



Don't miss out on future issues of the IHS Chemical Bulletin. Subscribe for free at: www.ihs.com/chem-bulletin

Deal or no deal? Focus is key in **using M&A to shape a winning portfolio**

Mukta Sharma P4

→ Insights...	6
Brexit: A dampened short-term outlook for European Petchem industry, but slight global impact	
→ Insights...	8
Chemical innovations to manage environmental change	
→ Insights...	10
Long-term price forecasting for commodity chemicals: what the future holds	
→ Insights...	12
Understanding US bulk chemical trade and logistics in the shale gas era	
→ Insights...	14
Acrylic acid: what does the longer-term future hold?	
→ Insights...	17
The economics of refining propylene to polypropylene	
→ Insights...	18
With the wave of announced new capacity in the region, is Southeast Asia ready for new crackers?	

vision & contents

The World is flat, **time for reinvention**

Roger Green, VP Europe & Africa Consulting, IHS Chemical



➤ **Since the 4th century BCE, the consensus view has been of a spherical world, and geographically, few disagree. Modern communications, from low-cost travel to social media, are democratising our views and effectively shrinking the planet, creating the ultimate levelling of the playing field, the flat World.**

Hopes, dreams, and aspirations are converging from Beijing, to Bogota to Brighton and the petrochemical industry's quest for sustainable competitive advantage has been more challenged. Plentiful sources of energy combined with technological advances create new opportunities for petrochemical players.

The flat world rewards reinvention. Access to commodities and energy supplies are no longer the only routes to success in the petrochemical industry. The needs of our customers in key industrial segments: automotive; aerospace and technology, increasingly focus on functional performance and innovation.

Europe is home to some of the most advanced companies. Their

increasingly sophisticated requirements present a significant opportunity for the region's chemical industry to focus more on speciality products. It is perhaps unsurprising that eight of the top fifteen global speciality chemical companies are European-headquartered.

These European leaders did not start life as speciality focused enterprises, but evolved from a simpler resource-intensive, commodity focus, shedding low margin non-differentiated products. In some cases companies such as ICI seem to have disappeared entirely, yet it took a radical path, splitting off the Zeneca fine chemical business, selling commodity fertilizers and acquiring speciality businesses from Unilever. Companies including Akzo Nobel, Astra Zeneca, Ineos and Victrex contain direct ICI heritage. Other parts of the business live on in companies as diverse as Syngenta, and Lonza. The DNA is complex, the results demonstrate the power of evolution and the benefits of reinvention.

Reinvention offers salvation for chemical companies, who have an opportunity to reevaluate their portfolios, a journey that IHS Chemical Consulting has long been guiding clients along in Europe and elsewhere. The following sections share our thoughts on M&A as a tool to deliver transformation, and other insightful analysis. The team at IHS Chemical is here to help transform your business.

In this issue

➔ Feature..... 4

Deal or no deal? **Focus is key in using M&A to shape a winning portfolio**

➔ Insights 6

Brexit: A dampened short-term outlook for European Petchem industry, **but slight global impact**

➔ Insights 8

Chemical innovations to **manage environmental change**

➔ Insights 10

Long-term price forecasting for commodity chemicals: **what the future holds**

➔ Insights 12

Understanding US bulk chemical trade and **logistics in the shale gas era**

➔ Insights 14

Acrylic acid: **what does the longer-term future hold**

➔ Insights 17

The economics of **refining propylene to polypropylene**

➔ Insights 18

With the wave of announced new capacity in the region, **is Southeast Asia ready for new crackers?**

Cover credit: Shutterstock

@IHS4Chemical



www.linkedin.com/company/ihs

Americas:

Tel: +1 800 447 2273

Email: ChemicalSalesAmericas@ihs.com
or ChemicalConsulting@ihs.com

Europe, Middle East, Africa:

Tel: +44 (0) 1344 328300

Email: ChemicalSalesEMEA@ihs.com
or ChemicalConsulting@ihs.com

Asia Pacific:

Tel: +65 6439 6000

Email: ChemicalSalesAPAC@ihs.com
or ChemicalConsulting@ihs.com



© 2016 IHS. All rights reserved. No part of this publication may be reproduced or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, or be stored in any retrieval system of any nature, without prior written permission of IHS Global Limited. Any views or opinions expressed do not necessarily represent the views or opinions of IHS Global Limited or its affiliates. **Disclaimer of liability:** Whilst every effort has been made to ensure the quality and accuracy of the information contained in this publication at the time of going to press, IHS Global Limited and its affiliates assume no responsibility as to the accuracy or completeness of and, to the extent permitted by law, shall not be liable for any errors or omissions or any loss, damage or expense incurred by reliance on information or any statement contained in this publication. Advertisers are solely responsible for the content of the advertising material which they submit to us and for ensuring that the material complies with applicable laws. IHS Global Limited and its affiliates are not responsible for any error, omission or inaccuracy in any advertisement and will not be liable for any damages arising from any use of products or services or any actions or omissions taken in reliance on information or any statement contained in advertising material. Inclusion of any advertisement is not intended to endorse any views expressed, nor products or services offered, nor the organisations sponsoring the advertisement. **Trade marks:** IHS Maritime & Trade is a trade mark of IHS Global Limited.

NEW
Mobile-optimized
site, so you can access
our content on the go



IHS Chemical Week

Corporate Solutions

Empowering your organization to read beyond the headlines

From the plant to the business suite, every user has access to:

- **Real-time news and same-day analysis** across all markets and regions on chemweek.com
- **Business Daily** - Exclusive daily digest that includes insider intelligence and curated data
- **Magazine** - Containing thought-leading features and profiles of the industry's biggest names
- **20+ years of searchable archives** - Allowing you to track a company, product or market



Improve your performance across a variety of roles and regions:

Markets followed	Regions covered	Data tracked	Department that would benefit
Petrochemicals	Middle East	Pricing & feedstocks	C-suite executives
Specialty chemicals & plastic	North America	Projects	Marketing/business development
Fine chemicals	Europe	Plants	Purchasing/procurement
Pharma intermediaries	Asia Pacific	M&A	Strategy & planning
Renewables	Latin America	Company financials	Technical, engineering and R&D
Industrial gasses	Africa	Regulations	Legal and regulatory

Visit [CHEMWEEK.COM/MYCWACCESS](https://www.chemweek.com/mycwaccess) for more information.



Feature

Deal or no deal? Focus is key in using M&A to shape a winning portfolio

By Mukta Sharma



➤ **Merger and acquisition (M&A) activity is quite** possibly the biggest strategic lever exploited by companies seeking to increase value generation, cost efficiencies, and market share. In the chemical industry, the motivation for M&A activity has changed dramatically.

Historically, most transactions were designed to expand portfolios and/or gain scale. Many deals gave chemical companies entrée into complementary areas, accruing benefits from the increase in market presence, although they frequently brought with them non-core legacy businesses, and some failed to deliver the anticipated returns. By the late 2000s, many executives began to understand the perils of getting these deals wrong, and adopted a more cautious approach. The pace of industry M&A activity slowed, especially during the years following the global financial crisis.

Today the chemical industry finds itself in a low-growth environment. IHS estimates overall global petrochemical capacity grew at an average of 3.9% per year between 2010 and 2015, a drop from the previous five-year average of 5.9%, and forecasts average annual growth at 3.5% from now until 2020. This rate is

slower than GDP growth over the same periods, from a multiple of 2.3 times GDP in the past to 1.5 times GDP today and a forecast of 1.1 times GDP over the next five years. This limits organic growth opportunities and is driving companies to seek alternative sources of growth and value.

Companies Challenged to Shape a Coherent Portfolio

In this environment, companies have become more disciplined about M&A activities as a means to boost returns and enhance growth. Recent deals have focused on tactical and strategic portfolio management rather than simply expanding. Research from IHS Chemical reveals an increasing number of companies using M&A activity to enter new markets, which helps them grow the business without the inherent risk of greenfield projects. And when acquisitions include assets that are unlikely to deliver long-term positive impact, buyers quickly sell them off.

Activist shareholders are further encouraging M&A, demanding actions that improve returns. Hedge fund Trian Partners famously pressed DuPont to break up the company to address high corporate expenses, poor-performing acquisitions and disappointing financial performance. Air Products cited shareholder value as a reason to spin off its Versum Materials division and sell another division to Germany's Evonik Industries earlier this year (table 1).

