Introduction to LNG Projects

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Introduction
Overview of LNG Projects
Overview of the LNG Industry

- LNG is natural gas that is liquefied by cooling to -160ºC.
- Volume is reduced to 1/600 of that of gas to permit efficient shipping.
- Specialized LNG carriers keep LNG cold for international transport.
- Traditional vessel carries the equivalent of about 3 Bcf of natural gas.
- Regasification terminals receive, store and vaporize LNG for delivery as natural gas.
• Pacific Basin is historically the dominant LNG market
  – Japan, Korea and Taiwan – established markets
  – Growth opportunities in China and SE Asia
  – Long-term contracts

• Atlantic Basin more flexible
  – Trading between North America and Europe
  – Supplied increasingly from Middle East
  – US shift from LNG imports to exports

• Will US export capability, expansion of the Panama Canal, and Qatari supply to Europe and Asia, drive alignment of Pacific and Atlantic Basins?
Overview of the LNG Industry

- Natural gas currently accounts for 21% of aggregate global energy supply. It trails both crude oil (32%) and coal (26%).
- Between 2012 and 2035, Global gas demand expected to rise at an average rate of 1.9% p.a., outstripping crude oil (0.8% p.a.) and coal (1.1%). By 2035, natural gas is forecast to be:
  - Primary energy source in OECD (31% of primary market)
  - Third source in non-OECD behind oil and coal (24% of primary market)
- “World LNG Demand Will Double by 2020 as Gas Usage Rises 25%, Shell Says” – Bloomberg
- “Shale gas opens door to U.S. LNG exports” – MarketWatch
- “Report: Exports won't much affect natural gas prices” – Houston Chronicle
Global LNG trade fell in 2012 after 30 years of consecutive growth
- Global flows fell by 1.6% from 241.5MT in 2011 to 237.7MT in 2012

Asian countries most dependent on LNG imports
- Japan and Korea consume 52% of global market

Majority of LNG is traded under long term contracts

However spot/short-term market continues to grow
- 73.5MT in 2012 (31% of total traded volumes)
- Spot market is dominated by Asian buyers (72%)

Currently 17 countries exporting LNG
- Qatar (77.4MT), Malaysia (23.1MT), Australia (20.8MT) and Nigeria (20MT) were the largest producers in 2012

Development in liquefaction capacity
- Majority of committed growth expected from Australia (62MTPA of capacity FID)
- Increasing role of North America (USA and Canada)
LNG v Natural Gas Supply

- LNG need arises from significant available reserves
- Higher capital costs for LNG
- Scale of commitments linked to:
  - Liquefaction/regasification trains
  - Specialized ships
- Long development time
- Traditionally, long-term contractual structure required to ensure economics and secure financing
- Contractual inter-dependency across LNG chain
LNG Exports by Country (2012)

- Qatar, 77.4, +1.9
- Malaysia, 23.1, -1.9
- Australia, 20.8, +1.6
- Nigeria, 20, +1.2
- Indonesia, 18.1, -3.3
- Trinidad, 14.4, +0.5
- Algeria, 11, -1.6
- Russia, 10.9, +0.4
- Oman, 8.1, +0.2
- Brunei, 6.8, +0
- UAE, 5.6, -0.3
- Egypt, 5.1, -1.3
- Yemen, 5.1, -1.5
- Peru, 3.9, +0.1
- Eq. Guinea, 3.8, -0.1
- Norway, 3.4, +0.6
- US, 0.2, -0.1

Source: International Gas Union, 2013
LNG Imports by Country (2012)

Source: International Gas Union, 2013
Introduction to the LNG Industry

Liquefaction Capacity by Country (2012 and 2017)

Source: International Gas Union, 2013
LNG Project Components

- Production
- Transportation
- Liquefaction
- Shipping
- Receiving, Storage and Regasification Facilities
- Transportation of Gas to Buyers
Liquefaction Project

LNG Buyer

Gas Suppliers

LNG Sales Contract

Gas Supply Contract

Gas Purchaser And LNG Seller

Processing Contract

Plant Owner
Liquefaction Project

- Gas Supply Contract ("GSA")
- Processing Contract
- LNG Sales Contract
- Transportation Arrangements
HIGH-LEVEL CONTRACTS (COVERING MULTIPLE STAGES)

Project Development Agreement between Project Developers
Framework Agreement(s) or Implementation Agreement(s) between Project Developers and Host Government(s)

