The LNG Value Chain and Opportunities for India

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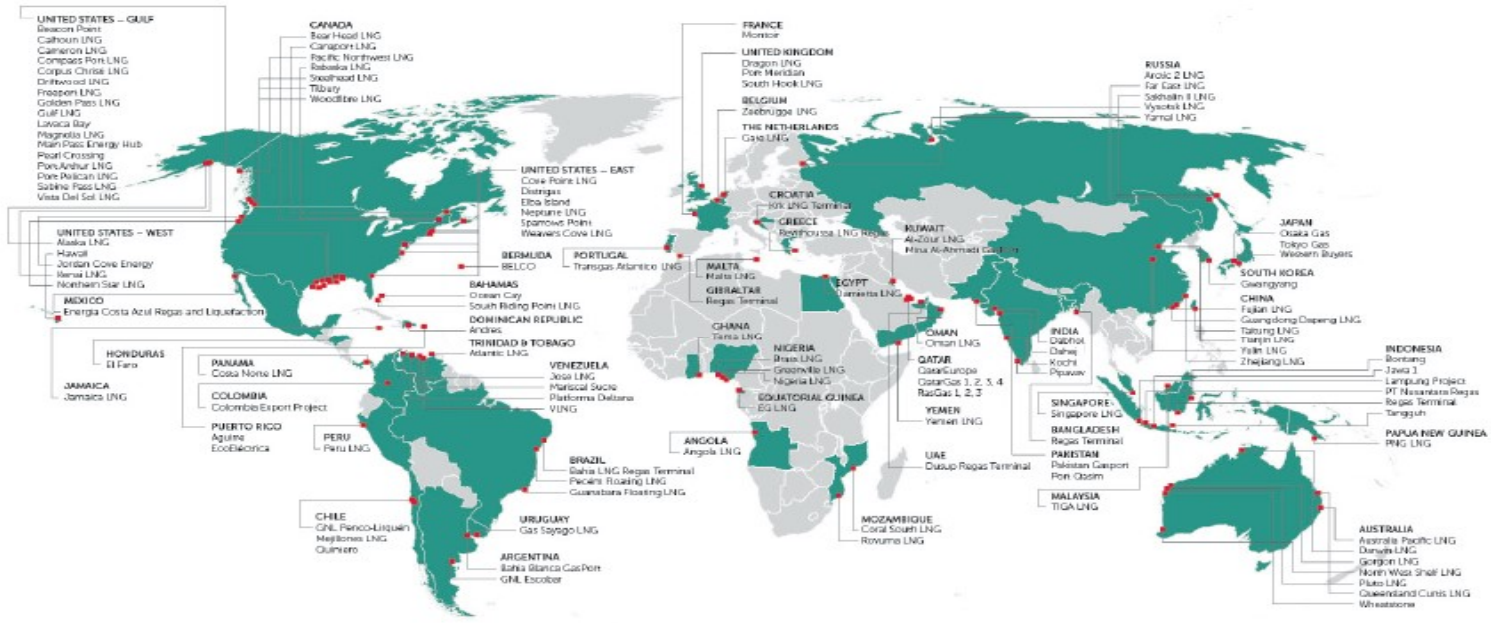
BAKER BOTTS

Baker Botts: 150+ Major LNG Projects Worldwide

150+ Major LNG Transactions	50+ Lawyers with LNG Project Experience	Negotiated $500+ Billion in LNG Sales Agreements	Chartered 85+ LNG Vessels (~20% of World Fleet)	Negotiated 60+ Shipbuilding Contracts



The industry leader, from drill bit to burner tip.