Dow-DuPont Merger and Split to Boost Value

The \$130-billion mega-merger of Dow and DuPont is a prime example of this trend which brings together two global chemical giants - with a twist. After completing regulatory review, executives plan to integrate the two companies into one, removing \$1.5 billion in cost. Approximately 18 to 24 months after the merger completes, the firm will separate into three companies that focus on:

- Agriculture, with \$16 billion in revenues
- Global material science, a \$51 billion business
- Specialty advanced materials, the smallest with \$12 billion in revenues

Although the scale of this deal is unprecedented, the proposed restructuring is surprising. Many merged companies spin off smaller businesses whose market or

Table 1: Top 10 announced chemical M&A deals by value

Target	Acquirer	Seller	Deal size (US \$ million)	Target sector
Syngenta	ChemChina	Syngenta	43,000	Ag/fertilizers
Airgas	Ari Liquide	Airgas	13,400	Industrial gases
Valspar	Sherwin-Williams	Valspar	11,300	Specialties
Axiall	Westlake Chemical	Axiall	3,800	Basics
Air Products' performance material business	Evonik Industries	Air Products	3,800	Specialties
Chemetall	BASF	Albemarle	3,200	Specialties
Nexo Solutions Holdings	WL Ross Holding	TPG Capital	1,670	Distribution
Novacap	Eurazao;Merieux Development	Ardian	784	Diversified
Nuplex Industries	Allnex; Advent International	Nuplex Industries	724	Specialties
BASF's industrial coatings business	AkzoNobel	BASF	531	Specialties

2016 July YTD. Excludes some transactions involving nonchemical assets.

Source: IHS

© 2016 IHS

mission is a mismatch for the new conglomerate. The plan to split the entire organization, almost from the start, is highly unusual. Yet DowDuPont executives believe that each of the three new companies will have enough critical mass, focus, and a leading position in its business segments to sustain itself for the future.

M&A-Fueled Business Growth Takes Many Forms

DowDuPont is not the only chemical industry leader using targeted M&A activity to create growth. For example, Air Liquide's acquisition of Airgas has brought together similar assets and removed considerable corporate cost. Today the company is focusing on best plays and seeking target areas with high growth and margin potential. A key benefit is Air Liquide's ability to expand its previously limited North American footprint with the acquisition of Airgas.

The merger between Sherwin-Williams and Valspar demonstrates targeted M&A to build on areas of common strength. In purchasing Valspar, Sherwin-Williams gains an enlarged presence in industrial coatings while reducing cost through consolidation. A further benefit is an increased presence in Europe and Asia for Sherwin-Williams.

Guidelines for Evaluating M&A Opportunities

IHS Chemical frequently helps clients assess the value of M&A opportunities and has witnessed many companies achieving growth through targeted deals. By focusing on structurally attractive segments, companies can bring together organizations with market overlaps, targeted adjacencies, and other synergies.

Our structured process, (shown in chart 1, above), uses a methodology designed to screen and evaluate acquisition targets through:

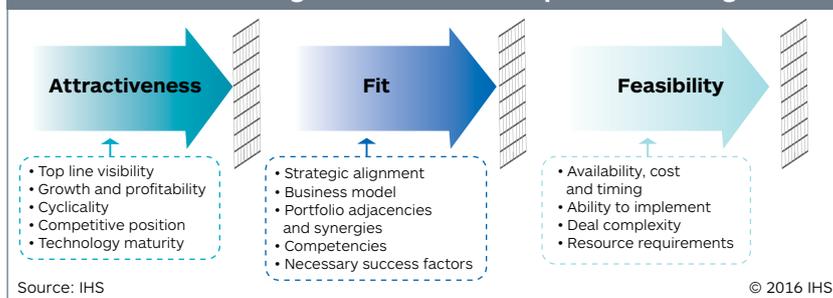
- The attractiveness of the target in terms of markets, technology, and growth potential
- Fit with the acquiror company and its corporate strategy
- The feasibility of acquiring the selected target

The weighting of criteria depends on the buyer's strategy, core capabilities and ability to take on and absorb an acquisition. For example, a company with a history of successful product development may feel comfortable investing in a target which is still in the process of commercializing a novel process or product. Another organization may seek only an established entity to add to its portfolio, one that can bring manufacturing, sales, or other efficiencies to the joint value proposition.

Enter the Dragon: Chinese Investment Goes Global

Chinese chemical companies are also pursuing more growth-related M&A activity, especially in the acquisition of European chemical firms. In 2011, for

Chart 1: Structured target evaluation: Example of screening criteria



example, Wanhua acquired Hungarian chemicals maker BorsodChem. Late last year, China Petroleum & Chemical (Sinopec) completed a 10% purchase of SIBUR, Russia's largest gas processing and petrochemicals company.

Looking ahead, the objective of China's M&A activity will evolve further. It is likely to be driven in part by the government's 2025 plan, which emphasizes the development of domestic capability in advanced technologies and materials. Because China's commodity chemicals industry is oversupplied and maturing, the industry's next step is likely to focus on acquiring new technology, know-how, and skills in higher-growth specialty chemicals and advanced materials.

Earlier this year, ChemChina agreed to purchase Swiss pesticide maker Syngenta, a \$43-billion mega-deal which has recently been cleared in the US and is expected to close later in 2016. ChemChina has also expressed interest in acquiring the performance products business of SGL Carbon, a German manufacturer to add to its growing portfolio.

High Stakes Need Investment Discipline and Expertise

To succeed in a low-growth economic environment while satisfying investor demand for higher returns, chemical companies must align around coherent, structured portfolios. Corporate carve-outs and divestments are increasingly a consequence of focused strategy implementation and portfolio management. M&A will increasingly act as the key lever to achieve strategic growth and recent activity has been high, driven by shareholder activism and supported by strong balance sheets, cheap debt and readily available cash. Industry stakeholders are aware that successful execution of M&A deals can create appreciable financial advantage and elevated industry position. With such high stakes, chemical companies must take a sophisticated and disciplined approach to transactions, so they can ensure deals create long-term value. ■

Mukta is a Managing Director in IHS Chemical's Consulting group in London, leading studies on investment strategy, transactions and due diligence.

Brexit: A dampened short-term outlook for European Petrochem industry, but slight global impact

By Michael Smith



➤ **We at IHS do not foresee a major impact of the** Brexit decision on demand for global petrochemicals, however this view comes with a couple of caveats, since we do see some fallout for the industry. The Brexit decision has certainly interjected greater uncertainty into a chemicals market already plagued by volatility due to significant price instability in the energy market. In addition, this referendum decision comes at a time when Europe has been showing signs of a fragile economic recovery and can ill-afford any unexpected, major economic aftershocks.

The exit negotiations related to the UK's departure from the EU and how strongly the EU responds to the UK exit is the wildcard in this equation, but it is unlikely the EU will take a hardline punitive approach toward the UK that could damage both economies. The UK and the countries that remain in the EU are significant trade partners across the business spectrum, which we will explore in more detail a bit later.

In the past, annual overall global chemical demand has typically grown at a rate of about 1.3 times the rate of GDP. As a result of Brexit, the IHS economic outlook for GDP growth has been revised downward and it is this reduction of economic growth that will invariably result in some lost demand for petrochemicals and polymers.

While the full impact of Brexit has yet to be felt, and notwithstanding the escalating negative rhetoric of US presidential election, recent economic news has been a little more upbeat. Early evidence suggests that

the impact of Brexit on the rest of Europe will be less severe than previously estimated.

While the UK economy will probably suffer a mild recession, the damage to the rest of Europe will be more limited. Forward-looking indicators are already flashing warning signs about the UK economy. The IHS/CPS Manufacturing and Services PMIs (Purchasing Managers Index) have decreased sharply and both now point to contraction. IHS predicts that real GDP will stagnate in the third quarter and contract slightly in the fourth quarter and early 2017.

