

Natural Gas Outlook: The Impact of U.S. LNG Diplomacy

Presented to:
T3 Fertilizer Conference
Houston, TX

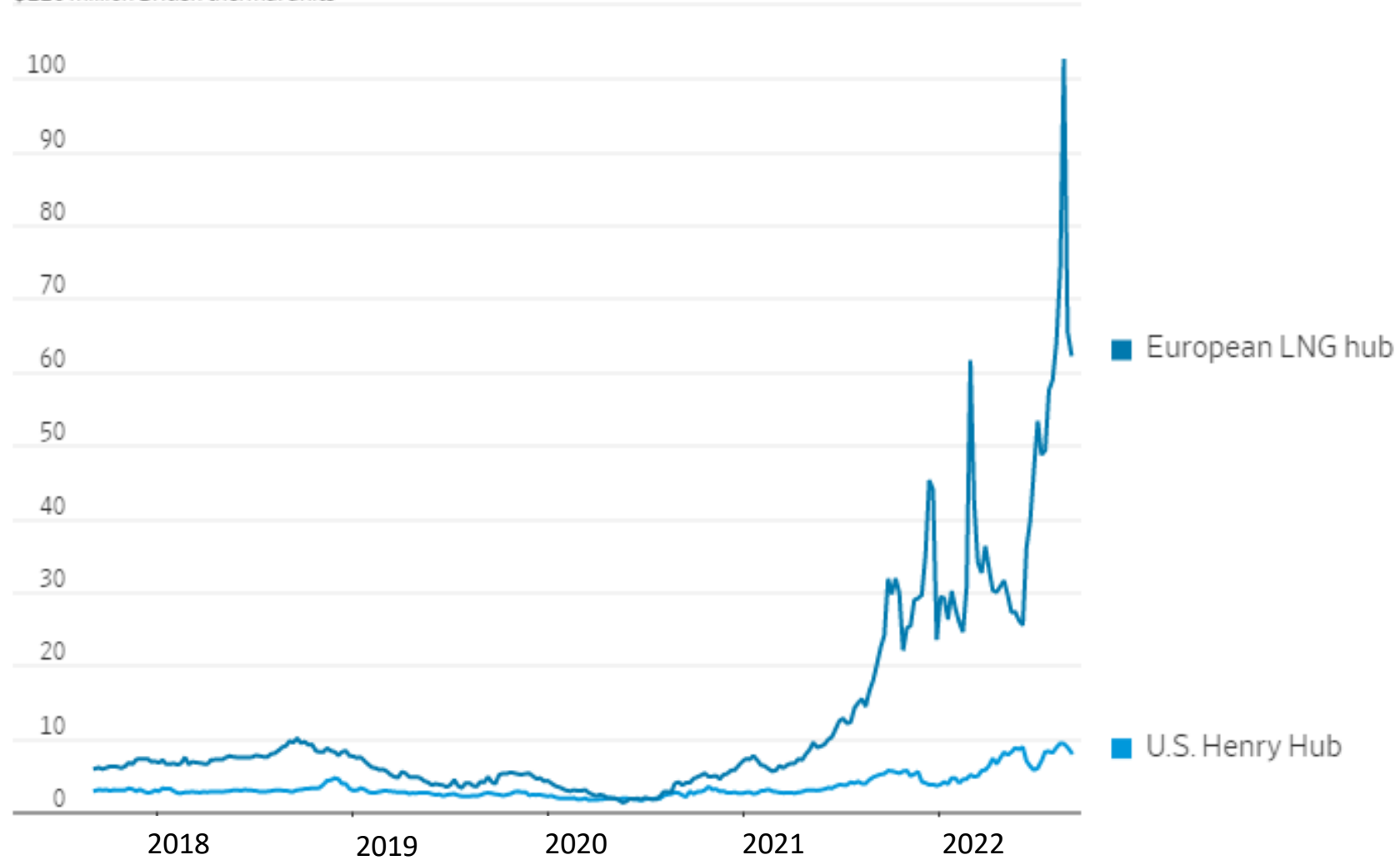
November 9, 2022



JOHN HARPOLE
PRESIDENT / FOUNDER
HARP@MERCATORENERGY.COM
303-825-1100

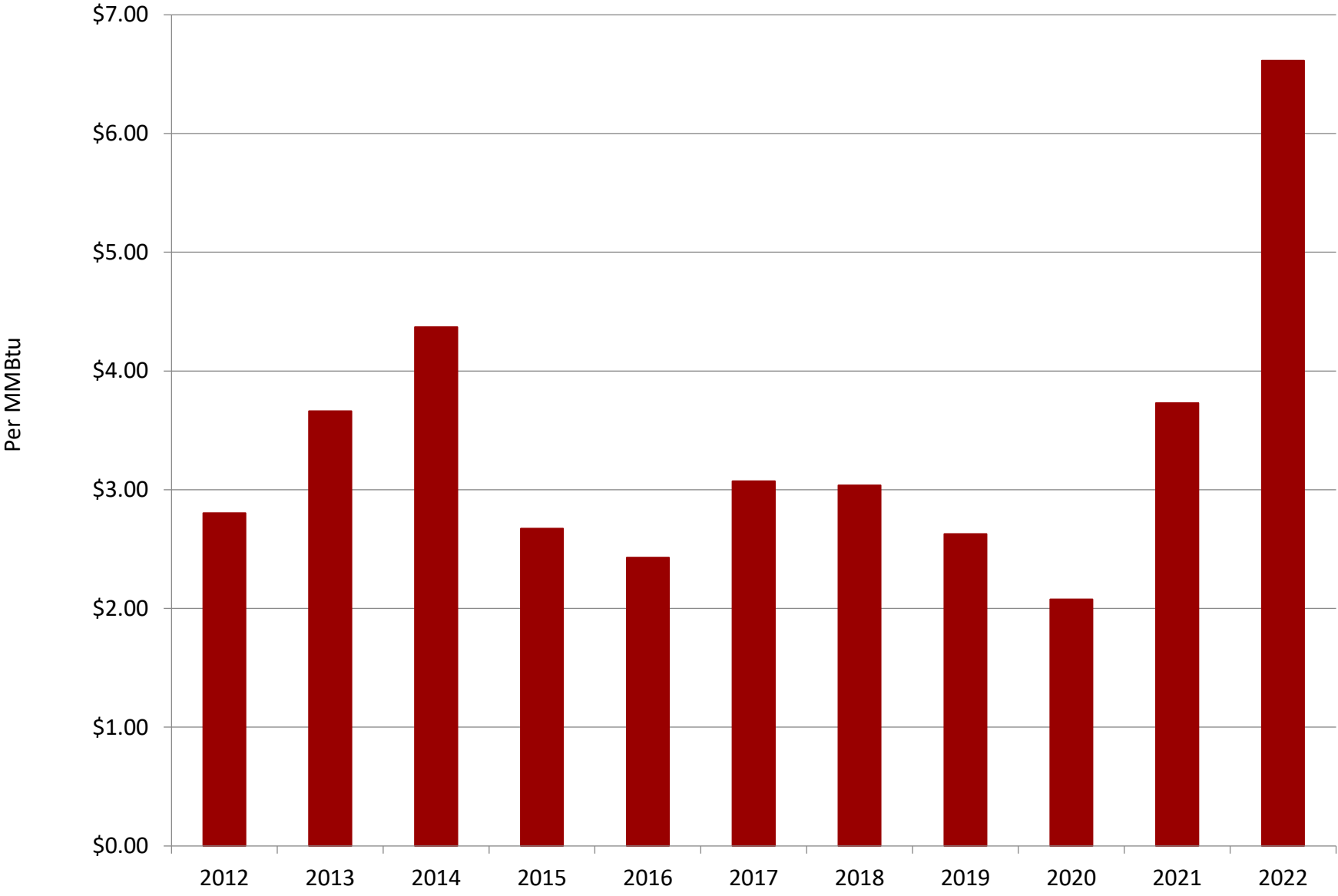
Natural gas price

\$110 million British thermal units



Source: FactSet

Historical NYMEX Henry Hub Index Prices (2012-October 2022)



Source: NYMEX – Average last 3 days of close as reported in Platts Gas Daily Report, An S&P Global Platts publication

One-Year Forward Strip

NYMEX Henry Hub	\$ 7.725
LNG Delivered Price to Europe	\$97.993

Comparative Forward Strips as of November 7, 2022

One-Year Forward Strip

NYMEX Henry Hub	\$ 5.747
LNG Delivered Price to Asia	\$30.310
LNG Delivered Price to Europe	\$35.837

Three-Year Forward Strip

NYMEX Henry Hub	\$ 5.067
LNG Delivered Price to Asia	\$25.383
LNG Delivered Price to Europe	\$29.777

* Settled price as of November 7, 2022

How did we get here?

- Over reliance on renewables
- Retired coal plants too early
- Retired nuclear plants too early
- Under reliance on fossil fuels

This is a trap laid by Vladimir Putin 20 years in the making.



- Putin's trap, enabled by pro-scarcity environmentalists
- Germany and EU take the bait
- U.S. LNG to the rescue
- The 3-year impact on world LNG markets

Closing Bell

LNG Diplomacy: Keystone XL Pipeline, Part 2?

October 2012

Closing Bell

The Glacial Pace Of LNG Exports

By John Harpole

September 2014

Closing Bell

The Putin Vortex

April 2014

Closing Bell

Time To 'Out' Russia?

By John Harpole

January 2015

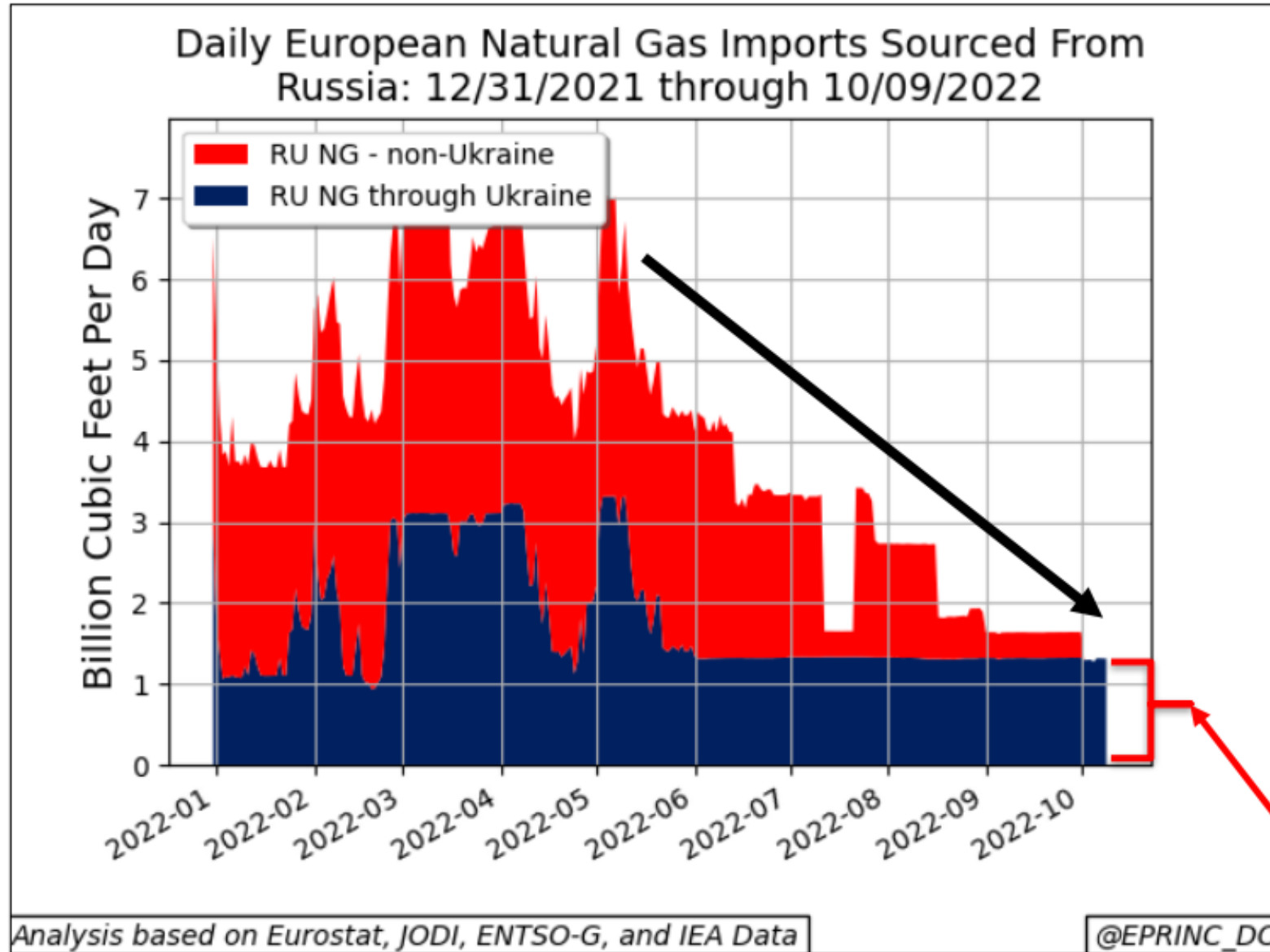
The Former Chancellor Who Became Putin's Man in Germany



Gerhard Schröder, Chancellor of Germany from 1998 to 2005

Title	Term	Income
Chancellor of Germany	1998 – 2005	? currently receives \$9,000/month stipend
Nord Stream I Chairman/Shareholder	2005 – 2022	\$270,000/year
Nord Stream II Board Member	2011 - ?	?
Rosneft Board President	2017 – present	\$600,000/year
Gazprom Board Member	2022 - ?	?

