

Completion of the World's Largest LPG Plant

Overcoming many obstacles during the construction boom, IHI successfully completed the last phase expansion of liquefied petroleum gas (LPG) plant for SONATRACH, thereby deserving client's trust for building the world's largest LPG plant.

The LPG plant was constructed during a span of thirty years in the industrial zone of Arzew in western Algeria. In 1984 IHI completed the Phase I of the project with an annual production of 4 million tons. Phase II of the project was completed in 1998 with an additional annual production of 2 million tons. On 3rd August 2010, IHI delivered the final phase, Phase III, with an annual production of 3 million tons and achieved completion of the world's largest LPG plant with a total annual production capacity of 9 million tons.



Full view of process trains

Location of the plant

The site of the LPG plant is located on the Mediterranean coast in the industrial area of Arzew in western Algeria.

A two and half hours direct flight from Paris will take you

to Oran, a major city on the northwestern Mediterranean coast of Algeria, and the second largest city of the country. A further 40 minutes' drive east from Oran airport will take you to the port town of Arzew, a long way from Japan.

The Arzew industrial zone is Algeria's primary industrial

zone with energy industrial complexes lining 20 km of the Mediterranean coastline. The first of these plants was built in the 1970s and all plants are operated by the national company, SONATRACH.

In a corner of this industrial zone lies the world's largest LPG plant, the GP1Z Plant, which spans approximately 2.5 km from east to west and approximately 0.6 km from north to south.

IHI's presence in Algeria

IHI first set foot in Algeria in the late 1960s and in 1973, IHI completed Algeria's first LPG plant with an annual production capacity of 800 000 tons in the port town of Skikda, 400 km east of the capital, Algiers. Building on this achievement, IHI has engaged in plant construction in Arzew for more than 30 years and completed several important projects:

- 1984 : Phase I of GP1Z Plant, four process trains with an annual production capacity of one million tons each, six tanks for storing LPG products, a ship loading facility for loading products onto tankers and related facilities.
- 1985 : Renovation of an old low-temperature ammonia storage facility.
- 1998 : Phase II of GP1Z Plant adding two process trains with an annual production capacity of one million tons each and related facilities.
- 2006 : IWPP plant, combining a gas turbine-based power generator with a seawater desalination facility that uses the Heat Recovery Steam Generator.
- 2008 : Diagnosis and renovation of an old LPG plant built by another company.
- August 2010 successful completion of performance tests for three additional process trains with an annual production capacity of one million tons each as well as two PC type LPG product storage tanks, the first in Algeria.

Through the ever-changing international situation, IHI has consistently managed the entirety of the turnkey projects, including plant engineering, procurement, transport, construction, and commissioning (Turnkey projects are a form of contract in which plant facilities are provided

complete and ready to operate as if just by turning a key.).

The foundation for the GP1Z Plant started with the site preparation that was carried out during the construction of Phase I project. The Phase II project was carried out during a period of political instability and under highly volatile and stressful conditions.

The challenges of the Phase III project that was recently completed was the timely delivery amidst the global boom in plant construction.

As in the first two phases, IHI successfully completed Phase III project on time and satisfied the required levels of economic and environmental performance, such as an annual production capacity of one million tons per train, sufficient purities and yields of products, the requirements related to power and fuel consumption as well as the exhaust gas constituents.

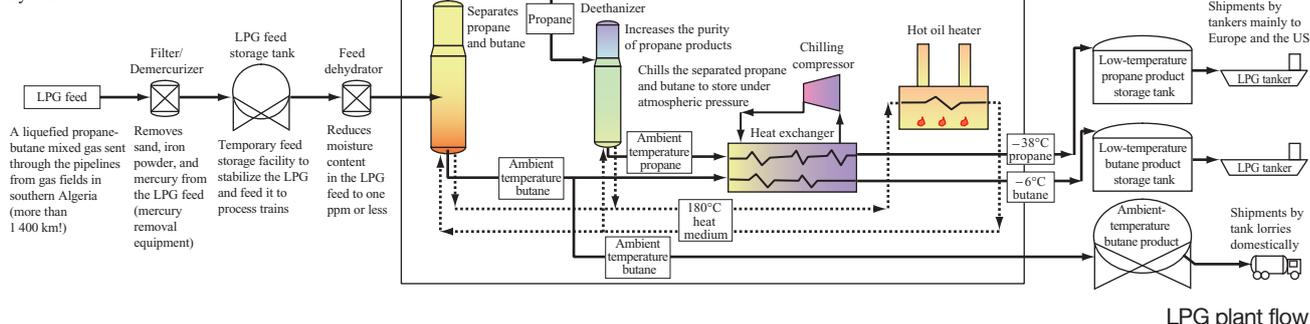
Throughout IHI's successful delivery of several plants in the Arzew industrial area, complex, the relationship of trust with its client SONATRACH were strengthened, which was yet another significant achievement for both parties.

