Gaffney Cline

Market Advice and Estimates of Contemporary LNG Contract Prices

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Basis of Opinion

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This report relates specifically and solely to the subject matter as defined in the scope of work (SOW), as set out herein, and is conditional upon the specified assumptions. The report must be considered in its entirety and must only be used for its intended purpose.

Executive Summary

As a result of recent price volatility, the natural gas industry has become a greater focus of attention globally, and has also been the topic of government level dialogue focusing on the desire for greater security of supply and price stability.

The degree of instability in global gas markets has increased still further from that which existed when the first of these reports was published. The primary cause of this is the substantial shortfall in Russian gas imports to Europe, which estimates suggest will have fallen by 50 billion cubic meters, or 1,900 PJ (around a third) during 2022. To put this into context, this shortfall is equivalent to around half of Australian LNG exports in 2022, or 60% of the natural gas demand of the United Kingdom. The largest compensatory effect to meet European demand has been a very substantial increase in US LNG exports to Europe, and a commensurate reduction in exports to Asia. This in turn has resulted in greater LNG volumes from Australia and Qatar being delivered to customers in Asia, as well as lower LNG imports in price sensitive markets such as India and Pakistan, as well as China, which has also been importing larger amounts of Russian pipeline gas

The significant rise in recent and anticipated LNG deliveries into Europe has also prompted many European gas buyers or network operators to invest heavily in Floating Storage and Regasification Units (FSRUs), seen as a fast track means to create entry capacity for LNG into the European gas networks. This is expected to have an increasing effect on supply stabilisation in coming years.

In the last two years, volatility in LNG prices has consistently risen. Volatility has been particularly high over the last one year. The correlation between Brent and EAX[1] had been high up to March 2022. However, the last nine months have seen a deterioration of the correlation, likely to have been mainly due to the impact of the Russian-Ukraine conflict. Currently, Asian gas markets exhibit extremely high volatility and demonstrate a low correlation with crude oil markets.

As a consequence of this gas supply environment, oil slopes negotiated for individual natural gas purchase agreements could vary considerably depending on the seller, buyer, location, and source of the natural gas. It is possible, therefore, that individual gas contracts with virtually identical terms, negotiated within weeks of one another, could vary in price materially depending on prevailing conditions.

The disruption to wholesale market pricing has led some governments to introduce natural gas price controls, at both a wholesale and retail level, and these represent major unplanned fiscal pressures on many national budgets, especially in Europe where the cost of energy related subsidies has been estimated at approximately US$500 billion.[2] The events of the last few months have also led to a re-examination of the value of security of supply, and what level of price premium might be appropriate to mitigate supply disruptions of this kind.

[1] EAX is a ICIS price index broadly equivalent to JKM
[2] https://www.cnn.com/2022/09/08/business/liz-truss-energy-price-cap-europe/index.html

Finally, the widespread economic consequences of these market disruptions have also created additional momentum around the Energy Transition debate, with some commentators suggesting that it underlines the need to accelerate moves away from natural gas, and more rapid deployment of electrification, renewable energy technologies and zero carbon fuels such as green hydrogen.

With this backdrop of global disruptions, this report is the second in a series intended to assist in estimating medium-term LNG prices based on an oil index, which is produced to inform the ACCC's LNG netback price series. As informed by the ACCC scope of work, this will be focused on publishing oil-linked longer-term forward LNG netback prices extending to 5 years, calculated by reference to an oil slope. The report should be read in conjunction with the previously published paper on methodology, which sets out the background and logic of the calculations and estimates adopted in this report.

While the methodology is considered robust and appropriate, it should be noted that the disruption to global supplies over the last several months has introduced unpredictability and unprecedented price volatility, making any attempt to forecast price levels much more challenging than it would be in more routine market conditions. The methodology report highlights many of the features that contribute to uncertainty and the level of confidence users of the netback series reports need to be aware of and apply, but the reader also needs to consider some of the current market events.

- First, the significant shortfalls in Russian pipeline gas to Europe have created a sudden and unprecedented demand for LNG deliveries to Northwest Europe, which manifested itself in very substantial and unprecedented wholesale market prices. Given the way in which global LNG markets are interconnected, this has been reflected in wholesale gas prices in other major markets, such as Asia.
- One of the consequences of these market conditions has been a reversal of the usual premium that has historically applied to LNG deliveries to Asia, with Europe offering the premium global price for larger periods of Q3 and Q4 of 2022.
- Secondly, much larger volumes of US LNG exports have been diverted to meet this European demand, which has led to LNG from Qatar and Australia meeting a higher proportion of Asian demand, while at the same time LNG demand in China, India and Pakistan have been reduced, largely owing to the price sensitivity of these markets.
- Thirdly, the increasing global concerns over security of supply has created increasing interest from buyers seeking long-term LNG supply, which has been particularly noticeable with respect to long-term SPAs and tolling agreements with both existing and future US LNG export terminals.
- Finally, the economic impact on many European economies has resulted in proposed EU price controls on European wholesale gas prices, whose impact is not yet apparent. This is part of a much higher degree of oversight generally at a government level, and in some cases the bringing into government ownership of some aspects of the natural gas supply chain. One of the consequences of this is a proliferation of orders or charters for FSRUs to facilitate much higher LNG deliveries to the countries most affected by the Russian shortfalls.

For this report, therefore, gas buyers should place additional emphasis on an understanding of the wider trends in the global gas markets, to be considered alongside the calculations of the oil slope set out further in the report.

Notwithstanding the exceptional features above, the methodology developed by GaffneyCline (see box 1 below) sets out an estimated oil slope for medium-term LNG contracts for Asia delivery of 15.1%. This represents an increase of 2.3% (a proportional rise of 18%) in the anticipated medium price of natural gas, compared to June 2022.

Box 1: Methodology to Estimate Medium-term LNG Contract Prices[3]

GaffneyCline estimates the oil slopes for medium-term LNG contracts using prices observed under medium-term LNG contracts entered over the previous 12 months. If there is sufficient data for medium-term LNG contracts (e.g.. 5 or more transactions with full or partial reported oil slope within the previous 12 months), then the volume weighted average of these slopes will be used as the primary input derive LNG oil slope estimates.

If there is insufficient data on medium-term contracts, three main sources of insight can be applied to understanding contemporary LNG contract pricing, in addition to reported contracts of the duration of interest (3-6 years). These are:

1. Short-term international tenders
2. Long run cost of US LNG Exports
3. Long-term contract signings

The relationship between these three sources varies, based on the market conditions prevailing. For example, when there is considerable volatility in the market, shorter-term/international tender prices can depart substantially from longer-term market fundamentals and are less helpful in signalling an oil slope up to 5 years out.

Conversely, when the market is very well correlated, and volatility is low, tender prices are a much better signal for a 5 year look ahead and deserve greater emphasis in the approximation process.

When average levels of correlation / price volatility apply, a 5 year look ahead is likely to be equally affected by shorter-term, longer-term, and calculated long run costs of LNG delivered from the US.

Recognising these dynamics, in the event that the alternative data sources are used to complement data on medium-term LNG contracts, they will be weighted differently depending on the observed volatility in key oil and gas price indices over the previous 12 months:

- Where oil and gas indices have experienced high volatility and have been **less than 40%** correlated, more weight will be given to longer-term deals
- Where oil and gas indices have experienced average volatility and have been **more than 40% and less than 60%** correlated, equal weight will be given to the three measures
- Where oil and gas indices have experienced low volatility and have been **more than 60%** correlated, more weight will be given to shorter-term deals.

These three parameters will be combined to produce a single slope data point with medium-term LNG contract slope data using a simple arithmetic average to generate the final six-monthly oil slope estimates. See Appendix III for a detailed explanation of the methodology.

[3] See the ACCC website for a full explanation of GaffneyCline's methodology https://www.accc.gov.au/system/files/GaffneyCline%20methodology%20discussion%20paper%20LNG%20price%20estimates.pdf

The starting point for the estimated oil slope is the analysis of medium-term contracts. However, we have observed that no medium-term oil-indexed contracts have been entered within the last 12 months, for which data is available from the usual subscription price reporting services.

We, therefore, move to a secondary analysis, taking a combination (that depends on the degree of market volatility) of international tenders, US LRMC and long-term SPAs. Based on the methodology set out, in a volatile market such as the one that exists today, we place a weighting on the various input parameters in the proportion of 1:2:3.

- Least weighting on international tenders (on the basis that they reflect short-term market pressures)
- Medium weighting on US LRMC
- Most weighting on Long Term SPAs

Applying the process to the data and calculations above, the following oil slope estimation is calculated (without reference to the non-conforming but illustrative data points from the assessment of medium-term contracts).

Contract Type	Weights	Slope	Section
Volume-weighted international tenders	1	23.0%	3.2
LRMC US exports converted to slope	2	13.3%	3.3
Volume weighted long-term deals*	3	13.7%	3.4
Published Slope Estimate		**15.1%**	
*Long-term slope of 13.0% is adjusted +5% for financing benefits			

Note that these estimates are sensitive to assumptions about market volatility and the corresponding weighting (as explained in Box 1 and **Appendix III**). For example, a greater weight for international tenders would result in a higher average slope.

Note regarding current unprecedented volatility in global gas markets

Current volatile global gas market conditions do not readily lend themselves to price forecasting. Whilst the current near-term market volatility persists, historical measures of oil and gas correlation, price volatility and other fundamental features of the oil slope derivation in this report have less applicability than in more stable times.

