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# Q3 2016

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# IRAN

## PETROCHEMICALS REPORT

INCLUDES 5-YEAR FORECASTS TO 2020

Published by:BMI Research

# Iran Petrochemicals Report Q3 2016

INCLUDES 5-YEAR FORECASTS TO 2020

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

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**BMI Research**
Senator House
85 Queen Victoria Street
London
EC4V 4AB
United Kingdom
Tel: +44 (0) 20 7248 0468
Fax: +44 (0) 20 7248 0467
Email: subs@bmiresearch.com
Web: http://www.bmiresearch.com

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# BMI Industry View

The lifting of sanctions will stimulate an immediate export boost for the Iranian petrochemicals industry, which has been operating well under capacity even as it has expanded in recent years. The government has ambitious plans for the sector with the hope that foreign investment will enable it to leverage its massive upstream resources to expand basic chemicals output. However, Iran continues to face infrastructural and regulatory difficulties and a depressed market outlook. Until these are overcome, the industry will struggle to meet the target of more than doubling petrochemicals capacity to 129mn tonnes per annum (tpa) by 2021.

The surge in capacity will not be sustainable if feedstock supply is not forthcoming and markets do not absorb output. Some complexes are suffering feedstock shortages, particularly during winter months. Iranian petrochemical complexes need 30-35mn cubic metres of gas per day. Besides pressure on supply, Iranian ethane feedstock is nearly three times more expensive than in Saudi Arabia. While the plants may nominally come on stream, operation rates could 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.

Investor wariness will 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.

- Planned projects would raise Iran's petrochemicals capacity three-fold to 180mn tpa by 2022, although it is uncertain whether this target will be reached. **BMI** expects the next five years to see the completion of the Olefins 11 and 12 project, which will have capacities of 2.0mn tpa and 1.2mn tpa respectively. Meanwhile, the USD12bn petrochemical hub at Chabahar - the Makran Petrochemical Plan - will add 1.2mn tpa of ethylene and 900,000tpa of PE.

- Iran's main export market, China, will 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.

- This quarter, Iran has seen a 0.2 point increase in its overall petrochemicals Risk/Reward Index (RRI) score to 63.6 due to a two-point increase in its market risk score. Further detailed investment agreements could hike the score further. Significant obstacles to investment remain and further reform to investment regulations is necessary, alongside infrastructural improvements, if Iran is to match its Arabian Gulf

neighbours. It remains in third place behind the UAE in the regional RRI rankings, but has increased its lead over Kuwait.

- We forecast growth of 3-6% leading to a boost across a range of industrial sectors. Oil and gas will gain the most attention, but petrochemicals are also very well placed as the provider of raw material for growth industries, such as packaging and automotive sectors. Pent-up demand, a youthful population, a skilled workforce and a large hydrocarbon and consumer story all make Iran one of the most positive and relatively well-balanced growth stories in the Middle East over the next decade.

# 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.<br>▪ The petrochemicals sector is set for rapid expansion.<br>▪ Import and export incentives offered in special economic zones, good relations with neighboring countries and a favourable location are key advantages for the industry.<br>▪ A large domestic market, skilled workforce and laws supporting foreign investments. |
| **Weaknesses** | ▪ International sanctions have impacted on petrochemicals projects, which led to a fall in exports and related decline in capacity utilisation, while joint ventures with foreign firms have been delayed or abandoned.<br>▪ Iran is a late developer in petrochemicals and is at least a decade behind regional rivals such as Qatar and Saudi Arabia.<br>▪ Historical lack of expertise at the state-owned National Petrochemical Company makes it difficult to successfully commission new petrochemicals plants in the country.<br>▪ Lack of access to foreign technology. |
| **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.<br>▪ 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.<br>▪ Development of petrochemicals special economic zones.<br>▪ Ethylene supplies are being extended and pipeline capacity doubled.<br>▪ Iran needs foreign companies' technology. |

**SWOT Analysis - Continued**

| | |
|---|---|
| | ▪ 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 understood. |
| | ▪ 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.
- Sanctions relief will boost economic growth notably.

**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.
- The long term potential in Iran across a range of sectors is enormous given a large population, well-educated workforce and pent-up demand.

**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.

**Political SWOT Analysis - Continued**

- 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.<br>▪ 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.<br>▪ 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.<br>▪ 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.<br>▪ A collapse of the nuclear deal is a distinct possibility, which would drastically worsen the economic outlook. |

# Operational Risk

**SWOT Analysis**

| | |
|---|---|
| **Strengths** | ▪ Iran boasts high numbers of skilled graduates in technical fields such as engineering, construction and science.<br>▪ The outlook for Iran's economic and trade growth is improving due to the gradual lifting of sanctions, which began in 2013.<br>▪ The transport network offers good internal and cross-border connections, and is currently able to meet the country's supply chain needs.<br>▪ Low levels of violent crime mean that foreign workers and business property are relatively safe. |
| **Weaknesses** | ▪ Costs of employment are increasing because the Iranian Labour Code affords workers a high level of protection and generous benefits.<br>▪ 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.<br>▪ Trade bureaucracy is highly time consuming and places an onerous burden on importers and exporters.<br>▪ Businesses in Iran face heightened security risks due to the country's involvement in regional conflicts and the presence of several active domestic terrorist groups. |
| **Opportunities** | ▪ The literacy rate of the labour force is increasing as the benefits of investment in primary school education are filtering through.<br>▪ 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.<br>▪ Relaxing of sanctions is resulting in greater foreign direct investment inflows. |

**SWOT Analysis - Continued**

| | |
|---|---|
| | ▪ The threat of IS has increased the urgency of reaching an agreement over Iran's nuclear programme, and offers an avenue for greater cooperation, increased dialogue, and better relations with global powers. |
| **Threats** | ▪ 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. |
| | ▪ Even when sanctions are lifted, the impact of cyber and financial crime on businesses will remain significant, requiring investors to provide expensive security and preventative measures. |

# Industry Forecast

The UN and the EU abolished sanctions against Iran in January 2016, enabling European and Asian majors to enter into the oil, gas and petrochemicals sectors. With foreign investment, Iran has the capability to double its petrochemicals capacity over the next five years, provided the government puts in place a conducive regulatory framework. Asian and European markets are likely to be the favoured export destinations, prompting a rush of interest from petrochemicals producers from target markets.

**Production**

Sanctions relief has already boosted Iran's petrochemicals output and exports. Iran exported 19mn tonnes of petrochemical products in FY2015/16 (ending March 19), an increase of 15% y-o-y, according to the **National Petrochemical Company** (NPC). The NPC reported that average capacity utilisation in the industry was 76%, which was up 2 percentage points from the previous year. Oil Minister Bijan Namdar Zanganeh has set a target of 30% growth in the value of petrochemical production to USD22bn by 2018, a figure that would require capacity growth, an improvement in product prices and increasing added value in the production chain.

In January 2016, the government announced it aimed to attract USD8-10bn in foreign finance into the petrochemicals industry, with European and Asian producers leading investment. This will be crucial if the country is to meet its ambitious targets. NPC has said the country's petrochemical output could increase by nearly 12% in FY2016/17 due to capacity expansion and export recovery. NPC plans to launch 15 new petrochemical units by FY2016/17, thereby increasing the country's capacity by 8.5mn tonnes. Even existing capacity could spur massive growth in output, although feedstock problems will place a constraint on growth. To operate at reasonable levels of capacity utilisation, olefins output would have to increase by one-third and polymers by one-third.

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 2020, ethylene capacity alone will total 12.28mn tonnes per annum (tpa), with the completion of the Olefins 11 and 12 projects, which will have capacities of 2.0mn tpa and 1.2mn tpa respectively.

We have included in the forecast the plans for the USD12bn petrochemical hub at Chabahar, on the Gulf of Oman, which will add to the company's major petrochemical operations at Assaluyeh and Bandar Imam.

The first phase of a major petrochemical complex in the Chabahar free trade-industrial zone (FTZ) will be completed by 2018. The first phase includes six plants, whereas the full project is comprised of 18 plants with an annual output of 23mn tpa. The FTZ enables foreign investors to buy as much as 100% of any plant, and the project is also exempt from income tax for 20 years. Dubbed the Makran Petrochemical Plan, the project will be the biggest carried out by private investors in Iran and will include capacities of 1.2mn tpa of ethylene and 300,000tpa each of low density polyethylene (LDPE), high density polyethylene (HDPE) and linear low density polyethylene (LLDPE). Polypropylene (PP) is also set to be included, but no firm capacities are indicated.

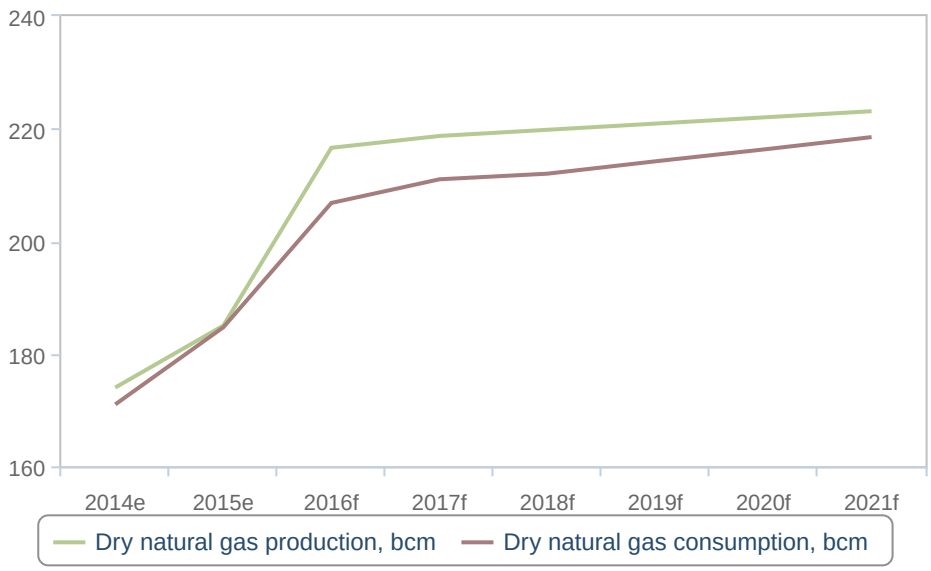
The revival of Iranian production will depend largely on exports. The petrochemical industry is the second largest source of foreign earnings for Iran after oil. Although demand for imports in China is currently high, growth rates are expected to decrease in the long term. This limits the growth of export for products from Iran in the future. At the same time, however, new possibilities are revealed: especially exports to Western and Eastern Europe as well as to other Asian countries. To fulfil this aim, numerous constructions of petrochemical plants are supposed to be completed with the aid of foreign investors.

However, lower petrochemicals prices will limit the amount of export revenue growth Iran will receive from petrochemicals. The potential scale of Iran's exports could exacerbate surpluses in some basic chemicals segments. Low naphtha prices are also a setback for ethane-based production in Iran, and its main export market, China, is exhibiting a downturn.

While export volumes may be boosted, given huge infrastructure deficits, the domestic economy will not undergo a boom, rather a steady acceleration in growth. However, the sustained decline in oil prices over the coming years will weigh on exports and government spending. The lack of investment over the past decade will ensure that a boom in the economy is not forthcoming for several years.

