WGCPARIS2015
WORLD GAS CONFERENCE
"GROWING TOGETHER TOWARDS A FRIENDLY PLANET"

26th World Gas Conference | 1-5 June 2015 | Paris, France

12 years of Cooperation between PETRONET, India and ELENGY, France

From training to cooperation

Authors

Rajender SINGH, Director (Technical) Petronet LNG Limited, India

Alain GOY Head of technical department Elengy, GDFSUEZ, France

Table of Contents

Background and review of initial co-operation actions

During late 1990s decision was taken by Indian Government that for meeting the energy need of the country, increasing the share of gas and energy security of India there is need to import LNG. For this reason in 1997 it was decided to create a special purpose company (i.e. Petronet LNG Limited), which was mandated to create LNG storage and regasification facilities in India.

It was decided by this company to select the LNG supplier through global tender route and based on the above process RasGas, Qatar was selected as long-term supplier of LNG. Initially till the company formally came into existence the activities were executed by a dedicated team from GAIL India, thereafter the company (Petronet LNG Limited) was formally incorporated on 2nd April 1998 with GAIL, INDIA, BPCL, IOCL & ONGC being the promoters with 12.5% equity each making a total of 50%. Remaining 50% equity was decided to be kept with Private sector.

Since at that time there was no LNG expertise available within India it was thought prudent to select a strategic partner having expertise in LNG field. Therefore through a detailed process in 1997 (i.e. even prior to formal creation of Petronet LNG Limited) GDF was selected as a strategic partner, which later became equity partner also.

Background of Gaz de France (GDF)

Since 1965, GDF was operating LNG terminals with success (total availability of its 3 LNG terminals in Le Havre, Fos Tonkin and Montoir de Bretagne, zero personnel or materiel accident in operation, zero damage to third parties or impact on neighboring). GDF was a pioneer in Europe, with the involvement in the first ever commercial LNG chain between Arzew, Algeria and first ever LNG terminals in Europe (Canvey Island, UK, and Le Havre, France)

Le Havre, 1965

Fos Tonkin 1972

Montoir de Bretagne, 1980

At that time, GDF is also internationally known for the research and development on LNG process (ageing, mixing in tank, liquefaction, safety simulations) and GDF does its own engineering for LNG activities.

And GDF is also a long term buyer of LNG and a reliable partner, able to sign long term gas purchase agreements under "take or pay" clauses

At that time, GDF decided to extend its activity to international market, and particularly in the infrastructure design and asset management based on its historical roots, LNG being one of them.

In 2008, GDF became GDFSUEZ, and import terminals were dedicated to its 100% subsidiary, ELENGY, and we will see that links were not affected by these changes.

Gaz de France (now ELENGY/GDFSUEZ) as strategic partner assisted PLL in conceptualization, design, construction and commissioning of India's first LNG terminal at Dahej, state of Gujarat.

PLL, as explained above, is promoted by four Indian Public Service Companies, with vast experience in designing and operating Oil & Gas installations. GDF supplemented PLL with the additional skills in cryogenics and LNG, with some specific features which are usually not available with a consultant.

GDF remained with PLL for all steps of the project including pre-project phase of site selection, concept of the facility, interaction with various authorities for preliminary and final approvals. After detailed reviews sites of Dahej in Gujarat and Kochi in Kerala were selected.

The First French engineer expatriate in Delhi under long term contract in PETRONET premises brought to the Indian project team its previous experience of operation manager in Montoir LNG terminal, and ,of course, the full back office of GDF.

Time was dedicated to the site selection and the basis of design of the future facility.

FEED was performed by Sofregaz, subsidiary of GDF at this time. PLL team in this regard was led by its First Director (Technical).

The Second expatriate, brought its commercial expertise and contributed to assist PLL in:

- the long term procurement of LNG from Qatar, under an FOB(free on board basis)
- the use of certain access channels to the Gulf of Khambat
- the setting up and contractual aspects of the international tender for the chartering of two new-built LNG Carriers
- the Project Financing of the Dahej construction project

It is time to point out the similarities between LNG chain from Bethioua (Algeria) to Montoir (France) and the chain between Ras Lafan (Qatar) and Dahej (India)

- Same distance
- Similar conditions of shipping
- Similar size for 2 vessels
- Similar trading conditions (free on board)

In that respect, it was relatively simple to transfer the right procedures, order of magnitude or conditions, from an experienced LNG European company to a new comer, the first Indian importer of LNG; the transfer of references, this open and permanent benchmark, was a permanent advantage for PLL in the progression of its pioneering enterprise.

