

Setting the pace

Completion of the first RasGas Expansion Project makes Qatar a leader in LNG

Each of the three natural gas liquefaction trains in the first RasGas Expansion (RGX) project was a milestone in its own right. Together they represent one of the largest and most innovative LNG projects ever completed – setting the pace for the mega-trains now under construction at Ras Laffan Industrial City. Alex Forbes reports.

In March this year, at what is rapidly becoming the largest concentration of natural gas-based industry in the world, His Highness Sheikh Hamad Bin Khalifa Al Thani, the Emir of the State of Qatar, will preside over a ceremony that will mark a defining moment in the development of Qatar as a gas-producing and exporting nation.

The inauguration by HH The Emir, of the RasGas LNG Train 5 will mark the completion of an impressive portfolio of major projects that make up the massive undertaking known as the first RasGas Expansion project – or RGX.

Together with Qatar's existing LNG projects – the first phases of RasGas and Qatargas – RGX will give the nation a position of leadership in world LNG. Combined nameplate LNG production capacity in Qatar will rise to 30.7 million tonnes per annum (Mta), well ahead of the other producers such as Indonesia, Malaysia and Algeria.

The RGX project also adds significant new dimensions to RasGas beyond its base LNG business. With the completion of the Al-Khaleej Gas (AKG1) project, RasGas now supplies domestic sales gas to fuel the country's development. RasGas LNG Trains 4 & 5 produce a lean LNG, which provides product variety and marketing range for LNG, while allowing the extraction of LPGs for sales. As part of the RGX project, new LPG storage and export systems were built. The RGX project portfolio also included a major new helium facility, launching Qatar and RasGas into the global helium business.

So how did a nation of fewer than a million people come to dominate such a key and fast-growing part of the global natural gas industry?

Qatar's story begins in the early 1970s, with the discovery of a huge gas-bearing geological structure in the Arabian Gulf.

At that time it was impossible to foresee that Qatar's North Field would turn out to be the world's largest non-associated gas field, with proven reserves today of more than 900 trillion cubic feet (Tcf) of natural gas, making Qatar the world's third-largest holder of gas reserves.

"Getting the development under way took enormous courage" says Dr Ibrahim B Ibrahim, whose many roles include being Vice Chairman of RasGas and Economic Adviser to the Emir.

