

LNG Strategies

Summary Highlights

一. Strategies

1. Existing Project: distressed second hand contract/participating interest
2. Proposed Project: cheap LNG | off-taker equity bonus | IPO anchor investor

二. Strategy Execution

1. Louisiana
2. Cherry-picking

三. Why Louisiana? LNG Mecca

1. Not only pipelines, but hubs!
2. \$90 billion worth of projects proposed
3. Extreme weather condition is not a concern

四. LNG Production Cost

1. E&P (Exploration & Production): \$0.60 - \$1.20/mmBtu
2. Liquefaction: \$0.90 - \$1.30/mmBtu
3. Shipping: \$0.50 - \$1.80/mmBtu
4. Storage & Regasification: \$0.40 - \$0.60/mmBtu

Total Cost: \$2.40 - \$4.90/mmBtu

五. NG Market Price

1. Henry Hub Price as of Oct. 23 (spot price): \$2.95/mmBtu
2. NYMEX Future Price as of Oct 23: \$2.99 – 3.28/mmBtu

六. Building a LNG Plant + LNG Supply Chain

1. Liquefaction Plant: \$2 billion – \$50 billion, depends on capacity, tech., etc.
2. Regasification Terminal: \$500 – 800 million, assume 700 MMcfd capacity
3. global regasification capacity = 9.5 Bcfd = 2.5x liquefaction capacity
4. Building a new LNG export terminal requires 5 components:
 - 1). Pre-treatment (6% of overall construction cost)
 - 2). Utility (16%)
 - 3). Liquefaction plant (50%)
 - 4). Storage (18%)
 - 5). Loading/marine (10%)

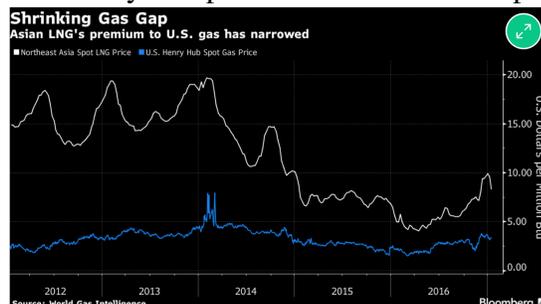
七. Pre-FID Regulatory Process Cost

1. \$150 million = barely enough to go through FERC permission process
2. The Pre-FID feasibility study + permitting process is only 6% - 9% of total CAPEX (Pre-FID + Construction Cost)
3. Without FERC approval, would not be able to
 - 1). gain export license to trade with the Far East (including China)
 - 2). start construction

—. Overarching Strategy Proposal

1. Under Construction Project Participation

- i). Take over second-hand contract or project participation interest at distress
- ii). Buy discounted LNG at spot and profit from spread trading
- iii). Challenge with strategy surrounding “under construction project”:
 - Toshiba (refer to case study below) is an extreme case; not easy to find distressed deal at the moment
 - Troubled firms reluctant to give steep discount and tends to ask close business partners/industry counterparts who have done businesses with them first
 - Commodity trading leaders tend to be the first vulture to gobble up a small number of good opportunities
- iv). Case Study / Inspiration: Toshiba – Freeport LNG Story



- 2013Q3 (when LNG priced at premium in Asia), Toshiba signed a 20-year “take-or-pay” tolling contract with Freeport LNG to buy the rights to liquefy 2.2 MTPA LNG. The tolling charge could range from \$2.25 - \$3.50 / mmBTU. Even though Toshiba signed conditional agreements with multiple buyers to sell more than 50% of this 2.2MTPA output, but none are legally binding! In June 2016, Toshiba flagged \$8.5 potential loss in its Power Unit. Pundits estimated Toshiba’s Freeport LNG contract at \$7.0 - \$8.5 billion. In 2017Q1 Toshiba asked Japanese JERA to market its LNG contract scheduled to delivery from Freeport LNG, Texas in 2019. (Freeport LNG Terminal, Train 2 and 3 are scheduled to complete construction / start operation in 1H2019), else it will sell LNG in spot markets at a loss or waste its timeslot.
- <https://www.reuters.com/article/toshiba-lng/corrected-nuclear-not-only-problem-as-toshiba-liable-for-billions-in-gas-contract-idUSL4N1G22V2>
- http://www.lngworldshipping.com/news/view_jera-seeks-buyers-for-toshibas-lng_46195.htm

