

Impact of Russia/Ukraine War on World Natural Gas & Oil Markets

ALTERNATIVE POWER PLAYS PODCAST

THE BRATTLE GROUP

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MARCH 28, 2022



Introduction

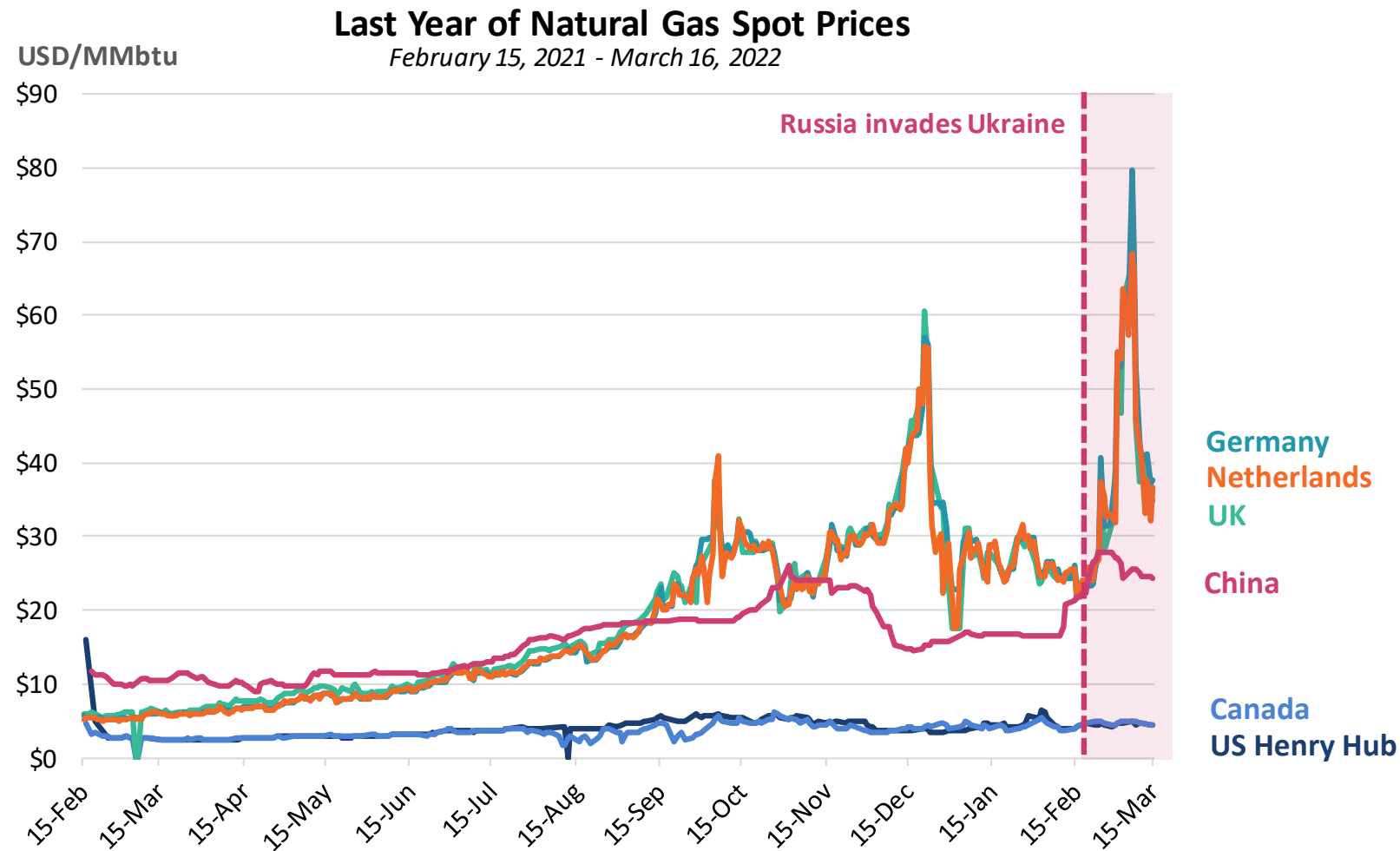
Today's topic is how the Ukraine war by Russia is likely to affect world energy markets, with primary focus on natural gas. This is a topic widely mentioned in the news, but often discussed briefly without the additional context needed to fully assess the risks and possible outcomes. We will be discussing recent price spikes, Russia oil & gas supplies in relation to world needs, LNG and the US gas market, and key takeaways for this year and 3-5 years in the future.

To provide an expert view, we will interview Mr. Steve Thumb, who is a nationally noted oil & gas expert, who was in charge of oil and gas forecasting for three decades at the widely used source, Energy Ventures Analysis, until he recently retired. Previous to that, he was Vice President of Strategic Planning at the energy divisions of three Fortune 500 Companies. In addition, he has authored or co-authored over 40 EPRI and Gas Technology Institute reports on key oil & gas topics.

We will not be offering any forecasts today, but rather we will try to explain where the world's oil and gas supplies come from, how much they may be disrupted by the Ukraine War, and what the short and long run implications could be for the US, the EU, and Russia. Spoiler alert – *Steve regards the situation as a long run game changer, not just a bad stretch of extreme short run pain and market dislocation. He will explain.*

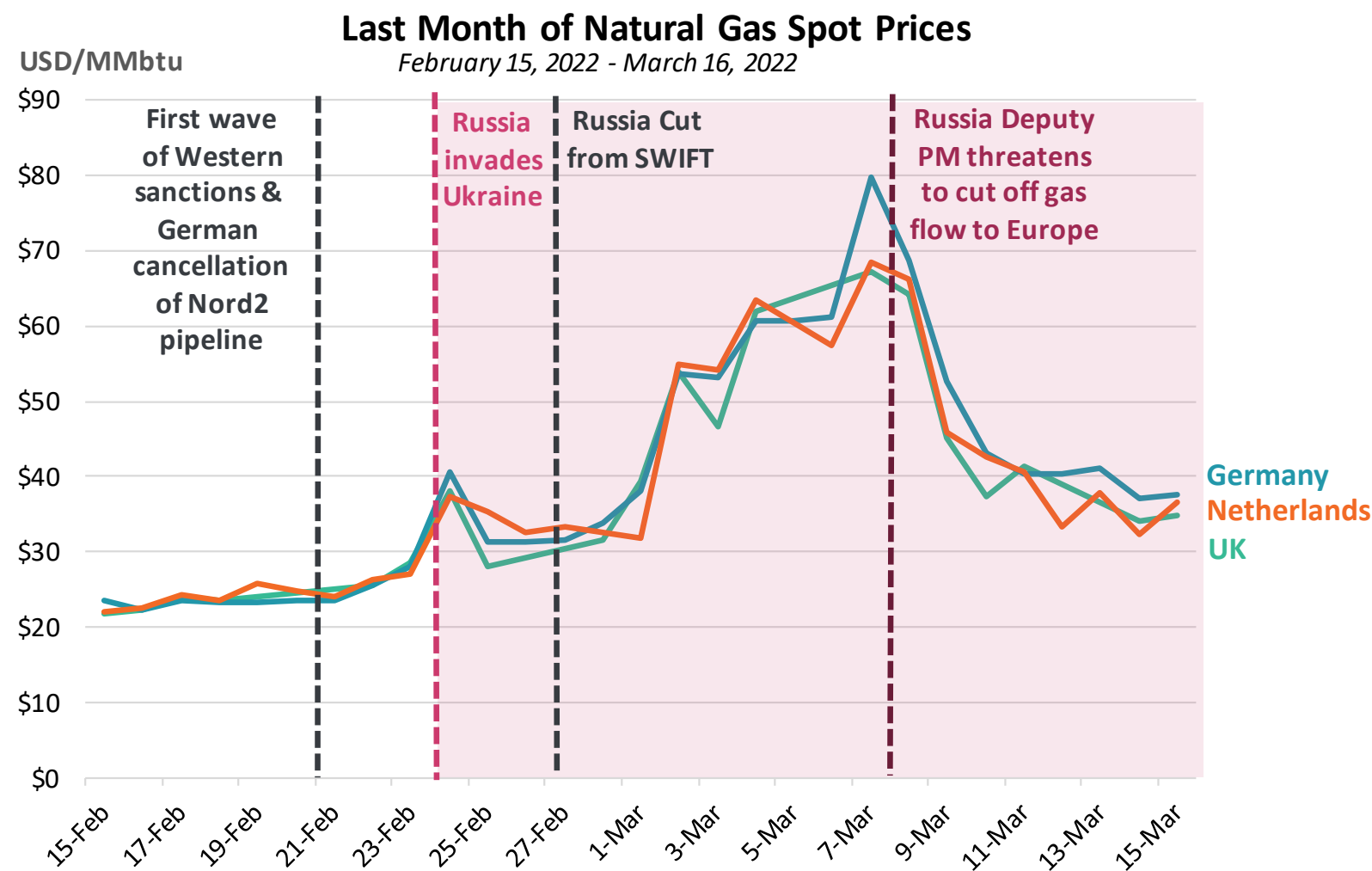
This will be a longer than usual segment because of the richness of the material. Numerical information will be presented and will be available to listeners on Brattle's and Buchanan's websites.

