G2M2 Outlook: Key Global Trends Impacting North American LNG

GPCM User Conference

Nov 13, 2024

The Leader in Energy Market Simulation Systems

Providing energy companies, consultants, and regulators advanced tools to support:

- **Investment and M&A Strategy**
- **Environmental and Sustainability Goals**
- **Credible Risk Analysis**
- **Trading Strategy**
- **Policy Development and Assessment**
- **Energy Security**

Roadmap

- Short term drivers
- Medium term drivers
- Long term drivers
- Scenarios

Short-Term Drivers (2024-2025)

Weather impacts:

- cold winters in Europe, heatwaves in Asia.

Geopolitical factors:

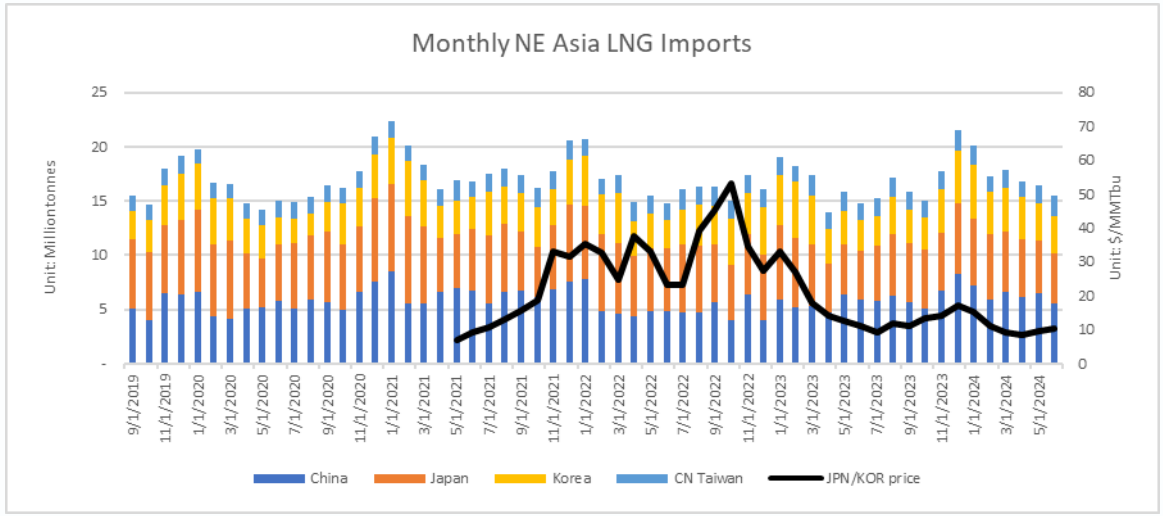
- Russian sanctions

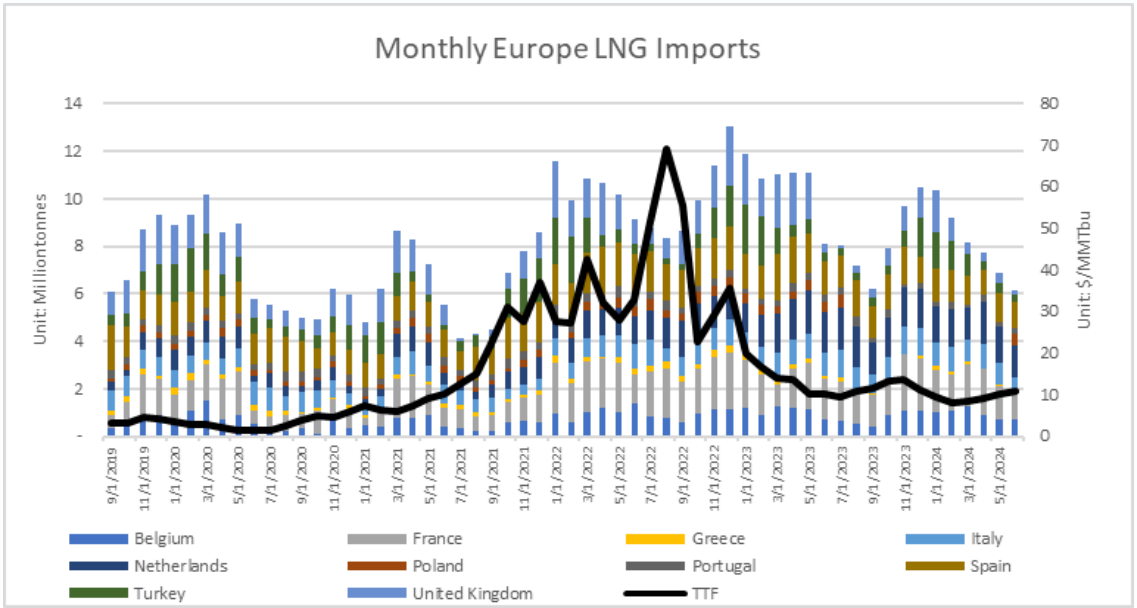
Supply chain disruptions: U.S. LNG supply interruptions.

Weather Impacts

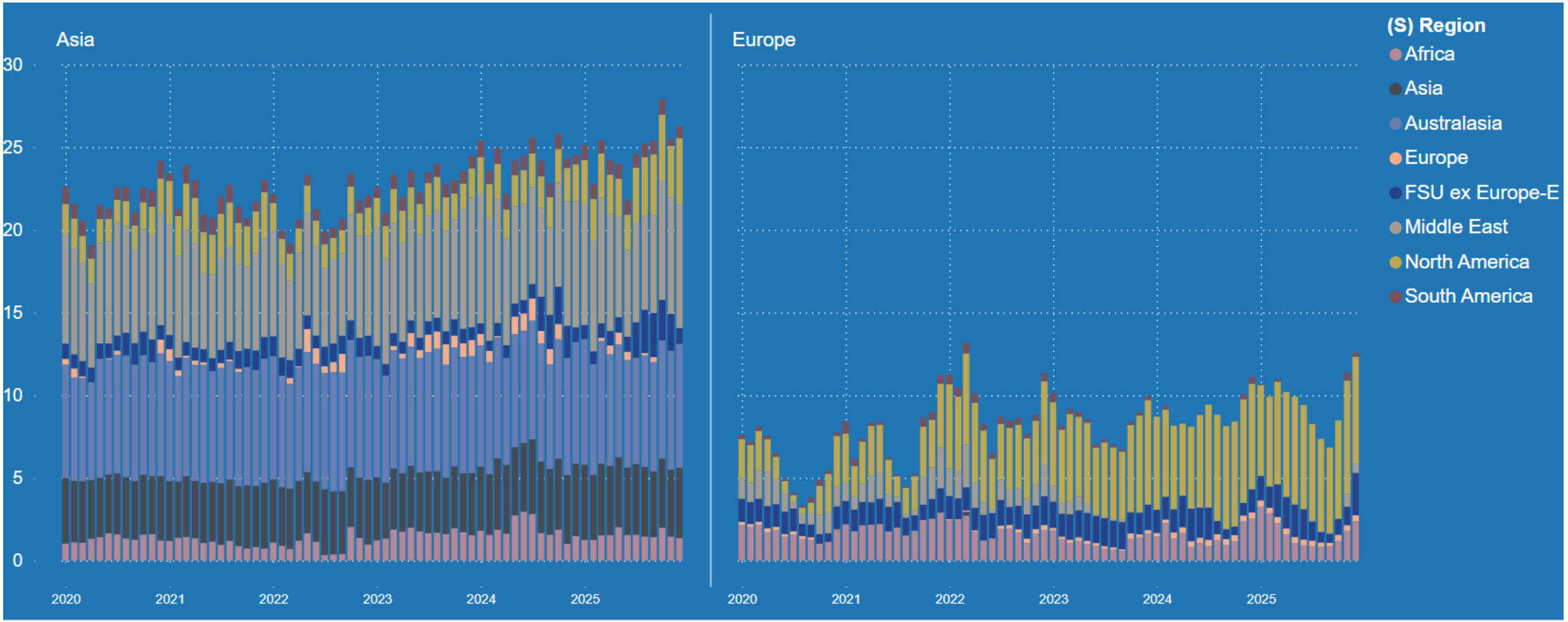
- El Niño/La Niña effects on Europe and Asia.
  - El Niño: warmer than normal for Northern Hemisphere for both winter and summer.
    - 2023 summer - record high temperature in China and Japan
    - 2023-2024 winter – mild winter in Europe
    - Drought in Asia
  - La Niña: by contrast, often leads to colder winters, which increases the need for natural gas for heating.
    - 2020/2021 US and Europe Colder winter
    - Drought in Americas
- As of Oct 2024, a higher likelihood of La Niña developed in coming months – colder than normal in northern hemisphere

Extreme weather conditions are a major driver of volatility in global gas demand, leading to sharp seasonal surges in both Europe and Asia.





LNG Imports into Asia and Europe by Origin

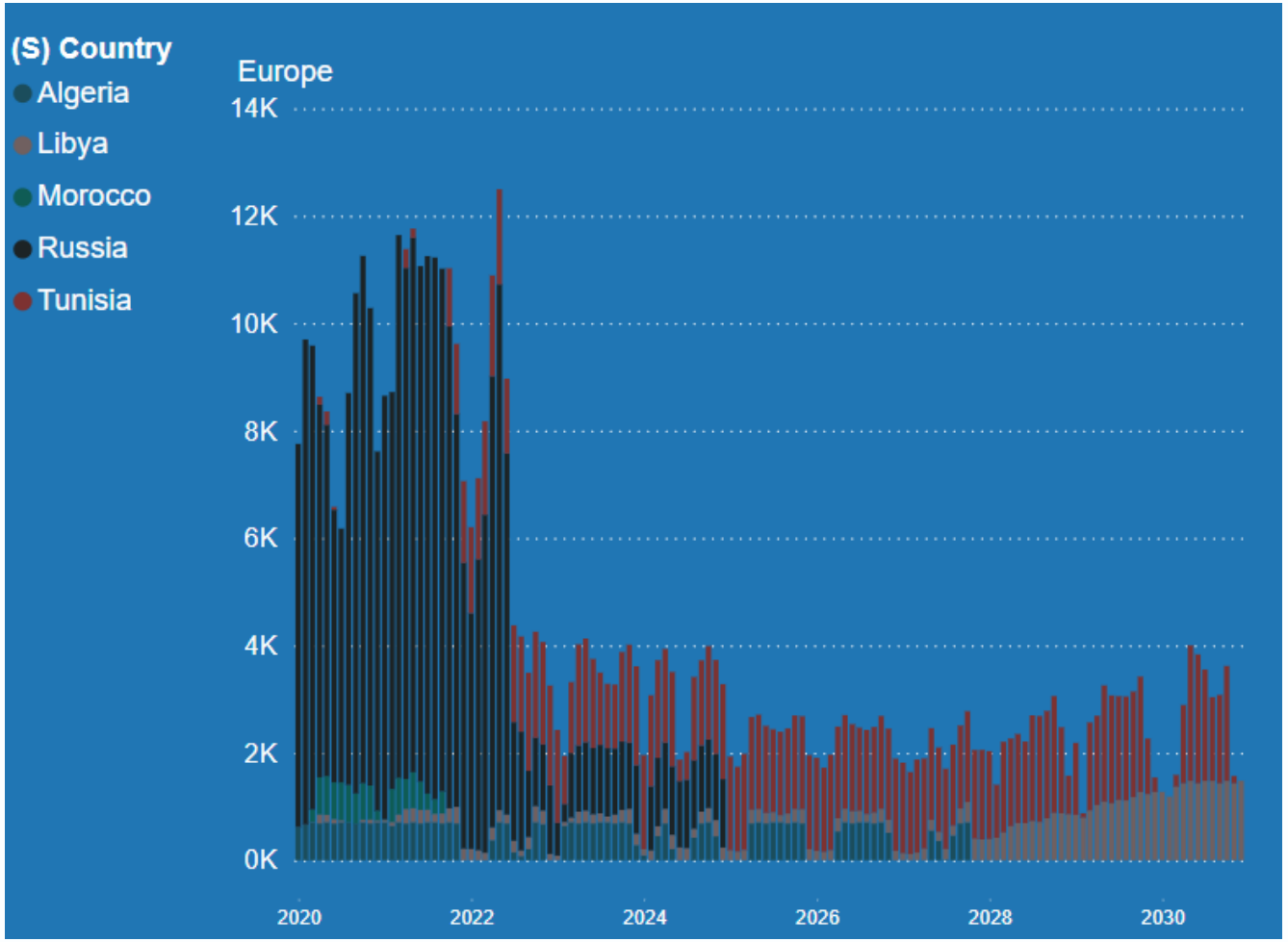


Unit: Million Metric Tons

Geopolitical Factors

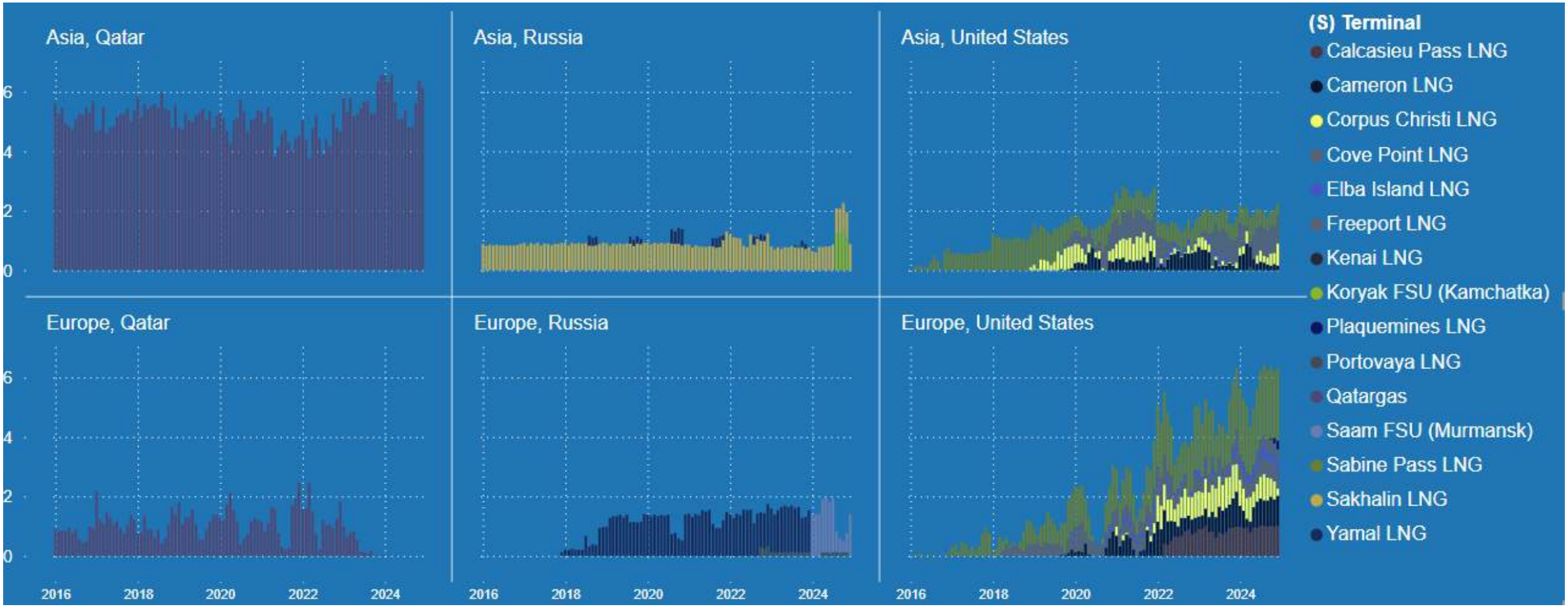
- Russian sanctions limit gas flows to Europe.
- Instability in the Middle East may disrupt supply. (See the next chart)