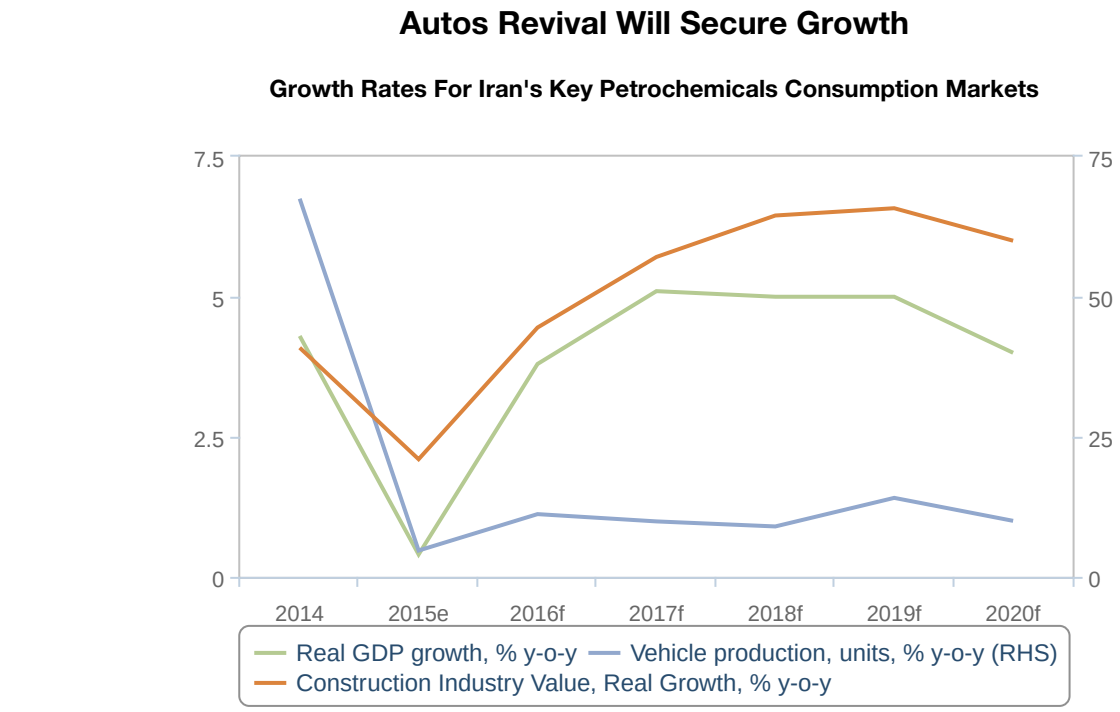
**Gas Production Will Exceed Demand Growth**

**(2014-2021)**




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

The industry is faced with structural problems. In the short term, it is grappling with the issue of falling crude oil prices, which are leading to a concurrent slump in naphtha prices. Access to increased natural gas supply, the source of ethane feedstock, will be crucial to maintaining competitiveness. 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. Ironically, the chief driver of lower oil prices will be the influx of Iranian crude on the global market.




*e/f = BMI estimate/forecast. Source: 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. As the lifting of sanctions will only be fully finalised by the end of the year, we look to 2016 for the real results. We estimate 4.7% growth in vehicle production in calendar year 2015 and forecast growth of 11.2% in 2016. At the moment, much of this growth is still coming from the effects of the interim deal that was agreed and allowed some imports to recommence. By 2020, we see the volumes exceeding 1.9mn units, with an improved economy and favourable demographics adding to the choice of brands as key drivers of growth. This will, in turn, stimulate domestic consumption of a wide range of petrochemicals used in car-making, including synthetic rubber, engineering plastics and polyurethanes.

The construction industry is set for slightly better growth than previously forecast, which should improve the market performance of construction-related petrochemicals such as polyvinyl chloride (PVC) and certain applications of polyethylene (PE) and PP. We forecast 4.5% y-o-y real construction industry growth

in Iran in 2016, but have raised our five-year average growth from 4.3% to 6.1% as a result of the lifting of international sanctions.

**Table: Iran's Petrochemicals Industry, 2011-2020 ('000 tpa, Unless Otherwise Stated)**

| | 2012 | 2013 | 2014 | 2015 | 2016f | 2017f | 2018f | 2019f | 2020f |
|---|---|---|---|---|---|---|---|---|---|
| Ethylene capacity, '000 tpa | 7,876 | 8,376 | 8,876 | 11,076 | 11,076 | 11,076 | 11,076 | 11,076 | 12,276 |
| Propylene capacity, '000 tpa | 1,870 | 1,960 | 2,410 | 2,740 | 2,740 | 2,740 | 2,740 | 2,740 | 2,740 |
| Benzene capacity, '000 tpa | 1,090 | 1,090 | 1,390 | 1,770 | 1,770 | 1,770 | 1,770 | 1,770 | 1,770 |
| Tolouene capacity, '000 tpa | 625 | 625 | 825 | 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 | 1,295 | 1,295 | 1,295 | 1,295 | 1,295 | 1,295 | 1,295 |
| Acrylonitrile butadiene styrene capacity, '000 tpa | 290 | 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 | 1,690 | 2,310 | 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 | 1,260 | 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 | 2,385 | 2,685 | 2,685 | 2,685 | 2,685 | 2,685 | 2,685 | 2,985 |
| Low density polyethylene capacity, '000 tpa | 2,075 | 2,375 | 2,375 | 2,375 | 2,375 | 2,375 | 2,375 | 2,375 | 2,675 |
| Linear low density polyethylene capacity, '000 tpa | 1,395 | 1,995 | 1,995 | 1,995 | 1,995 | 1,995 | 1,995 | 1,995 | 2,295 |
| PE capacity, '000 tpa | 5,255 | 6,755 | 7,055 | 7,055 | 7,055 | 7,055 | 7,055 | 7,055 | 7,955 |
| Polypropylene capacity, '000 tpa | 1,040 | 1,040 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 | 1,290 |
| Vinyl acetate capacity, '000 tpa | 180 | 320 | 320 | 320 | 320 | 320 | 320 | 320 | 320 |
| Vinyl chloride capacity, '000 tpa | 630 | 930 | 930 | 930 | 930 | 930 | 930 | 930 | 930 |
| PVC capacity, '000 tpa | 640 | 640 | 940 | 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 | 8,865 | 11,505 | 14,705 | 14,705 | 14,705 | 14,705 | 14,705 | 14,705 | 14,705 |
| Ammonia capacity, '000 tpa | 4,930 | 6,365 | 6,365 | 6,605 | 6,605 | 6,605 | 6,605 | 6,605 | 6,605 |
| Urea capacity, '000 tpa | 7,405 | 10,620 | 10,620 | 12,560 | 12,560 | 12,560 | 12,560 | 12,560 | 12,560 |

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

# Macroeconomic Forecasts

## Rapid Uptick In Growth As Shackles Are Removed

***BMI View**: Iran's economy will see a substantial uptick in growth over the coming years as a result of the removal of sanctions in Q216. Given huge infrastructure deficits, the economy will not undergo a boom, rather a steady acceleration in growth.*

- The outlook for Iran's economy is the best it has been in over a decade as sanctions on the economy will are removed from Q216.
- The sustained decline in oil prices over the coming years will weigh on exports and government spending.
- The lack of investment over the past decade will ensure that a boom in the economy is not forthcoming for several years.
- We forecast substantial growth across a range of sectors. Oil and gas will gain the most attention, but consumer segments are also very well placed.

**Table: Iran - Key Economic Indicators**

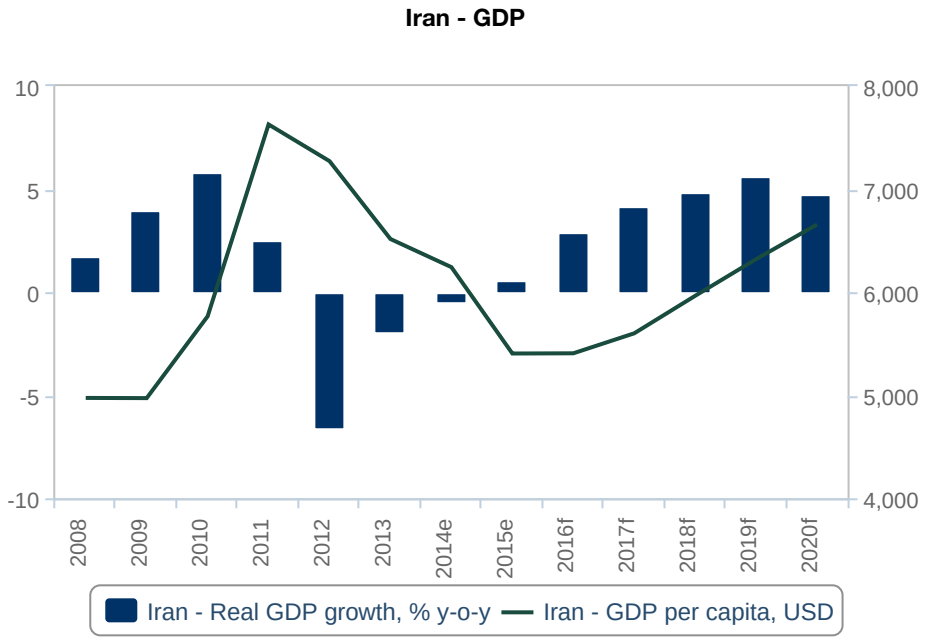
| | 2013 | 2014 | 2015f | 2016f | 2017f | 2018f | 2019f |
|---|---|---|---|---|---|---|---|
| Real GDP growth, % y-o-y | -1.9 | -0.5 | 1.3 | 3.1 | 4.1 | 5.3 | 4.1 |
| Unemployment, % of labour force, ave | 13 | 11 | 10 | 10 | 10 | 10 | 9 |

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

The removal of almost all sanctions on Iran's economy - which we expect to occur in H116 - will cause a significant uptick in economic growth over the coming years, reaching between 3% and 6%. Iran has huge potential across almost all sectors, not just oil and gas which attracts most of the attention, and we highlight industries related to the consumer - especially autos and food and drink.

Pent-up demand, a youthful population, a skilled workforce, and a large hydrocarbon and consumer story all **make Iran one of the most positive and relatively well-balanced growth stories in the Middle East over the next decade**. That said, there are, of course, major impediments facing the Iranian economy - not least the rampant corruption in the country and the years of underinvestment across almost all sectors - which will prevent it from truly booming in the coming years.

## Rapid Expansion Following Nuclear Deal

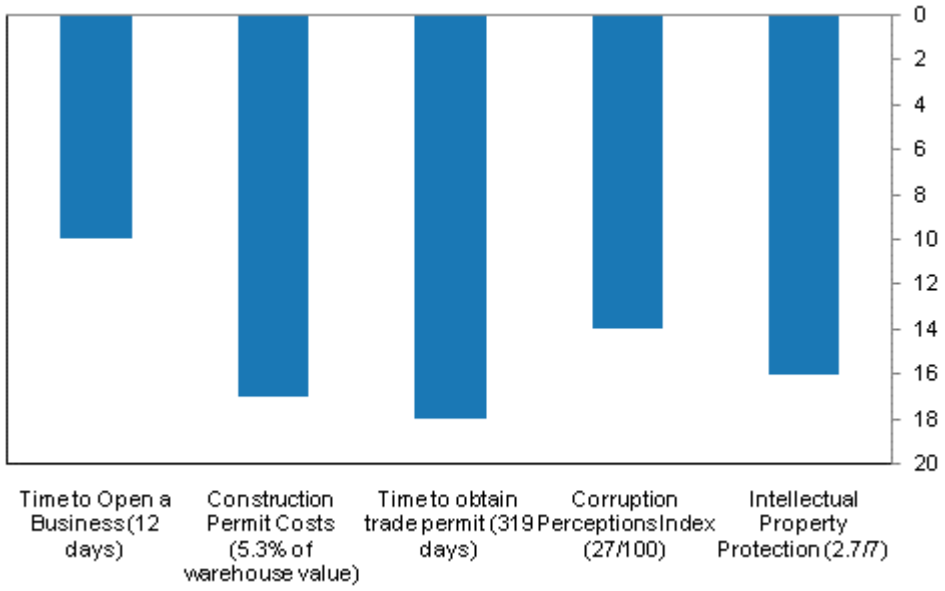



*e/f = BMI forecast. Source: UN, BMI*

Iran's oil and gas sector presents one of the most exciting opportunities globally. Iran has the fourth largest oil reserves and second largest gas reserves globally, and years of sanctions have kept the industry far below potential. While Iran will certainly not allow unfettered access to its oil reserves given historical suspicion and its desire to protect industries of national security, the government is likely to push for partnership with local firms. Even with these restrictions, as well as substantial investment deficits, the country has enormous potential. Our Oil & Gas team expects Iran's oil production to reach 4.1mn barrels per day (b/d) in 2020, an additional 640,000 b/d from current levels - the largest increase in the Middle East over the period.