International Natural Gas Prices over Past Year



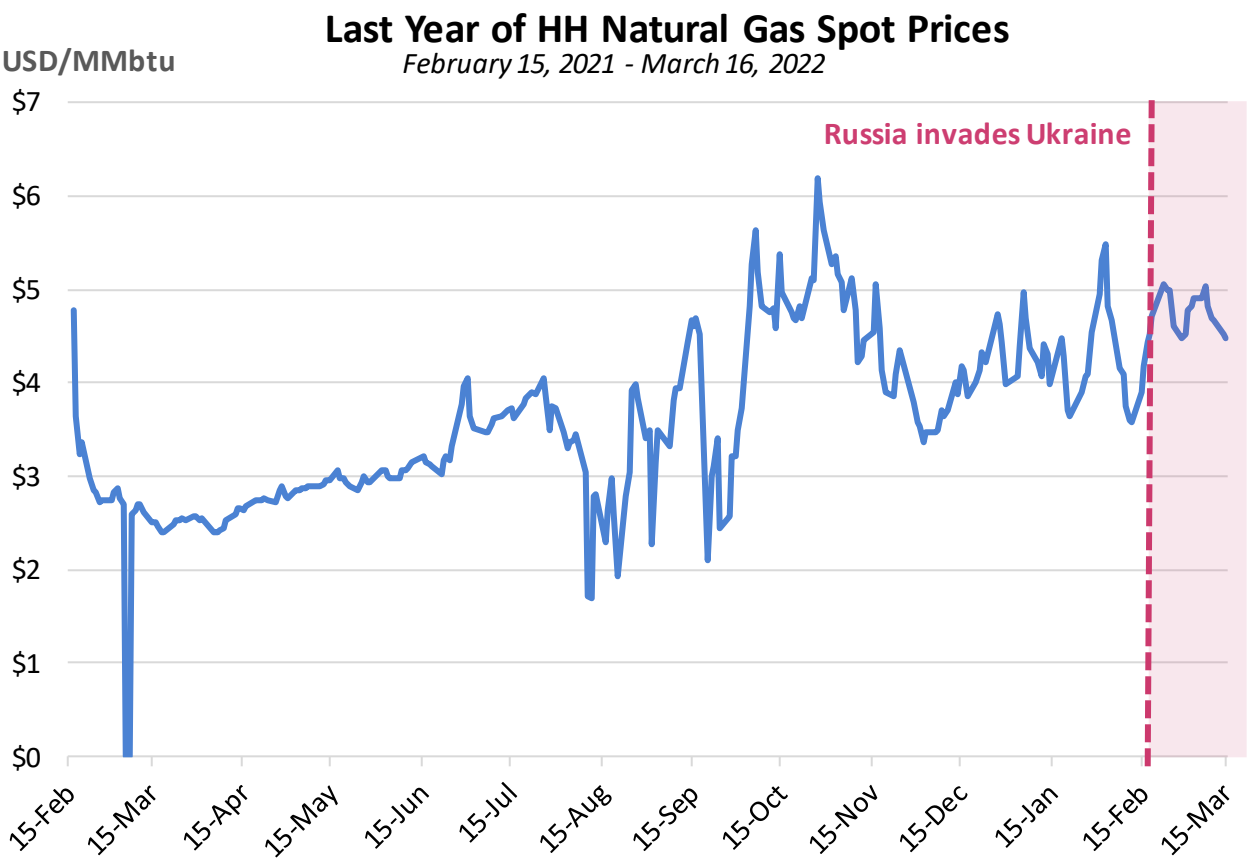
Source: Bloomberg Spot Price Indices.
Note: China prices are Hebei delivered prices.

EU Gas Prices – Up to and during the war



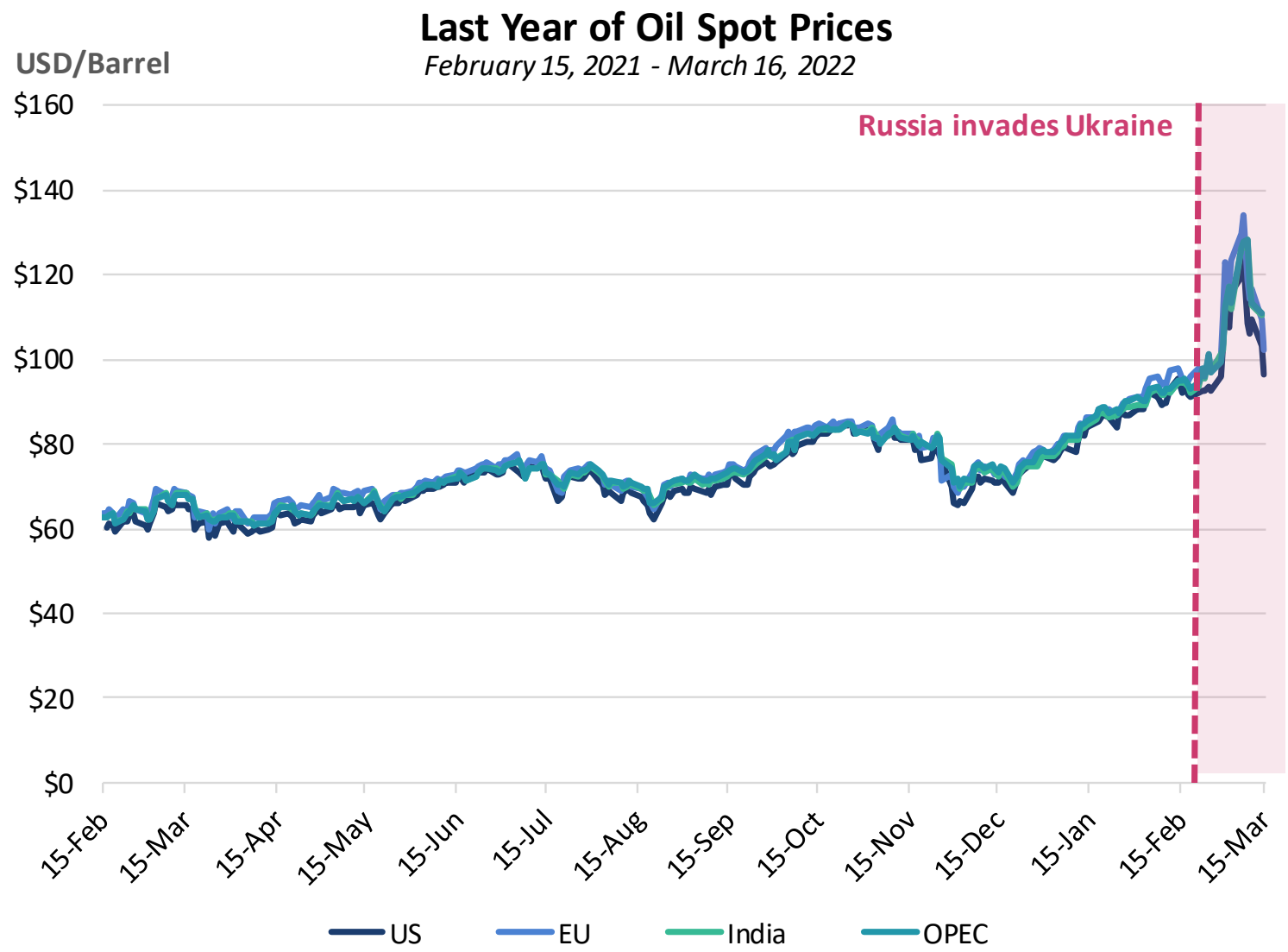
Source: Bloomberg Spot Price Indices.

U.S. Henry Hub Spot Gas Prices – past year



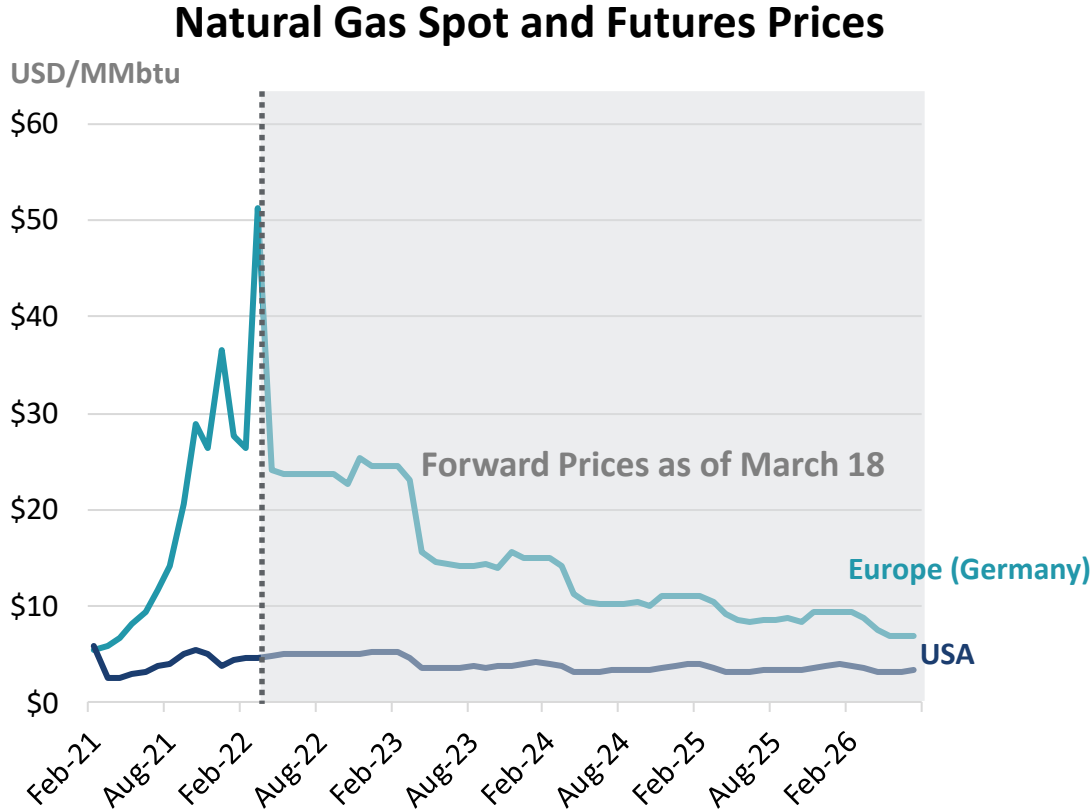
Source: Bloomberg Spot Price Indices.

