

Online Training of “SAARC Professionals on LNG Business Strategies”

15th - 19th November, 2021

Question & Answer sessions

Question	Answer
What is the status of TAPI pipeline? When it would be in operation? Would you please give an idea about the costing of sub-sea gas pipeline?	a) TAPI Pipeline is under implementation. Completion is subject to financial tie-up for all contracts, expected to take another 3/4 years. b) Estimated capital costs of sub-sea pipelines vary between US\$ 25,000-100,000/ km. 20 to 50 MMSCMD.
How big is a "Big Market Size"?	Big is a relative reference. A competitive market can be described as one which has at least 10 active companies participating and which trade at least once in a week. In terms of volumes, a big market size is about 20 to 50 MMSCMD.
What is the possibility of SAARC Member States jointly pursuing augmentation of gas supplies for its Members?	There are several opportunities for SAARC Member States to work jointly. An energy hub would be helpful in benchmarking pricing of energy i.e., power, gas etc. SAARC nations can consider to have their own affordable benchmark and not pay Asian premium. There are already cross border power sales happening. India is already having power trading exchange for many years and a gas exchange has started functioning recently and West India LNG price is now being reported internationally.
What is the possibility of SAARC member countries jointly pursuing in securing sustainable gas supplies for its members?	Buyers can jointly influence the market and seek better price and other supply conditions. With increasing demand of gas, SAARC countries gas requirement would be substantial and it would be worthwhile to jointly pursue the efforts however, it may not be welcomed by the sellers. However, this is a gradual process. First, the countries may commence bilateral or trilateral cooperation and trade. This would require the infrastructure and commercial agreements. Successful intra-regional trade will lead to developing understanding and postulates for any commercial international trade, and subsequently for establishment of Gas Hubs / Exchanges in the region.
If churn outs are higher, what will be the effect on end consumers price?	Higher churn rates indicate higher liquidity in the hub. A churn rate of 10 is taken as a maturity threshold level of a hub. Higher churn rates of a hub demonstrate its ability to function as a price benchmark even beyond its market area.
How energy mix decision may have impact on having gas hub in the Asian or SAARC countries?	As discussed in session 1 of the training program, there is a clear direction of increasing contribution of natural gas in the primary energy mix of countries including SAARC nations. This

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	would mean larger volumes of gas will be consumed over the years. A gas hub would therefore be even more relevant for SAARC nations.
In your opinion, how SAARC countries can move forward in terms of regional level integrated planning of energy sector so that optimized energy mix can be ensured for each country?	Inter-connected energy network needs to be developed comprising of all forms of energy i.e., power, oil & gas and even coal. Seasonal & regional energy requirements and surpluses can be gainfully shared & utilized as per standard international practices.
As you have pointed the opportunities for collaboration among SAARC countries, is the regional level institutional capacity sufficient to benefit from such opportunities?	Regional Institutional set up will not be sufficient for such energy sector collaboration. It would require larger commitments to work together. It would be best driven by private sector companies on commercial considerations.
Is there any rule for creating relation between LNG Storage and Regasification capacity?	The terminal capacity is planned to meet the demand of the gas and need to plan throughput of R-LNG accordingly. Terminal capacity depends on two major aspects i.e., receiving capacity and Vaporization capacity. The receiving capacity has further two components: Maximum possible number of available unloading slots and capacity of unloading (rate). This analysis is usually done for month (30 days). The two are therefore related and need to be considered while deciding on the capacity of the terminal. The vaporization capacity is further dependent on pumping rate of LNG and vaporization system.
Why pipeline operators/developers are tagged as Monopoly? Pipelines are capital intensive projects and other players just want to utilize the infrastructure on short term basis, sometimes by supplying the gas to existing customer of pipeline operator.	Pipelines are classified as monopolies as a single pipeline is the least expensive way to serve the market for any conceivable quantity shipped. Thus, once a pipeline is laid it would not have any competition in transportation and delivery of gas from any other means till it reaches capacity saturation. Competition can only come once third-party access is allowed for a certain portion of the pipeline capacity.
Developing gas storages in depleting gas field, would it be cost effective while knowing that not all gas could be recovered and considering other associated operational requirements.	Gas storage in depleted gas fields is popularly used in US. Interstate gas pipelines operators particularly use it to storing, load balancing and supplying. A base volume natural gas is already in the depleted fields. A proper system of inventory management exists. It is cost effective and evolved system.
How much LNG on truck is safer as compared to other fuels which are also transported in the same manner?	Transporting LNG by truck is safe. Typical capacity of truck varies between 7 to 15 tons. Due to unique properties of LNG, it is actually safer compared to other petroproducts like LPG or diesel. In case of any spillage LNG would evaporate off quickly while LPG and diesel stay at spill site and are major fire hazard.
How many LNG carriers can be berthed with land-based LNG Terminal?	I believe that by LNG carriers you mean LNG ships. The berthing of ships at any terminal is dependent on the number of jetties that are available at terminal. Many terminals have more