Overview of the process trains of the LPG plant

There are nine process trains, each consisting of separation and chilling facilities with an annual production capacity of one million tons of low-temperature propane and butane. In addition, the LPG plant has a total of eight low temperature product storage tanks: six metallic tanks with a capacity of 70 000 kl each and two new PC concrete tanks. The plant also has ship loading facility for large tankers to transport the products overseas, various utility facilities for producing water, compressed air and steam as well as other utilities necessary for operating the plant, and several operational buildings form part of the LPG plant such as control room, electrical rooms and offices.

This LPG plant receives through pipelines LPG feedstock (liquefied propane-butane mixed gas) produced in the gas field of Sahara in southern Algeria, 1 400 km from the Site. The LPG feedstock first passes through filters and a demercurizer in order to remove sand, iron powder, and other impurities as well as mercury before being stored in feed

Process flow of LPG
The processes from receiving feed to shipment use equipment provided by IHI.



LPG plant flow

tanks. The stored LPG feedstock is then pumped into process trains, where dehydration units reduce the moisture content in the feed to one ppm or less and a fractionator separates the propane and butane by using oil heated to approximately 180°C. The separated propane is further purified in a deethanizer and then transferred to a chilling section together with the butane. The propane is chilled to -38°C and the butane to -6°C, after which these products are transferred to low temperature product storage tanks. From the storage tanks, the products are sent through pipelines, which are approximately 2 km long, to the jetty and then loaded onto tankers. Ambient temperature products are also loaded onto tank lorries for shipment to the domestic market.

Execution of Phase III project

- (1) Providing services to meet the needs of the client as well as the needs of the times

When the contract for the Phase III project of the GP1Z Plant was concluded, the gas fields in southern Algeria were undergoing rapid development. To increase LPG production, the client's primary need was to start operation of the plant as soon as possible.

To meet this need, IHI made several proposals for the upcoming Phase III project by appropriately adopting design details from the existing plant based on its feedback in order to reduce the potential risks in the client's original plan. The client accepted our proposals, demonstrating their trust in IHI. IHI, working jointly with the client developed a mutually satisfactory plan to ensure that the usability of the Phase III Plant was equivalent to that of the existing plant.

During the design stage, IHI used 3D CAD and computer simulation techniques to design and evaluate the plant. IHI also adopted the most sophisticated technologies and devices from the control system and other rapidly advancing fields. IHI further proactively adopted environment impact assessment, plant risk assessment, and other engineering techniques that were not used for the existing plant. In this manner IHI developed a safer, more environmentally friendly, easier-to-use plant.



Unloading a tower at the local port



Installation of the tower

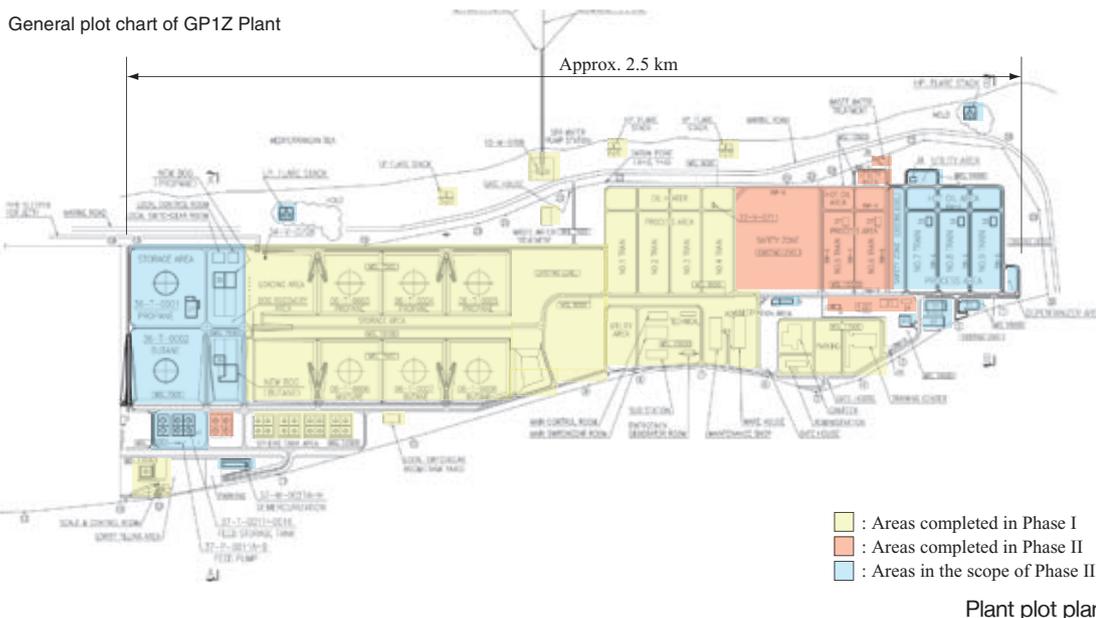
- (2) Procurement and transport management