Oil Prices in the Past Year

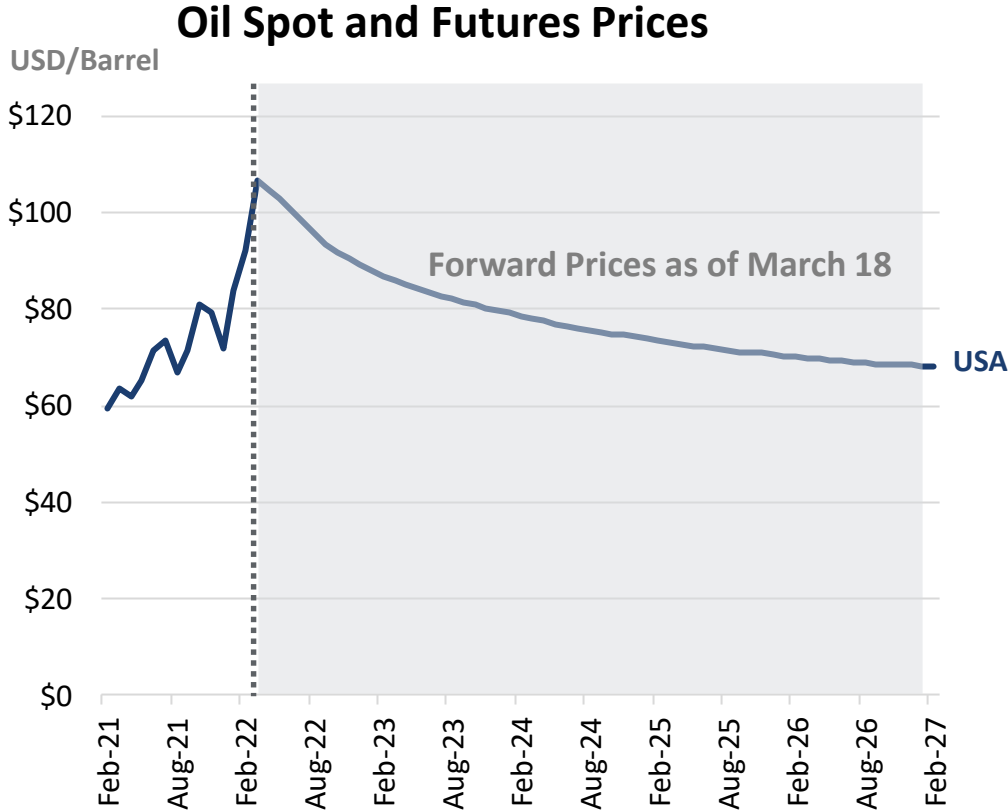


Source: Bloomberg Spot Price Indices.

Gas & Oil Prices and Futures



Source: Bloomberg Price Indices.



Source: Bloomberg Price Indices.

2019 World Oil and Gas Production

Oil Production (thousand barrels/day)

U.S.	17,045	18%
Saudi Arabia	11,832	12%
Russia	11,540	12%
Other Middle East	9,720	10%
Africa	8,399	9%
South & Central America	6,174	6%
Canada	5,651	6%
Iraq	4,779	5%
UAE	3,998	4%
China	3,836	4%
Other Asia Pacific	3,814	4%
Other Europe	3,414	4%
Other CIS	3,074	3%
Mexico	1,918	2%
Total	95,194	100%

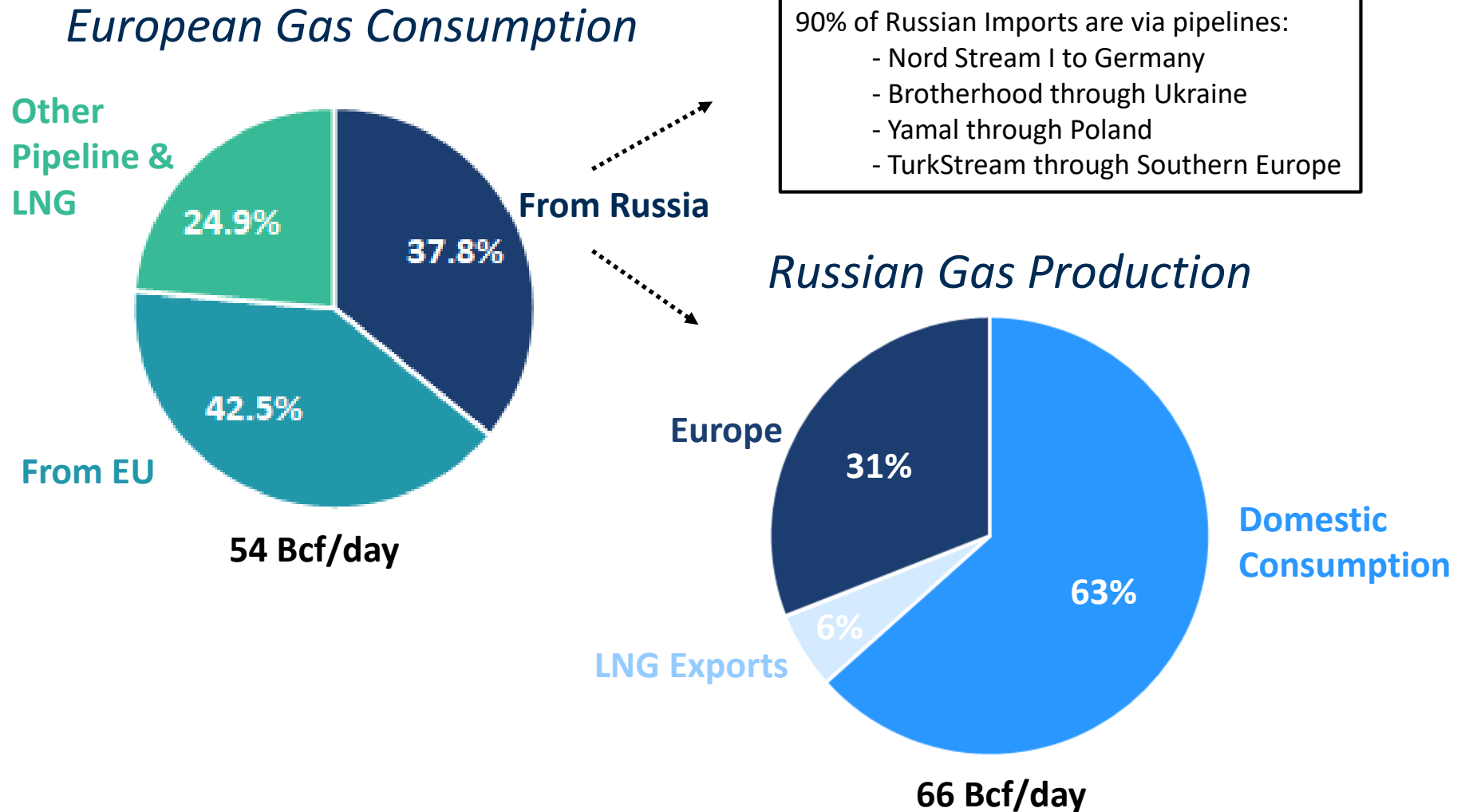
Source: BP Statistical Review of World
Energy 2020, PDF pg. 19

Gas Production (bcf/day)

