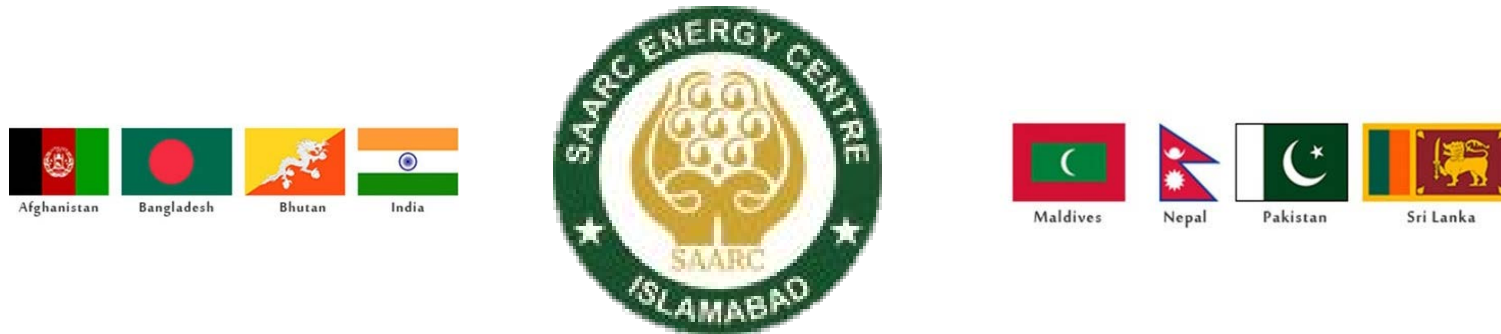


LNG BUSINESS STRATEGIES : TRAINING FOR PARTICIPANTS FROM SAARC COUNTRIES

SAARC ENERGY CENTRE,
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Session 5

LNG Pricing

Practices & Risk Management



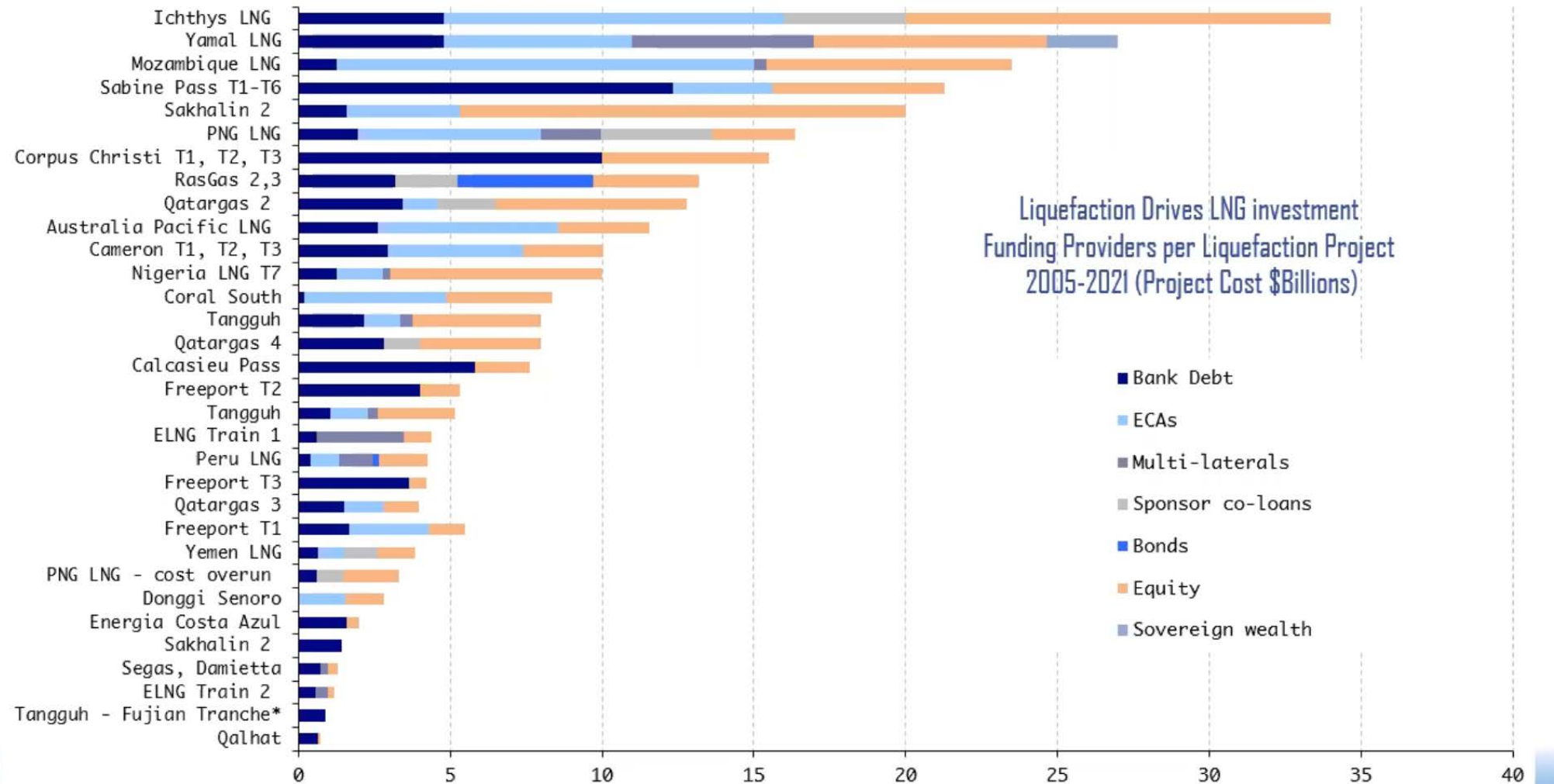
Agenda

- Gas and LNG pricing mechanisms
- Factors affecting LNG prices
- Portfolio optimization
- Risk analysis and tools for risk management / mitigation