In 1999, with the end of the FEED studies, the next step was ready i.e. the call for tenders.

A Third expatriate, with both experience in LNG operations, and engineering management joined the flag.

He was instrumental for the preparation of the first Technical Services Agreement, dedicated to the preparation of the EPC contract for the Dahej terminal.

He headed a team of French engineers along with the Indian engineers which was in charge of:

- The writing of the tender
- The pre qualification of possible contractors
- The call for tender
- The clarification with the bidders

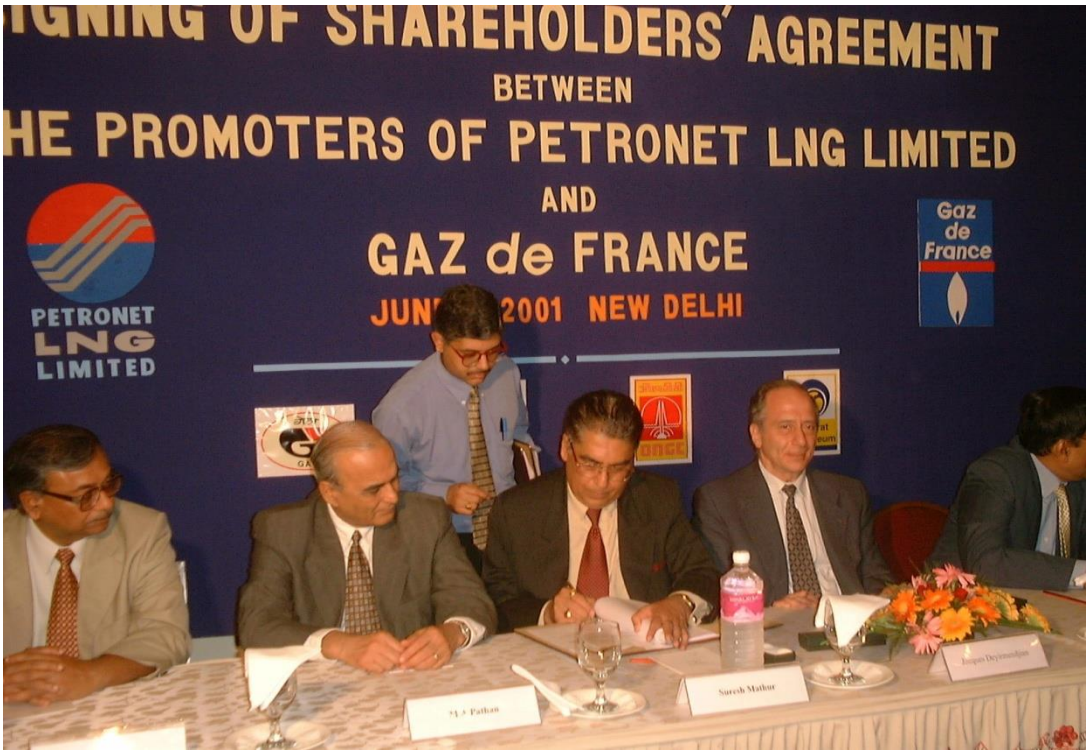
Every clarification was produced by the team and validated by the Project leader.

After a fair competition and transparent process, the Japanese consortium led by M/s IHI was awarded the EPC contract on 28th December, 2000.

PLL desired to keep ELENGY as Owner's partner and maintain the independent status of PMC. Therefore again following a transparent process FOSTER WHEELER, UK was selected as PMC, sharing activities with a dedicated team from ONGC.

It was also keeping in view financial involvement of GDF

June 2001 the shareholder agreement was signed



Time of EPC contract

GDF members were assigned to work as owner's representative in order to validate the detailed engineering. Some specific instances in which inputs from experts of GDF were critical are:

- Air recirculation and plume simulation around the air heaters, first regasification of this type in the world
- LNG Berth detail design, including berthing and mooring dolphins, due to local weather conditions and stress by the ship on the structure, and the final design of the ship hull in view of fenders position.
- Breakwater re-design due to the shore configuration and soil conditions

Finally the construction of the terminal was completed within cost and schedule in December 2003 and the terminal was put into service in early 2004.First Cargo arrived at Dahej on 30th Jan 2004.

