

Boom times

Gulf countries are expected to account for around 20% of the world's ethylene production by 2010 compared to the current 8%, the Gulf Petrochemicals and Chemicals Association (GPCA) has predicted. Some 50% of all new ethylene projects being developed in the world are located in the region, the Association has said. The Dubai-based GPCA has forecast that the region will account for 40% of total global petrochemical production within ten years.

Over US\$15 billion is being invested in Qatar's petrochemical sector over the next five years, by which time it will become the world's fourth largest producer. While oil reserves are modest, the tiny Gulf state's natural gas reserves are the third largest in the world after Russia and Iran at 25.8 trillion cubic metres (tcm). Since the first phase of the North Field gas project began in 1987, major new petrochemical and fertiliser complexes have been established and more projects are set to come onstream in coming years. Proposals announced in the first half of 2007 indicate that the petrochemical industry will lead to further expansion in the years ahead, making Qatar a major gas producer in the region.

Expansion in gas production capacity has made Qatar a major focus of growth in ethylene capacity, along with associated downstream industries. It has a competitive advantage over other Gulf states, with relatively inexpensive upstream costs in accessing the massive gas reserves in the North Field leading to lower prices downstream. As feedstock accounts for 70% of production costs, Qatar's gas fields give it a competitive cost advantage. Iran holds larger gas reserves such as the South Pars field, which is adjacent to the North Field. Yet, the Iranian petrochemicals sector is years behind in technology, giving Qatar an advantage over this potential rival in the petrochemicals sector. Qatar is also making greater use of non-associated gas fields, making the petrochemicals sector far less dependent than other states on the oil sector – which is heavily influenced by OPEC quotas – for growth.

In February 2007, Qatar's second deputy prime minister and minister of energy and industry, Abdullah bin Hamad, claimed that petrochemicals production would rise from 12 million tonnes per annum (tpa) in 2006 to 28 million tpa by 2010. Currently planned projects suggest ethylene capacity

of over six million tpa within five years. The government's priority is to double production of urea, ammonia, low-density polyethylene (LDPE), high-density polyethylene (HDPE) and other petrochemicals that can utilise Qatar's large gas reserves as feedstock. See Table 1 on the opposite page.

the Q-Chem II project, which will include a 1.3 million tpa ethylene cracker in Ras Laffan Industrial City. Q-Chem will have a 53.85% capacity share and the remainder owned by Qatofin, a joint venture between QP, QPC and Total Petrochemicals. When the \$850mn Q-Chem II project comes onstream in 2008, it will include a



Qatar's petrochemical future

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Qatar is one of the Middle East's petrochemical pioneers and has utilised its massive gas fields to generate rapid industrialisation, but rising construction costs and increasing demand for ethane feedstock may scupper future plans for expansion

Foreign majors bring growth

The development of the petrochemicals industry has been conducted through a number of joint ventures between State-owned Qatar Petroleum (QP) and international partners. This strategy has given it access to technology and markets. Qatar's development strategy stands in stark contrast to its rival gas producer, Iran, where inefficient State-owned corporations struggle to reconcile Islamic revolutionary ideals with the realities of globalisation.

QP's joint venture with France's Total Petrochemicals, Qapco, dominates the sector. In 2006, Qapco had 525,000tpa of ethylene capacity, but this is set to grow to 750,000tpa by 2007 as a result of the second ethylene expansion project (EP2). In addition, Q-Chem operates a petrochemicals complex in Mesaieed with 500,000tpa of ethylene capacity and 462,000tpa of polyethylene – comprising 273,000tpa of HDPE, 189,000tpa of LDPE and 50,000tpa of hexane-1. The complex is undergoing expansion under

350,000tpa PE plant and a 345,000tpa normal alpha olefins plant. This will be accompanied by Qatofin's 450,000tpa LLDPE plant in 2008, with investment totalling \$1.2 billion. See Table 2 overleaf.

Planned projects

Announced plans include a proposed 1.2 million tpa cracker joint venture between QP and Shell Chemicals at Ras Laffan for completion in 2011-12 and a mixed-feed cracker with capacity for 800,000-900,000tpa of ethylene at Mesaieed that QP is planning in a joint venture with Honam Petrochemical. In May 2007, QP and Honam Petrochemical announced that the proposed cracker would have 300,000tpa unallocated production which could be used for a new ethylene derivatives plant. Ethane gas supply has been committed for the project, which is slated to start up after 2010. Current planned downstream products include 700,000tpa PP plant and a 600,000tpa styrene monomer plant which will also feed a

220,000tpa PS plant. The project will also include mixed xylenes production, although no figure has yet been put on production capacity. Total Petrochemicals announced in May 2007 that it was likely to participate in a third olefins project, a mixed feed cracker, in Qatar.