Gas Production/ Pipeline	Liquefaction/ LNG Marketing	LNG Transportation	Regasification/ Pipeline/ Gas Storage	Gas Marketing

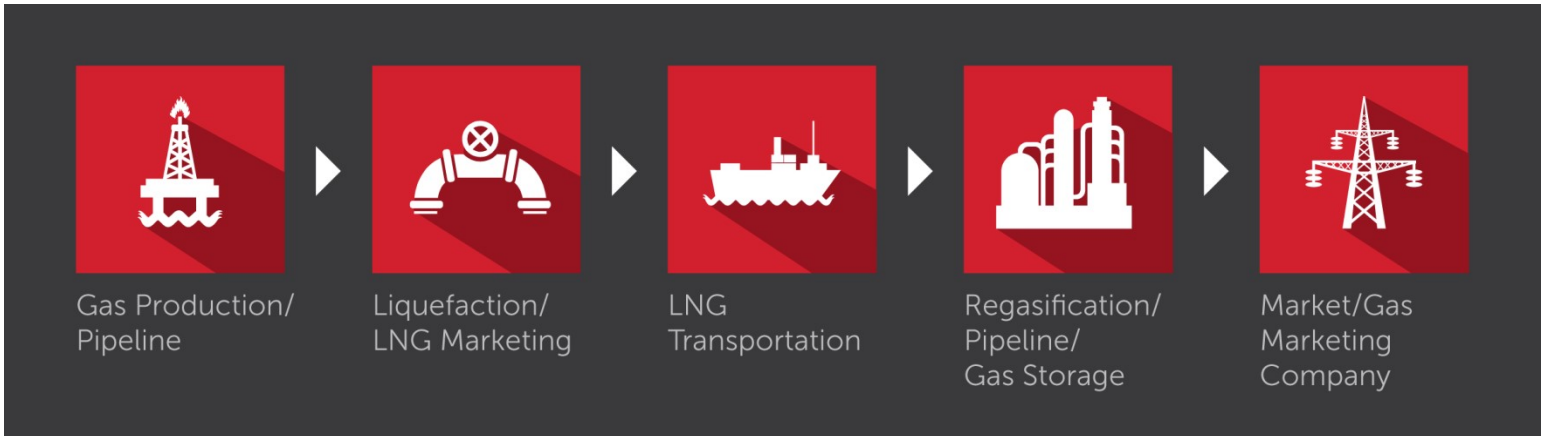
Overview

LNG Value Chain

LNG Global Trends: 2019

Opportunities for India

LNG Value Chain



- The LNG value chain is a series of separate but interdependent activities
- Each activity has its own commercial arrangements connecting the participants, but issues in one part of the chain will affect others - each link in the chain must be economically, technically and commercially viable
- Requires alignment of start-up dates, operational activities and financial incentives, even if no continuity of ownership interests along the chain
- Traditionally, IOCs would be active across the full LNG value chain

LNG Value Chain - Gas Production

- Wells drilled to bring natural gas (and other reservoir components e.g. condensate) to the surface
- Development of upstream facilities and infrastructure for the production of gas
- Processing may occur on-site or natural gas may be transported to a facility for treatment and processing
- Treatment of the natural gas includes removal of components (hydrogen sulphide, nitrogen, carbon dioxide and water) and heavier liquids
- Depending on the natural gas source, the treated natural gas may need to be transported (via pipeline) to a liquefaction facility

LNG Value Chain - Liquefaction

- Natural gas cooled at liquefaction facility to -162^{0}C reducing to 1/600th of its gaseous volume
- Liquefaction facilities are extremely expensive to construct, with long construction periods - though floating LNG may offer a quicker and cheaper alternative
- Organised in LNG "trains" - typically of capacities between 2 and 6 MTPA
- LNG terminals may have multiple trains with differing ownership and offtakers
- LNG stored in large insulated tanks, ready for shipping
- LNG piped from storage tanks to the loading jetty
- Pumped into LNG carrier