Basis of Gas Pricing

- Cost, value and competition form the basis gas pricing
- Different markets are at different stages of development internationally
- South Asia Region going through the stages of development the developed countries have already gone
- Today stands at where developed markets were 15-20 years ago; however, possibility to learn quickly

LNG Export projects- Project financed



International Prices

- Stranded natural gas reserves in pockets far away from the markets
- Natural gas markets scattered all over world in regional fragments
- Overall world market getting more and more liberalized, yet the degree of regulatory control different in different markets
- Gas exported at premium to domestic prices by gas exporting countries and gas bought at premium to domestic prices by gas importing countries...

There is no one international price that may serve as benchmark price for all the markets

Reliable Natural Gas Price Benchmarks

- **Pricing Transparency**

- Timely reporting of physical trades
- Helps establish a price index for pricing long term deals
- Facilitates development of futures market

- **Market Diversity and Size**

- Multiple participants
- Large volumes

- **Access to Infrastructure**

- Non-discriminatory third –party access :
higher volumes

- **Standardization of Contracts**

- Standard contracts to access infrastructure
- Standard contracts for sale and purchase
- Short & simple contracts

- **Physical Delivery Point**

- Allow physical delivery of gas

International Practices

- North America: Liberalized gas market, common access regime
- Russia: Suppressed domestic prices, high export price, all prices regulated
- Europe: Prices based on competition with alternative fuels
- Asia: Market not liberalized, pricing different in different countries

Natural Gas Pricing

- Unlike Oil, natural gas is sold by units of energy (Btu, Therms, Joules). Customer pays for the energy derived from gas, not for a specific volume of gas
- As natural gas is difficult to transport, its prices are tend to be set locally or regionally unlike oil where prices are set globally. This has led to distinct different gas markets
- About 55% of traded natural gas is transported by pipelines. Price of such natural gas is set through :
Negotiations, regulation or open market mechanisms like oil market
- In LNG market majority of the cargoes are sold on long term basis with prices :
 - Indexed to cost of feed gas
 - Floating prices in the destination market
 - Indexed to Oil or other commodities
- In mature gas markets traded prices are influenced by
 - Supply – demand scenario
 - Weather variations, disruptions

Gas - on - Gas Pricing

- Gas prices are set in relation to regional gas supply & demand where gas competes with other gas. Popular in US, UK and NW Europe
- Large number of buyers & sellers competing without government intervention
- Established benchmarks or Hub prices with transparent , regularly updated and easily available pricing information
- Infrastructure is openly accessible and usage fee are reasonable
- Characterized by common regulations, standardized contracts, extensive infrastructure, government support and truly liberalized market

Gas Pricing Indexed to other Energy Sources

- Such pricing mechanism is practiced in areas having limited gas grid and emerging gas trading market. Larger part of the gas remains priced linked to Oil products (Diesel, Kerosene), Coal, Electricity under long term contracts
- As a result of weakening / delinking of Oil & Gas bond, such markets are shrinking.
 - Increasing access of short term cargoes at negotiated prices with no linkage to oil
 - Entry of US LNG

Gas Pricing linked to Oil

- Largely practiced in traditional LNG markets of North Asia – Japan, Korea, Taiwan and emerging LNG markets such as China, India, Pakistan and Bangladesh.
- Asia has been a major consumer of LNG for long. It consumes 2/3rd of global LNG production.
- The major Asian consumers shifted from coal & oil to LNG over a period of time after experiencing oil shock and negotiations with LNG suppliers for :
 - LNG prices at a discount to current oil prices
 - A price cap (ceiling) on LNG prices to ensure stable gas prices
- In return of long term contract with guaranteed minimum LNG prices Japan particularly gave credit facility to developers to fund export projects

Evolution of LNG Pricing

Evolution of LNG Pricing in Asia

1969	Start of Asian LNG trade (Alaska to Japan)	Fixed pricing -\$0.52/MMBtu
1973-74	First oil crisis (High oil prices) (\$10.41/b or \$1.90/MMBtu)	Changed to crude oil index to capture higher oil price
1986	Oil price crash	Provisional pricing Introduction of S-curve
Late 90s	Market changes, supply to new markets	New price indices and mechanisms emerging

Presently several hub based price index are in vogue

Pricing Mechanisms – Changing Trends

Country	Pricing Mechanism (Formula)
USA	HH Based (Gas)
Canada	Oil indexed (moving towards Hybrid)
Russia	Oil Indexation
Australia	Oil Indexation
Mozambique	Hybrid Indexation
Tanzania	Likely to follow Mozambique

