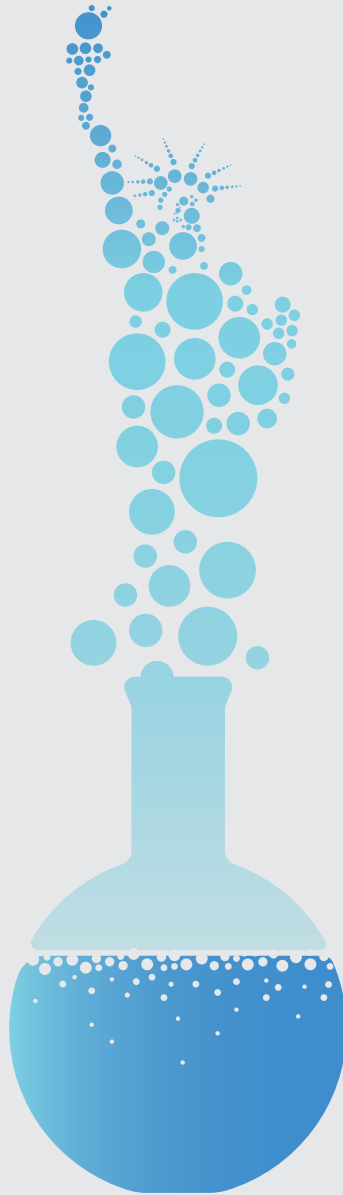


# GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS



## UNITED STATES CHEMICALS 2016



*Economy - Chemicals - Energy Reforms - Petrochemicals - Agrochemicals  
Paints and Coatings - Specialty Chemicals - Distribution*

# SHALE STATE OF MIND: AN INTRODUCTION TO THE U.S. CHEMICAL INDUSTRY

Journalist: Harriet Bailey

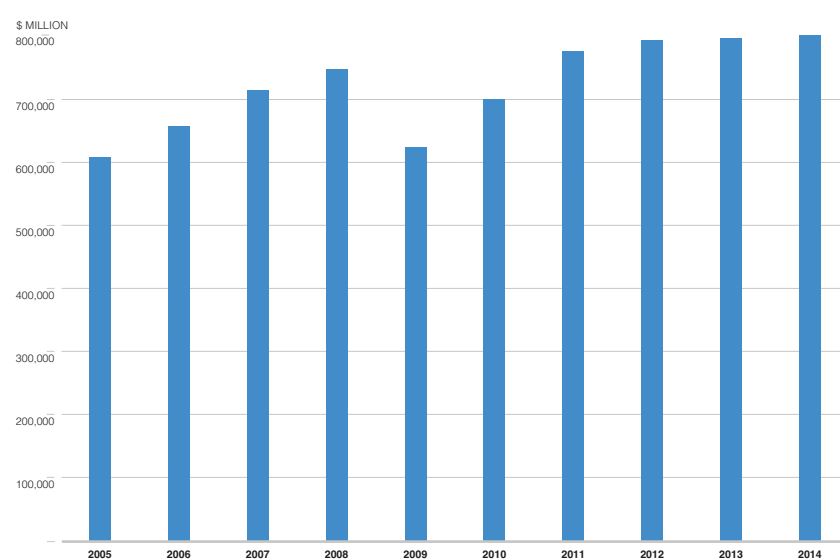
The outlook for the chemical industry in the United States has shifted dramatically in the space of only a few years. Revenues currently stand at approximately \$820 billion, and are expected to exceed \$1 trillion before the end of the decade. Accounting for more than 80% of the overall chemicals market in the North American Free Trade Agreement (NAFTA) region, comprising Canada and Mexico as well as the United States, the space is seeing what is being dubbed by the Boston Consulting Group as a “once-in-a-lifetime renaissance.”

The driver behind this reversal of fortunes is the shale gas revolution, which has provided the United States with a low cost feedstock to rival its main competitors in China and the Middle East, as well as helping to offset the decline in production from conventional gas reservoirs. Advancements in hydraulic fracturing and horizontal drilling technologies, more commonly known as fracking, have facilitated significant productivity increases. Although it was estimated that the United States was sitting on a host of untapped shale deposits during the time of the global financial crisis, it took another five years for the impact of the country’s abundance of natural gas reserves to make its way downstream: wells drilled in January 2014 produced more than nine times as much gas per day as five years previously, according to the U.S. Energy Information Administration (EIA).

The EIA’s most recent projections for U.S. proved natural gas reserves are at a record high of 388 trillion cubic feet, with Texas, Pennsylvania, and Oklahoma tak-

VALUE OF U.S. CHEMICAL SHIPMENTS (2005-2014)

Source: Statista



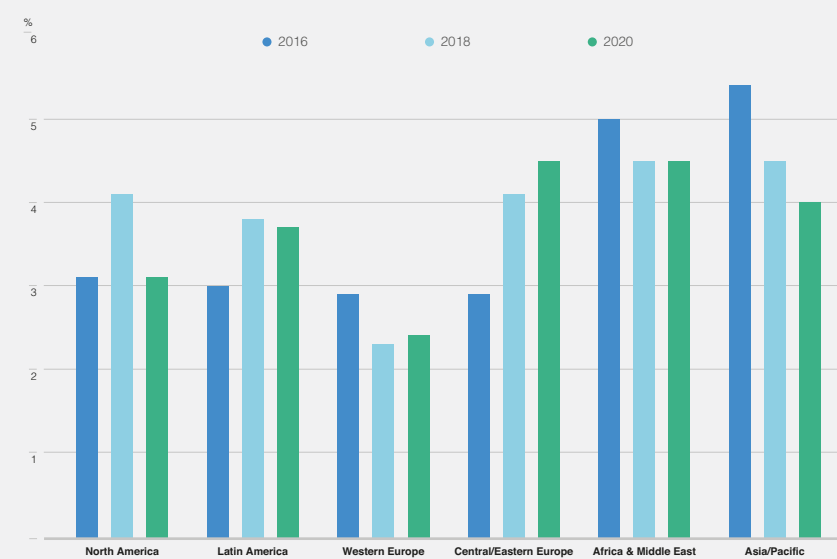
ing the top three positions respectively. Texas’ own Barnett shale play is not only the largest in the country, but was also the first deposit to be drilled horizontally; Pennsylvania’s Marcellus shale reserve, which also runs through West Virginia and New York, saw an increase of 10.4 trillion cubic feet of proved reserves added in the last year, out of an additional 50.5 trillion cubic feet in total. The deposits in the Appalachian basin, which were previously thought to have been depleted, have the potential to satisfy demand for natural gas in the entire northeast of the country. Across the United States, shale gas

reserves are expected to support requirements for almost a century.

