

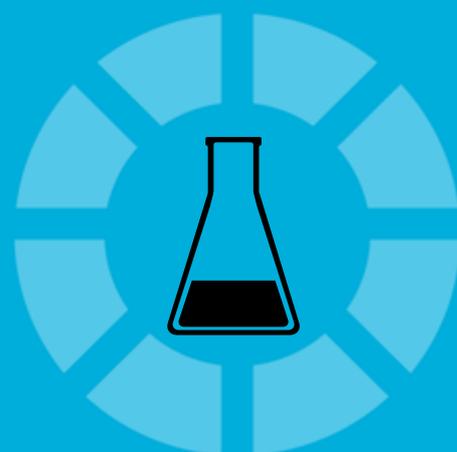
**Q3 2015**

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# **IRAN**

## **PETROCHEMICALS REPORT**

INCLUDES 5-YEAR FORECASTS TO 2019



# Iran Petrochemicals Report Q3 2015

INCLUDES 5-YEAR FORECASTS TO 2019

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## Part of BMI's Industry Report & Forecasts Series

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## BMI Industry View

***BMI View:** The future of the Iranian petrochemicals industry is brightening, with prospects of a lifting of sanctions. We note, however, that the country will be unable to ramp up production and attract investment in the long term unless talks over its nuclear programme result in a breakthrough.*

If Western sanctions are lifted, Iran's petrochemicals capacity is expected to reach 100mn tonnes per annum (tpa) by 2020. Until now, the industry's capacity utilisation levels have been low due to a collapse in exports; and many projects are half-completed and in dire need foreign investment. At the same time, domestic consumption has been hard hit by the country's isolation. As a result, while the prospect of a lifting of sanctions will improve the outlook for the country's petrochemicals industry, it will be a long road to full recovery.

In addition, while plants may nominally come on stream, operation rates are likely to be low and plants will be operating at a loss unless Iranian producers can pass on the full costs of production onto consumers in export markets. To operate at reasonable levels of capacity utilisation, olefins output would have to increase by a third and polymers by a third, but the demand may not exist and may not have existed even without the sanctions regime.

### **Key Developments And BMI Forecasts**

- By 2019, Iranian ethylene capacity should have exceeded 11mn tpa and polymers capacity should be around 10mn tpa, with much of the expansion completed over the next two years.
- The automotive industry is seeing a surge in output, which is stimulating consumption of a wide range of petrochemicals used in car-making, including synthetic rubber, engineering plastics and polyurethanes.
- However, the construction industry is set for slow growth, which will limit the market performance of construction-related petrochemicals although there will still be a turnaround from the years of contraction.
- This quarter, Iran has marginally raised its Petrochemicals Risk/Reward index score by 0.2 points due to a 5.0 points improvement in its market risk score. However, its market risk score remains one of the lowest in the region due to the dominance of state-owned enterprises, uncertainties in feedstock and structural problems within the market. Iran remains in third place in the Middle East and Africa region, 2.1 points ahead of Qatar and 3.6 points behind the UAE.

# SWOT

## SWOT Analysis

### Strengths

- OPEC's second largest oil producer, accounting for 10% of the world's oil reserves, providing easy and inexpensive access to abundant petrochemicals feedstock.
- The petrochemicals sector is set for rapid expansion.
- Import and export incentives offered in special economic zones, good relations with neighboring countries and a favourable location are key advantages for the industry.
- A large domestic market, skilled workforce and laws supporting foreign investments.

### Weaknesses

- International sanctions have impacted on petrochemicals projects, leading to a fall in exports and related decline in capacity utilisation, while joint ventures with foreign firms have been delayed or abandoned.
- Iran is a late developer in petrochemicals and is at least a decade behind regional rivals such as Qatar and Saudi Arabia.
- Historical lack of expertise at the state-owned National Petrochemical Company makes it difficult to successfully commission new petrochemicals plants in the country.
- Lack of access to foreign technology; concerns about future if trade sanctions stepped up.

### Opportunities

- The alleviation of international sanctions will provide foreign investors with an opportunity to participate in the sector's expansion, although the business environment will remain challenging.
- Development of the massive South Pars gas field and greater utilisation of associated oil and gas in other fields will increase the amount of available raw feedstock.
- Development of petrochemicals special economic zones.
- Ethylene supplies are being extended and pipeline capacity doubled.

**SWOT Analysis - Continued**

- Iran needs foreign companies' technology.
- Establishment of new free zones in Arak, north-west Iran, and the development of Jolfa into a mega-port is expected to enhance trade with neighbouring countries such as Azerbaijan (including the autonomous Nakhchivan enclave) and Armenia.

**Threats**

- Concerns over oil production levels could undermine sector growth if feedstock supply is less than originally thought.
  - Cancellations of existing contracts with foreign companies by Iran could deter future foreign direct investment.
  - The prices of petrochemicals products in Iran are about 50-70% lower than international market prices, which is likely to hinder the domestic sector.
-

## Political

### Political SWOT Analysis

- Strengths**
- Since the overthrow of the Pahlavi family in 1979, there has been some reduction in the level of political corruption, while wealth distribution has improved marginally.
  - The Revolutionary Guard and Basij militia are fiercely loyal to the supreme leader, helping to maintain social stability.
- Weaknesses**
- The country has one of the poorest human rights records in the region, and authorities do not hesitate to quell dissidents. A number of journalists and anti-government protesters are being held in custody.
  - While decision-making ultimately rests with the supreme leader, the regime is heavily fragmented, and consensus is hard to reach.
  - Widespread perceptions of electoral fraud during the course of June 2009's presidential elections have damaged the regime's legitimacy in the eyes of many Iranians.
- Opportunities**
- The Majlis (parliament) is more than just a rubber stamp; the move by 150 parliamentarians (out of 290) to hold former president Mahmoud Ahmadinejad accountable for his handling of the economy in March 2012 is a positive indication that checks exist.
  - The victory of moderate cleric Hassan Rouhani in Presidential elections in June 2013 is leading to a significant improvement in relations with the West.
- Threats**
- Despite progress in nuclear talks, the prospect of further US and EU sanctions and the possibility of a military strike by the US or Israel cannot be dismissed.
  - Youth unemployment is high.
  - The strong influence of the Revolutionary Guards within the political and economic arena will continue to present a challenge to reform.

## Economic

### Economic SWOT Analysis

- Strengths**
- Iran has the world's second largest proven oil reserves after Saudi Arabia, and the world's second largest proven gas reserves after Russia.
  - Oil and gas aside, Iran is rich in other resources and has a strong agricultural sector.
- Weaknesses**
- Local consumption of hydrocarbons is rising rapidly; this, coupled with ageing technology in the sector, will have a negative impact on its oil and gas exporting capacity.
  - International sanctions discourage foreign oil companies from bringing much-needed technical knowledge and equipment to maintain oil output levels.
- Opportunities**
- The gas sector remains underdeveloped despite significant improvements in recent quarters, and there is considerable room to maximise this source of revenue.
  - A shortage of housing, provides opportunities for investment in residential construction.
- Threats**
- Lower oil prices will have a marked impact on the economy. Although an Oil Stabilisation Fund exists to protect the economy at times of weaker oil prices, it has increasingly been used to fund government overspending and could be close to empty.
  - Capital flight could accelerate should negotiations on the nuclear programme fail.
-

## Operational Risk

### SWOT Analysis

#### Strengths

- Iran boasts high numbers of skilled graduates in technical fields such as engineering, construction and science.
- The transport network offers good internal and cross-border connections, and is currently able to meet the country's supply chain needs.
- The banking sector is relatively well developed, allowing extension of finance and credit to citizens.
- A well established intelligence agency and robust counter-terrorist capabilities deter attacks in most areas of the country.

#### Weaknesses

- Costs of employment are increases because the Iranian Labour Code affords workers a high level of protection and generous benefits.
- The costs of inland transportation, as well as the risk of congestion and traffic accidents disrupting supply chains, is raised due to reliance on the road network as the dominant freight mode.
- There is widespread corruption and heavy handed censorship, which will pose unforeseeable operational costs and limit business activities.
- The expansion of IS in Iraq poses a significant risk to Iran's security.

#### Opportunities

- The literacy rate of the labour force is increasing as the benefits of investment in primary school education are filtering through.
- The development of road and rail connections with Iran's neighbours highlights the country's potential to develop into key transit point for East-West trade.
- Lack of external demand means that those who can invest in Iran are rewarded with cheap resources.
- Relaxing of sanctions is resulting in greater foreign direct investment inflows.

**SWOT Analysis - Continued**

**Threats**

- There is potential to combat the drug supply into Europe through programmes in Iran.
  - The availability of highly skilled labour is restricted as the brain drain results in an exodus of technically qualified workers.
  - The risk of electricity and water shortages will be enhanced due to growth in energy- and water-intensive agricultural, mining and manufacturing industries.
  - Lax intellectual property protection carries the threat of patent theft, fraud or infringement, leading to profit losses.
  - There is a risk of domestic hostility towards Westerners, triggered by international political events.
-

## Industry Forecast

***BMI View:** The prospect of sanctions relief is stimulating the Iranian petrochemicals industry with the government seeking to increase petrochemicals output by 7.5mn tonnes in 2015/2016, led by exports. While strong growth in the automotive industry is set to stimulate domestic consumption, the construction sector will see slower rates of growth.*

### Production

The country has significantly expanded the range and volume of its petrochemical production in recent years. Iran has the capacity to produce about 60mn tonnes of petrochemicals a year, but only 68% of this capacity is tapped on average due to several reasons, including a shortage of raw material.

Iran's **National Petrochemical Company** (NPC) announced in Q115 that it will launch 15 new petrochemical units by FY16/17, thereby increasing the country's capacity by 8.5mn metric tonnes. Currently 60 petrochemical plans are underway in the country. However, Deputy Oil Minister for Petrochemical Affairs Abbas Sheri Moqaddam anticipates a lower rate of expansion with 11 new petrochemical units providing 6mn tonnes per annum (tpa) of capacity. With the utilisation of existing plants expected to improve, the government is anticipating an increase in petrochemicals output of 7.1mn tonnes in FY2015/16. Resumption of exports will also help raise Iran's share of the Middle East's production output from 25% in 2014, although there are still doubts that it will reach its target of a 41% regional market share by 2020. However, in the short-term, the industry is grappling with the issue of falling crude oil prices, which are leading to a concurrent slump in naphtha prices. With the Iranian petrochemicals industry dependent on ethane for 80% of its feedstock and naphtha for just 8%, the narrowing price differential between ethane and naphtha threatens Iranian petrochemicals margins.

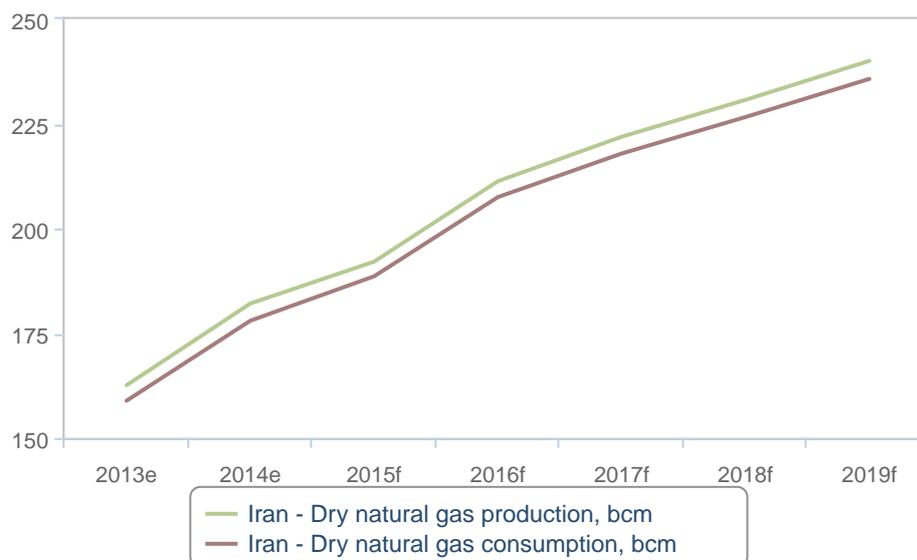
By 2022, the government targets petrochemicals output of 180mn tonnes with growth largely dependent on gas extraction, a figure that can only be achieved with vastly increased access to ethane as well as continued improvement in international relations. **BMI** forecasts that by 2019, ethylene capacity alone will total 11.08mn tpa, with the completion of the Olefins 11 and 12 projects, which will have capacities of 2.0mn tpa and 1.2mn tpa respectively. In the absence of any current decision to postpone the projects, **BMI** has included these capacities in its forecasts.

The surge in capacity will not be sustainable if feedstock supply is not forthcoming and markets do not absorb output. While the plants may nominally come on stream, operation rates are likely to be low and plants will be operating at a loss unless Iranian producers can pass on the full costs of production onto

consumers in export markets. To operate at reasonable levels of capacity utilisation, olefins output would have to increase by a third and polymers by a third, but the demand may not exist and may not have existed even without the sanctions regime.

## Gas Production Will Lag Behind Demand

Iran: Gas Production and Consumption, 2012-2019f



BMI/EIA

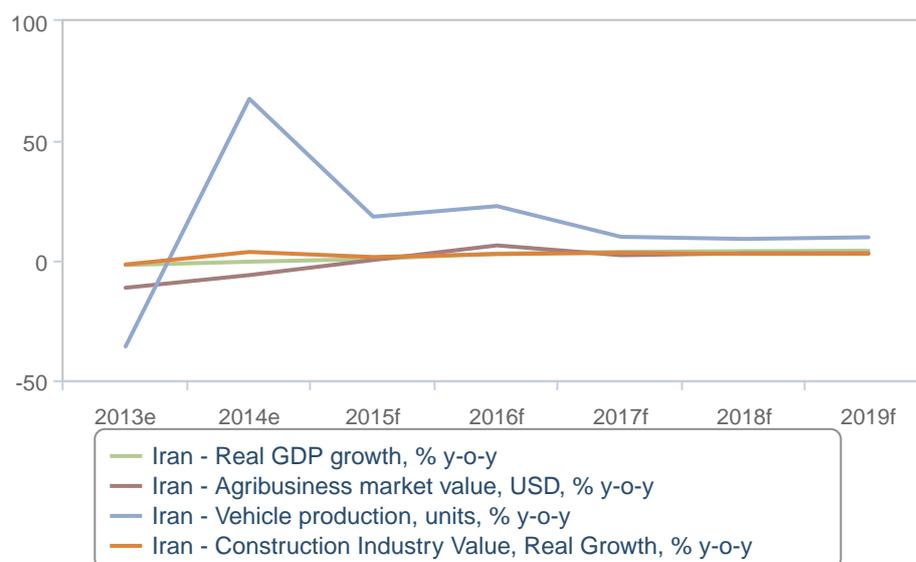
The industry faces significant structural challenges. The industry continues to ramp up capacities well ahead of demand growth, while at the same time some complexes are suffering feedstock shortages particularly during winter months. Iranian petrochemical complexes need 30-35mn cubic metres of gas per day. Aside from pressure on supply, Iranian ethane feedstock is nearly three times more expensive than in Saudi Arabia. This could change if the petrochemicals sector is able to raise the proportion of total natural gas allocated to the petrochemicals industry from 7% to 25% by 2015. This, too, looks set to fail owing to a crunch in investment.

Iran's main export market, China, will also move towards self-sufficiency, while Asian markets will be increasingly supplied by low-cost US petrochemicals output. Low-capacity utilisation is therefore going to be an enduring problem. Moreover, although Iran will be keen to secure tie-ups with European

petrochemicals producers, the country will retain a highly risky business environment and there is no certainty that Iran's isolation will end. The industry will need foreign skills and equipment if it is to add value to output and diversify its product portfolio.

## Autos Revival Will Secure Growth

Growth Rates For Iran's Key Petrochemicals Consumption Markets



National Sources/BMI

## Consumption

The automotive industry is undergoing a resurgence of activity as a result of economic recovery with output exceeding 1mn units in 2014 due to 67% growth. Strong growth is expected to continue throughout the forecast period, which should stimulate domestic consumption of a wide range of petrochemicals used in car-making, including synthetic rubber, engineering plastics and polyurethanes.

On the downside, the construction industry is set for slow growth, which will limit the market performance of construction-related petrochemicals such as polyvinyl chloride (PVC) and certain applications of polyethylene (PE) and polypropylene (PP). However, there will still be a turnaround from the years of contraction.