Reliable Natural Gas Price Benchmarks vs LNG Market

- Pricing transparency of spot cargoes is limited. Industry remains secretive about pricing
- Japan has a diversified & big market but access to infrastructure and standard contracts are missing
- China has a large and diversified market but lags in market liberalization
- Fully standardized LNG SPA is presently not feasible in spite of lot of efforts
- Both sellers & Buyers in LNG industry have not shown much interest to be transparent in pricing barring Cheniere, Sabine Pass and Corpus Christi projects who have shared their data. METI of Japan has published spot and short term cargoes data

LNG/RLNG (Imported Gas) Prices

LNG Cargos/deals can have following delivery terms:

- FOB (Free on Board): Shipping & Marine Insurance cost borne by buyer.
- CFR (Cost + Freight): Marine Insurance cost borne by buyer
- CIF (Cost + Freight + Insurance): All cost borne by Seller however Risk of Cargo remains with Buyer on Loading
- DES (Delivered Ex-Ship): Same as CIF except Risk of Cargo with Seller until unloaded at Regasification Terminal

LNG/RLNG (Imported Gas) Prices

- **Long Term Prices (Oil Indexed and Gas Indexed)**

- generally benchmarked or linked to Oil/Gas/Oil Products/etc.
- typical formula for determination of prices is:

$$\text{Gas Price} = \text{Slope} * \text{Underlying Commodity} + \text{Constant}$$

Where:

Slope – Defines the linkage with Underlying Commodity

Constant – Can be for various other costs and/or a premium

Underlying commodity can be crude, gas or a mix

$$\text{LNG price} : 115\% \text{ HH} + \text{USD } 3/\text{Mmbtu (for Liquefaction)}$$

Where HH: Henry Hub Gas Price

- **Short Term/Spot prices:**

- based on Demand & Supply both in domestic and international market
- price of each SPOT LNG cargo is generally fixed
- strip deal for purchase of certain no. of cargos may be linked to an underlying commodity

Underlying Commodity for LNG Price

- **Henry Hub:**

- Distribution hub on the natural gas pipeline system in Erath, Louisiana, owned by Sabine Pipe Line LLC.
- Pricing point for natural gas futures contracts traded on the New York Mercantile Exchange (NYMEX)

- **National Balancing Point or NBP:**

- A virtual trading location for the sale and purchase and exchange of UK natural gas

- **Brent Crude:**

- A major trading classification of sweet light crude oil that serves as a major benchmark price for purchases of oil worldwide
- Extracted from the North Sea and comprises Brent, Oseberg, Forties, Ekofisk and Troll crude fields

Underlying Commodity for LNG Price

- **Japanese Customs-cleared Crude or JCC or Japanese Crude Cocktail:**
 - Avg. price of customs-cleared crude oil imports into Japan as reported in customs statistics
 - Nicknamed the Japanese Crude Cocktail
- **ICE or Intercontinental Exchange:**
 - American network of exchanges and clearing houses for financial and commodity markets
 - Includes the year 2001 acquired International Petroleum Exchange (IPE) (now called as ICE Futures Europe) which operated Europe's leading energy futures exchange
- **NYMEX or New York Mercantile Exchange:**
 - Commodity futures exchange owned and operated by CME Group of Chicago
- **Dated Brent:**
 - Market term for a cargo of North Sea Brent blend crude oil that has been assigned a date when it will be loaded onto a tanker for delivery

LNG - Pricing Formula and Indexation

LNG : Typical Oil Indexed Formula Calculation

- **LNG price = B * P (Oil)**
- **Price of Oil = USD 60 / BBL**
- **One BBL of oil = 6 MMBTUs energy**
- **So 1 MMBTU of oil costs: $60 / 6 = 60 \times 1/6 = 60 \times 16.67\% = \text{USD } 10 / \text{BBL}$**

So, if you price LNG at **B (Slope) = 16.67% of Oil price per BBL**, both are equal in energy terms (LNG is 100% parity with oil on energy equivalence basis)

B is negotiated between buyer and seller and generally, **B ≤ 16.67** (LNG price is less than 100% oil parity price i.e., LNG price at a discount to oil price on energy equivalence basis) – Depending on market conditions, it has hovered between 11% to 15%.

When JCC was USD 100 / bbl (early 2014) :
LNG Price = 14.5 % of JCC Price = \$ 14.5 / MMBTU
When JCC Price was USD 53 / MMBTU (July 2015) : LNG
Price = 14.5% of JCC Price = \$7.69 / MMBTU
When Oil Price is USD 40 / BBL (May – June 2020): LNG
Price at 11% slope of Oil price = \$ 4.4 / MMBTU

Average spot LNG Price for June 2020
delivery in Asia: \$ 1.85 / MMBTU

Average spot LNG Price for October 2021
delivery in Asia: >\$ 34.00 / MMBTU

Pricing Structures

Cap and floor structure

- Convince financiers of debt servicing and adequate return earning ability at low crude price
- Reduces fuel price volatility
- Typical pricing formula

