



RYSTAD ENERGY

REBALANCING EUROPE'S GAS SUPPLY

OPPORTUNITIES IN A NEW ERA

SEPTEMBER 2022

Co-sponsors



Technical input from



Rebalancing Europe's gas supply – September 2022

The study

- EU calls for **phase out of coal, oil, gas supplies from Russia** as soon as possible and Russia threatens to **stop supplies**
- IOGP Europe and American Petroleum Institute **co-funded study** by Rystad Energy with technical input from ENTSO-G and GIE
 - **Unique study** capturing detailed **input from market parties along the full value chain**
- **Study scope** covers supplies to Europe (EU27 plus UK, NO, UA, CH, Balkan) in 2023 – 2040
- Study assesses ...
 - **annual and peak-day demand / supply** balances (including by **region**)
 - **infrastructure capabilities**
 - **supply sources available to Europe in short and longer term, and their cost of supply**
- Study uses on **EU demand forecasts** (EU pre-FF55 Baseline and FF55 Mix net-zero scenario); **no analysis of demand reducing effects** from crisis
- Building on the study, Rystad Energy together with IOGP, API and input from ENTSOG, GIE developed **policy considerations** which support the fast and effective rebalancing of supplies
- Separate studies confirm significant need for gas supplies to Europe to enable cost-efficient scale-up **of low carbon hydrogen production using CCUS to achieve net-zero objectives**
- Supply cost and price assessments are exclusively developed by Rystad Energy and were not discussed as part of the study

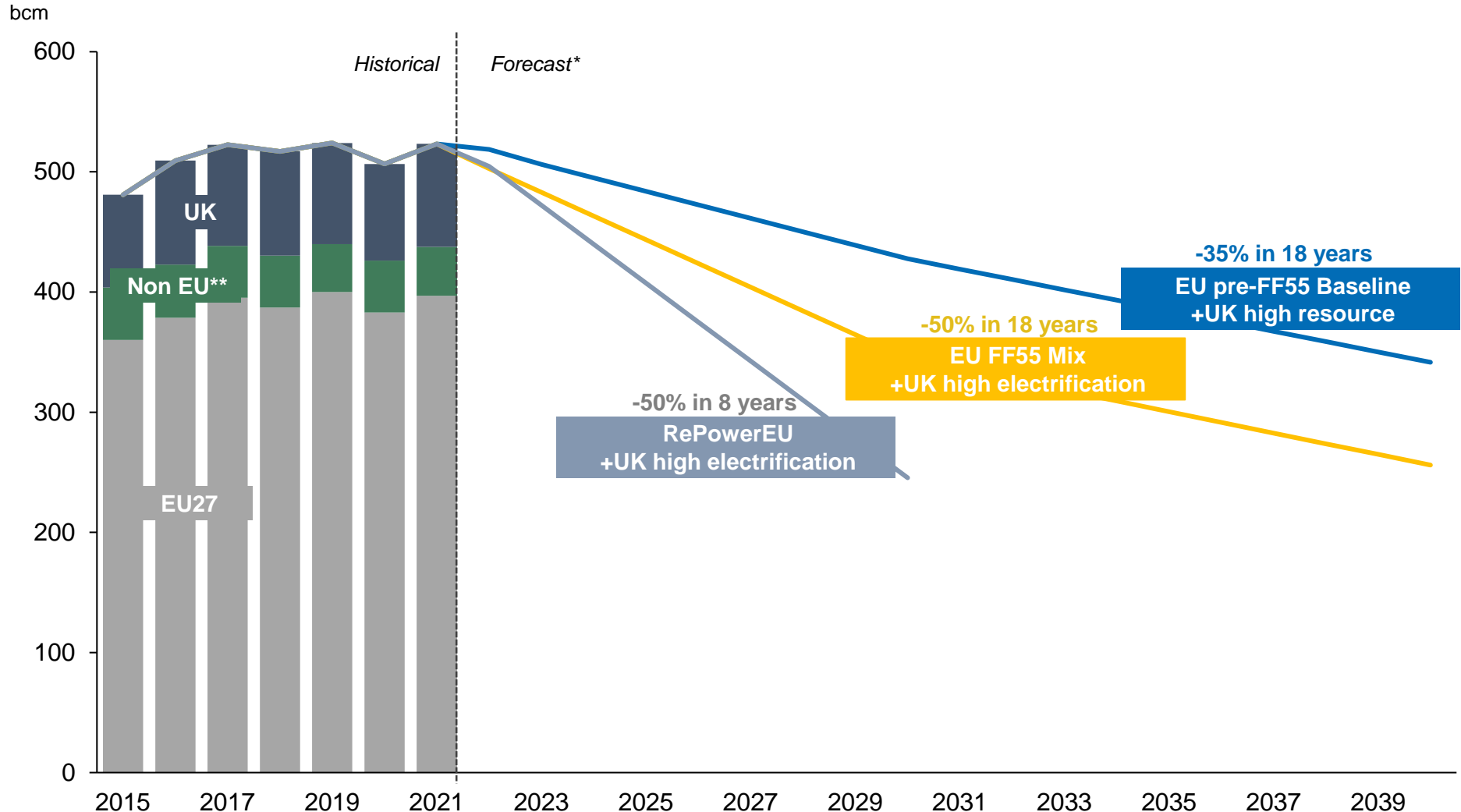


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NEEDED BACKGROUND INFORMATION

Study assumes demand reductions from 520 bcm to 260 or 340 bcm by 2040

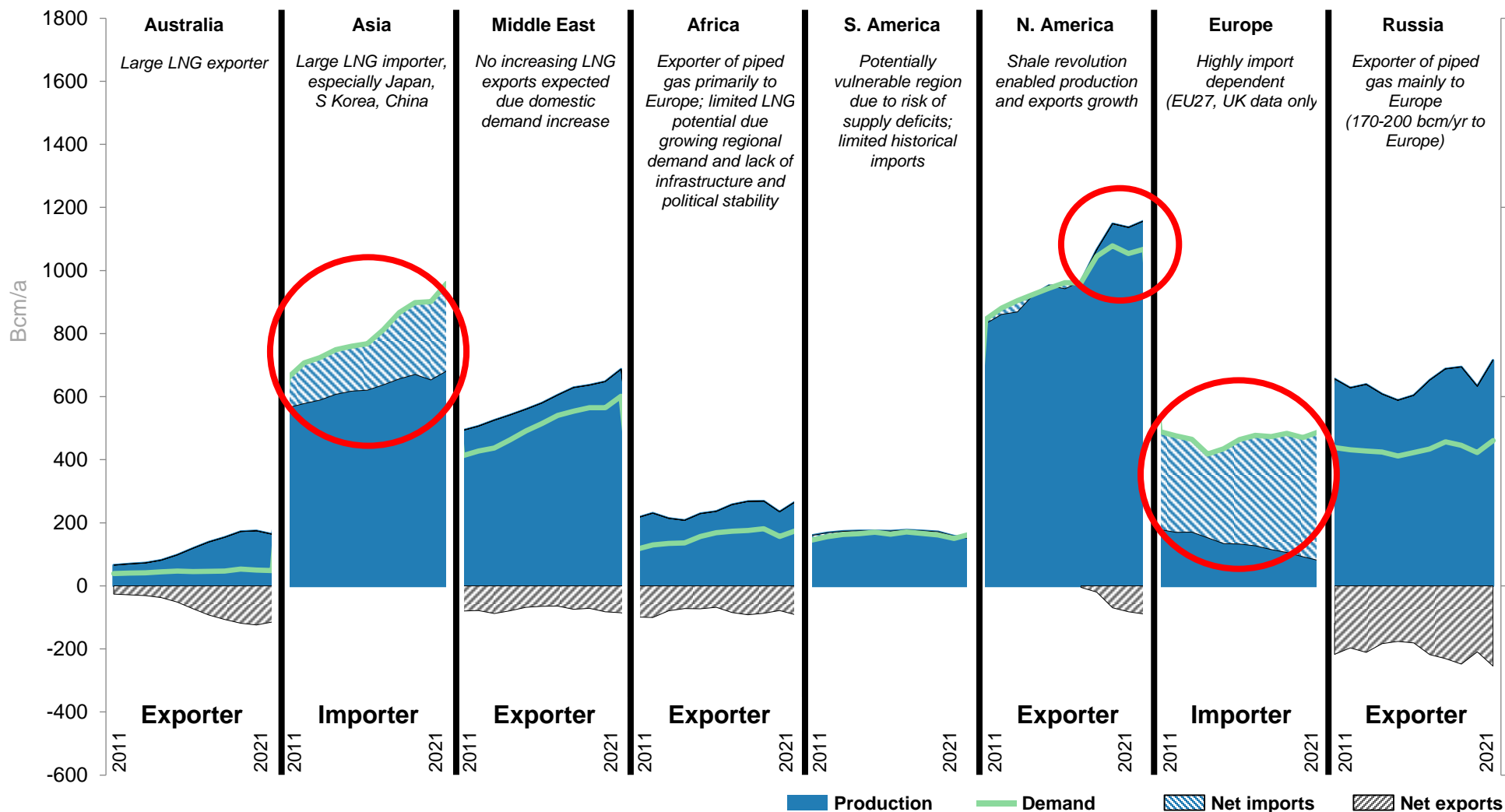
European natural gas demand forecasts



*EU and UK forecasts have 2030 and 2050 data points only; linear extrapolation used between data points **Norway, Albania, Moldova, Montenegro, North Macedonia, Serbia, Switzerland, Ukraine
 Source: Rystad Energy research and analysis, Rystad Energy GasMarketCube, European Commission, UK Department for Business, Energy & Industrial Strategy