**Table: Iran's Petrochemicals Industry, 2011-2019 ('000 tpa, Unless Otherwise Stated)**

	2011	2012	2013	2014e	2015f	2016f	2017f	2018f	2019f
Ethylene capacity, '000 tpa	5,376	7,876	8,376	8,876	11,076	11,076	11,076	11,076	11,076
Propylene capacity, '000 tpa	1,430	1,870	1,960	2,410	2,740	2,740	2,740	2,740	2,740
Benzene capacity, '000 tpa	1,090	1,090	1,090	1,390	1,770	1,770	1,770	1,770	1,770
Tolouene capacity, '000 tpa	625	625	625	825	825	825	825	825	825
Butadiene capacity, '000 tpa	240	240	240	240	240	240	240	240	240
Styrene capacity, '000 tpa	695	695	695	1,295	1,295	1,295	1,295	1,295	1,295
Acrylonitrile butadiene styrene capacity, '000 tpa	90	290	290	290	290	290	290	290	290
Styrene-butadiene rubber capacity, '000 tpa	90	90	90	90	90	90	90	90	90
Xylenes capacity, '000 tpa	1,590	1,590	1,590	1,690	2,310	2,310	2,310	2,310	2,310
Ethylbenzene capacity, '000 tpa	100	100	100	100	100	100	100	100	100
Ethylene dichloride capacity, '000 tpa	700	700	1,260	1,260	1,260	1,260	1,260	1,260	1,260
Ethylene glycol capacity, '000 tpa	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950	1,950
Ethylene oxide capacity, '000 tpa	1,770	1,770	1,770	1,770	1,770	1,770	1,770	1,770	1,770
High density polyethylene capacity, '000 tpa	1,785	1,785	2,385	2,685	2,685	2,685	2,685	2,685	2,685
Low density polyethylene capacity, '000 tpa	775	2,075	2,375	2,375	2,375	2,375	2,375	2,375	2,375
Linear low density polyethylene capacity, '000 tpa	1,095	1,395	1,995	1,995	1,995	1,995	1,995	1,995	1,995
PE capacity, '000 tpa	3,655	5,255	6,755	7,055	7,055	7,055	7,055	7,055	7,055
Polypropylene capacity, '000 tpa	1,040	1,040	1,040	1,290	1,290	1,290	1,290	1,290	1,290
Vinyl acetate capacity, '000 tpa	180	180	320	320	320	320	320	320	320
Vinyl chloride capacity, '000 tpa	630	630	930	930	930	930	930	930	930
PVC capacity, '000 tpa	400	640	640	940	940	940	940	940	940
PS capacity, '000 tpa	250	250	250	250	250	250	250	250	250
Polyethylene terephthalate capacity, '000 tpa	705	705	705	705	705	705	705	705	705
Methanol capacity, '000 tpa	5,345	8,865	11,505	14,705	14,705	14,705	14,705	14,705	14,705
Ammonia capacity, '000 tpa	4,930	4,930	6,365	6,365	6,605	6,605	6,605	6,605	6,605
Urea capacity, '000 tpa	7,405	7,405	10,620	10,620	12,560	12,560	12,560	12,560	12,560

e/f = estimate/forecast. Source: BMI

## Macroeconomic Forecasts

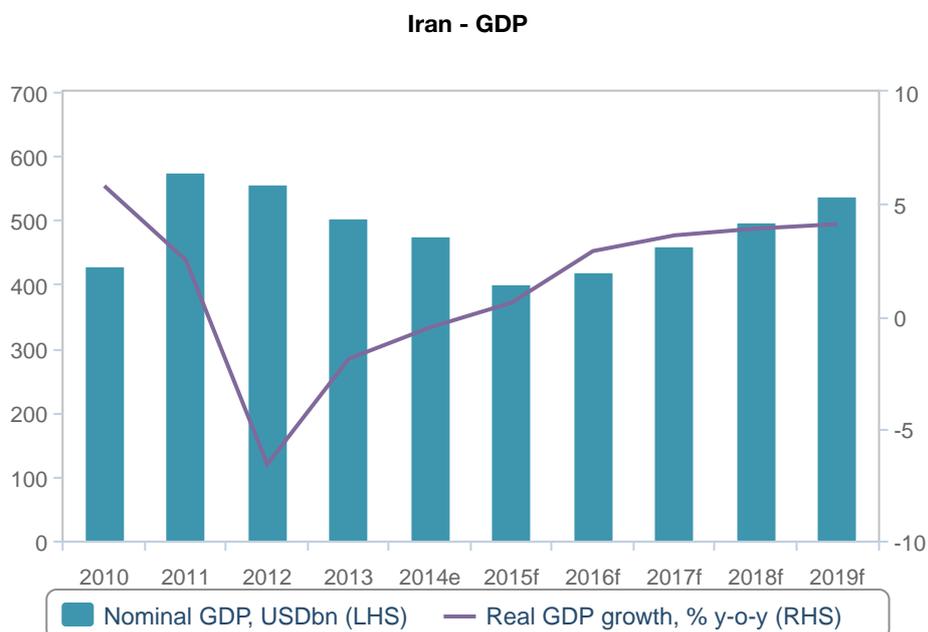
### Economic Analysis

***BMI View:** Real GDP growth in Iran will slow in 2015. Lower oil prices will force the government to cut spending, and a failure to reach a breakthrough in nuclear talks will ensure that foreign investment remains low. We have revised downward our real GDP growth forecast for the Iranian economy at 1.4% in 2015 and 2.2% in 2016, from 2.1% and 3.0% previously.*

The Iranian economy will expand slowly in 2015 compared to 2014, as oil prices are low and talks on the nuclear programme fail to reach a breakthrough. We have revised downward our real GDP growth forecast at 1.4% in 2015 and 2.2% in 2016, respectively, from 2.1% and 3.0% previously. The pace of growth will be marginally higher than demographic expansion, implying small productivity gains over the coming quarters.

Declining oil prices will force the government to cut current spending and investment in the country's infrastructure sector, which will result in slow expansion of private consumption and fixed investment. We forecast Brent crude prices to average USD55 per barrel (bbl) and USD58/bbl in 2015 and 2016, respectively, compared to an average of USD106.6/bbl over the 2012-2014 period, a result of oversupply in the market, dwindling global demand and OPEC inaction (*see 'More Pain Ahead, But H115 To Provide A Base', January 8*).

## Low Oil Prices A Key Constraint To Growth



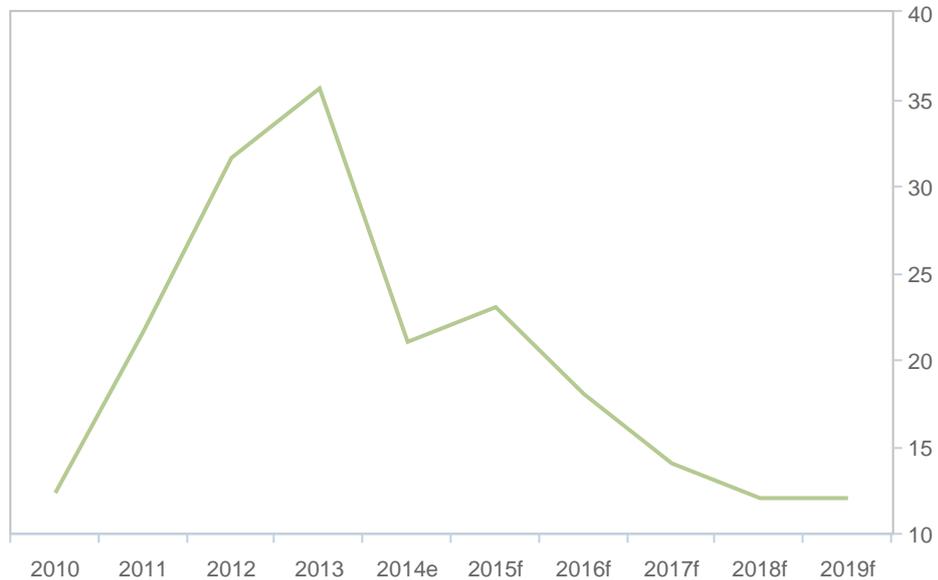
BMI/UN

Key international sanctions on Iran's banking and energy industry will also continue to damage the country's economic outlook. We do not foresee a breakthrough in talks between the P5+1 countries (United States, Russia, China, United Kingdom, France and Germany) and Iran over the next two years, and risks to talks are tilted slightly to the downside (*see 'Nuclear Talks: Breakthrough Unlikely Following Extension', 25 November 2014*). As a result, oil exports and foreign direct investment inflows will remain low.

**Private Consumption Outlook:** Consumer spending will remain modest over the coming quarters, and we expect expansion of 3.0% and 3.5% in 2015 and 2016 respectively, from 4.5% in 2014. The government will cut current spending this year in a bid to reduce a widening fiscal deficit, a result of falling oil revenues, and will be unable to prop up consumer spending. Elevated price pressures will also hit purchasing power as the government cuts energy and food subsidies. We project consumer price index (CPI) inflation to average 23.0% in FY2015/16 (fiscal year running from March 21 2015 to March 20 2016), from 21.0% in FY2014/15. The failure to reach a breakthrough in nuclear talks will also temper consumer and investor confidence, which had significantly improved since the election of moderate Iranian President Hassan Rouhani in June 2013 lead to an amelioration of relations with the West.

## Elevated Inflation To Hinder Consumer Spending

Iran - Consumer Price Index Inflation, % chg, ave

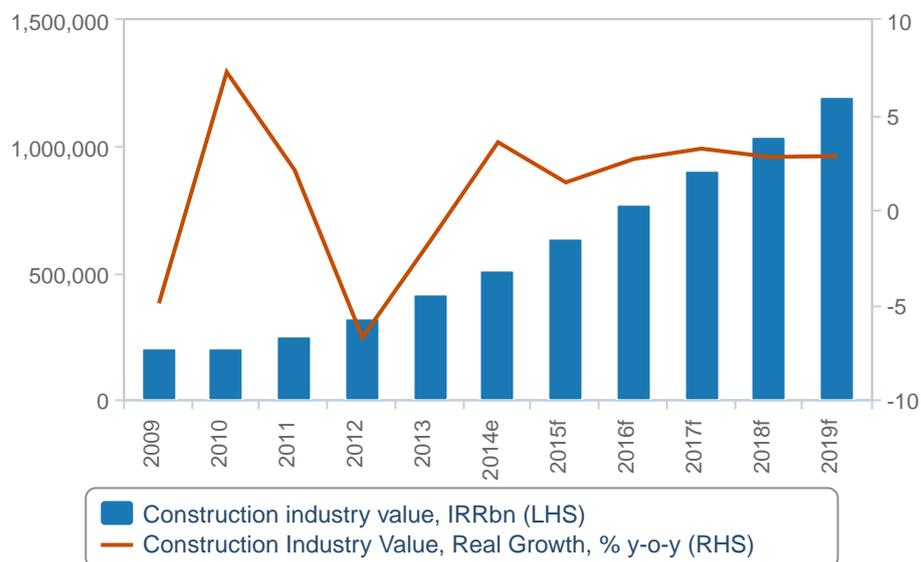


BMI/CBI

**Government Spending Outlook:** Government Spending will remain in negative territory over the coming quarters. On December 7, Iranian President Hassan Rouhani proposed a 6.0% hike in nominal terms to the FY2015/16 budget; discounted by inflation, this means that the government plans significant cuts to spending. Spending on the healthcare, education and services sectors will thus be subdued over the coming quarters. We project government consumption contracting by 3.0% in 2015 and 1.0% in 2016, from 4.0% growth in 2014.

## Declining Government Spending Hitting Industry In 2015

### Iran - Construction Industry



National Sources/BMI

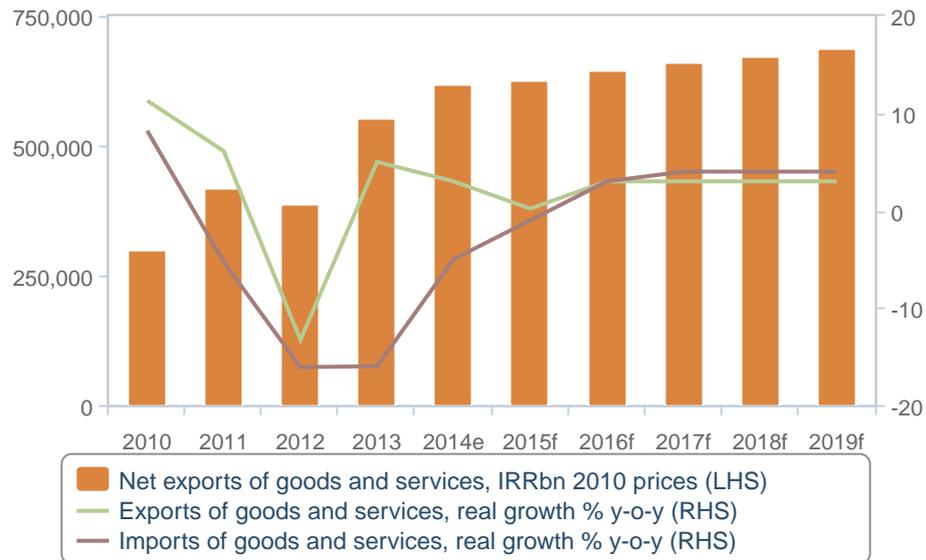
**Fixed Investment Outlook:** Capital formation growth will slow this year, and we project it to expand by 1.0% in 2015, from 3.0% in 2014. **BMI's** Infrastructure research team holds a relatively bearish outlook for the construction sector in 2015; we project real growth of 1.6%, from 2.8% in 2014, as the government's ability to finance projects is limited by falling oil revenues, and private sector investment remains low. The situation will gradually improve from 2016 as oil prices stabilise, and we project industry growth to average 2.9% over 2015-19.

A host of factors will also hinder foreign direct investment. Foreign companies in nearly every sector have recently expressed interest in returning to the Iranian market, but we believe that Western companies will be unable to undertake major investment in the country due to the sanctions regime. Involvement by firms less exposed to the US market will increase. Some companies are able to avoid the obstacles posed by sanctions by arranging payments in oil or financing in currencies other than the US dollar. That said, the complexity of arrangements to avoid sanctions will result in higher costs and delays in the completion of projects (*see 'Current Account In Deficit From 2015', January 6, 2015*). A further impediment will be Iran's difficult

operational environment; Iran scores poorly in **BMI's** Operational Risks Index, with 41.5 out of 100 ranking the country 13th out of 18 states in the MENA region.

## Surplus Narrowing As Energy Exports Stay Low

Iran - Net Exports



BMI/UN

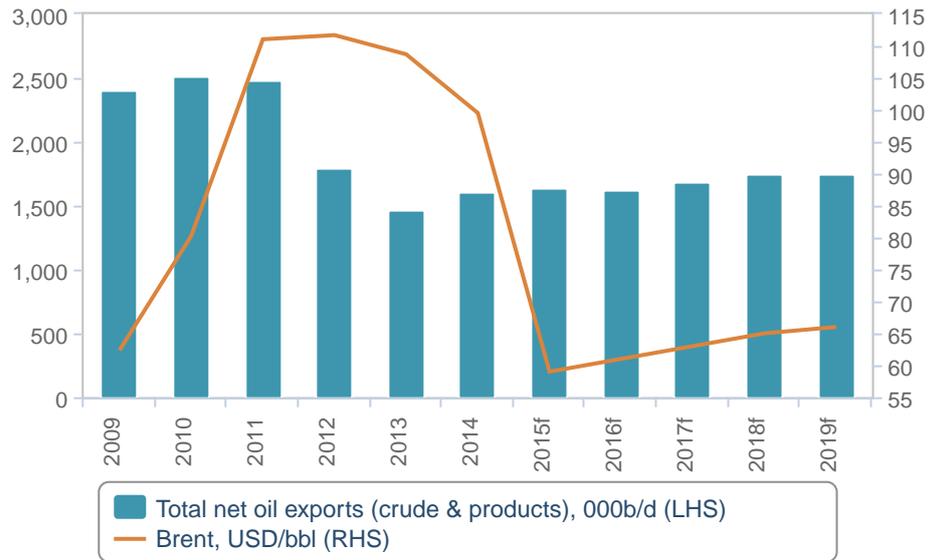
**Net Exports:** Iran's net exports surplus will narrow over the next five years. Export growth will slow in 2015 owing to a deceleration in energy production - oil exports accounted for 70.0% of total exports in 2013 - and we project total exports to expand by 0.5% in 2015, from growth of 6.4% in 2014. Low base effects and an uptick in condensates exports - which are not subject to international sanctions - lead to an acceleration of energy export growth in 2014. That said, we are pessimistic that large-scale projects which could boost oil and gas supply will come online in 2015, and energy production will expand slower than consumption.

