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U.S. Measures to Provide Liquefied Natural Gas for the European Union

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SUMMARY

U.S. Measures to Provide Liquefied Natural Gas for the European Union

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Lexie Ryan
Analyst in Energy Policy

Since Russia's full-scale invasion of Ukraine starting in February 2022, the 27 member countries of the European Union (EU) have taken moves to extricate themselves from a long-standing natural gas dependency on Russia. Prior to the war, Russia provided about 40% of the EU's total natural gas imports. In 2022, Russia substantially reduced its natural gas supplies to Europe, cutting flows through several pipelines. EU imports of Russian liquefied natural gas (LNG) increased during that time. Predominantly as a result of the reduction in pipeline supplies, the share of EU natural gas imports supplied by Russia was reduced to about 9% by September 2022. The EU says it intends to phase out imports from Russia entirely by 2030. Member states are searching for enough natural gas—as well as exploring other options beyond natural gas—to replace Russian supplies.

Faced with supply cuts on Russian natural gas flowing through pipelines, over the course of 2022 the EU turned to LNG. LNG imports met approximately a fifth of total EU natural gas demand in 2021, and although some member states are working to build new infrastructure, import capacity is constrained by the number and location of terminals. The United States, as the world's largest LNG exporter, has emerged as a key LNG supplier to the EU. The United States was already the top LNG supplier to the EU before Russia's war against Ukraine, providing 28% of EU's LNG imports in 2021. The Biden Administration promised even more to the EU in March 2022, setting new supply goals that U.S. exporters surpassed months before the end of 2022, largely because demand and prices in the EU were high. Commercial interests and administration goals aligned in this moment, but the federal government does not have direct control over LNG exports; the United States does not have a state-controlled natural gas exporting company and Congress is limited in its authority to direct private company actions in most cases.

Congress may take steps to encourage energy companies to export LNG to the EU. U.S. companies make decisions to build facilities and export natural gas based on commercial factors, such as LNG demand. Commercial challenges are less of an obstacle for U.S. LNG developers than in recent years due to high demand and prices, especially in the EU. Congress may attempt to ease the process of building U.S. LNG export terminals or reduce regulatory processes surrounding LNG export. These could include giving the EU FTA-country treatment, identifying ways to reduce construction costs, and amending the Natural Gas Act to clarify the scope of "public interest" considerations FERC must consider when determining whether to approve an application for an LNG terminal. On the EU side, infrastructure constraints, a preference for shorter-term contracts, and long-term net-zero goals may create uncertainty in demand for LNG around 2030 and later.

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Introduction

Historically, the United States has had an interest in European Union (EU) energy security, especially the EU's supplies of natural gas from Russia, upon which it has become increasingly dependent.[1] The development of the global liquefied natural gas (LNG) trade has provided another facet of the transatlantic relationship. Cheniere Energy's shipment of LNG from Louisiana to Portugal's Galp Energia in 2016 marked the first time the United States supplied natural gas to some EU countries.[2] In addition to supplying LNG, the United States has also sought to influence where EU members purchase gas, supporting projects that promote diversification of Europe's natural gas supplies and opposing projects that could deepen reliance on Russia, such as the Nord Stream 2 and TurkStream pipelines.

Since Russia's invasion of Ukraine on February 24, 2022, the United States has imposed several rounds of sanctions against Russia as well as taken measures to increase LNG exports to the EU.[3] The United States continues to explore measures to increase energy security for the European Union's 27 member countries.[4] For example, the Biden Administration pledged to provide the EU at least 15 billion cubic meters (bcm[5]) of additional LNG by the end of 2022,[6] choosing to cooperate with the EU rather than bilaterally with individual member states. They achieved this goal by August.[7] Depending on market dynamics, providing the EU with other sources of natural gas could lower a key source of income Russia relies on to fund its war.[8] Such action could also

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[1] The 27 EU members are Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden. Unless otherwise stated, "Europe" and "European" refer to the EU 27 in this report.

[2] Georgi Kantchev and Miriam Malek, "First U.S. Gas Shipment En Route to Europe," *Wall Street Journal*, April 21, 2016, https://www.wsj.com/articles/first-u-s-gas-shipment-en-route-to-europe-1461253153.

[3] For more information on U.S. sanctions on Russia, see CRS Report R45415, *U.S. Sanctions on Russia*, coordinated by Cory Welt.

[4] For information on other suppliers that could provide natural gas to countries in Europe, see CRS Report R42405, *European Energy Security: Options for EU Natural Gas Diversification*, coordinated by Michael Ratner.

[5] The United States uses billion cubic feet (bcf) as a term of measurement. The rest of the world uses meters. 35.2 cubic feet is approximately equivalent to 1 cubic meter.

[6] The White House, "FACT SHEET: United States and European Commission Announce Task Force to Reduce Europe's Dependence on Russian Fossil Fuels," March 25, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/03/25/fact-sheet-united-states-and-european-commission-announce-task-force-to-reduce-europes-dependence-on-russian-fossil-fuels/ (hereinafter The White House, "FACT SHEET: United States and European Commission Announce Task Force to Reduce Europe's Dependence on Russian Fossil Fuels).")

[7] In January-August 2022, the EU imported 39 bcm of LNG from the United States, compared to 22 bcm in 2021 as a whole. Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 15, issue 2, covering second quarter of 2022, https://energy.ec.europa.eu/data-and-analysis/market-analysis_en.

[8] Diminishing natural gas trade between Russia and the EU did not have an immediate impact on profits for Gazprom, Russia's state-owned natural gas exporter. Before Russia's invasion of Ukraine, natural gas exports to Europe accounted for 70% of Gazprom's revenues. Even after exports to the EU fell by 48% (January through August 2022 compared with 2021), Gazprom's profits increased by almost 100% in the first half of 2022 due to high natural gas prices. Victor Jack, "How Putin Has Maimed Gazprom," Politico.eu, October 16, 2022, https://www.politico.eu/article/russia-vladimir-putin-wounds-gazprom-ukraine-war-natural-gas-lng-energy/. Reuters found that over the course of 2022, Gazprom's exports volumes fell by 46% but the company may have earned a record-high revenue of $80 billion due to higher prices for natural gas (according to calculations by Reuters, as Gazprom has stopped disclosing financial results). However, lower prices for natural gas in 2023 may mean lower profits, with one estimate that Gazprom's exporting revenues could reach between $35 billion and $46 billion in 2023. Oksana Kobzeva, "Analysis: Gazprom's Export Revenue May Fall by 50% in 2023," Reuters.com, February 24, 2023, https://www.reuters.com/business/energy/gazproms-export-revenue-may-fall-by-50-2023-2023-02-14/.

provide more supply security to the EU. Without adequate natural gas supplies, the EU may face higher energy prices, as well as electricity blackouts, lack of heating during the winter months, lower industrial output, and diminishing economic activity. Furthermore, if the EU does not successfully diversify its natural gas suppliers, and remains dependent on natural gas, Russia may be able to use natural gas exports to the EU for political leverage.

Natural Gas in the EU and Russia's Supply Role

The EU is the world's second largest natural gas market, behind the United States, typically consuming around 400 bcm annually. The European Commission, the EU's executive arm, reports that this demand is expected to "remain relatively stable in the coming years."[9] The EU is the largest importer of natural gas in the world, typically importing 320 bcm or about 80% of its gas consumption.[10]

Natural gas plays a major role in the EU's energy mix. In 2021, natural gas comprised about 27% of the EU's primary energy consumption.[11] The European Commission Directorate-General for Energy stated that 26% of the EU's total natural gas supply is used in generating electricity, 23% is used in industry, and the rest is used mainly for heating buildings, making the fuel especially important for the winter months.[12] Goals established by European climate law with the intention to reach climate neutrality by 2050 may lead to the phasing down of natural gas use, or the restriction of imports to international partners with strict environmental requirements for natural gas export and production. European climate law goals also include cutting EU greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels.[13]

Because EU demand for natural gas has remained relatively flat while domestic production has fallen, the EU has grown increasingly dependent on natural gas imports. Russia has been the single largest source of natural gas for the EU, with Russian natural gas about 45% of the EU's total natural gas imports and 40% of its total natural gas consumption in 2021.[14] Other major natural gas suppliers include Norway (23% of total EU natural gas imports in 2021) and Algeria (12%).[15] Since Russia's war against Ukraine began, Norway has become the top supplier of natural gas to the EU.[16]

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[9] European Commission (EC), Directorate-General for Energy "Liquefied Natural Gas," fact sheet, accessed October 31, 2022, https://energy.ec.europa.eu/topics/oil-gas-and-coal/liquefied-natural-gas_en (hereinafter EC, "Liquefied Natural Gas")

[10] European Union Agency for the Cooperation of Energy Regulators (ACER), "Gas Factsheet," accessed October 3, 2022, https://www.acer.europa.eu/gas-factsheet.

[11] Primary energy consumption in 2021 was 1449.66 bcm. European Environment Agency, "Primary and Final Energy Consumption in Europe," October 26, 2022, https://www.eea.europa.eu/ims/primary-and-final-energy-consumption.

[12] EC, "Liquefied Natural Gas." Natural gas consumption in 2021 was 412 bcm. Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 14, issue 4, covering fourth quarter of 2021, https://energy.ec.europa.eu/data-and-analysis/market-analysis_en.

[13] European Council, "Council Adopts European Climate Law," press release, June 28, 2021, https://www.consilium.europa.eu/en/press/press-releases/2021/06/28/council-adopts-european-climate-law/.

[14] International Energy Agency (IEA), "How Europe Can Cut Natural Gas Imports from Russia Significantly Within a Year," press release, March 3, 2022, https://www.iea.org/news/how-europe-can-cut-natural-gas-imports-from-russia-significantly-within-a-year.

[15] EC, "Questions and Answers on REPowerEU: Joint European Action for More Affordable, Secure and Sustainable energy," press release, March 8, 2022, https://ec.europa.eu/commission/presscorner/detail/en/qanda_22_1512.

[16] EC, "Liquefied Natural Gas."

