian gas, such as Germany, though the magnitude of that impact is a matter for debate.²

Even full gas storage and maximisation of existing LNG capacity might not be enough for the EU to sustain a full embargo on gas in the winter of 2022-2023. Such a policy would need further action, including energy saving measures and a rapid increase in renewables, according to the March 2022 [RePowerEU communication](#) from the European Commission, which argues that around two thirds of Russian gas imports could be replaced by the end of 2022 thanks to gas diversification and reduced energy consumption. The Commission estimates that the EU could import around 50 bcm more LNG from the United States, Qatar, Egypt and west Africa. This could be complemented by around 10 bcm from alternative pipeline suppliers in Azerbaijan, Algeria and Norway. The rest of the energy savings would come in the form of investments in renewable energy and measures to curb energy demand and improve efficiency, for example by replacing gas heating with heat pumps.

Rising gas prices

Traditionally, most gas supplied to the EU has taken the form of long-term supply contracts between producing and consuming countries, usually linked to crude oil prices, with limited public data on the real price paid by different countries. Since the 2000s in particular, as part of the gas market liberalisation process initiated by the EU, an [increasing volume of gas imports](#) are now traded on more transparent EU market hubs, with the Dutch 'Title Transfer Facility' (TTF) becoming the [reference market for European gas](#). The rapid increase in TTF prices during the current geopolitical crisis (see graph below) gives a clear indication of how much more Europe has been paying for its gas in recent years. Following Russia's invasion of Ukraine in February 2022, gas prices spiked to unprecedented levels, reaching an all-time high on closing of €227 per megawatt-hour on 7 March 2022 (with an intraday high of €345). TTF prices have since halved but remain above €100 per megawatt-hour, well in excess of their levels over the past decade (see Figure 1).

EU gas prices were already rising in the second half of 2021, before Russia's invasion of Ukraine, although to a lesser extent. The International Energy Agency (IEA) [sees the reasons](#) in a strong rebound in EU demand after the ending of Covid-19 lockdowns, weather events impacting on the supply of renewables (e.g. lower wind speeds), and the reluctance of Russia to supply enough short-term volumes on market hubs.

The European Commission largely concurs with this view in its own [market analysis](#), but further notes that gas storage levels at Gazprom-owned storage sites are not only well below their usual levels, they are also lower than other gas storage sites owned by other operators. This may indicate a deliberate strategy by Russia and Gazprom to lower the overall volume of gas supply to Europe.

Figure 1 – EU natural gas prices (2012-2022)



Source: Tradingeconomics.com.

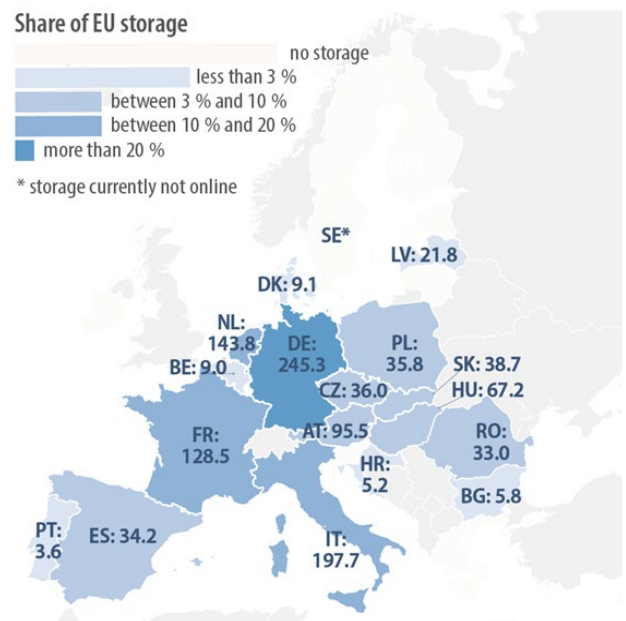
EU gas storage capacity

Usually, Russian gas arrives in the EU via pipelines and is fed into the general distribution network. In order to build extra capacity for winter – the prime consumption period, since gas is used extensively for household heating – some gas is stored in underground storage facilities, mainly underground caverns or salt formations, to be extracted again when needed.