UPSTREAM
- PSC with Host Government
- JOA between Upstream Participants
- Processing /Aggregation Agreements between Upstream Participants and Service Provider

PIPELINE
- Transportation Agreement with Pipeline Owner/Operator
- FEED Agreements with FEED Contractor
- EPC Agreement with EPC Contractor
- Land Use Agreements with Host Government or Land Owners
- O&M Agreement with Pipeline Operator
- Shareholders Agreement between Pipeline Owners
- Gas Sales Agreement if ownership passes at this point

LNG SALES & TRANSPORT
- Long Term Sales Agreement (FOB or DES) with LNG Buyer
- Charterparty Agreement or Shipbuilding Contract with Ship Owner / Shipyard

LNG PLANT
- Tolling Agreement with Plant Owner/Operator
- FEED Agreements with FEED Contractor
- EPC Agreement with EPC Contractor
- Port Services Agreements (including site rights) with Port Authority
- O&M Agreement with Terminal Operator
- Shareholders Agreement between Terminal Owners
- Liquefaction Technology Licence with licensor
- Gas Sales Agreement if ownership passes at this point
LNG Structural Issues

- LNG plant ownership and operation
  - Common facilities and liquefaction trains (expansion procedures, differences in ownership of different trains, financing issues)
  - Operatorship (RPO standard, liability limits, removal)
- LNG Contracts: tolling versus buy/sell
  - Exposure of plant to market risk
  - Control of LNG marketing
  - Objective of Government (mark-up in gas chain or gas chain participation)
- Participation through gas chain
  - Alignment: upstream → pipelines → LNG plant → shipping → terminal → market
  - Competition law issues
- Timing
  - Upstream → pipelines → LNG plant → shipping → terminal → market
- Fee structure
  - Take-or-pay/send-or-pay (buy/sell model) versus capacity charge/throughput charge (tolling model)
LNG Structural Issues (cont.)

- Operating concerns
  - Allocation of plant capacity
  - Multiple trains
  - Allocation of LNG/NGLs
  - Shipping and LNG inventory balancing
- Equity versus non-equity gas
  - Fee structure
  - Priorities of plant access/curtailment
- Scheduling
- Liability
  - Processing, Gas Supply and LNG Sales
  - Liability elements
  - Risk flow-through
## Project Development

### Overview of Legal Issues

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<th>Certain Contentious Key Terms</th>
<th>Complexity of Project Development</th>
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<td>Long lead time to develop projects, achieve FID</td>
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<td>Demand by buyers for equity positions in LNG projects</td>
<td>Complex JVs, typically including multiple parties from various countries</td>
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<td>Term of contract, volumes committed and make-up/make-good rights</td>
<td>Participation by Host Government</td>
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<td>Transportation terms and vessels designed to deliver LNG</td>
<td>Government approvals</td>
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<td>Supply source flexibility for seller; destination flexibility for buyer</td>
<td>Interface issues between phases, stages and parts of project</td>
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<td>Scheduling / Seasonality</td>
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</tbody>
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### LNG Supply & Demand

- Development of legal regimes in new supply sources
- Sanctions or other political considerations impacting “free market flow” of natural gas/LNG

### Additional Issues

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• Contract between Producers and Gas Buyer/LNG Seller
  – Term
  – Quantity
  – Price
  – These terms will be based on LNG Sales Contract

• Gas delivery points

• Gas quality and composition
  – Removal of liquids
• Capacity Entitlements
  – Liquefaction
  – Storage

• Processing Fee
  – Fixed component
  – Variable component

• Annual Program

• Lifting Schedules
LNG Sales

Nature of the Market & Key Concerns

- LNG is not a commoditized business
  - There is not a developed spot market like crude oil or LPG
- Market is primarily long term arrangements
  - “Base-load” sales of LNG are usually 20-25 years
- LNG sales are often take-or-pay to accommodate project finance
- LNG projects are capital intensive
  - Fully dedicated shipping is often required
  - For an integrated project, LNG sales price needs to support Seller’s upstream development, gas transportation, LNG infrastructure, cost of shipping (if DES) and return on investments
## LNG Sales