On the other hand, Eurozone businesses seem to have shrugged off the uncertainty resulting from Brexit. IHS PMIs point to continued, albeit sluggish, expansion. We expect real GDP growth of 1.5% in 2016, 1.2% in 2017 (up from 1.1% in our July forecast), and 1.5% in 2018. The upward revision in 2017 reflects slightly higher forecasts for Germany and Spain, where the impacts of Brexit are now expected to be milder than initially estimated.

Globally, the impact will be minimal. In the immediate aftermath of the Brexit decision, IHS foresaw global GDP growth in 2017 falling compared to IHS prior forecasts by 0.4%, from 3.1% to 2.7%. Since then, the world has moved on and global numbers have, at least temporarily, been corrected slightly higher; due in part to the improved forecasts for other parts of Europe. In the final analysis we are talking about losses in GDP growth of only a very few tenths of percent due to Brexit and on a global scale the Brexit effect gets lost in the general noise of even more impactful factors, such as Chinese economic development, Italian bank problems and presidential elections. The UK and European economies will suffer a bit short-term, but the consequences for the global chemical business in the mid- to long-term will be slight. The UK and Europe are mature, stagnant chemical markets; Brexit only serves to reinforce this continued development.

There is a caveat, however. Over the long term, how the UK fares outside the EU depends on many factors. These notably include the extent of the trade agreements that are reached not only with the EU but also with other regions/countries; how much the UK is affected by non-trade barriers when exporting to

Table 1: UK based chemicals capacity

2015	World	West Europe	UK	UK as % of World	UK as % of WEP
Ethylene	160.3	22.8	2.5	1.5%	10.8%
Propylene (PG, CG)	114.3	16.1	1.0	0.8	5.9
Methanol	111.8	3.1	—	0.0	0.0
Benzene	62.5	9.3	0.6	1.0	6.9
Paraxylene	47.8	2.0	—	0.0	0.0
Chlorine	90.6	11.1	0.7	0.8	6.6
Ammonia	225.8	12.6	1.2	0.5	9.7
Total	813.1	77.0	6.0	0.7	7.8

Source: IHS

© 2016 IHS

the EU; the amount of deregulation that is undertaken in the UK; what immigration policy is followed; how the City of London's role as a dominant financial center is affected; and how foreign direct investment into the UK is affected.

While some industry leaders are decidedly negative about the UK exit from the EU, others have been more bullish in their response. Chemical giant INEOS announced on 07 July 2016 the first major UK petrochemical investment decision since the Brexit vote—a multi-million GBP (pound sterling) expansion of its Hull manufacturing facility to increase production of ethyl acetate by 100,000 metric tons per year. “It is expected that the additional capacity will be available by the end of next year. “We believe in British manufacturing and will support it whenever we can,” said Jim Ratcliffe, chairman of UK-based INEOS (recently quoted in IHS ChemicalWeek). “This new investment in Hull, underpinned by our Scottish shale gas project, will enable us to significantly increase product for sale all over Europe and across the world,” Ratcliffe said.

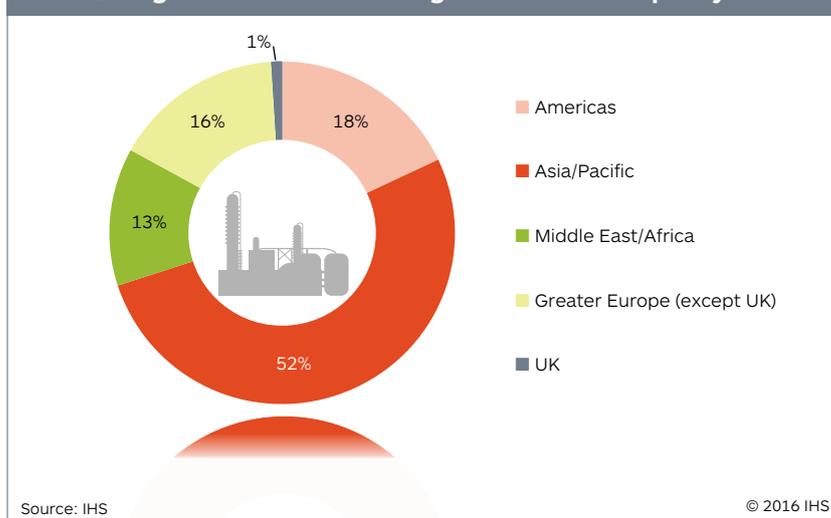
Other experts are not so positive and predict that the European chemical industry will be among the hardest hit industrial segments due to the large amount of trade between the UK and the rest of Europe, much of which is on the basis of intercompany transfers, which makes this decision trickier for these trading partners. Any change to the current regulatory framework governing this trade could negatively impact the ease of product flows between the EU and the UK and hurt both.

In spite of some of the more alarmist comments presented in the aftermath of the unexpected UK-referendum outcome, IHS Chemical believes that any significant impacts on the European and UK chemical industries will be primarily limited to lower short- and mid-term economic growth in the UK and the Eurozone.

It is important to remember that the UK will have two years to prepare for the exit after invoking Article 50, and additionally, the possibility of agreeing to an extension to this deadline for all or parts of the exit agreement certainly exists. With that being said, it is not in the interest of any of the parties to inflict further economic damage on the UK and thus, further reduce growth prospects in the whole of Europe.

Nevertheless, near- and mid-term prospects for the UK and European chemical industries have been dampened based on an expectation of slower economic growth and reduced consumption of consumer goods. While from a global perspective, the UK represents only 1% of the total global capacity to produce basic chemicals (including ethylene, propylene, methanol, paraxylene, benzene, chlorine, and ammonia), the country remains an important

Chart 1: Regional market share of global chemical capacity



Significant impacts on the European and UK chemical industries will be primarily limited to lower short- and mid-term economic growth in the UK and the Eurozone

European trading partner and consumer of many raw materials, as well as semi-finished and finished good.

At a time when waves of new global chemical capacity are being built and will begin to start up during the next 2-3 years, a slower than expected demand-growth scenario globally could result in an increase in surplus capacity for certain value chains, putting downward pressure on prices and overall profitability. One potential scenario could see slow growth in Europe combined with rising crude oil prices, leaving the producers a similar situation to the one seen prior to the collapse of crude oil pricing before 2014— high costs and slow growth that would, once again put profitability under additional pressure. ■

Michael Smith has 36 years of experience in the chemical industry, of which 10 have been in chemical consulting at CMAI, now IHS Markit. Mike is an expert in the areas of light olefins, polyolefins, chlor-alkali vinyls, as well as petrochemical pricing and international market strategies. He is currently Vice-President EMEA for Business Development.

Chemical innovations to manage environmental change

By Bhavesh Patel



➤ **Since the creation of earth there have been** lots of changes in the environment, some good some bad. Natural changes in the environment are part of what makes the earth such an amazing place and tests our greatest ability, the ability to adapt. The pace and intensity at which environmental change is occurring now has been found to be altered by our increased use of fossil fuels. Using fossil fuels releases Green House Gas (GHG) emissions which in turn creates global warming. The effects of global warming are quite real, just look at the melting ice in our cryosphere leading to rising water ocean levels, increased extreme weather, repeated droughts and wildfires, threat to agriculture, our infrastructure and transportation systems, and most importantly loss of life.

Global warming is a global issue and it effects all of us. Acknowledging this, governments in 2016 came together to pledge a reduction of emissions to reduce environmental impact. The pledge is an acceptable global temperature increase of 2.4-2.7° by the end of the century. This is quite a remarkable feat considering that if we do nothing, the rise in global temperatures would be nearly double that at 4.1-4.8°. Global

The only way to alleviate environmental pressures is by taking active part in finding sustainable solutions.

GHG emissions in 2014 totaled 6.8 billion metric tons of CO₂ equivalent¹. The major contribution categories include Electricity (30%), Transportation (26%), Industry (21%), Commercial & Residential (12%), and Agriculture (9%). In order to achieve the pledged targets of emission reduction, each of these categories will most importantly require new materials and technologies. Turns out the chemical industry supplies to companies and users of all five categories and it is one of the most critical industrial sectors in helping combat environmental change.

The following are innovations (current & future) by chemical companies' that promise to help reduce emissions and reduce our long-term dependency on fossil fuels as a source of fuel.

