Exploiting Big Bang Disruption in the Chemicals Industry
In North America, the shale gas revolution is driving a boom in the chemicals industry, as companies invest in new plants in order to take advantage of cheaper feedstock and lower energy costs. But this boom is more than another turn in the traditional business cycle. It represents a rapid and fundamental shift for the industry—a kind of Big Bang event characterized by nearly unconstrained growth.

As chemical companies focus on making the most of this growth, they also need to think about what comes next. Accenture's research suggests that the Big Bang will be followed by a sudden decline in growth—a Big Crunch. That downshift in growth will require a significant change in operations and strategies.

With that in mind, North American chemical companies need to understand the risks this cycle will bring, and how to avoid stagnation and decline as the Big Crunch unfolds. They will need to rethink everything from exports and global markets to increased asset flexibility and supply chain efficiency. And they should begin planning now, and preparing to drive high performance as the economic and competitive fundamentals of the industry change.
In their book, *Big Bang Disruption*, authors Larry Downs and Paul Nunes describe a cycle of rapid growth and decline that is increasingly common across industries.

Using the metaphor of the Big Bang theory of the universe, they describe how industries will often experience a stage of tremendous growth (a Big Bang), followed by a period of industry stagnation and below-average financial performance (a Big Crunch). This sudden change and decline is preceded by a relatively stable period (Singularity) and followed by a period of re-grouping (Entropy) (see Figure 1).

This Big Bang cycle is initiated by a disruption—often technology-based—that fundamentally changes the industry. Traditionally, broad change in business has been driven by new products, technologies or processes that are either cheaper or better. Big Bang disruptors, on the other hand, are typically both—they are cheaper and better, and they emerge rapidly.

This type of scenario appears to be playing out in the chemicals industry. Here, the disruptive element is the shale gas revolution in North America. Over the last several years, new technologies and drilling techniques, such as hydraulic fracturing and horizontal drilling, have opened up access to shale gas in the region, bringing large amounts of gas onto the market in a relatively short time. Less than a decade ago, high natural gas prices seemed to be a permanent part of the landscape in the region, and a key factor that was discouraging industrial investment. By early 2009, however, declining natural gas prices—coupled with rising oil prices—made it clear that a structural shift had occurred in the oil/gas price ratio, and that cheap natural gas was here to stay for the foreseeable future (see Figure 2).
This occurrence has led to a Big Bang stage of virtually unrestrained growth in the North American oil and gas arena—and downstream, in the chemicals industry. Chemical companies from around the world are investing in new plants in the region, largely to take advantage of low-cost gas as a feedstock, as well as an energy source (see Figure 3). According to the American Chemistry Council, announced US chemical industry investments that are linked to the shale gas boom now top $100 billion—and it seems that there is more to come. In a recent Accenture/ICIS global survey of chemical companies, more than half of the respondents said that they are already increasing or are planning to increase their levels of investment in North America over the next two years. The United States and Canada topped the list of regions in which companies are investing, slightly ahead of China and significantly outranking Western Europe and the Middle East and Africa.

The question is, how is this period of growth likely to lead to a Big Crunch? Experience suggests that such growth will eventually reach its limits and slow down. As more and more players invest in North America, the field will eventually become saturated. In addition, the industry will reach a point where the availability of low-cost gas is not “new” anymore, and most companies will be able to take advantage of North American gas as well as low-cost feedstocks from other regions. Crude oil development (encouraged by high oil prices) may also create greater oil supply, reducing oil prices relative to natural gas. For example, Mexico is embarking on a policy to allow and encourage foreign investment in hydrocarbon resources. These developments are also causing other Latin American countries to consider policies to attract investment as well. Overall, then, the entire global cost curve will shift down, and create a new, lower and flatter “normal” for costs—eroding the competitive advantage that many companies enjoyed at the start of the Big Bang.

That picture may be further complicated by increased North American exports of ethane—derived from natural gas—by the end of this decade. At least one chemical producer and one major gas company have already announced plans to ship ethane from the United States to markets such as Europe. Even with shipping expenses, this ethane may well be cheaper than alternatives such as naphtha. Such developments could flatten the global cost curve, adding another contributing factor to the Big Crunch.