During construction period, GDF representatives focussed on the commissioning preparation, on technical side and on organisation (advice of comparison between several options for operation assignment such as: operation by PLL itself, as a company, or by GAIL, one of the 4 parents companies, or somebody else, external)

Finally, the first option was selected.

Then GDF provided to PLL the job description of the staff of the terminal, with skills questionnaire and criteria of selection in view of the recruitment.

In parallel, GDF brought his experience on LNG tankers. GDF representatives worked with PLL on ships specifications, writing the call for tender, evaluation of bids, technical evaluation (with French experts from GAZOCEAN, subsidiary of GDF).

And in addition, GDF contributed to the preparation of the long term time chart agreement with ship owners.

Once again, we should notice a similarity between Montoir, with silty Loire river, and Dahej, with even more silty Cambay gulf water.

In Montoir, GDF experienced from 1980 the accumulation of mud in the ballast of the 2 LNG tankers coming regularly under the long term contract. For that reason, GDF made several experiments of flushing systems to avoid an excessive weight of mud and to clean the ballasts during laden voyage. This expertise was of course totally transferred to PLL in the specifications of its new built LNG tankers.

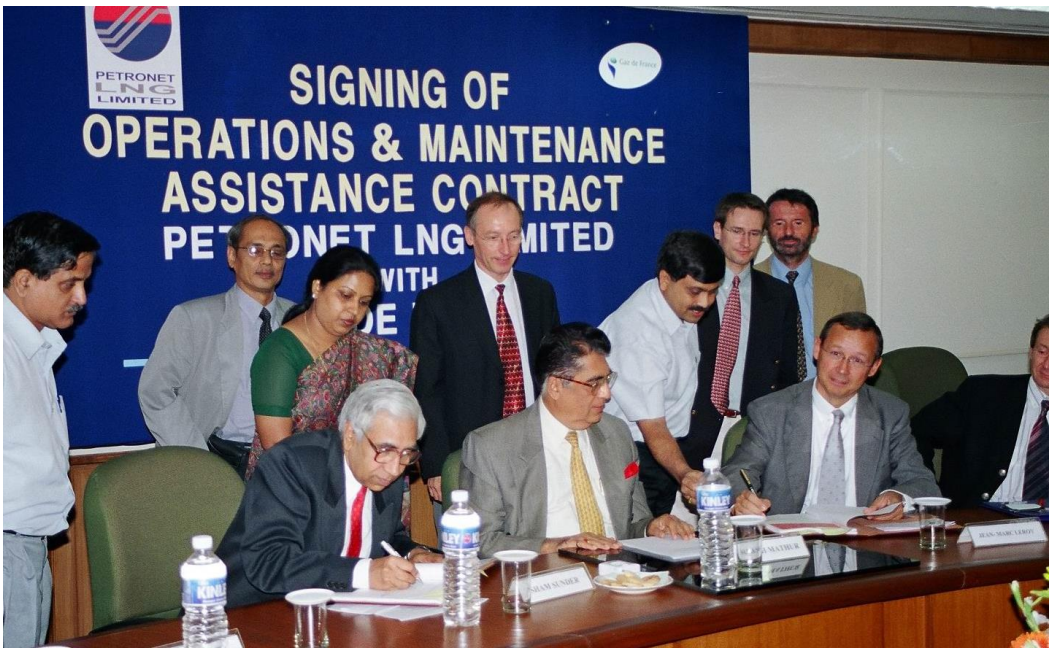
The order for 2 ships was awarded in 2002

The "Disha" was delivered on 10th January, 2004 and the first LNG cargo was delivered in Dahej on 30th January, 2004.

Towards long-term co-operation

After this first TSA dedicated to the EPC phase, GDF was asked by PLL to prepare a second TSA, dedicated to the operation.

The same was signed on 1st October 2003.