Electricity

The Electricity category by definition is the energy consumed by coal and natural gas companies. Being one of the largest producers of GHG emissions, the need to replace these sources of energy globally is inevitable. Renewable energy frontier countries Norway and Germany have already changed their policy to reflect the aggressive policy changes needed to sufficiently help the environment. Politicians in Norway approved a ban on all fossil fuel-based cars by 2025 and requiring all Norwegian cars to run on renewable energy (e.g. wind, solar, hydro, biomass)³. Similarly, Germany aims to harness at least 80% of its gross power consumption via renewable energy by 2050.

Wind and solar have become the top two sources of renewable energy. Wind turbines are typically installed in areas where natural wind flow has been monitored to be consistently good (e.g. Europe, areas of US). Important components of a wind turbine include turbines, the light-weight blades and advanced batteries or smart power-grid. Some of the largest brands of wind turbines in the world come from Siemens, GE, Vestas, Goldwind and Enercon. Chemical companies supply these powerhouses with the specialty chemicals needed to build the light-weight windmill blades, length ranging from 114-246 ft. Typical chemicals supplied would include advanced epoxies (e.g. quick curing), specialized coatings and adhesives (e.g. anti-discoloring agents), high performance biodegradable hydraulic fluids/lubricants, and composites to reduce tower weight.

Energy generation via solar power continues to rise mainly due to the reduced cost of components and increase in power efficiency. Cost of solar cells has dropped due to mass production investments by Chinese producers (Trina Solar, JA Solar, Jinko Solar) over the last 10 years. These producers utilize a number of chemicals that have been created to help increase the power efficiency of an individual solar panel. Solar cells are typically etched with a surface texturizing solution that reduces UV reflection and coated with specialized coatings to improve energy efficiency. In addition, the components are tightly held by heat-resilient adhesives and resins. Other chemicals include salts, specialty electronic chemicals, glues, and lubricants.

In both cases, chemical companies continue to innovate to increase efficiency of renewable energy generation systems and reduce the cost of power from renewables.

Transportation

By definition, the Transportation category includes fossil fuels uptake by all modes of transport for both industrial and consumer. This includes automobiles, buses, trucks, trains, planes, and all maritime vessels. The transportation category solely contributed GHG emissions of 1.76 billion metric tons of CO₂ equivalent in 2014. Major efforts are underway to reduce these emissions by using alternative materials designed by the chemical industry.

Solar Impulse 2, a solar powered airplane, is an example of the collaboration of 50+ companies with a common goal to half the world's energy consumption, save natural resources and improve quality of life on earth. In particular, chemical companies have created specialty materials to help with light weighting, structural support, battery efficiency, and solar power generation. Chemical producer, Covestro, developed a new micro-cell Polyurethane (PU) foam with improved insulation efficiency by reducing pore size by 40%. In addition, the company developed a Polycarbonate (PC) windshield to replicate the function of glass and reduce weight. Materials developed for Solar Impulse 2 and other R&D projects around the world are already making their way into other transportation applications with a promise of a sustainable future.

Agriculture

Emissions by the agricultural industry may not be as immense as those by Energy or Transportation, however at 9% of global GHG-emissions, they are significant. With a rising global population and increasing size of the middle-class, the agriculture industry faces a major challenge to grow enough food with limited space and resources. Solutions need to help make better use of available land, find an efficient source of around-the-clock lighting and enable a smarter logistics chain. With limited land, the emphasis is being put on urban farming or vertical farming centers in metro cities. These centers can use existing spaces in urban buildings with no soil requirements and can be combined with renewal energy systems such as solar/wind to create a sustainable closed-loop food haven. Because there is no soil or run-off water, these farms require effective water delivery systems and next generation agriculture chemicals. Chemical companies are developing next generation Agriculture chemicals that are highly efficient in supplying key nutrients while reducing

overall environmental impact. Examples of next generation Agriculture chemicals include controlled-release fertilizers, specialty coated seeds, chemicals used to find biological organisms to naturally combat weeds/insects/diseases, mixtures of chemical and biological fungicides, polymeric compositions.

Combination of urban farming centers with renewable energy systems is made possible by advanced Light-Emitting Diode (LED) systems. The hidden benefit of these systems is its ability to produce higher quality food. These systems are able to produce a single wavelength of light (typically pink) which has been found to increase plant growth and reduce disease/pest/weed infestation(s). Chemical

Innovations by chemical companies' promise to help reduce emissions and reduce our long-term dependency on fossil fuels

producers supply the necessary specialty electronic and adhesive chemicals important in creating the LED systems.

The environmental issues we face as a civilization are quite substantial and the only way to alleviate the pressure is by taking active part in finding sustainable solutions. The chemical industry is at the forefront in developing some of these solutions to help combat environmental change. It's important for policy makers, public & private investors to understand the importance of their support to the chemical industry's ability to innovate and help solve the environmental problem. ■

Bhavesh Patel is a Sr. Strategy Consultant for IHS Chemicals. He works side-by-side with clients to achieve their business goals and fulfill their strategic vision.

Bhavesh holds degrees in Masters in Business Administration and Chemical Engineering.

Long-term price forecasting for commodity chemicals: what is the outlook?

By Pat McSpadden



➤ **A long-term price outlook provides a quantitative view of the future. When combined with the underlying methodologies and assumptions, it also helps to illuminate WHY prices are expected to develop as forecast. The WHY is valuable because it reflects IHS's insights into market dynamics and highlights factors that may provide early warning of potential risks or opportunities impacting strategic planning, competitive analysis, and financial forecasting.**

What is a commodity chemical?

A commodity chemical is a product for which the price is primarily determined by interaction of demand, production cost, and supply. Many products are clearly commodities while others are clearly specialties. Some may have attributes of both and some specialties may become more "commoditized" over time.

What is the forecast horizon?

IHS conceptually distinguishes short-term forecasts from long-term forecasts (typically beyond 5 years).

Short-term forecasts reflect current conditions and perceptions for the immediate future. They are influenced by recent history and events. Generally, short-term forecasts exhibit greater volatility which may make it more difficult to discern structural relationships and trends applicable to the longer term.

Long-term forecasts are based on assessments of structural factors and fundamentals that drive markets through their impact on demand, supply, trade, innovation, and investment. The forecasts incorporate IHS's analysis of major economic, demographic, political, technological, and industrial trends that are expected to have significant impact. They are also "surprise free," meaning that long-term forecasts do not reflect unanticipated "events" or future market cycles that could cause temporary divergence from the underlying trends.

Correlation does not necessarily indicate causation.

It may be tempting to assume simplistic cause and effect relationships with respect to price. However, reality is usually more complex. Even if a price forecast mechanism can be represented by a few key

relationships, it is important to understand WHY this is expected to be the case. Long-term forecasts developed by IHS use a robust approach which considers global market dynamics and the potential for changing relationships over time.

Long-term forecasts are built upon the principle that interaction of demand, production cost, supply, and price will push a market toward equilibrium. In practice, such equilibrium is rarely achieved or maintained. Constant reassessment and recalibration are always underway in the market; multiple factors impacting supply, demand, price, and perception are always in motion.

Price forecasts are interdependent with forecasts for local and global supply, demand, and trade. Ultimately, price is a link which ties these factors together and stimulates market actions in pursuit of optimization and equilibrium.

When developing a long-term forecast, IHS assesses the interaction of demand, supply, price and perceptions to explain WHY prices are expected to follow the forecast path. By understanding these relationships, one is better equipped to anticipate the sensitivity of the price forecast to unforeseen events both within the specific product market and within the external environment.

Trade: An important consideration and a major differentiator of pricing dynamics

Products with fewer logistic challenges and trade barriers (such as benzene or polyethylene) tend to have price-setting mechanisms under which arbitrage links regional prices and pushes them toward equilibrium.

On the other hand, price forecasts for products with greater logistic challenges and limited trade flow (such as chlorine or ethylene) are strongly influenced by cost competitiveness through the value-chain and by the pricing dynamics of downstream derivatives (such as PVC or polyethylene) that have lower logistic hurdles and more active trade flow. An upstream intermediate's price may be forecast based on an estimate of the price that will provide an acceptable return for its producer. At the same time, it must enable the downstream derivative producer to achieve acceptable returns and a competitive cost position.

