China’s Chemical Industry: The new forces driving change
A new paradigm ahead?

As China’s economy and industrial base continue to expand, the country’s demand for chemicals remains undiminished. Following a decade of turbo-charged growth (with annual GDP growth remaining above 10 percent year after year, despite a relative slow down in 2008–2009), Chinese central planners are now aiming to ‘rein in’ the economy to an average annual growth rate of 7 percent for the period 2011–2015 - still an outstanding rate compared to western levels. 1

The chemical industry in China is both a key driver and prime beneficiary of this remarkable growth record. In the last decade, heavy investments in capacity have put China’s chemical industry at the forefront of the world scene. 2010 was a landmark year, as this report will show, with Chinese chemical output value exceeding that of the United States for the first time.

Will this trend hold? What are the drivers that will shape the future of the industry in the coming years? And, ultimately, how well are individual companies positioned to face these changes? In our view, success will depend on the ability of manufactures to cope with four different change drivers: a) the Chinese government’s goal to shift the current production model towards a more balanced and resilient one, as set out in the 12th Five Year Plan; b) both new and old mega-trends, including increased internal demand in China, continuous urbanisation, shifts in value chains, and environmental awareness; c) enhanced economic and financial volatility in world markets; and d) market dynamics that are narrowing the gap between local Chinese manufacturers and multinational players.

This document is intended to provide a pathway to changes that are already occurring and will likely affect the chemical industry in China in the coming few years. Overall, we anticipate an exciting period of change with plenty of opportunities along the way, although not exempt from challenges. The extent to which change is embraced and managed will be critical in deciding the winners and losers in this process.

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1 China’s lower GDP growth target may lift consumption, 3 March 2011, People’s Daily
Will China remain immune?

The second and third quarters of 2011 have seen softening in the economic recovery of the major western economies, which began in the second half of 2009. Many executives are eyeing the possibility of a ‘double dip’ recession in the US and Europe with mounting concern. Although the full effect on the real economy of the downgrade of the United States’ sovereign debt rating in early August and the ongoing debt drama in the European Union is still unclear, fears of a renewed credit crunch are rising across various industries. At the very least, budget reduction measures may hit those players with the highest exposure to government investments in the US and Europe.

The potential effect of these events upon the chemical industry in China is hard to predict. The last financial crisis took a large toll on export demand and investment budgets of MNCs, depressing prices across the industry and bringing widespread losses and capacity realignment. We also note that after two and a half years of deleveraging, MNC balance sheets are much less exposed to financial markets than they were in the summer of 2008.

Further, the Chinese economy is currently more balanced (i.e. less exposed to export activity) than it was before the global recession. 2008 also evidenced a Chinese banking system largely independent from global financial dynamics, and the effectiveness of financial policy implementation to be positively affected by the government’s direct ownership of financial institutions. Despite all these, the Chinese chemical industry remains intimately ingrained within global supply chains and fluctuations in global market dynamics are obviously critical to its performance.
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1.1 China’s chemical industry – continued growth

The chemical industry is the third largest in China, after textiles and machinery, and accounts for 10 percent of the country’s GDP. It accounts for 52.1 percent of the Asia-Pacific chemical manufacturing sector’s value, making China the second largest consumer of basic chemical products after the United States.²

Barring 2009, the local industry experienced double-digit growth up to 2010, when it clocked a 16.5 percent hike. This trend is forecasted to continue in the years to come.³

According to the China Petrochemical and Chemical Industry Federation (CPCIF), the industry’s output value for 2010 was CNY 5.23 trillion, 32.6 percent above the previous year. For the first time, this figure exceeds that of the United States (USD 734 billion, or approximately CNY 4.7 trillion). Total output dwarfed that of Japan (USD 314.9 billion) and India (USD 89.1 billion). This indicates how the market rebounded strongly from the financial crisis of 2008–2009, which was felt less acutely than elsewhere.

The figures also tell a story of continuous growth by a remarkably dynamic industry, made up of over 33,000 enterprises, with total revenue surging at 20.2 percent CAGR for the period spanning 2006–2010. This compares to 1.4 percent in Japan and 12.2 percent in India over the same period.⁴

Future growth in China continues to be supported by remarkable rates of investment in fixed assets, with a total of CNY 1.15 trillion in 2010 alone, according to CPCIF.

Specialty and fine chemicals represent an increasing share in economic growth and are important ingredients in China’s efforts to upgrade its industrial value chains. This chemicals segment contributed revenue of USD 189.3 billion in 2010.⁵

On the other side of the spectrum, agrochemicals enjoyed a more modest performance. The crop protection industry in China is a USD 2.9 billion market, growing by 6 percent in 2010, but for the moment it remains focussed on lower value generics. The market is highly fragmented, although multinational companies have a total market share of approximately 25 percent.⁶ The fertiliser market is more volatile — after a near collapse in 2009 (which followed a remarkable surge in the preceding years) it is yet to find a road to recovery.
Heavy investment in basic chemicals in China has largely resulted from a drive to secure self-sufficiency in the supply of critical commodities. At the current stage, China does not produce enough chemicals to meet its demand and remains a significant importer.

1.2 Global outlook and its impact on China’s chemical industry

Economic recovery in the US and Europe remains slow and fragile with persistently high unemployment levels. The unsettled debt crisis in Europe and elsewhere continues to cast a shadow. However, the chemical industry has coped surprisingly well and made a strong recovery from 2009. In fact, the industry is performing better than it has in more than a decade. The surge in demand, which has extended into a recovery in the prices of chemical products across the majority of sectors, has been led by the emerging economies, primarily — but not only — China.7

Petrochemicals have been at the vanguard of this rebound, dismissing fears that large capacity additions throughout last year — particularly in the Middle East — would hamper recovery. Developing countries, especially China, continue to display an insatiable need for chemicals to fuel their industrial expansion. Top players like Sinopec, ExxonMobil, Shell, Formosa Plastics and Saudi Basic Industries Corp—each posted growth in revenues of at least 30 percent in 2010 and enjoyed strong profit gains.8

Looking ahead, the consensus is that China will continue to gain a larger share of global output in 2011. Industry analysts forecast that up to 40 percent of global industrial growth this year will be generated in China.9 In a survey recently carried out by KPMG, executives from various chemical multinationals unanimously agreed that their operations in China will outpace their operations elsewhere.

It is worth noting that the rising price of crude oil in 2010 and the first half of 2011 is still not seen as a major threat by most executives. Undoubtedly, volatility in feed prices could have enormous implications should the trend continue, but current price levels are still far from the record peak of 2007 and are in fact viewed as a leading indicator of recovery. Furthermore, recent economic developments, including the slowdown in developed economies have brought a measure of moderation to world oil prices.