The purposes of this TSA were:

- Preparation of the operating and maintenance policy
- Theoretical and practical training of PLL operators, in India and in France
- Technical assistance during commissioning and writing of safety procedures
- Full time technical assistance during the first year in operation

Thus, Elengy contributed to the construction and commissioning phases for the terminal, by providing a range of services such as:

- training of the PLL personnel to operate the new terminal, with class room training, followed by practical training in Elengy two French terminals, at Fos Tonkin and at Montoir in Bretagne,
- Posting of engineers at Dahej to assist PLL during the critical and intensive commissioning phase, and then for taking ownership of the new plant. This was done

in 2 phases : first the writing of operation and maintenance procedures, including the emergency safety plan, and second by a permanent presence on site.

- after the commissioning, training of the maintenance managers in France in 2005, in rare and specific maintenance tasks, including practical disassembly and inspection of equipment

Training of the PLL Dahej terminal staff

Theoretical in Delhi

Then, practical in France

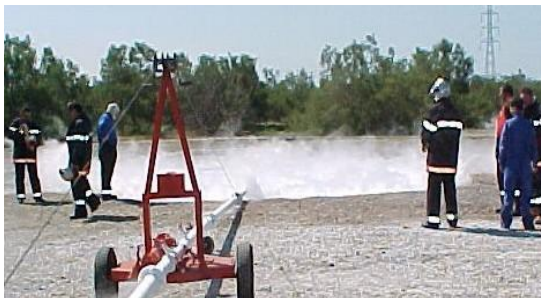
In control room

In workshop

This training gave the opportunity to check the involvement of the staff and the high educational level of these people.

The most difficult aspect was to accept the French food during these periods in France!

The fire fighting training gave to each person the opportunity to see real LNG when the pool is prepared, to see the plume of flammable vapours above the pool and to feel the heat of the large flames during the fire fighting itself, in a very safe manner.



For that reason, this training was continued every year since 2004, with the objective to train each new comer in PLL.

Commissioning

Although PLL team had personal with varied experience in commissioning of hydrocarbon facility (most of PLL team members came with prior experience of Fertilizer sector), yet experience of LNG was missing. GDF team supplemented the same, and that resulted into smooth commissioning of Dahej terminal

Four people from GDF remained in Dahej during commissioning, 4 shift managers from GDF terminals teams directly included in the Dahej shift teams for one year.

The commissioning was a success, due to the quality of the works by the contractor, the involvement of the personnel of PLL and the good preparation of this critical phase.

No leak, no accident, no loss

- 30th January, 2004 : first call of the ship
- 8th February, 2004 successful cooling down of the tanks

Marine operation

Once again, in a spirit of total confidence, PLL asked GDF to perform an audit of the DISHA LNG tanker (vetting) and an audit of the fitness of the berth

The mission occurred this time in order to benefit from the long stay of the LNG Tanker "SS Disha" alongside and the commissioning operation of the plant and gives inputs useful for the future regular operation of the PETRONET LNG LIMITED (PLL) Terminal.

This audit was led by a marine surveyor after being Master of LNGC Carrier for 14 years and the GDF senior LNG expert in the area of shipping and ship / shore interface having previously participated in the shipping evaluation of the project at end of 2000 and beginning of 2001, in the FEED phase.

PLL can thus have confidence in GDF as its people are aware of the features of the project, by previous involvement, and GDF involvement not only as reputed consultants, but also as share holders.

At Dahej port, there are very specific requirements to be met when unloading an LNG tanker, especially during monsoon conditions, which ultimately depend on the local weather conditions: safely unloading a gas tanker in monsoon conditions, particularly tankers arriving for the first time, was the focus of a real transfer of knowledge between Elengy and the Dahej port officer. This work gave operating limits for the berth (time of arrival according to the tide, conditions of berthing according to monsoon winds, mooring specific features with long lines, control of the ship during level variations with the tide, …)

These operating limits gave successful results.

PLL asked GDF to perform audit dedicated to this marine interface in 2007, 2008 and 2009 to help, train and control operators on this sensitive activity.

It is important to note that PLL achieved successful 1000 unloading in year 2014 (26th December 2014), at 120 % of initial capacity, without any accident on berth.

Since the signing of First TSA in October, 2003, PLL and Elengy began working together regularly under an annual technical service agreement, focusing on two main areas:

- to perform audits on safe and efficient operational management at Dahej
- to provide training on fighting LNG fires for workers at Fos Tonkin in France, as PLL has adopted Elengy philosophy of first emergency response directly by shift operators in the terminal;

The audit was conducted by Elengy experts in safety management systems as well as operations.