### The phoenix rises

From being a high-cost manufacturing destination a decade ago, the United States is now the most cost-advantageous region for chemical production outside of the Middle East. The chemical manufacturing sector, having undergone a mass relocation to Asia when the industry was in free fall, is now rejecting China and India in favor of the United States. In the first five years of the decade, companies in-

PROJECTION OF ANNUAL CHEMICAL PRODUCTION GROWTH BY REGION



jected \$135 billion of capital expenditure for new facilities and plants; as a result, the chemical industry is now one of the top exporting industries in the country, accounting for 15% of all global chemical shipments and around \$189 billion in trade, according to KPMG.

The two petrochemical giants Chevron Phillips Chemical and ExxonMobil Chemical were the first to take advantage of the developments in shale gas, with both announcing their plans for new 1.5 million metric ton (mt) ethane crackers in Texas in 2013. Since then, a further six plants have been announced along the Gulf Coast, and a further two for the northeast of the country from Shell Chemical and Brazil-based Braskem, bringing the total announced cracker capacity to ten in the space of less than two years. Furthermore, ten sites on the Gulf Coast have undergone expansions and upgrades to capitalize on the feedstock advantage, including the BASF TOTAL Petrochemicals LLC steam cracker in Port Arthur. In 2013, the cracker was revamped to process the lighter shale gas, while a tenth furnace was added a year later. Overall processing capacity is set to more than double to 41 million mt per year, according to analysis by market intelligence company ICIS, if all 20 projects come to fruition. Yet Braskem is currently re-evaluating its West Virginia project, in part due to current high construction costs in the United States.

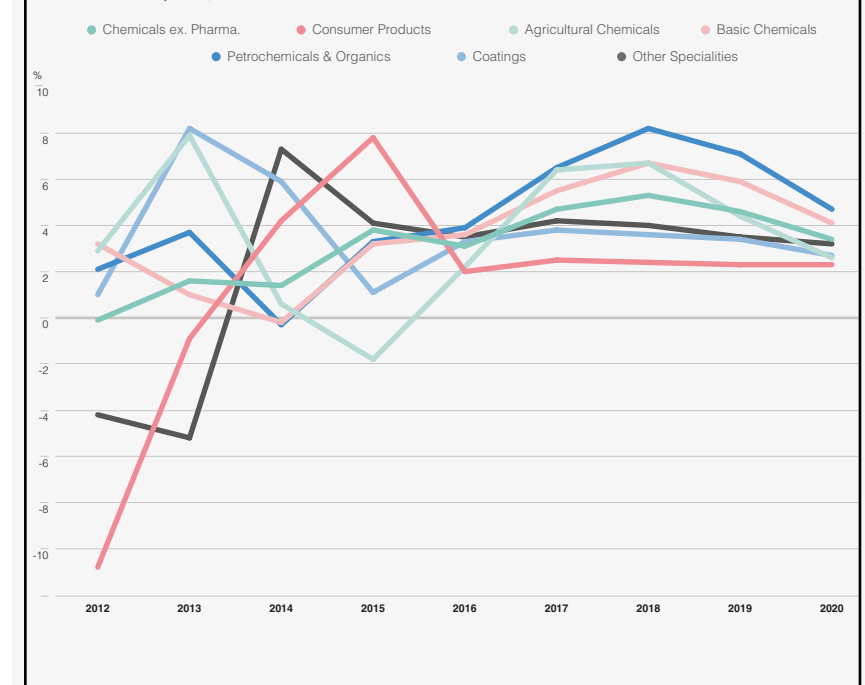
Two decades of stagnation and decline between 1990 and 2010 created a vast hole in the availability of qualified personnel not only to build the new facilities, but also to provide the expertise required to staff them in the future. With limited manufacturing capacity in the country and

no prospects of it ending, a generation of young people saw limited prospects in studying for the technical skills the chemical industry might require. Between 2010 and 2014, however, job growth increased 10% in industrial engineering and by one-third in the petroleum engineering space; the market was woefully ill prepared for such a draw on human resources.

The issue is compounded by the fact that the two fields have a higher proportion of their workforce nearing retirement than other areas. A quarter of workers are in the 55-years-and-older bracket, compared to 19% across all occupations. Although the ten years to 2013 saw engineering graduate numbers increase by almost 44%, petroleum engineering in particular is still suffering a shortfall. Economic Modelling

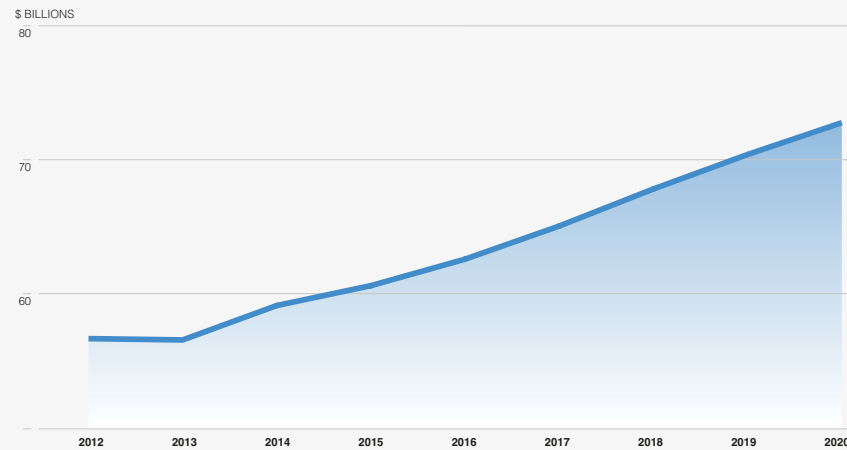
U.S. CHEMICAL PRODUCTION BY VOLUME, 2012-2020 (% CHANGE YEAR-OVER-YEAR)

Source: American Chemistry Council, December 2015



**R&D SPENDING**

Source: American Chemistry Council, December 2015



Specialists International (EMSI) figures suggest there were around 3,500 jobs on offer in 2013, for a graduate class of just 1,600 people.

