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Testimony of

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for the

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Energy security has re-entered the conversation surrounding European energy policy in a way that could only be compared with the 1970s oil shocks. At that time Western European nations decided that reliance on crude oil could be attenuated by bringing in Russian natural gas to support European industry and heating needs. Now, half a century later, the EU is facing an energy crisis, much of which is based on the combination of overreliance on Russian energy, underestimation of Russia's readiness to use gas flows for geopolitical purposes, and general lack of alternatives for immediate and seamless substitution.

The situation unraveled after Russia attacked Ukraine on February 24th, 2022. For almost a year now, to avoid a breakdown of its energy system, Europe has relied on energy efficiency measures, demand curtailment and ability to pay record prices for energy. Critical has been also U.S. support, both via active energy diplomacy and from the U.S. oil and gas industry, which turned out record volumes helping to sustain anti-Russian efforts around the world with flexible and commercially oriented supply.[i]

Europe and especially the EU are often painted with broad brush strokes as a unit, a black box with EU regulation or West European considerations determining the approach to and direction of policies. In the meantime, often multiple European approaches exist. In particular, the approach to energy security distinguishes the Europe's more developed and generally wealthier "West" from the Eastern bloc of countries, which emerged from Soviet dependance. While Western European countries have pushed energy security considerations to the side, their neighbors to the East have often worked tirelessly to ensure secure energy access. Countries like Poland, Lithuania, Latvia, and Estonia have been particularly concerned about dominance of Russian energy in Europe and often highlighted the need for diversification of both supply sources and supply routes. These efforts helped after Russia invaded Ukraine but could not completely diminish the impact that curtailment of Russian energy flows has had on Europe as a whole.

The "Four A's" of Energy Security

Europe's situation with regard to energy security lends itself well to analysis within the "*four A's*" framework as defined by: 1) availability, 2) accessibility, 3) affordability, and 4) acceptability of energy supply. While more expansive definitions of energy security exist, this approach is both, simple (yet not simplistic) and broad enough to provide a good understanding of energy security considerations in Europe and beyond.

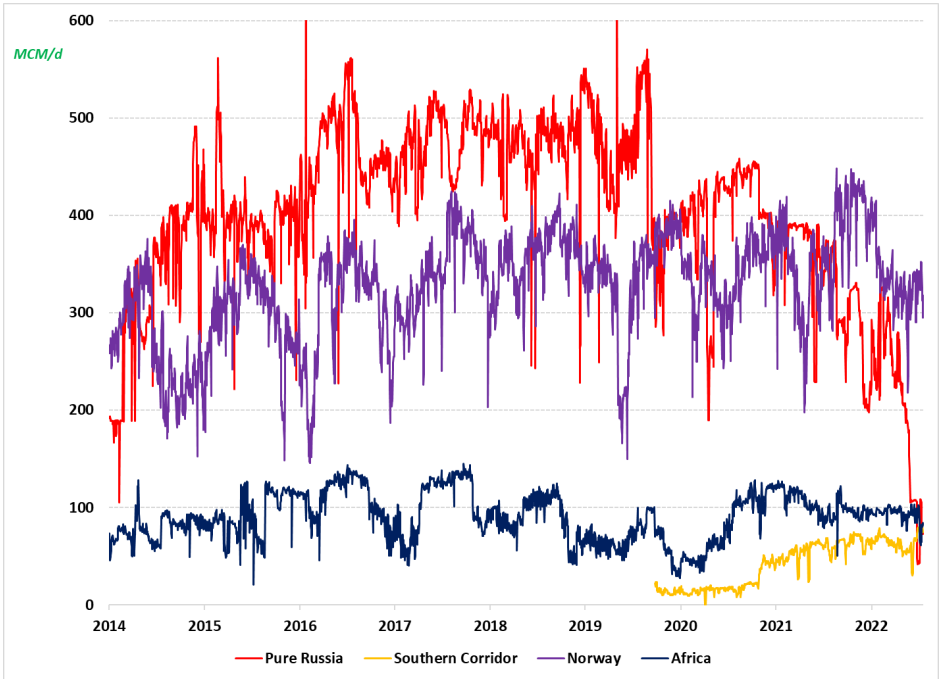
As the events of 2021 and 2022 have shown, Europe has not been able to ensure any and all of the four building blocks of the energy security equation. Much of the European "West," and most notably Germany, has been willing to overlook the warnings coming from Central and East Europe about the growing Russian dominance over the European energy supply and Russian willingness to use those supplies as an energy weapon. The case has been especially acute in the natural gas market, where Europe has visibly lacked a sufficient back up, or "credible threat," an alternative supply that could step in at any given moment and in doing so attenuate geopolitical and economic consequences of heavy reliance on Russian supply.[ii] Instead, countries like Germany and France were leading in the EU's move toward decarbonization, a transition underwritten by an ill-founded conviction that Russia would