## Impediments Remain Even Beyond Sanctions

**MENA - Rankings Indicators Of Business Environment (2014)**

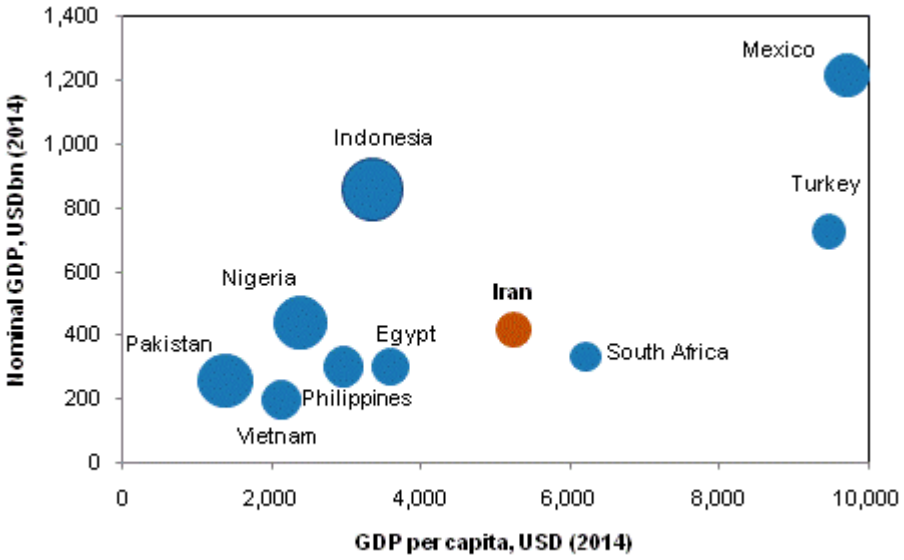



*Note: Out of 18 MENA countries, excludes West Bank; for CPI and IPP, a higher number is better. Source: BMI*

Lower oil prices will play a key role in limiting the impact of the unwinding of sanctions. We forecast oil prices (Brent crude) to average USD42 per barrel (/bbl) in 2015 and USD53/bbl in 2017 as a result of global oversupply. This will ensure that government spending and private consumption growth will be relatively low.

## High Spending Power In Iran

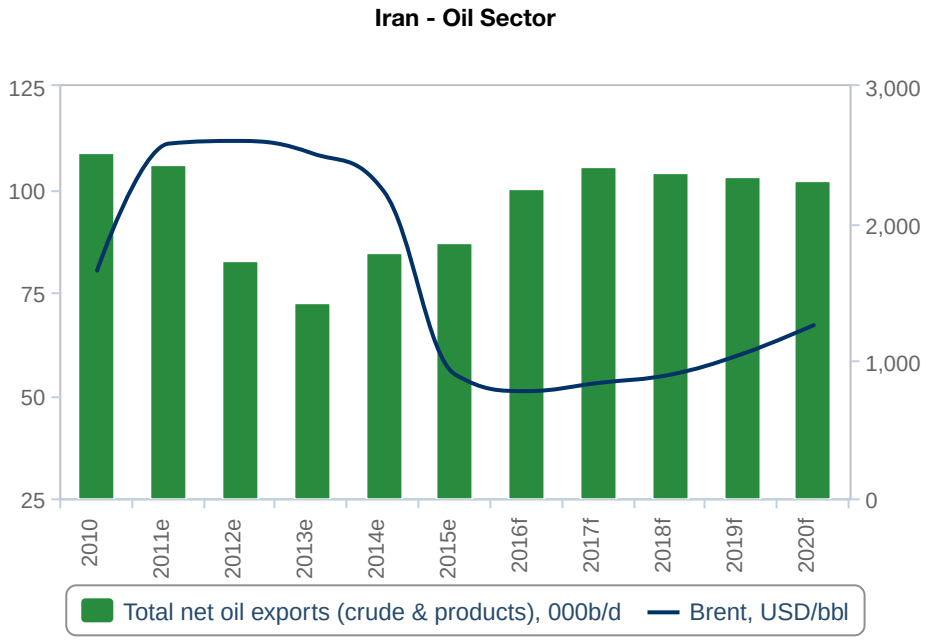
**Select Emerging Markets - GDP & Population**




*Source: BMI, UN. NB size of bubble indicates population size*

Fixed investment and exports will become increasingly important growth drivers, though this will be a slow process as opposed to a sudden jump once sanctions are removed. Indeed, while we expect President Hassan Rouhani's administration to undertake significant efforts to reform to the economy, the effects will be limited by a persistently opaque business environment, domestic resistance to opening up the economy and the slow political process.

**Increasing Output, But Not Enough To Offset Weak Prices**




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

In turn, the easing of financial sanctions will facilitate project finance and attract foreign investment into the infrastructure sector. International sanctions have severely restricted access to funding for projects, reflected in Iran's average construction industry growth of only -0.1% over the past six years. In fact, in the Financing Risk pillar of our Project Risk Index (PRI), Iran scores only 18.8 out of 100, with a particularly weak score of five out of 100 in the Cost of Financing subcomponent. Iran ranks 79 out of 82 countries globally in our PRI.

# Industry Risk/Reward Index

## MEA Petrochemicals Risk/Reward Index

***BMI View:*** *Sustained low oil prices are having a negative impact on petrochemicals development plans, thereby negatively affecting the Risk score for the Middle East and Africa region. However, the downside Risks in some markets have been outweighed by improved Rewards in others that are set for capacity growth. Egypt and Iran are seeing consistent quarter-on-quarter growth in their Risk scores accompanying improved investor perceptions, resulting in new petrochemicals projects. Overall, the MEA region saw its average score increase by 0.2 points over Q216.*

Key developments in the Middle East and Africa (MEA) region this quarter:

- Persistently low oil prices are continuing to have an effect on petrochemicals development plans in Qatar, which saw its score fall markedly this quarter, while the UAE and Saudi Arabia were stable. Qatar has fallen from fourth to fifth place, exchanging positions with Kuwait in our MEA Petrochemicals Risk/ Reward Index (RRI) ranking.
- Israel has seen its Risks score suffer on the back of the wave of violence with the Palestinians that started in September 2015, but this quarter it has seen its score improve as a result of an improved economic outlook.
- Iran will continue to improve its RRI profile following the lifting of international sanctions in Q116. The country has seen its score improve by 0.2 points this quarter, firming up its third place behind the UAE. It will need to secure foreign investment in new capacity and broaden its markets if it is to start rivalling Saudi Arabia, the regional leader.
- Despite the deterioration in the security environment of Egypt on the back of the downing of the Russian airplane, the country's Rewards score has remained strong, evidencing the large petrochemicals project pipeline. The strengthening economic outlook and the construction of world-scale facilities have led to an upward revision in Egypt's score.
- We expect a less volatile economic outlook for Sub-Saharan Africa in 2016, which should stabilise the decline in private construction projects. Currency weakness and lower commodity prices will remain a constraint for government projects.
- While Nigeria and South Africa are laggards in terms of industry growth, which is limiting their Industry Rewards scores, they remain too large to ignore over the long term.
- Although there have been some changes in our rankings this quarter, Arabian Gulf markets continue to offer the most attractive rewards, while Nigeria and Algeria remain the riskiest markets for investors.

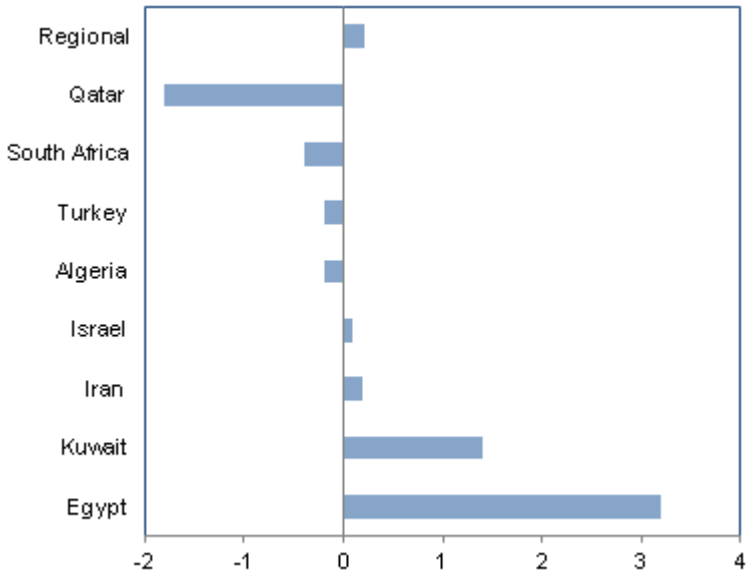
The Arabian Gulf markets remain the outperforming region in the region, offering both higher rewards and lower risks. That said, the impact of sustained oil prices is starting to be felt in the petrochemicals sector. This is particularly significant as our Oil & Gas team forecasts an average annual price of USD51 per barrel (bbl) for Brent in 2016 and USD53/bbl in 2017, which has a corresponding impact on naphtha. Gas-based

producers, particularly Saudi Arabia and Qatar, have been adversely affected, while those with a more diverse feedstock mix such as the UAE and Kuwait have fared better.

The impact of lower oil prices in Saudi Arabia has started to weaken the local market. Government financing - the main driver of growth in the country - will remain robust in 2016, but from 2017 onwards we expect the government to face growing pressure on its fiscal position, which will result in the rationalisation of the project pipeline.

**Change In Petrochemicals Score**

**Q316/Q216**




*Source: BMI*

Despite severe challenges, both Egypt and Iran hold significant potential as petrochemicals markets in the Middle East. As such, we anticipate these countries to see improvements in their RRI scores in the coming quarters.

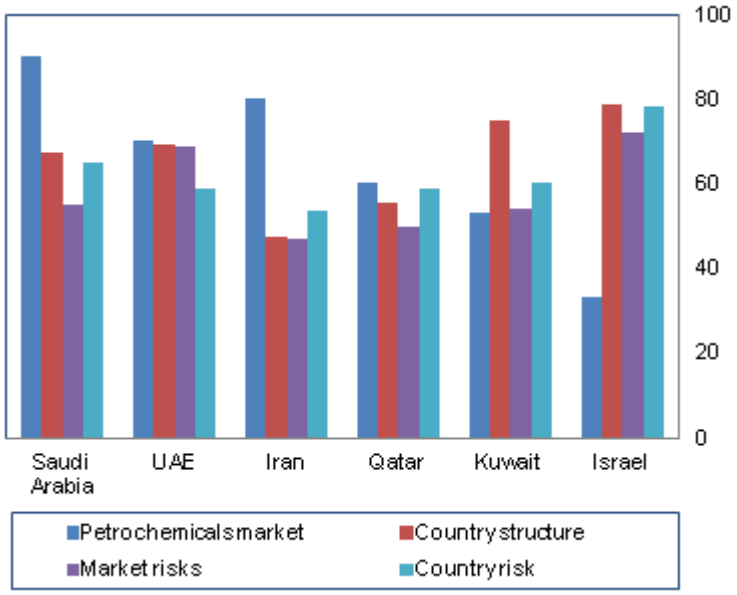
Egypt has faced a deteriorating security environment following the downing of the Russian airplane, which will have a direct impact on investment environment. That said, the robust government support for

petrochemicals should ensure that the industry reports a significant rise in capacity by 2020, utilising the country's strengths in feedstock.

With regards to Iran, we maintain a positive outlook for 2016 due to the lifting of sanctions, with its Petrochemicals RRI score steadily rising since the deal over its nuclear programme, which was reached in mid-2015. This has given it immediate access to frozen assets for an approximate value of USD30-50bn, which will free up resources for public spending. In addition, Iran will regain access to SWIFT and the international banking system, which will considerably improve project financing. This will result in the gradual return of private investment into the country, which will considerably benefit the petrochemicals sector. That said, we believe that Iran's business environment will continue to present severe challenges given including elevated political risk, macroeconomic weaknesses, a comparatively uncompetitive labour market and widespread corruption.

**More Rewards In High Risk Markets**

**Risk/Reward Ratings In The Middle East**



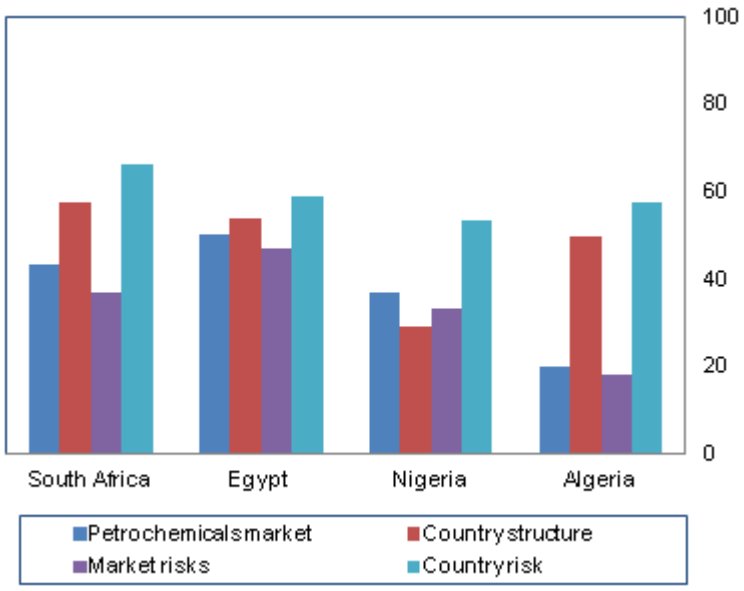

*Source: BMI*

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.