Europe – Daily Natural Gas Receipts During 2022

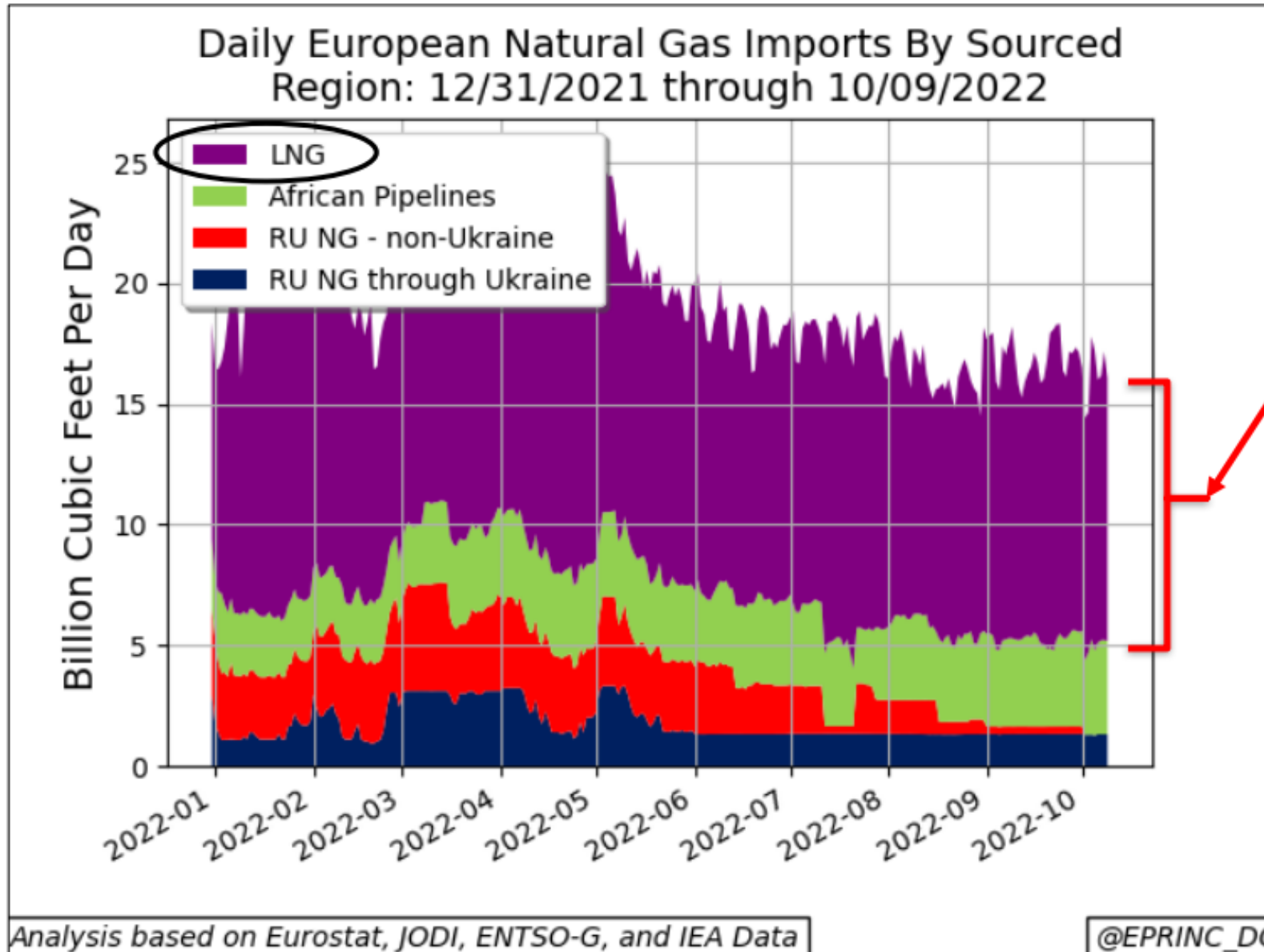


European supply diversification away from Russia
takes **17 bcf** out of **50 bcf** market

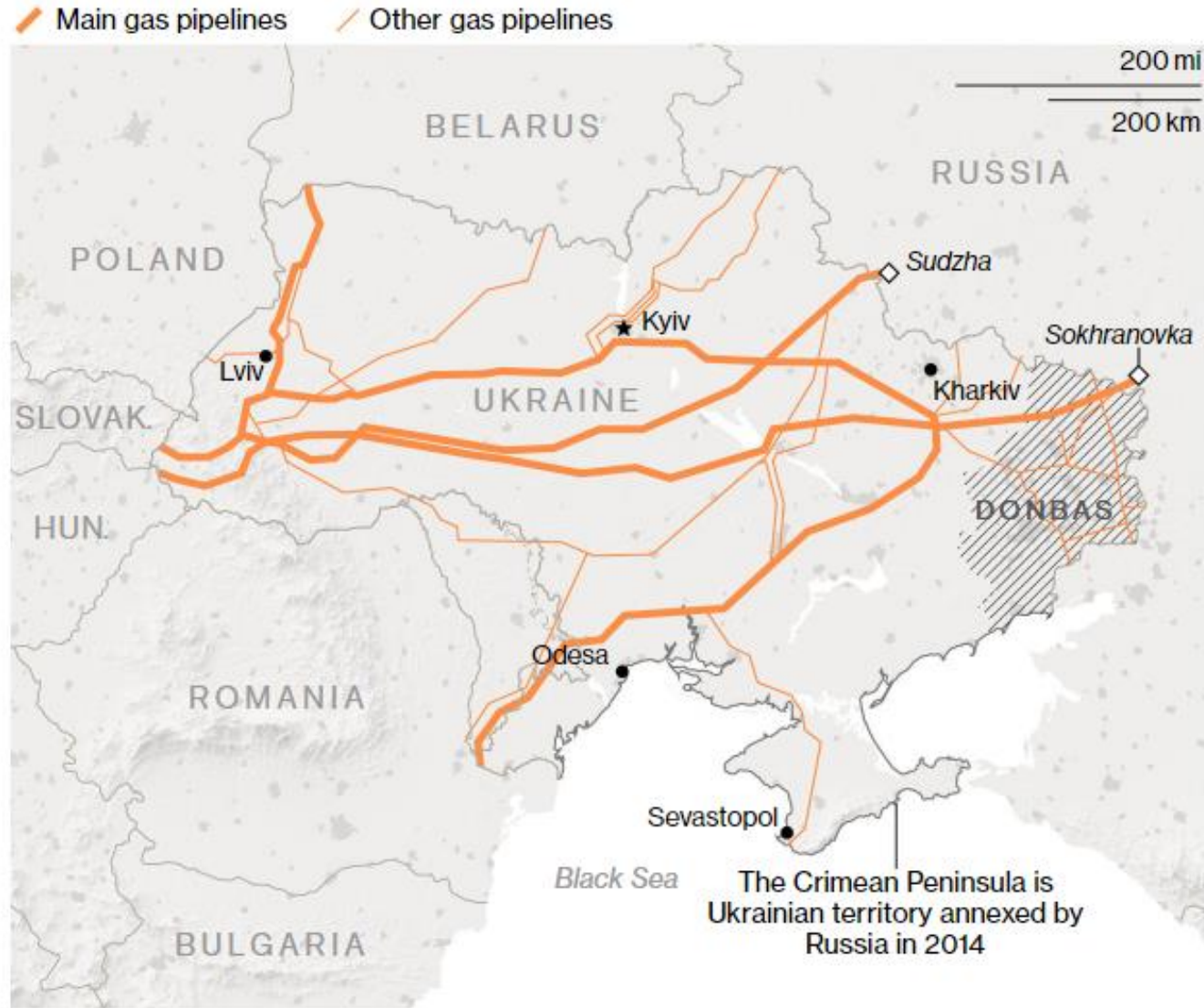


Source: Wood Mackenzie, "Wellhead to LNG: Producers & Export Deals," September 2022, Image: Reuters

Europe – Daily Natural Gas Receipts During 2022



Natural Gas Runs Through Ukraine



Source: The Oxford Institute for Energy Studies

Note: Only the portion of pipelines that run through Ukraine are displayed on the map

Linking the Super Powers



September 27, 2022



Baltic Natural Gas Pipeline Map



Source: NS Energy, Baltic Pipe Project, GAZ-System

September 28, 2022



U.S., EU officials on edge over pipeline explosions

Nord Stream leaks will not delay Oct. 1 Baltic Pipe start-up



European LNG infrastructure



Source: European Commission 2022, Clean Energy Wire

German government announces fifth floating LNG terminal



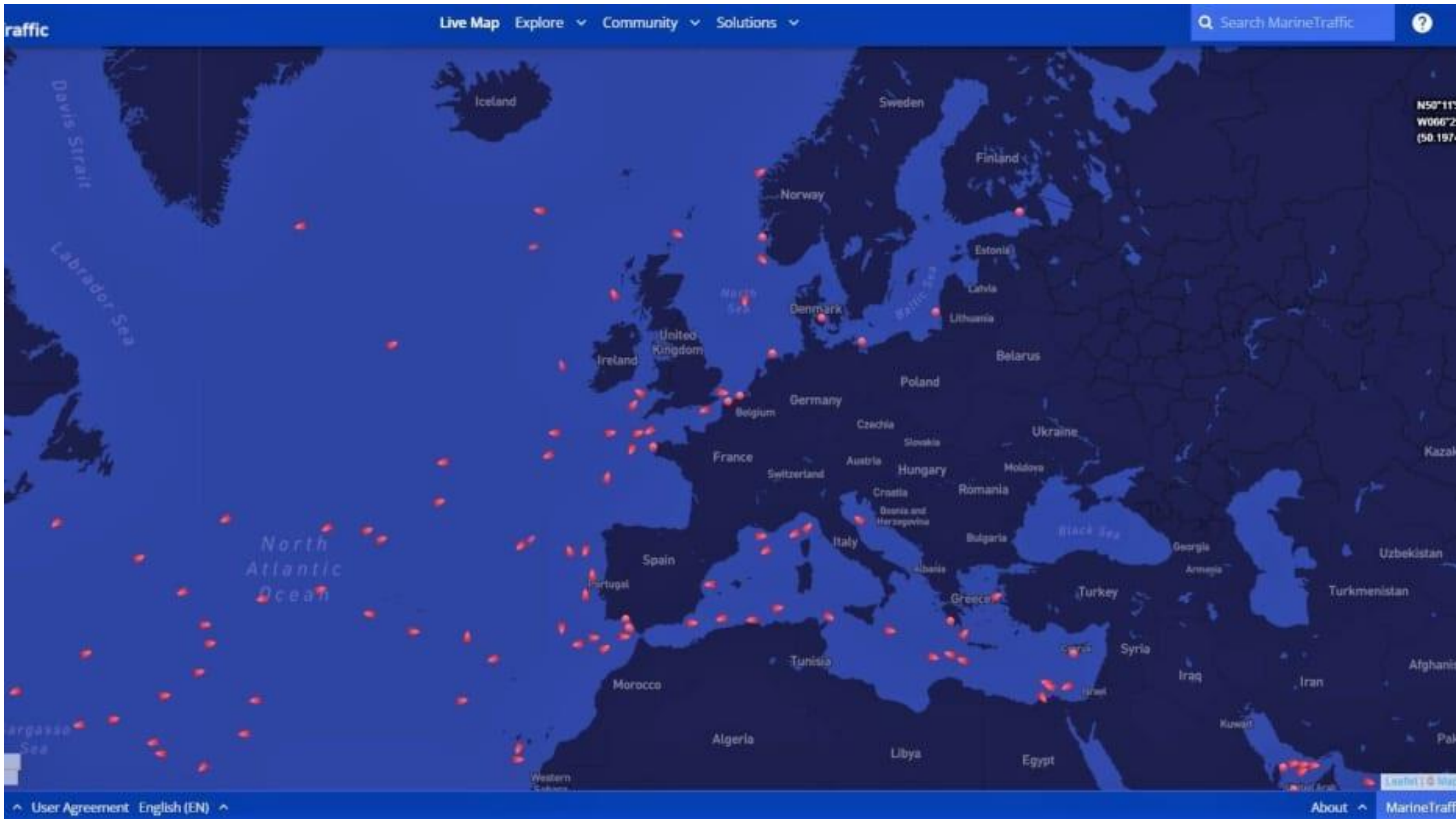
Source: euractiv.com, Nikolaus J. Kurmayer, September 1, 2022, Photo credit: [Offshore-mag.com](https://www.offshore-mag.com),