LNG Value Chain - LNG Transportation

- Specialised LNG tankers feature insulated double-hulled tanks
- Insulation cannot prevent all external heat from reaching the LNG, therefore some "boil-off"
- Boil-off can be used as fuel for the LNG tanker, burned in the boilers to produce steam, or reliquefied and returned to tanks
- LNG tankers typically between 120,000 and 190,000 m^3
- But, Q-Flex approx. 216,000 m^3 and Q-Max approx. 265,000 m^3
- Q-Max LNG tanker can carry enough natural gas to power 70,000 homes for one year
- LNG SPA will specify shipping arrangements:
  - Free on Board (**FOB**): Buyer arranges shipping , takes title when LNG is loaded
  - Delivered at Place(**DAP**): Seller takes costs and risks of shipping, Buyer takes title at the import terminal

LNG Value Chain - Regasification

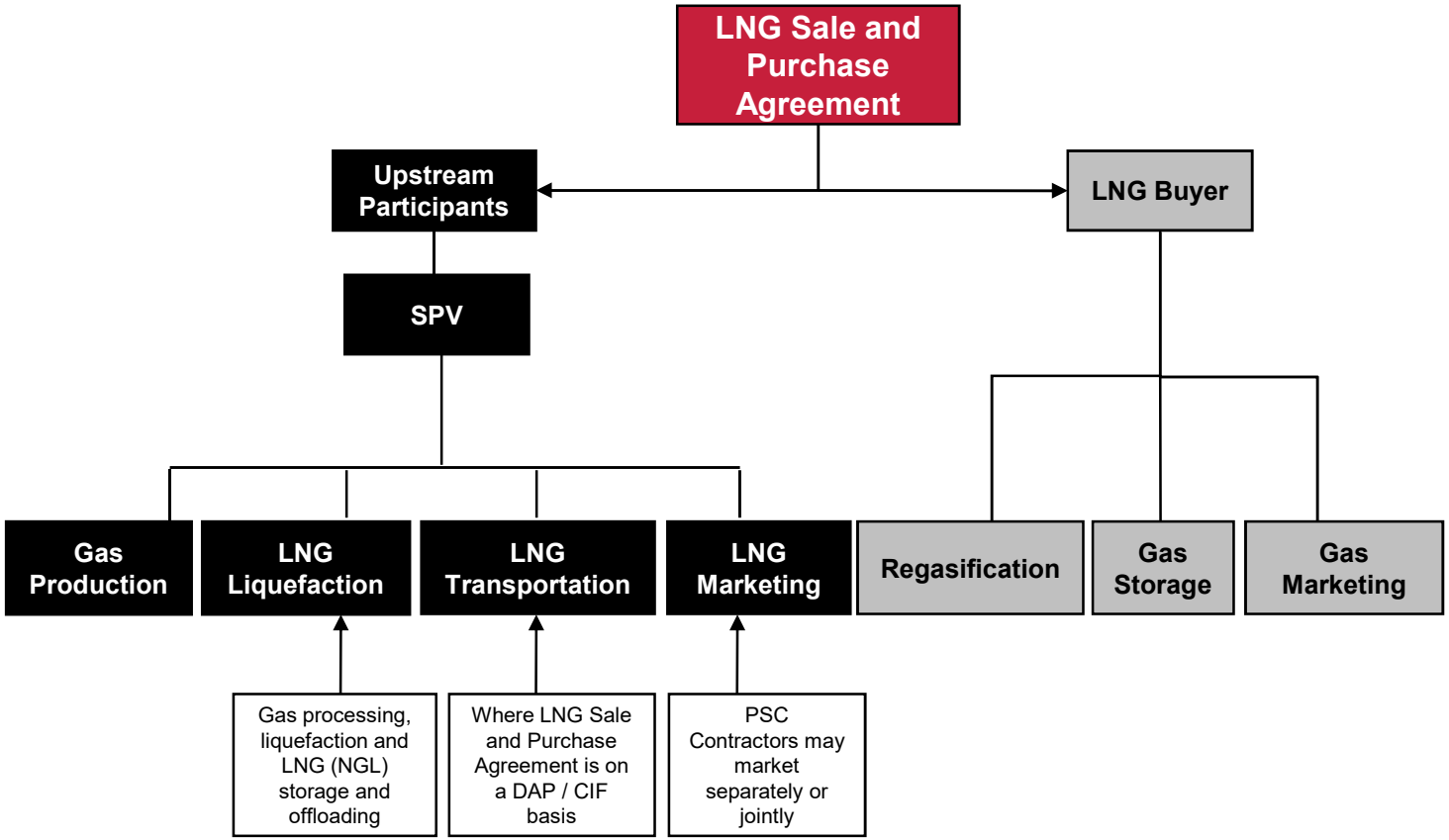
- LNG buyers will either own or contract for capacity in an LNG receiving terminal
- Receiving terminals can either be onshore or offshore
- LNG tanker is guided to the unloading jetty at the receiving terminal
- LNG is unloaded and stored in LNG storage tanks
- LNG then pumped into the regasification plant and converted back into a gaseous state
- Regasified LNG must comply with the specification set by the gas regulator or relevant pipeline transmission company