PLL found these services invaluable. The relationship between the two companies was thus characterized by a spirit of co-operation. PLL, being new to LNG terminal operation could benefit, from Elengy advances in safety management.

Audit in safety management

GDF is also assisting PLL for safety audit, the scope of which had been:

- To evaluate Safety Management System
- Six Key Activities are considered
  - Major Hazard Identification
  - Personal Training
  - Operational Control
  - Management of Change
  - Emergency Planning
  - Performance Monitoring

This first audit has been performed by GDF personnel expert in Safety System.

Indeed, the Context was of severe requirements in Europe, with the proof of implementation of a safety management system in oil and gas plants. For that, GDF selected a safety referential made by DNV, Norway, and called ISRS (International safety rating system).

For that reason, GDF had already an experience in that domain.

A general management system has already been set up for recent ISO and OHSAS certifications. As a consequence, it seems interesting to further progress in a critical domain related to safety i.e. Major accidents prevention.

Every analysis was carried out with the management of the plant and with some representative operators, temporarily involved in short working groups. A GDF referential, based on best practices for these activities, has been used as a guidance document. Its translation was implemented after the PLL decision to organize this safety management statement on Dahej Terminal.

The objective was the production of a report on the situation of the Dahej LNG Terminal for each of these key activities. The report identified some comprehensive progress actions to be submitted to the PLL management for implementation.

This audit benefited PLL in proposing some specific actions to strengthen the safety management system that has already been set up in relation with the OHSAS certification.

Audit in operation and maintenance management

As per Technical Service Agreement extension between GDF and PLL, GDF will provide assistance on operation and maintenance whose main objective is to follow up the implementation of the Standard Operating Procedures (SOP) elaborated by PLL with the assistance of GDF during the first year of operation, thus assisting PLL in monitoring the progress of the plant management system.

In order to implement this task, four one week missions on site by GDF operation expert with quarterly intervals have been scheduled during the year 2005/2006

Observations/recommendations have been compiled according to the following plan :

1. Fluid lockout management

2. Standard Operating Procedures application

3. Mockdrill scenario

4. Testing procedure for valves

5. Site visit report

Since then and until this day, an O&M audit has been performed every year by GDF to the benefit of PLL. The major benefit to PLL team being an independent assessment of preparedness of its O&M team and infusion of fresh ideas.

Engineering reviews for the Kochi contracts

The construction of PLL's second terminal at Kochi in the state of Kerala was very well organized, under three different EPC contracts:

- first for the two tanks, the major items of investment,
- second for the remainder of the LNG regasification process,
- and the third for the marine structures,

Elengy assisted PLL by providing services to verify the interfaces specified in the contract document and ensuring that the contracts are properly organized and structured, and they were successfully and simultaneously executed, with practically no issue involving interface conflicts, even the management of lay down area was very smooth.

Towards co-operation with new arrivals

Over 12 years, organizations see various people come and go, but the TSA has stayed the same, both in terms of its cost structure (with a 10% share in its capital, Elengy considers PLL a partner and provides services) and its volume of work with some changes as required with the elapse of time.

The continuity was made by direct actors, in charge of these activities. Direct relationship was built, based on mutual trust. It helps a lot of course to transmit the spirit of the co-operative TSA.

After the successful commissioning of Dahej, the first expatriate left Delhi and came back in France, to manage the construction program of the new LNG terminal under EPC contract. The lessons learnt in India on Dahej case were of course transmitted to its team.

This first representative has been replaced by a second one, based also in Delhi, who played active part of the continuity of the TSA

Interesting case of reverse training

In April 2004, visit of the brand new LNG terminal of Dahej by the team in charge of the EPC contract management for the new LNG terminal of Fos Cavaou (this terminal was ordered by GDF in may 2004, and cooled down in 2009)




A second case of reverse training

The future shift managers of coming new LNG terminal Fos Cavaou went to visit a brand new modern terminal in Dahej, in 2007

These people were recruited to start operation of New LNG terminal under construction. They were trained of course in existing Elengy terminals. But the detailed visit of a brand

new LNG terminal was extremely appreciated, in order to prepare the commissioning. Especially the interaction with PLL O&M team provided fresh ideas to GDF team.

