REVIEWING THE INTERNATIONAL GAS MARKETS

GAS MATTERS

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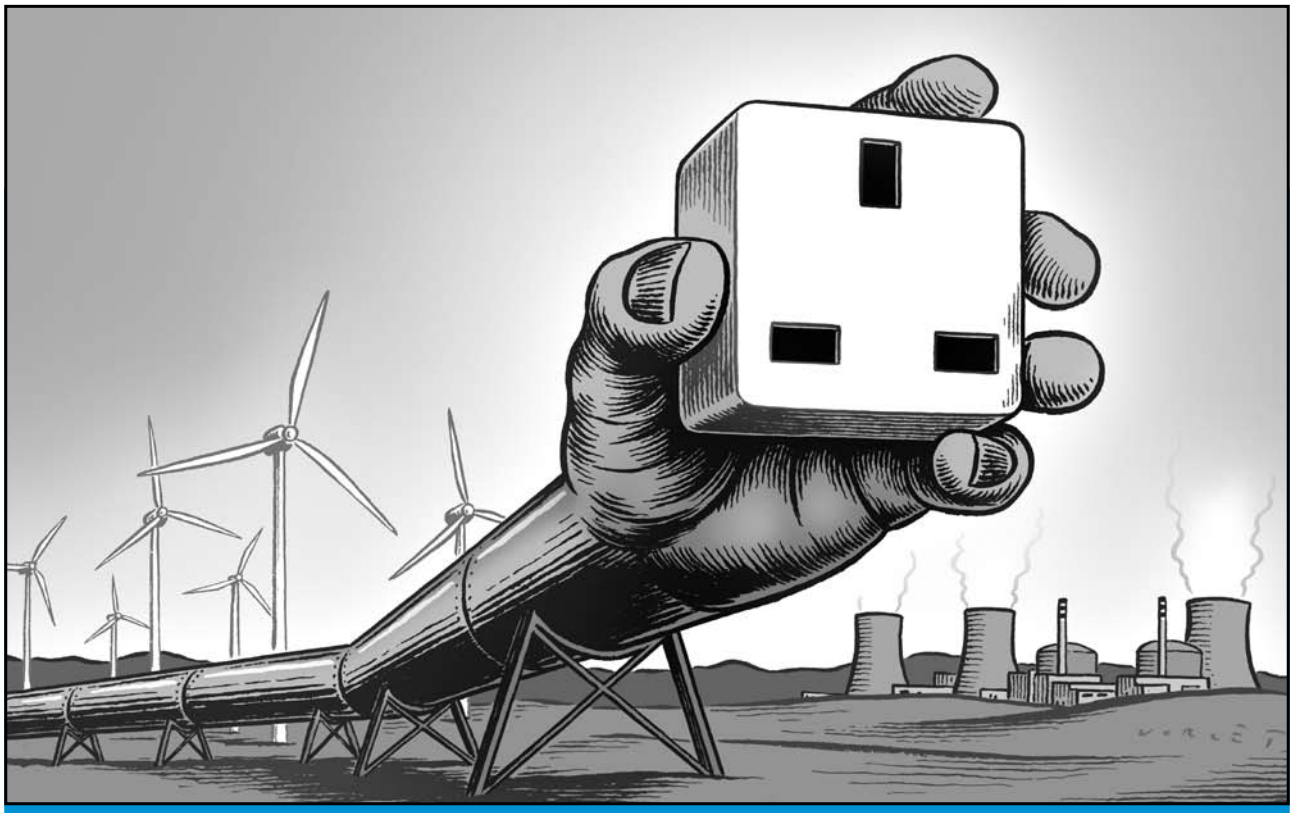

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The UK's Electricity Market Reform: a wake-up call on the need for gas
As the consultation on the proposed Electricity Market Reform (EMR) in the UK approaches its closing date on March 10, voices are being raised in the gas industry over the lack of clear vision for natural gas in the country's future energy mix. Gas Matters explains why the gas industry has found itself in limbo, unsure as to whether it is to be penalised as a carbon emitter, or rewarded as a provider of back-up generation capacity. **4**

South Africa's shale gale unlikely to blow for some time yet
While several of the countries in West and North Africa are rich in hydrocarbon resources, South Africa, which boasts the continent's largest economy, has very little in the way of oil and gas resources. But now the prospect of shale gas changing this picture is starting to emerge, although with no wells drilled yet, and opposition to shale gas exploration already emerging, shale gas is unlikely to make a big contribution any time soon. Gas Matters provides an update on the latest developments in the country. **11**