Domestic Production

Domestic production currently meets about 20% of EU natural gas demand and is decreasing due to field depletion, statutes and regulations,[17] and public opposition to local production in some cases. Prospects for increasing domestic natural gas production through unconventional methods are limited, with public sentiment in many EU member states largely opposed to hydraulic fracturing, and the absence of large-scale, recoverable reserves.[18] Since 2014, the Netherlands, the largest natural gas producer in the EU, has steadily cut production in its Groningen field, the largest in the EU, over concerns that extraction raises the risk of earthquakes.[19] North Sea gas fields, another important source of production from the Netherlands and the non-EU United Kingdom, are largely depleted.[20] New plans to extract more natural gas from the fields may conflict with net-zero carbon emission goals.

Storage

Natural gas storage is designed to supplement imports and domestic production. It plays a particularly important role balancing supply and demand during the winter months when natural gas is in greater demand, providing 25-30% of gas consumed between October and March.[21] With a technical storage capacity of approximately 114 bcm in 2022,[22] the EU has enough storage to hold just over a quarter of annual gas demand—amounting to about 40 bcm less than the EU imported from Russia in 2021. Storage facilities are not uniformly distributed throughout EU member states. An EU regulation adopted in June 2022 calls for sharing gas facilities among members, with countries with no domestic storage facilities able to store 15% of their annual domestic natural gas consumption in stocks located in other member states.[23] EU member state governments provided incentives in 2022 to private companies to offset the high price of purchasing the fuel and to ensure that enough storage was available to compensate for reduced Russian imports. Storing was expensive, with experts estimating the cost of filling storage in

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[17] For example, France and Bulgaria both contain existing or possible natural gas reserves but legislation prevents exploitation. France prohibits granting new permits and is banning all exploration and production of oil and natural gas by 2040. "France Passes Law to Ban All Oil and Gas Production by 2040," *Associated Press*, December 19, 2017, https://www.usatoday.com/story/money/energy/2017/12/19/france-passes-law-ban-all-oil-and-gas-production-2040/966132001/. Bulgaria passed a moratorium on exploration and extraction through hydraulic fracturing. Emiliya Milcheva, "Bulgaria Is Rich with Shale Gas, but Lacks Political Will to Exploit It," *Euractiv*, June 10, 2022, https://www.euractiv.com/section/energy/news/bulgaria-is-rich-with-shale-gas-but-has-no-political-will-to-exploit-it/.

[18] "Why Fracking Cannot Solve Europe's Energy Crisis," *The Economist*, October 4, 2022, https://www.economist.com/the-economist-explains/2022/10/04/why-fracking-cannot-solve-europes-energy-crisis.

[19] Shell, the partial owner of the Groningen field, estimates that an additional 50 bcm annually could be extracted from the field. The Dutch government has indicated they may be open to extending the life of the field given the current concerns about natural gas supply. Cagan Koc and Diederick Baazil, "The Massive Gas Field That Europe Can't Use," *Bloomberg.com*, October 6, 2022, https://www.bloomberg.com/news/articles/2022-10-06/dutch-close-europe-s-biggest-gas-field-despite-energy-crisis#xj4y7vzkg.

[20] Hamish Penman, "Stark Figures Show North Sea Gas Production Could Be on Course to Wrap up by 2030," *Energy Voice*, September 23, 2021, https://www.energyvoice.com/oilandgas/north-sea/351578/north-sea-production-2030/.

[21] EC, "Gas Storage," accessed October 31, 2022, https://energy.ec.europa.eu/topics/energy-security/gas-storage_en.

[22] Total natural gas storage capacity fluctuates, becoming less efficient the more gas is removed. Technical capacity, also known as working gas volumes, is the maximum amount of natural gas that can be stored at the facility. For technical capacity used in this report, see Gas Infrastructure Europe (GSI), "AGSI Storage Inventory," Aggregated Gas Storage Inventory, data for October 22, 2022, https://agsi.gie.eu/.

[23] EC, "Infographic – How Much Gas Have the EU Countries Stored?" last reviewed February 2, 2023, https://www.consilium.europa.eu/en/infographics/gas-storage-capacity/.

2022 at hundreds of millions of euros.[24] Although companies try to purchase natural gas for storage during times of lower prices, 2022 saw higher than normal prices throughout the year because of Russia's war against Ukraine. European countries stored natural gas at record high levels through the fall, and mild winter weather during the 2023 winter meant that gas storages were depleted less than normal, leaving the EU with the highest level of natural gas in storage facilities for this time of year in data going back to 2015.[25]

Pipeline Imports

In 2021, the EU imported about 140 bcm of pipeline natural gas from Russia via four major corridors: Nord Stream (Russia to Germany via the Baltic Sea), Yamal (to Poland and Germany via Belarus), TurkStream (to Turkey and southeastern Europe via the Black Sea), and via Ukrainian transit routes. In 2021, Russian pipeline natural gas was the single largest supply source of natural gas, accounting for 41% of total supply. Other sources of natural gas via pipelines include Norway (23.5% of total 2021 supply), Algeria (10.5%), Azerbaijan (2%), and Libya (1%).[26]

LNG

LNG accounted for 21.5% of the EU's natural gas imports in 2021. According to the European Commission, the top suppliers included the United States, providing around 28% of total EU LNG imports (22.3 bcm), Qatar (16.3 bcm, 20%), Russia (16 bcm, 20%, in addition to pipeline natural gas), Nigeria (11.2 bcm, 14%); Algeria (8.5 bcm, 11%), and Trinidad and Tobago (2 bcm, 3%) (**Figure 1**).[27]

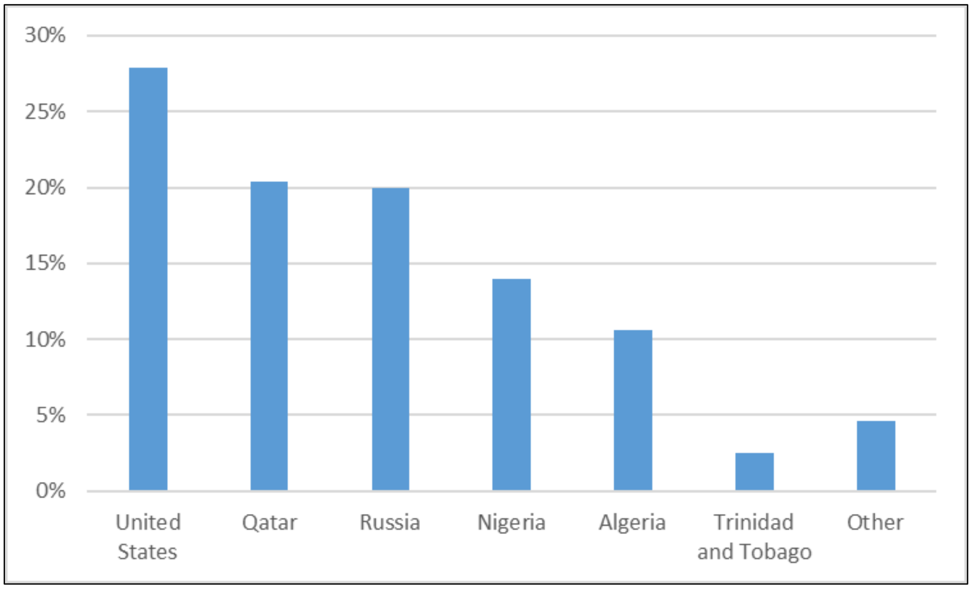
[24] Bozorgmehr Sharafedin, "European Gas Storage on Track to Meet Target but at a Cost," *Reuters.com,* August 4, 2022, https://www.reuters.com/business/energy/european-gas-storage-track-meet-target-cost-2022-08-04/.

[25] Georg Zachmann, Giovanni Sgaravatti, and Ben Williams, "European Natural Gas Imports," Bruegel, published February 8, 2023, https://www.bruegel.org/dataset/european-natural-gas-imports.

[26] Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 14, issue 4, covering fourth quarter of 2021.

[27] Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 14, issue 4, covering fourth quarter of 2021.

Figure 1. Top LNG Suppliers to the EU, 2021



Source: Figure created by CRS. Data from Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 14, issue 4.

Notes: Percentages may not add up to 100% due to rounding. Other sources include Angola, Brazil, the Dominican Republic, Egypt, Oman, Peru, Singapore, the United Arab Emirates, and Yemen.

As of December 2022, the EU has 22 operational LNG import terminals with a total annual capacity of 169 bcm.[28] In 2021, the largest LNG importers in the EU were Spain (21.4 bcm of 80 bcm total EU imports, about 27% of EU total), France (18.1 bcm, 23%), Italy (9.3 bcm, 12%), the Netherlands (8.6 bcm, 11%), and Portugal (5.9 bcm, 7%).[29] LNG terminals also provide natural gas storage capacity, and countries with LNG terminals may have additional storage facilities not located at the import terminals.[30]

Not every country has direct access to an LNG terminal, or sufficient pipeline interconnections to coastal countries with LNG terminals to meet demand for natural gas. For example, landlocked countries in central and eastern Europe, such as Austria, the Czech Republic, Hungary, and Slovakia, have limited options to build LNG import terminals within their national borders, but may access LNG imports via pipeline from other countries.

Supply Vulnerabilities

Due to access to ports, existing infrastructure, and supplier diversity, some EU member countries are more vulnerable to natural gas supply disruptions.[31] The following factors, among others, may indicate how resilient a country may be when faced with a gas supply crisis: the importance of natural gas to the total fuel mix, available storage, domestic production, and flexible import

[28] EC, "Infographic—Liquefied Natural Gas Infrastructure in the EU," last updated December 20, 2022, https://www.consilium.europa.eu/en/infographics/lng-infrastructure-in-the-eu/.

[29] Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 14, issue 4, covering fourth quarter of 2021.

[30] Information about storage facilities and LNG import terminals is available from Gas Infrastructure Europe's Aggregated Gas Storage Inventory, https://agsi.gie.eu/.

