

FIRST LNG IN INDIA: DAHEJ A SUCCESSFUL CHALLENGE AND A NEW ERA FOR INDIAN GAS MARKET

L'ARRIVEE DU GNL EN INDE: DAHEJ UN PARI REUSSI ET UNE NOUVELLE ERE POUR LE MARCHE DU GAZ INDIEN

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ABSTRACT

Indian market traditionally depended on the domestic sources of gas supply during last three decades. A segregated market development has taken place during this period near the source of gas production. It is during the last one decade when the gas supplies became short of natural gas allocations in the country and Government of India decided to import natural gas through LNG route. The first study to import LNG in the country was carried out with the help of Gaz de France in early nineties to import LNG at the suitable coastal locations in India.

Dahej – State of Gujarat, was identified as the preferred location for import of LNG based on the consideration to meet the shortfall of natural gas for the existing market in Gujarat and along HBJ pipeline.

Government of India, in July 1997, approved the formation of Petronet LNG Limited with the participation of four large national Oil & Gas Companies viz IOC, ONGC, GAIL, BPCL, Strategic partner (Gaz de France), LNG supplier and public.

This was the beginning of a real challenge to develop such a project for the first time in the history of the Indian gas industry.

RESUME

Durant les trois dernières décennies, le marché indien du gaz naturel a été approvisionné par des ressources gazières nationales. Ce marché s'est développé de manière fractionnée à proximité des sources de production de gaz. Depuis une dizaine d'années, les ressources gazières nationales ne permettant plus de satisfaire une demande croissante, le Gouvernement Indien a décidé d'importer du gaz naturel sous forme de GNL. Les premières études pour l'importation de GNL en divers endroits des côtes indiennes ont été réalisées au début des années 90 avec l'aide de Gaz de France.

Dahej, dans l'Etat du Gujarat a été retenu de manière préférentielle pour les premières importations de GNL de manière à apporter les ressources manquantes pour le marché existant du Gujarat et le long de la canalisation HBJ.

En juillet 1997 le Gouvernement Indien approuvait la création de la société Petronet LNG Limited avec la participation des quatre plus grandes compagnies pétrolières et gazières indiennes: IOC, ONGC, GAIL et BPCL, un partenaire stratégique: Gaz de France et la participation ultérieure du fournisseur de GNL et d'autres acteurs privés.

Ainsi a commencé l'histoire d'un vrai challenge pour développer le premier projet de ce type dans l'histoire de l'industrie gazière indienne.

INTRODUCTION

Energy demand in India has seen a steady growth for last 50 years and it is during last few years gas demand has become higher than production capacity from domestic resources. To sustain the growth of its economy, India needs to increase the energy resources and supply. While Government of India has launched an extensive exploration and production program under New Exploration Licensing Policy it has also decided in the 90s to import natural gas to meet the increasing gap between resources and demand. In 1997, the Government of India asked four major public sector companies: Gas Authority of India (GAIL), Oil and Natural Gas Corporation (ONGC), Indian Oil Corporation (IOC) and Bharat Petroleum Corporation Ltd (BPCL) to develop jointly LNG importation projects. A project company, Petronet LNG Ltd. (PLL) was created and incorporated in 1997 to develop the first LNG importation project. Early 1998, Gaz de France was selected as a strategic partner to bring its experience and know-how in LNG projects.

Market studies demonstrated that importing gas in Gujarat was making sense, as a potential market was developed in Gujarat itself but also all along the HBJ gas transmission pipeline operated by GAIL, crossing several states including Delhi. Kerala and neighbouring states such as Karnataka and Tamilnadu were identified as a second possible market due to a dynamic industrial growth. Therefore, Dahej in Gujarat and Kochi in Kerala were selected as preferred locations to set-up the two firsts LNG receiving terminals of PLL.