It is possible, perhaps likely, that the significant disruption in gas pipeline imports to Europe and regulatory and/or government action will continue to significantly impact forward LNG pricing. Such an outturn will, in turn, fundamentally influence both LNG prices globally and local gas market prices worldwide.

This being the case, shorter-term gas sale and purchase agreements could carry a significant premium over oil, medium-term contracts less so, and long-term contracts (more than 10 years) will be least affected. The flexibility of the methodology referenced in this report, therefore, serves to cater for adapting market conditions and allows for a changing weighting in the parameters that influence the estimations.

In parallel to the analytical approach to price forecasting set out, it is also worth bearing in mind general market sentiment garnered from confidential market sources. This suggests that an oil slope in the region of 16-17% or more is likely to apply to LNG delivered in the shorter term, where unmet European demand continues to dominate. In the longer term, futures market curves suggest that oil and gas prices stabilise and return to a relationship reflected by the thermal energy contained in the fuel adjusted for regas costs, potentially in the region of 12-14%.

We believe these market indicators are consistent with the analysis and recommendations in this report, which have arrived at a 15.1% slope estimate, but buyers in Eastern Australia may find that gas suppliers are seeking a higher level of price in the short term, particularly in the next 12 to 24 months.

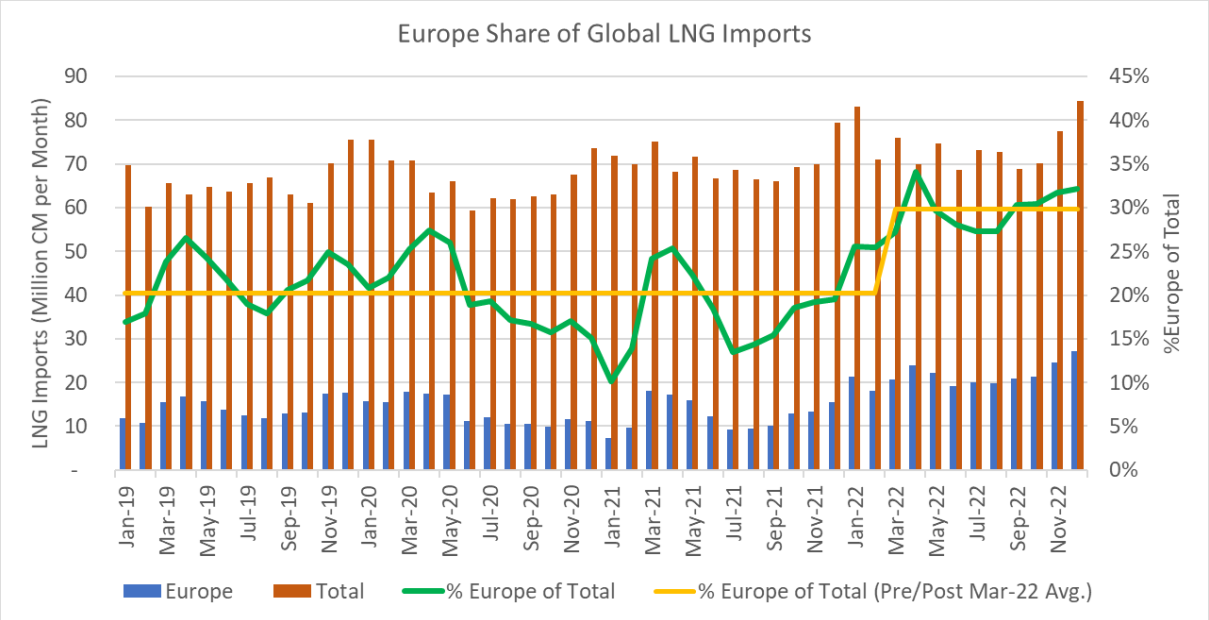
Discussion

1 Overview of LNG Market Developments

1.1 European Supply Disruption

As a result of the recent global supply disruptions, Europe's share of global LNG imports has changed from around 20% to 30% since start of Russia-Ukraine war. Europe is competing for gas from other regions to make up shortfall in Russian gas supplies. In order to better accommodate this increase in LNG demand, additional LNG regasification infrastructure, particularly the use of FSRU's, is planned to increase substantially.

Figure 1: Increasing Share of US LNG Exports Delivered to Europe

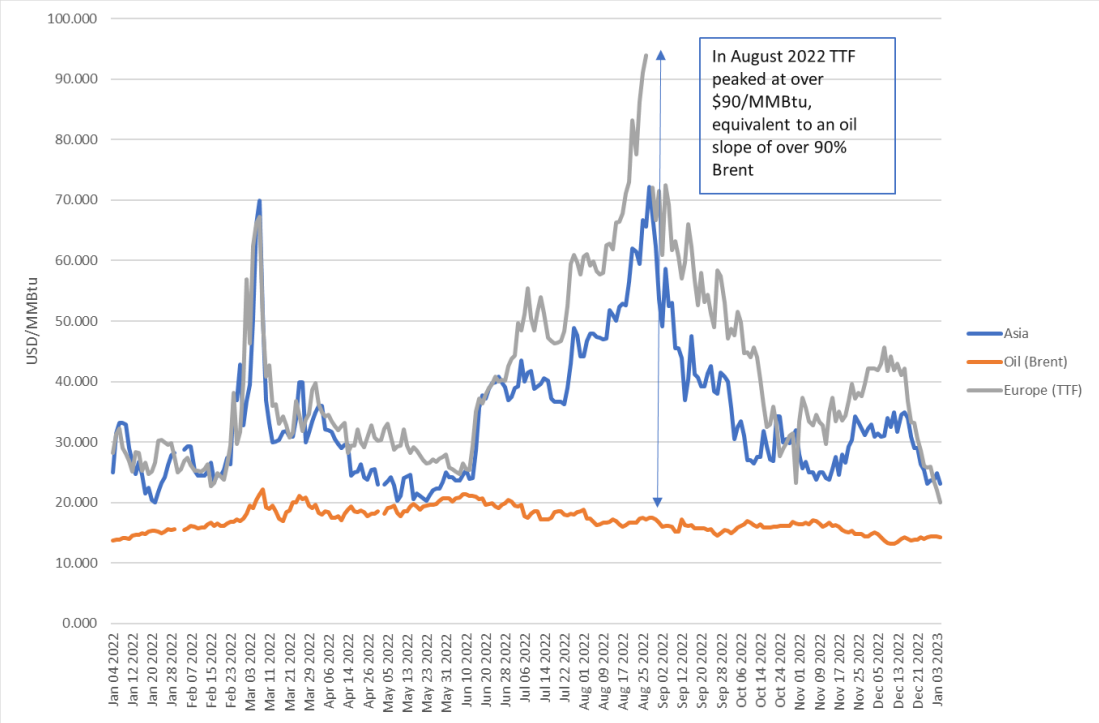


Source: ICIS, GaffneyCline Analysis

1.2 Impact on Wholesale Natural Gas Markets

The concerns over Russian imports and the geopolitical uncertainty that heavily influenced gas purchasing decisions during in Q3 of 2022 led to significant price shocks both in Europe and Asia (**Figure 2**).

Figure 2: Asian and European Gas Prices in 2022



In August 2022 the wholesale price of natural gas in Continental Europe, measured by reference to the TTF hub, reached over US$90/MMBtu which in oil terms is equivalent to approximately US$540/bbl. Asian prices followed suit, as LNG buyers around the world had to compete for volumes based on price. Of course, these wholesale prices applied only to short-term trades while many long-term contracts, especially those linked to oil, continued largely unaffected.

The disruption of the traditional relationships and correlations between global oil prices, and gas indices increasingly used in the LNG market, such as TTF and NBP in Europe, and JKM in Asia has impacted on LNG price setting in some fundamental ways, which may take months or years to restabilise.

1.3 Economic Effects and Price Regulation

On average, residential, commercial and industrial energy prices in Northwest Europe have risen by about 200-300% in recent months, depending on market segment and jurisdiction. As a result of this, many European economies have introduced temporary fiscal policies, such as the "Solidarity Contribution[4]", subsidies, and borrowing to alleviate the impact of energy price increases. The swings in economic rent between energy producers and consumers created by these high prices have also led to policy action by the EU and others. In November 2022, the EU introduced price controls on the wholesale price of gas traded on the TTF hub, which are intended to prevent a repeat of the very high prices seen in Q3 and Q4 of 2022. In addition, several European governments are seeking other ways to stabilise the situation, with Germany in particular having nationalised certain natural gas companies, as a way to both

[4] Council Regulation (EU) 2022/1854 of 6 October 2022 on an emergency intervention to address high energy prices ST/12521/2022/INIT

achieve continuity of operations, and create increased stability in future. In particular, this includes the emergency procurement of a number of FSRU's to rapidly create gas importation infrastructure to replace Russian pipeline imports.

1.4 Price Arbitrage and Short-Term Trading

The financial pressures arising from these gas price fluctuations have also extended into the LNG/gas trading sector, where the volatility experienced in recent months has placed a strain on balance sheets and credit lines, especially for gas traded via an index.

Finally, the normal geographic pricing differentials that has typified the LNG sector for the last several decades have also been put under some strain, for example with the usual price premium in Asian markets being reversed for significant periods of time, as European buyers seek to attract cargoes, and a material price difference emerging between NBP in the UK and TTF on continental Europe, which typically trade within a few cents, as entities seek to import LNG into Britain for export to Continental Europe.

1.5 Oil Price Stability and Impact on Pricing Trends

During this period of wholesale gas price instability oil prices have remained very stable, relatively speaking, and this has set up a pricing dynamic which is driving gas sale and purchase decisions, which is increasingly a function of the risk appetite of the market participant and their role in the gas value chain.