Companies have, however, recognized the problem and are taking steps to improve the situation. BHS Specialty Chemical, headquartered in Nampa, Idaho, and local school Boise State University have created a partnership enabling Ph.D. students to gain applied experience in the food chemicals niche. Netherlands-based DSM is highlighting the opportunities within the chemical industry to an even younger personnel base, promoting the benefits of Science, Technology, Engineering & Math (STEM) education at high schools and community colleges.

**East meets West**

Currently, the U.S. chemical industry directly employs more than 800,000 people and, according to estimates by the American Chemistry Council, affects a further 5.9 million jobs indirectly. With that figure set to rise dramatically, combined with an increase of around \$10 billion to \$21 billion in domestic demand for chemicals across a host of industries, the regulatory burden could prove a sticking point. Although fracking has been allowed to advance relatively unimpeded, to the great benefit of the U.S. economy, the chemical industry overall faces a host of compli-

ance issues from manufacturing to distribution.

A hot topic for day-to-day operations is the impact that a potential carbon cap may have as the industry experiences a rapid resurgence in activity. While the U.S. Environmental Protection Agency (EPA) plays an important role in safeguarding the health of the population, chemical companies fear restrictions on activity at a decisive moment in their future operations. Were this to be implemented, the additional costs in adhering to regulation would create a chain reaction effect, rendering the current cost advantages from shale gas redundant.

Regulators have also been dragging their heels on reform of the Toxic Substances Control Act (TSCA), which was first brought into law in 1976. As the key piece of legislation governing public health with regards to the safety of new and existing chemicals, both the EPA and the chemical industry are united in their aim to implement improvements to the outdated ruling; a finalized version is expected to be put in front of Congress and President Obama in 2016, bringing the 40-year-old law in line with twenty-first century operating procedures. Yet to ensure no legislation without representation, industry associations such as the American Chemistry Council and the Society of Chemical Manufacturers & Affiliates aim to educate and lobby lawmakers on their members' behalf.

Although domestic demand for chemicals is set to double, research by management consulting firm A.T. Kearney shows consumption of plastics, such as polyethylene, polypropylene and polyvinylchloride, has already reached its peak in the United States and Europe. Thus an increase in the western world's wealth as they emerge from recession will not spell an uptick in consumer demand. Globally, however, the middle class is still on the increase, with U.S.-headquartered Chemours Co. estimating almost five billion people will fall into that bracket by 2030, up from two billion people at present. This will be seen most strongly in Asia, particularly in highly populated China and India, as well as the emerging Association of South-East Asian Nations (ASEAN) region.

Formerly, the majority of the chemicals produced in the United States were destined primarily for use by domestic companies; exporting product was the exception rather than the rule. As traditional supply and demand markets invert, supply chains must also adapt to the new world order. Companies must now examine their distribution methods and impose greater product stewardship from beginning to end. The ports of both New Orleans and Houston are evolving in line with the increased traffic expected from the Gulf Coast's new and existing chemical operations. Their expansion projects, which will see a new 500,000 square-foot facility at the former and \$275 million injected into upgrade work at the latter, will coincide with the completion of the Panama Canal's expansion in 2016. The installation of a third set of locks will double the capacity of the link between the Atlantic and Pacific oceans and enable supertankers and modern container ships to traverse the canal.

The U.S. chemical industry has seen a dramatic reversal in its fortunes during the first half of this decade. Chemical companies have quickly recognized the opportunities available to them and invested in both modernizing their existing capabilities and constructing new ones. But two decades of neglect are not easily rectified and, in order to fully capitalize on the advantages that shale gas is bringing, industry, government and local communities must work together to solve infrastructure and personnel problems in the near term for long-term benefit. •

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## Mark N. Duvall

●●● Attorney at Law  
**BEVERIDGE & DIAMOND P.C.**

### reforms be for the chemical industry and what impact will they have on the way the EPA operates in future?

At present, the EPA has 90 days to review a pre-manufacture notification for a new chemical; if it takes no further action, the chemical can subsequently be manufactured commercially. Under the TSCA legislation currently under discussion in the Senate, the EPA would have to make an affirmative determination that a new chemical is likely to meet the safety standard. High-priority chemicals would be reviewed against certain scientific criteria in a set timeframe. If the chemical does not meet the required standard, the EPA would be required to regulate that chemical until it does.

The preferred outcome for the chemical industry is that individual states would feel less pressure to adopt state restrictions on chemicals in products. For many years, states have perceived a vacuum at federal level and have viewed the EPA as ineffective in regulating chemicals that are of concern to them. The state-specific requirements tend to be inconsistent and lacking the scientific review process normally conducted by the EPA.

Even more significantly, in a country where products are sold both nationally and internationally, any state restriction on the content of a product has, at the very minimum, national implications for companies that make and distribute products. Thus, if it is understood that the EPA is addressing chemical issues on a prioritized basis, the requirement for them to spend their limited resources on the adoption, implementation and enforcement of product regulatory programs lessens.

### The TSCA reform effort began in 2005. Could you outline activity in attempts to reform the TSCA legislation during the last 10 years and explain what is happening at present?

The Act applies to tens of thousands of chemicals, used in a number of different ways but predominantly in industrial activity with minimal consumer exposure. The safety standard in the earlier legislation was one of 'reasonable certainty of no harm', which was widely considered by the industry to be inappropriate for the chemicals under consideration. Until 2013, no compromise bills addressing various issues in the wording of the legislation achieved

bipartisan support. Beginning in 2013, a fresh approach was launched which has now resulted in legislation that is close to final approval. The House of Representatives passed its version of the legislation in June 2015, and the Senate passed its version in December. Once the two versions are reconciled, final legislation will be passed by both Houses of Congress and sent to President Obama for signature. He is expected to sign it.