[31] EC, "Liquefied Natural Gas."

infrastructure such as LNG import terminals and floating storage and regasification units (FSRUs) (**Table 1**).[32] FSRUs are specialized marine vessels that can store, transport, and regasify LNG for direct injection into natural gas pipelines. Compared to onshore terminals, which may take up to three years to build, FSRUs can be converted from an existing LNG tanker within 18 to 24 months. They require some onshore and port infrastructure, but not the extensive berthing, piping, storage tanks, and associated infrastructure required for conventional, onshore LNG import terminals. FSRUs may therefore enable importers to increase imports more quickly than building new onshore LNG import terminals.[33] Further, once converted, with certain limitations FSRUs can be relocated as needed.

Table 1 explores the varying natural gas storage, domestic production, and availability of EU LNG import infrastructure that exists currently or is projected to be online in the next year. The share of natural gas in each country's total energy mix and natural gas demand indicate how reliant that country is on natural gas as a fuel. The percentage of imports from Russia indicates how reliant the country is on natural gas from Russia, specifically. Existing and planned import terminals, storage capacity, and domestic production can indicate some of the flexibility a country has currently and may have in the future to respond to a natural gas supply crisis.

[32] Other factors that may also impact natural gas supply vulnerability include proven natural gas reserves, existing pipelines to natural gas exporters other than Russia, interconnections with neighboring countries, existing contracts, and possible Russian ownership of natural gas infrastructure, as well as characteristics that are difficult to quantify such as degree of market integration.

[33] See CRS Insight IN11956, *LNG Exports to Europe: What Are Floating Storage Regasification Units (FSRUs)?*, by Paul W. Parfomak and John Frittelli.

Table 1. EU Member State Natural Gas Supply Security Context

Member State	Share of Natural Gas in Energy Mix, 2021	Natural Gas Demand 2021, bcm	Percentage of Imports of Natural Gas from Russia in 2020	Natural Gas Storage Capacity as a Percentage of Annual Demand	Domestic Natural Gas Production, bcm, and Percentage of Annual Demand	Operational LNG Import Terminal Capacity, December 2022, bcm	Planned and Under Construction LNG Import Terminal Capacity, including FRSUs, December 2022, bcm
Austria	22%	8.5	86%	115%	0.77 (9%)		
Belgium	26%	17	7%	5%	0.01 (0%)	11	6
Bulgaria	16%	2.9	75%	20%	0.06 (2%)		
Croatia	33%	2.9	0%	17%	0.85 (29%)	3	3
Republic of Cyprus	0%	0	n/a	No storage	0 (0%)		2
Czech Republic	20%	8.5	100%	53%	0.19 (2%)		
Denmark	14%	2.3	0%	41%	1.31 (57%)		
Estonia	7%	0.4	93%	No storage	0 (0%)		7
Finland	7%	2.1	98%	No storage	0 (0%)		5
France	17%	40.6	17%	33%	0.02 (0%)	33	4
Germany	27%	87.1	66%	29%	5.14 6%)		31
Greece	24%	6.3	38%	No storage	0.01 (0%)	7	19
Hungary	40%	10.2	95%	68%	1.70 (17%)		
Ireland	32%	5.3	0%	No storage	2.05 (39%)		10
Italy	43%	67.6	43%	29%	5.03 (6%)	16	18
Latvia	28%	1.1	100%	223.60%	0 (0%)		2
Lithuania	36%	2.4	42%	No storage	0 (0%)	4	

Member State	Share of Natural Gas in Energy Mix, 2021	Natural Gas Demand 2021, bcm	Percentage of Imports of Natural Gas from Russia in 2020	Natural Gas Storage Capacity as a Percentage of Annual Demand	Domestic Natural Gas Production, bcm, and Percentage of Annual Demand	Operational LNG Import Terminal Capacity, December 2022, bcm	Planned and Under Construction LNG Import Terminal Capacity, including FRSUs, December 2022, bcm
Luxembourg	18%	0.7	27%	No storage	0 (0%)		
Malta[a]	40%	0.3	0%	No storage	0 (0%)	1	
Netherlands	40%	36.2	30%	39%	24.06 (66%)	20	5
Poland	20%	21.2	55%	18%	5.68 (27%)	6	8
Portugal	24%	6	10%	6%	0 (0%)	8	
Romania	32%	11.3	45%	30%	9.26 (82%)		
Slovakia	28%	4.8	85%	79%	0.06 (1%)		
Slovenia	12%	0.9	9%	No storage	0.01 (1%)		
Spain	24%	32.5	11%	11 %	0.06 (0%)	60	
Sweden	2%	1	1%	14%	0 (0%)		

Sources: Annual gas demand and total annual energy demand is available from BP, *BP Statistical Review of Energy 2022*, except Malta from Cedigaz (for annual gas demand), http://www.cedigaz.org, and IRENA (for total energy demand), http://www.irena.org. Storage capacity, also known as injection capacity, and existing LNG infrastructure is available from Gas Infrastructure Europe, http://agsi.gie.eu/. Domestic Production is available from the U.S. Energy Information Administration (EIA) dry natural gas production page, https://www.eia.gov/international/data/world/natural-gas/dry-natural-gas-production. Import dependency on Russia is available from Eurostat's Energy Trade visualization tool, https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html. The tool's Russia dependency rate is measured by share of net imports from Russia in gross inland natural gas consumption per country, and it does not clarify if it includes pipeline and/or LNG imports. Percentage for Austria is for 2021 and from ACER, https://aegis.acer.europa.eu/chest/dataitems/214/view. FSRU plans are from S&P Global Commodity Insights, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/081022-feature-europes-dash-for-new-lng-import-infrastructure-picks-up-pace; EC, https://www.consilium.europa.eu/en/infographics/lng-infrastructure-in-the-eu/.

Notes: Latvia and Austria's storage capacity is greater than 100% of annual demand because they have more storage capacity than their annual demand for natural gas. Both countries export excess gas to neighboring countries. Please note that numbers are not exact due to calculations performed to standardize units and rounding.

a. Total energy consumption for Malta was not available for 2021; therefore share of natural gas in energy mix and natural gas demand are from 2020.

Russia's War Against Ukraine: Natural Gas Supply Security Threats and Responses

Flows of pipeline natural gas from Russia to the EU fell in the months following Russia's 2022 invasion of Ukraine, continuing a trend that began a few years prior. Lockdown measures responding to the COVID-19 pandemic drove down natural gas demand across the EU in 2020. The volume of Russian natural gas imports fell, although the share of total natural gas supply was comparable to previous years.[34] In the second half of 2021, Gazprom, Russia's state-owned natural gas company, began to limit natural gas exports to European customers, restricting supplies on the spot market while still honoring long-term contracts.[35] Gazprom has the exclusive right to export natural gas from Russia via pipeline. As a result of Gazprom imposing limits, Russian pipeline supplies covered only 37% of extra-EU net[36] natural gas imports in the fourth quarter of 2021, the lowest quarterly share in eight years.[37] Also in 2021, Gazprom-managed natural gas storage facilities in the EU saw very low filling rates. For example, ahead of the heating season at the end of September, Gazprom storage facilities had a 22% filling rate compared to the EU average filling rate of over 74%, and on December 31, 23% compared to 52%, respectively.[38]

In the wake of Russia's 2022 invasion of Ukraine and the imposition of international sanctions on Russia (including Germany's decision to suspend the Nord Stream 2 pipeline project),[39] Russia reduced flows through the first 55 bcm-capacity Nord Stream pipeline and eventually ceased flows entirely in September 2022 (**Figure 2**). Later in September, unattributed explosions damaged both Nord Stream 1 gas lines and one from the non-operating Nord Stream 2. Gazprom also halted deliveries via the Yamal pipeline in May 2022. As a result, the share of EU natural gas imports supplied by Russia via pipeline declined from 40% in 2021 to 9% by mid-September 2022.[40]

[34] See Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 13, issue 4, Figure 10, covering fourth quarter of 2020, https://energy.ec.europa.eu/data-and-analysis/market-analysis_en.

[35] Victoria Zaretskaya and Warren Wilczewski, "Russia's Natural Gas Pipeline Exports to Europe Decline to Almost 40-year Lows," *Today in Energy*, U.S. Energy Information Administration, August 9, 2022, https://www.eia.gov/todayinenergy/detail.php?id=53379; Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 14, issue 4.

[36] Market Observatory of Energy DG Energy explains, "Net Imports Equal Imports Minus Exports and Do Not Account for Stock Changes."

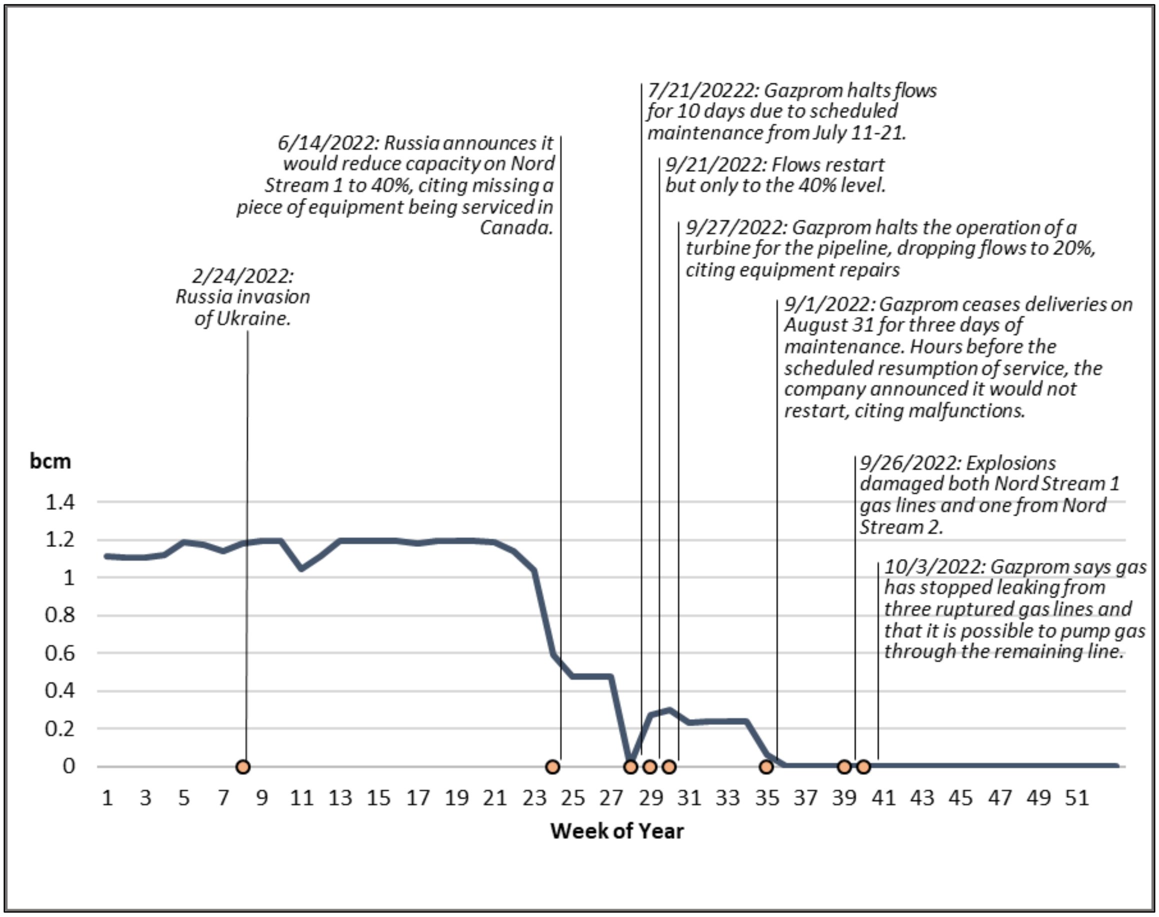
[37] Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 14, issue 4, covering fourth quarter of 2021.