The selection of Rasgas as LNG supplier and the signature of a 25 years LNG supply contract (LNG SPA) in June 1999, of 7.5 Millions tons of LNG per year was the first stone of the extremely challenging project of Dahej

WHY AN LNG PROJECT

India has a large unmet demand of natural gas and such demand can be materialised in short run with the import of LNG, as the gas imports through pipeline is considered as long-term option. Government of India focuses on the strategy for development of fuels like natural gas through domestic exploration, pipeline and LNG imports. It is presumed that the competition for gas export to India will build as large reserves of gas in neighboring countries like Iran, Bangladesh, Myanmar and Yemen etc., are yet to be monetized. The import of natural gas through pipeline route has been under consideration since last one decade and is yet to materialize due to various reasons. In this regard LNG imports have become more feasible due to its inherent transportation advantage, besides some of the large LNG producers are very closely located to the coastline of India.

LNG being a viable and environment friendly fuel has been considered as the major fuel in the energy basket by countries like India. The growth of supplies of LNG to Indian

markets will depend on the capacity to absorb the volatility of energy pricing and various contractual terms. Both Buyer and suppliers have to make mutually agreeable strategies for the future development and growth of natural gas business for mutual benefits. The long-term adjustments of share of energy basket have been projected for the future energy supplies where LNG imports and supply of domestic energy are given significant role.

The large gas reserves in Middle East countries are obvious potential supply sources for India due to the lower transportation cost, particularly on the West Coast of India. North field in Qatar is the biggest gas field in the World and thus the country has a large potential for development of these gas reserves for emerging markets like India. With such capabilities Qatar can become one of the largest supplier of LNG for India, besides other suppliers from Middle East. Iran is also in the process of developing the large stranded gas reserves in the South Pars field for gas supplies to India. These are some of the strategic considerations, why emphasis has been given for monetising of LNG projects and Dahej LNG project has taken a lead role in this regard.

THE CHALLENGES

Dahej: First LNG Project in India

The project of Dahej was the first LNG project initiated by the Indian Government and the four Indian Oil and Gas companies sponsoring Petronet LNG, usually developing projects independently and on their own balance sheet. One of the challenges has been to develop and coordinate between Indian Navratnas (Nine Jewels) companies to set-up a common project through the project company Petronet LNG. The second challenge for Petronet LNG and its sponsors has been to identify, to understand, then to manage efficiently all the requirements for such a complex project: LNG supply contract, development of a grass root LNG Terminal and a port, sea transportation, regassified LNG offtake contracts, port operation and management and last but not the least the financing of the project. The handling and co-ordination of the various components of the project was a complex task where Gaz de France, as a strategic partner has contributed by bringing its experience and know-how in importation of LNG.

The structure of the project is shown below:

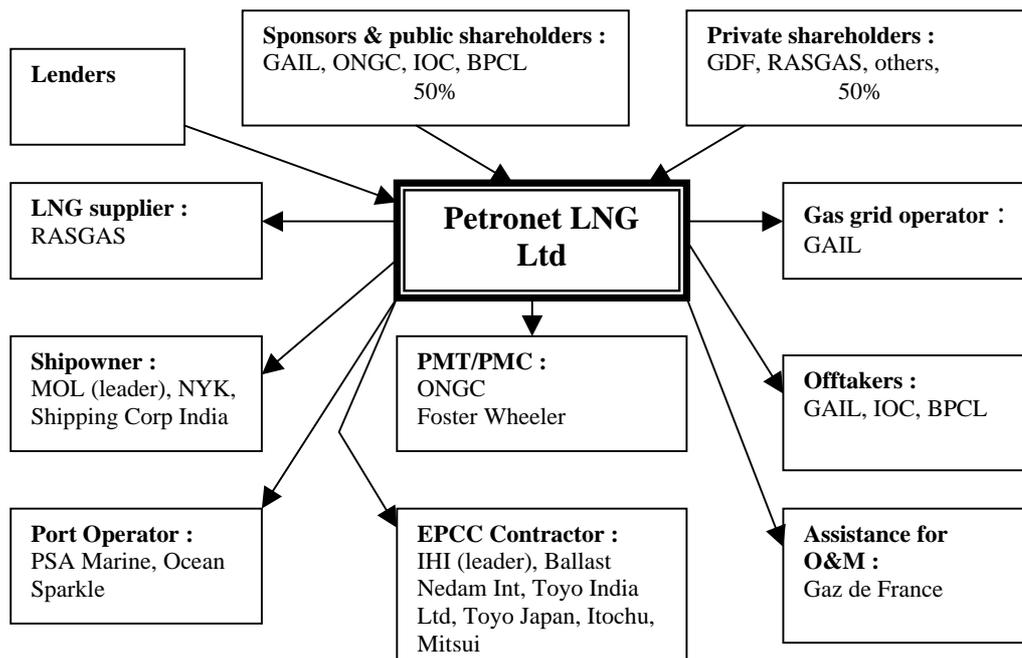


Figure 1: Project structure

Selection of an LNG Supplier

Petronet LNG Limited for the first time in the history of LNG business tied up LNG supplies through a global competitive bidding route. Petronet LNG Limited floated a global tender for supply of LNG in 1996-97, where all the leading parties in LNG business responded for the LNG supply. Based on the pre-qualification criteria the major LNG producers in Middle East and Asia Pacific region were selected to offer the commercial and technical bids for supply of 5 million tones of LNG for Dahej and 2.5 million tones of LNG for Kochi project. RasGas was selected on commercial considerations and technical capabilities they have for developing new LNG supplies. After the award of supply contract both Indian and Qatari Governments played the most critical role in resolving some of the complex issues and it the support of both the Government which resulted in signing of Worlds largest LNG supply contract for LNG quantity of 7.5 Million tones per year in July 1999 between Petronet LNG Limited and RasGas.

Site Selection

PLL carried out detailed study to identify suitable locations in India, having potential markets for the gas in the vicinity and keeping in view the existing gas infrastructure. Currently in India gas infrastructure exists for production and transportation of about 100 MMSCMD of gas. Most of the transmission infrastructure is installed in the north west of India for transportation of gas to shore from the western offshore fields and the transmission of this gas to end users. By far the largest of the transmission systems is the HBJ (Hazira-Vijaipur-Jagdishpur) line. This pipeline (2,300 km) transverses the states of Gujarat, Madhya Pradesh, Rajasthan, Uttar Pradesh, and Haryana. In addition to the HBJ pipeline, there also exist regional gas grids of varying sizes, in the states of Gujarat

(Cambay Basin), Andhra Pradesh (KG Basin), Assam (Assam-Arakan Basin), Maharashtra (Ex-Uran Terminal), Rajasthan (Jaisalmer Basin), Tamilnadu (Cauvery Basin) and Tripura (Arakan Basin). Fig-2 gives the location of LNG terminals and HBJ pipeline system.



Figure 2: Location of LNG Terminals

The future requirement of major gas sector infrastructure as well as other facilities would depend upon the mix of modes of gas imports i.e., LNG and pipeline gas. There would be a few permutations and combinations depending upon the mix of LNG and pipeline gas in the total system. Based on this study and the available network of pipelines, two locations namely Dahej in the state of Gujarat (5.0 MMTPA) and Cochin in Kerala (2.5 MMTPA) were finalized.

Dahej site is a strategic location where many public / private sector companies like GCPTL, IPCL & Indo-Gulf have developed port facilities. The presence of these facilities offers the advantage of sharing various port related facilities. Also the area, besides having potential for new consumers, has many existing liquid fuel consumers, which are ready to switch over to natural gas. Detailed studies and bathymetric surveys were carried out by the Indian National Hydrography Office to select and to validate the most suitable access channel to Dahej for large LNG Tankers through the Gulf of Khambat. These studies confirmed that the best route for large tankers was through the central channel which allows sufficient water depth at any time and safe sailing all along the 60 Nautical miles long route inside the gulf from open sea to site. The selected channel has been marked and nautical instructions updated.