Europe and Asia compete for LNG supplies from global sources

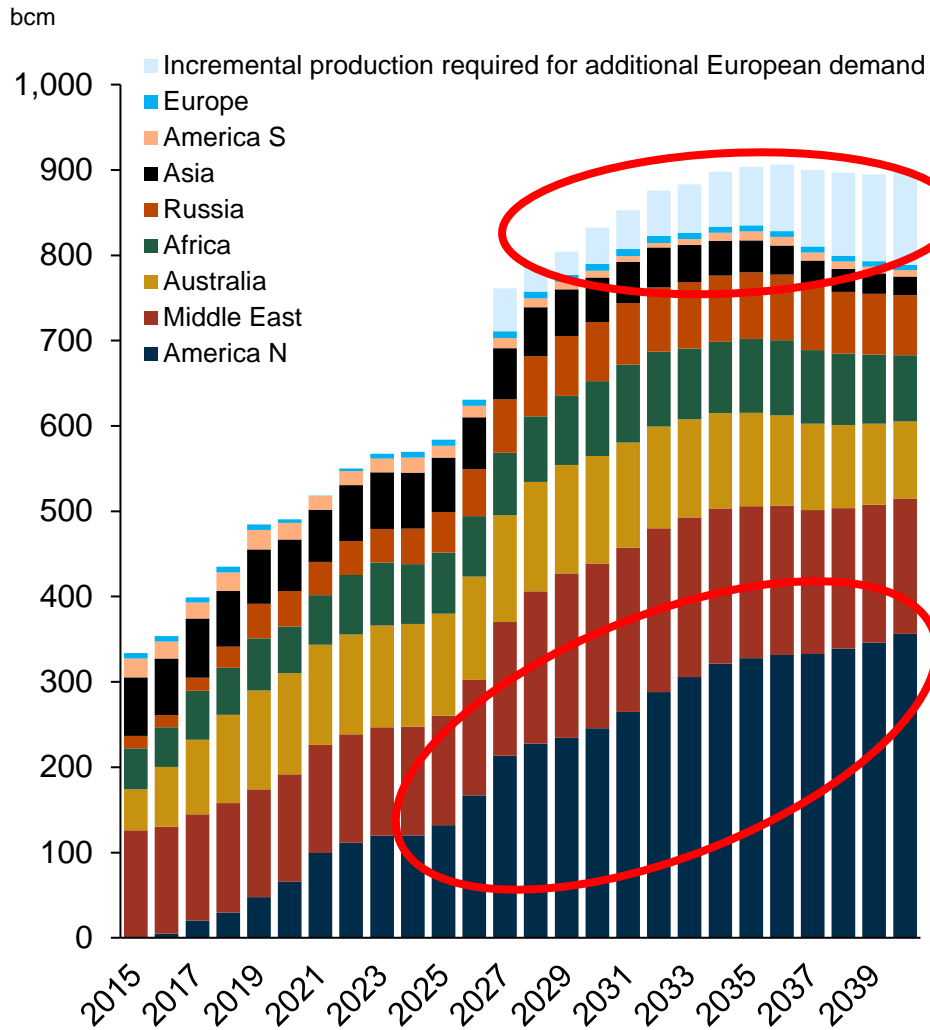
Global natural gas balances 2011-2021



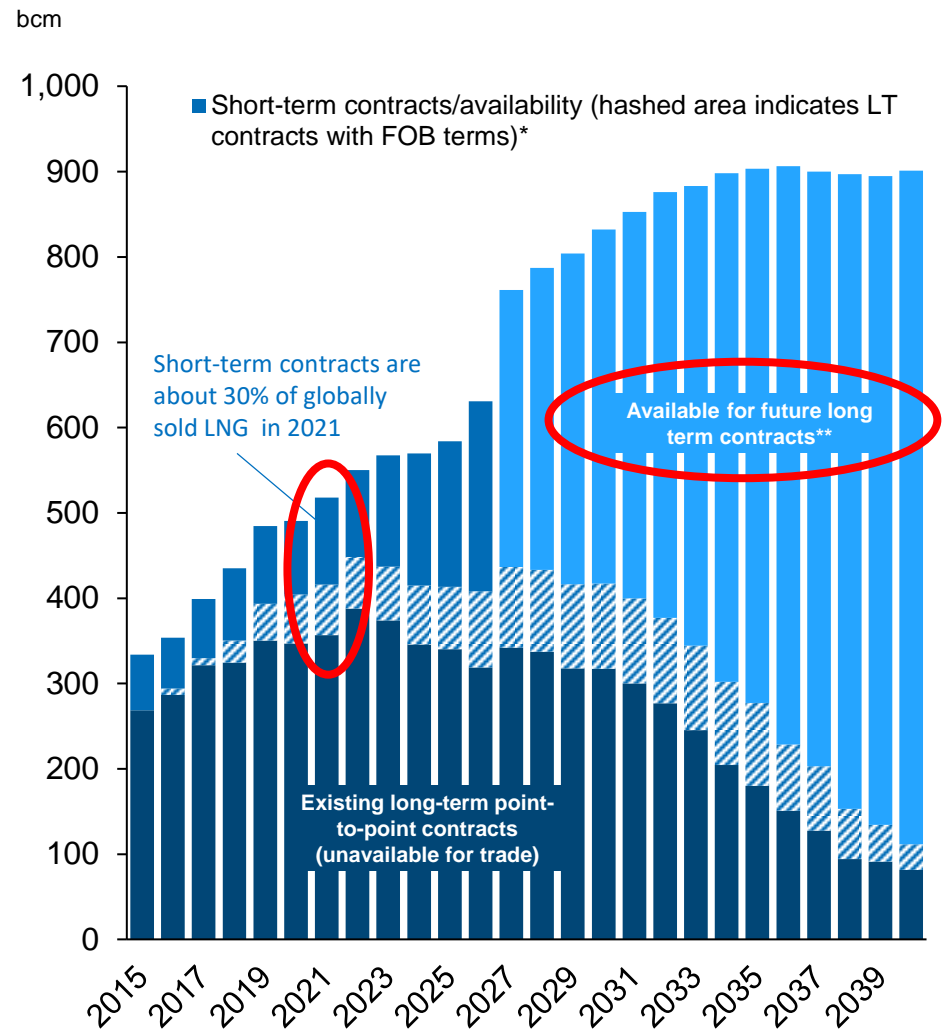
Source: Rystad Energy research and analysis; Rystad Energy GasMarketCube

Global LNG market growing to 900 bcm/a with N America becoming largest supplier; limited volumes (~200 bcm) available for short-term (spot) contracting

Global LNG production by region



Global LNG production by availability/types of contracting



*US LNG FOB potential treated as spot LNG under a high gas regime – treated as long term contracts and therefore unavailable upon assumed stabilizing market prices from 2027 onwards. **Includes incremental European demand. Source: GasMarketCube, Rystad Energy research and analyses

The study groups supplies by source, increment and timing

| Gas source | Increment group | Timing | Full resource potential 2022-2040 BCM | Comment |
|----------------------------|----------------------------|------------|---------------------------------------|--|
| Domestic | Base | Both | 2099 | <ul style="list-style-type: none"> Domestic resources connected to the European demand via pipelines Includes reserves in key fields such as Troll, Ormen Lange and Culzean |
| | Increment contingent | Long term | 653 | <ul style="list-style-type: none"> Includes all domestic resources not yet sanctioned for development Numerous small and low cost developments that benefit from existing infrastructure |
| | Increment exploration | | 150 | <ul style="list-style-type: none"> Exploration expected to yield limited potential given the mature nature of the domestic hydrocarbon basins |
| Special domestic increment | Troll max | Short term | 32.9 | <ul style="list-style-type: none"> Short term potential in maximizing the Troll field output according to 2021 levels |
| | Higher GCV | | 23.6 | <ul style="list-style-type: none"> Volume equivalent impact of increasing energy content in gas export |
| | Groningen | Long term | 382 | <ul style="list-style-type: none"> Key short term domestic production increment, should the politically guided curtailment be reversed |
| | Barents pipe | | 144 | <ul style="list-style-type: none"> Key long term domestic production increment Connects resources in the Barents Sea to the existing Norwegian pipeline network |
| | European shale | | 455 | <ul style="list-style-type: none"> Possible to produce 30 Bcm/yr from 2027, however politically sensitive |
| Piped gas | Europe piped gas imports | Both | 564 | <ul style="list-style-type: none"> Expected minimum imports from North Africa (Algeria and Libya) and Azerbaijan |
| | Algeria increase | Short term | 606 | <ul style="list-style-type: none"> Potential increase in Algerian exports, should gas be marketed instead of reinjected Export increase has been staggered to capture increasing marginal cost |
| | Turkey pass-through | | 89.5 | <ul style="list-style-type: none"> Potential re-routing of Turkey's share of TANAP gas from Azerbaijan Export increase has been staggered to capture increasing marginal cost |
| | TR/Azerbaijan expansion | Long term | 387 | <ul style="list-style-type: none"> Long term expansions of the TANAP/TAP infrastructure Includes multiple phases which have been staggered to capture increasing marginal cost |
| LNG | LT Contracted | Both | 858 | <ul style="list-style-type: none"> All known LNG contracts with Europe as destination |
| | Spot/FOB LNG | Short term | 1522 | <ul style="list-style-type: none"> Maximum potential of spot and US LNG FOB imports The market will be shared with Asia and 100% market share is therefore unlikely |
| | Available for LT contracts | Long term | 7863 | <ul style="list-style-type: none"> The global pool of expected long term LNG production to meet global LNG demand Europe will be able to capture a market share of this vast potential |

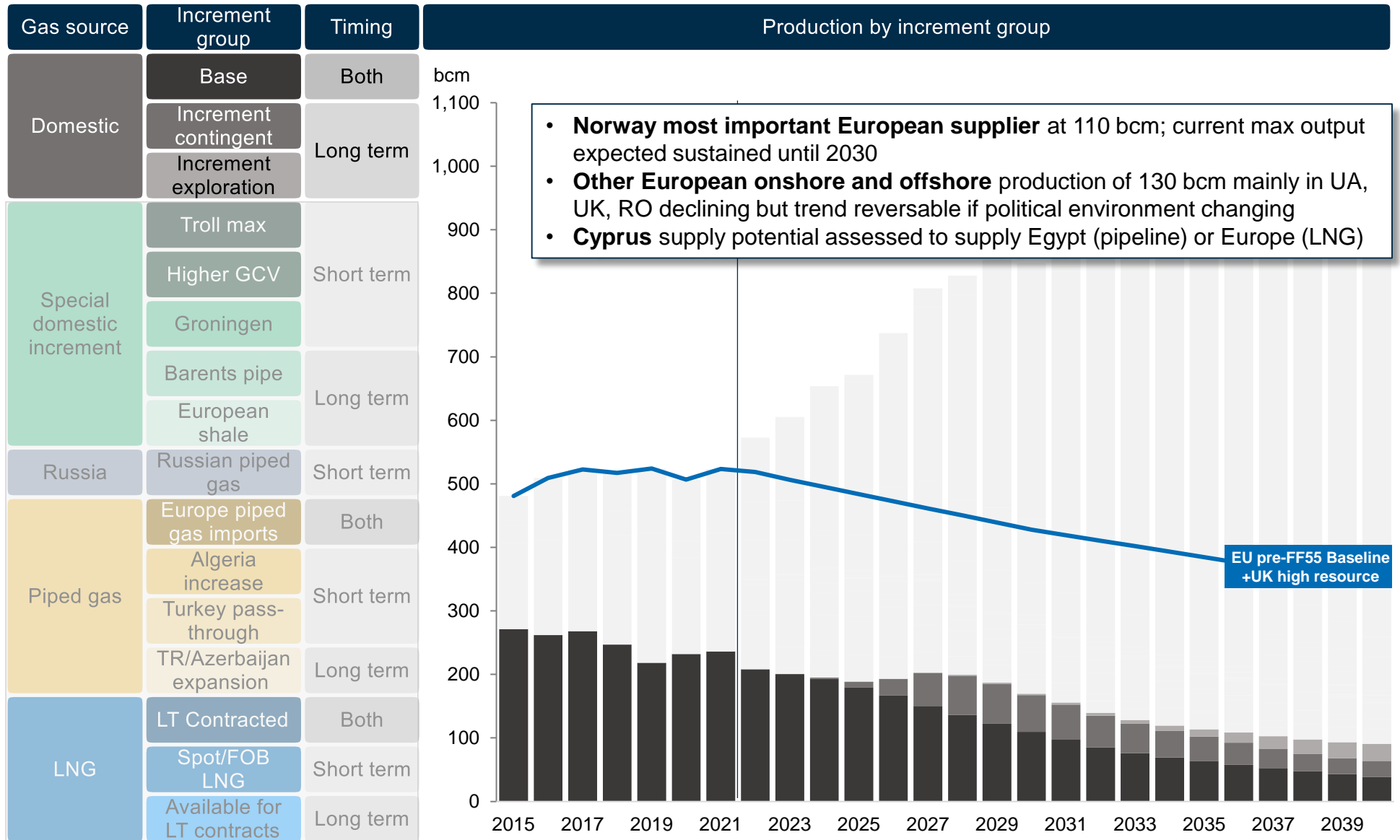
*Full resource potential is based on resources that are already producing or under development
 Source: Rystad Energy research and analysis



