



Oil & Gas Financing and Investment Series

Natural Gas/LNG Market Convergence

January 17, 2018

haynesboone

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LNG Market Outlook

Haynes and Boone Conference – January 2018



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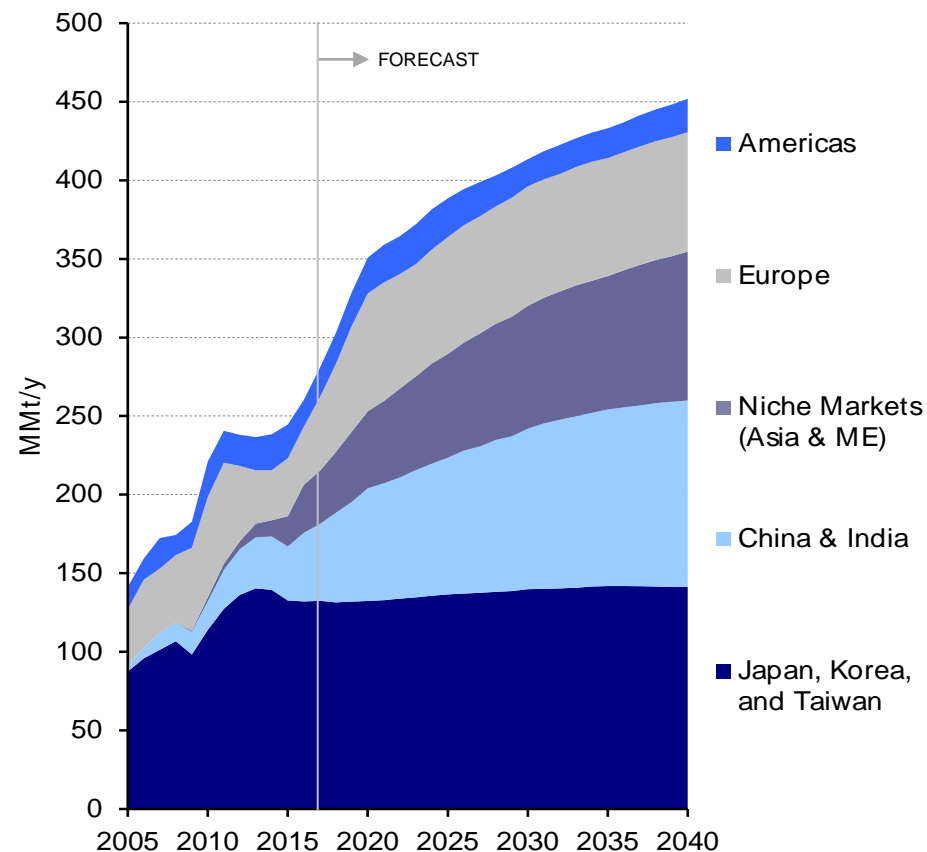
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Global Growth is Projected to Continue

Despite LNG demand leveling off from 2011 through 2015, long term outlook is positive for growth

- Increase in trade to 2021 is driven by LNG supply already under construction
- Increase in demand post 2021 offers opportunities to new projects

Global LNG Demand Forecast (2005-2040)