$P(\text{LNG}) = B * P(\text{Crude}) + A$, between Crude (floor) & Crude(cap)

Crude=Crude (floor), Crude<Crude (floor)

Crude=Crude (ceiling), Crude>Crude (Cap)

Where $P(\text{LNG})$ =Delivered price of LNG in US\$/MMBtu

B =Percentage linkage to Crude oil(\$/MMBtu)

A =Constant

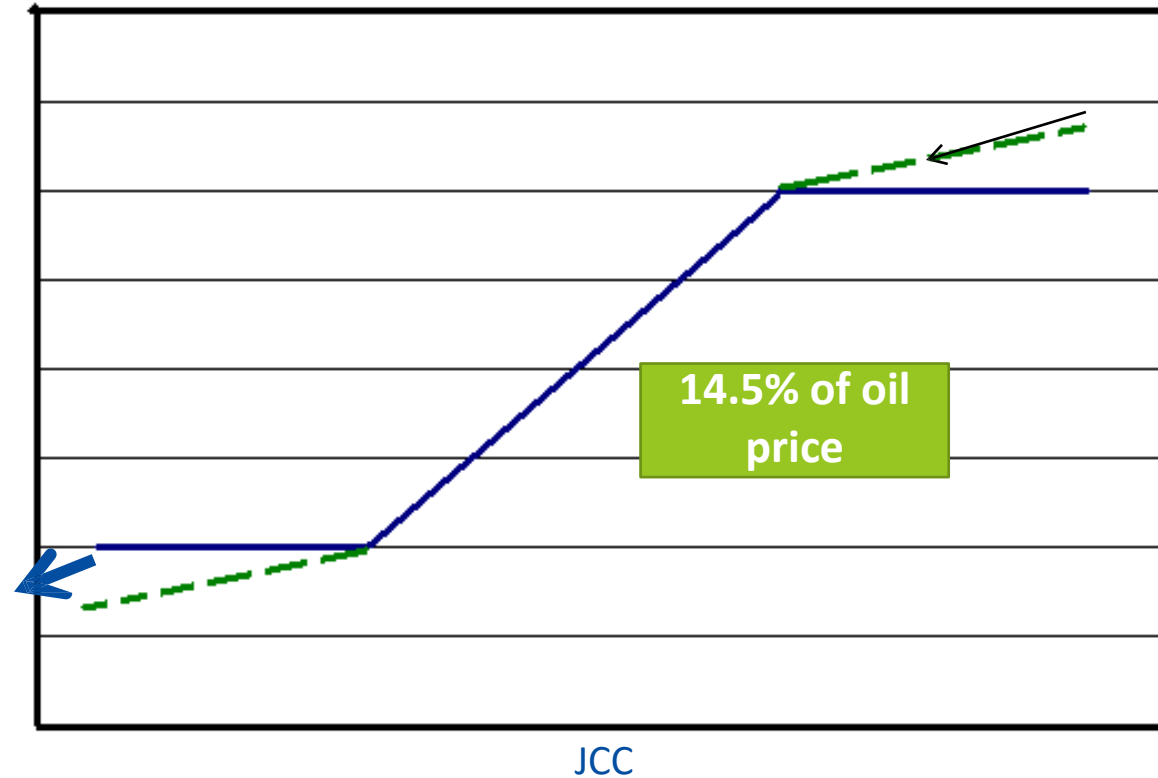
'S' Curve LNG Pricing

- Refined form of the Cap and Floor mechanism

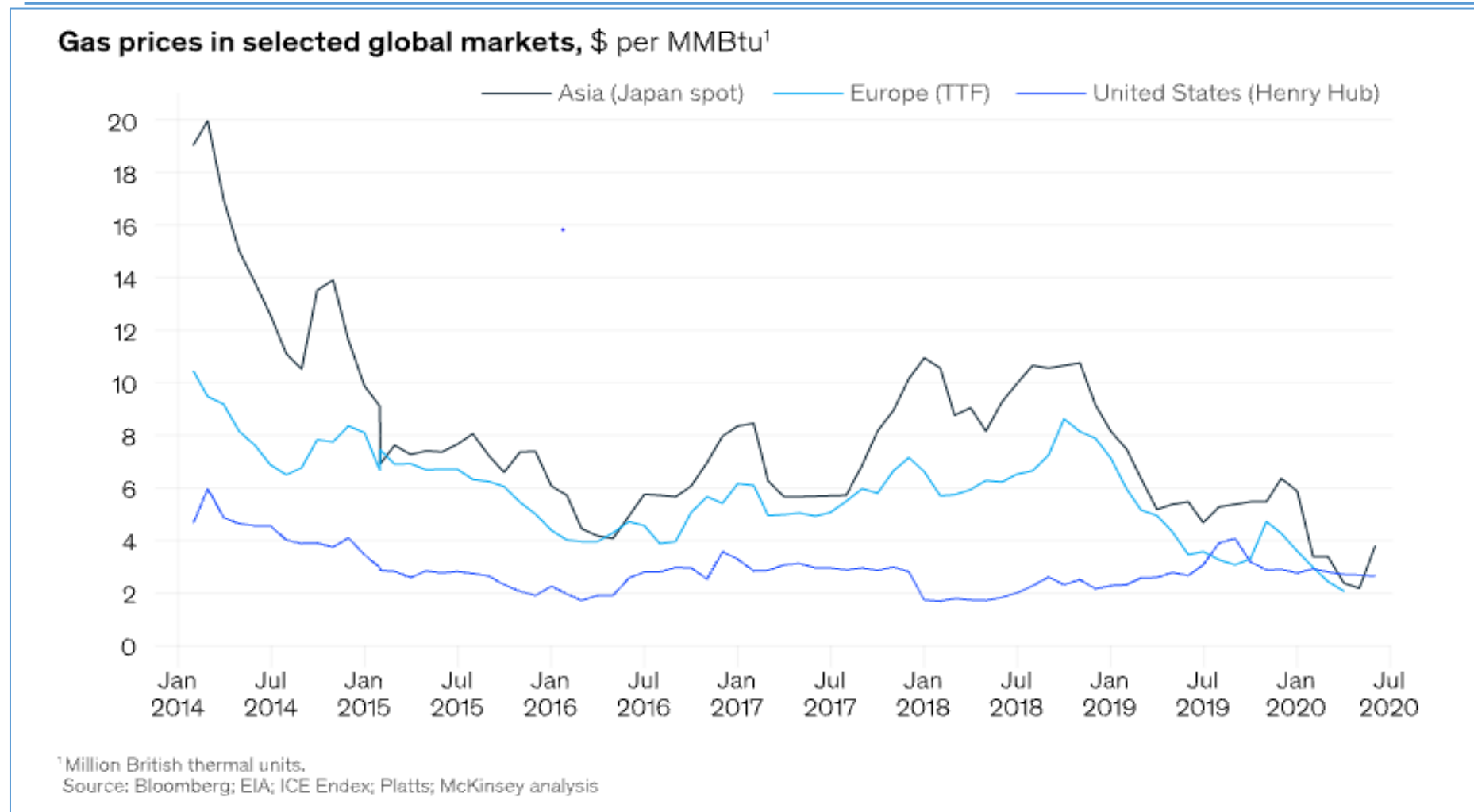
- Increasingly popular in the Asian LNG market

LNG Price Mmbtu

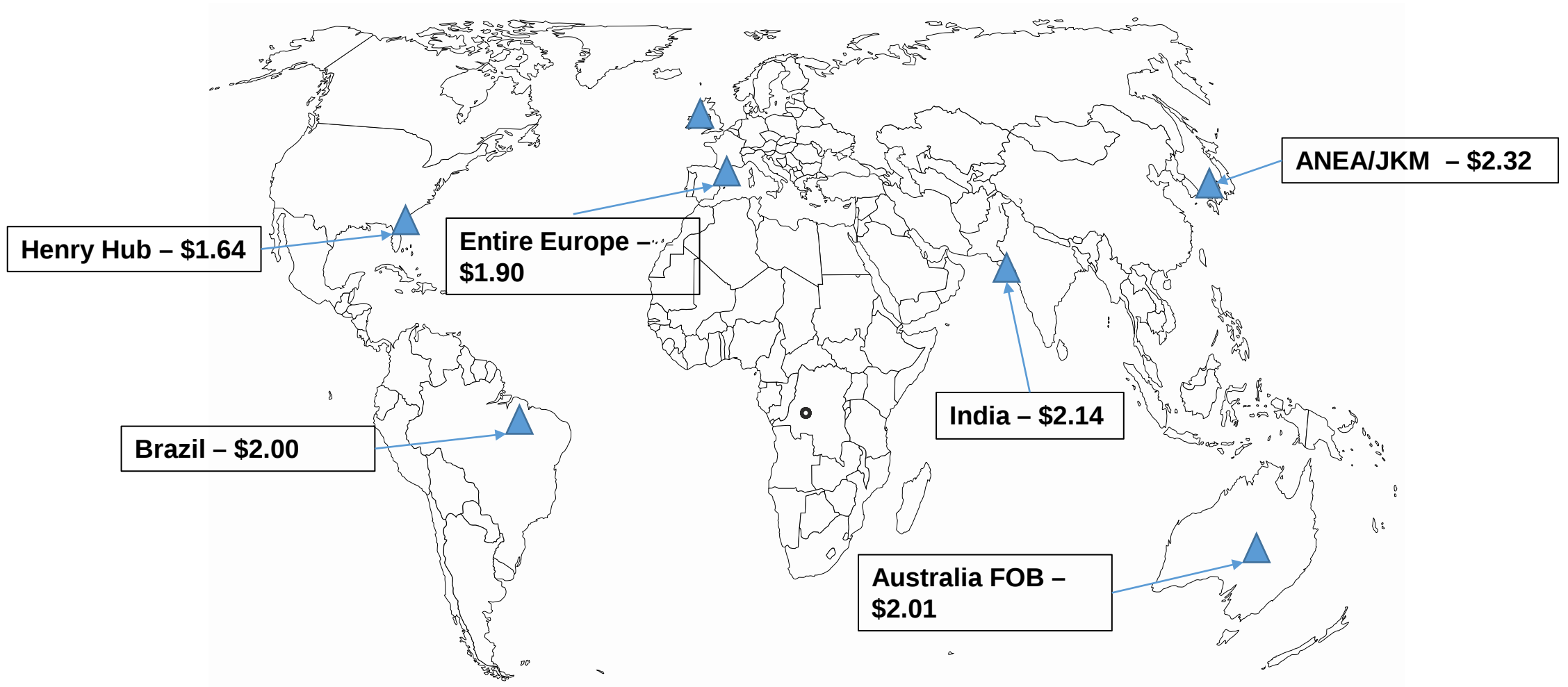
Floor Price of JCC
(Say \$ 30 / BBL)
Seller Protection