The NPD reinforces fears of a decline in Norwegian production
The Norwegian Petroleum Directorate (NPD) published a report on 2010 exploration, development and production activity on the Norwegian Shelf in January. Mainly a review of what has been happening in the last year, it also expresses views about the likely levels of future production, and concludes that "time is running out for the companies to implement measures that can curb the decline in Norwegian oil production. Gas Matters delves into the statistics that back-up this argument and weighs up some of the underlying implications. **14**

Tough new deadlines tighten regulatory screw on Europe's gas industry
As the Third Energy Package has officially come into force on March 3, Gas Matters reviews the latest plans by the European Union to achieve long-awaited natural gas and electricity reforms. In their first-ever energy summit in February, the European Union's heads of state and government have set challenging deadlines: completing the internal gas market by 2014 and ensuring that no member state is a "gas island" by 2015. Can it be done in time? Looking even further forward, to 2030 and 2050, the European Union's aspirations for energy are breath-taking in their scope. **19**

Pearl start-up coincides with the prospect of a promising decade for GTL
The start-up of Shell's Pearl gas-to-liquids (GTL) project planned for this year in Qatar, combined with the convergence of a number of external economic factors, heralds a promising new decade for an industry that has had its share of disappointments. In the context of a global push for greener energy policies and the current gas prices Gas Matters looks at the technological challenges and explains why GTL may become a more popular option for monetising increasing volumes of associated and non-associated gas. **24**

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Pearl start-up coincides with the prospect of a promising decade for GTL

The start-up of Shell's Pearl gas-to-liquids (GTL) project planned for this year in Qatar, combined with the convergence of a number of external economic factors, heralds a promising new decade for an industry that has had its share of disappointments. With natural gas looking increasingly abundant, and oil looking increasingly expensive, the market fundamentals for GTL have never looked better. Getting the technology to work on a commercial scale remains the big challenge, however. In the context of a global push for greener energy policies and the current, low, gas prices Gas Matters looks at the technological challenges and explains why the GTL option may become a more popular option for monetising increasing volumes of associated and non-associated gas.

Even before political turmoil in the Middle East and North Africa sent the price of Brent crude north of $100/barrel in February, oil prices were expected to remain strong for the foreseeable future. Meanwhile, the rise of unconventional gas production in North America, and the expectation that this success could be replicated elsewhere have transformed the outlook for natural gas. So a technology that can convert cheap natural gas into expensive oil products ought to have a promising future.

The combined worldwide capacity of Fischer-Tropsch (FT) GTL plants today is just 70,000 barrels/day (b/d). This capacity is about to treble as Shell starts up its massive Pearl GTL project at Ras Laffan

For decades, numerous companies have been working to develop technologies to do precisely that. The most prominent of these is based on work carried out during the 1920s by two German scientists, Professor Franz Fischer and Doctor Hans Tropsch. They were granted a patent in 1925. However, despite decades of effort, the combined world-wide capacity of Fischer-Tropsch (FT) GTL plants today is just 70,000 barrels/day (b/d).

This capacity is about to treble as Shell starts up its massive Pearl GTL project at Ras Laffan Industrial City in Qatar. The industry is waiting to see whether Shell's technology works as expected – because, as anyone who has followed the fortunes of the GTL industry will know, it has had its share of disappointments.

Assuming that Pearl works as planned – and there are good reasons for so doing – Shell could not be starting it up at a better time. At current oil prices its economics look too good to be true. It will produce 140,000 b/d of premium oil products, such as synthetic diesel, naphtha and kerosene, and 120,000 b/d of upstream liquids such as condensate and liquefied petroleum gas (LPG). Even when priced conservatively at just the price of crude, with an oil price of $100/barrel this output would yield revenue of around $9 billion/year.

Furthermore, the substitution of GTL-based products for oil and the reduction of crude oil-based products in the transportation sector are perceived to provide two major and highly desirable outcomes for Western economies – diminished reliance on imported oil and a significant reduction in CO_2 emissions. As natural and unconventional gas reserves are more geographically spread than oil, interest grows in the sustainable utilisation of natural gas to produce environmentally friendly transportation fuels.

