



cutting through complexity

KPMG GLOBAL ENERGY INSTITUTE

Asia Pacific's Petrochemical Industry: A Tale of Contrasting Regions

kpmg.com/energyaspac



CONTENTS

Executive Summary

3

Asia Pacific's Petrochemical Industry:
Exposed to Shifting Dynamics

4

Interview: Paul Harnick

8

Intra-regional Focus: China

9

Intra-regional Focus: North Asia

13

Intra-regional Focus: ASEAN

17

Conclusion

22

Contact Us

24

EXECUTIVE SUMMARY

With its robust economic growth and domestic consumption, Asia Pacific (ASPAC) has spearheaded the revival of the global petrochemical sector, which found itself subdued as a result of the 2008 financial downturn. Over the next decade, Asia Pacific is expected to drive two-thirds of global petrochemical demand.¹

To mitigate an expanding energy security dilemma and capitalise on rising forecasted demand, China's government has pursued a policy of petrochemical self-sufficiency. Today, China is the world's largest chemicals producer.²

China's ascendance as a petrochemicals producing and consuming powerhouse has amplified intra-regional competition. To compete in this overpopulated industry, North

Asian and Association of Southeast Asian Nations (ASEAN) petrochemical producers will have to execute strategies that are both innovative and sustainable.

With China and ASEAN's rapid modernisation, large demographic size and escalating domestic consumption, it appears the energy demand has gravitated to the east. Scrutinise the supply of feedstock trends however, and the shift of the petrochemical industry towards Asia is not wholly accurate.

In recent years, the industry has experienced a technological renaissance, shaking up global supply dynamics. Fast evolving trends in the petrochemical sector are promoting the industry's adoption of cost effective, non-

oil feedstocks such as natural gas liquids (NGLs) and associated gases. The Middle East and US are now established petrochemical powers, with comparatively favourable cost positions because of this feedstock diversification. It could be argued that the competitive advantage is shifting to producers outside of Asia Pacific.

This report reviews the prevalent megatrends in the petrochemical industry, with specific emphasis on the main intra-regional components of ASPAC: China, North Asia and ASEAN. It provides insight into the nuanced challenges these regions face over the next decade. This report aims to provide strategic solutions to ASPAC companies on how they can adapt their portfolio strategy to respond to rising regional and global competition.

¹ Interview, ExxonMobil, Singapore, March 2013, accessed via www.energyboardroom.com

² China identifies 58 chemicals to act on, International Chemicals Secretariat, accessed via <http://www.chemsec.org/what-we-do/influencing-public-policy/news-updates/1136-china-identifies-58-chemicals-to-act-on>

Asia Pacific's Petrochemical Industry: Exposed to Shifting Dynamics



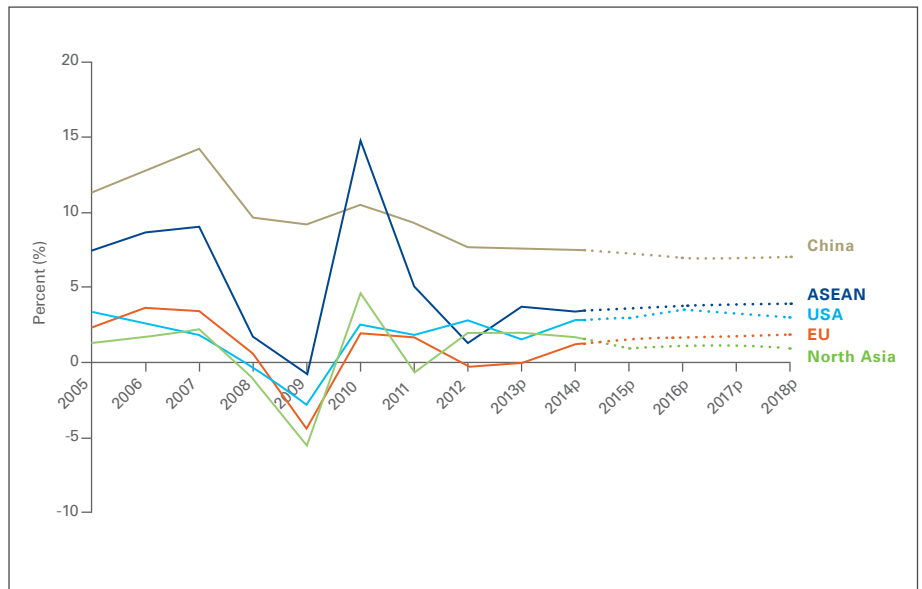
ASPAC's petrochemical industry faces fierce competition from regional counterparts that have embraced feedstock diversification as a means to compete in an increasingly cost sensitive industry

ASPAC: The Global Demand Engine

Since the 2008 financial crisis, Asia Pacific (ASPAC) has been the poster-child of the global petrochemical industry. A combination of favourable economic and demographic trends has stimulated a growing appetite for petrochemical products. Over the next decade, it is anticipated that two thirds of global petrochemical demand will originate from Asia Pacific.³ Such underlying demand and growth fundamentals have catalysed substantial investment into ASPAC's petrochemical industry.

Although macro-economic indicators such as GDP growth (Figure 1) and demand fundamentals such as GDP Per Capita (Figure 8) remain relatively attractive for a significant part of ASPAC, the availability of traditional feedstock and adoption of non-traditional feedstock has

Figure 1: GDP Growth



Source: World Economic Outlook Database October 2013, IMF; Statistics Department of Singapore

shaken up global petrochemical supply dynamics. In order to participate in the industry, petrochemical companies

in ASPAC, will need to assess what options are available for them to become more competitive.

³ Interview, ExxonMobil, Singapore, March 2013, accessed via www.energyboardroom.com

Lighter is Brighter

The petrochemical industry's growing preference towards lighter feedstocks as an alternative to naphtha has triggered a competitive edge for North American and Middle Eastern producers. The North American "shale gale" has revolutionised the sector and its impact on production growth is likely to fundamentally transform trade flows. Indeed, the shale boom has dramatically lowered prices of natural gas liquids (NGLs) such as ethane, the dominant petrochemical feedstock in the US. In 2013, ethane price hovered around (USD185.50/mt),⁴ while the price of the overriding Asian petrochemical feedstock - Japanese naphtha - averaged approximately USD850/mt (Figure 2).

Ultimately, the promotion of non-oil feedstocks such as natural gas liquids (NGLs) has sharpened inter-regional rivalries. With naphtha trading over three times the price of NGLs, the petrochemical industry is characterised by regional cost differentials and diversifying petrochemical flows. Presently, these traits are not balanced in the favour of ASPAC producers. US-produced ethane-based product will likely be channelled towards Asia over the next few years, undercutting the competitive standing of local Asian producers.

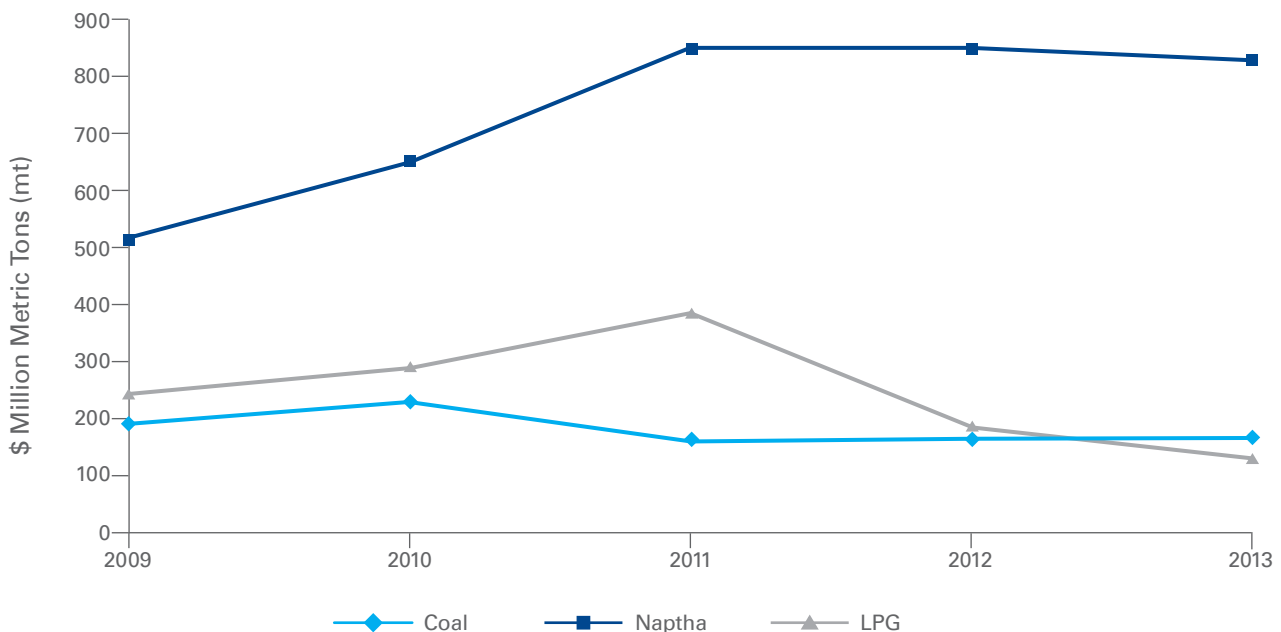
Diverse Regional Cost Curves

ASPAC's petrochemical industry is operating in a competitive and global environment in which the volumes of output generated by counterparts

in distant shores significantly impact local competition in North Asia and ASEAN. North Asian and ASEAN producers are grappling with volatile and high naphtha prices and uncertain feedstock supplies that are vulnerable to globally changing geopolitical forces, such as conflict in the Middle East. This results in higher input costs, leading to narrowing margins.

