



**Managing Petrochemicals
with Confidence**
**Despite Energy Volatility and
an Uncertain Global Economy**



Not more than five years ago, the market trajectory for petrochemicals seemed clearer than it does today. Energy markets were shaped by high crude oil prices.

OPEC controlled production volumes, virtually ensuring elevated per-barrel prices. Burgeoning shale developments in North America exerted downward pressure on the price of natural gas. Growth in developing countries – including China, Brazil, Russia, and India – fueled global economic expansion.

Over the last half decade, each of those realities evaporated. OPEC's 2014 decision to let market forces establish oil pricing, even in the face of weak demand, eliminated the organization's absolute control. Many North American producers began cutting crude oil production due to poor profit margins. Although India's economy is growing, Russia and Brazil are now wrestling with prolonged recessions while China's economic engine experiences numerous fundamental changes. Evolving geopolitical considerations and increasing regulations and sustainability requirements are adding to a collective sense of uncertainty.

Yet demand for petrochemicals continues to increase, as fundamental economic growth is driven by the consumption of durable and non-durable consumer goods. Basic energy sources – such as crude oil, natural gas, and coal – provide the raw materials and essential BTUs needed to produce higher-value chemicals and plastics. Without these key building blocks, companies throughout the chemical industry value chain cannot enable the conversion of energy-derived feedstocks into durable and non-durable consumer goods.

IHS Chemical has not seen such a high degree of uncertainty in the chemical industry for many years. Investment decisions, driven by assumptions regarding both feedstock dynamics and global economic growth, suddenly seem to carry a higher level of risk. Market volatility seems to have caused a collective pause in the approval of new projects, as strategic planners struggle to deliver sound investment cases to executive management. Facing price declines, shifting competitive positions, and expanding and contracting profitability within value chain segments, commercial managers have had to modify short- to medium-term tactics to optimize existing assets. For example, in the U.S., as on-purpose propylene produced from propane dehydrogenation (PDH) has experienced cash margin declines, polypropylene cash margins have risen to historic highs.



Evolving Market Conditions Shape Investment Decisions

To understand the massive shift that has occurred in the petrochemical market, consider the changing energy and feedstock values on a BTU basis over time. Figure 1 shows United States energy prices for crude oil and natural gas. The vast majority of petrochemicals produced today are derived from these two sources. The figure also shows the gas-to-crude ratio, the variation in prices for both energy sources over time in relation to one another.

These comparative trade values influence investment planning and facilities operations for chemical companies. For example, natural gas and crude traded near parity from 1998 through 2005. These values created non-competitive dynamics for chemical production in North America, resulting in the elimination of new investments and the closing of many assets.

Beginning in 2006, North America experienced heightened development in non-conventional oil and gas markets. Significant price differences between raw materials based on natural gas and those developed from crude oil transformed North America (once again) into a low-cost region for chemical production. Investment activity, driven by both domestic and international entities, accelerated after a decade of limited interest.

A dramatic decline in crude oil pricing in late 2014 created an overall drop in commodity chemical prices. Buyers anticipating lower prices following the decline in crude oil paused their procurement decisions; this shift in turn slowed demand growth, causing short-term oversupply and resulting price declines. Yet responses varied by region, market, feedstock, level of integration, and value chain.

In the United States, the gas-to-crude ratio remained at 25% to 30%. Margins for polyethylene in the U.S. shrunk, but margins for polystyrene and polypropylene grew to record-setting heights. Although the overall competitive advantage in North America has declined since the fall of oil prices, it continues to support favorable investment opportunities in the region (relative to other regions and other feedstock choices).

Looking ahead, IHS energy experts forecast low crude oil pricing (of well below US\$ 100 per barrel) for the next three to four years. (See Figure 2.) This forecast also assumes competitive natural gas pricing in North America, ranging from \$3 to \$4 per million BTU. Crude oil prices are projected to recover, as high-cost production is reduced and demand accelerates to match global economic growth. IHS also anticipates that ethane prices will increase above fuel value beginning in 2017, as new ethylene capacity in the U.S. comes online.