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	than one jetty. A given safety protocol is followed for berthing of LNG ships in sequence even when there is more than one jetty.
In case of virtual pipeline can loading of LNG be made simultaneously in more than one LNG Truck?	LNG terminals have a number of bays to load LNG trucks depending on the demand. Several trucks can be loaded at a time at an LNG terminal.
Acceptable limits for Boil off Gas?	The boil off in a containment system should be minimized. The new generation LNG ships have achieved boil off of less than 0.1%. A level of around 0.12% boil off is acceptable.
Conversion cost of diesel trucks to LNG trucks?	There is no exact information available. As per some estimates in India, conversion cost may be around INR 8-10 lakhs.
Cost of setting up a modification facility for conversion from diesel to LNG operated trucks?	There is no information available. Some heavy vehicle manufacturers are working on this aspect. An Indian auto manufacturer had displayed its LNG fueled truck some time back.
What is considered reasonable IRR for such projects?	12%
What is the role of Regulator in virtual pipelines?	There are no regulations so far. The Indian regulator had issued notice that any entity can build LNG satellite station anywhere in the country.
What are the operating temperatures and pressure of LNG in ISO Tanks during transportation? and for how many days can LNG be kept in iso tanks?	These tanks have vacuum insulation and performance may vary from tank to tank. Normally a good design tank would have a pressure of about 1-2 bar after filling at site and it may take about a week to reach a pressure of 7 bar if kept as such without use of LNG. These tanks have a Pressure release valve which will pop up at 7 bar to release some gas. If the gas is used then it can hold LNG for much longer time. In poorly designed tankers where the insulation is poor the pressure of 7 bar may be reached in 2-3 days.
What is the status of converting gas into hydrogen and adding to pipeline specially using stranded fields or flare gas in world and specially in India?	It is in R&D stage.
Are merchant terminals in India exempted from third party access. If yes on what grounds?	There are no regulations so far on LNG business and terminal operators are free operate as per their business model. However, some operators are offering third party access as also capacity booking.
How many transmission and distribution companies are in India and do they have separate network for their consumers?	There are 4 major and some minor gas transportation companies in India and around 46 distribution companies in CGD Business. Each distribution company has marketing exclusivity for first 8 years of its operation, for consumers up to 0.5 MMSCMD. Other large consumers can be supplied gas by either the transmission Co. directly or by the distribution company.

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Is gas pipeline tariff regulated or negotiated between the parties? What is the gas pipeline tariff mechanism in India, any illustration/ example? Also, what is the rate of return for pipelines used as common carrier?	Gas pipeline tariffs are regulated in India. Please refer to presentation for illustration. 12% post tax return on investment is norm. Tariff as fixed by regulator is assured for use of pipelines as common carrier.
How maximum pipeline capacity utilization is ensured and its impact on transportation tariff?	No assurance of maximum pipeline capacity is there. Tariff remains same for the period it is set. Can be reviewed only after the term is over. On bid out pipelines tariff is set for 25 years.
What is the rate of return for pipelines used as common carrier?	12% post tax return on investment.
Commercial and safety goes together, how PESO and PNGRB coordinate on safety?	There is no conflict or confusion on their roles. PNGRB sets the regulations and standards and PESO approves the technical designs and construction.
What are some of the software used for pipeline capacity calculation?	SCADA YOKOKAWA, PIPELINE STUDIO
May we create an energy hub inside SAARC region countries? Will it be helpful?	There are several opportunities for SAARC nations to work jointly. An energy hub would be helpful in benchmarking pricing of energy i.e., power, gas etc. SAARC nations can consider to have their own affordable benchmark and not pay Asian premium. There are already cross border power sales happening. India is already having power trading exchange for many years and a gas exchange has started functioning recently and West India LNG price is now ben reported.
Does Regulatory Framework should differ significantly between government company and public investor? If so, how?	The most important role of a Regulator is to have same regulations for everyone whether government company or a private entity. Create a level playing field for everyone.
What is the optimum capacity for setting up SSLNG facility?	The optimum capacity for a SSLNG distribution is 25,000-400,000 TPA. As far as small-scale liquefaction is concerned, it is not installed anywhere in India as off now. The stranded gas in North East is being used by local customers to the extent possible. Some small-scale compression to CNG is also attempted by some companies.
In terms of Gas volumes? would like to understand from Indian experience.	Discovered small fields say 10,000 to 100,000 SCMD
At what minimum utilization, terminal regasification services be tolled to multiple users? if a single user is utilizing about 80 to 90% of terminal capacity, is it feasible to allocate ragas	The objective of the terminal operator is to maximize the capacity utilization. There is no restriction on allocation of regas capacity even if 80-90% is being used by a single user. The available capacity can be allocated on term basis or offered for tolling.