IHS's country-by-country analysis includes assessment of demand, international competitive position through the primary value chains, logistic costs, and arbitrage opportunities expected to stimulate imports or exports of the base commodity and/or its primary derivatives.

What is a "global price-setting mechanism?" How is this reflected in regional markets?

When there are low barriers to trade, the IHS methodology may establish a global price setter. This is based on identification of the region driving global demand growth and evaluation of the last (and typically highest cost) incremental source of supply required to satisfy global demand.

The concept can be illustrated by the case of polyethylene. Polyethylene demand growth in China is a major factor driving the need for expanded global production capacity. With a preference for local self-sufficiency, producers in China will invest to expand local capacity within the constraints of technology and available feedstocks. IHS Market currently expects marginal local supply to be provided by naphtha-based steam cracker complexes with integrated polyethylene production. However, China is currently a major importer of polyethylene and local capacity expansion will not be sufficient to prevent the growth of imports.

The polyethylene price required to support such new capacity investment in China with an acceptable ROI is a global marker price. It determines the price at which potential imports must arrive in order to compete with incremental domestic supply.

Through netback calculations to cost-advantaged exporting regions (such as the Middle East and North America), the China price becomes a primary

determinant of the market-clearing export price in these regions due to the size of the China import requirement. In turn, the export price impacts the domestic price in the exporting region and import costs in other importing regions (such as West Europe or South America).

IHS has extensive global market knowledge and analytical capabilities across the spectrum of commodity chemicals. They draw upon these insights

Correlation does not necessarily indicate causation. It may be tempting to assume simplistic cause and effect relationships with respect to price. However, reality is usually more complex

to develop long-term forecasts that are robust and reflect a deep understanding of the product at hand, as well as the upstream and downstream markets and the external factors impacting these markets.

Pat McSpadden is Managing Director of IHS Chemical Consulting in the Americas region with experience in commercial feasibility analysis, litigation support and strategy development in the chemicals industry.

IHS CHEMICAL

IHS

Directory of Chemical Producers

The industry's most trusted database of global chemical manufacturers, plant locations and products. Comprehensive, easy-to-use searches help you find new customers, suppliers, and provide information about where your competitors produce chemicals and operate plants.

- >15,000 Chemical manufacturing companies
- >20,000 Chemical manufacturing sites
- >21,500 individual chemical products, extensively cross-referenced
- More than 90 countries
- Plant-by-plant capacity for 250 products
- Search by company name, product name, CAS number, plant location or ownership company

Visit www.ihs.com/dcp for more information and to request a quote.

9741_0815AW

Insights

Understanding US bulk chemical trade and **logistics** in the shale gas era

By Chris Geisler



➤ **The development of significant tight oil and shale gas deposits in the US has resulted in a large increase in US oil and gas production and corresponding increase in the availability of ethane and other natural gas liquids (NGLs) for chemical production.** This chemical feedstock and product expansion is impacting US manufacturing and support industries by creating greater opportunities for growth in transportation (i.e., domestic and export marine shipping, railroad, trucking), logistics services (i.e., loading, bagging, trans loading, storage, terminaling) and other manufacturing services.

While the price of oil has dropped significantly in recent years, the low manufacturing cost position of

international producers have announced new investments in North America based on shale gas derived feedstocks and a full slate of derivative capacity will eventually be announced as well.

Major chemical production additions include ethylene, propylene, methanol, ammonia and their derivatives, such as plastics and fertilizers. With the expected continued expansion in these major chemical chains, IHS Chemical estimates that more than 100 million metric tons (MMT) of new capacity will be added in the US chemical industry by 2025.

The vast majority of this new chemical capacity will be converted to plastics, significantly increasing the US net export position of these materials. New domestic fertilizer production will replace imports from South America, the Black Sea and the Middle East. By 2025, US bulk liquid chemical production will expand by nearly 50 MMT and US bulk solid chemical production will expand by 22 MMT. Ethylene and propylene (mostly converted to plastics) will expand US production by 20 MMT through 2025. The most notable bulk liquid chemical additions will be in methanol. The largest bulk solid chemical expansion will be in fertilizers and polyethylene. Polyethylene exports will first target South America and then Asia.

As these chemical products expand, we expect to see increased marine, rail and truck traffic primarily in the US Gulf Coast but possibly later to, and around, several of the East and West Coast ports and terminals.

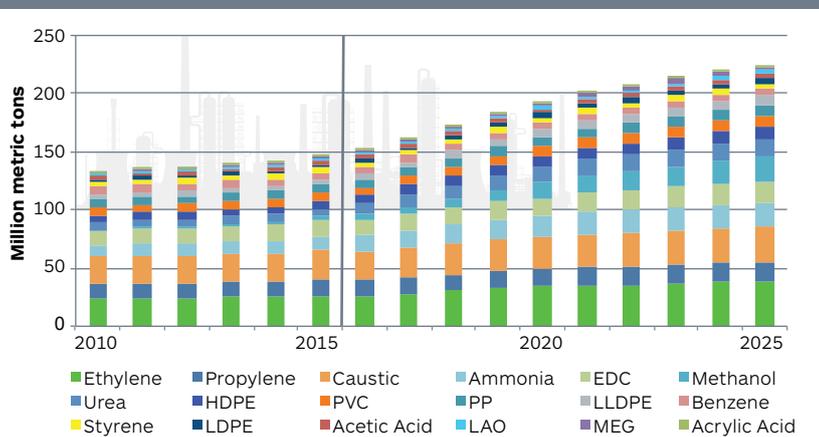
According to the ACC's 2015 Guide to the Business of Chemistry, 54% of all US business of chemistry shipments are made by trucks. The preferred transportation mode for US bulk chemicals however is rail or waterborne with 21 and 22% of the tonnage share, respectively. The vast majority of new olefin bulk chemical production will be converted to solid plastic resins (pellets) that are moved in bulk trucks and rail hopper cars or bagged and containerized for export. Bulk natural gas derivatives such as methanol and fertilizer will be moved primarily by marine, rail and truck.

Chemicals make up a significant part of the rail freight in the US, accounting for a 10% share of

As production expands, we expect to see increased marine, rail, and truck traffic primarily around the US Gulf Coast

the US, due to the natural gas and ethane advantage, is resulting in new grassroots methanol, ammonia and olefins (ethylene and propylene) and derivative investments. A number of existing US and new

Chart 1: US Bulk Chemicals Production



Source: IHS

© 2016 IHS

tonnage and 14% of revenues. In the US, waterborne transport is often the least expensive method of moving chemicals, and this provides significant business for ocean-going carriers, inland barge operators, and other water freight transportation companies. Chemicals are an important part of US waterborne traffic accounting for 22% percent of the waterborne tonnage.

International transportation of US bulk chemicals is dominated by waterborne shipments either containerized as in the case of plastic resins or by bulk tanker as in the case of liquid chemicals. In a recent study IHS evaluated historic and forecast US international bulk chemical imports and exports by US port. In total, the US will grow to an exporter of more than 30 million metric tons of bulk chemical liquids and nearly 17 million metric tons of bulk chemical solids. Imports of bulk chemical liquids and solids will drop by 11 million tons due to the growth of domestic US bulk chemical production.

The US will switch from being a net importer of liquid chemicals to a net exporter over the course of the forecast (by the year 2025). Increased domestic methanol production is a main driver of this switch. In 2010, the US was a net importer of 5 million tons of methanol needed to meet domestic demand. By 2025 the US will be a net exporter of more than 11 million tons of methanol.

The US is currently balanced on bulk solid chemicals with urea imports offsetting plastic exports. With the growth in polyethylene production and without a corresponding growth in US demand, the US will become a large net exporter of plastic resins. Urea imports will also greatly diminish over the forecast.

With low natural gas prices driving increased petrochemical investment in the US, an estimated 49 million metric tons of new bulk liquid chemical production will have been added over the period of 2010 to 2025, mostly in the US Gulf Coast, which will account for 89% of the production increase. For liquid chemicals, U.S. shale gas developments will result in increased production of syngas chemicals (ammonia and methanol), caustic soda, EDC and glycol.

As US production increases, fewer imports will be necessary to meet domestic demand. New methanol production is expected to replace global imports. Most of the import substitution will come at the expense of South America and the Middle East. Methanol imports into the ports on the Lower Mississippi River and Texas coast will diminish rapidly.

