

Global LNG Update and Outlook

GIIGNL Executive Committee Meeting

Frank Harris / 22 May 2023

Wood
Mackenzie

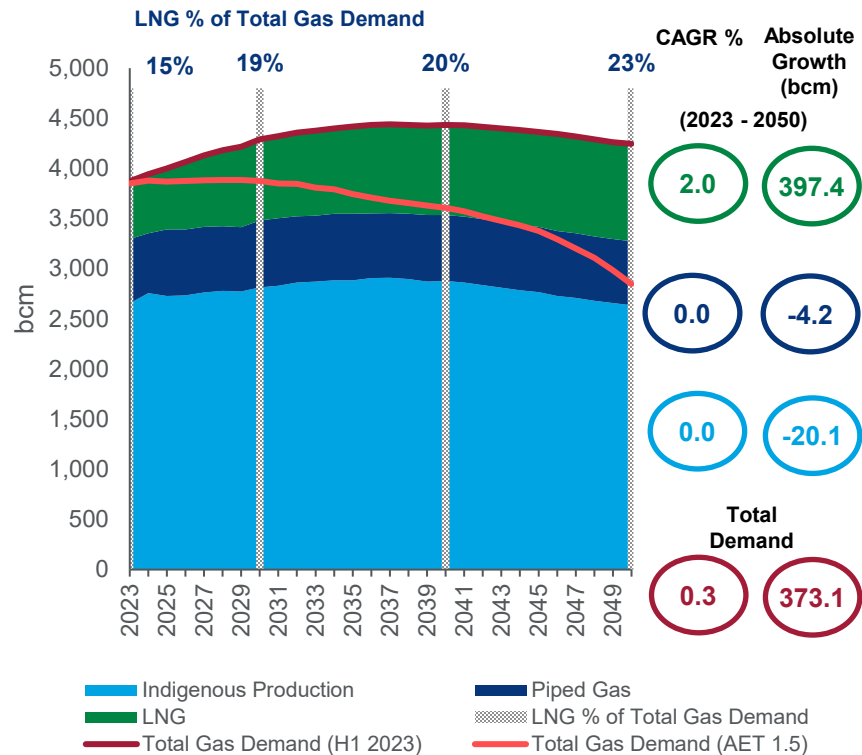


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1. Global LNG Market Update (Wood Mackenzie Base Case)

Gas demand peaks in 2037 before going into gentle decline; LNG continues to play a key role in the overall gas mix

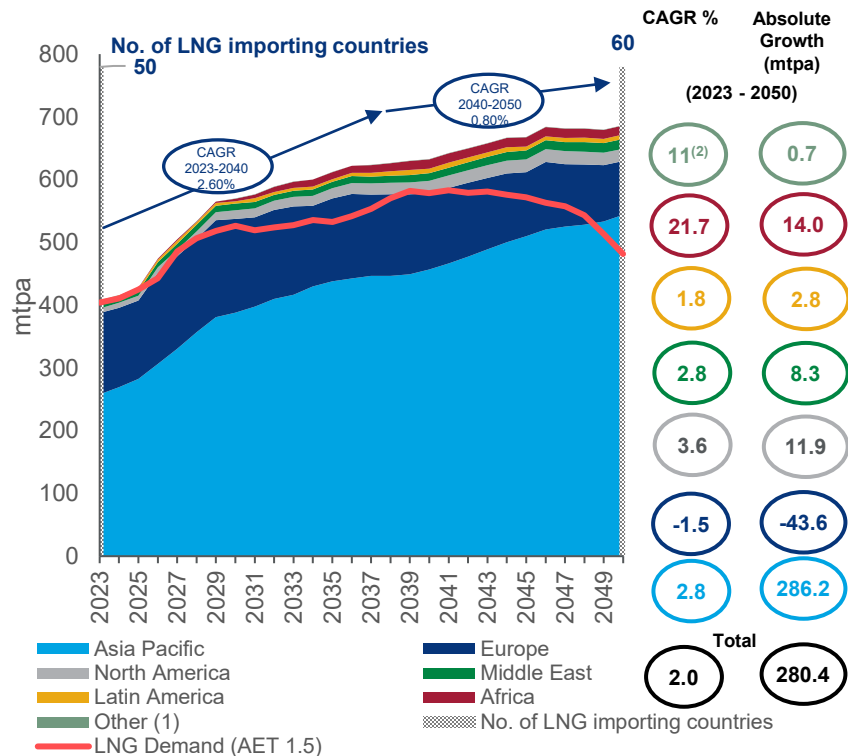
Gas Demand by Type of Supply (2023 – 2050)



- The energy transition continues to take hold, with gas demand impacted by growth in renewables and hydrogen
 - » But there are major uncertainties about the ability to meet net-zero targets and the relative importance of decarbonisation vs. energy supply security, particularly in the short-term
- Drivers of gas demand vary by region
 - » Asia is the growth engine driven by population/economic growth and the continued switch away from coal
 - » North America grows through 2036 and then declines, while Europe is in terminal decline
 - » Blue hydrogen (with CCS) helps to provide some support to gas demand, particularly in North America
- LNG plays an increasingly important (and growing) role in the gas supply mix as indigenous gas production in Asia and Europe continues to decline, and as large cross-border pipeline projects remain challenging
- In Wood Mackenzie's accelerated energy transition case (AET 1.5) gas demand peaks in 2024, and is ~1,400 bcm lower by 2050

LNG demand continues to grow through 2050, but growth slows post-2040 given the overall outlook for gas