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capacity to other users as it will increase operational and commercial issues?	
Restrictions by sellers on the buyers for cargo diversion are found antitrust laws of EU and Japan. For the purpose they have drafted a “model diversion clause based on risk-profit-sharing” to comply with the antitrust laws of EU and Japan. Can you enlighten us how this model diversion clause based on risk-profit-sharing will work and helpful to reduce the buyer risks while exercising this clause?	The model “diversion” clause with a profit-sharing element, has been drafted so as to comply with the antitrust laws of European Union (“EU”) and Japan. The background rationale is that parties to an LNG sale and purchase agreement (“LNG SPA”) may adopt this model clause as a part of their LNG SPA. The model clause is not a standalone clause but requires that it be integrated into a more comprehensive LNG SPA. In particular, this requires that parties include appropriate definitions in the contract and in doing so take the applicable law and its implications into account. While the profit-sharing mechanism in model clause reflect the additional costs and risks incurred by the seller and the buyer due to the diversion, in some instances the quantification of each cost and risk is time consuming and might therefore make the diversion much less likely to take place. In other cases, there can be unquantifiable risks, which are unique to each project. As such, in order to enable the contractual flexibility needed for a timely diversion and in order to increase the liquidity of the international LNG markets, the model clause adopts an approach where the parties to the contract have an option to either quantifying each cost and risk or, alternatively, choose to use a profit-sharing mechanism to encompass these costs and risks, whether known or unknown. Model clause has taken an approach where parties agree on a mutually acceptable percentage. In agreeing on the percentage, the parties should keep in mind that the share of the profits allocated to the seller should be premised to cover additional costs and risks the seller has to incur.
What are the other commodities which are indexed for LNG pricing other than oil?	LNG pricing has been attempted to be linked with some petroproducts which customers have been using. It has also been attempted to be linked with power tariff by power producers. There is some linkage attempted with ammonia by fertilizer sector.
Will hybrid pricing mechanism help Asian buyers to face oil price fluctuation?	In view of oil price volatility, many LNG buyers have moved to a hybrid pricing mechanism involving oil linkage and Henry Hub linkage.
What would be the most important factor while going for spot or long-term contract when demand at the downstream is uncertain?	In view of uncertain & fluctuating demand the risk is greater. Many buyers go in for locking only 50-75 % of demand on term basis. Remaining requirement is planned through spot market. Also, some of the contract conditions may be appropriately modified to inbuilt more flexibility particularly on volumes, period of supply and diversion rights to deal with demand uncertainty.
We know the supply security is the main concern for the buyer, but how much seller is concerned about the same. For example, the clauses of default are drafted in such a way that can	These days it is regarded as a buyers’ market which means that LNG is abundantly available and sellers are keen to contract sales. However, seller is equally concerned on supply continuity as buyer. The contract conditions are mutually agreed by seller & buyer after detailed discussion, negotiations. The buyer must try to visualize all possible conditions before signing off particularly