Further downstream, Qatar is establishing production facilities in the vinyl and industrial alcohol segments. The Qatar Vinyl Company (QVC) produces ethylene dichloride and vinyl chloride monomer, with plans for polyvinyl chloride production in the future. The Qatar Fuel Additives Company (Qafac) has 832,000tpa of methanol production capacity. It is set to launch a 2.2 million tpa methanol plant at Mesaieed in 2008, which will be the world's largest methanol facility, costing \$540 million.

New polyethylene capacity will also have a local market, with Qatar Plastics Products Company (QPPC), a joint venture by Qapco, Qatar Industrial Manufacturing Company and Italy's FEBO, boosting output of polyethylene films to 30,000tpa by 2008, in line with a rise in polymer capacity to two million tpa. Demand for plastics packaging in the Middle East region is expected to grow significantly over the next few years. The company wants to become the Gulf's largest converter of polymers into packaging material by the end of the decade. In 2005, production was up 18% compared to the previous year. By 2008, it expects to source 95% of its polymer field locally, compared to 80% at present.

Future feedstock shortfall?

While there are a number of major projects in the pipeline, the industry is facing a number of significant hurdles. One of the chief problems the Gulf petrochemical sector could face in the years ahead is a lack of feedstock for the planned projects. The massive rise in petrochemicals capacity may not be accompanied by a concurrent rise in output. Ethane will become less available and petrochemical development will likely require greater dependence on heavier feedstock such as propane, naphtha, or gasoil, requiring more costly cracking processes.

Feedstock depends on allocations from the Dolphin Project, which involves the utilisation of Qatari gas for energy-intensive industries and electricity generation in the UAE. The \$3.5 billion project – a joint-venture between the Abu Dhabi-owned Mubadala Development Company (51%),

Table 1 Announced Ethylene Cracker projects in the Gulf Region

Country	Company	Location	Capacity ('000 tpa)	Onstream	
Abu Dhabi	Borouge II	Ruwais	1,400	2010	
Iran	NPC No. 5	Kharg Island	500	2010	
	Amir Kabir No. 6	Bandar Imam	520	onstream	
	Marun No. 7	Bandar Imam	1,100	2008	
	Arvand No. 8	Bandar Imam	1,100	2010-11	
	Arva Sasol No. 9	Assaluyeh	1,100	Q4 07	
	Jam No. 10	Assaluyeh	1,300	Q4 07	
	Kavyan Petro No. 11	Assaluyeh	2,400	2012	
	Persian Gulf Petro No. 12	Assaluyeh	1,900	2012	
	Ilam Petro No. 13	Ilam	500	2010	
	No. 14	Assaluyeh	1,200	2013	
	Boushehr Petro No. 15	Assaluyeh	670	2014	
	Kuwait	Olefins II	Shuaiba	850	2008
	Oman	OPIC	Sohar	800-1,000	2011
	Qatar	Qapco	Mesaieed	200+	Q3 07
		Ras Laffan Olefins Co.	Ras Laffan	1,300	2009
QP-Honam		Mesaieed	900	2011	
QP-ExxonMobil		Ras Laffan	1,300	2012	
QP Shell		Ras Laffan	1,200	2012	
Saudi Arabia		Ineos-Delta	Al Jubail	1,200	2011
		National Chevron, Phillips	Al Jubail	1,200	2010
		Petrokemya	Al Jubail	1,300	2011
		PetroRabigh	Rabigh	1,300	2008
		Saudi Aramco, Dow Chemical	Ras Tanura	1,500	2013
	Saudi Chevron, Phillips	Al Jubail	300	Q1 08	
	Saudi Kayan	Al Jubail	1,350	2009-10	
	Sharq	Al Jubail	1,300	Q3 08	
	Sipchem	Al Jubail	1,200	2011	
	Tasnee/Sahara	Al Jubail	1,000	2008-09	
YanSab	Yanbu	1,300	Q3 08		

Source: Chemical Week

Total and Occidental Petroleum (24.5% each) – involves the construction of a 370km gas pipeline with a capacity of 56.6 million cubic metres per day, supplied by Qatar from 2008.

Delays in the Dolphin Project have already pushed back the completion of Qapco's Ethylene Expansion Project (EP2) at its ethane cracker. There may also be problems in store for Qatofin's 1.3 million

tpa ethylene cracker in Ras Laffan, due to come online at end-2008 or early 2009. The ethane feedstock for the cracker unit will be supplied by the Enhanced Gas Utilisation (EGU) project at the Ras Laffan site and Dolphin project's onshore facilities. According to the government, the facility will be upgraded to 1.6 million tpa, which would make it the world's largest ▶▶

ethylene cracker. Qapco has yet to announce a time-scale for the upgrade. However, this depends on the availability of feedstock from the Dolphin project and there are uncertainties over how much output from Dolphin will be allocated to the Ras Laffan cracker. A lack of ethane for the cracker will affect its ethylene supplies to a 450,000tpa LLDPE plant and a 250,000tpa LDPE 3 plant both located at Mesaieed, which will be connected to the cracker at Ras Laffan by a 120km pipeline and are due to come online by 2010.