## Poor Risk, Low Rewards In Africa

**Africa Risk Rewards Indices**

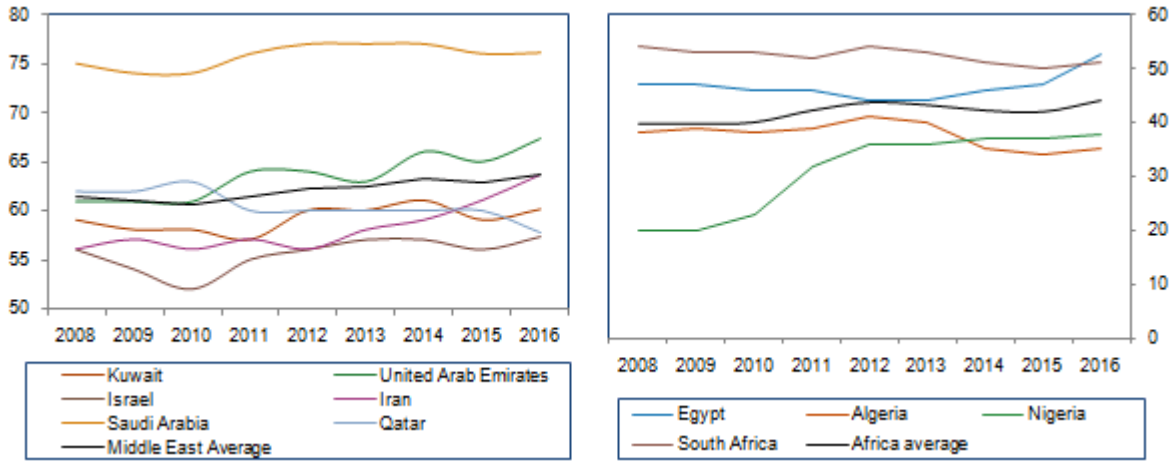



*Source: BMI*

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 languishes in 11th place in the regional ranking and is unlikely to make a significant recovery in the months ahead.

## Risk Factors Recover From 2008 Crash

**Iran & Egypt Strengthen Position**




*Source: BMI*

The election of President Buhari in March has provided some measure of certainty and stability, and investors are looking towards greater clarity and transparency in the investment environment. Endemic corruption, high security risks and an underdeveloped bureaucracy are major constraints to the country's petrochemicals industry growth. There are promising signs of a turnaround, with low crude prices driving down the cost of naphtha and a desire to add value to upstream resources. Growth in gas production is set to spur downstream petrochemicals industries, particularly fertiliser and methanol.

In contrast, 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.

**Table: MEA Petrochemicals Risk/Reward Index - Q3 2016**

| | Limits of potential returns | | | Risks to realisation of returns | | | | |
|---|---|---|---|---|---|---|---|---|
| | Petrochemicals market | Country structure | Limits | Market risks | Country risk | Risks | Petrochemicals rating | Rank |
| Saudi Arabia | 90.0 | 67.2 | 82.0 | 55.0 | 65.2 | 62.1 | 76.1 | 1 |
| UAE | 70.0 | 69.1 | 69.7 | 69.0 | 58.6 | 60.4 | 67.3 | 2 |
| Iran | 80.0 | 47.6 | 68.7 | 47.0 | 53.7 | 51.7 | 63.6 | 3 |
| Kuwait | 53.3 | 74.8 | 60.9 | 54.0 | 60.0 | 58.2 | 60.1 | 4 |
| Qatar | 60.0 | 55.4 | 58.4 | 50.0 | 58.9 | 57.1 | 57.7 | 5 |
| Israel | 33.3 | 78.8 | 49.2 | 72.0 | 78.1 | 76.2 | 57.3 | 6 |
| Egypt | 50.0 | 53.8 | 51.3 | 47.0 | 58.8 | 55.2 | 52.5 | 7 |
| South Africa | 43.3 | 57.4 | 48.3 | 37.0 | 66.4 | 57.6 | 51.1 | 8 |
| Turkey | 43.3 | 48.0 | 45.0 | 68.0 | 56.6 | 60.0 | 49.5 | 9 |
| Nigeria | 36.7 | 29.1 | 34.0 | 33.0 | 53.2 | 47.1 | 37.9 | 10 |
| Algeria | 20.0 | 49.6 | 30.4 | 18.0 | 57.6 | 46.4 | 35.0 | 11 |

*Source: BMI*

# Iran Petrochemicals Risk/Reward Index

This quarter, Iran has seen a 0.2 point increase in its overall Petrochemicals Risk/Reward Index (RRI) score to 63.6, due to a two-point increase in its market risk score. This comes following the lifting of sanctions, which will boost exports and encourage inward investment in the petrochemicals industry. Further detailed investment agreements could hike the score further. However, significant obstacles to investment remain, and further reform to investment regulations is necessary, alongside infrastructural improvements, if Iran is to match its Arabian Gulf neighbours. It remains in third place behind the UAE in the regional RRI rankings, but has increased its lead over Kuwait.

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.

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 poor business environment, but more generally displays a number of long-term financial, institutional and political risks - which make up its Country Rewards 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. Some of these issues are likely to improve following the lifting of sanctions, but over the short-term investment and trade will not have a major impact on the structural problems in the petrochemicals sector.

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 impacted 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.

# Market Overview

***BMI View*:** *Iran has significantly expanded the range and volume of its petrochemical production in recent years. It has the capacity to produce about 60mn tonnes of petrochemicals a year, but only 68% of this capacity is tapped on average. The government has also undershot its target of 100mn tonnes per annum of capacity by 2015 due to the sanctions regime. Iran is looking to expand its petrochemical industry in order to become the largest downstream producer in the Middle East region, once sanctions on the country are eased. Many European majors have shown interest in investing in Iran's petrochemical sector.*

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%.

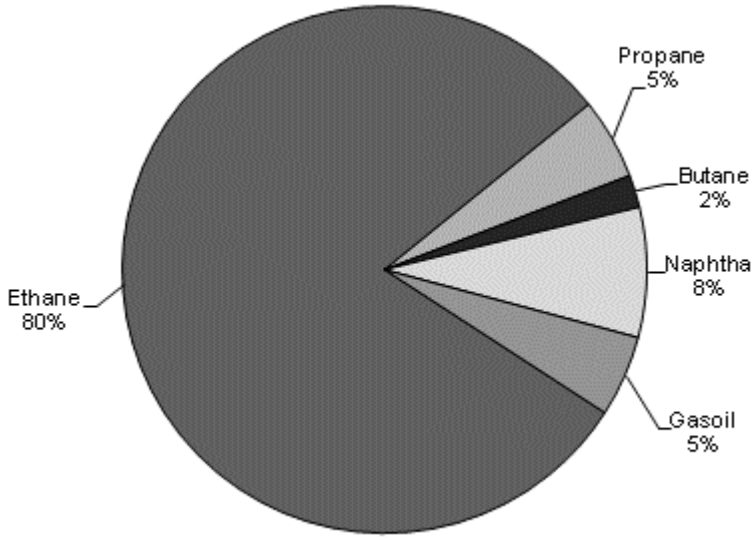
The NPC is wholly owned by the Iranian government. It is responsible for the development and operation of the country's petrochemicals sector and is the second largest producer and exporter of petrochemicals in the Middle East after **Saudi Basic Industries Corporation** (Sabic). NPC is aiming to become the largest petrochemical producer in the Middle East by 2024, overtaking Sabic. It has a number of hurdles to overcome, namely the long-term effects of international sanctions and the fragmentation of the company through the spinning off and privatisation of its subsidiaries. Construction costs are also high. Under the sanctions regime, petrochemicals projects struggled 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 its five-year plan (2010-2015) involved the construction of 30 plants with combined capacity for 37mn tonnes per annum (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. 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.

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 in the past due to sanctions.

Asian investors with little or no exposure to the US have shown greater interest in the sector and as such will have the advantage of earlier entry into the Iranian petrochemicals industry. While international sanctions have been relaxed, the US is likely to retain its own unilateral sanctions regime.

As Iran undergoes 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 that was 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 polymer plants will continue to operate well below nameplate capacity. Iranian producers had said plants were not performing at full capacity owing to technical problems.

**Table: Iran's Cracker Capacity, 2013-2020 ('000 tpa)**

| | 2013 | 2014 | 2015e | 2016f | 2017f | 2018f | 2019f | 2020f |
|---|---|---|---|---|---|---|---|---|
| NPC, Arak | 320 | 320 | 320 | 320 | 320 | 320 | 320 | 320 |
| NPC, Tabriz | 136 | 136 | 136 | 136 | 136 | 136 | 136 | 136 |
| NPC, Bandar Imam | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Amir Kabir, B. Imam (Olefins 6) | 520 | 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 | 1,100 |
| Arya Sasol, B. Assaluyeh (Olefins 9) | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Jam Pchem, B. Assaluyeh (Olefins 10) | 1,300 | 1,300 | 1,300 | 1,300 | 1,300 | 1,300 | 1,300 | 1,300 |
| Ilam (Olefins 13) | | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Kharg Island | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |

| Iran's Cracker Capacity, 2013-2020 ('000 tpa) - Continued | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **2013** | **2014** | **2015e** | **2016f** | **2017f** | **2018f** | **2019f** | **2020f** |
| Arvand P'chemical (Olefins 8) | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| Kavyan Petrochemical Assaluyeh (Olefins 11) | 1000 | 1000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Morvarid Petrochemicals | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 500 |
| Persian Gulf Assaluyeh (Olefins 12) | - | - | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 | 1200 |
| Makran Petrochemical (Chabahar) | - | - | - | - | - | - | - | 1200 |
| **Total** | **8,376** | **8,876** | **11,076** | **11,076** | **11,076** | **11,076** | **11,076** | **12,276** |

*e/f = BMI 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.

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.

**BMI** believes 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 total capacity of the petrochemical industry was 9mn tonnes per annum (tpa) in 2001 and the government's aim was to increase this capacity to 100mn tpa by 2015. However, sanctions posed difficulties in accessing technology and financing, and capacity grew to around 60mn tpa, with output at 43mn tpa. The new 2,700km-long West Ethylene Pipeline provides feedstock to 12 different petrochemical plants. The lifting of sanctions on Iran is expected to generate a significant boom in the natural gas production of the country, and this will strongly encourage new ethylene investments, which in turn will generate an additional polymer capacity.

## Post-Sanctions Outlook

Iran's economy will see a substantial uptick in growth over the coming years as a result of the removal of most sanctions in Q116. Given huge infrastructure deficits and other major impediments such as corruption, the economy will not undergo a boom - rather a steady acceleration in growth.

- The outlook for Iran's economy is the best it has been in over a decade, as most sanctions were removed in Q116.
- The sustained decline in oil prices over the coming years will weigh on government spending.
- The lack of investment over the past decade will ensure that a boom in the economy is not forthcoming for several years.
- We forecast substantial growth across a range of sectors. Oil and gas will gain the most attention, but consumer segments are also very well placed.

The removal of almost all sanctions on Iran's economy will cause a significant uptick in economic growth over the coming years, reaching between 4% and 6%. Iran has huge potential across almost all sectors, not just oil and gas which attracts most of the attention, and we highlight industries related to the consumer - especially autos and food and drink. The removal of all UN and almost all EU sanctions as well as all US secondary sanctions will allow non-US companies to invest in the country for the first time in five years. In addition, Iran has gained access to around USD50bn in frozen assets which will likely be used in part to finance infrastructure projects. Iranian banks are now re-connected to the international financial transaction system SWIFT which will facilitate trade into the country.

Pent-up demand, a youthful population, a skilled workforce and a strong hydrocarbon and consumer story all make Iran one of the most positive and relatively well-balanced economic growth stories in the Middle East over the next decade. That said, there are, of course, major impediments facing the Iranian economy - not least the rampant corruption in the country and the years of underinvestment across almost all sectors -

which will prevent it from truly booming in the coming years. In addition, aside from rare exceptions (like Boeing) US companies will not be allowed to do business in Iran given the still-standing US primary sanctions, which we do not expect to be removed for at least another two years.

Iran's oil and gas sector presents one of the most exciting opportunities globally. Iran has the fourth largest oil reserves and second largest gas reserves globally, and years of sanctions have kept the industry far below potential. While Iran will certainly not allow unfettered access to its oil reserves given historical suspicion and its desire to protect industries of national security, the government is likely to push for partnership with local firms. Even with these restrictions, as well as substantial investment deficits, the country has enormous potential. Our Oil & Gas team expects Iran's oil production to reach 4.1mn barrels per day (b/d) in 2020, an additional 640,000b/d from current levels - the largest increase in the Middle East over the period.