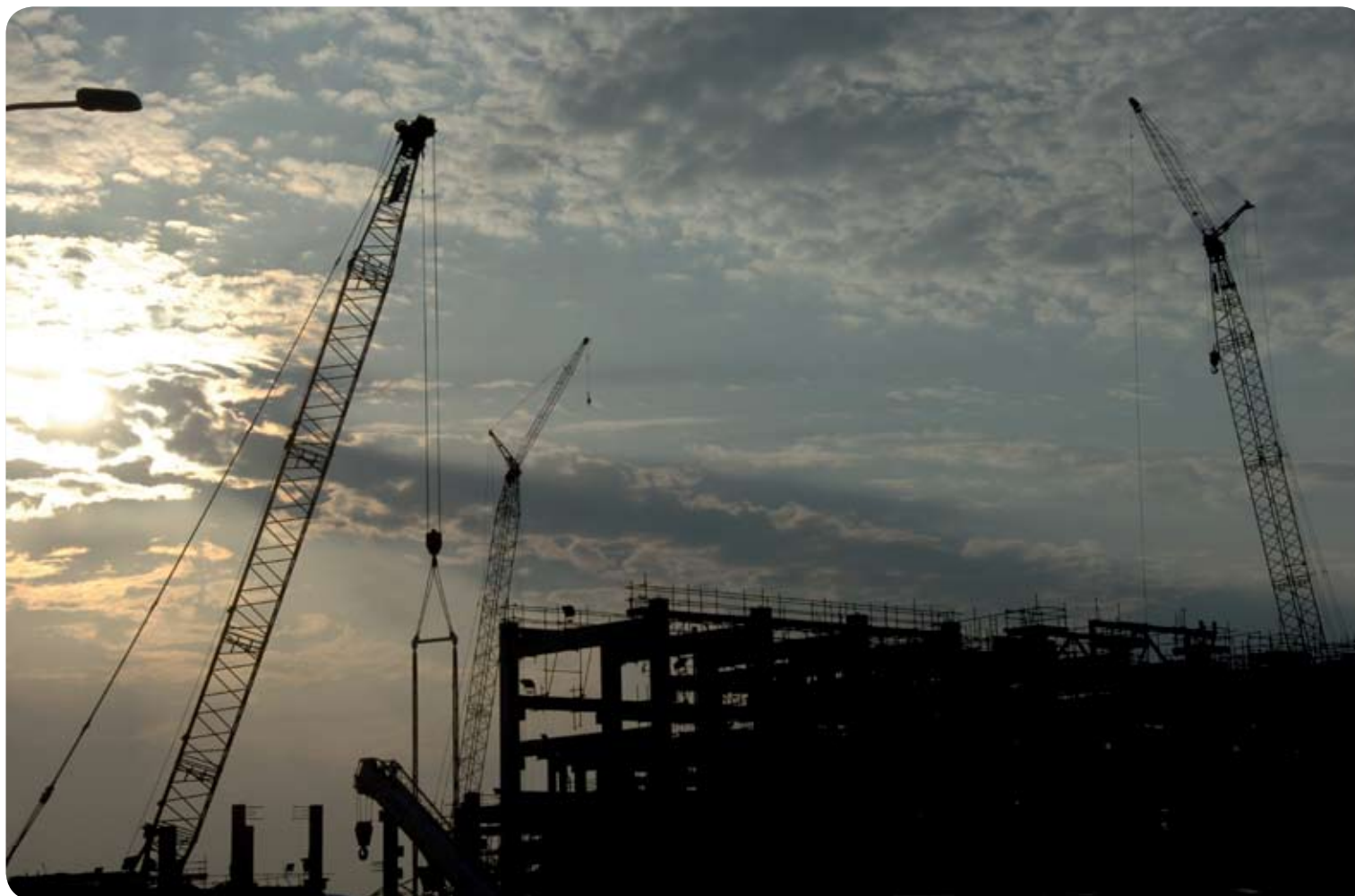
"To become credible in the minds of potential LNG buyers, notably in Japan, Qatar needed to invest around a billion dollars in constructing a port," says Dr Ibrahim. But there was no guarantee that Qatar would then win enough long-term contracts to supply LNG to justify such an investment. Nevertheless, the nation took a leap of faith and constructed port facilities and infrastructure at what is now called Ras Laffan Industrial City.

Qatar at that time recognised a need for expertise and technology to develop its LNG facilities. So it set out to attract suitable business partners. It succeeded in attracting Mobil (now part of ExxonMobil), Total and a number of Japanese companies, but only, says Dr Ibrahim, after keen negotiations between all parties.

With the required elements for LNG development in place, Qatar launched two LNG ventures. Qatargas started as a three-train 6 Mta project – since debottlenecked to 10 Mta. Serving primarily the Japanese market, it delivered its first cargo in 1997. RasGas, a two-train 6.6 Mta project serving primarily



Train 3, the first train under the RasGas Expansion Project



the market in South Korea, delivered its first cargo in 1999.

This was an excellent start, confounding the sceptics who doubted that Qatar would ever become a major LNG player. But the Emir's vision was that Qatar needed to become a much bigger player to really capitalise on its huge gas resources. And so it was that the concept of the RasGas expansion came into being.

His Excellency Abdullah Bin Hamad Al Attiyah, Second Deputy Prime Minister, Minister of Energy and Industry and Qatar Petroleum Chairman clearly set out the nation's vision for LNG development in those early days.

Qatar's ambitious plans were greeted with a degree of scepticism by many in the LNG industry. They found it difficult to envisage how Qatar would find sufficient markets to fulfil its LNG ambitions, given its location. It was hard to see how LNG from the Gulf would be able to compete in markets served by pipelines or by LNG suppliers much closer to home. This scepticism was soon to turn to admiration as Qatar moved close to obtaining its goal of producing 77 Mta by 2010.

A major sales and purchase agreement was signed in 1999 with a new Indian company called Petronet LNG, established by four major

Indian state-owned enterprises. The agreement was for 7.5Mta for a 25-year period, setting the scene for a long-term business partnership.

Meanwhile, Qatar was exploring the potential of advances in LNG technology.

Dave Marchak, RasGas Venture Manager and Ching Thye Khoo, Project Manager for the RGX offshore and onshore projects, describe how, with the use of new technologies and an innovative LNG plant configuration, RasGas, supported by its shareholders Qatar Petroleum and ExxonMobil, pursued a design for a liquefaction train with much larger capacity than those in operation at that time. Building and completing three essentially similar trains in quick succession allowed for the maximising of project execution synergies and the immediate transfer of lessons learned.