For those seeking price stability, and who have a longer-term perspective on cashflow and profitability, there has been a tendency to seek gas sale/purchase arrangements which rely on oil indices and a slope calculation. On the contrary, for those entities equipped to deal with the volatility and very complex, real-time risk management requirements of index traded gas, the potential for trading profits is a significant driver.

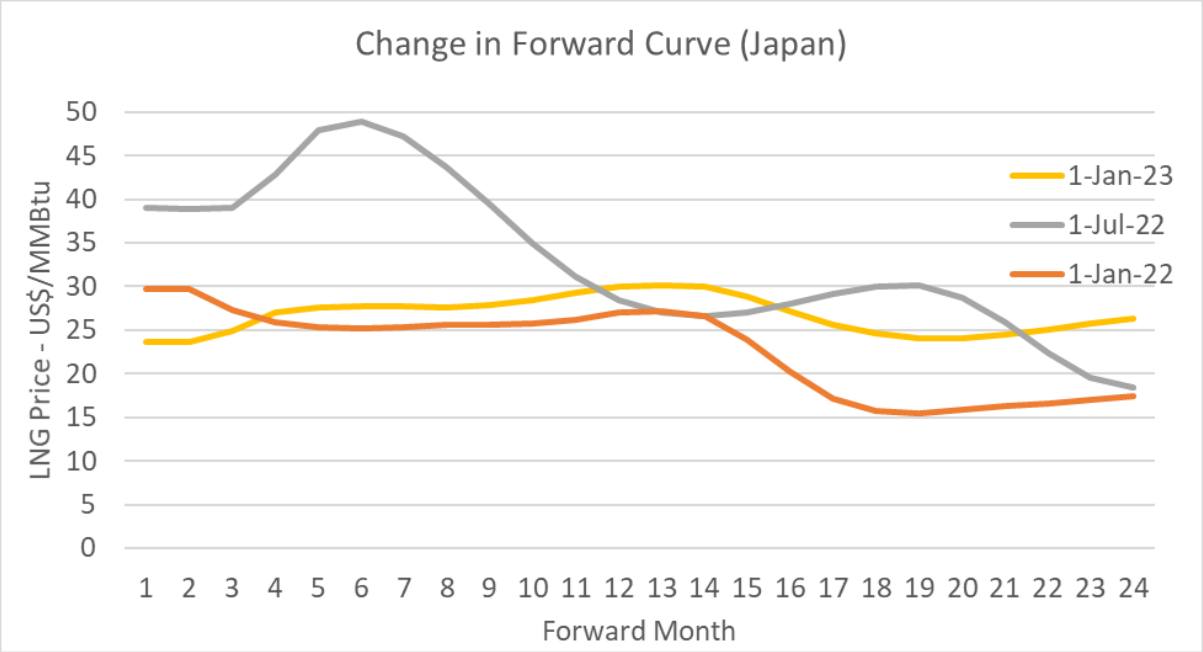
The purpose of this report is to inform gas buyers in Australia about the factors that are likely to be relevant in an arm's length negotiation for a gas supply. As such, while these wider features in the global gas market are important to understand, the methodology set out for this LNG netback series continues to be relevant and helpful in arriving at an expected price range over the next several years.

1.6 Forward Market Outlook

As we enter into 2023, there are signs that gas and LNG prices are set to enter a period of stabilisation, and forward market prices indicate a gradual return to a more typical pattern over the next two winter seasons. While the shortfall in Russian gas imports to Europe continues to create upward pressure, the emergency actions by EU and others appear to have alleviated the price instabilities of the last few months. Furthermore, additional LNG supplies from the US Gulf Coast, as well as other projects under development such as Mozambique, Senegal and, in the longer term, export projects such as Tanzania all suggest that in the longer term, substitute supplies can be brought on stream.

Figure 3 below indicates that while the second half of 2022 was characterised by record prices, the forward curve which reflects where future deliveries of LNG will be priced, has fallen since July this year. While it remains above the pre-Ukraine invasion levels set in January 2022, the difference is more modest.

Figure 3: Change in Gas Forward Price for Japan delivery



Source: ICIS, GaffneyCline analysis

There is continuing evidence that the high prices in price elastic importing countries have suspended LNG sale and purchase negotiations, but Petronet, a large Indian LNG importer, recently indicated that more stable LNG pricing may trigger a recovery in imports and terminal utilization. However, several long-term deals (15-20 years) have been signed in the last few months with US suppliers, predominantly by Chinese LNG importers. This appears to confirm a trend away from relying on spot deals, where the price volatility of the last few months has led to costly LNG import bills. These long-term deals have been reported to include tolling rates in the US$2/MMBtu to US$2.10/MMBtu range. However, growing demand for LNG, especially for projects that can deliver in the 2025/6 timeframe, and increasing concerns over inflation impacting construction costs suggests that there is upward pressure on this number. For these reasons, we are increasing our tolling cost from US$2.00/MMBtu to US$2.10 (an increase of 5%) when assessing the long-term pricing estimates for US exports.

Henry Hub prices in the US have shown much greater stability than wholesale market prices elsewhere with a re-stablisation in the futures curve to just over US$5/MMBtu for January 2024. The price reflects an anticipated continued demand for feedgas for LNG exports in the coming years. Translated into oil slope levels, this would place January 2024 oil indices, on a delivered to Asia basis, at around 12.8%, based on the January 2024 Brent futures price of US$81/barrel. This is significantly less than some spot prices that have prevailed in recent months and demonstrates that while short-term pricing is responding to the supply disruptions, longer-term trends are far more stable.

1.7 Pricing Trends / Market Sentiment

Although pricing information is notoriously hard to derive in the LNG sector, market indicators seen by the Gas and LNG team at GaffneyCline suggest that medium-term LNG deals of around 10 years are most affected by the current disruptions, and are typically being offered in the range of 16-17% in the case of contract renewals with LNG deliveries commencing in the short term. For LNG deliveries starting in the medium term, say 2024-2026, buyer and seller expectations appear to be lower, with a range of 12.5 to 14% being considered appropriate.

Furthermore, while FOB prices in the 10% range were seen prior to 2022 for LNG projects seeking AAA credit rated long term offtakers, prices in this range no longer appear achievable, other than potentially for LNG projects that have not reached FID and do not have market credibility.

However, pricing trends continue to be influenced by broader market fundamentals outside the current disruption, which have also changed considerably in recent years.

The LNG sector underwent a period of economic strain in the 2020 timeframe owing to COVID related demand reductions which coincided with a structural oversupply in the global LNG market. This caused spot prices to fall to unprecedented low levels, and some liquefaction plants were shut down for lack of market. Subsequently, faster than anticipated demand recovery and growth, especially in Asia, and delays in new plant construction and FID (e.g. including but not limited to Mozambique, some US projects which have since picked up the pace again) coupled with unplanned outages at LNG facilities (e.g. including but not limited to Hammerfest in Norway, Prelude, and for a brief period US Gulf Coast facility disruptions due to weather) saw a gradual increase in price to the point where supply shortages became apparent by winter of 2021/22.

During 2022, LNG imports reached 399.4 Million Tonnes (MT), a 5.6% increase over 2021, majority of growth coming from Europe with 71% increase to almost 116 MT to replace lower Russian pipeline gas. Additional European LNG demand resulted in major reduction in demand from Asia (especially China and South Asia) and Americas. Chinese LNG demand fell by 21% to 63.6 MT due to additional pipeline gas supplies and reduction in demand due to slower economic activity and the impact of the strictly applied COVID lockdowns. Most of the spot market imports were taken by Europe.

Preliminary analysis based on shipping movements suggests that in 2022, Australia, the US and Qatar all exported about 81 million tonnes of LNG each. The US would have been the bigger exporter but lost its lead due to a major outage in Freeport LNG facility in USA.

Since the last report was published in June, significant additional LNG export capacity has been sanctioned from US terminals. Cheniere has approved a 10 MTPA addition to its Corpus Christi LNG terminal, and Venture Global approved the second of three terminals in its portfolio, the 20 MTPA Plaquemines facility in Louisiana. Other LNG terminals are approaching FID, including the Energy Transfer project at Lake Charles, which will bring an additional 16.5 MTPA into the market. During 2023 other projects will be vying for FID, many of which are rapidly securing offtake. These include a floating LNG terminal, with an initial capacity of 3.5 MTPA, and another Venture Global terminal which is currently seeking firm offtake.

Turning to the Pacific basin, interest in the Alaska LNG export project (approx. 24 MTPA) appears to have revived, especially given Asian buyer concerns over the proportion of Gulf Coast LNG being taken to Europe.

