Energiegase: Methan, Biogas, Wasserstoff, Synthesegase.

TEIL 2 – Erdgasproduktion & Handel

WS 2023/24

Ruhruniversität Bochum

Lehrstuhl für Energieanlagen und Energieprozesstechnik

Prof Dr Gerald Linke, CEO DVGW, German Gas and Water Association

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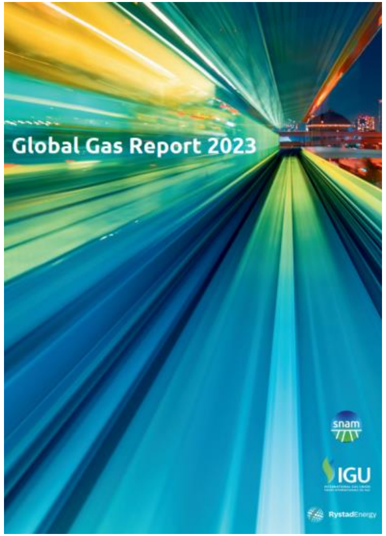
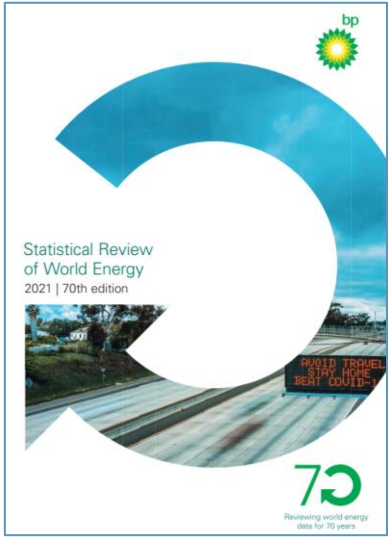
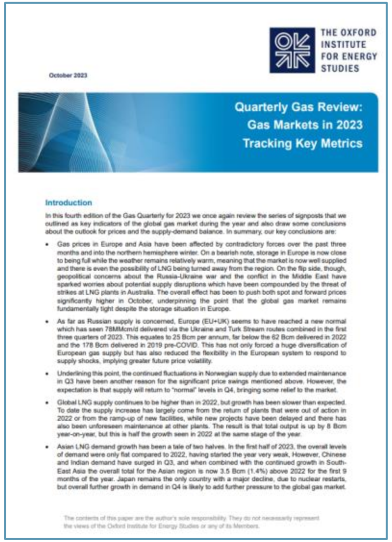
1. Globale/Europäische Gasentwicklungen in 2022
2. 2030ff: Wahrscheinliche Gasentwicklungen
3. Globale Transformation von Erdgas zu Wasserstoff
4. Erdgasversorgung Deutschlands
5. Gasproduktion (konventionell & unkonventionell) und Reichweiten
6. Einige größere Infrastrukturprojekte

Teil 2 - Erdgasproduktion & Handel

Literatur zum globalen Energie/Gas-Handel und zu Trends







THE OXFORD INSTITUTE FOR ENERGY STUDIES

October 2023

Quarterly Gas Review:
Gas Markets in 2023
Tracking Key Metrics

Introduction

In this fourth edition of the Gas Quarterly for 2023 we once again review the series of signposts that we outlined as key indicators of the global gas market during the year and also draw some conclusions about the outlook for prices and the supply-demand balance. In summary, our key conclusions are:

- Gas prices in Europe and Asia have been affected by contradictory forces over the past three months and into the northern hemisphere winter. On a bearish note, storage in Europe is now close to being full while the weather remains relatively warm, meaning that the market is now well supplied and there is even the possibility of LNG being turned away from the region. On the flip side, though, geopolitical concerns about the Russia-Ukraine war and the conflict in the Middle East have sparked worries about potential supply disruptions which have been compounded by the threat of strikes at LNG plants in Australia. The overall effect has been to push both spot and forward prices significantly higher in October, underpinning the point that the global gas market remains fundamentally tight despite the storage situation in Europe.
- As far as Russian supply is concerned, Europe (EU+UK) seems to have reached a new normal which has seen 78MMcm/d delivered via the Ukraine and Turk Stream routes combined in the first three quarters of 2023. This equates to 25 Bcm per annum, far below the 62 Bcm delivered in 2022 and the 178 Bcm delivered in 2019 pre-COVID. This has not only forced a huge diversification of European gas supply but has also reduced the flexibility in the European system to respond to supply shocks, implying greater future price volatility.
- Underlining this point, the continued fluctuations in Norwegian supply due to extended maintenance in Q3 have been another reason for the significant price swings mentioned above. However, the expectation is that supply will return to "normal" levels in Q4, bringing some relief to the market.
- Global LNG supply continues to be higher than in 2022, but growth has been slower than expected. To date the supply increase has largely come from the return of plants that were out of action in 2022 or from the ramp-up of new facilities, while new projects have been delayed and there has also been unforeseen maintenance at other plants. The result is that total output is up by 8 Bcm year-on-year, but this is half the growth seen in 2022 at the same stage of the year.
- Asian LNG demand growth has been a tale of two halves. In the first half of 2023, the overall levels of demand were only flat compared to 2022, having started the year very weak, However, Chinese and Indian demand have surged in Q3, and when combined with the continued growth in South-East Asia the overall total for the Asian region is now 3.5 Bcm (1.4%) above 2022 for the first 9 months of the year. Japan remains the only country with a major decline, due to nuclear restarts, but overall further growth in demand in Q4 is likely to add further pressure to the global gas market.

The contents of this paper are the author's sole responsibility. They do not necessarily represent the views of the Oxford Institute for Energy Studies or any of its Members.

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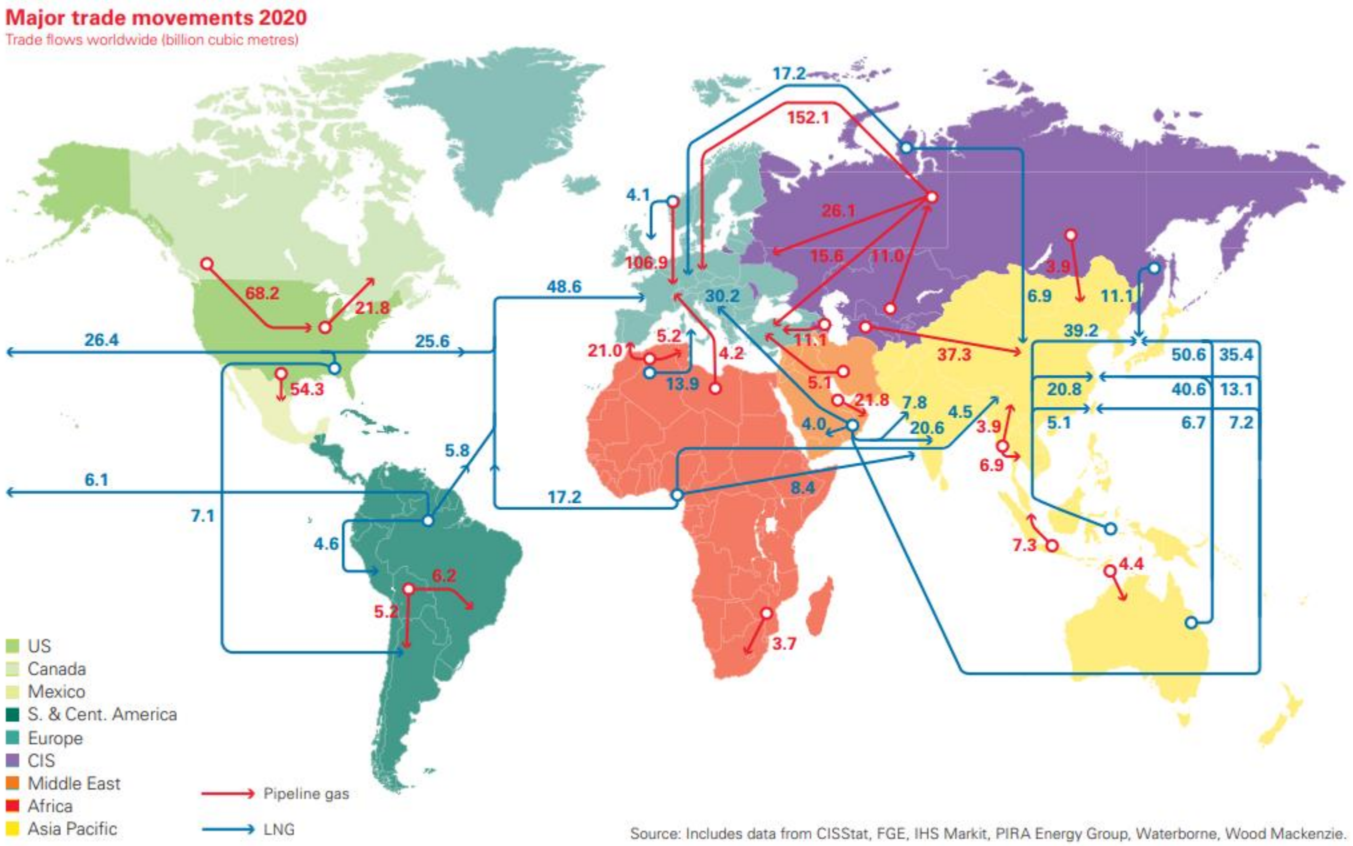
International gas trading: Movements in 2020



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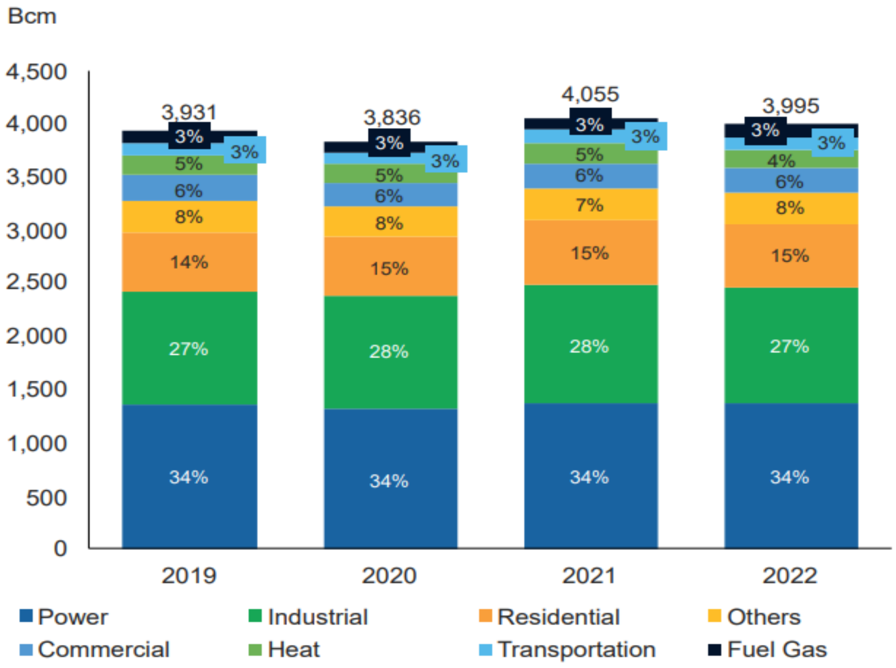
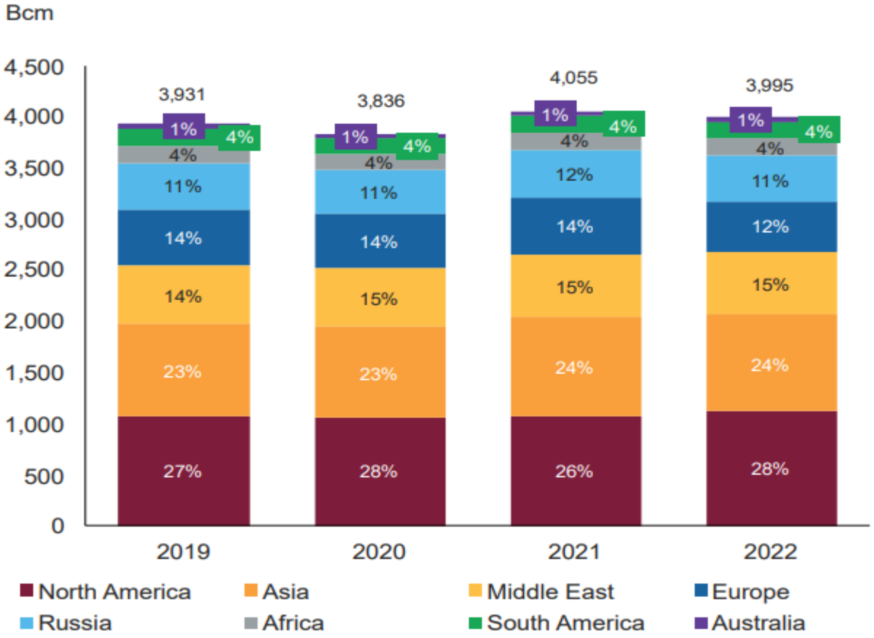
Global gas demand, split by demand sectors



Source: Rystad Energy

Global gas demand, split by region



Source: Rystad Energy

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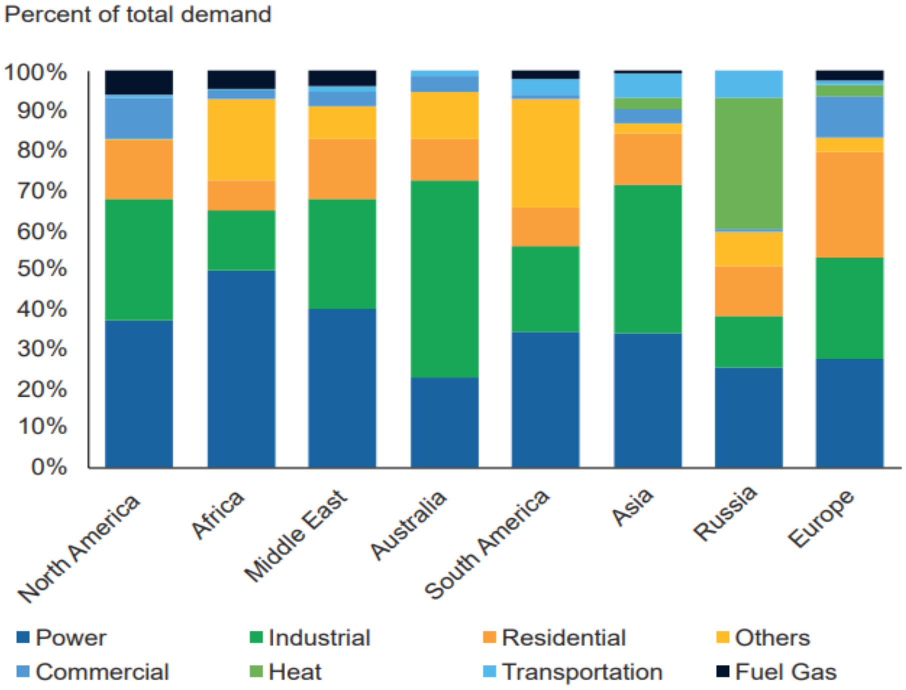
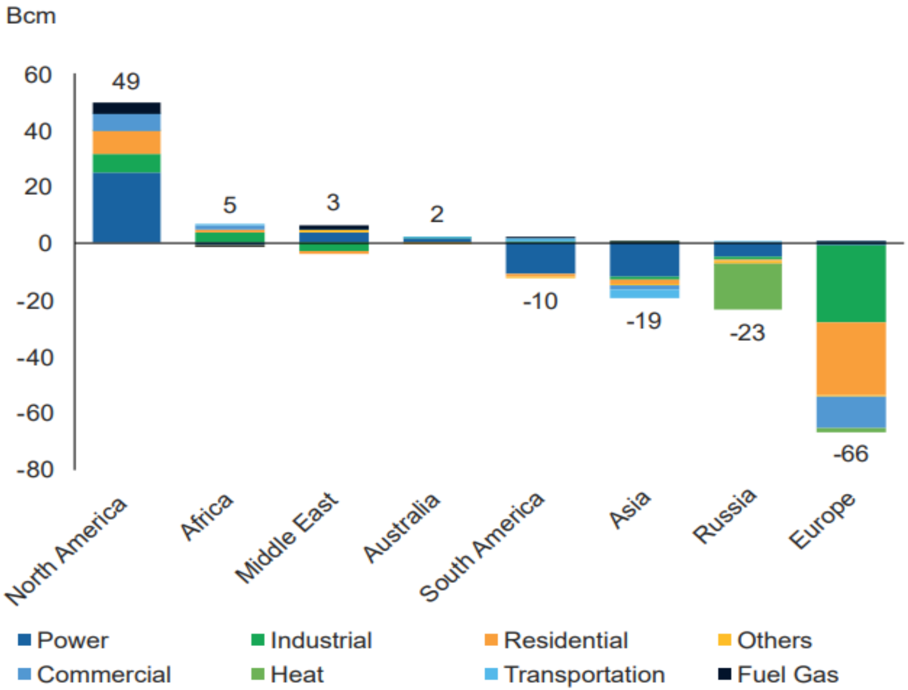
Global demand sector mix in 2022, split by region



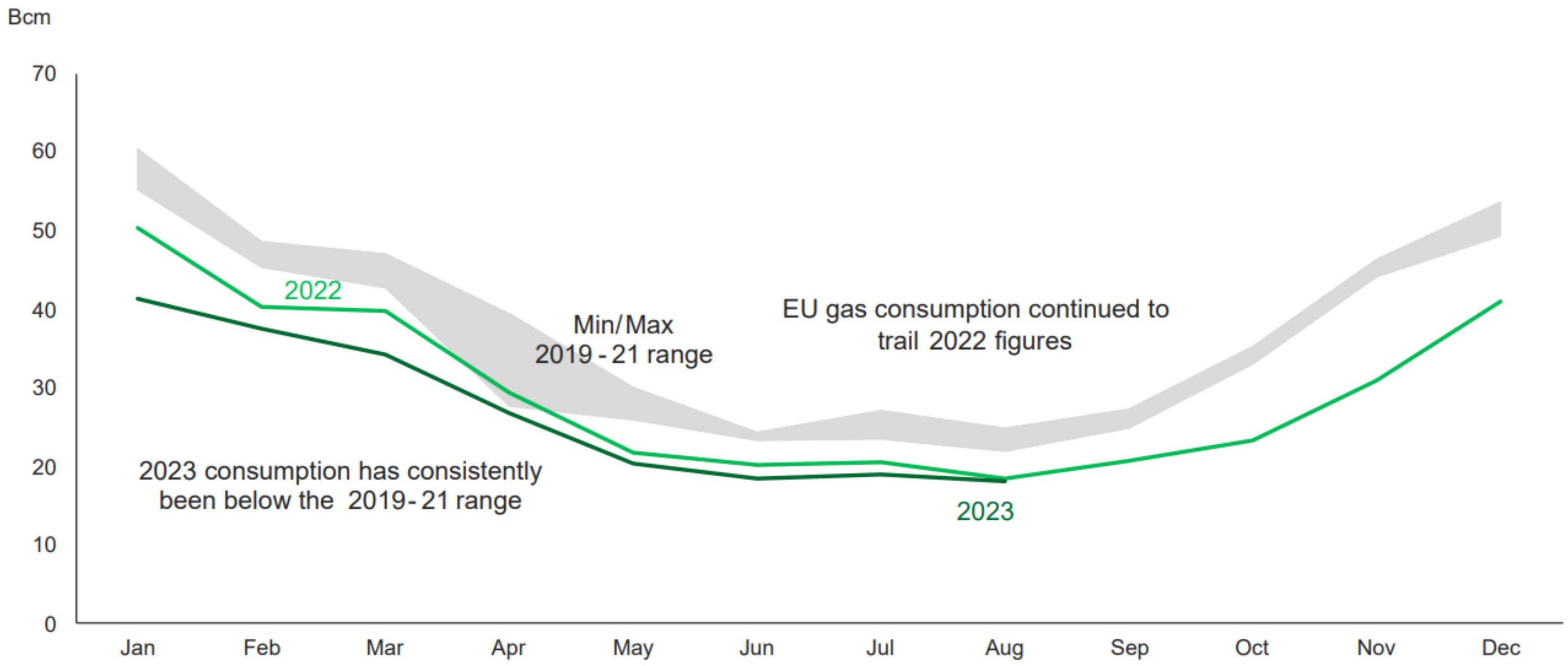
Source: Rystad Energy

Global gas demand sector year-on-year change, split by regions (2021 – 2022)



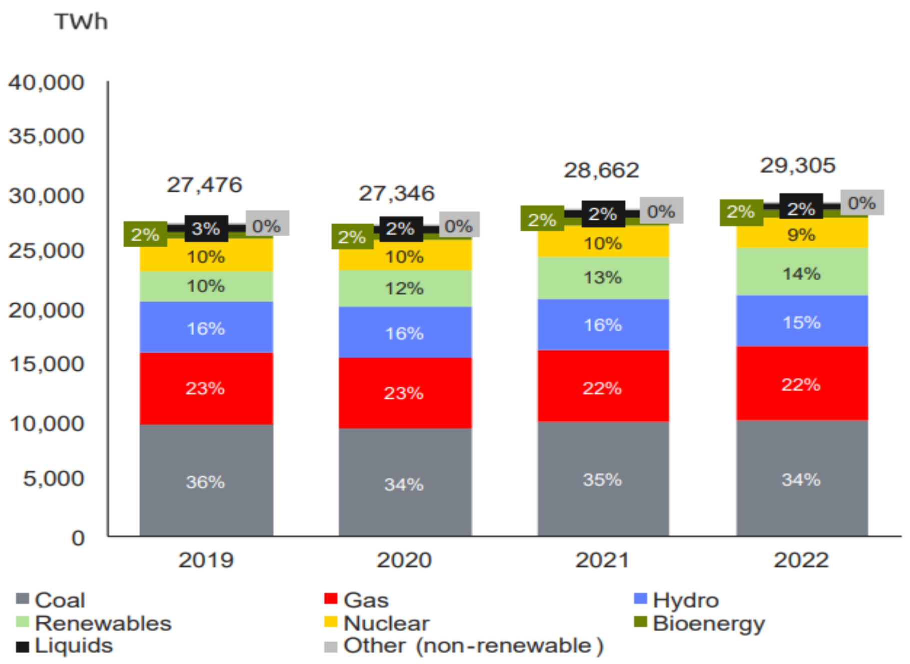
Source: Rystad Energy

EU27 monthly gas comsumption



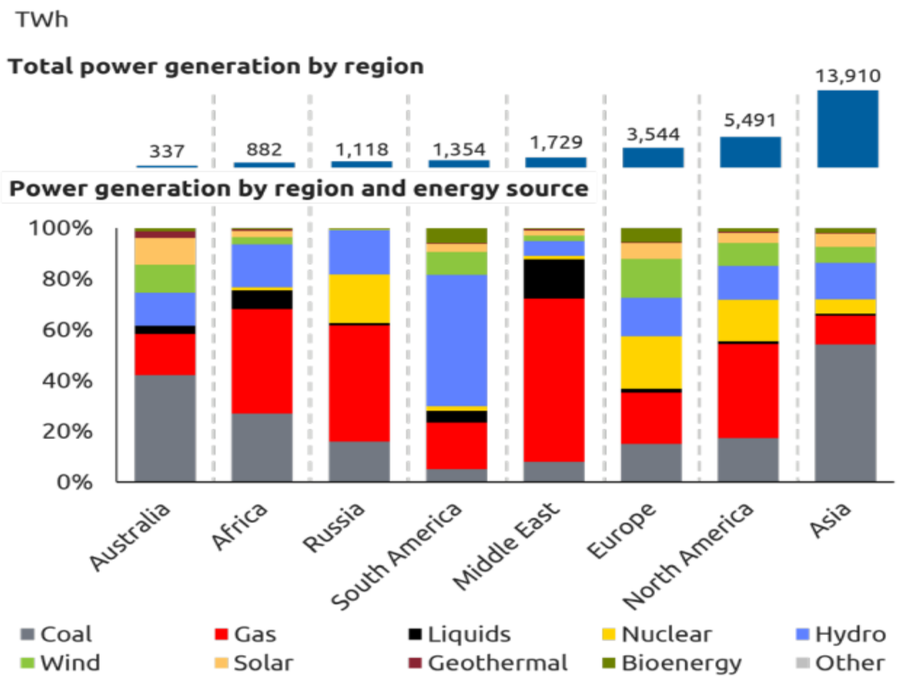
Source: Eurostat; Rystad Energy

Global power mix split by energy source



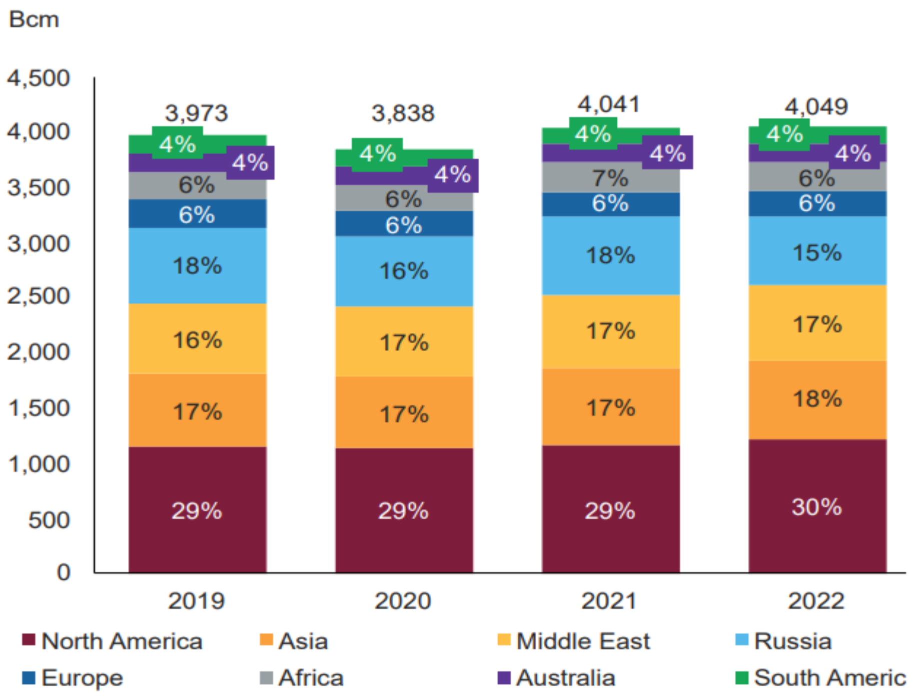
Source: Rystad Energy

2022 global power mix by region split by energy source



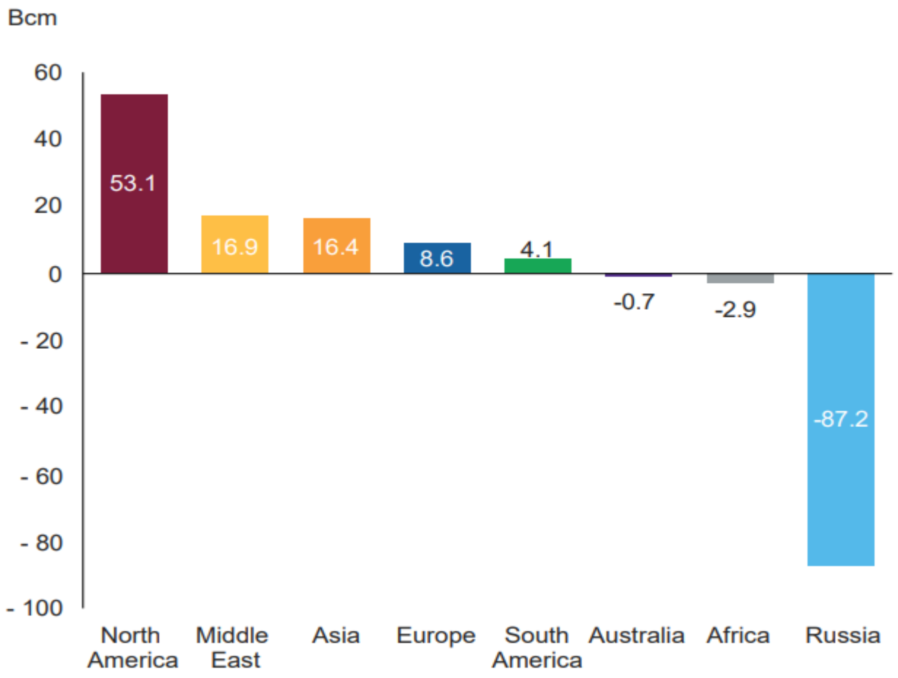
Source: Rystad Energy

Global gas production, split by region



Source: Rystad Energy

Global gas production year-on-year change (2021 – 2022)



Source: Rystad Energy

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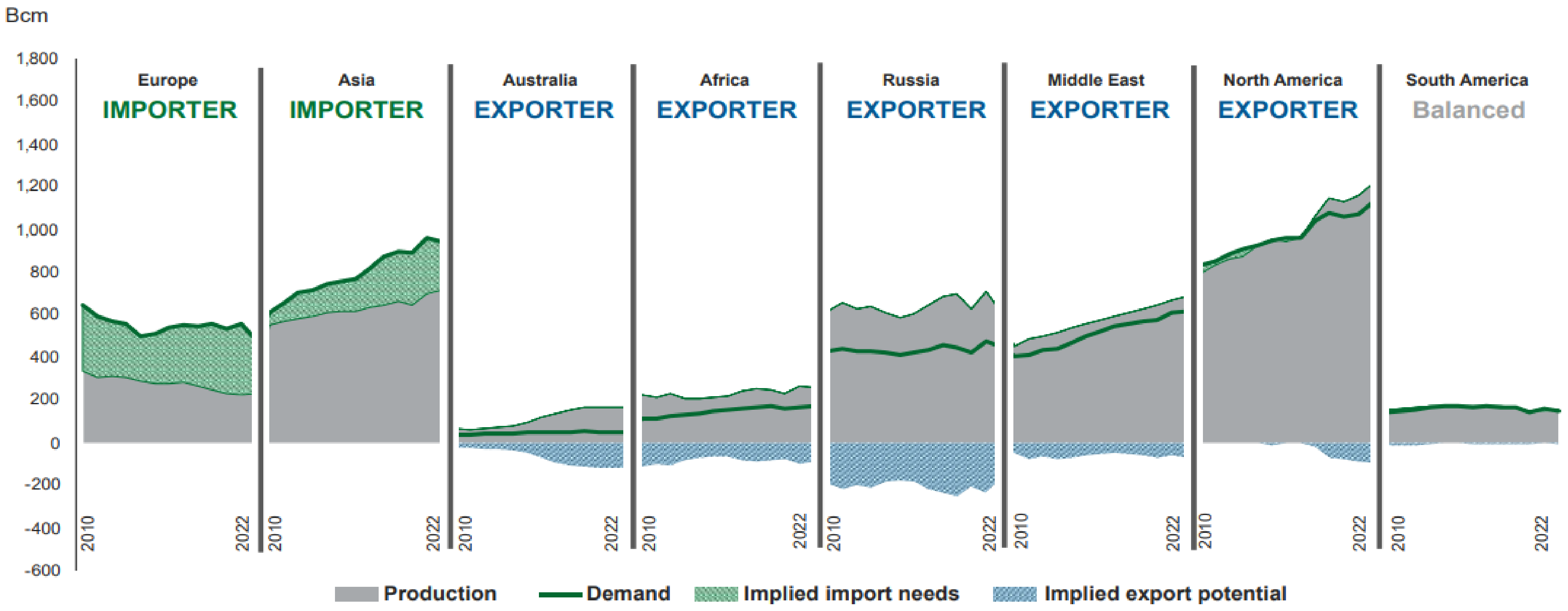
Gas demand, production, and import/export volumes, split by region