Growth of exports other than oil will accelerate gradually in 2015, partially compensating for low energy exports. This will result from a weaker rial - which we project to average IRR30,000/USD in 2015 in the official market, from IRR25,800/USD in 2014 - and the government's efforts to increase regional trade. As an illustration, Iran and Iraq recently planned to establish a joint bank, the Islamic Regional Cooperation

Bank for Development and Investment, with a view to increase trade transactions and facilitate bilateral trade.

### Low Prices Detrimental To Oil Industry

Iran - Oil Sector



National Sources/BMI

A weak rial will lead to a continued decline of imports in 2015, in line with a trend in place since 2011. Slow economic growth will also contribute to subdued imports, which we forecast to decline by 1.0% in 2015, before returning to growth of 2.0% in 2016.

**Table: Economic Activity (Iran 2010-2019)**

	2010	2011e	2012e	2013e	2014e	2015f	2016f	2017f	2018f	2019f
Nominal GDP, USDbn	429.4	575.4	555.8	504.7	476.7	401.4	418.5	459.5	498.7	539.3
Real GDP growth, % y-o-y	5.8	2.5	-6.6	-1.9	-0.5	0.6	2.9	3.6	3.9	4.1
GDP per capita, USD	5,766	7,628	7,272	6,516	6,074	5,050	5,201	5,643	6,054	6,476
Population, mn	74.5	75.4	76.4	77.4	78.5	79.5	80.5	81.4	82.4	83.3
Unemployment, % of labour force, eop	13.5	13.3	13.1	13.0	11.0	10.0	10.0	10.0	10.0	9.0

*National Sources/BMI*

## Industry Risk Reward Index

### MEA Petrochemicals Risk/Reward Index

***BMI View:** This quarter has seen the Middle East and Africa (MEA) region's average petrochemicals Risk/Reward Index (RRI) score fall by 0.1 point. Much of the movement is related to the impact of domestic economic and political risks on the petrochemicals market and local producers. Higher risk markets have seen some improvement this quarter, but this has been offset by declines elsewhere.*

We do not expect falling oil prices to be a further significant threat to petrochemicals development in Gulf Cooperation Council (GCC) countries in the short term and this is reflected in our Risk/Reward Index (RRI). However, long-term plans for ethane-fed production are being affected by the narrowing of the naphtha-ethane price differential, which is determined by the difference between crude oil and gas. Qatar has already seen a reduction in its planned projects. Algeria's cracker plans have been ruled out, which ensures it languishes in last place.

Lower oil prices will result in a worsening of Iran's macroeconomic outlook over the coming quarters. However, this should not adversely affect the petrochemicals industry, which will be boosted by the opportunities created by a reduction in sanctions. As such, Iran's score has improved this quarter. Iran has plenty of surplus capacity. In recent quarters, Iran's score has improved considerably. Since the previous quarter, the country has climbed from fifth to third place.

Our outlook for the Iranian petrochemicals industry in the short-to-medium term is turning more optimistic on the back of easing economic sanctions from the West related to Iran's nuclear programme, low base effects and rising domestic demand. In addition, the partial lifting of sanctions and the possibility of a permanent agreement is likely to attract the interest of foreign petrochemicals companies that are keen to invest in Iran and leverage its considerable potential. Should a long-term agreement be reached, we will see one of the biggest markets in the Middle East open up. However, we are still cautious over Iran's macroeconomic picture and its opaque regulatory environment.

For the petrochemicals sector, the major issue is price competitiveness of feedstocks. In the medium- to long-term, ethane-fed petrochemicals are facing increased costs as gas prices rise due to the tightening of the gas market and decline in production growth. This undermines their competitiveness vis-a-vis US producers which are increasingly deriving ethane from cheap domestic shale gas resources. However, in the short-term, oil prices will be crucial to petrochemicals margins in the region. The recent slump in oil prices

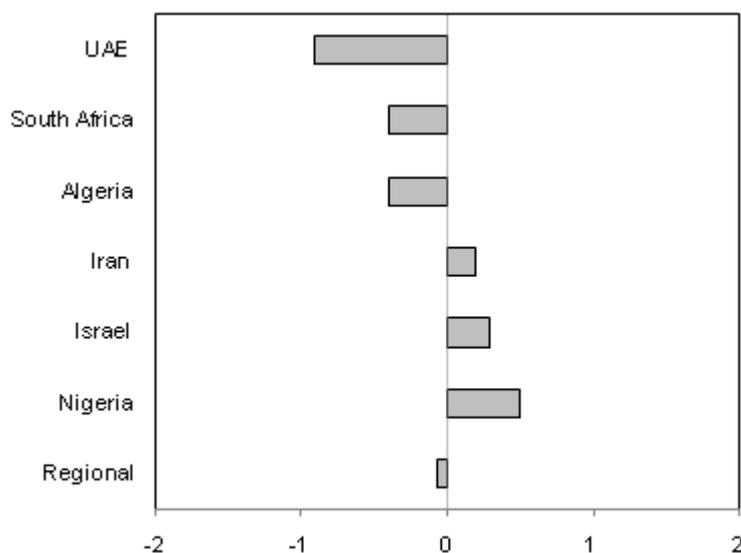
has led to a decline in naphtha prices, which will put pressure on regional producers based on gas, notably Qatar and Saudi Arabia. Mixed feed producers will fare better due to their flexibility.

Arabian Gulf producers are facing capacity constraints with the rate of capacity growth set to slow. Combined with heightened risk and declining competitiveness, this has prompted a downward revision in scores for Kuwait, Qatar, Saudi Arabia and the UAE.

Saudi Arabia continues to lead our MEA RRIs, but its score has fallen. Nevertheless, the declines in other Gulf states in recent quarters has ensure its top spot is likely to remain unassailable over the long-term. Qatar's reliance on ethane feedstock has limited its petrochemicals industry to some extent, as it does not produce the same range of by-products as other countries, such as the US and China, which rely on other feedstock such as naphtha. This means it is likely to be sidelined in the special chemicals markets because, although the government is seeking to redress this imbalance with mixed crackers, other industries are also capitalising on the increasing global demand, and Qatar will be left behind.

### High Risk Markets Improve

Change In Petrochemicals Rating, Q315/Q215



Source: BMI

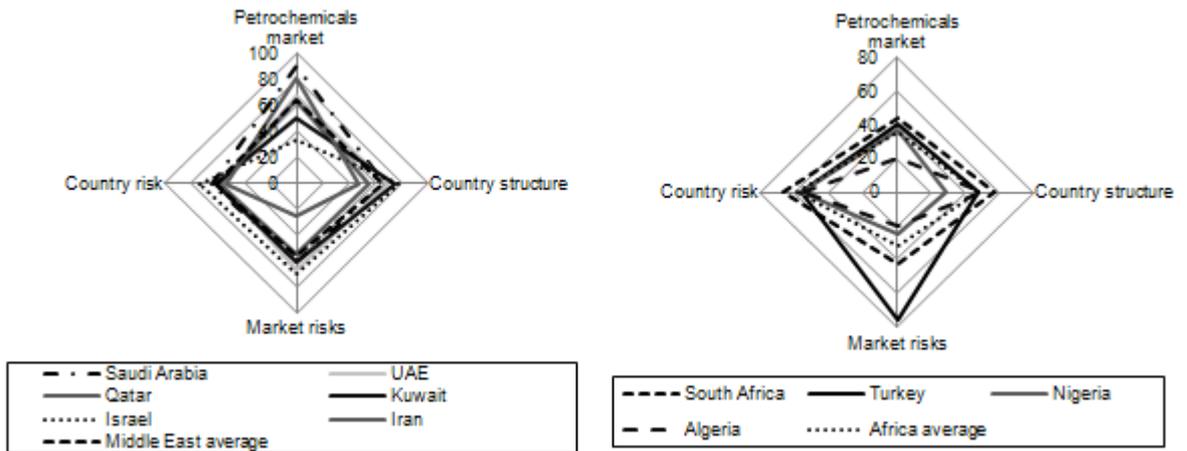
Capital constraints are a pertinent downside risk to our MEA Index, particularly in Sub-Saharan Africa, where governments have not always been able to realise their ambitious capacity expansion plans due to lack of capital. Market risks will often be dictated by the relevant regulatory frameworks. Although key markets in the region have maintained relatively robust real GDP growth, the weak external economic climate, in addition to red-tape and funding difficulties, could contribute to project delays and/or cancellations.

Unsurprisingly, African states retain their places at the bottom of our index table with Algeria continuing to see its score decline, this quarter due to deteriorating economic fundamentals. Algeria's score took a knock in the previous quarter due to a cut in our long-term capacity forecast. The deal between **Sonatrach** and **Total** for a new petrochemicals complex has failed. This means that Algeria is unlikely to capitalise on its gas reserves to generate downstream growth. It has managed to recover lost ground this quarter due to improved country risk factors. However, it languishes in 11<sup>th</sup> place in the regional ranking and is unlikely to make a significant recovery in the months ahead.

South Africa's domestic economic woes and lack of industrial dynamism have eroded its score in recent quarters with a further decline this quarter. In line with our subdued view for the South African economy, our forecasts for growth in the South African petrochemicals industry remain subdued. The government has been largely unable to energise major petrochemicals consumers.

## Strong Petrochemicals Market Scores Help Gulf states

### Risk/Reward Ratings, Q315



Source: BMI

However, Nigeria's prospects for petrochemicals expansion have improved even as the business environment has suffered from political instability and its score has risen this quarter, although it's unlikely to improve on its 10th place position. Growth in gas production is set to spur downstream petrochemicals industries, particularly fertiliser and methanol, but the business environment remains uncertain and will no doubt be affected by the turbulence that comes with presidential elections, which are due in February 2015.

The election of President Abdel Fattah al-Sisi in May 2014 has been a positive development for Egypt's petrochemicals sector in that it marks some stability and regulatory continuity. End markets are expected to improve, particularly in the construction sector, and this should help support growth in consumption. This quarter, its score remains stable.

Table: MEA Petrochemicals Risk/Reward Index - Q3 2015

	Limits of potential returns			Risks to realisation of returns			Overall rating	
	Petrochemicals market	Country structure	Limits	Market risks	Country risk	Risks	Petrochemicals rating	Rank
Saudi Arabia	90.0	67.2	82.0	60.0	64.7	63.3	76.4	1
UAE	66.7	69.1	67.5	67.0	56.7	59.8	65.2	2
Iran	80.0	47.6	68.7	25.0	53.7	45.1	61.6	3
Qatar	63.3	55.4	60.5	55.0	57.8	56.9	59.5	4
Kuwait	50.0	74.8	58.7	60.0	61.0	60.7	59.3	5
Israel	33.3	78.8	49.2	70.0	73.8	72.7	56.3	6
South Africa	43.3	57.4	48.3	42.0	67.5	59.8	51.7	7
Turkey	40.0	48.0	42.8	75.0	56.6	62.7	48.8	8
Egypt	43.3	53.8	47.0	38.0	55.6	50.3	48.0	9
Nigeria	36.7	29.1	34.0	25.0	56.2	46.8	37.8	10
Algeria	20.0	49.6	30.4	20.0	54.7	44.3	34.5	11

Source: BMI

## Iran Petrochemicals Risk/Reward Index

This quarter, Iran has marginally raised its score by 0.2 points due to a 5.0 points improvement in its market risk score. However, its market risk score is one of the lowest in the region due to the dominance of state-owned enterprises, uncertainties in feedstock and structural problems within the market. It remains in third place, 2.1 points ahead of Qatar and 3.6 points behind the UAE.

In the long term, much will depend on the extent of Iran's rehabilitation in the international community, and there is a risk that the sanctions regime may not be relaxed sufficiently to stimulate the export growth the country needs to justify planned capacity expansion. Iran's petrochemicals sector is yet to feel the benefits of the easing of international sanctions.

In terms of rewards, a poor regulatory and investment environment is counter-balanced by internationally significant hydrocarbons reserves and expanding domestic capacity. Iran needs a more positive political risk outlook and a breakthrough in terms of the regulatory regime if it is to improve its score and ranking. This looks unlikely in the short-to-medium term.

Iran remains the worst-performing country in the region in relation to factors such as financial infrastructure and trade bureaucracy, which weigh down its Rewards ranking. In terms of petrochemicals-related risk, Iran not only has a very poor business environment, but more generally displays a number of long-term financial, institutional and political risks - which make up its Country Structure score. Iran's largest banks are subject to international sanctions, while the economy is heavily protected with high tariffs and price controls.

The sanctions regime on trade and investment led to a resulting decline in investor sentiment, labour disputes over unpaid wages, technological difficulties and equipment failures. State-owned **National Petrochemicals Company** (NPC) dominates the petrochemicals sector, and the market is heavily regulated, with fixed prices that undermine profitability. Petrochemicals projects are prone to delays as they struggle with a lack of expertise, financial capital and the involvement of foreign majors. Additionally, international sanctions impact on the progress of existing projects, with producers finding it difficult to tap into international financial markets and forge partnerships with petrochemicals majors and import specialist equipment.

Global technology licensors have stopped doing business with Iran in order to maintain business interests in the US. The complexity of raising finance from abroad as a result of the sanctions regime has deterred global banks. The sanctions have undermined business with European firms, which are insisting on approval of contracts by the European Commission.

## Market Overview

***BMI View:** Iran claims to be the second largest petrochemicals producer in the Middle East, with a 27% share of output, compared with Saudi Arabia's 50%. It aims to represent 36% of regional output in 2015, by which time it hopes to implement 47 petrochemicals projects under the fifth five-year plan, adding 43mn tonnes per annum (tpa) of capacity and 28% of the total added capacity in the region.*

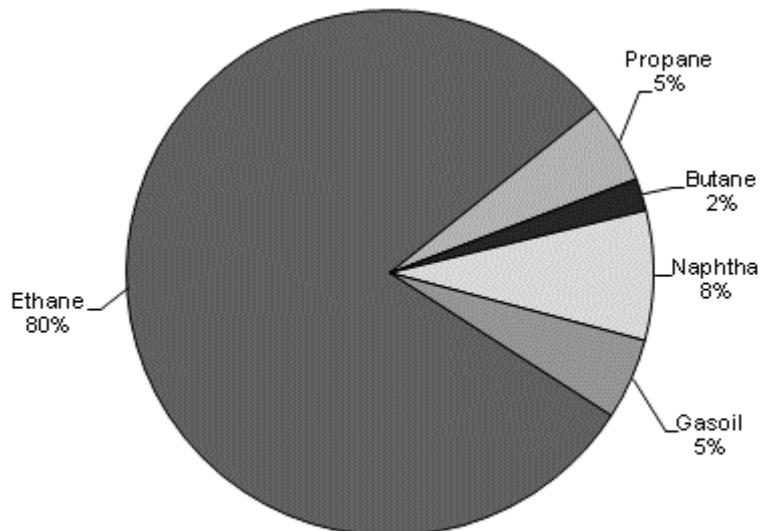
The Iranian petrochemicals industry has 81 companies, of which 51 are in the private sector (in reality, run by government-controlled funds). The privatisation of the **National Petrochemicals Company** (NPC)'s subsidiaries is set to lead to a further 19 firms going into private hands, with regulations requiring that the NPC share in any firm does not exceed 20%.

The NPC is wholly owned by the Iranian government. It is responsible for the development and operation of the country's petrochemicals sector and is the second largest producer and exporter of petrochemicals in the Middle East after **Saudi Basic Industries Corporation** (Sabic). NPC is aiming to become the largest petrochemical producer in the Middle East by 2024, overtaking Sabic. It has a number of hurdles to overcome, namely the effects of international sanctions and the fragmentation of the company through the spinning off and privatisation of its subsidiaries. Construction costs are also high. Petrochemicals projects are struggling to raise sufficient finance due to their inability to tap into global financial markets and import specialist equipment, and Iran lacks the necessary skills. These factors have led to long and costly delays with projects. Delays with upstream projects are also creating uncertainty over feedstock supply.

The government's petrochemicals investment programme under the current five-year plan (2010-2015) involves the construction of 30 plants with combined capacity for 37mn tpa, including the 15th, 16th and 17th olefin complexes, and eight large-scale methanol plants, as well as ammonia and urea production facilities. To support this growth, the government is establishing five new special economic zones (SEZs): Chabahar, on the coast of the Gulf of Oman; Qeshm Island, near Bandar Abbas; Kish Island and Lavan, on the south coast of Iran; and North Pars, north of Assaluyeh. Zones include Pars SEZ at Assaluyeh and Mahshahr Petrochemical SEZ at Bandar Imam. These are designed to host processing and plastic conversion industries and will have different product chains.