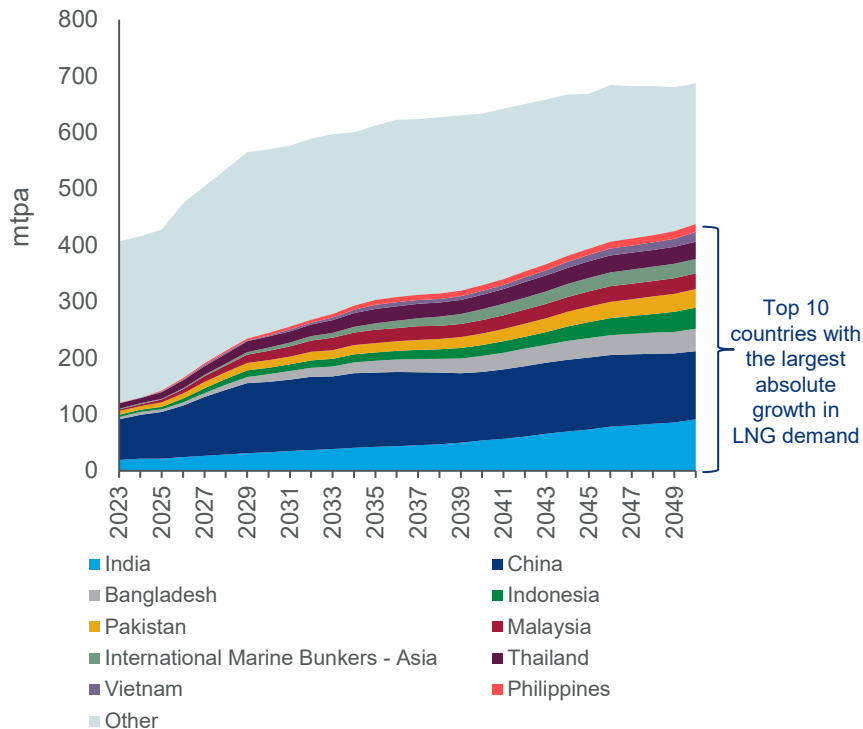
LNG Demand by Region (2023 – 2050)



- European LNG demand grows significantly over the next few years, peaks in 2029 and then declines
 - » However, LNG is an increasingly important component of Europe's gas mix given declining indigenous production and the loss of Russian piped gas (LNG grows from 37% of the mix in 2023 to 49% in 2050)
 - » LNG demand in 2050 is very similar to that in 2020
- Asia Pacific remains the growth engine for the global LNG market, with other regions showing only modest growth
 - » Indian Sub-Continent, China and Southeast (SE) Asia are all key (see next slide)
- Demand for LNG as a bunkering fuel remains a growth area, but growth is now lower than previously forecast as other technologies compete (e.g. ammonia)
- The LNG market continues to become more diverse as multiple additional countries start to import LNG
- In Wood Mackenzie's accelerated energy transition case (AET 1.5) LNG demand peaks around 2041, and is ~215 mtpa lower by 2050

LNG demand growth remains concentrated in a handful of Asian markets

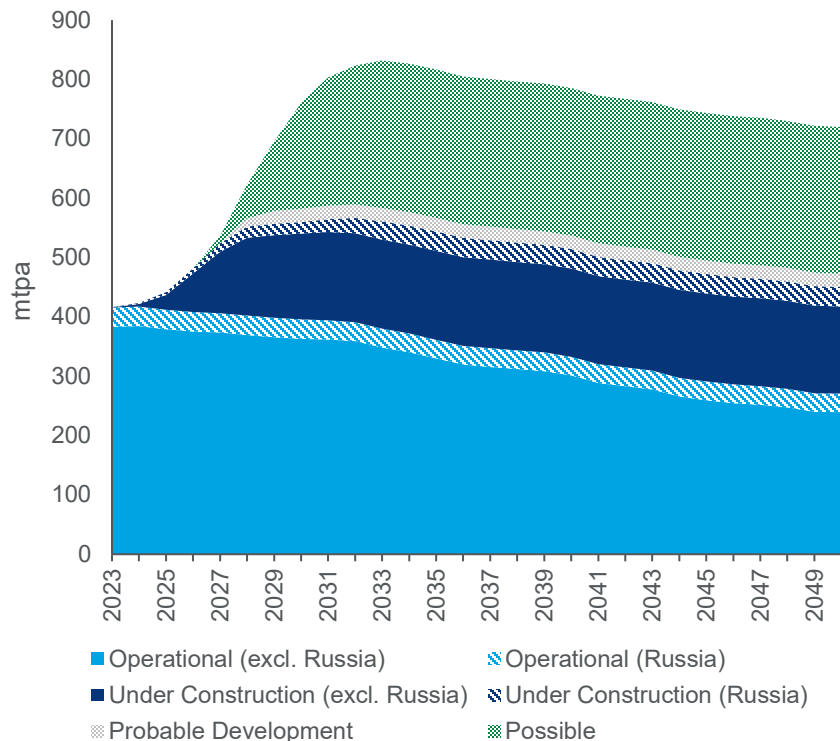
LNG demand by country (2023 – 2050)



- The top 10 markets in terms of absolute LNG demand growth between 2023 and 2050 are all in Asia, reinforcing the message that the region is the growth engine of the LNG market
- India (#1) and China (#2) account for 43% of net global growth across the period, and if Bangladesh, Indonesia and Pakistan (#3 to #5) are added, that increases to 77%
- However, this concentration creates risks to the global outlook if there are significant changes that adversely impact gas/LNG demand in any of these markets
- From a growth perspective, European markets, and particularly Germany, only feature up to 2030
 - » This is interesting given the common fixation on LNG in Europe at the current time, and the fact that Asian buyers are arguably more important in terms of ensuring that new supplies get developed

The LNG supply outlook remains complicated with existing projects in decline and under construction projects at risk of delay

LNG supply by status (2023 – 2050)