This scenario can be represented visually as a “sharkfin” graph, where a sharply rising growth line (representing industrial activity such as investments or profits) peaks and then declines fairly quickly (see Figure 4). Accenture’s research indicates that the shift to the Big Crunch will likely occur in the 2020 time frame, ushering in a period of lower margins and increased consolidation and realignment.

**Figure 3. North America is the focus of gas–based chemicals investment.**

Ethylene capacity development based on confirmed announcements

![Graph showing ethylene capacity development with data points for 2013 and 2023.]
Table 1. Chemicals Big Bang timeline.

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<tr>
<td><strong>Oil/gas developments</strong></td>
<td><strong>Singularity</strong></td>
<td><strong>Big Bang</strong></td>
<td><strong>Big Crunch and Entropy</strong></td>
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<tr>
<td>• Aftermath of energy shock</td>
<td>• Begins with oil</td>
<td>• Gas prices plummet; oil prices at high levels</td>
<td>• New gas uses</td>
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<td>• Low gas prices/declining oil prices</td>
<td>• Horizontal well in Barnett Shale</td>
<td>• E&amp;P focuses on oil and wet gas</td>
<td>• New oil sources</td>
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<td>• Horizontal drilling: Austin Chalk</td>
<td>• Low gas prices; oil prices mostly stable and low</td>
<td>• Transport hazards and backlogs</td>
<td>• Consolidation</td>
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<td></td>
<td>• Ends with mergers</td>
<td>• High foreign investment into North America</td>
<td>• Gas/oil ratio adjusts</td>
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<td><strong>Chemical environment</strong></td>
<td><strong>Shift to liquid cracking</strong></td>
<td><strong>Shift to gas cracking; co-product shortages</strong></td>
<td><strong>Global cost curve shifts down</strong></td>
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<tr>
<td>• Strong GDP and chemicals margins (late ’80s)</td>
<td>• North America investment plummets</td>
<td>• High margins</td>
<td>• High number of new players in North America</td>
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<tr>
<td>• Limited emerging market capacity</td>
<td>• Focus overseas</td>
<td>• Investments announced for North America</td>
<td>• Scale exports</td>
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<td></td>
<td></td>
<td>• Talent shortage; construction cost escalation</td>
<td>• Possible global over-capacity</td>
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<td><strong>Imperatives</strong></td>
<td><strong>Imperatives</strong></td>
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<tr>
<td>• Grow domestic share</td>
<td>• Expand in China and Middle East</td>
<td>• Build with less talent</td>
<td>• First-quartile global production costs</td>
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<td>• Improve process technology</td>
<td>• Maintain North America market share</td>
<td>• Re-orient supply chains</td>
<td>• Avoid the “whipsaw”</td>
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<td>• Differentiate and substitute</td>
<td>• Consolidations</td>
<td>• Secure base load overseas customers</td>
<td>• Create asset agility</td>
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<td></td>
<td></td>
<td>• New routes to “lost” co-products</td>
<td>• Contingency management</td>
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<td></td>
<td></td>
<td>• Emphasize “foresight” and strategy</td>
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<td></td>
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<td>• Protect domestic share</td>
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Figure 4. Chemicals industry “sharkfin.”

Decade themes

1980s “Strengthen the home market”
1990s “Age of Globalization”
2000s “The oil/gas shift begins”
2010s “Investment rush”
2020s “Crunch”

![Graph showing Oil/gas ratio and Fracking patents over time](chart.png)

Oil/gas ratio Fracking patents

- [Oil/gas ratio]
- [Fracking patents]

Source: IEA; Thomson.
The Big Crunch environment will require different approaches from those used during the Big Bang. To perform well in this stage, chemical companies will need to adjust their strategies, keeping four key imperatives in mind:

- Achieving and maintaining first-quartile global production costs.
- Avoiding the “whipsaw” of oversupply and reduced margins.
- Increasing asset agility.
- Establishing effective contingency management.

Achieving and maintaining first-quartile global production costs

Having low costs is always important in the chemicals industry, but during the Big Crunch, it will be critical, as companies will need to compete globally on a delivered-cost basis. Securing access to low-cost raw materials will continue to be key. So too will low-cost production capabilities. To a great extent, the industry has done well at establishing large-scale, efficient ethylene crackers that keep production costs down. Indeed, much of today’s Big Bang investment is focused on such plants. But chemical companies need to take the next step, and extend that efficiency out into all stages of production, and into supply and distribution.