New Dutch LNG Regas Terminal Will Double Import Capacity



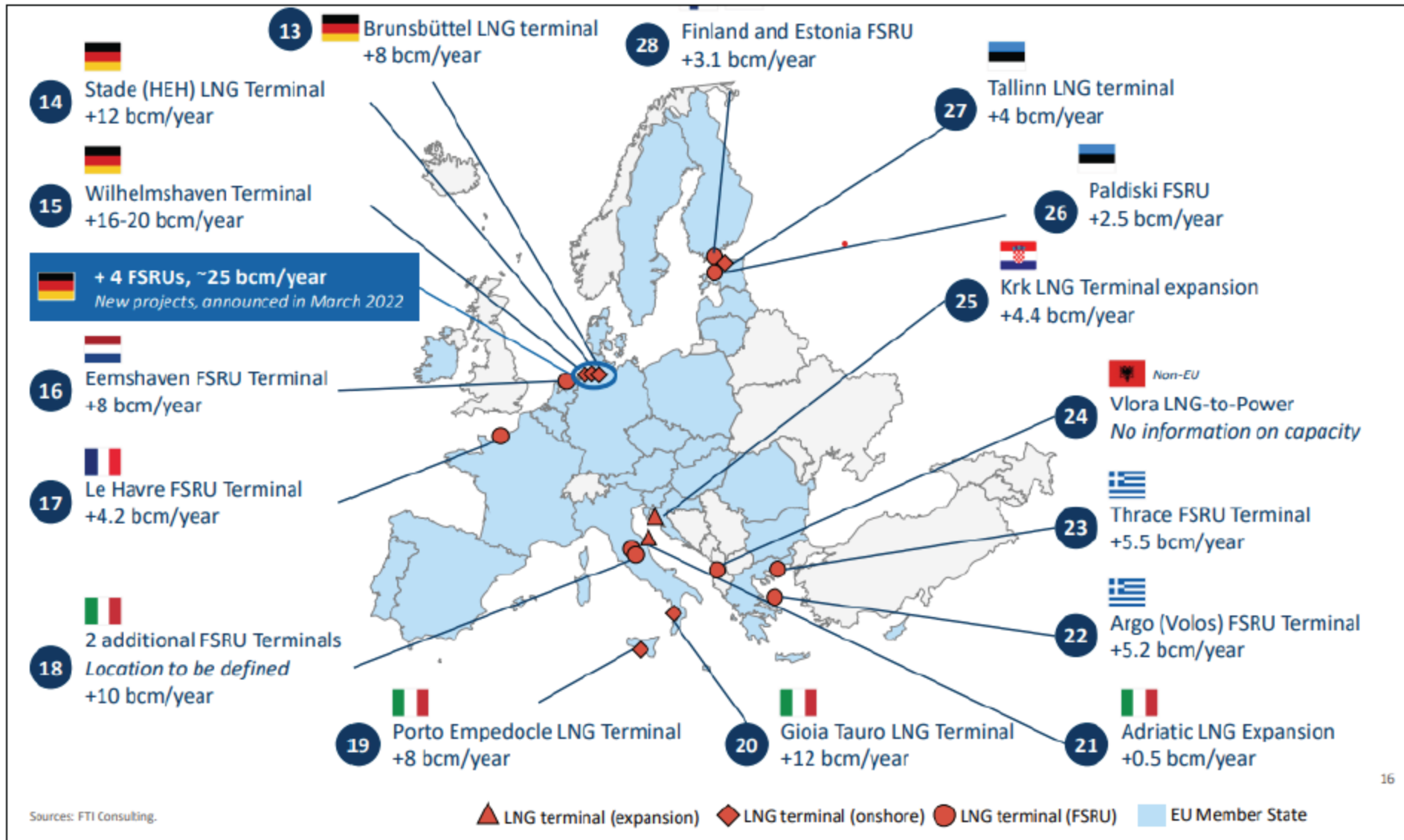
Source: Journal of Petroleum Technology, Blake Wright, September 19, 2022, Gasunie

Wave of LNG Tankers is Overwhelming Europe



Source: CNBC, Lori Ann LaRocco, October 24, 2022, MarineTraffic

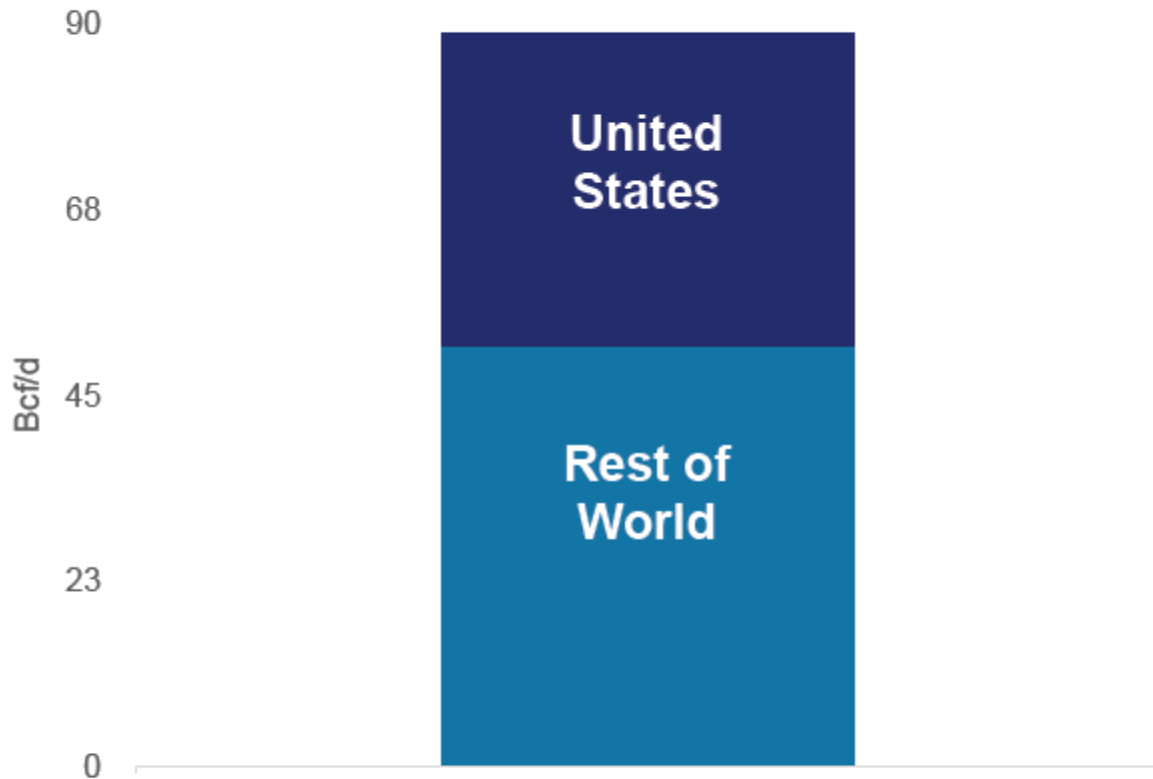
Europe has authorized 21 new LNG projects



<https://www.fticonsulting.com/-/media/files/emea-files/insights/white-papers/2022/may/new-lng-regasification-terminals-europe.pdf>

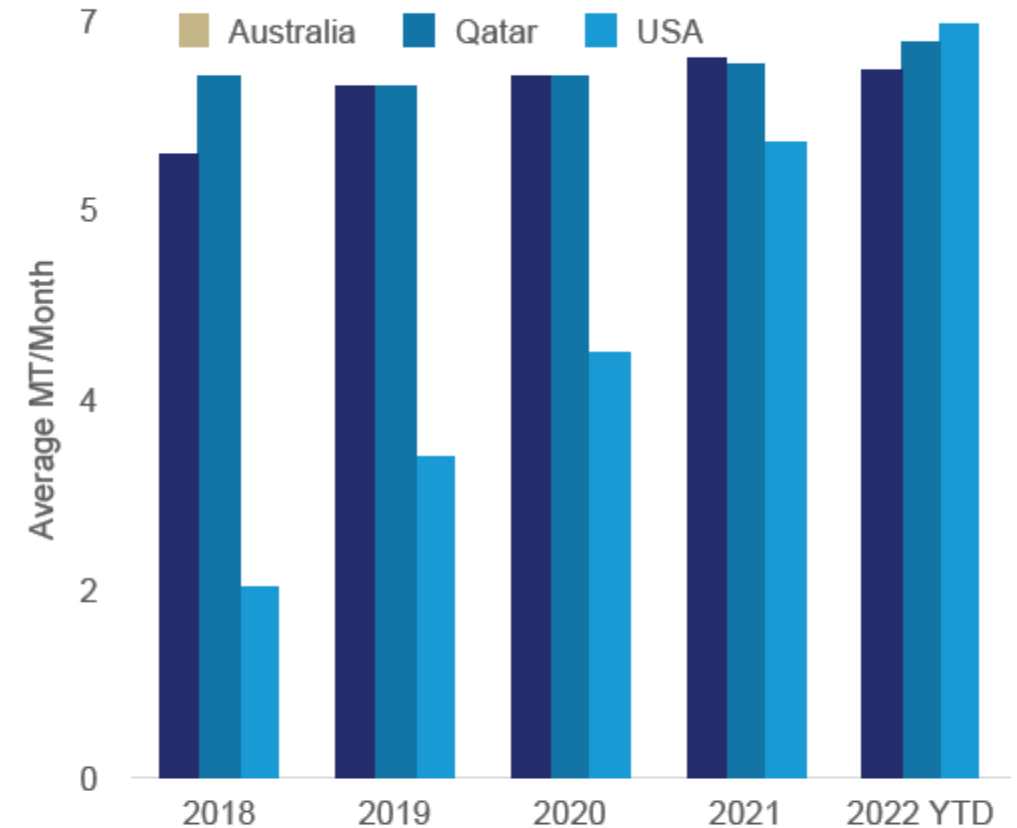
The United States has been the key driver of global natural supply growth

Net Global Natural Gas Supply Growth Since 2007



- Since 2007, 42% of global natural gas supply growth has come from the United States

Top 3 LNG exporters

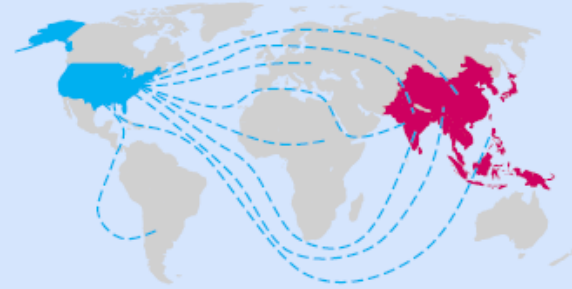


- US natural gas supply growth has supported LNG exports, with the US overtaking Qatar this year