[38] Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 14, issue 4, covering fourth quarter of 2021.

[39] See CRS CRS In Focus IF11138, *Russia's Nord Stream 2 Natural Gas Pipeline to Germany Halted*, by Paul Belkin, Michael Ratner, and Cory Welt.

[40] EC, "Statement by President von der Leyen on Energy," September 2, 2022, https://ec.europa.eu/commission/presscorner/detail/pl/speech_22_5389.

Figure 2. 2022 Weekly Nord Stream 1 Flows



Source: Figure created by CRS. Flows based on Bruegel, a think tank, https://www.bruegel.org/dataset/european-natural-gas-imports. Capacity changes and other events from David Sheppard, Derek Brower and Joe Miller, "Double Blow to Europe's Gas Supplies Sparks Price Surge," *Financial Times*, June 14, 2022, https://www.ft.com/content/8e0c4aa6-07a9-4217-961f-a1ff644d59d6; Christoph Steitz and Nina Chestney, "Russia Pumps Nord Stream Gas to Europe Again—but It's Not Enough," *Reuters.com*, July 21, 2022, https://www.reuters.com/business/energy/nord-stream-1-gas-pipeline-nominations-show-rise-july-21-operator-website-2022-07-21/; Kirsten Grieshaber, "Russia Cuts Gas Through Nord Stream 1 to 20% of Capacity," *AP News*, July 27, 2022, https://apnews.com/article/russia-ukraine-germany-d040fce8b07abc2ab6bb2cbf31a0df47; Geir Moulson and Joanna Kozlowka, "Russia's Gazprom Keeps Gas Pipeline to Germany Switched Off," *AP News*, September 2, 2022, https://apnews.com/article/russia-ukraine-germany-world-news-europe-government-and-politics-07245e4ceae0c0de233d426308827765; Paul Carrel and Stine Jacobsen, "EU Vows to Protect Energy Network After 'Sabotage' of Russian Gas Pipeline," *Reuters.com,* September 28, 2022, https://www.reuters.com/business/energy/mystery-gas-leaks-hit-major-russian-undersea-gas-pipelines-europe-2022-09-27/; and Caleb Davis, "Gazprom: Nord Stream Leaks Stop, Gas Supply Could Resume on Single Line," *Reuters.com*, October 3, 2022, https://www.reuters.com/business/energy/gazprom-nord-stream-leaks-stop-gas-supply-could-resume-single-line-2022-10-03/.

Notes: Flows through Nord Stream in 2021 generally reached 1.2 bcm per week, besides maintenance in July 2021 that caused a dip in flow that lasted a few weeks.

While Russian supplies via pipeline fell through 2022, imports of Russian LNG to many EU countries rose. *Financial Times* reported that Russian LNG imports increased by 40% year-on-year between January and October in 2022 compared to 2021, amounting to 17.8 bcm in 2022 through October.[41] This made Russia, as of November 2022, the second-largest source of LNG for Europe in 2022, according to Refinitiv. [42] Russia's LNG exports, particularly to Europe, is the purview of Novatek rather than Gazprom. By the end of 2022, Lithuania was the only EU LNG-importing country that banned Russian LNG imports. It, along with Estonia and Latvia, adopted sanctions that banned importing Russian pipeline gas starting on December 31, 2022.[43]

While Russian LNG imports rose during 2022, the EU imported even more LNG from other sources like the United States: U.S. LNG represented 42% of LNG imports to the EU by November 2022, compared to 16% from Russia.[44] The European Commission estimated that between January and September 2022, the EU imported 98 bcm of LNG, amounting to 39 bcm more than the same period in 2021.[45]

The EU has responded to Russia's war against Ukraine and reduced gas flows by exploring other supply options with long-term dual goals of decreasing dependence on Russian natural gas and lowering a source of income Russia uses to fund its war against Ukraine.[46] For example, under the European Commission's REPowerEU plan, announced in May 2022, the EU is seeking to fully phase out Russian natural gas and oil by 2030 by reducing energy consumption, diversifying energy supplies, and accelerating the rollout of renewables.[47] However, the high prices of natural gas and increase of Russian LNG imports resulted in the EU spending more per month on Russian LNG in 2022 compared to 2021 (**Figure 3**).

[41] Shotaro Tani, "Europe's Imports of Russian Seaborne Gas Jump to Record High," *Financial Times*, November 28, 2022, https://www.ft.com/content/81db1e45-6ef9-4034-879b-82597e2b87f9. Hereinafter Tani, "Europe's Imports of Russian Seaborne Gas Jump to Record High."

[42] Tani, "Europe's Imports of Russian Seaborne Gas Jump to Record High."

[43] Sergio Chapa, Anna Shiryaevskaya, and Aaron Eglitis, "Baltic Nation Seeks to Become LNG Hub in Pivot Away from Russia," *Bloomberg*, November 7, 2022, https://www.bloomberg.com/news/articles/2022-11-07/baltic-nation-seeks-to-become-lng-hub-in-pivot-away-from-russia.

[44] Tani, "Europe's Imports of Russian Seaborne Gas Jump to Record High."

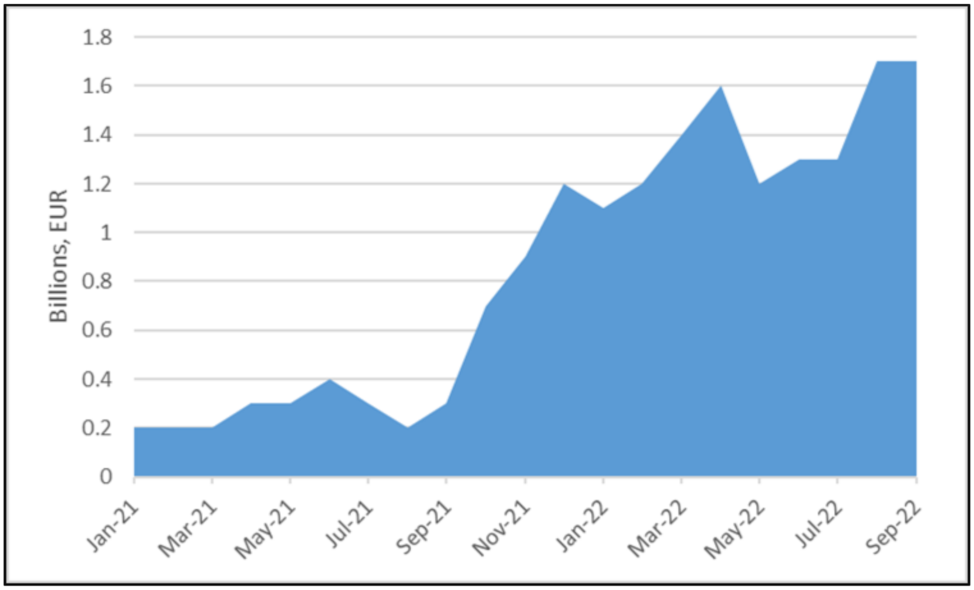
[45] EC, "Liquefied Natural Gas."

[46] In November 2022, the U.S.–EU Task Force on Energy security, established in March 2022, expressed an intention to "[curtail] Russia's energy revenues, which are used to fund the unprovoked and unjustified war." The White House, "Joint Readout of U.S.-EU Task Force Meeting on Energy Security," November 7, 2022, https://www.whitehouse.gov/briefing-room/statements-releases/2022/11/07/joint-readout-of-u-s-eu-task-force-meeting-on-energy-security/, hereinafter The White House, "Joint Readout of U.S.-EU Task Force Meeting on Energy Security."

[47] EC, "REPowerEU: A Plan to Rapidly Reduce Dependence on Russian Fossil Fuels and Fast Forward the Green Transition," press release, May 18, 2022, https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131.

Figure 3. EU Spending on Russian LNG (EUR)

January 2021–September 2022



Source: Figure created by CRS based on Elena Mazneva and Anna Shiryaevskaya, "EU Is Hooked on Russia LNG and Paying Billions to Keep It Coming," *Bloomberg,* November 30, 2022, https://www.bloomberg.com/news/articles/2022-11-30/eu-is-hooked-on-russia-lng-and-paying-billions-to-keep-it-coming.

