



Asian Oil and Gas Markets in a Carbon Constrained World

Presented by:

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Ten Commandments for Oil and Gas for JCCP

Ten Commandments for Oil and Gas

1. The market is tight, and *OPEC+ is in the driver's seat.*

- Omicron has the oil market worried, but demand recovers to surpass pre-COVID levels by March 2022.
- Inventories remain very tight in first quarter 2022, with prices US\$80/bbl+...and prone to spikes.
- By spring 2022 inventories begin to rebuild slowly and prices should ease a bit.
- Oil prices depend more on supply and less on demand. *As such, OPEC+ is critical for stability.*

2. Talk of a pre-COVID peak in oil demand in 2019 is nonsense. Oil demand will grow by 8 mmb/d between 2022-2030, before slowing. Gasoline and diesel will peak in 2034 and then slowly decline. **Total oil demand peaks in 2037.**

3. With ESG pressures inhibiting producers, the oil market looks tight through the mid-2020s. **OPEC spare capacity will be nervously watched—any supply outage globally can trigger a price spike.**

4. The refining business has no OPEC to control output, **but refiner's pain eventually leads to gain.** A painful period of low margins has prompted 2.6 mmb/d of refinery closures during COVID. This is set against 1.6 mmb/d of new capacity—thus global capacity has shrunk by 1 mmb/d. Moreover, China's export of gasoline and diesel have shrunk from 1 mmb/d in 2019 to around 400 kb/d in 2022, boosting margins.

Ten Commandments for Oil and Gas

5. Beyond a 2021-23 wave of capacity, there are no serious new plans for building grassroots refineries anywhere in the world. Expansions, upgrading, and petrochemical integration will happen, **but worries over peak demand are scaring off new investment.**
6. With continued demand growth, no major grassroots refineries, and significant refinery closures, **there will be another golden age of refining during 2024 to 2030—this will surprise the market.**
7. LNG demand has a long life, growing till the late 2040s, then peaking and remaining flat for years. **LNG has a much brighter future than oil.**
8. Recent extreme LNG price spikes have shocked the markets.
 - European supply issues are currently pushing Asian JKM prices, but LNG spot prices have also risen structurally. Oil indexed pricing will be more stable and generally lower than spot prices through 2025.
 - The CPC-Chevron deal and Qatar's sales have moved the oil-linked LNG price slope down to 10.5% or lower, but oil-linked price slopes are firming on supply worries. **The opportunity to secure very low LNG price slopes has passed.**
9. **The LNG market faces four distinct cycles.** Long market 2019-20, short market 2021-25, long market 2026-28 and another short market from 2029. We are now in a tight market phase.