## Ethane Provides Competitively Priced Feedstock

Iran Cracker Feedstock Sources



Source: BMI

Iran plans to invest about USD20bn to develop the Chabahar hub, which is the first new SEZ scheduled to be established. Five methanol projects, an ammonia and urea complex, and the 18th and 19th olefin complexes are planned at Chabahar. It will have access to 20mn cubic metres per day of natural gas and 3.6mn tpa of ethane from the South Pars gas field near Assaluyeh via an 800km pipeline that is due to be built by 2015. These could feed two crackers with 1mn tpa each of ethylene production capacity.

Iran is also seeking to diversify into polypropylene by installing propane dehydrogenation units and methanol-to-propylene converters as well as expanding refinery capacity. **Mehr Petrokimia** is planning a propane dehydrogenation facility that will supply 200,000tpa of propylene to a planned 200,000tpa plant at Assaluyeh. Completion is scheduled for 2015.

The Iranian petrochemical industry has a number of competitive advantages, mainly the easy availability of gas for feedstock and the large domestic market. Iran's petrochemicals chain is diversifying, and labour is highly skilled and relatively cheap.

Iran's global political isolation, heightened by its controversial nuclear programme, has led to a reduction in business from international contractors and banks, making it difficult to secure technology and finance for projects. Investors with an exposure to the American market have been cautious, mindful of the US's moves to enforce its own sanctions on Iran and the possibility of international sanctions. Asian investors with little or no exposure to the US are showing greater interest in the sector. While international sanctions have been relaxed, the US is likely to retain a punitive sanctions regime.

As Iran faces some international rehabilitation under President Rouhani, it is steadily recovering from the effects of the EU and US sanctions regimes, as well as more limited international sanctions, which prompted an economic crisis fuelled by the collapse of the *rial* and hyperinflation.

The lack of sufficient local expertise in technology has caused delays in project implementation. Delays with project completion have knock-on effects throughout the petrochemicals chain, pushing back downstream projects by months and years. Insufficient ethylene feedstock is likely to undermine the confidence of potential foreign investors, who are essential to providing much-needed capital, technology and expertise to the Iranian petrochemicals sector.

Over the long term, operating rates can only be raised through market diversification, a process that has been severely curtailed by the sanctions regime imposed by the US and the UN. Asia, particularly China, represents around 37% of exports, while the Middle East comprised 25%, South Asia 18% and Europe 11%. The dependence on the Chinese market could cause problems for Iranian petrochemicals producers as it slows. Market growth is particularly limited in the petrochemicals-intensive automotive and electronics segments, where investment has been severely curtailed. Even with strong export growth, the anticipated moderation in domestic consumption over the medium term means that polymer plants will continue to operate well below nameplate capacity; Iranian producers had said that plants were not performing at full capacity owing to technical problems.

**Table: Iran's Cracker Capacity, 2013-2019 ('000 tpa)**

	2013	2014e	2015f	2016f	2017f	2018f	2019f
NPC, Arak	320	320	320	320	320	320	320
NPC, Tabriz	136	136	136	136	136	136	136
NPC, Bandar Imam	500	500	500	500	500	500	500
Amir Kabir, B. Imam (Olefins 6)	520	520	520	520	520	520	520
Marun PC, B. Imam (Olefins 7)	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Arya Sasol, B. Assaluyeh (Olefins 9)	1,000	1,000	1,000	1,000	1,000	1,000	1,000

## Iran's Cracker Capacity, 2013-2019 ('000 tpa) - Continued

	2013	2014e	2015f	2016f	2017f	2018f	2019f
Jam Pchem, B. Assaluyeh (Olefins 10)	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Ilam (Olefins 13)		500	500	500	500	500	500
Kharg Island	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Arvand P'chemical (Olefins 8)	1000	1000	1000	1000	1000	1000	1000
Kavyan Petrochemical Assaluyeh (Olefins 11)	1000	1000	2,000	2,000	2,000	2,000	2,000
Morvarid Petrochemicals	500	500	500	500	500	500	500
Persian Gulf Assaluyeh (Olefins 12)	-	-	1,200	1,200	1,200	1,200	1,200
<b>Total</b>	<b>8,376</b>	<b>8,876</b>	<b>11,076</b>	<b>11,076</b>	<b>11,076</b>	<b>11,076</b>	<b>11,076</b>

e/f = estimate/forecast. Source: BMI

## Privatisation

The government intends to privatise the petrochemicals sector in order to accelerate petrochemicals projects and support production. It is uncertain which Iranian private sector businesses would be capable and willing to take charge of production facilities and invest in expansion, and **BMI** believes it is unlikely that foreign investors will pursue acquisitions in Iran amid uncertainty caused by increased international isolation.

Privatisation is an obligation under the terms of Article 44 of the Iranian constitution, which requires 80% of the country's state-owned companies to be sold. Divestment is being pursued through the sale of shares in the **Persian Gulf Holding (PGH)**, which comprises 15 petrochemical plants and represents 40% of national petrochemicals output and 33% of domestic supply. However, Sheri Moqqadam, managing director of state-owned NPC, which owns 38% of PGH, said in September 2013 that the company will try to prevent the issue from happening, warning that 'it will lead to annihilation of petrochemical industry with regard to current status so we will do our best to maintain the remaining 38% of Persian Gulf Holding [in the hands of state]'.

**BMI** believes that floating a minority stake on the stock exchange is unlikely to provide the petrochemicals industry with the capital it needs in the long term, while the allocation of nearly half the company to cooperatives and personnel will add nothing of value to the privatised firms.

## Industry Trends And Developments

The Iranian government failed to reach the targets of its 20-Year Outlook Plan (1995-2015), which aimed for a rise in Iran's share of Middle Eastern petrochemicals output from 12% to 34%, with up to 100mn tonnes per annum (tpa) of capacity, of which 75% would be exported. The main reason for this failure is the effect of sanctions. As a result, the reduction in the sanctions regime should stimulate exports and therefore output, but much depends on the outcome of talks in June.

### Upstream Developments

Over the past three years, Iran has expanded its refining capacity to about 1.8-1.9mn barrels per day (b/d) in order to reduce its dependence on imported fuels, given international sanctions have restricted the country's ability to import the requisite amounts of fuels. While most plans for greenfield refineries will not materialise under the current sanctions regime and the falling oil prices, we believe the first phase of the Persian Gulf Star refinery could come online by 2016/2017, which would further boost Iran's gasoline production capacity.

The country is the third largest natural gas producer in the world. About 35-30% of domestic production comes from the giant offshore South pars gas field shared with Qatar. Sizeable production also comes from the Kangan and Tabnak fields, in addition to associated natural gas production originating from the Khuzestan, Ilam and Kermanshah provinces. However, despite impressive production growth, sanctions have affected its natural gas sector which remains underdeveloped compared to its potential, and used mostly to meet domestic demand.

Last quarter, we have revised our gas production forecast for Iran, on the back of tangible success in developing the South Pars gas field. In 2014, Iran boosted its natural gas output by about 20bn cubic metres (bcm). Part of this increase was due to an increase in associated gas production and a reduction in gas flaring, but the biggest factor comes from the partial start-up of production at Phase 12 of the South Pars gas field. This is an important and symbolic development for Iran. While having the second largest gas reserves in the world, sanctions have affected Iran's natural gas sector, starving it from sufficient investment and technology. This has resulted in gas production growth far below the country's actual resource potential.

Notably, progress had stalled at the giant offshore South Pars field, shared with Qatar. The field's development entails 24 phases, of which phases 1-10 were completed before 2011. However, the start of Western sanctions saw the international companies developing further phases exit the country. In addition, Iran was prevented from accessing the necessary finances and technology required for the development of

further phases. As a result, it was extremely uncertain as to whether Iran would successfully develop further phases in a context of continued sanctions. Reflective of this situation, we had previously forecasted slow progress on South Pars.

Iran's successful start-up of Phase 12 however highlights that the country is managing to partly develop these phases despite continued sanctions. Despite the slow pace at which development is occurring, this is prompting us to review our production forecast to the upside, with output likely to continue increasing in the coming years.

While we have revised production to the upside, we will mention however that sanctions have been slowing the development of the phases. For example, Mehdi Etesami, managing director of offshore rig constructor Iran Marin Industrial Company, recently highlighted that the deadlines for South Pars are unrealistic, mentioning that his company lacks the resources to buy the necessary equipment and faced severe problems when sourcing it from abroad due to sanctions.

This is similar to a recent interview with Gholam-Hossein Khaje-Ali, former managing director of South Pars gas field's main contractor Sepanir Oil & Gas Energy Company. He highlights that the inability to obtain the necessary equipment, preventing completion and a full ramp-up at several of the ongoing phases. This shows that a full ramp-up of South Pars to its maximum capacity is highly unlikely in a context whereby sanctions remain in place.

Currently, phases 1 to 10 are producing at full capacity, with Phase 12 expected to ramp-up to full capacity (30bcm) by 2016/2017. According to press statements, Phases 15 and 16 could be the next to come online, with a possible start-up in 2015/2016. The two phases would add some 20bcm of natural gas production when fully ramped-up.

## International Sanctions And The Petrochemicals Industry

At the time of writing, President Obama had relieved Iran of some of its nuclear-related sanctions and the EU was allowing trade in petrochemicals products. The increased potential for an easing of the international sanctions regime and the ongoing talks have encouraged foreign investor interest in the petrochemicals sector and exports are now recovering.

The sanctions imposed from October 2012 had global implications as they affect freight deliveries to countries outside the EU and came alongside even more wide-ranging US sanctions that the US government is increasingly eager to enforce. The Obama administration specifically targeted Iran's petrochemical sector

with a prohibition on the provision of goods, services and technology to the industry and the authorisation of penalties against any person or entity that engages in such activity.

European firms were already cutting ties with Iran before the latest round of sanctions, with a direct impact on supplies of monoethylene glycol (MEG), diethylene glycol, polyethylene terephthalate (PET) and polyethylene (PE) as downstream consumers refuse to accept material produced in Iran. Technological transfers, equipment and machinery are also affected. **National Petroleum Company** (NPC) said it was sourcing more equipment from local suppliers in order to reduce reliance on foreign producers, but **BMI** doubts that local suppliers will provide sufficient technology and quality. While an easing of sanctions should help trade, only a permanent settlement over the nuclear programme will improve access to technology and investment.

## Current plans

Completion of 67 part-build petrochemical projects, which were scheduled to become operational by 2015, are to be launched in the sixth five-year economic development plan (2015-2020). The total capacity of the projects are estimated at over 60mn tpa and involve USD40bn in investment. However, projects with a completion rate of under 10% are set to be cancelled. The West Ethylene Pipeline project, which was 13% complete in Q314, narrowly misses out on cancellation.

Iran plans to open 11 new petrochemical units in the current Iranian year, which began on March 21, according to Deputy Oil Minister for Petrochemical Affairs Abbas Sheri Moqaddam. The new units, which will come into operation in 2015, aim to increase the country's petrochemical production by 6mn tonnes. Iran has significantly expanded the range and volume of its petrochemical production in recent years. Iran has the capacity to produce about 60mn tonnes of petrochemicals a year, but only 68% of this capacity is tapped on average due to several reasons, including a shortage of raw material.

The Iranian government is seeking to set up a new petrochemical hub in the south-eastern port city of Chabahar with an investment of USD20bn, adding 15mn tpa to the country's petrochemical production. The hub will focus on exports to India and China, despite the move by both countries towards greater self-sufficiency in basic chemicals.

The Indian government is planning to invest in both the Iranshahr and Chabahar petrochemical sites in the Sistan and Baluchestan province of Iran, according to NPC's deputy director, Mohammad Hossein Peivandi. Geographical proximity will ultimately reduce transportation costs for India. Iranshahr is around

1,000km nearer to India and China than other Iranian petrochemical production sites such as Mahshahr and Asaluyeh, Peivandi said in June 2014.

Two Indian state-run fertiliser companies have jointly appointed India-based **SBI Capital Markets** (SBICap) to look for Iranian partners for building a India-Iran joint urea plant in the petrochemicals hub at Chabahar. The two companies, **Rashtriya Chemicals and Fertilizers** (RCF) and **Gujarat Narmada Valley Fertilizers and Chemicals**, are seeking Iranian partners for the proposed urea joint venture to capitalise on low gas prices in Iran for producing the commodity. The proposed project is expected to cost an estimated INR70bn (USD1.16bn), according to two officials from India's fertiliser ministry. Iran has offered to provide gas for the project at a rate of USD3.00 per million British thermal units, which makes it cheaper for India to produce urea in Iran and then transport it to India.

NPC was set to bring several petrochemical projects on stream in the western part of Iran during the Iranian calendar year that ended on March 2015, according to NPC's deputy managing director Mohammad-Hassan Peyvandi. The company's petrochemical projects in the western provinces of Lorestan, the western city of Mahabad and the Autonomous Region of Kurdistan were planned to be completed during the last Iranian year. Peyvandi stated that the construction of the West Ethylene pipeline and the expansion of the upstream industries were to be taken up seriously during the year.

In Q214, the **Persian Gulf Petrochemical Industry Company** (PGPIC) started construction of two new petrochemical plants at the Chabahar Port in Iran. A 1.2mn tpa ethane cracker and three PE plants are being planned as part of a mega petrochemicals and fertiliser project. The PE facility will produce 300,000tpa each of low-density polyethylene (LDPE), high-density polyethylene (HDPE) and linear low-density polyethylene (LLDPE). The site, which has access to feedstock from the South Pars gas field and Khuzestan reserves, will also produce polypropylene (PP), methanol, ammonia and urea. The Chabahar Free Zone Organisation states that it will be on stream by the end of the decade.

NPC's sixth five-year plan focuses investment in the Qheshen free zone, south of Asaluyeh, which is the location of 13 ethylene crackers based on the Pars gas field. Iran's bold 20-year outlook plan envisions petrochemical output to reach 100mn tpa by 2015, but **BMI** regards this target, given current conditions, as unattainable. Given Iran's notoriety for lengthy project delays and a lack of investment from major global companies, we doubt NPC will come anywhere near reaching these targets. Success in achieving the government's ambitious objectives rests on a number of related factors: the strength of the domestic economy, Iran's diplomatic and trade relations, and progress on capacity expansion.

A number of projects are due to be completed before 2016. The government has already confirmed the 14th olefins complex, which will be built at Firouzabad and produce 1mn tpa ethylene, and the 15th olefins complex, planned at Genaveh with 500,000tpa of ethylene. The 17th olefins complex will be built at Dehloran in Ilam Province by **Dehloran Petrochemical Company**, will have a mixed-feed cracker with the capacity to produce 607,000tpa ethylene. Completion was expected in 2014/2015. The 16th olefins and methanol complex is already being constructed by **Bushehr Petrochemical Company** as part of Phase II of the Pars SEZ at Asaluyeh. Completion of the plants, with capacity for 1mn tpa ethylene and 1.65mn tpa methanol, was due in 2014. However, the 12th olefins complex has been postponed and this might have an impact on the completion dates of various other plants and petrochemical complexes.

Methanol forms a significant part of Iran's petrochemicals development. The country already possesses 5.3mn tpa of methanol production capacity and plans to add eight new methanol plants, each with capacity of 1.65mn tpa, by 2015. Although South Africa's **Sasol** has stated it will no longer pursue methanol investments in Iran due to the sanctions, Turkey's **Petkim** is pressing ahead with its joint venture (JV) with **Sabalan Petrochemical Company** for a facility due on stream in 2014. **Dena Petrochemical** is also purportedly planning another methanol complex in a JV with a Singaporean firm.

Construction of Marjan Petrochemical Complex at the Pars SEZ began in Assalouyeh in Q111. The complex will have the capacity to produce 1.65mn tpa of methanol when it comes on stream, possibly in 2015, at a cost of IRR2.12trn (USD212mn). This will put yet more pressure on demand for gas, and Iran will have to ensure significant increases in supply in order to fulfil growing domestic requirements.

The Kavyan crackers are linked to Iran's west ethylene pipeline, which is supplying several polymer plants along its route. The west ethylene pipeline and its offshoot, the Dena region ethylene pipeline, are set to have in total 11 downstream petrochemical projects along their routes, stretching from the south where the two Kavyan ethylene complexes and the Morvarid 5th olefins facility are based, to the north, linking seven downstream plants. The 1,200km pipeline carries ethylene produced by the Kavian petrochemical plant, in the south of the country, to petrochemical plants located in the west of the country.

The seven downstream plans along the main line include:

- **Kermanshah Polymer's** 300,000tpa HDPE plant at Kermanshah.
- **Lorestan Petrochemical Company's** 300,000tpa HDPE plant at Khoramabad.
- **Kordestan Petrochemical Company's** 300,000tpa LDPE unit at Sanandaj.
- **Mahabad Petrochemical Company's** 300,000tpa HDPE unit at Mahabad.