Comparative Analysis of Gas Prices in selected Global Markets



Global Gas/LNG Prices



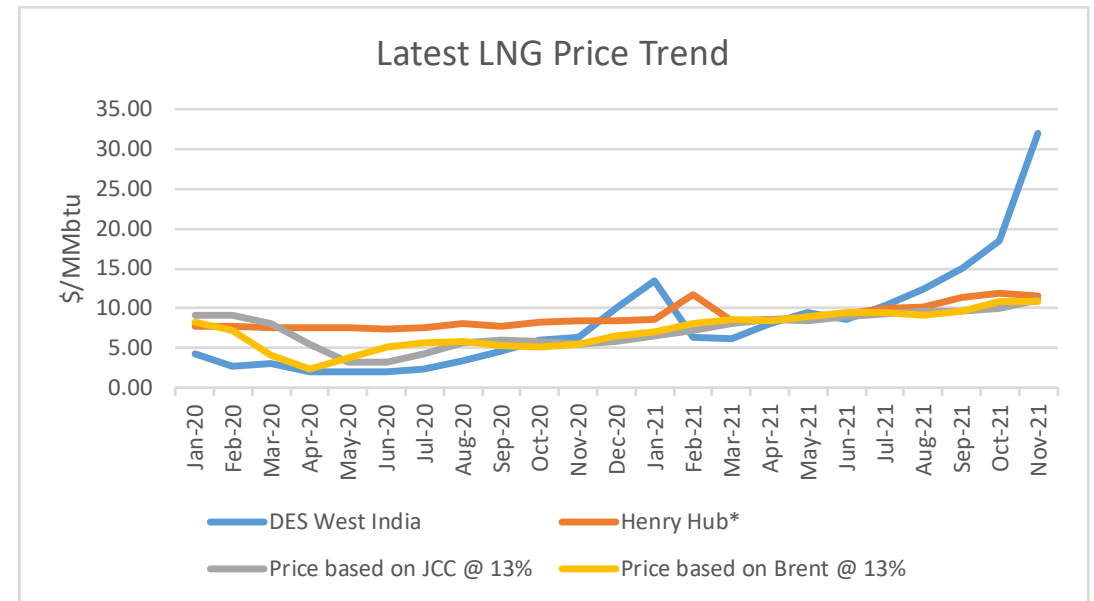
Source: Argus LNG Daily 31.3.2020
All prices are \$/MMBTU. A

- Latest pricing Trend-Very volatile

Month	DES West India	Henry Hub*	Price based on JCC @ 13%	Price based on Brent @ 13%
Jan-20	4.29	7.82	9.15	8.27
Feb-20	2.78	7.70	9.18	7.24
Mar-20	3.01	7.56	8.08	4.16
Apr-20	2.00	7.50	5.47	2.39
May-20	2.05	7.51	3.24	3.82
Jun-20	2.03	7.37	3.20	5.24
Jul-20	2.32	7.54	4.27	5.62
Aug-20	3.50	8.15	5.65	5.82
Sep-20	4.58	7.71	6.01	5.32
Oct-20	5.97	8.25	5.79	5.22
Nov-20	6.35	8.50	5.50	5.55
Dec-20	10.00	8.48	5.79	6.48
Jan-21	13.47	8.62	6.52	7.13
Feb-21	6.36	11.65	7.26	8.09
Mar-21	6.12	8.51	8.01	8.53
Apr-21	8.13	8.56	8.62	8.41
May-21	9.42	8.85	8.52	8.94
Jun-21	8.56	9.25	8.99	9.50
Jul-21	10.41	9.92	9.33	9.49
Aug-21	12.45	10.18	9.59	9.21
Sep-21	15.01	11.43	9.60	9.69
Oct-21	18.48	11.84	9.91	10.88
Nov-21	31.97	11.63	10.97	10.92

Note: *Henry Hub Formula HH *115% + \$3 liquifaction + \$ 2.50 transportation
Data of November -21 is tentative based on future projections