The GTL industry today

The world's largest operational FT plant is the 34,000 b/d Oryx plant in Qatar, a joint venture of South African energy and chemicals group Sasol and Qatar Petroleum. The slurry-phase distillate (SPD) technology used in the plant is based on Sasol's decades of experience with coal-to-liquids (CTL) and GTL projects in South Africa (see separate article, page 11). Inaugurated in 2006, Oryx experienced significant technology problems which meant it took three years to get it working at close to full capacity.

PetroSA operates a HTFT plant (high-temperature process – see separate box page 26) at Mossel Bay, South Africa, which started up in 1993 and produces 22,500 b/d of GTL products as well as a range of other products. Also located on the plant's site is a new semi-commercial plant employing LTFT technology (low-temperature process – see separate box developed by the GTL-F1 joint venture. PetroSA and its partners in GTL-F1, Statoil and Lurgi, expect it to be become the basis for a series of commercial-scale projects.

Shell has been developing GTL technology for decades, with much of the work carried out at its research facility in Amsterdam. In 1993, it started up a 12,500 b/d plant at Bintulu in eastern Malaysia. Following an explosion in an air separation unit in 1997, caused by the accumulation of particulate matter from forest fires in south-east Asia, the plant was re-built with a capacity of 14,700 b/d.

Bintulu has become a highly profitable project, working at a very high rate of availability. It is the technology developed there that forms the basis for Pearl.

Having completed construction of Pearl's two 70,000 b/d GTL trains, Shell is currently starting up the project and expects production to ramp up to full capacity by 2012. The plant has several world-scale components – the largest oxygen plant, the largest process water full-recovery system, one of the largest hydrocrackers and 300,000 tons of piping, structural steel and equipment, totalling $19 billion in capital expenditure, entirely financed by Shell.

The next plant to come on stream should be the much-delayed and vastly over-budget Escravos project in Nigeria

The plant should produce enough fuel for 160,000 cars/d and enough synthetic base oil each year to make lubricants for more than 225 million cars. The plant should also produce cleaner-burning kerosene for use in jet fuel, highly paraffinic naphtha for chemical feedstock in the production of plastics, and normal paraffin, which are used to produce household detergents.

The next plant to come on stream should be the much-delayed and vastly over-budget Escravos project in Nigeria. A joint venture of NNPC and Chevron, the plant uses the same technology as Oryx and will have about the same capacity. However, while Oryx cost around $1 billion to construct, the cost of Escravos has escalated to over $6 billion and the plant is not expected to start up until 2012 at the earliest. With the engineering, procurement and construction (EPC) contract awarded in April 2005, it is years late.

Small-scale GTL

As well as these large-scale GTL projects, there are a number of efforts under way to develop small-scale GTL for specialist applications. These include two technologies for which Brazil's Petrobras has agreed to conduct pilot studies.

One such study, in the north-east of Brazil, is with British firm CompactGTL. The intention is to install a GTL production module on an anchored floating production, storage and offloading (FPSO) vessel. According to Petrobras, this technology could find application in its pre-salt oil and gas projects, significantly reducing gas flaring and producing valuable products for the domestic and export markets.

A second Petrobras GTL test pilot is scheduled to start this year. Japan's MODEC and Toyo Engineering Corporation and Velocys/Oxford Catalysts are to build an integrated GTL demonstration plant of 960 litres/day based on innovative "microchannel" reactor technology. The objective is similar to that of the CompactGTL test: to develop a GTL production module capable of being deployed aboard an FPSO.

GTL technology

GTL conversion involves three main processes:

- the production of synthesis gas (syngas), a mixture of hydrogen and carbon monoxide, from a mixture of natural gas and oxygen;
- Fischer-Tropsch (FT) synthesis to convert the syngas into long-chain waxy hydrocarbons;
- and product upgrading of the resulting hydrocarbons using conventional refining processes such as hydrocracking and distillation.

There are two FT processes. The high-temperature process (HTFT) generally involves the use of an iron-based catalyst, whereas the now more popular low-temperature process (LTFT) generally uses cobalt.

The resulting long-chain hydrocarbons are upgraded to yield a product slate that includes diesel (gasoil), kerosene, naphtha, normal paraffin and base oils.