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KEY RESULTS

Domestic supplies important but challenged by resource potential, political environment

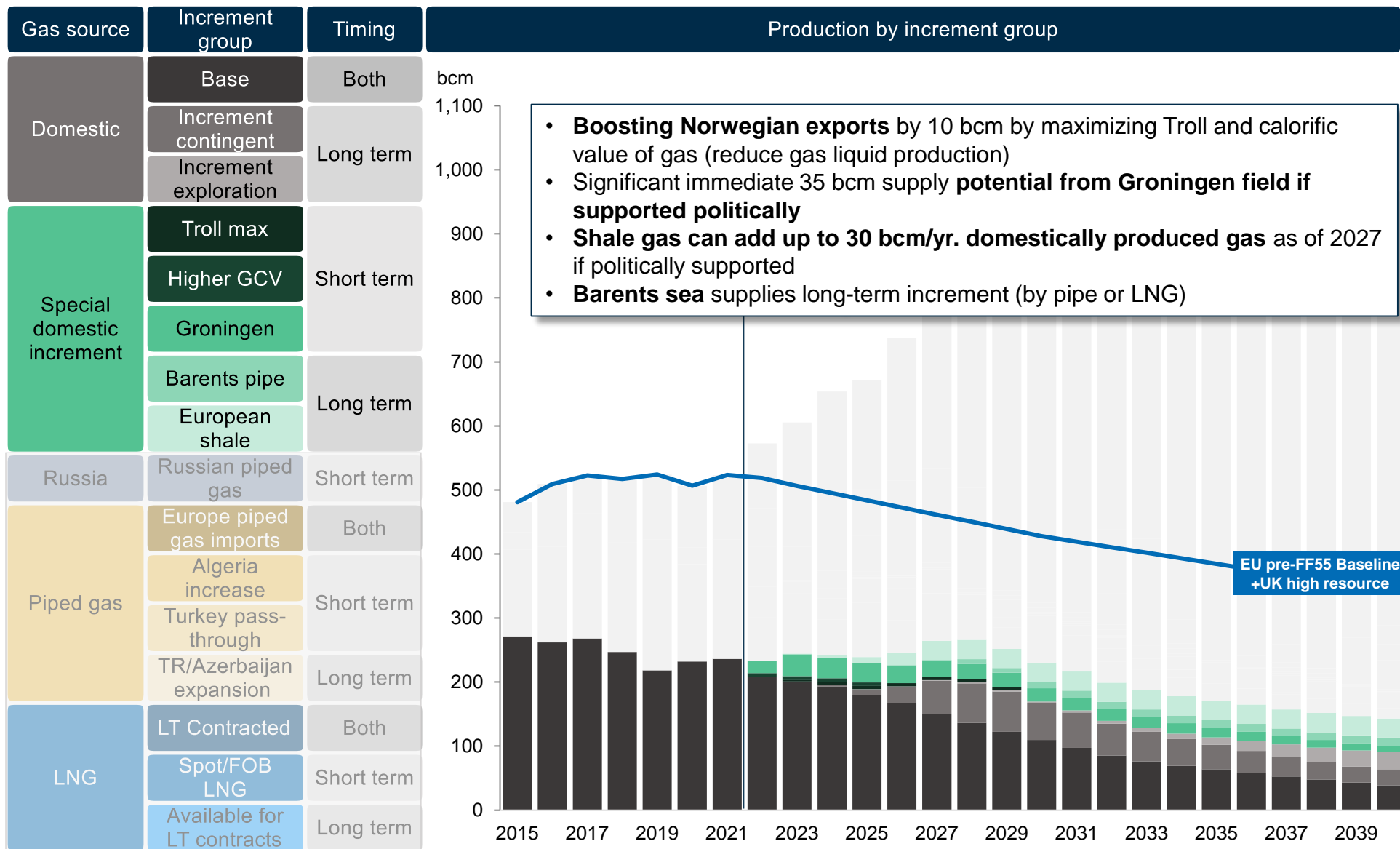


- **Norway most important European supplier** at 110 bcm; current max output expected sustained until 2030
- **Other European onshore and offshore** production of 130 bcm mainly in UA, UK, RO declining but trend reversible if political environment changing
- **Cyprus** supply potential assessed to supply Egypt (pipeline) or Europe (LNG)

EU pre-FF55 Baseline +UK high resource

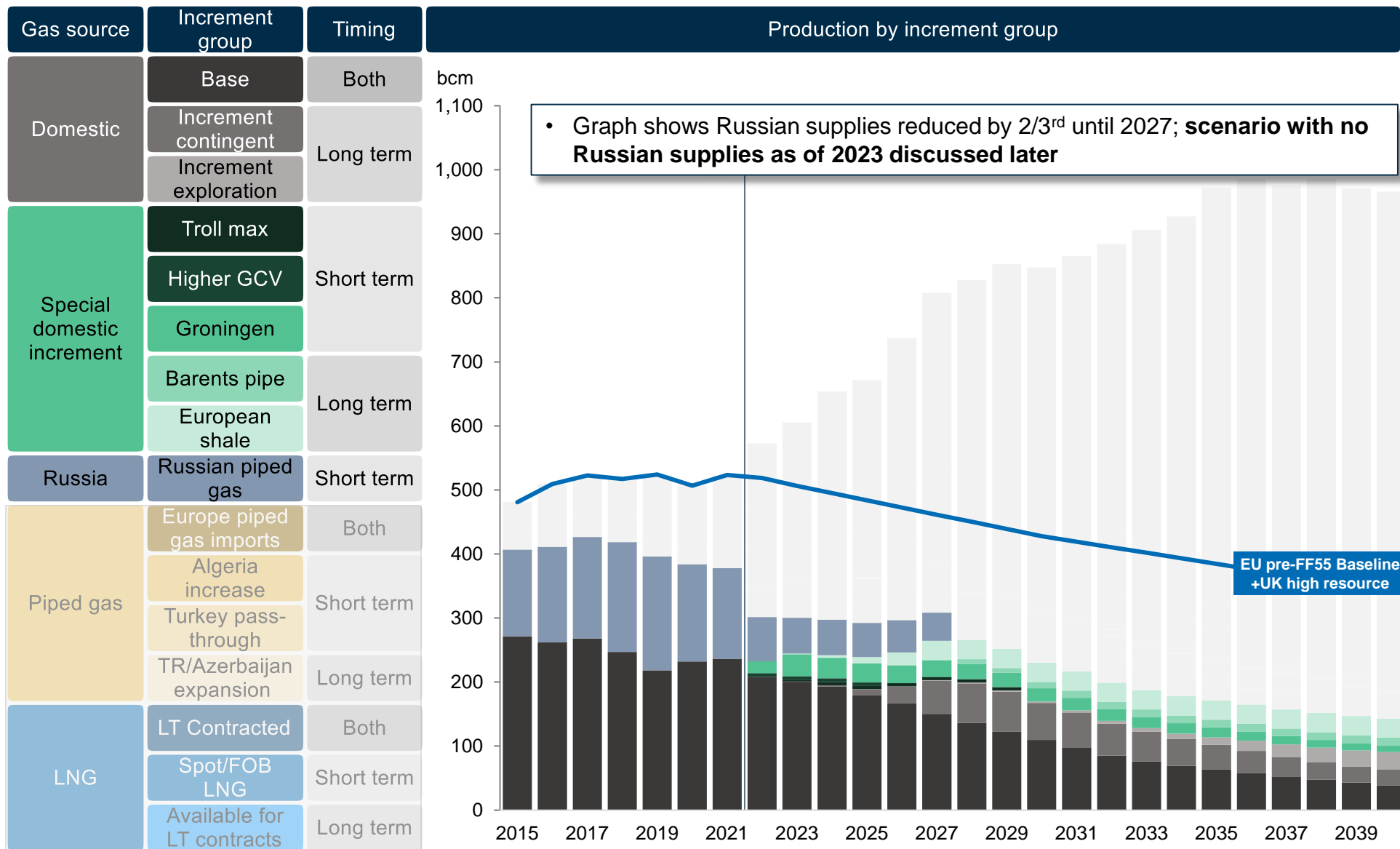
Source: Rystad Energy research and analysis

Moderate maximization of domestic supplies possible



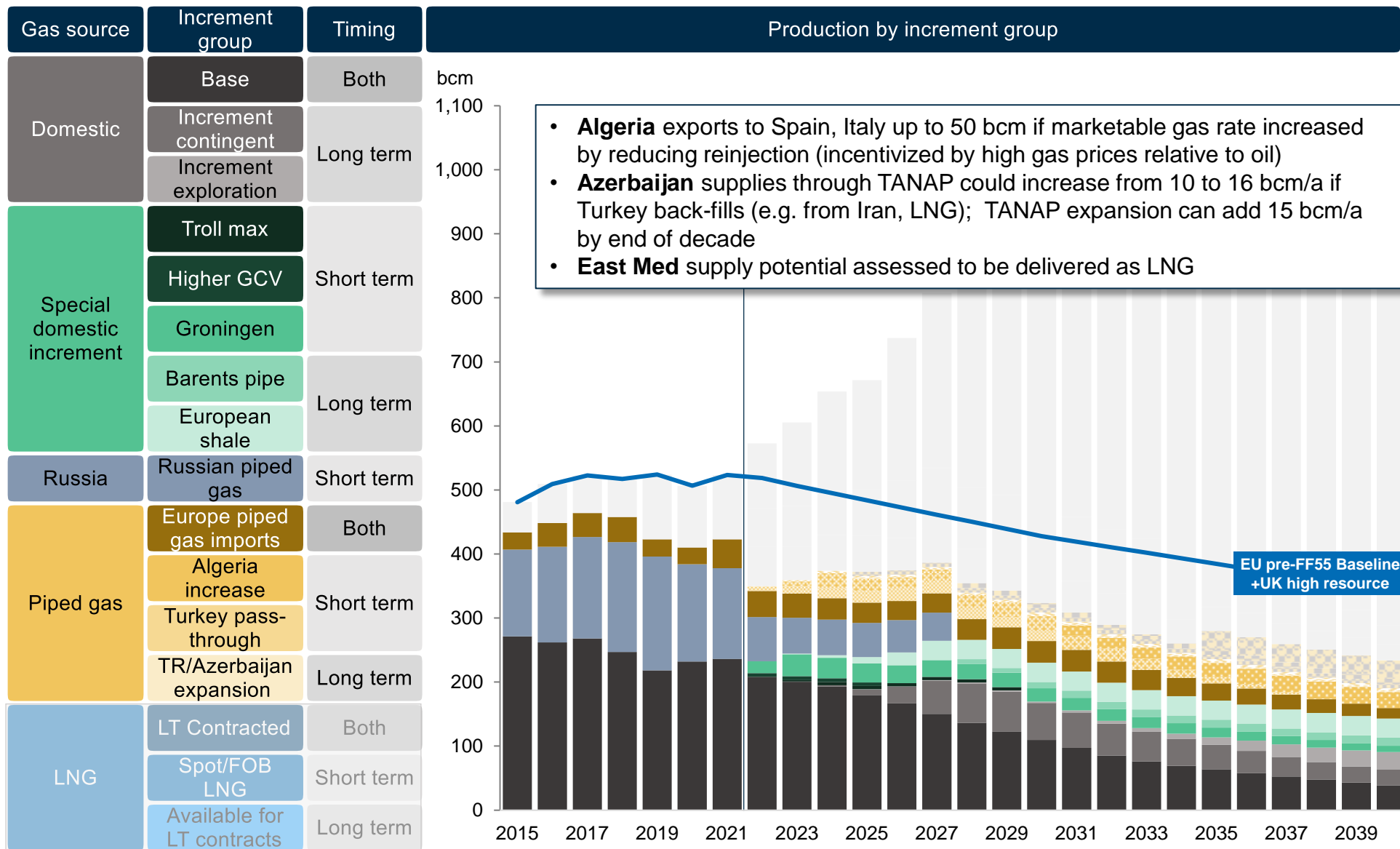
Source: Rystad Energy research and analysis