- **Miandoab Petrochemical Company's** 140,000tpa HDPE facility at Miandoab.
- **Andimeshk Petrochemical's** 300,000tpa LDPE plant at Andimeshk.
- **Ibn-e-Sina Hamedan's** 100,000tpa ethylene oxide and 80,000tpa ethoxylates complex at Hamedan.

The Dena region ethylene pipeline will provide feedstock to:

- **Kazeroon Petrochemical Company's** 300,000tpa HDPE/ LLDPE plant at Kazeroon.
- **Mamasani Petrochemical Company's** 300,000tpa HDPE plant at Mamasani.
- **Dehdasht Petrochemical Industry Company's** 300,000tpa HDPE plant at Dehdasht.
- A 300,000tpa HDPE plant at Boroujen.

Areas where Iran is falling behind are the vinyl and styrenes segments. With polyvinyl chloride (PVC) capacity set to reach 940,000tpa and polystyrene (PS) capacity at only 250,000tpa by 2015, Iran risks becoming more dependent on imports. However, with PVC and PS prices likely to come under pressure, **BMI** does not believe the markets in these petrochemical products will be strong enough to justify export-orientated production, which is the industry's chief motivation for expansion. **BMI** believes it may be advantageous for Iranian producers to delay opening new plants in these sectors until the markets recover. This might be inevitable because of problems with feedstock allocation, which is exacerbated by cold weather in winter, when energy supplies are diverted to the power generation sector.

Investor wariness will not just affect Iran's hopes of diversifying downstream operations, but also its ability to increase upstream capacities, which are crucial to the development of the petrochemical sector. The political will to liberalise the petrochemicals sector is also wavering. Overbearing state interventionism and price fixing have prevented the growth of the industry. A reduction in state involvement in the sector and the provision of more facilities to investors are essential to secure future growth in petrochemicals capacity. A growing export market is also essential to help offset the negative impact of domestic sales at government fixed rates.

## Company Profile

### National Petrochemical Company

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- Strengths**
- Iran's largest petrochemicals producer with a high level of integration throughout the value chain.
  - The Middle East's second largest single producer after Saudi Arabia's Sabic and is allied with more than 50 subsidiaries, including nine production complexes and 27 project implementing companies.
  - It has an overwhelming share of the Iranian market and dominates Iran's export markets.
- Weaknesses**
- NPC is notorious for lengthy delays in project completion.
  - Ethane costs are higher than its regional competitors, making it difficult for NPC to boost margins in an over-supplied global market.
  - Sanctions have constrained NPC's ability to diversify markets.
  - Political decisions often overrule NPC's commercial interests.
- Opportunities**
- NPC's sixth five-year plan focuses investment in the Qheshen free zone, south of Assaluyeh, which is the location of 13 ethylene crackers based on the Pars gas field.
- Threats**
- International sanctions are jeopardising growth in investment, technology acquisition and trade.
  - Natural gas production growth is lagging behind growth in cracker capacity.
- 

**Company Overview** NPC is wholly owned by the Iranian government. It is responsible for the development and operation of the country's petrochemicals sector and is the second largest producer and exporter of petrochemicals in the Middle East after Saudi Arabia's Sabic. NPC's major activities are the production, sale, distribution and export of chemicals and petrochemicals. It is allied with more than 50 subsidiaries, including nine production

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complexes and 27 project implementing companies. NPC operates as a holding company, making policy, planning, directing and overseeing the activities of its subsidiaries and affiliates. The group operates major sites through operating subsidiaries in Arak, Bandar Imam Khomeini, Isfahan, Kharg Island, the Khorasan provinces, Urmia, Shiraz and Tabriz. NPC markets and distributes its products internationally through its subsidiary, the Iran Petrochemical Commercial Company.

Karoon Petrochemical Company (KRNPC) was the first international joint venture (JV) company in the petrochemicals field to be registered in Iran after the 1979 revolution. The firm's shareholders are NPC (40%), Swedish company Chematur Engineering (30%) and Hansa Chemie International from Germany (30%). The KRNPC plant, under construction at Bandar Imam Khomeini, should produce 80,000 tonnes per annum (tpa) of toluene di-isocyanate (TDI) and methylene phenyl di-isocyanate (MDI) for use in polyurethane foam, insulation material, roof sealing, adhesives, automobile parts and floor coverings. Hansa Chemie's total investment in the firm amounts to about EUR380mn (USD462.19mn). It will be responsible for marketing the plant's output in Europe.

## Strategy

NPC's sixth five-year plan focuses investment in the Qeshm free zone, south of Assaluyeh, which is the location of 13 ethylene crackers based on the Pars gas field. Iran's bold 20-Year outlook plan envisages petrochemical output to reach 100mn tonnes per annum (tpa) by 2015, but **BMI** regards this target as very unlikely to be achieved. Given Iran's notoriety for lengthy project delays and a lack of investment from major global companies, we doubt NPC will come anywhere near reaching these targets. The success in achieving the government's ambitious objectives rests on a number of related factors: the strength of the domestic economy, Iran's diplomatic and trade relations, and progress on capacity expansion.

Construction of the Marjan Petrochemical Complex started at the Pars Special Economic Energy Zone began in Assalouyeh in 2011. The complex will have the capacity to produce 1.65mn tpa of methanol when it comes onstream by 2015 at a cost of IRR2.12trn (USD212mn).

NPC is set to bring several petrochemical projects on-stream in the western part of Iran during the Iranian calendar year that ends on March 2015, reported **Shana** news agency in April 2014, citing NPC's deputy managing director Mohammad-Hassan Peyvandi. The company's petrochemical projects in the western provinces of Lorestan, the western city of Mahabad and the Autonomous Region of Kurdistan are planned to be completed during the current Iranian year. Peyvandi stated that the construction of the West Ethylene pipeline and the expansion of the upstream industries are set to be taken up seriously during the year. Another petrochemical project in Lorestan is expected to come online by the later part of the Iranian year, Peyvandi added.

NPC inaugurated its Morvarid Petrochemicals Complex (Olefins 5) in 2010. Morvarid came onstream a year later than scheduled and was originally due to be constructed at Kharg Island, but the site was moved to the mainland at Assaluyeh in Bushehr. It has

the capacity to produce 500,000tpa of ethylene and will provide feedstock to a 500,000tpa ethylene glycol plant due to open at Morvarid. Technip provided process technology for the cracker as well as detailed engineering and procurement, which it carried out together with the local Nargan group.

The Pardis Petrochemical Complex, also at Assaluyeh, is designed to produce 1.08mn tpa of urea following the completion in July 2010 of the second phase of the project, the first having been completed in 2001. However, an explosion at the complex in August 2010 - just a month after the project was completed - caused significant damage. The complex is 51% owned by the private sector Ghadir Investment Company and 49% owned by NPC.

International sanctions are having a deleterious impact on the progress of existing projects, with NPC finding it difficult to tap into international financial markets, forge partnerships with petrochemicals majors and import specialist equipment. Global technology licensors have stopped doing business with Iran in order to maintain business interests in the US. Meanwhile, the complexity of raising finance from abroad as a result of the sanctions regime has deterred global banks. The sanctions have undermined business with European firms, which are insisting on approval of contracts by the European Commission. Iran is yet to feel the effect of the easing of international sanctions; we expect this feeling will lessen over the coming quarters.

In spite of the challenges facing the company, in November 2012 Kavyan Petrochemicals started up its 1mn tpa ethane cracker in Bushehr. The cracker was initially scheduled to come onstream in July 2012. No reason was provided for the delay in actual start-up of the ethylene plant. The second phase of the project will see the cracker capacity doubled to 2mn tpa.

The Kavyan crackers are linked to Iran's west ethylene pipeline, which is supplying several polymer plants along its route. The west ethylene pipeline and its offshoot, the Dena region ethylene pipeline, are set to have in total 11 downstream petrochemical projects along their routes, stretching from the south where the two Kavyan ethylene complexes and the Morvarid 5 Olefins facility are based, to the north, linking seven downstream plants. The second phase of the West Ethylene Pipeline was set for completion by end-2013 but is now expected to come onstream in 2015. The 1,200km pipeline carries ethylene produced by Kavyan petrochemical plant, in south of the country, to petrochemical plants located west of the country.

**Operational Data**    ■ Established: 1964

- Company Details**
- National Petrochemical Company
  - POB 19395  
Sheikh Bahaei Street  
Tehran  
6896  
Iran
  - Tel: +98 8805 9760

## Regional Overview

### Middle East And Africa Overview

***BMI View:** The break-through in talks over Iran's nuclear programme will lead to a surge in petrochemicals exports by the country, a situation that will put downward pressure on regional product prices and narrow margins. At the same time, ethane-based production is facing a more challenging competitive environment as the cost of naphtha declines, a trend that has caused petrochemicals producers in the Arabian Gulf to revise and even cancel major projects.*

Following an agreement regarding Iran's nuclear programme, which we expect to occur in June, we anticipate significant easing of sanctions on the country's key oil, banking and shipping sectors over the following 12 months. It is likely that Iran will immediately receive access to financial assets held overseas, and for banking sanctions to be significantly relaxed over the first few months of a deal. Sanctions on the country's oil sector will take longer to phase out.

The changing external circumstances should enable Iran's petrochemicals producers to trade and as a result raise output. This will cause over-supply in some basic chemicals markets. At the same time, rising Iranian oil exports will depress naphtha prices, ensuring that ethane-based production in the Arabian Gulf is placed at a competitive disadvantage. Oversupply in the crude oil market is also seen as another bearish factor for petrochemical producers, and this could worsen should Iran comes back to the global scene. Crude prices hit a six-year low in mid-March, after slashing more than half its value from June 2014 to January 2015 on concerns over increased shale production in the US.

Some Middle East traders have suggested the Iran nuclear deal will lead to severe market problems due to the potential scale of output that Iran can put onto the world market. At present, many Iranian producers are operating at half or less operational capacity. Not only will Iran raise operation rates of existing facilities, but it will be opening new ones. Managing Director of National Petrochemical Company Abbas Sheri-Moqaddam said: "This year, by implementing plans to supply feeds, production of petrochemicals will grow by at least 10mn tonnes." This would mark a 20% rise in output from 40mn tonnes reported in FY2014/15.

Projects at a planning stage or under construction in the Arab Gulf states would add a further 34mn tpa of petrochemicals capacity over the next five years, increasing their share of total global capacity by two percentage points to 16%. As such, Arab states will be in direct competition with Iran and the US in an increasingly oversupplied market.

Saudi Arabia has earmarked USD91bn over the next decade to build new petrochemical plants and expand existing ones, while also expanding refinery capacity. The UAE is driving up petrochemicals capacities, but producers face a challenging external market as well as the prospect of rising naphtha feedstock prices. Borouge will remain the focus of the development of the UAE's petrochemicals industry over the medium term, with an additional 2.5mn tpa coming on stream in 2014 following the completion of the Borouge 3 project in Ruwais, Abu Dhabi. It includes two Borstar PE units with a combined capacity of 1.08mn tpa, two Borstar PP units with a combined capacity of 960,000tpa and a 350,000tpa low-density PE (LDPE) unit. The forthcoming **Abu Dhabi National Chemicals Company** (Chemaweya) will also include an olefins plant, an aromatics complex and a range of downstream polymer and chemical units.

## Tightening Ethane Supplies

The Middle East is set to be left behind in the gas stakes as US shale gas production surges. Gas provides a rich and cheap source of ethane feedstock used by producers to transform into a range of petrochemicals products. Qatar and Saudi Arabia have used their plentiful resources to construct world-scale petrochemicals complexes, but these depend on large volumes of ethane that are unlikely to increase over the years ahead.

By the end of the decade, US gas production will be five times greater than Saudi Arabia. While Arabian Gulf states will increasingly come up against capacity constraints for ethane, with a resulting rise in feedstock prices, the US petrochemicals industry will enjoy access to abundant resources. Unless new sources of gas are found, including unconventional forms that the region's governments have yet to exploit, the Gulf's petrochemicals industry will face pressure on margins as it faces heightened competition, particularly in Asia. Where the Gulf can succeed is in heavier cracks, which can come from new mixed feed crackers that utilise locally available naphtha.

In the Middle East, the main factors behind rising ethane prices are the requirement to supply domestic markets to fuel economic growth and the desire to achieve higher revenues via export sales agreements. Domestic requirements include electricity generation, with natural gas seen as a cheap and easy way to meet consumption growth, which has registered a compound annual growth rate (CAGR) of 6-8%.

A tightening of the market, the rising costs of extraction and a need for incentives to encourage the drilling of non-associated gas are prompting governments to raise gas prices, reducing the differential with naphtha and eroding the region's competitive edge. However, over the short term, with crude prices remaining stubbornly high, Middle Eastern ethane-based petrochemicals production is still likely to prove a challenge to naphtha-based production, particularly in Europe.

The UAE is particularly vulnerable to a gas supply deficit during summer months, forcing it to rely on supplies from Qatar while it taps largely undeveloped offshore sour gas fields. Qatar's dependence on ethane, the tightening on supplies and subsequent rises in feedstock costs as well as its lack of indigenous oil resources means it is being forced to cut back on planned major projects in the face of pressure on margins.

Reliance on ethane in Saudi Arabia and Qatar is also limiting product diversification due to the fact there are significantly fewer by-products compared to naphtha. In polymers, this will invariably lead to an overwhelming reliance on polyethylene (PE) grades. Research and development will need to focus on greater utilisation of PE as an alternative to polypropylene (PP) in engineering plastics applications.

Qatar's reliance on ethane feedstock has limited its petrochemicals industry to some extent, as it does not produce the same range of by-products as other countries that rely on other feedstocks such as naphtha. This means it is likely to be sidelined in the special chemicals markets because, although the government is seeking to redress this imbalance with mixed crackers, other industries are also capitalising on the increasing global demand, and Qatar will be left behind.

Should Iranian sanctions be permanently lifted and oil prices fall further, OPEC may eventually decide to cut oil production in June, when it is scheduled to meet next, and just before the deadline for a final nuclear deal. This would tighten the naphtha market, providing yet more pressure on naphtha based production.

The biggest loser of a naphtha price rise would be Kuwait, the gas-poor Gulf state that has relied heavily on its oil resources. It has capitalised on the narrowing of the naphtha-ethane price differential as well as the diversification of downstream production. Kuwait's petrochemical development strategy includes the expansion of Aromatics and Olefins III projects and entering the specialised petrochemical industry.

Flexibility in feedstocks and diversification of production slates will be key to facing the surging growth of US ethane-based output in the decade ahead. In such a scenario, Saudi Arabia and Iran are likely to triumph while smaller producers will fall by the wayside, although we do not discount the potential of gas-rich North African states.

## Diversification The Long-Term Focus

Saudi Arabia's focus will be on developing high-performance and speciality grades, which can add value to exports and put the Saudi Arabian industry in direct competition with Japanese producers and other more mature markets. As a result, Saudi Arabia's manufacturing base will grow, moving the country away from

exporting basic chemicals and importing finished goods as it grows its five industrial clusters: minerals and metals processing, automotives, plastics and packaging, home appliances and solar energy.

Kuwait, the UAE and Qatar are also likely to pursue diversification, although on a smaller scale. Kuwait is set to be a growth driver in the Gulf States, benefiting from cracking heavier feedstock to produce a wider range of products. By using a mixed feed, Kuwait's Olefins III complex will be able to diversify production when it comes on stream in 2016. Meanwhile, the UAE's petrochemicals industry will benefit from the rapid expansion of capacities in highly integrated, state-of-the-art complexes but will be limited by the narrow product range and lack of downstream diversification. Qatar will benefit from its access to cheap feedstock. However, this competitive advantage is being eroded by rising gas prices and the pressure on feedstock supply caused by growth in cracker capacity, which has out-paced growth in gas supply. Qatar also has a narrow portfolio that focuses on PE that makes it vulnerable to external shocks at a time of heightened competition and increasing Asian self-sufficiency.

## Africa Falls Behind

Turning to Africa, Egypt is set to be the main focus of expansion. Gas shortages are plaguing the petrochemicals and chemical fertiliser sectors. Egypt needs around 500,000 tonnes per annum (tpa) of ethylene in order to sustain downstream production, but in 2014 local production was well below this level. Schemes that could boost downstream developments, bringing much-needed investment into the industry, include the first stage of a complex in Alexandria led by **Egyptian Ethylene & Derivatives Company** (Ethydco). The USD1.3bn scheme involves building a 460,000tpa ethylene and 20,000tpa butadiene plant by 2015. Meanwhile, Carbon Holdings will also manufacture 1.35mn tpa PE, as well as PP, butadiene and benzene. Work is due to be completed in 2020.