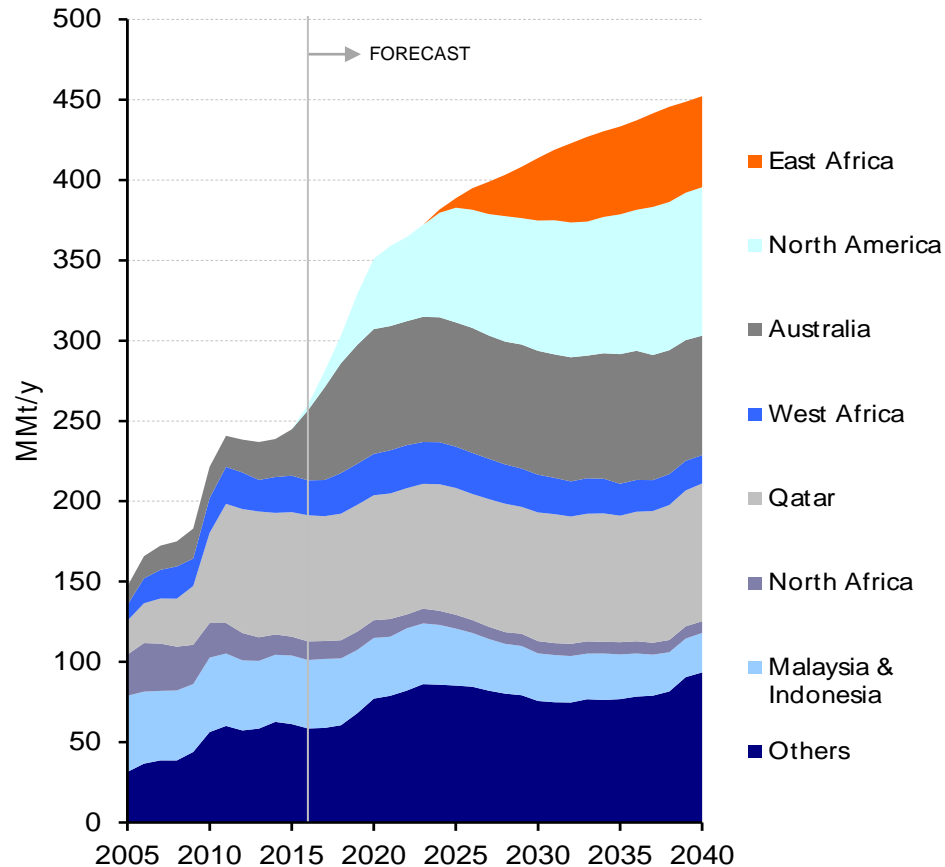


New long term supply needed post 2022

New export regions will increase global market share

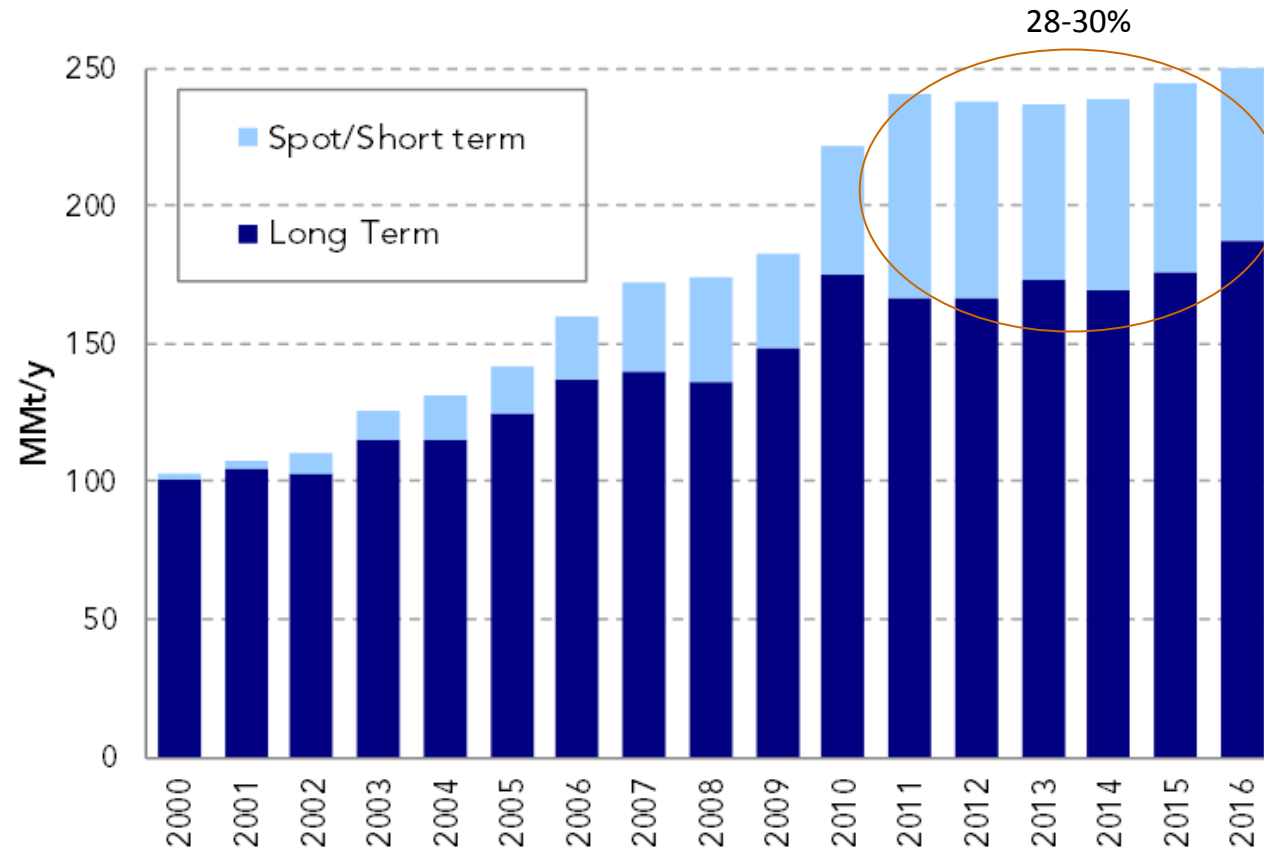
- Global LNG production reached 260 MMt/y in 2016 after flat production of 240-245 MMt/y in 2011-2015
- Australia and Qatar projected to provide close to 44% of global supply by 2020
 - Limited growth from both countries post 2020. Market share drops to around 35% by 2040
- New supply regions emerge by the end of next decade to satisfy incremental demand
 - East Africa and North America grow to close to 149 MMt/y by 2040 – gaining a 33% global market share.

Global LNG Supply Forecast (2005-2040)



The amount of spot and short-term trade has increased

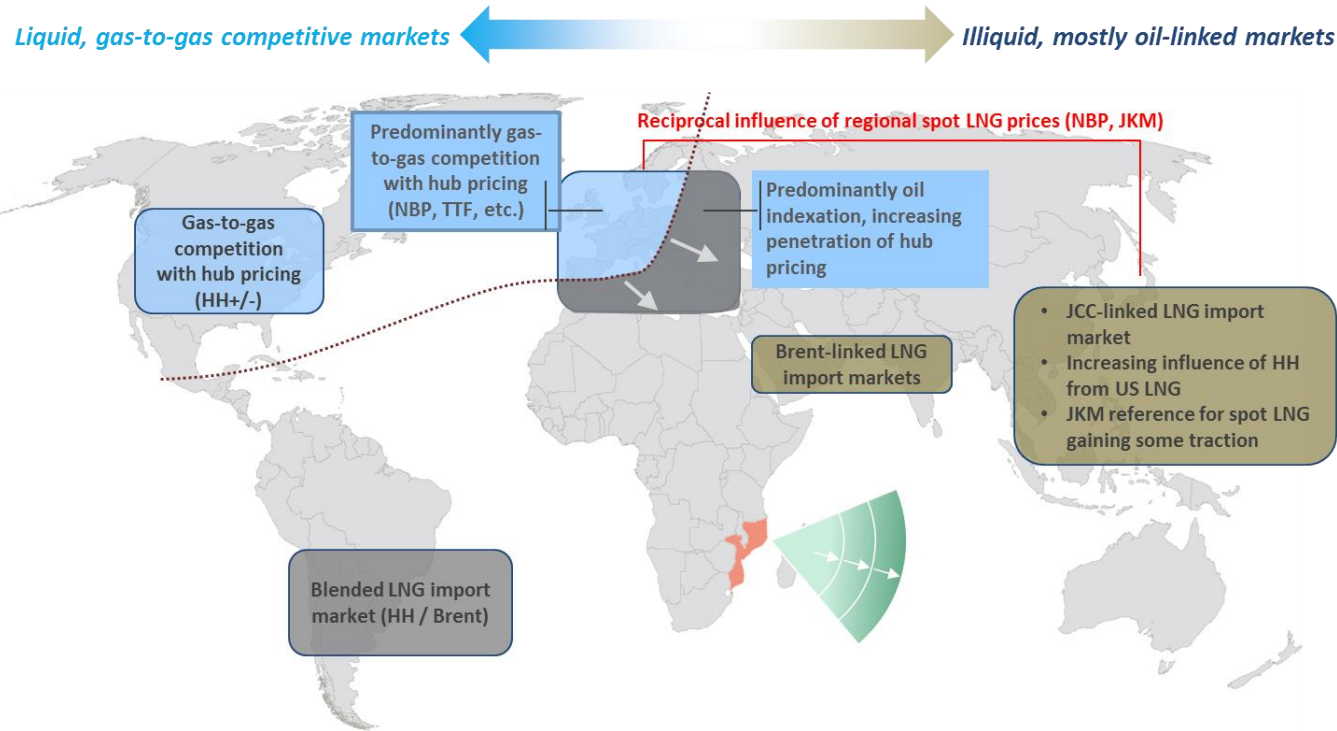
Development of LNG Spot/Short-Term trades