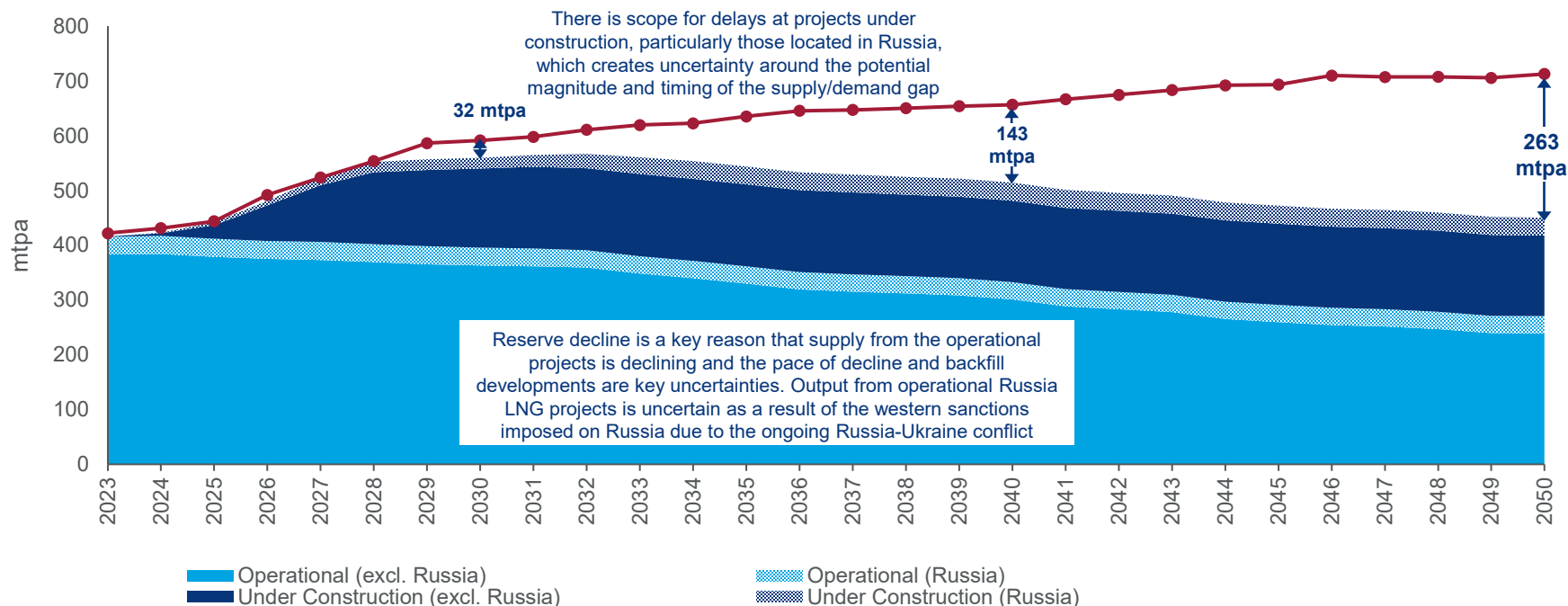


- Supply from existing operational capacity continues to decline across the forecast period, decreasing by ~145 mtpa, with those declines geographically concentrated in Australasia and SE Asia
 - » There is also uncertainty about the output from facilities in Russia given that western sanctions limit access to western-made technology and expertise
- ~180 mtpa of capacity is currently under construction around the world, with over half of that in the US and Qatar
 - » Significant capacity is under construction in Russia, but there are major uncertainties about the timing of its completion, which impacts the supply/demand outlook
 - » There also continues to be scope for delays elsewhere in the world
- The continued decline in 'known' supply, combined with growing demand, creates a need for pre-FID supply (see next slide)
 - » Significant pre-FID capacity continues to target that supply-demand gap, with the US and Qatar again being key

With several projects having reached FID in recent months, the need for additional pre-FID LNG is now limited pre-2030

However, given the decline in output from existing projects and the risk of delays to those under construction, the supply-demand gap could be wider and/or open up earlier

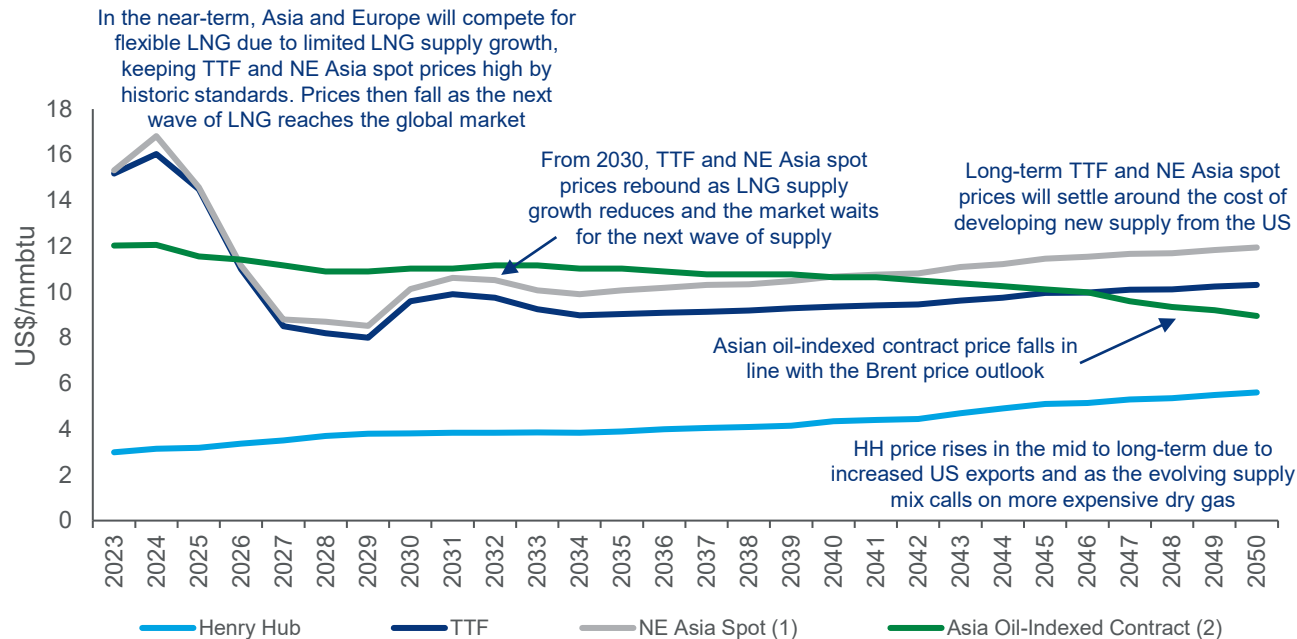
Balance of Global LNG Demand vs. Operational and Under Construction LNG Supply (2023 – 2050)