The KPMG survey mentioned above also offers a fair picture of trends in various sub-segments of the chemical industry. Nearly all the companies surveyed agreed that bulk petrochemicals (refiners, olefin crackers) and bulk chemicals (non-petrochem) will see ‘moderate growth’, while more than 50 percent of the respondents felt that the sectors poised for ‘rapid growth’ are electronic materials, fine chemicals, food chemicals, specialty plastics, water treatment chemicals and other specialty chemicals. Opinions were divided on fertilisers, with less than half agreeing that this sector will achieve ‘moderate growth’ and 25 percent feeling the sector will ‘stagnate’. Overall, the survey indicates more growth in downstream industries than upstream commodity chemicals when there is increased focus on domestic consumption. These results are consistent with the mega-trends analysed in the next section of this report.

1.3 New capacity in the upstream petrochemical chain

To satisfy ever-growing petrochemical demand, Chinese oil and chemical players will continue expanding ethylene production capacity, which is expected to approach 26 million tonnes per annum (tpa) by 2015, with an average increase of around 11 percent per year, according to the stated targets of the government.10 This is a remarkable build-up from the current 17.9 million tpa, which is already double the capacity on stream five years ago.

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In 2010, two new ethylene crackers went on stream: a 1 million tpa ethylene plant owned by Zhenhai Refining and Chemicals in Zhejiang Province, and Shenhua Group’s coal-based Methanol-to-Olefins (MTO) plant, with an annual ethylene production capacity of 300,000 tonnes, in Baotou, Inner Mongolia. Two ethylene capacity expansion projects also went on stream — Sinopec’s 200,000 tpa ethylene plant in Tianjin was expanded to 1.2 million tpa, and a CNOOC-Shell joint venture ethylene unit in Huizhou, Guangdong Province was expanded to 950,000 tpa. Local governments too are racing to build new ethylene plants. The governments of Liaoning, Heilong, Chengdu, Yulin, Wuhan, Shaixing, Jinshan, Zoucheng, Yan’an, Pucheng, and Zhanjian are planning to invest in ethylene and ethylene derivative complexes over the next 4 to 5 years. Collectively, these greenfield projects account for over 6.25 million metric tonnes of ethylene capacity, equivalent to 4.4 percent of global capacity in 2010.11

World ethylene production by country, 2010 and 2015 forecast (‘000 tonnes capacity)

<table>
<thead>
<tr>
<th>Country</th>
<th>2010</th>
<th>2015F</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>25,390</td>
<td>25,500</td>
</tr>
<tr>
<td>China</td>
<td>16,290</td>
<td>25,700</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>12,670</td>
<td>16,520</td>
</tr>
<tr>
<td>South Korea</td>
<td>7,480</td>
<td>7,580</td>
</tr>
<tr>
<td>Japan</td>
<td>7,350</td>
<td>6,000</td>
</tr>
<tr>
<td>Germany</td>
<td>5,745</td>
<td>5,505</td>
</tr>
<tr>
<td>Iran</td>
<td>5,375</td>
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<tr>
<td>Canada</td>
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<tr>
<td>Thailand</td>
<td>4,425</td>
<td>4,425</td>
</tr>
<tr>
<td>India</td>
<td>3,555</td>
<td>9,405</td>
</tr>
</tbody>
</table>

Source: Business Monitor International Ltd.

11 Cassava-based fuel alcohol plant shut down, 6 June 2011, China Chemical Reporter
1.4 Industry structure

Local government-owned players, still answering to state policy directives, have profit maximisation goals and product portfolio strategies that are similar to privately owned companies and multinationals, thanks to a web of shared interests and joint ventures. Not insignificantly, all local majors have free-float stock interest listed in major exchanges and answer to minority shareholders. As we will discuss later, many of these companies are already immersed in the internationalisation process, with the primary aims of securing feedstock for their operations and obtaining access to technology.

Private companies are in many cases bridging the technological and organisational gaps that separated them from international players and are starting to deliver world-class products. A considerable portion of this development is related to the internationalisation of some large Chinese companies (the car industry being a prime example) that poses challenges and opportunities for their local supply chains.

Lastly, multinationals, although still the critical suppliers of technology and value-added products, have seen local competition progressively erode their competitive edge. As a result, many are leaving aside historical concerns about IP protection and committing to local R&D and product localisation. Furthermore, some of the traditional concerns, such as the perceived risk of IP leakages in joint investments with domestic partners, are becoming less of an issue as multinationals have become sufficiently localised to successfully navigate around them.

Against the background of these developments, the Chinese chemical industry continues to be dotted with numerous small-scale low efficiency non-integrated producers that maintain a competitive edge in the low-end markets. The government is actively encouraging the consolidation of the domestic industry in a bid to improve efficiency and increase local R&D. For example, there are plans to reduce the number of agrochemical companies, currently over 2,000, and to promote a small number of industry leaders over the next decade. Recently, environmental and energy efficiency policies have been active tools of industry restructuring, by closing down polluters and companies with obsolete technologies, or forcing them to change their practices. In other cases, government investment agencies or companies are the instruments for this consolidation — as with China BlueStar, or certain transactions of Anhui Investment Holding.

Local majors consolidate and expand

The landscape of the chemicals industry in China has not changed much in the last few years. Sinopec and PetroChina are still the two players, although they would be better described as downstream integrated oil and gas companies. This is also the case with China Blue Chem, a subsidiary of CNOOC. Another big player, Sinochem, however, is in the process of evolving by acquiring sizeable offshore oil and gas operations overseas.

Sinopec is the country’s largest producer and distributor of chemical products and the fifth largest producer of ethylene in the world. It produces and distributes a great variety of petrochemical products, including intermediates, synthetic resin, synthetic fibre monomers and polymers, synthetic fibre, synthetic rubber and chemical fertiliser. The company integrates its petrochemical production with its refining business and distributes most products in the domestic market. It has several chemical JVs with numerous Western companies, including BASF, BP and Exxon. Its net profit in 2010 was CNY 71.8 billion, with revenue rising 42 percent to CNY 1.91 trillion.12 PetroChina, Asia’s biggest company by market value, is primarily focused on oil and gas production, but has extensive downstream interests in chemicals production. It is a major producer and distributor of chemical products in China. Most of its chemical plants are integrated with its refining.

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The company plans to optimise its refining strategy by accelerating construction of more refineries in coastal areas, such as Zhejiang and Guangdong provinces. Its output in 2008 was 3 metric tonnes per annum (MTA) of ethylene and 16 MTA of other chemicals.

Petrochina is aggressively seeking out overseas acquisitions and plans to establish three operation centres, in Singapore, London, and New York. It has also laid down initial foundations in the Asian market by acquiring stakes in the Osaka refinery in Japan and Singapore Petroleum Co. PetroChina has announced two joint ventures with British chemicals firm Ineos Group Holdings for trading and refining activities at the Grangemouth refinery in Scotland and Lavera refinery in France.

China BlueChem, a subsidiary of China National Off shore Oil Corporation (CNOOC), is engaged in the development, production and sale of mineral fertilisers and chemical products. The company primarily operates through four business segments: urea, phosphorus fertilisers, methanol, and others.