Natural Gas Prices vary by region, and Sale Price Structures Have Diversified

Global LNG market not yet commoditized

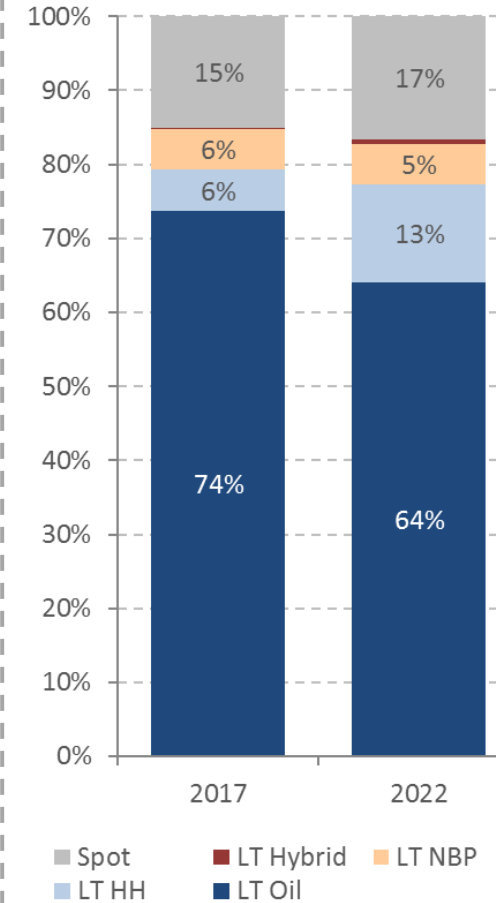
US\$ / mmbtu



JCC: Japanese Crude Cocktail, HH: Henry Hub * 115% + 3.00 Liq. Fee

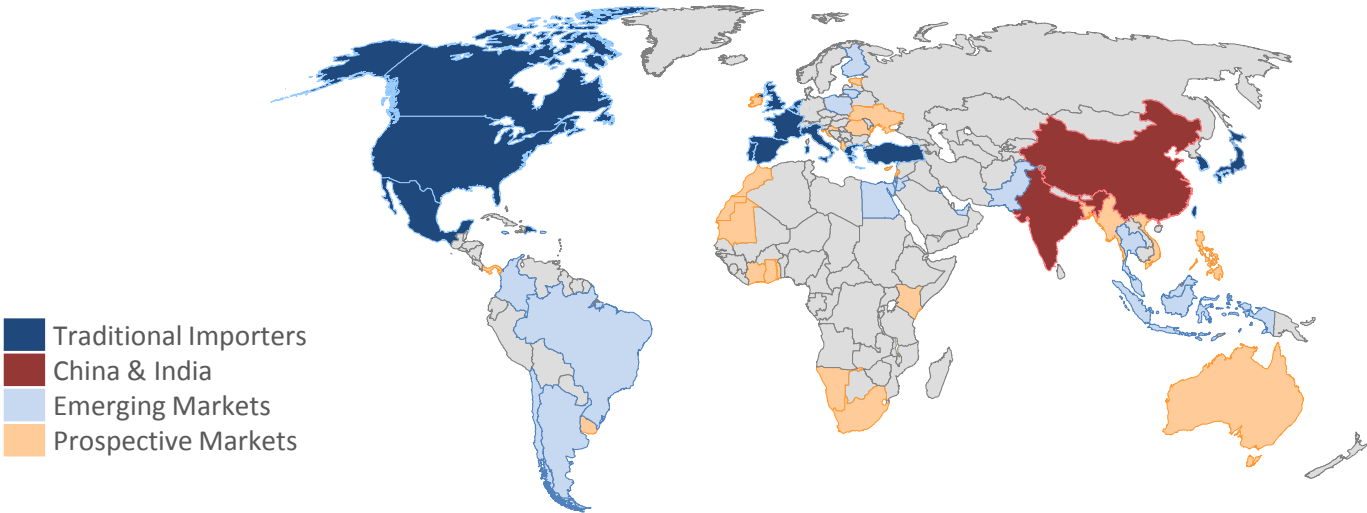
Gas Sales by Price Structure

Percentage

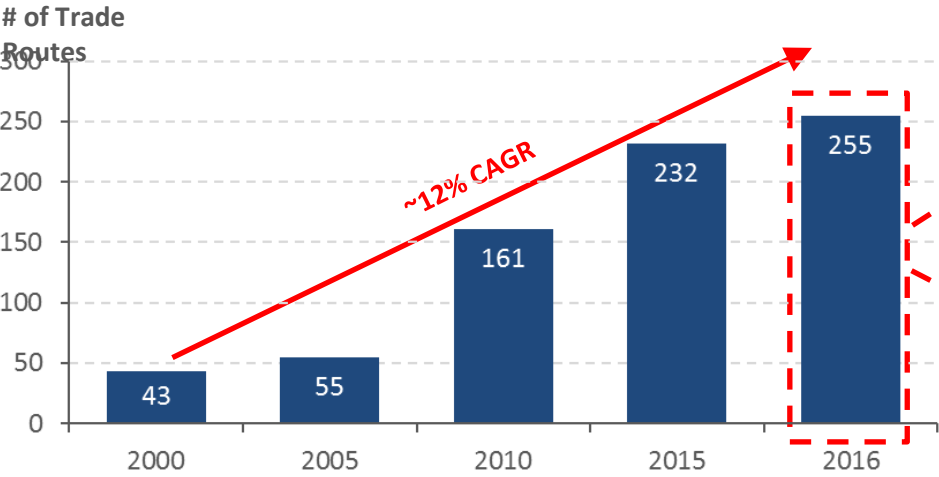


LT: Long-Term LNG Sale and Purchase Agreements

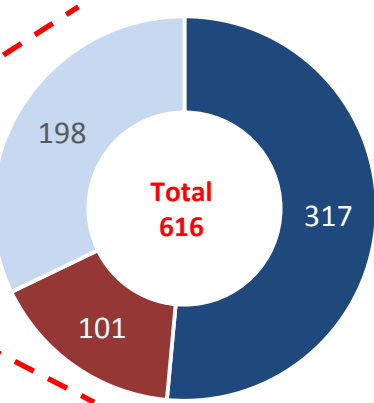
The Global LNG Trade Has Grown Increasingly Complex



