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**Keywords:** Saudi Arabia, Kuwait, Qatar, petrochemicals, polymers, olefins, ethylene, propylene

**Petrochemicals bounce back**

Petrochemicals are used to produce durable and nondurable consumer products that improve the quality of life. Demand for petrochemical-based products is dramatically increasing in developing nations. Asia is responsible for much of this new demand. A growing middle class in both India and China will reshape demand patterns for all petrochemical and chemical products.

The petrochemical industry continues to follow cycles of expansion and contraction as more efficient production units put pressure on older facilities. While Asia remains the epicenter for growing demand, the Middle East continues to expand petrochemical capacity based on cost-advantaged feedstocks. Much of the new production will be exported to Asia and Europe. In North America, the growing supply of shale gas has reset regional natural gas prices. North American petrochemical producers have transformed themselves and are now visibly competitive in the global market. Commercialization of new and expanded feedstocks and raw materials are prompting changes in the global petrochemical market.

The Middle East (ME) ethylene boom has concluded, and the era of great expansions has slowed for the decade. Most of the Middle Eastern countries are looking to expand further into downstream petrochemicals as opposed to exporting the building blocks. Previously, the ME had a great advantage in the production of ethylene, propylene and their derivatives due to abundant, cheap feedstocks. The abundance continues, but only for those projects that have it guaranteed and set aside at a certain price. It is unlikely to see any new projects this decade due to supply and price restraints. Iraq may see a boom sometime after 2020, but that’s a long way off as this nation continues to rebuild and focus on more pressing issues, such as gas-fired power generation.

Although the availability of inexpensive gas prompted many companies to move forward with massive expansion plans, the region is facing new uncertainties in providing sufficient feedstock. This is a serious concern for proposed projects, especially in Iran and Saudi Arabia.

ME domestic gas prices are expected to eventually increase as production costs have risen significantly. This may push governments to set higher prices for petrochemical feedstocks. New feedstock prices for petrochemical projects in Saudi Arabia could even increase to over $2/MMBtu—well above the $0.75/MMBtu price seen in the past. Even with higher feed gas prices, ME petrochemical projects are still economical, but they certainly less attractive for new investment. The larger issue will be getting feedstock committed for new projects.

**ME ETHYLENE AND PROPYLENE PRODUCTION**

Ethylene and propylene are the principal petrochemical products and a major feedstock for other polymers. In recent years, the world witnessed possibly the largest expansion ever for new ethylene and propylene plants, and most of it was located in the ME. These additions will have a significant influence on the global petrochemical industry in the near term.

The 2008–2012 boom saw an average annual growth rate in ethylene capacity of nearly 12%, from 16.9 million tpy (MMtpy) to 26.3 MMtpy. While such growth will be limited to a 5.6% average annual growth rate from 2012 to 2016, we will still likely see ethylene production capacity reach 32.6 MMtpy. The wild card is Iran; as this nation tries to complete its current projects, we are cautiously optimistic. It is possible, however, that the political situation in Iran and the potential for petrochemical sanctions may result in further delays. With Iran removed from the picture, the average annual growth rate from 2012 to 2016 drops to just 2.8%, with the largest growth coming from Borouge III in Abu Dhabi. Fig. 1 illustrates the ethylene capacity expansion in this region.

**Fig. 1.** Ethylene production capacity in the ME, 2008–2016.

**Saudi Arabia**

This nation is the largest ethylene producer in the region. At present, ethylene production in Saudi Arabia is 1.45 MMtpy, up by 5 MMtpy from nearly three years ago. Ethylene is produced in large Saudi petrochemical complexes such as Sadaf, Yanpet, United, PetroKemya, Tasnee, Yansah, PetroRabigh, Saudi Kayan, Saudi Ethylene and Propylene Company (SEPC) and Sharq III. Propylene capacity in Saudi Arabia has grown to 3.38 MMtpy.

The wave of the Saudi petrochemical sector’s massive increase in ethylene and propylene production capacity is beginning to recede. While Saudi Arabia will remain a global leader in the petrochemical industry, the large ethane-based projects are a thing of the past due to a lack of feedstock availability.

