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The ‘antelope' gets to its feet – how Qatar's big projects are
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The mood in the gas-to-liquids industry is surprisingly upbeat, given the state of the global economy and developments in the rest of the natural gas industry.
That came across clearly at a GTL conference in London last month, where much of the optimism was driven by developments in Qatar: Oryx appears to have solved its technology problems, and Pearl GTL remains on track to complete its first train in 2010. Elsewhere, new technologies and players are emerging, notably in small-scale GTL. However, what was also evident is that final investment decisions on major new projects look unlikely until construction costs fall well below current levels.

News that the Oryx gas-to-liquids (GTL) plant this year reached 100% of production capacity – even if only for a limited time – is heartening for an industry that has been going through years of dramatic highs and lows. Named after a long-horned antelope native to the deserts of Qatar and the plains of southern Africa, the Qatar Petroleum/Sasol joint venture was inaugurated in June 2006, but did not load its first cargo until the spring of 2007 and is only now, three years later, approaching its full design capacity.

With a nameplate production capacity of 34,000 barrels/day of GTL products – Oryx is currently the largest GTL plant in the world. At the time of its inauguration it was seen as a symbol of the commercial viability of a technology that has been a long time coming. A particularly encouraging aspect was that it had been project financed, meaning the onus was on the project's sponsors to convince hard-nosed bankers that GTL was a technology whose time had come.

Inevitably, when news began to emerge that the plant was experiencing major problems in ramping up to full capacity, the disappointment in the industry was palpable. Eventually, after much speculation and rumour, Sasol held a web-based press conference in May 2007, in which chief executive Pat Davies explained what the problems were and what was being done to address them.

In short, unanticipated behaviour within the Fischer-Tropsch (F-T) reactors that form the heart of the plant was leading to attrition of the catalyst, producing a fine sediment that was clogging equipment downstream of the reactors. Oryx has since modified the internal structure of both reactors and installed additional filtration equipment, solutions that appear to have worked.

Last month, Riann Welgemoed, the project's technical manager, announced that the plant had achieved 100% of its production capacity for a short

period in January, and that average production rates were steadily increasing.

“We maintained sustained improvement during 2008 and for me January was quite special because that was when the dream became reality. Our seven-day production average is now beyond 33,000 barrels/day (b/d), our 30-day average is beyond 29,000 b/d, and our 90-day is beyond 26,000 b/d. And we are still improving,”
Welgemoed told CWC's XTL conference in London,

Welgemoed added that the plant had produced more than 11 million barrels of product since start-up, with more than half of that produced during 2008. During the first quarter of 2009, the plant produced 2 million barrels.

So how has the market been receiving these products?

“To date we have shipped 42 cargoes; 31 diesel and 11 naphtha,” said Welgemoed. “Initially, as was expected, our products went into the spot market, but we are now starting to get repeat customers, and even some mid-term contracts.” He is optimistic that the project will soon secure long-term contracts.

“Our customer profile is quite broad. We're talking about end-users, refiners, oil majors, general traders and some niche markets. Biomass to liquid (BTL) naphtha is mostly going into the Asian market, while the GTL diesel is going either to the Arabian Gulf or to north-west Europe. We have received very positive feedback from our customers on the consistency of the products that we produce.”

Interestingly, in an industry that traditionally has jealousy protected its intellectual property, Oryx engineers have been working with engineers on Shell's Pearl project, on which construction is now in full swing, with some 42,000 workers on site.

“As a pioneer Oryx takes its role in the development of GTL very seriously,”
said Welgemoed. “We are eagerly awaiting the start-up of the Pearl GTL plant.
I can say that the two companies are working together to incorporate lessons learned from Oryx GTL within the start-up and commissioning planning of the Pearl project. We believe that we have to work together in the industry to make GTL grow.”

Welgemoed insisted that Oryx would be profitable even at oil prices below $40/barrel, a claim that is credible because the project was unusually cheap.
Because the EPC contract was awarded on a lump-sum turnkey (LSTK) basis to Technip before the construction cost overheating that began in 2004, overall investment has been a little over $1 billion, giving a specific capital cost of around $30,000 for barrel per day of capacity – a figure unlikely to be matched any time soon.

The deal was not such a good one for Technip, conceded chief technology officer Sanjiv Ratan, because procurement and construction did extend into the cost-inflationary period. He added that in the current era of

high cost volatility, future projects were more likely to be undertaken on a reimbursable contract basis than the LSTK model.

