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Hydrocarbon Engineering | April 2014

## Pieces of the U.S. shale puzzle: the future of European ethane and propylene markets

According to a report by the U.S. Energy Information Administration (EIA) in June last year, shale oil and gas resources formed 29% of total U.S. crude oil production and 40% of U.S. gas production in 2012. Considering that in 2008 shale barely featured in U.S. crude demand at all, such growth over four years is staggering and is attributable largely to the relatively low cost and high volumes available from shale fields in North America. The effects of this change do not only affect domestic U.S. gas and oil producers however, but have had and will continue to have an ever greater influence on global chemical markets, in particular those in Europe and in Brazil.

This article examines how the use of shale feedstock in the United States affects European ethane and propylene cracking and what the consequences for those markets are.

### The United States of ethane

According to a report from BenteK, the production of Natural Gas Liquids (NGLs) due to shale gas development in the United States is expected to increase by more than 2.8 MMB/d in 2016, representing an increase of 40%.

Shale tends to have a high NGL composition (often referred to as “wet gas”), where on average 75% is methane, ethane accounts for 16%, propane 5% with the remaining 1% butane, hexane and other gases. However, as methane is then sold at natural gas prices – primarily for use as fuel – and considering that natural gas reached a ten year low in 2012 of \$2.27 per million British thermal units (MBtu), the incentive to continue exploration simply for methane is low.

Ethane is a different story though – primarily because of its use as a feedstock for ethylene: between October 2011 and June 2013, the cost of ethane dropped dramatically. By contrast, the price of ethylene grew to almost \$1250/mt in June 2013, meaning that the ethane cracker margins rocketed, while naphtha cracker margins oscil-

lated around the zero point. Such low ethane prices combined with its domestic availability means that the financial motive for using ethane to produce ethylene is obviously much clearer and is the reason behind ethane becoming the feedstock of choice for many U.S. producers.

### Investment and overbuilding

The logical result of the above trends has been an increase in investment in specific ethane to ethylene crackers in the United States. Shell Chemicals, Oxychem, Sasol, ExxonMobil Chemical, Dow Chemical and Chevron Phillips Chemical have all announced new ethylene crackers, while BASF, Ineos and Equistar will be doing expansion work either this year or 2015. The American Chemistry Council announced only last week its expectation that over the next five years, domestic capital investment will reach \$60bn.

The resulting increase in ethylene capacity will reach 8mt/year, requiring an extra 12mt of ethane feedstock. According to Platt's, if ethane surpluses reach their peak of almost 5.5mt in 2015, the result could be an ethane deficit by 2017, eroding the competitive advantage that the U.S. currently profits from in the olefins market. Overbuilding could thus present a huge problem, assuming that all of the planned projects are actually carried out.

### The ethane effect on Europe

While Western Europe is estimated to house a variety of shale formations – the EIA estimates almost 800 trillion cubic feet of technically recoverable resources – hydraulic fracturing (“fracking”) is still an extremely political and controversial topic. Fracking as a technology has not yet shaken off its image as water table contaminator and destroyer of greenbelt areas in Europe, to an extent that few politicians are willing to stick their necks out and endorse it. That said, British Prime Minister David Cameron announced on January 13th his support for shale development in the U.K. only days after the Financial Times reported that Total would become



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the first major producer to invest in British shale. France's President François Hollande meanwhile has supported a ban on the use of fracking technology.

Additionally, as Europe's infrastructure was built around cracking naphtha, (directly linked to the price of crude oil) the 2013 average of \$108/bl for Brent crude has caused some significant suffering for European petrochemical companies. Dwindling of North Sea reserves and the Eurozone crisis have taken further toll on an industry already struggling in the face of American competition.

It is perhaps not surprising then, that companies such as Ineos Europe AG, Italy's Versalis and Austria's Borealis are jumping on the bandwagon and trying to arrange contracts with U.S. producers to import ethane for feedstock. However, legislation currently pending in Congress could limit LNG exports from the United States as many fear that exports will raise domestic prices and harm manufacturers: essentially aiming to preserve their competitive advantage. Even if European imports of ethane go ahead and begin to address margin shortfalls, the amount of investment needed to ensure feedstock availability, security and to renew aging infrastructure over the long-term is still lacking. Current estimates state that by 2015, 33% of crackers in Europe will become uneconomical, prompting majors such as Shell to sell some European assets in order to avoid crippling construction and maintenance upgrade costs.