Lower oil prices will play a key role in limiting the impact of the unwinding of sanctions. We forecast oil prices (Brent crude) to average USD40 per barrel (/bbl) in 2015 and USD53/bbl in 2017 as a result of global oversupply. This will ensure that government spending and private consumption growth will be relatively low.

Fixed investment and exports will become increasingly important growth drivers - though this will be a slow process due to constraints on the global banking and insurance sectors, given remaining US sanctions. Indeed, while we expect President Hassan Rouhani's administration to undertake significant efforts to reform the economy, the effects will be limited by a persistently opaque business environment, domestic resistance to opening up the economy and the slow political process.

In turn, the easing of financial sanctions will facilitate project finance and attract foreign investment into the infrastructure sector. International sanctions have severely restricted access to funding for projects, reflected in Iran's average construction industry growth of -0.1% over the past six years. In fact, in the Financing Risk pillar of our Project Risk Index (PRI), Iran scores only 18.8 out of 100, with a particularly weak score of five out of 100 in the Cost of Financing subcomponent. Iran ranks 79 out of 82 countries globally in our PRI.

With banking sanctions lifted and access to SWIFT, Iranian producers hope to save up 2-5% of overall costs with each transaction. However, the Iranian central bank has said it would need months after the lifting of sanctions to unify the exchange rates between the Iranian rial and the US dollar. Iran has been using two exchange rates for the rial - the free market rate and a state-endorsed rate - to cope with the limited foreign currency availability in the country.

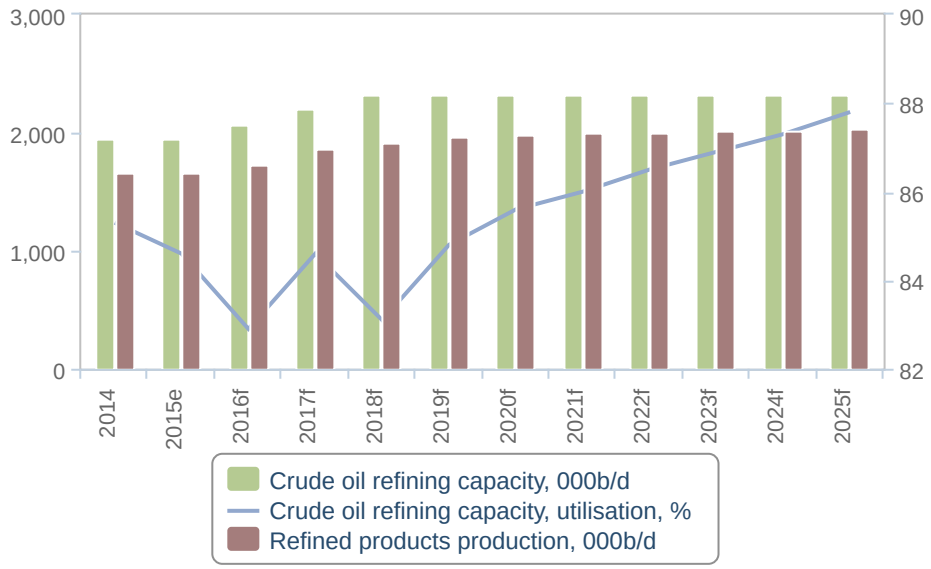
## Upstream Developments

Currently, Iran has seven large refineries (over 100,000b/d), with a number of smaller facilities of less than 60,000b/d each. While refining capacity estimates vary wildly due to the lack of reliable data, we estimate combined capacity currently stands at about 1.955mn b/d. All refineries are operated by the National Iranian Oil Refining and Distribution Company (NIORDC), a National Iranian Oil Company (NIOC) subsidiary.

Refinery output figures to October 2015 indicated Iranian refined fuels production would essentially be flat year-on-year at 1.7mn b/d. Fuels price increases reduced fuels demand in 2014 allowing Iran to be near self-sufficient for refined products, though gasoline imports will be required to at least 2016.

**Refining Capacity Forecast**

**(2014-2025)**




*e/f = BMI estimate/forecast. Source: National sources, BMI*

Historically, Iran has predominantly been a net refined fuel exporter. However, the country has historically been a net gasoline importer to meet domestic demand. Given the constraints of sanctions on the Iranian budget, the country has focused on maximising gasoline production to become self-sufficient.

Key to meeting this target will be the completion of the Persian Gulf Star refinery, which according to reports reached 86% completion in January 2016. The facility has been specifically designed to process natural gas condensate - much of which will be derived from the new South Pars phases coming online in 2016 - into fuels. Gasoline and high octane gasoline will be the target product with at 62% of output, 24% will be diesel and 12% jet fuel and LPG.

The refinery will have a 360,000b/d capacity, though is being constructed in three 120,000b/d phases. The first phase is targeting completion in June 2016, though we expect this will be set back to later in the year. That said, the project is due to receive EUR650mn from the National Development Fund to support its completion. The subsequent two phases of the facility are due to follow six and 12 months after phase one respectively.

The Gulf Star refinery will see Iran's refining capacity increase to 2.3mn b/d in 2018. More importantly, once fully operational, the facility will make Iran self-sufficient in gasoline production.

There are several other proposals for new refinery expansions and greenfield refineries, though other than the Persian Gulf Star, none are included in our forecast. Given the Gulf Star is forecast to make Iran self-sufficient in refined fuels, and the international fuels market remains well supplied, we do not expect investment into new refining capacity.

Iran's existing facilities will however target foreign investment to improve efficiencies and upgrade fuels standards. Saipem has reportedly signed a memorandum of understanding (MoU) to upgrade the Pars Shiraz and Tabriz refineries. We expect a similar trend over the coming years as Iran looks to become more efficient and produce cleaner burning fuels.

**Table: Proposed Greenfield Refineries**

| Refinery | Capacity (b/d) | Project Status Update (NIORDC) | Details |
|---|---|---|---|
| Persian Gulf Star | 360,000 | First phase to come online in mid-2016. | Gasoline production focus. |
| Hormuz | 300,000 | NIORDC: Licensor contract: concluded EPC suggestions under estimation | Heavy/ extra heavy crude Blend of crude oil from Soroush, Norouz and South Pars oil fields. Iran Heavy export crude oil and Forouzan Heavy crude oil. |
| Pars (Shiraz) | 120,000 | NIORDC: Basic Design : 19% Overall Progress: 2.9% | Qualifying of oil products to meet 2009 Europe Standards (Euro-V) South Pars field gas condensates. |
| Kermanshah (Anahita) | 150,000 | NIORDC: Basic Design is in Progress, Licensors contract: in progress to sign. | To be developed privately. Blend of crude oil from North Dezful, Naftshahr, Maleh Kooh (Kerman) |
| Tabriaz (Shahriar) | 150,000 | NIODR: Basic design: 43.8% Overall Progress: 2.35% | Crude oil mixture from North Dezful and Maroon fields in Iran and Kashagan field in Kazakhstan Aims to produce Euro-5 gasoil |
| Khuzestan (Abadan) | 180,000 | Basic Design: 25% Overall Progress: 1.02% | Heavy crude refinery, refining from Azadegan, Yadavaran and Jofeir fields. Planned products production: |
| Caspian (Golestan) | 300,000 | NIORDC: A pre-feasibility study has been prepared. Bankable feasibility study is being done by KBC. | Aimed at exports to nearby countries |

*Source: Industry sources, EIA, NIORDC*

## Current Plans

Iran is likely to look to China - its main oil export market - for investment in new petrochemicals projects, although Europe and India are likely to play a strong role in the sector. China reportedly owes Iran over USD20bn in outstanding oil payments. The cash has been frozen in overseas banks after the US-led sanctions made it difficult for Beijing to transfer money to Tehran. Accordingly, the two countries have reportedly reached a deal to settle a part of the frozen money through China's funding of Iranian petrochemical projects.

Iran's Oil Minister Bijan Zangeneh has recently said Iran may award phase two of the North Azadegan oilfield to China for development. China's **China National Petroleum Corp** (CNPC) and Iran's **Petroleum Engineering and Development Company** (PEDEC) have already signed an initial agreement to produce 25,000 barrels a day from the field in the second phase. CNPC also operated the first development phase of North Azadegan.

China's energy companies were reportedly instructed in 2010 to slow or stop work in Iran because of pressures from the US which has a sanctions regime in place against Tehran. State-run **Sinopec Group** and CNPC had been reported to begin producing 160,000b/d of oil from South Azadegan and Yadavaran in southwestern Iran from October 2015. Sinopec officials have said they expected the first phase of the Yadavaran oilfield to yield 85,000b/d.

Chinese investors are reportedly preparing to back at total of 21 petrochemicals plants in Iran. By the beginning of 2016, USD12bn of the finance had been referred to the Central Bank of Iran for receiving facilities. In April 2016, it was announced that Chinese investors had provided EUR1.9bn in finance for the first phase of the Bushehr Petrochemical Plant, which is expected to go into operation in Q117; it was 60% complete in Q116. The first phase is focused on methanol production, while the second will produce polyethylene. It is the second petrochemical plant in Iran being constructed by Chinese investment after Masjed Soleyman's plant, which

Interest is not restricted to Chinese producers with European majors showing interest in the sector. In Q116, Iran's National Petrochemical Company (NPC) and French energy giant Total have signed an MoU to set up a petrochemical complex in Iran. Appraisal studies are focused on a cracker unit fed by ethane, naphtha, liquefied petroleum gas (LPG) and other liquid feedstock.

German chemicals producer BASF also indicated in Q116 that it intends to invest up to USD4bn in building petrochemical facilities in Iran Parsian Mineral Industries Special Zone. In the first phase, the company would take a 60% stake in the project, while Iran would provide capital for the remaining 40%. BASF is willing to fund a larger amount for the phase 2 of the project, according to NPC.

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 narrowly missed out on cancellation.

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 under pressure, the markets in these petrochemical products was not strong enough to justify export-orientated production in the short-term, which is the industry's chief motivation for expansion. **BMI** believes the post-sanctions outlook could provide an opportunity for Iranian producers to open new plants in these sectors.

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.

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 polyethyelene (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.

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.

A number of projects are due to be completed by 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**, and 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 special economic zone (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.

Construction of the 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 at a cost of IRR2.12trn (USD212mn). It was due for completion in 2015, but by end-2015 it was only 30% complete. It 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.
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- **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.

# Company Profile
## National Petrochemical Company

**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.
- The P5+1 deal offers new prospects for growth in investment, technology acquisition and trade.

**Threats**

- Natural gas production growth is lagging behind growth in cracker capacity.
- The narrowing ethane-naphtha cost differential is working against NPC's favour with most planned capacity utilising domestic ethane feedstocks.

**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 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 tpa by 2015, but BMI regards this target as 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.

International sanctions have had 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 licensers 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 deterred global banks. The sanctions undermined business with European firms, which are insisting on approval of contracts by the

European Commission. As such, the alleviation of sanctions should improve NPC's operating environment.

A number of plants have been proposed over the years with NPC tabulating a 30 petrochemical projects for which it is seeking investors. Some of the most significant projects are focused on converting methane gas into olefins for conversion into derivatives. Additionally, the company is looking to expand production of aromatics in the benzene and styrene chains, a move that would significantly diversify downstream products.

If NPC manages to leverage the country's feedstock potential, it will rival Saudi Arabia's Aramco as a globally competitive petrochemicals producer. However, projects still remain focused on lower value, high volume production. It will need to add value to its production chains in order to realise significant margins.

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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 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.

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- A 300,000tpa HDPE plant at Boroujen.

**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:*** *Although there has been a doubling of feedstock prices in the Middle East, operating rates remain high due to continuing cost advantages as well political reasons. This raises the prospect of over-supply in key export markets in Europe and Asia. The situation will be exacerbated by new capacity due to come online leading to a surge of commodity grade chemicals in 2016.*

**Capacity Expansion Surge In 2016**

Additional output is expected from: Saudi Arabia's naphtha-fed **Sadara Chemical**'s 350,000 tonnes per annum (tpa) low density polyethylene (LDPE) plant and two linear low density polyethylene (PE) lines totalling 750,000tpa that will start up by end-2016; and Kuwaiti **Equate**'s debottlenecking of an additional 175,000tpa polyethylene (PE) at its plant by mid-2016. In the second phase of **Petro Rabigh**'s expansion plans, the Saudi Arabian company will also bring online its 424,000tpa benzene plant. Rabigh Refining and Petrochemical (Petro Rabigh), a joint venture between Japan's **Sumitomo Chemicals** and state-owned **Saudi Aramco**, will start up its new phenolacetone plant in June 2016 as part of the second phase of expansion. The new plant will be able to produce 275,000tpa of phenol and 160,000tpa of acetone.