To compound the difficulties experienced by ASPAC producers, the three intra-regional environments are competing against one another. The ascendance of China as a petrochemical producing juggernaut, embracing nascent coal-to-olefins and coal-to-methanol production, presents further challenges for North Asian and ASEAN producers.

Figure 2: Petrochemical Feedstock Prices



Source: KPMG Analysis, UN Data, EIA

⁴ *European chemical companies adapt to changing times*, Reaction Magazine, July 2014, accessed via <http://www.kpmg.com/global/en/issuesandinsights/articlespublications/reaction/pages/european-chemical-companies.aspx>



Considerable base petrochemical capacity is due to come-online in ASPAC over the next three years. Investors are likely to face different investment risk-return scenarios than when their investments were originally sanctioned. The industry environment is constantly changing, rendering the projection of future

cash flows, profit margins and yields more complex and difficult to forecast, model, or participate. This has resulted in a number of companies reviewing future investment from their capital programme.

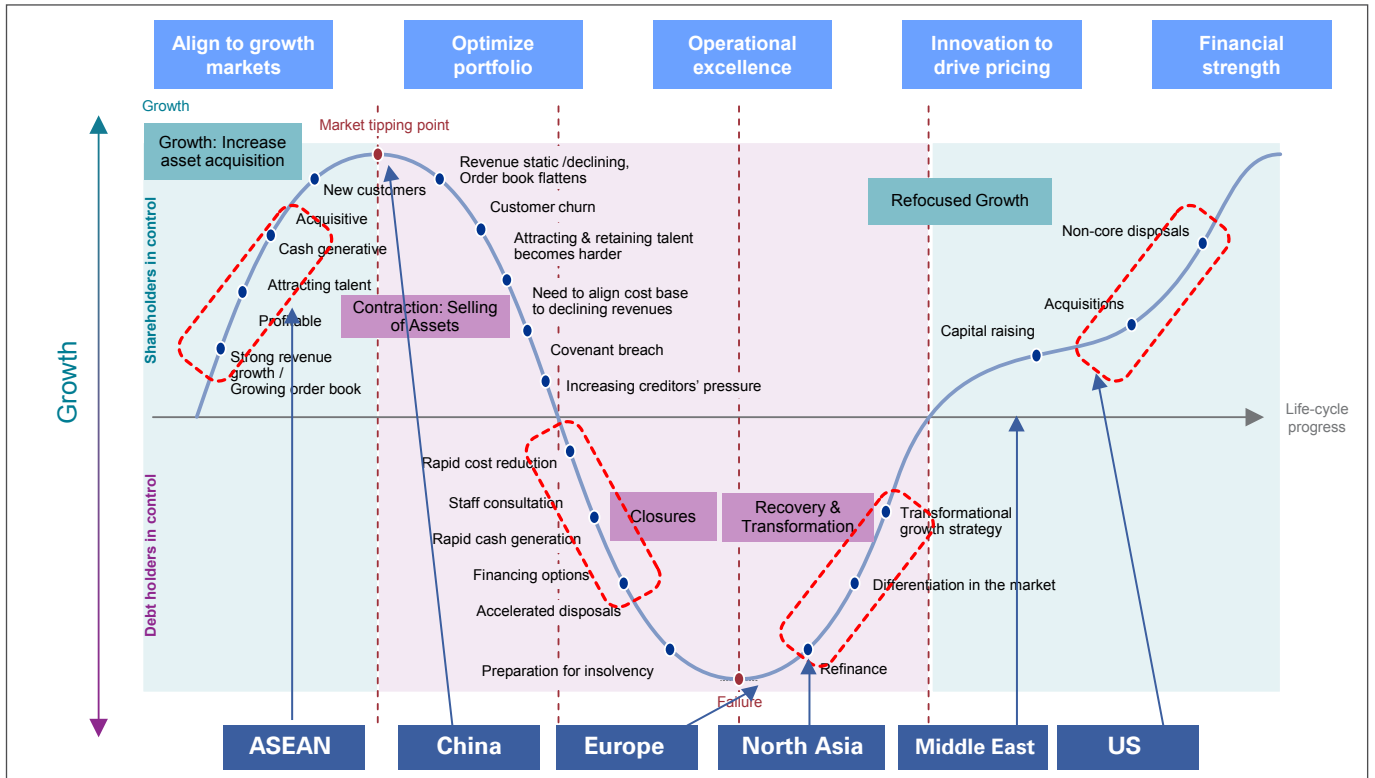
These market fundamentals are causing many oil and gas companies

to re-assess the relative value and contribution of their ASPAC petrochemical assets. In particular, integrated oil and gas companies who assess the relative contribution of their portfolio of business will note the comparatively lower return of the petrochemicals division.

ASPAC petrochemical producers must be cognizant of the market conditions and broader global context that they operate in.



Figure 3: Regional Petrochemical Competition and Life Cycle



Source: KPMG Analysis

Regional Competitive Status

Figure 3 illustrates different market conditions within which petrochemical companies operate. Each region faces contrasting challenges in their economies and their respective markets that they must contend with. Currently, the global situation can be loosely characterised by three conditions:

1. Growing demand accompanied by growing investment and fragmentation.
2. Stagnant demand accompanied by portfolio rationalisation and market consolidation.
3. Technological innovation has provided access to low cost feedstock, contributing to the growth of the industry.

Based on projected economic growth and rising domestic consumption in ASEAN, investors and companies may find strong growth opportunities, and therefore the region is a representation of the first condition outlined above. However, as with

the other regions, ASEAN is not immune to the fast changing trade, supply and capital flows shaping the industry. With these changing flows, petrochemical producers in ASEAN have to decide if they are to "build internally or buy externally." That is, to build their own petrochemical plants and serve the intra-ASEAN region, or import finished products from abroad.

As Figure 3 conveys, there are many parallels between the state of the European and North Asian petrochemical industries. Both regions have reached a market tipping point and therefore represent the outlined second condition. In both regions aging assets are ill-equipped to compete in a changing global environment. Despite steps towards portfolio rationalisation, there remains an imbalance in supply and demand, caused by flattening economic growth and overcapacity.

The success of both of their petrochemical industries will depend on a carefully calibrated set of

strategies that involve innovation, geographical expansion into emerging markets and a rigorous focus on cost, efficiency and ongoing innovation.

By contrast, the US petrochemical industry is experiencing the third condition outlined: growth. Domestic producers have capitalised on an increase in feedstock made available through hydraulic fracturing. Access to cheaper feedstock has in turn attracted larger volumes of investors, keen to exploit the increasing margins.

Due to a considerable capacity growth surge in commodity petrochemicals, China was on route to reach the market tipping point. Nonetheless, targeted policies to cool overcapacity concerns, and the gradual redirection of the industry towards high-value products, are long term corrective measures. The big question for China's petrochemical industry will be the role of coal as a core feedstock. The ramifications of large scale coal adoption will markedly change China's competitive stature.

Interview with Paul Harnick, KPMG, Global COO, Chemicals and Performance Technologies



Paul Harnick is the Chief Operating Officer of KPMG's Global Chemicals and Performance Technologies practice. He specialises in emerging market strategy development and complex, cross-border mergers and acquisitions in the chemical industry.

With their vast supplies of non-oil based feedstocks and technological ingenuity, the US and Middle East are well-established and powerful petrochemical regions. How would Asian producers compete?

The Middle East has been a global powerhouse of petrochemical production for many years and the vast majority of Middle Eastern products already find their way to Asian markets. The game changer for global petrochemical production has been the shale gas revolution in the US which, over the course of the next five years, will fundamentally transform global petrochemical trade flows. The scale of capacity expansion is vast and despite the recent return to growth, the US economy is mature and will not be able to absorb all of the new capacity. As a result, much of the product will enter global markets and the majority of this is likely to find its way to Asia, where it will compete with local production and existing imports from the Middle East. For local Asian producers, this influx of cheap, ethane-based product is likely to have a negative impact on their ability to successfully compete. For downstream consumers of basic chemical product in Asia, however, there may be a margin benefit from the ability to access lower priced raw materials.

Global competitors, operating on different cost structures, are worrying Asian petrochemical producers. To sustainably compete

in a fast evolving sector, how can Asian producers enhance their operational excellence and improve their cost-efficiency?

Operational excellence is a core competency within the global chemical company and it is no surprise that the companies at the forefront of the industry are those who truly excel in this area. The challenge for Asian producers is to embed a more rigorous cost culture throughout their organisations and to focus on driving excellence through all areas of the organisation from supply chain to operations, to channel management to sales and marketing, R&D and finance.

Over the next five years, what will be the key supply and demand trends shaping Asia's petrochemical industry?

In addition to the impact from US shale dynamics, other key supply side dynamics will include the rationalisation of the petrochemical industry in China (as the government drives further focus on innovation and quality of growth) as well as ongoing rationalisation and restructuring in Japan. On the demand side, China will continue to be a huge consumer of chemical product – there is much talk in the world about the slowdown of China, but 6-7 percent is still greater than almost anywhere else and the growth is on a much larger base than ever before, so the absolute scale of demand growth remains huge. Elsewhere, the next growth engine,

not just for Asia, but for the global chemical industry, is likely to be the ASEAN region. While challenges remain in some countries around logistics, infrastructure and the ease of doing business, many of the key criteria for chemical industry growth are in place – including population growth, urbanisation and growth of the middle classes driving consumerism.