continue delivery of energy resources while Europe works toward phasing out fossil fuels.[iii] Consequently, new LNG import capacity became an unpopular option in many countries outside of the post-Soviet bloc, seen as an unnecessary expense and burden given energy transition goals.

Availability and Accessibility of Supply

The system had begun to unravel already in 2021, when Russia cut volumes of natural gas flowing to Europe to a contracted minimum while draining (instead of restocking) Gazprom-owned gas storage inventories in the runup to the 2021/2022 winter.[iv] The ***Availability*** of supply has been hit even harder post-February of 2022 after Russia's invasion on Ukraine. First, Gazprom halted deliveries via Yamal pipeline as part of the sanctions against "unfriendly countries." Second, the company continued decreasing amounts of gas flowing via Ukrainian transit. Gazprom had also progressively cut volumes to Germany via Nord Stream 1. The pipeline eventually exploded as a result of what seems was an act of sabotage and has been unable to operate ever since. This impacted ***Accessibility*** of supply for what would be half of typical German annual demand or ¼ of total Russian exports to Europe before the Covid -19 pandemic (See Figure 1 for curtailment of Russian gas volumes).

Figure 1. EU27 Natural Gas Imports

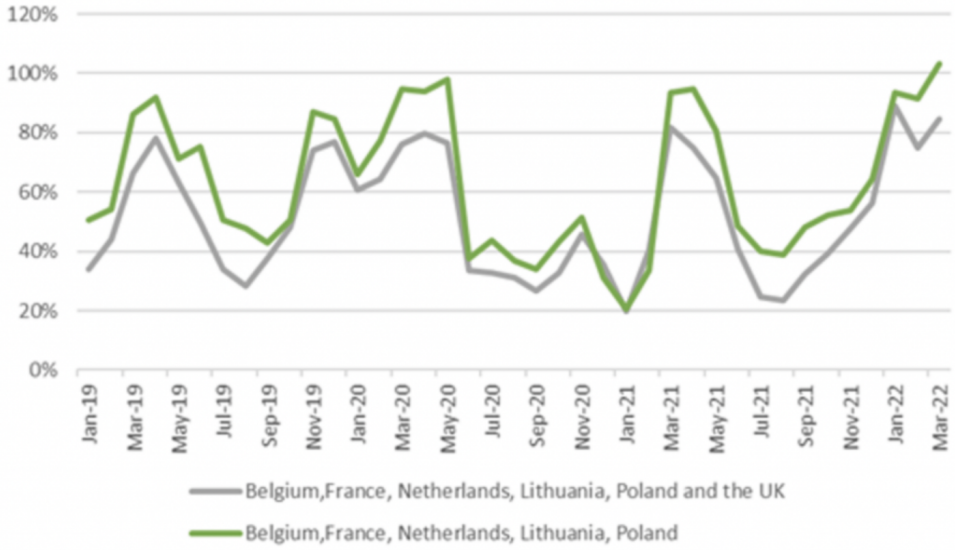


Source: Collins et al.[v]

Crucially, global gas supply has not been able to fill the void left by Russian gas. Much of the Russian gas that would otherwise go to Europe became stranded with no infrastructure ready to send it to other demand centers. In the meantime, Europe has drawn as much as possible of the globally available but limited in volumes LNG, which significantly tightened the market. Some inroads have been made in the short-term by pushing the limits of productivity or capacity, including increase in gas production from Norwegian fields,