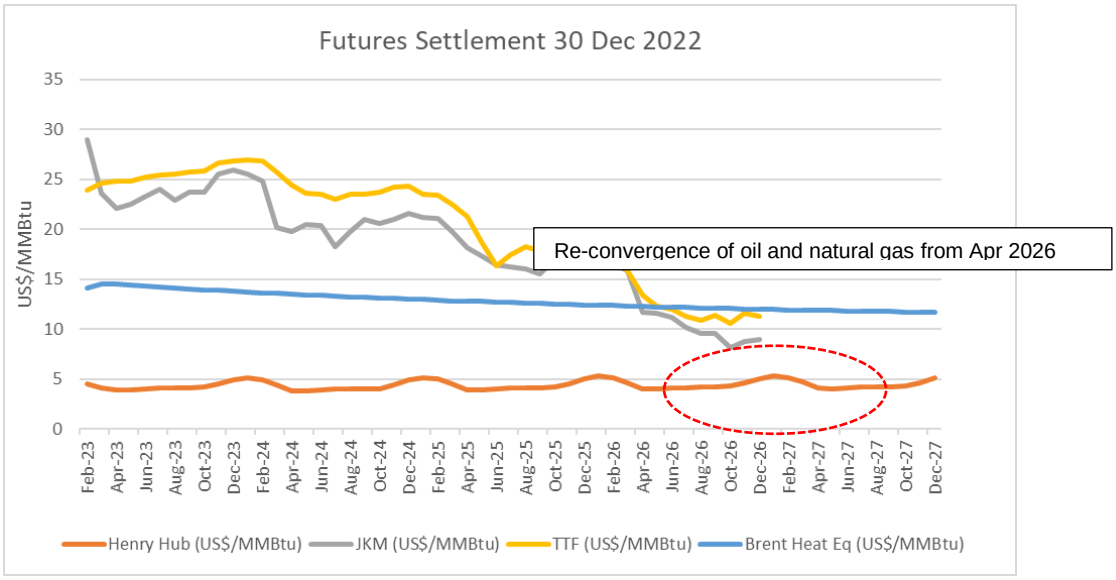
However, with the market oversupply of the 2018-2020 still relatively fresh in the minds of LNG developers and lenders, it is likely that many US and other LNG export projects currently under consideration may not finally come to market. An indication of the continuing challenges to achieving FID for US export projects was the cancellation by Shell and Vitol of their conditional offtake contracts from the Driftwood LNG project in September 2022, at the height of the European gas market disruption. The project now looks less likely to proceed, and the focus is on projects that can come to market prior the 2025/6 timeframe when LNG supply pressures are anticipated to ease.

Re-exports remain a relatively low proportion of trades, mainly owing to the recent pricing volatility which can reverse pricing differentials in less than the time a vessel can respond. Floating LNG storage, using "slow steaming" or other techniques to keep LNG on the high seas and profit from price changes has also seen an uptick in the last 6 months.

As discussed in the previous report, since 2020, the relationship between the price of natural gas and oil has become increasingly uncorrelated, as each commodity has responded to its own market conditions. With fuel switching offering operational and economic challenges, the structural separation of the oil and natural gas markets continues to lessen the linkages between the two. In the longer term, market forces should enable both commodities to establish a more stable relationship.

The graph below indicates that the futures market is anticipating a gradual convergence of oil and gas prices, anticipated after the Apr-2026 timeframe. This realignment is at risk until the energy security situation in Europe is resolved. Russian gas imports are substituted from other sources or returned to a much more reliable basis. Spot prices should ease with additional LNG supplies coming onstream in 2026/27. Futures settlements for JKM and TTF beyond Dec-2026 are not shown as there is no open interest beyond these dates.

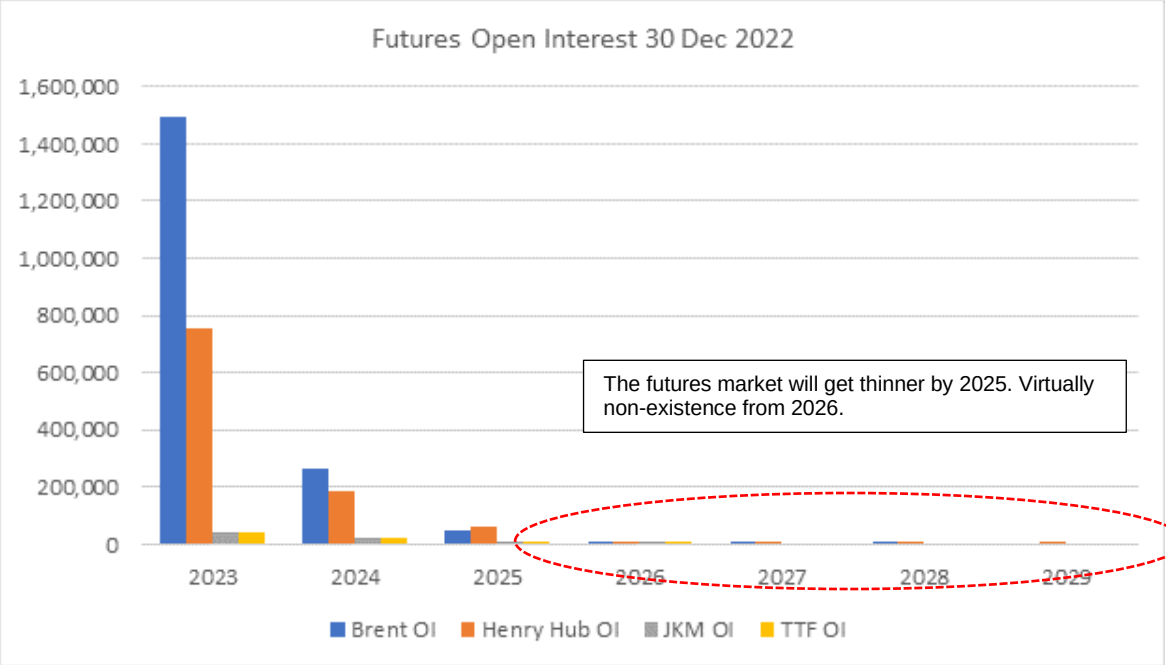
Figure 4: Futures Market Price Curves



Source: ICE, CME and GaffneyCline Analysis

JKM and TTF futures prices are gradually converging to oil equivalent prices in 2026 in a very thin market. Thus, the reliability of JKM, as well as TTF futures beyond 2024, is limited as a market indicator.

Figure 5: Open Interest for Oil and Gas Futures Markets



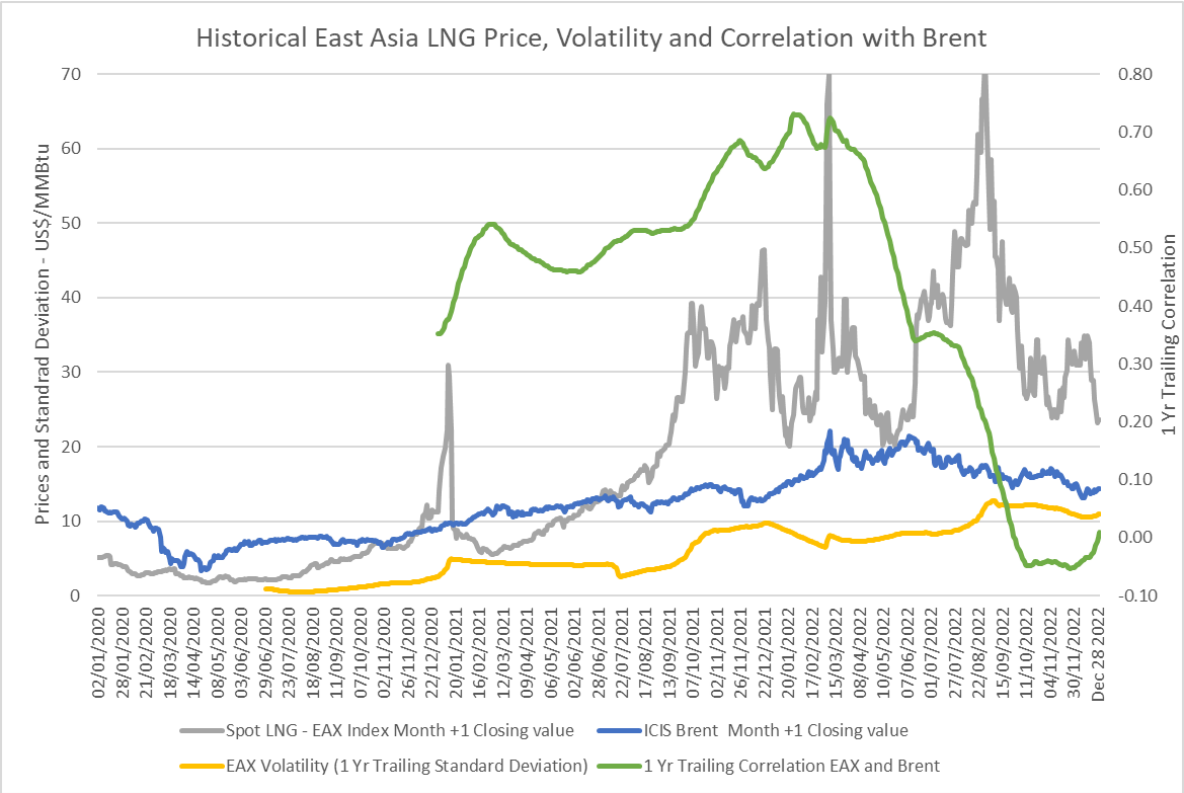
Source: ICE, CME and GaffneyCline Analysis

In the context of oil indexation applied to natural gas, the analysis set out below provides some additional insights that help put this report into context:

The last three-year data for east Asian LNG prices (EAX[5]), volatility and correlation with Brent crude oil prices are shown in the next chart.

[5] The EAX is published by ICIS Heren and is calculated by averaging each day's DES front-month and second-month ahead assessments for Japan, South Korea, Taiwan, and China. GaffneyCline consider this to be a good proxy for Platts JKM pricing.

Figure 6: Natural Gas Price Correlation and Volatility



Source: ICIS and GaffneyCline Analysis

Figure 6 above demonstrates the very unstable correlation between spot LNG prices and Brent in recent months. This market feature may cause some buyers to place a risk premium on index-priced gas, compared to Brent. This would have the effect of depressing oil slopes slightly, compared to gas supplied under identical terms, but priced against an index such as JKM, and may also encourage some buyers towards oil-indexation until a more stable pricing environment starts to emerge. However, the effect of a tight market on gas prices generally is a bigger influence on prices and slope, which is why we are seeing oil slopes much higher than in previous years.