Having abandoned the Arzew petrochemicals complex, Algeria is unlikely to add value to domestic upstream output which would have allowed the country's petrochemicals industry to grow. As the rising consumption is set to be met by imports, the potential for expansion in manufacturing is limited. Given continued delays in investment in the energy sector, net hydrocarbons exports will remain flat over the coming years which will limit the availability of feedstock for downstream diversification, whether in fertilisers, methanol or in the polymers chain. The government's inability to liberalise the economy and declining public revenues will also constrain both private and public investment.

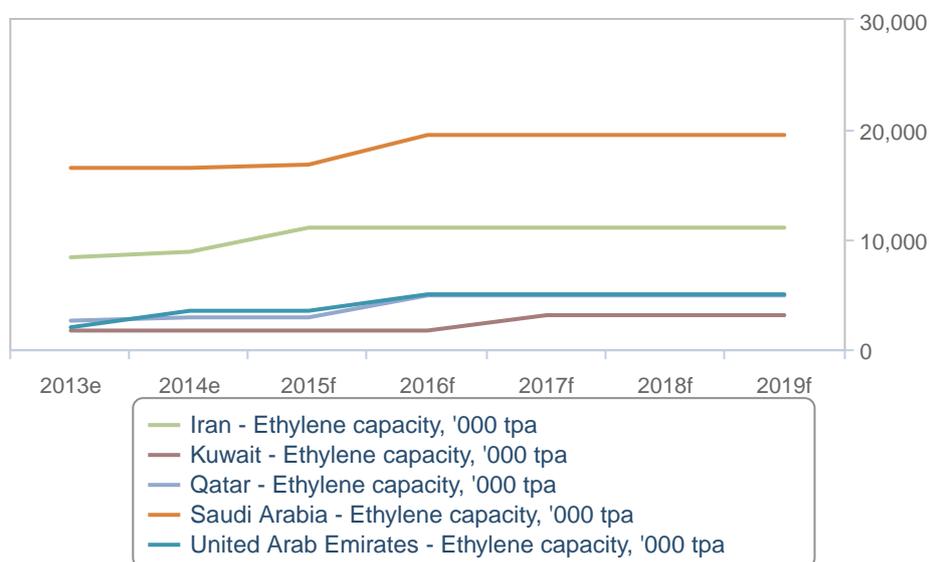
Sub-Saharan Africa will lag behind in gas-based feedstock, in spite of the high rate of petrochemicals consumption growth in the region. While Nigeria has the most promising prospects in feedstock, the business environment militates against investment and progress has been slow. Meanwhile, South Africa is

likely to decline in importance. North Africa's unexploited gas fields could offer major rewards, although instability has caused a setback. Gas-rich Algeria is still some way off constructing a world-scale complex due to regulatory problems. However, plans for new developments in Egypt - put on ice during the Arab Spring rebellion - are likely to come to fruition in coming years, utilising the country's gasfields and exploiting its geographically strategic position.

Investment in the African downstream sector will be concentrated in fertiliser and liquefied natural gas (LNG) production, while the basic chemicals segment will generally fail to capitalise on the region's massive oil and gas reserves. North Africa retains its advantage in ethane feedstock, West Africa is a major oil producing hub and South Africa has a sophisticated and significant petrochemicals market accounting for half of the continent's petrochemicals revenues. Although there is tentative interest in developing the Nigerian industry, most investment in petrochemicals production is concentrated near hydrocarbons reserves along the North African coast.

### Saudi Leads Ethylene Capacity Growth

Ethylene Capacity, Tonnes Per Annum, 2013-2019



e/f = BMI estimate/forecast. Source: National Sources/BMI

## Global Industry Overview

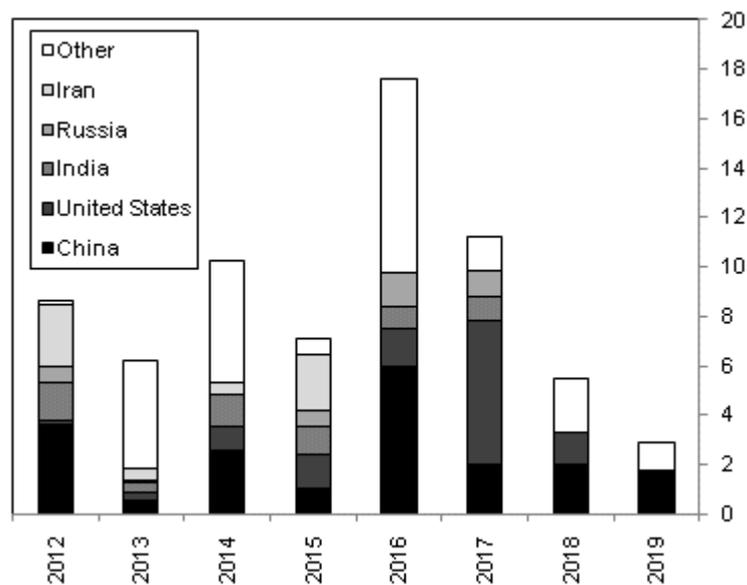
### Project Cancellation: the Impact of US Expansion and Low Oil Prices

A slow and uncertain global economic recovery coupled with strong growth in US petrochemicals capacities is leading to the cancellation of many planned world-scale complexes. As a feedstock, naphtha will continue to track crude oil prices, but the price differential with ethane is narrowing as natural gas prices increase and new ethane availability becomes scarcer. This is likely to re-establish some sort of balance in the global market, in which Middle Eastern petrochemicals producers have hitherto gained the upper hand.

The cracking of heavier naphtha feedstock allows for greater petrochemicals product diversity, thereby benefiting Asian producers in the long term. The Middle East will have to engage in a serious drive towards adding value and establishing downstream conversion industries to support sales. Demand for propylene derivatives remains strong in Asia, and **BMI** believes this is where the growth will be strongest (North American production will be less significant). Heavier cracks allow for a higher level of propylene extraction.

## US and China Lead Ethylene Expansion

Cracker Capacity Rises, mn tpa



Source: BMI

In the Middle East, ethane is already climbing in cost, although it remains at a substantial discount to naphtha. Nevertheless, ethylene production from export-oriented steam crackers associated with gas-based feedstocks is set to alter the global ethylene markets. Investment is set to continue in the Middle East and sharply increase in North America, followed by growth in Russia and Central Asia and the Caucasus. Altogether, over the next decade ethylene demand will grow by an annual average of 3.5%.

In Q115, **Braskem** postponed indefinitely its involvement in the petrochemicals element of the massive Comperj complex in Brazil, the only planned Greenfield development in South America for many years. Concerns about the competitiveness of feedstock were core to the decision, although the country's own economic travails were also a factor. Instead, Braskem has opted for a smaller scale expansion at an existing complex.

Braskem's decision follows the cancellation of two major complexes in Qatar: Al-Karaana and Al Sejeel. Together, these would have added ethylene capacity of near 3mn tpa and up to 5mn tpa of derivative products. The decision was prompted by the fall in oil prices, which reduced the competitive advantage of

Qatar's ethane feedstock over naphtha. The possibility of ethane supply constraints also raised the possibility of higher feedstock costs. However, projects currently under construction are too far advanced to cancel, such as **ExxonMobil's** joint venture with QP which will see an ethane-fed cracker with capacity of 1.6mn tpa ethylene and downstream units including 1.3mn tpa of polyethylene (PE) plants and a 700,000tpa ethylene glycol unit. The complex is due on stream in Q415, although delays to engineering contracts could push the date back to 2016.

Across the Arabian Gulf, in Iran new complexes are at risk of being delayed or cancelled. The NPC aims to raise ethylene capacity at the Kavyan complex to 2mn tpa by 2015, making it the country's largest ethylene production site, but this could also be postponed. The West Ethylene Pipeline, fed by Kavyan, is also in danger of failure and its route could be shortened, threatening the planned polymers plants that it supplies. For Iran's plants to operate at reasonable levels of capacity utilisation, olefins output would have to increase by a third and polymers by a third, but the demand may not exist and may not have existed even without the sanctions regime.

Concerns over feedstock costs also prompted **Sonatrach** to cancel its joint venture with **Total** for a petrochemicals complex in Arzew, Algeria. This ruled out a cracker with 1.1mn tpa of ethylene capacity and around 1.4mn tpa of derivatives capacities.

## Outlook for 2015: Falling prices

Petrochemicals prices fell sharply in Q414 due to the fall in crude oil prices, which caused a fall in naphtha feedstock prices. The key oil Benchmarks of Brent and WTI fell 22.5% and 19.5% respectively from late June 2014 to late December 2014.

Naphtha is setting the marginal price for olefins - ethylene and propylene - and in turn influences the price of derivatives, such as polyethylene (PE) and polypropylene (PP). The rate of change is influenced by market trends with a tighter market likely to support prices. Over-supply of olefins and sluggish demand in some markets, particularly Europe, meant that prices fell faster than naphtha. However, PE and PP declined less due to lower inventories, which helped tighten the market and support prices.

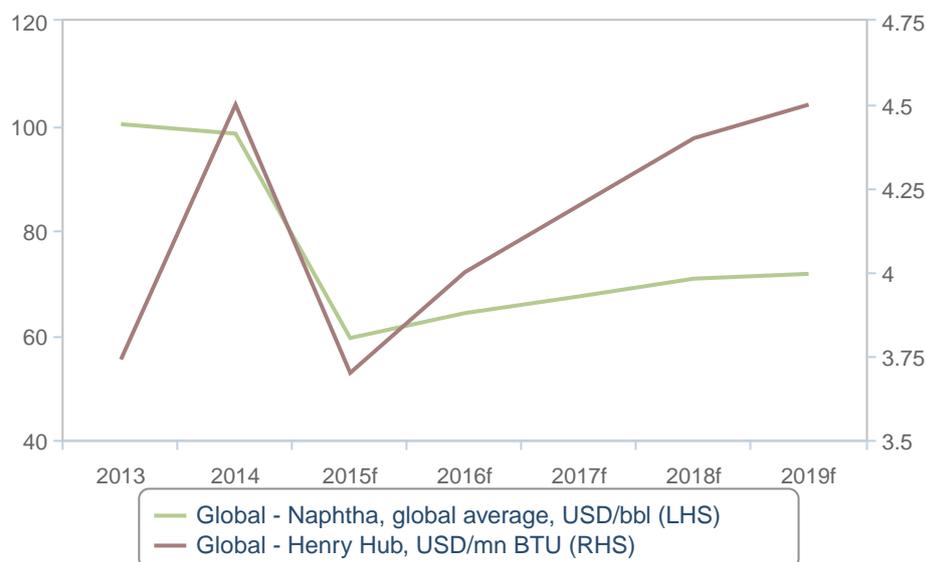
Price dynamics in 2015 will again follow oil price trends as the differential between ethane and naphtha feedstocks narrows. Our core view is that oil prices will trade in the USD90-100/bbl range in the coming months and over 2015, under the assumption that OPEC will act to curb supply in late November. If however, OPEC does not cut production we see a plausible scenario with Brent hitting USD60/bbl over the coming months, presenting major risks to a vast part of current and planned production.

The effect on naphtha prices in Rotterdam will be less than in Singapore, which will limit the effect of the oil price decline on European petrochemicals output. As such, European producers will remain saddled with competitiveness issues in an uncertain market environment. While European cracker margins will rise, a rapid decline in polymer prices reported at the start of 2015 still threatens overall petrochemicals margins.

The US will not escape the pressures either as lower naphtha prices erode the competitive advantage of ethane-based feedstocks. At the same time, the Arabian Gulf states - particularly Saudi Arabia and Qatar, which largely based on ethane - will see upward pressure on ethane prices. The winners in the competitiveness stakes are likely to be highly integrated naphtha-based producers in Asia.

## Ethane-Naphtha Gap Narrows

### Feedstock Prices



*f = BMI forecast. Source: BMI/Bloomberg*

## Medium-term outlook

The global ethylene market will fall into three types of market categories: countries attracting new export-oriented ethylene investments based on advantaged feedstocks (North America, Middle East, and Russia and the Caspian), fast-growing markets with facilities based on naphtha feedstock but still reliant on imports from gas advantaged producers (China, India and South East Asia) and countries hosting high-cost, ageing

plants that will be subject to rationalisation, consolidation and specialisation (EU and developed northeast Asian markets).

The global ethylene market is forecast to grow at a CAGR of over 6% over the period 2014-2019, although this will lag behind rising cracker capacity. As a result, over the next five years and in spite of over-capacity, the compound annual growth rate (CAGR) for naphtha feedstock demand will be around 3.5%, with Asia-Pacific building on the 40% global market share it achieved in 2013. The North American market is expected to see a CAGR of 2.5% while the European market is estimated to grow at a CAGR of 2.0% from 2013 to 2019.

In response to growing demand, polymer capacities are rising fast. Polyethylene (PE) capacity will increase from around 150mn tpa in 2012 to around 175mn tpa by 2019, growing at an average rate of around 3.5% a year, which is less than global demand growth of 4.5%. Supply will be increasingly served by growth in North East Asia, which will see PE capacity grow from just under 22mn tpa in 2012 to over 35mn tpa by 2019, a situation that will depend on decisions made on Chinese capacities. Western Europe will be the only region to see a decline in PE capacity with a further 300,000tpa due to be removed by 2019 following the loss of nearly 2mn tpa in recent restructuring.

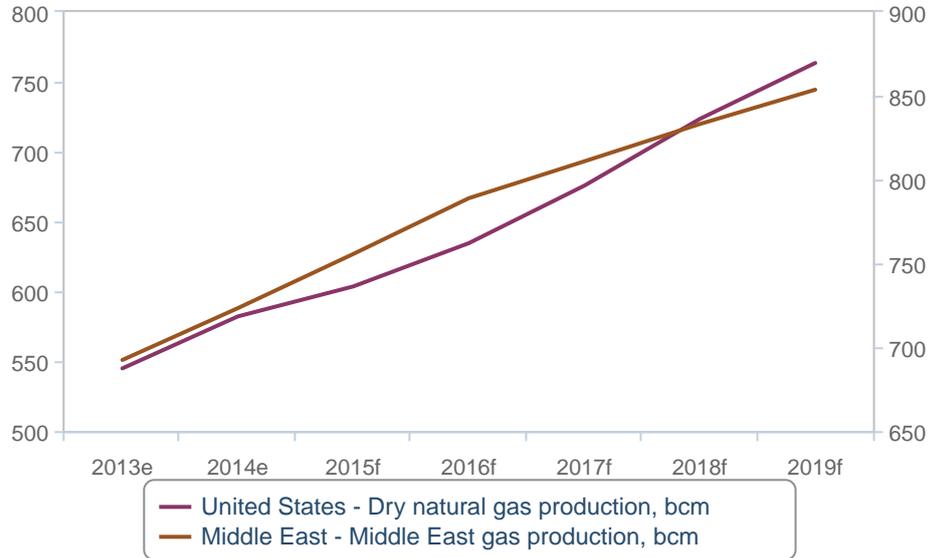
Polypropylene (PP) is likely to follow a similar course. Over the past five years North American PP demand has fallen as PP-consuming manufacturing sectors have contracted, while the European market has stagnated. In contrast, in India annual PP consumption growth has averaged over 10%; the North East Asian market has grown 6% a year and the Latin American by 5%. These trends are set to continue over the medium term, with developed and emerging markets to travel on very different growth trajectories. With demand growth set to outstrip supply, the PP sector will be in balance by 2019.

## China versus the US: feedstock wars

Unconventional feedstocks will define the development of the global petrochemicals industry going forward. While the US is building export-oriented petrochemical projects based on shale gas, China is seeking greater self-sufficiency with cheap coal-to-olefins to boost capacity. These two dynamics could reshape the global petrochemicals markets and trade flows, with China, the motor of growth in recent years, set to see its import growth diminish while US production floods the market. As such, **BMI** believes that the process of consolidation and capacity cut-backs in mature markets such as Europe, where naphtha-fed and relatively small-scale units are increasingly uncompetitive, may not be over.