2. Proposed Project / Greenfield Project Participation

- i). As Off-taker of the 1st Cargo
 - Negotiate contract with best value LNG: Attempt to negotiate for the best price + discuss flexibility/conditional terms, explore whether possible to negotiate time down to 8 – 10 year contract, with renewal priority privilege, rather than been locked into a traditional 15 – 20 year contract. Innovative form of contracting, deviate away from industry conventional? Consider appropriate hedging strategy as progresses toward construction completion/delivery date.
 - Free Equity: Negotiate for equity bonus (ask for free minority equity stake just for agreeing to be an off-taker of the 1st cargo).

- ii). As equity or debt financial investor
- iii). As “anchor” investor of IPO
 - Step 1: join as Equity partner/investor (long-term)
 - Step 2: announce to become Buyer/Off-taker of the first cargo (long-term)
 - Step 3: Partner on current/short-term LNG trading deals (short-term)
 - Step 4: Partner on part of the modular construction/support services or logistics
 - Step 5: Try best to increase the valuation of the company + expedite all permitting application processes when possible, then IPO the company
- iv). Challenge with strategies surrounding “proposed project.”
 - Project timing + uncertainty in context of peers and global industry backdrop
 - Intermediate to long-term financial and resource commitment
 - Same as the pharmaceutical dilemma of “bidding on the right drug,” blockbuster winner takes all.
 - Difficult to strike a balance between push too hard and stretch to max.
- v). Case Study / Inspiration: Monkey Island + Magnolia Investor Presentations
 - Off-taker / buyers’ agreement: essential ingredient for any project to receive lender financing or attract any serious equity investor.
 - A good number of well-developed proposals, but only limited number of serious financial sponsors and buyers with significant impact.
 - Significant risks and tremendous uncertainties involved with extensive time horizons, financial sponsor / first off-takers must be compensated fairly for the risk taken and efforts involved in making such investment decision.
 - Be mindful of global level LNG infrastructure construction activities – timeline and capacity, potential concern for excessive capacity and competition when multiple projects have the same anticipated completion time?
 - Cheniere Success is not duplicable: Serendipity worked miracle, with timing and strategy. Was on the verge of bankruptcy as it was in the middle of building an import facility for the purpose of LNG import regasification. Then Shale Revolution happened before the completion of its regasification / import terminal. Figured out right strategy, converted import terminal into an export terminal. Savings on construction cost many peer projects would not be able to duplicate due to unique geographic features.

二. Execution Plans

1. **Louisiana (LA), GOM: Assess Gulf of Mexico, especially Louisiana, projects.**
2. **Cherry-pick: Take the time + a deep breathe to “cherry-pick.” Specifically, sit through more pitches and establish ongoing dialogues with presenters we met.**

三. Why Louisiana? LNG Mecca.

1. **Export is the only way forward**
 - U. S. leading shale natural gas (NG) production region, Marcellus/Utica, sufficiently supplies Northeast Coast with the lowest transportation cost.
 - The other major production regions, namely Barnett (TX), Eagle Ford (TX), and Haynesville (TX + LA), are all located in the South, near the Gulf of Mexico (GOM).

- Due to its warm climate, the domestic demand from GOM production region's immediate neighborhoods is relatively weak in comparison to that of the Northeast region (with both cold winter and summer air conditioning usage peaks).
- The U. S. has abundant shale NG supplies well distributed throughout the country, besides Marcellus/Utica and GOM, Appalachian Mountains, and a region area in Southern California are rich in NG. The Mountain Ranges and along with West Coast states are covered by supplies from both Appalachian Mountains production regions and from GOM production regions.
- Conclusion: To alleviate depressing NG price, GOM production region has to sell their NG elsewhere, globally.
- Louisiana has more than \$90 billion LNG export facilities projects in planning stages!