Pipeline Imports by Source Country into Europe (Excluding Turkey and East Europe)



Unit: MCM

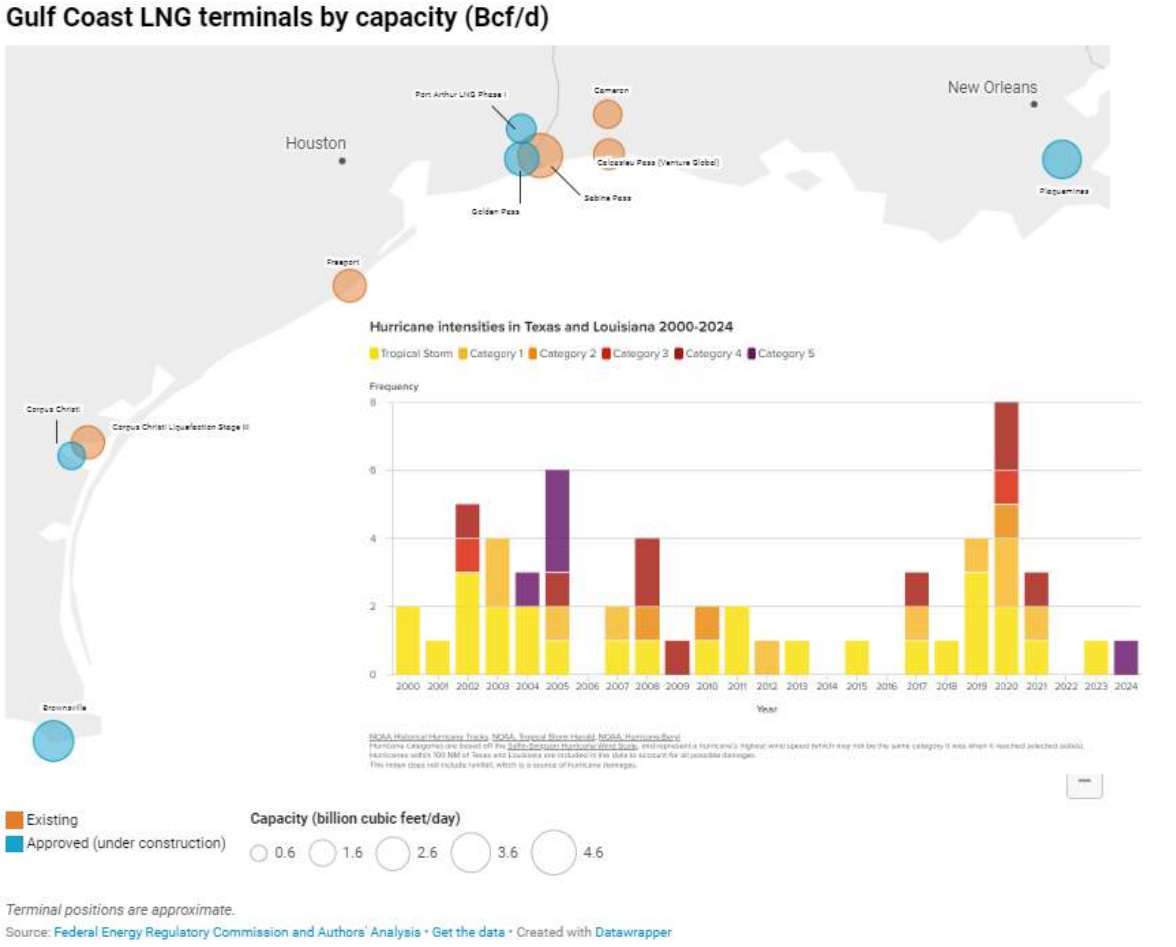
LNG Flow by Source Country to Asia and Europe



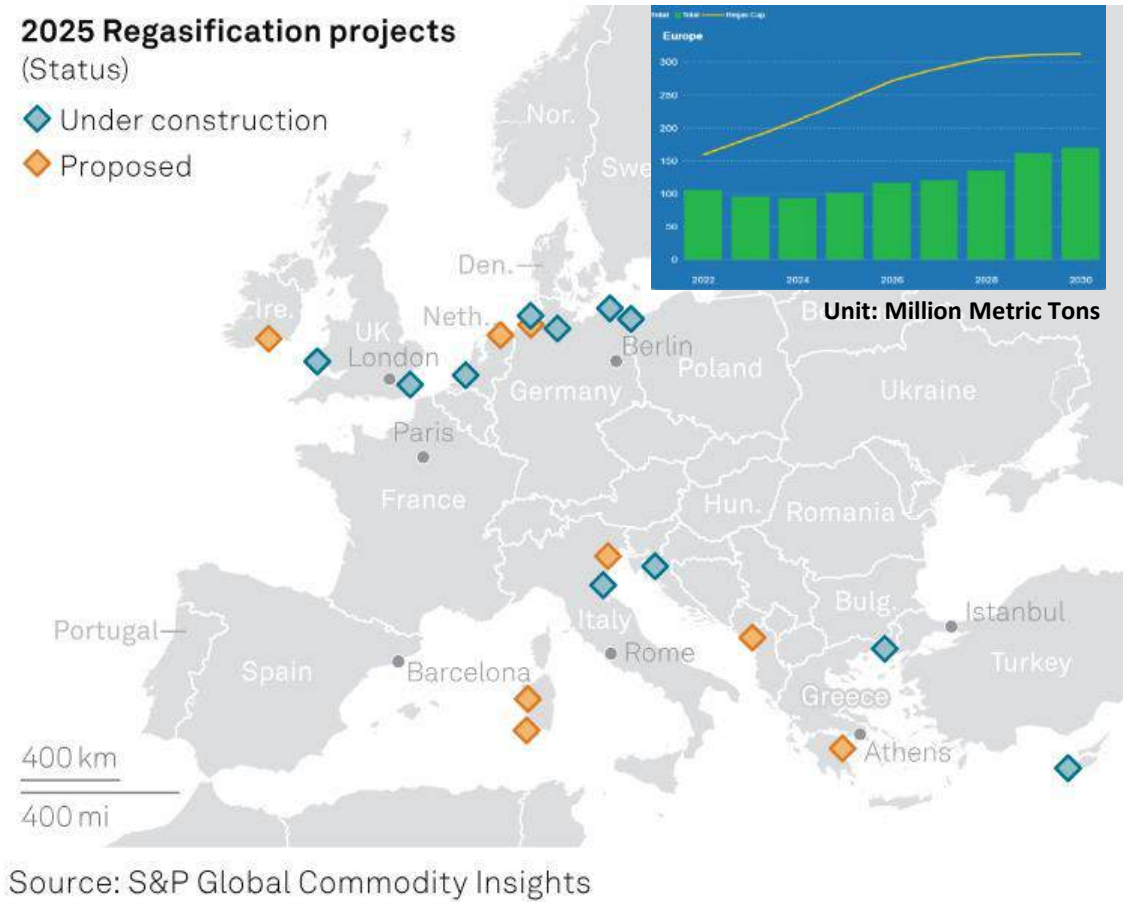
Unit: Million Metric Tons

Supply Chain Disruptions

US Gulf Coast LNG Project
Inset: Hurricane intensities in Texas and LA 2000-2024



Europe LNG Import Projects Coming Online in 2025
Inset: Regasification capacity versus volume through 2030



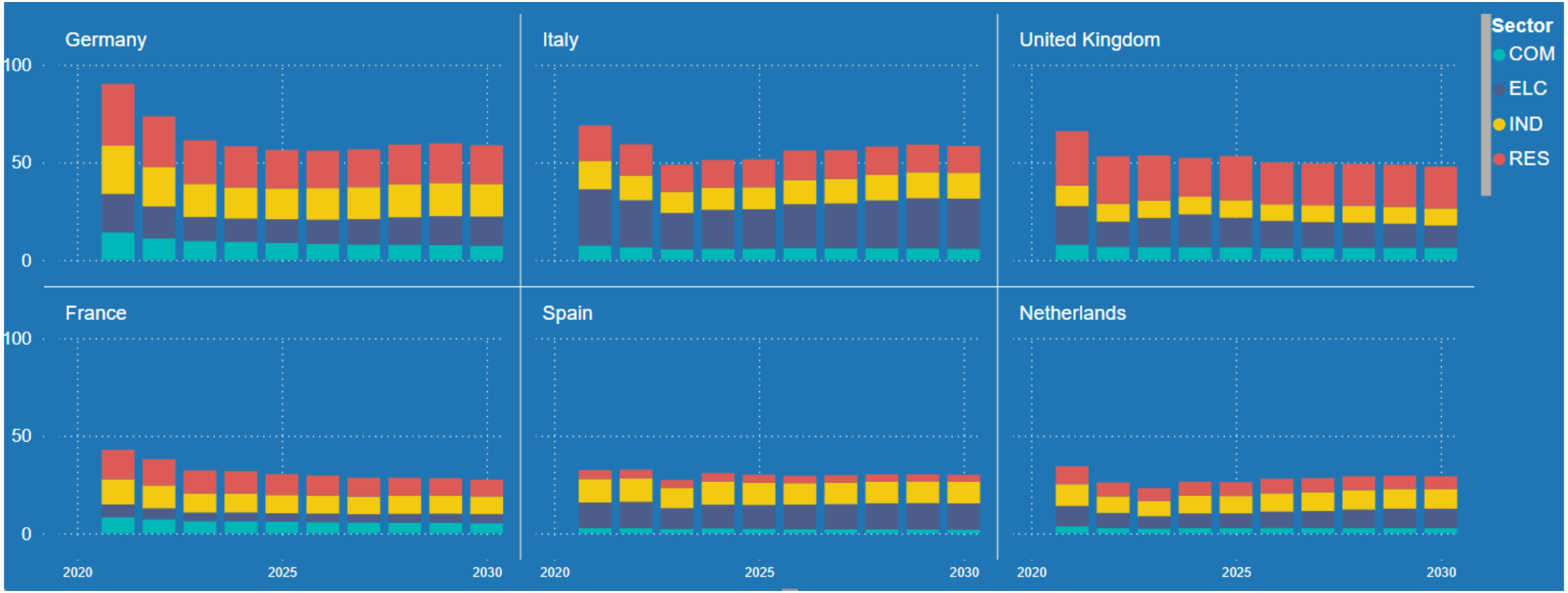
Source: S&P Global Commodity Insights

Medium-Term Drivers (2026-2030)

Policy impacts on European gas demand.

