LNG BUSINESS STRATEGIES : TRAINING FOR PARTICIPANTS FROM SAARC COUNTRIES

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Session 7

LNG Receiving Terminals
Agenda

• LNG Receiving Terminals: Introduction to the key features
• Demand Assessment, Assurance of Off-take, Pipeline Connectivity
• Requirement of LNG Suppliers and users
• Capex and Financing of Land based terminals
• FSRU: Key features and benefits
• Comparison of Land-based RLNG terminal & FSRU,
• RLNG Tolling contracts, RLNG Contracts with aggregators / consumers / marketing companies,
• Small scale LNG (ssLNG)
LNG Value Chain

Floating Storage & Regasification Unit (FSRU)

Onshore/Land based Receiving Terminal

[Diagram of the LNG value chain]
LNG Receiving Terminals

19 MTPA of receiving capacity was added in 2020.

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<tr>
<th>+4 new terminals in 2020</th>
<th>+4 expansion projects at existing terminals</th>
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<tbody>
<tr>
<td><strong>850.1 MTPA</strong></td>
<td><strong>China and Chinese Taipei</strong> expanded existing LNG plants</td>
</tr>
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Growth in **2020**:

- Was primarily driven by existing LNG markets: China, India, Chinese Taipei, the USA (Puerto Rico) and Brazil
- 2 new FSRUs: Brazil and Croatia
- 147.3 MTPA of new regasification capacity under construction as of February 2021
Receiving Terminals Capacity and Utilization

- Japan, 210.5, 35%
- China, 79.9, 83%
- Spain, 43.8, 37%
- United Kingdom, 38.1, 38%
- Turkey, 20.1, 51%
- Chinese Taipei, 15.4, 114%
- Italy, 11, 82%
- Pakistan, 9.8, 73%
- Netherlands, 9, 77%
- Canada, 7.5, 8%
- Belgium, 6.6, 90%
- Bangladesh, 7.6, 59%
- Kuwait, 5.8, 73%
- Chile, 5.5, 45%
- Smaller Markets, 27.3, 40%
- South Korea, 136.8, 30%
- United States, 45.8, 5%
- India, 39.1, 65%
- France, 25, 66%
- Mexico, 16.8, 7%
- Singapore, 11, 36%
- Thailand, 11.5, 49%
- Brazil, 14.8, 12%
- Indonesia, 8.6, 36%
- Malaysia, 7.3, 37%
- UAE, 6, 25%
- Portugal, 5.8, 70%
- Egypt, 5.7, 0%
- Greece, 4.6, 49%

17-Nov-21
Important Issues for Consideration

• Market assessment for Demand of Gas
• Decision on Land based or FSRU
• Financial feasibility and commitment of funds
• Site conditions, land availability and EIA
• Marine and Port Infrastructure
• Within time and budget completion of Terminal
• Commitment of Off-take/Use
• Pipeline connectivity of sufficient capacity reaching to customers
• Operational efficiencies of terminal and its maintenance
Land Based - LNG Receiving Terminal

Port & Jetty, Storage Tanks
Regasification and Utilities
Typical Process Flow
Floating Storage & Regasification Unit (FSRU) Scenario 2020

• The total FSRU fleet consisted of 43 units at the end of 2020.

• Total FSRU cargo capacity at the end of 2020 stood at around 6.4 million cubic meters.

• The order book comprised of 7 FSRUs, 5 of which were scheduled for delivery in 2021.
FSRU - LNG Receiving Terminal

Unloading Hose

Storage Tanker

Regasification Plant

Gas Export

17-Nov-21
Comparison of LNG Terminals and FSRU
FSRU/Onshore LNG terminal

- FSRU enjoys advantages when considering economic efficiency, flexibility, responding time to requirements, environment protection etc.

- LNG terminal, due to it’s better peak shaving ability and expandability, can easily deal with seasonal fluctuations in demand and fulfill national strategic storage demands in comparison with FSRU.
Capex Comparison

Capex Comparison Of Terminal with FSRU (3MTPA)

<table>
<thead>
<tr>
<th>Component</th>
<th>LNG Terminal</th>
<th>FSRU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jetty including piping</td>
<td>US$60m</td>
<td>US$60m</td>
</tr>
<tr>
<td>Unloading Lines</td>
<td>US$100m</td>
<td>N/A</td>
</tr>
<tr>
<td>Tanks 1X180000m3</td>
<td>US$85m</td>
<td>In FRSU</td>
</tr>
<tr>
<td>FSRU Vessel</td>
<td>N/A</td>
<td>US$250m</td>
</tr>
<tr>
<td>Process equipment</td>
<td>US$130m</td>
<td>In FRSU</td>
</tr>
<tr>
<td>Utilities</td>
<td>US$60m</td>
<td>N/A</td>
</tr>
<tr>
<td>On-shore Infrastructures</td>
<td>N/A</td>
<td>US$30m</td>
</tr>
<tr>
<td>Land Fee and others</td>
<td>US$125m</td>
<td>US$20m</td>
</tr>
<tr>
<td>Total</td>
<td>US$560m</td>
<td>US$360m</td>
</tr>
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</table>

The cost of a new FSRU is approximately only 60% of the cost of a new onshore terminal.
The operating cost of the FSRU is usually 2.5% of capex each year, but the actual USD/day-rate will depend on the location of the FSRU. Sources quote OPEX in the range of US$20,000-45,000/day.