Source: Wood Mackenzie, IHS Markit
 Note: 2022 YTD = January 1 to June 15, 2022



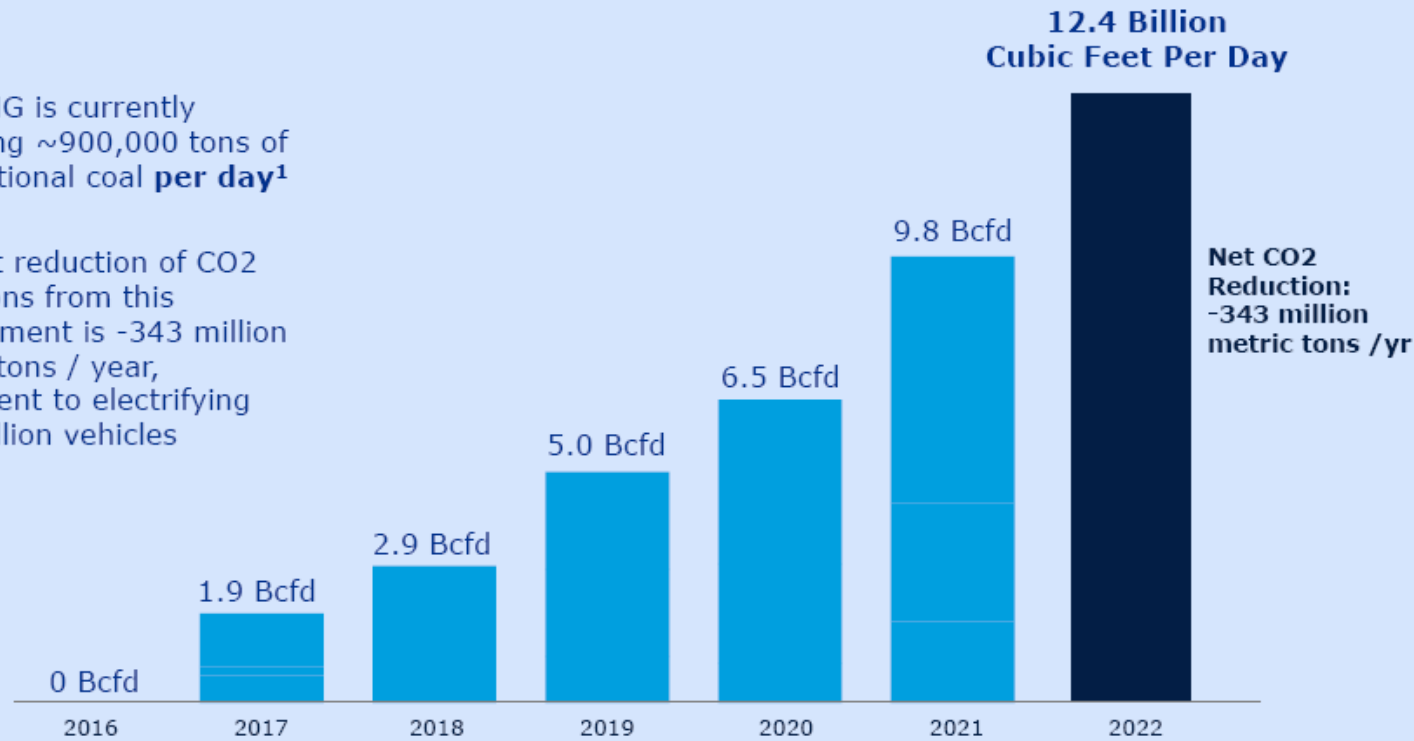
U.S. LNG Export Capacity



LNG export facilities are currently located predominantly on the Gulf Coast

U.S. LNG is currently replacing ~900,000 tons of international coal **per day**¹

The net reduction of CO₂ emissions from this replacement is -343 million metric tons / year, equivalent to electrifying 125 million vehicles

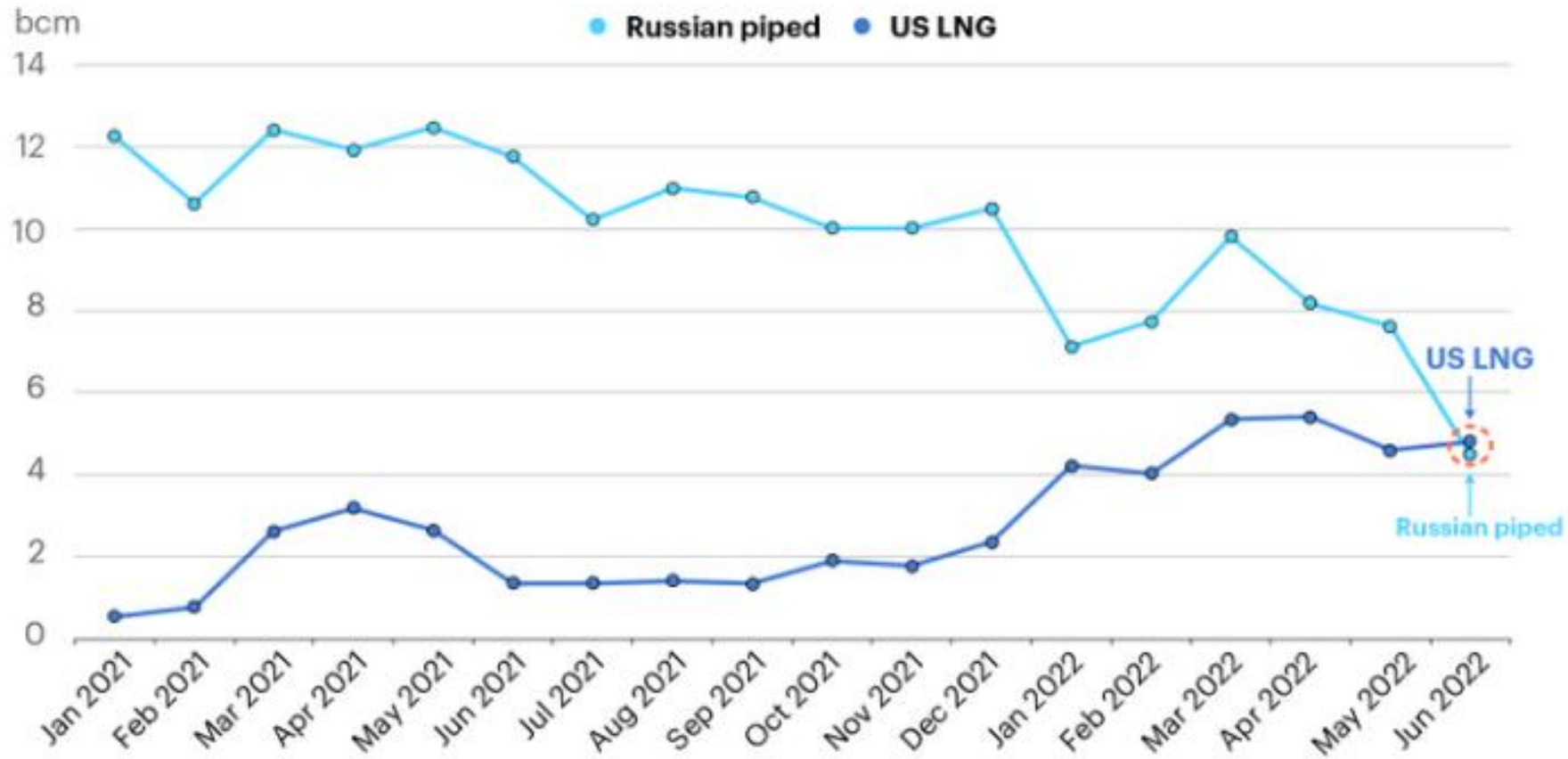


1. International coal displaced is calculated by total thermal unit generated by gas divided by average heating content of coal (~19.8 mmbtu/short ton) // Net GHG reduction is calculated based on the emission differential between coal and natural gas (~560 CO₂e kg/MWh) based on a study from ICF.

Source: EIA U.S. Natural Gas Exports and Re-Exports by Point of Exit, Reuters, EIA CO₂ emission coefficient.

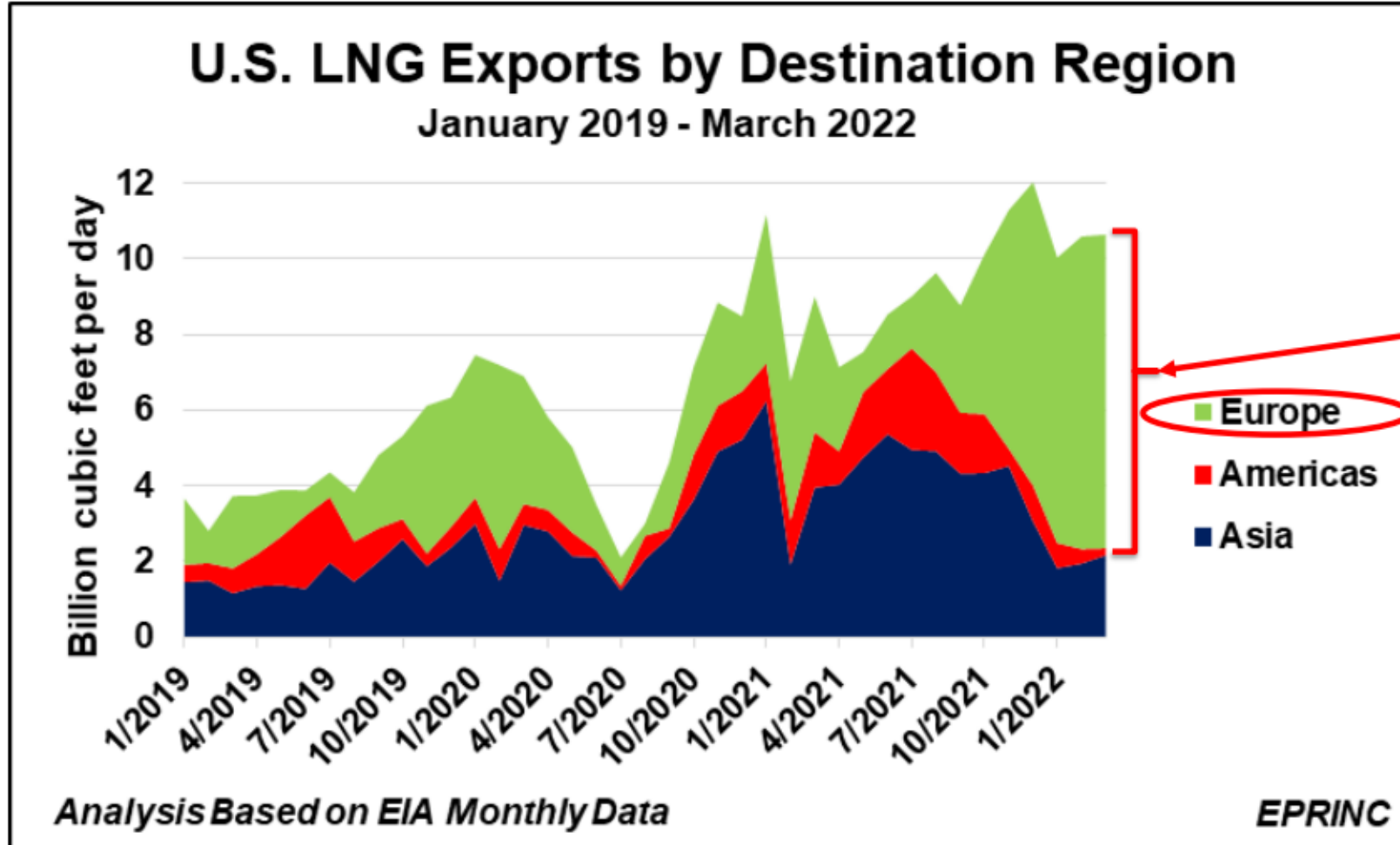
US liquefied natural gas (LNG) overtakes Russian piped gas in EU gas imports in June 2022