The cancellation of the world's largest single fully integrated gas-to-liquids (GTL) facility in February 2007 will also cut off a potential naphtha stream that would have provided feedstock for an additional cracker. The Palm GTL facility was to have been set up by ExxonMobil and QP and situated at Ras Laffan. The high costs of the ExxonMobil-QP GTL project were the principal factor behind the decision to abandon it. However, Shell-QP's Pearl GTL project and Sasol-QP's Oryx GTL plant are still due to go ahead, providing naphtha, normal paraffins, kerosene and lubricant base oils. Pearl GTL was launched in July 2006, and involves using dry gas feedstock for manufacturing 140,000 billion barrels per day (bpd) of liquid hydrocarbon products, with two 70,000bpd GTL trains and associated facilities. The Oryx GTL plant came fully onstream in January 2007, following delays caused by damage to a supporting utility system. The \$950mn, 34,000bpd plant produces 24,000bpd of diesel, 9,000bpd of naphtha and 1,000bpd of liquified petroleum gas (LPG).

Rising costs, peaking Asian demand

The Gulf states are also facing rising construction costs, which could impact on the profitability of new cracker and associated downstream units. The cancellation of the Palm GTL project is testament to the problem of rising costs eating into profit margins. Construction costs are sky-high, forcing developers to maintain high prices even as overall supply rises. Costs for oil and gas development have risen by 53% since 2004. Gulf states also depend on imported labour for manual work, adding to the complications. Workers are scarce and materials, such as cement and copper, are exorbitantly priced in Arab states in the Gulf region, putting them at a competitive disadvantage compared to Iran. Some projects may be delayed or cancelled as engineering, procurement and

Table 2 Qatar petrochemicals joint ventures

Company	Partners	Annual capacity (tonnes)
Qapco	QP (80%), Total Petrochemicals (20%)	750,000 ethylene 500,000 ethylene 273,000 HDPE
Q-Chem	QP (51%), Chevron Phillips Chemical (49%)	189,000 LDPE 50,000 hexane-1
Qatofin	Qapco (63%), Total Petrochemicals (36%), Qatar Petroleum (1%)	1450,000 LDPE (from 2008)
Qatar Vinyl Company (QVC)	Qapco (31.9%), Norsk Hydro (29.7%), QP (25.5%), Arkema (12.9%)	220,000 VCM 175,000 EDC 580,000 caustic soda
Qafac	Industries Qatar (IQ) (50%), Taiwan's Chinese Petroleum Corporation (CPC) (20%), Lee Chang Yung Chemical Industry Corporation (LCYCIC) (15%), International Octane (15%)	832,000tpa of methanol
Qafco	Industries Qatar (75%), Yara International (25%)	2mn tpa ammonia 2mn tpa urea

construction costs in the Middle East have inflated faster than other parts of the world.

An additional factor is Qatar's dependence on Asian markets, particularly China. Demand growth in Asia, led by the surging Chinese market, has underpinned global petrochemicals growth. But a sharp slowdown in Chinese growth would have a severe effect on Middle Eastern exporters. Meanwhile, China is set to witness a massive rise in petrochemicals capacity. Consequently, global petrochemical prices are likely to soften by 2010, coinciding with a rapid increase in cracker capacity in the Gulf. This could result in an imbalance in

Source: Author's research

worldwide supply and demand, depending on demand growth in Asia. However, Qatar should have a competitive edge over other Gulf states, providing it can secure guaranteed ethane supplies from the Dolphin Project. Despite project delays, Qatar's situation is far better than that of Iran, where a number of major petrochemicals projects face years of delays and possible cancellation due to poor planning, political interference and the impact of controversies over its nuclear programme on investment. ●

Upcoming projects in Qatar

	Partners	Capacity	Completion date
Ethylene Expansion Project (EP2)	Qapco	Increasing PE capacity by 200,000tpa to 750,000tpa	2007
Fuel Grade Methanol	QP, Petroworld Ltd	12-15,000tpa fuel grade methanol	2008
Qatofin LLDPE	Qapco (63%), Atofina (36%), QP (1%)	450,000tpa LLDPE	Q3 08
MGC/DME	QP, Mitsubishi Gas Chemicals, Itochu	1.7mn tpa dimethyl ether (DME)	Q4 08
QP-Honam	QP (70%), Honam Petrochemical (30%)	800,000-900,000tpa ethylene 700,000tpa PP	2009
Q-Chem II	QP (51%), Chevron Phillips (49%)	350,000tpe HDPE, 350,000 alpha olefins	Q1 09
Qatar Melamine	Qafco (60%), Qatar Intermediate Industries Holding Company (40%)	60,000tpa melamine	Q1 09
LDPE 3	Qapco	250,000tpa LDPE (Expandable to 300,000tpa)	2010/11