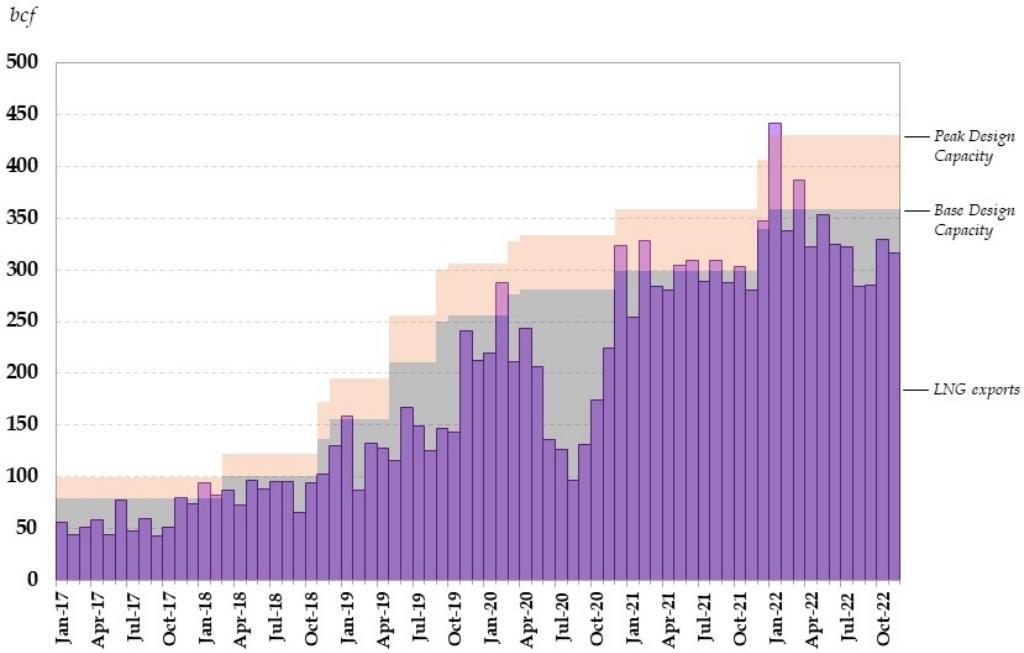
delaying maintenance, as well as pushing limits of both, regasification capacity in the EU (Figure 2) and liquefaction capacity in the US (Figure 3).[vi] China's economic downturn in the face of no-Covid policy has also helped allowing for additional flexibility and redirection of some LNG volumes to Europe. [vii]

Figure 2. EU LNG Import Terminals Capacity Utilization



Source: Mikulska and Miles (2022)[viii]

Figure 3. US LNG Exports, Monthly Jan2017-Nov2022



Source: Kenneth B. Medlock III (2023)[ix]

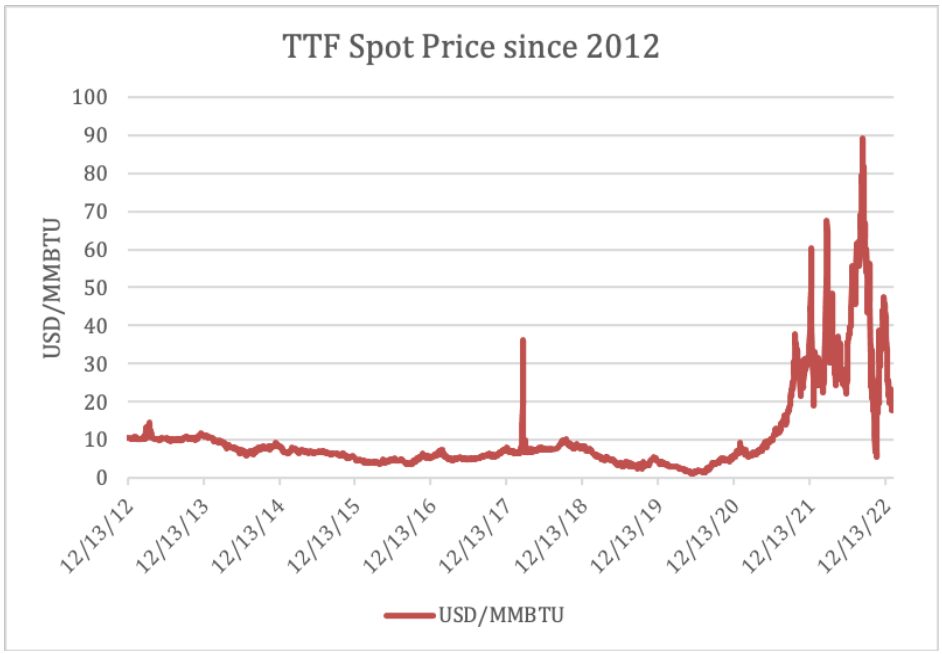
At the same time, it's worth noting that limitations to ***Accessibility*** were a big impediment to securing even the gas supply that was available to Europe. This includes 1) insufficient LNG import capacity, especially in Germany which had the largest gas shortage after Russian gas volumes decreased but no LNG import terminals until the very end of last year; 2) lack of interconnections to channel the supply from existing LNG import infrastructure to centers of immediate demand, including lack of access to plentiful LNG import infrastructure in Spain and Portugal but also, to an extent, in Italy and the UK. And while the advances in diversification infrastructure in Central and Eastern Europe helped, they were too small to assuage the deficits on the European scale, even with new LNG terminals often operating far above nameplate regas capacity.[x]