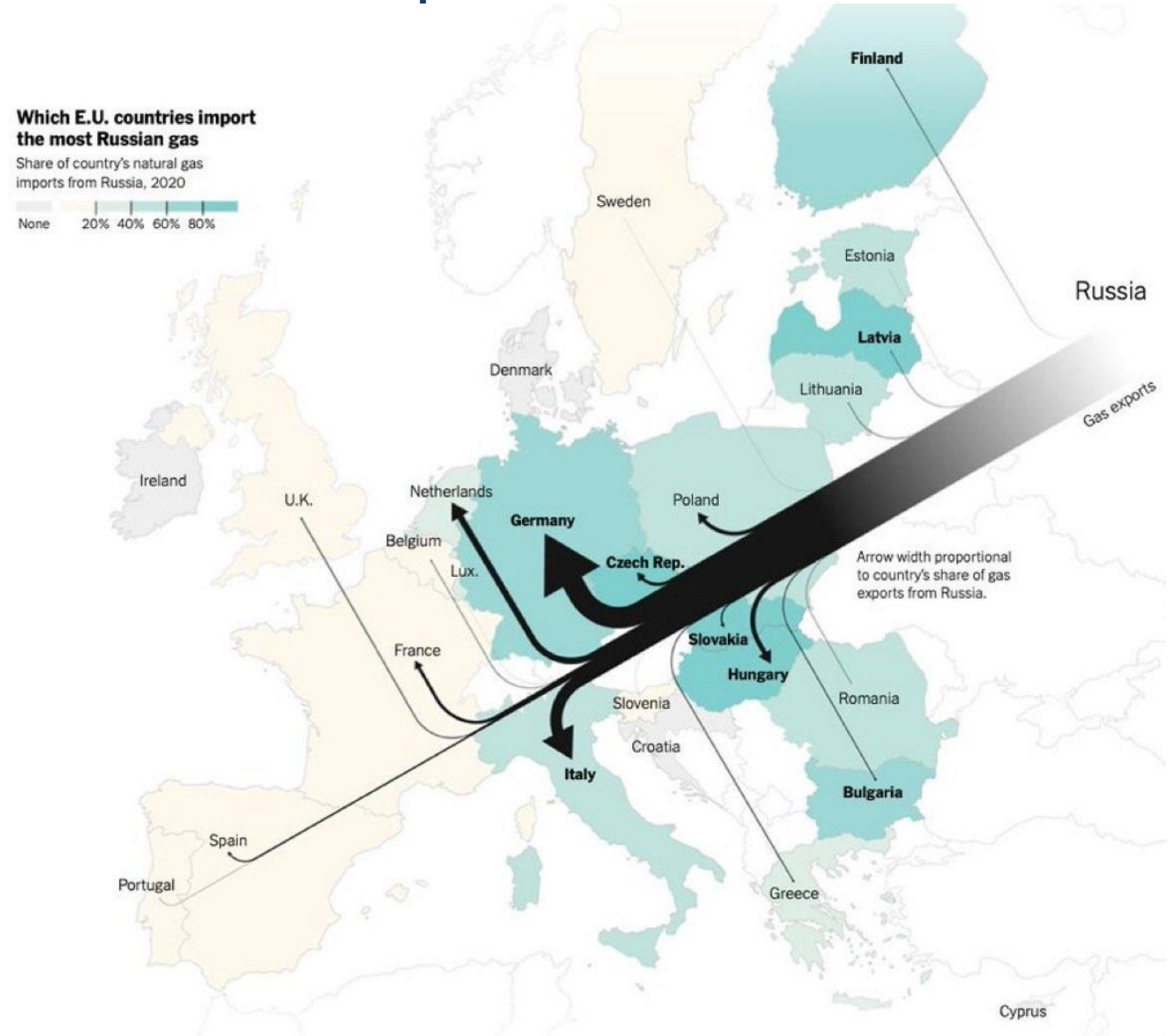
U.S.	89	23%
Russia	66	17%
Other Asia Pacific	48	12%
Other Middle East	26	7%
Iran	24	6%
Africa	23	6%
Other Europe	23	6%
Qatar	17	4%
China	17	4%
South & Central America	17	4%
Canada	17	4%
Other CIS	16	4%
Mexico	3	1%
Total	386	100%

Source: BP Statistical Review of World
Energy 2020, PDF pg. 36

2019 European Gas Consumption / Russian Gas Production

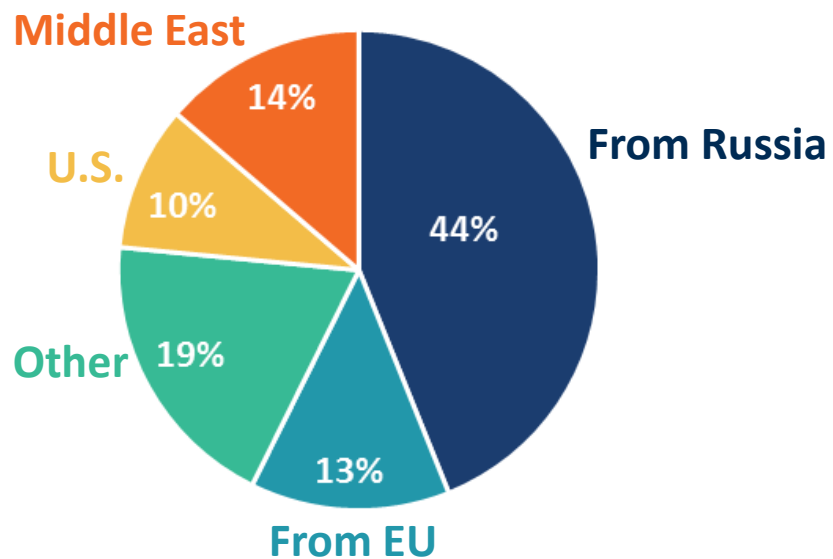


Russian Gas Flows to Europe



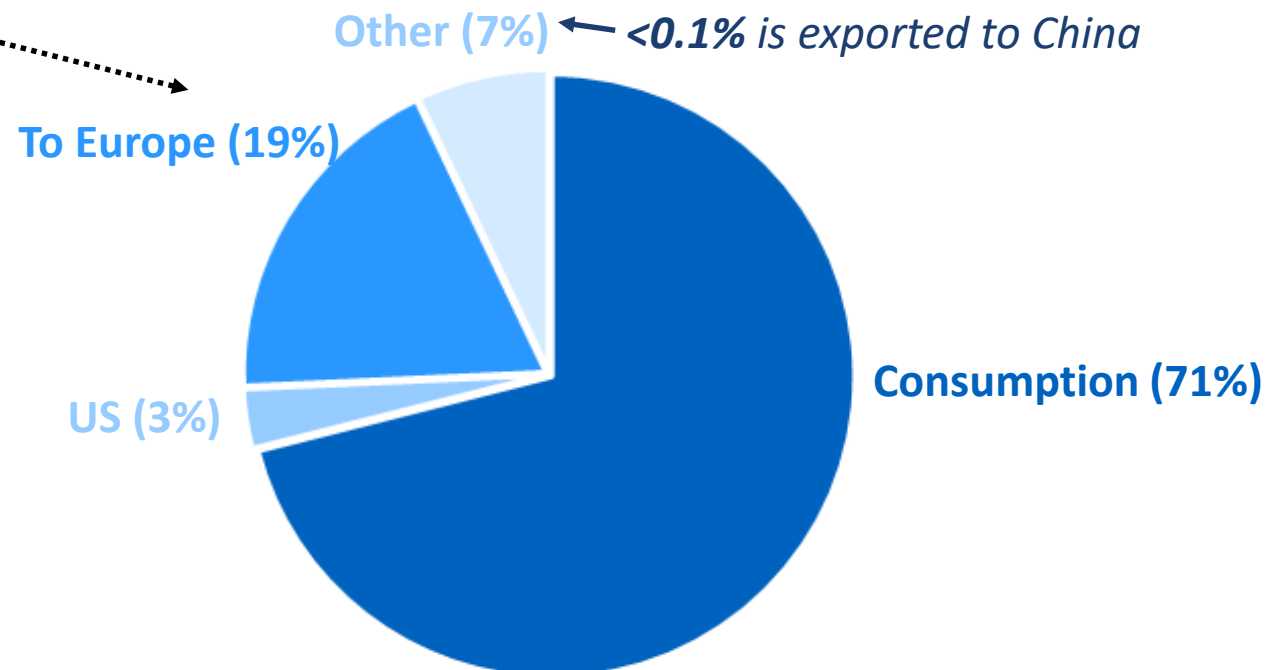
2019 European Oil Consumption and Russian Production

European Oil Consumption



4.9 million barrels/day

Russian Oil Production



11.5 million barrels/day

Current Sanctions Against Russia

Sanctions now prevailing against Russia include:

- **Banking** – 7 banks are cut-off from SWIFT messaging system
- **Frozen assets** – affects at least \$284B (~45%) of holdings of Bank of Russia
- **Bans on Russian goods**
 - Import ban on nonindustrial diamonds, seafood, and alcohol (Vodka)
 - Export ban on luxury goods (tobacco products, clothing items, jewelry, vehicles, art and antique goods)
- **Transportation** – Russian aircrafts and ships are banned from their airspace and ports
- **Technology** – semi-conductors, chips, sensors, et al. are blocked for sale to Russia, which will affect the compressor stations and pipeline flow management technology

Sources:

1. Reuters. <https://www.reuters.com/business/finance/eu-excludes-seven-russian-banks-swift-official-journal-2022-03-02/>
2. NBC News. <https://www.nbcnews.com/data-graphics/russian-bank-foreign-reserve-billions-frozen-sanctions-n1292153>
3. NBC News. <https://www.cnbc.com/2022/03/11/biden-to-ban-us-imports-of-russian-vodka-diamonds-and-seafood.html>
4. Reuters. <https://graphics.reuters.com/UKRAINE-CRISIS/SANCTIONS/byvrjenzmve/>
5. European Commission. https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1511

European Goals



Aspirations or declarations to reduce further commerce with Russia include:

- Following the invasion of Ukraine, the European Union announced REPowerEU, which diversifies gas supplies through LNG and pipeline imports and reduces faster the use of fossil fuels.
- This will **reduce the demand from Russian gas by two thirds within a year and eliminate the dependence on Russian gas by 2027-2030**