Sinochem Group, a leading petroleum company and a major service provider of chemical products, is aggressively outward looking. Its main business is spread across energy, agriculture, chemicals, real estate and finance. The group has over 200 subsidiaries and branches and is the controlling shareholder of several listed companies, including Sinochem International and Sinofert.

The company is expanding its petroleum exploration and production business and extending upstream operations in the Middle East and South America. In May 2010, Sinochem signed an agreement with Statoil to acquire 40 percent equity of Peregrino offshore oil field in Brazil. This is Sinochem’s biggest overseas acquisition to date and is a crucial step in its efforts to boost its international profile.

Last year, Sinochem actively promoted the merger and acquisition of refineries and gained a controlling share in Shandong Hongrun Petrochemical. In June 2011, the company received environmental clearance for its first major refinery, a 240,000 barrel-per-day plant in Quanzhou on the south-east coast of China that represents a USD 4.6 billion venture. The plant, which Sinochem aims to start operating by end of 2013, would be one of the major greenfield refineries China that wants to add in the 2011–2015 period and will process crude oil from Kuwait.

In its chemical business, Sinochem is concentrating on fields like fluorine chemicals, rubber, chemical logistics and pharmaceuticals. As China’s leading fluorine chemical producer, Sinochem is keen to cement its advantage in upstream resources and R&D.

**Local player, global strategy**

China National Chemical Corp (ChemChina), which is state-owned and one of China’s leading chemical products manufacturers, completed 95 key construction projects under the 11th Five-Year Plan (2006–2010) and a number of technical upgrades. In its early days, ChemChina formed major business segments in advanced chemical materials, rubber products, chemical equipment manufacturing, and basic chemicals. Today, however, it is restructuring the business with a “3+1” concept. This strategy calls for the company to view materials science as its core, and life sciences and environmental science as its future, with all three sectors being supported by the traditional basic chemicals sector. The company has 24 state-level research institutes, two key national laboratories and more than 40 technical research centres. It has been involved in setting up strategic alliances for technological innovation. ChemChina saw strategic outbound investment when it signed a merger agreement deal with leading Israeli crop protection company, Makhteshim Agan, in early 2011. ChemChina will hold 60 percent of stake.

ChemChina saw record results in 2010. The company’s revenues increased by nearly 30 percent compared with 2009 and its profits grew by nearly 65 percent.

**MNCs move to next stage**

Most Western multinationals have a long history of involvement in China, and have been establishing joint ventures in the country since the 1990s. They are now an integral part of China’s chemical industry and have made heavy investments, with their R&D investment geared increasingly towards local markets.
Despite rapid wage increases, China continues to be attractive as a low-cost destination and presents a major opportunity for European and US chemical companies. In fact, multinationals which ventured in early and built up ventures with leading local companies are now moving to the next stage of investment and increasingly tailoring products for the Chinese domestic market.

A number of enterprises have developed leading positions in the region and have successfully capitalised on the opportunities thrown up by China’s industrial blueprints. Companies like BASF, Dupont, Dow, Akzo, Lanxess, DSM and Bayer continue to be well positioned and should benefit from their strong focus in niche sectors and high-end, specialty chemicals. Most of them have shifted their focus closer to the consumer market and away from commodities.

BASF believes that straight bulk chemical markets will become more competitive within the coming years and large-scale upstream investments — which are not integrated into downstream specialty products — will make limited economic sense. Instead, the company will focus on developing value-added products that are back integrated into current manufacturing, and present high entry barriers due to capital or technological requirements, such as specialty plastics, specialty chemicals, and catalysts.

BASF now sees opportunities for new high-performance plastics in China that can leverage the energy efficiency goals of the 12th Five Year Plan. It is currently investing in new plants, research facilities and capacity expansions across China, and has developed new applications for plastics in solar energy. In addition, BASF’s fully biodegradable polymers will play a crucial role in meeting the need for sustainable solutions in agriculture, waste management, and other industries.

In order to meet growing demand for engineering plastics, BASF will more than double its capacity for engineering plastics in its Pudong operation by 2015.

**DuPont** also forecasts that China will fuel growth across all its segments – agriculture, auto, photovoltaic and electronics. It will concentrate on innovative new products, ranging from specialty crops, hybrid rice, and seeds, to bio-fuels and new materials for the auto sector.

The company has 21 plants, five R&D and technical centers, four offices and 19 joint ventures in China. It has over 6,500 employees in the country and saw its 2010 sales reach USD 2.8 billion (Mainland China and Hong Kong), an increase of 51 percent over 2009.

**Bayer MaterialScience** sees advantages in the Chinese market too, with a steady expansion of the automotive, construction and railway sectors. China is Bayer’s third largest market, with 2010 group sales up 30 percent year-on-year. Bayer, which operates from Shanghai Chemical and Industrial Park, has built world-scale facilities with low production costs for its material science division in the area of Polycarbonate and Polyurethanes. The site is the company’s largest single investment outside of Germany. In July, the company decided to move the main business of the Bayer MaterialScience polycarbonate global headquarters from Germany to Shanghai where it intends to substantially expand its polycarbonate portfolio.

**Dow Chemicals**, which has a long history in China, has adopted a different strategy for China. Currently, 75 percent of its products to China are import based, but the US company is focusing on building a large chemical manufacturing site in central China. Dow has 5 business centres across Greater China in Beijing, Shanghai, Guangzhou, Taipei and Hong Kong, 17 manufacturing sites and nearly 3,500 employees. Greater China is Dow’s second largest market behind the US and a key component of the company’s global business.
Greater China accounted for roughly 40 percent of Dow’s 2010 Asia-Pacific sales. At least 90 percent of Dow’s China sales comes from its Performance business. Dow has significant research and development facilities aimed at customizing its portfolio for the local China and Asian market. The Shanghai Dow Center at Zhangjiang Hi-Tech Park in Shanghai is a state-of-the-art research and development facility which houses with over 80 integrated labs. Dow has had ups and downs with its integrated ethylene production plans. It is now progressing with its world-scale coal to chemicals project in Shaanxi province in central China with Shenhua Group, China’s largest coal company.

For Akzo Nobel, innovation and sustainability will be the key strategies for the China market, along with achieving economies of scale. At the moment, Akzo Nobel is placed in the high-end segment of the market, and its major challenge is to develop products geared towards China’s fast growing middle class.

Akzo’s strategy for its paints division focuses on the different stages of urbanisation in China, benefiting strongly from the drive for eco-efficient paints in infrastructure projects (railways, airports and construction equipment), urban development (building activity, household fittings and appliances) and environmental regulations.

Increasing urbanisation and an affluent middle class are proving to be boons for chemical makers. Germany’s leading specialty chemicals company Lanxess, which already has a strong presence in China, is banking on rapid urbanisation and the need for rubber, amongst other chemicals.