Many EU member states have explored infrastructure that would offer access to alternative supplies, such as leasing existing or building new FSRUs. Germany, the Netherlands, France, Ireland, Italy, Greece, Poland, Estonia, Cyprus, and Finland had all announced plans to install 25 FSRUs, many of which were scheduled to come online by the end of 2022 or in 2023 (**Table 1**).[48] The increase in demand for these facilities has caused a doubling in charter costs compared to 2021, as well as a shortage of vessels.[49]

Europe is looking to contract with suppliers outside of Russia to use existing and planned terminals.[50] For example, the EU reportedly signed natural gas supply memoranda of understanding with Israel, Egypt, and Azerbaijan.[51] Individual EU members have also worked

[48] S&P Global Commodity Insights and S&P Global Market Intelligence, "S&P Global Platts Atlas of Energy Transition," accessed October 6, 2022, https://www.spglobal.com/commodityinsights/en/market-insights/special-reports/electric-power/atlas-of-energy-transition.

[49] Paul Burkhardt and Anna Shiryaevska, "Floating LNG Terminal Rates Spike in Europe on Ship Shortage," *Bloomberg*, October 3, 2022, https://www.bloomberg.com/news/articles/2022-10-03/floating-lng-terminal-rates-spike-in-europe-on-ship-shortage.

[50] For an overview of EU responses, see https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/eu-action-address-energy-crisis_en.

[51] EC, "EU and Azerbaijan Enhance Bilateral Relations, Including Energy Cooperation," press release, July 18, 2022, https://ec.europa.eu/commission/presscorner/detail/en/IP_22_4550; Sarah El Safty and Ari Rabinovitch, "EU, Israel and Egypt Sign Deal to Boost East Med Gas Exports to Europe," *Reuters*, June 15, 2022, https://www.reuters.com/business/energy/eu-israel-egypt-sign-deal-boost-east-med-gas-exports-europe-2022-06-15/.

bilaterally with suppliers outside of the EU. The German government has secured LNG supplies with Qatar and the UAE,[52] and Italy has worked with Algeria and Egypt.[53]

Individual countries have reacted differently to long-standing dependence on Russian natural gas, sometimes responding in opposing ways to Russia's war in Ukraine—and complicating supranational EU action.[54] Poland, Germany, and Hungary provide three examples of differing and sometimes conflicting preferences, approaches, and timelines.

1. Poland has been seeking to end natural gas dependence on Russia for years, completing its first LNG import terminal in 2016[55] and constructing a new natural gas pipeline connecting Poland, Norway, and Denmark in 2021.[56] State-owned oil and gas company PGNiG also notified Gazprom that it would not sign another long-term gas deal after the current contract expired in 2022.[57] To date, they have not.
2. Germany forged increasingly close energy ties with Russia for decades, up to a few months before Russia invaded Ukraine in 2022. Before then, Germany pursued strong energy ties with Russia, constructing the Nord Stream pipeline to directly link the two countries and allowing a German subsidiary of Gazprom to be in charge of filling Germany's largest natural gas storage capacity, Rehden. After Russia invaded Ukraine in 2022, Germany fast-tracked its first LNG import terminal, chartered six FSRUs,[58] took control of Rheden[59] and fully nationalized

[52] Andrew Mills and Maha El Dahan, "Germany to Get New Qatari LNG Flows Through QatarEnergy, ConocoPhillips Deal," *Reuters*, November 29, 2022, https://www.reuters.com/business/energy/qatarenergy-conocophillips-sign-lng-supply-deal-germany-2022-11-29/; Andreas Rinke, "Germany Inks LNG Deal as Chancellor Visits Gulf to Secure Energy," *Reuters*, September 25, 2022, https://www.reuters.com/business/energy/germanys-scholz-sees-progress-lng-diesel-projects-uae-2022-09-25/.

[53] Alberto Brambilla and Chiara Albanese, "Italy Secures Enough Supplies for Winter Without Russian Gas," *Bloomberg*, September 27, 2022, https://www.bloomberg.com/news/articles/2022-09-27/italy-secures-enough-supplies-for-winter-without-gas-from-russia.

[54] For more information about EU responses to Russia's war against Ukraine, please see CRS Congressional Distribution memo CD1329985, *European Energy Issues, Sarah E. Garding*, available to congressional clients from the author.

[55] For details, see CRS Report R42405, *European Energy Security: Options for EU Natural Gas Diversification*, coordinated by Michael Ratner.

[56] Jo Harper Warsaw, "Warsaw and Budapest Split over Russian Energy Ties," *Deutsche Welle*, April 27, 2022, https://www.dw.com/en/warsaw-and-budapest-split-over-russian-energy-ties/a-61595947; EC, "Launch of the Baltic Pipe," September 27, 2022, https://ec.europa.eu/info/news/launch-baltic-pipe-2022-sep-27_en.

[57] Under the terms of the 1996 contract, the parties must formally submit declarations on future cooperation three years before the deal's expiration. "UPDATE 1—Poland's PGNiG Tells Gazprom It Plans to End Gas Supply Deal in 2022," *Reuters*, https://www.reuters.com/article/pgnig-gazprom/update-1-polands-pgnig-tells-gazprom-it-plans-to-end-gas-supply-deal-in-2022-idUSL8N27V469.

[58] Guy Chazan, David Sheppard, and Camilla Hodgson, "Germany Finishes Construction of Its First LNG Import Terminal," *Financial Times*, November 15, 2022, https://www.ft.com/content/ada3fc2b-c845-4c0a-92c7-984498812fc4; Zsuzsanna Szabo, "Germany's Third Hoegh FSRU Arrives at Brunsbuttel LNG Terminal," *Upstream*, January 19, 2023, https://www.upstreamonline.com/lng/update-germany-s-third-hoegh-fsru-arrives-at-brunsbuttel-lng-terminal/2-1-1390451 (hereinafter Szabo, "Germany's Third Hoegh FSRU Arrives at Brunsbuttel LNG Terminal").

[59] Nikolaus J. Kurmayer, "Berlin Forces Storage in Gazprom Facilities on German Soil by Decree," June 1, 2022, https://www.euractiv.com/section/energy/news/berlin-forces-storage-in-gazprom-facilities-on-german-soil-by-decree/.

the subsidiary,[60] and fully halted the required certification for Nord Stream 2.[61] Three of the new FSRUs had started up by the end of January 2023.[62]

3. Hungary signed an agreement in August 2022 for additional supplies of natural gas from Russia[63] and, earlier in 2022, became the only EU country to agree to Russian terms to pay for natural gas from Gazprom in rubles.[64] Prime Minister Viktor Orban continues to not support additional sanctions on Russian energy,[65] citing existing sanctions for "destroying Europe's economy."[66] He has not gone as far as vetoing sanctions, for which the EU requires unanimity among members to enact.

Despite the new contracts with suppliers and for filling up gas storage for the 2022/2023 winter season, concerns remain. The EU may be facing a natural gas shortfall of 30 bcm in 2023, European Commission President Ursula von der Leyen warned in November 2022. In addition to further disruptions in supply from Russia, she pointed to lack of global LNG export capacity, and competition for supplies from Asia.[67] The International Energy Agency (IEA) and the EU Agency for the Cooperation of Energy Regulators (ACER) have separately warned that even if the EU fills natural gas storage for winter 2022-2023, replenishing stocks for winter 2023-2024 may be difficult, especially if pipeline supplies from Russia fall to zero.[68] Such a scenario would increase the risk of supply disruptions, and also underscores the necessity for the EU to look for a permanent replacement for Russian supplies, resume accepting supply from Russia, or find an alternative to natural gas.

Expected EU Demand for LNG

The continued decline of Russian pipeline natural gas in the EU has led to an increase in LNG imports. Compared to the same months in 2021, in 2022 LNG imports were up by 119% in July, 70% in August, 83% in September, 59% in October, and 84% in November. The EU is

[60] Melissa Eddy, "German Government Nationalizes Gas Unit Seized from Gazprom," *New York Times*, November 14, 2022, https://www.nytimes.com/2022/11/14/world/europe/germania-gazprom-nationalized.html.

[61] Sarah Marsh and Madeline Chambers, "Germany Freezes Nord Stream 2 Gas Project as Ukraine Crisis Deepens," *Reuters*, https://www.reuters.com/business/energy/germanys-scholz-halts-nord-stream-2-certification-2022-02-22/.

[62] Szabo, "Germany's Third Hoegh FSRU Arrives at Brunsbuttel LNG Terminal."

[63] Wilhelmine Preussen, "Hungary Signs New Gas Deal with Gazprom," *Politico*, August 31, 2022, https://www.politico.eu/article/hungary-signs-deal-with-gazprom-over-additional-gas/.

[64] Harper, "Warsaw and Budapest Split over Russian Energy Ties."

[65] Justin Spike, "Hungary Announces 'State of Danger' over War in Ukraine," *AP News*, May 25, 2022, https://apnews.com/article/russia-ukraine-hungary-government-and-politics-legislature-a84941c75996412128792824601a82a2; Krisztina Than and Anita Komuves, "Hungary Cannot Support Any New EU Energy Sanctions Against Russia—govt," *Reuters*, September 29, 2022, https://www.reuters.com/world/europe/hungary-cannot-support-any-new-eu-energy-sanctions-against-russia-govt-2022-09-29/.

[66] Justin Spike, "Hungary to Poll Public on Support for EU Sanctions on Russia," *AP News*, September 22, 2022, https://apnews.com/article/russia-ukraine-hungary-european-union-c8357ca4816a0a6e7ad936cbf0eccb36.

[67] Benoit Van Overstraeten, "EU Risks 30 bcm Gas Shortage in 2023 Storage Filling Season—von der Leyen," *Reuters*, November 9, 2022, https://www.reuters.com/business/energy/eu-risks-30-bcm-gas-shortage-2023-storage-filling-season-von-der-leyen-2022-11-09/.