### What will be the consequences for manufacturers and distributors on a nationwide level?

They will face more challenges regarding regulation and greater scrutiny on new chemicals. However, manufacturers and distributors may have the opportunity to influence the EPA's selection of high priority chemicals and to have input into their subsequent evaluation or restriction. Additionally, manufacturers and potentially processors will face increased fees for a wider variety of activities in order to help pay for TSCA administration; limited fees are currently in place, but these are capped at \$2,500 and are only applicable if certain conditions are met.

### Looking towards the future, what are the principal sustainability issues you will be tackling and how is this area of the industry regulated?

Sustainability considerations have been a major stimulation to innovation in the industry, highlighting the importance of removing any unnecessary barriers to innovation. The EPA has been promoting greener technologies through its 'Design for the Environment' Program. This is, however, a hazard-based program that does not take exposure into account, eliminating risk as a decisive factor. The mere presence of a chemical that has toxicological issues associated with it at some level renders it ineligible in that program, regardless of whether the low levels of use would create risk. If it can be detected in the parts per trillion level, it is unlikely to have any significant health or environmental impact, but at this level of disclosure many chemicals are affected. TSCA legislation is risk-based, but it is much easier to administer a hazard-based program and explains why this approach is favored at the state level. •

### ●●● Could you introduce Beveridge & Diamond and explain more about the areas in which you work?

Beveridge & Diamond is a boutique law firm focusing on environmental and natural resource law, litigation and alternative dispute resolution. Our 100 lawyers are based in seven offices across the United States. In addition to the traditional environmental areas of air, water and waste, we work in a wide variety of related areas, including product restrictions, design and disposal. Furthermore, we work with companies on their sustainability efforts. In the chemicals area, we have been working with the Environmental Protection Agency (EPA) regarding the implementation of the Toxic Substances Control Act (TSCA). We have played a significant role in the efforts to modernise this piece of legislation, which dates from 1976.

### How important will the imminent TSCA



MS



PH

## Mike Shannon & Paul Harnick

●●● MS: Global Chair  
PH: Global COO  
**CHEMICALS AND PERFORMANCE TECHNOLOGIES, KPMG**

### ●●● Could you introduce us to KPMG's Chemicals and Performance Technologies segment on a global level?

MS: We provide audit, tax and advisory services to the chemicals sector. KPMG has professionals in every major market worldwide focusing solely on providing services to our clients. Paul and I spend a lot of time travelling to different parts of the world to meet with our clients and to gain first-hand understanding of the sector.

PH: The energy practice within KPMG, of which the Chemicals and Performance Technologies segment is a part, is a strategic priority to the company. We are extremely strong in areas such as transfer pricing, international tax and tax optimization, while key areas of focus on the advisory side would be mergers and acquisitions; working capital optimization; cost reduction and process efficiency; and supply chain management. As a company,

we perform external audit services for 32% of chemical companies around the world worth more than \$1 billion, and we provide either tax or advisory services for the vast majority of the remainder.

### What are the main differences between the chemical industry in the United States as it stands now versus other regions worldwide?

MS: The United States is now the number one strategic focus area in the world. Although China is bigger in terms of output, the focus is on the United States from a strategic and investment perspective. Although the sudden drop in the price of oil has somewhat levelled the playing field, the low price of natural gas means the United States is still the most cost-advantageous region for the production of chemicals outside of the Middle East. We are also seeing the return of manufacturing, taking advantage of cheaper raw materials.

PH: If you had asked us three years ago if we would ever see a world-scale commodity chemical plant being built in the United States again, we would have categorically said no. Our expectations for growth lay in the emerging markets of China, India, and Brazil, in that order. Now, although China remains at the top, India and Brazil have fallen off the list, to be replaced by the Association of South-East Nations (ASEAN) region in particular, and Europe. Brazil has been teetering on the brink of recession for the last 18 months, while India continues to be constrained by a lack of feedstock and very weak infrastructure. Both countries really struggle from a legislative standpoint, with Brazil in particular having one of the most complex tax regimes globally. As such, we are not seeing global chemical companies prioritize investment in either of these regions. Combined with the \$135 billion worth of new capacity under construction in the United States, this is causing a fundamental shift in the world chemical marketplace.

### Considering the chemical industry is now one of the strongest areas of the U.S. economy, what challenges does the uptick in production spell for companies themselves?

MS: The reality is that the U.S. economy will likely not be able to absorb all of the molecules coming out of the ground, and

the country will have to increase its exports. Since the chemical industry has not needed to focus heavily on export procedures for the last 15 years, this will prove a significant challenge.

### In the search for new end markets for the chemical industry, which industrial segments and geographies may prove able to absorb this extra capacity?

PH: There are a number of traditional end markets for chemical products, but we also need to look at what is happening in the automotive and construction industries, for example. The U.S. automotive industry is fairly strong at present, unlike its Chinese counterpart. More broadly, global mega trends tend to drive demand for chemical products, as does population growth and urbanization in emerging markets. Geographically, China continues to be a substantial end market for chemicals, despite its current woes. Many of our clients are looking at the ASEAN region as the next growth area; Indonesia for example has a potential 250 million consumers, while Vietnam has a low-cost manufacturing base and is benefitting from companies withdrawing their operations from China to take advantage of low wage rates.

MS: Even the traditional end markets for chemicals are undergoing change. Cars today require far more chemicals than 15 years ago, with for example carbon fiber replacing steel and plastics and other composites replacing aluminum. The transformation within those subsectors will have an extraordinary impact on the chemical industry. With urbanization, newer housing is more energy efficient and sustainable technologies are required.

### Petrochemicals are seeing a resurgence in the United States. How are the dynamics between low oil prices globally and high volumes of feedstocks playing out?