Source: Rystad Energy

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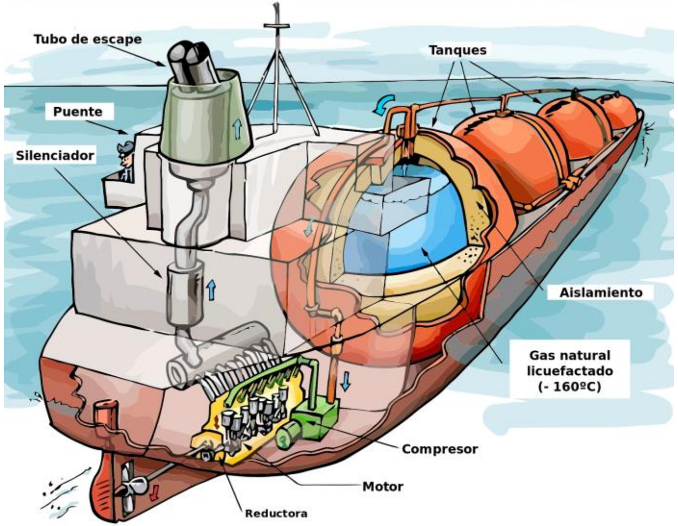
How to transport Gas

Source: EUGAL



Source: Wikipedia

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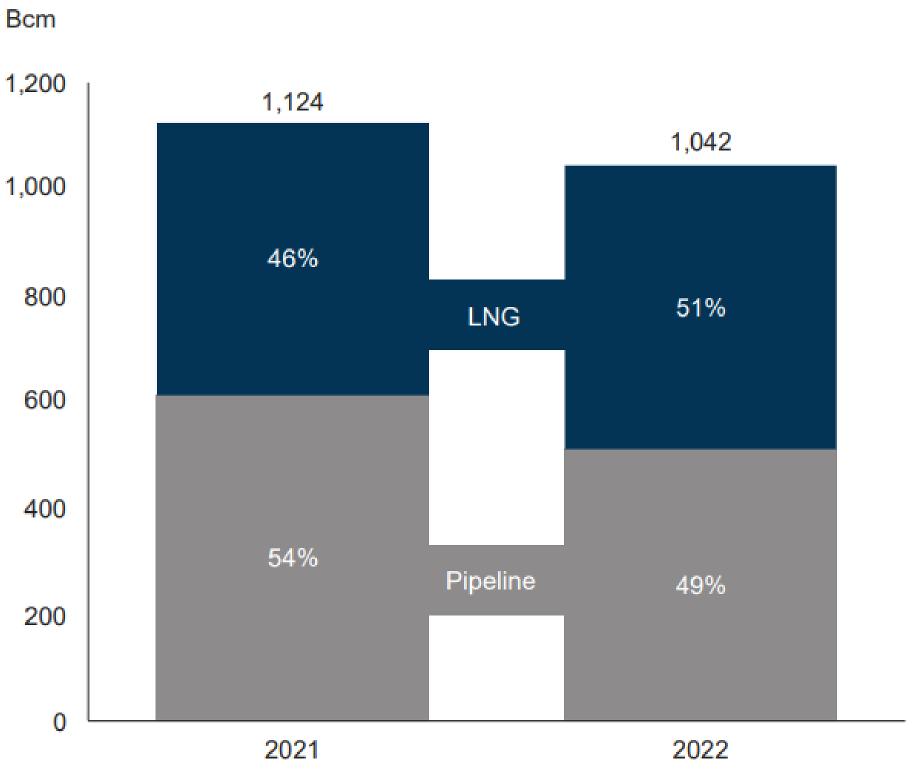
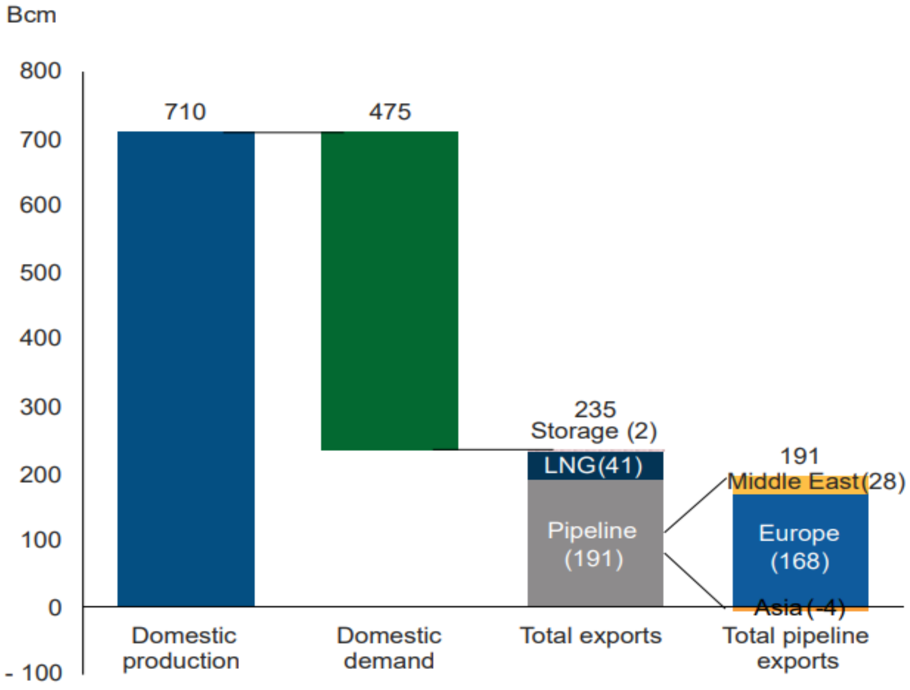
Global net gas export volumes, split by flow type



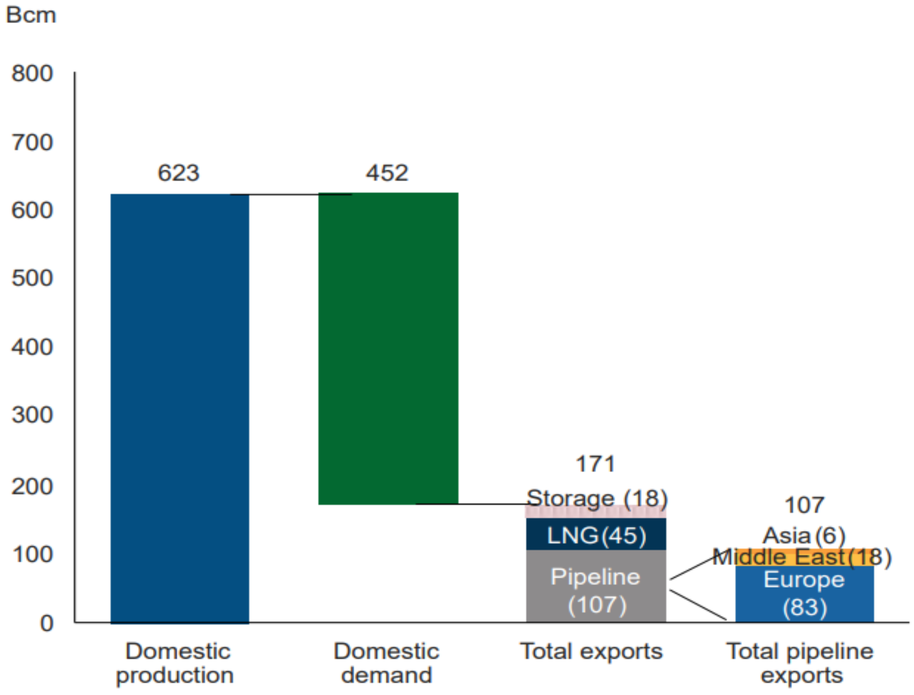
Source: Rystad Energy

Russian gas flows 2021



Source: Rystad Energy

Russian gas flows 2022



Source: Rystad Energy

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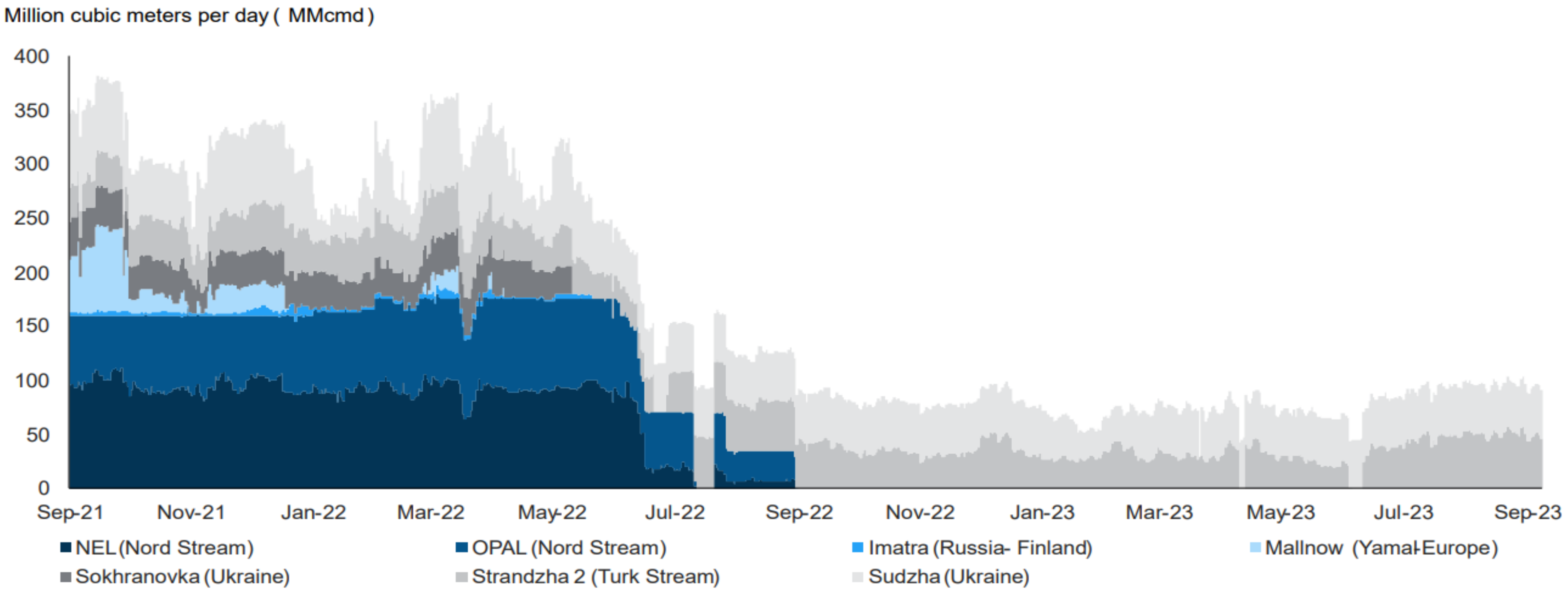
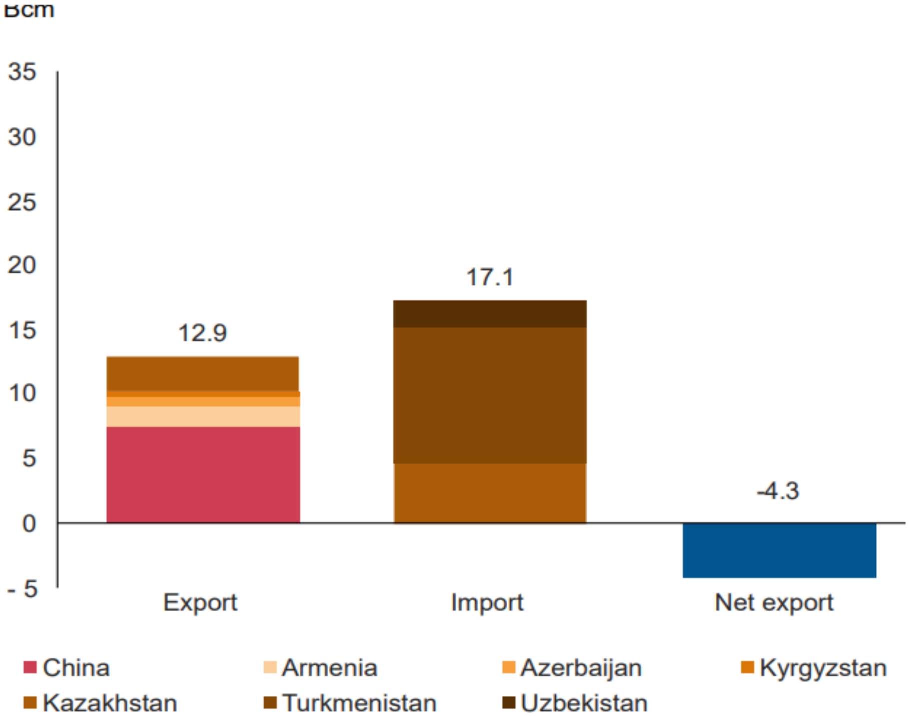
Russian pipeline gas flows to Europe by entry point



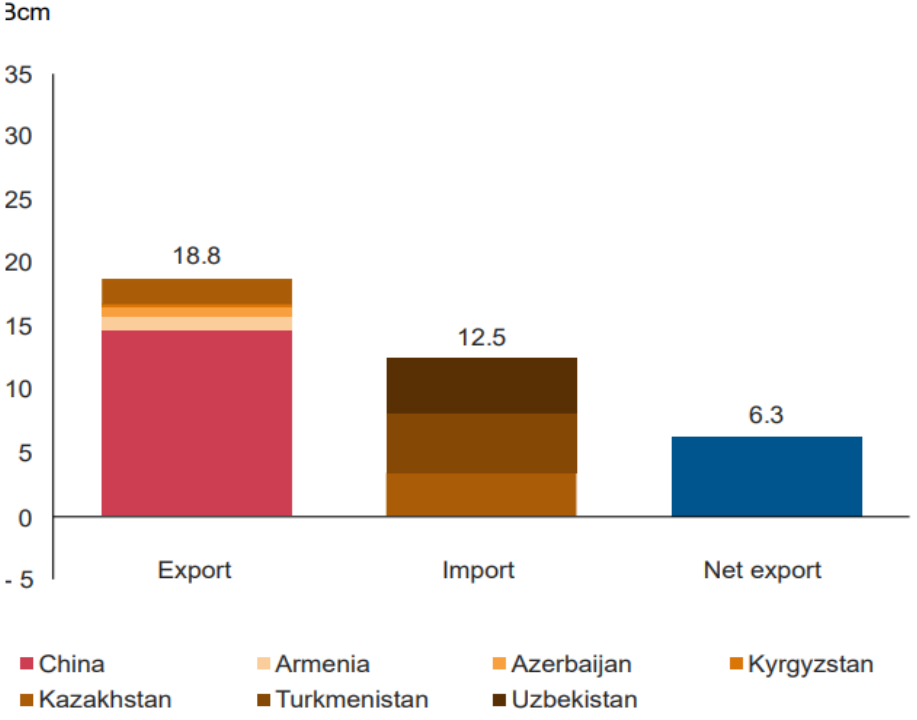
Source: Rystad Energy

Russian pipeline gas imports/exports with Asia 2021



Source: Rystad Energy

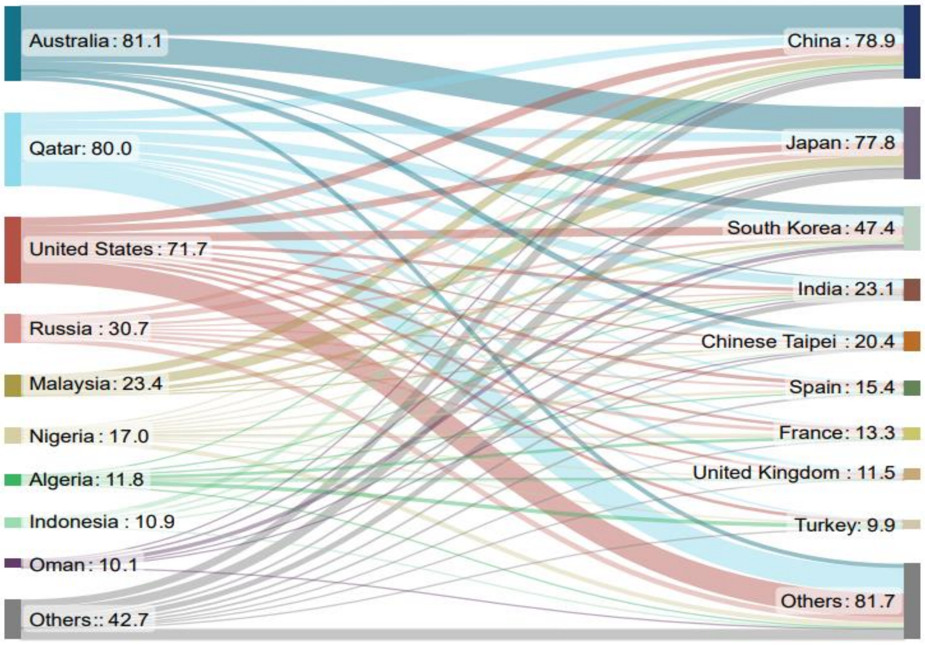
Russian pipeline gas imports/exports with Asia 2022



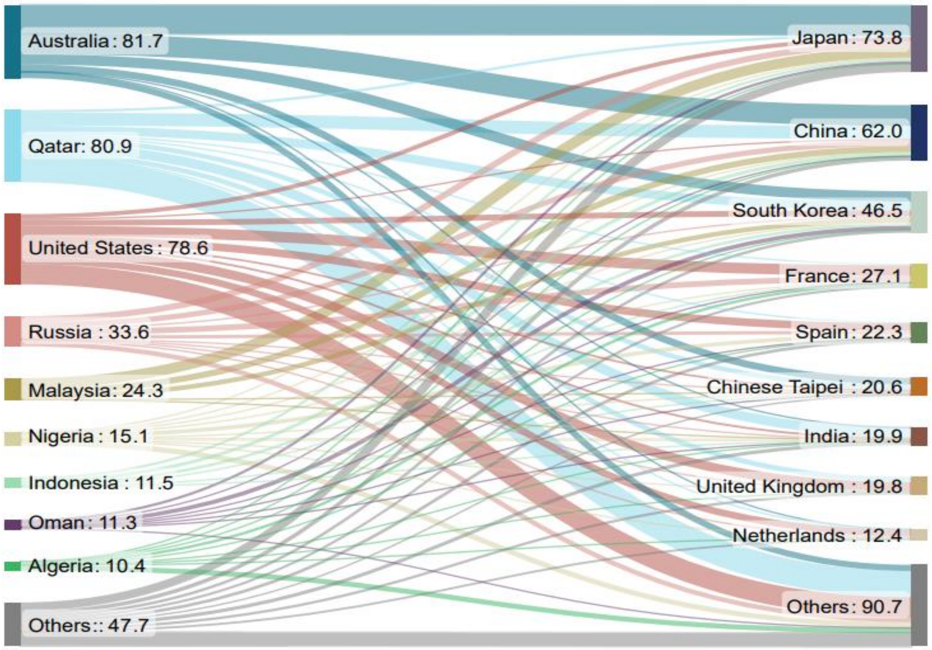
Source: Rystad Energy

Global LNG trade flows 2021

Global LNG trade flows 2022

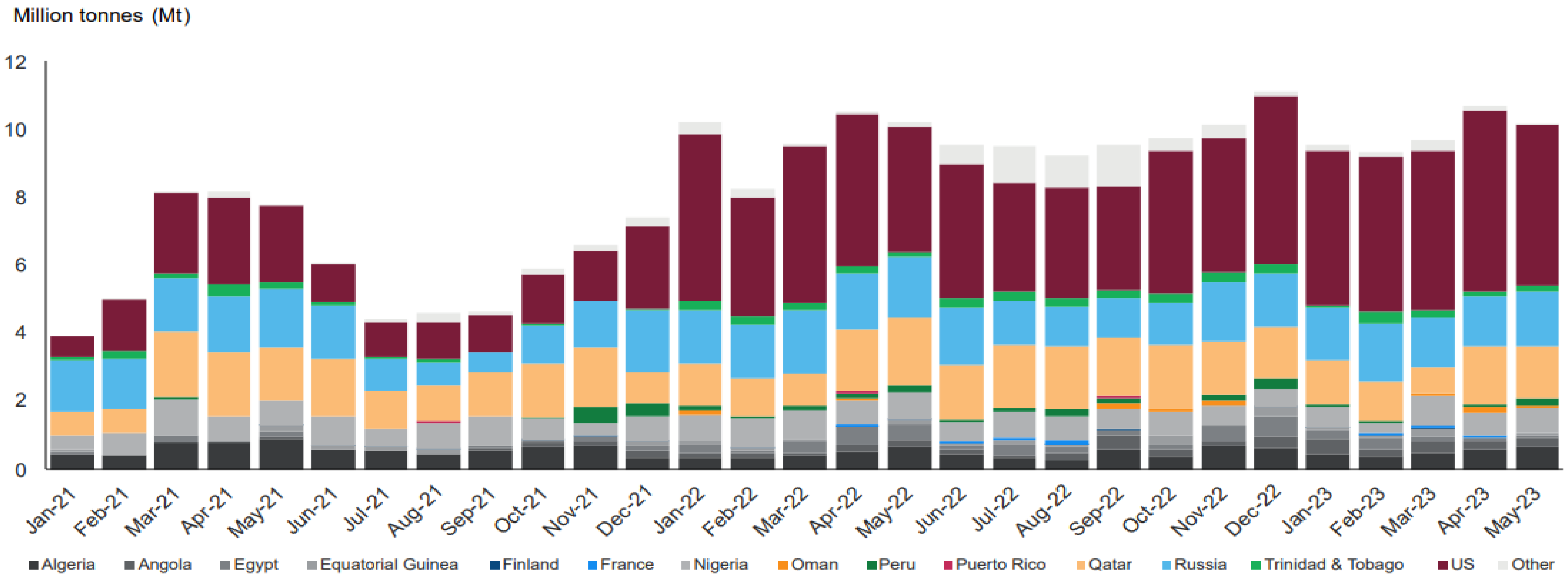


Source: Rystad Energy



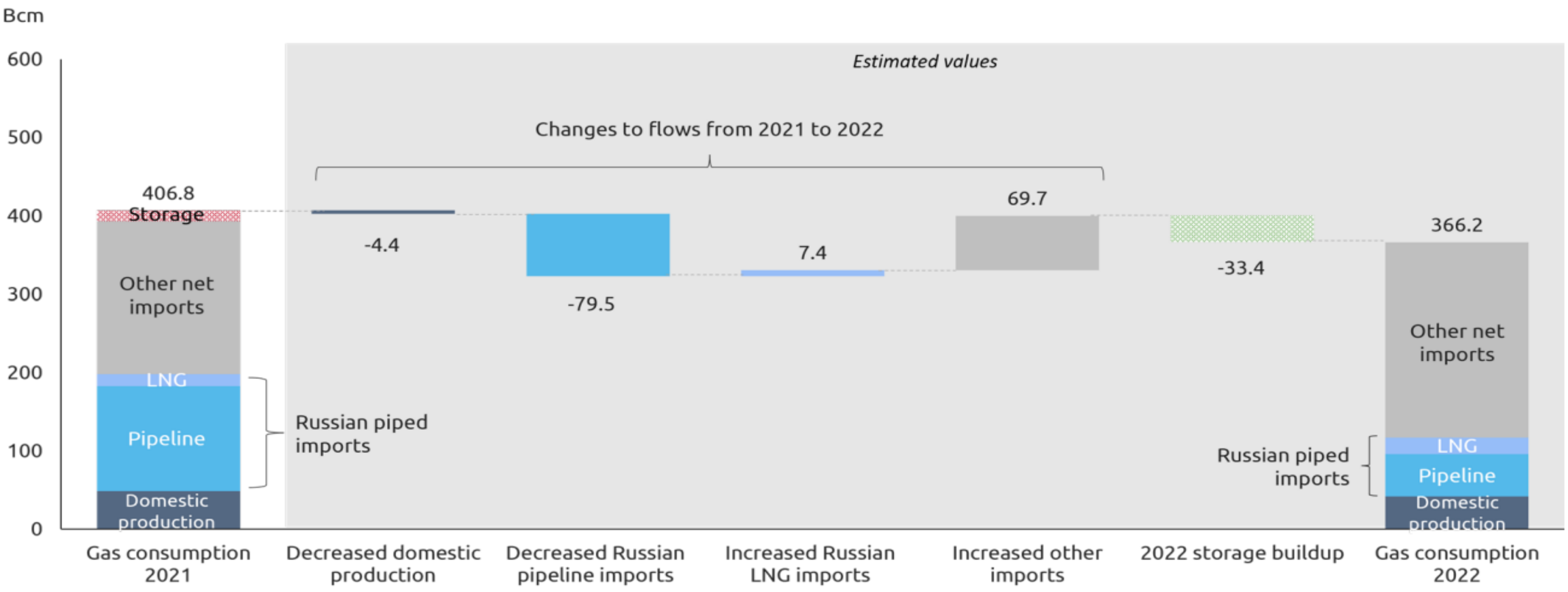
Source: Rystad Energy

European LNG imports by origin



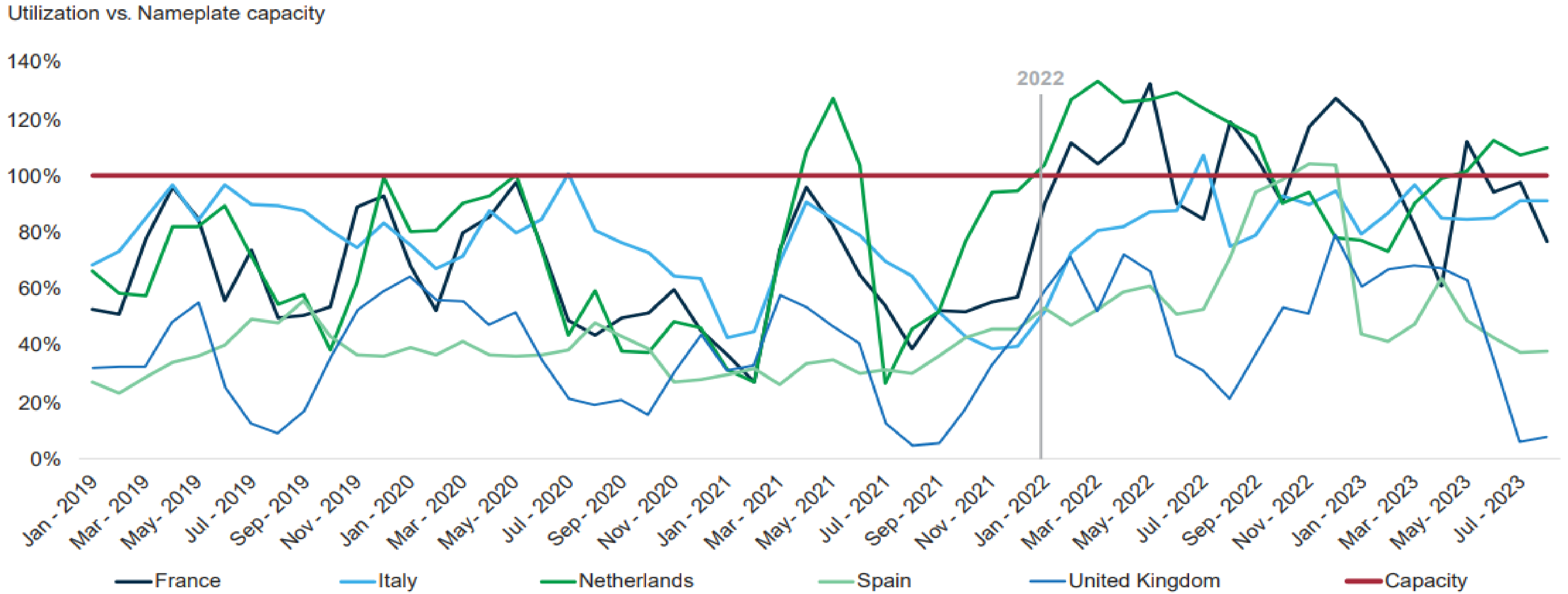
Source: Rystad Energy

Estimated changes in EU27 gas availability from 2021 to 2022, split by source



Source: Rystad Energy

Regasification utilisation in selected European Countries



Source: Rystad Energy

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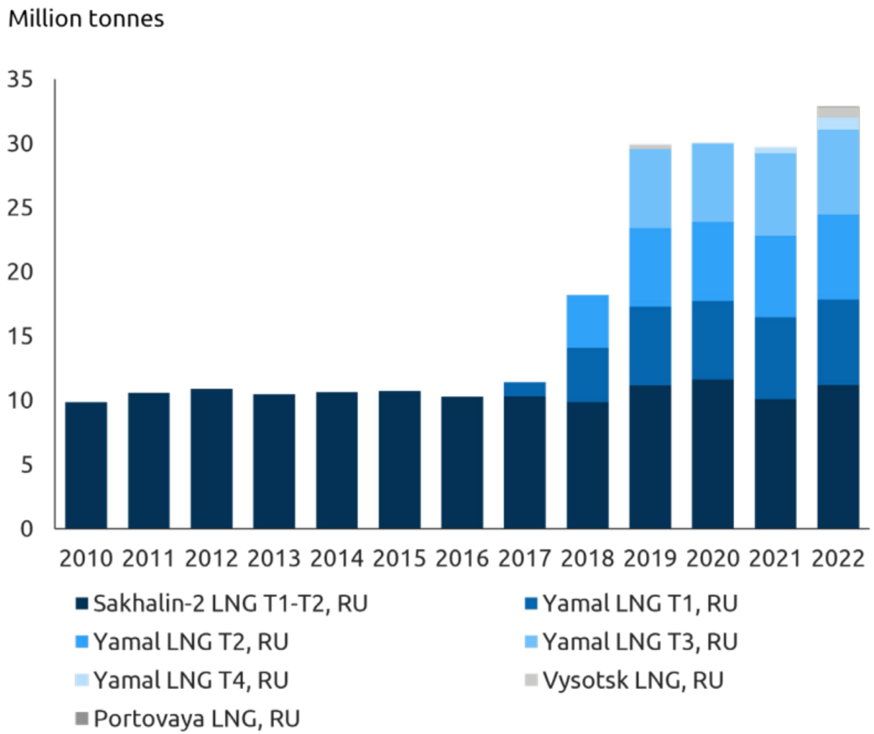
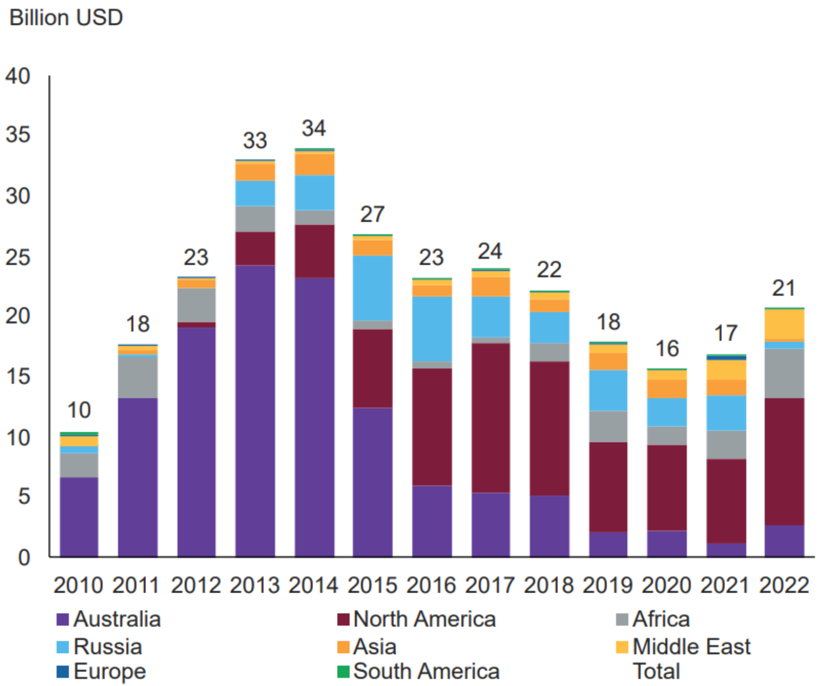
Russian LNG production capacity