of Country-to-Country Trade Routes



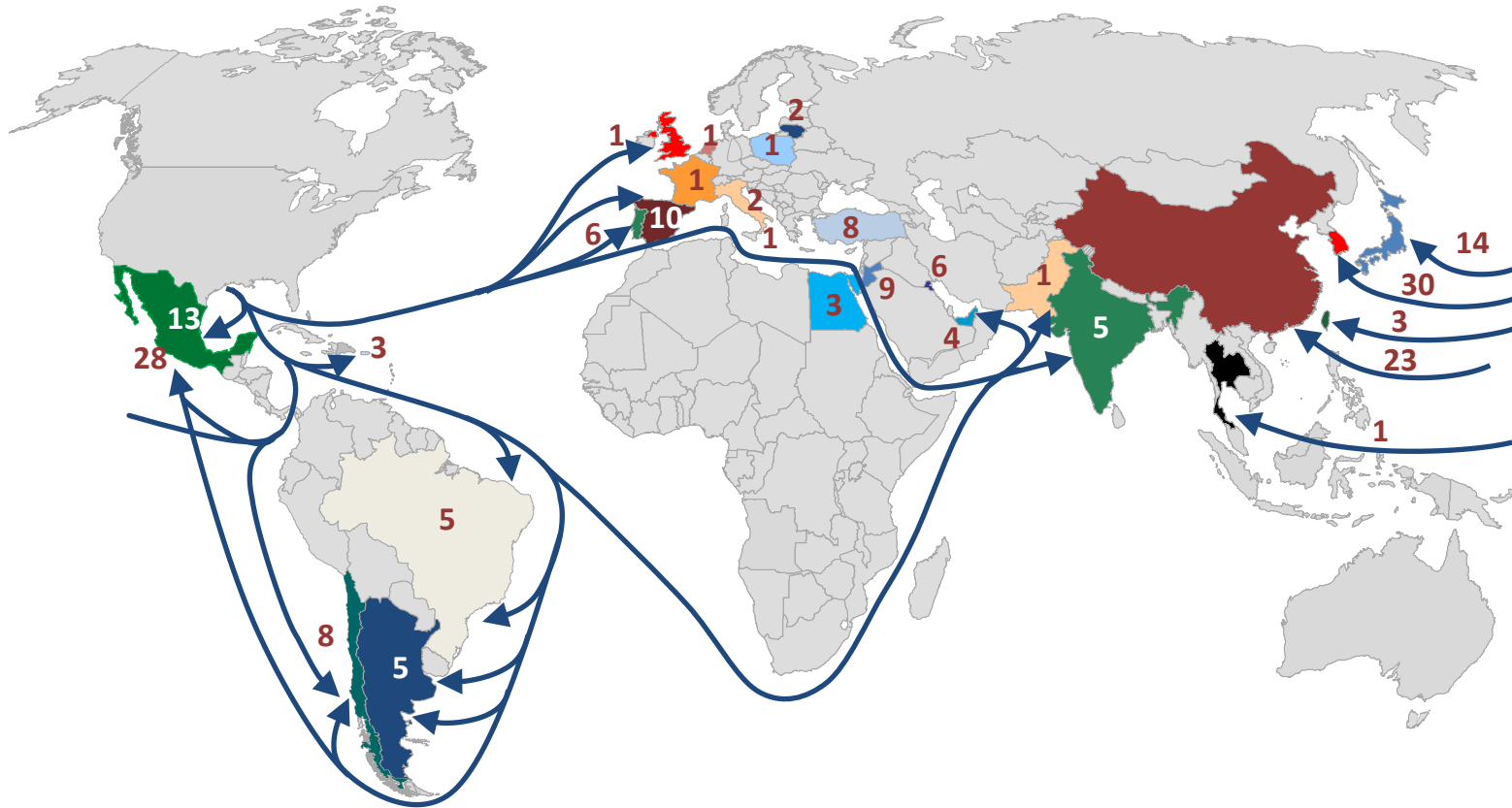
of Port-to-Port Trade Routes



The Ramp Up of U.S. Exports Will Continue to Complicate Trading Patterns

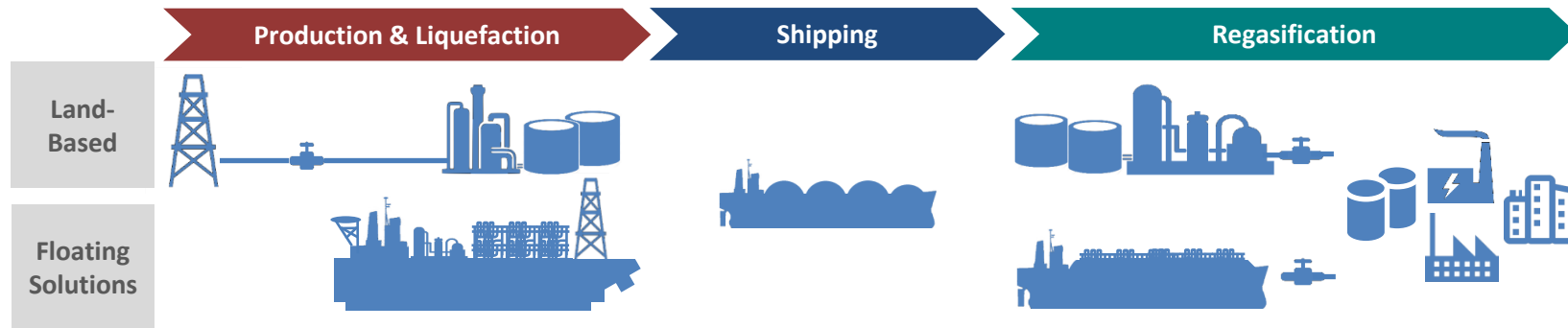
U.S. exports do not have any destination limitations and no minimum offtake obligation (take-or-pay)

- Destination of U.S. exports during 2017. Approximately 1.8 vessels were required to ship 1 million tons of LNG