Liquefaction capacity expansion

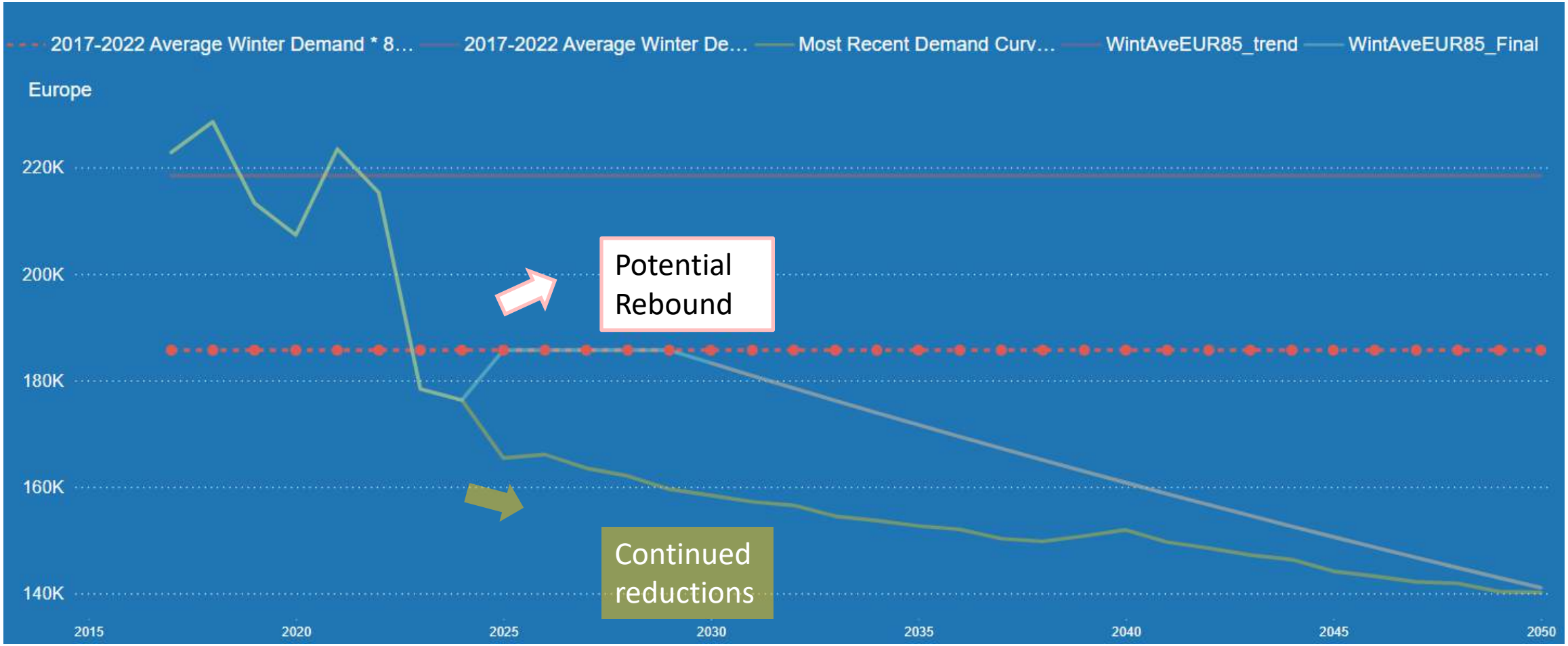
Policy and Regulation in Europe's Energy Transition



- Fit for 55 targets reduced natural gas use in power generation.
- Natural gas as a transitional fuel until 2040.

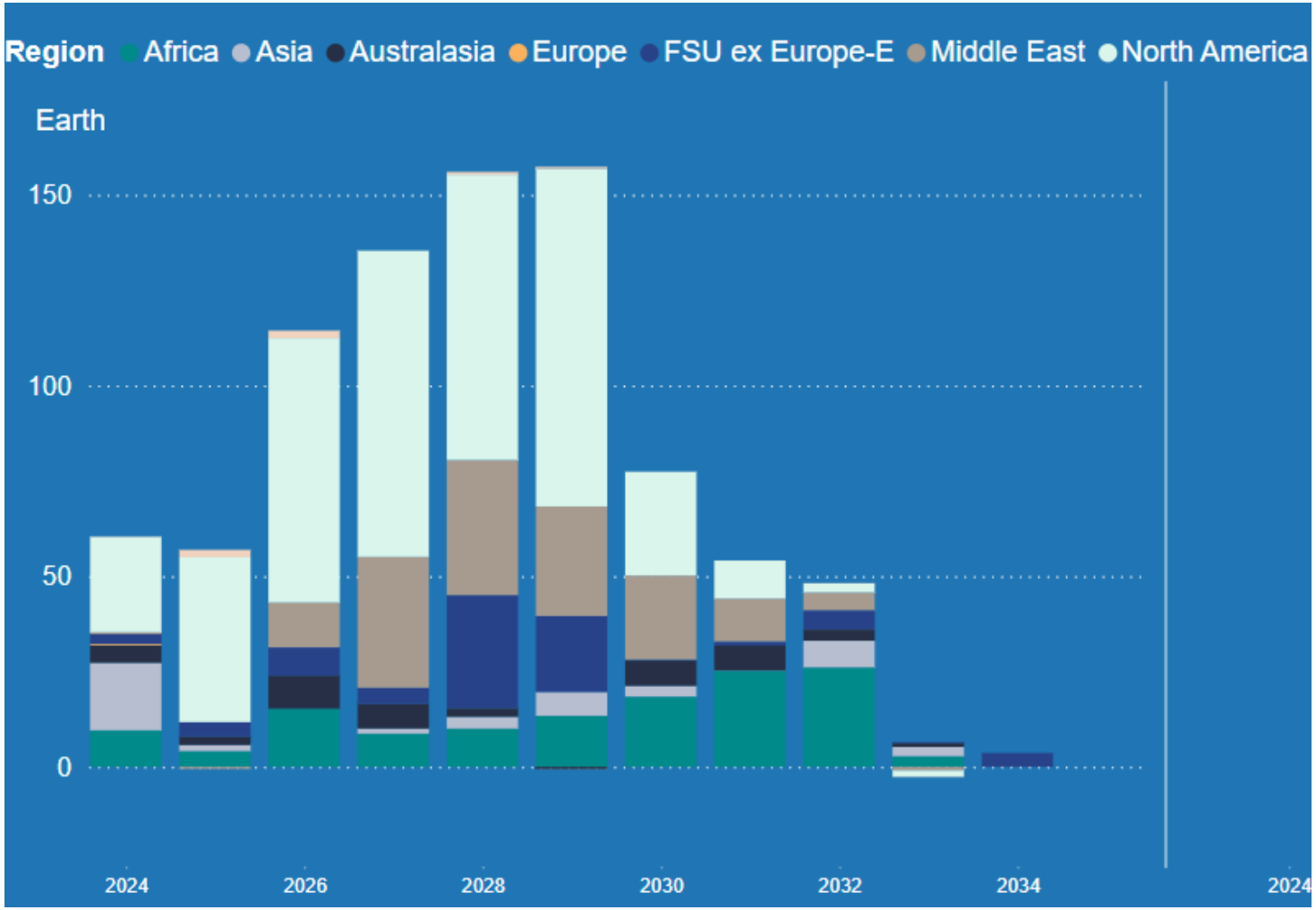
Unit: BCM

Demand Rebounds in Europe and Emerging Markets



Liquefaction Projects

- U.S., Qatar, and Africa are expanding liquefaction capacity.
- New liquefaction projects like Greater Tortue Ahmeyim FLNG.

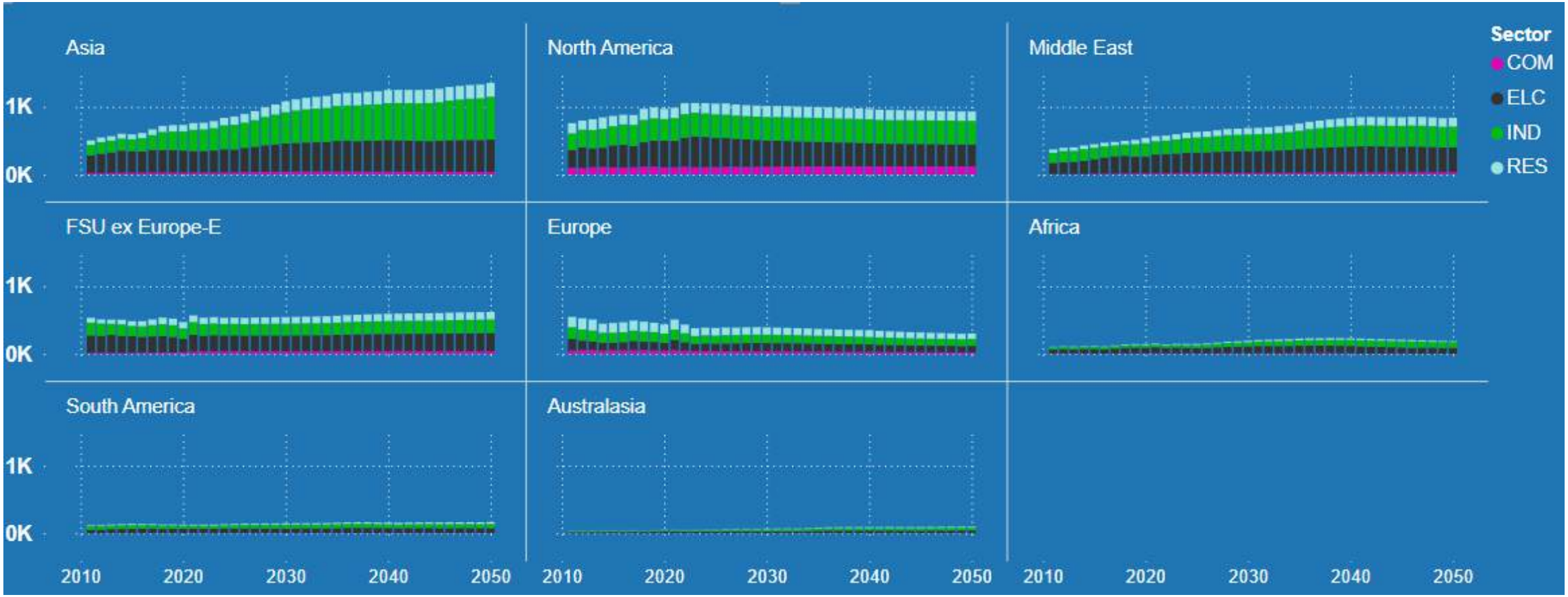


Unit: Million Metric Tons

Long-Term Drivers (Post-2030)

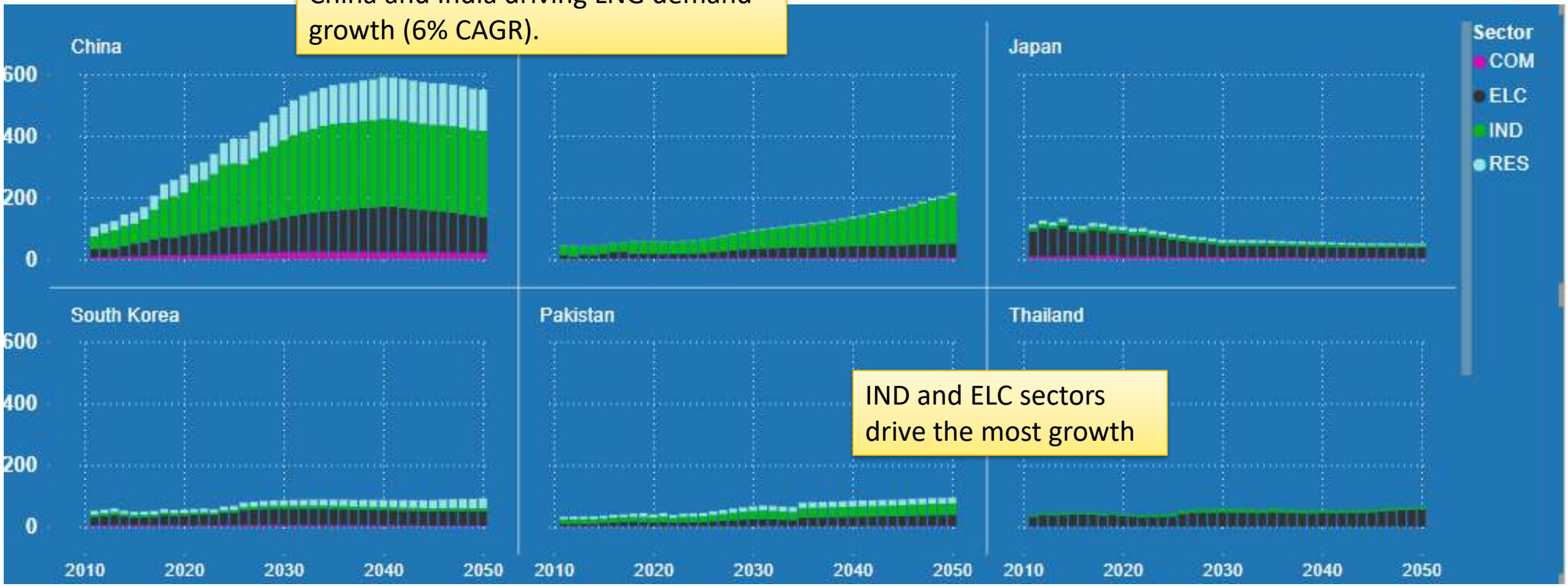
- Asia’s growing LNG demand, especially in China and India.
- Europe’s gas demand declines due to decarbonization policies.

Natural Gas Deliveries by Sector by Region - Global



Unit: BCM

China and India driving LNG demand growth (6% CAGR).