2 Summary of LNG Contracts Entered into within the Previous 12 Months

2.1 Medium-Term Oil Indexed Contracts

No Medium-Term Oil[6] Indexed Contracts have been entered into that are on public record or in the ICIS database within the last 12 months, though there are a number of reported transactions with unspecified oil price indices, such as the sale of LNG from the Northwest Shelf (Beach Waitsia Gas Project) in Australia, to BP's trading division in Singapore which is said to include an element of Brent oil pricing, in conjunction with JKM.[7]

However, there are some market insights that are of interest for medium-term oil linked LNG contracts reported in September 2022:

- It was reported that Pertamina sold ten cargos at a Brent Slope of around 23% FOB East Kalimantan. Two cargos in 2024, four in 2025 and four in 2026 were offered and deal was closed on 2 September 2022.
- Chinese buyers received limited offers covering 2023-2025 or 2024-2026 delivery with Brent oil linked slopes varying from 17% to 20%.

2.2 Long-Term Oil Indexed Contracts in the Last 12 Months

A total of 47 long-term LNG deals were agreed upon in year 2022, which compares with 49 signed in year 2021. Of these signed in 2022, 34 were signed with existing or prospective US sellers. **Table 1** below shows the long-term deals signed according to country of origin. Most of these SPAs and the associated contracted volume originated from the United States, followed by Qatar, with a much smaller number.

Table 1: Recent Long-term Sale and Purchase Agreements (by origin)

Origin	2022		2021	
	# of Contracts	Contracted Volume (MT)	# of Contracts	Contracted Volume (MT)
United States	34	861	14	340
Qatar	2	138	9	208
Russia	1	7	8	433
Mexico	2	92	-	-
Others	5	41	8	43
Undeclared	3	19	10	126
Total	**47**	**1157**	**49**	**1,149**

[6] For this analysis, a medium-term oil indexed contract is an SPA of less than 7 years duration, with a full or partial oil slope component of the price, for which reliable pricing information is in the public domain or can be derived from the subscription service operated by ICIS

[7] https://www.afr.com/companies/energy/beach-energy-inks-five-year-lng-deal-with-bp-singapore-20210927-p58v4g

As shown in the table below, most of the contracts' destination is China. Many contracts did not have declared destinations, but their LNG mostly originated from the United States. This could be due to buyers maintaining flexibility to divert cargo for the best pricing. Germany emerged as second biggest contract destination after signing three long terms contracts, two from USA and one from Qatar. This is the first-time that a long-term contract with Germany as a destination is reported in the ICIS database dating back to 1972.

Table 2: Recent long-term Sale and Purchase Agreements (by destination)

Destination	2022		2021	
	# of Contracts	Contracted Volume (MT)	# of Contracts	Contracted Volume (MT)
China	11	303	21	474
Germany	4	104	-	-
Japan	1	20	2	43
South Korea	2	17	1	42
Others	1	20	11	139
Undeclared	28	693	14	451
Total	**47**	**1,157**	**49**	**1,149**

The bulk of the contracts signed are indexed to Henry Hub. Only 6 contracts were reported to have been agreed upon based on an oil slope. A large share of Henry Hub pricing is due to the bulk of SPA's signed are from existing and upcoming LNG projects in USA.

Table 3: Recent Long-term Sale and Purchase Agreements (by pricing mechanism)

Contract Type	# of Contracts	Contracted Volume (MT)
Henry Hub	32	849
Brent	6	158
Brent & AECO	1	4
Undeclared	8	145
Total	**47**	**1,157**

2.3 International Tenders

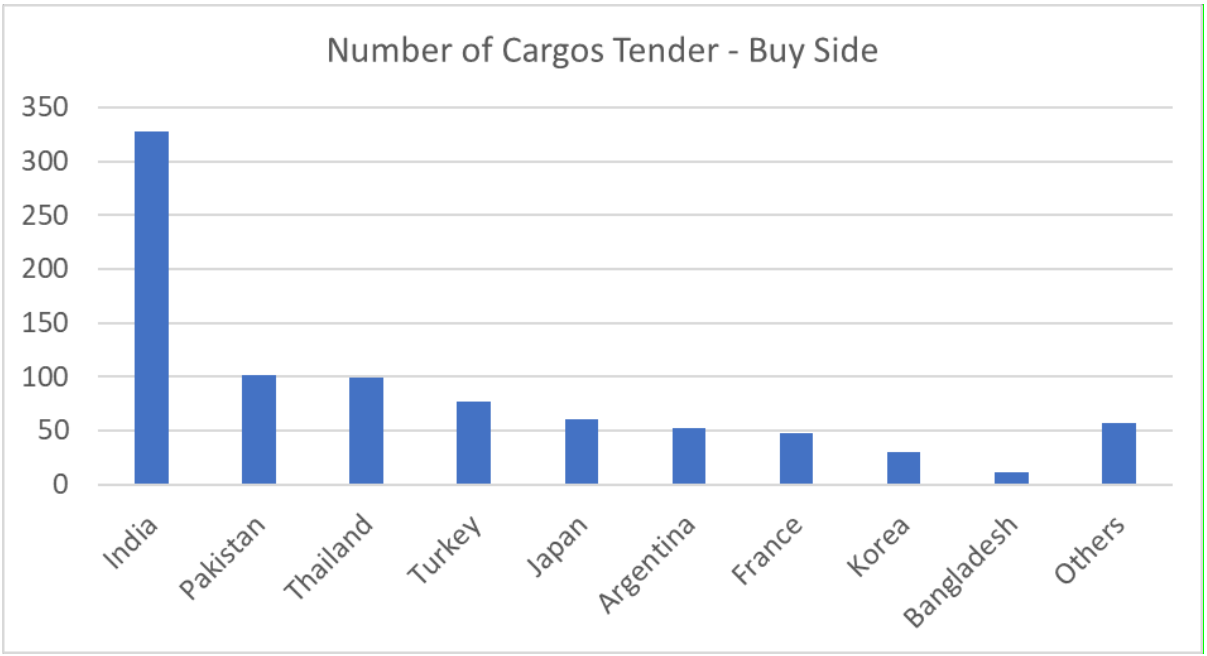
In the year 2022 a total of 413 international tenders were issued of which 227 were on the buy side and 186 were on the sell side.

65% of these tenders were for a single cargo, and 24% involved more than 1 and less than 5 cargoes. Only 11% of tenders were for 5 or more cargoes.

In terms of the number of cargos tendered, India is a dominant player on the buy side and accounted for 328 out of a total of 865 (approximately 38%) of the buy side cargos tendered. Pakistan and Thailand are other major buyers using tenders. On the sell side a total 358 cargos were tenders with main active players from Egypt, Australia, USA, Russia, Angola and Oman. Whilst China is a dominant importer, it still had high activity in sell side reported tenders, likely due to swap activity.

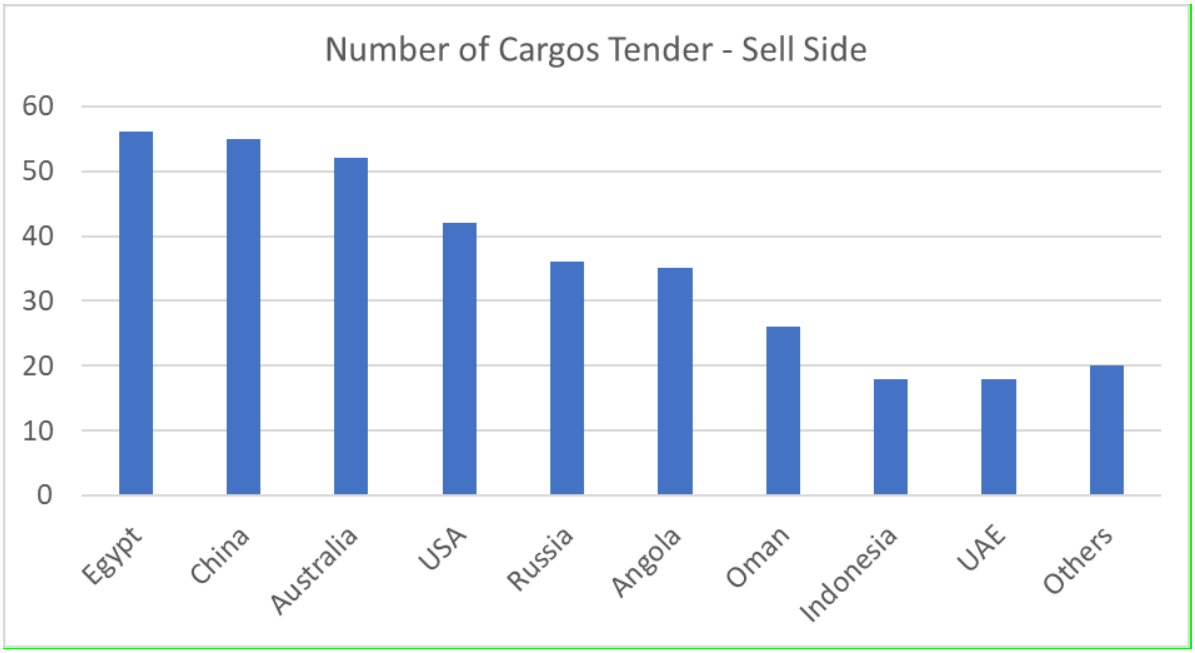
Figure 7 shows that the international tender data can be used as a good reference for Asia deliveries (ultimately netted back to Australia using ACCC methodology). Seven of the top 10 players in the international tender markets are Asian buyers, with European buyers typically rely on other market mechanisms.