2. Not only pipelines, but hubs!

- Louisiana has the most extensive and concentrated hubs + pipeline networks.
- Hubs, more important than pipelines. Hub = specific points where pipeline interconnections allow the transfer of gas from one pipeline to another.
- There are about 20 major hubs in the U. S. Louisiana Henry Hub is the dominant benchmark point due to its strategic location in the Gulf Coast producing area and the number of pipelines connections from there to the East Coast and Midwest consumption centers. Louisiana once was a NG import location before the Shale Revolution.
- Henry Hub has 12 delivery points and 4 major receipt points. More than a dozen major gas pipelines converge and exchange gas there. (this may explain the downside of building LNG export terminal elsewhere, including Mexico. Better stay close to Henry Hub for cheaper price NG supplier + transportation cost options + more flexibility with delivery options).
- Henry Hub NG price benchmark.
- Since 1990, NYMEX (New York Mercantile Exchange) standardized NG contracts with delivery at Henry Hub. LA as the primarily NG trading center.

3. Extreme weather mitigation solutions

- Establish alternative LNG supplier arrangement: Buy from other supplier or build alternative plants elsewhere as back up.
- Entire region will be affected + entire industry will be affected. All plants will have to deal with temporary reduction in operating capacity, storage run-out, and additional shipping cost / delays.
- Buy NG and load up LNG @ local market off-peak season: coincidentally, these seasons often have lower chance of extreme weather. Build storage in China regasification/receiving ports, stock up for later usage. → Avoid extreme weather conditions + even better price. Buy on spot or through innovative way of contracting and planning liquefaction time.

4. Existing infrastructure lowers construction cost

- Existing ports/terminals/storage facilities/supporting infrastructures shorten construction cycle and contribute to cost saving.

- Case-in-Point: Cheniere Sabine Pass LNG, LA (Existing import terminal and supporting infrastructures, simply “plug-in” liquefaction plant would do)
- Case-in-Point: Sempra Cameron LNG, LA (naturally-formed salt cavern underground storage area for LNG + Hackberry Port/Import Terminal by Calcasieu Lake).

5. Supportive local communities

LA re-emergence as an oil/gas center (**Renaissance of NG/LNG in Louisiana**)

- In the past 30 years, a shift of power from LA to TX happened in the oil/gas industry, primarily due to the following reasons:
 - **Tax policies:** Texas is 1 of the only 7 states without state income tax + favorable tax / incentives for corporations
 - **Digital oil fields + knowledge base:** Digital oil fields allow all decisions made with expert team centralized in one headquarters office. University of Texas system has one of the best petroleum engineering programs in the world.
 - Depressing oil/gas price result in headcount cut and office consolidation (shrink of oil major Louisiana office).
 - **Diverse industry base + resourceful community:** technology, defense, medical (some of the countries’ best hospitals), school system
- LA community is proactive in redeveloping its oil/gas industry
- Supportive in project approval, not much community protest/environment protest
- Tax treatment + incentives
- Relatively lower cost of living
- Knowledgeable talent base with oil/gas industry expertise

四. LNG Production Cost @ LNG Supply Chain

1. E&P (Exploration & Production): \$0.60 - \$1.20/mmBtu

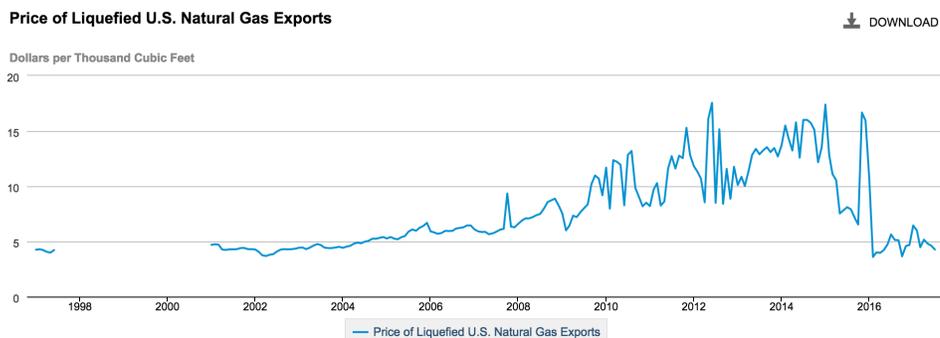
2. Liquefaction: \$0.90 - \$1.30/mmBtu

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Total Cost: \$2.40 - \$4.90/mmBtu