Additionally, the UAE is ramping up production at the third phase of its expansion, known as Borouge 3, which is heightening market competition. Borouge 3 comprises a 1.5mn tonnes per annum (tpa) cracker and derivative plants, including high density polyethylene (HDPE) and LLDPE units with a combined capacity of 1.08mn tpa, a 350,000tpa LDPE and two polypropylene (PP) units with a combined capacity of 960,000tpa.

Added to this is the planned Chemaweyaat complex, which Abu Dhabi hopes will be the world's largest petrochemical complex when it starts bringing facilities into operation in 2016. The first part of the development, Tacaamol, will use heavy naphtha feed for aromatics units and a lighter naphtha feed for a 1.5mn tpa mixed feed cracker. This will capitalise on the lower price of naphtha as well as more the diverse product portfolio that naphtha provides. The availability of naphtha in the UAE is being boosted by refinery expansion at Ruwais, helping to retain the Emirati industry's competitive edge and enabling it to produce a wider range of products.

**Iran's Threat To Arabian Gulf Producers**

Adding to the supply woes is the expected return of Iran in the global polymer scene. The country is a major PE producer in the Middle East that was prevented from exporting to its main market - Europe - by international sanctions imposed on suspicion that it was developing a nuclear weapon. Arabian Gulf producers in the Gulf Co-operation Council (GCC) will compete directly with Iran in the European market, a prospect that is unsettling them. Buyers may also turn more cautious in procuring cargoes amid the bleak macroeconomic outlook prevailing in the Middle East. Buying appetite could also be affected by Middle East polymer suppliers becoming more cautious over giving credit to less established players. This could worsen the buying appetite even further for 2016.

The prospects for strong exports-led growth in Iran are good as the Iranian government aims to raise capacity from the current 60mn tpa to 100mn tpa by 2020. The relief of sanctions should raise the operating rates from 68% of capacity, as they were in 2014, even as capacity grows. In 2015/16, Iran plans to open 11 petrochemical units, increasing the country's petrochemical production by 6mn tonnes.

The dominant ethane feedstock in the Arabian Gulf has declined in competitiveness as a result of lower naphtha costs, which have been driven down by falling crude prices. This has benefitted more naphtha-reliant competitors, particularly in Asia, its main export market. At the same time, slackening demand in export markets has weakened product prices.

Qatari petrochemicals production in particular is threatened by reduced demand growth in key export markets and the surge in output from Iran. Qatar's reliance on ethane feedstock has limited its petrochemicals industry to some extent, as the country does not produce the same range of by-products as competitors which rely on other feedstock. The country's drive towards diversification with a mixed feed petrochemicals complex, which would help diversify and take advantage of lower naphtha costs, has received setbacks in recent months with the cancellation of major projects. Current circumstances do not support a revival of shelved plans or any further capacity expansion beyond 2016.

Over the medium term, Saudi Arabia is likely to become better placed than some smaller ethane-orientated regional rivals as it develops mixed feed crackers and continues efforts to diversify and add value to the production chain. Its main competitor is likely to be Iran, as the international sanctions regime is eased.

Kuwait is arguably in a better position than other Gulf producers as its production is geared towards naphtha feedstock. Heavier cracks from naphtha should be conducive to diversification. The first phase of

debottlenecking operations at Equate's PE facilities put it on course for a 175,000tpa increase in capacity in 2016. This will be followed in 2017 with **Kuwait Petroleum Corporation**'s Olefins III project, which should see ethylene capacity grow 1.4mn tpa with a corresponding rise in polyethylene and ethylene glycol capacities.

However, delays to the establishment of the Al-Zour refinery project are set to undermine Kuwaiti petrochemicals competitiveness. The Al-Zour project was set to raise downstream refinery capacity to 1.4mn barrels per day (b/d) by 2019, but it looks set to be delayed until 2020 as costs escalate and Kuwait continues in its effort to secure financing. In the meantime, refining capacity is set to decline as a result of consolidation within the refining sector, a move that could restrict naphtha supply to petrochemicals and raise feedstock costs.

**Market Diversification Crucial To Growth**

The Arabian Gulf states are seeking counter Iran's rise with a comprehensive free trade agreement between Gulf Cooperation Council countries and the EU that could reduce export costs and increase production returns for companies participating in the Gulf states' chemicals industry. However, this may be insufficient to give producers an edge, particularly given the slow growth in the EU market.

Larger external markets like China and India are witnessing a slowdown in demand while they are at the same time becoming self-sufficient. Adding to the issue of reduced sanctions on Iran, which offers the prospect of a massive rise in Iranian exports, these market factors will constrain prices and growth.

For exporters, diversifying away from China is essential. With the Chinese market moving towards a situation of self-sufficiency as its market growth slows and capacities continue to rise, Gulf output will need to diversify to other markets as well as increase the portfolio of products and diversify away from a narrow focus on polymers.

India is an obvious alternative; however, similar to China, India is also aiming for self-sufficiency. We note that while it is unlikely that India will reach this target in the short term, capacities in India will grow in the long term, making the country increasingly self-sufficient. This will force exporters in the Arabian Gulf to look to South East Asia and other regions for growth opportunities.

Middle Eastern producers see Vietnam and South East Asia as strategic growth markets that could help make up for the loss in sales on the Chinese market. A quarter of Vietnam's plastic imports come from Saudi Arabia, for example.

Arabian Gulf producers are also seeking to diversify their product portfolios. 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, benefitting 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.

We note that Qatar's reliance on ethane feedstock has limited its petrochemicals industry to some extent, as the country does not produce the same range of by-products as competitors which rely on other feedstock. The US and China, for example, also rely on naphtha. Due to the lack of diversification, Qatar is likely to be sidelined in the special chemicals market. Although the government is seeking to redress the balance with mixed crackers, other industries are also capitalising on the increasing global demand, which will cause Qatar to be left behind.

**Tightening Ethane Supplies**

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.

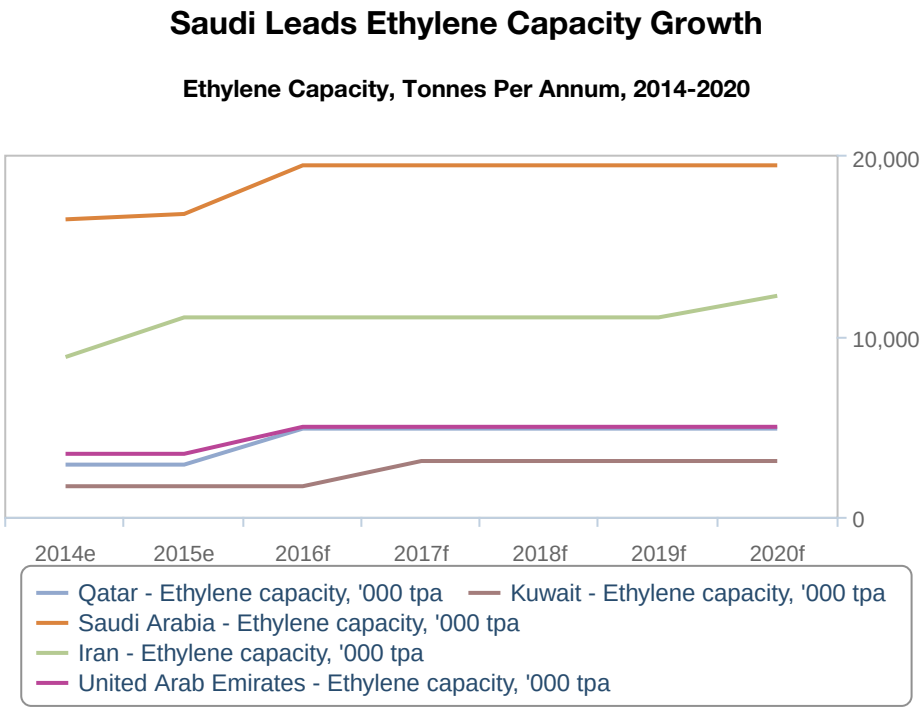
Reliance on ethane in Saudi Arabia and Qatar is also limiting product diversification due to the fact that there are significantly fewer by-products compared to naphtha. In polymers, this will invariably lead to an overwhelming reliance on PE grades. Research and development will need to focus on greater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




*e/f = BMI estimate/forecast. Source: National sources, BMI*

**Modest Upside In Africa**

Turning to Africa, 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 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.

Egypt is one of the most promising growth markets for petrochemicals and in spite of infrastructural and feedstock constraints it is set to become a significant exporter of petrochemicals over the long term. Plans will be put into operation in 2016 for a series of new plants over the next five years, culminating in **Carbon Holdings**' world-scale Tahrir Petrochemicals project, set to come into commercial operation in 2020.

However, gas shortages are plaguing the petrochemicals and chemical fertiliser sectors. Egypt needs around 500,000tpa 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. In 2015, the fertiliser sector was the focus of expansion. Production was supported by the opening in H1 of **Sonatrach**'s joint venture with Oman's **Suhail Bahwan Holding Group**, Al Djazaïria Al Omania Lil Asmida (AOA), which was built at a cost of USD2.6bn and produces ammonia and urea for fertiliser. AOA has a capacity of 2.4mn tpa, leading to an increase in national production by about one-third. The launch of the AOA plant follows the announcement of modernisation and expansion plans at two other large ammonia and urea facilities.

The country also has around 178,000tpa of PE, 40,000tpa of vinyl chloride monomer (VCM), 35,000tpa of polyvinyl chloride (PVC), 120,000tpa of methanol (rising to 1.12mn tpa by 2017) and 990,000tpa of ammonia, which should increase to 5.6mn tpa when new fertiliser plants enter production. These rises in capacity will also result in the production capacity for urea hitting 3.59mn tpa.

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. The government is attempting to attract foreign direct investment (FDI) into the country's petrochemicals sector. However, a lack of skilled labour, political and social unrest and sabotage of upstream infrastructure could delay projects planned in the coming years. The focus of investment is the fertiliser sector, which uses domestic gas resources and has access to significant markets in sub-Saharan Africa. Urea capacity is set to exceed

8mn tpa by 2020, which should make Nigeria a major exporter of fertiliser, as well as ensuring self-sufficiency in the long-run. Methanol is also set to grow with total additional capacity of 3.6mn tpa over the next five years.

# Global Industry Overview

Global supply is showing stronger growth than demand, especially in the case of polyethylene (PE). Global petrochemical prices continued to fall in Q116 amid weak oil prices. Upstream petrochemical prices track crude prices, so lower oil prices have been passed on through the petrochemicals chain, even when the dominant feedstocks vary by region. European and US prices fell by over 3%, although there was some upside in Asia even as olefins and some polymers were lower. Nevertheless, Europe promises opportunities for producers due to anticipated market tightening.

**Short-Term Outlook: Stable But Weak Polymer Markets**

There is strong justification for predictions of sustained low naphtha prices. The weakness of the Chinese market, underlined by its currency devaluation and stock market crash in August, will ensure soft economic growth for the world's second largest energy consumer. On the supply side, the Iranian nuclear agreement threatening to release more crude on the global market; the absence of production cuts from OPEC; high crude stock levels; booming shale gas supplies in North America; and European market stagnation mean that there is little upside for oil prices in the short-to-medium term.

While short-term fluctuations in price are evened out over longer periods, petrochemicals producers will have to ensure they are more resilient to greater volatility in a lower price environment. **BMI** believes there will be resilience to sub-USD50 per barrel (/bbl) crude prices, but in a sluggish market environment there will be further scope for petrochemicals product cuts.

In relation to olefins, which are produced using naphtha or ethane feedstock, the global build-out in on-purpose propylene production accelerated in 2015 and is set to impact the global market in 2016. With the contract price of ethylene USD280/tonne higher than propylene in Q116, compared to USD55/tonne in Q115, cracker operators are gearing themselves more to ethylene production. Propylene prices hit a seven-year low in March 2016 due to high levels of supply, although maintenance turnarounds in Q216 were expected to support higher prices for both olefins.

Naphtha-based producers will have the upper hand in 2016, although some ageing plants - particularly in Europe - will still struggle with high operating costs and unplanned outages. Lower naphtha prices are supporting European and Asian cracker margins with an apparent medium-term reversal of the situation seen in past years when crude was USD100/bbl. At the time of high crude prices, operators in these regions were seeing downward pressure on margins due to resulting high naphtha feedstocks costs. The situation

became even worse when co-product credits declined, following the collapse of butadiene prices. Additionally, new US ethane-based PE capacity from 2017 was set to further upset the global market.