### Nature of the Market & Key Concerns (cont.)

- Sufficient annual volume (allowing optimized shipping capacity)
- Creditworthy buyer(s)
- Assurance of adequate gas reserves
- Destination restrictions or Diversion Provisions /Profit Sharing arrangements
- “Bankable” terms
- (supports financing of infrastructure)
- Sound contractual basis governed by established ‘neutral’ law
- In Asia and MENA often English law, in The Americas often New York law
Long Term Sales Agreements (SPA)

- **Term**
  - Typically 15-25 years
  - Start Date and Conditions Precedent
- **Delivery**
  - DES/DAP – Seller arranges for shipping
  - FOB – Buyer arranges for shipping
- **Pricing**
  - Asia – fixed, subject to adjustment based on a basket of alternative fuels
  - U.S. – based on market index
- **Take-or-Pay and Deliver-or-Pay**
  - Buyer pays “take-or-pay” payment if does not take a minimum amount of LNG, but right to make-up LNG
  - Seller pays “deliver-or-pay” payment if does not deliver minimum amount of LNG
- **Quantity**
  - Minimum annual quantity, scheduled quantity, upward or downward flexibility
  - Excess quantities of LNG
Long Term Sales Agreements (SPA)

- Quality
  - Knowing Receipt versus Unknowing Receipt
  - Scope of Damages
- Scheduling
  - Annual delivery program and ninety day schedule
- Late delivery / late receipt
- Destination Flexibility
  - Historically destination fixed, increasingly flexibility (subject to upside sharing)
- Loading Port
- Force Majeure and Scope of Facilities
- Title and Risk Transfer
- Taxes
  - Customary for Seller to be responsible for taxes up to the point of delivery, and Buyer to be responsible for taxes from the delivery point onwards
  - Offshore title transfer
Short Term / Spot Sales Agreements (MSA)

- **Key Features**
  - Short term/spot LNG sales often pursuant to a Master Sales Agreement (MSA)
  - An MSA is more balanced and less customized point-to-point delivery contract, covers limited number of cargoes and time
  - Commercial terms included in separately executed confirmation memorandum (quantity, price, delivery period, specifications, details of ports and vessel)

- **Failure to deliver**
  - Remedy: replacement cost, downstream contract termination cost, or damages
  - Sole remedy and often capped at 100% of contract price

- **Failure to take**
  - Remedy: make-up costs and/or take-or-pay; or limited payment of damages
  - Sole remedy and often capped at 100% of contract price
LNG Sales

Short Term / Spot Sales Agreements (MSA) (cont.)

• Off-Spec LNG
  – Spec typically reflects the composition of domestic pipeline gas
  – Buyer and seller cooperate in dealing with off-spec LNG
• Knowing receipt of Off-Spec LNG
  – Seller must notify Buyer of the extent of off-spec LNG
  – If Buyer accepts Off spec LNG, parties agree reimbursement of treatment costs
  – If Buyer rejects or parties do not agree treatment costs = failure to deliver
• Unknowing receipt of Off-Spec LNG
  – If Buyer accepts Off spec LNG, no cap on reimbursement
  – If rejects, failure to deliver plus indemnity for loss (unlimited or up to 100% cap)
• Payment and Credit Support
  – Parent company guarantee or stand-by letter of credit are customary
  – Often include material adverse change (MAC) security provisions
• Termination
  – Does default lead to termination of all or only affected transactions?
LNG Receiving/Regasification Facilities

- Construction and Regulatory issues
- Port facilities
- Capacity entitlement
  - LNG regasification
  - LNG storage
- Ability to process LNG to local gas specifications
- Access to pipelines and gas storage facilities
Dealing with Supply Chain Risk
LNG Project Contract Chain

- **Gas Producers**
  - GSA
  - Liquifaction Facility
    - LNG Vessel
      - LNG Sales Contract
      - Processing Agreement
      - Other Contracts
    - EPC Contract
  - EPC Contractor
  - Host Government
- **Regas Facility**
  - GTA
  - Pipelines
    - GSA
    - Power Plant
      - GSA
      - Pipelines
      - Electricity Buyer
      - PPA
- **Port**
  - EPC Contractor
  - Host Government
• **Upstream arrangements**
  – Gas supply contract from producer to LNG processor or to processing capacity holder
  – Transportation contract for delivery of gas to the plant

• **Processing/liquefaction arrangements**
  – Buy/Sell – LNG processor buys gas and sells LNG
  – Tolling arrangement – LNG processor produces LNG but does not take title or market the LNG