Extension to new activities

Plant health monitoring review

Dahej is now more than 10 years old and PLL management rightly thought of a program to organize monitoring of equipment health and measure to prevent ageing: first mission in 2014

Kochi terminal

After its successful cooling down in September 2013, PLL applied the same good recipe to its terminal and asked Elengy to perform audit in safety management and operation management. Of course, the reference is now Dahej management system, but independent auditors are preferred

A collaboration of equals

As the time is passing by both PLL and Elengy are facing similar difficulties such as low send out from Montoir and Kochi gas terminals, though for different reasons, and they are jointly working for practical solutions such as using terminals as multi-service depots (imports, exports, cargo division, retail LNG) and managing the boil off (without flaring) during low send out periods.

At Kochi the LNG terminal was ready for operation by Feb 2013, but the connected RLNG evacuation pipeline and hence the consumers were still not ready. Even till now the major segments of the pipeline are not ready for various socio-economic and political issues. The consumers that are connected to the completed portion of pipeline can consume only about 2 to 5% of capacity of the terminal. For this purpose PLL had to think about various options for handling BOG as the send out is much below the minimum required for re-condensation.

At Kochi PLL has installed minimum send out compressors (temporary API 11 P compressors on hire and permanent API 618 compressor) for handling the BOG during low send out. Other schemes are being developed in consultation with GDF. These include installation of economizer exchanger between BOG compressor and re-condenser to reduce the minimum turn down requirement.

Also PLL has utilized the previously kept option of reloading the LNG into small scale LNG carriers for the purpose of using the terminal as storage option and at the time of writing this paper two such re-loadings have been carried out.

Case of Montoir and Fos Cavaou

After a very busy period in 2008/2010 in Montoir (with a record on unloaded quantities), the LNG transit goes East, toward Asia, and the unloaded quantities in Montoir decreased seriously. At the same time, for commercial reason, some customers were interested to use Montoir terminal as a hub for their precious product. In that view, after several changes in the process lines, Montoir staff was able to perform successfully several reloading of cargoes. Same opportunities occurred in Fos Cavaou terminal, and reloading flowrate has been increased last year. And in addition, "trans-shipment" was performed in Montoir, a transfer of LNG between 2 large tankers, from berth to berth.

Fos Cavaou terminal, with reloading enhanced capacity

Montoir terminal, transhipment operation

Based on that experience, ELENGY was able to make a good practice and transfer it to PLL. Nothing is really revolutionary, but the global picture gives a solid frame for safe operation on the following technical aspects

- Long period storage and consequence of LNG quality : simulation of ageing
- Boil off gas management : pressure in tanks and in tanker
- Flaring quantities : calculations and measurement, to be discussed/evaluated /agreed before commercial operation to avoid dispute
- Control of operation in the terminal : control room procedures
- ESD sequence dedicated to loading
- Ship shore communication plan
- Custody transfer

Zero send out compressors

In Montoir and in Kochi, initially no provisions were made for interruption of send out, in a perspective of continuous operation. Facing a new situation without send out, the boil off of the terminal cannot be recondense with LNG.

In both plant, a similar solution was adopted: short term hired high pressure BOG compressors, connected temporarily to the natural gas grid are installed for temporary service, in order to stop the flaring.

And in the meantime, study of a permanent solution, with permanent HP compressor for the same service. Elengy and PLL were able to exchange in real time on solutions.

Opportunities for co-operation in different matters and conclusion

There are future plans to construct new LNG terminals outside India, and the lessons Elengy and PLL have learned from this TSA will be repeated as they co-operate on new industrial schemes, such as "small-scale" terminals serviced by vessels.

Knowledge is the key to success, and here we have people who work together to turn that key, opening new doors and new markets.

Co-operation is a fragile equilibrium, and partners need to fight everyday to keep the balance. GDF was obviously attracted by a large Indian market, full of development opportunities. GDF was proud to be selected by the First Indian LNG importer, PLL, and made all its effort to succeed in the partnership.

The Technical service agreement was a way to:

- Stay on the side of PLL, and not at the place of PLL
- To give the credibility of their new activity in India to the lenders
- To be consistent with the position of shareholder in PLL.

The multi cultural context of this TSA gives opportunity for men and women to increase their understanding and their skills, in both companies.

Now the trust is built and PLL + Elengy are ready to go together elsewhere to provide operating support, based on their experience.