European and Asian spot prices are forecast to shift downwards significantly from current levels, and to cycle through 2027-32

Henry Hub (HH) and Brent prices look relatively stable by comparison, albeit that Henry Hub is rising and Brent is falling

Global Gas/LNG Price Outlook (2023 – 2050) (real, 2023)

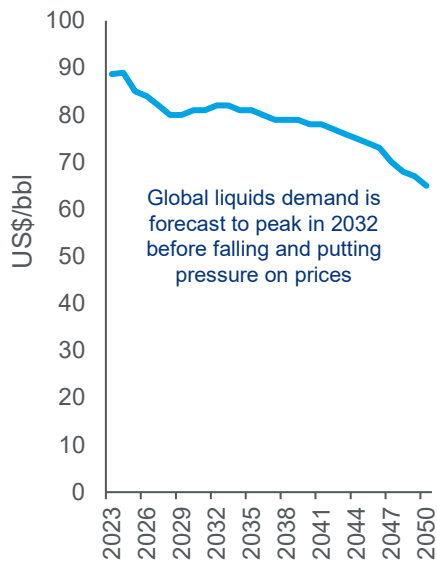


Source: Wood Mackenzie Global Gas Service

Notes: (1) NE Asia spot price is Wood Mackenzie Research's forecast of NE Asian Spot prices (proxy for the JKM price) and is shown on a delivered ex-ship (DES) basis.

(2) Asian oil-indexed contract assumption (DES) = 13% Brent + 0.50

Brent Price Outlook (2023 – 2050) (real, 2023)



Source: Wood Mackenzie Macro Oils Service

LNG contracting behaviour by end-user buyers remains complex, and continues to change as the market evolves

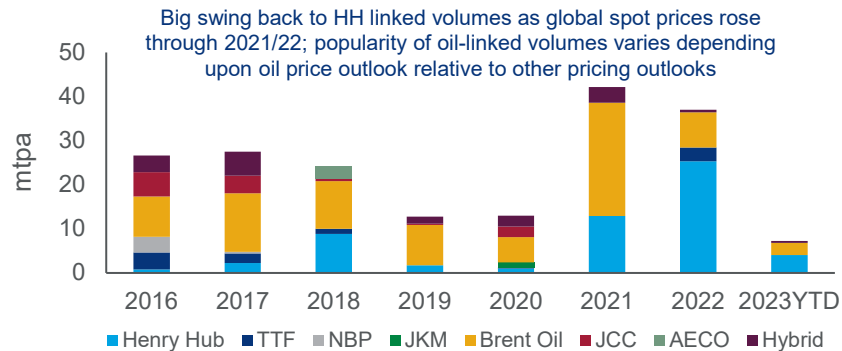
ACQ of Contracts by Duration (2016 – 2023YTD)



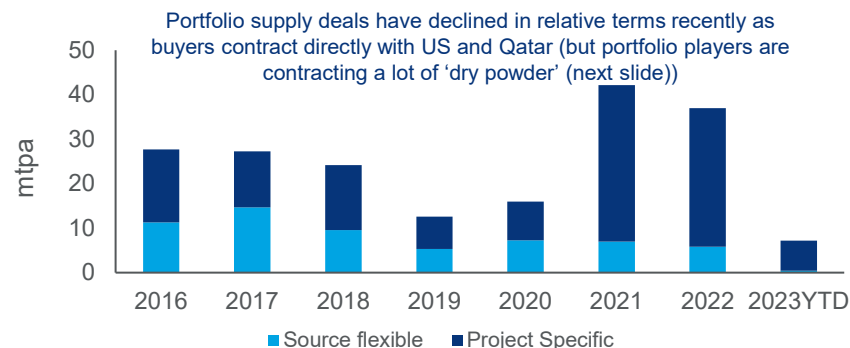
ACQ of Contracts by Size (2016 – 2023YTD)



ACQ of Contracts by Pricing Indexation (2016 – 2023YTD)



ACQ of Contracts by Source (2016 – 2023YTD)



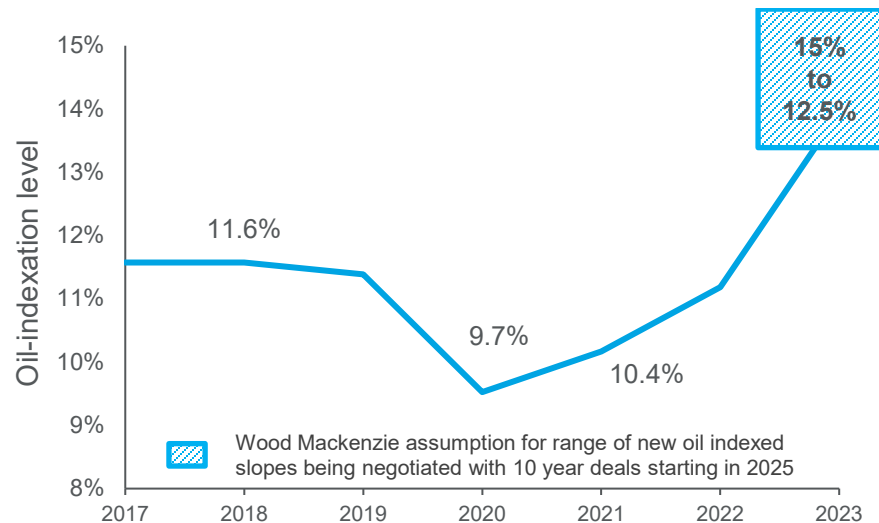
Portfolio players/traders are also active buyers of LNG, for subsequent re-sale out of their portfolios and/or delivery via their market positions