For example, chemical companies today typically (but not always) co-locate ethylene crackers and polyethylene plants at the same facility. They often ship products by rail or truck from there to a warehouse or a packaging facility, and then on to the customer or to a port for further transport. Each of those steps involves transportation and storage costs, and the potential for delay. To avoid such problems, chemical companies can build more of those facilities at one site—and there is often an opportunity to do so with the current Big Bang investment levels. Some companies are taking this approach—but many others are not.

Chemical companies also have an opportunity to control costs in plant construction. Plants are getting larger, making construction more difficult to manage. The industry has seen a number of major projects that have experienced huge cost overruns—some on the order of $1 billion—and lengthy delays. Those costs can have a significant impact on the long-term profitability of a plant, and later start dates can mean missed opportunities to take advantage of market upswings. Chemical companies can bring more rigor to the management of these capital projects in order to complete them on time and within budget—which can have a significant impact on their overall cost picture. For instance, an ill-timed start-up would have equated to approximately $700,000 of lost cash flow per day for a new North American ethylene cracker in 2011.²

Avoiding the “whipsaw” of oversupply and reduced margins

In the Big Crunch, companies are likely to run into the whipsaw effect of having to recoup large capital investments as capacity moves into excess, margins decline and competition for market share grows.

In that environment, the plant and supply chain efficiencies discussed earlier will be vital. Companies will also need to gather and use more timely information about global operations and markets to quickly identify opportunities and root out costs.

Strong relationships with customers and channel partners will be particularly important, and key to understanding what customers truly value and avoid the need to compete solely on price. Companies that have a large technology portfolio and the ability to collaborate and tailor products and services to specific customer needs will be in a better position to thrive.³ Those that focus simply on low-cost commodity production—the approach possibly being pursued by a number of new entrants in the North American market—are likely to struggle post Big Bang.⁴

At the same time, North American producers will need to place a stronger emphasis on exports and global markets—which will require some rethinking of current approaches. Today, North American chemical exports tend to be something of an ancillary business. Companies typically work closely with domestic customers and sell the remainder of their product on the global spot market.

That approach can be highly profitable in the Big Bang stage—but not in the Big Crunch era, because there simply will not be enough domestic demand to go around. In the Accenture/ICIS research, about 77 percent of the respondents who are investing in North America said that they plan to focus on that region as a destination market for the output of their new capacity investments. However, by the beginning of the Big Crunch, the North American chemicals industry may have up to 1.6 times the ethylene-producing capacity the market needs, if all the currently discussed expansions come to fruition.

Clearly, then, most producers will be reliant on exports to absorb new capacity. Exporting will make up a larger and larger portion of business for North American producers.⁵ That means that it can no longer be a secondary concern. Instead, companies will need to build closer, more collaborative relationships with overseas customers by providing them with more technical support and services, building application development labs in other markets, and working in strategic partnerships with overseas customers. The goal, ideally, will be to obtain high-value, base-load overseas customers that can take up a large share of the company’s North American production capacity—and thus create sustainable demand and maintain acceptable margins.

Increasing asset agility

In the Big Crunch, companies will need to adapt to changing economics and meet the evolving needs of a range of customers around the globe. Having assets that allow them to adjust and avoid being tied to one approach—that is, “asset freedom”—will be key to achieving a sound return on capital across the changing business cycle.
With that in mind, chemical companies need to bring greater flexibility to the asset base, perhaps by establishing supply points such as plants or alliances in overseas markets. Companies can build flexibility into transportation, and develop networks that allow them to vary their use of railroads, trucks and ships as needed. In essence, this adds up to having multiple options, and being able to quickly reconfigure the production and transportation network to adapt to changing needs—and keep asset utilization high across the Big Bang and the Big Crunch.

For example, North American producers might want to leverage various port options for exports. It may be that chemical companies can create alliances with container carriers that make it more attractive to send products out through historically nontraditional ports. Doing so could enable them to take advantage of more attractive rates because it could allow carriers to balance cargos. Building packaging facilities at these alternate ports may also be an option, hauling resin in covered hopper cars to the port area before packaging and containerization.