Ten Commandments for Oil and Gas

10. Carbon issues are critical in today's oil and gas markets. There are several points to note:

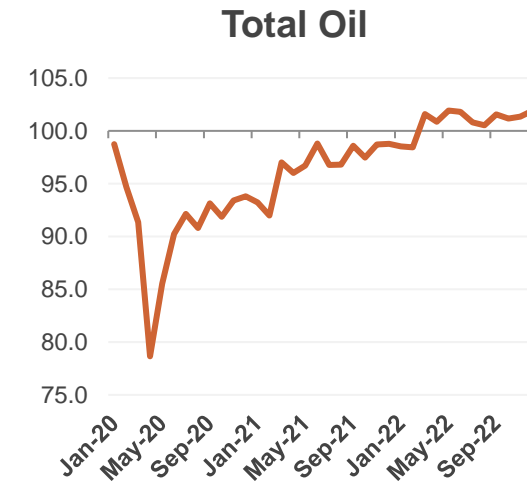
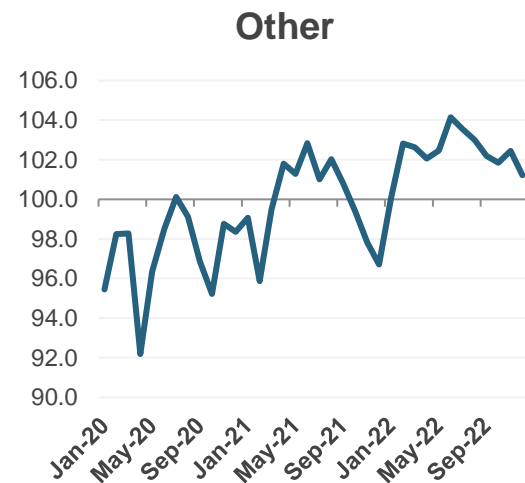
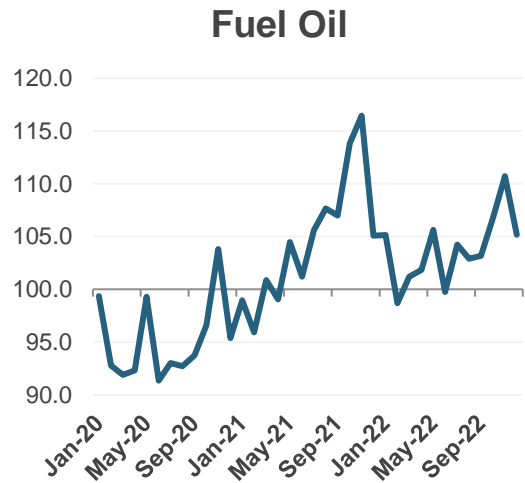
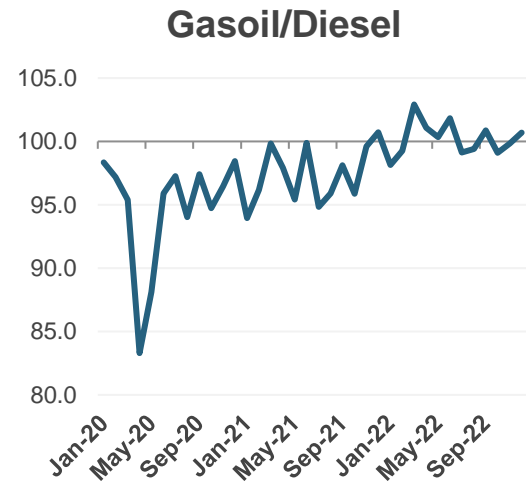
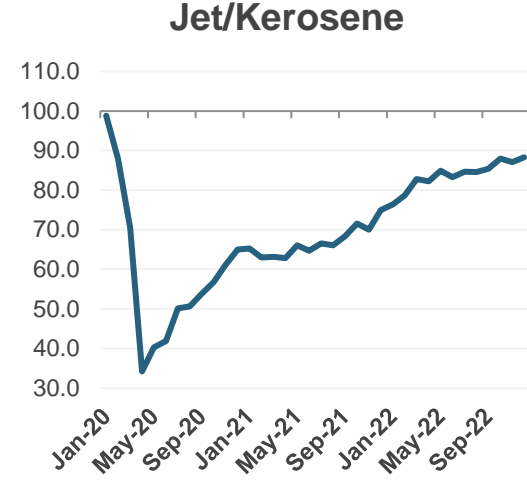
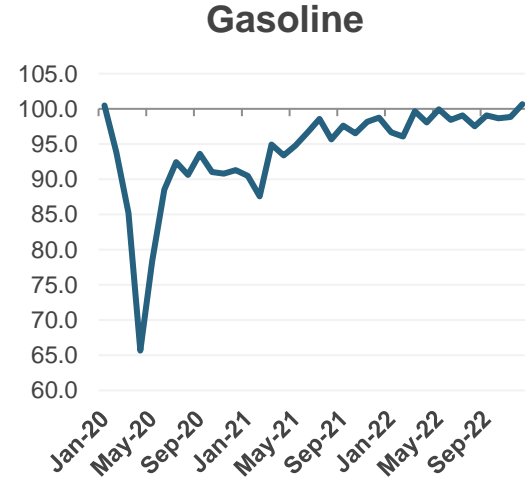
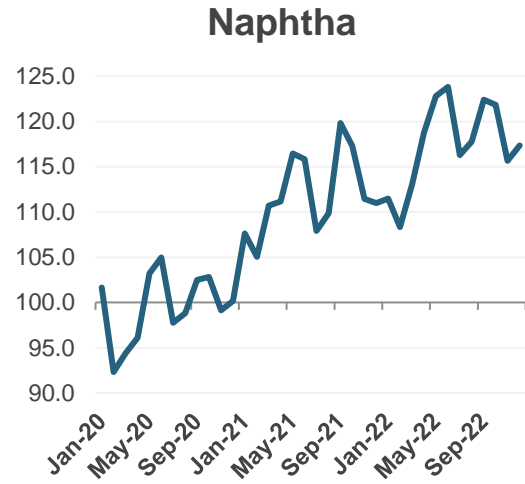
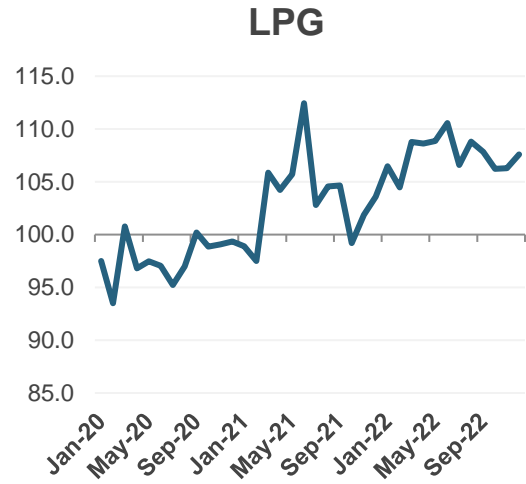
- Promises of zero carbon neutrality by 2050 are useful political statements but practically extremely hard to achieve. 2070-80 might be possible!
- Europe should not always be looked at as a model to follow. Europe is driven by its own unique politics. Asian countries need to position relative to others in Asia, and to a lesser extent the US.
- Hydrogen and ammonia have become politically popular, and investment will happen. But green hydrogen economics are challenging until the 2030s.
- Carbon neutral LNG is becoming more popular, but it is still a drop in the bucket. It is likely to grow substantially in the next 2-3 years, but long-term growth options are limited without clear standards and a global carbon price. CCS is the long-term future, but economics are challenging today.

Overall, the future is promising, but we need to remain realistic and practical when it comes to carbon issues. ***We must remember that redirecting the oil and gas market is like turning a big tanker around—the turn can happen, but it takes time.***