17-Nov-2021



Emergence of New Pricing Options

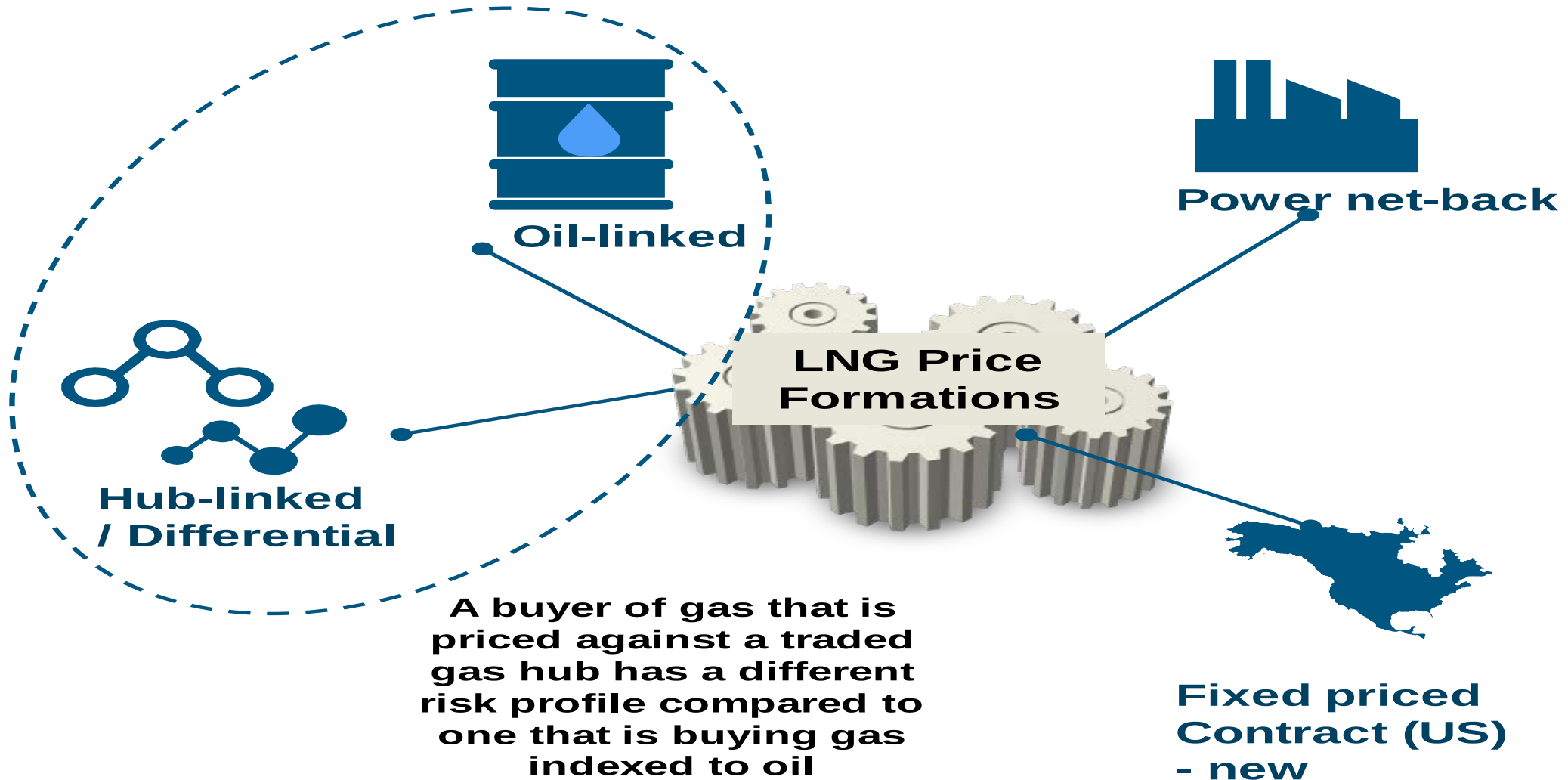
- **Alternative pricing indices** - Japan LNG Cocktail (JLC), and Japan Korea Market (JKM)
- **Phased pricing** - Lower pricing in the initial years that increase over time
- **Step-up pricing** - Different pricing slopes/terms are applied through the life of the long-term contract
- **Tranche pricing** - Different pricing are applied at different periods corresponding to the start-up of liquefaction trains to reflect the staggered commencement timing of trains and FID requirements on each train
- **Fixed price offers** - US based Tellurian proposed in 2017 to supply LNG at fixed-price of US\$8/mmbtu. Australia's Woodside Petroleum also contemplating sales of LNG on a fixed-price basis.

These alternative pricing contracts are now available to new and emerging buyers in Asia as evidenced in Bangladesh, Pakistan, India and Sri Lanka

Changing Pricing Trends

- For Long term oil price slope < 11% Vs 14.5% earlier
- Spot and short term trade is increasing- reached 40% (142.5 MT) in 2020
- Brent and Hybrid (HH/Brent) pricing structure also remains dominant
- Buyers prefer a single price review, rather than multiple price reviews
- S curves- offers protection with caps and floor
- LNG Hub Pricing being contemplated
- Global LNG price indicators have converged and differential between US, Europe and Asia are smallest in more than a decade

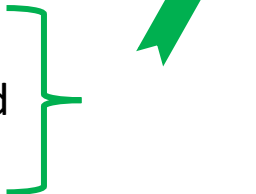
Portfolio Optimization & Risk Diversification



Understanding risk: Types of risk

Price risks are the greatest risks in an LNG trade and are currently complex and difficult to hedge

Types of risks

- **Operational** risks can be managed via contracts
 - **Credit** risks must be assessed and priced in, or prepayment required
 - **Volumetric** risks can be managed via portfolio
 - **Price risks** consist of 'underlying' price risk and foreign exchange risks
- 

Price risks

Contracts are priced via a formula based on the prices of underlying commodities at the destination:

- Gas hub: JKM, NBP, HH
- Oil: JCC, Brent
- End-use input substitute: heating oil, coal
- End-use output value: power

They can also include price floors and ceiling

This complexity may reduce as LNG spot markets mature

In the meantime – Trades must manage the risk that the value of these underlying commodities changes between contracting and delivery

Why Manage Risk?