The contract for this Phase III project was concluded amidst the backdrop of other large-scale projects being realized in Middle Eastern and other oil-producing countries, and there were concerns about delays in materials deliveries and labour shortages. To minimize such delays, IHI sought out suppliers of key major equipment requiring long lead time even before the contract was concluded. After concluding the contract, IHI, together with the manufacturers' top management, established cooperative system to share and solve problems expeditiously through regular meetings in order to ensure the timely delivery of the ordered components.

After completion of manufacturing of the equipment, logistics were arranged to transport those equipment to the construction site. For ocean transport of large equipment such as the fractionator, heavy cargo ships capable of berthing at the local port were needed. As only a few such ships were available in the world, IHI developed a shipping plan at the early stages of procurement in order to secure the appropriate ships. To effectively operate ocean transport under the tight conditions imposed by the enormous global demand for ships, IHI arranged each ordered ships to collect as much cargo as possible from different locations before arriving at site. Though there were approximately 290 000 items to manage in these shipments, IHI was able to deliver all items to the site by the time each of them was needed for erection, as a direct cause of prior planning and coordination as described above in consideration of the circumstances.

- (3) Securing and managing subcontractors

For the on-site construction work, IHI selected companies with which it had previous experience. A major Japanese general construction company was subcontracted to perform the civil engineering and construction work and a Japanese-Italian consortium



was selected to construct the large storage concrete tanks.

A company with previous working experience with IHI declined to perform the mechanical erection work due to their heavy work load created by the worldwide boom in plant construction. As a result, IHI decided to subcontract a Chinese construction company with construction experience in Algeria. In order to facilitate smooth communications between companies working not only together for the first time, but also a language barrier, Chinese engineers and supervisors were employed from outside of the company and a management organization was established to verify construction progress on-site and manage construction work and HSE (health, safety, and environment) considerations.

Regular management-level meetings with procurement and construction work subcontractors were held. IHI also established and operated a work system based on cooperation for sharing and solving problems. Everyone from top management to individual workers of each company worked together towards the same goal and, as a result, achieved great results.

(4) Assurance of contracted delivery time

At the peak of construction work, the total workforce on site reached a total of 3 800 people composed of 1 800 foreign nationals and 2 000 Algerians. Nationals of 24 countries participated in the construction of this plant.

During the worldwide construction boom, IHI faced problems due to delays in delivery of construction materials and equipment as well as labour shortages, which affected the construction schedule. However, thanks to the cooperation of the client, IHI completed and transferred control of the plant slightly ahead of the contracted delivery time.

As in the previous construction work, IHI faced several difficulties during the Phase III project, but the trust we earned from the client, led IHI toward success for this project.

Relationship of trust is the key for the success of project

During the Phase I project, every negotiation with client required an additional effort from IHI in order to move forward. This impeded the pace of the project, but IHI continued to make sincere efforts and completed construction as per the contract. The client highly appreciated IHI's efforts and thereby a relationship of trust was established. During the Phase II project, IHI built on its achievements of Phase I and delivered a plant that satisfied the client both in terms of delivery time and quality. This reinforced our relationship of trust. As a result of this long-term relationship of trust and client's great appreciation for the continued smooth operation of the GP1Z Plant over a period of more than 20 years, IHI was awarded the contract for the Phase III project as well. This strong relationship of trust was what enabled the smooth progress of this project.

We at IHI will continue to make efforts to meet the client's needs by using our project management and EPC (engineering, procurement, and construction) capabilities and experience which have been gained over many years in process plant construction.

Inquiries:

Overseas Project Group, Project Department,
Plant Engineering Operations, IHI Corporation
Phone: +81-3-6204-7620
Website: www.ihico.jp/