PH: The U.S. petrochemical industry is booming, which will have a severe detrimental impact on petrochemical production in Europe. Currently, the decline in the price per barrel of oil has contributed to a small but perceptible renaissance among European manufacturers; they remain cost disadvantaged to the United States, but less so than 12 months ago. Yet it remains to be seen how long oil prices remain at this level. •

# GLOBALLY POSITIONED: GROWTH STRATEGIES OF MULTINATIONALS

## Focusing on Core Competencies and Sustainable Innovation

Journalist: Harriet Bailey

●● The shale gas renaissance has given the United States a new lease of life in terms of its attractiveness to global chemical companies. More affordable and abundant feedstocks, particularly in comparison to Europe, have affected the strategies of household names such as The Dow Chemical Co., BASF Corp., and DuPont, resulting in increased investment in North America and even company-wide shake-ups.

While spin-offs are nothing new – GenCorp, Inc. spun out Omnova Solutions in 1999, while LANXESS Corp. was formed from Bayer’s chemical division in 2004 – companies are increasingly looking to divest non-core business units in order to focus on their strengths. The second half of 2015 saw two high-profile, standalone companies formed from peripheral divisions: The Chemours Co. was previously DuPont’s performance chemicals segment before being cut loose in July, while Covestro emerged from what had been Bayer MaterialScience in September. W.R. Grace & Co., meanwhile, will complete the spin-off of its construction chemicals and packaging business units in early 2016, creating two public companies.

Multinationals have also stepped up investment in their U.S. operations, with the availability of shale gas as the cherry on top of a densely packed cake. “North America is important to us for many reasons: it has an abundance of great universities, including six of the ten highest-ranked universities in the world; nine of the ten most active cities in the world for start-ups are here, drawing in the brightest minds from around the world; and the United States spends more than any other country globally on research and development (R&D),” explained Teresa Szelest-Shah, president of North American market and business development at BASF, which has decided to increase investment in the region from around \$500 million per

●●

*“Cars today require far more chemicals than 15 years ago, with for example carbon fiber replacing steel and plastics and other composites replacing aluminum. With urbanization, newer housing is more energy efficient and sustainable technologies are required.”*

*- Mike Shannon, Global Chair, Chemicals and Performance Technologies, KPMG*

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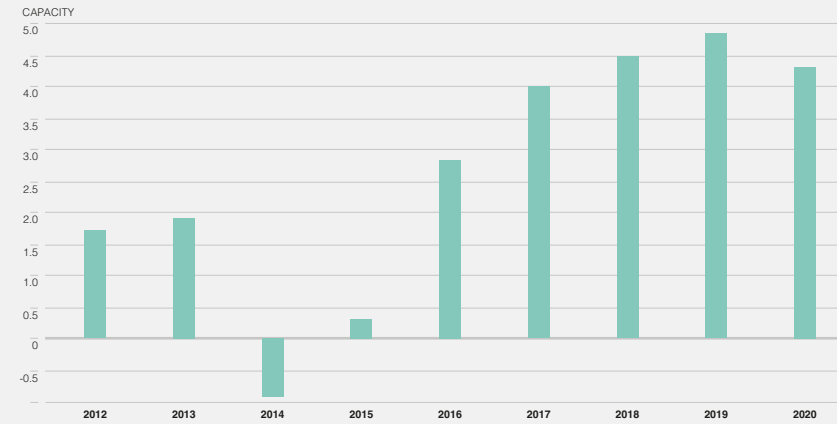
year in 2012 to \$1 billion in 2015.

In addition to relying on the hydrocarbon resource, global chemical producers have to innovate in order to remain at the top of their respective markets; new solutions are a differentiator as far as clients are concerned. “Innovation remains a significant competitive advantage, as well as the ability to provide tailor-made solutions,” said Anne Noonan, president of performance chemicals at Omnova. “We are seeing the specialty chemical industry develop around consumer-driven industries, such as the automotive, personal care, construction and electronics markets. Specialty chemical growth is also driven heavily by the trend for sustainability and eco-friendly products.”

Large chemical companies are increasingly focusing on developing

### U.S. CHEMICAL PRODUCTION CAPACITY 2012-2020 (% CHANGE YEAR-OVER-YEAR)

Source: American Chemistry Council, December 2015



### U.S. CHEMICAL PRODUCTION CAPACITY UTILIZATION (2015)

# 74.6%

Source: American Chemistry Council, December 2015

chemicals with high value-added properties and departing from their previous strategies surrounding bulk industrial chemicals. Both DSM and Dow are following this path, with DSM having divested its polymer intermediates and composite resins business to private equity firm CVC Capital Partners in 2015, in order to focus on its nutrition and performance materials businesses. Joe Harlan, vice chairman and chief commercial officer at Dow, said: “Some chemicals may have begun their lives as specialty products, but have commoditized over the last couple of decades. Since 2005, Dow has divested \$15 billion in revenue of products that had commoditized, including for example polycarbonates, styrenes and polystyrenes, chlorine and epoxy.”

Dow was forced to exit these businesses due to the dramatic increase in production of these chemicals by companies in typically low-cost markets, such as India and China. Here, operations are generally subsidized by the state and have different return on capital requirements, leading to over-production and a subsequent critical loss in value. To replace depleted revenue streams, the company has since acquired \$17 billion in specialty offerings.

#### Growth trends

As well as having rich shale plays across the country, the United States also plays host to certain industries seeing growth on the back of chemical innovation. The automotive industry is seeing a resurgence, thanks to slow growth in the Chinese automotive industry and a return of manufacturing to the country, while the construction industry is expanding to keep up with growing demand on both housing and new industrial sites.

“Cars today require far more chemicals than 15 years ago, with for example carbon fiber replacing steel and plastics and other composites replacing aluminum. With urbanization, newer housing is more energy efficient and sustainable technologies are required,” said Mike Shannon, global chair of KPMG’s chemicals and performance technologies segment.

More broadly, multinationals tend to look at global megatrends for R&D inspiration, with population growth underlying many developments, such as climate change and scarcity of resources.

Agriculture is also an area where specialty chemical innovation can have a significant role in protecting crops and improving harvests. Dow’s Harlan claims that yields in the United States have doubled since 1980 due to agricultural chemicals, in spite of challenges such as drought and lack of arable land. Many fertilizer projects are taking place in the Midwest and Appalachian regions; service provider Tecnimont has returned to the United States to work on a \$1.8 billion ammonia plant in Iowa.