Imports from Canada will also take a hit but still continue into the Northwest and Upper Midwest. As imports into other US ports decrease, the USGC will remain a key import location, followed by the Upper Midwest as the entry point for Canadian exports to the US. Ammonia imports will decrease as well.

Chart 2: US Net trade (major bulk liquid chemicals)

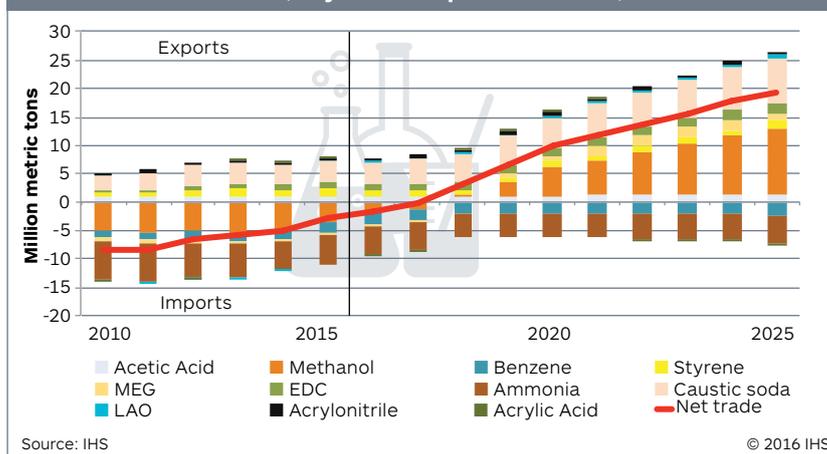
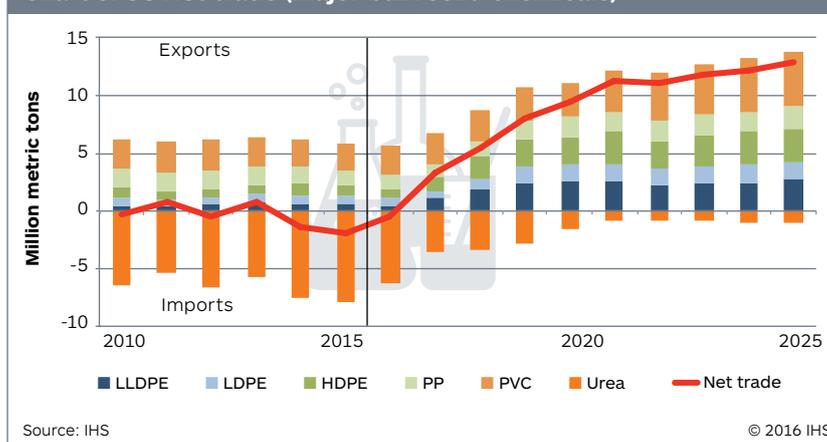


Chart 3: US Net trade (major bulk solid chemicals)



Due to low cost ethylene for manufacture of styrene and MEG, these bulk liquid chemicals will see increasing net exports. The growing styrene export position will result in an increase in benzene imports. The USGC will see the greatest change in international trade flows. Ports from Corpus Christi to New Orleans will generally see reducing international import shipments followed by increasing international exports. ■

Chris Geisler is Vice President of IHS Chemical Consulting for the Americas region with experience in acquisition due diligence, feasibility analysis, project finance, litigation support and strategy development for the chemicals industry.

Acrylic Acid: what does the longer-term future hold?

By David Byrne



Background

➤ **The acrylic acid industry and indeed the complete acrylic acid value chain, through acrylate esters and super absorbent polymers, continue to provide an extremely difficult business environment for all participants. In the last ten to fifteen years, the industry has swung from profit to loss, from tight supply to over-supply and the future does not appear to be that bright at this time. However, we may be at a turning point as both major and minor players begin to realise, and to act upon, the need for a rationalization of the current production environment, a re-think of the business model, and a strategic realignment for the future health of the industry. The days of adding capacity for capacity's sake, in order to chase market share at any cost have passed.**

Global production capacity grew by over 75% in the decade from 2006 to 2015, while global demand increased at a much slower pace, leading to today's situation of global over-capacity and overall low effective operating rates. During the same period, production capacity in China increased by almost 400% as Chinese producers acted to reap the benefits of high margins during the early years, fueled by the construction boom in the region and then, in later years, to take advantage of operating issues in other regions. In 2015, China now represents some 40% of

global capacity but closer to 25% of global demand. Quite obviously, something needs to change.

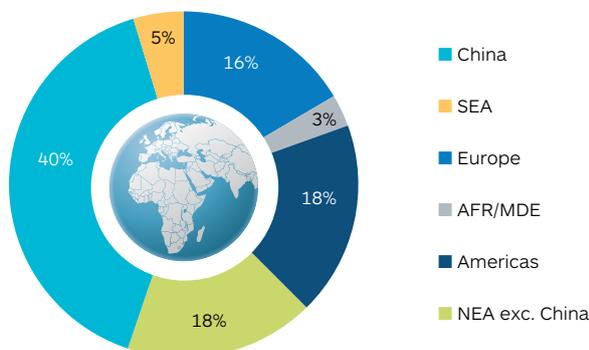
Growth versus rationalization

In any industry plagued by overcapacity, low operating rates and poor margins there are only two roads back to prosperity; one either grows their way to profitability from increased demand, or one rationalizes capacity to reduce the overhang. If one wishes to consider the growth opportunity for the acrylic acid chain, then one must evaluate the growth rates of the major end uses for the product. For crude acrylic acid there is roughly a 50% split between ester demand and glacial acrylic acids. The esters, e.g. primarily Butyl acrylate and 2-ethylhexyl acrylate are primarily consumed in the paints, coatings and adhesives markets and are thus essentially constrained to growth that tracks GDP. Glacial acrylic acid, on the other hand, is largely consumed in the production of Super Absorbent Polymers, which in turn are predominantly used in the baby diaper, adult incontinence and feminine hygiene or femcare industries. In these end uses, annual growth rates are estimated to be approximately 6-7% per year for the near future. Obviously, this provides a longer-term bright spot for the industry; unfortunately, survival in the current marketplace cannot depend on future sales. Thus, the industry needs to rationalize capacity and reduce the global oversupply. Therein lies the rub: while many will agree short-term rationalization is required, most will not agree that it is their own capacity, which needs to be shuttered. Some minor closure activity has occurred in the United States in 2015 but much more is needed, particularly in North East Asia to deal with the immediate oversupply situation. Should this not occur, then the current poor margin environment will certainly continue.

Business model & strategic realignment

In as much as one can define a business model for the global acrylics value chain today, it would be one of build capacity anywhere that one either has an upstream integration option to propylene or access to strong end-use markets. Such a model drove the proliferation of capacity, throughout the value chain, especially in the North East Asian region. The fallacy in such an approach is only realised when propylene

Chart 1: Crude acrylic acid capacity by region



Source: IHS

© 2016 IHS

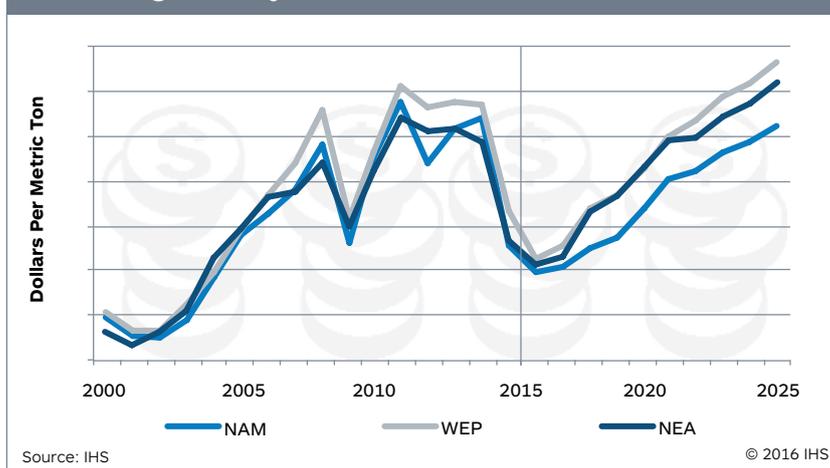
production in competing regions becomes significantly cheaper and/or when the strong end use markets, which in the case of China were driven by over-investment and government spending, prove ephemeral. Then the logic for the build anywhere model quickly becomes diluted.