An Innovative LNG Terminal

The basic engineering and detail feasibility report were carried-out in 1998 by Sofregaz, a French engineering company, assisted by Sogreah, also a French company, expert in marine engineering. Gaz de France was assisting PLL for reviewing the studies and for selection of final design.

Two site characteristics created new challenges. One was the morphology of the shore with a flat beach and a slope being less of 1/600 for first 1700 meters then suddenly assuming a significant slope of 1/20. The second one was the high content of silt in

suspension of the seawater and also some metallic components, all due to numerous rivers, which are flowing in the Gulf of Khambhat as Narmada river mouth few kilometres south of Dahej. This shore un-usual bathymetry led to the choice of a 2,500 meters long jetty to reach a depth of –16 meters at jetty head. A 650 meters long island type breakwater has been designed to shelter the jetty from southwest long period waves which could be generated in the open sea then propagated in the Gulf of Khambhat.



Figure 3: Jetty

Regarding the regassification process, the long trestle, high tide range & bad quality of seawater led to abandon the classic open rack vaporisers. After technical and economical studies, it was decided to use basically shell & tube vaporizers (STV) and air heaters arranged in a close loop with glycol water media and few submerged vaporizers (SCV) for emergency during cold weather. Use of heat recovery system from captive power plant gas turbines exhaust supplying hot water to the SCVs has also been decided to optimize the efficiency of the regassification facilities, when the power plant is running. This is the first time that a base load LNG receiving and regasification terminal will be using ambient air heating of this magnitude for LNG regasification.



Figure 4: Air heaters

The LNG Terminal of Dahej has been designed for a capacity of 5 Million tons of LNG a year and fitted with two above ground storage tanks of 160,000 m³ gross capacity (148,000m³ net capacity), a 32” unloading line, four 16” unloading arms (3 liquids, 1 gas), 7 STVs and 2 SCVs of a total capacity of 571 tons LNG /day and a 15 MW captive power plant comprising 3 gas turbines. The plant capacity is expandable to 10 MMTPA by adding a third LNG Tank and regassification facilities.



Figure 5: General view of the Terminal

The Construction of Dahej Project

An international call for Tender to select an EPC Contractor was elaborated by PLL and Gaz de France during summer 1999 and nine consortium were pre-qualified. PLL received six bids and carried out a very systematic and transparent selection process with the support of Gaz de France. As a result of this very competitive selection process, the EPC contract was awarded to the consortium led by IHI (Japan), comprising Ballast Nedam International, Toyo Engineering of India Ltd, Toyo Engineering Japan, Itochu (Japan) and Mitsui (Japan) at a very competitive cost. The contract was signed mid-January 2001 and the engineering and site grading started immediately. As the LNG SPA was planning the first LNG deliveries by very beginning of 2004, the contractual time schedule for the construction was really challenging with only 36 months for the construction, followed by 2 months for commissioning and start-up of commercial operation after a successful availability test. From there, the EPC contractor has a 3 months period to complete the performances test at 100% capacity than get the Provisional Acceptance Certificate as shown in figure 6 below.

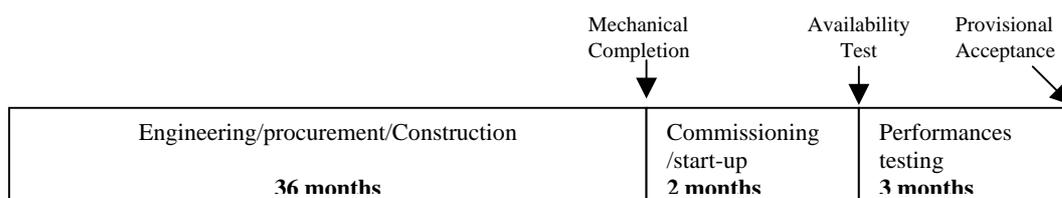


Figure 6: Project Completion Schedule

A Project Management Team was constituted by PLL with the support of ONGC and Foster Wheeler was selected as a Project Management Consultant. Gaz de France provided support and advice to PLL all along the engineering and construction process when particular difficulties were to be solved.