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<p>jeopardize the supply security by getting away by paying some of the cargo amount, while if the buyer defaults, it is on 100% take or pay. The slope of the contract is not exactly reflective of the price quoted by the supplier. The comments are requested on this aspect.</p>	<p>on pricing and non-performance. We are generally wiser and learn from issues that come up in contract implementation.</p>
<p>Internationally what percentage should be long-term and how much should be spot in a portfolio? any thumb rule?</p>	<p>There is no internationally accepted thumb rule ratio. Each LNG consumer needs to work out long term requirement, price risk appetite, security of supply, number of suppliers and prevailing market conditions to decide about the mix of long term / short term or spot quantities.</p>
<p>My question is what are the risks that the seller incorporates into the premium or the margin in LNG pricing in a long-term contract?</p>	<p>The project developer establishes the LNG project on financials assuring certain margins and would be happy to secure that margin. The volatility created in the market due to the reasons other than supply-demand equation or transportation disruptions can dramatically change market pricing and distort it. There are, however, debatable issues such as imposing 'Asian Premium'.</p>
<p>What is the maximum penalty or liquidated damages be imposed on seller if it refuses to supply owing to operational constraints or any other reasons constituting seller's failure to deliver under a long-term contract? We have observed that such liquidated damages are very less as opposed to the value of the cargo.</p>	<p>All contract conditions particularly the pricing & performance and consequential non-performance & penalties /LD on non-performance are mutually discussed, negotiated and finalized between the seller and buyer. Certain conditions of operations fall beyond the control of seller & buyer and such conditions are listed in the mandatory clause of 'Force Majeure' in the contract. If the operational constraints fall under such 'Force Majeure' clause then it is not considered non-performance. If the reasons of operational constraints do not fall under Force Majeure, then there would be corresponding penalty or remedy incorporated in the contract and need to be followed. Liquidated damages are part of negotiations while finalizing the contract and should be carefully decided. It is therefore important to visualize all possible situations & market conditions before signing a contract.</p>
<p>What cost components form part of RLNG terminals tolling charge?</p>	<p>Tolling charges of a regas terminal would depend on many factors Capex of the terminal, financing model, size of operations, Opex etc. Based on these it would work out its storage & regas charges. Terminal operators may add some margin and energy charges for regasification to it and charge as tolling charge. A recently commissioned regas terminal of 5 million tons capacity may charge about US\$ 1.00 per MMBTU as regas tolling charges.</p>
<p>Can you please comment on the composition of the Lean and Rich LNG at an appropriate time during this presentation?</p>	<p>Examples of representative composition of lean and rich gas was shared in the session 1 of the training program.</p>

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Which countries produce Lean and Rich LNG?	Each oil & gas producing basin is unique in composition. Gas composition in different basins within a country may be different. Qatar, Trinidad & Tobago and Papua New Guinea produce LNG with richer C2+ components. US LNG is largely shale gas based which is lean.
Is Third Party Access practiced in LNG Liquefaction facilities worldwide?	I believe you mean tolling by third party access. The answer is no. Tolling is popular in liberal, open markets like US and North Europe.
What are the new countries coming to the LNG market as exporter in the near future?	Mozambique, Tanzania and Canada have LNG projects in different stages of constructions and are likely to join the LNG producing countries club.
How long the life of LNG fleet/vessel?	The normal design life of an LNG ship is about 25 years. Beyond the design life the ship is subjected to through inspection of all major components through dry docking in a shipyard to assess its sea worthiness as per international regulations of ISGOTT, ICS, OCIMF. There are international certified agencies to assess and certify sea worthiness of the ship. However, with the emergence of new technologies, retrofitting of many efficient sub-systems (propelling systems) may be required during the life-time of a vessel.
What is the average IRR for LNG liquefaction project?	Generally, the liquefaction plants have return of about 12-15%.
More specifically, the IRR for Canadian project.	From the Canadian LNG, Kitimat (BC) data as available, Gross Margin was around US\$ 1.5 over DAT JKTC at US\$ 8.5 /mmbtu. (17.64%), but IRR would vary depending upon the utilization and indexing terms for pricing and actual movement of the indexed markers. However, in general Canadian projects may find it challenging to be competitive compared to US projects due to local social groups association in the projects and export tax on LNG.
Do you feel that the economies of SAARC who are the net consumers should invest in liquefaction facilities somewhere globally or remain as simple buyer?	Backward integration by investment in a liquefaction plant or even upstream gas production have been followed by several companies particularly Japanese to address the issues of security of supply and preferred treatment. In case the investment comes with the freedom to lift equity LNG and/or better pricing or other advantages then it is worthwhile.
Strategically, what will be a better option for non-LNG producing countries especially in the Asian region to expand their (existing) regassification facilities with a more longer-term view - (i) develop more FSRU based terminals, or (ii) invest in on-shore terminals?	LNG is produced by countries having abundant gas reserves. SAARC region is oil & gas deficit region and is therefore a major gas (LNG) importing region with increasing number of storage and regas terminals. Each country must develop its own plan to meet its long-term gas requirements. A comparative analysis of advantages of Floating FSRU based terminal vs Land based terminals was discussed in the sessions 1 & 7 of the training program. Land based terminals may address long term gas requirements better and may be advantageous, however, for early gas supply needs a FSRU based terminal is more suitable.
How do you see Virtual Pipeline as a solution for supply of energy to industries? which countries	Virtual pipeline is a good solution for gas consuming industries not connected with pipeline network. LNG by road trucks is becoming popular to meet the gas demand of such customers.

