

# SEIZING THE OPPORTUNITY IN U.S. PETROCHEMICALS

By Rohan Nath, Clint Follette, and Adam Rothman

**D**RIVEN BY A SURGING domestic supply of low-cost natural gas and natural gas liquids (NGLs), the U.S. petrochemical industry has been revitalized. A wave of investment is under way: companies and investors have already announced planned capital expenditures in excess of \$70 billion by 2020 and \$100 billion by 2023.

The opportunity is indeed sizable. But the prize will not be easy to win, especially for the substantial number of stakeholders, both U.S. based and foreign, that are new to the market or have had a limited presence historically. For these players, the dynamic U.S. market could present significant hurdles on several fronts—namely, project management, organizational development, feedstock sourcing, and sales and marketing.

To surmount these and other challenges, these competitors will have to develop strategies and capabilities specific to the U.S. market. Relying on what has worked in other parts of the world could prove to be a losing proposition.

## Investments and Implications

Most current and planned petrochemical investment in the U.S. is targeted at expanding production capacity for methanol, ammonia, ethylene and ethylene derivatives, and on-purpose propylene. These investments are being driven by specific considerations and present both risks and opportunities to new investors.

### METHANOL

Investment in methanol is being driven by a number of forces. U.S. producers' cost profile is benefiting from the low cost of domestic natural gas, which serves as both feedstock and fuel. Methanol demand, both in the U.S. and globally, is growing as a result of new applications, such as the use of dimethyl ether in fuels, and emerging technologies for converting methanol to olefins.

Assuming that announced plans for new methanol production capacity will materialize, the U.S. will move from being a net importer of methanol to being a net exporter. We believe that most of these projects will, in fact, be completed, given the price com-

petitiveness of U.S.-produced methanol vis-à-vis methanol priced on global markets.

New investors in methanol development face several challenges. One is securing sufficient offtake; this may entail developing export-oriented marketing and sales strategies. Another is moving with speed: the first plants to launch will likely be able to sell their output domestically, capitalizing on strong existing demand. Finally, investors will have to wrestle with challenges related to capital project management as growing numbers of players compete for scarce engineering, procurement, and construction resources.

### AMMONIA

Like methane producers, ammonia producers are benefiting materially from low domestic natural-gas prices, which translate into a stronger bottom line and increased competitiveness versus non-U.S. players. Today's newer, larger production plants are also much more efficient than the older, smaller ones, raising the financial incentive to build new capacity. Further, demand for ammonia-based fertilizer is rising, both in the U.S. and abroad, owing to the push to increase crop yields and to dietary shifts related to rising per capita wealth.

Given these forces, bullishness toward ammonia production is likely to remain strong. Plans to launch more than ten greenfield, brownfield, and debottlenecking projects between now and 2018, representing 12 million tons of capacity, have been announced. How many of these projects come to fruition remains to be seen, however. High capital costs could weigh on the prospects for some greenfield projects in particular. Global fertilizer prices will also obviously play a determining role. Ultimately, we can imagine the U.S. market balancing itself over the next few years with a slight shortfall of domestically produced supply, with world fertilizer prices being the main variable.

New investors seeking exposure to U.S. ammonia production will likely need to establish a presence in existing ammonia pipelines—or spend capital to convert ammonia

into more easily transportable products, such as ammonium nitrate or urea. Investors should also recognize the risks of overbuilding: if new capacity results in the U.S. exporting ammonia, there is a chance that some investors will not be able to achieve attractive returns. Finally, greenfield ammonia plants are expensive. A surge in building activity could drive construction costs up even further, making it harder for investors to capture their targeted results.

### ETHYLENE AND ETHYLENE DERIVATIVES

Investment in the production of ethylene and ethylene derivatives is being fueled by several factors. One is the low cost of ethane (a common feedstock for ethylene production), whose price hovered near historically low levels throughout much of 2013, reflecting a glut of domestic supply. This has given U.S. ethane-based steam crackers a strong cost advantage over their global competitors. In fact, only Middle Eastern ethane crackers, whose feedstock costs are subsidized, are more competitive.