Construction of the jetty by Ballast Nedam International and of the LNG tanks by IHI has been perfectly managed and ahead of schedule. The civil structures and process facilities were designed and erected by Toyo Engineering in a satisfactory manner without particular problems. All along the project, the construction of breakwater for

sheltering of the jetty had some difficulties and was seriously delayed but not affecting the start-up and the operation of the terminal.

The Transportation of LNG

The LNG supply Contract (LNG SPA) being an FOB contract, various ways for the transportation of LNG was examined. As it was the first LNG transportation project in India, none of the Indian shipping companies were experienced in operation of LNG Tankers. It was to finally decide to go for the selection of an international Ship -Owner associated with an Indian shipping company and to enter into time-charter with the selected party. According to Indian Government requirements it was specified that a special purpose company incorporated in India had to be created and a transfer of technology from the foreign company to the Indian party to be done within 5 years after starting the operation. Another requirement was that the Bidders should get the financing of the tankers and also select a shipyard and negotiate a building contract during the selection process in order to meet the time-constraint requirement.

The studies having established that 2 LNG Tankers each of 138,000-m3 capacities were required to transport five MMTPA of LNG between Ras-Laffan in Qatar and Dahej (1300 Nautical Miles), a technical specification was established. The call for tender was prepared by PLL with the support of Gaz de France and an international consultant and was issued on June 2000.



Figure 7: LNG Tanker “Disha” under construction

Here also, time constraint was very tough to meet the project deadline, considering the construction time for new LNG Tankers to be made available by end 2003. After reception of the bids from 4 pre-qualified consortiums, by the end of November 2000, the selection process was carried out by PLL in association with Gaz de France in four months only. By March 2001, the Ship-Owner consortium led by Mitsui OSK Lines, associated with NYK and Shipping Corporation of India was awarded and Time-charters agreements signed for both the LNG tankers on 31st March 2001. Simultaneously, a building contract was signed between the Ship-Owner consortium and the South Korean shipyard owned by Daewoo Shipbuilding Marine Engineering, with a delivery schedule of December 2003 for the first LNG Tanker and December 2004 for the second one. The challenge was met thanks to the motivation of the Bidders, all first ranking international players in the LNG tankers owning and operation.

Development of a New Port in Gujarat

Dahej is a small port of Gujarat where there are no public port infrastructures. Two private jetties are operated in the Northern vicinity of the LNG Terminal respectively by Birla-Copper since 1998 and Gujarat Chemical Port Terminal Company Ltd since June 2001. Both the companies have tied-up a contract for their port operation with same private group Ocean Sparkle Ltd.

To operate its own LNG jetty, PLL decided to select its own port operator with an experience in handling of LNG Tanker. PLL prepared a specification for port operator services and an international call for tender with the assistance of a port consultant, Port Authority of Nantes-Saint Nazaire (France) and the support of Gaz de France.

The Port Operator services comprise the pilotage, towing and mooring of LNG Tankers and also the maintenance of the marine facilities of the LNG jetty. A consortium led by PSA Marine (Singapore) and Ocean Sparkle (India) has been selected based on strict criteria of experience and cost effectiveness and a 10 years contract signed on November 2002. Four tugs of 65 tons bollard pull each have been supplied by the Port Operator, out of which two are fitted with fire fighting facilities and pollution fighting equipment. Marine crafts vessels such as pilot boats and mooring launches have been built in India for the purpose. The Port Operator is also in charge of running a Port Operation Centre installed in the LNG Terminal from where he is able to communicate with the LNG Tankers as well as pilots, tugs and neighbouring jetties to know about the traffic and ensure the safety of navigation and manoeuvring of the LNG tankers as well as during their stay at berth.