IEA analysis



International Energy Agency

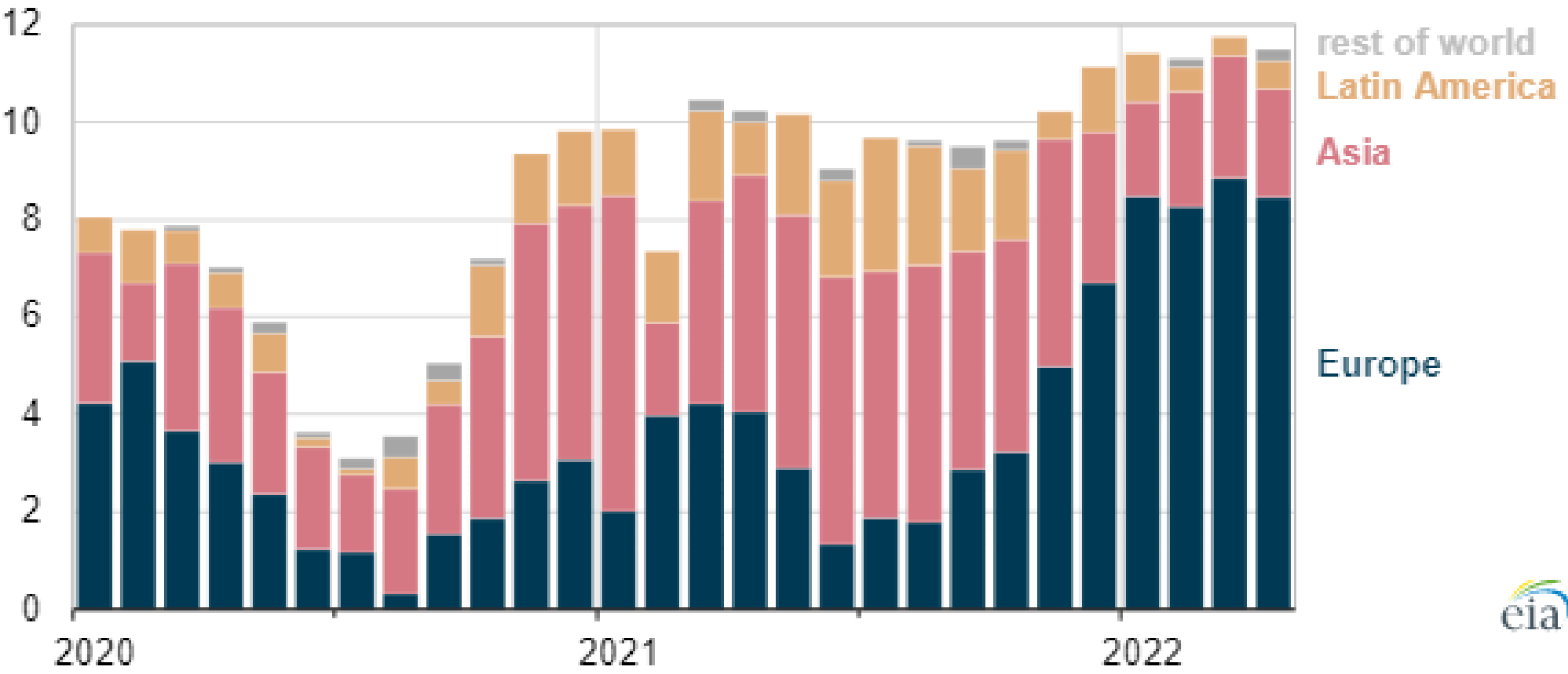
U.S. LNG Exports by Destination Region



With the winter 2021-2022 shortfall in natural gas supplies from Russia, Europe accelerated purchases of U.S. LNG at the rate of 8 BCF/d in the first three months of 2022.

U.S. liquefied natural gas exports to Europe increased during the first 4 months of 2022

Monthly U.S. liquefied natural gas exports by destination region (Jan 2020–Apr 2022)
billion cubic feet per day

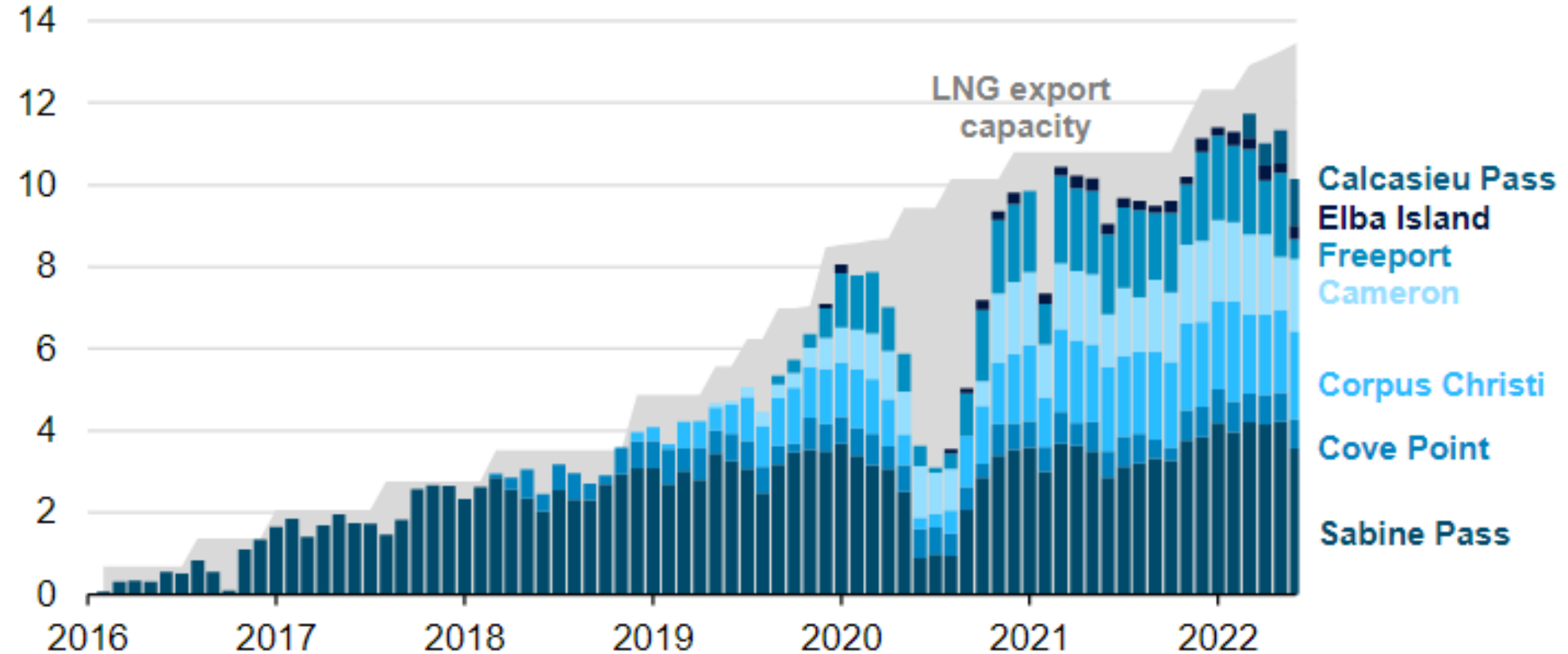


Note: Europe includes Turkey

The United States became the world's largest LNG exporter in the first half of 2022

Monthly U.S. liquefied natural gas (LNG) exports (Jan 2016–Jun 2022)

billion cubic feet per day

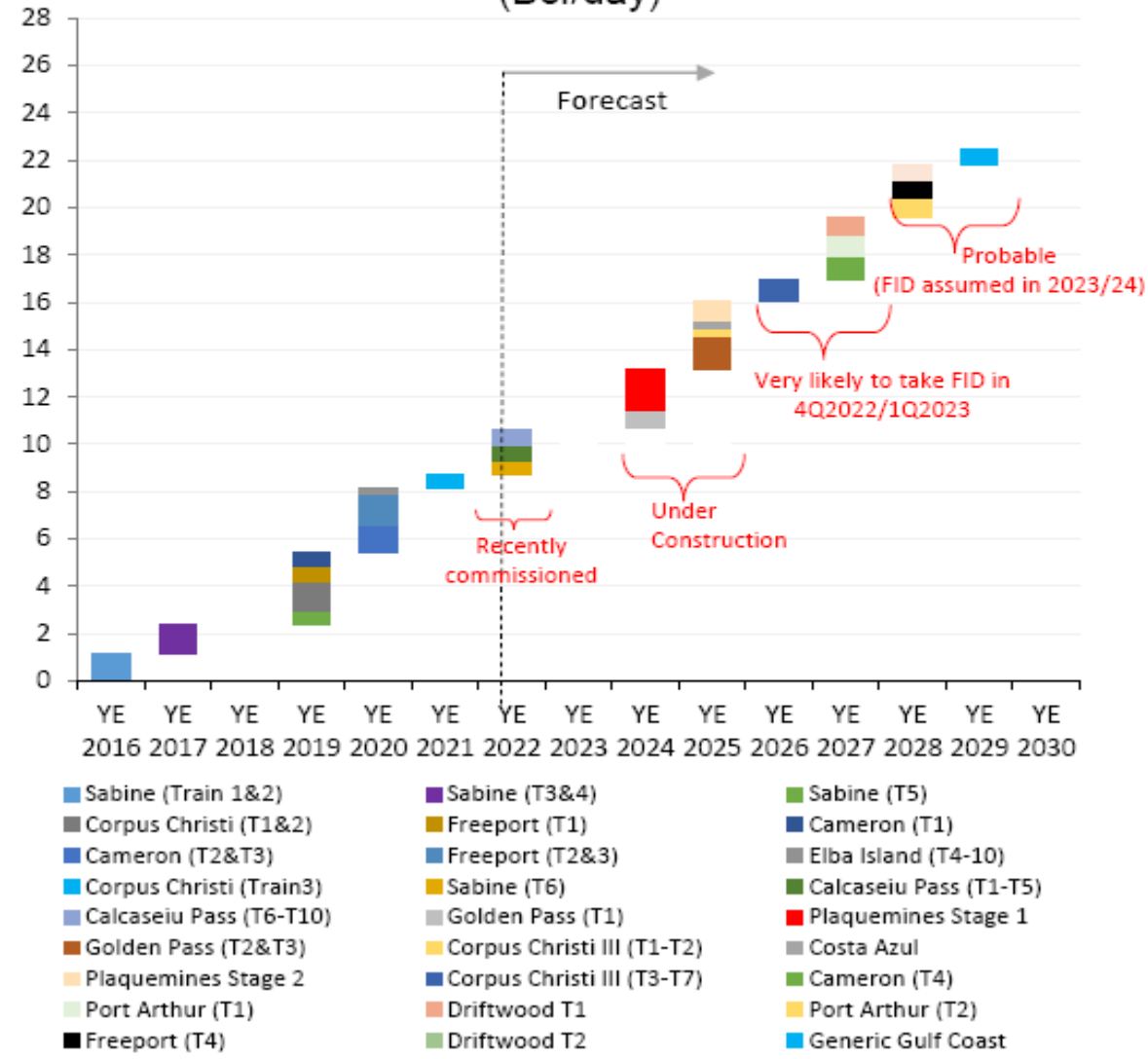


Data source: U.S. Energy Information Administration, [Liquefaction Capacity Table](#), and U.S. Department of Energy [LNG reports](#)

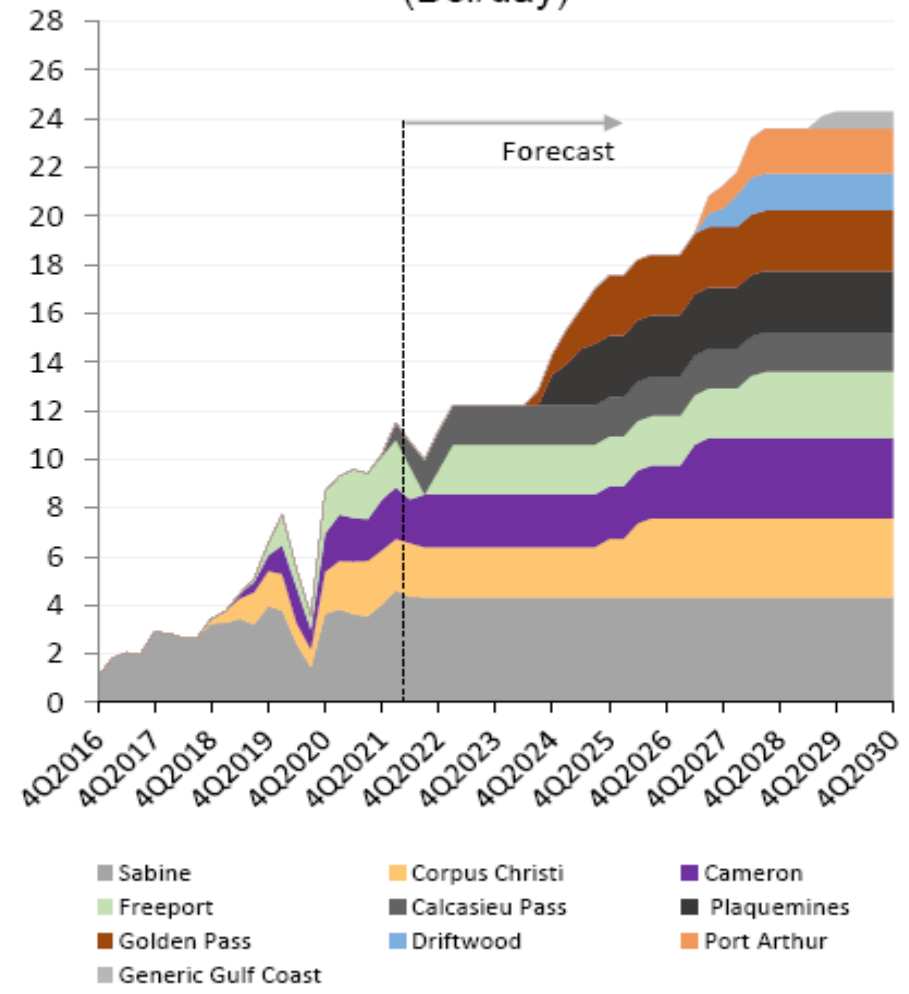
Note: June 2022 LNG exports are EIA estimates based on tanker shipping data. LNG export capacity is an estimated peak LNG production capacity of all operational U.S. LNG export facilities.