**BMI**'s expectations of weakening polymer prices were proven correct in 2015. The story in 2016 is one of greater price stability as markets have adjusted to lower naphtha costs. However, margins will still come under pressure from weaker demand and there is a growing risk of recession. The US economy is slowing, while China's economy appears to be barely growing in reality. Unlike the last global downturn, when the US led the world, with emerging markets and commodity producers following suit, this time emerging markets and commodity producers are leading the way, and developed markets risk being dragged into the mire.

Petrochemicals market tightening should be supported by some lengthy plant turnarounds in Europe. These will include **LyondellBasell**'s maintenance shutdown of polymer plants in France, a planned outage at **Total**'s Antwerp cracker and a possible shutdown of **Ineos**' PE and polypropylene (PP) capacity in Belgium. **Versalis** and **Unipetrol** are also running facilities well below capacity in Italy and Czech Republic respectively. As a result, European polymer buyers could face similar supply issues as seen in 2015.

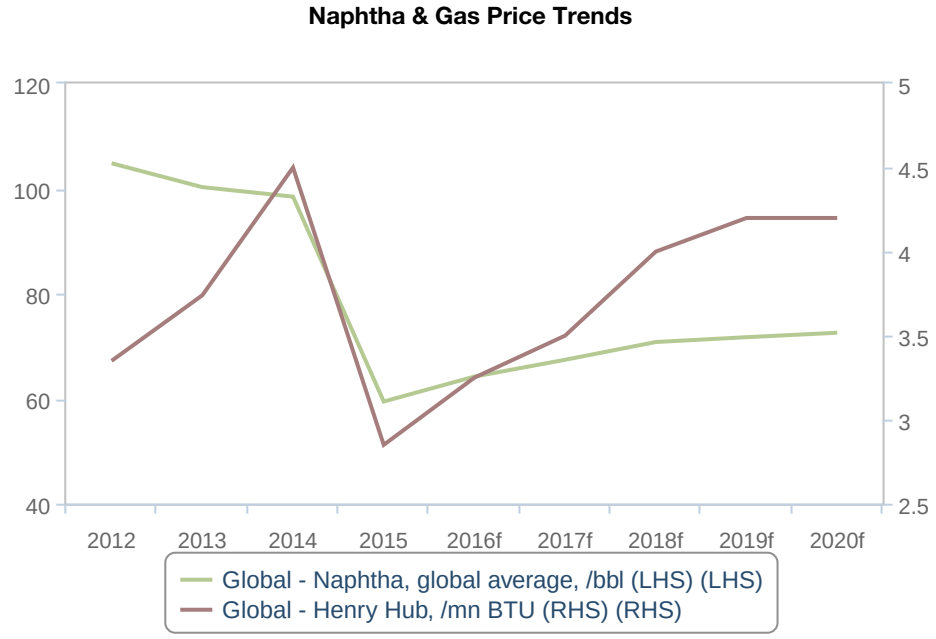
While petrochemicals producers are robust enough to deal with the challenges in 2016, when new US PE capacity hits the market in 2017 the supply-demand imbalance will become a major issue. Added to this is the amount of PE and PP capacity China intends to launch in its 13th Five Year Plan (2016-2020). China is seeking to become more self-sufficient up and down many of the petrochemicals value chains in order to boost employment and end-use manufacturing.

Already in 2016, PE markets will be impacted by projects like Borouge 3 (UAE) and Sadara (Saudi Arabia) in thee Middle East, Ethylene XXI (Mexico) in Latin America, Opal (India) in Asia and **Nova Chemicals**' expansion in Canada. Meanwhile, PP will also be boosted by Borouge 3 and a raft of units in China. Although PP markets are likely to be tighter than PE, the low price of propylene should bring down PP prices without affecting margins.

The other significant factor affecting markets this year is the end of UN-imposed sanctions on Iran, which will speed up polymer investments in the country. New PE capacity was scheduled to go onstream in 2016 with the 300,000 tonnes per annum (tpa) PE plant at Mahabad Petrochemical and a 300,000tpa low density polyethylene (LDPE) project by **Kordestan Petrochemical** at Sanandaj.

## Naphtha To Remain Low

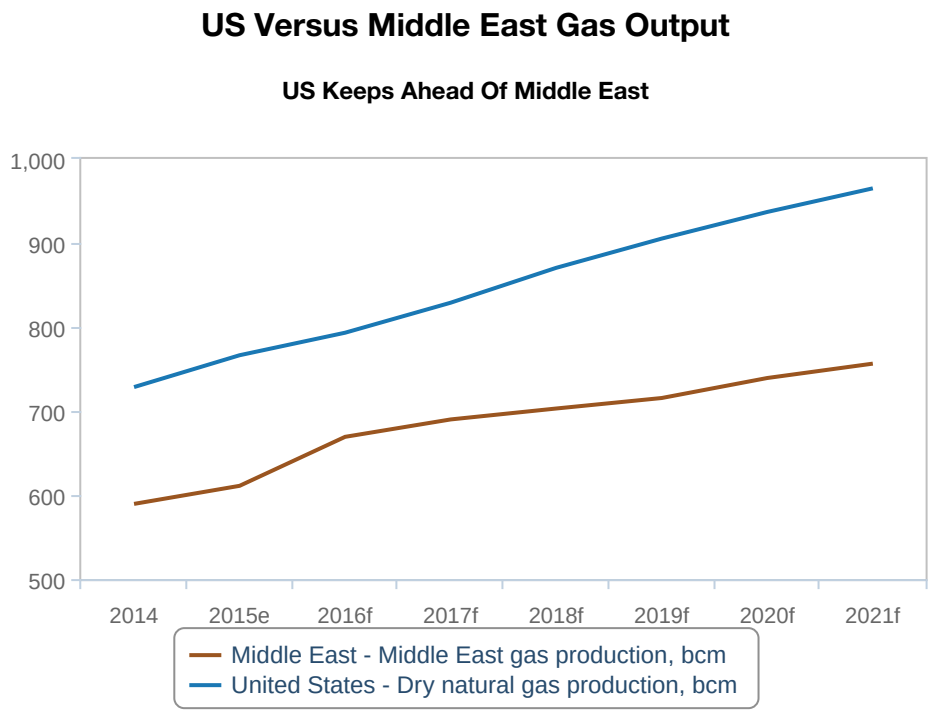



*f = BMI forecast. Source: BMI*

Naphtha is likely to remain the main feedstock in Europe and Asia for the foreseeable future, but the feedstock flexibility of new crackers in Asia will ensure that emerging Asian producers will retain an edge. In the event that oil prices do recover, this would restore much of the lost ethane cost advantage. However, the lower propylene yield in ethane cracking means there is still a place for heavier cracks in order to produce propylene derivatives, such as PP.

The cracking of heavier naphtha feedstock allows for greater petrochemicals product diversity, thereby benefitting 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).

**Could US Gas Run Out?**




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

**M&A Activity**

Tough market conditions, growth in cheap US exports and rising Chinese technical capability will be the industry-shaping changes that will begin to affect the global petrochemicals industry going forward. **Dow Chemical** and **DuPont** entered 2016 after agreeing to merge to form a USD130bn corporation. The companies, with positions in everything from plastics to agriculture, have substantial operations across Asia, particularly China. This merger will help them cope with the challenges posed by an increasingly competitive market.

They ended a year that saw strong M&A activity and new joint ventures. INEOS and **Solvay** announced the launch of their INOVYN joint venture in July 2015 that has led to developments in the formation of the polyvinyl chloride (PVC) market in Europe. Solvay also completed the acquisition of the Ryton PPS

(polyphenylene sulphide) business from **Chevron Phillips Chemical**, enlarging its high-performance polymers offering and entering a solid growth market.

**Indorama Ventures** (IVL) acquired 100% of the 600,000tpa PTA business of CEPSA Chimie Montreal. The 600,000 ton PTA plant will provide Indorama Ventures with feedstock security. IVL also acquired Indian polyethylene terephthalate (PET) manufacturer **Micro Polypet Private Ltd** (MicroPet), which has 216,000tpa capacity.

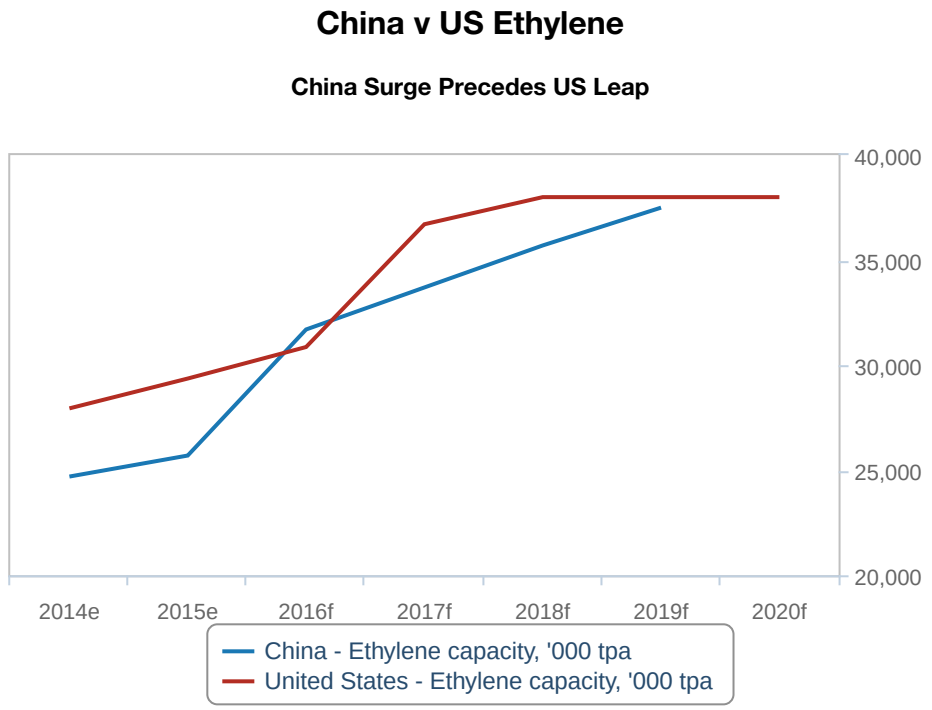
The **Samsung** group agreed to sell its stakes in petrochemical affiliates to the **Lotte** group, in a deal worth an estimated KRW3trn (USD2.66bn billion), exiting the petrochemicals industry to focus on mainstay businesses such as electronics and finance.

Solvay also completed the acquisition of Cytec and is integrating Cytec's businesses to deliver cost efficiency and expand its position in advanced lightweighting materials for the aerospace and automotive industries.

Total has been investing in specialised chemicals products in Germany, acquiring a majority 68% interest in Germany's **Polyblend**. Polyblend produces compounds - which are blends of polymers (polyethylene and polypropylene) and other ingredients such as mineral fillers, glass fibres, elastomers and additives - formulated to customer specifications. Meanwhile, it is planning to open two polypropylene compounding lines at the Carling Platform as part of its project to secure the French site's future.

**Long-Term Trends**

A slow, long-term oil price recovery would have a profound impact on both global PE and PP markets. Western Europe and Asia would benefit greatly from more competitive feedstock and buoyant demand, while North America would experience lower integrated margins. However, a prolonged period of low oil prices would put new Russian PE projects in jeopardy because of the resulting poor investment climate, leaving Russia as a net-importer of the chemical.