[68] IEA, *Gas Market Report, Q4-2022*, October 2022, https://www.iea.org/reports/gas-market-report-q4-2022 (hereinafter IEA, *Gas Market Report, Q4-2022*); Charlie Cooper, "Putin Threatens Europe Again as Brussels Braces for Winter," *Politico Pro*, October 12, 2022, https://www.politico.eu/article/eu-energy-crisis-package-gas-gazprom-putin-vladimir-alexey-miller-winter-kadri-simson/.

anticipating more LNG imports in 2023, with S&P Commodity Insights[69] expecting that around 10 new EU LNG import terminals could be online by the end of 2023.[70] By 2024, combined EU and UK import capacity may increase by 70 bcm, an increase of 34% compared to 2021.[71] The International Energy Agency (IEA) expects EU LNG appetite to continue to grow, and for European[72] LNG demand to account for 60% of the increase in global LNG trade through 2025.[73]

Short-term EU LNG demand may be met with projects that are already online, FSRUs, or projects that have already reached the construction phase. Opportunities may arise in the United States for export terminals that have not reached construction for several reasons. The EU will likely continue efforts to phase out Russian natural gas by 2030 under the REPowerEU plan. Decisions by Gazprom (see **Figure 2**) may also cut, or eventually cease, natural gas pipeline flows from Russia to the EU. However, EU energy transition policies and longer-term climate goals add uncertainty to fossil fuel demand later in the decade and beyond.[74]

Limits on Expanding U.S. LNG in EU Supply

After Russia invaded Ukraine in February 2022, the Biden Administration promised to provide 15 bcm of additional LNG volume from U.S. exporters for the EU through the end of the year.[75] The United States exported 22 bcm of LNG to the EU in 2021; the EU-U.S. joint statement on energy security set the 2022 objective at 37 bcm. Between January and November 2022, the EU imported almost 52 bcm of LNG from the United States, surpassing the 2022 objective before the end of the year (**Figure 4**).[76] In November 2022, the U.S.-EU Task Force on Energy Security set a 2023 objective of an additional 50 bcm as compared to 2021, amounting to 72 bcm.[77]

[69] S&P Commodity Insights provides benchmarks and information about the energy and commodities markets.

[70] Corey Paul and Dylan Chase, "Tight World LNG Supply Means 'Extreme' 2023 Market Volatility—Energy outlook," *S&P Capital IQ*, December 12, 2022, https://www.capitaliq.spglobal.com/web/client?auth=inherit#news/article?id=73459738&KeyProductLinkType=58.

[71] Victoria Zaretskaya, "Europe's LNG Import Capacity Set to Expand by One-Third by End of 2024," *Today in Energy*, November 28, 2022, https://www.eia.gov/todayinenergy/detail.php?id=54780. This source does not separate the UK and EU in reporting these numbers.

[72] The IEA makes references to Europe rather than the EU, referring to 43 total countries listed at https://www.iea.org/regions/europe. This report refers to IEA forecasts that do not distinguish the EU from the 43-country Europe.

[73] The IEA cautions that "The current forecast is subject to unusually large uncertainty due to Russia's unpredictable behaviour." IEA, *Gas Market Report, Q4-2022*.

[74] The EU is also looking to sources beyond U.S. LNG to replace Russian natural gas, including new pipelines, energy efficiency measures, and replacing natural gas with other energy sources.

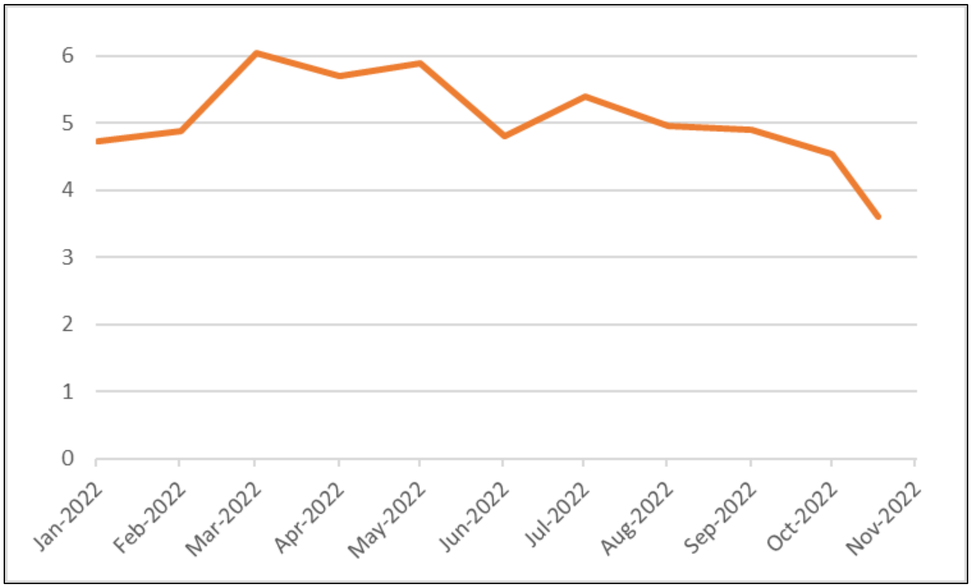
[75] The White House, "FACT SHEET: United States and European Commission Announce Task Force to Reduce Europe's Dependence on Russian Fossil Fuels."

[76] Market Observatory of Energy DG Energy, "Quarterly Report on European Gas Markets," vol. 15, issue 3, covering third quarter of 2022, https://energy.ec.europa.eu/data-and-analysis/market-analysis_en; EC, "United States of America EU-US Cooperation on Energy Issues," accessed October 20, 2022, https://energy.ec.europa.eu/topics/international-cooperation/key-partner-countries-and-regions/united-states-america_en#eu-us-liquefied-natural-gas-lng-trade.

[77] The White House, "Joint Readout of U.S.-EU Task Force Meeting on Energy Security."

Figure 4. Monthly Volumes of U.S. LNG Exports to the EU, January–November 2022

bcm



Source: Figure created by CRS. Data from EIA, "U.S. Natural Gas Exports and Re-Exports by Country," released January 31, 2023, https://www.eia.gov/dnav/ng/ng_move_expc_s1_m.htm. Based on European Council, "Infographic—Where Does the EU's Gas Come From?" last reviewed November 7, 2022, https://www.consilium.europa.eu/en/infographics/eu-gas-supply/.

While the United States has increased LNG supplies to the EU over the course of 2022, barriers limit the ability of U.S. suppliers to replace Russian natural gas. Even though EU LNG import capacity (169 bcm in December 2022)[78] exceeds the amount of Russian natural gas exported to the EU (155 bcm in 2021),[79] many EU LNG importers have already contracted with suppliers from countries besides the United States, including Russia, through Novatek. Additionally, import facilities may not run at full capacity at all times due to maintenance and operational issues, among other reasons. Export capacity is also limited on the U.S. side. With commercial factors driving developers' decisions, Congress may have limited options to help the EU directly replace Russian natural gas with U.S. LNG for EU consumers.

Barriers to exporting more U.S. LNG to the EU in the next three years include rising competition for LNG supplies around the world, the time required to build new export capacity, and high inflation. Longer term, some factors impacting the ability of U.S. exporters to deliver LNG to the EU past mid-decade are related to demand uncertainty and contract length preferences. These issues can impact projects that have been announced but have not yet begun to break ground (such U.S. projects have a combined capacity of 294 bcm; see **Table 2**) as well as potential future projects that have not yet been announced.

U.S. peak LNG export capacity at the end of 2022 was approximately 144 bcm (**Table 2**) but this does not mean exporters reached this full amount.[80] Export terminals do not operate at peak capacity all of the time, sometimes dealing with less-than-optimal operating conditions. Sustained

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[78] EC, "Liquefied Natural Gas."

[79] EC, "In Focus: Reducing the EU's Dependence on Imported Fossil Fuels," last updated July 26, 2022, https://ec.europa.eu/info/news/focus-reducing-eus-dependence-imported-fossil-fuels-2022-apr-20_en.

[80] EIA estimates that peak capacity is 13.8 Bcf/d, which is approximately 144 bcm.

outages may also occur due to storms, maintenance, or accidents. For example, an explosion at Freeport LNG in Texas took the facility offline on June 8, 2022, cutting total daily U.S. LNG export capacity by 11%.[81] The project was offline through the end of 2022 and has not returned to full capacity. Before the Freeport outage, utilization of peak capacity at the seven export facilities averaged 87% percent in 2022, and at times 100% or higher for certain projects.[82]

Table 2. Existing and Planned U.S. LNG Export Projects

As of January 18, 2023

Status	Capacity (bcm)
Existing	144
Approved, Under Construction	123
Approved, Not Yet Under Construction	195
Proposed	60
Pre-filing	39
Total	563

Source: Construction status and capacity from: Federal Energy Regulatory Commission (FERC), "North American LNG Export Terminals—Existing, Approved Not Yet Built, and Proposed," last updated January 18, 2023, https://cms.ferc.gov/media/north-american-lng-export-terminals-existing-approved-not-yet-built-and-proposed-8. Individual terminal capacity information can be found at the same source.

Notes: Developers initiate pre-filing under the NEPA review before filing a formal application; see https://www.ferc.gov/media/pre-filing-environmental-review-process. Please note that these numbers are not exact due to calculations performed to convert units and rounding.

Two new U.S. LNG export terminals were authorized in 2022, reaching the construction phase: (1) in May, Venture Global announced final investment decision in Plaquemines LNG in Louisiana, and (2) in June, Cheniere authorized a seven-train expansion at its Corpus Christi, TX, LNG facility.[83] These two projects may increase the country's total LNG export capacity by over a third, with the combined capacity of these two projects exceeding 50 bcm.

While U.S. export capacity in 2023 (estimated by EIA to reach approximately127 bcm[84]) may reach 80% of the amount of natural gas that Russia supplied to the EU via pipeline (140 bcm in 2021), not all LNG from the U.S. will likely be exported to the EU. Additionally, it takes time to

[81] Victoria Zaretskaya, "The United States Became the World's Largest LNG Exporter in the First Half of 2022," *Today in Energy*, U.S. Energy Information Administration, July 25, 2022, https://www.eia.gov/todayinenergy/detail.php?id=53159 (hereinafter Zaretskaya, "The United States Became the World's Largest LNG Exporter in the First Half of 2022").

[82] Companies can apply to the Federal Energy Regulatory Commission (FERC) for a capacity waiver to export more than the approved capacity. Zaretskaya, "The United States Became the World's Largest LNG Exporter in the First Half of 2022."