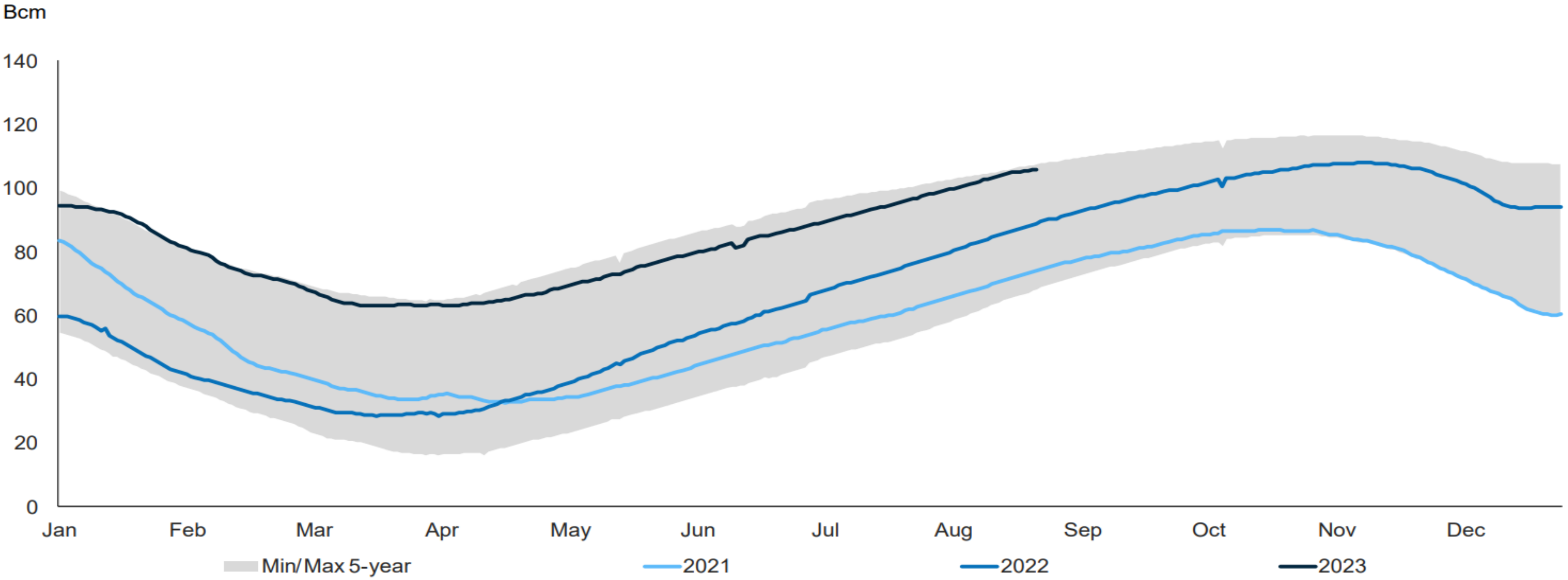
Source: Rystad Energy; IGU LNG Report

Global liquefaction capex, split by region



Source: Rystad Energy; IGU LNG Report

Daily European gas storage volumes and range in underground storage, excluding Ukraine



Source: Rystad Energy

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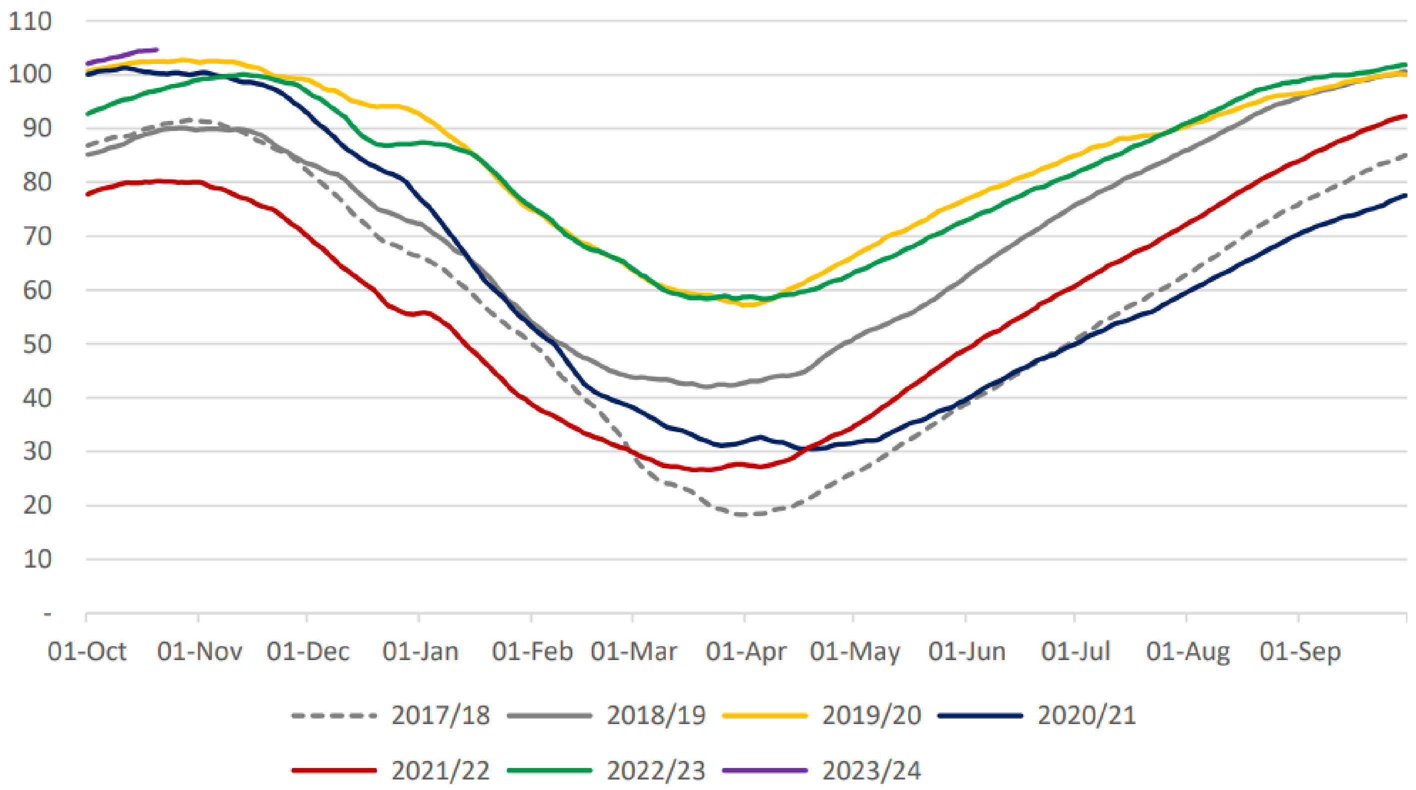
Latest trends in gas storages in bcm (Quarterly Gas Review of the Oxford Institute For Energy Studies)



Source: Data from Gas Infrastructure Europe (GIE) Aggregated Gas Storage Inventory.[22] Graph by the author

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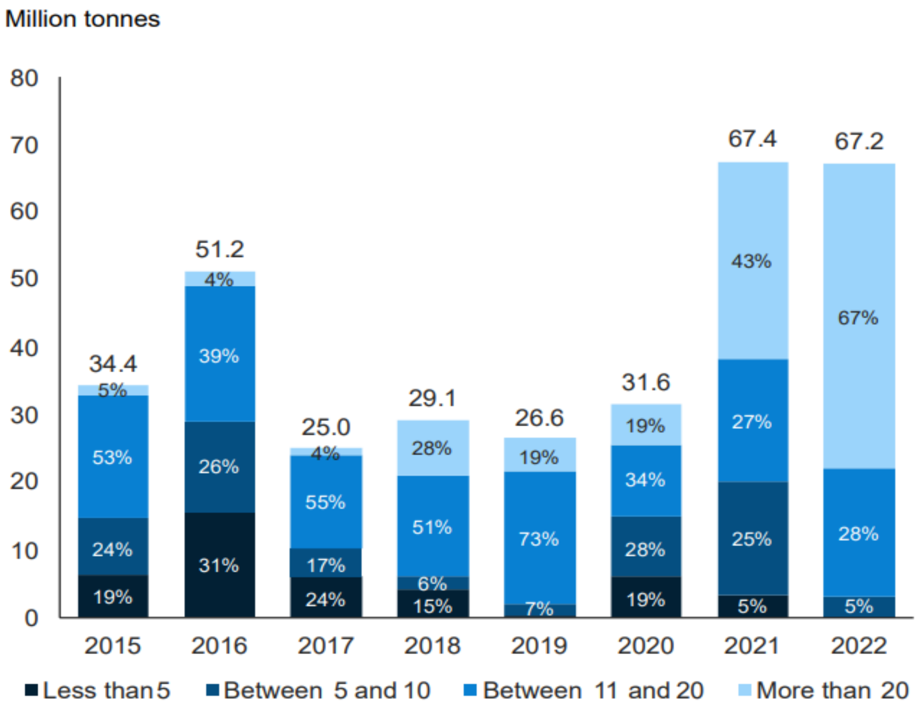
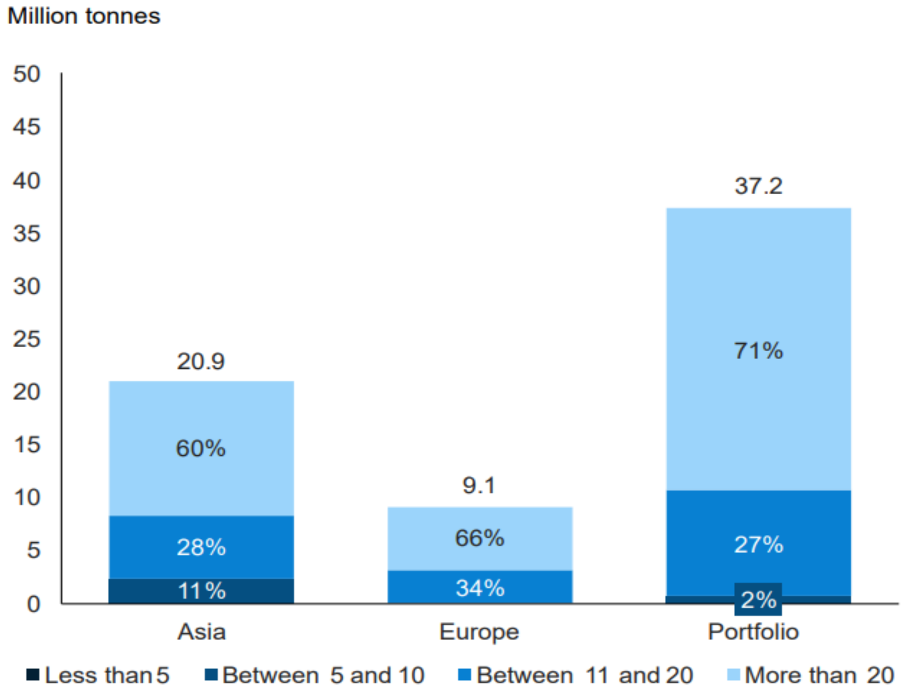
New LNG contracted volumes, split by duration



Source: Rystad Energy; IGU LNG Report

New LNG contracted volume duration (2022), split by duration



Source: Rystad Energy; IGU LNG Report

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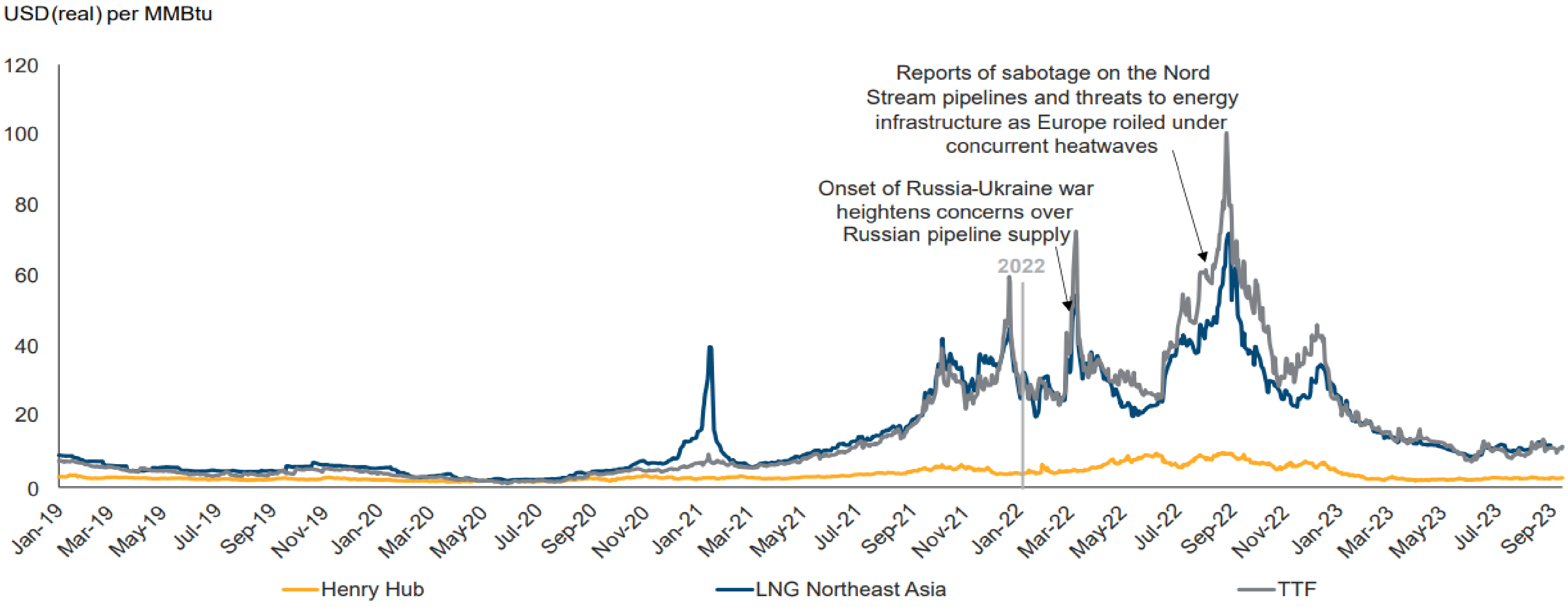
International natural gas prices



Source: Rystad Energy; Argus (LNG Northeast Asia)

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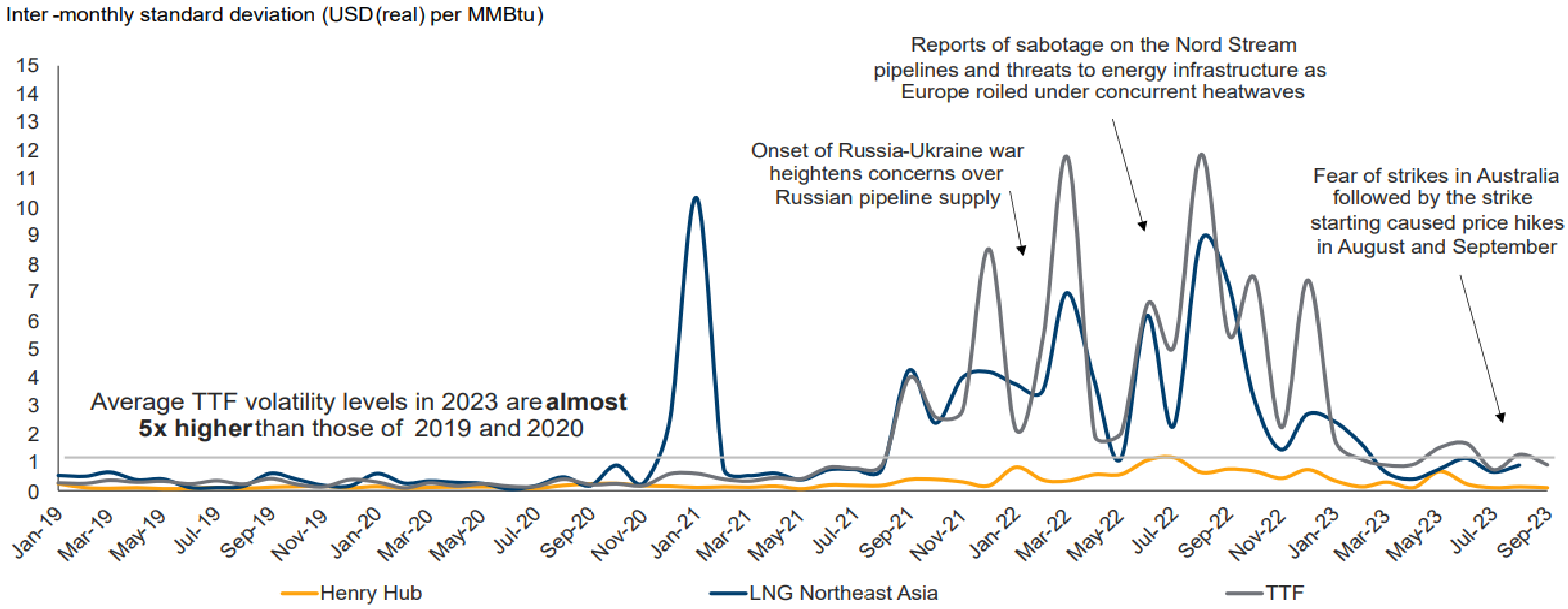
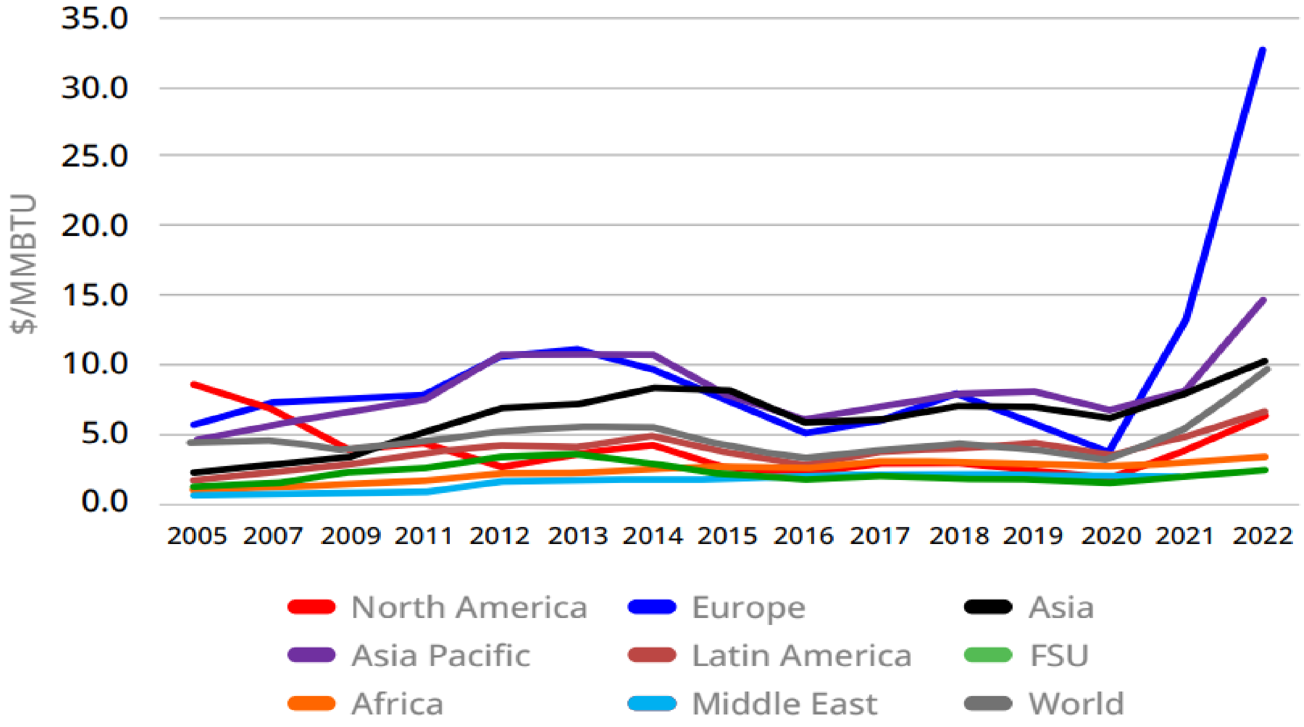
International natural gas price volatility



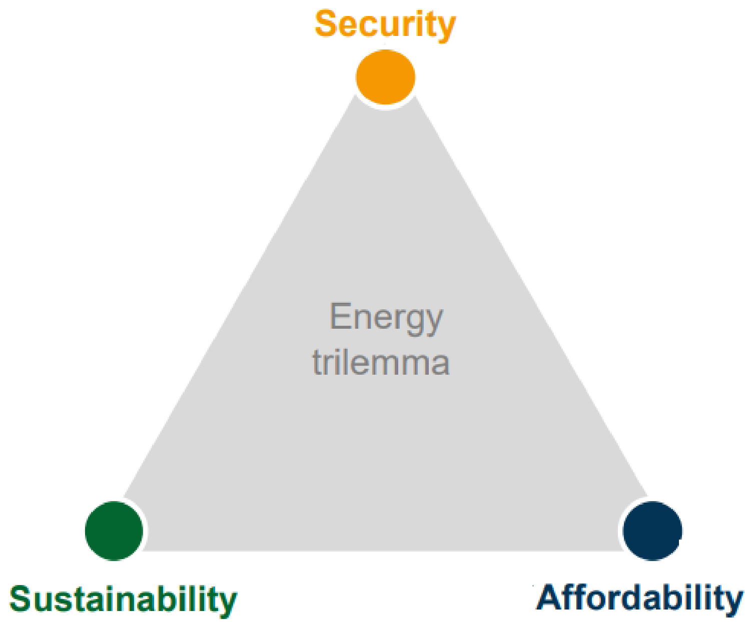
Source: Rystad Energy; Argus (LNG Northeast Asia)

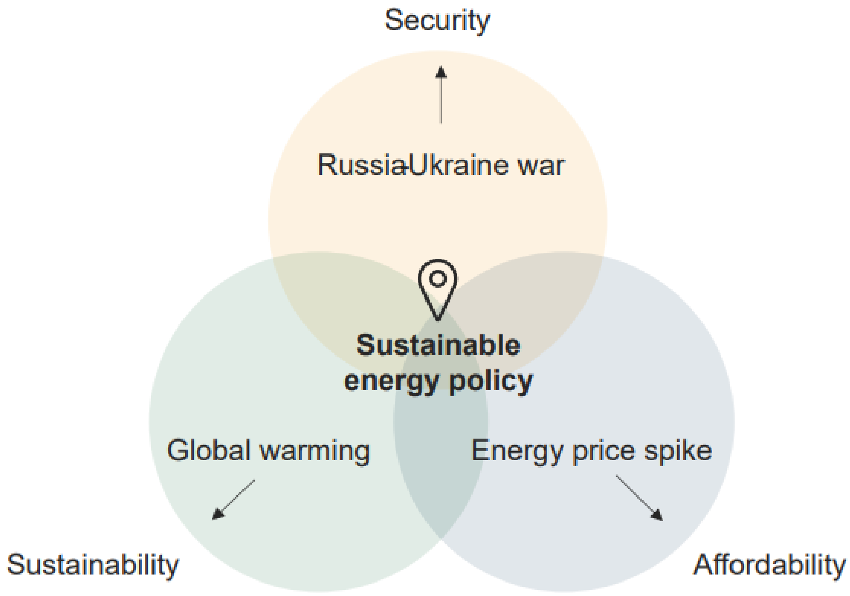
Wholesale price levels 2005 to 2022 by region



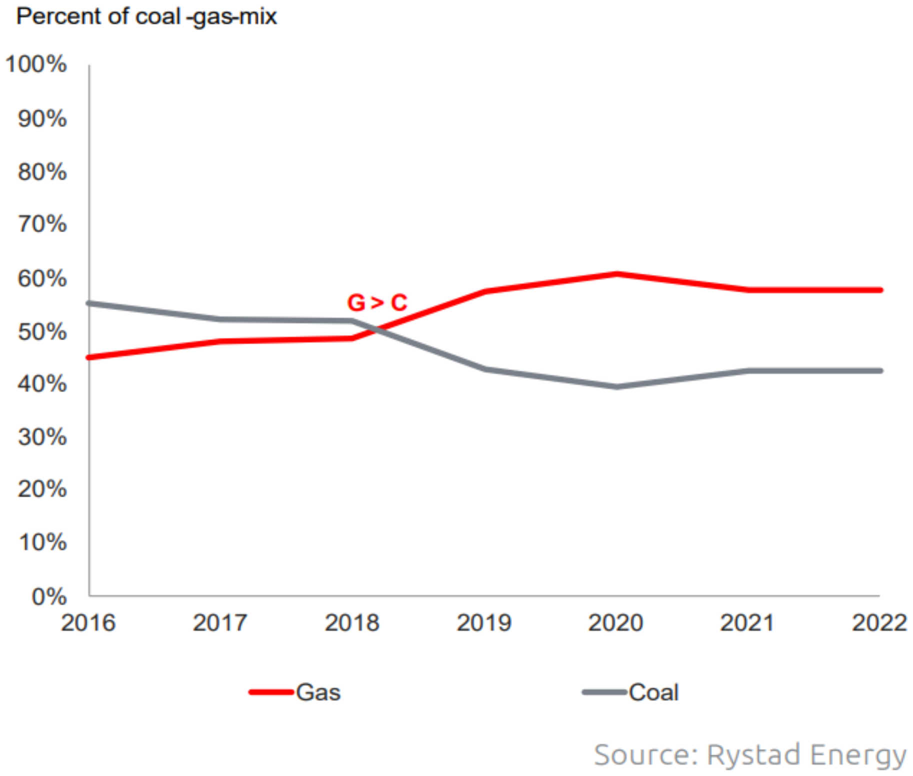
Source: IGU

Die Turbulenzen des Jahre 2022 haben die Bedeutung einer ausgewogenen Energiepolitik (innerhalb der Energie-Trias) deutlich gemacht

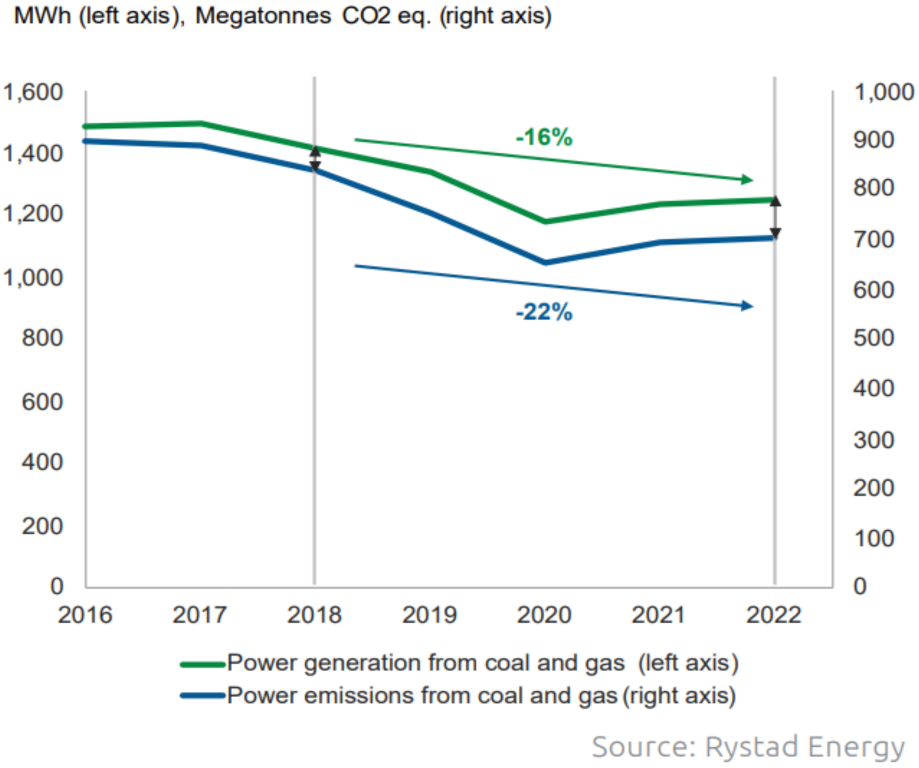




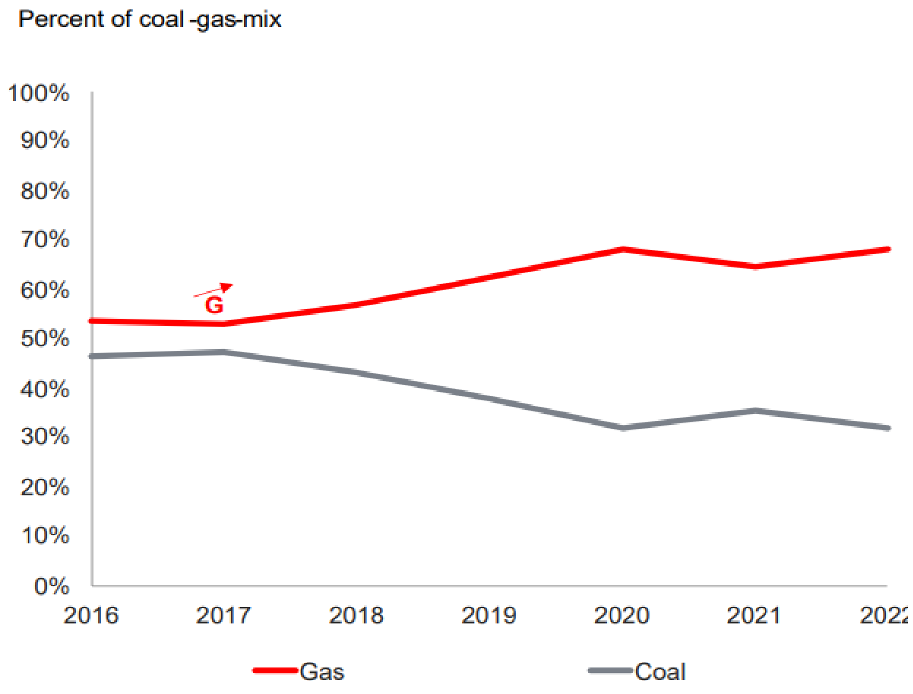
Emissions: Coal and gas in the European power mix