Going forward, accessibility is likely to improve given new floating storage and regasification units installed or soon to be installed in Germany, Finland, and the Netherlands among others. However, with little new LNG coming into the markets in 2023 and 2024 this could make markets even tighter, especially if Chinese demand rebounds. In addition, the market will likely tighten in the non-heating season as Europe strives to fill its gas storage to legally mandated levels of at least 90% until November 1st, 2023.

Affordability of supply

The push for winter preparedness has already been a contributing factor to extreme price rises in 2022, highlighting ***Affordability*** as a crucial feature of secure energy supply. Figure 4 shows how the prices skyrocketed in the Fall of 2022 as the last push for storage fill in preparation for winter was taking place and explosions idled Nord Stream 1 pipelines.

Figure 4. Natural Gas Prices in Europe, Dec. 2021-Jan. 2023 (Spot-Day Ahead)

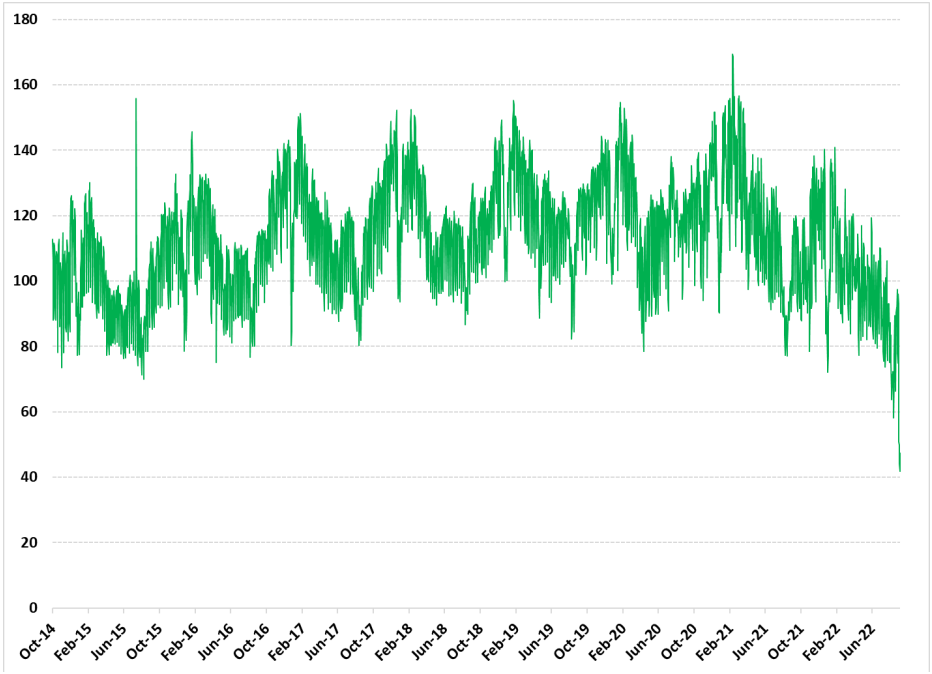


Data: Bloomberg; Author's Analysis

Thanks to the high storage levels and a very mild fall and winter 2022/2023, the prices of natural gas in Europe abated significantly, though they still stand at multiples of prices before the Russian invasion. But even though gas storage is filled to record high levels, promising a smaller burden for the next summer filling season, much of the gas that it contains was bought at the height of the price runup. In effect, many European utilities are faced with no good option to choose from: while sales of the stored gas mean heavy losses and the potential need to buy again in a high-price environment, a lack of sales leads to a lack of financial liquidity.