Russian piped gas supply assumed to reduce by 2/3 as of 2023 and cease in 2027



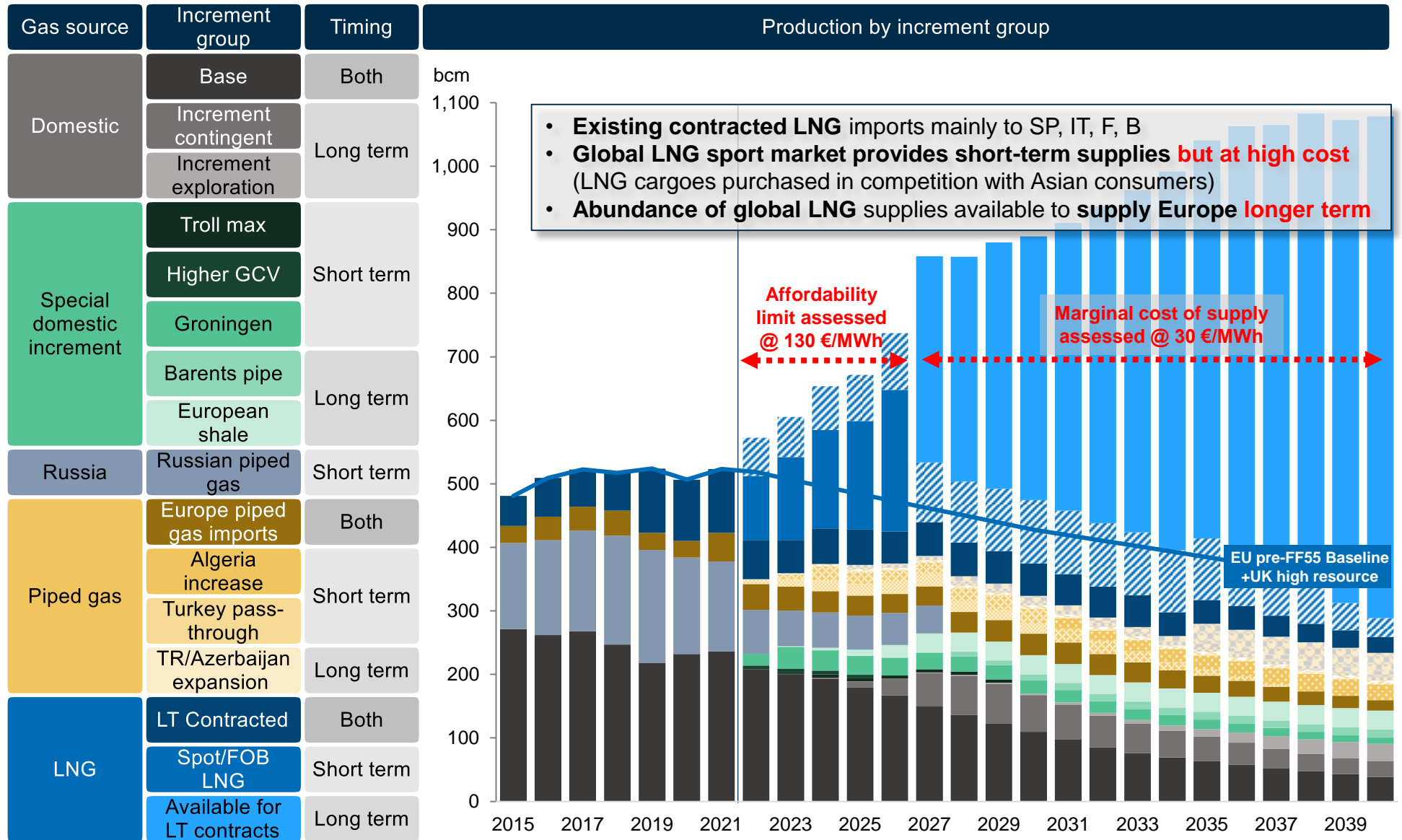
Source: Rystad Energy research and analysis

Non-Russian other pipeline imports to Europe contribute about 10% of overall supplies



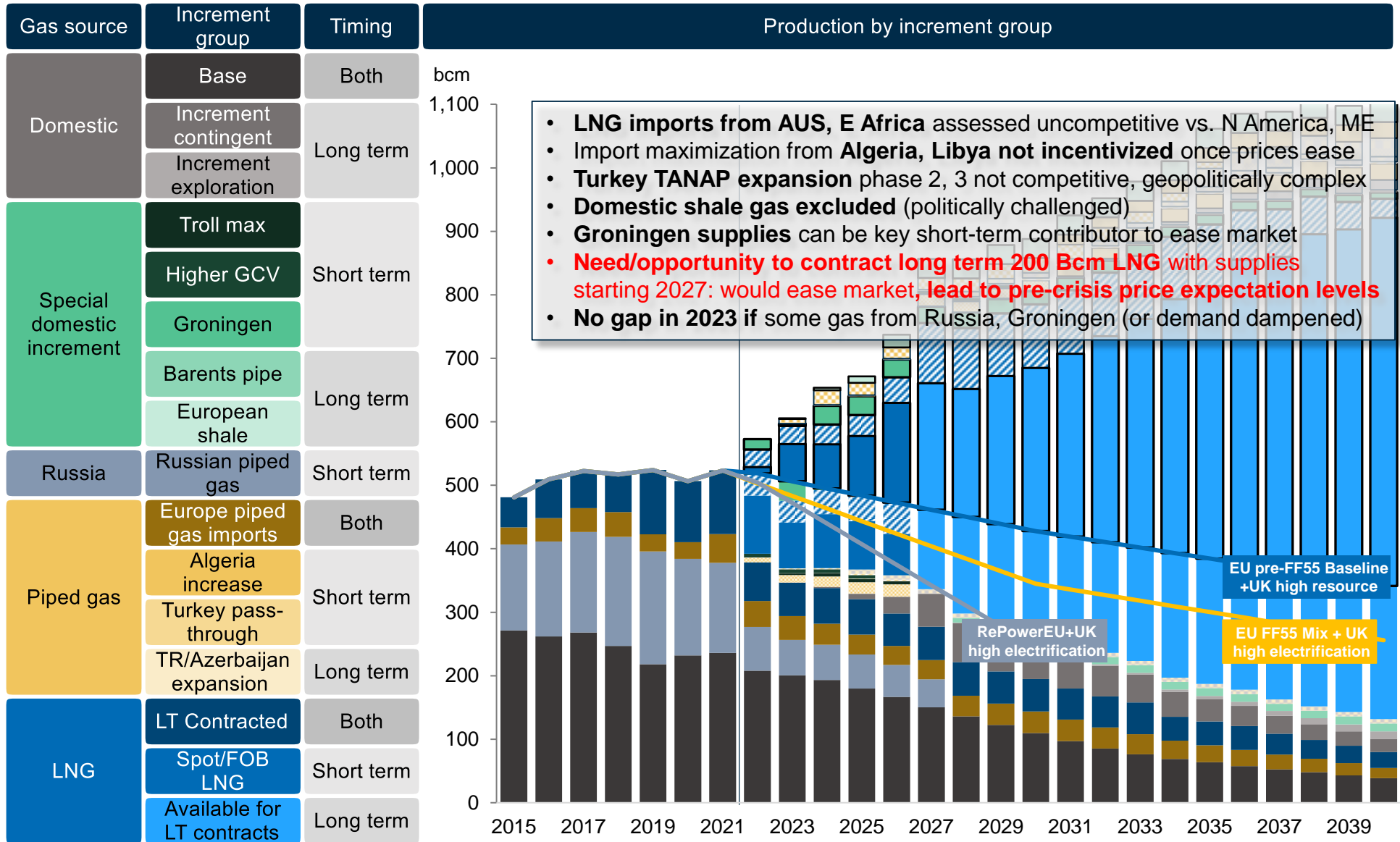
Source: Rystad Energy research and analysis

LNG is a crucial market balancing factor for Europe, both in the short and long-term



Source: Rystad Energy research and analysis

Ranking supplies by cost of supply filters out high-cost LNG, pipeline imports, politically challenged gas