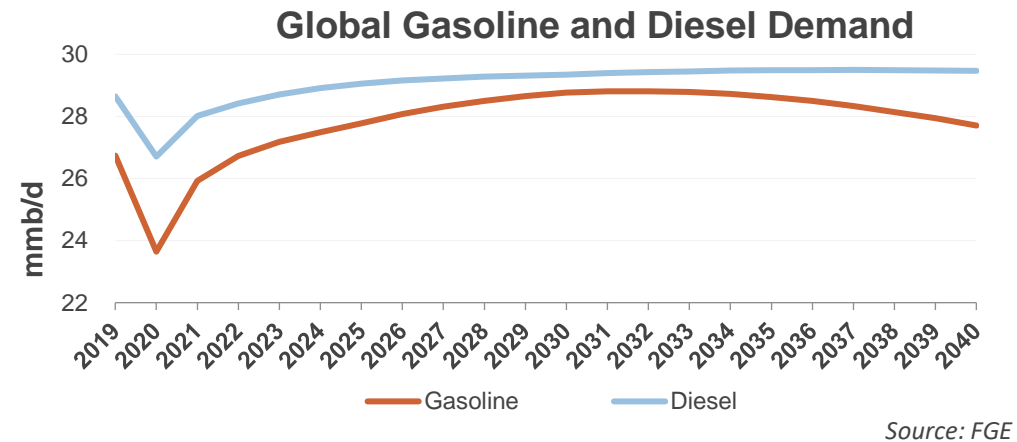
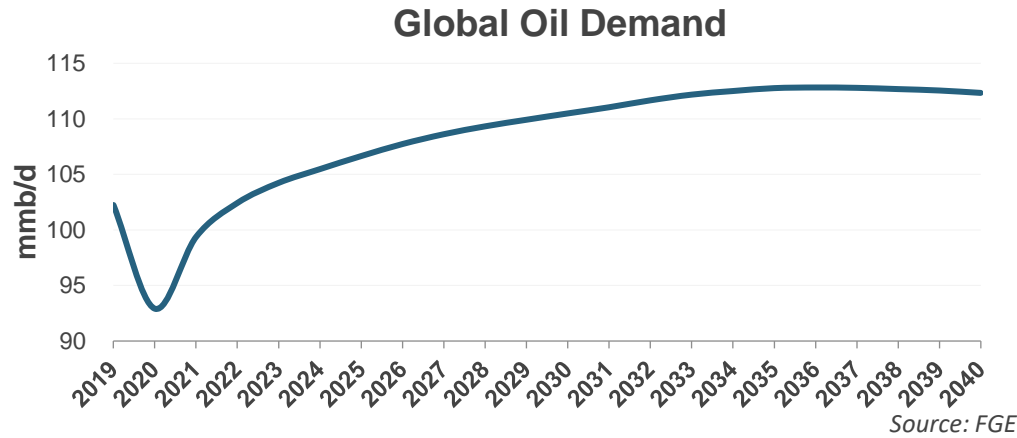
Oil Markets

Total Demand Close to “Normal”—Huge Variation in Recovery by Product

Change in Global Oil Product Demand (Same Month in 2019 =100)



Oil's Future: Where Do We Go?