## US versus Middle East Gas Output

### US Keeps Ahead of Middle East

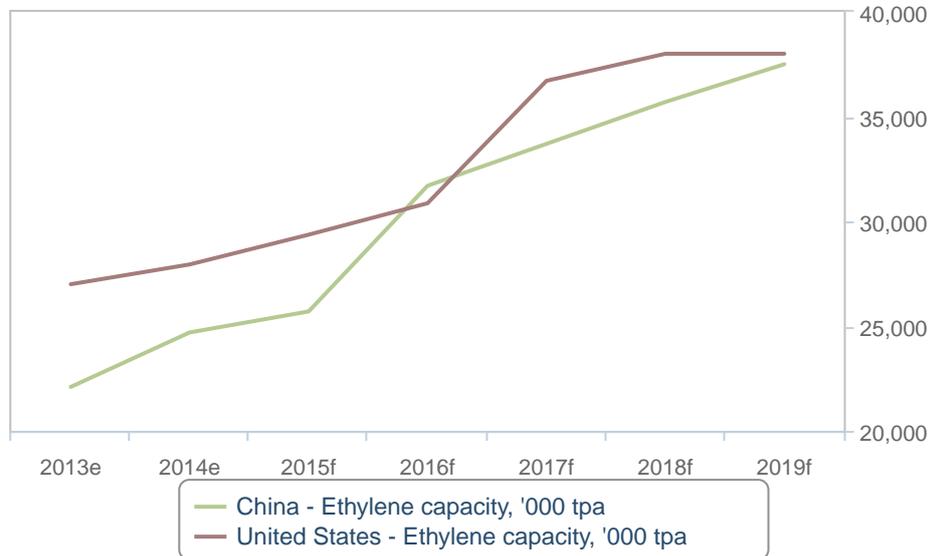


e/f = BMI estimate/forecast. Source: BMI/EIA

CTO plants are the cornerstone of China's drive towards self-sufficiency, utilising the country's abundant coal resources instead of naphtha which creates greater import dependence. However, there will be limitations on water resources and the threat of environmental pollution will contain the rate of capacity build-up well below what has been announced. As much as 11mn tpa coal/methanol-based capacity has been announced from 2013 to 2020, but only 3.7mn tpa of total capacity has been approved so far by the National Development and Reform Commission (NDRC).

## China vs Us Ethylene

### China and US are Rivals in Ethylene



e/f = BMI estimate/forecast. Source: National Sources/BMI

Around 65-75% of the new capacity set to come online in the US Gulf Coast over the coming five years will be exported, largely in the form of plastic resin. US petrochemicals producers will have a cost advantage of up to 60% over producers in Europe and Asia, which rely mostly on naphtha feedstock. While the global price of naphtha is likely to steadily fall over the next five years, declining 10% between 2012 and 2018, the price of gas is likely to rise, with average Henry Hub prices set to almost double over the same period. Ethane will still remain at a significant advantage compared to naphtha, but the competitive advantage enjoyed by gas-rich Arabian Gulf states will diminish due to supply constraints amid soaring demand from domestic industry and electricity generation.

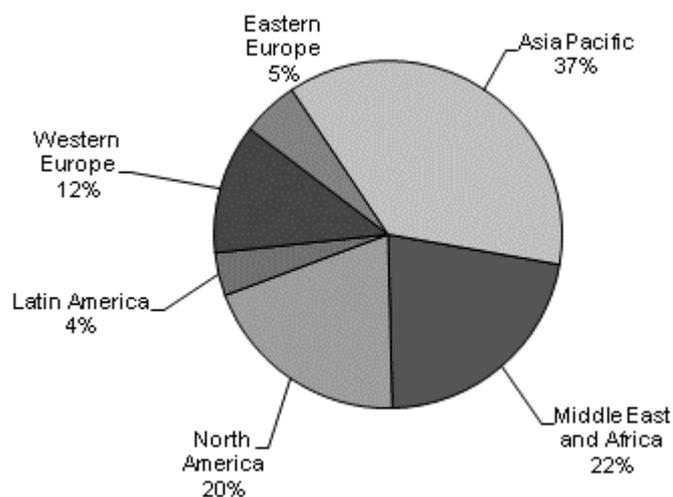
Shale gas is set to make a major impact on the structure of the global ethylene market going forward. Technically recoverable reserves of shale natural gas and oil on a global scale have been revised upwards by the US Energy Information Administration (EIA). Shale gas estimates are now at 206trn cubic metres, a 10% increase over 2011, while shale oil reserves are estimated at 345bn barrels (bbl). In total, shale gas represents 32% of the technically recoverable reserves in the world, while shale oil is 9%. China has the largest shale gas reserves, representing 15% of global reserves, followed by Argentina (11%), Algeria

(10%), the US (10%), Canada (8%) and Mexico (8%). Russia has the largest amount of technically recoverable shale oil at 75bn bbl, followed by the US (58bn bbl), China (32bn bbl), Argentina (27bn bbl) and Libya (26bn bbl).

The change in structure in the global market could lead a move to C4s, aromatics and heavier product lines, as well as the further development of bio-based and coal feedstocks for chemicals. This will provide an advantage over purely ethane-fed crackers, which have a lower capacity to produce olefins other than ethylene. In turn, this could protect the competitive edge of planned complexes based on mixed feed and naphtha-fed crackers, which are the majority due to come onstream in Asia and the Middle East over the coming years.

### Global Ethylene Capacity By Region

2014 (%)



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Source: BMI

## Global - Crude Oil, Refined Fuels And Natural Gas Prices, 10-year Forecasts

Table: Energy Price Forecasts, 2013-2018

	2013	2014	2015f	2016f	2017f	2018f
OPEC basket, USD/bbl	105.90	96.30	56.00	58.00	60.00	62.00
WTI, USD/bbl	98.00	93.06	52.00	55.00	58.00	59.00
Brent, USD/bbl	108.70	99.50	59.00	61.00	63.00	65.00
Urals, USD/bbl	107.90	98.09	57.00	59.00	61.00	63.00
Dubai, USD/bbl	105.40	96.50	55.00	57.00	59.00	61.00
Unleaded gasoline, Rotterdam, USD/bbl	115.19	110.71	70.25	69.90	69.95	70.50
Unleaded gasoline, New York, USD/bbl	118.70	114.83	70.75	71.15	72.20	73.00
Unleaded gasoline, Singapore, USD/bbl	115.89	112.46	69.75	70.65	72.00	73.20
Unleaded gasoline, global average, USD/bbl	116.59	112.67	70.25	70.57	71.38	72.23
Gasoil/diesel, Rotterdam, USD/bbl	124.81	111.00	67.85	71.50	75.00	78.00
Gasoil/diesel, Singapore, USD/bbl	123.15	112.45	67.75	72.00	75.50	78.20
Gasoil/diesel, global average, USD/bbl	124.84	111.82	67.90	71.73	75.10	78.00
Naphtha, Rotterdam, USD/bbl	100.27	98.30	59.30	64.00	67.20	70.56
Naphtha, Singapore, USD/bbl	100.27	98.62	59.60	64.40	67.60	71.00
Naphtha, global average, USD/bbl	100.27	98.46	59.45	64.20	67.40	70.78
Jet/kerosene, Rotterdam, USD/bbl	127.30	116.21	71.24	76.50	79.50	83.45
Jet/kerosene, New York, USD/bbl	125.10	117.36	72.25	77.50	80.50	84.20
Jet/kerosene, Singapore, USD/bbl	122.65	112.38	67.20	73.50	77.00	81.20
Jet/kerosene, global average, USD/bbl	125.02	115.32	70.23	75.83	79.00	82.95
Bunker fuel 180, Rotterdam, USD/bbl	95.07	83.64	44.14	44.00	46.00	45.50
Bunker fuel 180, New York, USD/bbl	97.52	96.85	52.09	50.00	51.50	50.50
Bunker fuel 180, Singapore, USD/bbl	93.96	86.96	45.80	46.50	48.50	47.75
Bunker fuel 180, global average, USD/bbl	95.52	89.15	47.34	46.83	48.67	47.92
Bunker fuel 380, Rotterdam, USD/bbl	91.24	79.84	40.16	42.50	44.50	42.50
Bunker fuel 380, New York, USD/bbl	93.13	83.55	44.16	45.00	46.75	44.50
Bunker fuel 380, Singapore, USD/bbl	95.84	83.27	44.94	45.50	47.50	45.00
Bunker fuel 380, Singapore, USD/bbl	95.84	83.27	44.94	45.50	47.50	45.00
Bunker fuel 380, global average, USD/bbl	93.40	82.22	43.09	44.33	46.25	44.00
Bunker fuel, Rotterdam, USD/bbl	93.16	88.04	42.15	43.25	45.25	44.00
Bunker fuel, New York, USD/bbl	95.33	94.02	48.13	47.50	49.13	47.50
Bunker fuel, Singapore, USD/bbl	94.90	90.23	45.37	46.00	48.00	46.38
Bunker fuel, global average, USD/bbl	94.46	90.76	45.22	45.58	47.46	45.96

**Energy Price Forecasts, 2013-2018 - Continued**

	2013	2014	2015f	2016f	2017f	2018f
Henry Hub, USD/mn BTU	3.74	4.50	3.00	3.30	3.50	4.00

f=BMI forecast. Source: BMI/Bloomberg

**Table: Energy Price Forecasts, 2019-2024 ( Global 2019-2024)**

	2019f	2020f	2021f	2022f	2023f	2024f
OPEC basket, USD/bbl	63.00	67.00	69.00	72.00	74.00	75.00
WTI, USD/bbl	60.00	62.00	65.00	68.00	72.00	73.00
Brent, USD/bbl	66.00	70.00	72.00	75.00	77.00	78.00
Urals, USD/bbl	64.00	68.00	70.00	73.00	75.00	76.00
Dubai, USD/bbl	62.00	66.00	68.00	71.00	73.00	74.00
Unleaded gasoline, Rotterdam, USD/bbl	71.00	71.00	71.00	71.00	71.00	71.00
Unleaded gasoline, New York, USD/bbl	73.70	73.70	73.70	73.70	73.70	73.70
Unleaded gasoline, Singapore, USD/bbl	74.50	74.50	74.50	74.50	74.50	74.50
Unleaded gasoline, global average, USD/bbl	73.07	73.07	73.07	73.07	73.07	73.07
Gasoil/diesel, Rotterdam, USD/bbl	79.00	80.00	81.00	81.00	81.00	81.00
Gasoil/diesel, Singapore, USD/bbl	79.30	80.20	81.00	81.00	81.00	81.00
Gasoil/diesel, global average, USD/bbl	79.10	80.07	81.00	81.00	81.00	81.00
Naphtha, Rotterdam, USD/bbl	71.60	72.50	73.40	73.40	73.40	73.40
Naphtha, Singapore, USD/bbl	71.80	72.60	73.30	73.30	73.30	73.30
Naphtha, global average, USD/bbl	71.70	72.55	73.35	73.35	73.35	73.35
Jet/kerosene, Rotterdam, USD/bbl	84.85	98.50	98.50	98.50	98.50	99.50
Jet/kerosene, New York, USD/bbl	85.60	98.50	98.50	98.50	98.50	99.50
Jet/kerosene, Singapore, USD/bbl	82.60	97.00	97.00	97.00	97.00	98.00
Jet/kerosene, global average, USD/bbl	84.35	98.00	98.00	98.00	98.00	99.00
Bunker fuel 180, Rotterdam, USD/bbl	45.35	45.35	45.35	45.35	45.35	45.35
Bunker fuel 180, New York, USD/bbl	50.35	50.35	50.35	50.35	50.35	50.35
Bunker fuel 180, Singapore, USD/bbl	47.60	47.60	47.60	47.60	47.60	47.60
Bunker fuel 180, global average, USD/bbl	47.77	47.77	47.77	47.77	47.77	47.77
Bunker fuel 380, Rotterdam, USD/bbl	43.00	43.00	43.00	43.00	43.00	43.00
Bunker fuel 380, New York, USD/bbl	45.00	45.00	45.00	45.00	45.00	45.00
Bunker fuel 380, Singapore, USD/bbl	45.50	45.50	45.50	45.50	45.50	45.50
Bunker fuel 380, Singapore, USD/bbl	45.50	45.50	45.50	45.50	45.50	45.50

**Energy Price Forecasts, 2019-2024 ( Global 2019-2024) - Continued**

	<b>2019f</b>	<b>2020f</b>	<b>2021f</b>	<b>2022f</b>	<b>2023f</b>	<b>2024f</b>
Bunker fuel 380, global average, USD/bbl	44.50	44.50	44.50	44.50	44.50	44.50
Bunker fuel, Rotterdam, USD/bbl	44.18	44.18	44.18	44.18	44.18	44.18
Bunker fuel, New York, USD/bbl	47.68	47.68	47.68	47.68	47.68	47.68
Bunker fuel, Singapore, USD/bbl	46.55	46.55	46.55	46.55	46.55	46.55
Bunker fuel, global average, USD/bbl	46.13	46.13	46.13	46.13	46.13	46.13
Henry Hub, USD/mn BTU	4.20	4.20	4.20	4.20	4.20	4.20

*f=BMI forecast. Source: BMI, Bloomberg*

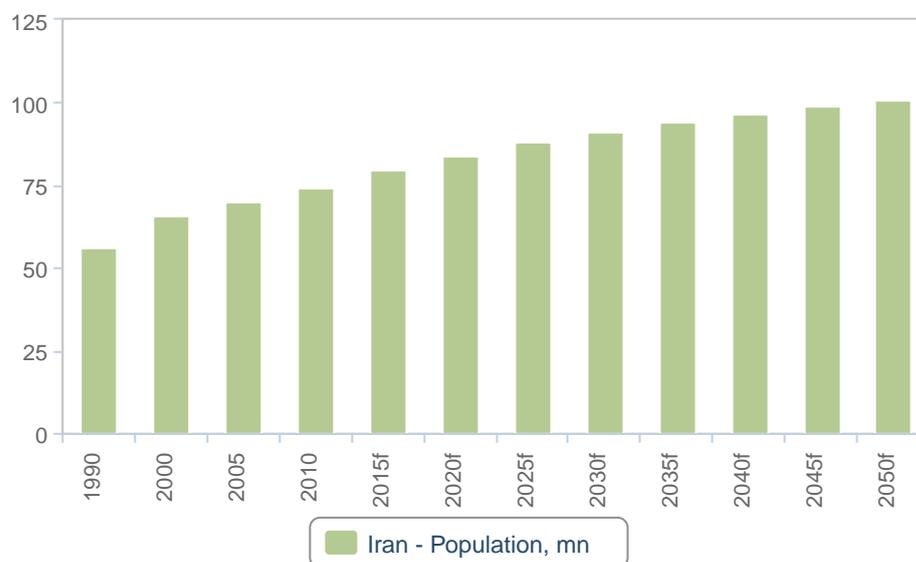
## Demographic Forecast

Demographic analysis is a key pillar of **BMI**'s macroeconomic and industry forecasting model. Not only is the total population of a country a key variable in consumer demand, but an understanding of the demographic profile is essential to understanding issues ranging from future population trends to productivity growth and government spending requirements.

The accompanying charts detail the population pyramid for 2015, the change in the structure of the population between 2015 and 2050 and the total population between 1990 and 2050. The tables show indicators from all of these charts, in addition to key metrics such as population ratios, the urban/rural split and life expectancy.