• **LNG offtake arrangements**
  – FOB sale (at loading arm of loading terminal) versus CIF (at receiving terminal)
  – Shipping contract
• Downstream arrangements
  – Receiving terminal arrangements, for example, storage and revaporisation service agreement
  – Downstream pipeline arrangements – firm transportation contract
  – Market arrangements – gas sales agreement

• The contract chain links together the gas chain into buy/sell or service for a fee
  – Who is obliged to whom
  – Payment flows generally in reverse direction from gas flow
What can go Wrong

- Governmental approvals
- Construction delays
- Market shifts during long start-up lead time
- Force majeure events – physical or governmental
- Gas flow and payment flow breakdowns
  - End user does not put the first dollar into the chain
  - Physical breakdowns in the chain, such as shutdown of port
Should start-up risk be allocated differently than operating risk?

- Construction risk is fundamentally different from operating risk
- Ability to mitigate the two types of risk will be different
- Have to negotiate allocation of these risks separately, for example, a delay in start-up of pipeline
Who is expecting what at each link in the supply chain?

- Nature of LNG projects
  - LNG projects involve expenditure of huge amounts of money, often billions of dollars for the gas chain
  - LNG projects involve long lead times, years not months
  - due to capital intensive nature, LNG projects are usually supported by long-term contracts through the gas chain of 20 years or more

- Relationship of risk and return: There is a limit to how much risk any one link in the gas chain will take of the total gas chain liability
Most parties in chain will be investing significant capital or taking on significant contractual commitments (for example, terminalling or pipeline capacity)
  - Expect a return on investment
  - Expect to be covered to maximum extent possible on their contract liabilities

Different links in the chain will have different commercial positions
  - Links tied to the market (for example, producer, LNG offtaker, gas marketer, end user): Market based pricing, considerable risk and corresponding return
  - Links that are service providers (for example, pipelines, processor (maybe), shipping, terminal operator): Fixed & variable service charge based on capacity
Examples

- Pipeline earning 10¢ tariff would be unwilling to take full chain exposure
  - Damages that may be suffered through the chain for a pipeline failure may be 10, 20 or more times what the pipeline would earn
  - Other parties may have to absorb pipeline risk or mitigate it in other ways

- EPC contractor for liquefaction plant will limit delay damages it takes on, in light of total return earned by the contractor, or will increase contract price to cover larger exposure

Generally, the party with the biggest expected return will take the biggest risk
• Use conditions precedent to resolve risk before undertaking major investments or major contractual commitments
  – For instance, governmental approvals
  – Consider how conditions precedent run through the contract chain – all jump at once?
  – Can be exceedingly complicated with different countries being involved

• Allocate risk through send-or-pay and take-or-pay

• Step-in rights where damage amounts are inadequate (for example, pipelines)
• Force majeure
  - How far upstream and downstream

• Allocating cost risk
  - Tariff set at assumed cost
  - Can share cost overruns or cost savings (upside and downside cost risk) 50/50 or other basis
  - Or one party takes all cost risk
• Damages
  – Liquidate the damage (for example, agree to an amount for the damage rather than reimburse actual damages)
  – Cap the damages (even if liquidated) to match risk and return
  – Obligation to mitigate damages
  – Exclude consequential damages except to extent implicitly covered by liquidated damages
• Where liquidated damages fail
  – Willful misconduct (economic breach)
  – Lift limitations on damages

• Termination
  – Extended force majeure
  – Default
  – Lender issues
First Example

- End user of the gas is delayed for non-force majeure
- Expectation is mitigation and damages
- Mitigation possibilities: Regasified LNG is sold in the market or LNG cargoes are diverted to different terminal
U.S. LNG Exports
Regulatory Issues
North American LNG

2014

Operational Import Terminals (15)
Proposed Export Terminals (16)
Potential Export Terminals (22)
Existing Export Terminal (1)

Total Import Terminals: (15)
Total Export Terminals: (38)

Source: Federal Energy Regulatory Commission
Combination of new technologies for hydraulic fracking and horizontal drilling have vastly increased domestic gas supplies.

Projections vary, but many believe that the US now has more than 100 years’ worth of natural gas and will be energy self-sufficient within the next 15 years.