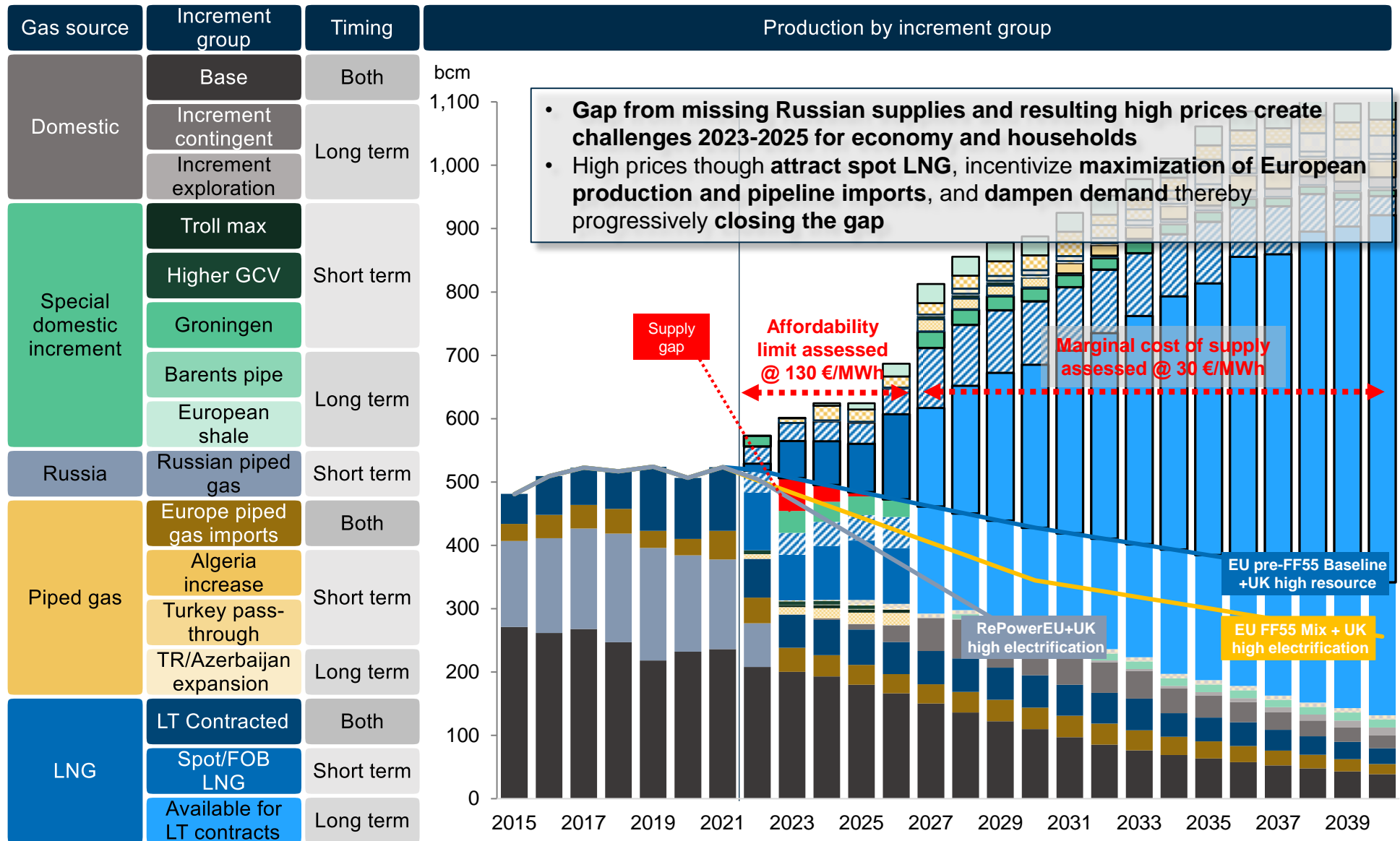
Source: Rystad Energy research and analysis, Rystad Energy GasMarketCube, European Commission, UK Department for Business, Energy & Industrial Strategy



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WHAT IS THE SUPPLY GAP IF RUSSIA STOPS SUPPLIES?

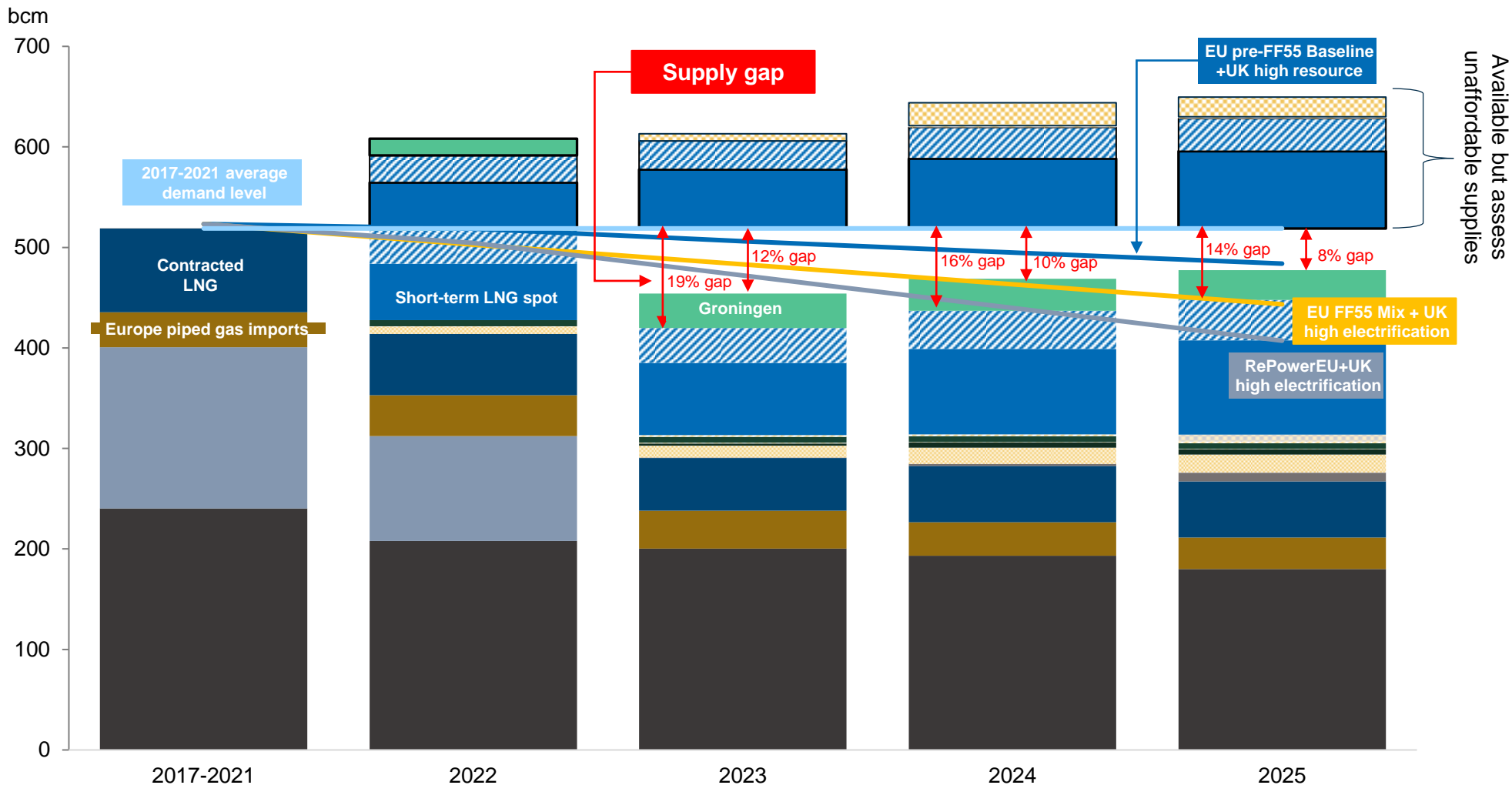
No Russian supplies as of 2023 creates supply gap in 2023 - 2025 but ...



Source: Rystad Energy research and analysis, Rystad Energy GasMarketCube, European Commission, UK Department for Business, Energy & Industrial Strategy

Supply gap versus 2017-2021 average demand: gap of up to 19%

Short-term supply with high-cost / non-affordable gas filtered out, and without Russia from 2023



Source: Rystad Energy research and analysis, Rystad Energy GasMarketCube, European Commission, UK Department for Business, Energy & Industrial Strategy

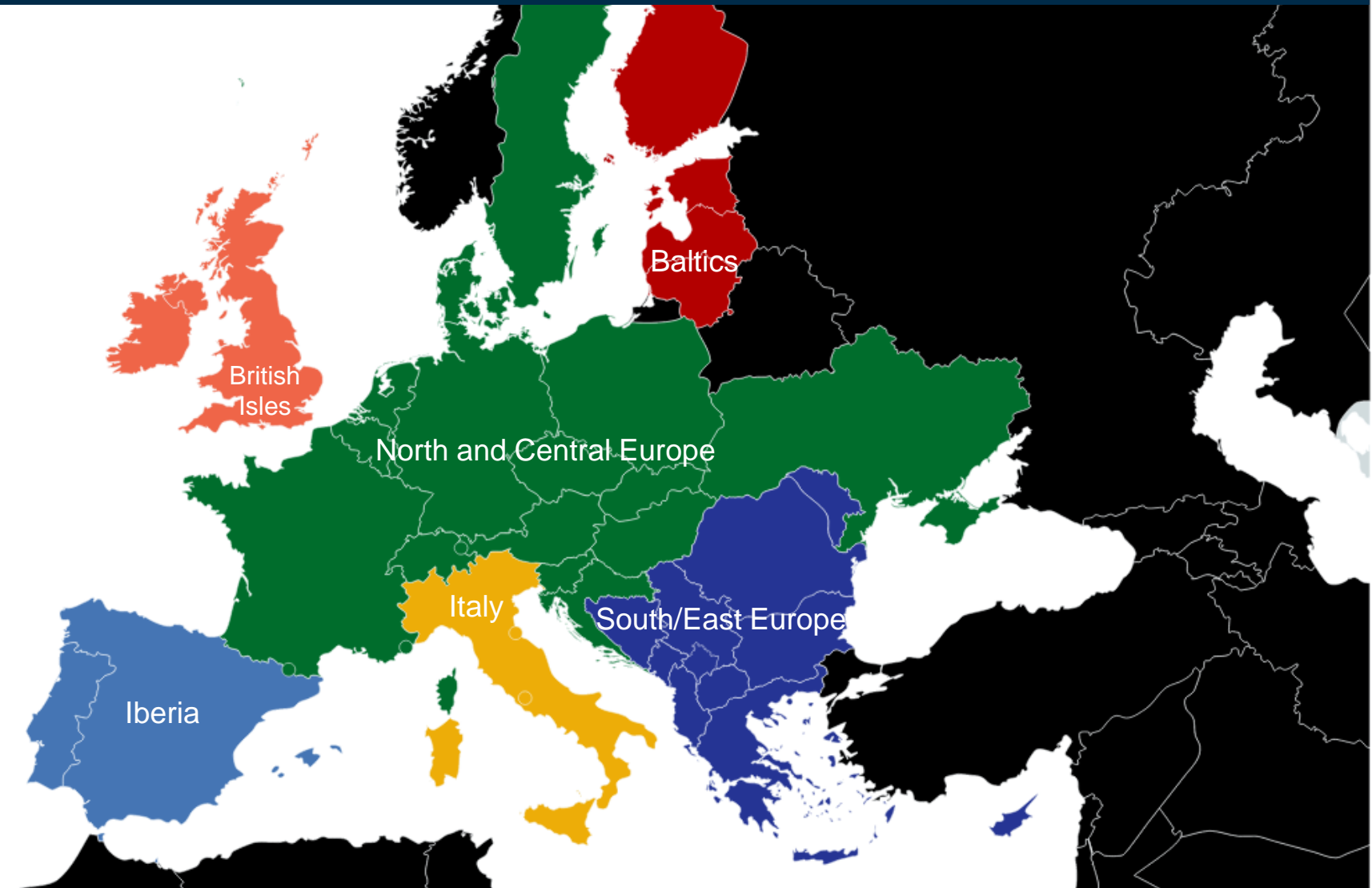


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REGIONALIZATION

Regional grouping of countries which are relatively well connected by infrastructure