Emission: Power generation and emissions from coal and gas in EU

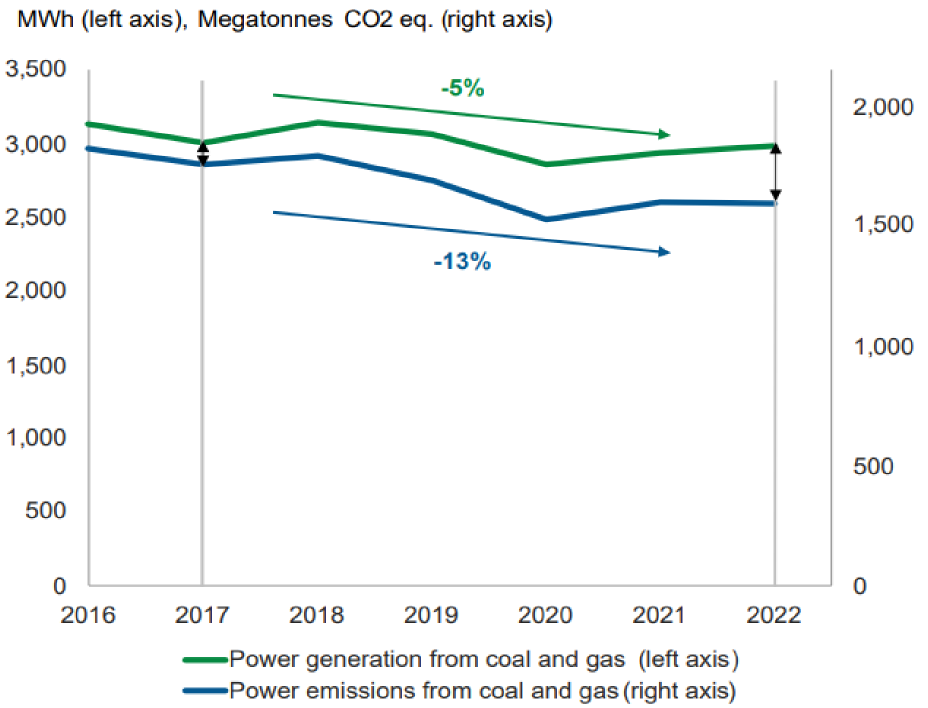


Emissions: Coal and gas in the North American power mix



Source: Rystad Energy

Emission: Power generation and emissions from coal and gas in NA



Source: Rystad Energy

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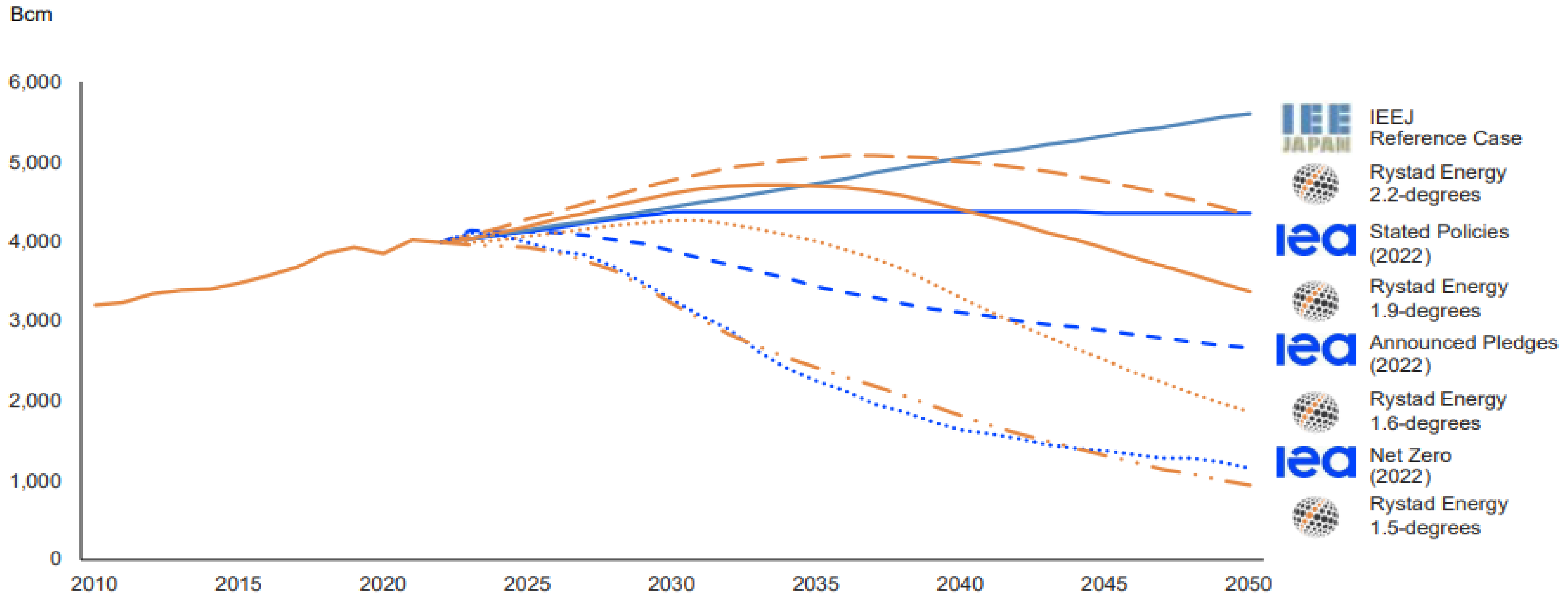
Global gas demand scenarios from various institutions

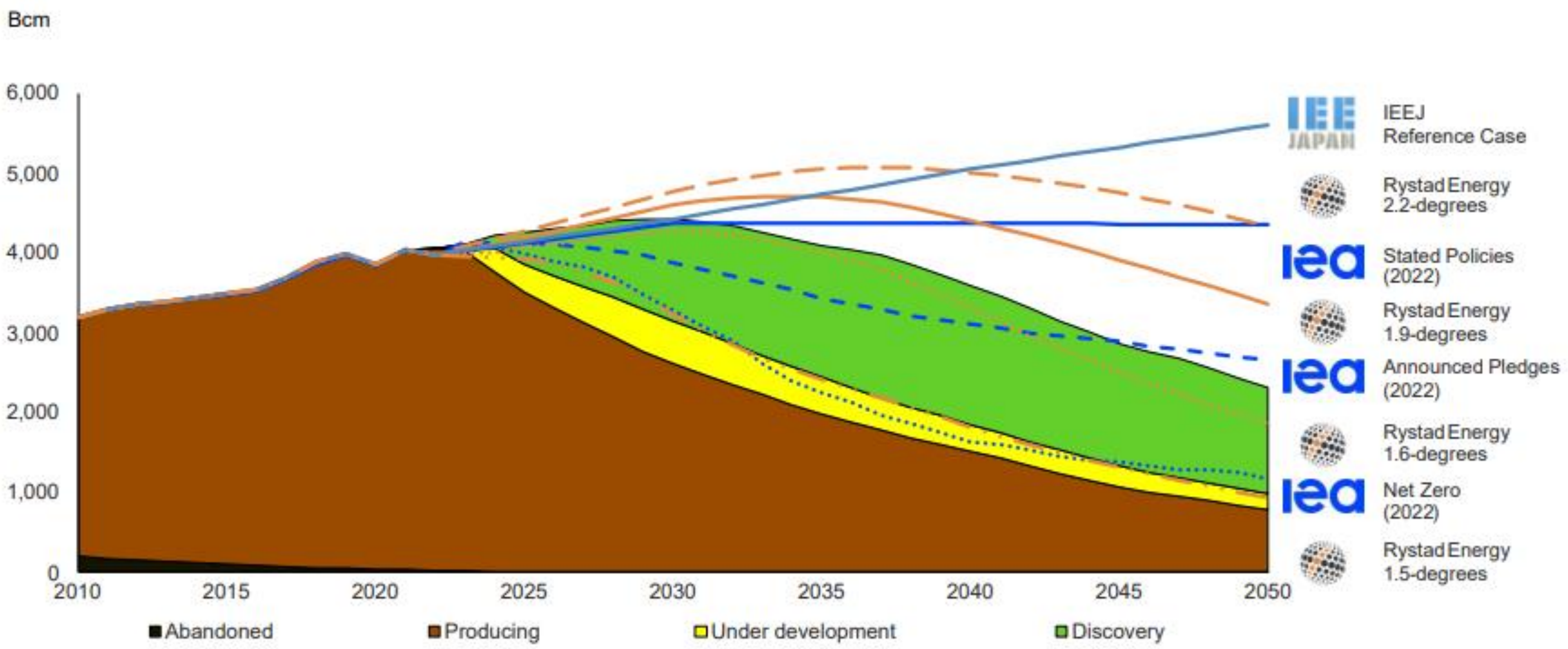


Sources: IEA; IEE Japan; Rystad Energy

Global gas demand scenarios from various institutions

Scenarios	Power Generation in 2050	Final energy consumption CAGR	Share of electricity in final energy consumption (2050)	Goals & policies assumptions
IEEJ Reference	30% Gas, 36% Renewables Renewables vs 2021: x2.2	1.3% 0.5%	29%	Incorporates past trends and expected effects of policies and technologies to date, while reconciling energy security and climate action
IEA STEPS (2022)	13% Gas, 65% Renewables Renewables vs 2021: x4.0	1.1% 0.3%	28%	Reflects current policy settings incl. European Green Deal, US Methane Emissions Reduction Action Plan, China 14th Five-Year Plan.
IEA APS (2022)	6% Gas, 80% Renewables Renewables vs 2021: x6.0	0.3% -0.1%	39%	Assumes commitments incl. Nationally Determined Contributions under the Paris Agreement, EU Fit for 55 package, and G7 Commitment will be met on time
IEA NZE (2022)	0.1% Gas, 88% Renewables Renewables vs 2021: x8.0	-1.1% -0.6%	52%	Assumes universal access to electricity and clean cooking are achieved by 2030 and relies solely on emissions reductions within the energy sector to achieve 2050 net zero emissions
RE 2.2-DG	12% Gas, 69% Renewables Renewables vs 2021: x3.8	1.2% -0.0%	22%	Corresponds to global warming limited to 2.2°C with gas plays a crucial part facilitating the decarbonization process
RE 1.9-DG	7% Gas, 82% Renewables Renewables vs 2021: x6.1	0.8% -0.3%	28%	Corresponds to global warming limited to 1.9°C with a more gradual transition towards renewable energy
RE 1.6-DG	3% Gas, 92% Renewables Renewables vs 2021: x9.7	0.2% -0.5%	37%	Corresponds to global warming limited to 1.6°C and requires a considerably aggressive transition, which the world has almost sufficient manufacturing capacity to meet
RE 1.5-DG	1.4% Gas, 94% Renewables Renewables vs 2021: x10.9	-0.7% -0.3%	41%	Corresponds to global warming limited to 1.5°C and envisions net zero emissions by 2050, but requires extensive carbon removal and investment in hydrogen and biofuels

Global gas demand scenarios from various institutions versus operational, approved and discovered assets (2010 – 2050)



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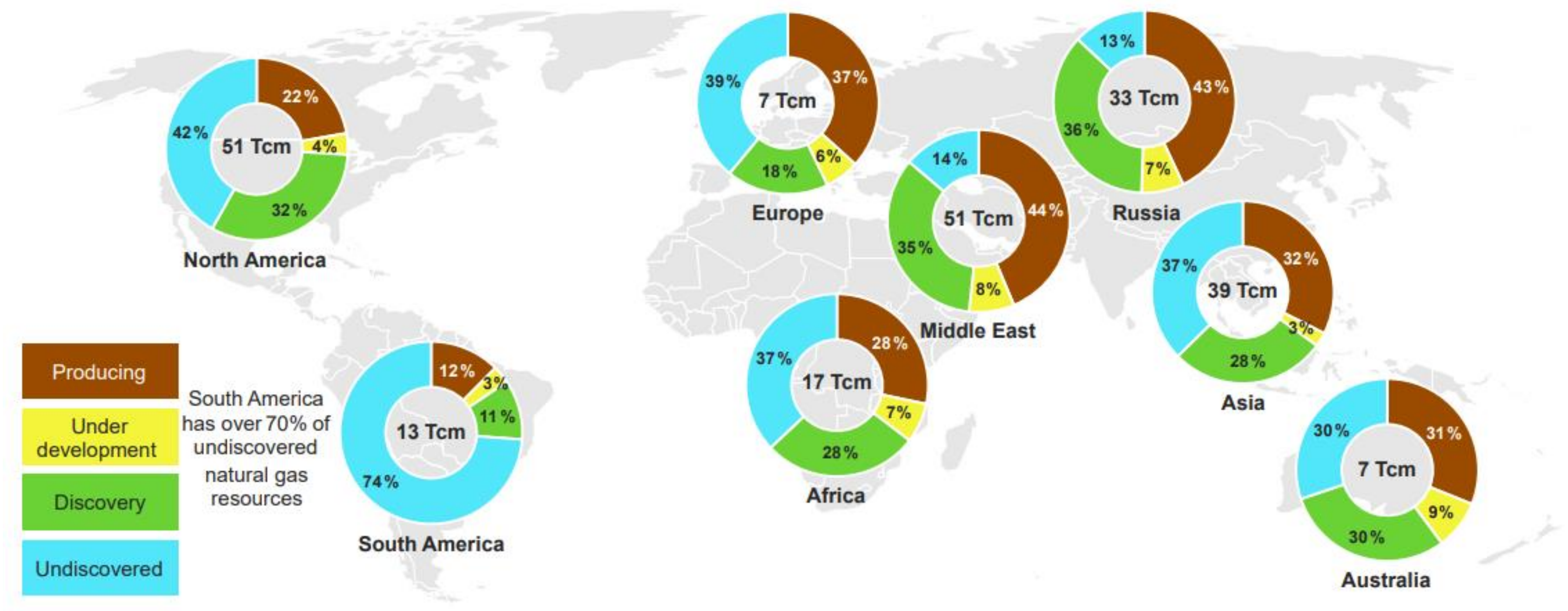
Existing gas production by regions



Source: Rystad Energy

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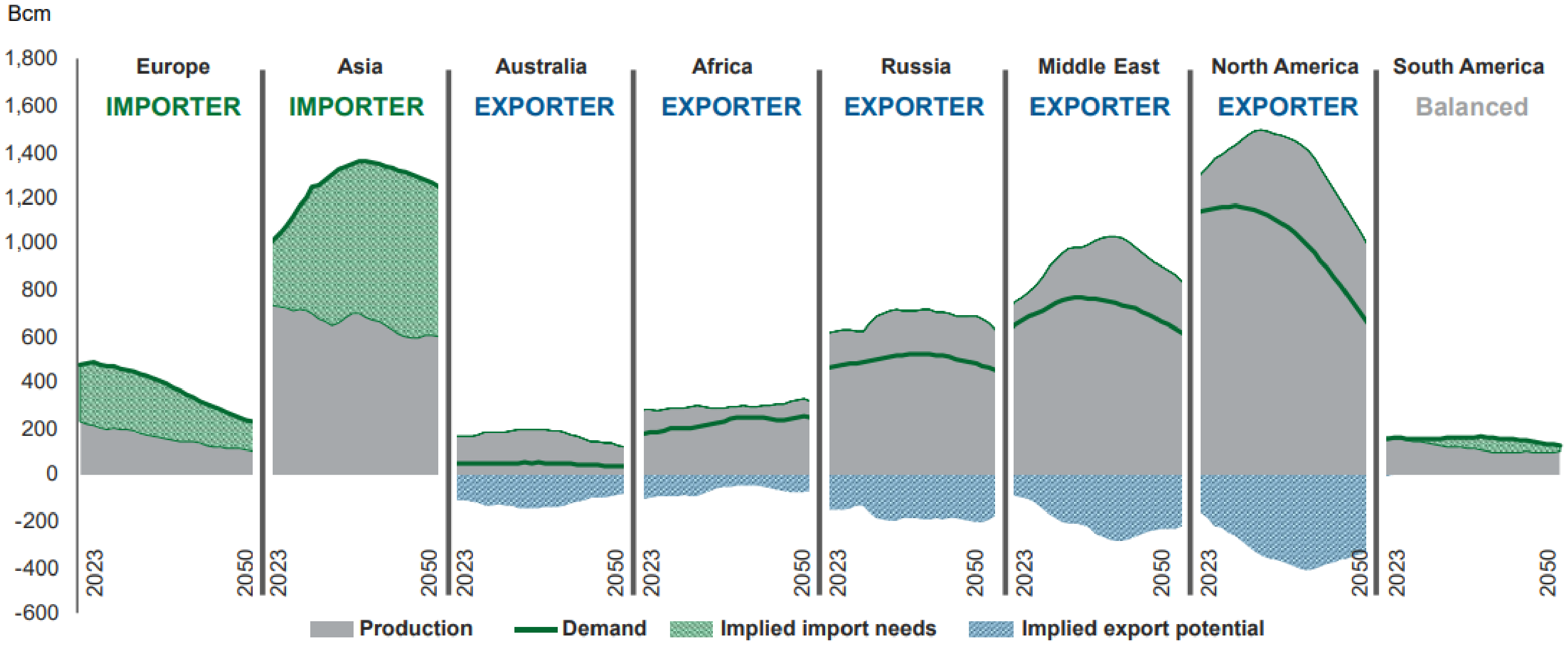
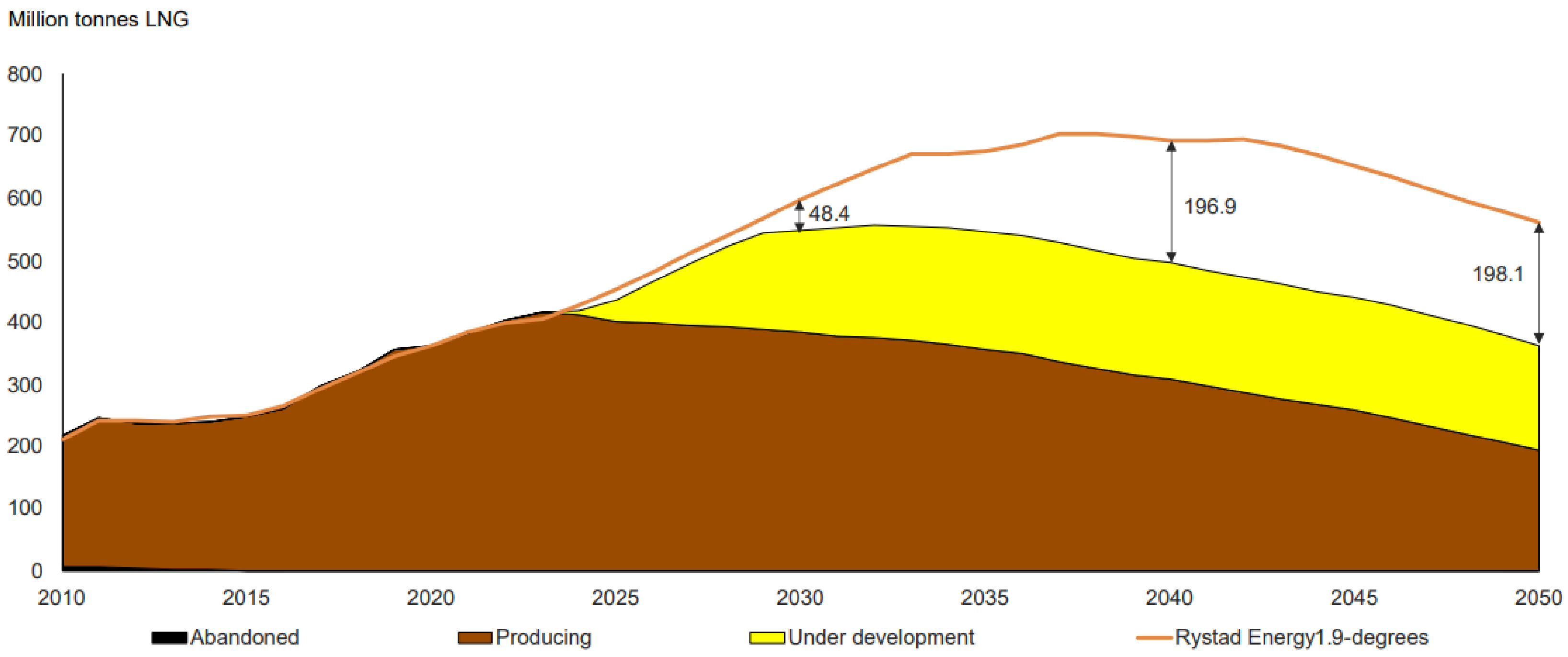
Gas production and import/export volumes



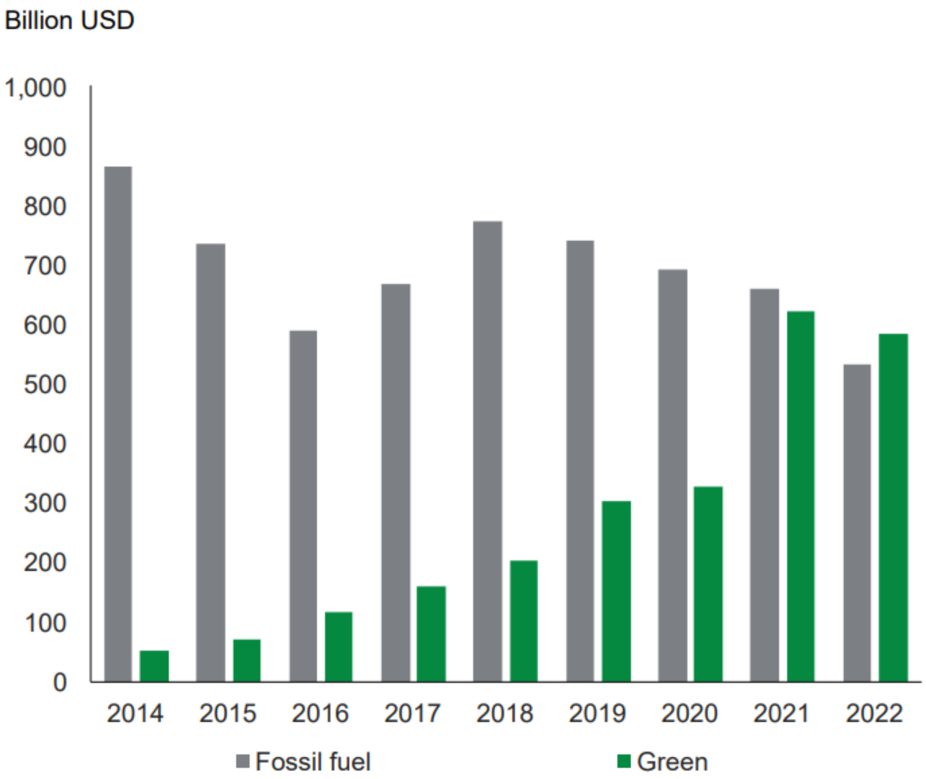
Source: Rystad Energy

Potential LNG import scenario against operational and approved production (2010 – 2050)



Source: Rystad Energy

Green debt issuance against fossil fuel debt issuance



Source: Bloomberg League Tables

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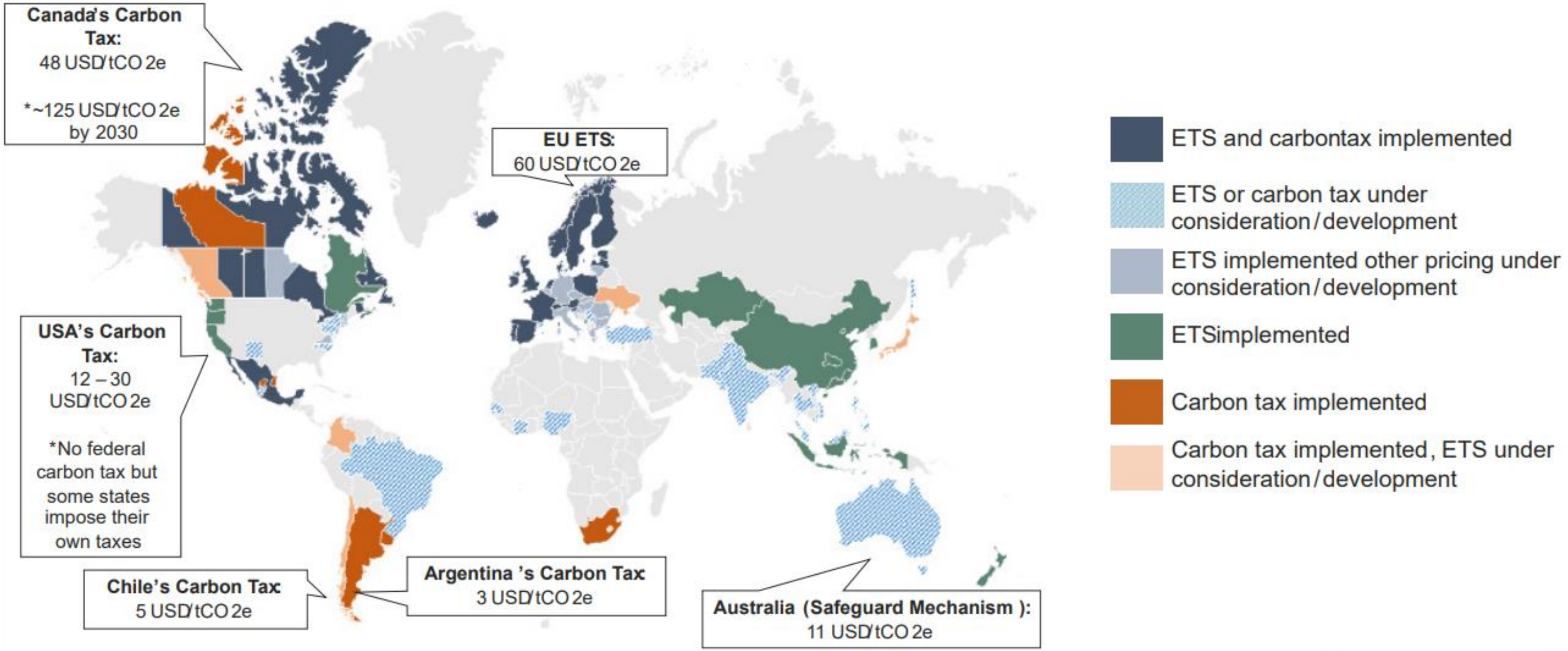
Global carbon pricing map



Source: Rystad Energy; World Bank

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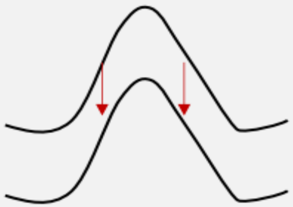
Gas decarbonisation framework

	Power generation	Industry	Buildings
Conservation & efficiency Use less	Demand response	Optimisation of processes and CHP	Insulation
Low carbon gases H_2 Swap and Blend	CH4 Fossil → H_2 Swap some or all natural gas with low carbon gases such as hydrogen or biomethane		
Low carbon electrons Swap	Renewable power generation	Electrification of processes	Electrification
Carbon capture CCS Clean	CCS CCS in power	CCS CCS of industrial emissions	Limited technological feasibility

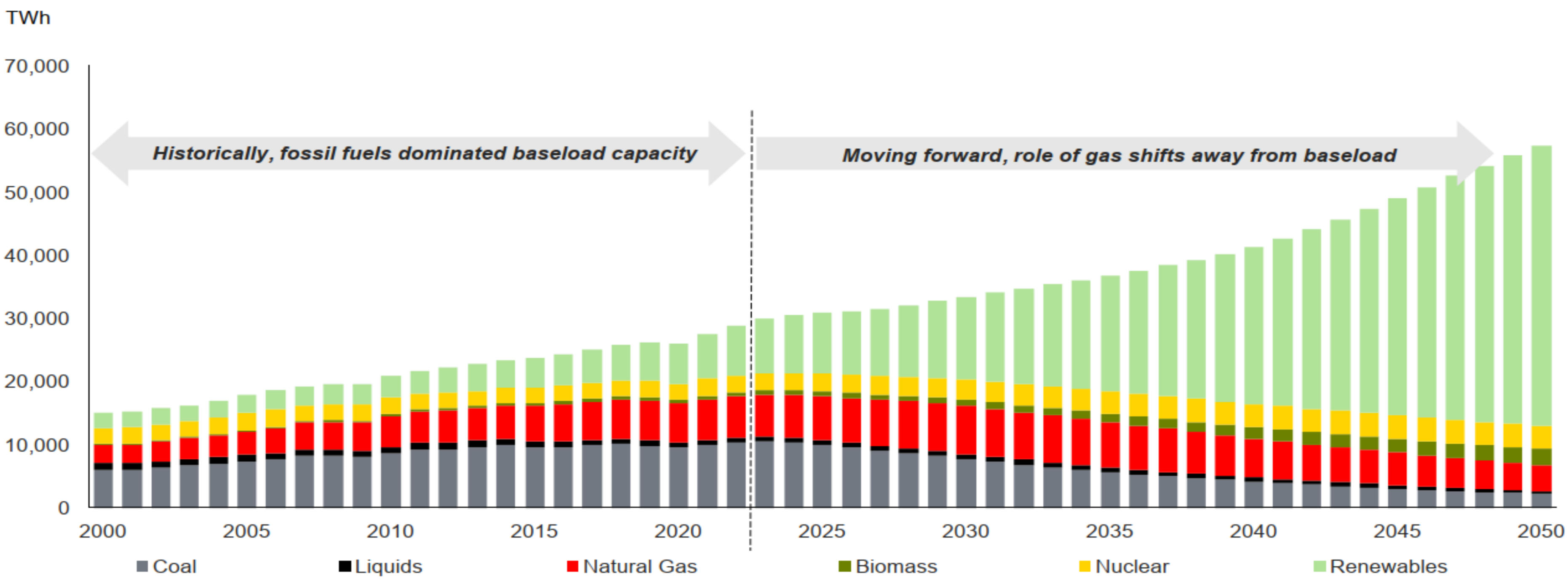
Source: Rystad Energy

Energy conservation demand management measures

Demand measure	Aim	Impact on peak demand	Impact on energy demand
 • **Energy efficient appliances** • **Cogeneration/ CHP** • **Demand response**	Reduce the overall energy demand	*Decrease*	*Decrease*
 • **Demand response** • **Ecosystem integration**	Shift peak demand to off -peak hours (load levelling)	*Decrease*	*Unchanged*