Over the next five years, what investment opportunities and M&A trends do you see arising in Asia's petrochemical industry?

Overall, there is likely to be an increase of M&A activity in Asia's chemical industry over the next five years. Ongoing petrochemical rationalisation in China and Japan may drive merger activity. Chinese chemical companies are also increasingly looking to externalise so I expect to see them purchasing assets outside of China – both in Asia and elsewhere around the world. Over the last twelve months, Japanese chemical companies have been hugely active in M&A processes in the US – a trend I expect to continue – while they have also achieved a head start on the competition with some of the investments they have already made in the ASEAN region and they are likely to continue investing here. FDI flows from outside Asia will continue to be focused on China but with a gradually changing mix as non-Asian investors increasingly look to capitalise on the growth opportunities in ASEAN.

Intra-Regional Focus – China



China's petrochemical expansion is entering a phase of slower but targeted growth. Domestic policy will seek to strike a balance between innovation, self-sufficiency and environmental sustainability.

China continues to be the prime architect shaping global petrochemical demand. Despite well-documented economic and regulatory pressures amplifying investor anxiety - in particular stresses in the housing market - China's GDP is anticipated to grow by 7.3 percent in 2014. High domestic consumption, export expansion and an agile monetary policy are forming the backbone of the Chinese economy. Our basket of forecasts anticipates China's economic growth to moderate to an average GDP growth rate of 6 percent through 2020. To OECD countries such healthy growth from an increasingly expanding base rate would be considered a robust economic achievement – not a cause for investor flight. It is important to make the distinction that China's economic growth will be slower, not lower.

Drivers of Demand

As a consequence of unprecedented modernisation, demand forecasts show that China is and will remain the overwhelming engine of ethylene demand growth. Symbolically, this

demand trend is important. In volume, scope and global impact, ethylene is the largest and most important petrochemical commodity, providing a remarkable range of derivatives with critical feedstock.⁵

China's demand translates into two million tonnes per annum (mtpa) of ethylene equivalent growth, contributing to 50 percent of the 90mmt world growth in ethylene equivalent demand from 2014-2030.⁶ In addition, as standards of living improve and urbanisation expands, high-end engineered plastics, such as those used in domestic appliances, or sophisticated products such as liquid crystal alignment film resin, used in LCD televisions, are experiencing rising demand in China.

A Balancing Act

China's petrochemical industry is in the midst of transition. Building on China's 12th Five Year Plan (5YP - 2011-2015), which sought to improve energy security and environmental standards, the Xi Jinping administration has been quick to build on and tweak China's petrochemical strategy. Indeed

in the face of overcapacity, state-owned enterprise (SOE) dominance and environmental degradation, reforms focusing on sustainability, modernisation and competition were the focal point of the 2013 third plenary session.

China's quest for petrochemical self-sufficiency has reshaped ASPAC's olefin trade and undercut North Asian producers. Due to China's capacity expansion, domestic ethylene and propylene supply has lengthened, while imports requirements for the two petrochemical products have declined. North Asian olefin exporters traditionally supplying the country have had to seek alternative markets. A similar story is gathering pace a step up the value-chain. China's paraxylene (PX) expansion drive is expected to increase by 41 percent from 2013-2017,⁷ contributing to narrowing PTA-PX spreads and is indicative of the over-capacity issues plaguing the wider ASPAC petrochemical industry. As a result of capacity growth, the regional outlook for olefins, aromatics and a number of petrochemical

⁵ *A New World Order Evolving in Long Term Ethylene Markets*, Wood Mackenzie, February 2013

⁶ *China's ethylene self-sufficiency to peak at 2018*, Wood Mackenzie, May 2014, accessed via <http://public.woodmac.com/public/media-centre/content/12088979>

⁷ *Asian Paraxylene, End of Golden Years*, Platts, May 2013 accessed via <http://www.platts.com/news-feature/2013/petrochemicals/asia-paraxylene/index>



intermediate feedstocks such as purified terephthalic acid (PTA), monoethylene glycol (MEG), PE/PP resin, has been bearish for some time.

Responding to overcapacity issues, the Chinese Communist Party (CCP) is implementing supply cooling measures, particularly for low-grade specialty products. The government is actively reducing its support for international petrochemical investments. International companies that cannot offer access to specialist

feedstocks or to proprietary technology will likely struggle to penetrate the Chinese petrochemicals market.

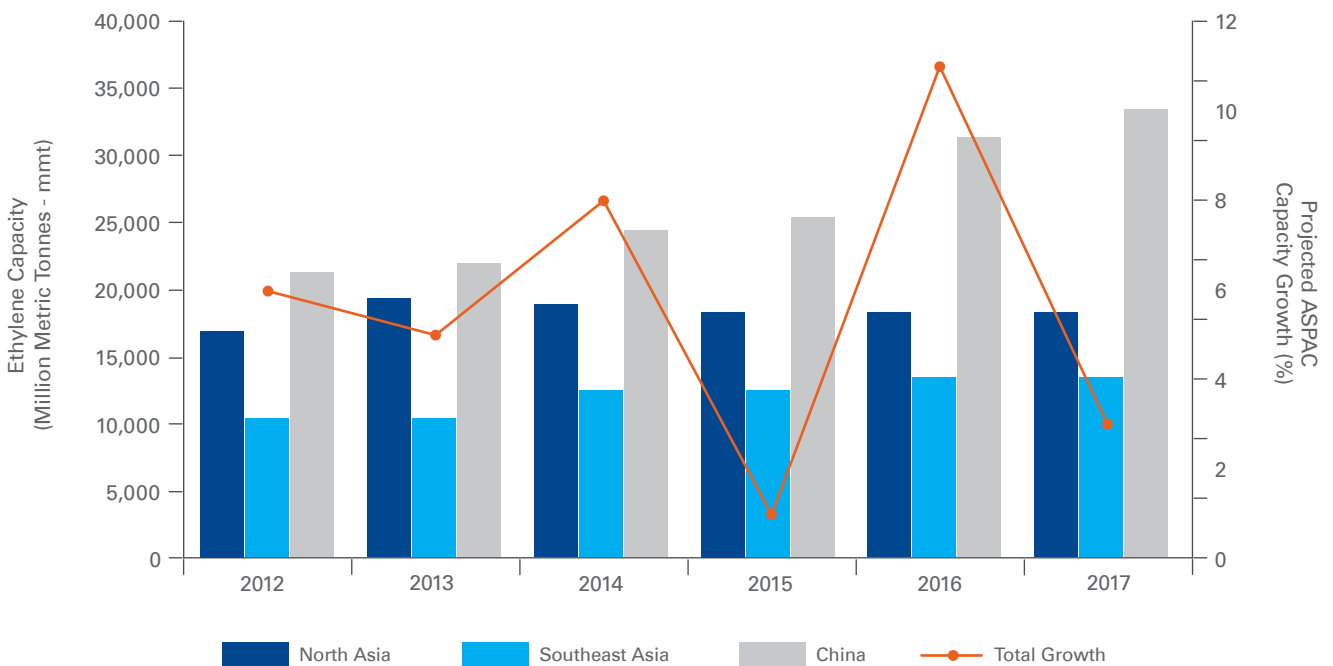
China's petrochemical expansion is entering a phase of slower but targeted growth. Domestic policy will seek to strike a balance between innovation, self-sufficiency and environmental sustainability.

Battle of the Feedstocks

An apt example of the innovation

and expansion occurring in China's petrochemical industry is in ethylene production. Over the next three years, China's ethylene capacity will increase by 36 percent and its contribution to Asia's total ethylene capacity will rise from 45 to 51 percent (Figure 4). Responding to escalating global competition and operational costs, China's petrochemical industry is gradually migrating from naphtha as the core feedstock, towards coal - a resource it has in abundance.

Figure 4: ASPAC's Ethylene Capacity Growth



Source: ICIS 2014

China has 'in-house' technology with the capability to turn coal to liquids in a cost-effective manner. By 2020, three dozen coal-to-olefins (CTO) and methanol-to-olefins (MTO) projects in China are anticipated to come on-stream.⁸ As figure 5 depicts, if coal based crackers come on-stream as planned, coal based capacity will contribute 39 percent to ethylene capacity, up from a present day 16 percent.