- The cost of LNG process is est. \$2 - \$5/mmBtu, depends on the costs of 1). NG production, 2). Liquefaction, 3). Distance of shipment and storage arrangement.
- Liquefaction process is the most expensive component.
- Regasification contributes the least cost in the LNG supply chain.
- Price of Liquefied U. S. Natural Gas Exports, July 2017 average:
 - \$4.26/Mcf (per thousand cubic feet)
 - or \$4.12/mmBtu (1Mcf = 1.037 mmBtu)
- EIA (U. S Energy Information Administration):
<https://www.eia.gov/dnav/ng/hist/n9133us3m.htm>



五. NG Market Pricing

1. Henry Hub Price as of Oct. 23 (spot price): \$2.95/mmBtu
2. NYMEX Future Price as of Oct 23: \$2.99 – 3.28/mmBtu
3. Forward Price: Henry Hub + differential
4. EIA website, price 1 week
delayed...<https://www.eia.gov/dnav/ng/hist/rngwhhdD.htm>

六. Building a LNG Plant + LNG Supply Chain

1. Cost of Building an LNG Plant

- Liquefaction plant: \$2.0 – \$50.0 billion, depends on capacity, technology, etc.
- Regasification terminal: \$500 – 800 million, assume 700 MMcfd capacity
 - U. S. imported 100 Bcf/month @ Summer 2007 (at US LNG import peak, through its 11 LNG receiving/regasification terminals)
- Globally, more regasification plants than liquefaction plants:
 - global regasification capacity = 9.5 Bcfd = 2.5x liquefaction capacity
 - allows flexibility for LNG suppliers to land @ market with highest price

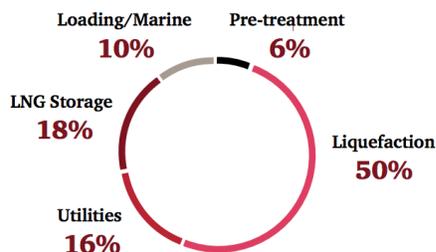
There are multiple components to the LNG value chain and typically the spend proportions would be as indicated:



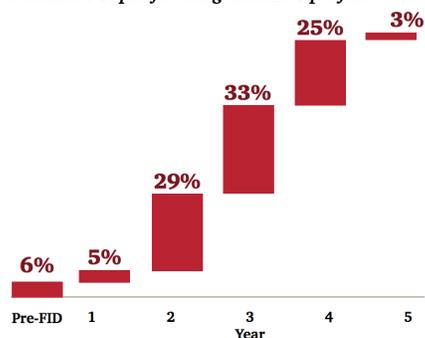
2. Components of an LNG Plant

- LNG plant: It is not only about the liquefaction plant (refrigerator)
- Port: Building and operating deep-water port is critical!
 - Count enough time for port construction, in addition to LNG plant building
 - FLNG – Floating LNG where liquefaction happens on dock still cannot do without a port terminal for pipelines and compressors to transfer NG!
- Internal pipelines
- Storage units
- Miscellaneous supporting infrastructure

Examining the LNG Plant percentage, this might be broken down as follows for a greenfield project:



Indicative Capex for integrated LNG project



七. Pre-FID Cost, Regulatory Approval Process

1. FERC Preliminary Review Cost (Pre-Filing Application): \$35 - \$50 million

2. EPC (Engineering & Contracting Process): \$65 million

3. FERC Limited Noticed to Proceed (LNTP Process): \$ 50 million

Post DOE, Pre-FID Regulatory Compliance Cost = \$150+ million

- Without passing FERC review, will not receive non-FTA approval.
- Without non-FTA approval, won't be able to sell LNG to China.