LNG Contract ACQ (by type of Buyer)

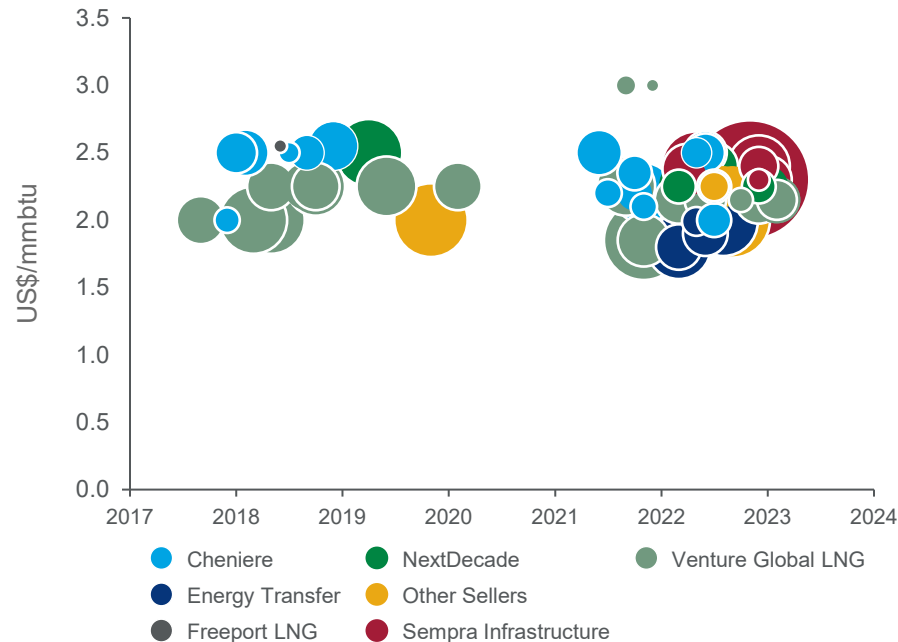


LNG contract pricing evolution is also complex, with oil-linked slopes increasing and US capacity fees staying low

Evolution of Oil-Indexation Levels (2017 – 2023)



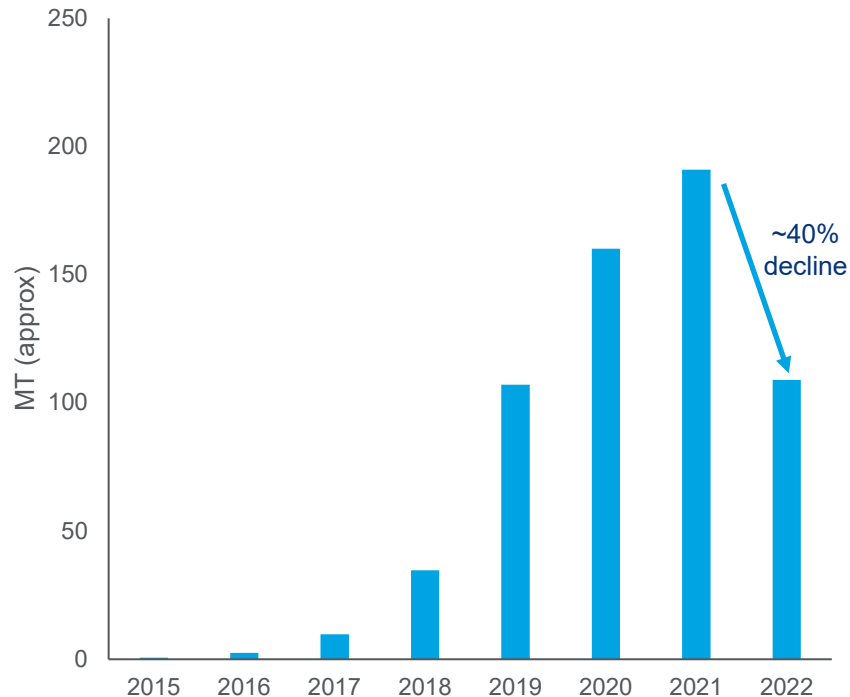
US Liquefaction Fee Evolution¹ (2017 – 2023)



Source: Wood Mackenzie LNG Service. Note: Date denotes the year a contract was signed. (1) The bubble sizes are adjusted to represent the total volume contracted (centre of the bubble indicates price and date). Other sellers include: Delfin LNG, Commonwealth LNG, Dominion Resources.

Has the market turmoil in 2022 hurt JKM's emergence as a key price marker for LNG?

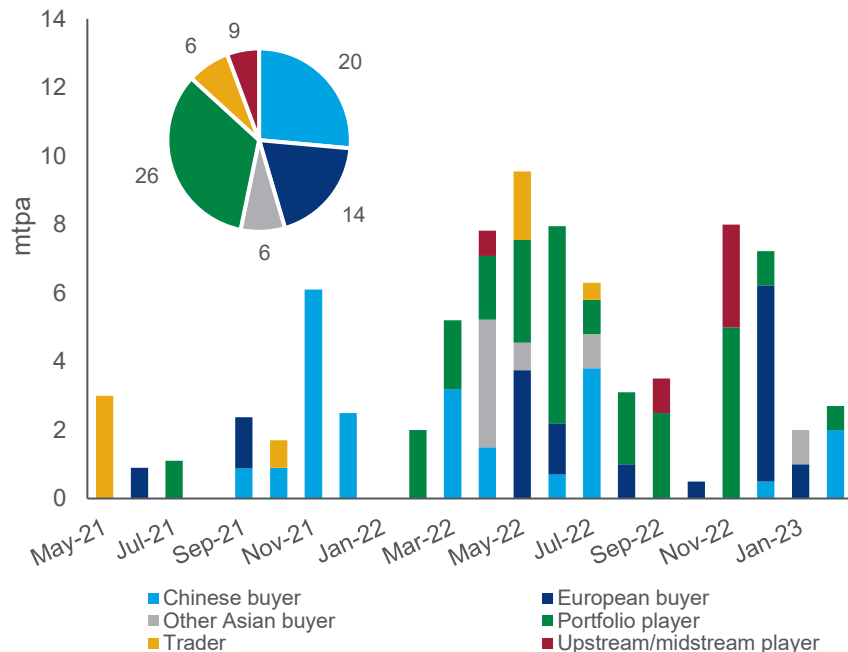
JKM Swaps cleared on ICE and CME (2015 – 2022)