[83] Corey Paul, "High Financing Costs Present New Challenge for US LNG Projects," *S&P Global Market Intelligence*, September 21, 2022, https://www.capitaliq.spglobal.com/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=72210355.

[84] In December 2022, EIA forecasted U.S. LNG exports to average 12.3 Bcf/d through 2023—approximately 127 bcm. The average exports amounts to less than the existing capacity in **Table 2** because Freeport LNG is expected to remain offline in early 2023, and export facilities do not always function at peak capacity throughout the year. U.S. Energy Information Administration, "Short-Term Energy Outlook," December 6, 2022, https://www.eia.gov/outlooks/steo/archives/Dec22.pdf.

build new infrastructure. The U.S. Department of Energy (DOE) in 2018 estimated that it could take four to six years to build a new LNG export terminal.[85]

Regulatory Considerations

Under the Natural Gas Act (NGA), both DOE and the Federal Energy Regulatory Commission (FERC) are responsible for authorizing activities related to the export of natural gas. DOE's Office of Fossil Energy and Carbon Management is responsible for authorizing the export of the commodity. FERC is responsible for authorizing LNG export terminals.[86] Other agencies, like the Coast Guard and state agencies, provide supporting materials for the permitting processes.

Pursuant to Section 3(a) of NGA, parties seeking to enter into natural gas transactions with foreign buyers must file for an export authorization under the rules and procedures established by DOE.[87] Applications to export to countries with which the United States has a free trade agreement (FTA) are assumed to be in the "public interest" and granted automatically. Neither the EU nor its member states are among those countries that currently have FTAs with the United States. Applications to export to EU member states and other non-FTA countries are subject to a public interest determination by DOE. The NGA does not specify what DOE must evaluate to make that determination. According to DOE, its primary public interest evaluation is on the domestic need for natural gas that is proposed to be exported, but may consider any other issues determined to be appropriate (e.g., U.S. energy security, economic impacts, environmental considerations, among others). In March 2022, as the EU sought new natural gas supplies after Russia invaded Ukraine the previous month, DOE issued two long-term orders authorizing LNG exports from two current export projects to non-FTA countries. DOE explained, "While U.S. exporters are already exporting at or near their maximum capacity, with today's issuances, every operating U.S. LNG export project has approval from DOE to export its full capacity to any country where not prohibited by U.S. law or policy."[88] DOE's orders applied to the only two projects operating with approval just to FTA countries; all other export facilities at the time had already obtained approval to export to non-FTA countries. Future projects would be similarly required to obtain the non-FTA authorization to export to the EU.

Pursuant to Section 3(e) of the NGA, FERC is responsible for authorizing the siting, construction, expansion, or operation of an LNG export terminal, onshore or in state waters.[89] Specific aspects of project siting, construction, and operation are generally subject to requirements established in federal, state, and local law.

Both DOE and FERC authorizations are subject to environmental review under the National Environmental Policy Act (NEPA, 42 U.S.C. §§4321 et seq.) and other laws applicable to federal agency actions. Documenting compliance with NEPA requires the preparation of an environmental impact statement (EIS) or an environmental assessment (EA). For its NEPA review for LNG terminal authorizations, FERC requires the applicant to provide detailed information

[85] Department of Energy Office of International Affairs, *Global LNG Fundamentals*, March 15, 2018, https://www.energy.gov/ia/downloads/global-lng-fundamentals.

[86] For more information on the Natural Gas Act and the National Environmental Policy Act, see CRS Report R42074, *U.S. Natural Gas Exports: New Opportunities, Uncertain Outcomes*, by Michael Ratner et al.

[87] 15 U.S.C. §717b(a); DOE regulations implementing those requirements were promulgated at 10 C.F.R. Part 590, "Administrative Procedures with Respect to the Import and Export of Natural Gas."

[88] Department of Energy, "DOE Issues Two LNG Export Authorizations," *Energy.gov*, March 16, 2022, https://www.energy.gov/articles/doe-issues-two-lng-export-authorizations.

[89] 15 U.S.C. §717b(e).

regarding the project and resources affected at the project site.[90] If DOE's export authorization is tied to a FERC LNG terminal authorization, DOE adopts FERC's NEPA review, and acts as the "cooperating agency" to FERC as the "lead agency.[91]

According to the Office of Fossil Energy and Carbon Management at DOE, as of December 16, 2022, 15 non-FTA applications with a total combined quantity of 20.7 bcf/d (or approximately 216 bcm) are pending under DOE review, with some applications submitted as far back as 2012.[92] All but two of these projects are also seeking to export to FTA countries, and have already obtained automatic approval to export to FTA countries, with the exception of one project seeking approval for a design increase.[93] Also, as of January 17, 2023, FERC identified 8 existing LNG export terminals, 16 approved (5 under construction and 11 not under construction), and 8 proposed projects (5 with applications pending at FERC and 3 projects in the pre-filing stage).[94] Capacity totals are available in **Table 2**.

Commercial Considerations

Methods that exporters have taken in 2022 to send additional LNG to the EU are unsuited to replace Russian natural gas in a more permanent manner. Over the course of 2022, U.S. exporters sent more LNG to the EU largely by exporting less to markets outside of Europe. Exporters diverted cargoes scheduled under contracts away from Asian and South American countries and paid contractual penalties that were largely offset by higher prices in Europe. Diversions, high spot prices, and the resulting natural gas shortages have reportedly caused power shortages and the closure of factories in emerging market countries.[95] Faced with diversions and high prices on the spot market, countries responded in several ways. Some, such as India and China, turned towards Russia to supply more natural gas.[96] Others, such as Pakistan, sought fossil fuel replacements (such as coal) or rationed fuel.[97] The EU may also face more competition for LNG if prices rise in other countries in Asia and South America.[98] The easing of pandemic-related restrictions in China may also draw more cargoes toward Asia.

[90] FERC's regulations implementing NEPA are established in 18 C.F.R. §380. Among other requirements, they include "Environmental information to be supplied by an applicant" (§380.3); and "Environmental reports for Natural Gas Act applications" (§380.12).

[91] U.S. Department of Energy, Office of Fossil Energy and Carbon Management, "Liquefied Natural Gas (LNG)," accessed October 28, 2022, https://www.energy.gov/fecm/liquefied-natural-gas-lng.

[92] U.S. Department of Energy, Office of Fossil Energy and Carbon Management, "Summary of LNG Export Applications of the Lower 48 States," last updated December 16, 2022, https://www.energy.gov/fecm/articles/summary-lng-export-applications-lower-48-states.

[93] Two applications for projects from the following companies are under non-FTA review only: (1) SeaOne Gulfport, LLC, and (2) Freeport LNG Expansion, L.P.; FLNG Liquefaction, LLC; FLNG Liquefaction 2, LLC; and FLNG Liquefaction 3, LLC.

[94] See FERC, "North American LNG Export Terminals—Existing, Approved Not Yet Built, and Proposed," https://cms.ferc.gov/media/north-american-lng-export-terminals-existing-approved-not-yet-built-and-proposed-8.

[95] Stephen Stapczynski, Anna Shiryaevskaya, and Faseeh Mangi, "Europe's Energy Crunch Will Trigger Years of Shortages and Blackouts," *Bloomberg*, November 7, 2022, https://www.bloomberg.com/news/articles/2022-11-08/eu-energy-crisis-sparked-by-ukraine-war-to-create-blackouts-in-poor-countries.

[96] Stephen Stapczynski, Anna Shiryaevskaya, and Faseeh Mangi, "Europe's Energy Crunch Will Trigger Years of Shortages and Blackouts," *Bloomberg*, November 7, 2022, https://www.bloomberg.com/news/articles/2022-11-08/eu-energy-crisis-sparked-by-ukraine-war-to-create-blackouts-in-poor-countries.

[97] Benjamin Storrow and Sara Schonhardt, "Why Russia's War Is Causing Blackouts in Asia," *Politico.com*, February 25, 2023, https://www.politico.com/news/2023/02/25/why-russias-war-is-causing-blackouts-in-asia-00084435.

[98] Jarrett Renshaw and Scott Disavino, "Analysis: U.S. LNG exports to Europe on track to surpass Biden promise,"

Securing enough financing to start construction on projects that may provide more LNG after mid-decade may require time. Because companies do not have to reach final investment decision (FID) on their projects before obtaining approval from regulators, some projects have secured non-FTA export authority from DOE but have not yet secured enough financing to reach FID. For example, Rio Grande LNG signed several long-term contracts before the developer obtained FERC approval.[99] Twelve projects, with a combined capacity of 29.19 bcf/d (or approximately 302 bcm), have received non-FTA export authority but are pending full or partial FID. Many of these projects are at least three years away from initial operation.[100]

Financing difficulties may arise when some importers prefer shorter contracts than U.S. exporters are willing to agree to. EU consumers have tended to favor contracts with a shorter duration to align with the EU's energy transition and net-zero emissions goals. Russia's invasion of Ukraine in 2022 changed the conversation as the EU reoriented immediate priorities to emphasize security of supply. The United States and the European Commission established a Task Force that calls for the European Commission to focus on, among other issues, efforts to "support long-term contracting mechanisms and partner with the U.S. to encourage relevant contracting to support final investment decisions on both LNG export and import infrastructure," and "ensuring stable demand for additional U.S. LNG until at least 2030 of approximately 50 bcm/annum."[101] Nevertheless, longer-term EU LNG demand remains unclear, as several emissions and climate change goals could impact natural gas. Any measures explored to facilitate new construction may need to consider future demand uncertainty.