There has been growing concern about the low levels of gas in EU storage since 2021 and the impact this could have on the EU's resilience to cope with interruption of gas supplies from Russia. The Commission has therefore proposed an urgent [new regulation on gas storage](#) to ensure all sites are filled to at least 80% by November 2022 (and 90% in subsequent years). The proposal is currently being negotiated between the Parliament, Council and Commission under an urgent procedure.

According to the European Commission, total available EU gas storage capacity is 1110.7 TWh (equivalent to 113.7 bcm), which is less than overall annual gas imports from Russia. Storage capacity is not evenly distributed across the EU (see Figure 2), with five countries accounting for almost three quarters of the total (Germany, Italy, France, the Netherlands and Austria), while around a third of smaller EU Member States have no storage capacity of their own, although some have arrangements to access gas stored in

Figure 2 – EU storage capacity (TWh and share)



Data source: [European Commission](#).

neighbouring countries. A [2017 external study](#) produced for the European Commission found that Member States had very different regulatory arrangements for gas storage and only a few had mandatory storage obligations.

Already at the onset of the winter of 2021-2022, Europe's gas storage levels were unusually low. According to the IEA, storage sites owned or controlled by Russian energy provider [Gazprom were filled to just 25 % of their working storage capacity](#) at the beginning of the heating season. This was confirmed by the European Commission's [gas market report for Q3 2021](#), which noted that Gazprom storage sites in 2021 had the lowest average filling rate in the EU (22 %), despite being above average (>90 %) in previous years. The European Network of Transmission System Operators for Gas (ENTSOG) provides [regular data](#) for the seasonal outlook of gas storage. These confirm that storage levels in the 2021-2022 period were consistently below the levels of 2016 to 2020. This raises concerns about how easily the EU can fill its storage capacity in 2022, to prepare for the possible interruption of gas supplies and/or high heating demand next winter. A recent [report](#) from the Agency for the Cooperation of Energy Regulators (ACER) found that actual gas in storage in the EU-27 was only around 20 % of annual consumption (as at 1 October 2021), with filling levels of only 72 % on average and particularly low storage levels in Gazprom-owned sites. The ACER report findings lend further support to the need for urgent EU action on gas storage.

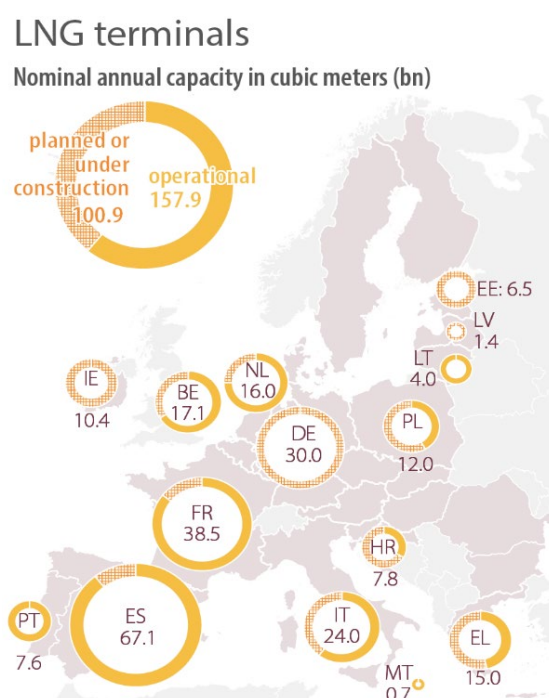
Coordination of EU action on gas storage would complement the security of supply framework for oil, where strategic stocks already exist in line with IEA requirements, and could potentially be used to cushion the effects of a supply interruption from Russia. Under the EU's [Oil Stocks Directive](#) (2009/119/EC), EU countries must maintain emergency stocks of crude oil and/or petroleum products equal to at least 90 days of net imports or 61 days of consumption, whichever is higher.