Europe Has a Two Part Plan

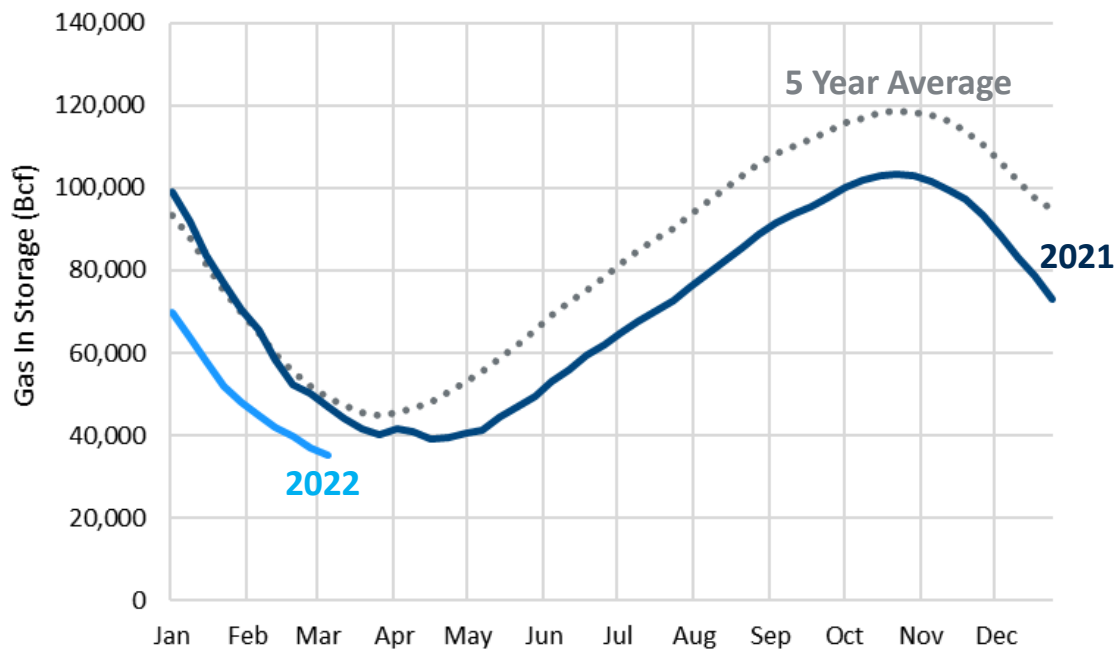
Part I: Reduce Russian Gas Imports

- * Increase LNG imports
- * Increase pipeline imports from other countries
- * Increase European gas production
- * Increase biomethane and hydrogen imports
- * Conservation and/or fuel switching within the power sector.

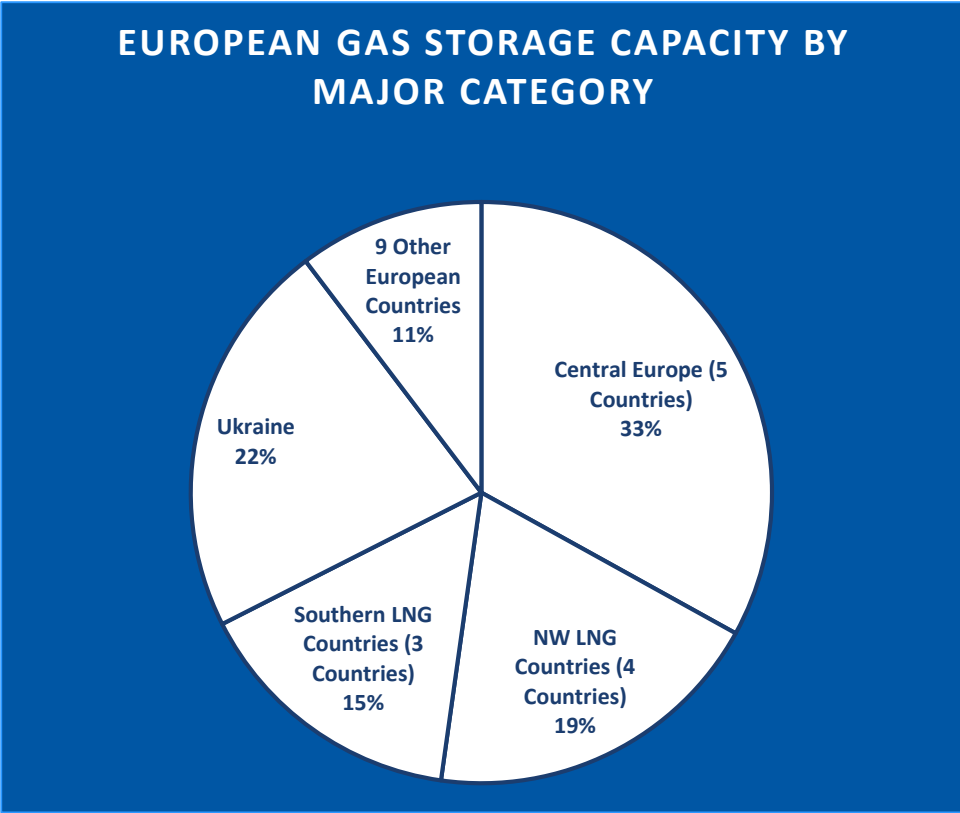
Part II: Fill Storage

- * Attain 90% a capacity factor before winter starts

European Gas Storage Inventories



Source: GIE AGSI, [AGSI+ \(gie.eu\)](https://gie.eu).
Note: Contains only EU + UK storage. Does not include Ukraine or Serbian data.



The goal is to reach 90% full by end of October

Major gas pipelines serving Europe

From Russia

From other Sources

European Gas Production
(North Sea and Onshore)
21.1 Bcf/d

Trans-Mediterranean
ALG ->TUN->ITL
2.9 Bcf/d

Maghreb-Europe
ALG ->MOR->SPN
1.2 Bcf/d

MedGaz (1.0 Bcf/d)
GALSI (1.0 Bcf/d)
Greenstream (1.1 Bcf/d)
ALG ->SPN and ALG ->ITL

Yamal Europe
(parallel to Northern Lights)
RUS->BEL->POL/GER
3.2 Bcf/d

Nord Stream I
RUS->GER
5.3 Bcf/d

Nord Stream II
RUS->GER
5.3 Bcf/d (Expected)

Northern Lights
RUS->BEL->POL
4.9 Bcf/d

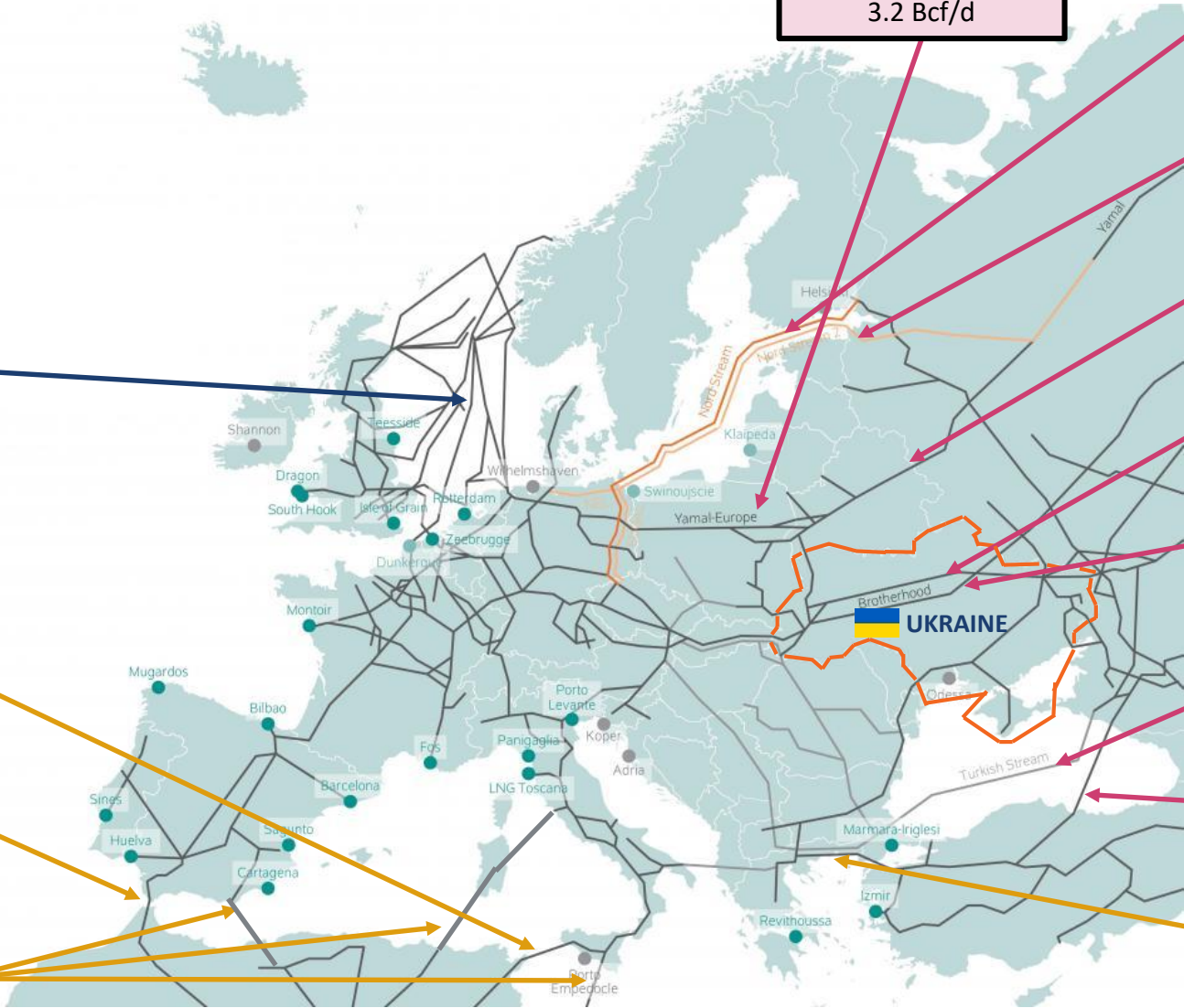
Progress Pipeline
RUS->UKR->HUN/ROM/SLO
2.5 Bcf/d