Grouping of European markets into regions

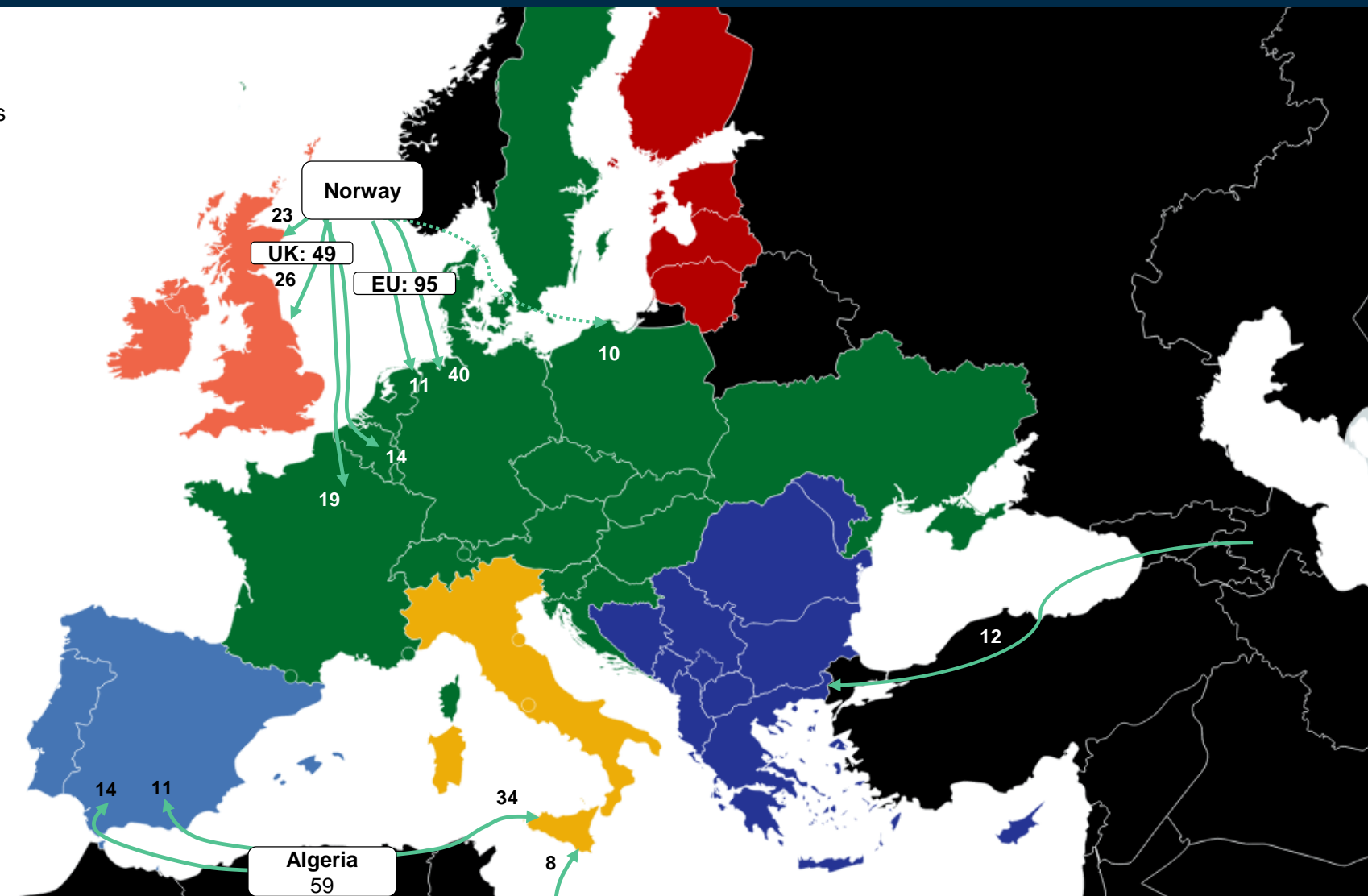


Non-Russian pipeline imports from North Sea, N Africa, and Turkey

LNG and non-Russian pipeline import capacities by region

Bcm/yr

→ Pipelines



Significant LNG regas capacity into Europe; interconnecting regions through rerouting

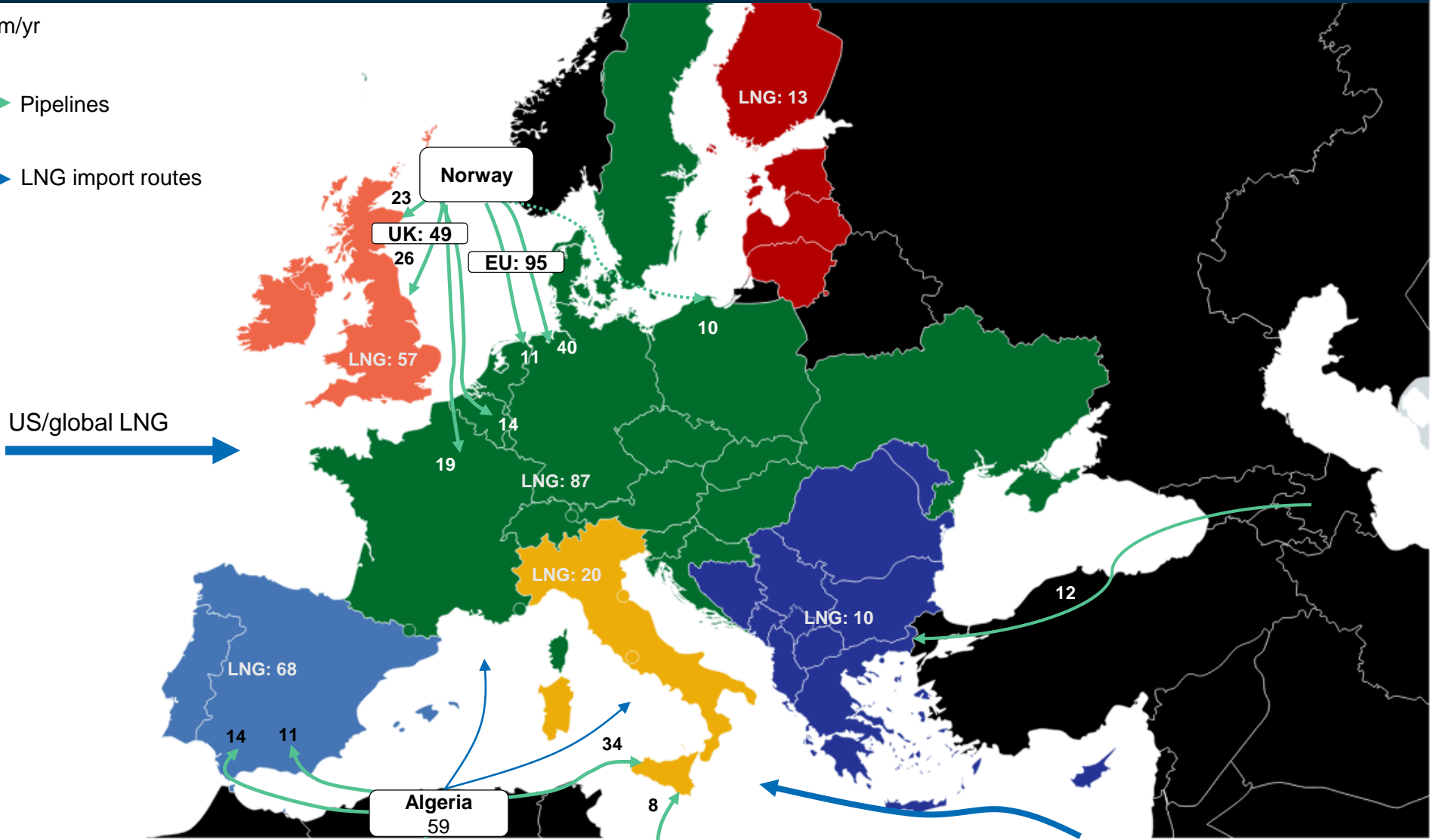
LNG and non-Russian pipeline import capacities by region

Bcm/yr

→ Pipelines

→ LNG import routes

US/global LNG



Connectivity between regions varies with significant bottlenecks between Spain and France; Poland and Lithuania and no capacity for reverse flows from Italy to Greece