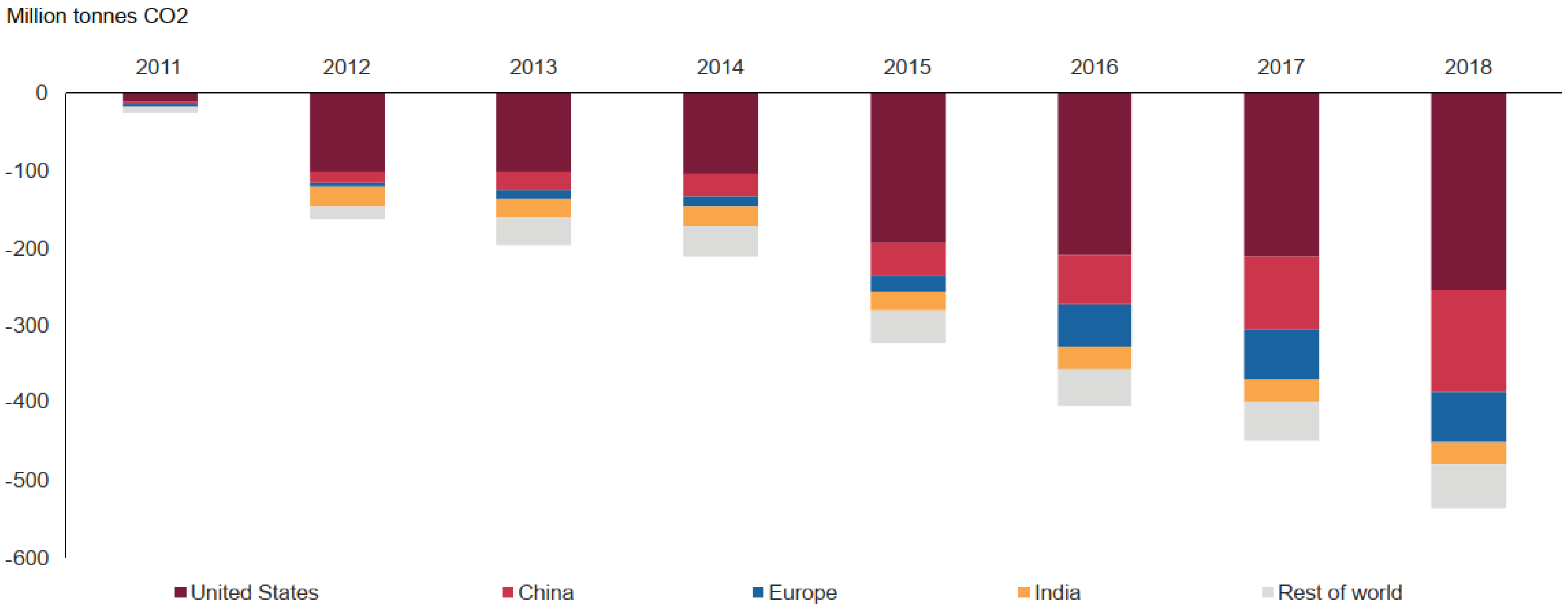
Source: Rystad Energy

Power generation by primary energy sources (1,5° scenario)



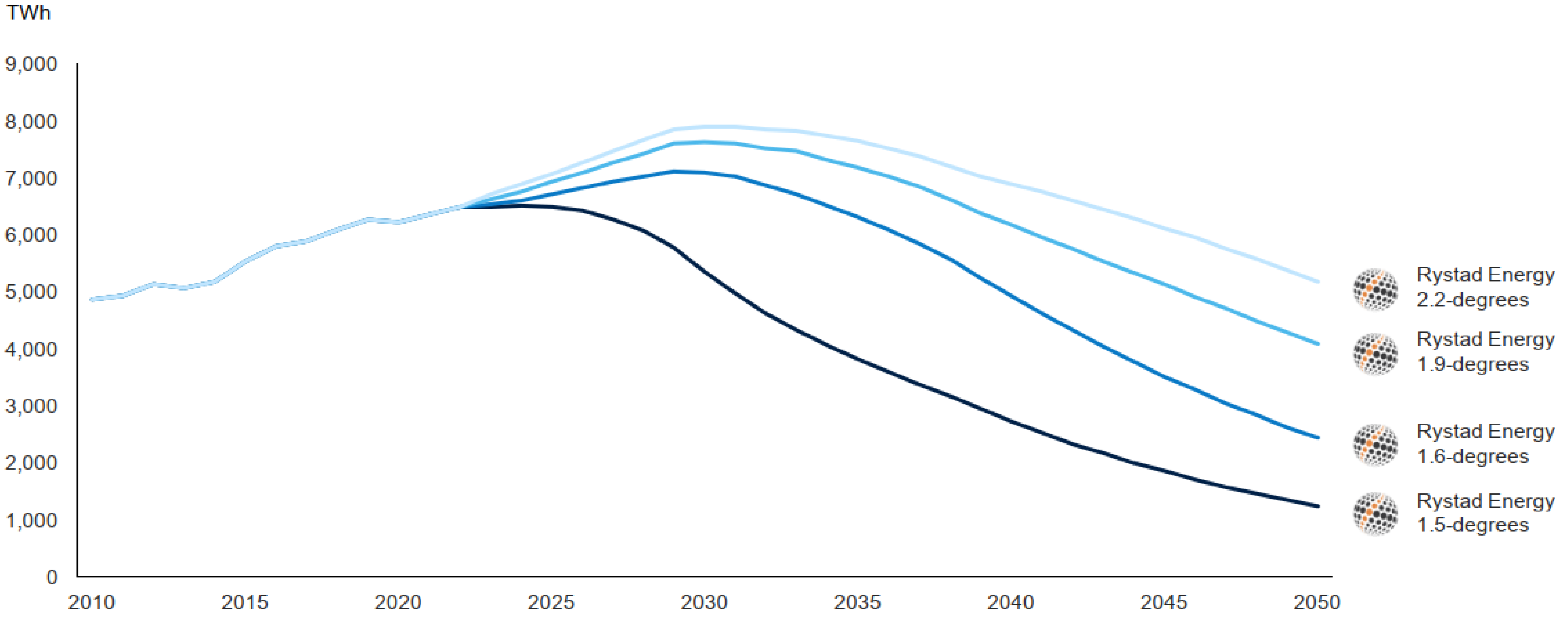
Source: Rystad Energy

CO2 savings from coal-to-gas switching in selected regions compared with 2010



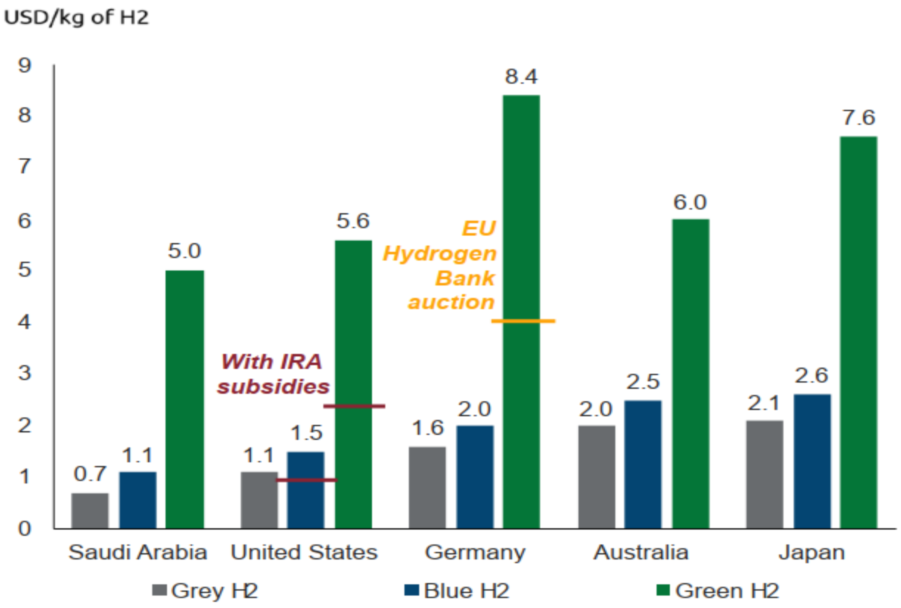
Source: IEA – The Role of Gas in Today's Energy Transitions, 2019

Power generation by natural gas in varying degree-scenarios

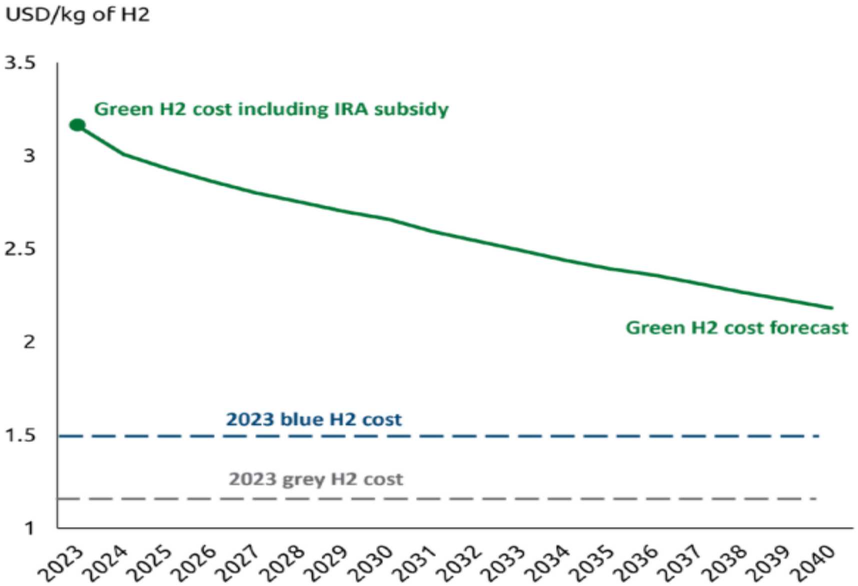


Source: Rystad Energy

Levelised cost of hydrogen[24] for selected countries (2023)[25]



Production cost forecast of green hydrogen in the United States[26]



[24] Grey H2 uses natural gas as feedstock, while blue H2 is the same except that all CO2 emitted is captured. In contrast, green H2 is generated via electrolysis of water.

[25] Results and calculations are based on Rystad Energy assumptions extracted from the Rystad Energy Dynamix cost dashboards, with the capacity factors used ranging from 12% to 30%, CCS costs (transport and storage) being 12 USD/ tonne of CO2, and feedstock costs used ranging from 30 USD/ MWh to 120 USD/MWh.

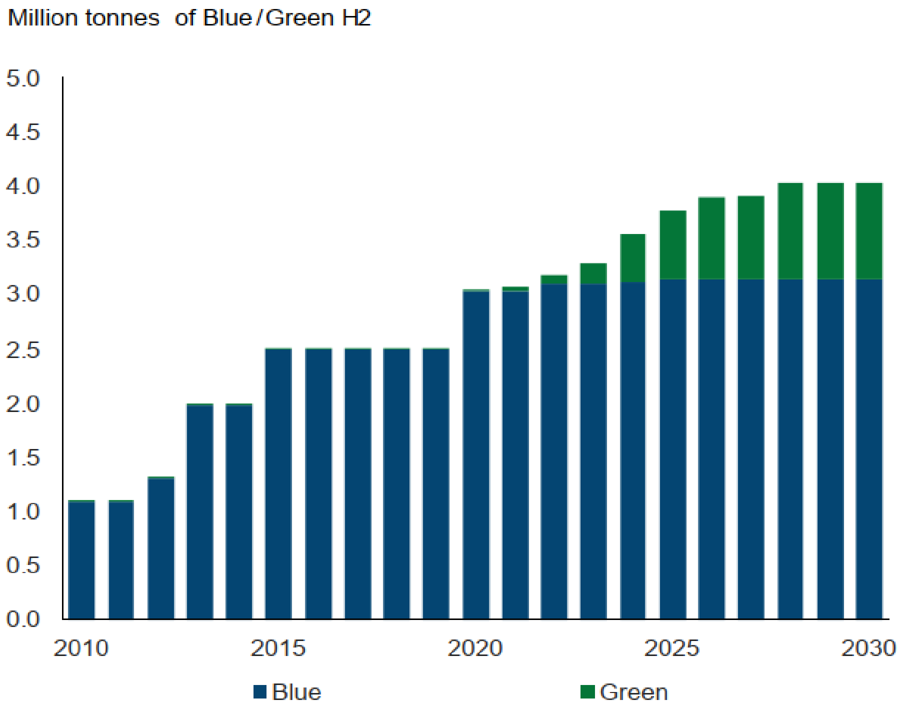
[26] Cost reduction of green H2 is dependent on location of production (i.e., renewable conditions and relevant renewable power source), size of plant and technology and cost development of electrolyser. Lower prices can be achieved in favourable markets. The Henry Hub 2022 average natural gas price was approximately 22 USD per MWh, compared to the green hydrogen price at 95 USD per MWh in 2023.

Source: Rystad Energy

DVGW

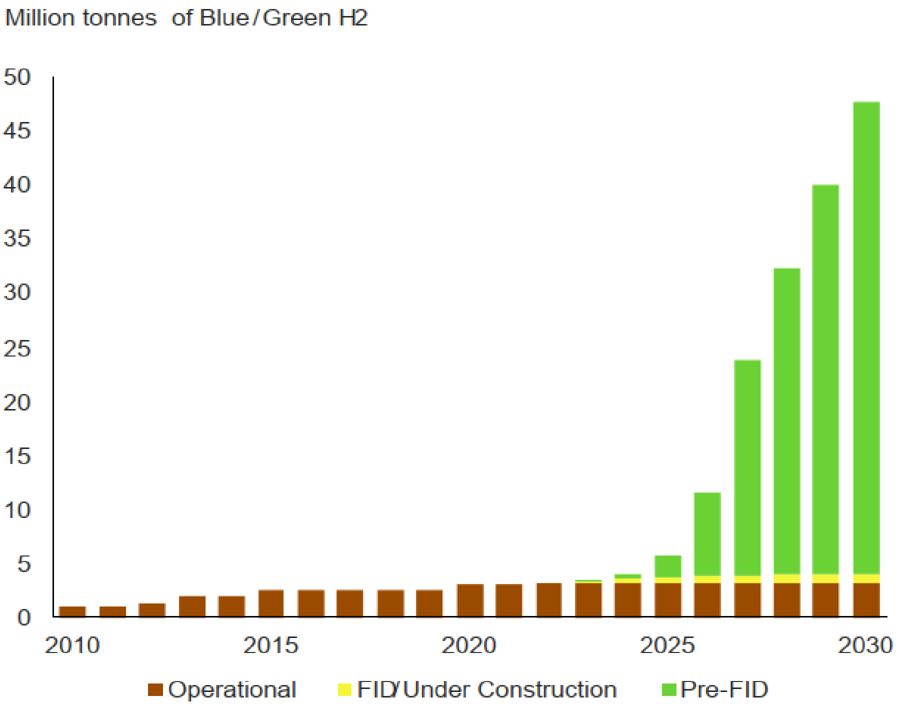
Possibilities with renewable and low carbon gases

Clean hydrogen cumulative capacity post-FID projects only (2010 – 2030)



Source: Rystad Energy

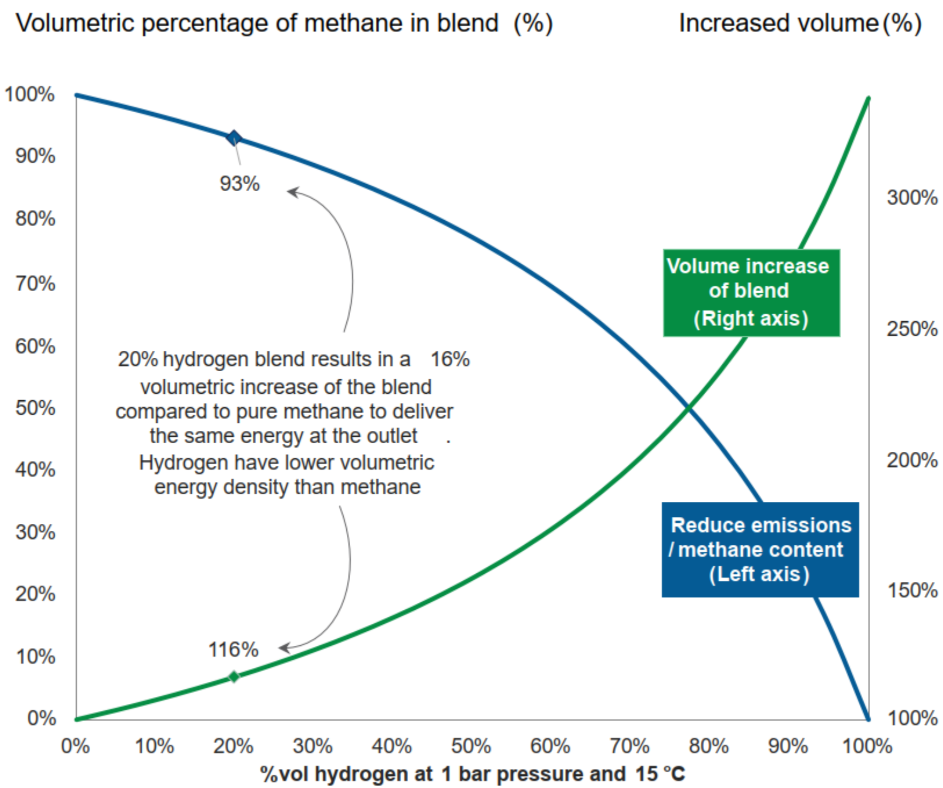
Clean hydrogen cumulative capacity by status, including pre-FID projects (2010-2030)



Source: Rystad Energy

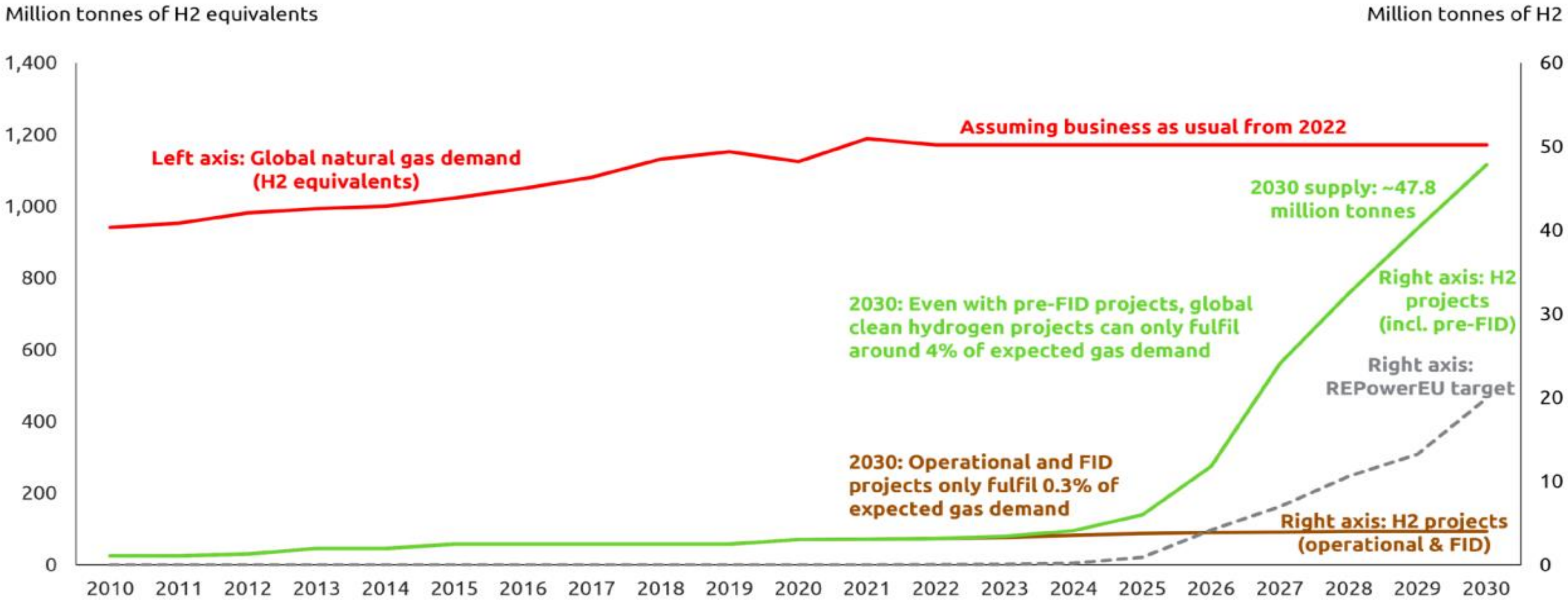
DVGW

Volumetric methane content and corresponding volume of blended substance



Source: Rystad Energy

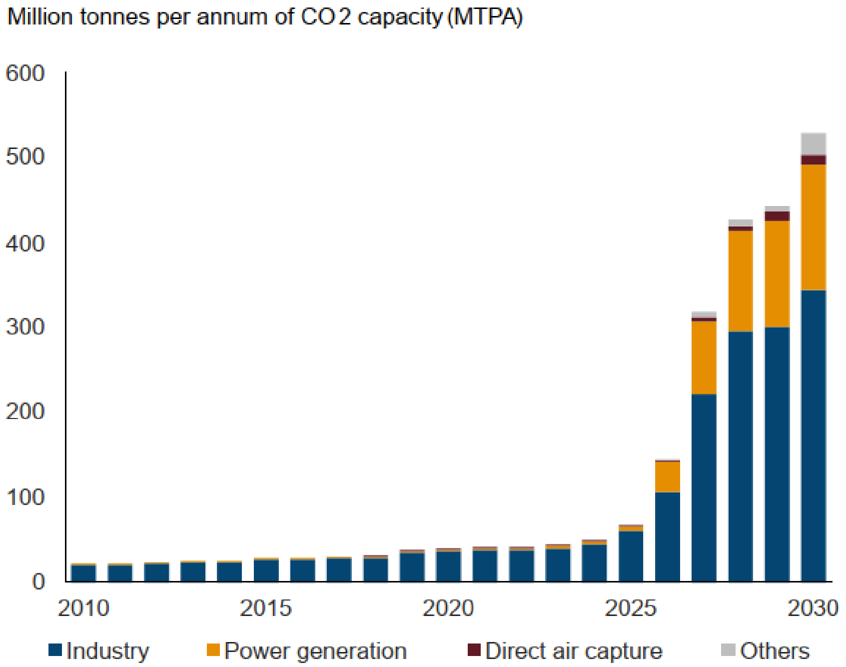
Cumulative blue and green hydrogen capacity (right axis) against gas demand expressed in hydrogen equivalent (left axis)



Source: Rystad Energy

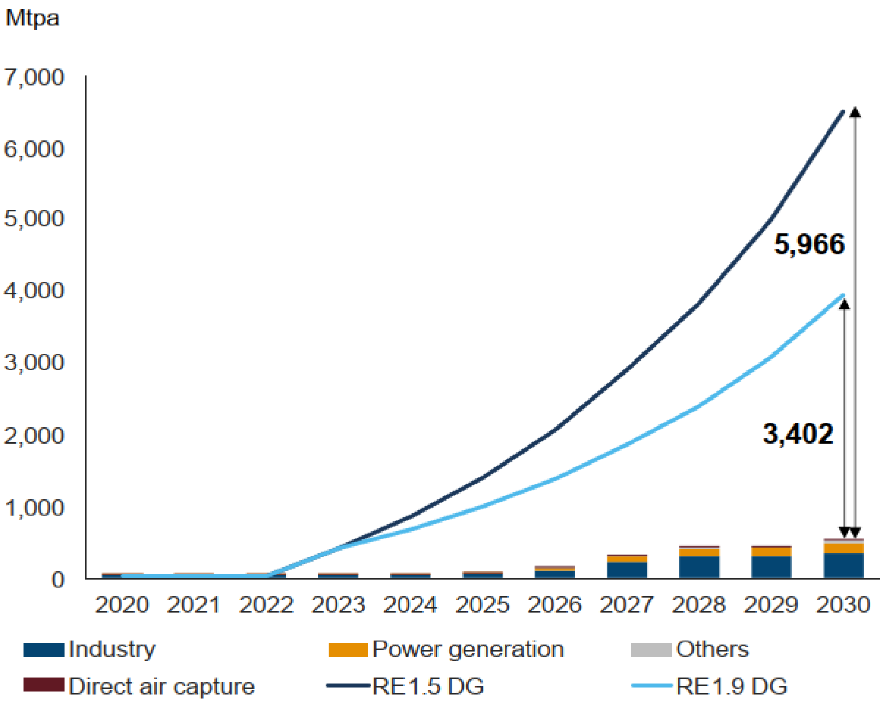
Contributions from CCUS

CCUS capture projects pipeline (operational, FID, pre-FID)



Source: Rystad Energy

CCUS capture projects pipeline against expected CCUS capacity across various scenarios



Source: Rystad Energy

DVGW

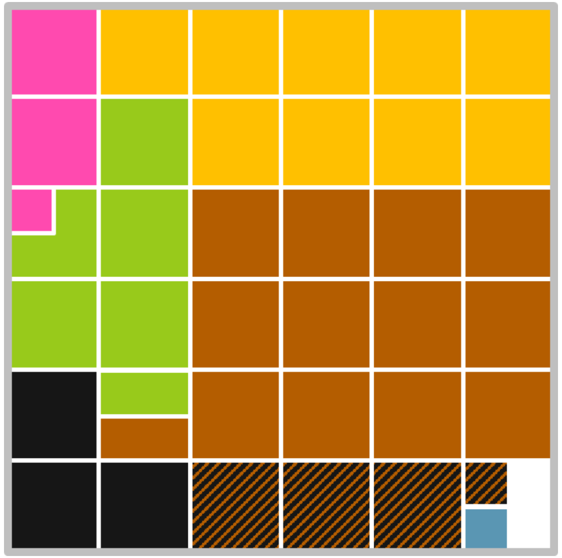
Prominent industry initiatives in reducing methane emissions

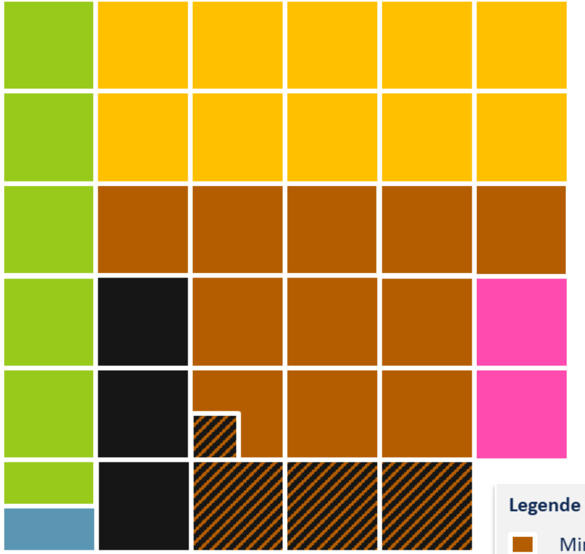
Initiatives	Description	Targets		Members
Global Methane Pledge	A global effort to reduce methane emissions, launched at COP 26.	30%	To cut global methane emissions by at least 30% by 2030, using a 2020 baseline.	Australia, France, Saudi Arabia, USA, and 146 other countries.
OGCI Oil and Gas Climate Initiative	A CEO-led initiative from 12 energy companies focused on CCUS, methane emissions reductions, and tackling transport emissions.	45%	Leading the oil and gas industry's response to climate change and speeding up action towards net zero emissions, in accordance to the Paris Agreement, which calls for a reduction in emissions by 45% by 2030.	Aramco, BP, Chevron, CNPC, and 8 other companies.
OGMP Oil And Gas Methane Partnership 2.0	A flagship oil and gas reporting and mitigation programme for methane emissions.	60%	Helping oil and gas companies understand their methane emission profiles through five different levels of reporting and subsequently mitigate these emissions in a cost-effective way, focusing on the most material sources. To achieve 60% - 75% reductions in methane emissions by 2030.	2i Rete Gas, Abu Dhabi National Oil Company, Adrigas SpA, Aker BP, and 101 other companies.
Methane Guiding Principles	A partnership between industry and government to develop guidance in methane emissions reporting and reduction.	No specific targets announced.	To 1) continually reduce methane emissions, 2) advance strong performance across the gas supply chain, 3) improve accuracy of methane emissions data, 4) advocate sound policy and regulations on methane emissions, and 5) increase transparency.	Apa, Baker Hughes, Beijing Gas, BP, and 23 other signatories.
CLEAN	The only initiative specifically seeking to decrease methane emissions in the LNG value chain, created by the world's largest LNG buyers.	No specific targets announced.	The "Coalition for LNG Emission Abatement toward Net-zero" (CLEAN), recognizes LNG as a transition fuel and aims to increase the visibility of methane emissions with LNG suppliers, and develop and share best practices to reduce emissions.	Kogas and Jera, with the suppport of the governments of Japan, USA, Korea, Australia, and EU.