Unit: BCM

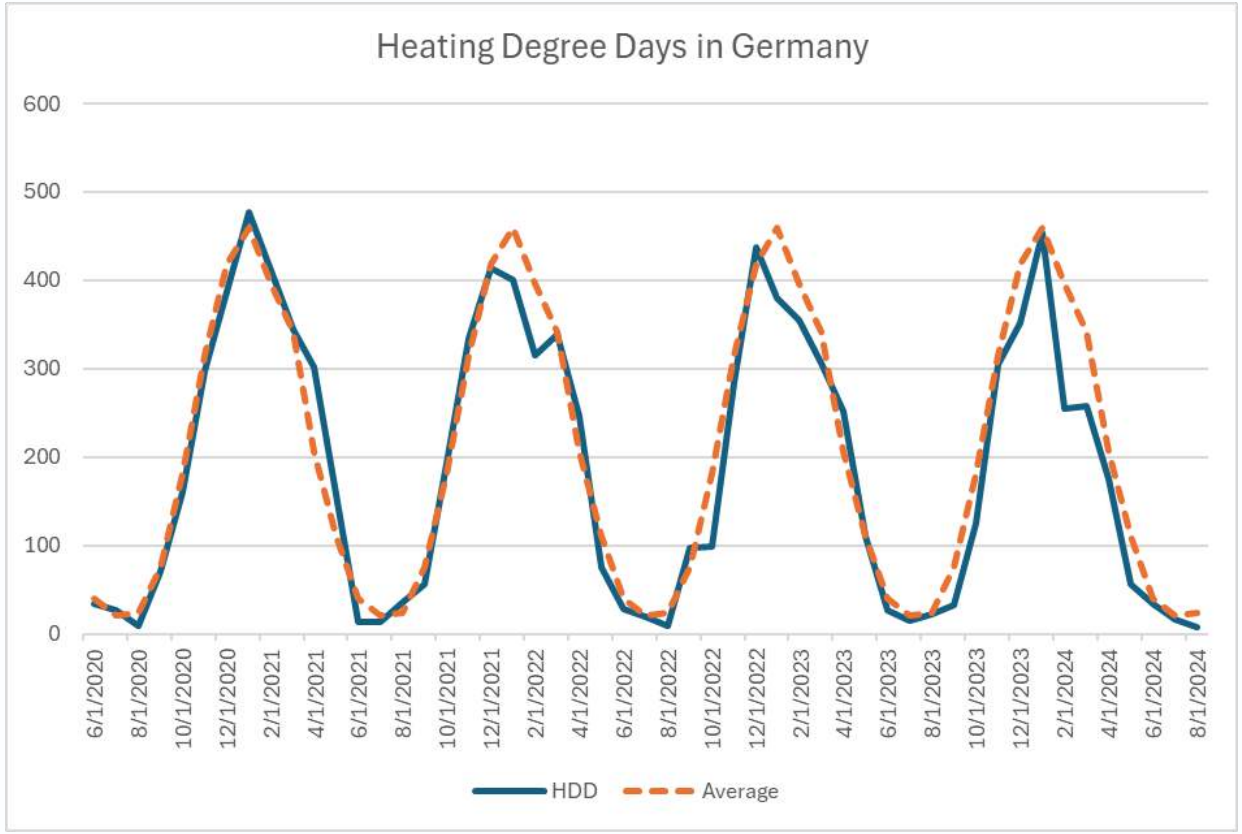
Scenario Based Forecasts

Upcoming Winter:

Typical winter

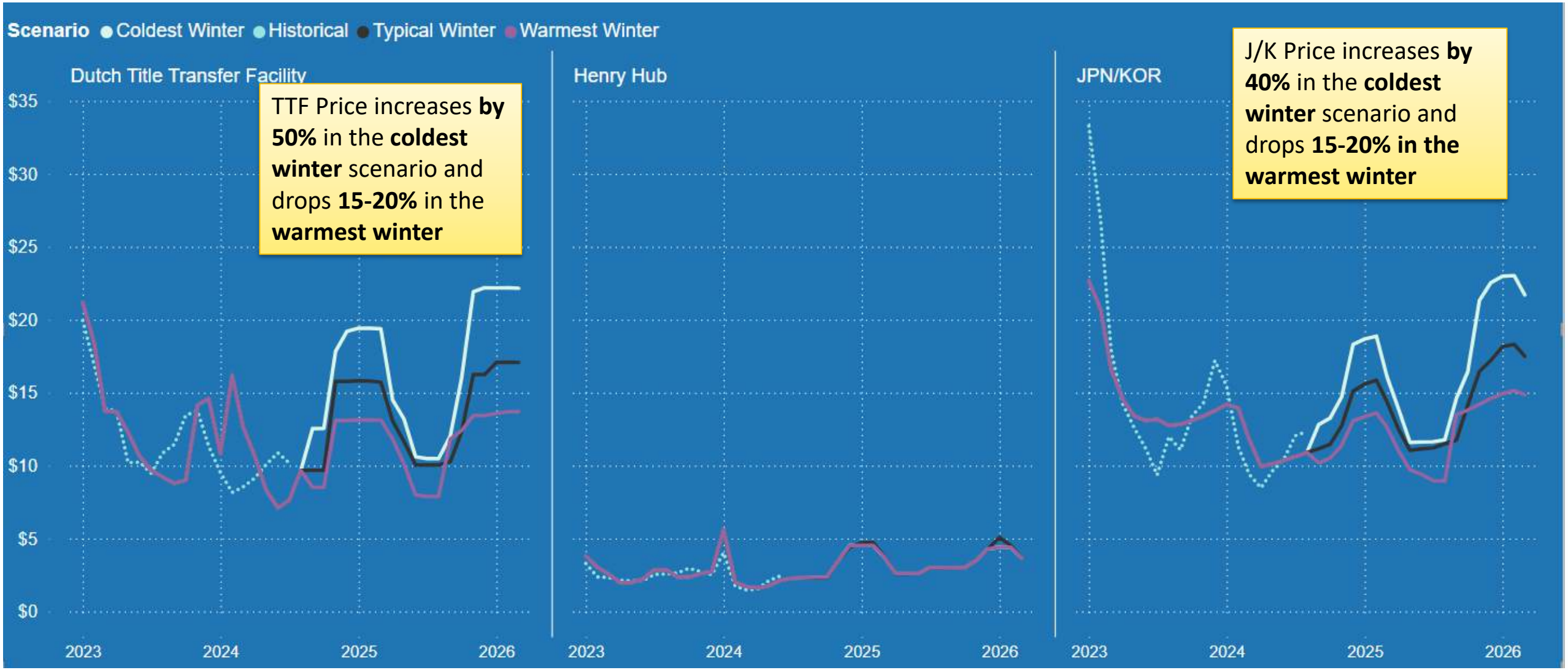
- Coldest winter
- Warmest winter

Scenario Based Forecasts



- Upcoming Winter:
- Typical winter
  - Coldest winter
  - Warmest winter
  - Based on 20 years weather.

Global Market Prices by Winter Sensitivity



Unit: $/MMBTU

Scenario Based Forecasts

Medium and Long Term Scenarios

A Perfect Storm

- Higher Demand
- Higher Demand + LNG Delay

Medium and Long Term Scenarios

A Perfect Storm:

Muted demand + Ontime LNG Projects

Higher Demand:

Stronger demand growth with Ontime LNG Projects

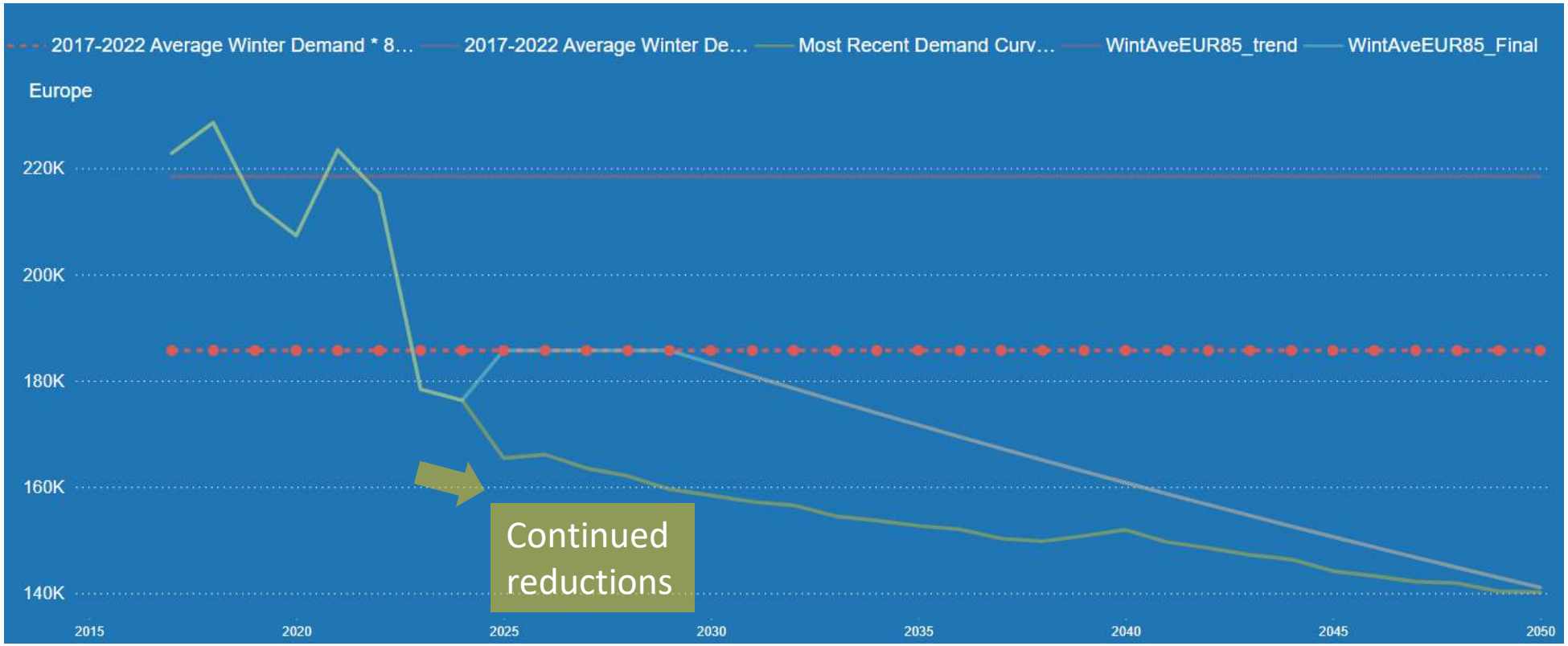
Higher Demand + LNG Delay:

Stronger demand growth with delays of LNG projects

Perfect Storm – Muted Economy & Ontime LNG

- **Muted Economic Growth in Europe**
- **LNG Terminals Come Online on time**

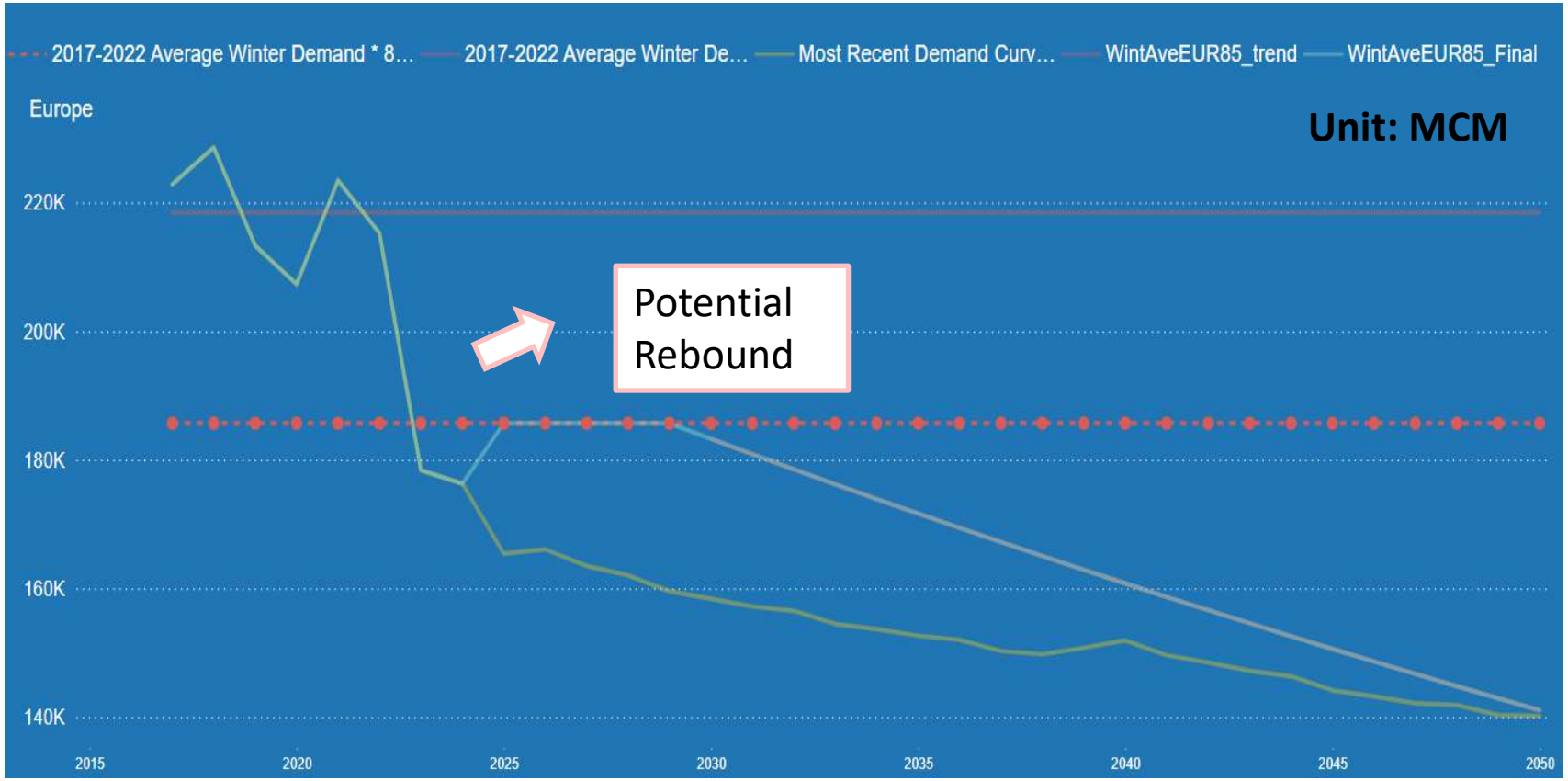
Winter Demand for Europe Market (Unit: MCM)



A perfect storm of muted economic growth in key markets with an on-time ramp-up of LNG liquefaction capacities from an oversupply period for the global LNG market.