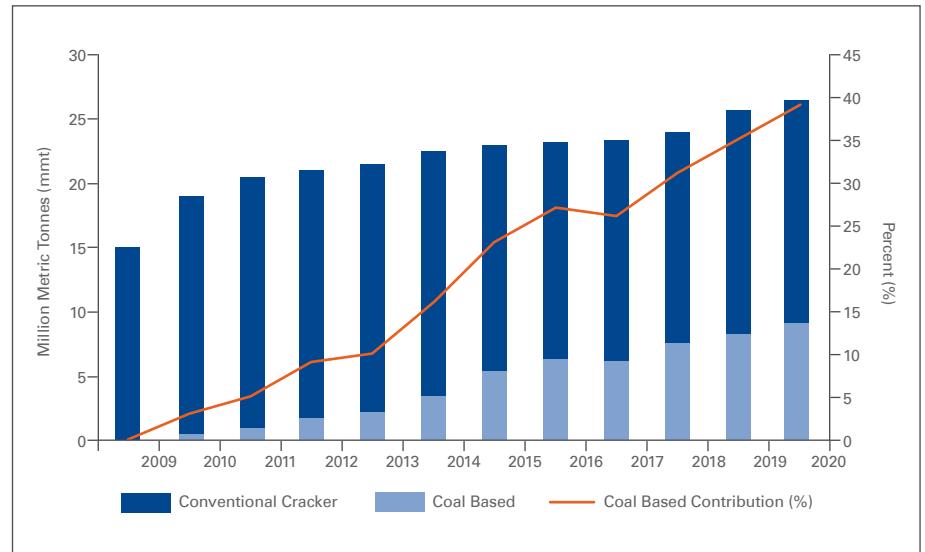
According to the U.S. Energy Information Administration, China has claimed the largest shale gas reserves in the world (1,115 trillion cubic feet).⁹ Despite considerable reserves and investment plans, China has not started commercial production. To drive gas production on a commercial scale, China must overcome environmental - specifically water shortages - and technical challenges. Unless China can commercialise its shale reserves, shale gas is not expected to impact China's energy mix before 2020.

Environmental Reform

Despite investment enthusiasm surrounding coal-based ethylene projects in China, limitations on water resources and environmental pollution concerns could limit the potential of CTO. Facing critical environmental and pollution troubles, the CCP has recently introduced a couple of stringent energy policies, in an effort to curb the consumption and importation of low quality internationally sourced thermal coal.

In September 2014, the National

Figure 5: China's Ethylene Capacity Growth & Coal Contribution



Source: ICIS 2014

Development and Reform Commission stated it plans to ban the use of low quality coal from 2015 in populous and prosperous eastern cities that are the focus of national efforts to fight air pollution.¹⁰ Moreover, in October the Chinese finance ministry stated it was reintroducing tariffs of 3 percent on anthracite and coking coal, 5 percent on briquettes and 6 percent on other coals, imposing duties that were scrapped in 2007 when coal consumption was soaring. The tariffs are also aimed at supporting China's domestic coal industry, which has suffered from tumbling prices, heavy debts and new domestic capacity. The ramifications of these policy measures will likely be an increase in domestic coal prices. Whether the price hike will hinder CTO investment remains to be seen, but it is unlikely.

China is trying to craft a delicate balance between meeting environment targets and energy sustainability. If successful, the contribution derived as an advantaged feedstock, could be revolutionary and would help reassert China's competitive stature vis-a-vis the US and Middle East.

Nonetheless, for many commodity petrochemical products, China's demand picture is expected to outstrip supply by 2020. Capitalising on this potential supply gap, advantaged suppliers in the US and Middle East will seek to export excess capacity and target opportunities within China and ASPAC holistically. This arrival of cheap, ethane-based product will continue to translate into stiffer competition for local Asian producers.

Coal chemicals may yet prove revolutionary and help reassert China's competitive stature vis-a-vis the US and Middle East.

⁸ *Coal-to-Olefins Technology in China Could Soon Flood Global Polyethylene Markets*, Platts, March 2014, accessed via <http://www.platts.com/presreleases/2014/032414b>

⁹ *Water Shortages Will Limit Global Shale Gas Development, Especially in China*, Business Week, accessed via <http://www.businessweek.com/articles/2014-09-02/water-shortages-will-limit-global-shale-gas-development-especially-in-china>

¹⁰ *China ban on low-grade coal set to hit global miners*, Financial Times, September 2014, accessed via <http://www.ft.com/cms/s/0/7b025356-3d3d-11e4-a2ab-00144feabdc0.html>

Targeting the Top of the Value-Chain

While base petrochemicals such as olefins and aromatics contribute to the bulk of China's petrochemical market, the supply and demand of speciality products has risen exponentially. The 12th 5YP placed special attention on enhancing China's petrochemical capacities and developing organic materials, resins, synthetic fibres and monomers.¹¹

Moreover, the maturity of manufacturing in China, for example, from textiles to electronics and automotive – has increased the

demand and widened spread margins for advanced chemicals.

The CCP has reduced their support for international investment into the 'bloated' petrochemicals sector. However; the maturity of China's petrochemical industry does provide opportunities for international entities already established in China. They may look to the development of China's specialties products sector, which in part, hinges on their ability to deploy technology to deal with the additional complexities involved. There are a significant number of successful Chinese

players operating in specialties products but international companies still remain the benchmark with respect to product quality, technical excellence and customer service. As such, there is further room for collaboration between domestic and international entities.

Ultimately, for the value-add sector to flourish, securing steady and capable talent remains one of China's greatest challenges. As business competition in sectors such as specialty chemicals intensifies, the war for talent is likely to step up as too.

Table 1: KPMG INSIGHT: CHALLENGES & SOLUTIONS

China's Petrochemical Challenges

Three Step Success Strategy

Regional Competition: There are major shifts occurring in the balance of petrochemical supply. The North American "shale gale" and vast quantities of cheap indigenous crude in the Middle East, has amplified petrochemical supply competition. The long term threat is an erosion of competitiveness for producers, and that petrochemical consumers may capitalise on the lower costs curves abroad and seize potential arbitrage opportunities.

Innovation: Chinese petrochemical producers should continue to innovate and invest in R&D to enhance their production processes and quality of products. Additionally, turning towards coal chemicals as an advantaged feedstock will widen the product-feedstock spread and improve the competitiveness of petrochemical plants. To enhance operational flexibility, future petrochemical complexes should be capable of absorbing a diversity of feedstocks. As growth in the commodity plastics market slows, companies should shift their activities to the specialties side of the market.

Environmental Regulations: China is now producing a greater share of CO2 emissions than both the EU and US.¹² Under the 12th 5YP, the country is tightening its regulatory regime to clamp down on fossil fuel industries and is promoting clean energy sectors. As such, further regulation on China's petrochemical industry can be expected.

Energy Efficiency: For China's petrochemicals industry to become self-sufficient and competitive, coal will play a central role as a feedstock and power source. To reduce coal consumption, Chinese petrochemical plants should aim maximise their operational excellence and energy-efficiency. Here there are lessons to be learned from IOC's who are tightening their value chain and investing in co-generation.

Space Compression: Vast infrastructure developments in China are enhancing the integration of the mainland market. With train routes and port facilities improving, the mainland market is becoming more liquid, increasing the commoditisation of products.¹³ Consequently, China is witnessing narrowing bid-ask spreads and greater domestic competition, pushing margins down.

Cost Optimisation: Successful companies will need to enhance their understanding of the true cost involved in serving individual customers versus competitors. To achieve this and build competitive edge, benchmarking analysis would be valuable. Extending the use of pricing models and decision processes will optimise customer portfolios and drive pricing decisions that support their margin and volume levels.

¹¹ China's chemical industry enters new era with sustainability, KPMG China, 2012, accessed via <https://www.kpmg.com/CN/en/IssuesAndInsights/ArticlesPublications/Documents/China-chemical-industry-sustainability-201209.pdf>

¹² Global Carbon Project, 2014, accessed via <http://www.globalcarbonproject.org/>

¹³ Optimizing value in today's changing global petrochemical market, 2012, accessed via <http://www.kpmg.com/th/en/Issuesandinsights/articlespublications/reaction/pages/reaction-magazine-6th.aspx>

Intra-Regional Focus – North Asia



North Asia's petrochemical is beset by overcapacity, high priced input and low growth. The developing global industry trends demand innovation and adaptability.

North Asian Producers: Feeling the Pinch

Out of the three intra-regions of ASPAC, North Asia's petrochemical industry is facing the sharpest uphill climb. Sedate economic growth in the three major markets: Japan, South

Korea and Taiwan has contributed to flattening internal product demand. With market developments in North America and Middle East, North Asian producers have fallen behind on the cost curve, impacting their competitiveness (Table 2). Combined

with high priced feedstock values, uncertain demand profiles and deteriorating supply/demand balances, Asian petrochemical companies are being forced to develop strategies to cope with the challenging commercial environment.

Table 2: North Asian Petrochemical Country Snapshot



JAPAN

- With its nuclear power programme on pause and lacking natural energy resources, Japan is facing a sharpening energy-security dilemma.
- Increasing reliance on LNG and naphtha imports have contributed to an escalation of feedstock, transport and utility costs. As a result, the competitiveness of Japan's petrochemical industry is eroding.
- No net capacity growth is planned for olefins and aromatics through 2020.
- Japanese petrochemical companies are actively adapting their strategy through either portfolio rationalisation, technological enhancement or both.