A second factor is the high domestic and global price of ethylene. Ethylene prices are set by the economics of naphtha steam crackers (which are particularly common in Europe and Asia), and naphtha prices remain relatively high. For U.S. ethylene producers, the combination of high ethylene prices and low feedstock costs has led to a substantial widening of margins compared with margins for many non-U.S. producers.<sup>1</sup>

Because of these factors, companies and investors have announced plans for the creation of more than 10 million metric tons of new ethylene production capacity. We expect U.S. ethane supply to exceed domestic demand for most of the decade. If ethane is temporarily in short supply and prices rise during that span, upstream and midstream capacity can and will likely be brought online within 12 to 18 months to reestablish the supply glut.

Stakeholders new to the U.S. ethylene market will face unique challenges. The U.S. market for common derivatives is growing

at only 1 or 2 percent per year, making market entry difficult. The dynamics of the ethylene derivatives market—especially the market’s strong differences by region—can be particularly hard to understand and navigate, even for players with considerable market experience elsewhere in the world. Hence new entrants will need to hire the right sales and marketing staff. And the cost of recruiting these personnel, who are in short supply, will be steep. To mitigate the risks, aspiring market entrants should consider partnerships or joint ventures with existing U.S. producers.

### ON-PURPOSE PROPYLENE

Investment in on-purpose propylene is being driven primarily by a shifting balance between supply and demand. The growing use of ethane and other NGLs in U.S. steam crackers has resulted in a material reduction in propylene production. The domestic supply of propylene has been further reduced by the closure of several refineries. Simultaneously, strong demand for propylene derivatives is pushing propylene’s price higher: it reached \$1,740 per ton in February 2013 and remained above \$1,620 per ton in February 2014, compared with an average price of approximately \$1,330 in 2012. Propylene’s price has also remained high relative to that of ethylene: although propylene has been cheaper than ethylene historically, contract prices for polymer-grade propylene were 1.35 to 1.65 times higher than those for ethylene in 2013.

To date, investors have announced plans to build more than five propane dehydrogenation units to boost U.S. propylene supply. How many of these plants are ultimately completed will hinge to a large extent on the spread between propane and propylene prices. The potential for overbuilding of production capacity and for rising propane prices could narrow this spread over time, reducing the financial incentive for additional investment. Hence projects that are last in line to be built, or that have not secured committed buyers and fixed-price contracts for the plants’ output, are less likely to be completed.

For new investors, a major challenge will be gaining access to feedstock. Investors will

need to spend capital to construct pipeline connections to fractionation facilities. They will also need to negotiate skillfully with hydrocarbon owners to obtain competitively priced feedstock. Another challenge will be to secure contracted offtake. Without a deep knowledge of the U.S. Gulf Coast olefin market, specifically, owners may find it difficult to “sell out” their plants or obtain advantaged pricing. A final challenge for investors is the propylene market’s potential for extreme volatility, as evidenced by price swings in the past few years.

### Managing the Major Challenges

Players seeking to establish a footprint in the U.S. petrochemical market will have to address challenges related to project management, organizational ramp-up, feedstock sourcing, and sales and marketing. We offer some suggestions for tackling those challenges below.

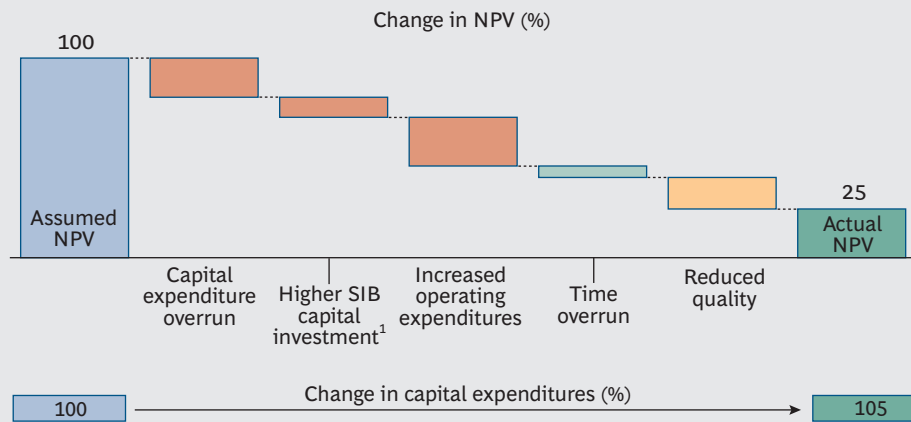
#### PROJECT MANAGEMENT

Many of the projects that companies and investors will be undertaking will necessarily be large and highly complex. The potential for problems is proportionately great; indeed, The Boston Consulting Group estimates that fully 75 percent of “megaprojects” across industries are beset by delays, budget overruns, or quality problems. The impact on investors’ returns can be substantial: we calculate that such problems can reduce a project’s net present value by fully 75 percent and increase necessary capital expenditures by as much as 5 percent. (See Exhibit 1.)