### Population

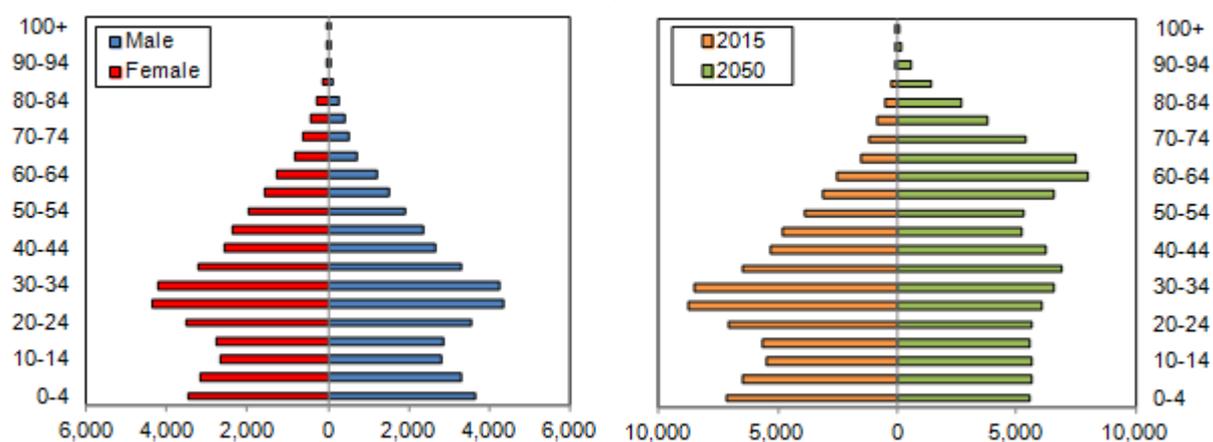
(1990-2050)



*f = BMI forecast. Source: World Bank, UN, BMI*

## Iran Population Pyramid

2015 (LHS) &amp; 2015 Versus 2050 (RHS)



Source: World Bank, UN, BMI

Table: Population Headline Indicators (Iran 1990-2025)

	1990	2000	2005	2010	2015f	2020f	2025f
Population, total, '000	56,361	65,911	70,152	74,462	79,476	84,148	88,064
Population, % change y-o-y	na	1.6	1.2	1.3	1.3	1.1	0.8
Population, total, male, '000	28,807	33,504	35,917	37,656	39,915	42,307	44,213
Population, total, female, '000	27,554	32,406	34,235	36,805	39,560	41,840	43,850
Population ratio, male/female	1.05	1.03	1.05	1.02	1.01	1.01	1.01

na = not available; f = BMI forecast. Source: World Bank, UN, BMI

Table: Key Population Ratios (Iran 1990-2025)

	1990	2000	2005	2010	2015f	2020f	2025f
Active population, total, '000	28,945	40,290	48,583	53,034	55,945	58,184	60,945
Active population, % of total population	51.4	61.1	69.3	71.2	70.4	69.1	69.2
Dependent population, total, '000	27,415	25,620	21,569	21,427	23,530	25,964	27,118
Dependent ratio, % of total working age	94.7	63.6	44.4	40.4	42.1	44.6	44.5

**Key Population Ratios (Iran 1990-2025) - Continued**

	1990	2000	2005	2010	2015f	2020f	2025f
Youth population, total, '000	25,543	22,850	18,115	17,585	19,140	20,362	19,984
Youth population, % of total working age	88.2	56.7	37.3	33.2	34.2	35.0	32.8
Pensionable population, '000	1,872	2,770	3,453	3,841	4,389	5,601	7,134
Pensionable population, % of total working age	6.5	6.9	7.1	7.2	7.8	9.6	11.7

f = BMI forecast. Source: World Bank, UN, BMI

**Table: Urban/Rural Population And Life Expectancy (Iran 1990-2025)**

	1990	2000	2005	2010e	2015f	2020f	2025f
Urban population, '000	31,748.6	42,210.8	47,393.5	51,332.8	55,362.4	59,374.4	63,078.7
Urban population, % of total	56.3	64.0	67.6	68.9	69.7	70.6	71.6
Rural population, '000	24,613.2	23,700.3	22,758.8	23,129.5	24,113.9	24,774.2	24,985.6
Rural population, % of total	43.7	36.0	32.4	31.1	30.3	29.4	28.4
Life expectancy at birth, male, years	61.2	68.7	70.0	71.3	72.8	74.2	75.5
Life expectancy at birth, female, years	65.8	70.6	73.1	75.1	76.6	78.0	79.2
Life expectancy at birth, average, years	63.4	69.6	71.5	73.1	74.6	76.0	77.3

e/f = BMI estimate/forecast. Source: World Bank, UN, BMI

**Table: Population By Age Group (Iran 1990-2025)**

	1990	2000	2005	2010	2015f	2020f	2025f
Population, 0-4 yrs, total, '000	9,312	6,316	5,483	6,555	7,146	6,751	6,148
Population, 5-9 yrs, total, '000	8,905	7,552	5,476	5,416	6,507	7,116	6,729
Population, 10-14 yrs, total, '000	7,324	8,981	7,154	5,613	5,487	6,494	7,105
Population, 15-19 yrs, total, '000	5,822	8,800	9,247	7,215	5,643	5,466	6,474
Population, 20-24 yrs, total, '000	4,697	6,932	9,143	8,993	7,067	5,595	5,424
Population, 25-29 yrs, total, '000	4,054	5,315	6,859	8,704	8,726	6,997	5,541
Population, 30-34 yrs, total, '000	3,535	4,442	5,202	6,521	8,484	8,649	6,937
Population, 35-39 yrs, total, '000	3,030	3,886	4,693	5,210	6,497	8,410	8,579
Population, 40-44 yrs, total, '000	2,123	3,372	4,112	4,833	5,262	6,431	8,333
Population, 45-49 yrs, total, '000	1,620	2,857	3,421	4,032	4,757	5,193	6,353

**Population By Age Group (Iran 1990-2025) - Continued**

	1990	2000	2005	2010	2015f	2020f	2025f
Population, 50-54 yrs, total, '000	1,526	1,929	2,800	3,244	3,895	4,665	5,101
Population, 55-59 yrs, total, '000	1,393	1,431	1,766	2,637	3,109	3,788	4,548
Population, 60-64 yrs, total, '000	1,140	1,322	1,336	1,639	2,500	2,985	3,652
Population, 65-69 yrs, total, '000	898	1,145	1,257	1,279	1,550	2,340	2,813
Population, 70-74 yrs, total, '000	507	825	1,055	1,129	1,143	1,369	2,090
Population, 75-79 yrs, total, '000	269	508	654	802	876	902	1,105
Population, 80-84 yrs, total, '000	135	203	347	413	528	598	637
Population, 85-89 yrs, total, '000	48	66	112	172	216	290	343
Population, 90-94 yrs, total, '000	10	17	21	38	63	84	119
Population, 95-99 yrs, total, '000	1	2	3	4	8	15	22
Population, 100+ yrs, total, '000	0	0	0	0	0	1	2

*f = BMI forecast. Source: World Bank, UN, BMI*

**Table: Population By Age Group % (Iran 1990-2025)**

	1990	2000	2005	2010	2015f	2020f	2025f
Population, 0-4 yrs, % total	16.52	9.58	7.82	8.80	8.99	8.02	6.98
Population, 5-9 yrs, % total	15.80	11.46	7.81	7.27	8.19	8.46	7.64
Population, 10-14 yrs, % total	13.00	13.63	10.20	7.54	6.90	7.72	8.07
Population, 15-19 yrs, % total	10.33	13.35	13.18	9.69	7.10	6.50	7.35
Population, 20-24 yrs, % total	8.34	10.52	13.03	12.08	8.89	6.65	6.16
Population, 25-29 yrs, % total	7.19	8.06	9.78	11.69	10.98	8.32	6.29
Population, 30-34 yrs, % total	6.27	6.74	7.42	8.76	10.68	10.28	7.88
Population, 35-39 yrs, % total	5.38	5.90	6.69	7.00	8.18	9.99	9.74
Population, 40-44 yrs, % total	3.77	5.12	5.86	6.49	6.62	7.64	9.46
Population, 45-49 yrs, % total	2.88	4.33	4.88	5.42	5.99	6.17	7.22
Population, 50-54 yrs, % total	2.71	2.93	3.99	4.36	4.90	5.54	5.79
Population, 55-59 yrs, % total	2.47	2.17	2.52	3.54	3.91	4.50	5.17
Population, 60-64 yrs, % total	2.02	2.01	1.90	2.20	3.15	3.55	4.15
Population, 65-69 yrs, % total	1.59	1.74	1.79	1.72	1.95	2.78	3.19
Population, 70-74 yrs, % total	0.90	1.25	1.50	1.52	1.44	1.63	2.37
Population, 75-79 yrs, % total	0.48	0.77	0.93	1.08	1.10	1.07	1.26
Population, 80-84 yrs, % total	0.24	0.31	0.50	0.55	0.66	0.71	0.72

**Population By Age Group % (Iran 1990-2025) - Continued**

	1990	2000	2005	2010	2015f	2020f	2025f
Population, 85-89 yrs, % total	0.09	0.10	0.16	0.23	0.27	0.34	0.39
Population, 90-94 yrs, % total	0.02	0.03	0.03	0.05	0.08	0.10	0.14
Population, 95-99 yrs, % total	0.00	0.00	0.00	0.01	0.01	0.02	0.03
Population, 100+ yrs, % total	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*f = BMI forecast. Source: World Bank, UN, BMI*

## Glossary

**Table: Glossary Of Petrochemicals Terms**

ABS	acrylonitrile-butadiene-styrene	MTBE	methyl tertiary butyl ether
AN	acrylonitrile	NOC	national oil company
AS	acrylonitrile styrene	OX	orthoxylyene
bbf	barrel	PE	polyethylene
bcm	billion cubic metres	PET	polyethylene terephthalate
b/d	barrels per day	PG	propylene glycol
BR	butadiene rubber	PO	propylene oxide
btu	British thermal units	PP	polypropylene
DMT	dimethyl terephthalate	PS	polystyrene
EB	ethylbenzene	PTA	purified terephthalic acid
EDC	ethylene dichloride	PU	polyurethane
EG	ethylene glycol	PVC	polyvinyl chloride
EO	ethylene oxide	PX	paraxylyene
GTL	gas-to-liquids	q-o-q	quarter-on-quarter
HDPE	high density polyethylene	SBR	styrene butadiene rubber
IOC	international oil company	SM	styrene monomer
JV	joint venture	TDI	toluene diisocyanate
LAB	linear alkylbenzene	tpa	tonnes per annum
LDPE	low density polyethylene	VAM	vinyl acetate monomer
LLDPE	linear low density polyethylene	VCM	vinyl chloride monomer
LNG	liquefied natural gas	y-o-y	year-on-year
MEG	mono-ethylene glycol		

Source: BMI

# Methodology

## Industry Forecast Methodology

**BMI**'s industry forecasts are generated using the best-practice techniques of time-series modelling and causal/econometric modelling. The precise form of model we use varies from industry to industry, in each case determined, as per standard practice, by the prevailing features of the industry data being examined.

Common to our analysis of every industry is the use of vector autoregressions, which allow us to forecast a variable using more than the variable's own history as explanatory information. For example, when forecasting oil prices, we can include information about oil consumption, supply and capacity.

When forecasting for some of our industry sub-component variables, however, using a variable's own history is often the most desirable method of analysis. Such single-variable analysis is called univariate modelling. We use the most common and versatile form of univariate models: the autoregressive moving average model (ARMA).

In some cases, ARMA techniques are inappropriate because there is insufficient historic data or data quality is poor. In such cases, we use either traditional decomposition methods or smoothing methods as a basis for analysis and forecasting.

**BMI** mainly uses OLS estimators and in order to avoid relying on subjective views and encourage the use of objective views, **BMI** uses a 'general-to-specific' method. **BMI** mainly uses a linear model, but simple non-linear models, such as the log-linear model, are used when necessary. During periods of 'industry shock', for example poor weather conditions impeding agricultural output, dummy variables are used to determine the level of impact.

Effective forecasting depends on appropriately selected regression models. **BMI** selects the best model according to various different criteria and tests, including but not exclusive to:

- $R^2$  tests explanatory power; adjusted  $R^2$  takes degree of freedom into account;
- Testing the directional movement and magnitude of coefficients;
- Hypothesis testing to ensure coefficients are significant (normally t-test and/or P-value);
- All results are assessed to alleviate issues related to auto-correlation and multi-collinearity.

**BMI** uses the selected best model to perform forecasting.

Human intervention plays a necessary and desirable role in all of our industry forecasting. Experience, expertise and knowledge of industry data and trends ensure analysts spot structural breaks, anomalous data, turning points and seasonal features where a purely mechanical forecasting process would not.

### **Sector-Specific Methodology**

#### **Plant Capacity**

The ability of a country to produce basic chemical products depends on domestic plant capacity. The number and size of ethylene crackers determines both a country's likely output and also its relative efficiency as a producer. We therefore examine:

- Stated year-end capacity for key petrochemicals products: ethylene, propylene, polypropylene, polyethylene and other petrochemicals;
- Specific company and/or government capacity expansion projects aimed at increasing the number and/or size of crackers and downstream processing facilities;
- Government, company and third-party sources.

#### **Chemicals Supply**

A mixture of methods is used to generate supply forecasts, applied as appropriate to each individual country:

- Basic plant capacity and historic utilisation rates. Unless a company imports chemicals products for domestic re-sale, supply is expected to be governed by production capacity;
- Underlying economic growth trends. The chemicals industry is highly cyclical. Strong domestic or regional demand should be met by increased supply and higher plant utilisation rates;
- Third-party projections from national and international industry trade associations.

#### **Chemicals Demand**

Various methods are used to generate demand forecasts, applied as appropriate to each individual country:

- Underlying economic growth trends. The chemicals industry is highly cyclical. Strong domestic or regional demand is expected to require larger volumes of either domestically produced or imported olefins (ethylene, propylene), polyolefins (PE, PP) or downstream products;

- Trends in end-user industries. Strong demand for motor vehicles, construction materials, packaging products and pharmaceuticals imply rising demand for basic chemicals;
- Government/industry projections;
- Third-party forecasts from national and international industry trade associations.

### **Cross Checks**

Whenever possible, we compare government and/or third party agency projections with spending and capacity expansion plans of the companies operating in each individual country. Where there are discrepancies, we use company-specific data, such as physical spending patterns to determine capacity and supply capability. Similarly, we compare capacity expansion plans and demand projections to check the chemicals balance of each country. Where the data suggest imports or exports, we check that necessary capacity exists or that the required investment in infrastructure is taking place.

## **Risk/Reward Index Methodology**

**BMI's Risk/Reward Index (RRI)** provide a comparative regional ranking system evaluating the ease of doing business and the industry-specific opportunities and limitations for potential investors in a given market. The RRI system is divided into two distinct areas:

**Rewards:** Evaluation of sector's size and growth potential in each state, and also broader industry/state characteristics that may inhibit its development. This is broken down into two sub-categories:

- **Industry Rewards.** This is an industry-specific category taking into account current industry size and growth forecasts, the openness of market to new entrants and foreign investors, to provide an overall score for potential returns for investors.
- **Country Rewards.** This is a country-specific category, which factors in favourable political and economic conditions for the industry.

**Risks:** Evaluation of industry-specific dangers and those emanating from the state's political/economic profile that call into question the likelihood of anticipated returns being realised over the assessed time period. This is broken down into two sub-categories:

- **Industry Risks:** This is an industry-specific category whose score covers potential operational risks to investors, regulatory issues inhibiting the industry and the relative maturity of a market.
- **Country Risks:** This is a country-specific category in which political and economic instability, unfavourable legislation and a poor overall business environment are evaluated to provide an overall score.

We take a weighted average, combining Industry and Country Risks, or Industry and Country Rewards. These two results in turn provide an overall Risk/Reward Index score, which is used to create our regional ranking system for the risks and rewards of involvement in a specific industry in a particular country.

For each category and sub-category, each state is scored out of 100 (100 being the best), with the overall Risk/Reward Index score a weighted average of the total score. Importantly, as most of the countries and territories evaluated are considered by **BMI** to be 'emerging markets', our index is revised on a quarterly basis. This ensures that the index draws on the latest information and data across our broad range of sources, and the expertise of our analysts.

### Indicators

The following indicators have been used. Overall, the index uses three subjectively measured indicators, and 41 separate indicators/datasets.

**Table: Petrochemicals Risk/Reward Index Indicators**

	Rationale
<b>Rewards</b>	
<b>Industry Rewards</b>	
Cracker capacity, current year	Objective measure of sector size
Cracker capacity, future year	Forecast of sector development
Downstream capacity, current year	Objective measure of domestic demand
<b>Country Rewards</b>	
Financial infrastructure	Score from BMI's Country Risk Index (CRI) to denote ease of obtaining investment finance. Poor availability of finance will hinder company operations across the economy.
Trade bureaucracy	From CRI. Low trade restrictions are essential for this export-based industry.
Physical infrastructure	From CRI. Given the size of manufacturing units, sector development requires strong supporting power/water/transport infrastructure.
<b>Risks</b>	
<b>Industry Risks</b>	
Industry regulatory environment	Subjective evaluation against BMI-defined criteria. Evaluates predictability of operating environment.
<b>Country Risks</b>	
Structure of economy	From CRI. Denotes health of underlying economic structure, including seven indicators such as volatility of growth, reliance on commodity imports, reliance on single sector for exports

**Petrochemicals Risk/Reward Index Indicators - Continued**

	<b>Rationale</b>
Long-term external economic risk	From CRI. Denotes vulnerability to external shock, which is the principal cause of economic crises.
Long-term external financial risk	From CRI. Denotes vulnerability of currency/stability of financial sector.
Institutions	From CRI. Denotes strength of bureaucracy and legal framework and evaluates level of corruption.
Long-term political risk	From CRI. Denotes strength of political environment

Source: BMI

**Weighting**

Given the number of indicators/datasets used, it would be wholly inappropriate to give all sub-components equal weight. Consequently, the following weighting has been adopted.

**Table: Weighting Of Indicators**

<b>Component</b>	<b>Weighting, %</b>
Rewards	70, of which
- Industry Rewards	65
- Country Rewards	35
Risks	30, of which
- Industry Risks	40
- Country Risks	60

Source: BMI

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