Brotherhood
RUS->UKR->HUN/ROM/SLO
3.1 Bcf/d

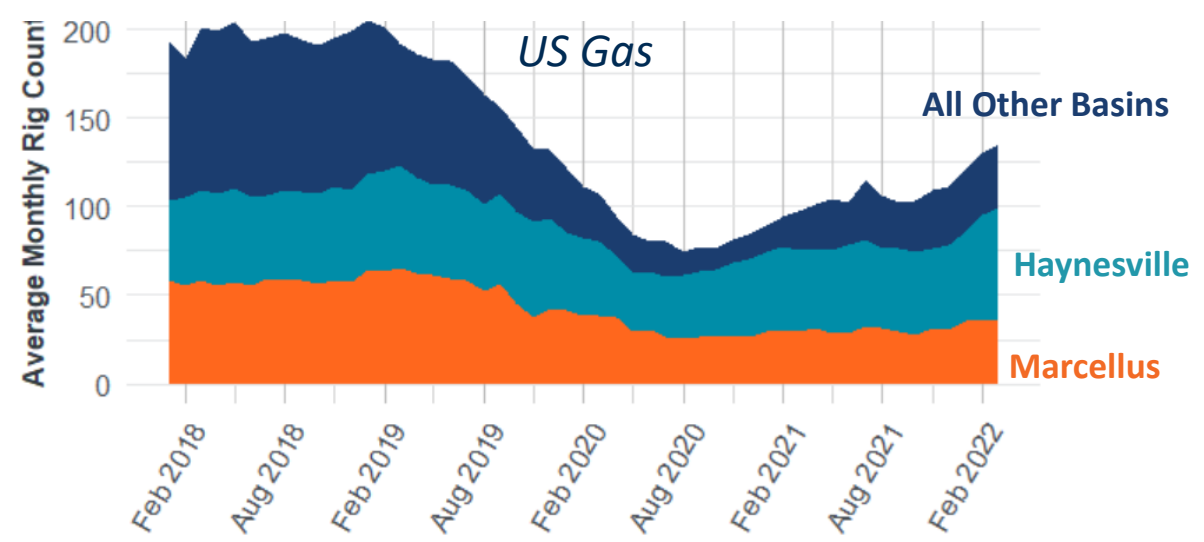
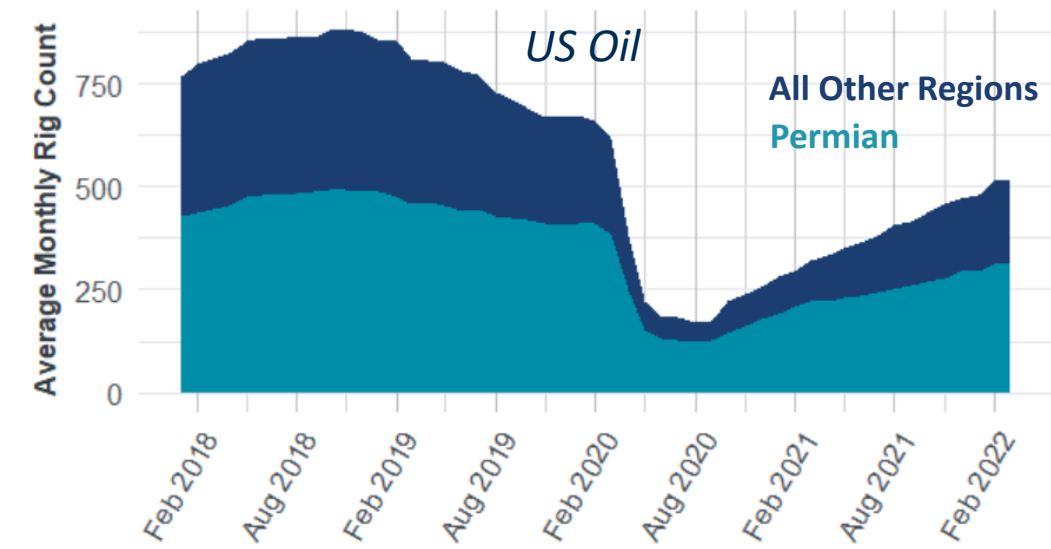
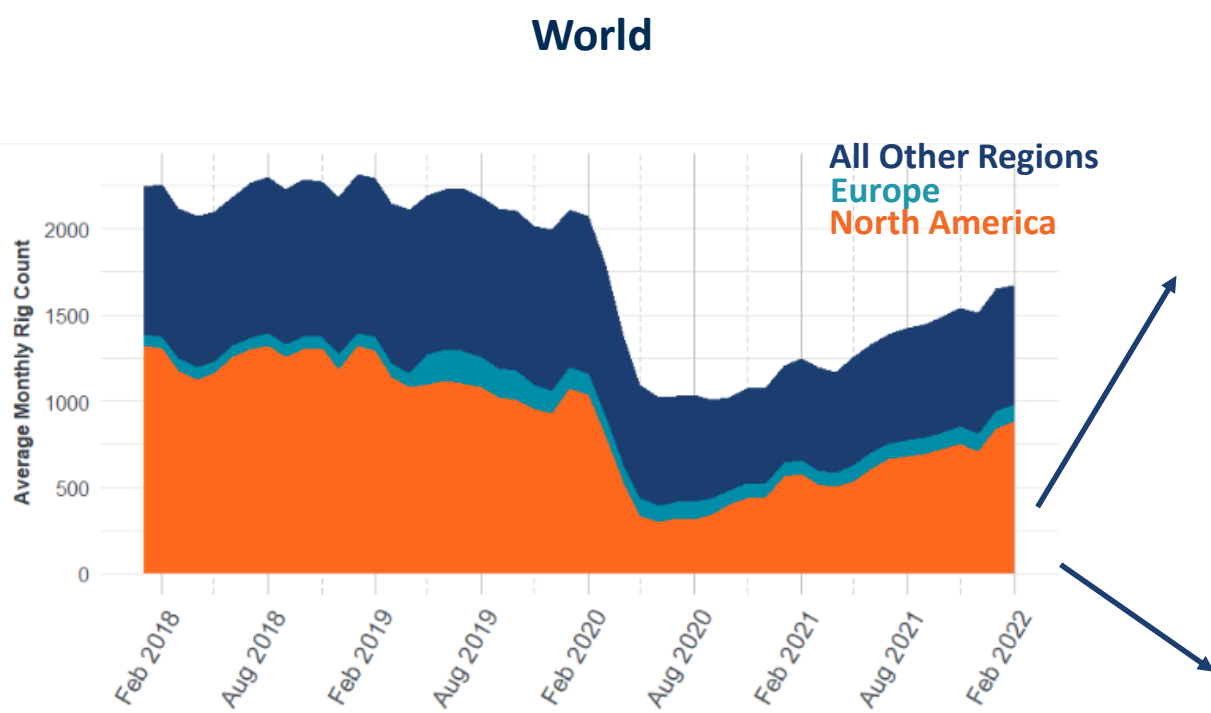
TurkStream
RUS->TUR->BUL
3.0 Bcf/d

Blue Stream
RUS->TUR->BUL
1.5 Bcf/d

Trans Adriatic Pipeline
AZR->TUR->GRC->ITL
1.0 Bcf/d (expanding to 2.0)



World Oil and Gas Rig Count, 2018 – Present



World LNG Production

Trade Movement for LNG in 2020 (Bcf/day)

		TO					Total
		Asia Pacific	Europe	South and Central	Middle East & Africa	North America	
FROM	Australia	10.26	-	0.01	-	0.01	10.28 21.8%
	Qatar	6.94	2.92	0.09	0.31	-	10.26 21.8%
	US	2.55	2.47	0.69	0.13	0.09	5.94 12.6%
	Russian Federation	2.17	1.67	0.01	0.06	-	3.91 8.3%
	Malaysia	3.18	-	-	-	-	3.18 6.7%
	Other	8.32	4.04	0.55	0.39	0.24	13.53 28.7%
	Total	33.42	11.11	1.34	0.89	-	47.10

Source: BP Statistical Review of World Energy 2020, PDF pg. 44

LNG Expansion Projects

LNG Capacity Under Construction as of May 2021 (Bcf/day)

Country	Liquefaction	Country	Regasification
Qatar NFE	16.8	China	7.9
USA	6.6	India	3.9
Russia	3.4	Kuwait	1.1
Kuwait	2.1	Egypt	1.0
Canada	1.4	Europe	0.8
Mexico	0.7	Thailand	0.7
Other (5 countries)	1.4	Japan	0.4
		Other (9 countries)	2.8
Total by 2025	22.1	Total	18.6
Total by 2027	32.4		

Notes: Qatar North Field expansion Phase 1 will be online in 2025 and Phase 2 in 2027. LNG Canada will be online in 2025. Europe includes Finland, Poland, Turkey, Cyprus and Italy. Following countries are constructing both liquefaction: Kuwait, Mexico, Indonesia and Egypt.