High prices of energy have also dealt a severe blow to the European industry (See Figure 5), with high-energy and high-gas intensive users affected the most, including most prominently chemical and fertilizer industry.[xi] The prospect of high energy prices into the short-to-medium term also creates a reason for concern about potential de-industrialization as companies consider options to re-shore to other countries where costs of energy are lower and less volatile.

Figure 5. Industrial Gas Demand in Europe*



Data source: ENSTOG; Analysis: Collins et al.[xii]

**This is not a Europe-wide picture, but still constitutes a material indicator that includes gas flows to industrial consumers in Belgium, part of France (Terega), Part of Germany (ONTRAS), Italy, Luxembourg, the Netherlands, and the UK*

Europe is trying to avoid this outcome by introducing heavy subsidy schemes, at both national and EU-levels, including some developed as a response to the U.S. Inflation Reduction Act. Whether these will be successful remains to be seen. However, subsidies toward energy prices for individual consumers and industry are likely to be a heavy burden

on European states and tax payers. This, in turn, could negatively impact the ability of at least some EU member countries to address other societal needs while not being able to completely neutralize the spike in energy prices. Inflationary pressures that already exist are likely to deepen, which can potentially lead to societal dissatisfaction, electoral upsets, and a general backlash and instability that could make Europe even less attractive for investment. Heavy governmental and regulatory involvement and the willingness of governments to step in could also become a serious deterrent for some commercially-minded actors.

The mild winter in 2022/2023 has allowed the European gas and electricity markets and consumers some breathing room. With no need for governmentally regulated gas rationings and storage levels high in February 2023, Europe is currently rather assured of availability of natural gas for the rest of this winter season (at least under average winter conditions). Indeed, if the winter continues to be mild, the next storage filling season is also likely to be less challenging as some of the storage-retained volumes substitute for what usually would be Russian gas flowing over summer into the European storage. Even so, the pressure on prices of natural gas and gas-powered generation will continue to impact the European industry, consumers, and European budgets well into the future, even if additional LNG supply relaxes the markets in the second half of the 2020s. The pressure will, among others, result from the hurried, previously unbudgeted investments in natural gas infrastructure that Europe did not plan to make but which have been clearly critical to support its energy security.

Acceptability of Supply

This leads to the last feature of the *"Four A's"* framework: ***Acceptability***. What's acceptable in energy supply to Europe has changed dramatically in February of 2022 with Germany's cancelling of the Nord Strom 2 pipeline right before Russia entered Ukrainian soil. Suddenly Russian energy became undesirable while natural gas (in particular LNG), nuclear power and even coal from non-Russian suppliers became acceptable and sought after.