It has started the construction of its largest leather chemical plant in the country, in Changzhou, Jiangsu province. China’s rising demand for leather goods will present market opportunities for leading domestic and multinational leather chemical manufacturers. The USD 40 million facility, located in Changzhou Yangtze Riverside Industrial Park in Jiangsu province, is due to start production in the first half of 2013, with a planned capacity of 50,000 tonnes a year.

Saudi Basic Industries Corp (SABIC), the largest listed company in the Middle East, has a strong market position in China, generating double digit growth year-on-year. Since its establishment in China in 1985, SABIC is now one of the leading petrochemical and engineering plastics products supplier and investor here. It has 17 offices, 3 manufacturing plants in Shanghai, Guangzhou and Tianjin, one Technology & Innovation Centre in Shanghai, and employs over 900 staff in the Greater China Region.

The company has extensive plans for the region. It plans to build a USD 1 billion polycarbonate plant at its petrochemical complex in Tianjin, northern China, with joint-venture partner Sinopec. The new plant will have an annual production capacity of 260,000 metric tons and is expected to be operational by 2015. Sabic has also announced a new 60,000 sqm Research & Development Centre and Greater China Regional Headquarters in Shanghai. The new centre will be fully operational in 2013.

1.5 Feedstock flow and energy mix

The future is increasingly moving toward a point in which natural gas will play a greater role in the global energy mix. Unconventional natural gas resources are now estimated to be as large as conventional resources. The increasing competitiveness of alternative sources of energy (shale gas, coal bed methane, sand tars, biopaths), not to mention concerns about energy security, have all brought the debate about feedstock flexible processes to the centre stage.

China has a weak overall feedstock position and is heavily dependent on imports of oil and natural gas. Although the country is starting to develop its own oil and gas resources in its western regions, the huge rise in domestic demand over the past 15 years has largely been met through increased imports. Dependence on oil imports has been running at well over 50 percent for the past five years.
This has driven the government to take a number of steps to secure supplies of oil and gas, such as the recently completed Kazakhstan-China oil pipeline (linking the Dushanzi refinery in western China’s Xinjiang region to the Caspian Sea) and Turkmenistan-China gas pipeline. In addition, China’s internal pipeline network has been greatly expanded in the past decade by the completion of the West-East Pipeline, which carries natural gas from Xinjiang to Shanghai.

Leading domestic oil companies have also increasingly been seeking to acquire overseas interests in foreign oil/gas companies.

**Coal as chemical feedstock**

China’s abundant coal reserves make innovative coal exploitation feasible. The government’s New Energy Industry plan includes blueprints for the development of ‘clean coal’ technologies, which include coal-to-gas, coal-to-liquids and integrated gasification combined cycle (IGCC).

Coal to chemicals enjoys a significant advantage in terms of cost, with oil being four times more expensive. Several of the leading domestic mining, power generation, and coal chemicals companies have shown an interest in coal-to-olefins (CTO) projects, with three major plants already under construction and at least six more pending approval.

International petrochemical giants are also eyeing the Chinese market thanks to China’s abundant coal resources. Dow Chemicals and Shenhua are jointly developing a much publicised USD 10 billion project in Yulin, North Shaanxi. Two other Western companies, Total Petrochemicals and Celanese are also making plans. Total and China Power Investment have agreed to study a potential 1 million tpa polyolefin complex in Inner-Mongolia. They hope to complete the plant after 2015, at a cost of up to USD 4 billion.

Celanese too plans to build one or two coal-based ethanol plants in China — each with a capacity of 400,000 short tonnes/year — that will involve a new process based on the company’s acetyl chemistry platform.

Although the government has encouraged coal chemistry, it is now insisting that such projects have a minimum capacity of 600 kilo per tonne annually (KTA). In 2010, the use of coal in the Chinese chemicals industry was 200 MTA, only 6 percent of China’s total coal consumption. By 2015, this figure is likely to increase by 50 percent, rising to 300 MTA.

According to industry experts, coal is an advantageous feed only if international oil prices stand above USD 80 per barrel.

However, the picture is complicated by the volatility of oil prices and regulatory concerns over the environmental impact of these processes. As a result, the scope for CTO and CTL may be limited in the near term. This view seems to be borne out by the results of a recent KPMG survey, in which around 50 percent of respondents described coal-based chemistry projects as ‘high risk’.

**Gas resources**

Another noticeable trend is the steady development of indigenous gas resources, especially shale gas, which may lead to a radical change in

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18 The future of chemicals industry, trends and opportunities, 2011, Booz & Company
19 Exploiting China’s coal, 15 Nov 2010, Chemical & Engineering News
20 Celanese to enter China fuel markets through coal to ethanol plants, 10 Jan 2011, ICIS
21 Coal to chemicals gains upper hand, 5 Nov 2010, ICIS

Bio-based plastics

As oil supplies tighten, efforts are being made to harness the utility of bio-based plastics. Performance Polymers Business Unit of Evonik Industries has developed polyamides from biogenic raw materials. These new polymers, however, need to fulfill demanding technical requirements. Evonik has developed new polyamides, which are produced fully or partially from monomers obtained from castor oil. These bio-based polyamides are said to be resistant to high temperatures, and also extremely rigid and capable of withstanding heavy impacts. As a result they are ideally suited for parts that need to withstand hot conditions, such as the engine covers of cars. One of Evonik’s products, which is an extremely rigid, fibre-reinforced variant, is suitable for high-stress housing. Other polyamides with high impact resistance can be used as an additive in the soles of premium athletic footwear. Bio-based polyamides can also be used for extreme applications as a charge air duct in turbochargers.
the supply mix over the coming decade. It remains to be seen how swiftly this affects the chemical industry, but as of now, China is definitely in the thick of energy change dynamics.

The 12th Five-Year Plan reflects a major policy shift, which aims to give gas a much more important role in the broader energy system. It is targeting an 8.3 percent share for gas in the primary energy mix in 2015, or 260 billion cubic metres (cbm) annually, based on China’s energy consumption goals. This is an upward shift from the 85 billion cbm of gas consumed in 2008, or 3.8 percent of the energy mix.

Various factors will lead to high gas usage — ample availability of gas, which lowers average gas prices, implementation of China’s policy for gas usage, slower growth of nuclear power, and greater use of natural gas in road transportation.  

Bio-pathways
China has been an enthusiastic pioneer of bio-pathways, beginning small-scale production of bioethanol a decade ago, under the 10th Five-Year Plan. In 2007, the National Development and Reform Commission set a production target of 10 MTA, to be achieved by 2020.

However, as China loses more and more land to urbanisation and industrialisation, food security is becoming a pressing issue. In March 2011, COFCO closed its cassava-based fuel alcohol plant in Guangxi region because high selling prices and unsalable products made the plant uncompetitive there compared with cheaper traditional fuels.
The traditional cost advantage of China is noticeably eroding, even though the process is happening more slowly than some commentators claim. Exchange rate control is less sustainable - with the question of how much and how fast the currency will appreciate is the subject of fierce debate. On top of this, labour costs are rising as the number of new workers entering the market since 2010 has fallen short of the replacement factor (a direct result of the nation’s one-child policy).