LNG Value Chain - Gas Marketing

- Regasified LNG is then delivered to the consumer (often power plants, petrochemical plants or the gas network) via pipeline
- The regasification facilities owner may construct its own pipeline network as part of the facilities, or may tie-in to an existing downstream pipeline network
- The LNG buyer will typically seek to back-to-back its LNG purchase obligations with its gas delivery obligations

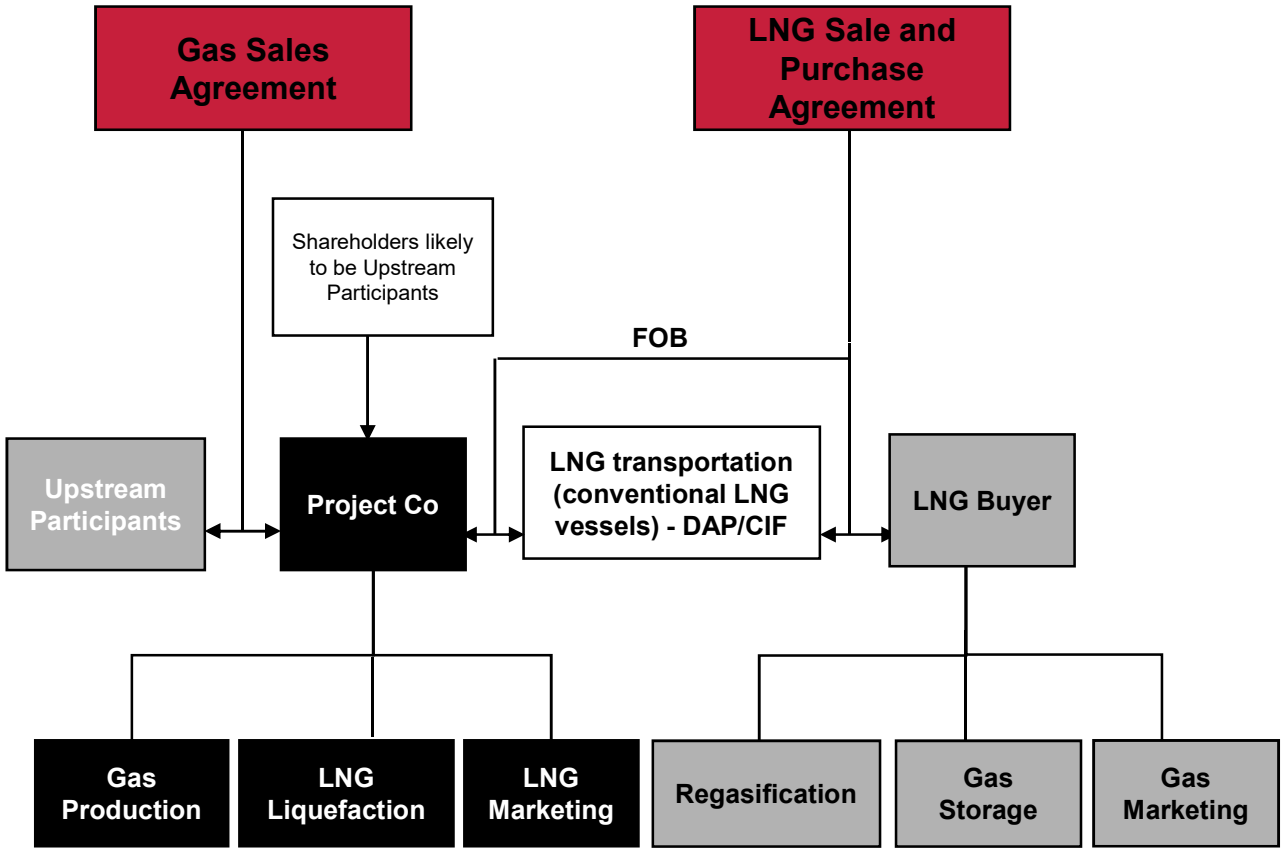
Common Project Structures

Integrated Upstream Model: Participants own gas supply and LNG plant, and market own LNG