Source: Global Methane Pledge; Oil and Gas Climate Initiative; Oil and Gas Methane Partnership 2.0; Methane Guiding Principles; Jera; Kogas

Teil 2 - Erdgasproduktion & Handel

Zusammensetzung des Primärenergiebedarfs 2019 und 2021





Unsere deutsche Primärenergie:

3.500 TWh

Daten der AGEB für 2021
1 Kachel = 100 TWh
Rundung auf ±25 TWh

Legende

Mineralöl	1077
Erdgas	1003 *
Erneuerbare	545
Braunkohle	315
Steinkohle	291
Kernenergie	210
Andere	44

* Korrektur der Zwischenberichtsdaten

Quelle: DVGW 2022

Natural gas consumption in Germany 2021

- Das Netz versorgt 1,8 Millionen Industrieabnehmer, Gewerbe und Dienstleistungsunternehmen, lokale Kraftwerke und etwa 20 Millionen Wärmekunden

- es ist 500.000 km lang
- hat einen Wiederbeschaffungswert von 270 Mrd. Euro
- ist die unsichtbare Infrastruktur, die ohne Baustellen in den Ballungszentren den neuen Energieträger liefert

Terrawattstunden Energie aus dem Gasnetz

Quelle BDEW & EKS 2022

Direkte physikalische Gasflüsse nach Deutschland nach Staaten 2022 (bdew/FNB)

aus dem Ausland nach Deutschland über GÜP in Mrd. kWh (einschl. sämtlicher Transitmengen)	**Jan 2022**	**Feb 2022**	**Mrz 2022**	**Apr 2022**	**Mai 2022**	**Jun 2022**	**Jul 2022**	**Aug 2022**	**Sep 2022**	**Okt 2022**	**Nov 2022**	**Dez 2022**	**Jahr 2022**
Russland	50,8	48,3	52,1	52,6	54,2	32,9	13,0	10,3	0,0	0,0	0,0	0,0	**314**
Polen	0,0	0,2	2,6	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	**3**
Tschechien	20,0	18,1	20,1	19,9	16,2	12,1	4,4	4,2	1,8	0,0	0,0	0,1	**117**
Österreich	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,0	1,4	2,1	**4**
Schweiz	0,1	0,0	0,8	0,5	0,7	0,9	0,0	0,9	3,2	2,7	3,5	3,5	**17**
Belgien	10,8	14,4	16,4	23,9	23,3	23,9	25,5	25,5	24,2	26,0	21,8	21,9	**258**
Niederlande	21,0	17,2	18,3	19,4	14,8	15,0	20,8	19,2	21,4	29,3	28,8	27,2	**253**
Norwegen	40,8	36,9	38,5	41,2	35,0	34,2	40,9	42,7	37,3	46,6	42,9	40,9	**478**
Frankreich	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,4	1,8	0,6	**4**
Direkte LNG-Importe**	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,9	**1**

*** Erläuterungen hierzu auf Folie 3**

**** via deutsche Terminals und FSRU**

Quelle: FNB

Summenbildung für Deutschland insgesamt aufgrund von möglichen Ringflüssen nicht sinnvoll.

Direkte physikalische Gasflüsse nach Deutschland nach Staaten 2023 (bdew/FNB)

aus dem Ausland nach Deutschland über GÜP in Mrd. kWh (einschl. sämtlicher Transitmengen)	Jan 2023	Feb 2023	Mrz 2023	Apr 2023	Mai 2023	Jun 2023	Jul 2023	Aug 2023	Sep 2023	Okt 2023	Nov 2023	Dez 2023	Jahr 2023
Russland	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0			**0,0**
Polen	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0			**0,0**
Tschechien	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0			**0,0**
Österreich	0,0	0,0	0,1	0,0	0,0	0,0	0,0	0,0	0,3	0,4			**0,9**
Schweiz	0,0	0,1	0,3	0,2	0,1	0,0	0,0	0,7	0,3	0,2			**1,9**
Belgien	21,4	20,0	20,7	23,6	24,4	13,8	14,8	10,9	8,9	12,9			**171,4**
Niederlande	29,4	23,8	24,2	24,4	22,9	16,2	16,2	18,3	14,1	13,2			**202,6**
Norwegen	39,0	36,4	38,7	37,9	37,6	33,8	35,8	33,6	21,8	26,6			**341,0**
Frankreich	1,7	2,2	0,3	0,1	0,8	0,2	0,1	0,0	0,4	0,3			**6,1**
Direkte LNG-Importe**	3,6	4,5	4,9	6,9	7,1	6,9	5,4	6,2	5,5	5,3			**56,4**

* Erläuterungen hierzu auf Folie 3

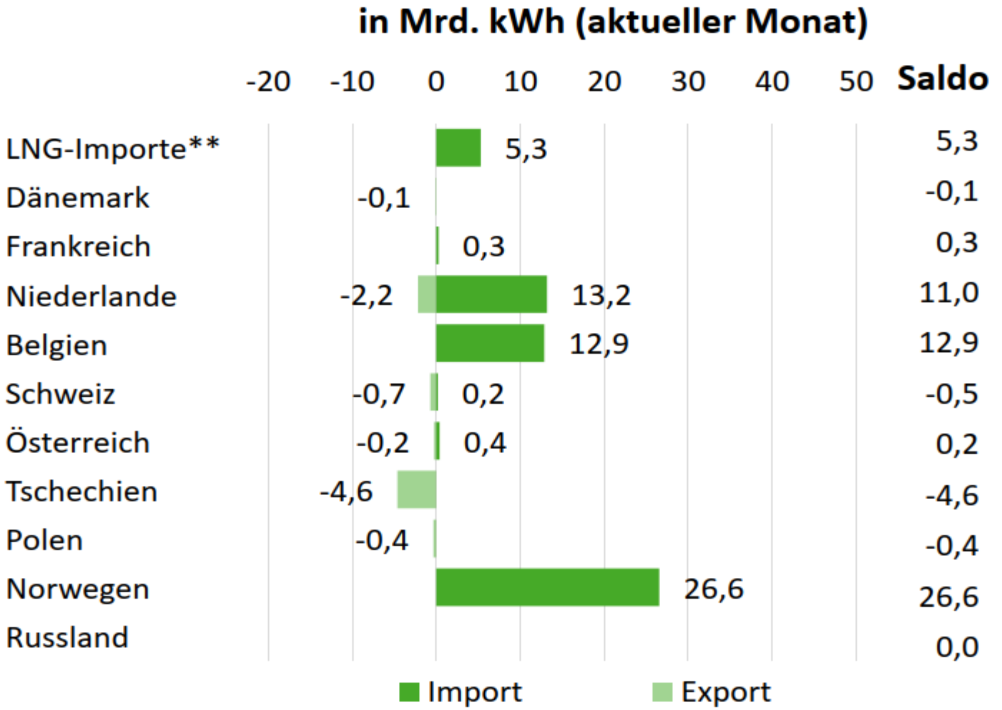
** via deutsche Terminals und FSRU

Quelle: FNB

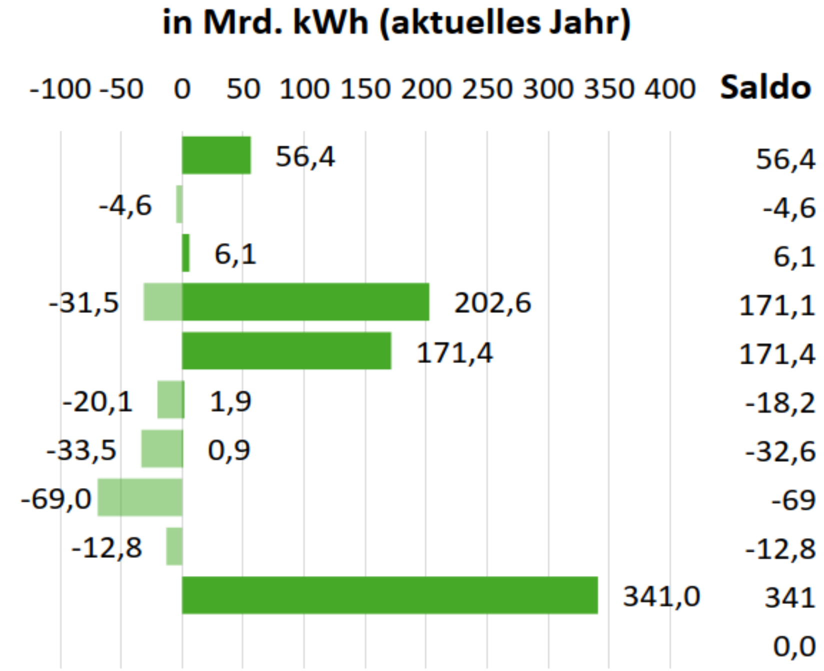
Summenbildung für Deutschland insgesamt aufgrund von möglichen Ringflüssen nicht sinnvoll.

Gasflüsse an Grenzübergabepunkten (bdew/FNB)

Nettoimport aktuelles Jahr: 608,7 Mrd. kWh



Quelle: FNB

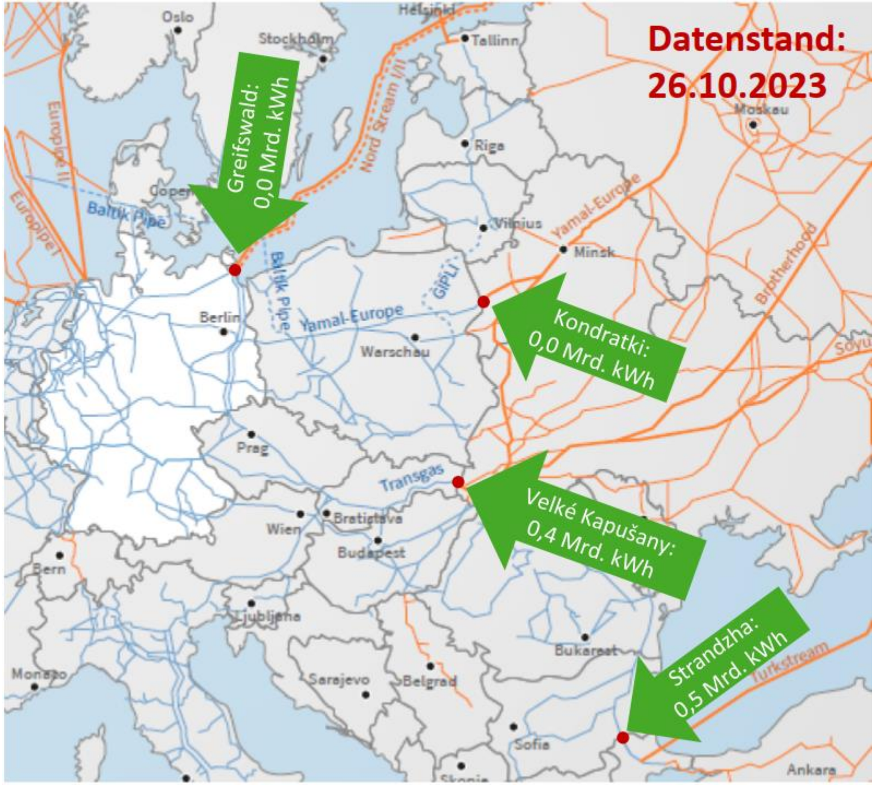


* Erläuterungen hierzu auf Folie 3

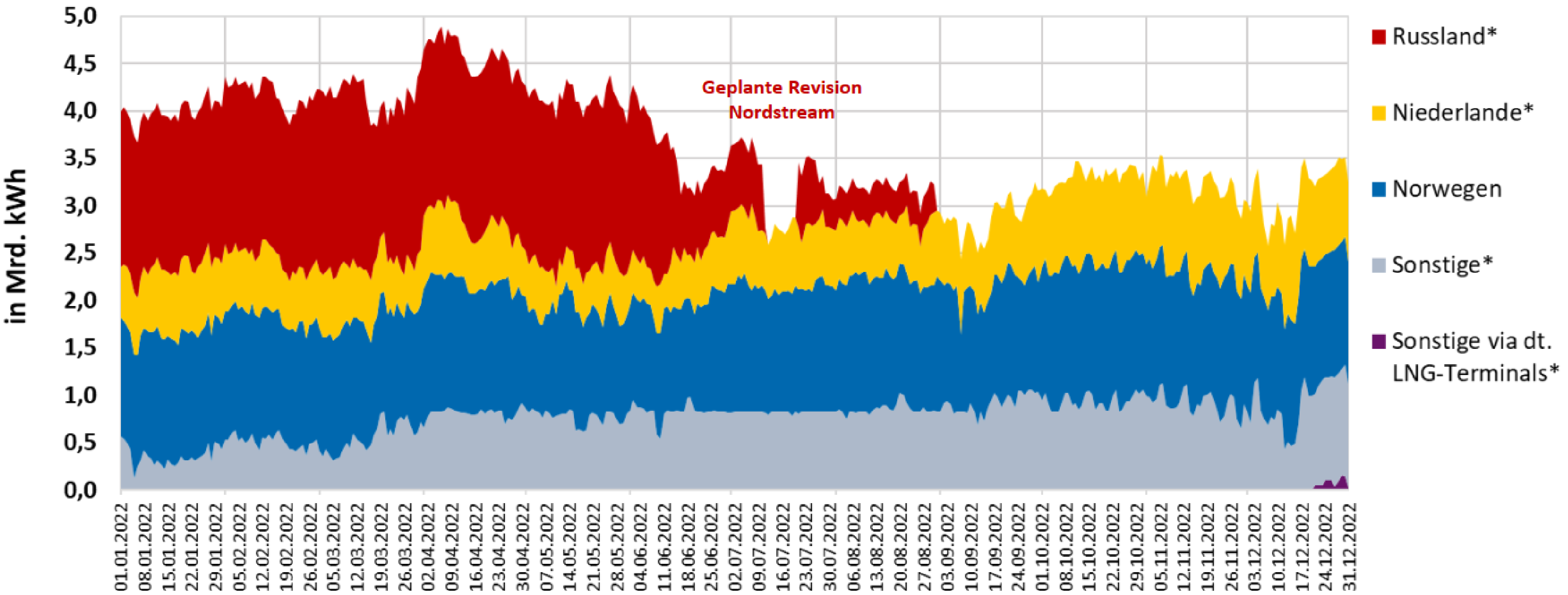
** direkt via deutsche Terminals und FSRU

DVGW

Gasflüsse aus Russland an ausgewählten europäischen Grenzübergangspunkten (Quelle: ENTSOG)

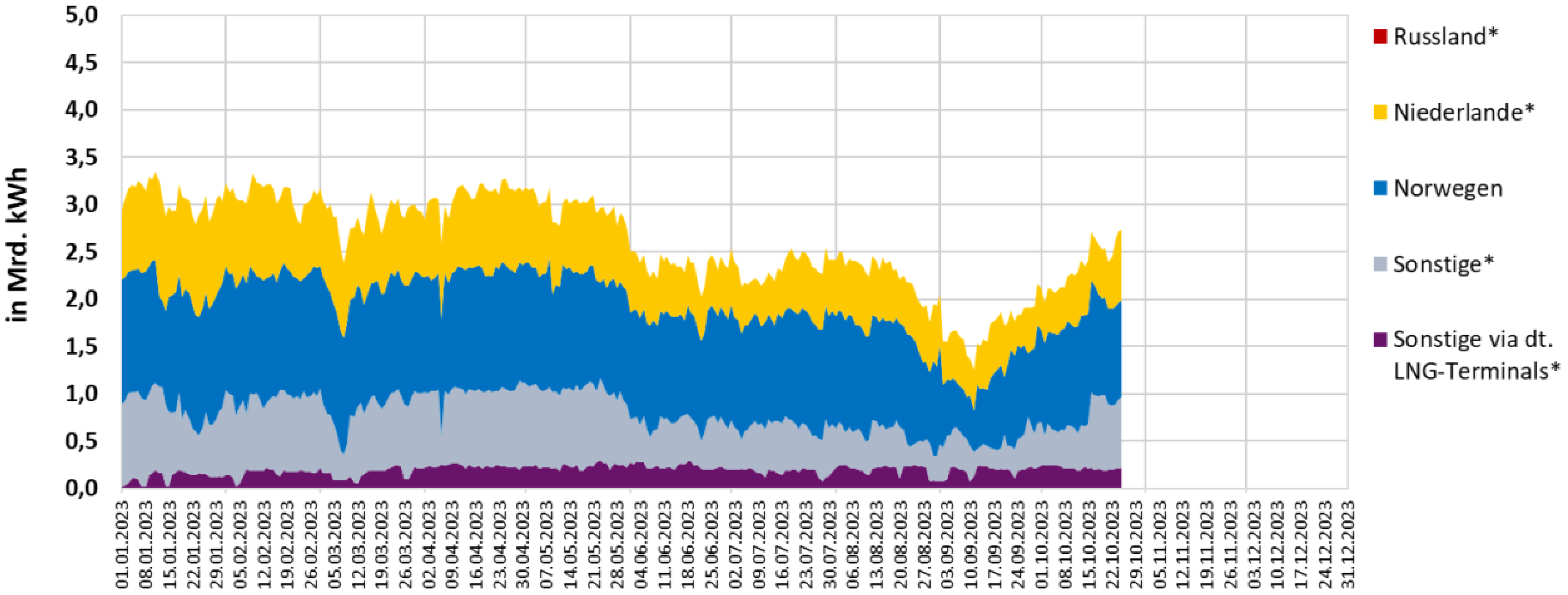


Gasflüsse nach Deutschland nach Herkunft bis 31.12.2022
(Quelle: ENTSOG, FNB)

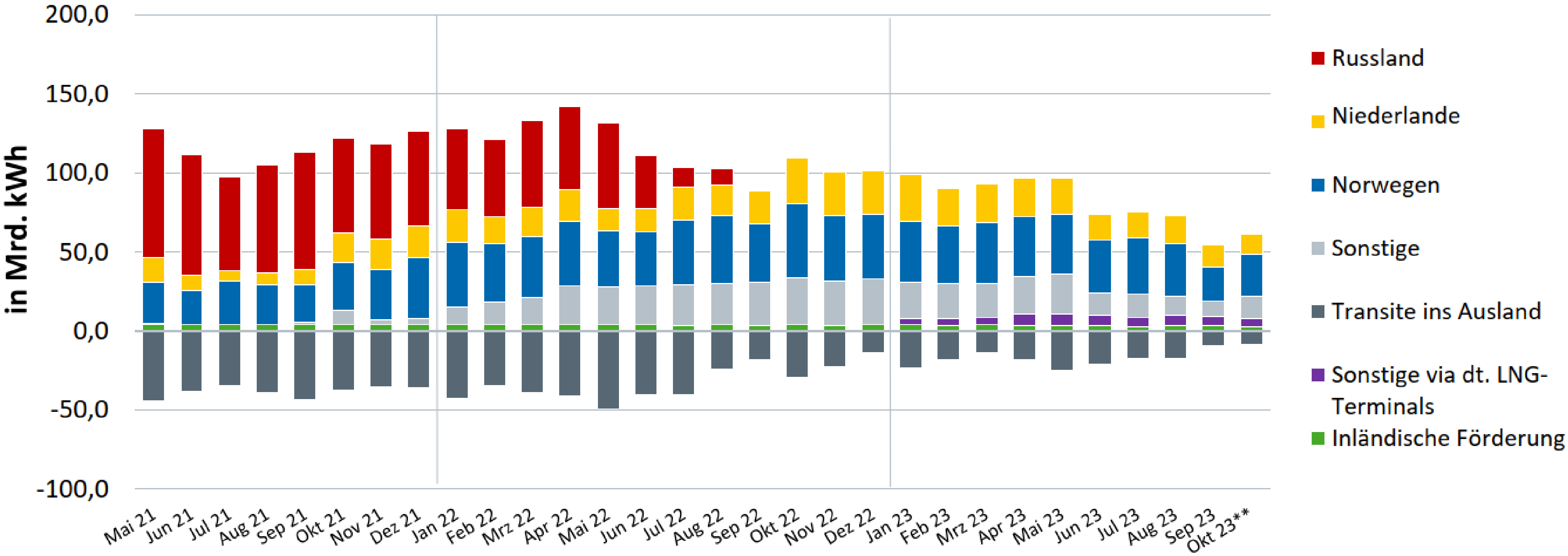


DVGW

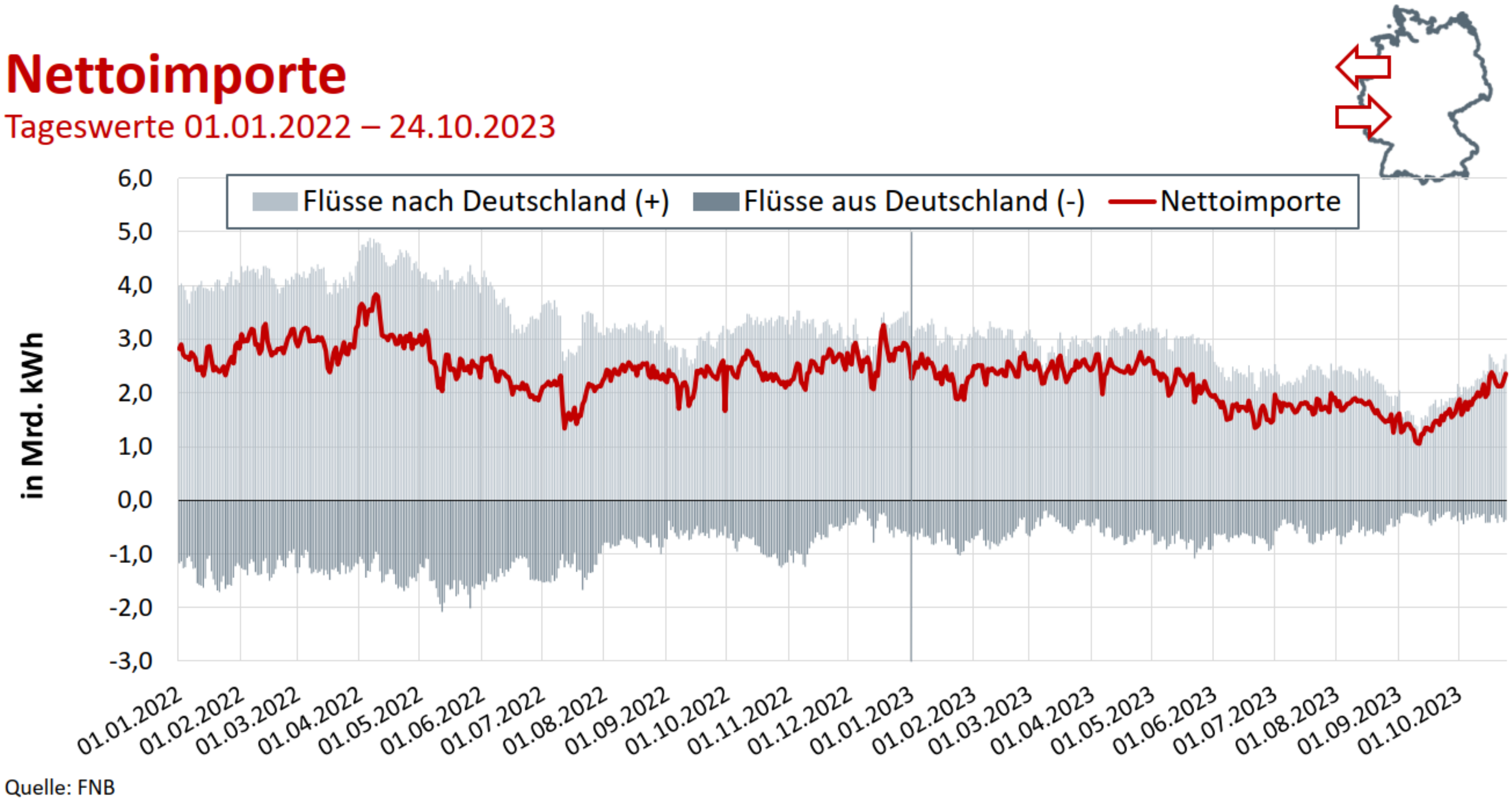
Gasflüsse nach Deutschland nach Herkunft in 2023 bis 25.10.2023
(Quelle: ENTSOG, FNB)



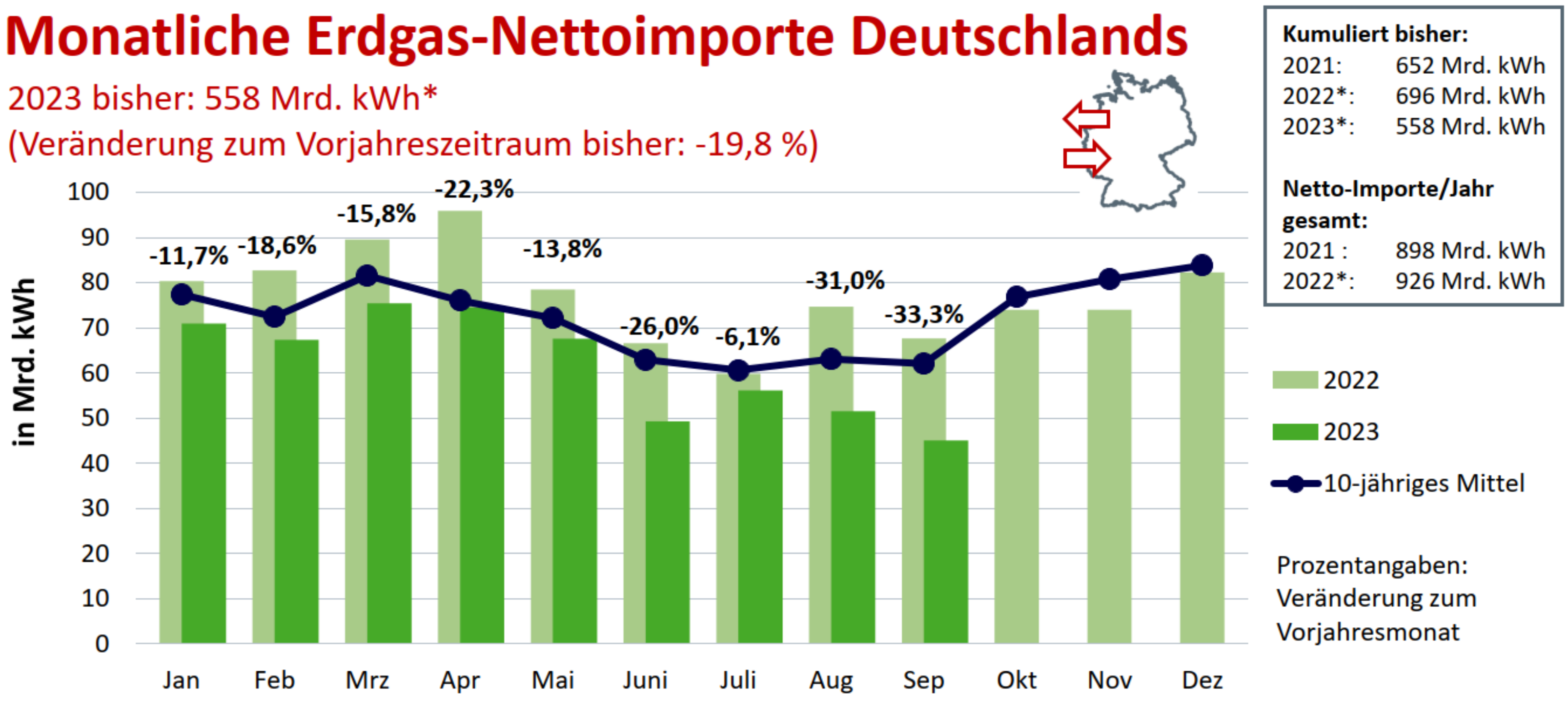
Struktur des Erdgasaufkommens in Deutschland
(Quelle: ENTSOG, FNB, bdew)



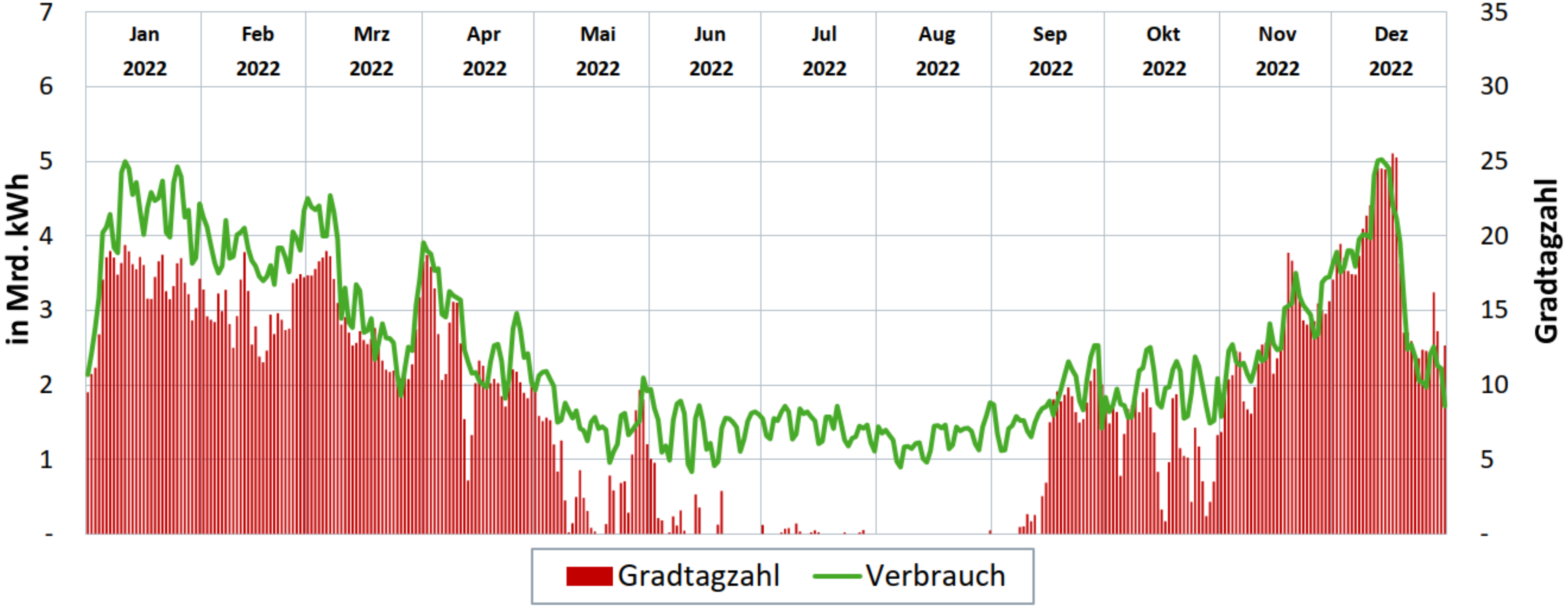
Struktur des Erdgasaufkommens in Deutschland
(Quelle: ENTSOG, FNB, bdew)



Struktur des Erdgasaufkommens in Deutschland
(Quelle: ENTSOG, FNB, bdew)