An additional 13 LNG projects have been approved by FERC, but have not started construction. These consist of 3 expansions of existing terminals (5.7 Bcf/Day) and 10 new terminals (20 Bcf/day).

Major pipelines (Eastern Russia)



**Altai Gas Pipeline
(Power of Siberia 2)**
(Not shown)
RUS->Western China
4.8 Bcf/d (expected)

Power of Siberia
RUS->CHN
3.7 to 4.6 Bcf/d
Came online 2019;
expanding to 2023

**Sakhalin-Khabarovsk-
Vladivostok Pipeline**
RUS->CHN & LNG Exports
3.5 Bcf/d (Expected)

Source: Energy & Power Magazine

Russian Difficulty Selling Oil

Even without sanctions, there is emerging reluctance to buy Russian oil

- Shell, after initially announcing a purchase of crude Russian oil, reversed its stance and will close its 500 service stations in Russia (with net closing costs of over \$3B)
- International Energy Agency forecasts a potential reduction of 3 million bpd of Russian oil production beginning in April 2022
- Some Russian shipments have been discounted in order to sell -- likely to be marketed privately to get around sanctions
- In addition to reputational risks, there are financial risks like the risk that banks might stop issuing credit to buyers

However, other experts predict an uptick in oil purchases from Russia; a recent Bank of America report notes, there is “no way US E&P and OPEC+ can displace the 8 mn b/d oil exports from Russia in the near term for reasons including supply chain bottleneck and lack of excess supply”

Sources:

1. Oil Price, [Russian Oil Exports Rise Despite Reluctant Buyers | OilPrice.com](#)
2. Bank of America, Research Marketing (confidential), March 22, 2022.
3. Bloomberg, “Russian Oil Sales Going Underground as Cheap Crude Tempts Buyers”, March 15, 2022, [Russian Oil Sales Going Underground as Cheap Crude Tempts Buyers – Bloomberg](#)
4. Reuters, [Remorseful Shell abandons Russian oil | Reuters](#)

Major Takeaways – Gas Importing vs. Exporting Countries

Gas Importing Countries

- Heightened tension between energy security and decarbonization
- Economics for electric vehicles, hydrogen, biomethane have improved
- High gas prices
 - Era of worldwide (2020/Covid-19) gas-on-gas competition is over
 - Regional boundaries and linkages become permanent (for next 5-10 years)
- Europe reduces Russian gas and oil imports
 - However, results below its goal
- Europe greatest challenge will be next winter
 - Unclear if storage will be 90% full
- If Russian oil is curtailed, there is room for UAE, Iraq, Iran, Venezuela to provide capacity
- Tension in solving problem with permanent fossil fuel expansion versus renewable development

Gas Exporting Countries

- Demand for LNG has increased, and potential profit very high
 - Some 13 projects before FERC approved are developed; US can supply much of the Russian gas lost to Europe
 - Back to long term contracting for LNG? At cost-basis, or opportunity cost margins?
- Higher drilling activity for both gas and oil
 - Less seasonality to natural gas? Prices higher than in 20-teens
 - Depends on how much the majors change their strategies from risk-averse buybacks to expansion
- Economics for electric vehicles improved, eventually damping LR oil sales
- Tension in solving problem with permanent fossil fuel expansion versus renewable development

Major Takeaways – by time frame and geography

	Europe	Russia	USA
Short run – thru winter 2022/23	Attempt at 2/3 reduction in ngas by winter. Need to fill storage to 90%, if possible via increased existing LNG flows; shift electric dispatch towards coal;	High prices offset volume losses. Ruble down 50%, hard currency starvation Buyers reluctant to take Russian oil, many majors unfold their involvement.	Higher consumer prices, esp. for gasoline. Accelerated ngas and oil expansion, LNG capacity plans
Mid/long – 2025- 2030	Attempt at 2/3 reduction in all Russian energy imports; tension over switching to gas vs. renewables; new supplies are LNG, not new pipelines, but will take years to build new LNG capacity	Iron Curtain reestablished? Unlikely to divert lost EU sales to China due to pipeline limits, LNG development expense, blocked access to capital and technology. Oil rerouting competition from expanded OPEC production?	Substantial LNG production and export to EU; Tension over US support for expanded oil and gas vs. renewables, but geopolitical balance favors O&G

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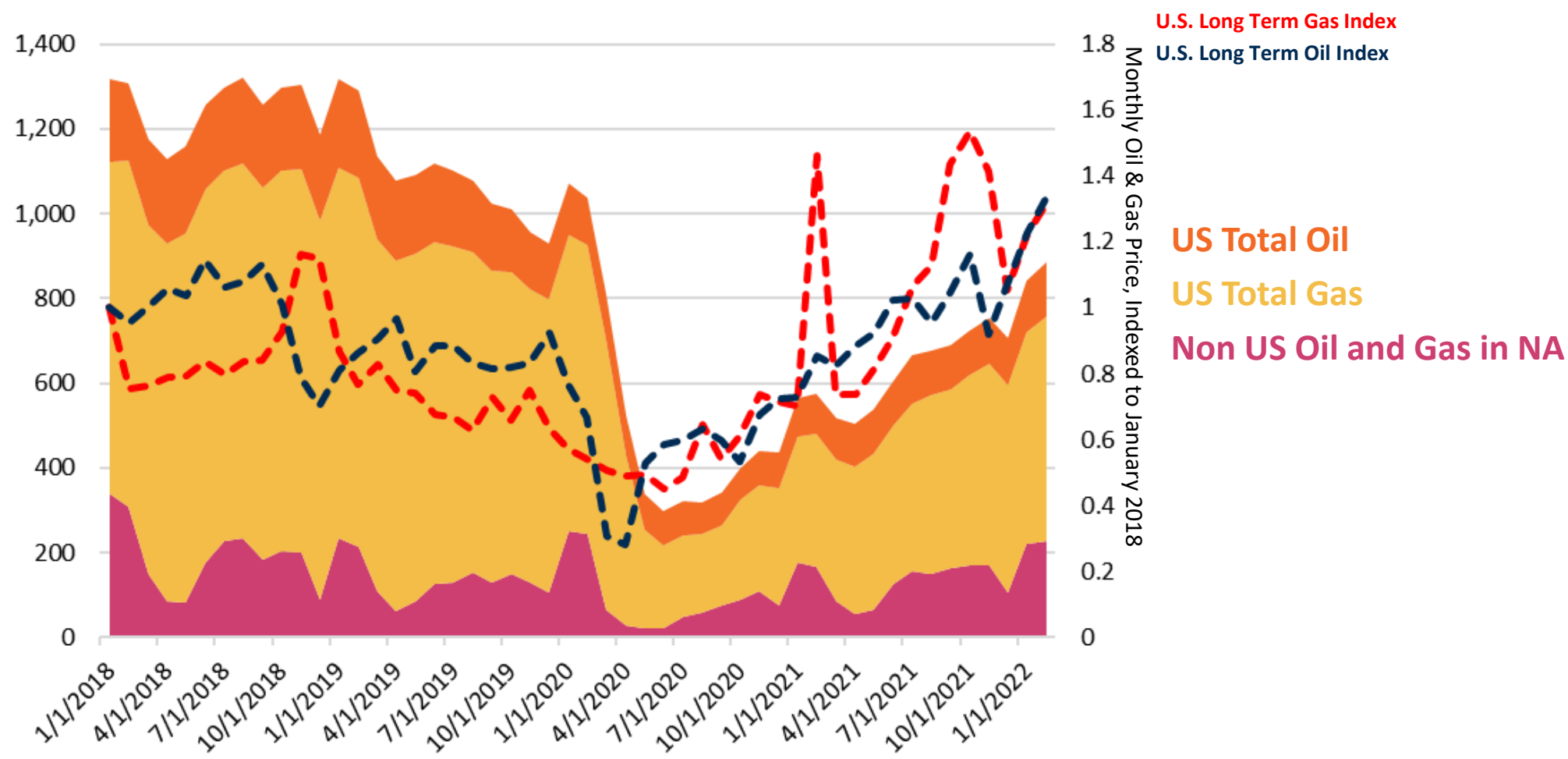
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\$30 Billion+ in energy transactions managed	150+ Years of direct energy experience
3 Landmark Litigation Wins that opened doors for energy production in the Appalachian basin	