Companies can also consider innovative legal and business structures to help them get the most out of their assets. For example, a 2012 US IRS ruling allows the use of master limited partnerships, or MLPs, for some chemical operations, including ethylene crackers. This allows a chemical company the flexibility to monetize existing assets and potentially fund new projects, through the MLP structure, typically combined with an off-take agreement and a contract with the MLP to manage the assets. MLP can provide significant tax advantages, enable the company to capture more value from the cracker asset, and provide additional funds to finance growth. It also represents a lower-risk investment with stable returns, making it attractive to investors. At least one chemical company has pursued this MLP strategy, and it seems likely that others will soon do so, as well.

Also, the large magnitude of new capacity coming online can be viewed almost as a “rebuilding” of the industry within the holistic context that includes infrastructure. Besides the focus on ramping up new high-value scale assets, companies need to be explicitly involved in the development of infrastructure and policy to accommodate the same growth. For instance, the economics of container and parcel tanker movements in Gulf Coast ports will depend on further port development. If all the discussed ethylene crackers for the Port of Houston service area were to come into fruition, the new material alone could account for an approximate 11 percent increase in export freight volume by 2018. This excludes anticipated increases from other industrial exports that are likely to occur, related to energy, fuels and other manufacturing in the US Gulf Coast. Port depths and breadths, across the Gulf Coast may need to accommodate the ship sizes allowed after the Panama Canal expansion. The benefit would mean improved shipping economics, as freight costs can reduce by almost 50 percent per unit with larger ships, increasing the competitive pressures between alternative routes (such as rail to West Coast ports).

Petrochemicals companies are currently very focused on expanding capacity on time and within budget and sometimes the efforts needed on the broader infrastructure are neglected. For example, company coordination and support through local organizations for things as simple the construction of a new, low-cost, bridge to alleviate port road/rail bottlenecks can be crucial. While the cost of this may be significantly less than building a cracker, not making the investment can cause backlogs, delays and higher costs when the crackers and associated derivative plants start up. Therefore, companies must work with federal and local governments, carriers, as well as port authorities and other industries to ensure the proper infrastructure investments are made.

Establishing effective contingency management

To a great extent, planning in the industry is based on an extrapolation of today’s trends. For example, many companies now assume that there will be continued demand growth in Asia, and that low-cost natural gas feedstocks will provide an ongoing advantage for the North American region. But the future can be difficult to predict. Consider the fact that just a few years ago, chemical companies thought that high gas prices had more or less permanently put an end to new plant investment in North America.

A number of factors could change the industry’s course. For example, demand in China could slow down further and material-performance requirements could become more rigorous as manufacturers there focus more heavily on durable goods that call for a higher degree of sophistication (see Figure 5). Or shale developments in other regions, such as the Middle East, Mexico or China, could bring new sources of low-cost feedstock into the market. And of course, the upheaval created by Big Crunch itself could open the door to new, unforeseen risks and opportunities.

In a world where change is both rapid and hard to predict, chemical companies may need to take a more formal approach to contingency planning. They must also understand, quantify, plan and monitor key risks, and be prepared to mitigate risks as they arise. To do so, they can establish a business intelligence/analytics program that monitors energy, economic and political developments and outlooks. Such programs can also help them predict trends in customer industries, globally, and therefore support improved planning sales, production and distribution.

Figure 5. China’s changing product mix.

China finished good export shares

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<thead>
<tr>
<th>Year</th>
<th>Nondurable</th>
<th>Durable</th>
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<tr>
<td>1Q00</td>
<td>80%</td>
<td>20%</td>
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<tr>
<td>1Q14</td>
<td>60%</td>
<td>40%</td>
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Note: Basic materials excluded.
Based on a classification of 85% of China’s exports.
Source: Accenture analysis of GTIS data.
Conclusion

To successfully and profitably navigate beyond the current Big Bang and into the upcoming Big Crunch, North American chemical companies will need to recognize and contend with rapid change, and be prepared to adjust their business strategies and the way they operate in a relatively short time frame. That shift will evolve over the next few years, but companies should begin preparing for it now. That means recognizing that today’s boom cannot continue indefinitely, and positioning for the next stage of evolution. Taking time now to plan for this shift can help companies position themselves to thrive both today and tomorrow.
References


4. Ibid.


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