- In recent years JKM seemed to have crossed the Rubicon and was being more widely adopted in LNG contracts as well as in spot/ST trade
- In addition to public disclosures and market intelligence about the use of JKM in term deals, JKM swaps trade suggested that more LNG was being sold using JKM which necessitated the increased use of derivatives to hedge and risk manage those positions
- However, in 2022 exchange cleared JKM derivatives trade fell sharply as high prices led to an increase in the cost of hedging, making trading more difficult
 - » But anecdotal evidence indicates that derivatives trade may have switched to OTC markets and that the overall total was similar
- In addition, the extremely high JKM prices witnessed in 2022 may lead to buyers viewing oil or HH-linked deals as less volatile (See Section 2)

There has been a huge amount of US LNG volume contracted in the last two years, but again the picture is complex

US LNG Contracts (ACQ) signed since May 2021 by buyer type



- Contrary to public opinion, European deals are a relatively small part of the overall picture
- Chinese buyers were buying at a rapid clip up until mid-2022, but the pace has slowed, perhaps reflecting geopolitical complexity?
- The portfolio players have been big buyers as highlighted earlier, with Chevron, ExxonMobil and ConocoPhillips making significant purchases
- We have also seen more activity from US producers and midstream companies, with deals for liquefaction capacity and/or LNG offtake, rather than just netback deals from international prices

2. Perspectives on the Global LNG Market Outlook

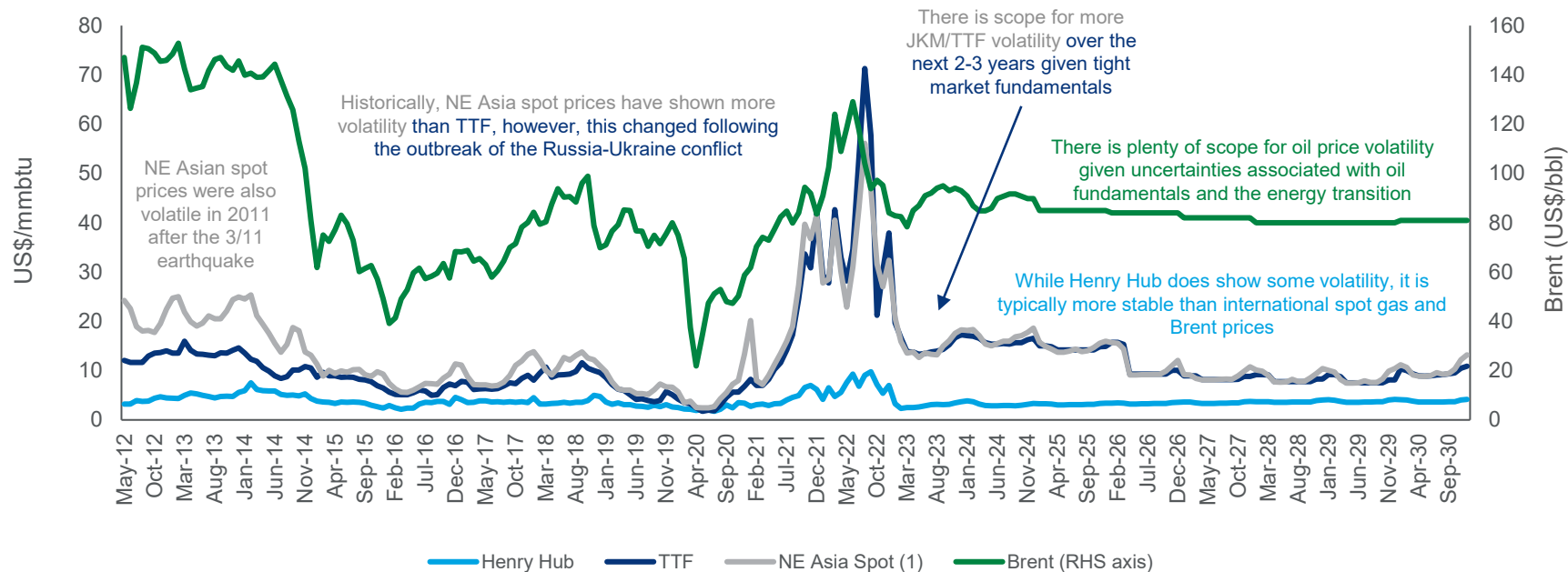
The LNG market appears to be becoming harder to predict, creating challenges and opportunities for buyers