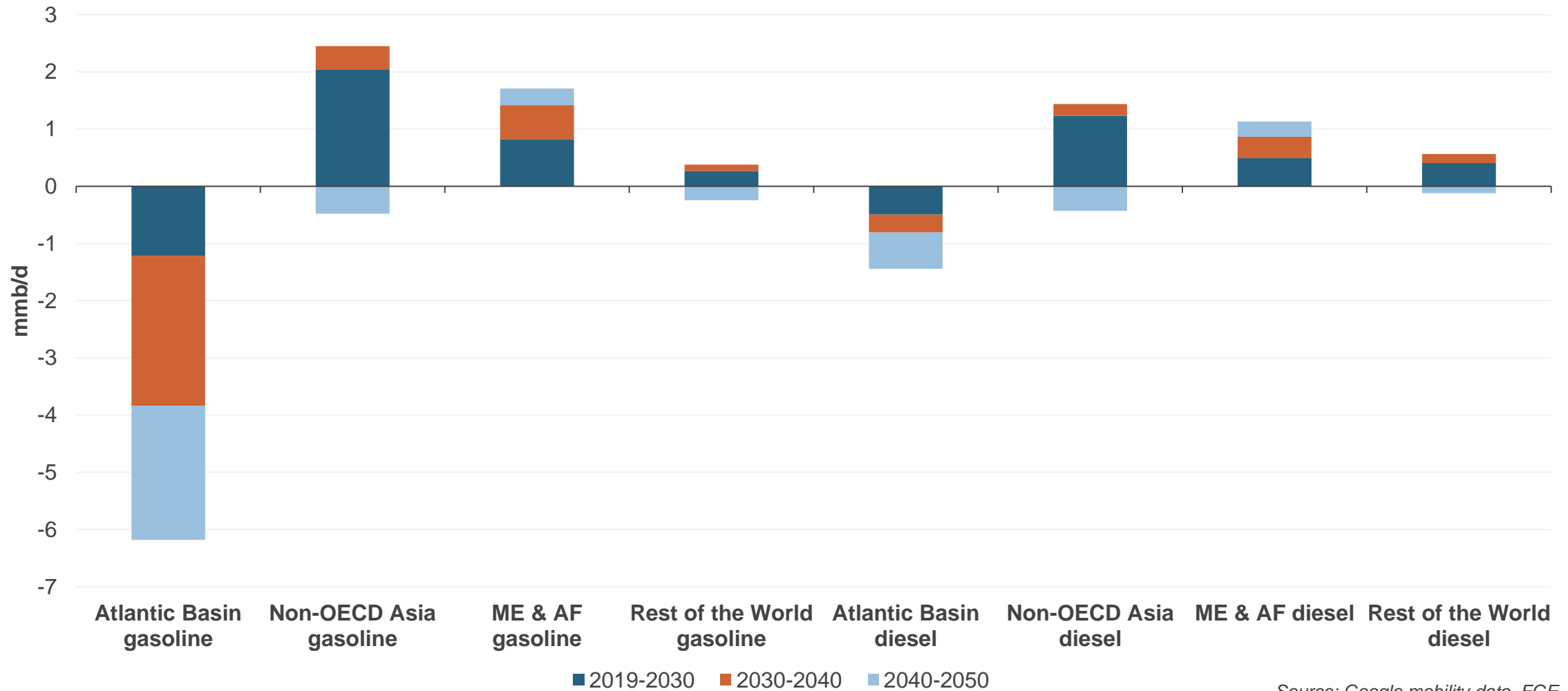


- Some say we have already reached the peak: **Nonsense!**
- Short term:
 - 2020 demand loss around 8.9 mmb/d
 - 2021 demand gain around 5.9 mmb/d
 - 2022 = 2019 demand
- Long term:
 - 2022 to 2030 = 8.0 mmb/d growth
 - 2030 to 2037 = 2.3 mmb/d growth } 10+ mmb/d growth
 - 2034 gasoline and diesel demand peaks
 - Total oil demand declines after 2037, but very slowly
 - In 2050, demand is still higher than 2019 levels

Oil is still a huge business! It takes a long time to get rid of it!!

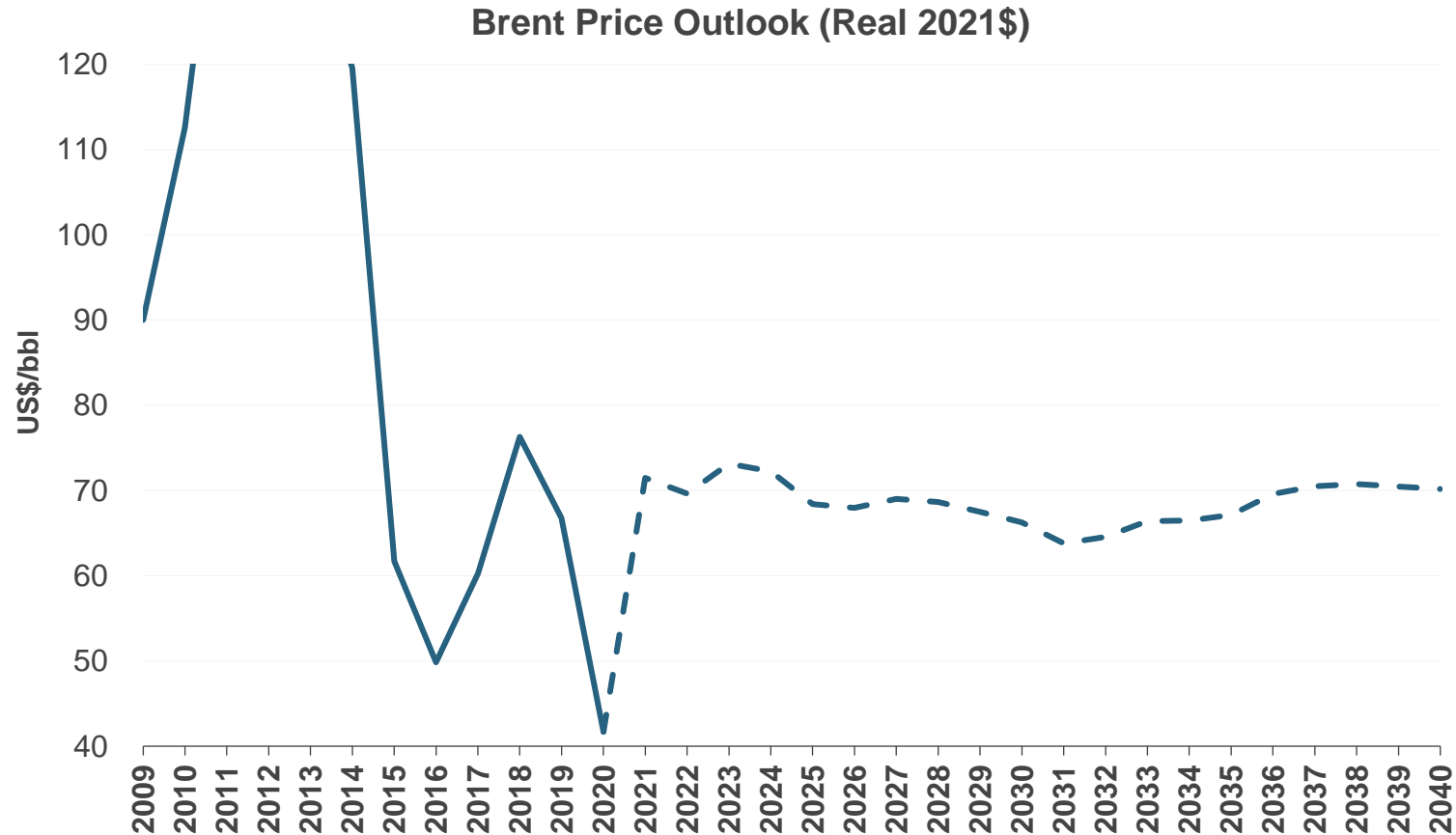
Reduction in Global Road Fuel Demand Largely Focused on EU & North America

Regional Road Fuel Demand Outlook by Decade



Source: Google mobility data, FGE

Long-Run Oil Price Seen at US\$70bbl (Real 2021\$)—A Reluctance to Invest in “Old” Fuels Raises Costs, Supporting Price