Innovation also highlights issues surrounding a company’s competitiveness in the marketplace. With multinationals such as BASF ramping up operations in the United States, it makes sense to move R&D activities to the country as well. “By 2020, 25% of our R&D activities will be done here under the global Bioscience Research platform, which is headquartered in Research Triangle Park, North Carolina,” explained Szelest-Shah.

BASF also recently completed a \$25 million investment to its R&D site in Ohio, adding new chemical and process engineering capabilities.

The Germany-based company has globalized its R&D function to leverage insights

from the best research institutes worldwide. “These collaborations are at the epicenter of our focus on innovation. The ability to find the right partners both for long-term and short-term research aligns with how BASF thinks. We can tap into the best solutions for some of the global challenges we are currently addressing, on urban living, smart energy and food supply, much faster than if we just looked internally,” continued Szelest-Shah.

In March 2013, the company launched a collaborative research initiative with Harvard University, the Massachusetts Institute of Technology (MIT) and the University of Massachusetts (UMass) Amherst to create the North American Center for Research on Advanced Materials (NORA).

#### Going green

While global megatrends help drive innovation, the chemical industry also recognizes the role that sustainability and eco-friendly measures can play in R&D opportunities. Although viewed by many outsiders as the cause of environmental issues, the chemical industry considers itself maligned. Chemtura’s CEO Craig Rogerson said: “The continuing improvement of a product relative to its sustainability is a key driver for a lot of the innovation within this industry. The message that many companies want to broadcast is that specialty chemicals are really part of the solution in meeting the requirements for making our environment cleaner and safer.” Covestro, for example, tests all products in its pipeline against sustainability measures to ensure that they will have a reduced environmental impact compared to their predecessors. “One example of this sustainable innovation is our Dream Production proj-

## Innovation. Sustainability. Growth.

### Innovation.



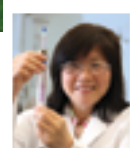
Chemtura's lube oil additives help meet demanding emissions and fuel economy standards and facilitate clean wind-turbine energy, and our refrigeration oils are compatible with non-ozone depleting refrigerants. Our brominated products reduce mercury emissions from coal-fired power plants and play a critical role to enable deep-well drilling. Our high-purity metal organics are used in high-brightness LED lighting and thin-film solar panel applications.

### Sustainability.



Chemtura is committed to Responsible Care®, the chemical industry's voluntary initiative to protect the environment, ensure safe and secure operations, and safeguard the health and safety of employees and the communities in which we live and work.

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We help our customers grow by delivering sustainable competitive advantages through cutting-edge technologies and a deep understanding of the end-use applications.



For more information, visit [chemtura.com](http://chemtura.com).

ect, which is turning carbon dioxide from a waste greenhouse gas into an ingredient for producing premium polyurethane foam – the type of foam that is found in many everyday items, including upholstered furniture, shoes and automotive parts, and is also used to insulate buildings and refrigeration equipment.”

It is not only R&D at the start of the chemical chain where sustainability measures are being taken into consideration. Distributors are also looking at ways to dispose of the waste products associated with raw material production in order to differentiate themselves from their competitors and provide client companies with added-value solutions. “We have termed this ‘100% utilisation’ – 100% of the materials that go in produce 100% viable materials coming out, whether it is for the initial application it was designed for or something else. What we have done, using our laboratories, is to find a secondary application for the material, which we sell to other industries. This does not detract from the producers’ primary sales and turns by-product, which had been a liability, into an asset,” explained Alan Chalup, COO at Basstech International.

In this case, a problem surrounding sustainable operations has been the driving force behind innovation and has had a positive impact across the supply chain. Basstech’s clients initially sold the waste product to their existing customers, negatively affecting sales of its main products. By providing this solution, Basstech is able to take this problem out of its clients’ hands as well as create an additional revenue stream.

The combination of negative perspectives of the chemical industry and the benefits to companies across the supply chain by solving sustainability issues indicates “green chemistry” will continue to push innovation into the future. Increasingly, sustainability is underlying companies’ daily operations, such as at BASF: “Our commitment to sustainability is embedded in our purpose: We create chemistry for a sustainable future. The whole company has assessed its portfolio of products and technologies to identify which are advancing sustainability solutions. Those which are not then become the focus of our research,” stated Szelest-Shah. In addition to company growth resulting from internal strategies, the external needs of a number of end markets will also serve as a catalyst of the chemical industry’s expansion. •



## Teresa Szelest-Shah

President, Market and Business Development, North America  
**BASF CORP.**

### ••• Could you explain how BASF has refined or expanded the focus of its specialty chemicals segment since the industry falter of 2012-13?

Much has changed in the last three years, both within BASF and also within the industry as a whole. What we see continuing to drive change is the impact of shale gas. For a company such as BASF, the recent affordability of some of the base chemicals that feed down into our specialty chemicals segment has seen us step up our investment here. Three years ago, we were investing approximately \$500 million per year in North America capital; today that has risen to \$1 billion.

The specialty chemicals market itself is developing in line with the North American market as a whole. Some segments, such as those related to the automotive industry, are doing very well, but industries that may be supported by high oil pricing may not be doing as well today in a low-priced market.

Overall, BASF continues to see the specialty chemicals market as a whole as attractive and in line with our core values and strengths such as innovation. With globalisation of our research and development (R&D) function, we now have in North America more than 1,800 people at 27 R&D locations, including six major hubs. With this set-up, we are uniquely situated to support development of products and services for our customers and partners in the specialty chemicals market.

### How do your facilities in the United States play a part in BASF’s global corporate strategy for the specialty chemicals segment?

A key element of our strategy is to be present where the demand is. North America is important to us for many reasons: it has an abundance of great universities, including six of the ten highest-ranked universities in the world; nine of the ten most active cities in the world for start-ups are here, drawing in the brightest minds from around the world; and the United States spends more than any other country globally on R&D. By 2020, 25% of our R&D activities will be done here under the global Bioscience Research platform, which is headquartered in Research Triangle Park, North Carolina. We opened our new North America Headquarters building in Florham Park, NJ in 2012. This building is our showcase for sustainable construction, in which many BASF-enabled products are used.