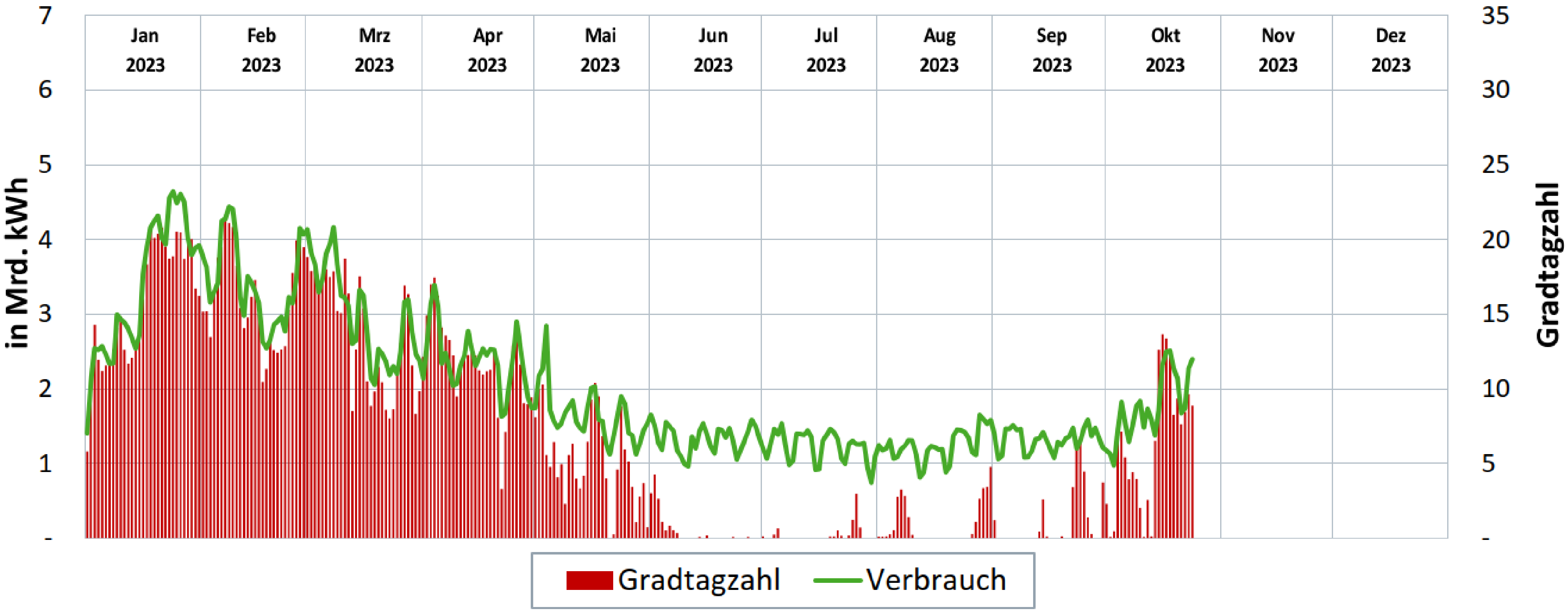


Erdgasverbrauch in Deutschland in 2022
(Quelle: ENTSOG, FNB, bdew)

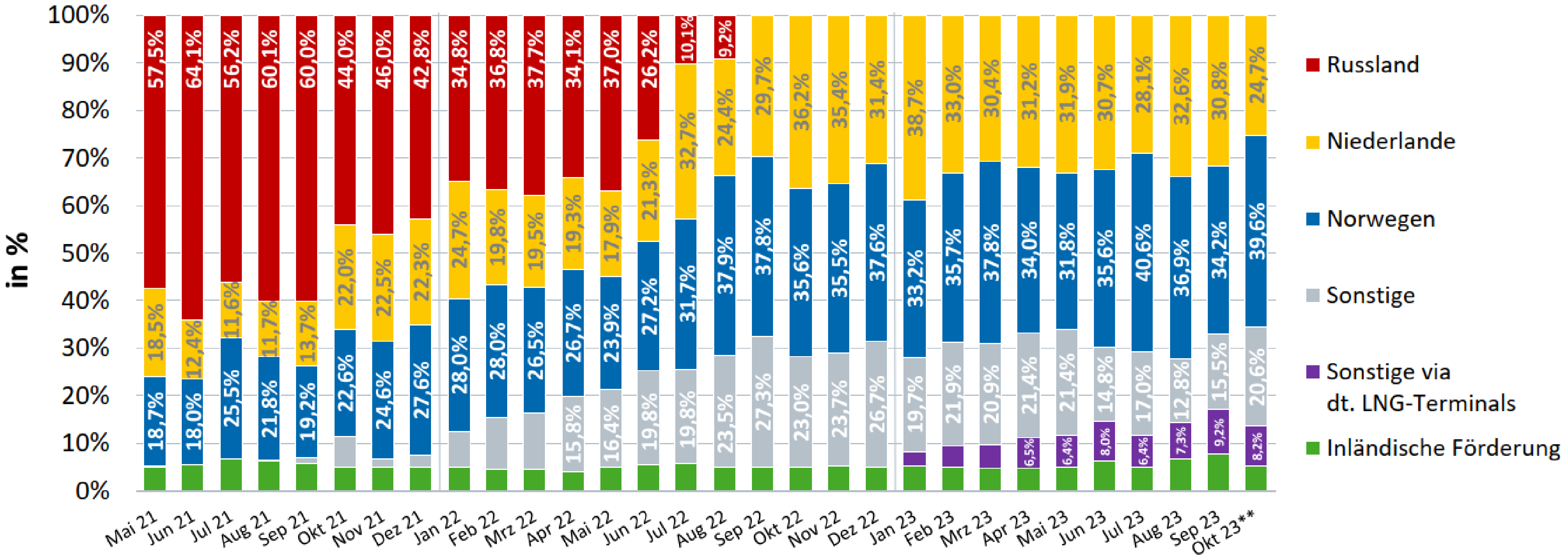


DVGW

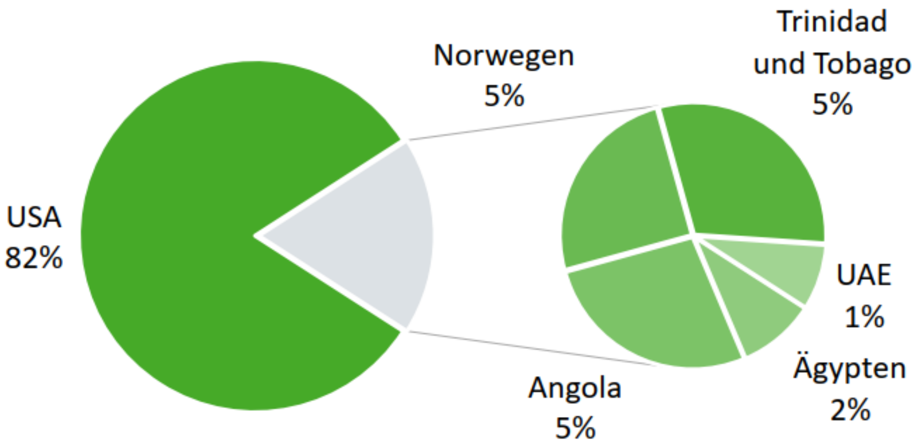
Erdgasverbrauch in Deutschland in 2023 bis 25.10.2023
(Quelle: ENTSOG, FNB, bdew)

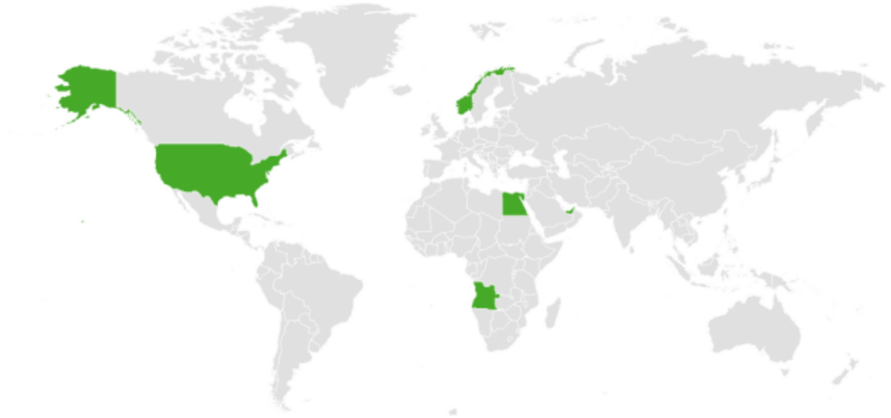


Herkunft des in Deutschland verbrauchten Erdgases
(Quelle: ENTSOG, FNB, bdew)



Verteilung der LNG-Liefermengen nach Herkunftsland 2023
(Quelle: Vesselfinder, bdew, BGR, FNB)





Anlieferung von LNG an deutsche Terminals
(Quelle: Vesselfinder, bdew, BGR, FNB)

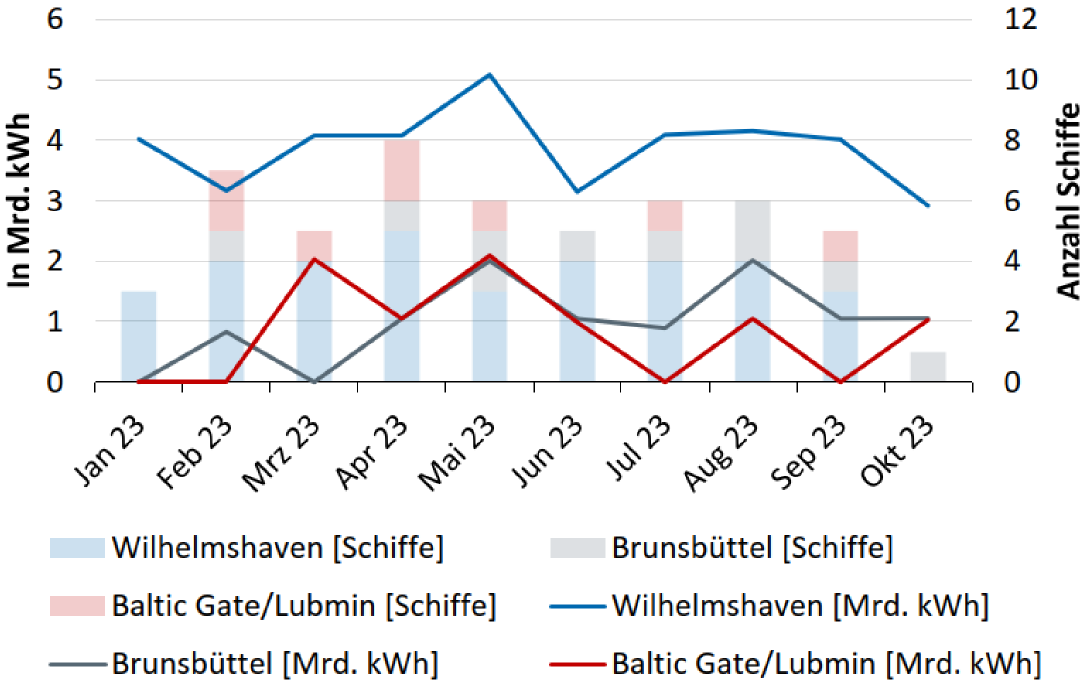
Status:

❶ Wilhelmshaven: Regelbetrieb

❷ Baltic Gate/Lubmin: Regelbetrieb

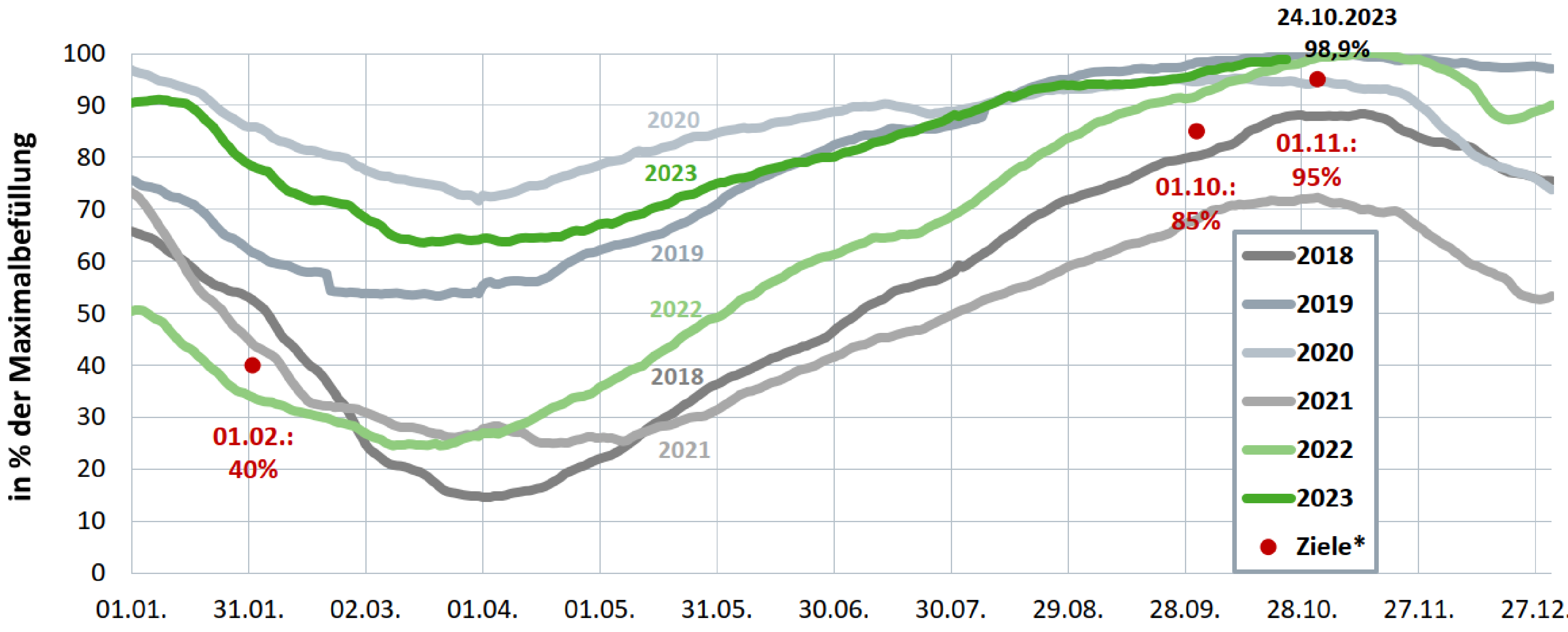
❸ Brunsbüttel: Regelbetrieb

❹ Stade: Ab Ende 2023

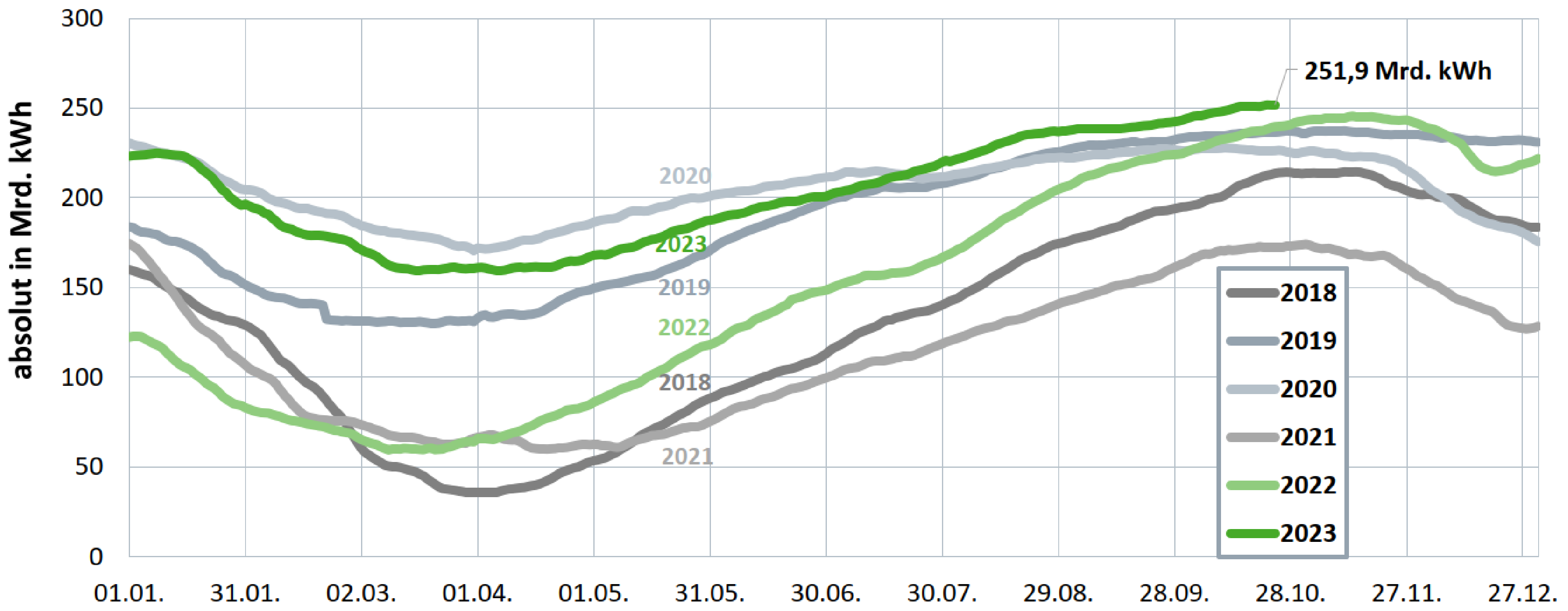


DVGW

Prozentuale Speicherfüllstände Deutschlands
(Quelle: GIE)



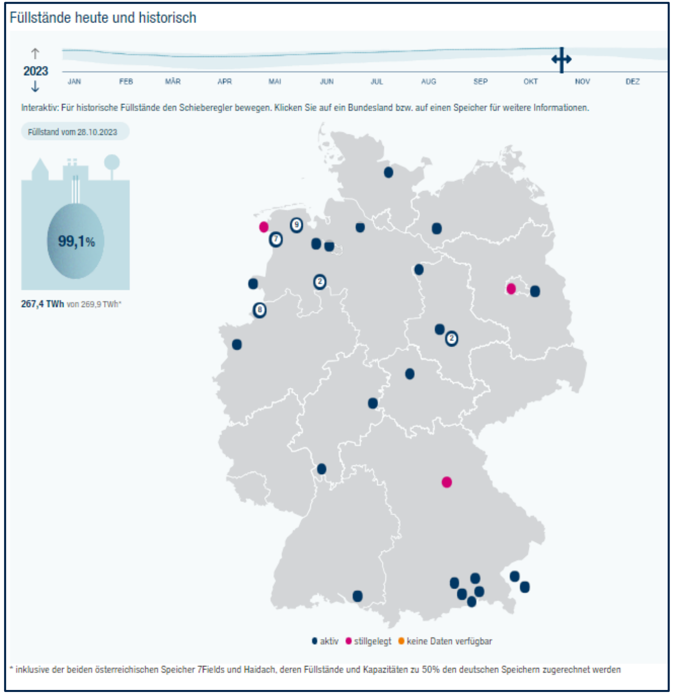
Absolute Speicherfüllstände Deutschlands
(Quelle: GIE)



Informationen zur Versorgungssicherheit und Speicherreichweite im Winter 2023/24

Der DVGW hat eine interaktive, webbasierte Karte zur Visualisierung der Speicherfüllstände
inklusive der beiden österreichischen Speicher 7Fields und Haidach
entwickelt

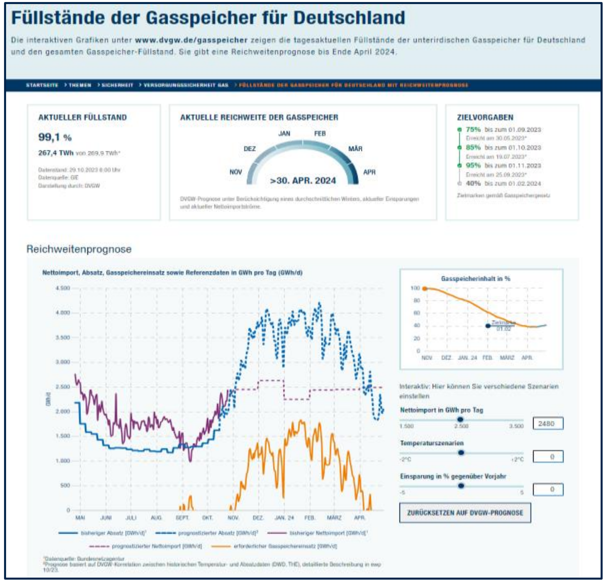
Karte zu den Füllständen der Erdgasspeicher:
https://www.dvgw.de/themen/sicherheit/versorgungssicherheit-gas/fuellstaende-der-gasspeicher-fuer-deutschland-mit-reichweitenprognose#/2023-10-29



Informationen zur Versorgungssicherheit und Speicherreichweite im Winter 2023/24

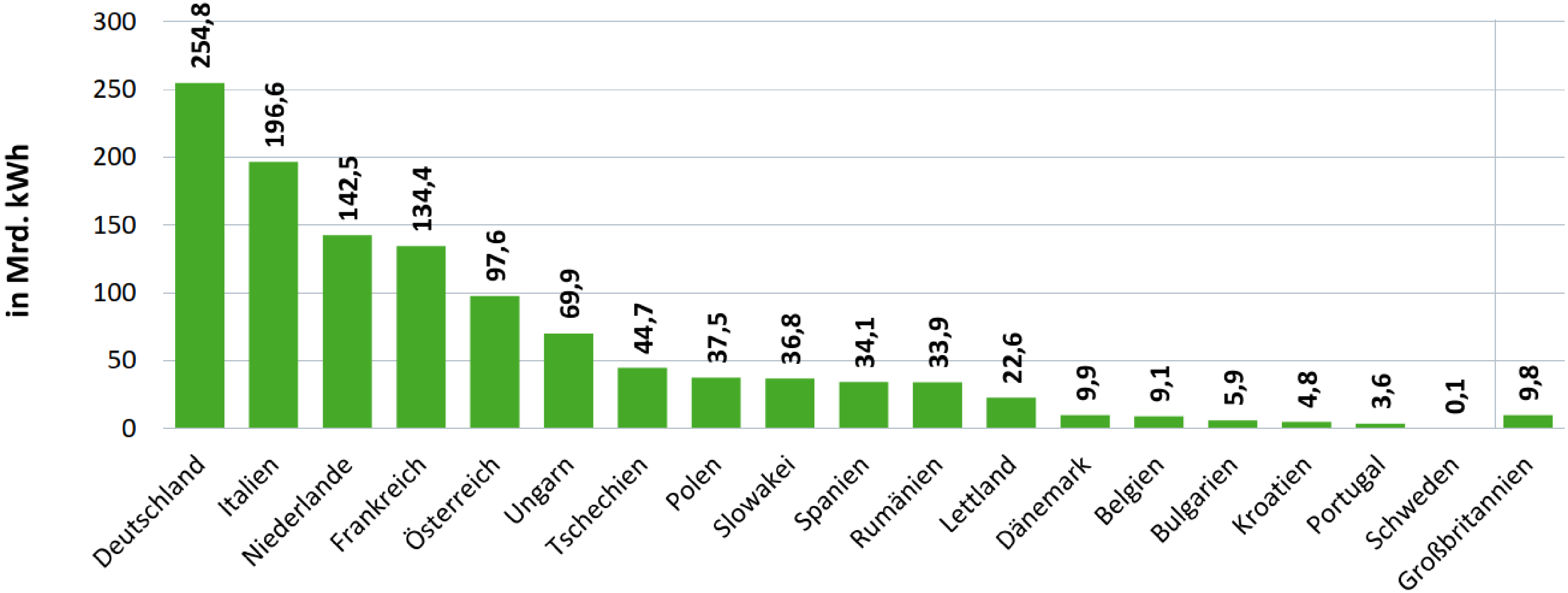
Ergänzt wird diese Darstellung durch eine Speicherreichweiten-berechnung
und eine ausführliche Erläuterung in der ewp

Tool zur Speicherreich-weitenberechnung



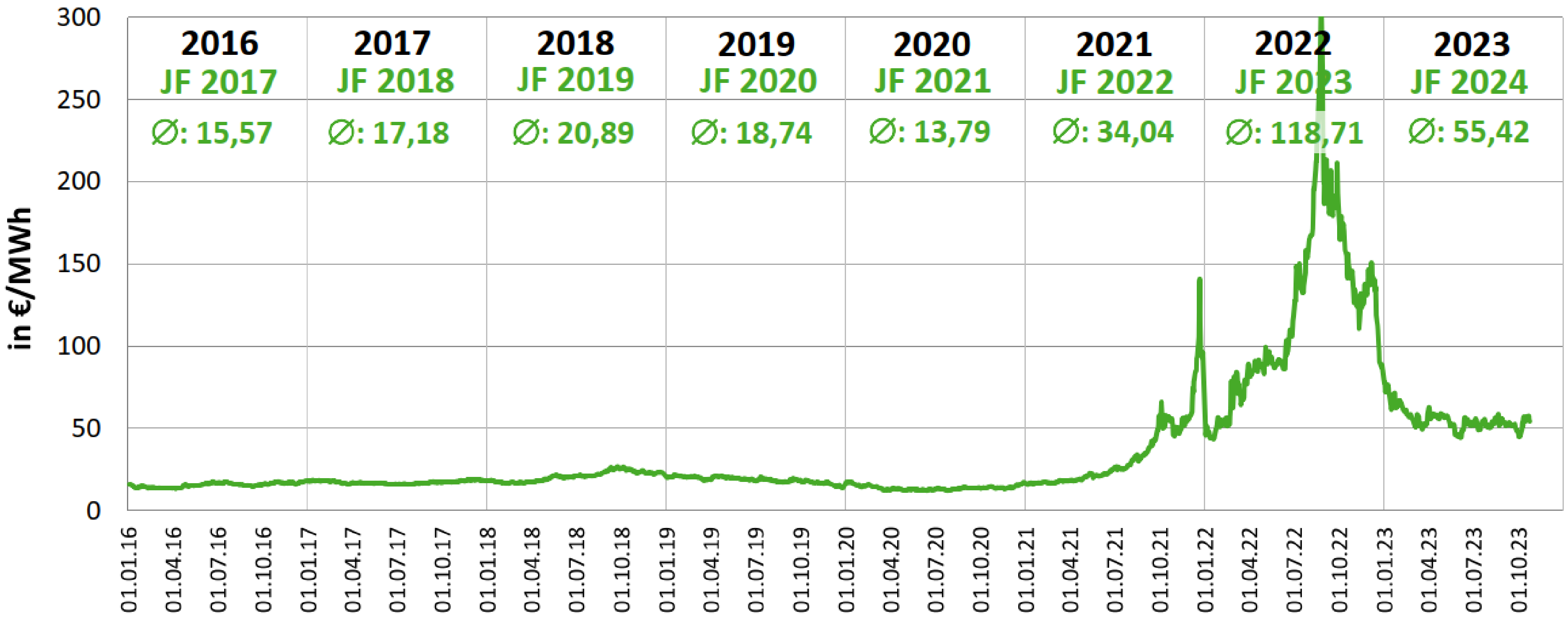
Berechungsverfahren zur Speicherreichweite:
siehe ewp-Sonderdruck

Arbeitsgasvolumina in Europa – Ländervergleich
(Quelle: GIE, 2023)



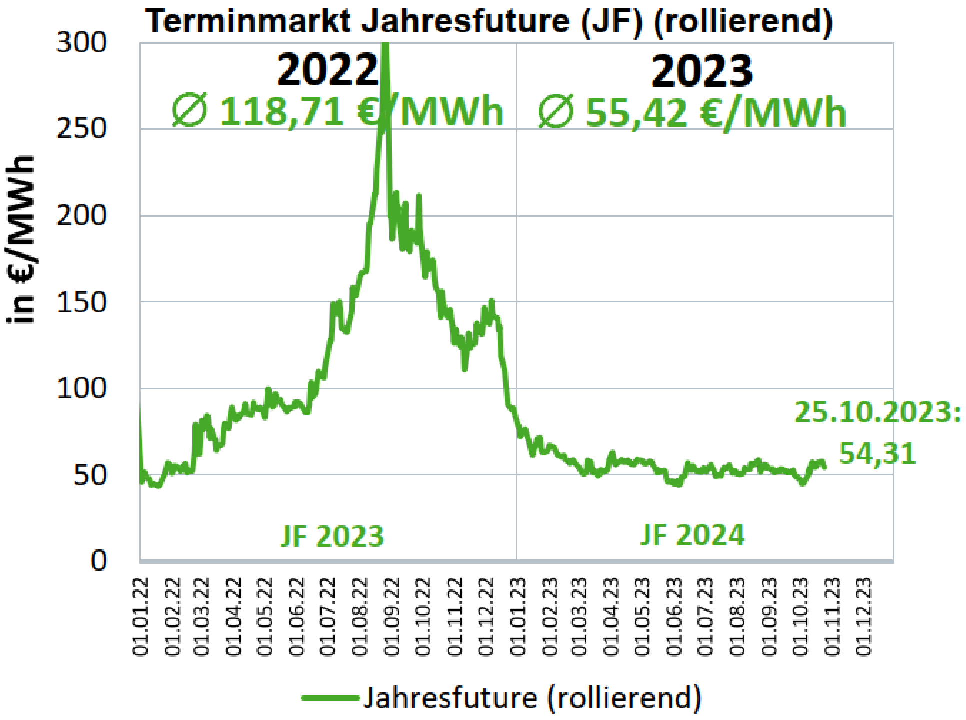
DVGW

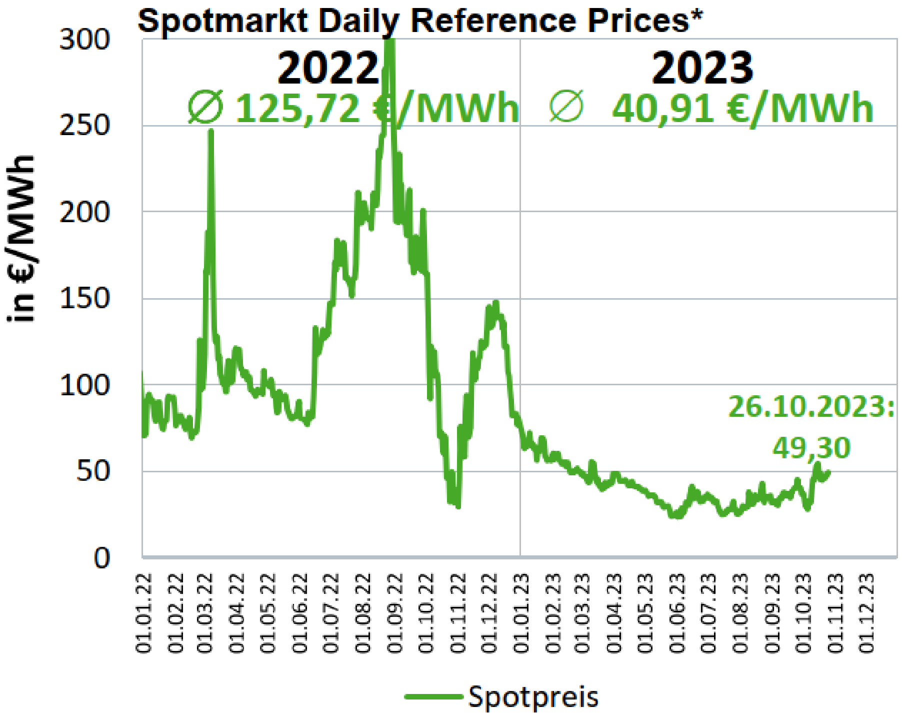
Preisentwicklung Erdgas Großhandel: Terminmarkt Jahresfuture (JF) (Quelle: EEX)