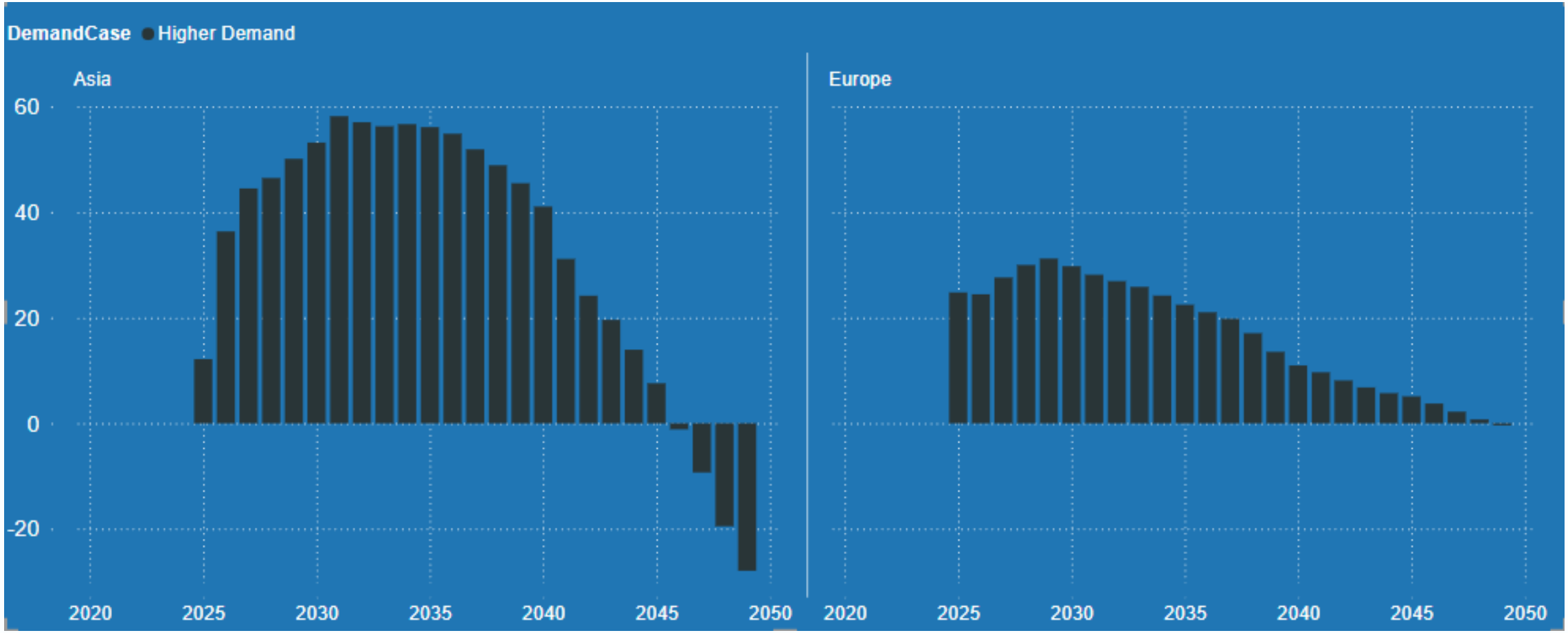
Demand Rebounds in Europe and Emerging Markets

- **Economic Recovery in Europe**:
  - Returning back to 85% average with reduction, of pre-war level, through 2030.
- **Emerging Market Growth**:
  - Climate Targets Remain, But Gas Plays a Role
  - Especially for China, India and Vietnam.
- LNG Terminals Come Online on time



Stronger recovery of demand in Europe with uptake in emerging markets, including China and India. Although the market begins to tighten, LNG terminals continue to come online as planned, balancing the increasing demand with growing supply

CAGR by Sector for Asia and Europe by Scenario

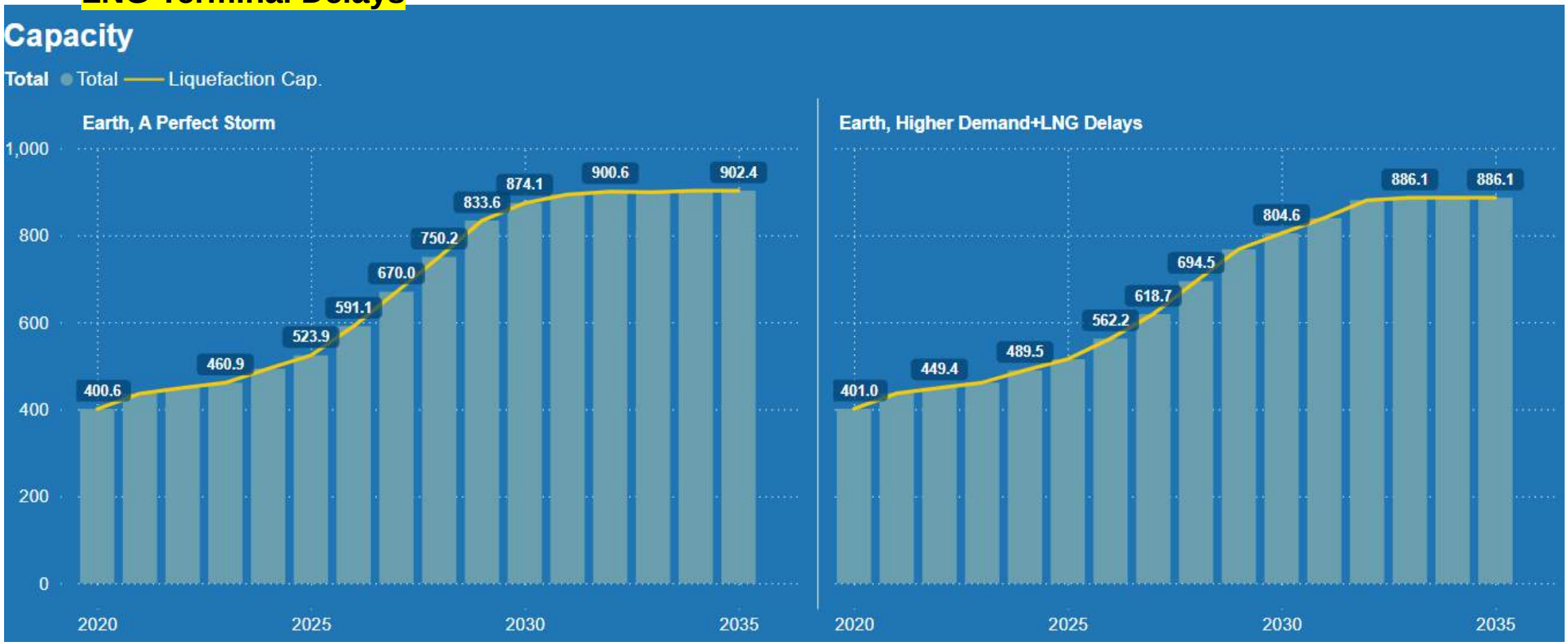


Unit: BCM

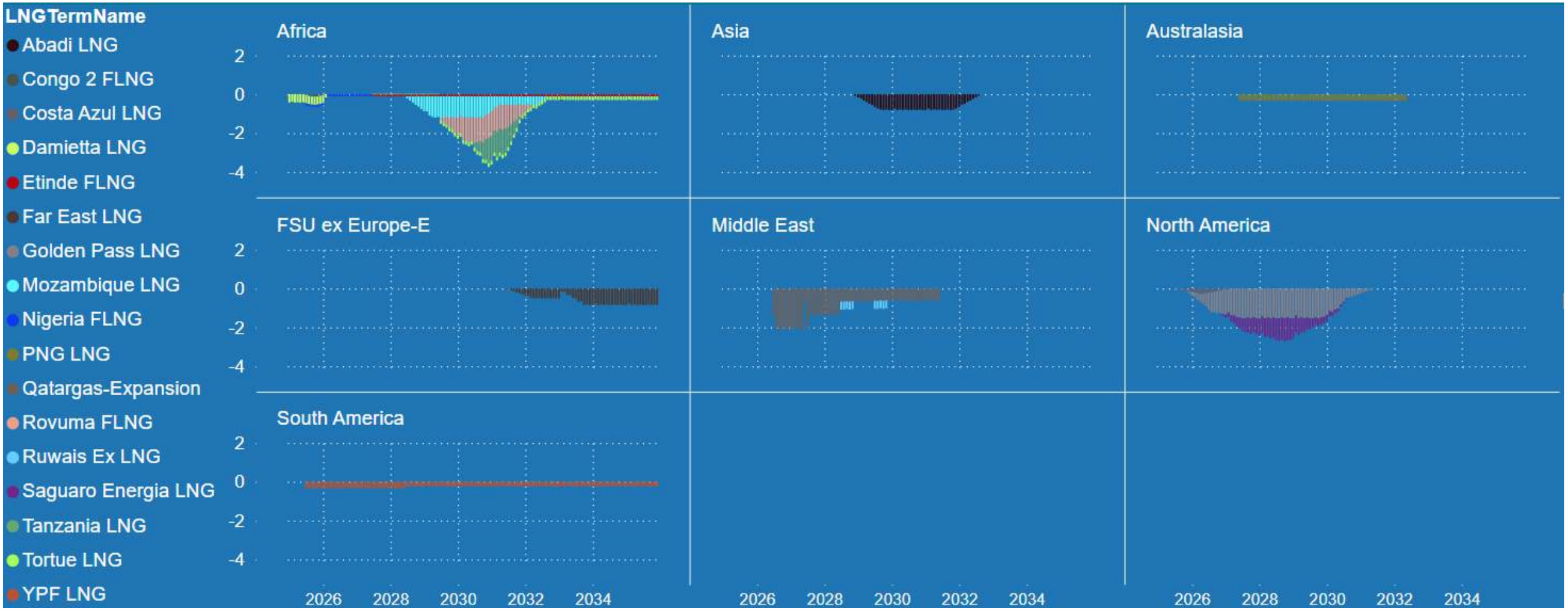
Increase the demand curve of Asia (China and India) to as high as 5% and Europe as high as 6.1% in the year 2030. The actual consumption depends on the price elasticity of demand in response to the market price.

Delayed LNG Terminals & Higher Demand

- **Economic Recovery Strengthens in Europe**
- **Rapid Growth in Emerging Markets**
- **LNG Terminal Delays**