LNG as a possible substitute for Russian gas

LNG is natural gas cooled down to below -160 degrees Celsius, then transported via specially designed ships in a liquid state. LNG accounted for [around a quarter](#) of gas imports to the EU in 2020, with the rest supplied by pipelines. The main advantage of LNG over pipeline gas is that it can be flexibly imported from a wide range of supply countries, so it enhances rather than diminishes security of supply. The main disadvantage of LNG is that supplies are often more costly, since Europe would be competing directly with Asian countries where LNG is the norm and pipeline infrastructure is rare. There are also environmental concerns involved in the process of transporting gas at very low temperatures over large distances, leading to high greenhouse gas emissions. From the point of view of security of supply, a further consideration is that LNG requires specific import capacity to be built, so the gas can be received and regasified to enter the pipeline network.

The EU-27 has a total annual capacity to receive and regasify LNG of 158 bcm per year,³ with more than 100 bcm of new LNG projects either planned or under construction (see Figure 3). LNG capacity remains unevenly distributed across the EU. Some Member States, even large ones such as Germany, currently have no operational LNG import capacity. Around 37 % (60 bcm) of the EU's total LNG capacity

Figure 3 – LNG capacity per Member State (operational and planned)



Author's own calculations based on data from [Gas Infrastructure Europe](#) (March 2022).

is located in Spain, which has limited pipeline connections to France and thus the rest of Europe. Importing more LNG raises the question of how to increase pipeline transmission capacity, for example via the [MidCat pipeline](#) crossing the Pyrenees mountains, which has faced considerable difficulties in the past in securing planning consent and public support.

France has the second-largest LNG infrastructure in the EU with about half of Spain's capacity (33 bcm). Other major LNG importers within the EU are Italy (15 bcm), the Netherlands (12 bcm) and Belgium (11 bcm).

LNG import capacity is lower in eastern and south-eastern Europe, the regions most dependent on Russian gas and therefore more vulnerable to an interruption of physical supplies due to the war in Ukraine. Some countries such as Poland and Lithuania have recently built LNG terminals that have enhanced their security of supply and allowed them to end imports of Russian gas.

Germany currently has no LNG import capacity and is entirely reliant on pipeline gas, with most coming from Russia. To accelerate the diversification process, Germany has signed a memorandum of understanding between its national promotional bank and energy providers RWE and Gasunie to build the country's first LNG terminal at Brunsbüttel.⁴ Yet new LNG terminals typically take several years to build so cannot counter the risks of an interruption of Russian gas supply in the short term. Floating storage regasification units (FSRUs) are [another way](#) of importing LNG to Europe. These can be built more quickly and deployed more flexibly, but usually come with lower capacity because of their smaller size compared with LNG terminals.

South-eastern Europe remains heavily dependent on pipeline gas from Russia, often through a limited number of supply routes. In 2009, geopolitical disputes caused an interruption in gas supplies via the Brotherhood pipeline, which passes through Ukraine. This led to a physical interruption of gas supplies to households in south-eastern Europe in the depths of winter.

EU action to reduce dependence on Russian gas

In April 2022, the European Parliament adopted a new [resolution](#) on Ukraine, calling for an immediate and full embargo on Russian imports of oil, coal, nuclear fuel, and gas, and for both Nord Stream 1 and 2 pipelines to be completely abandoned. This energy embargo would be accompanied by a plan to continue ensuring the EU's security of energy supply in the short-term. Parliament's resolution calls for common strategic energy reserves and energy purchasing mechanisms to be established at EU level, with the aim of increasing energy security while reducing external energy dependency and price volatility. The resolution also calls for work to begin on creating a gas union, based on common purchases of gas by Member States.