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<p>have successfully implemented the virtual pipeline projects. kindly elaborate on the safety requirements of the same.</p>	<p>Many countries like Japan, Korea, China and Norway are using this concept for long time. In SAARC region, India is supplying LNG to dozens of customers by road trucks for the last several years. The safety requirements are the same as for any type 2 storage tank and a vaporizer in a regas terminal, however these operations are of much smaller scale compared to a regular LNG regas terminal.</p>
<p>What is the biggest FSRU in operation?</p>	<p>The biggest FSRU in operation is of Qmax size which is 260,000+ cubic meter LNG storage capacity. It is owned by MOL.</p>
<p>So far, I know all the LNG terminals in India are onshore. So, what are reasons behind less terminal utilization? Are there any weather issues on terminal utilization?</p>	<p>Majority of terminals are onshore in India. There is a FSRU based floating terminal in operation also. The utilization of terminals varies from over 100% to a low level of about 20%. Low utilization is essentially due to delay in creating pipeline connectivity with targeted gas markets. There is no weather-related issue or impact.</p>
<p>How do you see the competition of small-scale LNG (LNG by trucking) vs large scale (FSRU/ Land Based) in the SAARC region? How big is the LNG by Trucking, a challenge for the large-scale Terminals?</p>	<p>There is no competition between LNG by road and FSRU/ Land based LNG import terminal. LNG is imported, stored and regassified in the LNG terminal and the regassified LNG is supplied to customers who are connected with pipeline network. In LNG by road, LNG is loaded into the trucks at the terminal and supplied as LNG to those customers which are not connected with pipelines and need gas. LNG by trucking is much smaller in volume compared to supply of R-LNG for example by a 5 million tons capacity terminal operating at 50% capacity.</p>
<p>what are the barriers/challenges for production and promotion of LNG?</p>	<p>The challenges faced in the LNG value chain have been shared in the sessions 1 ,2 & 3 of the training program. However, the general challenges in Liquefaction are availability of gas reserves, financing a project, timely completion of liquefaction plant, Marketing tie-up of major part of produced LNG on long term with customers etc. The number of LNG producers and also consumers has grown over the years showing good growth. As far as LNG consumers are concerned, two issues are important i.e., availability of infrastructure, and the price arbitrage and switching costs for consumers from existing fuels. Other aspects are the Environmental norms or Regulatory restrictions on prevailing fuels being consumed.</p>
<p>what is the average cost of various stages of LNG Value chain?</p>	<p>It varies across the countries. A historical cost analysis has been done by OIES in its paper "Outlook for Competitive LNG Supply OIES NG 142". An illustration from the study was also shared in the Session 3.</p>
<p>What are the average tolling fees for LNG in various parts of the world?</p>	<p>There is no concept of an average world tolling fee. Tolling fee depends on various factors viz cost of the liquefaction facility, financing structure, economy of scale, taxation etc. The reported tolling fee for liquefaction in a US project is typically around US\$ 3.00 per MMBTU. The tolling fee for a regas terminal similarly would depend on various factors and typically may be around US\$ 1.00 per MMBTU.</p>

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<p>Disparity in energy consumption has been noticed when comparing developing and developed countries. Natural gas dominates the energy share in developing countries. So how would you comment on the future planning in terms of exploring sustainable and economical fuel choice for such countries.</p>	<p>We discussed in 1st session of program that the energy transition trends in the world is towards a cleaner energy with clear targets with time lines for achieving reduction in emissions. UN sustainable goals also say affordable energy and protecting the environment. Therefore, the developing countries also need to plan their energy choices under above guiding principles. Developing countries are constrained to opt for the cheapest energy source including agricultural wastes and biomass. As long as Natural Gas / LNG is cheaper than the Petroleum products, it makes a natural fuel choice. For sectors like Fertilizers, Refineries and Petrochemicals, it replaces Naphtha if it is cheaper. Role of natural gas in the energy mix is therefore going to be significant for long time. Adoption of cleaner technologies and shift to renewable energy sources is imperative</p>