Regions and the interconnectivity between them, 2023

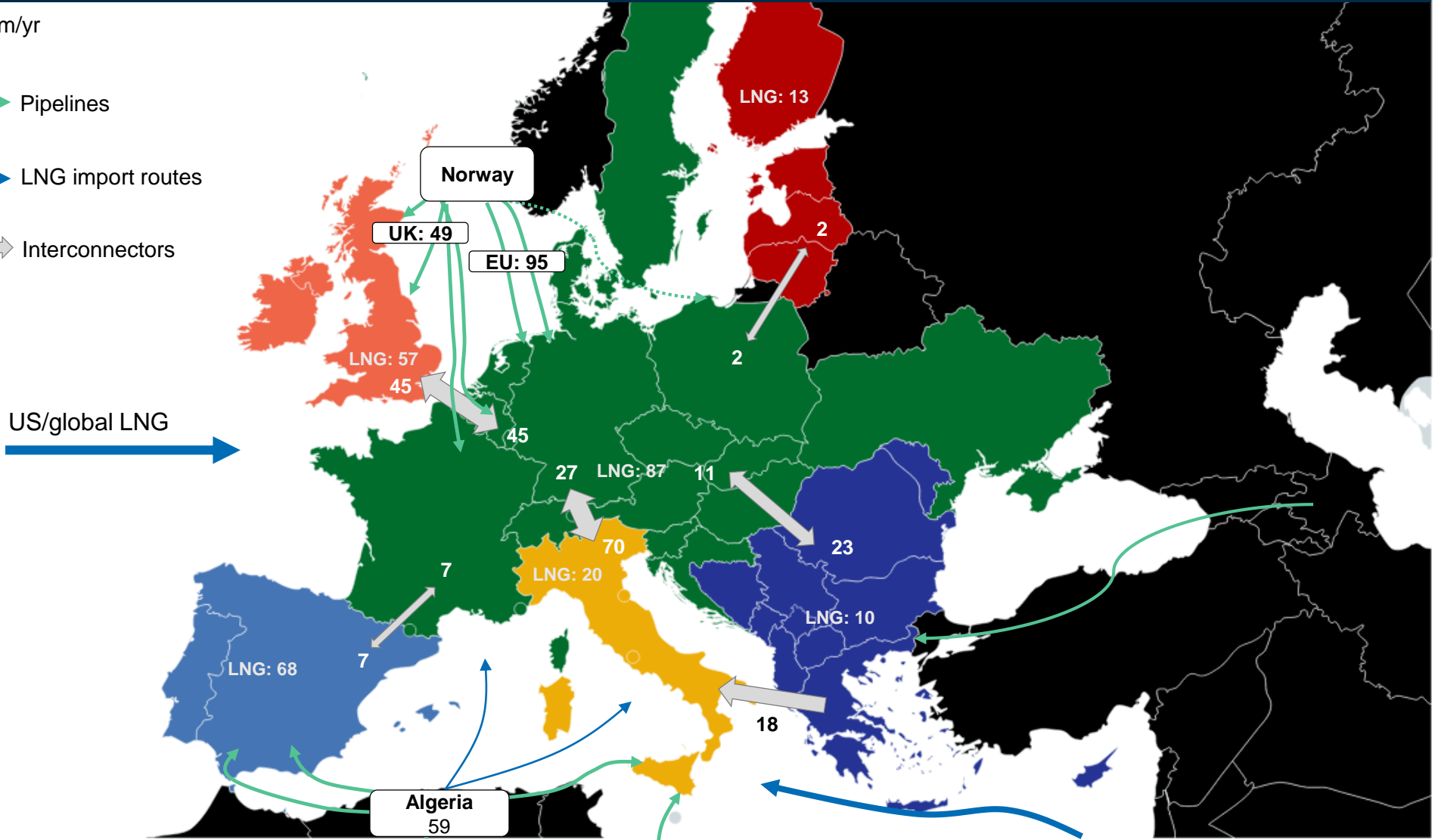
Bcm/yr

→ Pipelines

→ LNG import routes

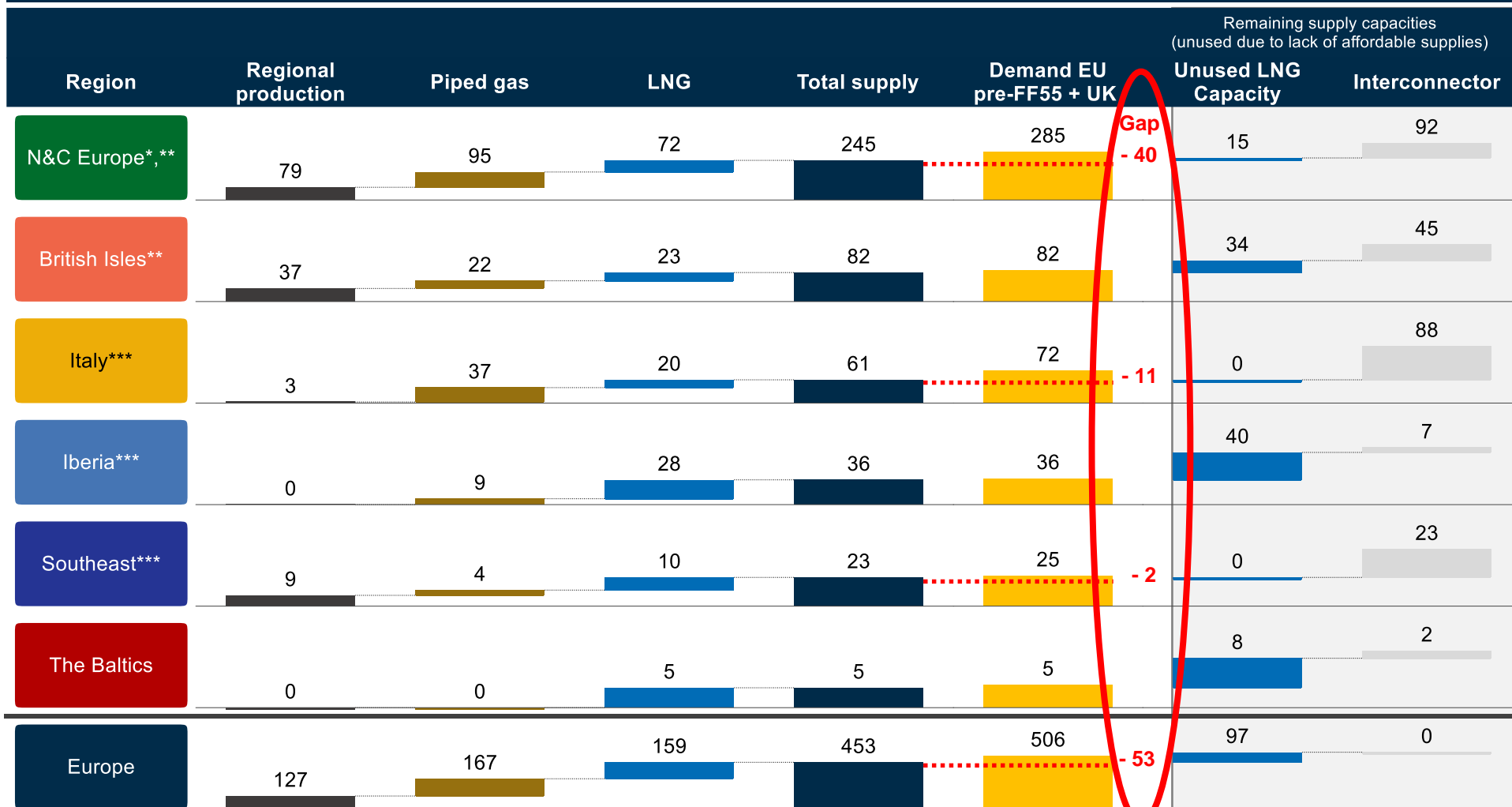
↔ Interconnectors

US/global LNG



Without Russian gas in 2023: while interconnectors/LNG reroute can shift supplies, N&C Europe, Italy, S/E Europe **compete for globally remaining affordable supplies**

Regional balances, 2023 (unit: bcm/year)



*N&C Europe treated as a region of residual uncontracted LNG **Norwegian exports assumed flexible and maximised up to capacity ***Contractual obligations respected
 Source: Rystad Energy research and analysis, Rystad Energy GasMarketCube, European Commission, UK Department for Business, Energy & Industrial Strategy, ENTSOG

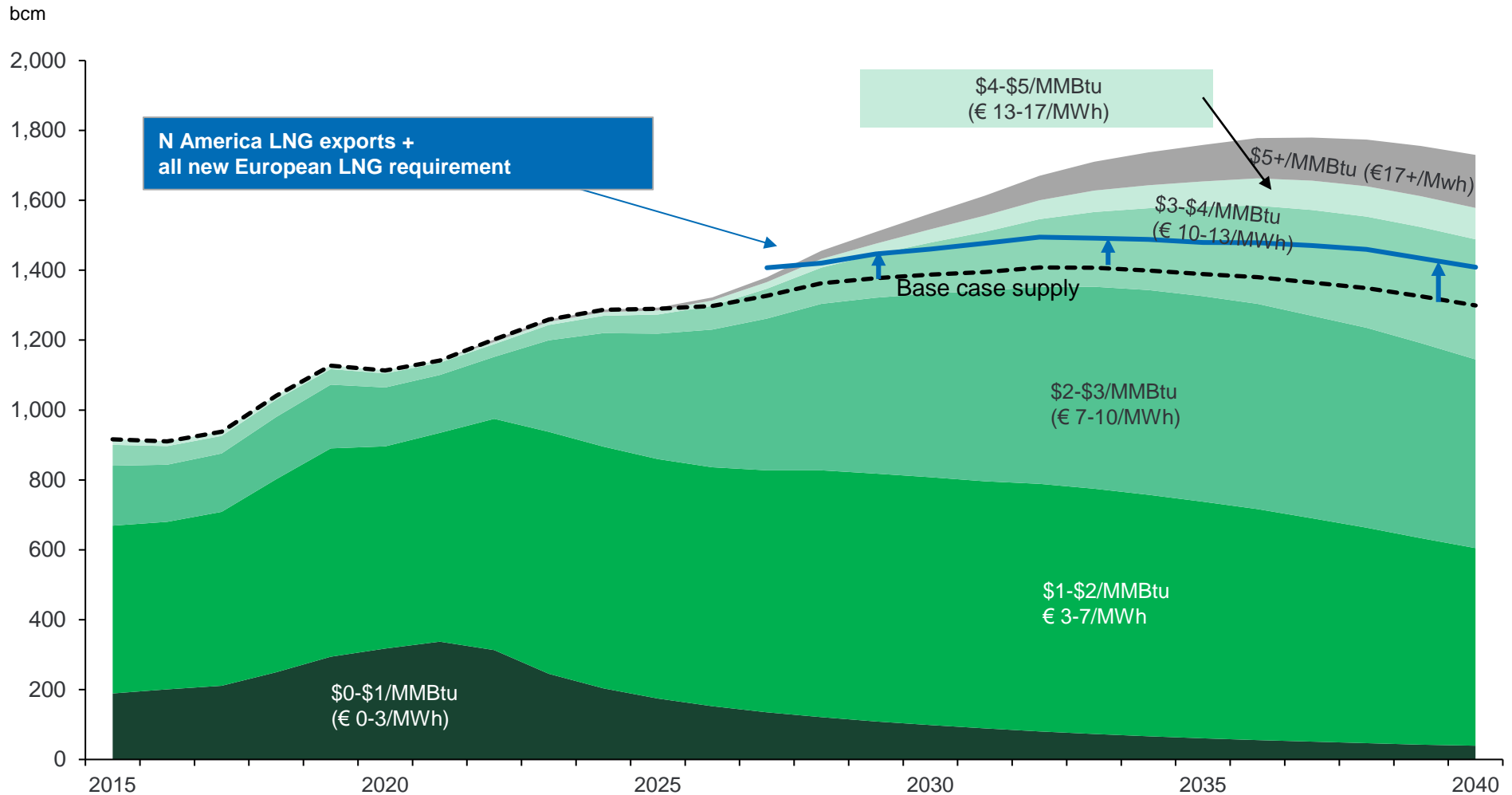


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DEEP DIVE ON LNG

Low-cost supplies in N America; new European demand ~7% production increase

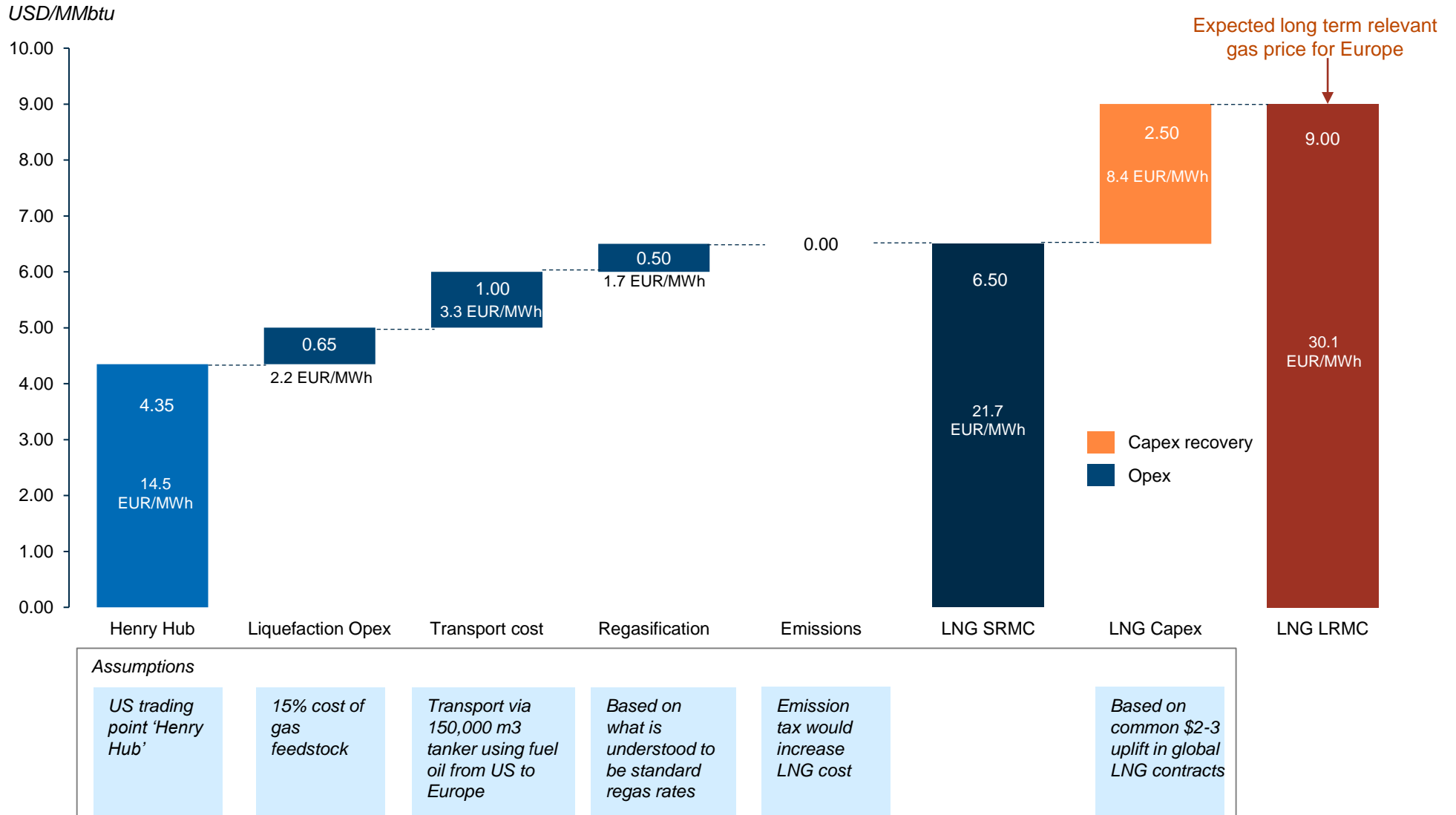
US and Canada natural gas supply potential by lifecycle and breakeven price