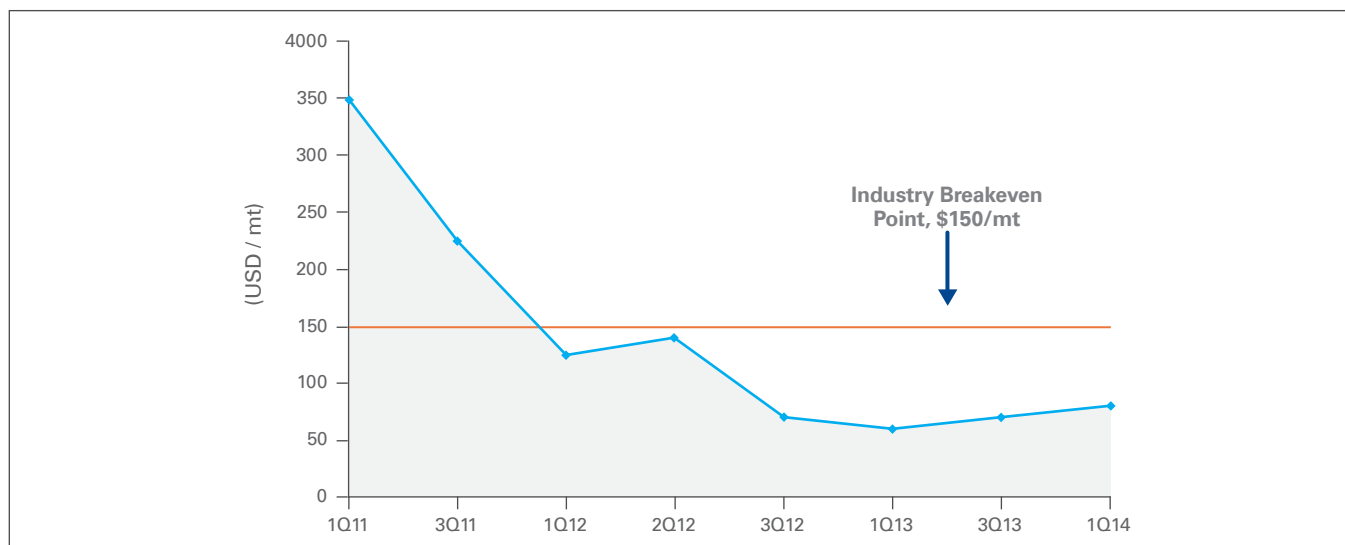
SOUTH KOREA

- High feedstock and utility costs, in addition to regional & domestic commodity petrochemical expansion, are all forces suppressing South Korean petrochemical profit margins.
- Polyester feedstock supply chains, such as PTA and Monoethylene Glycol (MEG) are facing oversupply concerns.
- China's drive towards petrochemical and plastics self-sufficiency (China may become a PTA exporter by 2015), has caused import demand from China to plummet.
- From 2013 - 2017, South Korea's PX capacity is expected to grow by 94 percent. The scale of such growth is unsettling market equilibrium, lowering utilization rates and driving down margins.
- Considering the changing competitive landscape, South Korean producers need to adapt to the evolving petrochemical supply and demand trends and consciously tap into emerging markets.



TAIWAN

- Previously Taiwan was a petrochemical powerhouse, exporting to China approximately 10 million mmt annually.
- In the last few years, domestic producers have seen exports to China plunge by over 90 percent. With the signing of the Economic Cooperation Framework Agreement in 2013, bi-lateral economic arrangements with China are improving.
- With tariff barriers expected to fall, Taiwan's export competitive advantage over North Asia rivals will improve; yet questions will likely remain over their competitiveness vis-à-vis Chinese domestic players.
- Experiencing declining Chinese demand, expansion plans have stalled and sales focus has shifted towards the domestic market; however, the domestic petrochemicals market was subdued in 2013 and economic trends for 2014 have remained unsupportive.
- Expect industry-wide capacity utilisation rate cuts for a number of petrochemical products.

Figure 6: Asia PTA-PX spreads (quarterly average)

Source: Standard Chartered, KPMG Analysis

Over-Capacity Concerns

The diminishing margins in Asia Pacific's PX industry, illustrates the narrative of decline for North Asian commodity petrochemical producers.

Total ASPAC PX capacity-based projects coming on-stream from 2013-2017 is expected to grow by 40 percent, reaching over 40 million mt/year. In that time, South Korea's PX capacity growth is anticipated to rise by 94 percent from its current 5.4 million mt/year. China's PX capacity is expected to rise by 41 percent in the same period. In the Middle East, PX capacity during the same period is expected to surge by 200 percent, reaching 10.85 million mt/year by 2017, from the current 3.4 million mt/year.¹⁴ While upward demand trajectory spurred such capacity investment, PX producers are operating in a market that has changed significantly during the long lead time between the commissioning of these projects and them coming on-stream. Ultimately, the flood of new PX facilities has led to a regional over-capacity crisis.

With China also increasing its PTA capacity growth for self-sufficiency purposes, the North Asian PX market is quickly losing a core demand

market. The net-result for North Asian suppliers has been an imbalance between supply and demand, contributing to three years of narrowing PTA-PX spreads. The PTA-PX spread narrowed 83 percent from a quarterly average peak of USD 354/mt in 1Q11 to USD 70/mt in 3Q13, considerably below the industry's breakeven point of USD 150/mt (Figure 6).

North Asian producers are responding to tepid market conditions by optimising asset utilisation or in some cases, halting PX production altogether. In February 2014, South Korea's Hyundai Cosmo (HC) Petrochemical cut operating rates at its 800,000 tonne/year PX unit to 75 percent from 80 - 85 percent. Lotte Chemical's 250,000 tonne/year No 1 PX unit shut on squeezed margins.

Japan: Adapting to a New World Order

In Japan, the fiscal policies of Prime Minister Shinzo Abe, who took office in December 2012, have arrested deflation and helped produce moderate GDP growth.

A central feature of Abenomics has been aggressive fiscal stimulus, which has depreciated the value of

the yen and helped bolster chemical exports. However, despite a small rise in exports, imported raw material costs – which contribute the bulk of a base petrochemical producer's bottom line – have increased.

In 2018-2020, significant new ethylene production capacity will occur in North America, the Middle East and China, putting further downward pressure on operating rates.¹⁵ The mature economies of Europe and North Asia have an aging asset base with a feedstock choice limited mostly to naphtha and as such face adjustment. North Asian producers have two options: implement portfolio rationalisation or product specialisation.

Japan's ethylene consumption has trended down to around 5 million mt/year, while annual capacity remains around 7.6 million mt/year.¹⁶ Domestic overcapacity and reduced Chinese imports have led to companies Asahi Kasei, Mitsubishi Chemical, and Sumitomo Chemical announcing plans to shut or adjust ethylene units. Although it is a step in the right direction for Japan's olefins industry, capacity will still be 6.4 million mt/year and therefore an overcapacity gap will remain.

¹⁴ *Asian Paraxylene, End of Golden Years*, Platts, May 2013, accessed via <http://www.platts.com/news-feature/2013/petrochemicals/asia-paraxylene/index>

¹⁵ *A New World Order Evolving in Long-Term Ethylene Markets*, Wood Mackenzie, February 2014

¹⁶ *Japan: Heading for Higher Ground*, IHS Chemical Week, April 2014, accessed via <http://www.chemweek.com/>

Depicted below are some examples of the activities that North Asian petrochemical companies have adopted in order to ensure their survival in the petrochemical industry.

Case Studies



Case Study 1: Oil and Gas major seeks Cost Optimisation and Operational Excellence support:

An assessment was made of a Joint Venture (JV) between a global oil and gas major and a Taiwanese oil company. The client was a PTA manufacturer, facing the challenge of having excessive production capacity in a highly competitive domestic and regional market. Their challenges were compounded as export sales dramatically fell due to both increasing PTA production in China and a subsequent loss of intra-regional market share to those players.

The client was looking for support to reduce cost, improve operational excellence and cut losses in order to

re-stabilise and establish a platform for renewed growth. Opportunities with a Replacement Cost Operating Profit (RCOP) benefit range between USD 8.3, and 18.3m and working capital benefits between USD 2.8m and USD 5.8m were identified and strongly supported by the client.

Efficiencies were identified and delivered by:

- **The application of an External Investor Lens methodology** to bring an independent perspective to the JV. The estimated baseline costs were calculated, and used a hypothesis-driven approach to identify potential areas of improvement. Hypotheses were tested through the use of

comparator insights, analysis of the JV's performance data, and client interviews and workshops. Hypotheses covered the full range of activity in the business: direct production, maintenance, procurement, support functions, logistics and sales.

- **Strategy Realignment:** Potential opportunities to increase export sales and to reduce the number of active production lines to resize the business for the declining export market were reviewed.
- **Developed a supplier assessment tool** raise efficiency in the feedstock procurement process in an effort to reduce costs.

Case Studies



Regional Case Study

Case-Study 2: Mitsubishi Chemical – Road to Recovery

High energy and feedstock costs remain the most intractable problem for petrochemical producers. As a result, chemical manufacturers are switching their portfolios from petrochemicals to high-value-added, specialty products such as the life sciences, where technology determines the competitiveness, not raw material costs. Mitsubishi Chemical is one Japanese company that has adapted its operations and strategic approach to ground realities.

- **Portfolio Rationalization:** In May 2014, Mitsubishi Chemical

announced the shutdown of the company's number-one naphtha cracker and benzene unit at Kashima, Japan. Mitsubishi's 2014 ethylene output for the first quarter decreased by about 20.8 percent compared with the April–June 2013 quarter.¹⁷

- **Operational Restructuring:** Developing solutions to establish more efficient production configurations, as evidenced by efforts by Asahi Kasei and Mitsubishi Chemical to unify their naphtha crackers, aiming to achieve more efficient configuration. Operations will be consolidated at

the Mitsubishi facility at Mizushima, and Asahi Kasei's facility will be closed. The shared operation of a naphtha cracker will be managed under a 50-50 joint venture.