At the same time, those downstream companies using ethylene to make other materials such as polyethylene and polyvinylchloride (PVC) are struggling to adjust to the ethane impact. In Brazil for example, PVC producers are in competition with U.S. companies who are able to use ethane from shale as their feedstock. Even with the cost of export, transportation and duty on imports, those U.S. producers can still compete with Brazilian ones, which is forcing them to either reduce their margins or lose market share. As neither of those options are appealing, companies in Europe and Brazil alike must squeeze their fixed cost base and optimize their production processes in order to remain competitive.

### **Pretty propylene**

The above factors may seem to paint a rather dire picture for the European petrochemicals market, but the impact of propylene on European success must not be forgotten. As mentioned above, us-

ing ethane to make ethylene is highly efficient if ethylene is the end product required. However, as ethane use has increased, it has simultaneously caused a decrease in propylene availability – formed as a co-product of naphtha cracking. The ethylene-only expansions mentioned above could further frustrate propylene supply, demand for which is estimated to be growing at a Compound Annual Growth Rate (CAGR) of 4.6% globally, spurred mainly by Asian consumer growth. The supply shortage has already provoked an increase in prices, prompting a number of on-purpose propylene projects in the U.S., alone capable of reducing the demand gap to 750,000 tons per year.

There is some skepticism as to what extent propylene-on-purpose plants can realistically address the supply shortage however and in the meantime, European plants already producing propylene can benefit from price increases. Even if the aforementioned ethane import contracts materialize, margins will still be reduced due to transportation and security costs, whereas the naphtha needed to make propylene is available and the infrastructure to produce it is up and running.

### **Strategic investment decisions**

Whether producers in Europe and the United States follow the ethylene or the propylene route, fundamental strategic decisions cannot be avoided. Some may consider it more beneficial to admit defeat and close plants: the closure of the Ineos-owned Grangemouth plant being a case in point. Others may instead decide to invest further in the assets they have and not give up the ghost quite yet. Total for example announced in September last year that it would invest €160m in its Carling petrochemical platform before 2016, citing its "industrial responsibility to anticipate and adapt" its production to international demand. Considering the huge cost of capital required, producers that choose to follow the Total path must manage such projects properly, assessing early on how best to use available technology and update and maintain existing assets.

Once key strategic decisions have been made, some time must be devoted to analyzing where fixed costs can be reduced. While energy and feedstock make up a huge part of total operating costs, areas such as maintenance and staff management can together account for almost 45% of the fixed cash costs of a refinery. While most Plant Managers consider those costs to be almost entirely unavoidable, the proper evaluation and

optimization of processes can positively affect efficiency by up to 25%.

Where maintenance is concerned for example, a lack of proper scheduling processes can mean that tools are not available on time, work permits cannot be issued, staff stand around waiting to be able to work and the backlog increases exponentially. However, by identifying the root cause of problems and addressing them directly, backlogs can be reduced and staff time fully utilized, increasing efficiency, reducing the cost of overtime and ensuring a safer environment.

If managers take the time to really look at their existing processes and identify where and how they can be improved, the potential for cost reduction and therefore margin improvement is high, which could make all the difference to surviving in the face of new competition.

### **Onwards and upwards**

The above developments in the global chemicals markets mean that at present, it would be logical for a number of European producers to invest in their existing assets and play the long game. Ethane is extremely difficult to transport due to its low boiling point and high vapor pressure, meaning it must be kept either extremely cold or pressurized, placing a significant brake on its current transportability. By contrast, naphtha availability in Europe is still high and much easier to transport across long distances.

The pace of change however that America's shale play has started will no doubt increase over the coming years, and producers in Europe must ensure that they remain at the forefront of new technological and logistical advances and higher added-value products if they want to remain a piece of the energy puzzle at all. In the face of such competition, the shale game can only be played to win.