The Challenge of Marketing LNG in India

A large and developing country like India, which has complex problems of managing 1000 million people, where food subsidy is the inherent part of social obligation of Government and energy sector is also contributing to a large extent for growth of agriculture sector. It is a difficult process to move from a Government controlled regime to market-determined price regime immediately, unless adequate market infrastructure and social security is provided. Oil sector price liberalisation was implemented in phased manner and now gas sector is also on the path of liberalisation

Gas Sector in India was deregulated for private participation and is moving towards market determined price mechanism. There has been number of new gas discoveries by private parties during the last five year and some of them have been put on production. The private producers are charging market price from the consumers, though the volumes are not very large. The gas discovery in East coast deeper offshore by Reliance would also set a new market price dynamics. As the gas market grows, the natural gas is likely to replace the high cost petroleum products and create a new demand of its own.

Dahej project structure has been developed considering market constrains and has been designed to use existing infrastructure and capabilities to facilitate LNG supplies to consumers at competitive price. Though Indian market has lot of appetite to consume large volume of LNG, but rigidity of contracts, linkage of LNG with crude oil prices are the areas of concern for the consumers of gas who are used to fixed price of gas supply. However, the consumers are responding fast to accept the contractual obligations of LNG supply, as LNG will be more beneficial compared to other fuels. Dahej project has also

given a new confidence to develop LNG projects in India. The new LNG terminals besides Petronet 5 Million tones LNG terminal at Dahej are LNG project by Shell at Hazira, which is at the advance stages of construction. The LNG terminal by Petronet at Kochi in Kerala on West coast and Indian Oil Corporation (IOC) with Petronas at Kakinada on East coast is under active consideration.

Getting Project Finance, a Long but Successful Story

Developing first LNG project and arranging finance for a project where chain of activities from liquefaction, shipping, regassification and pipeline transportation is involved is a challenging task in developing gas markets. It is certainly a difficult task to develop a project and finance it for all such chain of activities specifically, where the revenue stream generates from the regassification company. Petronet LNG Limited was approved by the Government with a share capital of 285 million US\$, where the share of NOC's was 50%. Initially, financing for Dahej project was arranged by consortium of Indian bankers for 300 million US\$ for short period of 3 years, so that once the project is completed and goes on stream the same funding can be made for long term. Now the project is mechanically completed and the full funding has been arranged by the consortium of Indian bankers replacing the short term loan.

Petronet LNG Becomes an Operating Company with the Support of Gaz de France

It was decided that the Operation and Maintenance (O&M) of Dahej would be carried-out by PLL in association with ONGC, one of the sponsors of PLL, bringing its long experience in operation in the gas sector. As Dahej LNG Terminal is the first LNG plant to be operated in India, the assistance of an experienced LNG operating company was strongly desired by the project Lenders. Gaz de France, as a reputed LNG operator, but also strategic partner and shareholder of PLL since the beginning of the project, having a perfect knowledge of the project was selected. A technical services agreement between PLL and Gaz de France was negotiated and signed on October 2003. Through this agreement Gaz de France had to provide theoretical and practical training to the operators of PLL and to assist them during commissioning and start-up and during at least one year after taking over of the plant by PLL. With the assistance of few Gaz de France experts, deputed at site, the O&M team of PLL prepared the future operation methodology based on high standards of organization based on a safety management system.

CONCLUSION

The Indian energy market is under the evolving stage and the market would take some time to adjust to the new price dynamics of deepwater, piped gas and imported LNG. As India stands competitive to receive LNG, the ways and means to be found that how large volumes of LNG can be brought at competitive price to various locations for meeting the gas demand. The energy market in India is in the process of transformation from controlled price to market determined price and various initiatives are being taken by the Government of India to make the market transparent and investor friendly for the benefit of new players.

Petronet LNG Dahej project for import of 5 MMTPA of LNG on the West coast of India is one of the innovative project to supply LNG on competitive terms to market in

India by procuring LNG and developing facilities on most competitive terms in order to give the best supply price to consumers. Petronet LNG project can be the role model project for emerging markets and will show a path to build LNG projects under consideration by developers in new and emerging gas markets world wide.

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