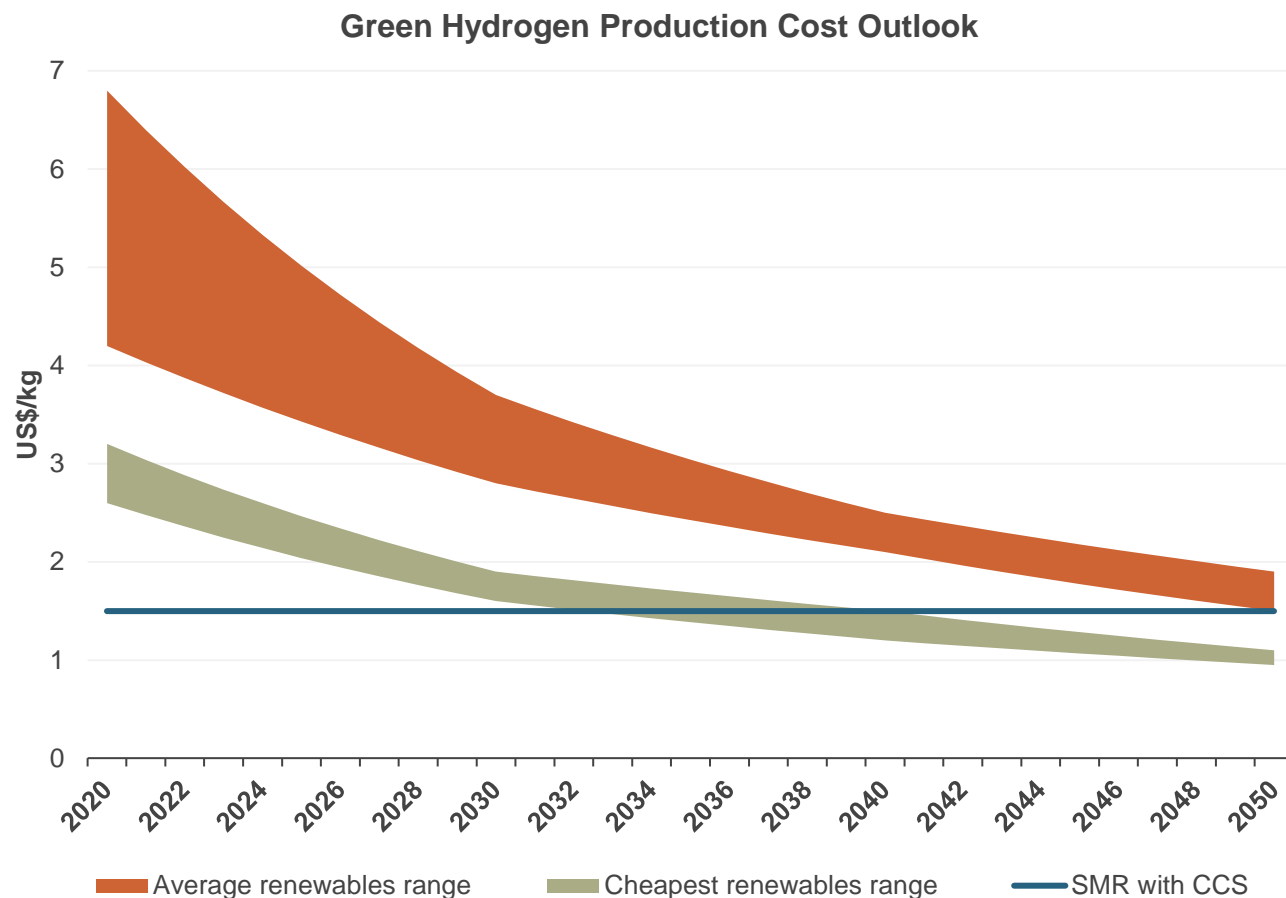


Source: Platts*, FGE

*Prices in this report marked with the source Platts are sourced from S&P Global Platts, © 2021 S&P Global Inc. All rights reserved.

Green Hydrogen Production Cost Outlook

Green hydrogen in the most suitable locations is set to be cost-competitive with blue hydrogen around 2030.



Source: FGE, IEA, IRENA

- Electrolyzer costs are projected to come down by up to 80%.
- Renewable electricity cost will at least halve.
- Higher electrolyzer efficiency.
- Higher electrolyzer utilization.
- While in most locations, green hydrogen production costs are 2-3 times higher than grey/blue, green hydrogen can already come down to below US\$3/kg in regions with favorable conditions, such as above-average (up to 50%) wind power capacity utilization and low electricity prices.
- The electrolyzer stack cost accounts for around 50% of the CAPEX cost in alkaline and PEM electrolyzer systems.
- Via higher utilization of renewable electricity, surplus electricity prices can be even negative, reducing the production cost.
- Alternatively, running the electrolyzer at high utilization rates and using grid electricity can reduce the cost per kg of hydrogen.

Refinery Margins Ahead: **Good Winter**, **Worries in 2H22-23**, **Golden Age in 2024-30**

Good Winter

Closures Helping: Prolonged pain from unprecedented weak refining margins have led to 2.3 mmb/d of refinery closures globally. This has offset the impact from 1.6 mmb/d of new capacity.

Demand is Back: Demand is now very close to “normal” levels, and product inventories have drawn below the 2019 mark. **Margins have finally found a strong footing!**

Potential Upside: Winter looks very promising, and margins will remain at current high levels with upside potential from higher natural gas-to-oil switching.

Worries in 2H22-23

New Capacity Coming: Some pullback in margins is expected during 2H 2022 as China commissions three new mega-refineries and Malaysia’s RAPID refinery as well as Saudi Arabia’s Jizan projects ramp up further.

Not a Disaster: That said, demand growth and new capacity look pretty-well matched during 2022-2023. Also, China’s regional impact is driven by product exports, which will be constrained by quotas.

Golden Age

Investment Stalls: Prolonged weakness in margins, volatility in oil prices, concerns surrounding peak oil demand, and clean energy talks have deterred investments in the refining business.