Note: Breakeven based on a 7.5% real hurdle rate. Prices are in real terms. Assumed exchange rate: 1 EUR = 1.02 USD
 Source: Rystad Energy GasMarketCube

Long-term European LNG supply cost expectations compare with pre-crisis levels once market distressed

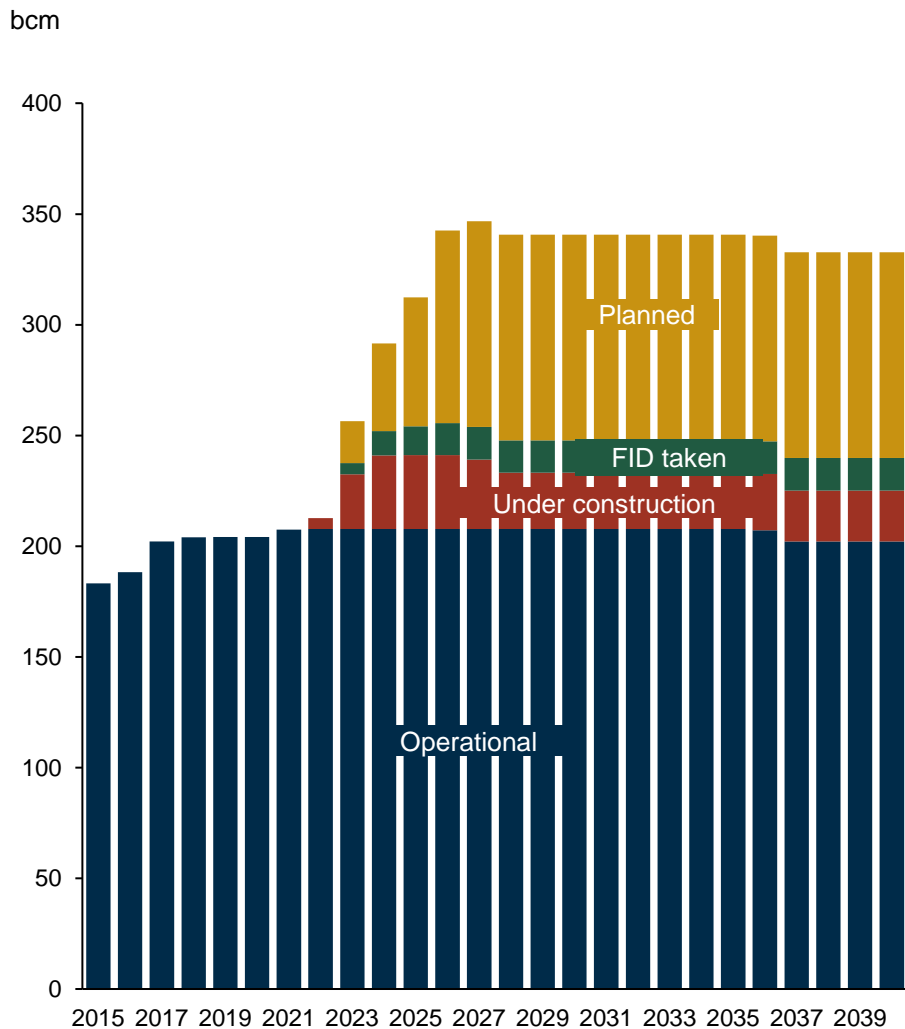
LNG price forecast buildup based on long term Henry Hub assumption



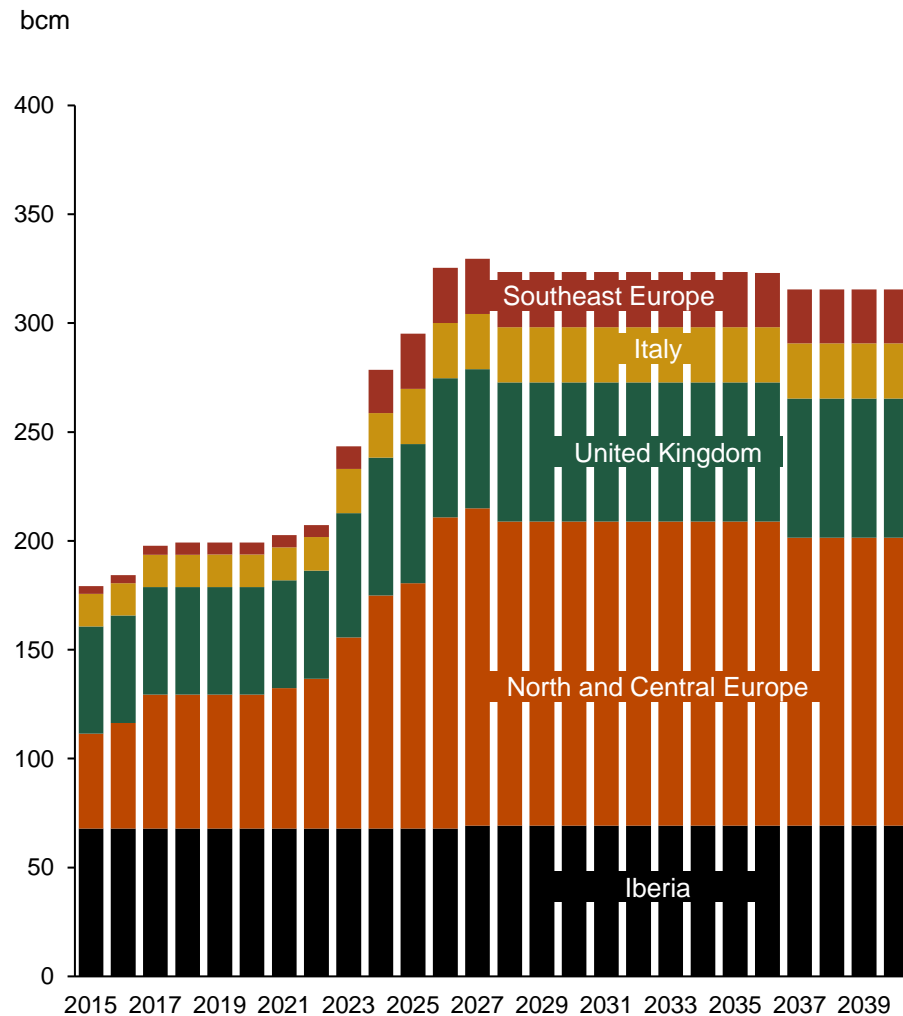
Prices are in real terms. Assumed exchange rate: 1 EUR = 1.02 USD Source: Rystad Energy research and analysis

European LNG regas/import capacity can grow by 120 bcm to 330 bcm per year

Infrastructure status on European regas capacity



European regas capacity split by geography



Source: Rystad Energy research and analysis; Rystad Energy GasMarketCube



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CONCLUSIONS

Main findings of the study

2023-2025

It will not be possible to fully substitute Russian imports; the shortage can be progressively reduced if new supplies can be procured

The shortage leads to **high prices**, which **attract** LNG cargoes, **incentivize** the full production of existing fields in Europe and **maximize** pipeline imports from neighboring countries

Europe's interconnected gas **infrastructure and integrated gas market make a significant contribution to energy resilience** by rebalancing flows within and across the regions

However, **significant demand reductions are needed**, as households and industry reduce consumption and switch to alternative energies

2026 onwards

New long-term supplies from abundant and low-cost global resources can fully substitute Russian supplies and rebalance the market.

Long-term contracts are needed to underpin the necessary LNG projects while some adjustments to the European gas infrastructure are needed

LNG imports can then become the key alternative supply source, in addition to maximized European resources and pipeline imports

The relative **low cost of developing and supplying alternative volumes** to Europe are expected to let gas prices drop to **pre-crisis expectation levels**

Policy considerations

European Production

Re-assess potential of all European natural gas production sources, incl. shale gas (significantly lower carbon footprint), review no-go areas, accelerate permitting procedures and impact assessments

Member States should **review NECPs** to reflect the potential of domestic resources and lift bans and moratoria

Recognize significant **role of Norway** as reliable supplier, and further deepen EU's partnership

New Imports

EU to facilitate the sourcing of new supplies from 3rd countries, but **contracts to be concluded between market participants** in competition with each other

Long-term LNG purchases and infrastructure-use contracts are needed and should be supported by an appropriate European legal framework

Address missing North America midstream infrastructure bottlenecks (pipeline capacity, liquefaction) to fully enable LNG exports to Europe

Infrastructure

Address bottlenecks to **increase system resilience** and harvest benefits from further EU market integration

Consider establishing a **short-term / emergency Projects of Common Interest instrument** to support necessary EU network, LNG re-gas, and storage reinforcements

Carefully **re-assess gas demand reduction forecasts** and infrastructure downsizing with aim to ensure security of supply

In a nutshell

- For Europe's gas market to rebalance, **LNG projects and domestic production need to be incentivized** through long term contracts and a favorable regulatory framework allowing investments in E&P activities
- **Delays in making right decisions will prolong the period of suffering** and risk to permanently damage Europe's industrial base
- Europe can decide what happens next: a **vision is needed grounded in reality to securely supply energy to Europe's citizens and economy from diverse sources, at affordable prices, while meeting the climate objectives**



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Rystad Energy is an independent energy consulting services and business intelligence data firm offering global databases, strategy advisory and research products for E&P and oil service companies, investors, investment banks and governments. Rystad Energy is headquartered in Oslo, Norway.

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