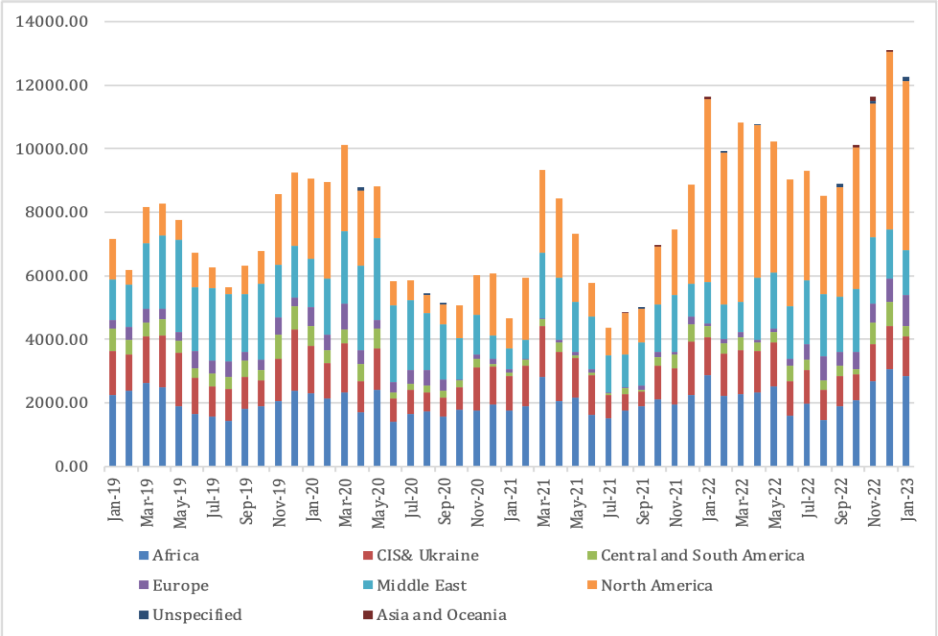
The reliance on piped Russian gas has been particularly difficult to address in an immediate fashion given the need for expensive infrastructure that takes times to build on both ends of the demand-supply equation. In effect, much of Europe is still accepting whatever gas Russia is willing to flow its way. Since these volumes diminished, however, and non-Russian supply is either unavailable and/or inaccessible, other fuels are being put to work, including coal and nuclear power, even in countries which have been trying to eliminate either or both from their energy mix. In addition, domestic natural gas production that was had been slotted for a permanent phaseout (i.e., in Groeningen) remains online. Importantly, natural gas and nuclear power have been included in the taxonomy of decarbonizing fuels, all pointing to another change in acceptability of fossil fuels among Europeans. But this acceptability is only short-term, portrayed as a setback, rather than a matter of necessity as Europe hopes to transform into a zero-carbon economy. At the same time, it's unclear how short the short-term will be, given the current lack of immediately available alternatives to traditional energy sources and long lead times for renewable investment.

The short-term rhetoric is also not without consequences to both European and global security of gas supply. To begin, if European customers fail to commit to long-term contracts, they will likely have to purchase natural gas on a secondary and/or spot market. This could mean volatility, high prices and possibly shortages of natural gas and not only in Europe. Also, countries that committed to long-term contracts could lose those volumes if unable to outbid wealthy European customers. Indeed, this has already been the case last year where countries such as Pakistan, Vietnam, or Bangladesh were not able to attract LNG shipments and even saw their contracted LNG volumes travel to Europe instead. And while Europe was able to fill their gas storage to the rim and prevent explicit gas rationing, these countries were less fortunate with Pakistan,[xiii] in particular, in the midst of experiencing an acute energy crisis and many in the region rethinking previously planned investment in natural gas, decreasing the number of potential long-term contracts even further.

Importantly, lack of long-term contracts will not impact all LNG providers to the same degree. Instead, private, commercial LNG producers, including those in the U.S., are likely to be impacted more given their general reliance on anchor consumers for financing and reaching a final investment decision. Thus, gas markets would be more likely to become dependent on state-owned or state-supported LNG producers, including Russia, increasing their geopolitical and/or economic leverage. Such development would undermine the trend toward a more flexible and more liquid natural gas market that the entry of U.S. LNG producers in particular has introduced.

If anyone wondered previously whether U.S. LNG makes a difference, those doubts should have completely disappeared over the last year as U.S. LNG poured into Europe (Figures 6 & 7). It is also easy enough to imagine a counterfactual where Russian attacks on Ukraine and the diminishing supply of natural gas to Europe come while the U.S. is a net gas importer or depends on Russian gas itself. The response from the US would possibly have been much more muted, and the U.S. would have to engage in price competition with Europe and Asia for the limited supply of natural gas available in the global market, with prices of energy skyrocketing in the U.S. as much as, if not more than they did in Europe.