Exposure to risk affects profits and viability of the company

- **Stakeholders-** Concerned company's financial performance/profitability upon fluctuations in the prices of commodities
- **Consumers-** concerned about price shock of LNG, as LNG cost is a significant component of total input cost
- **Producers-** concerned about low LNG price that would ultimately affect their FID and investment decisions

Risk Management

- Involves complete or partial mitigation of risk
- Risk management streamlines the revenue stream of company as it fixes input (purchase) and / or output (sale) price
- Risk management is not speculation but protecting return on investment by generating leads and predictability

Flexibility is important

- Allowing a seller flexibility in LNG trade pricing method, may give the Buyer an opportunity to have some attractive price deal on physical or paper risk management.
- For example for the same fixed volume, certain % of volume linked to crude oil, and other parts linked to mix of HH or any other index

Common Objectives of Hedging

- To provide flexibility to the customers by offering pricing alternatives:
 - Fixed Prices to customers.
 - Price formula offer to customers with Cap mechanism.
 - Pricing at desired indexation
- Protect margins relating to purchase/sale of a commodity
 - Risk mitigation required for purchase and sale on different indices.
- Mitigate inventory price risk.
- Cost optimization for Internal Consumption

Managing risk: Hedging strategies

- Underlying price risks can be hedged
- Hedging involves the use of a financial instrument to offset losses/gains in the underlying asset
- LNG can rarely be perfectly hedged due to the lack of liquid LNG paper trading, but 'flat price' risk can be exchanged for 'basis' risk, i.e. differences in price movements between LNG and the hedging instrument (e.g. crude oil)

While hedging limits downside, it also limits upside, and has transaction costs: spot trading exists so that sellers have the flexibility to maximise profits – so you may not want to hedge too early or inflexibly

Managing risk: Risk management tools

Underlying price risks can be hedged using derivatives

- **Forwards:** bilateral contract to buy/sell physical LNG on a specified future date at a price agreed in the present, with position settled on delivery (unless otherwise specified in the contract)
 - e.g. an LNG seller agrees to sell 10,000 mmbtu in 3 months at \$5/mmbtu
- **Futures:** standardized forward contract traded on an exchange, with positions marked to market and requiring a margin to be deposited; need not involve physical delivery
 - e.g. a trader who is long futures but does not want to take delivery can sell (short) their contracts, possibly taking a gain/loss; such paper trading avoids the (substantial) physical delivery costs and eases speculation
- **Swap:** a bilateral contract to exchange sequences of cash flows for a specified period, where one cash flow is fixed and the other varies with the underlying (essentially a (series of) cash-settled forwards))
 - e.g. an LNG seller with a cargo priced on JKM could buy a JKM swap to receive a fixed cash flow in delivery month(s) in exchange for the revenue earned on delivery, which depends on the variable JKM price
- **Options:** purchased for a premium, the right but not the obligation to buy (call) or sell (put) at an agreed 'strike' price before or on the expiry date
 - e.g. an LNG buyer could purchase a European call option to buy 10,000 mmbtu on 30 June for \$4.50/mmbtu and would only exercise this option if the market price on 30 June was greater than \$4.50/mmbtu
- **Swaption:** an option on a swap: i.e. the right but not the obligation to enter into a swap in the future

Examples of various pricing structures

Price with a Cap:

Lets say HH Cap is fixed at \$3/MMBTU for CY'19 with a upfront estimated premium of \$0.18/MMBTU then maximum price will be charged to customer at HH of \$3/MMBtu irrespective of HH movement above \$3/MMBTU. Downside shall be as per actual.

Price with Index range i.e. Collar:

Index will have a cap and floor like HH cap of \$2.8/MMBTU & floor of \$2.0/MMBTU. Price to customer is protected from any upside/downside above/below cap/floor

Basis Swap for HH and Crude exposure:

Locking the spread between HH and Crude by pre-empting the futures market

Managing risk: Portfolio optimisation

LNG sellers have options over time and space

In spot trades, the actual source of a cargo is flexible; for this reason, LNG sellers consider:

- can they get a better price for their cargo on a different route?
- will this change within the time period of the trade due to price volatility?

If yes, then they should seek to use their flexibility to capture the *extrinsic* value of their options:

- a supplier with multiple cargoes available in different locations can 'cargo swap', or even make a deal with another supplier
- a supplier could divert a cargo to a new route and backfill an existing commitment through a spot trade

How can the extrinsic value of a portfolio be estimated?

- traders can do relatively well by thinking through their strategic options (see next slide)

Managing risk: Portfolio optimisation

An example from BG of using flexibility in a portfolio to maximise value



Note : Numbers are indicative based on 3.1 tbtu per cargo
 * Includes diversion payment

Source: BG, 2013

Thank You
Q & A