A proper decision framework can dramatically increase the odds of success with large projects. Such a framework should be based on four tenets. The first is the judicious application of lean principles: this can translate into designing less, building less, building faster, and eliminating unproductive time and effort. The second is the establishment of effective, comprehensive project-management systems, underpinned by strong functional support. The third tenet is an emphasis on standardization and replication. Companies often succumb to the temptation to customize smaller projects, often with little or no discernible penalty.

## EXHIBIT 1 | Megaprojects Can Be Affected by Delays, Budget Overruns, and Quality Problems

Net present values can fall by 75%, and capital expenditures can rise by 5%



Source: BCG experience.

Note: The change-in-NPV graphic is an illustrative example.

<sup>1</sup>Stay-in-business (SIB) capital refers to capital invested in assets already built in order to improve their productivity and profitability.

But customizing megaprojects can translate into exponentially greater complexity and related cost. It is therefore critical that companies strive to maximize standardization in petrochemical projects. The fourth tenet is operating discipline in project management and delivery: decision making should be timely, transparent, and informed.

We have found that the use of such a framework can lead to substantially better outcomes. In our experience, it can reduce projects' capital intensity by 20 to 35 percent.

### ORGANIZATIONAL RAMP-UP

Companies that are ramping up their organizational capabilities will face several challenges. They include difficulty developing talent for new managerial roles; conflicts between and among functions; potential disagreements between local-site management and corporate headquarters; heightened competition for scarce industry talent; and frequent changes in organization structure, roles, incentives, responsibilities, processes, and job rotations owing to the short organizational life cycle common to high-growth industries.

Our experience confirms that companies can succeed on those fronts by establishing the right vision, structure, and tools. Lead-

ers must commit to a strategic direction and launch a culture of growth. They should design appropriate processes for funding, staffing, and managing growth, and remove obstacles and disincentives that limit growth. They must align incentives with growth objectives and reward entrepreneurialism. Once companies have taken these steps, they can focus on the task at hand: designing an efficient, low-cost organization; developing well-defined roles; and recruiting skilled talent, including a sales force with the right experience.

### FEEDSTOCK SOURCING

Feedstock is the biggest cost driver in basic chemicals, accounting for the majority (often 70 percent or more) of operating expenses. To ensure sufficient access to feedstock and minimize related costs, a company must develop an advantaged strategy.

Strategy formulation should focus on three steps. First, the company should determine and thoroughly understand the factors that influence the feedstock landscape, including sources of supply and demand. Second, it should develop a forward-looking, scenario-based view of feedstock availability and pricing that assumes different levels of resource productivity and competitive investment. Finally, the company should develop

different scenarios for future feedstock supply and evaluate the robustness of its options by anticipating the likely dynamics of each scenario and determining whether the company has a winning strategy. (See Exhibit 2, which illustrates the development of a strategy for ethane.) The right plan can result in significant competitive advantage.