USGC LNG feed gas is expected to reach ~24 Bcf/d by 2030, adding ~14 Bcf/d to regional demand (from 2021 average of ~10 Bcf/d)

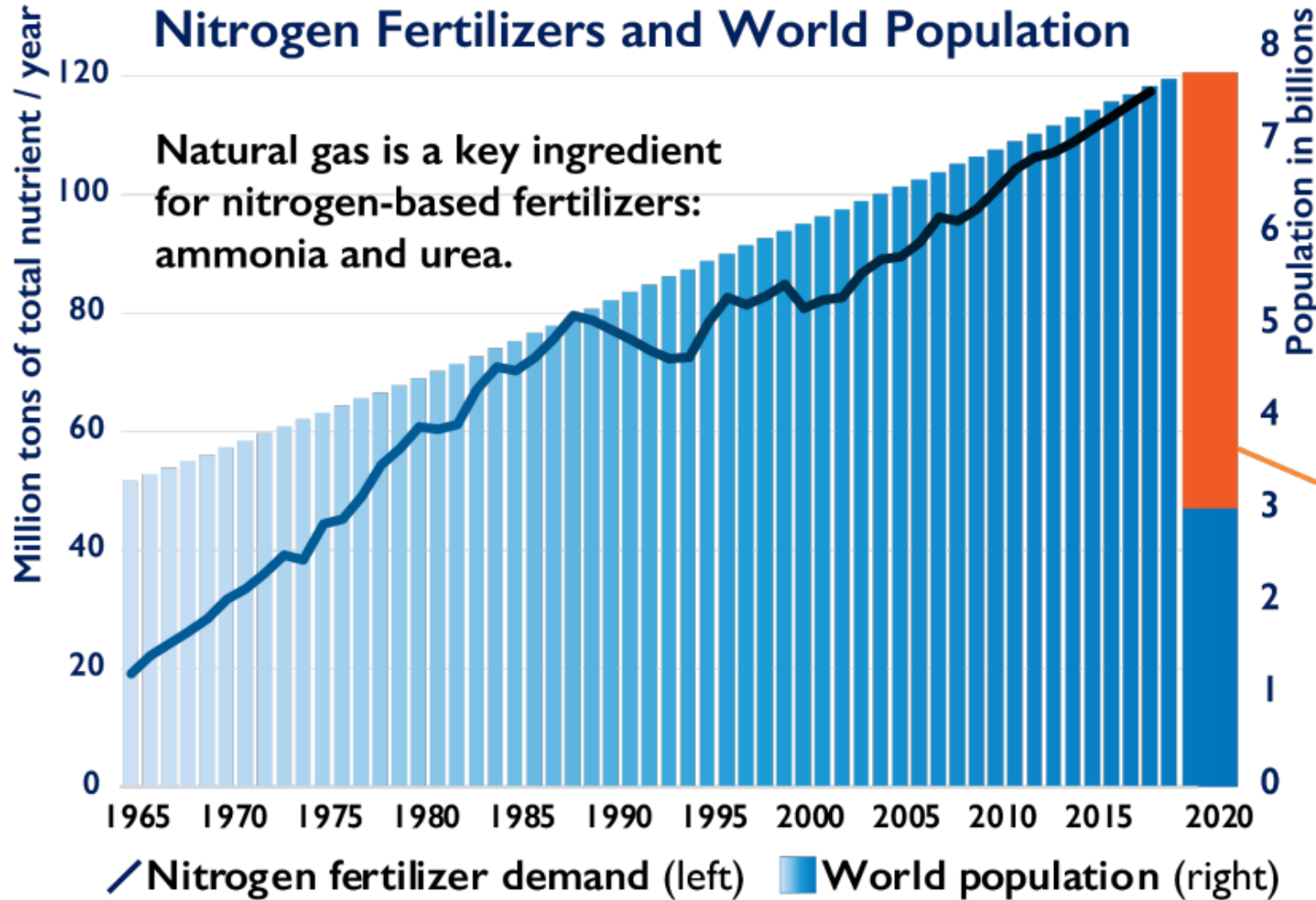
USGC LNG Export Nameplate Capacity Forecast (Bcf/day)



USGC LNG Feed Gas Volume Forecast (Bcf/day)



Natural Gas is Critical for Global Food Production



Without fossil fuel-based fertilizers, agriculture can support, at most, 3 billion people on plant-based diets, vs. today's 8 billion on mixed diets.

Sources: Vaclav Smil, FAO, World Bank, Statista,

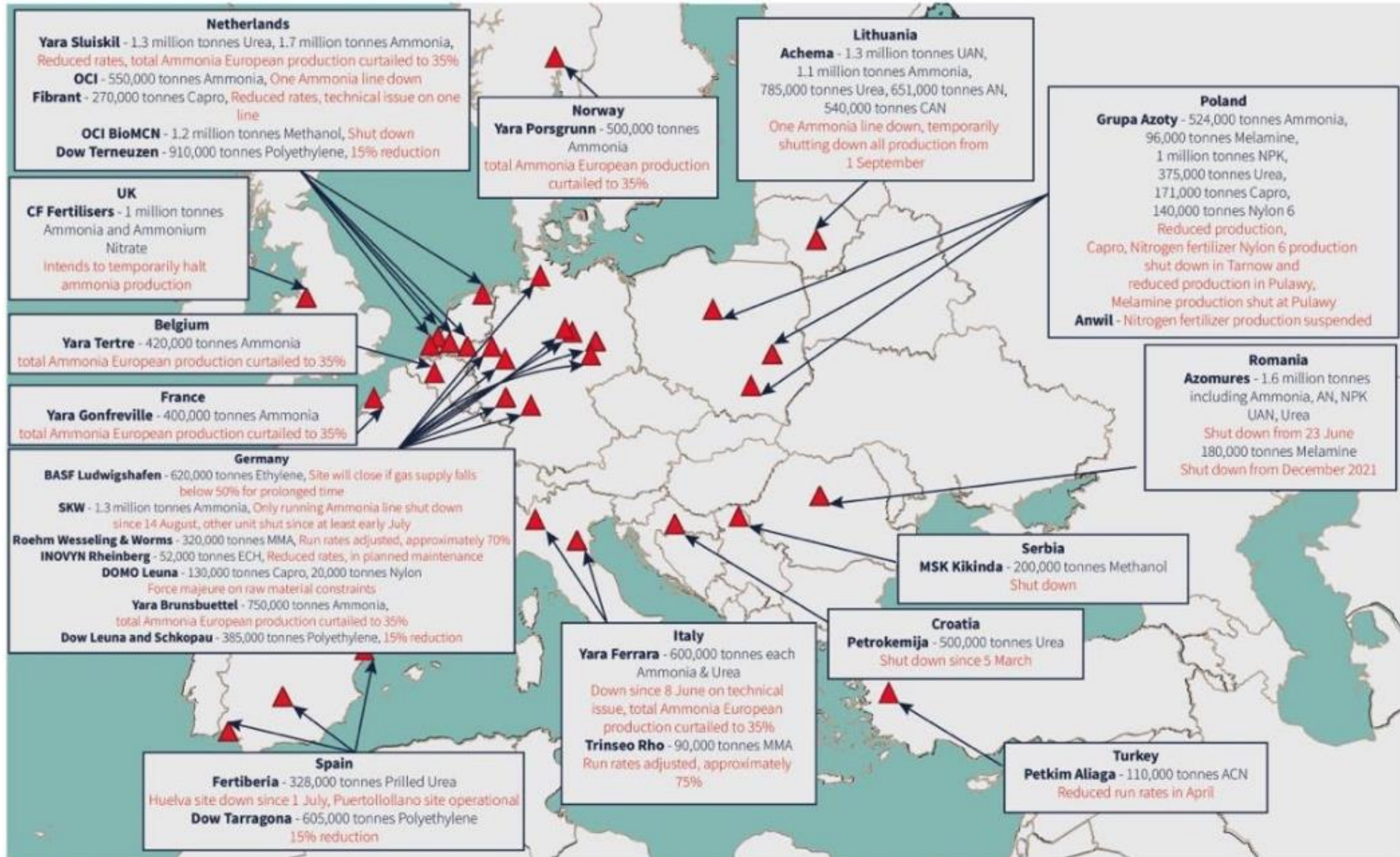
65-70% of the world caloric food intake is related to 4 grains:

- Wheat
- Rice
- Corn
- Soybeans



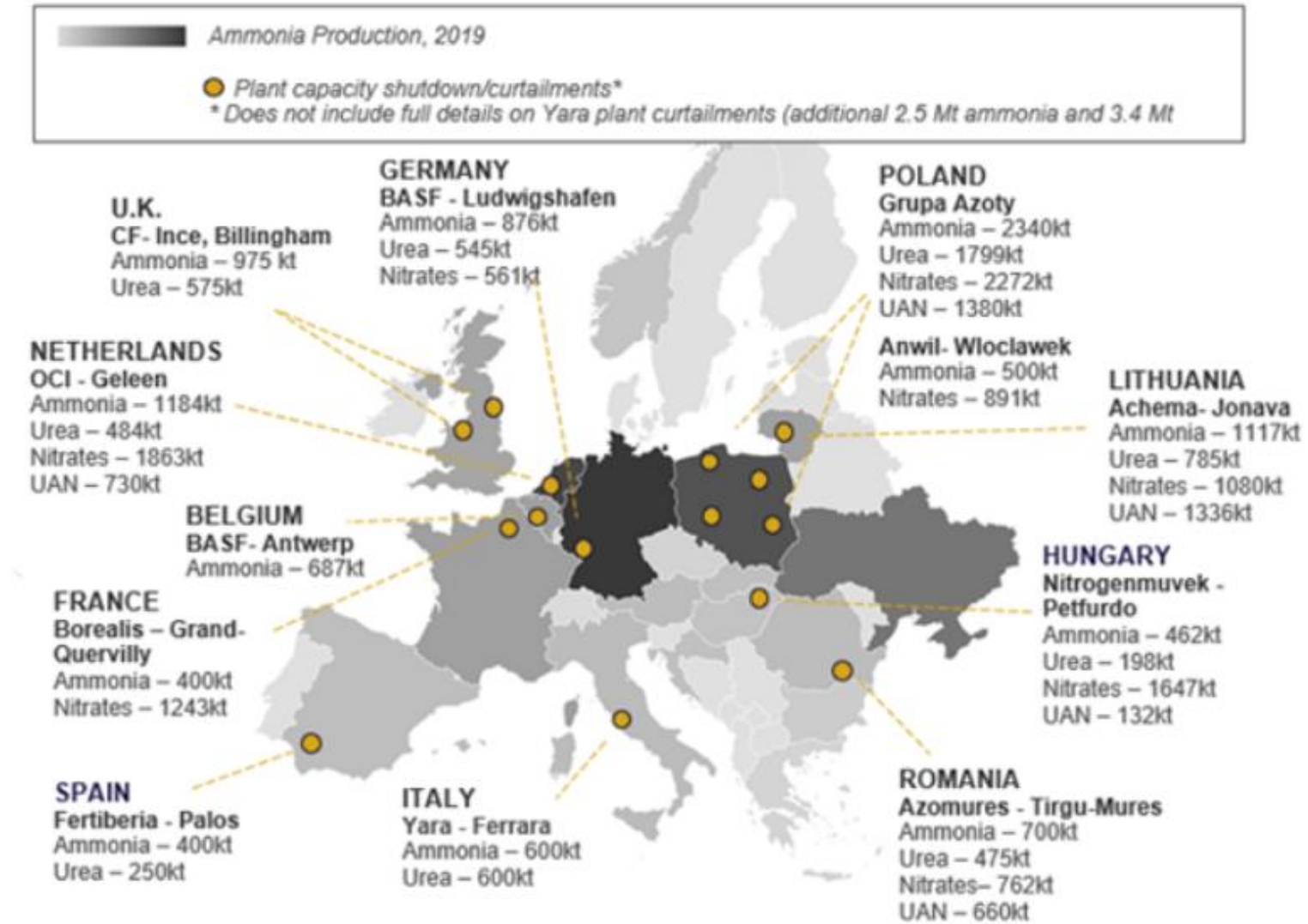
All require intense use of nitrogen fertilizers