Figure 7: Buy Side Cargos Tender by Country



Equally, as illustrated in **Figure 8,** Australia is very well represented on the sell side, though not as predominantly as was the case in June 2022. However, we would still anticipate a reasonable link between short term tender pricing data used in the methodology, and the pricing environment relevant to gas buyers in Eastern Australia.

Figure 8:Sell Side Cargos Tender by Country



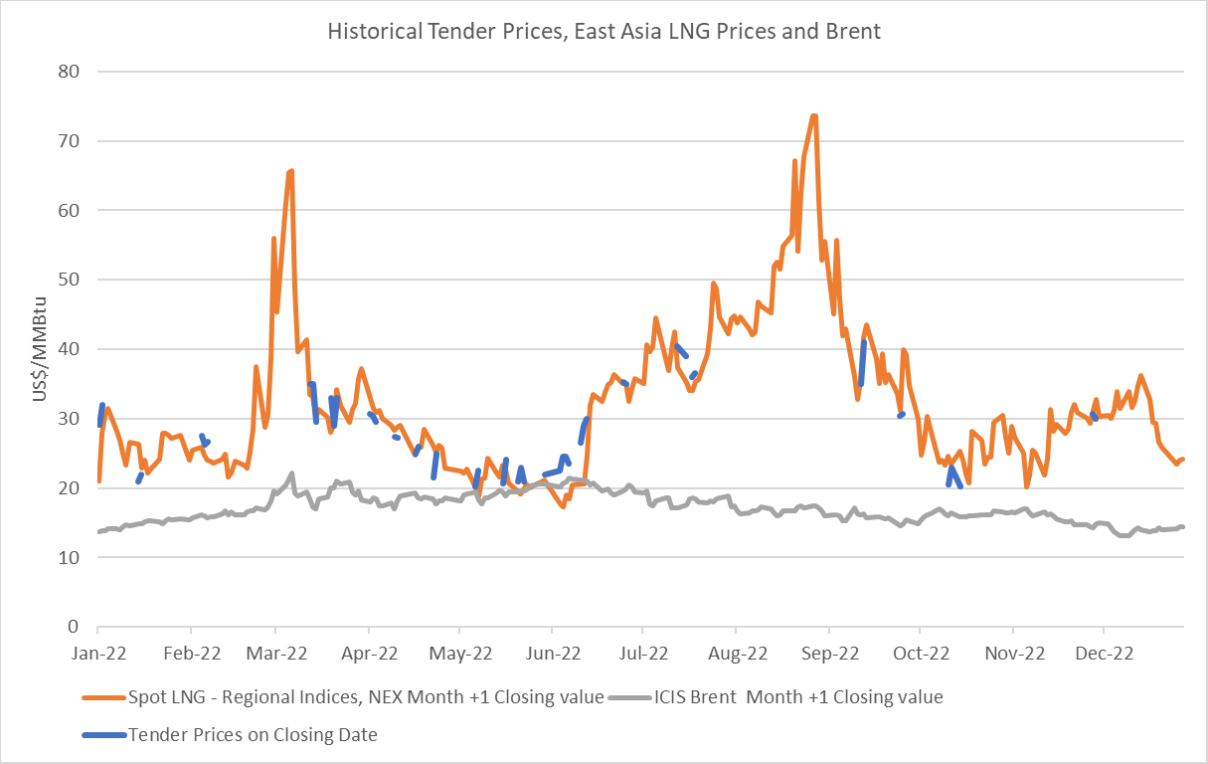
In terms of contract pricing, limited information is available. Based on available information most of the cargos were tendered at a fixed price. Brent Slope linked and NE Asian marker were second and third preferred choices.

Table 4: Recent Tenders (by pricing mechanism)

Contract Pricing Type	Buy Side	Sell Side	Total
Fixed Price	201	34	**235**
Slope	123	-	**123**
NE Marker	52	36	**88**
TTF linked	21	19	**40**
HH linked	12	1	**13**
Unknown	456	268	**724**
Total	**865**	**358**	**1,223**

In terms of pricing, available tender prices closely follow East Asian spot LNG indices. This is not surprising as tenders cater for the short-term markets. During extreme spot price movements, tender price information is sparsely available.

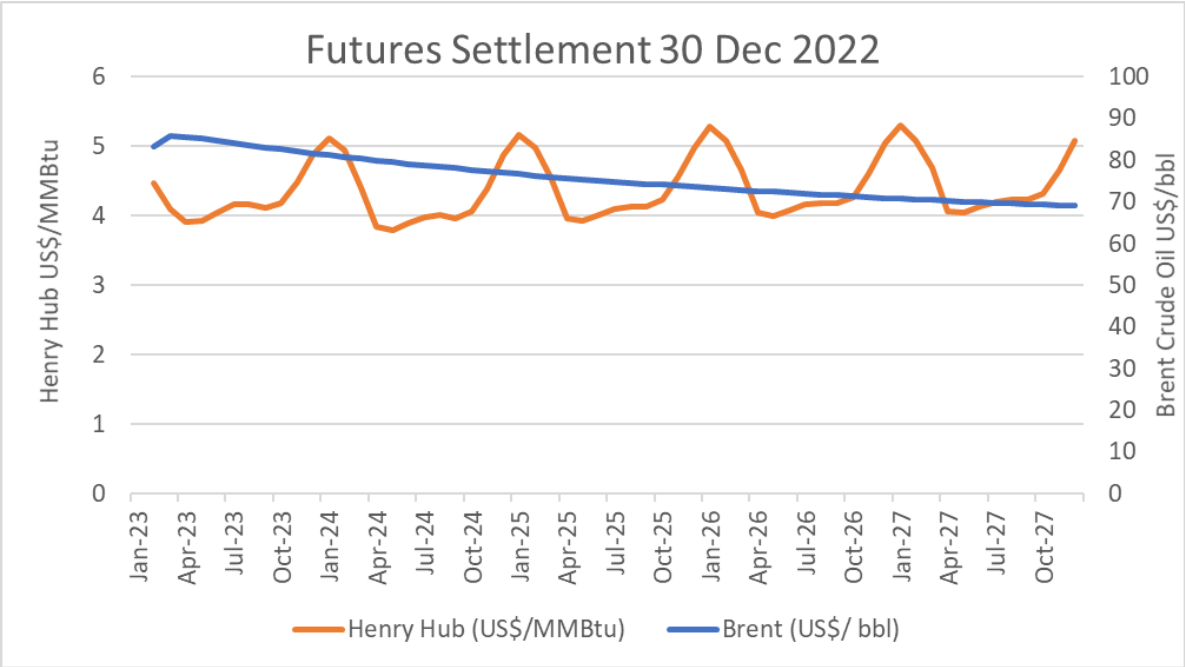
Figure 9: Historical Tender Prices



2.4 Estimation of US LRMC

Based on the analysis of Henry Hub futures prices, delivered gas into a Gulf Coast US LNG terminal would be expected to attract a price of US$4.45/MMBtu on average over the medium-term period corresponding to the focus of this report (Jan 2025 to Dec 2027), and it is assumed this would attract a surcharge of 15% to address basis differential, fuel and other charges, reflecting typical LNG tolling terms.

Figure 10: Brent Crude Oil and Henry Hub Gas Futures Curve



The methodology includes an assumed US$2.1/MMBtu tolling charge for use of the liquefaction facilities, and it is noted that in the last 12 months, two tolling style contracts were agreed, with a rate of just over US$2/MMBtu. Partly in consideration of these data points, a change is proposed to the US$2/MMBtu tolling assumption, which is set to US$2.10/MMBtu in this report.

Based on an average delivery distance of 10,000 nautical miles (approximate average for Japan, China and Taiwan) and a round trip fee through the Panama Canal, US Gulf Coast in June 2022 exporters would be expected to have to meet a freight cost estimated at US$2.3/MMBtu for delivery to Asian markets. Given the additional pressures on shipyards both for conventional LNG carriers and FSRUs, we are increasing this estimate to US$2.4/MMBtu for this report. Given that charter rates in recent months have been very volatile as well as spot gas prices his may not fully reflect LNG vessel charter rates and single voyage charters which could be more or less than this figure which is cost-reflective of a new vessel.

Table 5: Summary of Total LRMC Estimates for July 2024 to June 2027

Components	US$/ MMBtu	Description
Average Henry Hub Futures during period of interest	4.45	Average of Jan 2025 to Dec 2027
Liquefaction Surcharge	0.67	15% for fuel and other charges
Liquefaction Tolling Fee	2.10	
Shipping Charges	2.40	All-inclusive shipping charges
LRMC Estimate	**9.62**	

Based on the analysis of Brent futures prices, US$72.3/bbl is the average futures market price for the period Jan 2025 to Dec 2027. By back calculating the average delivered cost and the average price of oil, the calculated % slope for LRMC in terms of Brent is 13.3%.

3 Price Derivation

Based on the pricing methodology (set out in Appendix III) the estimation of a medium-term oil indexed price for delivery to Asia will follow the process set out below:

3.1 Medium Term Contract History and Data

As noted in the discussion above, GaffneyCline's proprietary access to market activity and the ICIS database of LNG contracts has not identified any documented oil indexed contracts of up to 6 years duration.