Some EU member states have preferred LNG cargoes from sources deemed to be more environmentally friendly. In October 2020, for example, media outlets reported that the French government worked to block a contract to import LNG from a proposed facility in Texas, citing the Trump administration's rollbacks on methane emission limits. The incident arose amid trade disputes between Europe and the United States involving issues beyond natural gas.[102] Although a similar deal ended up being signed several months later, environmental concerns remain a topic for debate when discussing LNG. In response to the establishment of the joint Task Force for Energy Security, two dozen Members of Congress signed a letter along with Members of the European Parliament calling for an emphasis on phasing out fossil fuels and not building any new fossil fuel infrastructure. While exploration and production of natural gas in the United States are

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Reuters.com, July 26, 2022, https://www.reuters.com/business/energy/us-lng-exports-europe-track-surpass-biden-promise-2022-07-26/ and Stephen Stapczynski, Anna Shiryaevskaya, and Faseeh Mangi, "Europe's Energy Crunch Will Trigger Years of Shortages and Blackouts," *Bloomberg*, November 7, 2022.

[99] Office of Fossil Energy and Carbon Management (FECM), U.S. Department of Energy, "Liquefied Natural Gas (LNG) Exports," September 30, 2022, https://www.energy.gov/sites/default/files/2022-10/LNG%20Snapshot%20September%2030%202022.pdf, hereafter FECM, "Liquefied Natural Gas (LNG) Exports."

[100] FECM, "Liquefied Natural Gas (LNG) Exports."

[101] EC, "Joint Statement Between the European Commission and the United States on European Energy Security," press release, March 25, 2022, https://ec.europa.eu/commission/presscorner/detail/en/statement_22_2041.

[102] A new deal between France and the U.S. exporter, NextDecade, was signed in June 2021. Sarah White and Scott DiSavino, "France Halts Engie's U.S. LNG Deal Amid Trade, Environment Disputes," *Reuters*, October 22, 2020, https://www.reuters.com/article/engie-lng-france-unitedstates/france-halts-engies-u-s-lng-deal-amid-trade-environment-disputes-idUSKBN27808G; Ben Lefebvre, "French Government Blocks U.S. LNG Deal as Too Dirty," *Politico*, October 21, 2020, https://www.politico.com/news/2020/10/21/french-government-blocks-lng-deal-431028; Jordy Lee and Morgan D. Bazilian, "Why U.S. Natural Gas Is No Longer Too Dirty for France," *Foreign Policy*, January 25, 2022, https://foreignpolicy.com/2022/01/25/us-natural-gas-france-deal-cheniere-energy-transition-climate-change/.

topics outside the scope of this report, upstream and downstream ramifications of increasing LNG exports may generate similar debate.

After Russia's invasion of Ukraine, EU importers demonstrated willingness to compromise with U.S. exporters' priorities. Several deals made during 2022 indicate that some EU consumers are willing to concede to longer contract duration. According to a *Reuters* article published in February 2022, a few weeks before Russia invaded Ukraine, long-term contracts[103] accounted for 70% of global LNG sales, and 50-55% of LNG sales to Europe.[104] With the EU seeking to end all Russian natural gas pipeline imports by 2030, European LNG importers have locked in supply past 2030 by agreeing to some long-term contracts with U.S. companies. For example:

- In December 2022, RWE AG, a German utility, signed a 15-year contract to purchase LNG from the proposed Port Arthur project. Port Arthur has not been commercially authorized, though Sempra stated its goal to make Phase 1 FID in early 2023.[105]
- In June 2022, EnBW, a German utility, signed a 20-year contract to purchase LNG from Venture Global.[106]
- In June 2022, Ineos, a European chemical company, signed a 20-year contract to purchase LNG from Sempra, with first supplies in 2027 from either Port Arthur or Cameron LNG Phase 2. Both are not yet commercially approved. In its press release, Ineos noted that the LNG will go to "customers in Europe and around the world."[107]

It is unclear how much longer European companies will be willing to contract for gas as net-zero targets loom, and whether and how effectively the European Commission can encourage Member States and companies to commit to long-term demand.

While companies have pointed to problems securing project financing as a barrier to construction in the past, market dynamics through 2022 were favorable to export facilities. Some experts anticipate that high LNG prices may drive the official approval of more projects through 2023.[108] However, high inflation caused increasing engineering, procurement, and construction contract costs.[109] Higher interest rates also drove up the costs of capital. This could push exporters to seek

[103] *Reuters* defines a long-term contract as lasting 10-25 years. Marwa Rashad, "Explainer: Should Europe Use More Long Term LNG Contracts?," *Reuters*, February 7, 2022, https://www.reuters.com/business/energy/should-europe-use-more-long-term-lng-contracts-2022-02-07/ (hereinafter Rashad, "Explainer: Should Europe Use More Long Term LNG Contracts?").

[104] Rashad, "Explainer: Should Europe Use More Long Term LNG Contracts?" Rashad discusses Europe, rather than the EU, in this article.

[105] Sempra, "Sempra Infrastructure Announces Sale and Purchase Agreement with RWE for Port Arthur LNG," press release, December 28, 2022, https://www.sempra.com/sempra-infrastructure-announces-sale-and-purchase-agreement-rwe-port-arthur-lng.

[106] Stephen Stapczynski, "German Utility Signs Long-Term Deal to Buy LNG from the US," *Bloomberg*, June 21, 2022, https://www.bloomberg.com/news/articles/2022-06-21/germany-s-enbw-signs-long-term-deal-to-buy-lng-from-the-us?.

[107] INEOS, "INEOS Enters the Liquified Natural Gas LNG Market with a 1.4 Million Tonne per Annum Agreement with Sempra Infrastructure," press release, June 22, 2022, https://www.ineos.com/news/ineos-group/ineos-enters-the-liquified-natural-gas-lng—market-with-a-1.4-million-tonne-per-annum-agreement-with-sempra-infrastructure/.

[108] Corey Paul, "US LNG Export Capacity Could Double by Early 2030s on Rising Tide of Demand," *S&P Global Market Intelligence*, July 27, 2022, https://www.capitaliq.spglobal.com/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=71372281.

[109] Corey Paul, "High Financing Costs Present New Challenge for US LNG Projects," *S&P Global Market Intelligence*,

longer, more lucrative, or otherwise more favorable supply contracts, or delay projects. For example, in November 2022, Energy Transfer postponed FID for Lake Charles LNG, citing the increasing engineering, procurement, and construction costs due to rise in inflation.[110]

Congressional Approach

Congressional options to influence U.S. LNG trade with the EU are limited by the structure of the U.S. energy system, with developers typically making construction, investment, and export decisions based on commercial factors.[111] There are no national natural gas exporters that the government can direct to export a specific amount of LNG to the EU. It does not appear that U.S. producers depend on congressional action to export more LNG to the EU. Furthermore, as a member of the World Trade Organization (WTO), the United States generally agrees to non-discrimination obligations or most-favored nation (MFN) treatment, for example, not to offer a tax credit or otherwise financially incentivize favoring exports to the EU, or any other trading partner, without extending the same benefits to other WTO members.[112]

Congress could expedite environmental reviews for natural gas exports by limiting the scope of DOE and FERC reviews for their respective authorizations. For example, Congress could amend the NGA to define what constitutes exports consistent with the "public interest." Congress could also amend the NGA to specify the scope of impacts FERC must consider when determining whether to approve or deny an application to site and operate an LNG export terminal. By establishing limits on each agency's authorities, such amendments could limit DOE's and FERC's potential obligation to assess upstream and downstream impacts of natural gas exports and LNG terminals.

Congress could explore amending the Natural Gas Act to remove the differentiation between FTA and non-FTA destinations. Alternatively, Congress could amend the Natural Gas Act to establish that export to the EU, EU member countries, or a group of countries that includes EU member countries (such as World Trade Organization members or allies) is automatically deemed in the public interest and export authorization based on export destination is granted immediately. Congress has debated this issue. Legislation proposed under the 117th Congress would have extended FTA-treatment to EU members or otherwise expedited regulatory approvals to the EU, including:

- American Gas for Allies Act (H.R. 6977);
- Energy Security Cooperation with Allied Partners in Europe Act of 2021 (H.R. 2046, S. 819); and
- Energy Unleashing in Response to the Offenses of Putin against Europeans Act or the EUROPE Act (H.R. 6944).

September 21, 2022, https://www.capitaliq.spglobal.com/web/client?auth=inherit#news/article?KeyProductLinkType=2&id=72210355.

[110] Dylan Chase, "Energy Transfer Postpones Lake Charles LNG Decision over Inflation," *S&P Global Market Intelligence*, November 2, 2022, https://www.capitaliq.spglobal.com/web/client?auth=inherit#news/article?id=72819620.

[111] This report focuses on domestic measures the United States can take to provide more LNG produced in and exported from the United States to the EU. Possible actions outside the United States, such as offering financing options for LNG projects abroad, are outside the scope of the report.

[112] For more on the WTO, see CRS Report R45417, *World Trade Organization: Overview and Future Direction*, by Cathleen D. Cimino-Isaacs and Rachel F. Fefer.

None of these bills proceeded past initial committee referral before the end of the 117th Congress.

Factors outside of Congress's control could further affect the EU's supply of natural gas. Weather, especially warm or cold winters, could impact demand and supply immediately as well as for the following heating season. Demand around the world, especially in Asia as China's pandemic-related restrictions ease, may also impact the availability of tankers, and could depend also on the weather, as well as COVID-related lockdowns. Outages or other problems with physical infrastructure may impact supply for months depending on severity. Relying on infrastructure build-out to bolster the EU's natural gas security means that unexpected stoppages, such as cyberattacks, hurricanes (especially around the Gulf Coast) and other storms, and equipment failures on U.S. soil could impact natural gas supply security.

Appendix. Methodology Note

This report discuss the European Union and uses data sources that reflect EU information, when available. There are several reasons why this report discusses the EU instead of Europe as a continent or specific member countries. The EU is clearly defined as its 27 member countries by the international community, media, and energy data sources. "Europe" has no single definition. Europe can encompass the EU plus certain other neighboring countries like the UK, Switzerland, Norway, Turkey, and others. Europe can also refer to the continental landmass, which would include some of Russia. Additionally, the EU makes supranational policies that are binding for its members and speaks with one voice on certain internal and external matters. Because of this, other countries negotiate with the EU as a geopolitical entity. EU members also follow their own internal and external policy that can sometimes differ from other EU members.

Author Information

Lexie Ryan
Analyst in Energy Policy

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