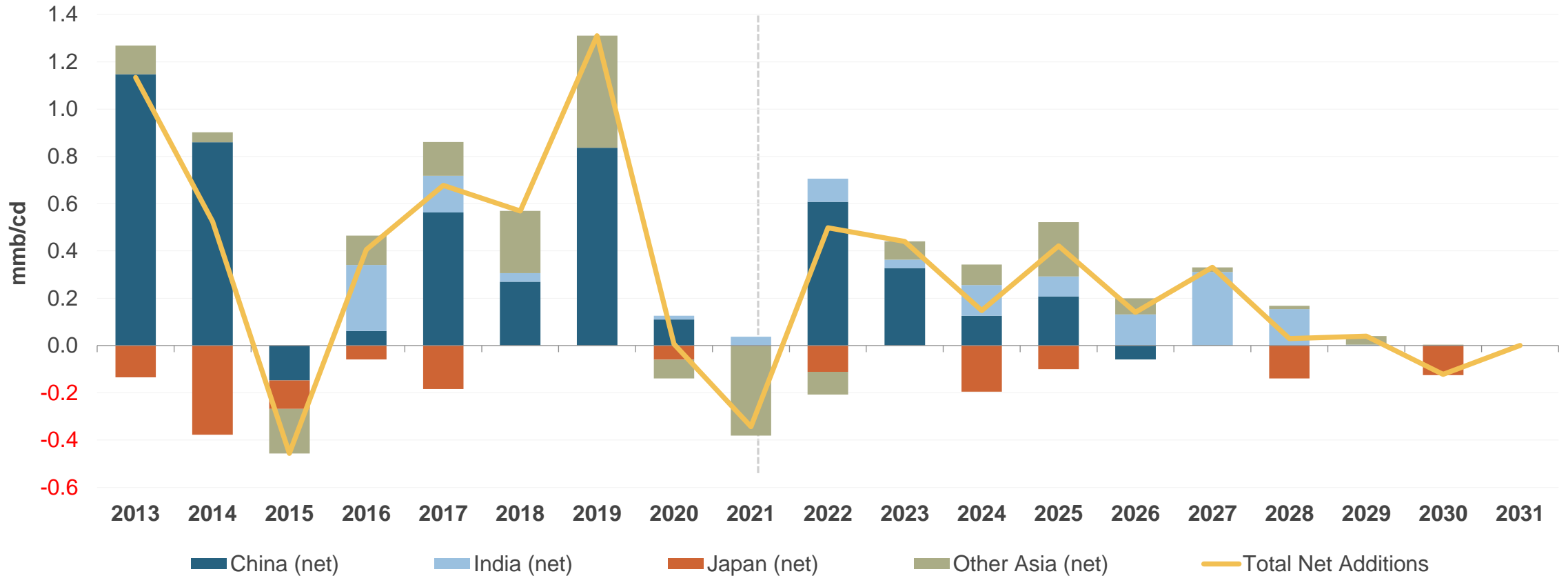
Demand Growth Ahead: No mega-grassroots refineries are expected after 2024, but oil demand growth of 10 mmb/d is still ahead of us.

Another “golden age of refining” awaits the downstream industry during 2024-2030!

Slowdown thereafter, driven by increasing product length in the Atlantic Basin.

Asia's Calm After the Storm—No Mega Refining Projects Post-2025

Asia Refining Capacity Additions (by Country)



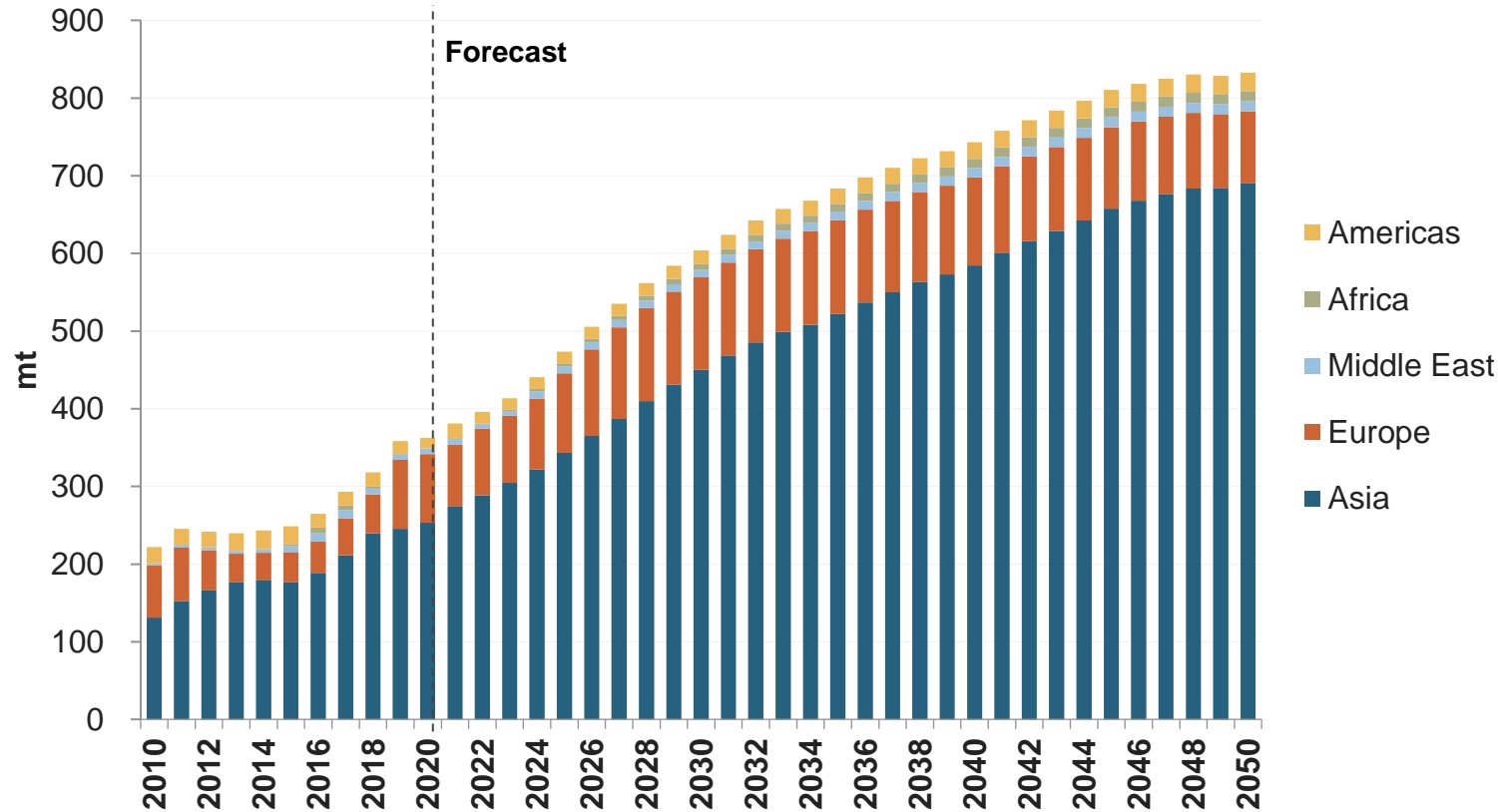
*Weighted for risk of delays.