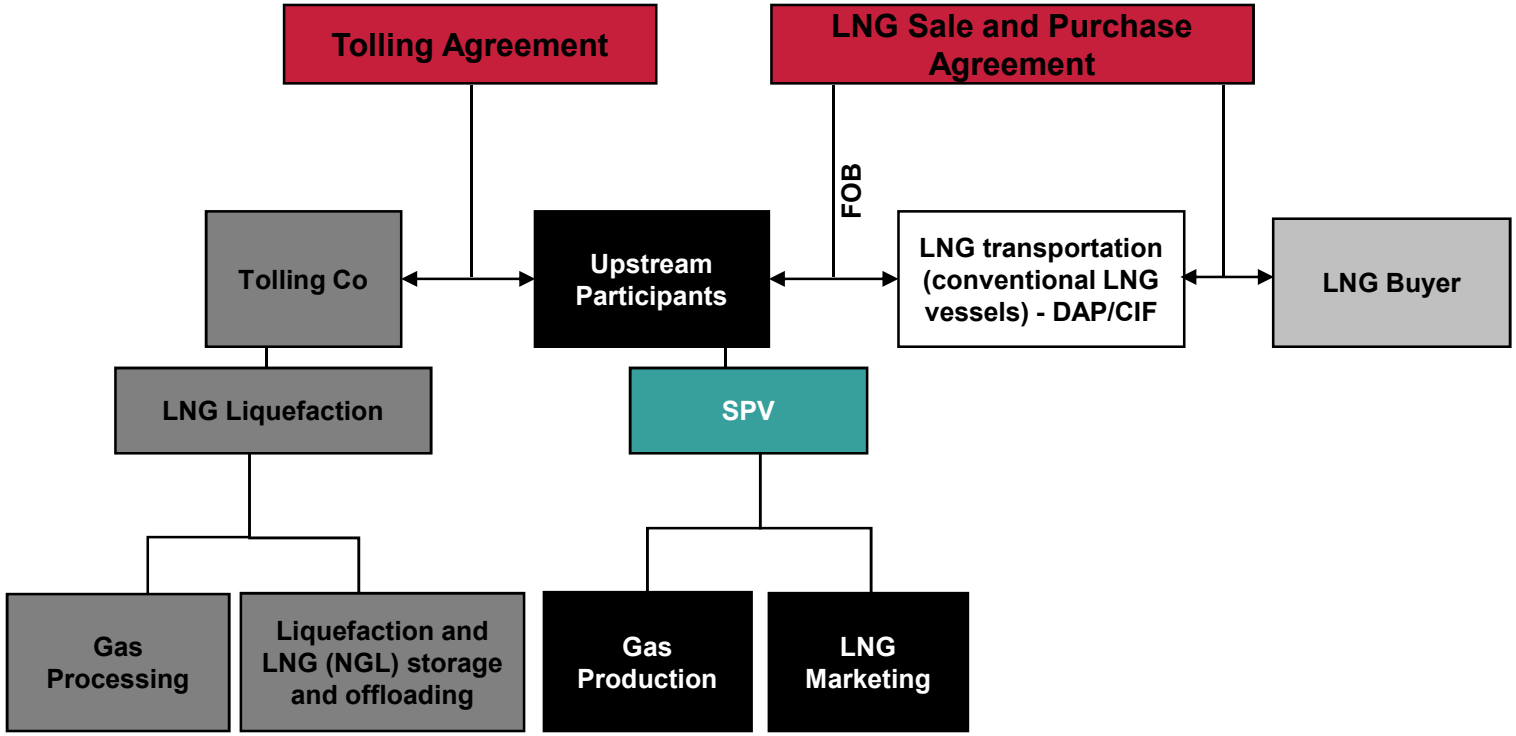
Common Project Structures

Merchant Model: Project company that owns the liquefaction facility purchases natural gas from third party and sells LNG to offtakers