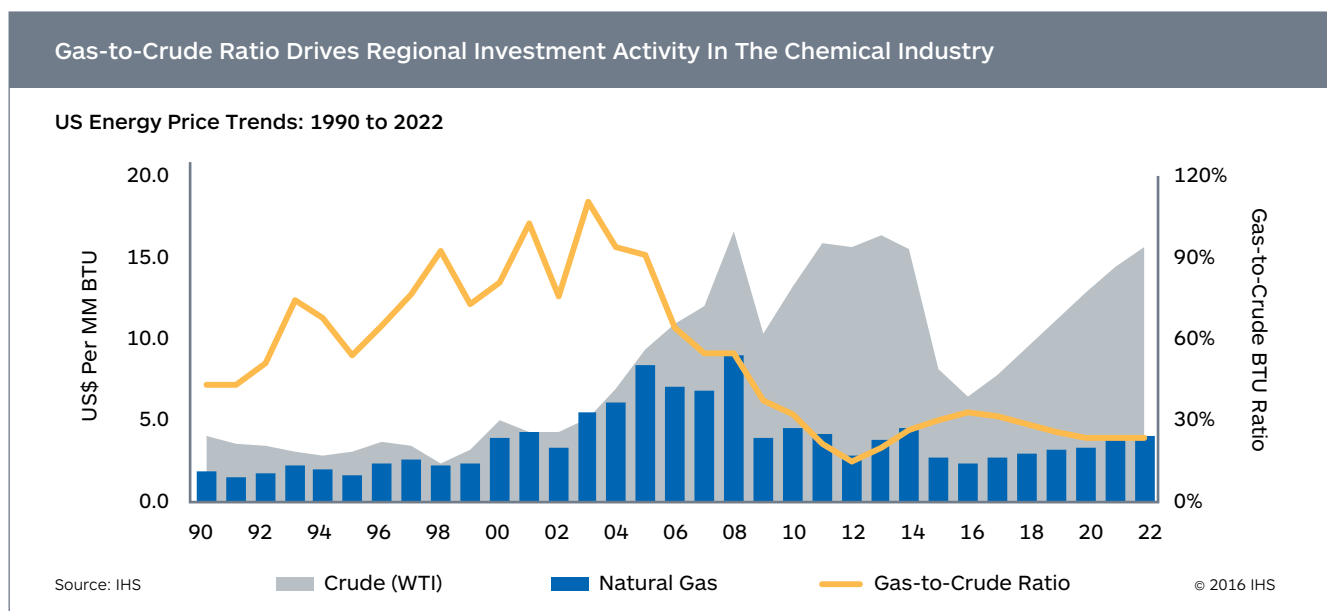


Figure 1. U.S. Energy Prices and Gas-to-Crude Ratio 1990-2022

Energy Values Influence Plans for Location and Technology

When planning investments in new capacity, chemical companies must consider a variety of factors and how they impact one another. After all, the interconnectedness of the end-to-end chemical supply chain forms complex relationships; sometimes changes to one part of the market ricochet, creating unintentional and unanticipated impacts elsewhere. Energy volatility creates complexity not just from energy to base chemicals, but throughout the complete value chain.

Energy and feedstock assumptions, including pricing and availability, should be factored into capacity planning decisions. Chemical companies that consider issues ranging from location to timing and technology can be better prepared to respond to dynamic market conditions.

For example, companies relying on light olefins will be well-served to study and develop scenarios that depend on different feedstock streams, including methane, ethane, propane, naphtha, and even coal. Each feedstock has different capital requirements, offers a range of cash cost performance, and provides individual return on investment results – depending on where the gas-to-crude ratio trends.

Geography is certainly a key in investment decision making. When reviewing the location of chemical assets around the world (see Figure 3), it is clear that China's past decade of investment activity has created a huge cluster of capacity. IHS expects this steady growth to continue over the next five years. From 2015 to 2020, China capacity (for basic chemicals) is expected to grow from 175 to 216 million metric tons (MMT), as facilities expand from the original coastal areas to the inland areas to the west.

Basic chemical capacity growth is not limited to China, however. North America is expected to expand from 90 to 121 MMTs in the next five years. The pace of investment may be slower than in the past decade, but IHS anticipates significant growth in order to keep up with the global growth in demand.