3.2 International Tenders

An analysis of oil linked international tenders over the last 12 months has turned up two examples but detailed pricing information is missing for both of them in database. One of these tenders awarded in April 2022 for delivery of Japan reported slope to Brent in the range of 20% to 30%.

Separately, it was reported that Pertamina sold ten cargos at Brent Slope of around 23% from FOB East Kalimantan. Two cargos in 2024, four in 2025 and four in 2026 were offered and deal was closed on 2 Sep 2022. GaffneyCline has considered this tender for price derivation.

3.3 US LRMC

From section 2.4 above, the estimate of US LRMC over the relevant period renders a delivered price to Asia of US$9.6/MMBtu which is calculated to be the equivalent of a slope of 13.3%.

3.4 Long Term SPAs

An analysis of oil linked international long-term contracts over the last 12 months has turned up 3 examples as shown in **Table 6,** first two are DES to Asian destinations and last one is FOB Middle East. As set out in the methodology, GaffneyCline has estimated that a 5% surcharge would be applied to adjust long-term contracts to be comparable to mid-term contracts.

Table 6: Oil Slope Pricing for Long-Term SPAs

Date Signed	Contract Start	Contract End	Annual Contract - MTPA	Total Volume - MT	Reported Slope
Jan-22	2025	2035	0.6	6.6	10.9%
Jan-22	2023	2032	1.5	16.5	12.8%
Dec-22	2025	2034	2.35	35.3	13.5%
				Weighted Average	**13.0%**

3.5 Oil Slope Final Calculation

The starting point for the estimated oil slope is the analysis of medium-term contracts. As noted above, there are no examples which strictly fall within the criteria could be used as a reference.

Moving to the secondary analysis from which to draw, taking a combination (that depends on the degree of market volatility) of international tenders, US LRMC and long-term SPAs, the following conclusions are derived:

Based on the methodology set out, in a volatile market with low correlation to crude oil such as the one that exists today, it is proposed to place a weighting on the various input parameters in the proportion of 1:2:3.

- Least weighting on international tenders (on the basis they reflect short-term market pressures)
- Medium weighting on US LRMC
- Most weighting on Long Term SPAs

By applying the process to the data and calculations set out above, the following oil slope estimation is calculated (without reference to the non-conforming but illustrative data points from the assessment of medium-term contracts):

Contract Type	Weights	Slope	Section
Volume weighted international tenders	1	23.0%	3.2
LRMC US exports converted to slope	2	13.3%	3.3
Volume weighted long term deals*	3	13.7%	3.4
Published Slope Estimate		**15.1%**	
*Long term slope of 13.0% is adjusted +5% for financing benefits			

The determination of a 15.1% oil slope represents an increase of 2.3% (a proportional rise of 18%) in the anticipated medium price of natural gas, compared to June 2022.

While the methodology is considered robust and appropriate, it should be noted that the disruption to global supplies over the last several months has introduced unpredictability and unprecedented price volatility, making any attempt to forecast price levels exceptionally hard.

Given the global gas market disruption, and the potential for major European supply interruptions during the second half of 2022 and into 2023, the prices derived from the analysis set out in this report may be impacted by rapidly changing market conditions, and this should be taken into consideration in the context of any natural gas pricing negotiations in the coming months. This will be revisited in the next Report #3, prepared for the end of June 2023.

Appendix I
Glossary of Terms

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List of Standard Oil Industry Terms and Abbreviations

ACQ	Annual Contract Quantity
A$	Australian Dollars
Bbl	Barrels
/Bbl	per barrel
BBbl	Billion Barrels
Bscf or Bcf	Billion standard cubic feet
Bscfd or Bcfd	Billion standard cubic feet per day
Bm^3	Billion cubic metres
boe	Barrels of oil equivalent @ xxx mcf/Bbl
boepd	Barrels of oil equivalent per day @ xxx mcf/Bbl
BTU	British Thermal Units
CAPEX	Capital Expenditure
DAT	Delivered At Terminal
DCQ	Daily Contract Quantity
DES	Delivered Ex Ship
FDP	Field Development Plan
FEED	Front End Engineering and Design
FID	Final Investment Decision
FOB	Free on Board
GBP	Pounds Sterling
GJ	Gigajoule
HH	Henry Hub (US gas hub price)
ICIS	International Commodity Intelligence Services
JKM	Platts Japan Korea Marker (TM)
LNG	Liquefied Natural Gas
LRMC	Long Run Marginal Cost
m^3	Cubic metres
Mcf or Mscf	Thousand standard cubic feet
MMcf or MMscf	Million standard cubic feet
m^3d	Cubic metres per day
Mm^3	Thousand Cubic metres
Mm^3d	Thousand Cubic metres per day
MM	Million
MMBbl	Millions of barrels
MMBTU	Millions of British Thermal Units (approx. 1.055 GJ)
Mscfd	Thousand standard cubic feet per day
MMscfd	Million standard cubic feet per day
MMtpa	Million tonnes per annum
NBP	National Balancing Point (UK gas hub price)

p.a.	Per annum
PJ	PetaJoule
cfd or scfd	Standard Cubic Feet per day
scf/ton	Standard cubic foot per ton
SL	Straight line (for depreciation)
SPE	Society of Petroleum Engineers
SPEE	Society of Petroleum Evaluation Engineers
ss	Subsea
T	Tonnes
TD	Total Depth
Te	Tonnes equivalent
THP	Tubing Head Pressure
TJ	Terajoules (10^{12} Joules)
Tscf or Tcf	Trillion standard cubic feet
TTF	Title Transfer Facility (NL gas hub)
TOP	Take or Pay
US$	United States Dollar

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Appendix II
Methodology for Normalising Contract Terms

Australian Competition & Consumer Commission
February 2023

The negotiation of a major Sale and Purchase Agreement between an LNG seller and buyer will typically be examined on a sophisticated basis, with each side taking advantage of a support group whose role it would be to quantify the financial implications of various terms and conditions contained in the contract.

A firm LNG offtake by an FOB buyer would be priced according to the following features and variables:

- ACQ. Base project economics would be based on an expectation that the buyer would undertake to purchase a quantity of gas equal to the ACQ. This would then be inputted into the master project economic model, which would generate a project return, which may be further subdivided into an equity return, based on the fixed portion of debt that may be present, and the cost that had been negotiated.
- The starting point for the model would most likely be an approach that contains some reasonable degree of contract flexibility, coupled with what might be considered a "market price" for LNG at the time. Variations from these typical flexibility terms would be evaluated to determine whether a lower or higher indexation level would be appropriate.
- The considerations that the seller would bear in mind are set out below, and a basic assessment of the order of magnitude of each feature, in terms of changes to the price and oil indexation needed to generate similar economic returns, is set out at the bottom of the discussion.

With this base case in mind, the sellers would examine the various features of the contract and may assign a change in the project returns, which could be translated into a pricing discussion to be had with the counterparty.

The methodology involved in assessing a price change resulting from a number of the key contract parameters could be viewed as follows:

- FOB versus DES. The seller may take the view that using an FOB sales basis would preclude the sellers from organizing their shipping fleet to take advantage of operational synergies, fast or slow steaming, or another mechanism that could either save on the cost of freight or result in a slightly higher average cost of gas sold.
- Lack of diversion rights/profit sharing clause. A FOB off-taker in LNG aggregation and trading would not typically agree to any restrictions on LNG destination or sales price, as might have been the case with a utility buyer (FOB or DES). As such, the seller would not benefit from periodic LNG sales on a spot basis at prices higher than the contract price. This represents an opportunity cost, therefore. The basis for assessing this opportunity cost might be an assumption that a small portion of LNG sales could be redirected and that the seller might share any net profits under a 50/50 arrangement.
- Downward Flexibility Quantity (DFQ). If the buyer is offered the option to reduce the ACQ by a DFQ, the seller would typically assume the frequency and amount by which the ACQ might be reduced and rerun their project model based on that lower sales volume. This could then be translated into an equivalent higher base price to keep the seller's economics "whole". Some allowance may be made for being able to insert a spot cargo into the ADS, to partially compensate for the lack of cash flow as a result of

the buyer using their DFQ, but the assumption would be for a lower price, given the short-term nature of the cargo, which might, for example, be sold through a tender.

- Upward Flexibility Quantity (UFQ). The opportunity cost for the UFQ is more complex to address as the existence of the UFQ means that up until the ADS is agreed, the seller would need to put aside sufficient capacity to be able to offer UFQ in the first place, unless the obligation to make it available is on a reasonable endeavours basis only. Typically, a reasonable endeavours obligation to supply gas would be classed as excess gas. As with the DFQ, some assumption might be made that if the buyer does not exercise their UFQ, then that same quantity of gas could be offered for sale on a short-term/spot basis.
- Excess Gas. Most LNG facilities can operate beyond their nameplate capacity, especially after one or two years of operation so buyers can take excess gas. Where excess gas is priced at the contract price, it represents a boost to project economics, as its marginal cost of production is less, and typically excess gas would only be marketed on a short-term/spot basis as the seller would typically be uncomfortable selling it on a long term/committed basis (especially before any formal debottlenecking process).
- Other factors that may influence price include whether the project is in a development phase or whether LNG is being re-marketed following the end of a previous contract, geopolitical risk and security considerations, and whether the buyer has equity participation in the project.