We also have nearly 100 manufacturing sites in North America, including two integrated Verbund sites in Freeport, Texas, and Geismar, Louisiana. We have made significant investments in new plants over the last few years, including a new dispersions plant manufacturing acrylic emulsion polymers for the coatings, constructions chemicals and adhesives industries, which began operating in Freeport this year. We made upgrades to the BASF TOTAL Petrochemicals LLC steam cracker in Port Arthur, Texas (one of the world’s largest), adding a tenth furnace and improved feedstock flexibility to take advantage of lighter, natural gas-based feedstocks. Our R&D site in Beachwood, Ohio, completed a \$25-million investment to add new cathode materials research and chemical and process engineering capabilities.

**How is BASF progressing in the targets for sustainability that it set itself in 2010?** Our commitment to sustainability is embed-

ded in our purpose: ‘We create chemistry for a sustainable future.’ Sustainability for BASF really represents the balance between three key areas: environmental, social and economic, and understanding how they come together in any single situation. Our headquarters building embodies our sustainability mandate, being one of New Jersey’s largest sustainable buildings. We have also received two Leadership in Energy and Environmental Design Platinum (LEED) certifications from the U.S. Green Building Council for both the exterior of the building and the indoor environment. Sustainability is also the topic of some of our corporate social responsibility work in North America. For example, we recently gave \$1 million to the Louisiana State University to conduct forward-thinking research on sustainable living.

### Could you talk about some of your partnerships with companies, research institutes and universities?

These collaborations are at the epicenter of our focus on innovation. The ability to find the right partners – both for long-term and short-term research – aligns with how BASF thinks. We can tap into the best solutions for some of the global challenges we are currently addressing, on urban living, smart energy and food supply, much faster than if we just looked internally. In March 2013, for example, we launched a collaborative research initiative with Harvard University, the Massachusetts Institute of Technology (MIT) and the University of Massachusetts (UMass) Amherst to create the North American Center for Research on Advanced Materials (NORA).

### Looking forward, you plan to invest around \$5 billion in North American capital projects over the next five years. Where do you expect to see BASF by 2020?

BASF will continue to innovate and drive sustainable solutions with our customers and partners and further strengthen its raw materials and feed stocks and innovation throughout our value chains. It will leverage the abundance of talent in this region. In 2015, BASF celebrated its 150th anniversary because of its ability to continuously reinvent itself, innovate, and collaborate, and we plan to continue in this fashion for the next 150 years – creating chemistry for a sustainable future! •

# REDEFINING REFINERIES: THE U.S. PETROCHEMICALS INDUSTRY

Journalist: Harriet Bailey

At the start of the decade, the world was recovering from a global economic crisis. Although the United States was faring better than others, its petrochemical industry was not a specific area of focus; building a new plant was an unthinkable proposition, as manufacturing had been steadily migrating to the lower-cost markets of China and the Middle East.

Germany's BASF cited these reasons when announcing a strategic cutback in its European operations in 2014. Switzerland-headquartered INEOS, meanwhile, confirmed its profits in Europe had halved between 2011 and 2014, compared to a tripling in the United States. In an open letter to the president of the European Commission, INEOS chairman Jim Ratcliffe expressed his concerns about the future of the petrochemical industry on the continent, predicting "much of it will face closure within the next 10 years."

According to KPMG's Global COO for the Chemicals and Performance Technologies segment Paul Harnick, however: "The decline in the price per barrel of oil has contributed to a small but perceptible renaissance among European manufacturers. They remain at a cost disadvantage to the United States, but less so than 12 months ago."

Two years later, however, the situation was wholly different. Oil prices had jumped in price by \$40 per barrel to peaks of \$120 per barrel, leading the United States to produce more oil and minimizing its reliance on imported feedstocks. This coincided with the widespread implementation of hydraulic fracturing and horizontal drilling technologies, which unlocked new shale gas plays across the country. Almost overnight, the United States became the destination of choice for petrochemical companies. The latest figures from the American Fuel & Petrochemical Manufacturers (AFPM) highlight how quickly global petrochemical companies have committed to the United States for their manufacturing operations. "Over the last few years, the chemical industry has announced over 256 industry projects with a cumulative investment of \$158 billion," said Melissa Hockstad, vice president of petrochemicals at AFPM. This includes around ten new feedstock crackers, mainly based on the Gulf Coast, and plans to build another ten. Companies have wasted no time in taking advantage of the fresh potential for the United States. Yet this has undermined chemical industries in other parts of the world, particularly Europe, Brazil and India, which are losing their export markets to the United States. The resounding impression of Europe among petrochemical companies is of a stagnant market with expensive labor and energy costs. Although 22 chemical plants closed their doors in the UK in the five years between 2009 and 2014, INEOS recently committed around \$677 million to the construction of a new ethane port terminal at its Grangemouth facility in Scotland, which will enable U.S. gas imports to reach ethylene plants owned by companies such as ExxonMobil Chemical and Shell Chemical. Low-cost feedstock availability combined with its global positioning and the comparative ease of doing business have been significant factors in the growth of the U.S. chemical industry and its importance on the world stage. Not content with importing low-cost U.S. ethane gas to Scotland, INEOS is also executing a bold plan to use U.S. feedstock in its European cracker complexes via a \$1-billion project that will see around 800,000 metric tons (mt) of gas transported to Norway via a network of pipelines and new shipping vessels. Braskem America's CEO Fernando Musa

"The decline in the price per barrel of oil has contributed to a small but perceptible renaissance among European manufacturers. They remain at a cost disadvantage to the United States, but less so than 12 months ago."

- Paul Harnick, Global COO, Chemicals and Performance Technologies, KPMG

also highlighted how the United States' reputation and cohesiveness have played to the company's advantage during this period of rapid expansion: "More than 50% of our polypropylene production takes place outside of Brazil, with the majority being in the United States. This market is far more sophisticated in terms of product development and technology than our home market."