Figure 6. EU27 LNG monthly imports by region of origin

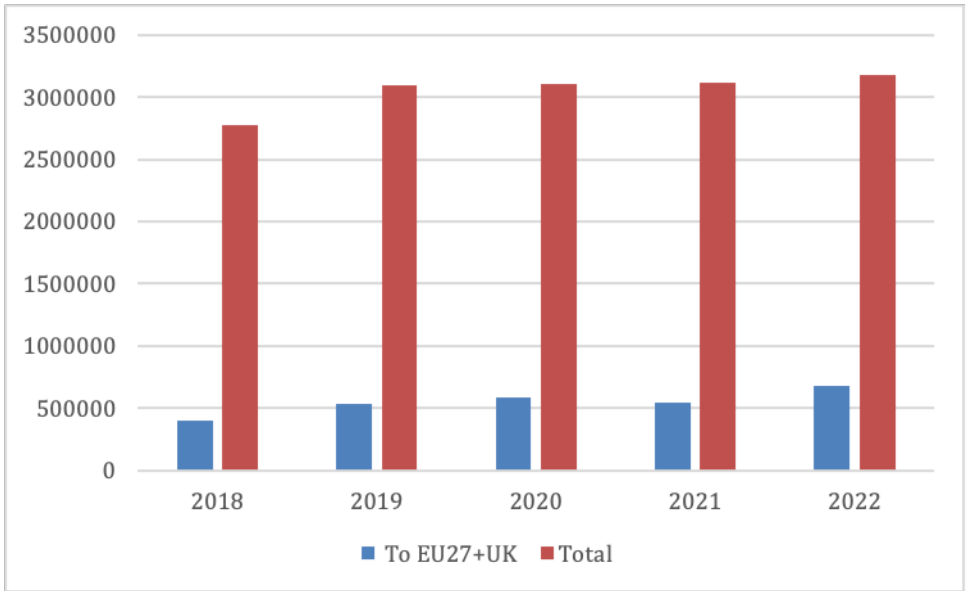


Data Source: Cedigaz; Author's analysis

Oil and oil products

The geopolitical value of US energy exports is also very much pronounced in the case of oil. More geographically diversified supply of crude oil and crude oil products has been able to diminish the economic and geopolitical power of large oil suppliers improving energy security of the U.S. and globally.[xiv] A relatively quick response time to changes in price by US shale oil producers led to moderate oil prices in the past decade, offsetting global oil crunches resulting from political and geopolitical events and instability in oil producing countries, including most-recently Russia.[xv] We have also seen an increase in the flows of U.S. oil to Europe as the latter tries to wean itself off Russian crude and its products (Figure 7).

Figure 7. Annual U.S. Exports of Crude Oil and Petroleum Products (Mbbl)



Data Source: EIA / Author's Analysis

What's Next

Going forward, European energy security will be impacted by a myriad of factors, many of them political in nature, including the push for an energy transition. As Europe admitted itself, albeit too late to prevent the 2021/2022 energy crisis, natural gas and nuclear power should be counted as decarbonizing options. The admission has allowed for certain investments like FSRU's and new gas interconnections. However, many European countries see these fixes as short-term, which translates into a hesitant approach and insufficient commitment to longer-term contracts, deficiency that can impact availability, affordability, as well as nature of LNG flows in the future as some currently planned, commercially-oriented projects – including those in the US- may not come to fruition without sufficient financial backing while state-supported enterprises will.

At the same time, U.S. involvement in new nuclear power development in Central and Eastern Europe is an encouraging signal that incorporates both, energy and economic security. Responsible energy policy can and should consider "all of the above" options. Plans that are realistic, well-founded and accessible to all countries will have a chance to propel actual change, rather than those that are only written out as policy goal. For the U.S. this means responsible development and use of all of its resources that allow the country to use its comparative advantage while advancing the wellbeing of its population. The abundant and diverse resources also increase U.S.' geoeconomic power, which - as we have seen over the past year – allow the country to step in and help its allies when the need arises.[xvi]

[i] Anna Mikulska and Steven Miles, *US LNG 'GasLift' Floods European Terminals Ahead of Russia Gas Cutoff*, available at: https://www.bakerinstitute.org/research/us-lng-gaslift-floods-european-terminals-ahead-of-russia-gas-cutoff.

[ii] See: Kenneth B. Medlock III (2014), *A 'Credible Threat' Approach to Long Run Deterrence of Russian-European Hegemony*, available at https://www.bakerinstitute.org/research/us-lng-exports-weapon-against-russia/ & **A**nna Mikulska, "*How Much Gas Is Enough: Energy Security and Natural Gas Infrastructure in the Baltic Sea Region,*" chapter in *The Future of Energy Consumption, Security, and Natural Gas,* Edited by Kari Liuhto. Palgrave, 2021 Available at; https://link.springer.com/chapter/10.1007/978-3-030-80367-4_11 .