At their informal meeting in Versailles on 10 and 11 March 2022, the European Council made energy security one of three top priorities, alongside bolstering defence capabilities and building a more robust economic base. The [Versailles Declaration](#) calls for the phase-out of EU dependency on Russian gas, oil and coal imports 'as soon as possible', without however giving a specific date. To do so, the declaration calls, inter alia, for:

- diversification of supply routes and increased use of LNG;
- accelerated roll-out of renewables and increased production of their necessary components;
- reinforced interconnection of European gas and electricity grids;
- improved energy efficiency; and
- development of a hydrogen market.

The European Council asked the European Commission to propose a RePowerEU plan by the end of May 2022. The Commission's [RePowerEU communication](#) (8 March 2022) gives an idea of the main components of this strategy. It includes a [legislative proposal on gas storage](#) (adopted on 22 March 2022) that requires existing storage infrastructures in the EU to be filled up to at least 80 % of their capacity by 1 November 2022 and 90 % in subsequent years (see [EPRS briefing](#)). All storage

system operators would need to be certified, including those operated from third countries, while 100 % discounts on transmission tariffs would apply to gas entering and exiting storage. A storage obligation for gas would also close a gap in the EU's current gas market rules: the 2017 [Security of Gas Supply Regulation](#) does not currently provide for compulsory storage obligations, although a solidarity clause does require Member States to supply gas to their neighbours in the event of a sudden interruption of supplies.

The Commission's RePowerEU plan proposes to complement increased storage with a voluntary joint procurement instrument allowing the EU to purchase collectively a strategic stock of gas on international markets, under more preferential and transparent terms than would be possible for individual countries to negotiate. The Commission would set up a [task force on common gas purchases at EU level](#), initially with the objective of securing well-priced imports ahead of next winter. The task force would be supported by Member States, and involve a Commission-led joint negotiating team that would hold talks with gas suppliers and develop energy partnerships.

Member States are taking a series of individual actions to reduce their dependence on Russian gas. This includes Germany's announcement to suspend certification of the (already built) Nord Stream 2 pipeline; Poland and the Baltic States ending all fossil fuel imports from Russia by the end of 2022; and Italy and Spain actively seeking to source alternative pipeline or LNG supplies.

Next steps and ongoing legislation

The European Commission will come forward with a RePowerEU Plan by May, as requested by the Versailles informal European Council meeting. The European Commission and the United States recently [agreed](#) to set up a joint task force on energy security, to work towards importing an additional 50 bcm of US LNG to the EU annually, until at least 2030.

At the same time, the European Green Deal offers the perspective of decarbonisation and consequently a rapid reduction in fossil fuel imports. A big increase in renewable energy coupled with more ambitious energy savings are part of the Versailles summit declaration, and constitute an obvious way to reconcile the environmental goals of the European Green Deal with the equally important geopolitical goal of European energy security.

Other options are more controversial, including the possibility for the EU to use more indigenous fossil fuels such as coal, which may provide energy security but also contribute heavily to greenhouse gas (GHG) emissions and other pollutants. Another possibility is for the EU to keep up its domestic gas production, with [pressure on the Netherlands to delay the planned closure of its Groningen fields](#), and for EU countries to exploit to the full their gas and oil reserves in the North Sea. Nuclear energy is another option that remains potentially useful but also controversial. The French government, for example, is looking to build new nuclear power stations and delay decommissioning of others,⁵ while Belgium has decided to prolong the life of its existing nuclear power plants. Germany's energy ministry meanwhile decided against prolonging nuclear power plants scheduled for closure, citing security concerns as well as legal and resource constraints.⁶ Other countries keen to deploy nuclear energy, such as Poland, face a long process for approval and construction, so new nuclear is not really the solution to short-term security of supply risks.

In terms of ongoing legislation, in December 2021 the European Commission put forward a hydrogen and decarbonised gas markets package, consisting of three major legislative proposals: a [recast regulation on EU gas and hydrogen markets](#); a [recast directive](#) on EU gas and hydrogen markets; and an entirely new [regulation to reduce methane emissions](#) in the EU energy sector. The proposal to recast the EU regulation on gas and hydrogen includes a targeted revision of the [2017 Security of Gas Supply \(SoGS\) Regulation](#). This would encourage EU cooperation on gas storage, develop a (voluntary) joint procurement instrument to build up strategic stocks, and counter cybersecurity threats to EU gas networks. The new legislative [proposal on gas storage](#) (March 2022) would later be incorporated into this broader reform of the SoGS regulation.