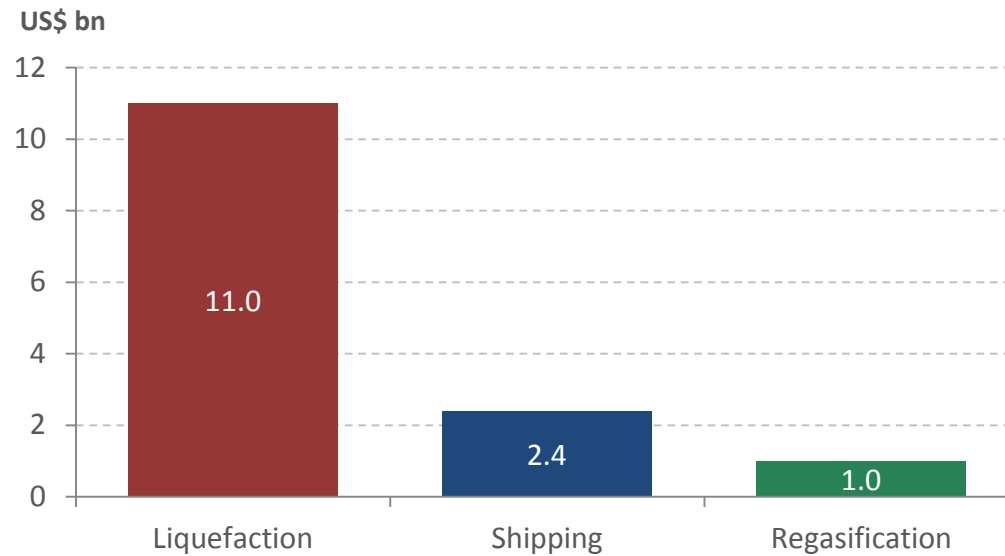


The number of cargos imported into each country is highlighted

LNG is Capital Intensive Industry and Remains Underpinned by Term Agreements



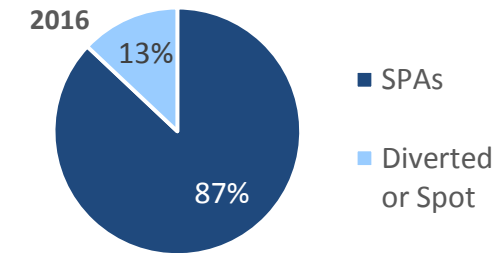
Capital Expenditure for a 10 million ton per annum project (2 Trains)



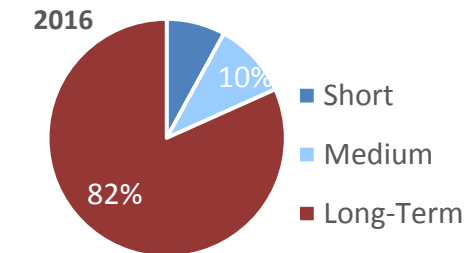
Shipping capital expenditure assumes 13 newbuild vessels acquired to service a 10 mtpa project
 Regasification capital expenditure for 1 land-based receiving terminal