Supplemental Slides

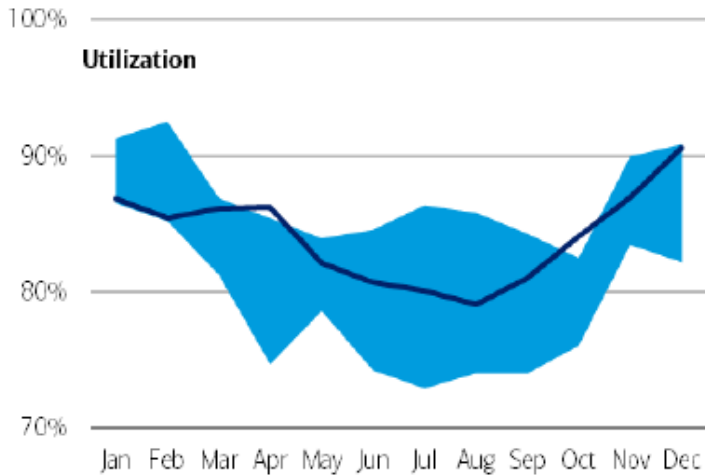
U.S. Oil and Gas Rigs vs. Long Term Prices



LNG Capacity and Utilization

Exhibit 4: Global LNG Utilization

LNG capacity utilization is already running near 5yr highs and there is little spare capacity available

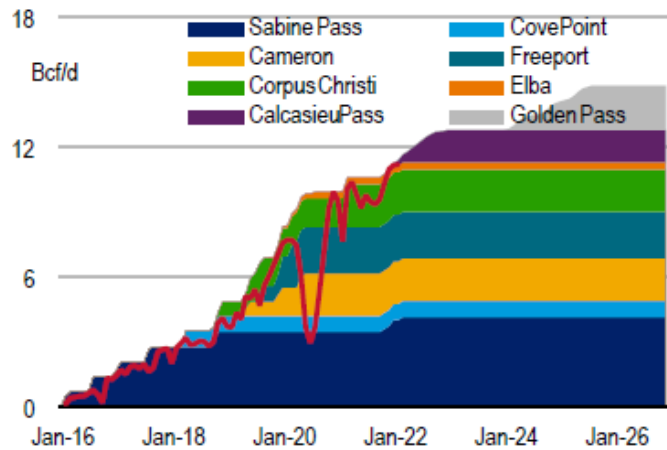


Source: Bloomberg, BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 6: US LNG projects, operational and under review

Despite global need, the US has limited LNG export capacity and is already running at maximum levels, which helps insulate the US from global prices...

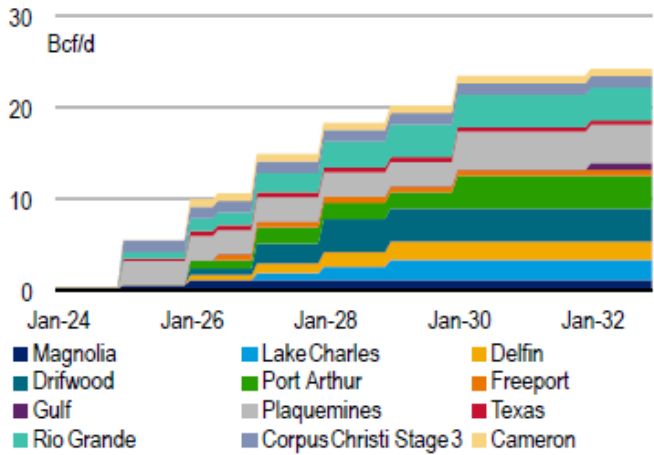


Source: Bloomberg, BofA Global Research estimates

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Exhibit 7: US LNG projects, approved but no FID

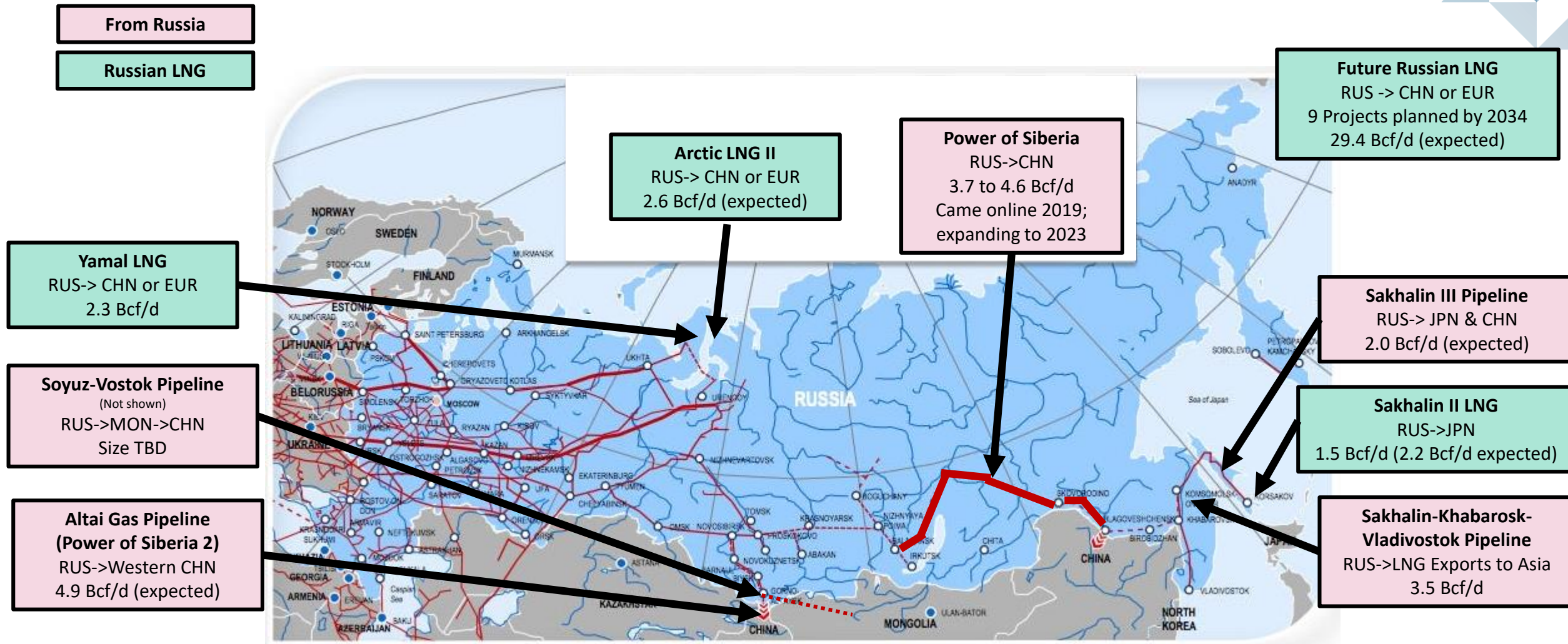
13 US liquefaction projects (22 Bcf/d) have received DOE and FERC approval, but have yet to make a final investment decision



Source: Platts

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Major pipelines (Eastern Russia)



Source: Gazprom via [Business Insider](#)

Russian Gas Expansion and Routing Options

Summary of Russian Gas Projects

Gas To The East That Can Go To West					Gas to The East Only			
<u>To China</u>	<u>To China</u>	<u>To China</u>	<u>To China</u>	<u>To China</u>	<u>To Far Eastern Russia</u>	<u>To Japan</u>	<u>To China</u>	<u>To China</u>
<u>Yamal LNG</u>	<u>Siberia Power -2 Pipeline (Altai Gas P/L)</u>	<u>Soyuz-Vostok Pipeline</u>	<u>Arctic LNG 2 LNG</u>	<u>Future LNG Projects</u>	<u>Sakhalin-Khabarovsk-Vladivostok (SKV Pipeline)</u>	<u>Sakhalin II LNG</u>	Siberia Power -1 Pipeline	<u>Sakhalin III Pipeline</u>
Nov. 2017 Train 4 (0.12 BCFD) online YE2021	Plans to start construction; online date unclear	Agreement for feasibility study Feb 2022, which will be completed in 2025	50% complete, but status in doubt ⁽¹⁾	9 projects planned by 2035	Sept. 2019 Currently at full capacity	Trains 1 & 2: 2009 Train 3: 2026 (0.64 BCFD)	Dec. 2019 Full Capacity in 20223	2025/2026
3 Trains: 2.2 BCFD	4.93		3 Trains - 2.6 BCFD	29.4	3.53	Trains 1 & 2: 1.5 BCFD	3.67	2.0
2014 contract for 0.4 BCFD	Feb. 2022 contract for 0.97 BCFD for 30 yrs.						Signed in 2014 for 3.67 BCFD	
Yamal fields near Arctic circle	Siberia fields and interconnects with Yamal hub to Europe	Siberia fields and interconnects with Yamal hub to Europe	Arctic gas fields; exports can go to China or Europe	Exports can go to China or Europe	Krimnskey field	Sakhalin II	Siberia fields	Sakhalin III
				Goal is to bring online 2/3 of theses projects to increase 2020 LNG capacity from 2.7 BCFD to 18.7 BCFD	Provide power at Vladivostok			Pipeline under Sea of Japan to Herlongyang province
China has a 29.9% ownership in project; Currently producing 14% above nameplate or 2.6 BCFD	Will sanctions have an impact?		China has a 20% ownership in project	Entire program in doubt due to financing and access to technology		Exxon leaves project; status of Train 3 questionable	Current capacity just over 1.0 BCFD	Sakhalin III - production starts in 2023 and peaks in 2034 at 2.0 BCFD

(1) Needs \$4.5 billion in financing of which 50% from China, 33% from Japan and rest unknown.
Russia currently can't get sensors, semiconductors, chips, etc.