The financial crisis that shook the world in 2008 acted as a catalyst to the ongoing changes affecting China’s economic model, which we expect to further unfold in the next five to ten years. The CNY 4 trillion stimulus package in late 2008 heralded some of the priorities of today’s Chinese law makers: rebalancing of east/west and rural/urban disequilibrium, a deeper concern for the environment, and the integration of the domestic market (via large infrastructure investments).

The 12th Five Year Plan takes these priorities forward. The Plan aims to move China from its position as an export-driven powerhouse towards a balanced economic model in which internal consumption has an enhanced role and the old ‘low cost, good enough’ export model is gradually abandoned in favor of high value added, technologically advanced manufacturing.

Despite the growth target being set at a more modest 7 percent, actual achievement is likely to be higher. Under the previous Five-Year Plan, projected annual growth was 7.5 percent, but actual growth was an average 3 percent more.

In addition to the actions of law-makers, or underlying them, a number of mega-trends are already at play that will help determine the success or failure of chemical companies in China. Some of these, such as demographic changes, are not new and bring about slow but firm adjustments. Others, including a progressive re-alignment in certain global supply chains, or the increasing importance of environmental questions, seem to have acquired momentum only recently.
China’s actual and forecast GDP growth vs. 5YP targets

2.1 Mega-trend I: Jump for domestic consumption
In recent years, the government has been trying to stimulate domestic consumption through a range of initiatives and subsidies. In 2011, consumption is forecast to increase as a portion of GDP growth to more than 50 percent, compared with 43 percent in 2010. This is still a long way from the contribution of domestic consumption in most Organisation for Economic for Cooperation and Development (OECD) countries, and well short of the average 70 percent of the US.

The 12th Five Year Plan aims to effectively increase disposable income levels and internal consumption. The measures include expanding social welfare coverage, regulating an increase in minimum wages and improving the productivity of the rural economy through a mixture of agricultural and educational reform.

According to a forecast by the Chinese Academy of Social Sciences, a government think tank, the number of ‘middle income people’ (defined as those whose food expense is around one third or less of their disposable income) will increase from 37 percent of the urban population to around 50 percent by 2023. Together with the undiminished pace of urbanisation already mentioned, this means that the current 250 million estimated consumers will become 400 – 420 million in the next twelve years. The growth in the size of the middle class will have an obvious impact on several sectors, primarily automotive, packaging and food.

China’s 12th Five-Year Plan: Seven Priority Industries

<table>
<thead>
<tr>
<th>Priority Industry</th>
<th>Chemical sectors affected (a sample)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New energy</td>
<td>Strong potential for pull demand in performance materials and composites, as well bio-plastics (e.g. PA11)</td>
</tr>
<tr>
<td>Energy conservation and environmental protection</td>
<td>Water-treatment chemicals, process improvement technologies, polymers (as a substitute for metals)</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>Potential push effect for catalysts, industrial cleaning technologies, bio-feedstock</td>
</tr>
<tr>
<td>New materials</td>
<td>Rare earth chemistry and high-end semiconductors (silicon derivatives, specialty materials) specifically targeted</td>
</tr>
<tr>
<td>New IT</td>
<td>Demand for performance materials and composites, performance resins and polymers, electronics materials</td>
</tr>
<tr>
<td>High-end equipment manufacturing</td>
<td>Demand for performance materials and composites, performance resins and polymers, electronics materials</td>
</tr>
<tr>
<td>Clean energy vehicles</td>
<td>Rare earth, TiO2, Lithium related chemistry. Performance polymers and resins, composites</td>
</tr>
</tbody>
</table>

26 China Chemical Tour, 24 March 2011, Deutsche Bank, London
Automotive sales and growth rate

<table>
<thead>
<tr>
<th>Year</th>
<th>New vehicle sales (million)</th>
<th>YoY growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>8.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>2007</td>
<td>10.0</td>
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<tr>
<td>2008</td>
<td>12.0</td>
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<tr>
<td>2009</td>
<td>14.0</td>
<td>18.0%</td>
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<tr>
<td>2010</td>
<td>16.0</td>
<td>13.0%</td>
</tr>
<tr>
<td>2011</td>
<td>18.0</td>
<td>11.0%</td>
</tr>
</tbody>
</table>

Source: CAAM

Automotive industry: The auto sector is one of the largest consumers of a wide variety of chemicals (polymers, resins, coatings) and promises to remain a major growth driver in China. The country’s vehicle sales expanded at a 25.7 percent CAGR in the last five years, reaching 18 million units in 2010, compared to 11.6 million units in the US. Although various limitations on car registrations and regulations may bring down this year’s growth rate to 5-10 percent, China’s motor vehicle penetration rate stood at only 5 percent at the end of 2010. This compares with a roughly 59 percent penetration rate in Japan (2008) and approximately 80 percent in the US (2008). 27

Opportunities in the auto-industry come from the reduction in weight achieved with the substitution of metals by plastics, which in turn supports fuel-efficiency. In addition, composites can also reduce manufacturing costs as they require less tooling and equipment. Lanxess launched an SCP manufacturing plant in Wuxi back in 2005 with an annual capacity of 20,000 tonnes, which was expanded in 2007 to 40,000 tonnes with a further expansion to 60,000 tonnes on track for 2011.

Although the sector has shown signs of slowing down this year, mainly because of the withdrawal of stimulus measures and efforts by the government to prevent severe congestion in the big cities, the longer term prospects remain upbeat.

As a recent KPMG study shows 28, the critical challenges for the automotive industry in China - a need to build more environmentally friendly and cost efficient models - will continue bringing significant opportunities to chemical manufacturers. From design changes aimed at substituting heavy metal parts with lighter high performance polymers and polycarbonates, to the new materials required by Fuel Cell Vehicles (FCVs), demand from auto-makers will continue to be an important driver of growth.

The food business: With more and more Chinese people entering the ranks of the middle-class and looking for broader health and lifestyle choices, such as ready meals and vitamin supplements, multinationals see room for expansion in this market. A number of food product scandals have spurred the market for value-added food products. Although the focus in the vitamin/nutrition markets is mainly on exports, companies like DSM believe that the domestic market will soon overtake the re-export market in terms of demand. The Dutch multinational is increasingly focusing on value-added food products, in addition to the highly profitable market for basic vitamins. An increasing focus on pre-mixing and services is enabling companies to further enhance margins and increase barriers to entry.

Lifestyle change and packaging: The growth of the middle class will drive demand for plastic packaging. EuroMonitor International forecasts remarkable growth for packaged food, beverages and tobacco in China, which bodes well for the packaging industry. We expect that this trend will also positively affect demand for polyethylene, polypropylene and PET, as well as other specialty chemicals such as paper and water chemicals and food additives.