In October 2021, the European Commission offered a 'toolbox' of measures to help Member States counter the negative impact of rising prices on consumers (especially vulnerable ones), in a way that is compatible with the green transition and the functioning of the energy single market. In March 2022, the European Commission's RePowerEU communication went further to propose windfall taxes on energy producers and a relaxation of State aid to industries in difficulty as a result of high energy costs, and promised to look into ways to optimise electricity market design so it is less impacted by volatile gas prices. The Commission notes that full implementation of the 'fit for 55' proposals (adopted in 2021 with a view to reducing GHG emissions by 55 % by 2030), would reduce the EU's annual fossil gas consumption by 30 % by 2030 (equivalent to 100 bcm). Combined with additional measures in the RePowerEU plan (to be outlined on 18 May 2022), these are expected to cumulatively reduce use of natural gas by 155 bcm, equivalent to the volume imported from Russia in 2021. This shows that energy security and climate action are not contrasting goals but rather complementary aims for the EU as a whole to undertake.

Policy implications

EU action to substitute Russian gas by either increasing alternatives or reducing demand will raise a number of important policy questions, some of which are listed below:

- **Asymmetric storage capacity** of Member States. Underground gas storage is concentrated in a handful of Member States. Not all Member States have sufficient (or any) gas storage capacity, so sharing mechanisms must be envisaged.
- **Asymmetric LNG capacity**. Existing LNG capacity alone cannot substitute all Russian gas. High LNG capacity in the Iberian peninsula cannot be readily used for supply across the EU owing to a lack of pipeline interconnections. LNG import capacity is geographically concentrated in parts of the EU least dependent on Russian gas.
- **Frontloading of renewables investment**. This was identified at Versailles as a key policy aim, but questions remain regarding unequal funding capabilities at national level to promote renewables, and whether EU targets are sufficiently ambitious. Action to rapidly ramp up renewables may also face constraints in terms of procurement and installation capacity, as well as availability of skilled labour for this role.
- **Measures to reduce energy demand**. These will have to play a significant role in substituting for Russian gas but, just as for renewables, this poses the question of a lack of centralised coordination at EU level regarding the specific policy tools used by Member States and the precise level of ambition in the short term. This raises questions about whether the EU energy efficiency targets are sufficiently ambitious and strongly enforced.
- **Buffer against negative economic and social consequences**. Taking into account the social and economic implications of higher energy prices will preoccupy policy-makers. While the overall macro-economic shock will be unevenly distributed, all Member States will be affected, and all will need to address the shock somehow. Yet, Member States also have varying capacity to provide economic support for companies (e.g. through targeted State-aid measures) or individuals (e.g. by reducing value added tax (VAT) on petrol prices or subsidising heating), raising questions over possible (market) distortions or unfair competition.

Link between EU energy policy responses and the 'fit for 55' package. This will be key to ensure policy effectiveness and prevent the emergence of contradictory policy objectives. The current discussion in many Member States on lowering VAT on petrol is a case in point, as it runs counter to both the EU's overall objective to reduce oil and gas consumption via market mechanisms, and the climate action objective of disincentivising the use of fossil fuels in the transport sector.

ENDNOTES

- ¹ REPowerEU: European Commission communication, 8 March 2022.
- ² For an overview of different calculations on the impact of a full gas embargo in particular on Germany, see for instance the [March 2022 study](#) by the German Council of Economic Experts.
- ³ All figures from [Gas Infrastructure Europe](#).
- ⁴ German Federal Ministry for Economic Affairs and Climate Action, [press release](#), 5 March 2022.
- ⁵ French Ministère de la Transition Ecologique, [press release](#), 18 February 2022.
- ⁶ German Federal Ministry for Economic Affairs and Climate Action, [press release](#), 8 March 2022.

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