At present, two petrochemical projects are likely to be constructed in Saudi Arabia, and these projects are scheduled for completion in 2015 and 2016. We only list the reported ethylene capacities at this time, as the final configurations have yet to be decided, as shown in Table 1. Even with Aramco as a partner, feedstock availability and price weigh heavily due to shortages in the Kingdom. It should be noted that Aramco provides feed gas for petrochemical projects at a fixed price of $0.75/MMBtu. The cheap feedstock is a great advantage for the petrochemical industry in Saudi Arabia.
Iran

In spite of various sanctions, Iran continues to be a major petrochemical player in the region. Iran’s petrochemical developments owe their recent success to affordable feedstock and a 10-year tax holiday for investors. In 2010, Iran produced around 40 million tons of petrochemical products. The continued expansion of the domestic petrochemical industry has resulted in an average annual growth rate of 22% for petrochemical product output and a 28% increase for export volumes since 2005. Iran’s ethylene capacity stands at 5.3 MMtpy, which represents about 21% of the ME’s ethylene capacity. Propylene capacity stands at 1.1 MMtpy. Figs. 2 and 3 illustrate Iran’s ethylene and propylene production capacities by project in 2011.

The Jam petrochemical complex remains the largest ethylene producer in Iran. Ethylene production capacity of this complex is approximately 1.32 MMtpy. The plant also produces 305,000 tpy (305 Mtpy) of propylene. FACTS Global Energy (FGE) forecasts that Iran’s ethylene and propylene production capacities will increase significantly after the completion of petrochemical projects now under construction, as summarized in Table 2. By 2014, Iran’s ethylene production capacity is expected to increase to 8.5 MMtpy, while its propylene production capacity will increase to 1.4 MMtpy. In spite of its difficulties in attracting foreign investment, Iran continues to achieve its goals of increasing petrochemical production capacity.

While expansion plans continue, Iran’s new projects will be challenged by such issues as long delays in completion dates due to a lack of financial resources and/or feedstock availability. In recent years, several petrochemical projects have faced feedstock supply shortages, thus forcing them to run well below nameplate capacities. For instance, the largest ethylene producer in the country, Jam, has experienced a feedstock (ethane) shortage since 2009. The Jam ethane cracker operates at 50%–60% of its capacity due to insufficient ethane supplies from the South Pars gas projects. This also resulted in the derivative plants cutting production due to the ethylene shortages.

Iran is blessed with abundant and easy-to-develop gas resources that have allowed the country to sell feed gas to petrochemical projects at very low prices—around $0.4/MMBtu–$0.5/MMBtu. Accordingly, Iranian projects have significant economic advantages compared to other international petrochemical producers. However, a recent price increase is a major concern, particularly for the private players in Iran’s petrochemical industry. This is seriously threatening the projects’ economics and future expansion of the domestic petrochemical industry.

It is worth noting that, in October 2009, the Iranian Parliament finally approved the general outline for increasing energy prices and passed a bill to cut energy subsidies. Based on the approval,
the price of natural gas will be set gradually to market prices from the start of the reform plan on Dec. 19, 2010. Industrial projects, including the petrochemical projects, now have to pay around $2/MMBtu for natural gas for the first year of the reform plan, which is considerably higher than the past price of $0.53/MMBtu in early 2010. The ethane price has been set at $1.45/MMBtu for the first year of the reform plan. For the longer term, Iran is planning to increase gas prices for industrial projects to 65% of the average export gas price within 10 years. These higher gas prices will make many new gas-based projects economically unfeasible.

Qatar

Ethylene is now produced by three major petrochemical companies in Qatar with a total production capacity of 2.6 MMtpy. Qatar Petrochemical Co. (Qapco), Qatar Chemical Co. (Q-Chem) and Ras Laffan Olefins Co. (RLOC) are the ethylene producers in this nation. Qapco’s ethylene production capacity is roughly 800 Mtpy, Q-Chem has a production capacity of 500 Mtpy, and RLOC has a production capacity of 1.3 MMtpy.