Like Europe, Brazil is no longer a priority for investment. "If you had asked us three years ago [...] our expectations for growth lay in the emerging markets of China, India and Brazil, in that order," explained KPMG's Harnick. "Brazil has been teetering on the brink of recession for the last 18 months [and] really struggles from a legislative standpoint."

Brazil's complex tax structures are also proving a deterrent, as companies shun the nation in favor of easier U.S. operations.

## Texas two-step

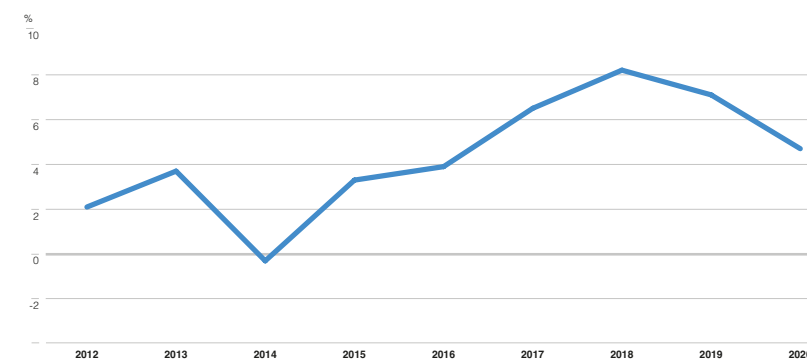
As the United States switches its position from a net importer to a net exporter of natural gas, a host of new construction and expansion projects are underway on the Gulf Coast to double the nation's polyethylene capacity by the end of the decade. Braskem is the third largest company worldwide in terms of polypropylene capacity, but is currently investing in a small specialty polyethylene plant in Texas, aiming to capitalize on the export market. "Our supply chain concerns are therefore very different depending on the product," explained CEO Musa. "Polyethylene requires a greater focus on port access and exporting challenges in the Gulf Coast region, while polypropylene concerns cover rail infrastructure nationwide."

ExxonMobil Chemical is building two, new 650,000-mt per year (mt/y) polyethylene plants in Texas, without any access to the rail network. This suggests that they will be used in large part to service their overseas gas supply contracts, rather than for the domestic market. Houston-based petrochemicals manufacturer LyondellBasell is planning to inject up to \$4 billion into construction and expansion projects along the Gulf Coast by 2020. Three existing ethylene projects are set to expand the capacity of their facilities by roughly 360,000 mt each, while the company's large Channelview complex is building an entirely new plant. Projects already in progress when oil prices dipped will all reach completion by around 2017, which could have a significant impact on service companies, as expansion efforts make themselves felt downstream. "We expect to see a significant increase in maintenance work as a direct result of the increase in the number of plants," outlined Tony Spencer, CEO at third-party personnel company CertifiedSafety. "But these better-designed facilities should be able to run for longer between maintenance events. So with the new generation of plants the frequency of turnarounds will decrease, but the overall project volume should increase."

Projects that had not yet broken ground were mostly postponed and those in the planning stages were shelved. Once oil prices return to the \$60 to \$80 per barrel price range, a second wave of project announcements will be on the cards. This two-step process may prove beneficial to the industry in the long run, allowing it the time to adapt to increased capacity and space out a rise in demand over a longer period. The shake-up in the petrochemicals space and demand for product has even seen new players enter the market. Altivia, a specialty chemical company focused on iron-based salts and phosgene derivatives, ventured into the petrochemicals space with its acquisition of Haverhill Chemicals in November 2015. Haverhill, the third largest producer of merchant phenol and acetone after Ineos and Shell, was forced into bankruptcy after being cited by OSHA for 23 safety violations following the death of a worker in 2014. Altivia CEO J. Michael Jusbasche stated that he expects the business to grow organically as global commodity markets recover, and inorganically through acquiring the non-core assets of larger petrochemical companies.

## U.S. PETROCHEMICAL PRODUCTION BY VOLUME, 2012-2020 (% CHANGE YEAR-OVER-YEAR)

Source: American Chemistry Council, December 2015



a longer period.

The resurgence in the U.S. chemical industry has also opened up the market to foreign investors like never before. AFPM's Hockstad said: "More than 60% of the announced investment is coming from companies outside of the United States." "Foreign investors will likely continue to have an interest in investing in the United States due to its favorable feedstock, capital expenditure, and demand environment," said Andrew Walberer, partner in A.T. Kearney's chemical industry practice. "[Japan-based] Mitsui, for example, has been a co-investor in new Gulf coast projects."

## Asian persuasion

With North America competing globally with natural gas liquids, China shifting from naphtha to coal, and the Middle East having access to low-cost naphtha, countries outside of these regions will look to tap into one or more of these areas. According to PwC partner Vijay Sarathy, the Japanese

and Korean chemical industries are not faring as well as neighboring China. "They are looking for ways to become involved in the U.S shale revolution to mitigate the effect the temporary lull in the price of oil has had on their crude oil-derived naphtha sources," he said.

On the flip-side, Asia's exceptional demand for chemicals for its growing middle-class has also seen Chinese companies directly investing in their own chemical projects in the United States. The Shandong Yuhaung Chemical Co., for example, held a groundbreaking ceremony at a \$1.85-billion site in Louisiana in September 2015. Crucially, the company claims that it is cheaper to ship methanol from the United States to China than using more expensive natural gas sources on its home turf. Taiwan's Formosa Petrochemical Corp. is considering plans for a \$9.4-billion petrochemical complex at an adjacent site. Increased Chinese investment into the United States also opens the door to two-way trade partnerships.

The U.S. petrochemical industry is now switching to long-term thinking as a result of the shale gas revolution. The first wave of projects may have been built at a premium, but will still benefit from being the first movers in the market, having had the pick of location and taken advantage of low-cost feedstock years ahead of their competitors. Slower movers, on the other hand, have had the opportunity in 2015 to re-group and focus on their financials, while still seeing new plants come online before the end of the decade. The unpredictability within the industry is consistent with such a dramatic direction change. Yet as AFPM's Hockstad makes plain: "The shale manufacturing boom will help the United States continue to redefine its energy future."