Table AII.1: Summary of Contract Term Reconciliation Process

Scenario	*Assumption (based on 14.8% JCC with typical levels of flexibility)*	*Price implication $/MMBtu*	*Price implication %JCC*	*Price implication %JCC*	*Resulting indexation*	*Resulting indexation*
			$50 oil	*$80 oil*	*$50 oil*	*$80 oil*
Base price inexation with no flexibility by seller and control by the buyer over shipping efficiencies	13.75		$ 7.40	$ 11.84		
FOB basis for sale compated to DES	A 5% saving in freight costs by being able to control shipping logistics	$ 0.09	0.17	0.31	13.92	14.06
Lack of diversion rights	Assumes that 1 in 20 cargoes could be sold for an additional $1/MMBtu	$ 0.03	0.05	0.09	13.80	13.84
Downward flexibility quantity	A 10% buyers option to reduce the ACQ with no mitigation from spot sales with no price or volume mitigation	$ 0.17	0.31	0.57	14.06	14.32
Upward flexibility quantity	A 10% buyers option for a firm commitment to deliver 10% more than the ACQ with the potential to mitigate by selling the equivalent on a short term basis at a $1/MMBtu discount	$ 0.10	0.19	0.35	13.94	14.10
Excess gas	An average of 5% in addition to the ACQ sold at the contract price	$ (0.08)	-0.14	-0.26	13.61	13.49
Median pricing assuming 10% DFQ, Excess Gas, FOB, no diversion, $80 oil				1.05		14.80

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Appendix III
Pricing Methodology

Based on the analysis set out in the report on methodology, three main sources of insight can be applied to understanding contemporary LNG contract pricing, in addition to reported contracts of the duration of interest (3-6 years). These are:

1. Short term international tenders
2. Long run cost of US LNG Exports
3. Long term contract signings

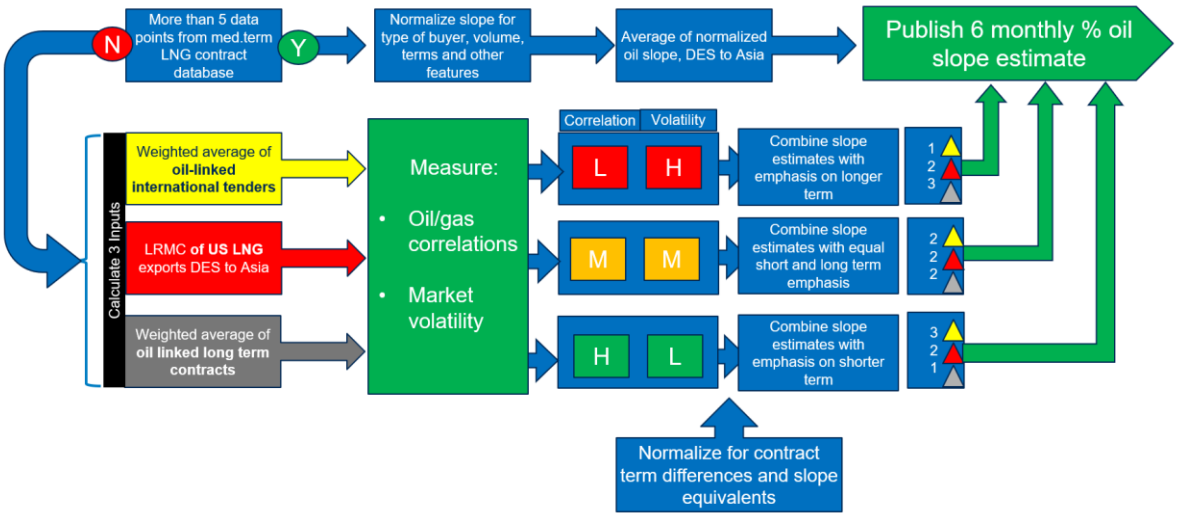
The discussion in the sections above demonstrates that the relationship between these three sources of insight varies, based on the market conditions prevailing. For example, when there is considerable volatility in the market, shorter term/international tender prices can depart substantially from longer term market fundamentals and are less helpful in signalling an oil slope up to 5 years out.

Conversely, when the market is very well correlated, and volatility is low, tender prices are a much better signal for a 5 year look ahead and deserve greater emphasis in the approximation process.

When average levels of correlation / price volatility apply, a 5 year look ahead is likely to be equally affected by shorter term, longer term, and calculated long run costs of LNG delivered from the US.

The methodology is illustrated schematically below:

Figure AIII.1: Methodology Flow Diagram



Note: For the purposes of the flow chart above long term contracts for input #3 would be those signed in the previous 12 months, but not necessarily flowing. Medium term contracts are those with a duration of less than 7 years, long term contracts would include those of 7 years or more. This cut off is based on the typical tenor of LNG loans of more than 7 years. A 5% price difference would be applied as a mechanism to convert from a long-term LNG SPA to a deemed medium-term price, based on an assumption that a prospective seller would not be able to use the credit support from a firm offtake to lower the cost of an LNG debt instrument.

The methodology and derivation of approximate 5-year oil-linked LNG slope is set out in more detail below:

1. If there is sufficient data that can be sourced for medium-term LNG contracts (e.g. 5 or more transactions with full or partial reported oil slope within the previous 12 months), then the volume weighted average of these slopes will be used as the primary input derives LNG oil slope estimates.[8]
2. If there is insufficient data from this source, then any price points that can be sourced (if any) pursuant to # (1) above will be modified using the following approach:
   a. Calculate the volume-weighted average of internationally tendered cargoes linked to oil
   b. Calculate the long-run marginal cost of US LNG exported to Asia
   c. Calculate the volume weighted average of any long-term contracts linked to oil

   These three parameters will be combined following the process set out below to produce a single slope data point and combined with the slope data derived from #1 using a simple arithmetic average to generate the final six-monthly oil slope estimates.
3. In an environment where oil and gas indices have experienced high volatility and have been **less than 40%** correlated within the previous 12 months: Combine the oil slope derived from (1) and the coefficients calculated from 2 (a), (b) and (c) in the proportions 1:2:3, thereby placing more emphasis on longer-term deals
4. In an environment where oil and gas indices have experienced average volatility and have been **more than 40% and less than 60%** correlated within the previous 12 months: Combine the oil slope derived from (1) and the coefficients calculated from 2 (a), (b) and (c) in equal proportions to calculate an overall oil slope
5. In an environment where oil and gas indices have experienced low volatility and have been **more than 60%** correlated within the previous 12 months: Combine the oil slope derived from (1) and the coefficients calculated from 2 (a), (b) and (c) in the proportions 3:2:1, thereby placing more emphasis on shorter term deals.
6. In the event of lack of tender related oil pricing, or longer-term SPA pricing, or both, the following amended process will be adopted:
   a. When there is no recent tender related oil pricing data the input otherwise derived from this feature of the analysis would be excluded, and the averages re-calculated with reference to inputs #2 and #3. In this case the greatest emphasis will be placed on actual contract terms entered into by unrelated counterparties (of whatever term) and the US LRMC derived pricing would be applied with lesser emphasis in the ratio 3:2 with the greater weighting on longer term SPAs—regardless of market volatility.
   b. In the unlikely event there are no long-term oil linked contracts from which to derive data, the same logic would apply and the weighting between recent oil-linked tender data and US LRMC would be applied in the ratio 3:2 respectively.

[8] If GaffneyCline considers that there are relevant medium term LNG contracts that were executed outside (but reasonably close to) the 12-month period, then to the extent these can be used to place less reliance on the alternative data sources, GaffneyCline may account for these in the calculation of LNG prices as it considers appropriate.

c. Finally, in the event that no oil-indexed data can be sourced *neither* from the recent international tender activity *nor* longer-term signed SPAs the ***previous six-monthly report*** LNG slope will be utlised, and adopted as the current six-monthly price estimate.

Worked examples to illustrate the methodology are included below. ***Example 1*** shows how the oil slope would be derived, based on 6 example contracts for which oil slope data is available:

Table AIII.1: Worked Example 1

Example Contract	*Volume (MMtpa)*	*Slope adjusted for terms and delivery point*
1	***0.5***	***11.0%***
2	***1.25***	***11.5%***
3	***1***	***10.0%***
4	***0.35***	***10.2%***
5	***0.8***	***10.4%***
6	***1***	***12.0%***
Total volume / Weighed average	***4.9***	***11.0%***

In this example, the contracts range between 10% and 12% in indexation (adjusted for contract terms where appropriate) and from 0.35 to 1.25 MTPA in annual quantity. The resulting price slope is 11%.

Example 2 shows a more likely scenario, where only limited contract data has been obtained, in this case from 3 example contracts. Depending on the degree to which oil and gas prices are correlated, there are three different scenarios for deriving the relevant oil slope. The three example scenarios involve an oil/gas correlation of 50% (average), 35% (low) and 65% (high correlation, and therefore each hypothetical scenario places a differing emphasis on short- and long-term contract pricing:

Table AIII.2: Worked Example 2

Example Contract	*Volume (MTPA)*	*Slope adjusted for terms and delivery point*
1	*0.5*	*11.0%*
2	*1.25*	*11.5%*
3	*1*	*10.0%*
Total volume / Weighed average	*2.75*	*10.9%*
Volume weighted international tenders		*13.1%*
Volume weighted long term deals		*10.3%*
LRMC US exports converted to slope		*9.5%*
Oil/index correlation 50%	*Averaged slope*	*10.9%*
Oil/index correlation 35%	*Averaged slope*	*10.7%*
Oil/index correlation 65%	*Averaged slope*	*11.1%*

Depending on how markets have behaved in the 12 months prior to the price determination, the oil slope could be between 10.7% and 11.1%. GaffneyCline will provide its recommended approximate slope, based on our market assessment.

It is envisaged that as LNG markets and the half yearly report evolve over the coming months, the methodology could be revised and simplified.