DVGW

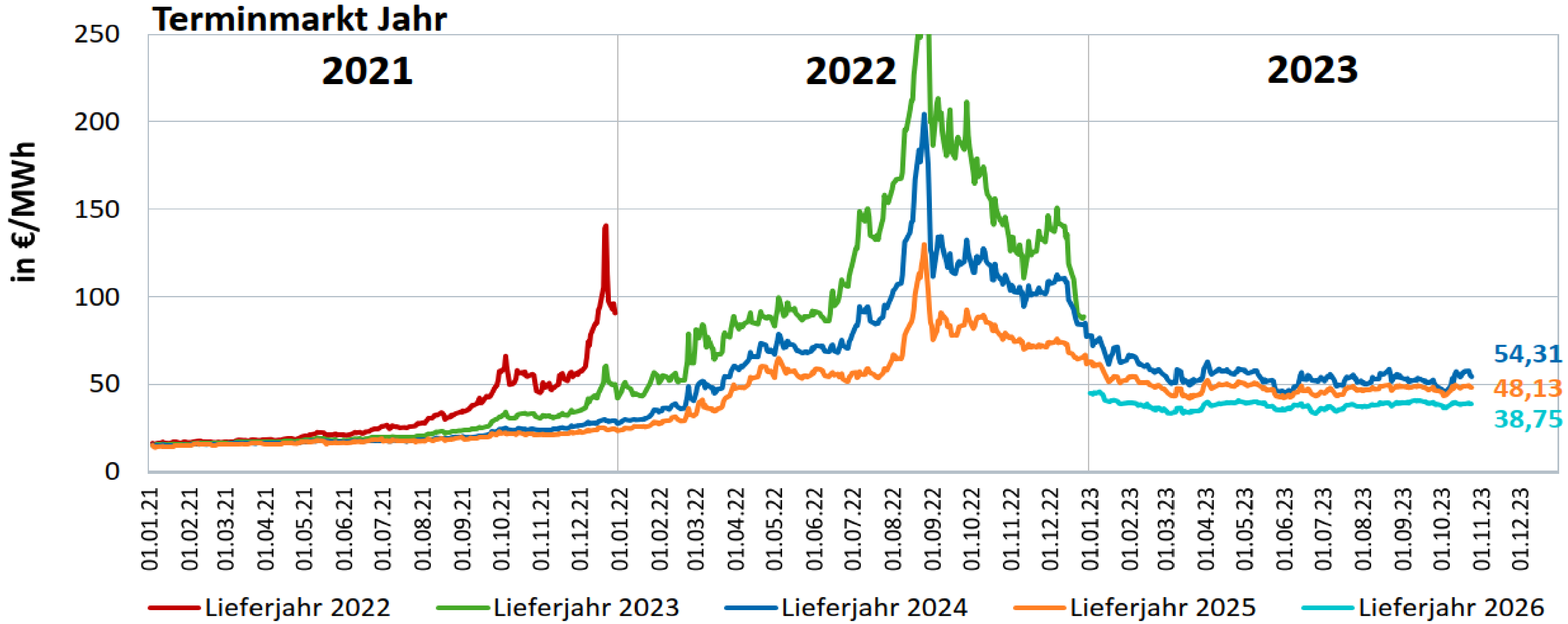
Preisentwicklung Erdgas Großhandel 1/2022 – 10/2023
(Quelle: EEX)



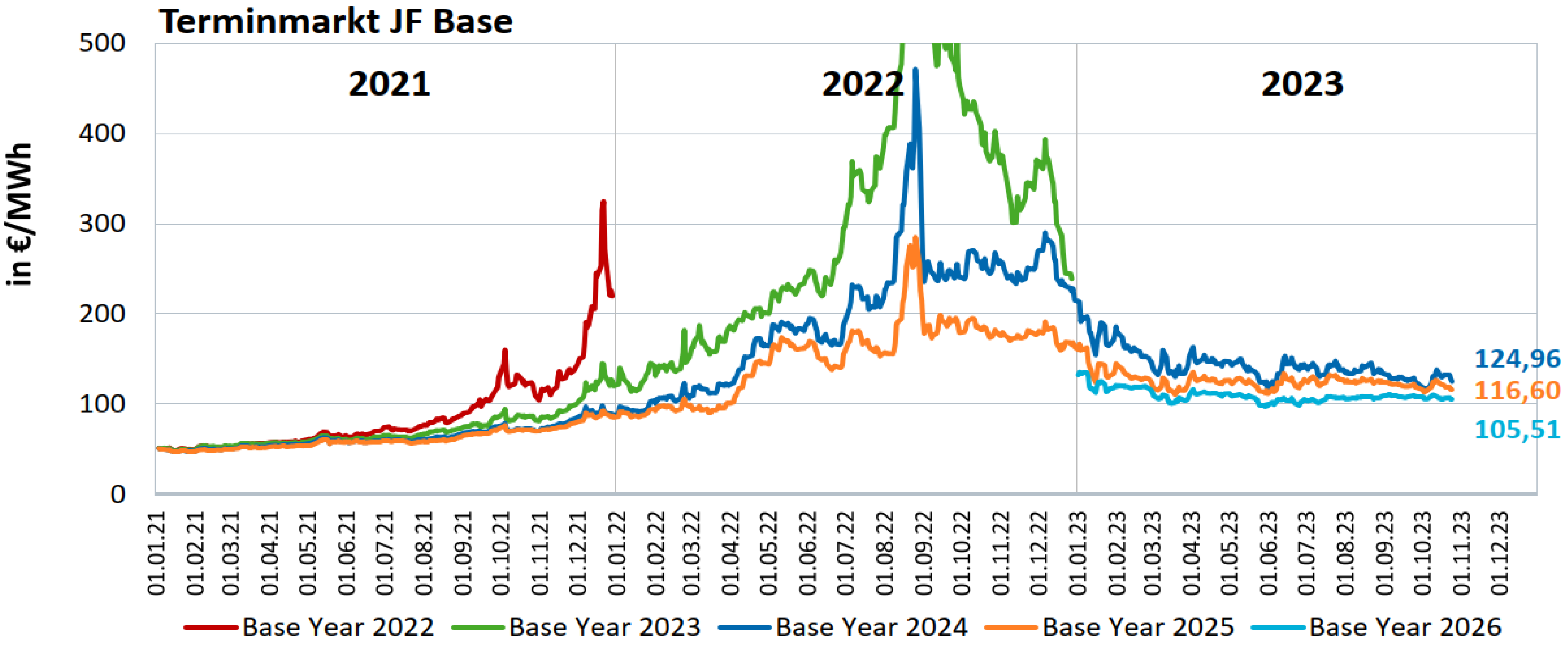


DVGW

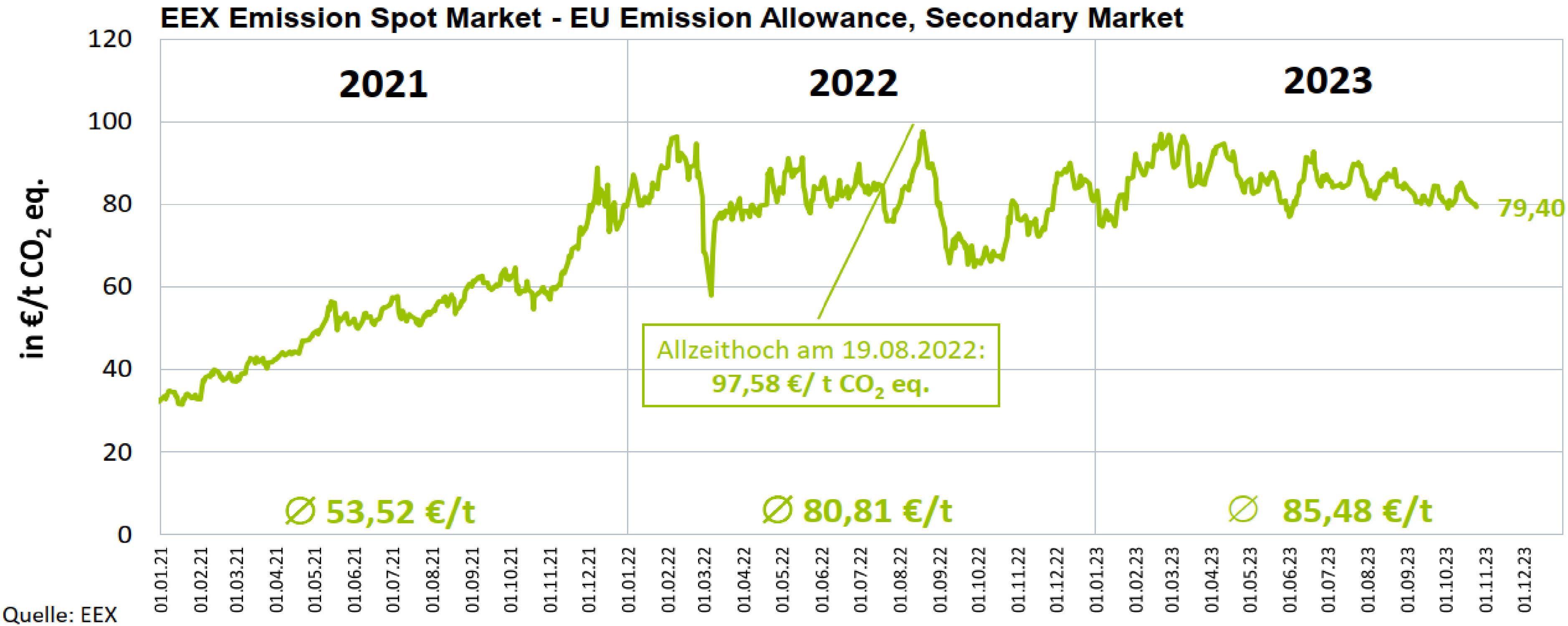
Terminmarkt Erdgas: Jahresfuture 2022 – 2026 im Zeitraum 1/2021 – 10/2023 (Quelle: EEX)



Großhandelsmarkt Strom: Futures 2022 – 2026 im Zeitraum 1/2021 – 10/2023 (Quelle: EEX)

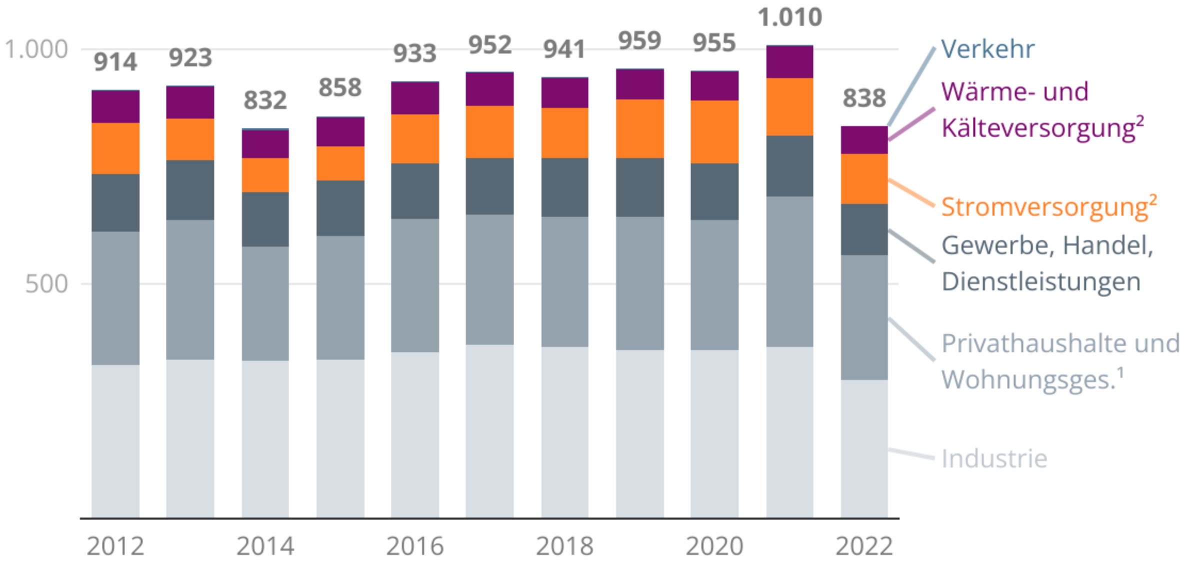


Preisentwicklung CO2-Emissionszertifikate im Zeitraum 1/2021 – 10/2023 (Quelle: EEX)



Quelle: EEX

Erdgasabsatz nach Abnehmern in Deutschland (in Mrd. kWh) (Quelle: AGEB, bdew)

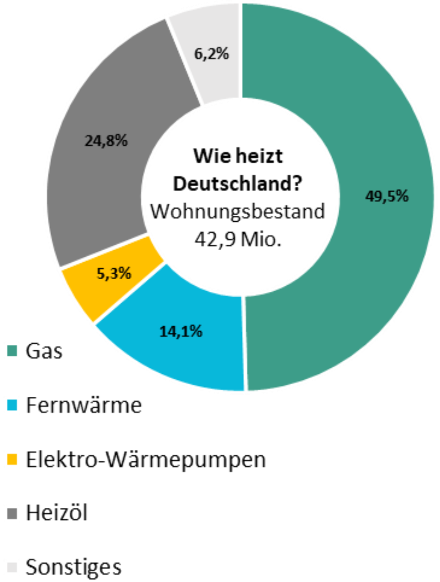


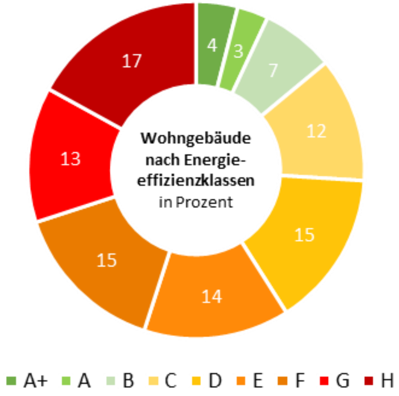
2022 vorläufig
Der Erdgasabsatz enthält nicht den Eigenverbrauch der Gaswirtschaft.

[1] ab 2018 einschl. Absatz an Wohnungsgesellschaften
[2] einschl. BHKW <1 MW

Stand: 10/2023

Beheizungsstruktur 2021





Teil 2 - Erdgasproduktion & Handel

1 Globale/Europäische Gasentwicklungen in 2022

2 2030ff: Wahrscheinliche Gasentwicklungen

3 Globale Transformation von Erdgas zu Wasserstoff

4 Erdgasversorgung Deutschlands

5 Gasproduktion (konventionell & unkonventionell) und Reichweiten

6 Einige größere Infrastrukturprojekte

Conventional natural gas reserves

Global gas flows and quantities

Type	Billion m³
Annual production	3 670
Global reserves	197 100
Global resources	850 000
Globally remaining potential	1 047 100

Three quarters of the global reserves can be found inside the strategic ellipse

Definition of „Reserves and Resources“

The **Bundesanstalt für Geowissenschaften und Rohstoffe (BGR)** in Hannover uses the following definition:

Reserves (confirmed reserves):
Part of the total potential, which has been detected with great accuracy and which can be produced with the currently available technical means in an economic way.

Resources:
Part of the total potential, which either has been detected, but is currently not economically producible - or has not been detected geologically.

Total potential:
The sum of reserves und resources, which means the remaining potential that is available for future consumption.

Definition of the static range of reserves, ressources and remaining potential

$$\text{Static range} = \frac{\text{reserves}}{\text{current yearly production}}$$

Conventional Natural Gas, Reserves-to-Production Ratio 2015

Country	Reserves-to-Production Ratio in years	
	Reserves	Remaining Potential
Russia	75	312
Iran	167	216
Qatar	146	158
USA	128	323
Turkmenistan	12	82
Saudi Arabia	77	302
United Arabian Emirates	95	217
∑	**69**	**200**
World	**55**	**289**

1) Reserves + Resources = Remaining Potential

Source: BGR 2016

Further energy gases

Further energy gases

- Apart from conventional natural gas, so-called unconventional natural gas is also produced (for example shale gas in the U.S.A. and coal bed methane in Australia)
- Europe, however, relies on an increasing production of biogas, biomethane and hydrogen as well as their derivatives, such as synthesis gases

There are 3 big „shale gas reservoirs“: Southern North Sea, Northern Germany, Poland. However: so far no production of unconventional gas in Europe

Shale gas

Tight gas

Coal bed methane

DVGW

Unconventional natural gas: types

Tight Gas

- Gas stored in **porous sandstone**
- low vertical permeability
- no gas flow without „fracs“ (naturally or artificially created)

Source: Schlumberger 2010

Shale Gas

- Gas stored in **„bedrock“**
- very low permeability
- Necessity of „Fracs“

Coal Bed Methane

- Gas stored in **coal bed**
- Natural fracs often filled with water or gas
- Decisive measure: Removal of water

Methane hydrates

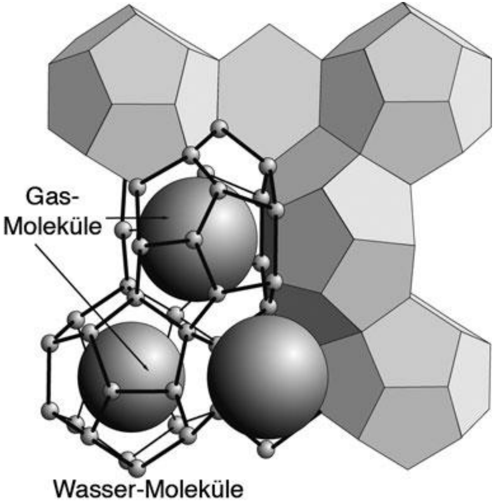
Relevance for our future energy supply

Methane hydrates - energy source of the future in the long term?

Potential: twice the energy content of the natural gas, mineral oil and coal deposits of the world

However: At present there is **no known technical and economical method of extraction**. Climate policy reinforces these challenges enormously

Pictures of methane hydrates and the principle embedding of methane in ice crystals



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DVGW

The European gas network is well developed and secures gas liquidity (1/3)

The gasnetwork continued to be expanded in recent years. Project example:

OPAL

approx. 480 km DN 1400/PN 100 from Greifswald to Olbernhau (Erzgebirge), investment: approx. 1 billion €

Gazelle

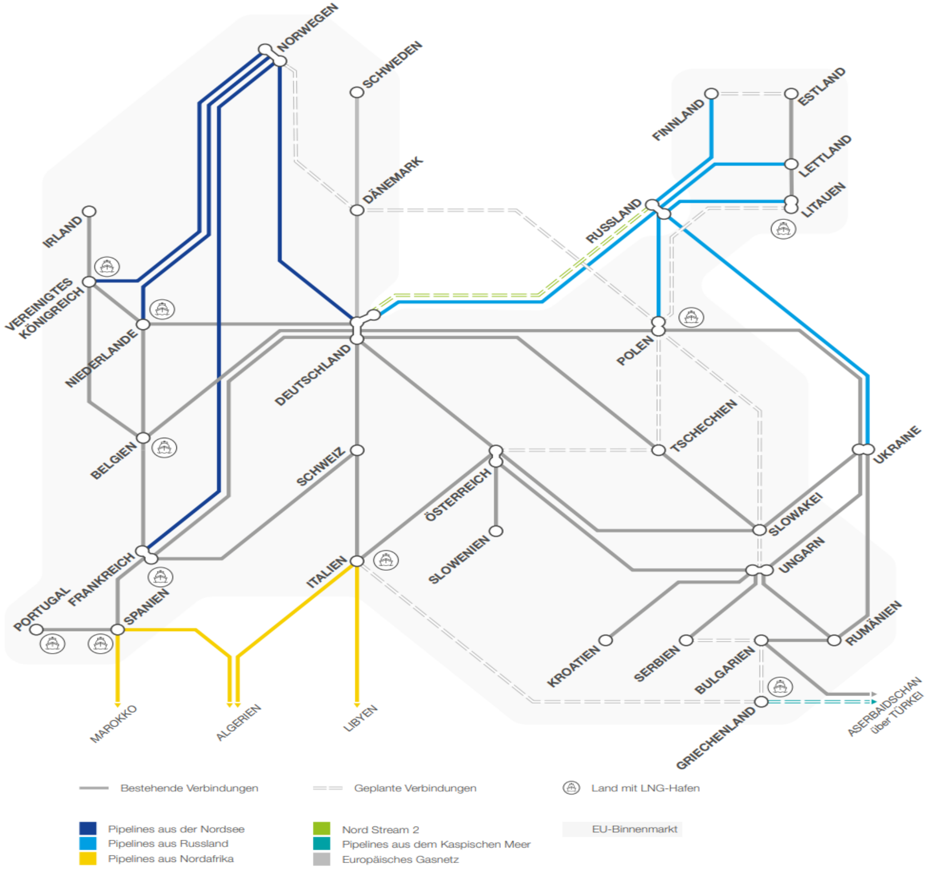
approx. 160 km DN 1400/PN 84, from Brandov/Olbernhau (Erzgebirge) to Waidhaus (Bavarian Forest), investment: approx. 400 million €

NEL (Northern European Natural Gas Line)

approx. 440 km DN 1400/PN100, investment: approx. 1 billion €, continuation from Greifswald to the region around Bremen (Rehden), from there connections in direction of **Benelux, France, UK**

Commissioning: 2012 – 2013

Dimensioning: approx. 440 km DN 1400 PN 100



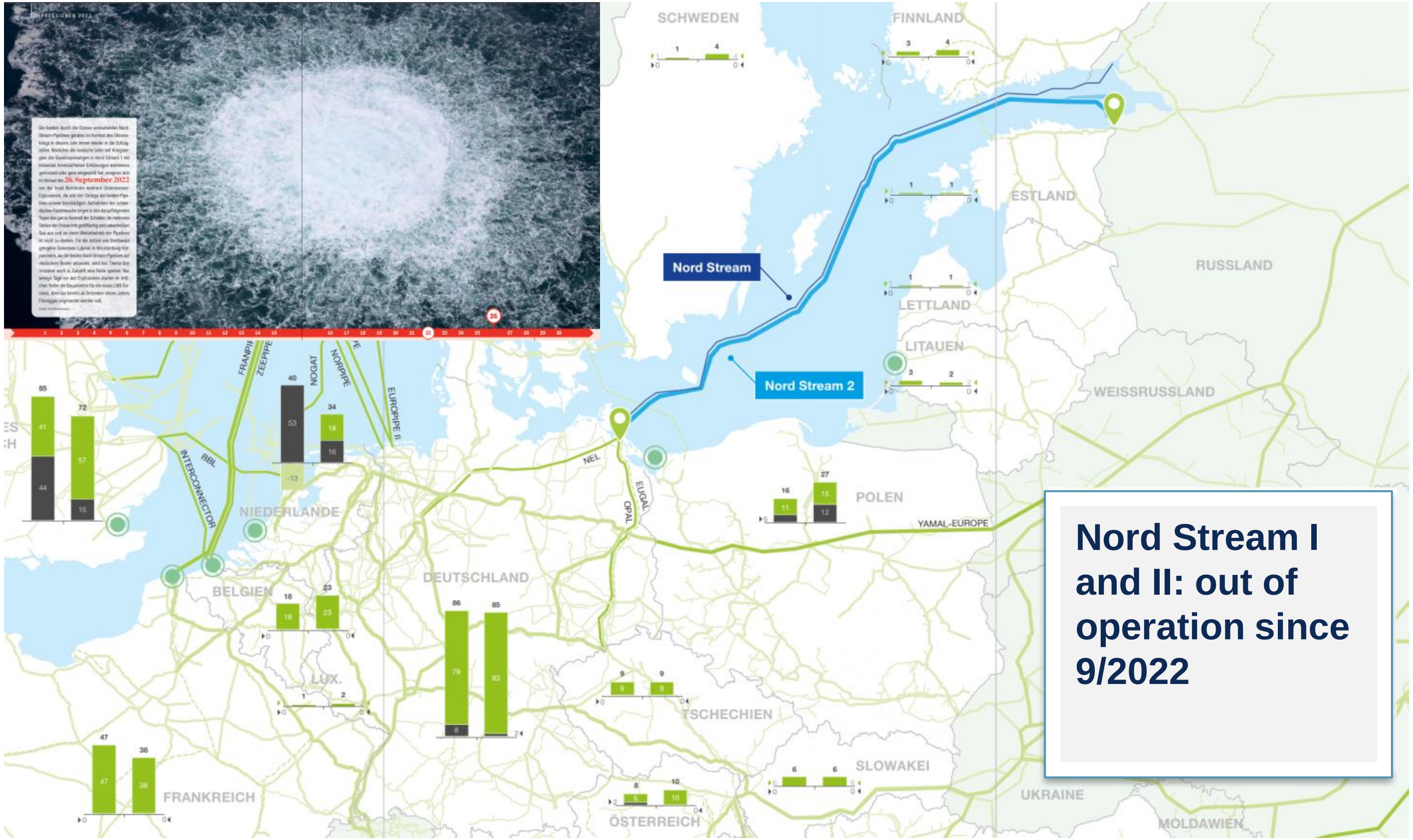
The European gas network is well developed and secures gas liquidity (2/3)

The gas network continued to be expanded in recent years.
Project example:

Turk Stream
4 offshore lines through the Black Sea (910 km DN 800/PN 335). Capacity: 63 billion m³/a (20°C)
Landfall at Kiyiköy (European part of Turkey), onshore continuation to Ipsala (Turkish-Greek border). Length: 1100 km, 910 km offshore
In operation: since 2020

TAP
Directed from the Turkish-Greek broder via Greece, Albania and the Adriatic Sea (offshore) to Southern Italy; upstream: TANAP (Trans Anatolian Pipeline) and SCP (South Caucasus Pipeline)
Length: 878 km , 113 km offshore
In operation: since 2020

The European gas network is well developed and secures gas liquidity (3/3)



Nord Stream I and II: out of operation since 9/2022

DVGW

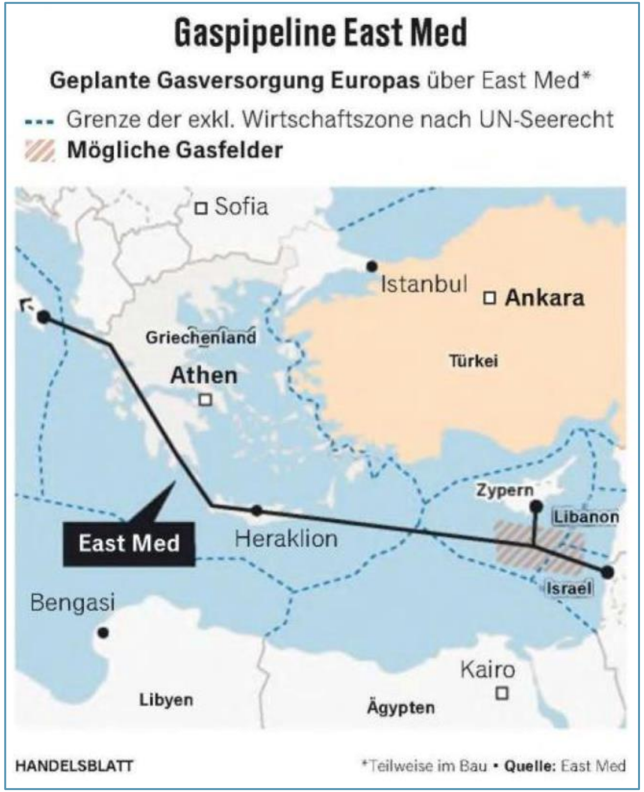
Deutsche LNG-Projekte

Tab. 4: Inventar der in Betrieb oder Bau befindlichen Anlagen bzw. weitere geplante Regasifizierungsanlagen

Eigner Betreiber	Ort	Art	Inbetriebnahme	Kapazität [bcm]	Anmerkung
2022/2023					
Uniper	Wilhelmshaven I	FSRU	21.12.22	6	
Deutsche Regas	Lubmin I	FSRU	14.01.23	4,5	Verlegung nach Mukran geplant
German LNG Terminal (KfW, Gasunie, RWE), DET	Brunsbüttel I	FSRU	20.01.23	3,5	Erste Anbindung
2023/2024					
German LNG Terminal (KfW, Gasunie, RWE), DET	Brunsbüttel I	FSRU	12/23	5	Zweite Anbindung
Hanseatic Energy Hub (Buss-Gruppe, Partners Group, Dow), DET	Stade I	FSRU	Q1/24	6	
Deutsche Regas	Mukran II	FSRU	10/23	5	
TES, EON, ENGIE, DET	Wilhelmshaven II	FSRU	Q1/24	4	
2024/...					
German LNG Terminal (KfW, Gasunie, RWE)	Brunsbüttel	Land-terminal	2025	8	NH3 Ready
Hanseatic Energy Hub (Buss-Gruppe, Partners Group, Dow)	Stade	Land-terminal	2025	13	Bio LNG, SNG
TES, Uniper	Wilhelmshaven	Land-terminal	2025	16	SNG (eNG)

Quelle: DVGW

Possible future projects?



Mittelmeer-Pipeline

Neues Rückgrat für Europas Gasversorgung?

Eine Pipeline soll zunächst Erdgas und später Wasserstoff aus dem Nahen Osten nach Europa bringen. Aber: Das Projekt ist politisch umstritten.

Diskutiert wird das Pipelineprojekt schon seit Anfang der 2000er-Jahre, als Israel vor seiner Küste mit der Gasförderung begann. Lange gab es Zweifel an der Wirtschaftlichkeit des Vorhabens. Der Bau soll sieben Milliarden Euro kosten. Auch der Streit über die Abgrenzung der Wirtschaftszonen im östlichen Mittelmeer bremste die Pläne. Aber die gestiegenen Gaspreise, die Versorgungsengpässe in Europa und die Bemühungen der EU, sich vom Lieferanten Russland abzunabeln, lassen das Projekt in einem neuen Licht erscheinen.

Quelle: Handelsblatt: 25.10.22