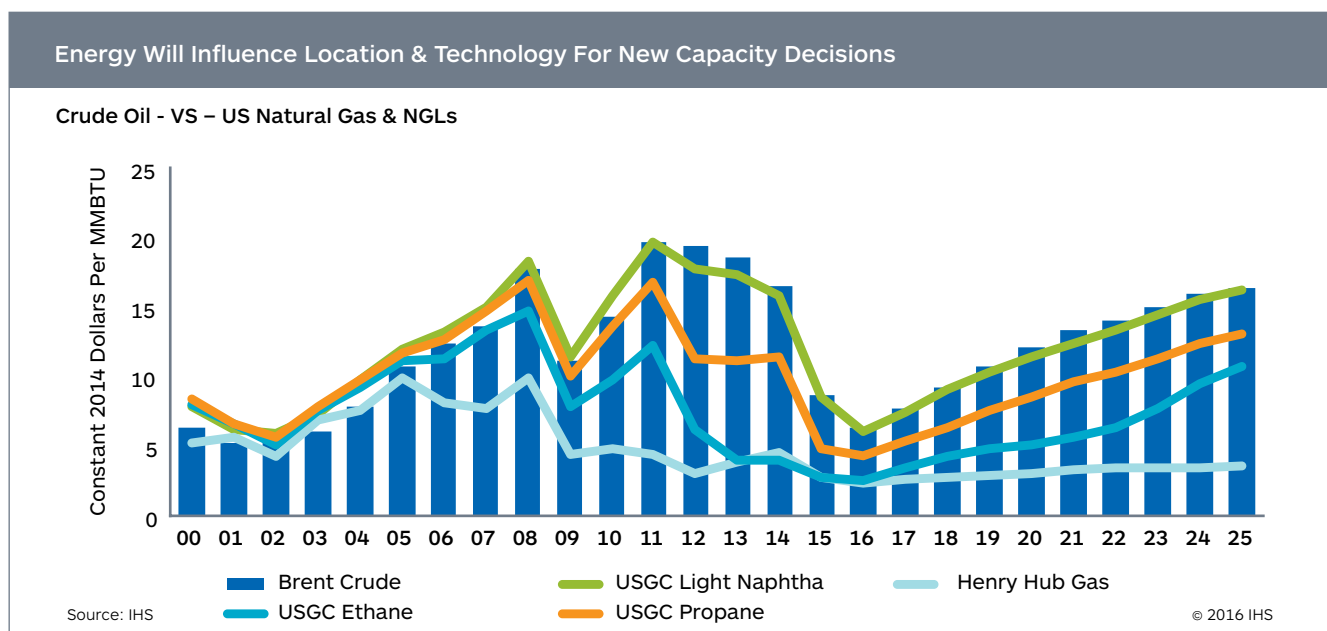


Figure 2. Projecting Prices of Energy and Feedstocks

Successful Investment Planning and Near Term Asset Management Demands Flexibility

Earnings volatility and industry cyclicality create significant challenges for the chemical industry. The high level of uncertainty in energy markets and economic fundamentals is challenging planners to identify the best path forward for capacity investments while at the same time optimizing the existing asset base.

What once appeared to be routine planning assumptions regarding future investments are no longer obvious. In today's market, the impact of volatile energy markets, changes in economic growth, operating performance of existing assets, unplanned supply interruptions, and geopolitical turmoil can be difficult to predict. Yet these factors can dramatically effect market cycles and corporate performance. Chemical companies across the value chain – from energy and feedstocks to consumer goods manufacturers – must create strategic plans that consider each of these variables.

In many chemical companies, boards are requiring higher projected returns on investment decisions to compensate for higher risk premiums. Some boards are deferring approvals until market conditions signal a more predictable outcome.



It's important to note that build cycles for most projects average four to six years. Therefore, any delay in the execution of new facilities projects could limit chemical production from 2020 to 2022. A delay in investment decision making today could result in supply limitations not seen since the late 1980s.

In order to gain decision-making confidence and ensure successful implementation of operating plans, industry boardrooms and executive teams need help parsing trends and planning investment activities. Understanding the complex, dynamic changes in the

petrochemicals value chain is essential to anticipating evolving market forces and creating effective strategies for success. By combining scenario planning flexibility with analytical capabilities, industry expertise, and strategic insight, IHS Chemical can support this effort and enable companies to confidently create integrated value-chain forecasts that provide the basis for capacity investment decisions that are flexible and responsive as market volatility evolves.

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Figure 3. Basic Chemical Capacity by Location

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