Polymer composites

Four main sectors drive the growth of polymer composites — construction, automotive, aeronautics, and wind energy. Polymer composites are becoming the material of choice for replacing traditional materials in the automotive industry. Compared to traditional elements, composites have higher strength-to-weight ratios, better resistance to chemical and heat impacts, and greater design flexibility.

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Source: CAAM
2.2 Mega-trend II: Urbanisation to sustain demand

China expects its urbanisation rate to rise from 47.5 percent in 2010 to 51.5 percent by the end of 2015, with an average annual increase of four percent, according to the target set in the 12th Five Year Plan. The pace will accelerate in the next 20 years, with the urban population slated to reach 70 to 75 percent by the end of 2030, according to a recent report from the Chinese Academy of Social Sciences. Urbanisation is at the centre of China’s reform and development and will be one of the most important driving forces of the country’s economic growth in the next few decades.

The urbanisation process is expected to bridge the wide gap spawned by the Chinese government’s long-held “Dual structure in urban and rural areas”, which in effect restricts the relocation of rural residents to cities. The China Centre for International Economic Exchanges calculates that one person moving into a city can create economic value of CNY 100,000. With 200 million Chinese people expected to move into cities and towns in the next 10 years, a potential CNY 20 trillion could be added to the economy in the period.

29 China expects 51.5% urbanization rate by 2015, 5 March 2011, Xinhua
30 Urbanization to exceed 70% by 2030, CASS, 7 April 2011, Bloomberg
32 What China’s Five Year Plan means for business, July 2011, McKinsey Quarterly

Despite recent set-backs in landmark infrastructure projects, government-supported investment in infrastructure will remain high, especially in the power grid, railways and telecommunications. Improved infrastructure is seen as critical to the country’s urban development program, and the central government has laid out clear plans for expanding the penetration and capacity of these networks. Power generation and grid investment from 2011–2015 is expected to reach CNY 5.4 trillion, while budgeted rail and city subway spending amounts to CNY 4 trillion. Investment in water resources is set to double in 2011, reaching CNY 400 million, with the figure expected to hit CNY 4 trillion by 2020.31

These ambitious targets will remain largely unchanged and will be backed up by significant government investment. Companies involved in these massive projects set worldwide industry standards and have enormous procurement power.32

Wide-ranging construction and infrastructure projects will drive demand for an extensive range of chemicals — chlor-alkali, coatings and...
any construction related materials are the expected beneficiaries of this process, but the derived demand effect will likely be much more wide ranging.

With the 12th Five-Year Plan focussing on sustainable development, China is also experimenting with energy-saving construction. The Ministry of Housing and Urban-Rural Development has selected 40 key cities for public building energy-saving reconstruction projects during the five year period. These cities are required to reconstruct no less than 4 million square metres in the next two years, with a fiscal allowance of CNY 20 per square metre.

China’s real estate industry has enjoyed rapid growth during the past five years, contributing strongly to overall GDP and local government budgets. But the overheated market has raised fears of speculative bubbles and social instability linked to rising housing costs, forcing the government to announce a mega plan for affordable public housing. China has set a goal of building 10 million homes for people on lower incomes this year alone, at a cost of CNY 1.3 trillion, and a total of 36 million units over the five-year period.33 The aggressive 2011 target is coupled with the continuation of many public-housing projects started in 2010 (around half of the 5.8 million units).

Inland development: One of the most significant aspects of the 12th Five-Year Plan is the focus on developing inland regions of China, mainly the middle and western provinces. Driven

Polycarbonates and polyurethanes

Anticipating the trends, global companies have invested strongly in specialty polyurethane (PU) and polycarbonate (PC) segments, as China is the strongest growth market for these products. China is currently the largest global market for polycarbonates, accounting for 30 percent of world demand, and is expected to be the largest global market for polyurethanes soon — it already accounts for 20 percent of world demand.

Polyurethanes are used primarily in the automotive, construction and electrical/electronics industries, but also in a number of specialty applications: wheels and tires for forklift trucks, for example, are made from high-performance polyurethane elastomers. The range of application for polyurethane is almost unlimited: mattresses, upholstered furniture, car seats, car bumpers and sports shoes, to mention just a few. As a thermal insulation material, polyurethane foam is used in refrigerators and freezers in the downstream industry, as well as cold chain logistics, construction and solar water heaters. Its use as a building material in energy efficient buildings is gaining ground.

BASF is also heavily present in the polyurethane business. It started the construction of a new chemical plant in North China’s Tianjin municipality in April 2011. The Tianjin project will include a centre for sales and technology services in addition to a space for manufacturing an organic compound used in the production of polyurethane foams.

BASF also started building a chemical plant in Southwest China’s Chongqing municipality this year. The project is expected to cost USD 5.3 billion - the largest investment of any German company in central and western China. With the State-owned Chongqing Chemical and Pharmaceutical Holding Group Company (CCDHC) as its co-investor, the project is expected to realise an annual production value of CNY 50 billion. Its product MDI, a core PU raw material, is widely used in industrial production, including auto manufacturing and in heat insulators for home appliances and shipping containers. BASF is now focussing on MDI, which is a high barrier-to-entry product.

Bayer Material Sciences is another company that has benefitted from the expansion of automobiles, construction and railway projects in China. Bayer’s facilities for polyurethanes and polycarbonates in the region operate at very high rates and de-bottlenecking measures were needed this year to cope with the growth in demand. Polyurethanes is the largest business unit within Bayer MaterialScience, and its state-of-the-art PU and PC facility at the Shanghai Chemical Industrial Park is a low-cost production site currently undergoing further expansion.

One of the applications of polycarbonates is in Light-emitting Diodes (LEDs) or light-emitting diodes. Bayer supplies various grades of polycarbonate that are suitable for the LED market, which includes commercial and retail lighting, signs and displays, traffic control systems, and automotive lighting.

33 Why the world should heed China’s five-year-plan, 7 March 2011, Reuters
by the relocation of manufacturing from the coastal regions, faster urbanisation, and sustained policy support, the inland provinces will experience more rapid GDP growth over the next five years. Inland development received a preferential share of the CNY 4 trillion stimulus in 2008, driving stronger industrial production growth compared with the coastal provinces. An annual evaluation report published by the government has forecast that the region’s economy will grow 13 percent in 2011, higher than the national average.

Polyparylene sulphide - PPS

Polyphenylene sulfide, or PPS resin, is a high performance thermoplastic widely used in the fields of electric appliances, electronic devices, rail transportation, aerospace and paints. PPS is a crystalline and wholly aromatic polymer, as well as a special thermoplastic characterised by extreme heat resistance and dimensional stability with wide ranging applications. PPS, as a new material, is on the list of new materials that have been given priority in the 12th Five Year Plan.

Chinese company Lumena New Materials has gained a head-start in PPS production after acquiring Sino Polymer in late 2010, becoming one of the largest producers of PPS resin in the world. Lumena’s R&D section has produced various grades of PPS resin and developed new applications of PPS compound for use in rail transportation. The demand for this application of PPS compound as an insulator will increase as China is going full gear construction of large-scale subway and high speed rail systems in big cities.