Pearl on-track

Pearl, one of Oryx's neighbours at Ras Laffan Industrial City, is a behemoth of a project – one of the largest, if not the largest energy project under construction in the Middle East. When completed it will fill an area the size of London's Hyde Park and will produce four times as much GTL product as Oryx, 140,000 b/d from two F-T trains, along with 120,000 b/d of upstream products, such as LPG, condensate and ethane. When ramped up to full production, it will process 1.6 Bcf/d of gas and will account for a significant percentage of Shell's cash flow.
Despite the project's size, Shell is confident that its technology will work because scale-up factors in the critical components are relatively modest, when compared with the company's 14,700 b/d Bintulu project in Malaysia, which has been performing at very high rates of reliability and availability over the past five years. For example, the F-T reactors are just 1.13 times as large as the ones at Bintulu. Another reason to believe that Shell will not encounter the specific problem that Oryx did is that its uses a fixed-bed reactor design rather than the slurry-phase design used at Oryx.
To obtain high capacity Shell's strategy has been to install a lot of components – 24 F-T reactors, for example – rather than making each one much bigger.
The challenge at Pearl is project execution because of its sheer scale and the number of companies working on it. So far, the project management contractor, a consortium of JGC and KBR, appears to have construction on track.
A measure of how well things are going was Shell's announcement last month of specific dates for completion and start-up of the first train. Until now the company has been keeping timings vague, saying only that the first train would come on stream “around the turn of the decade”, with the second following on about a year later.
“We're expecting that construction will be completed around the end of 2010,” Guy de Kort, vice-president for XTL development at Shell Gas & Power told the conference, “with ramp-up during 2011.” He added that of the project's 24 F-T reactors, 15 had already been installed, along with six of the eight cold boxes for the world-scale air separation units that will provide oxygen to the process.
When it comes to the scale of its investment, however, Shell has said only that the guidance it published at the time of final investment decision in 2006 still holds. The integrated project will produce 3 billion barrels of oil equivalent
(boe) at a development cost of $4-6/boe, which equates to a total investment of
$12-18 billion. Shell are financing all of these costs from its balance sheet.
Not everyone is convinced. Unlike Oryx, Shell has borne the full brunt of the cost escalation that occurred between 2004 and 2008 and many now believe that the project will end up costing significantly more than $20 billion.
Is that a problem for Shell? Certainly not, so long as the project works as intended. Producing more than 250,000 b/d of high-value products, annual production, assuming availability of 95%, lower than Bintulu's, will be 90 million barrels. Even assuming that the products

can be sold only at crude price, that will generate revenue of $4.5 billion/year at an oil price of $50/barrel and $9 billion/year at $100/barrel.

Actual revenues would be higher, because the price that the GTL products will realise will be made up of three components: crude price, refining margin and any premium that Shell can realise for the exceptional properties of GTL products. Clearly, this will be a very profitable project in any foreseeable oil price scenario – again, so long as it works as intended.

Asked by Gas Matters whether Shell was planning any further GTL projects, de Kort said the main focus was on getting Pearl up and running, but that the company continues to evaluate potential opportunities elsewhere. The company is also continuing to develop its SMDS (Shell Middle Distillate Synthesis) process to improve efficiency, reduce costs, and cut carbon emissions. A new laboratory has been constructed in Amsterdam and Shell also runs a GTL research lab at the recently inaugurated Qatar Science and Technology Park.

Escravos and small-scale GTL

Two other significant projects were mentioned only in passing at the conference.

The first was the recently announced proposal for a GTL project in Uzbekistan, which would bring together Uzbekneftegas, Sasol, and Petronas in a joint venture to develop a commercial-scale plant using Sasol's F-T technology. A heads of agreement was signed in April but details of the project remain sketchy.

The second was the Escravos GTL project in Nigeria, construction of which has been under way for some time, but which has been beset by delays and massive cost over-runs. It uses essentially the same design as that used for Oryx, and will have the same 34,000 b/d capacity, but the latest cost estimates for the project put the required investment at $6 billion, a graphic illustration of how timing and location can affect project economics. According to Technip's Sanjiv Ratan, $2 billion of the cost is accounted for by the fact that the project is being constructed in a swamp, not the project–friendly environment of Ras Laffan Industrial City. But that still means that the GTL plant itself will cost four times as much as Oryx, assuming costs don't rise still further.

One of the surprises of the conference was the emergence of a new GTL player in Japan, Nippon GTL Technology Research Association. Arata Nakamura, general manager of the project planning department, said the company had brought a 500 b/d demonstration plant on stream in April. Located at Niigata, the plant employs an unusual F-T process which uses carbon dioxide rather than oxygen to produce synthesis gas.

The company was established as recently as 2006 by six private Japanese energy companies, including Chiyoda and Inpex, and has been working with JOGMEC (the Japan Oil, Gas and Metals National Corporation) to develop commercial GTL technology. If all goes well, the company hopes to construct a 15,000-20,000 b/d commercial plant in the latter half of the next decade.

Another interesting development, this time in small-scale GTL, was an announcement by Velocys, recently bought by Oxford Catalysts for $35 million, of significant progress in developing its “microchannel” technology. If it comes to fruition, this technology, which has so far cost $160 million to develop, will lead to the commercialisation of cubic reactors measuring “2 ft by 2 ft by 2 ft” with a production capacity of 500 b/d – a far cry from the enormous reactor vessels being

used by the Qatari projects. Each of the two reactors at Oryx weighs 2,100 tonnes and could hold the water from three Olympic swimming pools.

Inevitably there has been speculation over when we might see new FIDs for large projects like Oryx and Pearl. One credible contender is PetroSA, owner of the Mossel Bay plant in South Africa, which, along with its partners StatoilHydro and Germany's Lurgi, has been developing a low-temperature Fischer Tropsch technology called GTL.F1, which it has proven with a 1,000 b/d “semi-commercial unit” at Mossel Bay.

Gareth Shaw, PetroSA's GTL commercialisation manager, said that with the technology now ready for commercialisation, the partners were looking at potential locations and for potential partners for a commercial-scale plant.

However, asked by Gas Matters when that might go ahead, he replied that nothing was likely to be finalised until construction costs had fallen significantly from 2008's highs – much the same story we have been hearing recently from other sectors of the natural gas industry.

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