Characteristic	Selected Examples / Observations	Key Questions / Implications / Opportunities / Challenges for Buyers
Volatility	- We've seen unprecedented swings in international spot gas prices in the last 15 months, but prices were becoming more volatile before the Russia-Ukraine conflict, and volatility looks set to continue - Oil prices also have scope to continue to exhibit significant volatility	- How best to manage price volatility? - Do certain types of pricing indexation offer more risk mitigation / opportunities?
Uncertainty	- Gas/LNG demand outlook is becoming more uncertain, with gas demand already forecast to decline post-2040 - While decarbonisation efforts progress, there are multiple pathways and no general consensus - The Russia-Ukraine conflict appears to have shifted momentum, at least temporarily, in favour of supply security rather than decarbonisation - Long-term impact of recent high prices on demand is also uncertain - Oil market outlook is also highly uncertain; price upside driven by resilient demand and challenged supply or price collapse driven by demand destruction? - US\$65/bbl WM Base Case forecast for 2050 vs US\$27/bbl in AET 1.5 - ESG could have a big impact on the financing of new LNG supply - Future role of Russian gas (LNG and pipeline) is uncertain	- What is a realistic demand forecast on a short, medium and long-term basis? - Requirement for flexibility / optionality - Where will oil prices go, how attractive (or not) are oil-linked supply contracts? - Can sufficient new LNG supply be developed to satisfy demand? - The attractiveness of re-contracting existing supply vs securing new supply varies depending upon scenario
Complexity	- LNG market continues to grow in absolute terms, with more participants and more contracting options, but supply is becoming geographically concentrated - As globalisation is increasingly challenged, geopolitical challenges emerge, particularly around the US, China, Russia and the Middle East, with potentially major impacts on gas resource development and LNG flows - Decarbonisation increasingly calls for a transition from LNG to low-carbon gas	- How reliant do buyers want to be on any particular supply source? - What's an appropriate contracting strategy? - How do buyers position for a shift to low-carbon gas in terms of both infrastructure and supply?
Ambiguity	While there are many net-zero goals out there (country and corporate), what is achievable vs aspirational?	- How big an impact on demand will decarbonisation have? - What are the implications for LNG procurement? - How important is decarbonising LNG supply and what are the appropriate options?

Note: Not intended to be exhaustive

The oil price seems to have always been volatile, but international gas price volatility has been increasing

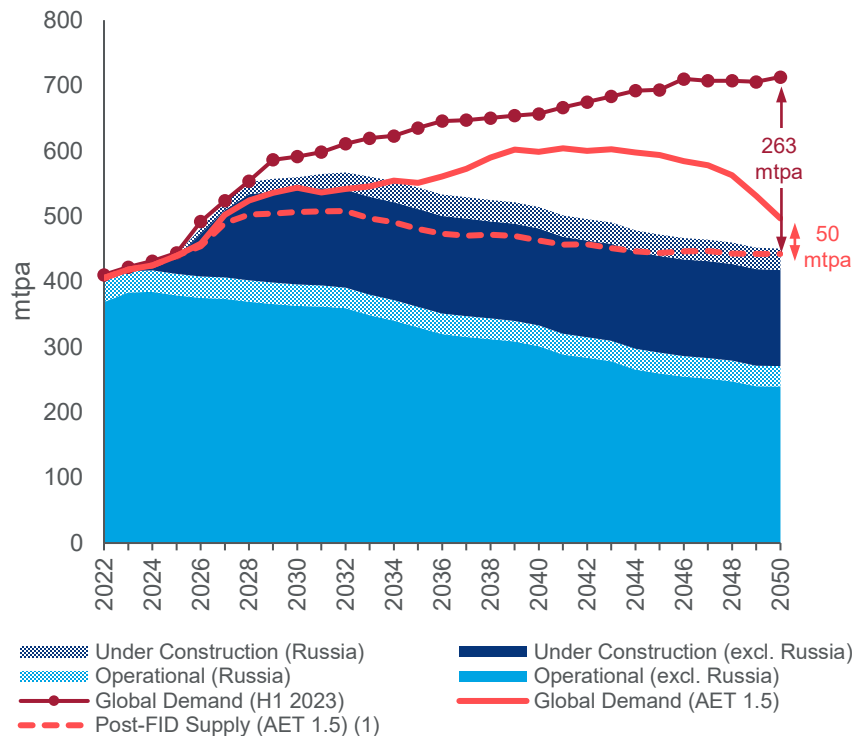
Monthly Prices: Henry Hub, TTF, NE Asia spot and Brent² (2012 – 2030) (real, 2023)



Source: Wood Mackenzie, the Argus Media group, NYMEX. Note: (1) NE Asia spot price is Wood Mackenzie Research's forecast of NE Asian Spot prices (proxy for the JKM price) and is shown on a delivered ex-ship (DES) basis. (2) Wood Mackenzie only forecasts the Brent price on a monthly basis through to 2024, and so from 2025 onwards annual prices are shown on a monthly basis

What happens when the LNG demand line no longer always goes up, and you aren't sure how quickly it will go down?

Operational, Under Construction and Pre-FID Supply called to meet demand (2023 – 2050)