Trade & Shipping Charter Coverage

% of Global Trade by Dedicated SPAs

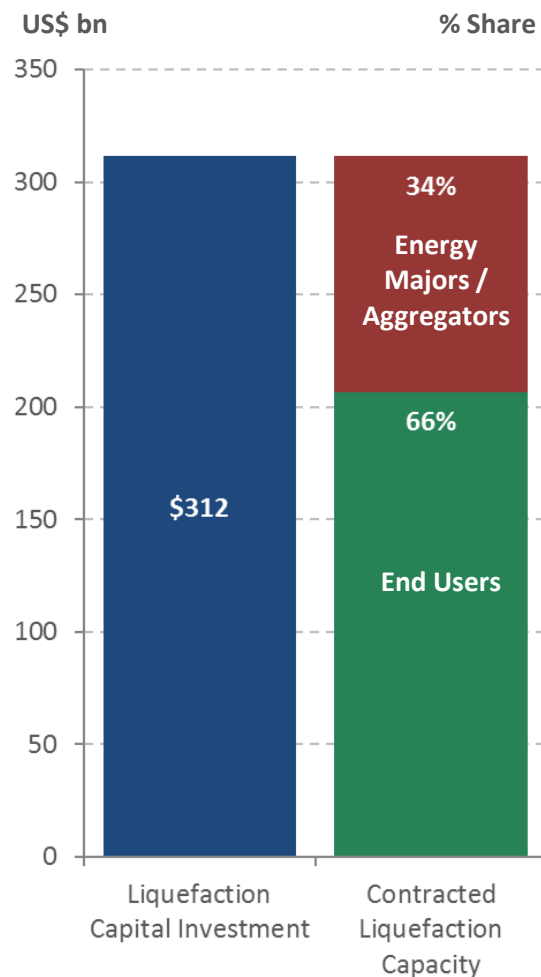


Percentage of Fleet by Charter Length

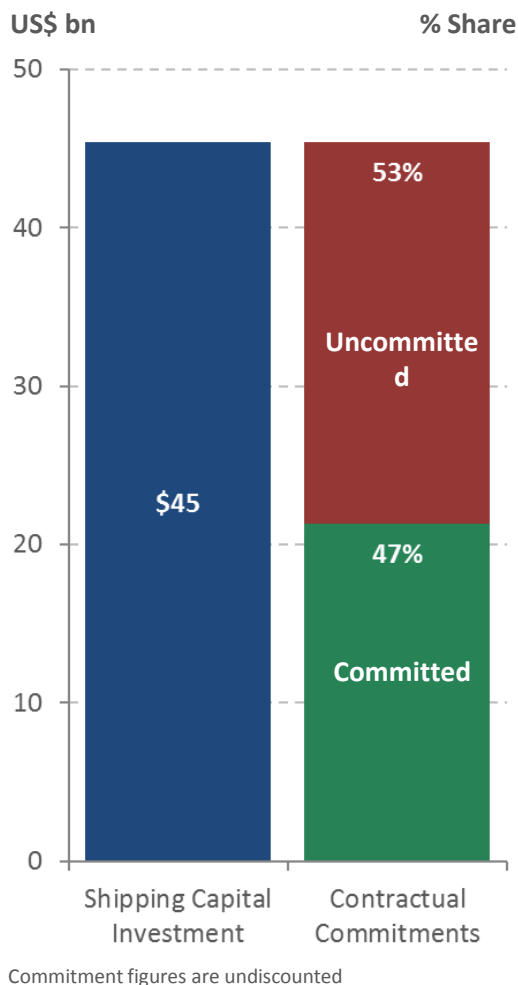


A Significant Portion of Capital Investment Remains Uncontracted

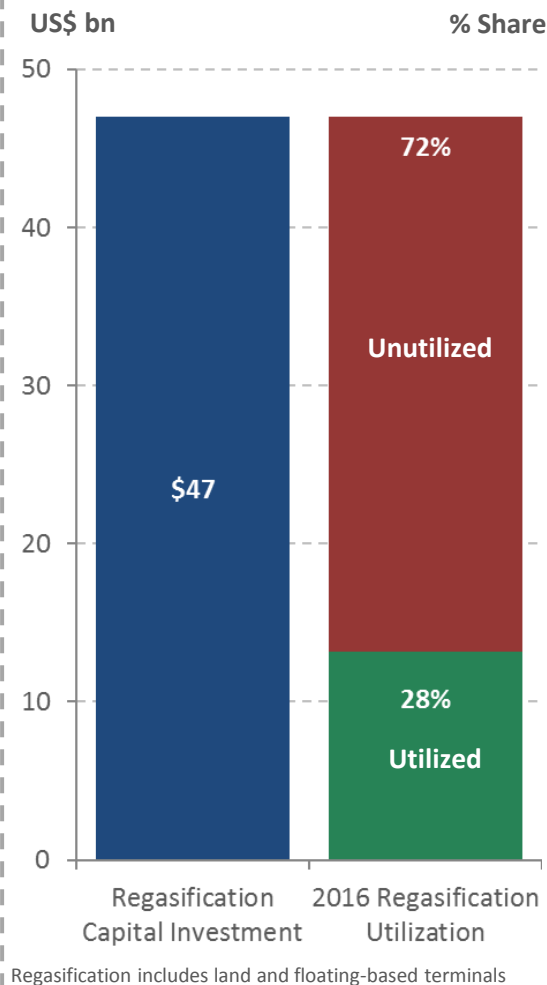
Estimated Total Liquefaction Capital Investment: 2010-2017



Estimated LNG Shipping Capital Investment: 2010 - 2017



Estimated Regasification Terminal Capital Investment 2010- 2017



Introduction to Poten & Partners

A Unique and Full Service Company providing Commercial and Consulting Services to the energy and ocean transportation industries for over 75 years

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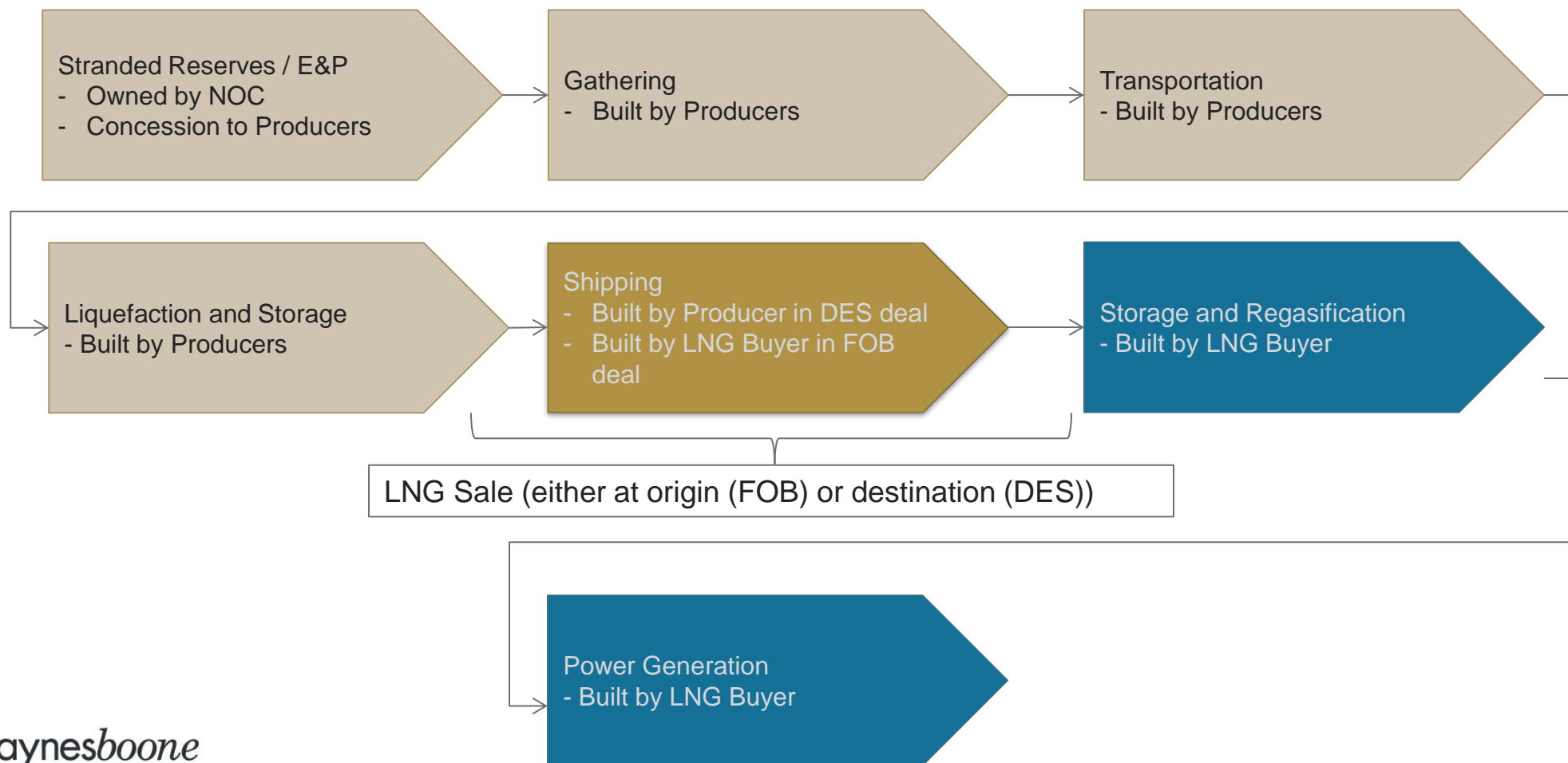
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Developments in LNG Pricing Structures