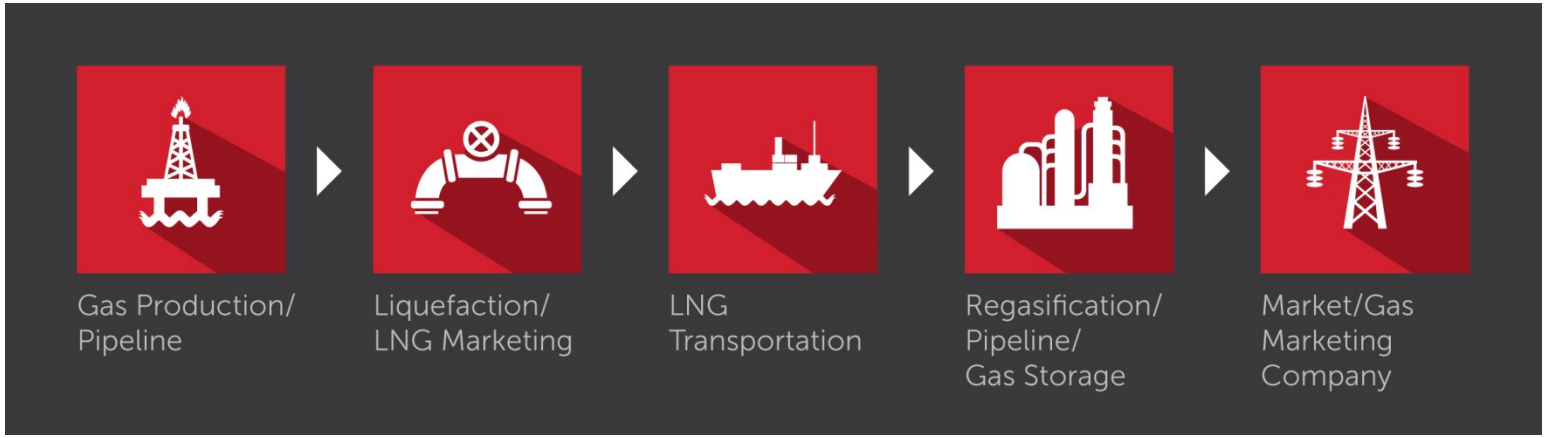


Common Project Structures

Tolling Model: LNG plant does not take title to natural gas feedstock or LNG produced at the plant, but provides liquefaction and processing services