- **Value-add Products:** The company is divesting from general purpose petrochemical products and focusing on two growth areas where it holds an advantage, such as in high-performance industrial polymers (Figure 8). In refocusing its product strategy, Mitsubishi's polymers business, which is part of the company's industrial materials segment, reported a 12.6 percent rise in 1Q14 sales.¹⁸

Source: IHS Chemical Week

Summary

North Asia's petrochemical producers are at a crossroads. Faced with the rise of low cost competition and access to finished products from the US, Middle East and China and operating in a cyclical sector, North Asian producers need to drive a renewed focus on core

competencies. The industry is beset by overcapacity and low growth and the developing industry trends demand innovation and adaptability.

To regain competitiveness, North Asian producers will need to reassess their business strategies to optimize

operational structures and asset portfolios and redefine their product and customer strategies. In the absence of market consolidation, i.e. the overall trend of market configuration, companies can only look internally at what they do to ensure their survival.

¹⁷ Japan: *Heading for Higher Ground*, IHS Chemical Week, April 2014, accessed via <http://www.chemweek.com/>

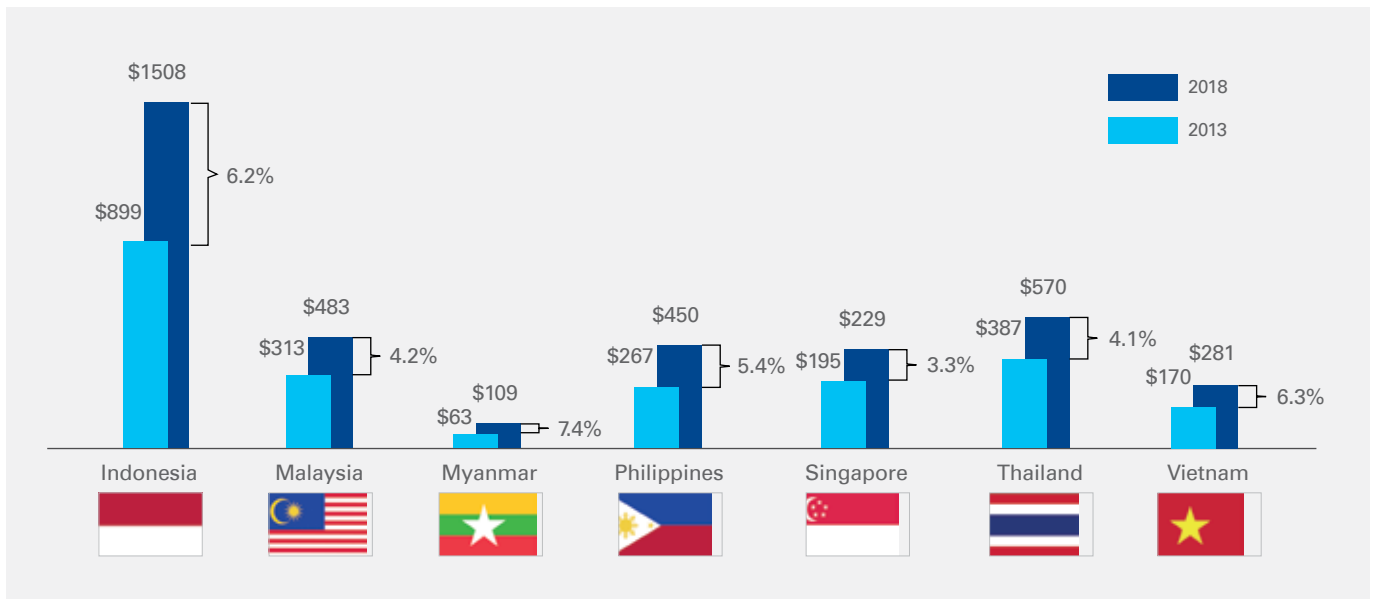
¹⁸ Japan: *Heading for Higher Ground*, IHS Chemical Week, April 2014, accessed via <http://www.chemweek.com/>

Intra-Regional Focus – ASEAN



With a population of 626 million – twice as large as the United States - and forming a combined GDP of US\$2.4 trillion, larger than Brazil, India or Russia, ASEAN stands out as a potentially huge market of untapped resources and opportunities.

Figure 7: GDP (USD bn), Real GDP Growth CAGR (2013 - 2018, %)



Notes: GDP values are real GDP adjusted with 2005 prices and exchange rates (base); 2. FDI range determined on 2011 data with a 15% adjustment
 Source(s): BMI; KPMG analysis
 Source(s): BMI; BP Data, KPMG analysis



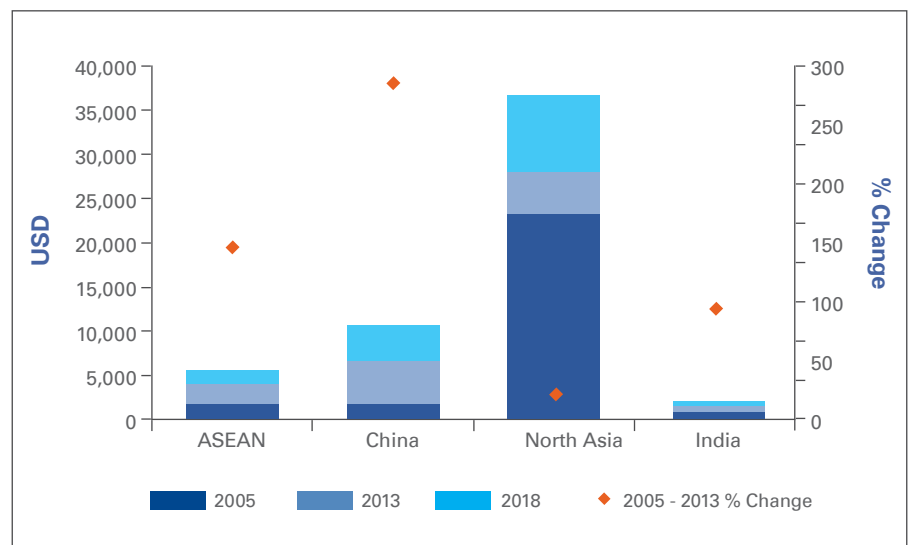
ASEAN: Moving as One

Global energy demand is heavily focused on Asia. Asia's imports will account for nearly 80 percent of inter-regional net imports by 2035, up from 57 percent today.¹⁹ In particular, ASEAN is poised to play a central role in this growth story. In December 2015, ASEAN will achieve its long held ambition to establish the ASEAN Economic Community, consolidating the ten member states into a single market and production base.

With a population of 626 million – twice as large as the United States and forming a combined GDP of US\$2.4 trillion, larger than Brazil, India or Russia, ASEAN stands out as a potentially huge market of untapped resources and opportunities. While global GDP growth is anticipated to be 3.8 percent for 2015, ASEAN-5 is forecast to be 5.3 percent.²⁰ The intention of the ASEAN Economic Community is to not only be an integrated market but a single investment destination, facilitating intra-regional trade, foreign direct investment and energy connectivity. Indeed, large economic powers such as China, Japan, India, South Korea, and Australia-New Zealand have already reached out to ASEAN to establish Free Trade Agreements with (FTAs).²¹

With ASEAN's modernisation, the region's GDP per capita grew approximately 150 percent from 2005-2013 (Figure 8). Admittedly

Figure 8: Asia: GDP Per Capita Growth



Source: IMF World Outlook Database 2013, 2014

from a low base, the rate of GDP per capita growth in ASEAN is eight times that of North Asia. With such a development in consumer income, domestic consumption levels of commodity petrochemicals and plastics increase markedly. This transition has taken place in ASEAN and presents petrochemical investors with significant opportunities, particularly as capacity output, although growing, remains behind the intra-regional demand.

As Figure 9 and 10 depict, the ASEAN region faces an alarming oil and gas security dilemma. The declining productivity and increasing consumption of the region's traditional oil and gas export leaders, Indonesia and Malaysia, has resulted in these

countries becoming net-energy importers. Consequently, ASEAN petrochemical companies are highly vulnerable to supply disruption, geopolitical volatility and regionally high oil and gas feedstock prices. These exposures drive up delivered feedstock and utility costs and push down petrochemical margins (Figure 11).

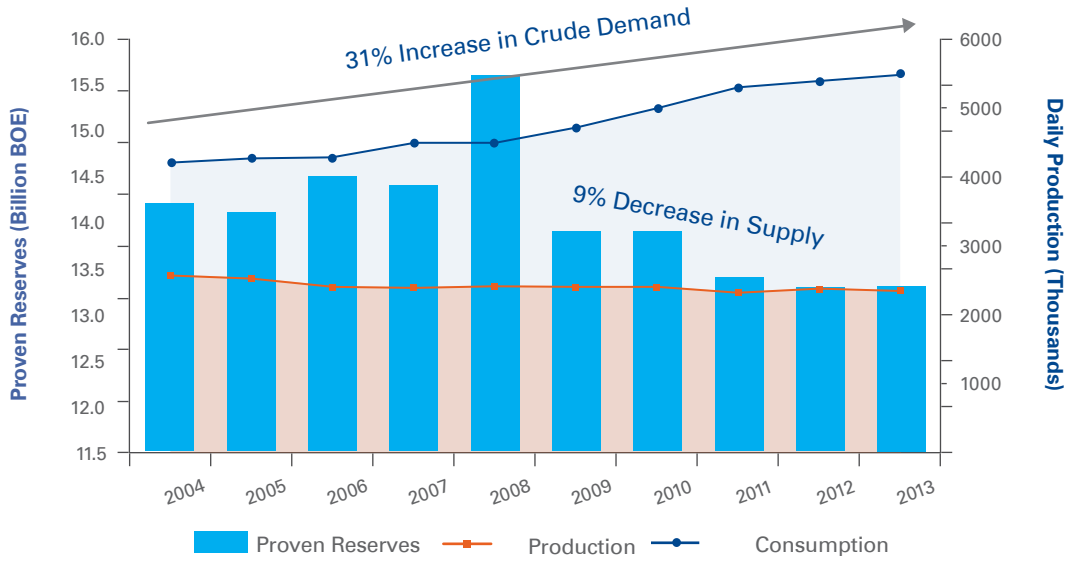
Table 4 illustrates a country snapshot of the diverse petrochemical activity in ASEAN. If ASEAN producers are to serve the nascent demand potential, they must drive down feedstock costs and adapt to the surrounding competitive environment, or downstream petrochemical consumers will look to China, US and Middle East to access lower priced raw materials.