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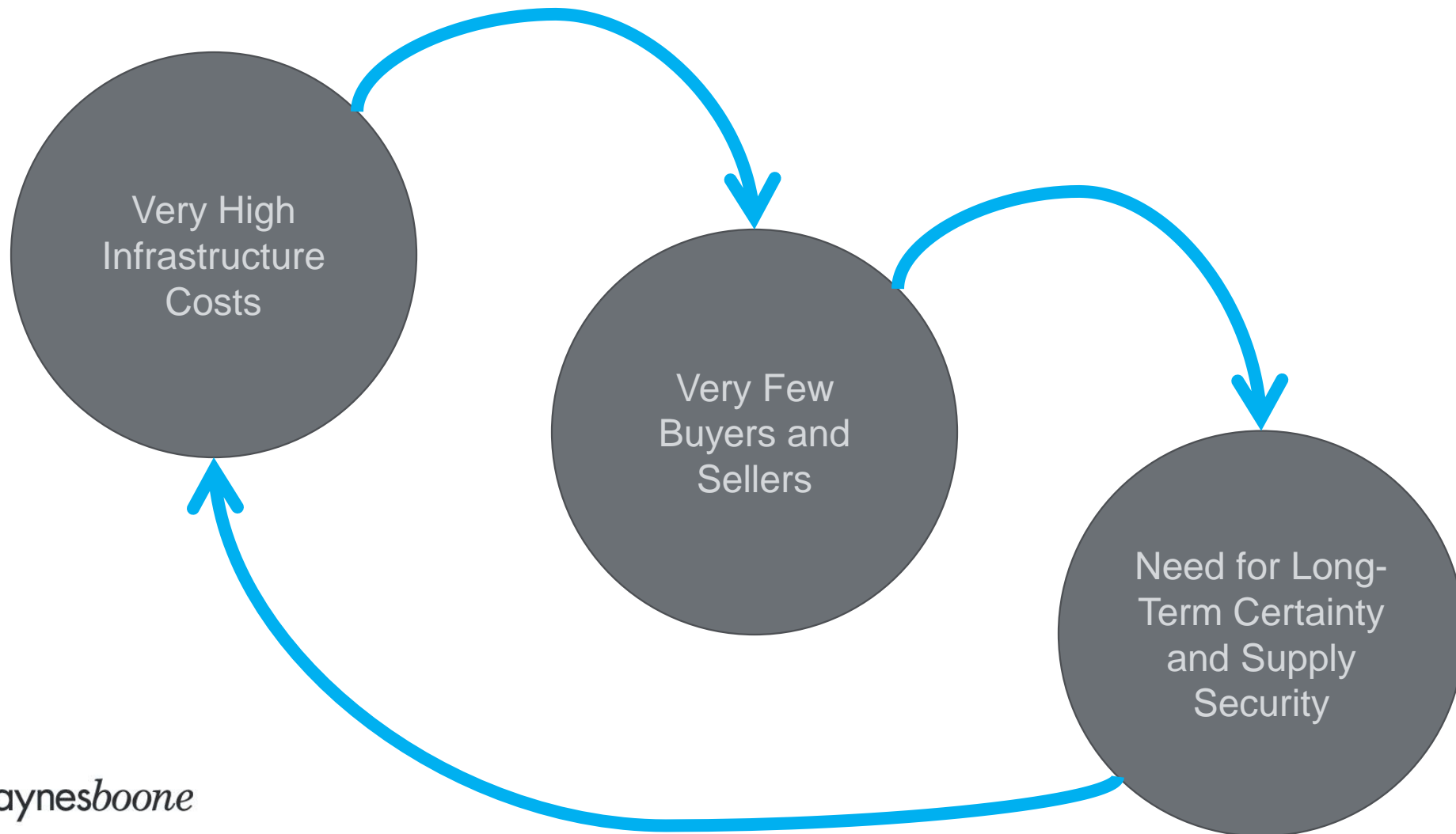
Old School LNG Value Chain (Very Typical Structure)



Why was LNG organized in point-to-point trades?

- Very high infrastructure costs:
 - Reserve development
 - Gas infrastructure in the producing country
 - Liquefaction infrastructure in producing country
 - Shipping
 - Regasification infrastructure in receiving country
 - Gas demand infrastructure (e.g., construction of or conversion to gas-fired power)
- Very few buyers and sellers
- Everyone was incentivized to build exactly the “right” amount of capacity at each step in the chain.
- Contract terms were designed around certainty and supply security and were therefore very inflexible (take-or-pay, precise annual scheduling, tight delivery windows, destination restrictions)
- No significant economic advantage to switching to gas in many cases, and some domestic resistance in some cases

The Vicious Circle of LNG Point-to-Point Transactions



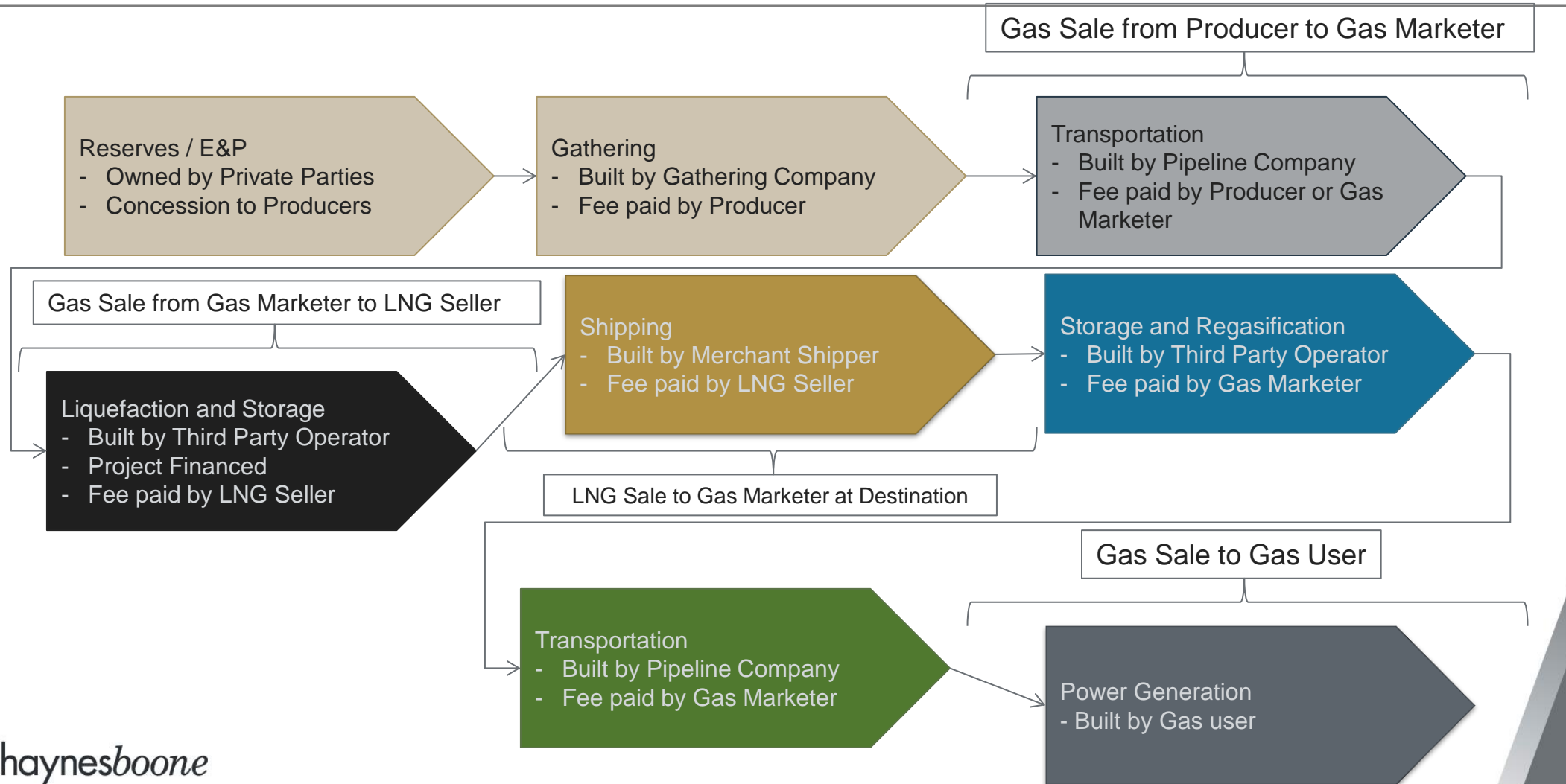
How the point-to-point vicious circle began to break down