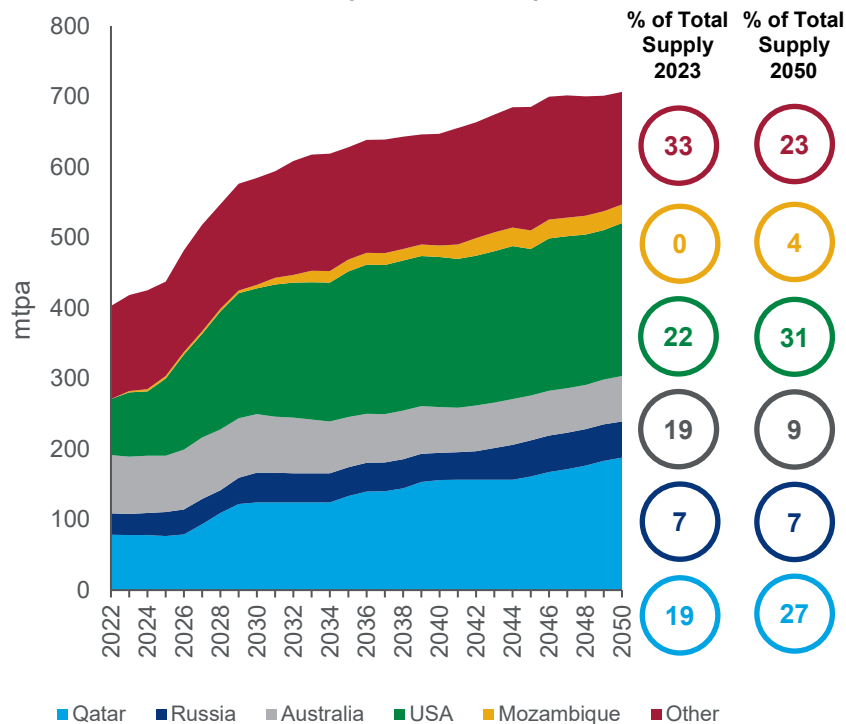


- Given the range of LNG demand uncertainty, the forward trajectory is hard to predict. Key factors that will influence market dynamics include: the rate of decline, whether the decline follows market expectations, and when it begins
- If LNG demand declines gradually**, it's a stable environment and the market is more likely to develop pre-FID supply (but as demand is declining, it may be harder to secure the long-term contracts needed to sanction that supply if buyers are concerned about becoming over-contracted)
 - » This could push-up the cost of supply and prices as shorter tenor contracts are more expensive
- If LNG demand declines rapidly**, then the need for pre-FID supply will be lower and sanctioning new projects likely becomes more difficult as buyers may prefer short/mid-term contracts to new long-term ones (and the risk of stranded capacity also increases)
 - » If less new supply is developed, it could potentially feed volatility in the short-term (price increases), but stranded capacity could depress prices
- If the decline rate is higher than expected**, there is a risk of stranded volumes and downwards pressure on price, but if it is **lower than expected**, there is a risk of a lack of supply and higher prices, volatility is to be expected
- When the decline starts** will also impact dynamics; if it's sooner (like AET 1.5), it creates a higher risk of pre-FID supply becoming stranded which may impact LNG projects getting sanctioned, creating volatility
- Given the **range of possible outcomes around long-term LNG demand**, it is likely that it is going to become harder to sanction new capacity and the risk of demand/supply mismatches becomes greater, making it harder for buyers (and sellers) to navigate the environment, and creating volatility

Source: Wood Mackenzie. Note: (1) As the AET 1.5 dataset was published in September 2022, this does not include supply from projects that have since reached FID, including Gabon FLNG (0.7 mtpa), ZLNG (2 mtpa), Marine XII Phase 2 FLNG (2.4 mtpa), Plaquemines Phase 2 (6.66 mtpa) and Port Arthur Phase 1 (13.46 mtpa). It also doesn't reflect subsequent supply revisions that were included in the H1 2023 Base Case

LNG supply is becoming increasingly concentrated, with the US and Qatar forecast to account for almost 60% of supply in 2050

Operational, Under Construction and Pre-FID Supply called to meet demand (2023 – 2050)



- A new wave of US LNG will come online from the mid-2020s with output forecast to grow by nearly 130 mtpa between 2023 and 2050
- Qatar's North Field South is expected to reach FID later this year and together with North Field East, will help drive LNG supply growth in the 2020s. Further expansions will increase supply by ~60 mtpa by 2050
- The outlook for LNG supply from Russia is highly uncertain and growth is limited
- The contribution of Australian LNG reduces as reserves decline, with overall supply falling by ~20 mtpa (2050 compared to 2023)
- While we forecast growth from Mozambique, the outlook is uncertain
- New FLNG projects will be critical for unlocking supply in the East Mediterranean and Africa, but developing these remains challenging
- New LNG projects on the west coast of Canada and Mexico will provide additional supply to Asia, but again they are challenging developments due to the local environments
- With almost two-thirds of the world's LNG supply concentrated in Qatar and US by 2050, increased support for new projects in different regions/countries will be required to ensure supply diversity and minimise the risks associated with dependence on a single supply source

» But geopolitics complicate the picture

There are numerous potential challenges associated with developing new LNG supplies

It may be risky for buyers to assume that they will be able to easily access the additional supplies that they require

- Securing the debt financing needed to develop new pre-FID LNG supply is likely to become more challenging
 - » The uncertainty around the longer-term outlook for LNG demand may lead to offtakers being less willing to sign the long-term contracts needed to underpin the financing
 - » Shorter tenor contracts will be commensurately more expensive, and this may be unpalatable for buyers
 - » Given ESG and NGO pressures, some financial institutions are likely to continue to reduce the amount they are willing to lend to LNG facilities, which could create further challenges for financing new projects
 - » It's not clear that equity financing will ride to the rescue if debt becomes harder to secure – a more uncertain LNG market outlook only plays to certain types of equity provider
- US projects face increasing costs (development and financing), which coupled with liquefaction fees remaining relatively low (slide 12) due to competition between developers, makes financing from both debt and equity markets more challenging and squeezes developer returns, which may restrict the development of incremental supplies
- Projects in certain geographies will always be challenging, and ESG pressures just add to the difficulties



Q&A

Frank Harris

Head of Global LNG Consulting

Biography

Frank has worked for Wood Mackenzie for over 26 years and focuses on providing LNG-related commercial advice to clients. This encompasses: strategy development, LNG project development, the sale and purchase of LNG, project financing, transaction support and market/competitor analysis.

Over a near 20 year period of involvement in the LNG financing / transaction space, Frank has supported the debt financing of numerous liquefaction facilities across the Americas, Africa and the Middle East, as well as several import terminals, including FSRUs. He has also supported clients with raising equity for LNG facilities, and on the sell and buy-side of multiple LNG related divestments / acquisitions.

His clients include upstream players, utilities, traders, project developers, a broad range of financial institutions, midstream players and Governments.

Frank is a founding author of Wood Mackenzie's LNG Research Service, is widely recognised as a leading commentator on the global LNG industry, and has an extensive network of contacts within the industry.

Prior to joining Wood Mackenzie, Frank spent four years as a member of Andersen Consulting's utilities team where he worked on engagements related to the development and implementation of strategies for companies in liberalising energy markets. During his 25+ years in the energy industry Frank has been involved in a variety of markets in Europe, Asia, the Middle East, Australasia and the Americas.

Frank graduated from the University of Bradford Management Centre in 1991 with a First Class BSc (Hons) in Business Studies.

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