¹⁹ BP Energy Outlook, 2035, BP, accessed via http://www.bp.com/content/dam/bp/pdf/Energy-economics/Energy-Outlook/Energy_Outlook_2035_booklet.pdf

²⁰ World Economic Outlook, 2014, IMF, accessed via, <http://www.imf.org/external/pubs/ft/weo/2014/02/pdf/c2.pdf>

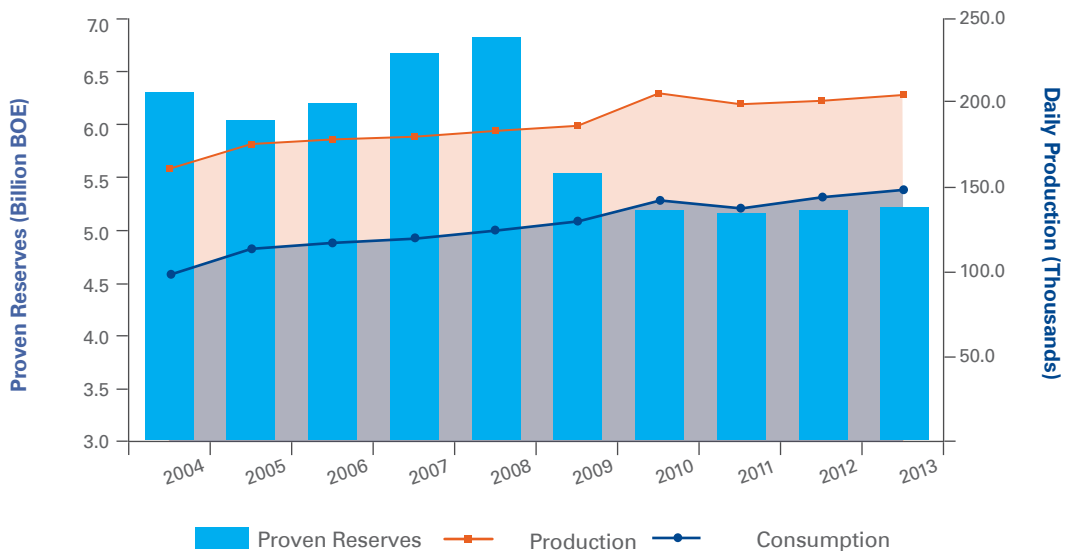
²¹ Kishore Mahbubani, Lee Kuan Yew School of Public Policy, Singapore, accessed via: <http://www.energyboardroom.com/interviews/interview-kishore-mahbubani-lee-kuan-yew-school-of-public-policy-singapore>

Figure 9: ASEAN Crude: Supply & Demand Dynamics



Source: BP Statistical Review, 2014

Figure 10: ASEAN Gas: Supply & Demand Dynamics



Source: BP Statistical Review, 2014

Figure 11: Petrochemical Margin Calculation

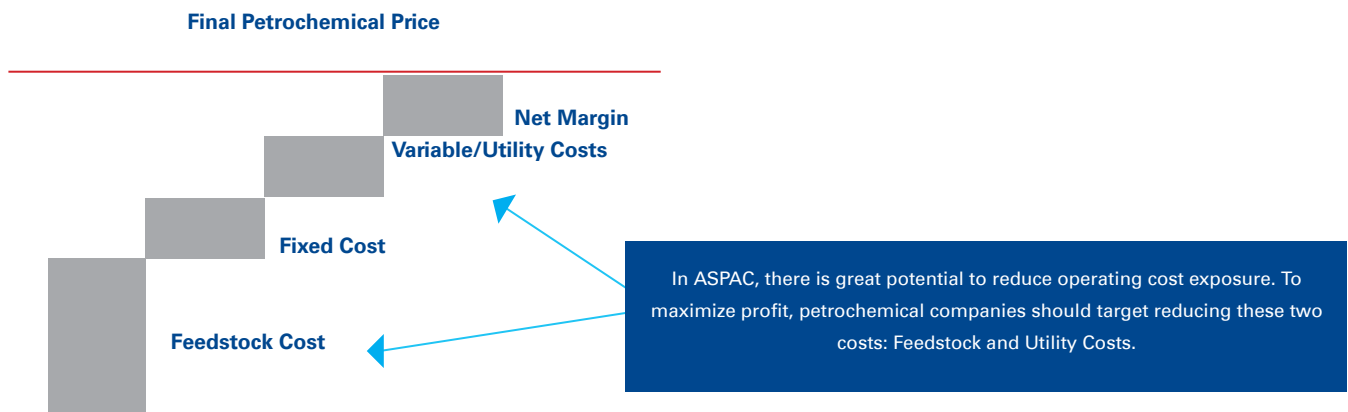


Table 3: ASEAN Petrochemical Country Snapshot

	<ul style="list-style-type: none"> • Approximately 90 percent of Indonesia's cracker feedstock is naphtha. • One of the petrochemical business is the lack of production integration. Due to regulatory policy, petrochemical players in Indonesia lack value chain integration. Foreign companies can only operate in either the upstream or downstream sector, not both. • Crude oil production declined to 826,000 b/d in 2013. This is approximately 50 percent of oil produced in 1995. As such, security of feedstock is a concern. Indonesia is now a net-oil importer, contributing to a rising fiscal deficit. • Vast and economically growing demand market of over 300 million people, presents a huge opportunity to investors. Demand for petrochemical products far outweighs domestic supply. • There is particular need for commodity petrochemical investment such as in PE, which has import portions ranging from 20 - 100 percent and PP, which has an import share of 30 percent. • To penetrate the Indonesian market, a joint venture with local partners is one solution that will facilitate market entry and operations.
	<ul style="list-style-type: none"> • Fiscal reform has catalysed deepwater & EOR investment. In 2012, Malaysia discovered the fourth largest amount of hydro carbons in the world - the first time in many years a Southeast Asian state has been in the top ten. • Petronas's refinery and petrochemical integrated development (RAPID) project has been postponed to 2018, putting back 3 mtpa of new petrochemical capacity and a refinery with a processing capacity of 300,000 b/d. • The facility will feature SRT VII cracking heaters, which are designed for cracking gas and liquid feedstock to produce 1.1 million tonnes of ethylene each year. • RAPID has potential to be a world-class and competitive project, rivalling the petrochemical plants of Singapore. Malaysia's Johor belt has the potential to meet its ambition to become a leading integrated refinery, petrochemical & storage hub in ASPAC; but to sustainably compete, domestic petrochemical plants must tap into gas sources.
	<ul style="list-style-type: none"> • Growth in the domestic resins market is prompting petrochemical producers in the Philippines to consider investment in downstream industries. Despite attracting international players, the domestic petrochemical industry is still in its infancy compared to that in North Asia and Singapore. • With lackluster upstream activity, the Philippines is highly reliant on import oil and gas. • A factor affecting the viability of the industry is the subject of incentives, fiscal and non-fiscal, which will be made available to future plants. The ultimate objective is for naphtha to have a zero tariff, being the primary raw material of the cracker. Capital incentives and tax holidays are also expected to boost the otherwise marginal returns of the cracker plant. • The Philippines economy is forecasted to grow at a real GDP growth rate of 6.3 percent in 2014. With GDP per capita increasing markedly, there is a growing domestic demand for petrochemical products and plastics.
	<ul style="list-style-type: none"> • The Singapore government has proactively fostered a competitive and modern refining and petrochemical industry. Jurong Island remains a magnet for petrochemical investment. • Gradually turning away from commodity petrochemicals and towards high-value specialties. ExxonMobil, Shell and Lanxess have all channeled huge investment into expanding the technological prowess and energy efficiency capabilities of their petrochemical complexes. • Despite no natural energy resources, Singapore has sought to reduce feedstock exposure by supporting technological advancement and energy efficiency through establishing various R&D science parks. • First LNG terminal opened in 2013, there are plans for a second one. The diversification of Singapore's gas supplies will reduce gas feedstock supply concerns.
	<ul style="list-style-type: none"> • Supported by offshore gas fields in the Gulf of Thailand, the Map Ta Phut industrial complex, has grown into one of the world's biggest petrochemicals hubs. • Thailand's petrochemicals outlook however has been overshadowed by domestic political unrest. Thailand has cut natural gas imports after demand growth in Asia's fourth-largest user of the fuel plummeted to two-decade lows. • The economy has experienced a slowdown. Hopes for export-oriented growth to offset domestic sales have not come to fruition. This is partly because China has become increasingly self-sufficient in petrochemicals. • Due to internal country risk, Thailand's petrochemical players PTTGC and SGC have looked to other markets in ASEAN, in particular Indonesia. In late 2013, PTTGC signed a Memorandum of Understanding with Pertamina to form a JV to establish a fully integrated petrochemical plant. The plant will produce products such as ethylene and propylene and commence operations during 2018, and it is hoped that it will eventually enjoy a 30 percent market share.
	<ul style="list-style-type: none"> • Self-sufficiency in oil production gives a feedstock advantage, which has supported the development of the petrochemicals industry. Margins however, are dictated by crude oil prices and as such are subject to cost volatility. • Has attracted some foreign investment for polyvinyl chloride (PVC) production. • A lack of refining capacity has hamstrung the domestic petrochemical industry for years. With a desire for value-chain integration, refining expansion plans - tripling capacity by 2017 - will improve margins.