[iii] See: Kenneth B. Medlock II, Anna Mikulska, and Luke (Leelook) Min, *Natural Gas Balance in Europe: Germany as a Case Study*, available at: https://www.bakerinstitute.org/research/natural-gas-balance-europe-germany-case-study

[iv] See EIA report available at: https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2021/09_30/

[v] Gabriel Collins, Anna Mikulska, and Steven Miles, *Gas Geoeconomics Essential to Win the 'Long War' In Ukraine—And Asia*, Baker Institute Research Presentation, September 2022

[vi] Steve R. Miles, Gabriel Collins, and Anna Mikulska, *US Needs LNG to Fight a Two-Front Gas War*, available at: https://www.bakerinstitute.org/research/us-needs-lng-fight-two-front-gas-war

[vii] Gabriel Collins, Kenneth B. Medlock III, Anna Mikulska, and Steven Miles , *Strategic Response Options if Russia Cuts Gas Supplies to Europe,* available at: https://www.bakerinstitute.org/research/strategic-response-options-if-russia-cuts-gas-supplies-europe

[viii] Anna Mikulska and Steven Miles, *US LNG 'GasLift' Floods European Terminals Ahead of Russia Gas Cutoff*, available at: https://www.bakerinstitute.org/research/us-lng-gaslift-floods-european-terminals-ahead-of-russia-gas-cutoff

[ix] Kenneth B. Medlock III, *U.S. LNG Exports: Supply, Siting, and Bottlenecks. The U.S. Natural Gas Market in Global Setting*, Publication upcoming March 2023.

[x] For pre-2022 Russian invasion considerations see: Gabriel Collins and Anna Mikulska (2018), *Gas Geoeconomics in Europe: Using Strategic Investment to Promote Market Liberalization, Counterbalance Russian Revanchism, and Enhance European Energy Security,* available at https://www.bakerinstitute.org/research/egas-geoeconomics-europe; A 2022 follow up: Gabriel Collins, Anna Mikulska, Steven R. Miles, *Winning the Long War in Ukraine Requires Gas Geoeconomics*, available at: https://www.bakerinstitute.org/research/winning-long-war-ukraine-requires-gas-geoeconomics-0

[xi]Aura Sabadus, *Poor Demand, High Costs Stifle Europe Industry Despite Falling Prices*, available at: https://www.icis.com/explore/resources/news/2023/01/18/10846094/insight-poor-demand-high-costs-stifle-europe-industry-despite-falling-gas-prices/

[xii] Gabriel Collins, Anna Mikulska, and Steven Miles, "*Gas Geoeconomics Essential to Win the 'Long War' In Ukraine—And Asia*," Baker Institute Research Presentation, September 2022, available at: https://collinsresearchportal.com/2022/09/12/gas-geoeconomics-essential-to-win-the-long-war-in-ukraine-and-asia/

[xiii] Charles Kennedy, *Pakistan has no option but to ration natural gas this winter*, available at https://oilprice-com.cdn.ampproject.org/c/s/oilprice.com/Energy/Natural-Gas/Pakistan-Has-No-Option-But-To-Ration-Natural-Gas-Supply-This-Winter.amp.html

[xiv] Jim Krane, Kenneth B. Medlock III, "Geopolitical dimensions of US oil security," *Energy Policy*, Volume 114, 2018, Pages 558-565, ISSN 0301-4215, available at: https://doi.org/10.1016/j.enpol.2017.12.050

[xv] Jim Krane and Mark Agerton, *OPEC Imposes 'Swing Producer' Role Upon U.S. Shale: Evidence and Implications*, available at: https://www.bakerinstitute.org/sites/default/files/2015-08/import/CES-Krane-Agerton-2015EnergyForum3qtr.pdf

[xvi] Gabriel Collins, Anna Mikulska, and Steven Miles, "*Gas Geoeconomics Essential to Win the 'Long War' In Ukraine—And Asia*," Baker Institute Research Presentation, September 2022, available at: https://collinsresearchportal.com/2022/09/12/gas-geoeconomics-essential-to-win-the-long-war-in-ukraine-and-asia/