In 2011, Lumena plans to commence the construction of a PPS resin production line of 25,000 tpa and a PPS fibre production line of 15,000 tpa in order to increase production capacity. These are expected to commence operations in October 2012.

The inland region is now an important element in China’s energy and industry master plan. The central government has approved plans for an energy industry “golden zone”, linking Shaanxi province and the autonomous regions of Ningxia Hui and Inner Mongolia in northwestern China. The blueprint for the zone connects the energy-rich regions of Yulin city in north Shaanxi province, Ordos in southwest Inner Mongolia and the Ningdong energy and chemical base in Ningxia Hui autonomous region. The zone covers nine cities and areas in Shaanxi and Gansu provinces and the Ningxia Hui and Inner Mongolia autonomous regions. Energy production in this area accounted for 21 percent of China’s primary energy output in 2010. At least 20 state-owned enterprises have invested more than CNY 120 billion in the Ningdong energy and chemical base and have developed the base into an advanced production facility for chemicals including carbinol, dimethyl ether and coal-based alkene.

For the chemical industry, these policies may herald significant challenges as well as opportunities. A redistribution of industrial demographics will demand major adjustments in supply chains, with a consequent realignment in production capacities, logistics and technologies. As is always the case with change, concerns abound — many companies see the comparative lack of an educated labor force in tier 2 and tier 3 cities, and the reluctance of specialised workers to relocate to these less-developed areas, as a limiting factor. Also, logistics costs, traditionally high in China, are often cited. The extent to which these issues can be solved in the coming years will determine the depth and speed at which this ongoing process will unfold.

2.3 Mega-trend III: Sustainability here to stay

Environmental focus and energy efficiency is one of the most significant drivers in China and a key point of differentiation for Western companies. Over the past few years, energy efficiency, consumption and environmental conservation have moved to the forefront of Chinese political thinking. As local companies move towards worldwide standards at varying speeds, foreign multinationals appear to hold a competitive advantage in terms of both process and product technology.

The 12th Five-Year Plan aims to make China a cleaner, greener place by 2015. The New Energy Development Plan pushes the energy efficiency agenda forward, targeted at adjusting China’s energy structure, controlling the total volume of energy consumption, and
constructing a safe, stable, economical, clean and modern industrial energy system. An important goal of the plan is to increase the share of non-fossil fuel energy from the present 8.3 percent to 11.4 percent. It has set a carbon intensity reduction target of 17 percent, as well as a reduction target of 16 percent for energy intensity per unit of GDP.

Environmental standards and enhanced control upon hazardous substances are also top of the agenda. For instance, the State Council, China’s Cabinet, published the revised version of Regulations on Safe Management of Hazardous Chemicals in China on 11 March 2011. The regulations, which have clauses for the production, storage, use, sales and transporting of hazardous chemicals, will come into force on 1 December 2011.

This follows legislation by the Ministry of Environmental Protection, which enacted what is popularly known as China REACH in October 2010. This is a revised version of the Provisions on Environmental Administration of New Chemical Substances of 2003 and is similar to EU standards.

To achieve the planned targets for energy intensity and pollution control set in the 12th Five-Year Plan, the Chinese Academy for Environmental Protection estimates that China will increase its pollution treatment investments to CNY 3.1 trillion. Energy/environmental policy directives are likely to generate increased growth in sectors such as water treatment and building materials.

China will also strengthen energy saving and emission reductions in road and water transport in the next five years, as the central government has decided to allocate funds to encourage this process. According to the Ministry of Finance and the Ministry of Transport, public institutions and companies that carry out energy-saving and emissions-reducing work will be eligible for the funding support. Those engaged in the program may receive up to CNY 10 million in awards for their energy-saving and emissions-reduction efforts.

Among the expected winners from this trend will be those with a superior technological edge in environmentally sensitive processes and products, such as industrial water treatment, bio-fuels and bio-plastics, as well as those benefiting from a ‘green’ derived demand, e.g. specialty polymers and resins for the auto sector, bio-based plastics, polysilicon for solar wafers, high performance materials for insulation, and last generation fluoride. Although the current status of the industry seems to grant foreign multinationals an advantage over local manufacturers in this regard, the general consensus is that the current gap is narrowing quickly, as we describe in our section on R&D.

As mentioned elsewhere, the recent past has provided numerous examples of environmental regulations being used as an industrial policy tool in order to clear excess or obsolete capacity. We don’t foresee much change in the application of this policy in the future, and in fact a more rigid enforcement of the legal framework may be likely. Furthermore, the ongoing internationalisation of major local players, as well as the ever increasing transparency needs of the investor community, will bring about self-regulation trends similar to those existing in Europe or the US, including environmental audit reports.

2.4. Mega-trend IV: High value-added global supply chains gravitating towards China

Both industrial policies and economic dynamics continue to attract technologically advanced value chains towards China. A commonly cited example is the government sponsored building of an indigenous high-speed rail industry, a direct consequence of government investment in milestone infrastructure (CNY 1.5 trillion was earmarked for this purpose in the 11th Five-Year Plan).
In order to access contracts, multinational players are expected to bring technology and a certain relocation of their supply chain to China. Similar examples can be found in the aviation industry, with Airbus inaugurating its only non-European assembly operation in Tianjin in September 2008, and Aviation Industry Corporation of China announcing at this year’s Paris Air Show that it will supply Ryanair with mid-sized planes.

In the nuclear energy sector, China Guangdong Nuclear Power Corporation has announced the ACPR-1000, a development based on Areva’s technology.

However, the trend is not limited to government actions — global market dynamics have a major influence too. For example, the electronic components industry, which is traditionally associated with more mature economies in the region, be it FPDs and LEDs from South Korea and Japan, or PCBs from Japan and Taiwan, is visibly shifting to the mainland. This shift is particularly noticeable in high value-added links of the chain consisting of materials and components.

A reverse effect is also visible, although typically in low value-added links of the value chain. In the last few years, salary inflation for unskilled labour has deteriorated China’s competitive edge against competing countries, such as Vietnam or India.

The consequences for chemical manufacturers in China are not hard to foresee. Dow Corning and Wacker Chemie’s USD 1.8 billion joint investment in Zhangjiagang, Jiangsu Province, at the end of 2010 may be a good example of how multinationals are finding opportunities in these trends. Advanced materials manufacturers are also beefing up capacity at the high end of the technological spectrum to meet the expected surge in demand: Dupont, Dow Chemicals and Honeywell Specialty Materials, to name but a few, are reported to be actively looking into expanding their specialty and electronic materials groups. The increased investment in localised R&D in the last few years is also closely linked to this trend.