The impact that this would have on unit costs, along with the relatively low cost of producing gas from the North Field, meant that Qatar could start to consider looking at markets in Europe.

Then came another milestone: in 2001 RasGas signed a major supply deal with Italian gas company Edison for 4.6 Mta for a 25-year period commencing 2008.

Together, the deals with Petronet and Edison were enough to convince Qatar Petroleum and

ExxonMobil to expand the RasGas project by adding another two trains, each with capacity of 4.7 Mta, enough to take total capacity to 16 Mta. It was not long before a decision was taken to add a third such train, taking total capacity to 20.7 Mta.

The RGX project was initiated in 2001 when EPC contracts were signed with CMS&A – Chiyoda, Mitsui, Snamprogetti & Almana – for onshore workscope and with J Ray McDermott for the offshore scope. The inauguration of Train 5 in March 2007 will mark the completion of all major projects in the RGX portfolio.

Each of the three huge liquefaction trains at the heart of the RGX project has turned out to be special in its own way, both technologically and commercially.

The first – RasGas Train 3 – was the largest operational liquefaction train in the world when it was commissioned in early 2004. With capacity of 4.7 Mta, it was 40 per cent larger than the previous largest train.

Moreover, Train 3 marked the first passage of LNG into India; its first cargo landed at Dahej on the west coast of India in January 2004. This was a market that many established players had failed to break into. Qatar's success, says Dr Ibrahim, was an early sign that it was approaching the LNG business in its own unique way.



Underlying these achievements was a unique and continuous learning process. This ensured that lessons learnt during construction of Train 3 contributed to the success of Train 4, while lessons from Trains 3 and 4 contributed to the success of Train 5.

Train 4, inaugurated by the Emir in November 2005, was the first in the Middle East to be dedicated to markets in Europe. It meant also that Qatar began 2006 with nameplate capacity of 26 Mta – enough to make it the world's largest de facto producer of LNG in 2006, when Indonesia still had more capacity than Qatar, but not enough gas to utilise it fully. Train 4 was also the first application of acid gas reinjection in Qatar. A key addition to Train 4 in the midst of project execution was an NGL-recovery project. This allowed RasGas and Qatar to produce lean LNG for the first time, and also to export LPGs.

The new Train 5, says Khoo, will be the fastest train of its size ever to be constructed. Train 5 was completed with an outstanding safety performance that was five times better than the industry norm. In addition Train 5 is the most environmentally friendly LNG train RasGas has built, added Marchak: it is the first train to incorporate a Dry Low NoX technology on all its gas turbines, which will dramatically reduce emissions to the atmosphere.

Underlying these achievements was a unique and continuous learning process. This ensured that lessons learnt during construction of Train 3 contributed to the success of Train 4, while lessons from Trains 3 and 4 contributed to the success of Train 5. As the construction periods of the three trains overlapped, this was no easy matter. Doug Smith, Offshore Project Manager, explained how the systematic application of lessons learned ensured that Train 5 exceeded all expectations in achieving an unprecedented level of quality.

The benefits are obvious in the time that it took to construct the trains. The first two each took 33 months. When it came to Train 5, says Khoo, RasGas and its main contractor, CMS&A, were confident it could be done in 30 months. In fact, mechanical completion was achieved on 25 October 2006, just under 28 months from EPC award, a new world record for a large-scale LNG train.

To really appreciate the scale of this achievement, you need to visit Ras Laffan Industrial City to see for yourself just how large these trains are. They are still among the largest in the world and undoubtedly the prime focus of the RGX development.

That said, the LNG trains are only part of the RGX story. The expansion project also involved constructing the offshore production facilities that supply raw gas and liquids, as well as the first phase of the Al Khaleej Gas (AKG-1) processing plant that now supplies sales gas to the home market. Along the way, RGX involved construction of a major helium production facility, and innovative projects to extract natural gas liquids from LNG and to reinject acid gas.

Having broken new ground in so many ways, the RasGas Expansion Project exemplifies RasGas' vision 'To Be The Pacesetter', and paves the way for the next wave of expansion at Ras Laffan City. Six mega-trains, each with capacity of 7.8 Mta, by far the largest in the world, are currently being built, two by RasGas and four by sister company Qatargas. When completed, in 2010, these mega-trains will raise Qatar's LNG production capacity to 77 Mta, making it by far the world's largest producer of LNG.