In that case, then, what should the business model become? Given the already stated case that rationalization throughout the value chain is required in the short-term that is quite clearly the first step to be made on an industry wide basis. Subsequently, rational decisions will be needed concerning the location of new capacity when product demand becomes more aligned with the already installed capacity. Should the production be placed in areas with advantaged propylene or in areas where there is strong evidence for firm future demand and demand growth? The answer to both of these questions is “yes” - in fact, both of these factors will be key to the future success of players in this industry but to realise this will require a realignment of industry structure, away from the integrated model currently in play and towards a less integrated, regionally dispersed model.

Let us consider the propylene side of the equation first and what this indicates about where new acrylic acid capacity could be most advantageously located. The accompanying chart provides IHS’ forecast of acrylic acid cash costs through to 2025, which is based on IHS’ propylene price forecast. (More details of these forecasts can be found in the Global Acrylates and Super Absorbent Polymers Market Advisory Service available from IHS.)

It quickly becomes apparent that the North American region has had, and will continue to have a cost advantage over both Western Europe and North East Asia by virtue of the propylene advantage extant in the region. Thus, it would seem logical for new acrylic acid capacity to be added in North America, although individual company strategies may dictate otherwise as is currently the case with the new capacity being added in Antwerp by Nippon Shokubai. However, this does not imply that new production capacity for the remainder of the value chain also needs to be added in North America. Instead, derivative production units, whether for the acrylate esters or for Super Absorbent Polymer, should be installed in the major consuming regions, thus minimizing the number of products which need to be transported, while providing increased flexibility for the acrylic acid producer. Rather than moving multiple products, producers would be advantaged by focusing on the transportation of crude acrylic acid from North America to consuming units in the other regions. Focusing in particular on the higher growth Super Absorbent Polymer, such realignment implies the industry moving away from the fully integrated

Chart 2: Regional acrylic acid cash costs



approach as seen with the likes of BASF and Nippon Shokubai, and towards a non-integrated approach as currently followed by Evonik. In fact, by disconnecting the value chain, more opportunities would be

The industry is plagued by overcapacity, caused by over-exuberant expansions. The road to recovery has only two paths; capacity reduction and increased demand

provided for further development in the industry.

The acrylic acid value chain will remain a difficult environment for the near future. However, capacity rationalization when combined with favorable demand growth for a major end use will eventually return the industry to profitability. At that time, future development needs to occur in a realigned fashion in order to secure that profitability for the longer term. One such approach is the de-integration of the value chain, allowing for the manifestation of regional strengths. ■

David Byrne is Senior Director, C3 Derivatives and Styrenics with IHS Markit Chemical.

Operationalize Your Strategic Insights with the NEW WORLD ANALYSIS

Your trusted source for annual strategic business planning and now will also be **your operational support document**



How would your decision making change if you had more robust, dynamic, detailed data backed up by expert analysis and frequent updates? The New World Analysis is not just a source of strategic data – it is now your operational support guide.

It guides you to better buying and selling decisions and can help you stay in sync with key market changes, leading to fully-informed quarterly reviews.

New World Analysis along with constantly updated supply demand balances and forecasts will now also have:

- Trade grids at country level to help you with in-depth supply chain optimization
- Quarterly updated Pricing/cost and margin forecasts and base case assumptions to see the impact of changing market conditions
- Upside and Downside Sensitivities to base case with price drivers and a qualitative analysis of what could move the market from the base case forecast for price/cost/margin forecast
- All this delivered through traditional as well as a new user friendly dynamic interface

Learn more about the New World Analysis. www.ihs.com/TheNewWA



The economics of refining propylene to polypropylene

By Khevna Naran Shah



➤ **Propylene produced from refineries fluctuates** in prominence in the petrochemical industry from region-to-region over time, influenced by market conditions. With global demand for polypropylene growing at 4 percent year on year and regional refinery capacity changes in developing countries due to fuel specification regulations and increased gasoline demand, refiners often evaluate the opportunity to monetize propylene produced by the Fluidized Catalytic Cracking (FCC) into polypropylene. Apart from refinery capacity additions, existing FCC propylene production, is another source often considered through diversion of propylene from LPG blending or employing higher-yield catalysts in the existing FCCs.

Currently, there is around 40 million tons of refinery propylene capacity globally. Looking at the next business cycle, IHS expects at least 7 million tons of refinery propylene capacity to be added globally by 2030. The bulk of this refinery propylene production is expected to go into FCCs, providing an option for polypropylene production. Regions with notable growth in FCC propylene supply are the Middle East, Africa, Indian Subcontinent, Southeast Asia and Northeast Asia.

When gauging their competitiveness along the value chain to the finished product, new facilities now place their propylene cash cost of production in context of larger scale and multiple routes to propylene, such as steam cracking, propane dehydrogenation, coal-to-olefins and coal-to-methanol.

The global demand for polypropylene has given rise

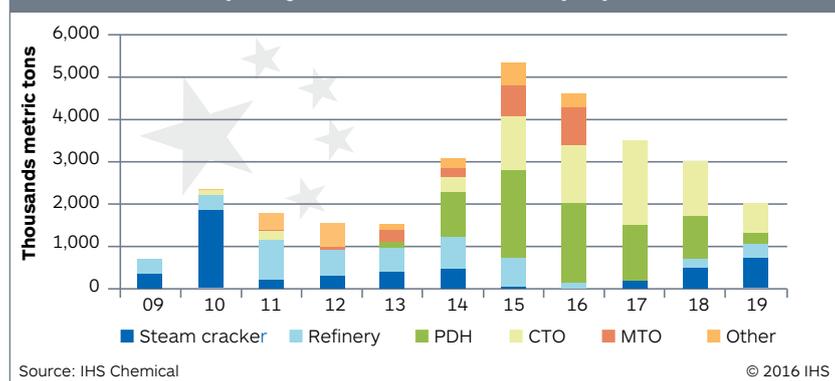
to the propane dehydrogenation route in parallel to the propane surge from shale gas and shale oil supply in the United States. In fact, factors such as lighter cracker feedstocks, propane availability and strong polypropylene demand have facilitated an alternative in propane dehydrogenation and metathesis not only in North America, but the Middle East and China. Similarly, the coal-to-olefins and coal-to-methanol routes have gained prevalence in China to meet growing polyethylene and polypropylene demand. That said, IHS expects in the long term to 2030 around 40 percent of all propylene will still come from the traditional steam cracking of naphtha and liquid feedstocks. In short, strong demand with changing feedstocks has unlocked a variety of propylene production routes.

The economics of propane dehydrogenation have improved through technological advancements. For propane dehydrogenation to be cost-competitive there must be a price differential between propylene and propane of at least \$200 per metric ton, a level that has easily been surpassed with the shale gas boom in the United States and the feedstock advantaged Middle East. Even with imported propane feedstock, China will have significant propylene capacity addition through propane dehydrogenation in the next 4 years. By 2019 around 5 million tons of additional propane dehydrogenation based propylene capacity is expected to come online, as shown in the chart of Chinese propylene capacity additions by production route.

Refiners with polypropylene capacity addition on their agenda need to consider the alternative value of propylene into gasoline and LPG blending in context of a competitive propylene production landscape, which has yielded competitive polypropylene capacity. With rising self-sufficiency in China, this competitive polypropylene capacity often targets the key growth markets in which these refiners are themselves located. Despite this, prudent planning and management of parameters such as upstream and downstream integration, polypropylene grade slates, logistics and marketing have resulted in success stories in refinery propylene polypropylene integration. ■

Khevna is currently a Senior Consultant in IHS Chemical Consulting bases in the Mumbai office. She has 12 years of industry experience in consulting, operations and design in India, Western Europe, Middle East and southern Africa.