To understand the probability adjusted capacity and methodology, please refer to [Energy Advisory #373](#), dated April 16, 2014.

LNG and Gas Markets

LNG Demand Sees Strong Growth Until the Late 2040s

Global LNG Demand by Region

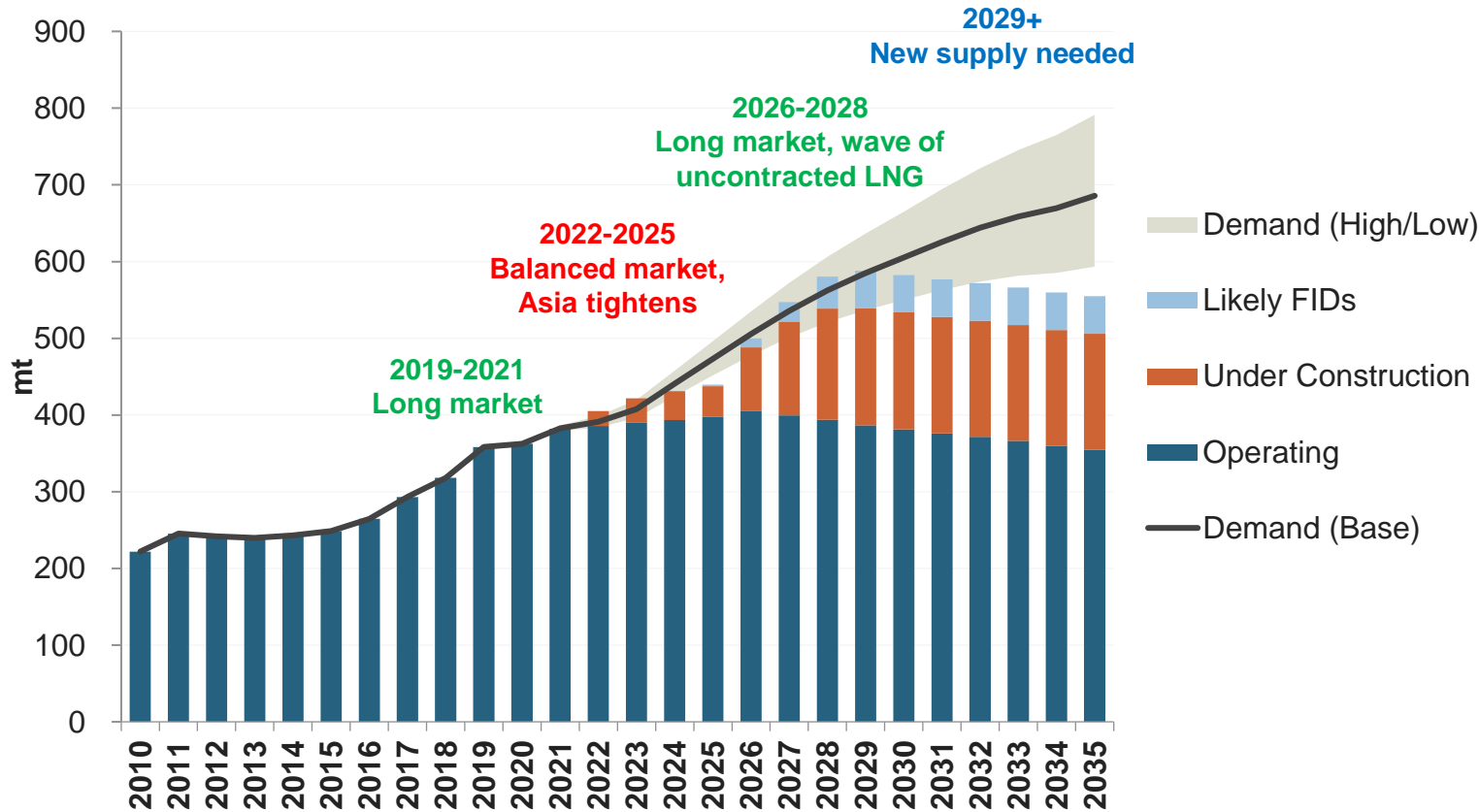


Source: FGE LNG ODS

- **LNG demand has come through COVID-19 relatively unscathed.** Demand proved to be extremely resilient even amidst the severe disruptions of the pandemic, and we see limited long-term impact to LNG demand.
- **The energy transition poses a threat, but LNG still has a big role to play.** While the rhetoric favoring renewables and clean fuels has ramped up significantly in the past year, practical considerations such as security and reliability of supply are still firmly in favor of natural gas.
- **Asia remains the heart of the LNG market and drives strong demand growth.** Developing Asian economies begin to shun coal, further supporting LNG demand.