Soaring gas prices hit Europe fertilizers, chemicals



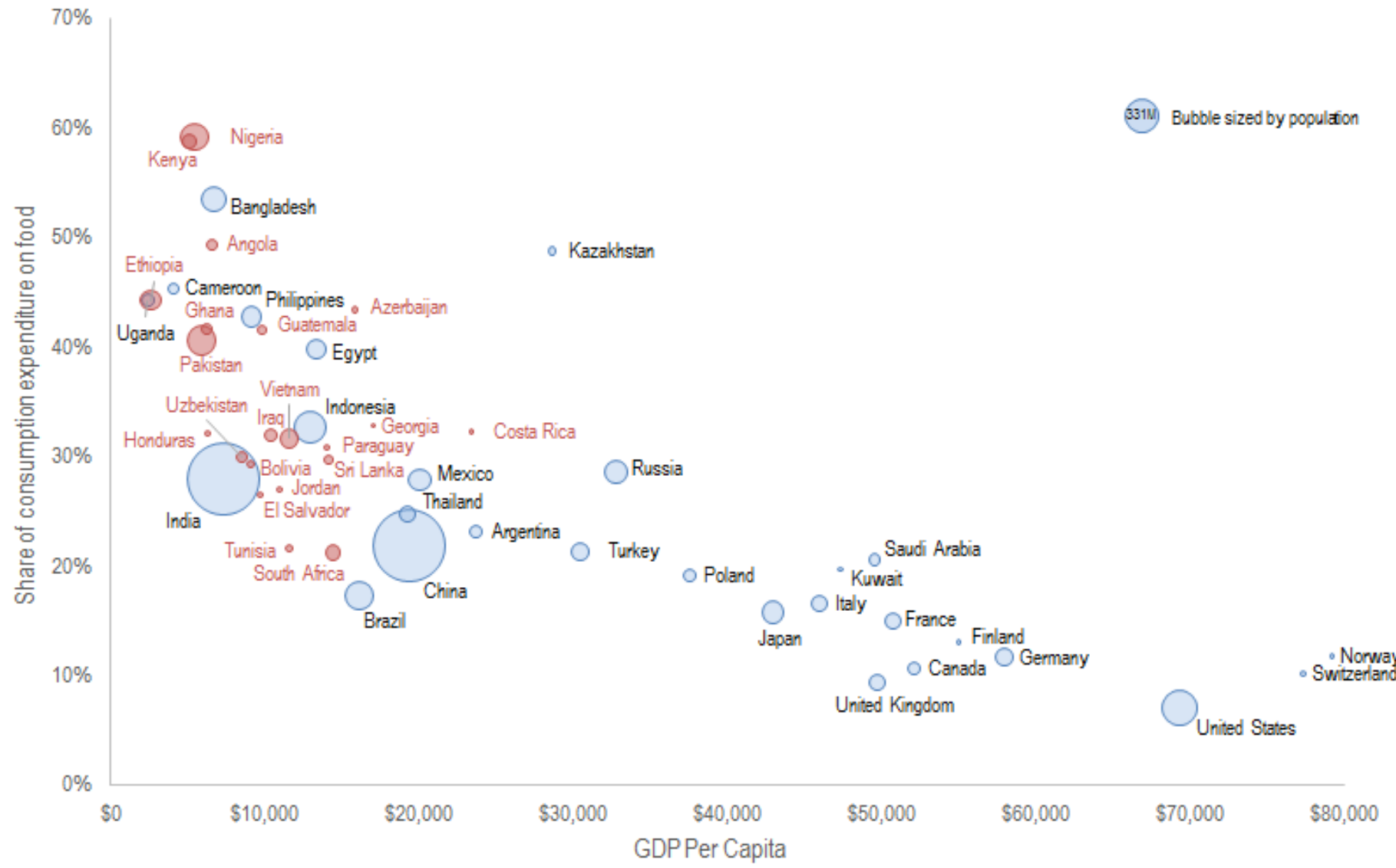
70% of Europe's nitrogen fertilizer plants have closed

Figure 1: European nitrogen production shutdowns and curtailments



DATA: CRU, IFA

Low-and-middle income countries are most vulnerable to rising food prices



Share of consumer expenditure spent on food (2020, latest data available) vs. GDP per capita, 2021. Food expenditure relates only to food bought for consumption at home (i.e., it excludes out-of-home food purchases) and excludes alcoholic beverages and tobacco products.

Surging Fertilizer Prices Set to Exacerbate African and Mid-East Food Crisis

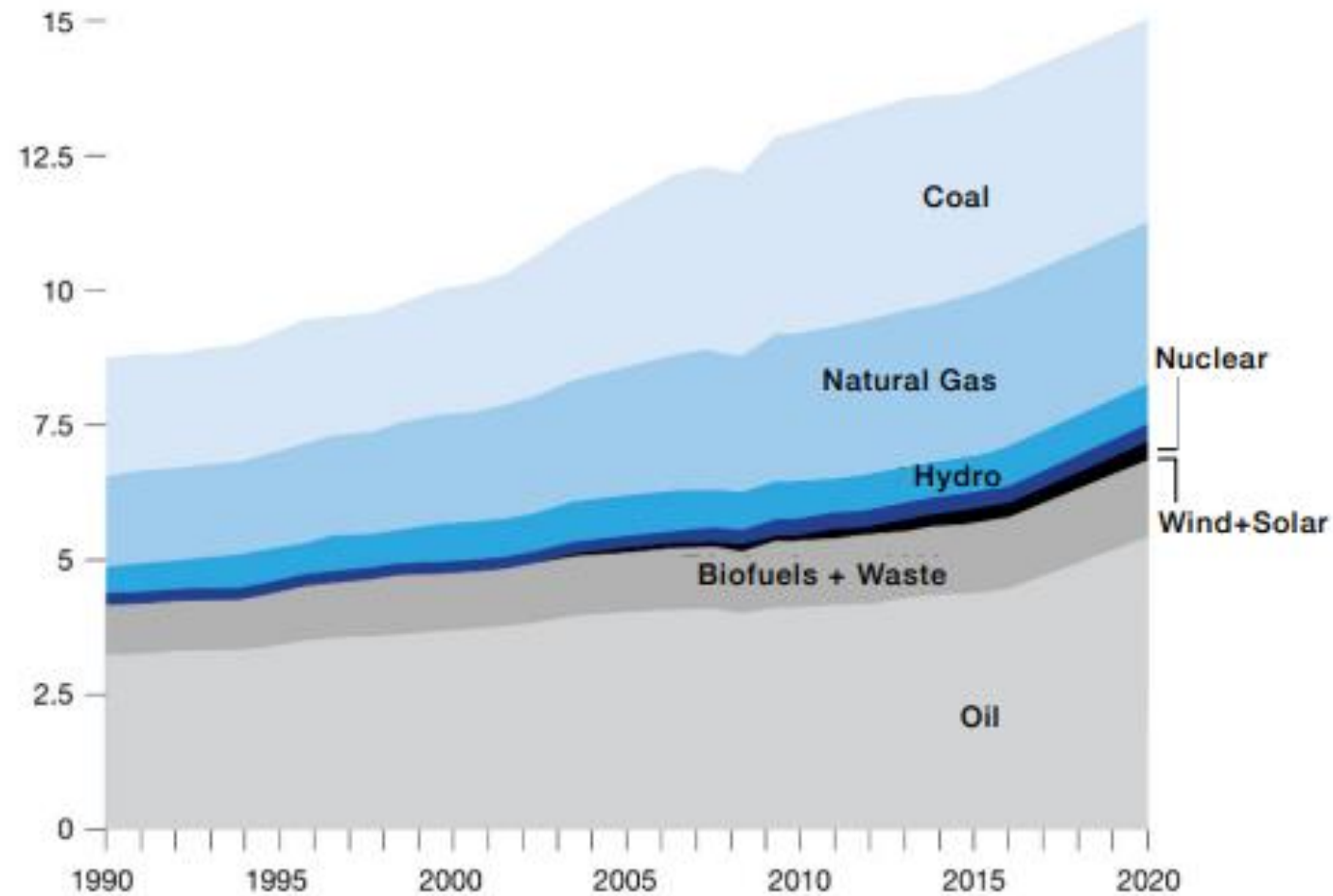
- Use of nutrients may shrink by a third in sub-Saharan Africa
- Import-dependent region may face increasing food shortages



“That could potentially curb cereals output by 30 million tons, enough to feed 100 million people.”

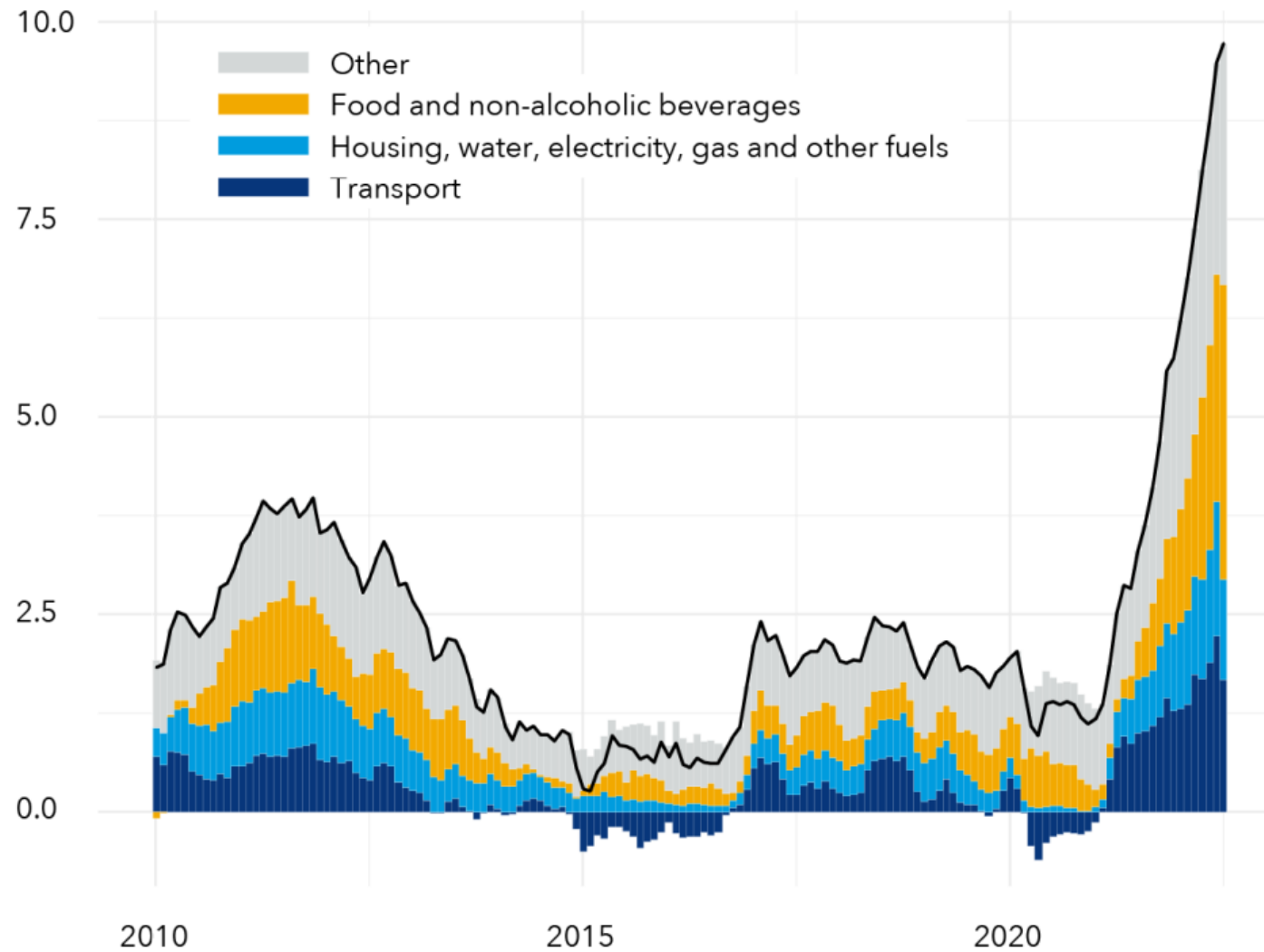
Growth in Global Energy Supplies

(Oil Equivalent Billion Tons/Year)



Note: 1 billion tons oil/year = 20 million barrels/day.