Chart 1: China capacity additions shift to on-purpose



With the wave of announced new capacity in the region, is Southeast Asia **ready for new crackers?**

By Pinjarus (Pin) Pinsem



➤ **In the past 10 years, 2010 was the major capacity addition year for Southeast Asia with three world scale crackers starting up, one plant in Singapore (Shell) and two plants in Thailand (MOC and PTTPE). Followed by 2013, where ExxonMobil started up its new cracker complex in Singapore. The total production capacity addition in the past 10 years was over 4.7 million metric tons. Can Southeast Asia beat the historical capacity addition over the next 10 years?**

From the 7 announced projects in the region, only RAPID is under the construction phase. Other announced projects are facing a different stage of challenge. Projects announced in Vietnam, Long Son and Victory are struggle with finding new JV partners, as the foreign partners have withdrawn from the project.

In 2015 QP exited the Long Son JV project with SCG, Petro Vietnam and Vinachem as the JV shareholders. The Long Son Project is yet to announce the new JV partner but expected to be announced by the end of 2016. In July 2016, Saudi Aramco withdrew from the JV with PTT for the Victory project in Vietnam. Shortly after the Saudi Aramco announcement, there has been news that the local government of Binh Dinh Province has canceled the project. However, at the time of writing this article, PTT and IRPC have indicated that they have not received an official confirmation letter on the cancellation of the project by the local government. They have also confirmed

their interest in investing in the Victory project but are reviewing the project size and economics. For both projects the production capacity, target startup date and a new JV partner are yet to be announced.

For Cracker projects in Indonesia, Pertamina has shown interest in investing in a new petrochemical complex since 2012. Pertamina has been working with several potential JV partners. However, the project is now on hold as Pertamina is concentrating on upstream development. Lotte Titan is the other company showing interest in developing steam cracker in Indonesia. The company plans to supply ethylene from the new complex to its PE Plants, which currently operates by imported feedstock. Lotte is in the process of acquiring land for the naphtha cracker complex, which is near its existing PE plants in Cilegon Banten, Indonesia. The company expects to start the designing phase by the end of 2016, after the completion of land acquisition.

PTTGC plans to diversify its feedstock for its ethylene production through the “Map Ta Phut Retrofit Project”. The new steam cracker is based on naphtha feedstock. Map Ta Phut Retrofit Project of PTTGC seems to face fewer obstacles as the company plans to build a new naphtha cracker in the existing Map Ta Phut complex, which is the home of its major production facilities. The announced naphtha cracker size at 500 KTA is smaller than the current world sale capacity. In the meantime, PTTGC also plans to invest

Table 1: New cracker projects in Southeast Asia (under construction/announced)

Project	Location	Company	Announced Ethylene Production Capacity / Estimated startup	Project Status
RAPID	Malaysia	PCG	1,000 KTA / 2020	Under Construction
Long Son	Vietnam	SCG	1,050 KTA/ 2022	Announced / finding new JV partner
Map Ta Phut Retrofit	Thailand	PTTGC	500 KTA/ 2020	Announced
Victory	Vietnam	PTT/IRPC	Capacity and startup target to be confirmed	Announced / finding new JV partner
Pertamina new petchem complex	Indonesia	Pertamina	Capacity and startup target to be confirmed	Announced/ finding JV Partner
Lotte Titan	Indonesia	Lotte Titan	Capacity and startup target to be confirmed	Announced/ land acquisition
JG Summit expansion	Philippines	JG Summit	Capacity expansion to 500 KTA from 320 KTA.	Announced

in the world scale steam cracker complex based on shale gas feedstock in US. The final investment decision for shale gas project is expected in early 2017. It is interesting to find out if PTTGC would decide to invest in two steam crackers at the same time.

The expansion project of JG summit was recently announced in June 2016. The company is expected to expand its existing cracker from 320 KTA to 500 KTA. The target expansion date has not been confirmed. The announcement of this expansion project is relatively recent news, only one and a half years after its existing steam cracker startup in late 2014.

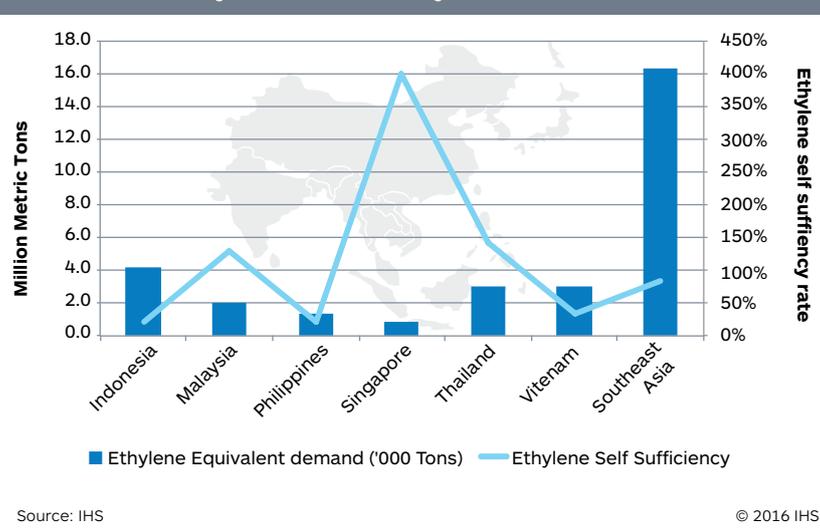
On the demand side, Southeast Asia's equivalent ethylene demand is estimated at 11.6 million tons in 2016, the ethylene equivalent demand is forecasted at 3.8% per year during 2015-2025 and reaches 16.3 million tons in 2025. Current ethylene production capacity is 11.8 million tons. IHS forecasts that capacity addition from RAPID is coming on stream in 2020 and one capacity addition of steam cracker in Vietnam is expected by 2022. This results in total firm production capacity of 14.0 million tons by 2025. Even with the firm capacity addition in the region, Southeast Asia's equivalent ethylene demand is expected to be higher than the region production capacity. It is obviously that SEA requires additional capacity to support ethylene demand growth in the region. The question is how many projects are required and could be materialized to support ethylene demand growth in this region.

Historically, Southeast Asia's self-sufficiency rate has been in range of 97% to over 100%. By 2025, Southeast Asia is expected to be deficit in ethylene equivalent demand with 82% ethylene self-sufficiency. However, with a closer look at country specific ethylene equivalent demand and self-sufficiency rate, Indonesia, Philippines and Vietnam are among the least ethylene sufficient countries in the region. This may help point out the opportunity for new cracker project(s) in these countries.

From the above demand and possible supply analysis, in order to maintain ethylene self-sufficiency rate in the region to the level of 100%, similar to the historical self-sufficiency rate, the region would need at least two additional world scale crackers by 2025, in addition to the two crackers (RAPID and one world scale cracker in Vietnam) which are included in the capacity listing by 2025. Excluding RAPID, which is now under construction, there are 6 announced cracker projects in this region. This means there is room for three new world scale crackers in the region. Most of the announced projects are also located in the less ethylene self-sufficient location such as Indonesia (2 projects), Vietnam (2 projects) and Philippines (1 project).

The domestic ethylene equivalent demand in the

Chart 1: 2025 ethylene self sufficiency rate in Southeast Asia



Unless 2 or more announced projects become materialized, by 2025 ethylene self-sufficiency rate in Southeast Asia would be at around 80% lower than historical self-sufficiency rate

country, and self-sufficiency rate are not the only indicators of the possibility of investing in new steam cracker project. The investment cost, feedstock price and its availability, type of derivative products integrated with the cracker complex, technology selection, policy & regulation and investment support program from local government are also the important factors contributing to the decision making of investing in new steam cracker complex, which are should be evaluated project by project. Southeast Asia is ready for new steam cracker projects, but time will reveal which of the announced projects would be materialized within the next 10 years. ■

Pinjarus (Pin) Pinsem serves as senior consultant, IHS Chemical Consulting, based in Bangkok Office. Contact Pin at: pin.pinsem@ihsmarkit.com



**Industry information
and expertise...**

**from process economics
to polymers.**

Every decision matters.

That's why leaders around the world rely on IHS to help them make the best choices.

As the premier provider of global market, industry and technical expertise, we understand the rigor that goes into decisions of great importance. We scale our thinking across virtually any operation or enterprise, from ground level tactics to high level strategy to match the scope of our customers' needs.

IHS... when decisions matter.



IHS.COM