Source: KPMG Analysis, SCBEIC, Oil & Gas Journal, BP Statistics

If ASEAN producers are to serve the nascent demand potential, they must drive down feedstock costs and adapt to the surrounding competitive environment, or downstream petrochemical consumers will look to China, US and Middle East to access lower priced raw materials.

Singapore – Innovation & Integration

Singapore through its well-integrated and modern refining, petrochemical, storage and trading infrastructure can act as a role model for the wider region. Jurong Island illustrates the proactive role of the Singapore government in developing a competitive and modern refining and petrochemical industry.

For decades petrochemical companies have been drawn to Singapore because of its efficient infrastructure, protection of intellectual property and attractive fiscal regime.

The emerging economies with fast growing populations (in particular: Vietnam and Indonesia) have the potential to become major demand

centers for finished products in Asia. Petronas' Refinery and Petrochemical Integrated Development (RAPID) project is an example of rising competition in ASEAN. The complex includes a naphtha cracker which will produce 3mmt of ethylene, propylene, C4 and C5 olefins annually. It also includes a petrochemical and polymer complex which will produce C4 and C5 derivatives. With such development, Malaysia's Johor belt has the potential to become a leading integrated refinery, petrochemical & storage hub in ASPAC, following Singapore's journey. Such competition indicates the intensifying competition within ASEAN, particularly at the lower end of the value chain.

In response to rising global and regional competition, Singapore has

adapted by shifting its petrochemical focus towards value-add chemicals.

The government's long-standing promotion of energy efficiency and specialty products has generated further international investment. Various R&D science parks are used to support technological developments. Mitsui Chemical established its first overseas R&D Centre in Singapore R&D Centre in 2006. Mitsui Chemical teamed up with the government's A*Star research agency to conduct research on catalysis science and technology. In 2006 BASF SE established its R&D Lab. With ASEAN and Asian basic chemical overcapacity issues, Singapore has been proactive in staying ahead of the technological curve to remain competitive.



Keeping Ahead of the Curve

In Singapore, major IOCs have recently pursued innovation initiatives to enhance their petrochemical capabilities in ASPAC. ExxonMobil's petrochemical expansion in 2013 was the single largest investment in its chemicals business, contributing a quarter of the company's global chemicals capacity. The plant develops a number of high performance polymers and specialty products, including proprietary

specialty elastomers.²²

An example of the high performance polymers can be seen in the polypropylene chemical plant. The plant is among the world's highest in capacity, using the ExxonMobil Polypropylene Technology for producing homo-polymer and impact co-polymer resins. ExxonMobil also licenses this proprietary innovation, which is a pioneering integration of polypropylene slurry and gas phase technologies.

Illustrating the sector's continued push towards innovation, the new cracker gives ExxonMobil the capability to bypass the refining processing steps and process crude directly into petrochemical products.²³ Such technological advancement is indicative of the competitive forces in the industry, helping ExxonMobil enhance its operational and technological excellence, while simultaneously improving its energy efficiency and lowering emissions.

²² ExxonMobil, Singapore Country Website, http://www.exxonmobil.com.sg/AP-English/about_who_profile_chemical.aspx

²³ Interview, ExxonMobil, Singapore, March 2013, accessed via www.energyboardroom.com

Singapore through its well-integrated and modern refining, petrochemical, storage and trading infrastructure can act as a role model for the wider region.

Table 4: ASEAN PETROCHEMICAL CHALLENGES & SOLUTIONS

Challenges	Three Step Success Strategy
<p>Dwindling Feedstock Supplies: Similar to North Asian producers, ASEAN producers are exposed to high operational (feedstock and utility) costs. It is not so much the absolute feedstock cost, but the relative difference compared to other regions such as the US, Middle East and increasingly China. For now, the cost structure they are operating on is significantly higher than these rival regions.</p>	<p>Diversify Feedstock: On the back of voracious domestic demand, a number of ASEAN countries have bold plans for their petrochemicals industry. New capacity builds need to achieve feedstock flexibility, particularly NGLs.</p>
<p>Talent Crisis: NOCs in particular face a tremendous challenge is procuring the talent with the right skill-set. In ASEAN, finding talent with technical expertise, particularly in engineering, is a difficult task.</p> <p>Going for Specialty: Singaporean producers with no feedstock cost advantage should aim to reduce raw material vulnerability by shifting away from commodity petrochemical products and towards speciality products. Producers that focus on specialty chemicals such as life sciences are more exposed to technological prowess, than raw material costs.</p>	<p>Change Management: NOCs should seek third party change management services. People and change management is designed to facilitate the effective transition of an organization and its people from current to future state and in doing so support the realization of business benefits.</p>
<p>Competitiveness: ASEAN countries, in particular Vietnam, Indonesia and Malaysia, have embarked on basic petrochemical product expansion. As a result of capacity excesses in ASPAC, overcapacity in the olefins and aromatics markets are suppressing market potential.</p>	<p>Operational Restructuring: In light of the changing market dynamics, ASEAN producers need to scrutinise their operational structures. A successful strategy will focus on quality business units, successfully divest non-performing assets and ruthlessly restructure the operational cost base in an effort to prepare for the next stage in the business cycle.</p>



Conclusion:
The petrochemical industry in ASPAC must be regarded as a multi-faceted, cross-regional system with many moving parts. There are also intra-regional dependencies which impact competitive positioning and relative success in the short and longer term.

There are certain parameters that

define how regions interact. Global and regional supply and demand forces are reshaping ASPAC's petrochemical industry, with influence from as far as the US and China. No region or country is immune to the fast changing trade, supply and capital flows shaping the industry. China's self-sufficiency drive and its subsequent erosion of North Asia's petrochemical standing, demonstrates how one

region can impact another.

To compete sustainably in this evolving ecosystem, investors and producers must adapt to their regional environments. Through introspection, ASPAC based petrochemical producers must rationalise their portfolios, enhance their operational excellence and ensure that they strategically adapt to macro trends and market realities.

The KPMG Global Energy Institute (GEI):

Launched in 2007, the GEI is a worldwide knowledge-sharing forum on current and emerging industry issues. This vehicle for accessing thought leadership, events, webcasts and podcasts about key industry topics and trends provides a way for you to share your perspectives on the challenges and opportunities facing the energy industry – arming you with new tools to better navigate the changes in this dynamic arena. A regional focus to the GEI provides decision makers with tailored insight within the North and South America, Asia Pacific and Europe, Middle East & Africa regions.

Register today to become a member of the KPMG Global Energy Institute, visit: kpmg.com/energyaspac



#KPMG_GEI

The KPMG Global Energy Conference (GEC):

The GEC is KPMG’s premier event for executives in the energy industry. Presented by the KPMG Global Energy Institute, these conferences are held in both Houston and Singapore and bring together energy executives from around the world in a series of interactive discussions with industry luminaries. The goal of these conferences is to provide participants with new insights, tools and strategies to help them manage industry-related issues and challenges.

For more information please visit kpmg.com/energyaspac



#KPMGGEC



CONTACT US

Pek Hak Bin

Partner, Head of Energy & Natural Resources

T: +65 6411 8138

E: pekhb@kpmg.com.sg

Mark Elia

Director, Energy & Natural Resources

T: +65 6507 1900

E: melia@kpmg.com.sg

Tim Rockell

Director, KPMG Global Energy Institute Asia Pacific

KPMG in Singapore

T: +65 6507 1998

E: trockell1@kpmg.com.sg

Paul Harnick

Global COO, Chemicals and Performance Technologies

T: +44 2076 948 532

E: paulharnick@kpmg.com

kpmg.com/energyaspac
kpmg.com/socialmedia



kpmg.com/app



The views and opinions expressed herein are those of the author and do not necessarily represent the views and opinions of KPMG LLP. The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity.

The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. Although we endeavour to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. No one should act upon such information without appropriate professional advice after a thorough examination of the particular situation.

© 2014 KPMG Services Pte. Ltd. (Registration No: 200003956G), a Singapore incorporated company and a member firm of the KPMG network of independent member firms affiliated with KPMG International Cooperative ("KPMG International"), a Swiss entity. All rights reserved.

The KPMG name, logo and "cutting through complexity" are registered trademarks or trademarks of KPMG International.

Publication name: Asia Pacific's Petrochemical Industry: A Tale of Contrasting Regions