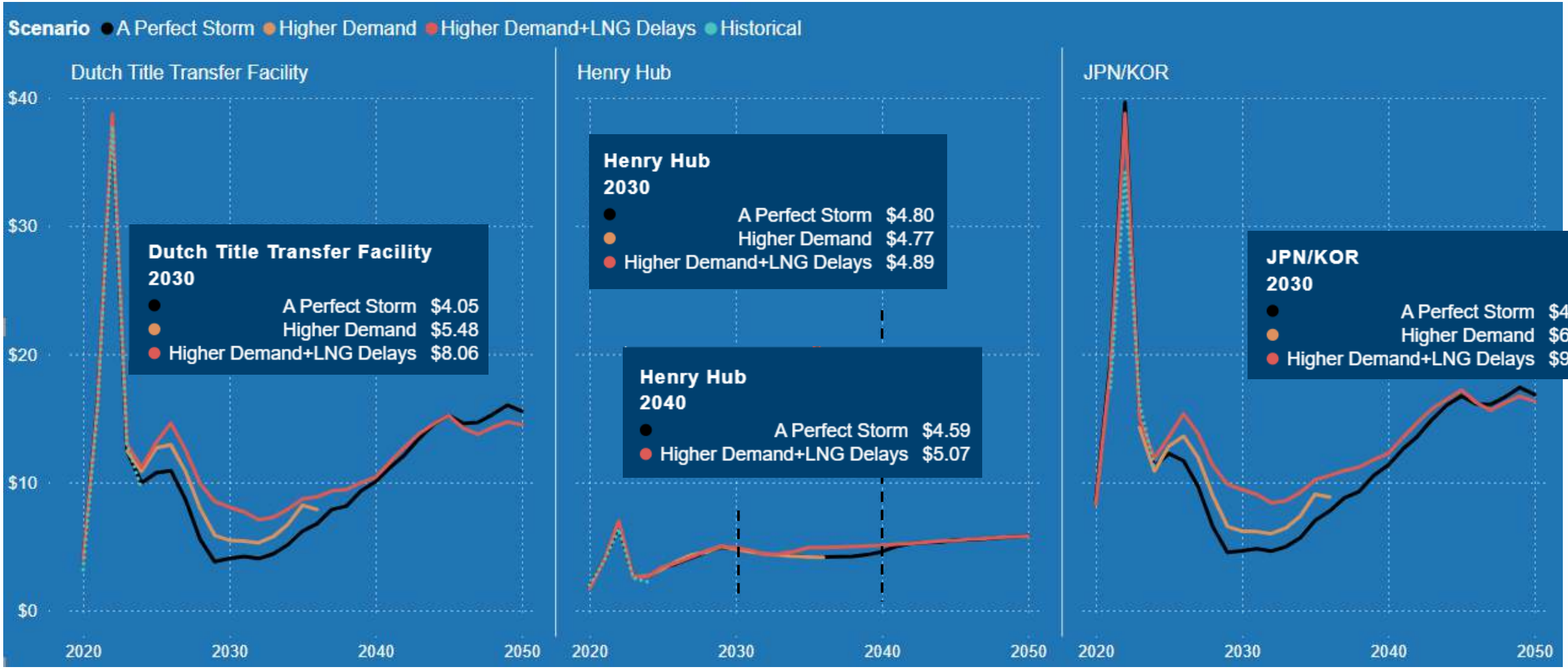


LNG Terminal Delays



Unit: Million Metric Ton

Regional Hub Price Forecasts By Scenario

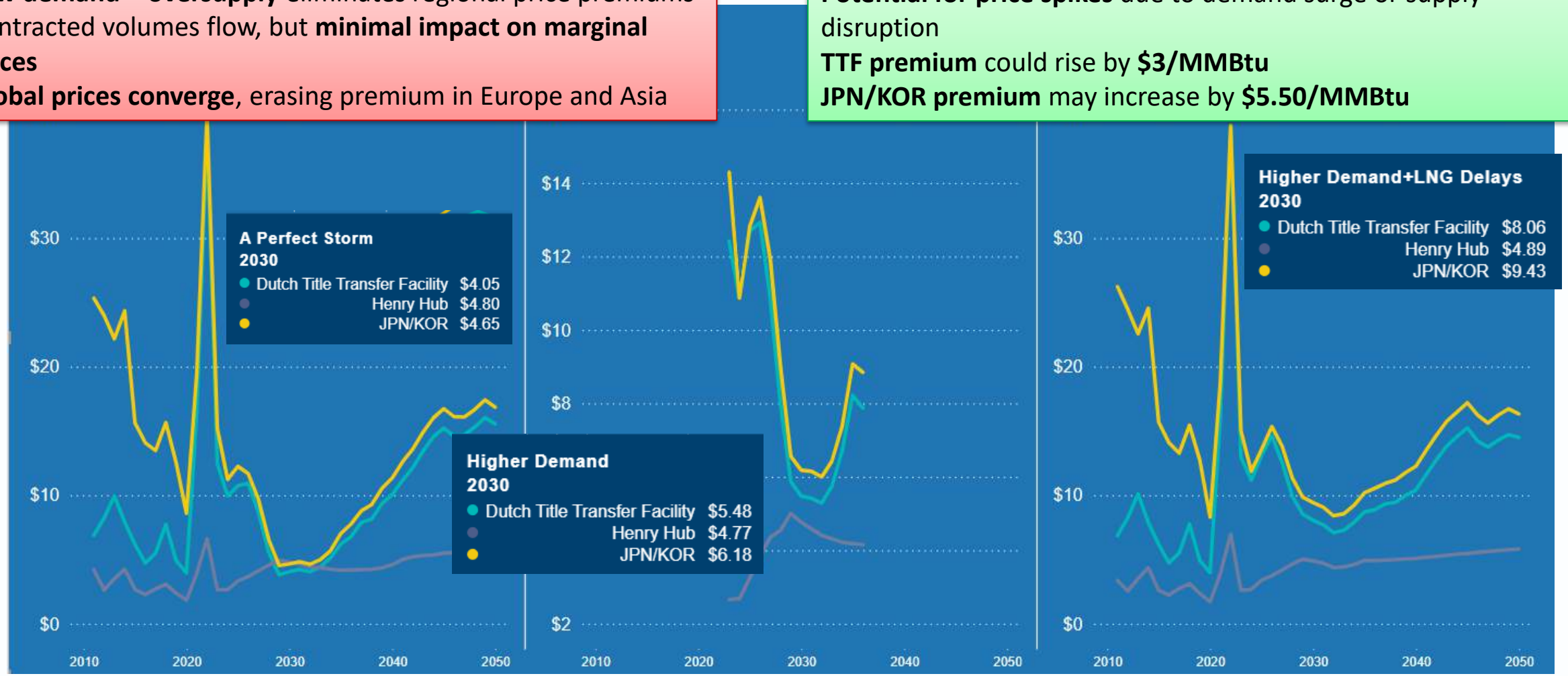


Unit: $/MMBTU

Regional Scenario Prices by Hub

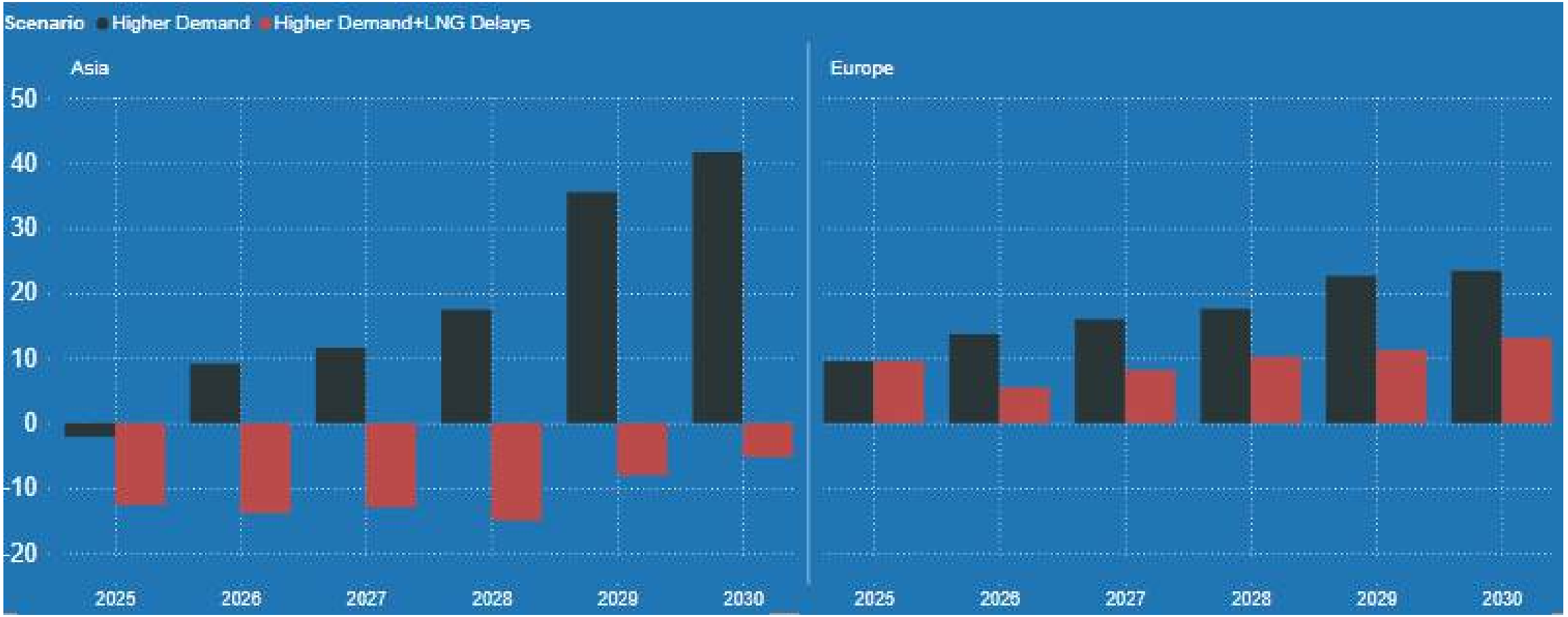
Perfect Storm:
Low demand + oversupply eliminates regional price premiums
Contracted volumes flow, but **minimal impact on marginal prices**
Global prices converge, erasing premium in Europe and Asia

Higher Demand + LNG Delay:
Potential for price spikes due to demand surge or supply disruption
TTF premium could rise by **$3/MMBtu**
JPN/KOR premium may increase by **$5.50/MMBtu**



Unit: $/MMBTU

Gas Consumption Delta by Scenario

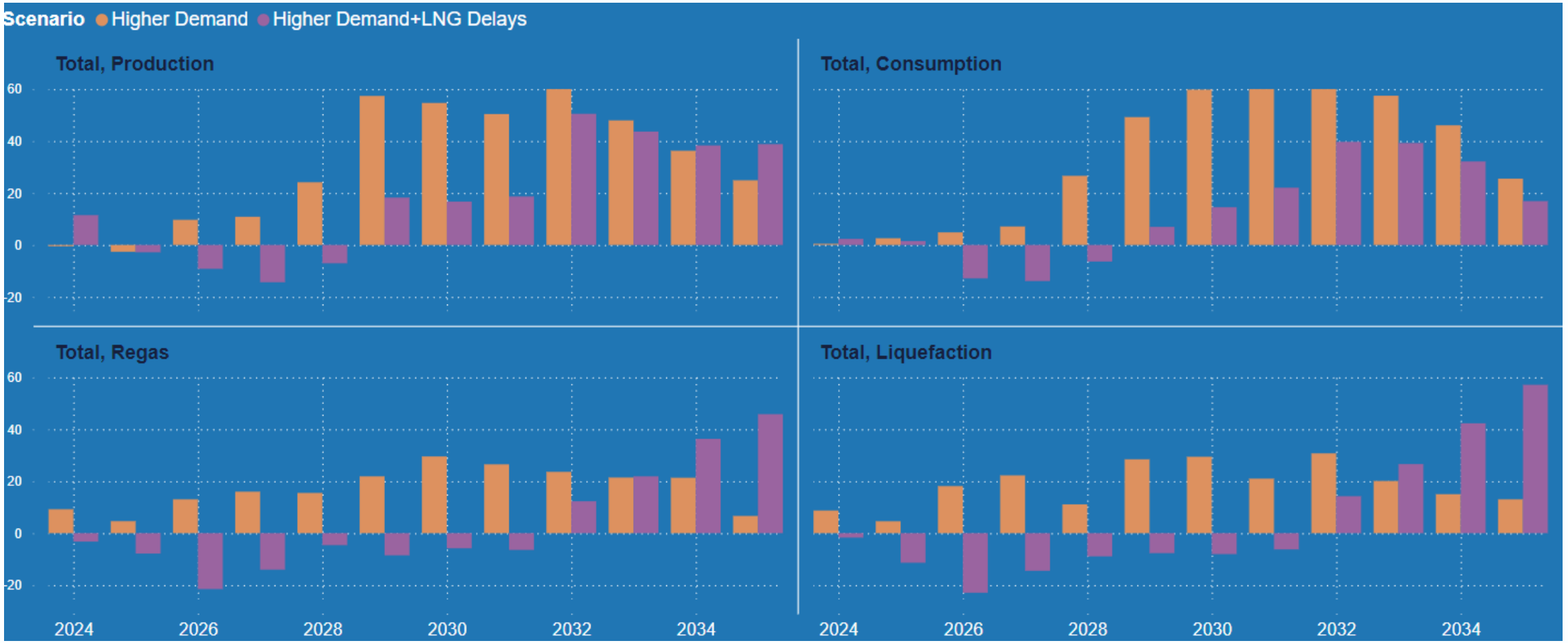


Unit: BCM

Higher Demand scenario sees about 3.8% increase in Asia (vs. 5% in the demand curve) and 4.8% (vs. 6.1% in the demand curve in Europe).

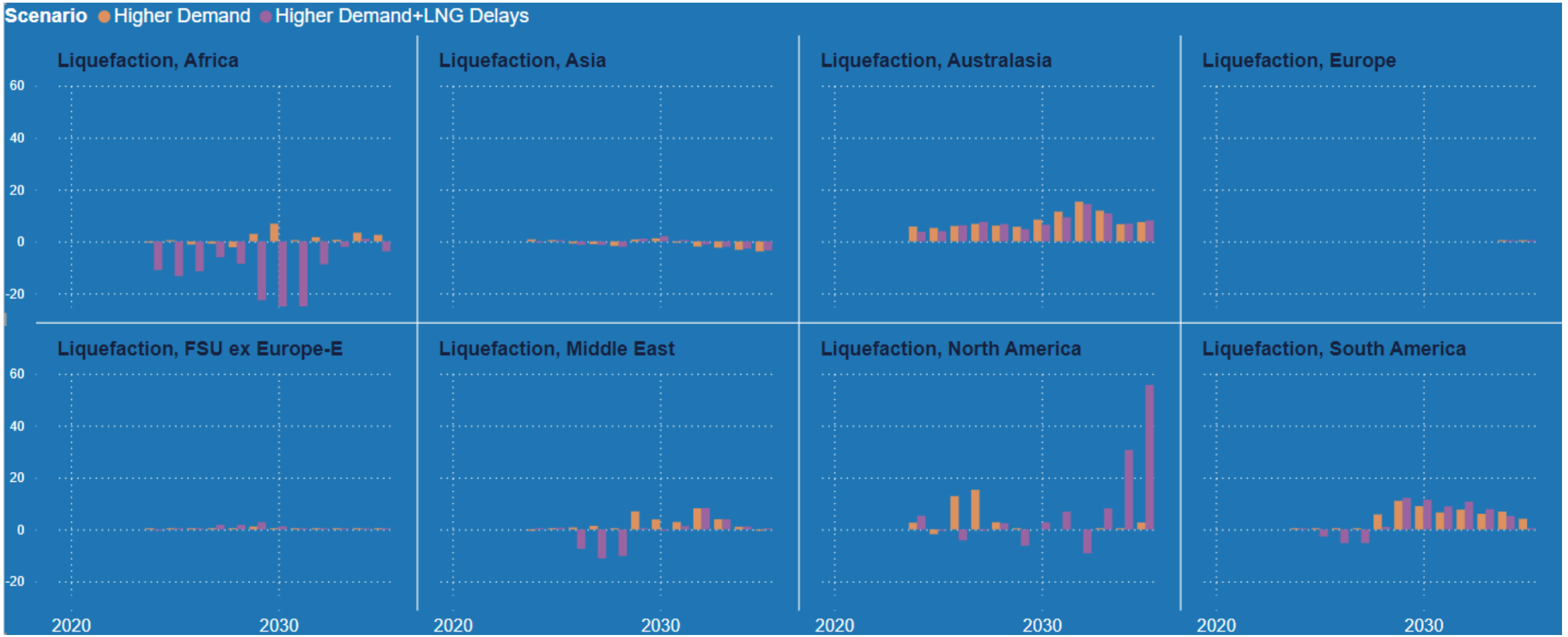
Higher Demand + LNG Delay scenario sees a negative impact through 2030 for Asia, and 3.3% (vs. 6.1% in the demand curve in Europe)