At present, the country has no propylene production; however, some of Qatar’s future plans could involve propylene production. As the configurations are not yet finalized for newbuilds, it is too soon to comment, and it seems unlikely at this stage. At present, Qatar Petroleum has two agreements to construct steam crackers. One is a joint venture between Qapco and Total that has an HOA professing an output of 1.4 MMtpy of ethylene. The other is a Qatar Petroleum/Shell HOA for a $6.5 billion steam cracker with a monoethylene glycol plant yielding up to 1.3 MMtpy.

Ethylene and Propylene Projects in Other Middle East Countries

The UAE

Abu Dhabi has a number of projects, and ethane is the only feedstock. Borouge I operates a 600-Mtpy ethylene plant, and Borouge II operates a 1.5-MMtpy ethylene plant that also produces 825 Mtpy of propylene. As Borouge II only uses ethane feedstock, the propylene primarily comes from the world’s largest metathesis unit, which has a capacity of 752 Mtpy.

The Borouge III petrochemical company is under construction, and it should be operational by mid-2014. The ethane cracker will produce 1.5 MMtpy of ethylene, thus raising total ethylene production to 2.6 MMtpy. The ChemaWeynat project is the other planned petrochemical venture. It is a 1.45-MMtpy naphtha cracker and grassroots olefins, aromatics and urea complex at Taawelah. While the project continues to be discussed, naphtha feedstock pricing issues from the Ruwais refinery appear to be the cause of the delays. At this point, the project is not included on FGE’s list of firm projects.

Kuwait

Kuwait’s ethylene production capacity is 1.65 MMtpy. Equate Petrochemical Co. operates an 800-Mtpy facility, and Kuwait Olefins Co. (TKOC) operates an 850-Mtpy facility. Both are located at Shuaiba. The only additional project to be mentioned is the Petrochemical Industries Co. (PIC) Olefins III project. While a feasibility study was completed in 2011, no details have emerged as to the intended configuration and feedstock. We understand that it will be a mixed-feed plant, which makes sense considering the uncertainties in Kuwait’s gas supply. The project’s location was moved to Al Zour, near the planned new refinery.

Oman

Oman continues to produce propylene at the Sohar refinery. The refinery operates in an olefin mode to produce roughly 327 Mtpy of propylene feedstock for the polypropylene plant owned by Oman Polypropylene LLC (OPP). There are no olefin expansion plans in Oman.

Iraq

At present, Petrochemical Complex No. 1 (PC1) in Khor al-Zubair, near Basrah, is producing ethylene from ethane feedstock supplied by the Rumaila oil field. The plant has the capacity to produce 152 Mtpy of ethylene, 110 Mtpy of ethylene dichloride, 66 Mtpy of vinyl chloride monomer, 60 Mtpy of polyvinyl chloride and 90 Mtpy of low-density polyethylene (LDPE) and high-density PE (HDPE). However, the plant is operating below its nameplate capacity and needs revamping. South Korea’s STX Heavy Industries signed a memorandum of understanding (MOU) with Iraq in 2010 to revamp the facility, but they have yet to be successful in enacting the MOU. This construction project remains delayed at this time. Iraq will likely continue to focus its efforts on increasing oil production and electrical power generation before focusing on its petrochemical industry.

ME growth is stymied by shortages of cheap natural gas feedstock

Low gas prices in the ME have provided an attractive environment for gas-based petrochemical projects. With the possible exception of Qatar and Iraq, these advantages have slipped away due to increased domestic gas consumption. Dubai and Kuwait are now importing liquefied natural gas (LNG), with others exploring LNG as an option. With world economic growth remaining slow and feedstock prices rising (natural gas or naphtha), the global olefins market continues to be oversupplied for the near term. However, existing ME olefin suppliers will be less affected than Asian petrochemical producers due to available low-feedstock prices. Elsewhere, naphtha-based projects will be most affected.

The outlook for new projects is less optimistic, unless investors can lock in a feedstock source and price from the government or build a combined complex with a refinery to provide naphtha feedstock. The boom era of olefins projects is over, and we will likely see investment moving further downstream in the petrochemical value chain to more intermediates and potentially beyond.

Stefan

08.30.2012

I am not sure the price of oil is the real problem, Kelli. Perhaps, its overly rapid rise due to speculators and its inability to have the price fall at the pump when the price of a barrel drops is the issue.

Roy

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