Most Significant LNG Project Agreements



Gas Production/ Pipeline	Liquefaction/ LNG Marketing	LNG Transportation	Regasification/ Pipeline/ Gas Storage	Market/Gas Marketing Company
Gas Sales/Supply Agreement	LNG Sale & Purchase Agreement (SPA)	Time Charter Party	Terminal Use/Terminal Services/Throughput Agreement	Gas Sales Agreement
Transportation Agreement	Liquefaction (tolling) Agreement	Ship Building Contract	Transportation/Gas Storage/Re-loading Agreement	Gas Marketing Agreement
Common Use Facilities Agreement	Liquids Processing/Sales Agreement	Transportation Services Contract	Shipper Cooperation Agreement	
Joint Venture Agreements	Engineering, Procurement, and Construction (EPC)	LNG Storage Agreement	Scheduling Agreement	
Joint Operating Agreements	License Agreement			

Financing Agreements

LNG Value Chain - Participants

- Who are the potential participants in an LNG project value chain?
  - Upstream producers
  - Gas sellers/suppliers
  - Upstream pipeline owners and operators
  - Liquefaction sponsors/project companies and operators
  - LNG buyers (long-term and spot)
  - LNG transportation/shipping providers (vessel owners and operators)
  - Regasification terminal owners, operators and capacity holders
  - Downstream pipeline owners and operators
  - LNG and gas marketing companies
  - Gas storage facility owners and operators
  - Gas buyers, power projects and industry

LNG Global Trends: 2019 and beyond

- **Global LNG demand continues to grow** – four year average of ~9.3% annually
- **New supplies** – from USA, Qatar, Russia and Africa, opening up new trade flows. Shift from point-to-point deliveries, reducing voyage length and costs, increasing global interconnectivity
- **Increasing market liquidity** – increase in tradeable volumes has led to increased short-term spot market trading rather than long term contracts. Gives buyer flexibility to opt for smaller volumes and even seasonally weighted deliveries
- **New types of end users** – LNG as transport fuel for trucks and ships (LNG bunkering). International Maritime Organisation (IMO) regulations on sulphur limits from 2020 expected to increase LNG for marine applications
- **Environmental solutions** – impetus to reduce environmental emissions and dependence on coal has led to shift towards LNG in countries such as China and India
- **Rise in floating terminals** – offer flexibility and access to smaller markets/cost reductions

Opportunities for India

- India is a key growth market for gas and LNG
- PM Modi has set target of 15% share for natural gas by 2030. Demand for gas is expected to double to 75 bcm by 2030 driven by strong growth in the power sector and demand for feedstock by heavy and petrochemical industries
- Main suppliers: West African nations of Nigeria and Angola, as well as Qatar
- In 2019, LNG imports grew by c.5%
- Although India has almost 17,000km of pipeline in operation, the Ministry of Petroleum and Natural Gas calculates over 14,000km more will be needed to achieve the 2030 goal. Indian government has pledged US$60 billion to develop a national pipeline network that would link mainland states and union territories
- Interest from foreign investors:
    - Exxon signed a memorandum of understanding with Indian Oil Corporation Ltd to explore "new models of delivering cost-effective natural gas in India"
    - BP in a tie up with Reliance Industries is investing US$5 billion in India's east coast to produce gas starting in April or May 2020

Opportunities for India

- Dynamics of India market will become more influential in setting terms for the global LNG industry
- Indian buyers/investors will increasingly demand flexibility from LNG sellers/owners on:
  - term/duration of supply
  - commercial terms of supply (quantities, take or pay, liabilities, price, price review, payment terms and security, flexibility of supply source/cargo size, destination, flexibility, re-export, shipping terms)
  - LNG carrier charter terms (shorter terms and reduced costs)
  - reduction in costs along the value chain
- LNG will need to prove itself as a clean, flexible and affordable fuel

Credits

- https://www.reuters.com/article/us-energy-india-gas/global-oil-majors-see-surge-in-indian-demand-for-natural-gas-idUSKBN1WT1QI
- https://lngunlimited.com/indian-lng-struggles-to-find-pipeline-capacity/
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- https://www.mckinsey.com/solutions/energy-insights/global-gas-lng-outlook-to-2035/~/media/3C7FB7DF5E4A47E393AF0CDB080FAD08.ashx

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