Global Gas Balance Delta by Scenario



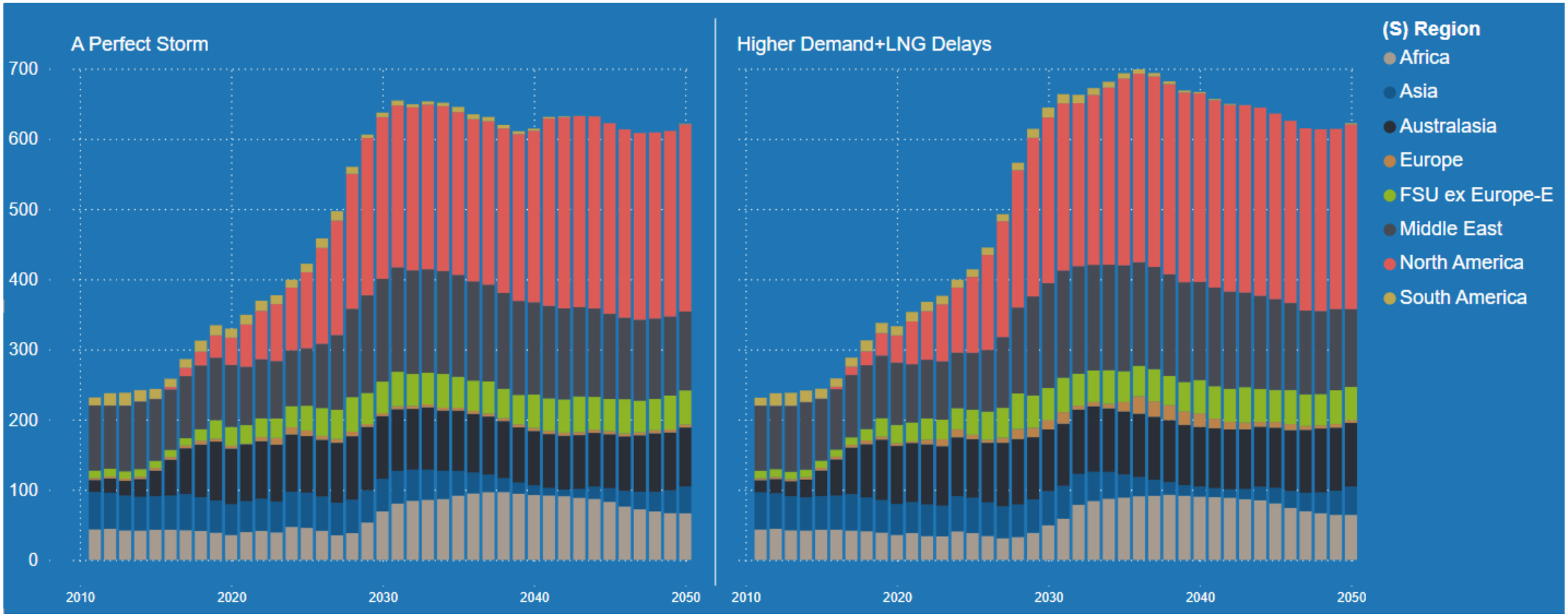
Unit: BCM

Regional Liquefaction Delta by Region

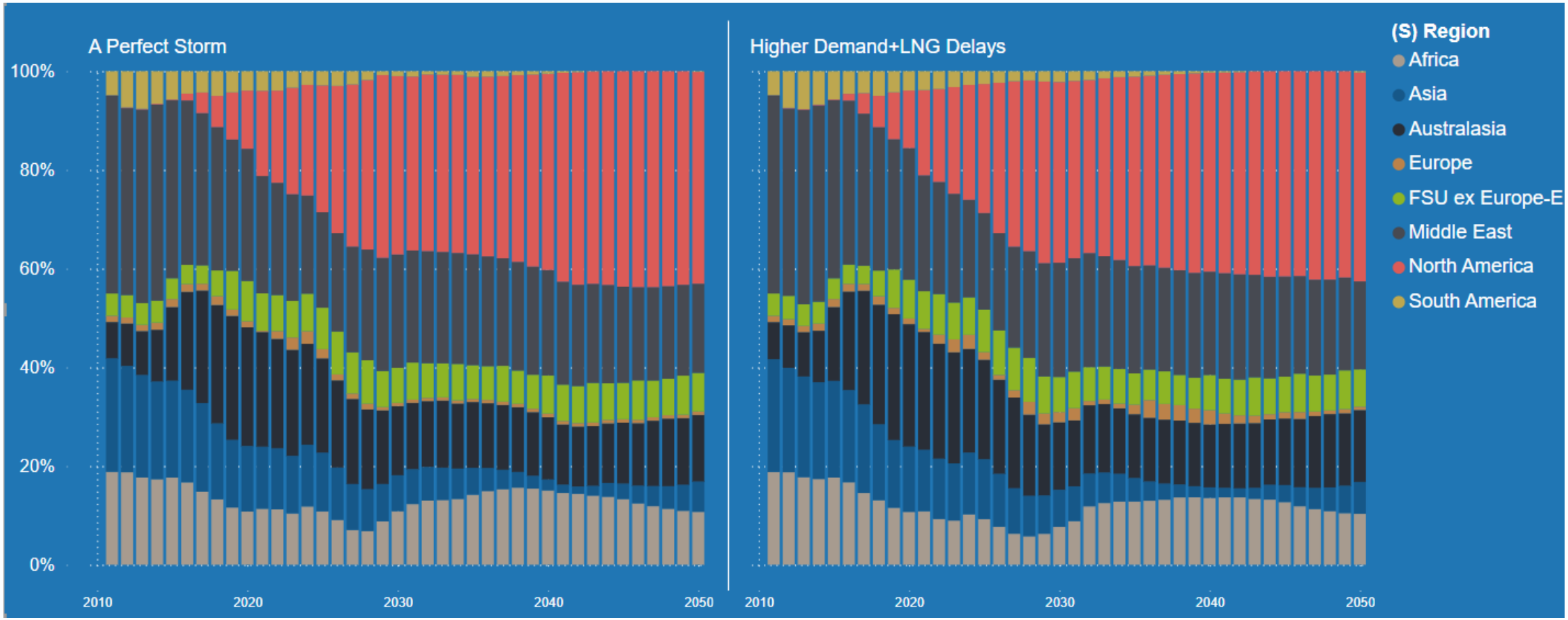


Unit: BCM

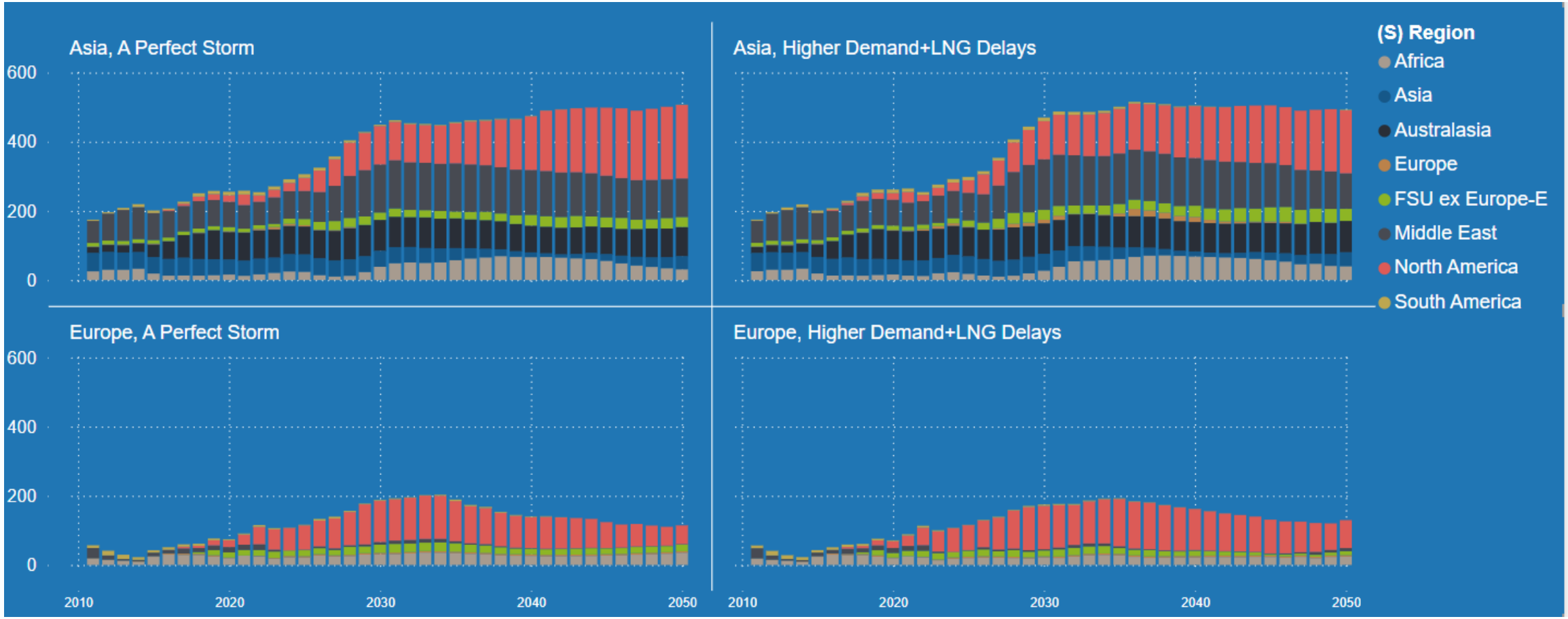
Global LNG Flow by Source



Global LNG Flow by Source (Percentage)

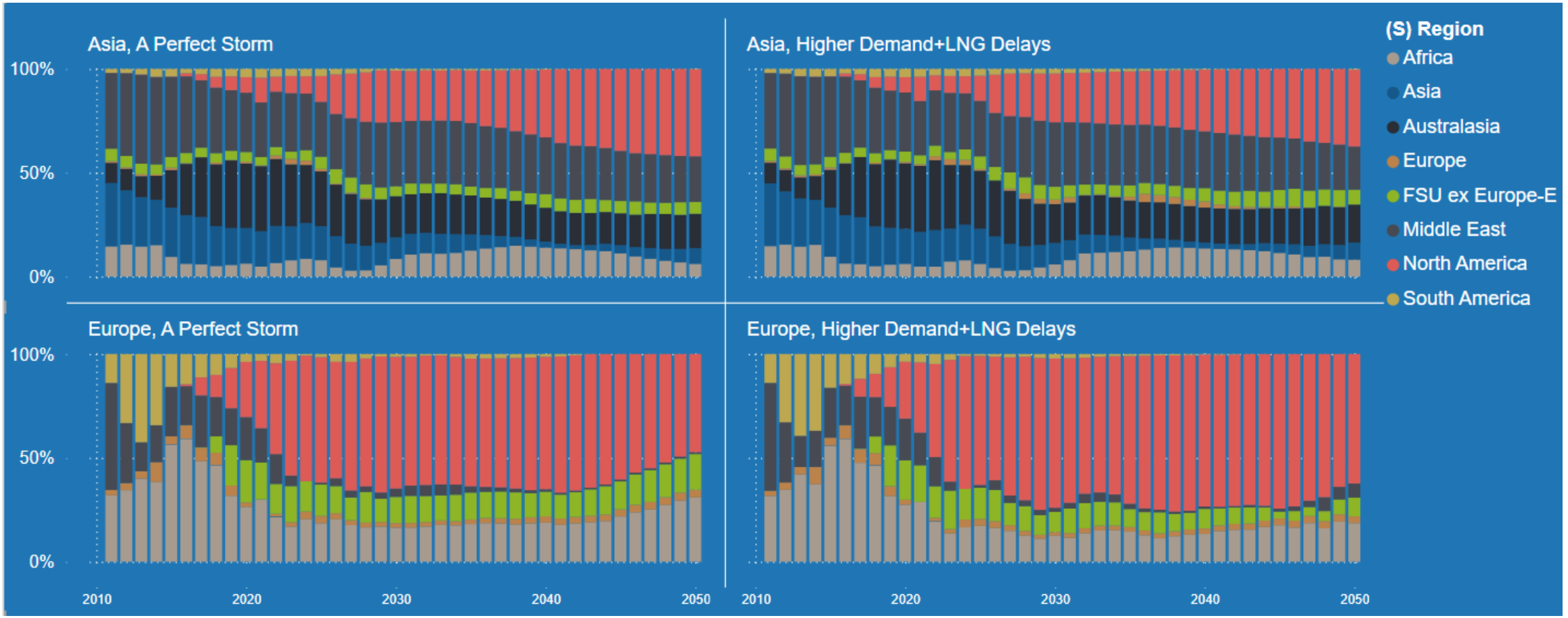


Regional LNG Flow into Asia and Europe by Source



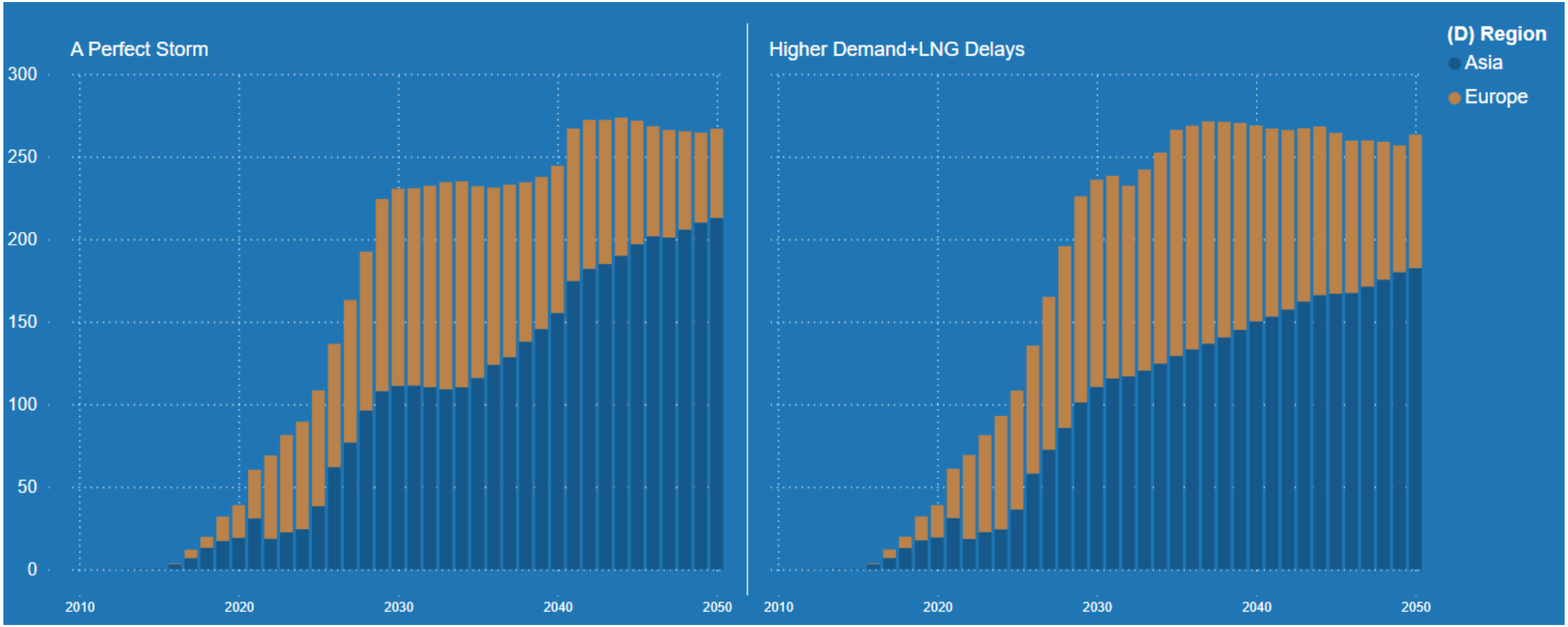
Unit: Million Metric Ton

LNG Flow into Asia and Europe by Source (Percentage)