At the other end of the spectrum, the outlook for manufacturers catering to industries such as garment production...
or low value plastic assembly may be less bright. Polyester and certain basic polyamides (particularly PA 6-6 and PA 6) manufactures may be affected. Some market signals suggest that market leaders may be progressively leaving the low cost end of the market to local manufacturers, while concentrating on monetising their technological advantage through technology licensing and customised services to higher end customers. This could be the rationale behind US-based Invista’s technology licensing agreement with China Prosperity or its announcement in late 2008 that it would develop a ‘commercial textile’ research centre in Shanghai.

2.5 Mega-trend V: R&D is ramping up

Despite certain scandals that have tainted China’s image in the last year, the growth in research and development activities in China is staggering. R&D Magazine, a publication of non-for-profit group Battelle, estimates that total R&D expenditure in China will reach USD 153 billion in 2011 (at PPP), surpassing Japan for the first time and increasing almost 9 percent over a year earlier. Several drivers lie behind this trend, many of them interconnected.

A key element is the existence of governmental support at different levels. Public funds are channelled through a mixture of incentives to private R&D activity (subsidies and tax rates), as well as through direct support to research institutes and universities cooperating with private R&D projects and the funding of state-of-the-art facilities at several clusters across the country.

Furthermore, as R&D remains a priority policy for several sectors, with state-owned enterprises also being asked to comply with these goals. Market dynamics are moving in the same direction. Dow Chemicals, for example, has for some years been talking of ‘localising’ its portfolio in China. The company officially inaugurated its 100,000 sqm Business and Innovation Hub for Asia Pacific in Shanghai in June 2009. Other multinationals, whose development activity in the country goes back longer, are starting to engage in basic research locally.

ExxonMobil Chemical will also beef up new premium products for Asia by opening a USD 90 million technology centre in Shanghai. Launched in March 2011, the 27,000 sqm Shanghai Technology Centre is ExxonMobil Chemical’s third-largest technology centre in the world. ExxonMobil too is driven by the urgency to produce tailor-made solutions for the local market.

Although IP rights legislation is enforced by industry executives to a certain extent, the situation falls short of the standards in OECD countries. On the other hand, multinational companies have learned to adapt to this situation by implementing a host of measures. The practice of ‘slicing out’ critical batch processes to other countries, or to concentrate basic research out of China, is now giving way to a more proactive management of IP assets and processes that includes, for example, a reluctance to register critical process technologies, fuscused process design to avoid knowledge dissemination, and H&R policies that align incentives and know-how.

As with other mega-trends, we foresee that the development of the 12th Five-Year Plan will be a catalyst to existing dynamics. The Plan targets to boost expenditure on research and development to 2.2 percent of GDP, well above the current 1.4 percent and the global average of 1.9 percent. It is also targeting the registration of 3.3 patents per annum for every 10,000 Chinese citizens. This overall goal will have an impact on all sectors of the chemical industry.

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42 ExxonMobil Chemical launches $90 m technology centre in China, 30 March 2011, ICIS
Further, the Plan sets explicit growth targets for new chemical materials, whose production value is likely to hit some CNY 260 billion by 2015, up by a CAGR of 16 percent. China’s self-sufficiency in new chemical materials is set to rise from 56 percent in 2009 to 76 percent in 2015. A development of the Plan for New Materials (to be released in September) is expected to unfold specific targets. Undoubtedly, extensive governmental support for R&D activity will be critical for reaching these targets.

### 2.6 Impact of mega-trends

<table>
<thead>
<tr>
<th>Chemical segments</th>
<th>Rise of consumer demand</th>
<th>Urbanisation</th>
<th>Sustainability</th>
<th>Shift in supply chain</th>
<th>Enhanced local R&amp;D</th>
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<tbody>
<tr>
<td>Olefins / BTX</td>
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<td>Fertilisers</td>
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<td>Pesticides</td>
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<td>Catalysts</td>
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<td>Paints and coatings</td>
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<td>Polymers and resins</td>
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<td>Water treatment chemicals</td>
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<td>Bio-materials</td>
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<td>Advanced materials</td>
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- **↑↑** Significant growth in demand
- **↑** Growth in demand
- **↑** Overall downward impact
- **↔** No significant direct impact

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Conclusion

After a period of turbulence in the world markets that affected the Chinese industrial sector, albeit to a lesser extent than other OECD economies, 2010 proved to be a good year for most players in the chemical industry.

Despite a relative slowdown in the second quarter of 2011, and the potential ripples from the ongoing turmoil in the financial markets, the general impression amongst executives and managers operating in China is cautiously optimistic.

The next five years will be affected by changes at the political and administrative level, with a change in leadership due in 2012. The 12th Five-Year Plan, announced in March 2011, sets a number of policy goals for the period. Despite some concern regarding the new government’s ability to implement such a wide-ranging plan in an increasingly complex and dynamic economy, China has a strong track record of achieving the goals set in previous plans. The stated goals of balancing the economy, strengthening the middle class and moving into a more value-added productive system, are not new in themselves. The real change is the emphasis placed on them, articulated in a set of very specific goals that will permeate all future governmental policy at both national and regional/local level.

We believe that governmental policy will add momentum to the longer term trends already visible in China’s economy and society. We have highlighted in this document what we think are the five top trends affecting the chemical industry in the medium term (domestic consumption, urbanisation, sustainability and conservationism, the shift of technology intensive global supply chains towards China, and research and development). In all cases, an overlapping between the fundamental trend and governmental goals exists. However, it is difficult to predict how certain geo-political, social and financial variables may evolve in the coming five years.

Overall, despite the fact that there are no obvious losers from these dynamics, some companies and portfolios will be in better position to reap the rewards of these changes. Generally speaking, downstream specialty players should be in a better position than commodity manufacturers in the upstream links.
As we have seen, performance materials and coatings used in the electronics and consumer industries will probably see the best side of the market. High value-added niche players (catalysts, performance lubricants, certain fluorides) will continue enjoying margins above the industry average.

The broad category of “bio-products” (bio-plastics, Nylon 11, bio-coatings) should also be positively affected by the changes in demand, but in our view only to the extent that the cost differential with non-bio substitutes remains limited. On the other hand, it will be sustainable processes — those manufacturers who can meet the requirements in terms of diminished pollution or energy efficiency, and those whose products support others in achieving this aim — that will make the difference.

The auto-industry, an important source of derivative demand in the last few years, will likely need a few quarters to recover its growth trend, as it digests its recent exceptional growth rates and adapts to local government measures to curb traffic expansion in the inner cities.

Another key driver of demand, building and infrastructure, may already have reached its peak in terms of growth, but it will remain a serious driver for the coming years. A growing share of that growth will come from western China, however.

Industry players should not lose sight of the momentous dynamics already in place between the Eastern and Western regions of China. The large energy infrastructure and upstream projects, either recently announced or already in progress, may eventually bring about a reshaping of the chemical landscape of the country.

Overall, the period ahead appears to be an interesting one, filled with both opportunities and challenges. Undoubtedly, the winners will be those with the ability to understand and act upon the levers of change.
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