The economics of the CompactGTL technology are not based on the sale of refined GTL products, unlike the large-scale projects. Instead it provides a way of developing small oil fields that have associated gas, without the need to flare the gas or find a market for it. Instead, the gas is converted into synthetic crude (syncrude) which is then mixed into the crude oil stream.

Project Development Challenges

Currently technologies for converting gas into oil products need access to significant natural gas resources at very competitive cost, as approximately 60% of the BTUs that enter the plant reach the end as a final product.

The economics of the CompactGTL technology provide a way of developing small oil fields that have associated gas, without the need to flare the gas or find a market for it

The production of syngas requires significant volumes of water – from fresh water supplies or from large water desalination and treatment facilities. The FT process, depending on the technology utilised, can produce 1.0-1.5 litres of process water for each litre of FT product produced and have a nearly neutral water balance. The challenge is to improve the efficiency with which the plant uses, captures, recirculates, treats and disposes of water.

Disposal of sulphur and CO_2 presents a significant challenge and requires a comprehensive management strategy covering production, handling, and marketing. The availability of geological storage for the produced CO_2 and the opportunity to utilise it for enhanced oil recovery can reduce the project's CO_2 footprint.

The optimisation of the balance between the endothermic (heat consumption) and exothermic (heat production) processes presents a significant process improvement opportunity for reducing the requirement for water, process steam and power for a GTL project and their cost. In many host countries, there would be significant interest in the supply of water for industrial purposes, irrigation and potable water systems, and a power supply, presenting GTL project sponsors with a unique opportunity to deliver additional value for various project stakeholders.

Continued catalyst development and improvement can also provide a higher conversion rate of syngas into a more selective and desirable slate of synthetic hydrocarbons, reducing the size and cost of further product upgrade stages.

Upcoming, potential projects

Several other projects are in the early stages of development. In April 2009, Sasol announced it had signed a Heads of Agreement to construct a GTL plant in Uzbekistan in a deal with Uzbekneftegaz and Malaysia's Petronas. A few months later, in July, it was announced that a joint venture company, Uzbekistan GTL LLC, was to be formed. The high-profile signing ceremony in Tashkent was attended by Sasol's CEO, Pat Davies, and the Petronas CEO, Hassan Marican.

A bird's-eye view of Pearl GTL project in February 2009

In April 2009, Sasol announced it had signed a Heads of Agreement to construct a GTL plant in Uzbekistan in a deal with Uzbekneftegaz and Malaysia's Petronas

The plant, to be built about 40 km south of Qarshi, would employ Sasol's SPD process to produce around 1.3 million tonnes/year of diesel, kerosene, naphtha and LPG. In March 2010 it was reported that a reimbursable services contract had been signed with Technip for a detailed feasibility study.

A particularly interesting development was the announcement last December that Sasol had agreed to take a stake in shale gas assets in Canada owned by Canada's Talisman Energy – with a GTL project seen as a potential monetisation option. Sasol plans to invest C$1,050 in a 50% interest in Talisman's Farrell Creek shale gas assets and the associated gas gathering and processing systems. As part of the deal, Sasol and Talisman agreed a joint feasibility study on the economic viability of a GTL project in western Canada.

Observers of the GTL industry have been speculating for some time about the technology's potential in North America. This is especially true in the United States, where gas prices are expected to remain low for the foreseeable future, while oil prices are expected to remain strong, and where there is considerable political and economic interest to reduce the dependence on imported oil.

In Angola, a recent bidding round attracted significant attention because the deepwater and pre-salt blocks are expected to be similar in geological characteristics and hydrocarbon reserves to Brazil's. As Brazil is currently determining plans for the massive Libra discovery and how further acreage is to be auctioned and developed, and Nigeria seeks a new wave of growth and investment in onshore and offshore projects, interest in GTL applications may well receive further stimulus.

If natural gas and LNG markets continue to operate in the expectation of subdued demand and lower prices, the large associated gas resource holders in the deep waters of the Atlantic Basin and Australasia, in Russia, the Caspian and Middle East, could look to GTL as an attractive means of monetising natural gas, maintaining a firm oil price link, creating value, and reducing gas flaring levels. Energy independence, job creation and global warming are other reasons why increasing volumes of associated and non-associated gas could be converted to liquids, thrusting this technology from a niche application into the mainstream, with onshore GTL plants and even, potentially, the first Floating GTL project.

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