- Debottlenecking of existing liquefaction facilities created spare supply.
- In Asia and Europe, increased construction and “overbuilding” of regasification capacity due to environmental benefits of gas-fired generation relative to coal and fuel oil as well as supply security concerns (e.g., Russian gas).
- In the US, increased construction and “overbuilding” of regasification capacity due to anticipated domestic gas supply shortfalls.
- Merchant investment in LNG shipping in anticipation of US import boom.
- A move away from destination limitations (including as a result of legal restrictions on these limitations)
- The US shale gas revolution.
- The increased role of LNG merchants, beginning with BG.

Why is US-produced LNG so different?

- Historically, LNG was produced with stranded gas that had little to no domestic value.
- The gas was essentially “free”; only infrastructure was needed to develop and liquefy it.
- Even in populous producing countries, there was very little infrastructure for transporting and using natural gas.
- The US has a robust gas transportation network and significant domestic demand.
- In every other LNG producing country, the biggest question is whether there are sufficient reserves to justify a liquefaction facility.
- In the US, the only question is whether there is demand for the LNG at a price sufficient to cover the US gas market price plus infrastructure costs. Reserves are assumed.

New US LNG Value Chain (One of Many Possible Structures)



How is US currently being priced?

- Most contracts supporting the financing of liquefaction facilities has been done on a tolling basis, meaning the offtaker pays a fee for a service of turning gas into LNG.
 - In many cases, even LNG sales contracts supporting these terminals are functionally tolling arrangements as the offtaker has significant flexibility in cancelling cargoes but still must pay an infrastructure fee.
- The most basic purchase arrangement for an FOB purchase in the US is Henry Hub plus a terminal fee.
- However, this is not what many LNG buyers want.

What do buyers want?

- Many buyers of LNG still want prices using oil-based pricing.
- This creates difficulties for both the buyer and seller:
 - This pricing structure does not match the US physical gas market and any seller using this price would take on significant price exposure.
 - This means both the buyer and seller have very significant credit exposure to each other beyond delivered unpaid risk:
 - If oil prices go down significantly relative to gas prices and the seller defaults, the buyer will have significant damages. Conversely, if oil prices goes up significantly relative to gas prices and the buyer defaults, the seller will have significant damages.
 - Currently, there is no way to hedge a significant long-term basis risk between oil and gas prices as there is no true correlation and therefore no market.
- Would an LNG buyer accept a fixed price, as offered by some US developers?
 - While these contracts could be hedged on both sides, there would be significant credit risk to both parties on the LNG sale for the same reason as the oil-vs-gas example described above. In addition, there would be significant credit exposure to any counterparty providing such a hedge and this would likely require material credit support, possibly even daily margining of full exposure.

What about existing LNG futures contracts?

- ICE is currently offering two futures contracts for LNG, one for DES deliveries in Asia and the other for FOB deliveries on the US Gulf Coast.
- Neither contract has been widely adopted as a proxy price in physical deals.
- Both contracts rely on floating prices based on prices voluntarily reported to Platts.

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LNG Infrastructure Investment Considerations

Mark Cole

Co-General Counsel and Secretary
USD Group

haynesboone

USD Group history (1998-2017)

- 1998-2002: rail car storage phase. Leverage railroad relationships to provide storage for railcars and relieve congestion. **Logistics arbitrage.** **Development /construction risk.**
- 2002- 2009: ethanol phase. Identify markets and provide unit train origin and destination solutions in California, Texas, Maryland, New Jersey. **Commodity and public policy arbitrage.** **Development/construction risk, public policy risk.**
- 2009-2014: crude phase. Identify markets and provide unit train and origin destinations in Niobrara, Bakken, Eagle Ford, Western Canadian oil sands and Louisiana Gulf Coast. IPO. **Commodity arbitrage.** **Development/construction risk, commodity risk, operations risk.**
- 2014-present: Diversification (including auto unloading in the Port of Philadelphia), learning lessons, studying markets, positioning for future, including a destination terminal in Mexico and greenfield development in the Houston Ship Channel. **Logistics, public policy, commodity arbitrage and perception risk arbitrage.** **Development/construction risk, perception risk (public markets), extreme commodity risk exposure.**

Global LNG Snapshot

- Abundant and growing supply:
 - Natural gas production
 - United States and Australia
 - Mexico?
 - Potentially inadequate pipeline and terminaling infrastructure
- Abundant and growing demand:
 - Coal to gas to reduce carbon emissions
 - Enhanced reliability and energy security
 - Decarbonization (gas is still a fossil fuel)
 - Energy efficiency (moderately dampens demand)
 - Wind and solar back up (gas fired peaking/back up power plants)

Political and Legal Feasibility for LNG Export Investment?

- US West Coast. **Very challenging.**
- Canada West Coast. **Very challenging.**
- Texas and Louisiana Gulf Coast. **Positive public opinion environment, Panama canal widening.**
- Mexico West Coast **??????**

Economic Feasibility for LNG Export Facility Investment?

- Asian LNG demand:
 - Japan: Eventual nuclear re-start, coal, poor demographics
 - South Korea: Pollution control, growing economy
 - China: Pollution control, growing economy
- European LNG/natural gas demand:
 - Spain: Dramatic increase in 2016 and 2017
 - Gazprom ?????????

What Next?

- Identify cross-border and local experts
- Anti-bribery, anti-corruption due diligence
- Insurance program earlier rather than later.
 - Delay in start up
 - Owner Controlled Insurance Program for construction?
 - Political risk/trade credit policies
 - Foreign Travel/Kidnap and Ransom

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