Dramatic effects on the US gas industry:
- Reduction/near elimination of US LNG imports
- Major decrease in domestic US gas prices
- Decrease in US energy imports
- Creation of a strong financial incentive for producers to pursue LNG exports because of higher prices for LNG on the global market
Projected US Gas Production

U.S. dry natural gas production
trillion cubic feet

History 2011 Projections


Shale gas
Non-associated offshore
Tight gas
Coalbed methane
Associated with oil
Non-associated onshore

Source: U.S. Energy Information Administration, Annual Energy Outlook 2013 Early Release
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US LNG Exports

- US LNG export projects have several key advantages:
  - Costs of construction of US export facilities generally lower because of existing infrastructure and potential to convert import facilities into export facilities
  - Currently low level of US gas prices makes LNG exports economically attractive, both for US producers and LNG buyers
  - Highly qualified construction workforce available locally
  - Developed gas market and pipeline infrastructure
  - US generally regarded as a stable legal environment
  - Widening of the Panama Canal (to be completed in 2015) significantly expands ability of LNG vessels to transport cargoes from the Gulf of Mexico to Asia, reducing travel distance from 16,000 to 9,000 miles (and lower transportation costs)

- These factors have resulted in a high level of interest, especially in Asia, for participation in US LNG projects, both equity and off-take
US LNG Export Approvals

• Government approvals needed from DOE and FERC
  – To date, 7 export approvals granted by DOE (Cheniere/Sabine Pass, Freeport LNG, Lake Charles LNG, Dominion Cove Point, Freeport Expansion, Cameron LNG and Jordan Cove)
  – 24 other companies currently seeking LNG export rights
  – Decisions will be made on a case-by-case basis
• Denial of export permit requires finding that exporting LNG would “not be in the public interest”
  – Domestic need for the gas to be exported
  – Adequacy of U.S. supply
  – Balance of trade
  – Environmental impacts
  – Job creation
  – Impact on GDP
  – Energy security
Pending Long-Term Applications to Export LNG to Non-FTA Countries Listed in Order DOE Will Commence Processing

**Last Revised 3/24/14**

<table>
<thead>
<tr>
<th>Current Processing Position</th>
<th>Company</th>
<th>DOE/FE Docket No</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>LNG Development Company, LLC (d/b/a Oregon LNG)</td>
<td>12-77-LNG</td>
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<tr>
<td>2</td>
<td>Cheniere Marketing, LLC</td>
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<tr>
<td>3</td>
<td>Excelerate Liquefaction Solutions I, LLC**</td>
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<td>Carib Energy (USA) LLC</td>
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<td>Gulf Coast LNG Export, LLC</td>
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<td>24</td>
<td>Louisiana LNG Energy LLC</td>
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** 12 Bcf/day EIA study “threshold” met
Opposition to US LNG exports principally from two sources:

- Domestic natural gas users (particularly manufacturers and chemical companies) concerned that LNG exports will significantly increase domestic gas prices (e.g., Dow Chemical)
- Environmentalists concerned that LNG exports will increase fracking operations, which they oppose (e.g., the Sierra Club)

DOE has commissioned two studies (EIA and NERA) of the potential cumulative impact of US LNG Exports

EIA study suggested 12 Bcf/day of LNG could be exported without a major impact on domestic gas prices

Subsequent EIA report released last week confirms modest impact on prices under realistic scenarios, and positive GDP impact under all scenarios
Secretary of Energy, Ernest Moniz, perceived as generally favorable to hydraulic fracking and US LNG exports:
- “A global ‘liquid’ [gas] market is beneficial to U.S. and global economic interests and, at the same time, advances security interests through diversity of supply and resilience to disruption.”
- “The environmental impacts of shale development are challenging but manageable.”
- On the legal standard: “One should move forward with [LNG export] licenses unless there is a clear public interest issue.”
- On the process: DOE should “make a transparent, analytically based evaluation application by application.”

Recent approvals of Lake Charles (August 2013), Cove Point (September 2013), Freeport Expansion (November 2013), Cameron LNG (February 2014) and Jordan Cove (March 2014) suggests momentum toward increased US LNG exports

*Quotes from 2011 MIT Study co-chaired by Moniz titled “The Future of Natural Gas” and Senate confirmation testimony
Three Paths Forward

- DOE may find that the US gas supply is adequate for both domestic needs and potential exports.

- DOE may find that supply is adequate for up to 12 Bcf/day of exports based on the EIA study but additional studies are being carried out for exports above that level.

- DOE may find that supply is adequate for up to some other specified quantity based on evidence in the record, and approve export projects up to that limit.