Source: BP, Statistical Review of World Energy 2022.



Source: IMF CPI database and IMF staff calculations.
Note: Chart shows median total inflation and in select categories across 88 countries, including 28 advanced economies and 60 emerging and developing economies.



People ask the question... Is oil and gas a sunset business?

A leading indicator of a sunset business is the inability to attract capital investments into expensive, long-term projects. This is not happening in natural gas.



- Over the past year and a half, nearly 50 binding contracts have been signed for LNG offtake from facilities on the U.S. Gulf Coast
- Of these contracts, about 75% contemplate a start date in 2026 or 2027
- Of these contracts, over 70% run for 20 years and about 25% run for 15 years
- Conclusion: **Sophisticated investors are betting material capital that this will remain a good business through at least 2045**

Globally, traditional agriculture industry uses*:

55% of non-forest land

80% of total freshwater

30% of fossil fuels

About 21-37% of total greenhouse gas (GHG) emissions are attributable to the food system

- Since 1960, the use of nitrogen fertilizer has increased 8-fold
- “From 1961 to 2013, food supply per capita increased by more than 30%,... mainly due to increased use of nitrogen fertilizer”

- 72% of the world's nitrogen fertilizer is made from natural gas (China still produces nitrogen fertilizer from coal.)
- Worldwide, approximately 11 BCF per day of natural gas production is converted to nitrogen fertilizer

11 BCF per day of natural gas is equal to:

- Two days of Colorado's natural gas production
- 11% of U.S. daily natural gas production
- 16% of Russia's daily natural gas production
- 22% of European Union daily winter demand
- 5 days of peak winter demand in Colorado
- 3.6 LNG tankers (at 3 BCF each)

If you eliminate fossil fuel production, you eliminate more than half of the world's population.



- European natural gas prices will remain 5x-10x the historical norm for the next 3 years
- That will cause the continued deindustrialization of Europe
- Emerging market hardest hit as food inflation hits 15%+ in 36 countries (Sub-Saharan Africa and South Asia most vulnerable)
- Food security and famine will be one of the top concerns of all world leaders
- Putin's goal of driving a wedge between EU countries will continue
- This is essentially a clash between globalism and nationalism
- This is also the clash between the extreme radical environmental agenda and energy pragmatism

The far green left still doesn't understand scale.

Daniel Yergin: "... this is a \$90 trillion world economy that gets 80% of its energy from hydrocarbons. It's not going to change overnight."

John Harpole

President

Mercator Energy

26 W. Dry Creek Circle, Suite 410

Littleton, CO 80120

harp@mercatorenergy.com

(303) 825-1100 (work)

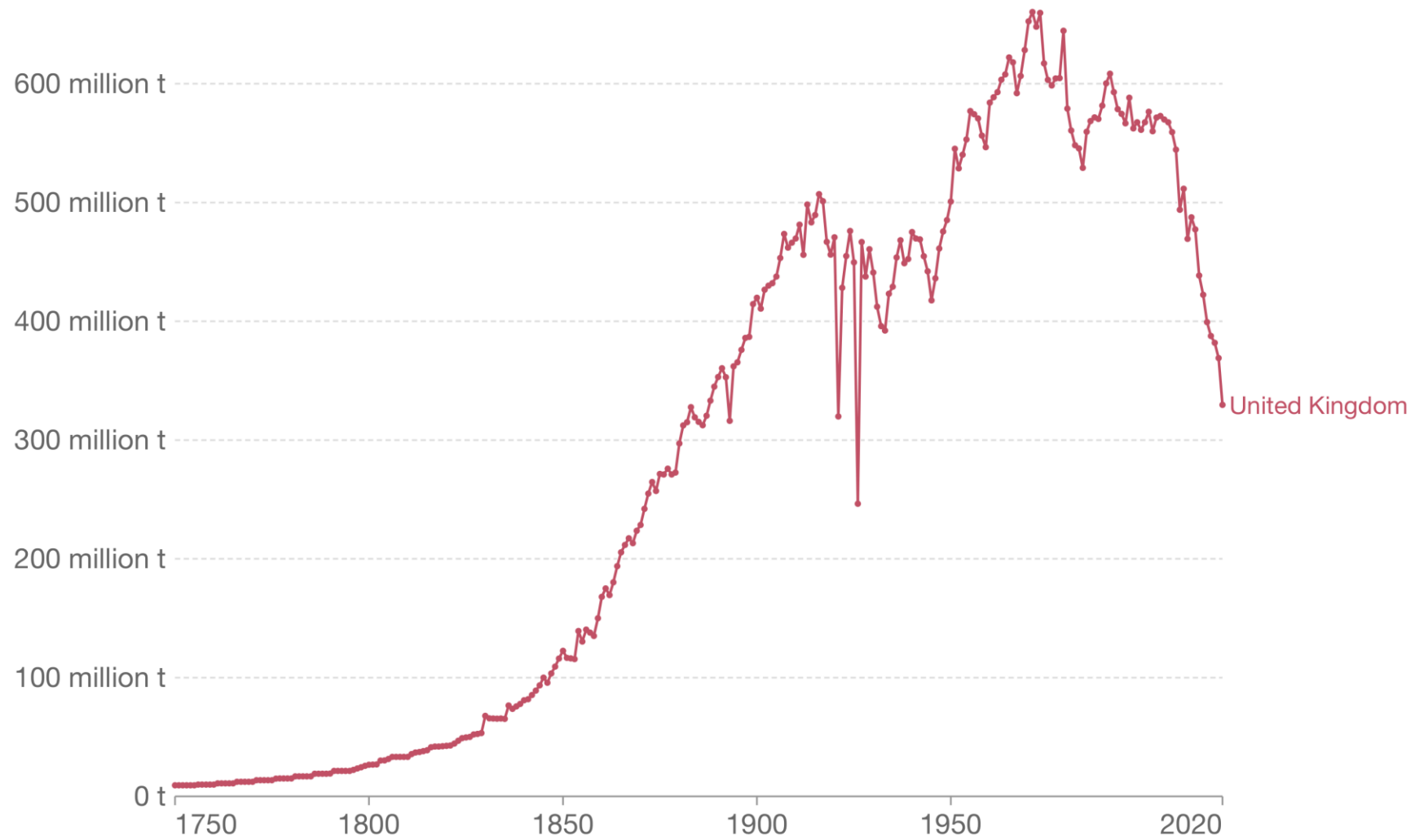
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Annual CO₂ emissions

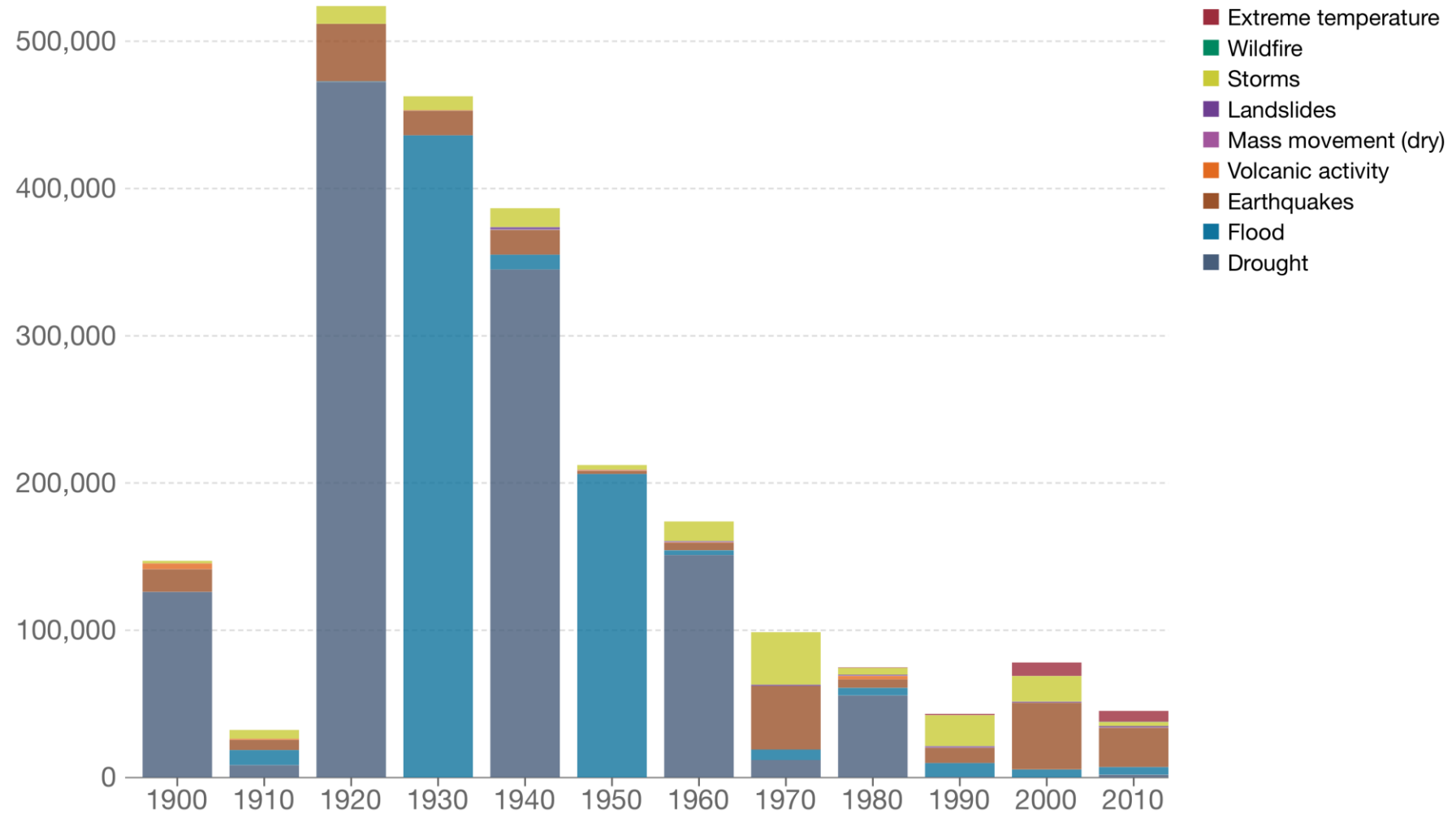
Carbon dioxide (CO₂) emissions from fossil fuels and industry. Land use change is not included.

Our World
in Data



Decadal average: Number of deaths from natural disasters, World

Our World
in Data



Source: Calculated by Our World in Data based on EM-DAT, CRED / UCLouvain, Brussels, Belgium – (D. Guha-Sapir)
OurWorldInData.org/natural-disasters • CC BY