### SALES AND MARKETING

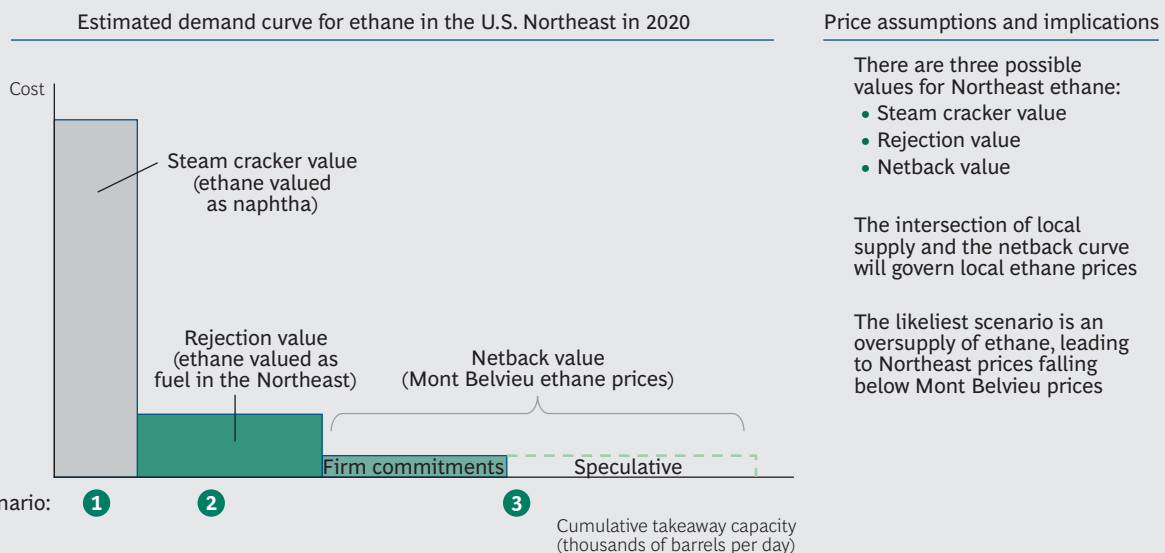
Success in this intensely competitive landscape will require a robust commercial strategy across four primary elements: market portfolio, sales channel mix, pricing, and product portfolio. The relative importance of each element, and the importance of sales and marketing in general, will depend on the specific product being offered and the contract dynamics of that particular industry. The importance of sales and marketing also stands to grow significantly in many markets as new capacity is brought online and competition rises.

The right market-portfolio strategy will seek to strike an optimal balance among high-netback markets, highly accessible markets that can support plant utilization, and markets where the company is seeking to establish a foothold. U.S.-based producers will first look to the domestic market,

which will likely have a higher netback and less complexity than other markets. But companies need to balance the strengths of the U.S. market with other markets' overall growth prospects and relative accessibility; in many cases, given the U.S. market's growth prospects and the increasing amount of new capacity, it might make sense to export. We suggest that companies divide markets into three categories: tier one markets, which are top-priority markets in which the company is hoping to place large volumes; tier two markets, where current demand is huge but netbacks are lower; and tier three markets, which the company plans to exploit selectively but not commit large volumes to over the longer term. Such a tiered strategy can be very effective for winning in globally sold commodities that are not often sold through long-term contracts.

The company's sales-channel mix will have to account for differences in markets: some markets may require a direct approach, while others may be better served through third parties, such as distributors or traders. Factors that will influence these decisions include customer size, preferences, and location; market infrastructure and maturity; and the availability of suitable strategic partners.

## EXHIBIT 2 | A Scenario-Based Approach to an Advantaged Feedstock Strategy for Ethane



Source: BCG analysis.

In formulating pricing strategy, a company can use game theory to gauge the likely competitive response to different approaches. Price is the most common lever for securing new accounts, but new entrants may struggle to determine precisely how low they need to push prices to penetrate the market. By understanding each customer's existing portfolio of suppliers and making some simple assumptions about customer and competitor behavior, however, new entrants can gain insights that allow them to optimize their pricing.

Product portfolio choices are a key element of marketing and sales strategy, especially for ethylene derivatives. Should a company produce well-known grades that have deep markets but also significant competition? Or, assuming it has the necessary R&D capabilities and application development organization, should the company produce differentiated grades that have a unique

value proposition and face less competition? The decision can be made only in the context of the company's overall strategy, capabilities, and cost position.

**T**HE SHALE GAS revolution in the U.S. has created a once-in-a-century opportunity in the country's petrochemical industry. For non-U.S. stakeholders seeking to crack the market, the challenges will be numerous. But players that manage to do so stand to reap the rewards for decades to come.

**NOTE**

1. At the end of 2013, U.S. ethane-based ethylene producers' margins stood at approximately \$0.30 per pound versus a historical average of \$0.10 to \$0.15. Their production costs were two to three times lower than those of their Asian and European counterparts.

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