The Four Cycles of the LNG Market

Global LNG Supply vs Demand

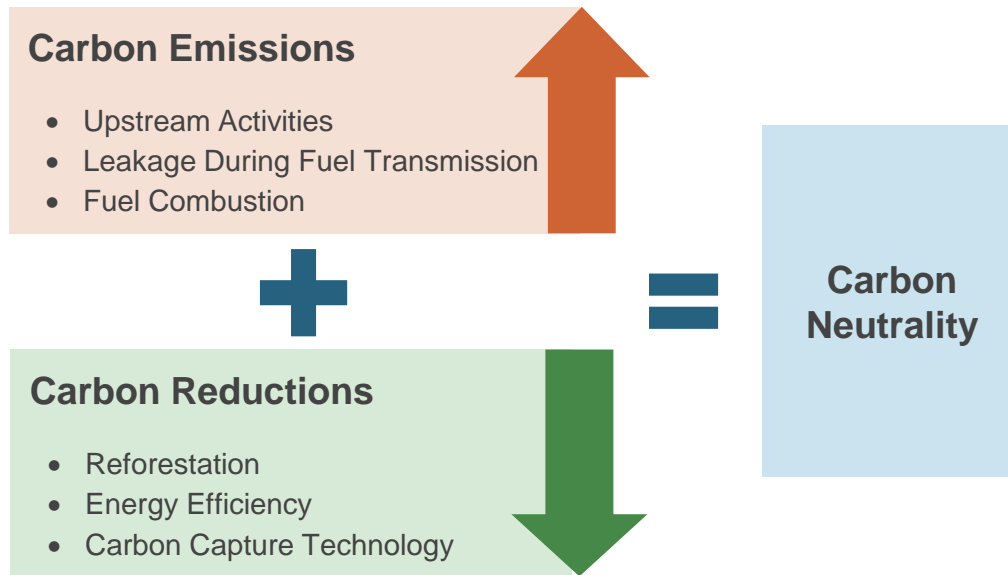


Source: FGE LNG ODS

- **Long 2019-2020:** Strong supply growth from the US and Australia outpaces Asian LNG demand growth.
- **Tight 2021-2025:** Europe pulls LNG in the early 2020s to rebuild inventories and make up for production declines. Towards the mid-2020s, a lack of FIDs in 2016/17 and construction delays cause supply growth to dry up.
- **Long 2026-2028:** The wave of FIDs in 2018/19 fully ramp up in this period. Qatari expansions and other likely projects add new supply, creating a highly competitive environment for sales into this period.
- **Tight 2029+?:** New FIDs will be needed to fill a growing supply-demand gap post-2029.

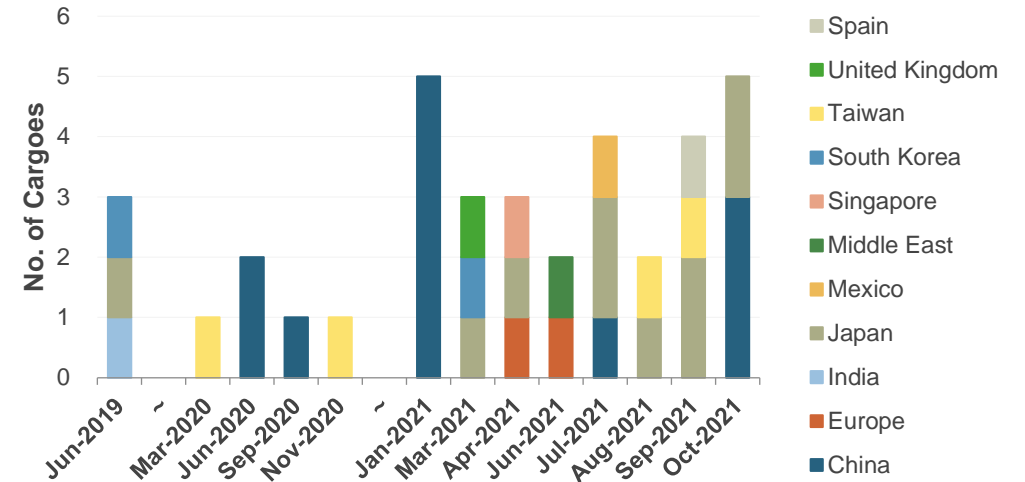
Important Emerging Issue: Carbon Neutral LNG

Carbon Neutrality Equation



- A carbon neutral LNG deal involves two components: a typical LNG supply deal, and carbon offsets that reduce carbon emissions equivalent to the emissions that would have occurred from consuming the LNG.
- Carbon neutrality comes at a premium.
- Carbon offsets are still a developing market, with more standardization required in the areas of accounting and pricing.

Public Carbon Neutral LNG Deals by Destination



Seller



Buyer



*Not an exhaustive list

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