For LNG terminal, the cost will be US$20000-40000/day.
In general, a LNG receiving terminal will cost Owner 36-40 months to construct comparing with 27-36 months for a new built FSRU.
### FSRU vs Land Based Terminal

<table>
<thead>
<tr>
<th>Item</th>
<th>FSRU</th>
<th>Land Based Terminal</th>
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</thead>
<tbody>
<tr>
<td><strong>Industry Status</strong></td>
<td>Emerging but increasingly accepted</td>
<td>Industry Standard</td>
</tr>
<tr>
<td><strong>Capital Cost</strong></td>
<td>Much lower Capital Costs</td>
<td>Higher Capital Costs</td>
</tr>
<tr>
<td><strong>Time to in-Service</strong></td>
<td>Rapid access to International LNG</td>
<td>Longer time of Implementation</td>
</tr>
<tr>
<td><strong>Construction Timeline</strong></td>
<td>18-24 months for Marine Infrastructure</td>
<td>36 months</td>
</tr>
<tr>
<td></td>
<td>18 – 32 months for FSRU</td>
<td></td>
</tr>
<tr>
<td><strong>Operating Cost</strong></td>
<td>Higher</td>
<td>Lower</td>
</tr>
<tr>
<td><strong>Unit Regasification Cost</strong></td>
<td>Cost effective way to meet low demand or to “grow into” LNG</td>
<td>Competitive as compared to FSRU</td>
</tr>
<tr>
<td><strong>Land Acquisition</strong></td>
<td>Minimal or no land necessary</td>
<td>Land Acquisition is time consuming and expensive</td>
</tr>
<tr>
<td><strong>Environmental Impact</strong></td>
<td>Minimal Impact</td>
<td>Bigger Environmental footprint</td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td>Can be relocated and used a regular LNG carrier for trading purposes</td>
<td>Cannot be relocated to another location</td>
</tr>
<tr>
<td><strong>Scalability</strong></td>
<td>Limited Scalability</td>
<td>Easy to expand</td>
</tr>
</tbody>
</table>
Regasification Project Structure and Financing

Merchant Structure
Tolling Structure transfers LNG import business risks such as supply and market risk or foreign exchange risk, to third parties.

Construction and Operating risks related to the terminal
Key Terms of the Terminal Use Agreement

Services & Scope

• Berthing of LNG Vessels at the LNG Terminal

• Unloading and receipt of LNG from LNG Vessels at the Receipt Point

• Storage of Terminal User’s Inventory

• Pumping, regasification and send-out (as Regasified LNG) of LNG held in Storage

• Transportation and making available for delivery such Regasified LNG to the Delivery Point

• Measurement and testing of LNG and Regasified LNG

• Maintenance of an electronic inventory tracking and management service
Receipt of LNG

- Title, Custody and Risk of Loss

- Quality and Measurement of Terminal User’s LNG

- Refusal to Accept Off-Specification LNG
Operating Conditions

- No Segregated Storage Facilities
- Maximum LNG Inventory
- Commingling of LNG in Storage and Regasified LNG Stream
- Standard of Operation of terminal
- Failure to Take LNG and Delivery of Regasified LNG
- Scheduling of LNG receipts – Nomination procedure
- Nomination and Scheduling of Regasified LNG Deliveries
- Gas Quality Specifications and Measurement of Gas at the Delivery Point
- Responsibility - Downstream Arrangements
Shipping and Port Charges

- Compatibility of LNG Vessels with the LNG Terminal
- LNG Vessel Requirements
- Berthing and Unloading
- Port Dues and Charges
Comparison of Services Charges

• Terminal Fees and Charges
  • Capacity fee and a Usage Fee
  • Use or Pay Charges

• Treatment of Fuel Gas and Lost & Unaccounted Gas
Other Provisions

- Invoicing and Payment
- Taxes Provisions
- Insurance provisions
- Terminal Owner Failure to Receive LNG or Redeliver Regasified LNG
- Liability clause
- Force Majeure related provisions
- Default and termination provisions
Small-scale LNG Pivotal to Meeting Demand

Small-scale LNG covers terminals with a liquefaction/regasification capacity < 1.0 MMTPA and vessels with < 60,000 cbm capacity

**Small-scale LNG vs Conventional LNG & Pipeline Supply**
- Lower investment cost
- Faster time-to-market
- Greater operational flexibility

**Growing Interest in Small-scale LNG Driven By**
- Lower greenhouse gas and SOX emissions
- Divergence in price of crude oil vs LNG
- Government policies promoting natural gas
- Flexibility in logistics & transport

**Small-scale LNG Taps Stranded Demand**
- Small-scale power generation
- Demand centers located in remote areas such as residential & industrial demand
- Land and marine transport fuel
- Places isolated from pipeline grid

50 mmscfd FRU in Bali, Indonesia

2,200 cbm bunkering barge in Jacksonville, USA
LNG Trucking Connects Stranded Customers

LNG-by-truck operations address an unmet need of utilities and industrial customers

**Off-grid Customers:** Complete LNG virtual pipeline solution, including LNG procurement, LNG transportation and on site LNG processing equipment

**Power Generation:**
- LNG supply during the summer in response to seasonal spikes in demand
- Begin service ahead of time by providing short-term supply

**Mining:** LNG supply to off-grid customers

**Pipeline Disruptions:**
- Gas supply for pipeline maintenance, peaking requirements, integrity testing, pigging operations, plant shutdowns and natural gas customers supply interruptions
- Mobile solutions for pipeline supply disruptions using mobile vaporizers, storage containers and LNG transport trailers
Cost of Implementing Small-scale LNG - Various Factors

- Transport Volume (Demand)
- LNG Price
- Transport Distance
- Facilities Cost
- Personnel Expenses
Thank You

Q & A