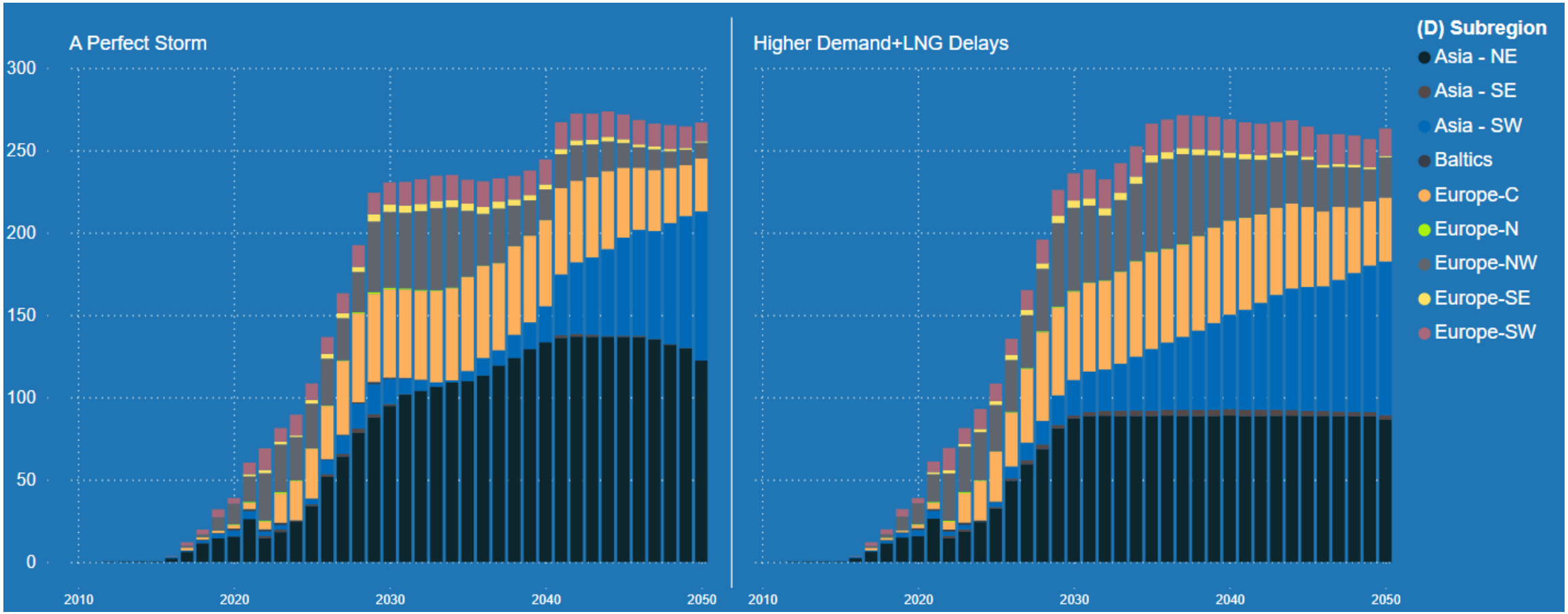
Unit: Million Metric Ton

North America LNG Export by Destination



Unit: Million Metric Ton

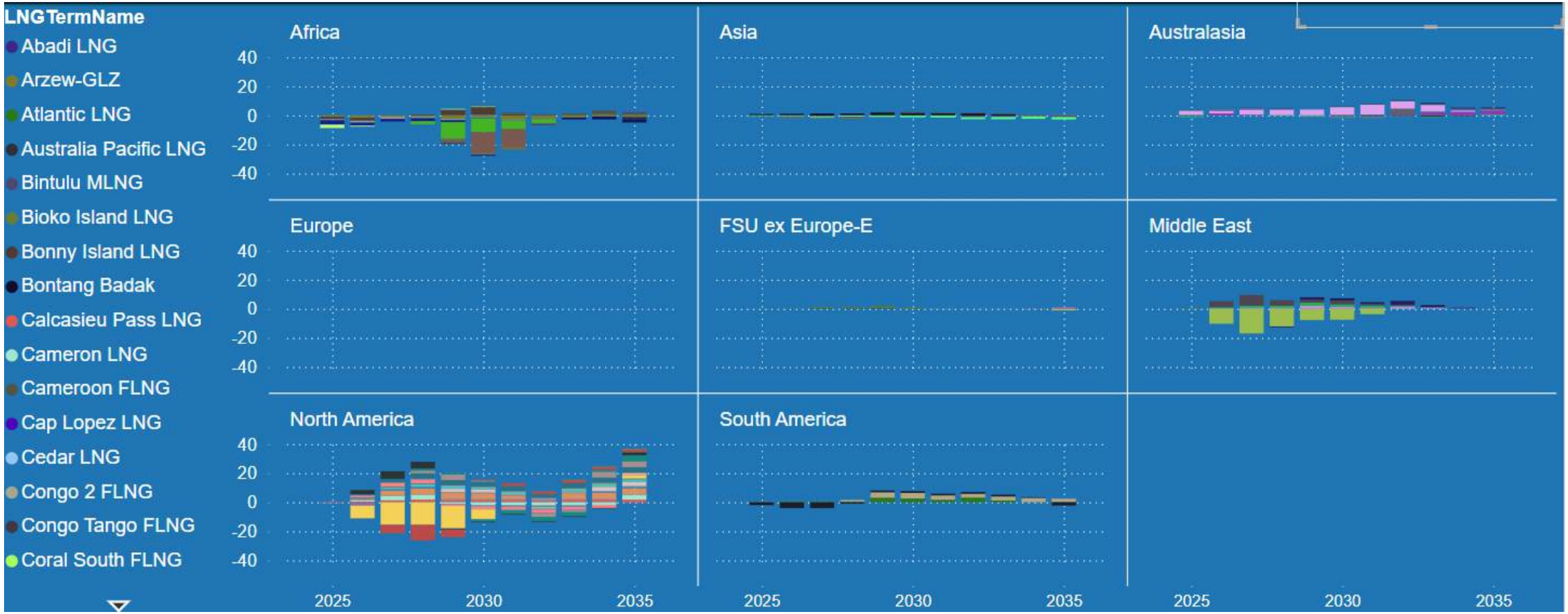
North America LNG Exports by Destination (Sub region)



Unit: Million Metric Ton

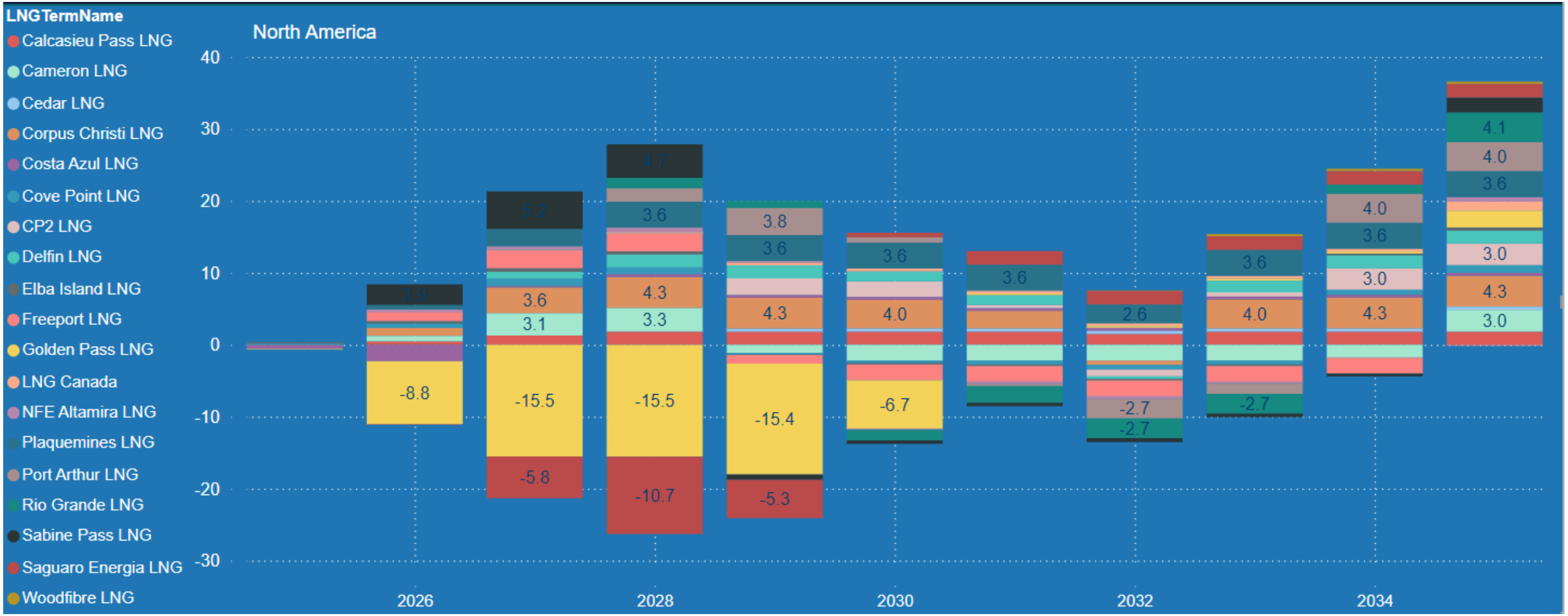
LNG Production Delta by Terminal

High demand + LNG Delays vs. base case – Perfect Storm



North America LNG Terminals Production Delta

High demand + LNG Delays vs. base case – Perfect Storm



Conclusion

Scenario-Based Planning is Essential

- Different assumptions lead to **materially different market outcomes**
- Sensitivity to key drivers like **demand growth**, **liquefaction delays**, and **economic recovery**

Market Implications for Decision Makers

- Need for **resilient supply chains** and **strategic contracts**
- Importance of **flexibility** in medium-term investments and planning
- **Diversification** crucial to managing **price volatility** and **market tightness**

QUESTIONS?

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RBAC leads the market in global and regional gas and LNG market simulation and predictive analytics in support of corporate investment and M&A strategy, ESG, risk analysis, planning, and commodity trading. Our products and expertise help companies go beyond the narratives and hype to identify the opportunities and define the risks inherent in the uncertainties of energy transition using reality and fact-based fundamentals and analysis.

We continuously enhance our market simulation systems with the latest software and computer technology while applying the best of mathematical economics to assist our clients achieve their goals. This is especially needed as we see fundamental shifts taking place in the energy industry to achieve energy transition goals and meet increasingly demanding requirements of ESG. We provide regularly scheduled updates of our simulation systems and databases to keep our clients up-to-date with the most current market information. We enhance the functionality of our systems to enable our customers to simulate the effect of new regulations or industry requirements.

Our aim is to continue to lead the market in best practices which raise the standard of market simulation, enabling rapid and flexible scenario generation, sensitivity analysis, risk-assessment and forecasting, giving clients the edge in the rapidly changing energy market.

Those using RBAC's products and services include energy industry firms and consultants, as well as government agencies involved with energy, transportation, and the environment.

RBAC's principal products include:

- **GPCM® Market Simulator for North American Gas and LNG™** focused on the North American gas & LNG markets. GPCM is the industry standard market simulator for North American gas.
- **G2M2® Market Simulator for Global Gas and LNG™** for simulating increasingly integrated gas and LNG markets worldwide.
- **Gas4Power®** for integrating gas and power market fundamentals to produce credible forecasts for both.
- **NGL-NA®** Market Simulator for North American Natural Gas Liquids

With RBAC's advanced simulation systems, licensees can create and run scenarios involving bio-methane (Renewable Natural Gas – RNG) mixed with natural gas and to assess the implications of carbon taxes and markets on supply, demand, and prices. Future enhancements will include the ability to simulate the advent of a future hydrogen market with both pure hydrogen pipelines as well as mixtures with methane. The Energy Analyst of today and the future needs these kinds of tools to conduct realistic assessments and help develop realistic strategies and plans to achieve the goals of the energy transition.

Dr. Robert Brooks founded RBAC in 1987 based on experience developing several well-respected predictive models for government and industry. He designed the first gas transportation model while getting his PhD at MIT and has led the industry ever since.

RBAC's staff includes industry-trained experts in natural gas supply and demand, transportation, storage, marketing, and trading. Our team applies its world-class expertise in mathematical modeling, statistical analysis, mathematical algorithm development, software engineering, and database design to current and future challenges, risks and opportunities in energy.