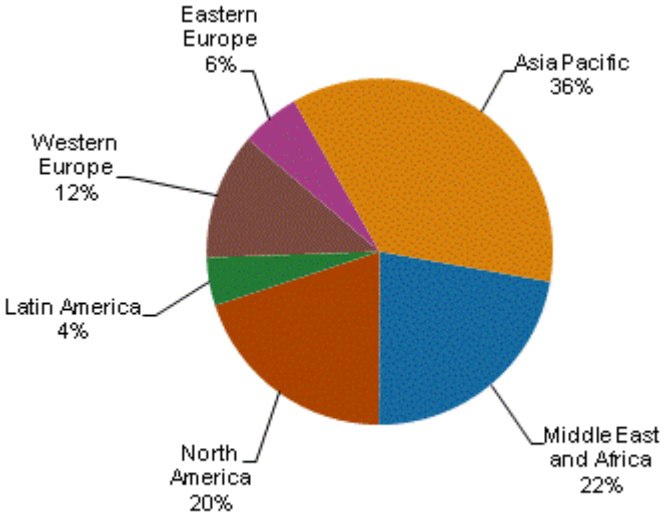



*e/f = BMI estimate/forecast. Source: National sources, BMI*

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

**2015 (%)**




*Source: BMI*

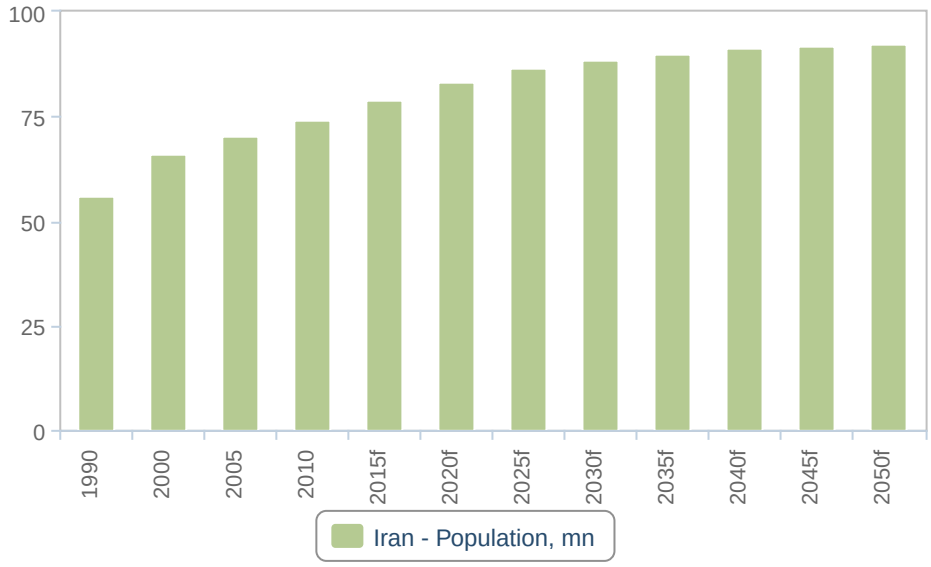
# Demographic Forecast

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**

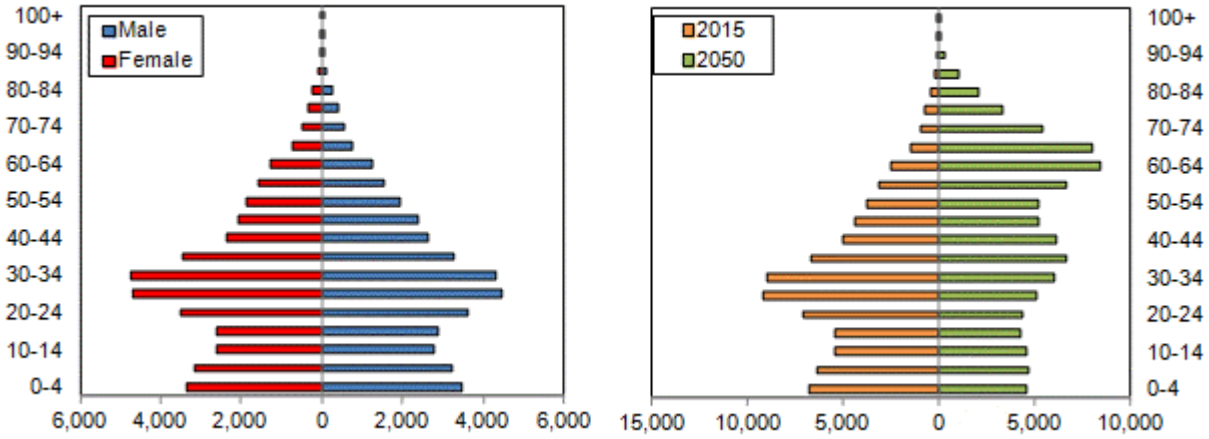
**(1990-2050)**




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

## Iran Population Pyramid

**2015 (LHS) & 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 | 56,169 | 65,850 | 70,122 | 74,253 | 79,109 | 83,403 | 86,496 |
| Population, % y-o-y | na | 1.7 | 1.2 | 1.2 | 1.2 | 0.9 | 0.6 |
| Population, total, male, '000 | 28,617 | 33,372 | 35,796 | 37,542 | 39,835 | 41,940 | 43,439 |
| Population, total, female, '000 | 27,551 | 32,477 | 34,325 | 36,710 | 39,274 | 41,463 | 43,057 |
| Population ratio, male/female | 1.04 | 1.03 | 1.04 | 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 | 28,800 | 40,064 | 48,413 | 53,171 | 56,428 | 58,737 | 61,495 |
| Active population, % of total population | 51.3 | 60.8 | 69.0 | 71.6 | 71.3 | 70.4 | 71.1 |
| Dependent population, total, '000 | 27,368 | 25,785 | 21,709 | 21,081 | 22,681 | 24,665 | 25,000 |
| Dependent ratio, % of total working age | 95.0 | 64.4 | 44.8 | 39.6 | 40.2 | 42.0 | 40.7 |

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

| | 1990 | 2000 | 2005 | 2010 | 2015f | 2020f | 2025f |
|---|---|---|---|---|---|---|---|
| Youth population, total, '000 | 25,492 | 23,011 | 18,251 | 17,418 | 18,677 | 19,449 | 18,237 |
| Youth population, % of total working age | 88.5 | 57.4 | 37.7 | 32.8 | 33.1 | 33.1 | 29.7 |
| Pensionable population, '000 | 1,876 | 2,773 | 3,457 | 3,662 | 4,003 | 5,216 | 6,763 |
| Pensionable population, % of total working age | 6.5 | 6.9 | 7.1 | 6.9 | 7.1 | 8.9 | 11.0 |

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

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

| | 1990 | 2000 | 2005 | 2010 | 2015f | 2020f | 2025f |
|---|---|---|---|---|---|---|---|
| Urban population, '000 | 31,640.1 | 42,171.7 | 47,373.1 | 52,442.2 | 58,046.4 | 63,173.8 | 67,253.7 |
| Urban population, % of total | 56.3 | 64.0 | 67.6 | 70.6 | 73.4 | 75.7 | 77.8 |
| Rural population, '000 | 24,529.1 | 23,678.4 | 22,749.0 | 21,811.2 | 21,062.8 | 20,229.5 | 19,242.9 |
| Rural population, % of total | 43.7 | 36.0 | 32.4 | 29.4 | 26.6 | 24.3 | 22.2 |
| Life expectancy at birth, male, years | 61.6 | 69.2 | 70.4 | 72.5 | 74.5 | 75.1 | 75.8 |
| Life expectancy at birth, female, years | 66.3 | 71.1 | 73.5 | 75.5 | 76.7 | 77.4 | 78.1 |
| Life expectancy at birth, average, years | 63.8 | 70.1 | 71.9 | 74.0 | 75.6 | 76.2 | 76.9 |

*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, '000 | 9,346 | 6,379 | 5,494 | 6,402 | 6,855 | 6,228 | 5,197 |
| Population, 5-9 yrs, total, '000 | 8,885 | 7,598 | 5,556 | 5,472 | 6,395 | 6,836 | 6,213 |
| Population, 10-14 yrs, total, '000 | 7,260 | 9,034 | 7,200 | 5,543 | 5,426 | 6,384 | 6,826 |
| Population, 15-19 yrs, total, '000 | 5,775 | 8,781 | 9,299 | 7,136 | 5,478 | 5,407 | 6,365 |
| Population, 20-24 yrs, total, '000 | 4,674 | 6,868 | 9,123 | 9,148 | 7,086 | 5,434 | 5,369 |
| Population, 25-29 yrs, total, '000 | 4,031 | 5,269 | 6,796 | 8,996 | 9,158 | 7,026 | 5,388 |
| Population, 30-34 yrs, total, '000 | 3,506 | 4,419 | 5,156 | 6,759 | 9,045 | 9,096 | 6,979 |
| Population, 35-39 yrs, total, '000 | 3,005 | 3,864 | 4,670 | 5,140 | 6,738 | 8,988 | 9,044 |
| Population, 40-44 yrs, total, '000 | 2,123 | 3,344 | 4,091 | 4,580 | 5,029 | 6,688 | 8,931 |
| Population, 45-49 yrs, total, '000 | 1,621 | 2,832 | 3,393 | 3,920 | 4,454 | 4,979 | 6,629 |

| Population By Age Group (Iran 1990-2025) - Continued | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1990 | 2000 | 2005 | 2010 | 2015f | 2020f | 2025f |
| Population, 50-54 yrs, total, '000 | 1,527 | 1,930 | 2,776 | 3,227 | 3,813 | 4,384 | 4,906 |
| Population, 55-59 yrs, total, '000 | 1,393 | 1,431 | 1,767 | 2,631 | 3,124 | 3,723 | 4,286 |
| Population, 60-64 yrs, total, '000 | 1,140 | 1,322 | 1,336 | 1,629 | 2,497 | 3,009 | 3,594 |
| Population, 65-69 yrs, total, '000 | 899 | 1,145 | 1,258 | 1,193 | 1,475 | 2,338 | 2,828 |
| Population, 70-74 yrs, total, '000 | 508 | 826 | 1,055 | 1,054 | 1,009 | 1,299 | 2,075 |
| Population, 75-79 yrs, total, '000 | 269 | 509 | 654 | 780 | 785 | 776 | 1,015 |
| Population, 80-84 yrs, total, '000 | 136 | 203 | 347 | 413 | 477 | 494 | 502 |
| Population, 85-89 yrs, total, '000 | 49 | 67 | 113 | 174 | 194 | 232 | 249 |
| Population, 90-94 yrs, total, '000 | 11 | 18 | 22 | 40 | 54 | 63 | 79 |
| Population, 95-99 yrs, total, '000 | 1 | 2 | 3 | 5 | 7 | 10 | 12 |
| Population, 100+ yrs, total, '000 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

*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 | 16.64 | 9.69 | 7.84 | 8.62 | 8.67 | 7.47 | 6.01 |
| Population, 5-9 yrs, % total | 15.82 | 11.54 | 7.92 | 7.37 | 8.08 | 8.20 | 7.18 |
| Population, 10-14 yrs, % total | 12.93 | 13.72 | 10.27 | 7.47 | 6.86 | 7.66 | 7.89 |
| Population, 15-19 yrs, % total | 10.28 | 13.34 | 13.26 | 9.61 | 6.93 | 6.48 | 7.36 |
| Population, 20-24 yrs, % total | 8.32 | 10.43 | 13.01 | 12.32 | 8.96 | 6.52 | 6.21 |
| Population, 25-29 yrs, % total | 7.18 | 8.00 | 9.69 | 12.12 | 11.58 | 8.42 | 6.23 |
| Population, 30-34 yrs, % total | 6.24 | 6.71 | 7.35 | 9.10 | 11.43 | 10.91 | 8.07 |
| Population, 35-39 yrs, % total | 5.35 | 5.87 | 6.66 | 6.92 | 8.52 | 10.78 | 10.46 |
| Population, 40-44 yrs, % total | 3.78 | 5.08 | 5.84 | 6.17 | 6.36 | 8.02 | 10.33 |
| Population, 45-49 yrs, % total | 2.89 | 4.30 | 4.84 | 5.28 | 5.63 | 5.97 | 7.66 |
| Population, 50-54 yrs, % total | 2.72 | 2.93 | 3.96 | 4.35 | 4.82 | 5.26 | 5.67 |
| Population, 55-59 yrs, % total | 2.48 | 2.17 | 2.52 | 3.54 | 3.95 | 4.46 | 4.96 |
| Population, 60-64 yrs, % total | 2.03 | 2.01 | 1.91 | 2.19 | 3.16 | 3.61 | 4.16 |
| Population, 65-69 yrs, % total | 1.60 | 1.74 | 1.79 | 1.61 | 1.87 | 2.80 | 3.27 |
| Population, 70-74 yrs, % total | 0.90 | 1.25 | 1.51 | 1.42 | 1.28 | 1.56 | 2.40 |
| Population, 75-79 yrs, % total | 0.48 | 0.77 | 0.93 | 1.05 | 0.99 | 0.93 | 1.17 |
| Population, 80-84 yrs, % total | 0.24 | 0.31 | 0.50 | 0.56 | 0.60 | 0.59 | 0.58 |

| 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 | 0.25 | 0.28 | 0.29 |
| Population, 90-94 yrs, % total | 0.02 | 0.03 | 0.03 | 0.05 | 0.07 | 0.08 | 0.09 |
| Population, 95-99 yrs, % total | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| 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 | orthoxylene |
| bbl | 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 | paraxylene |
| 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 |
|---|---|
| **Rewards** | |
| **Industry Rewards** | |
| 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 |
| **Country Rewards** | |
| 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. |
| **Risks** | |
| **Industry Risks** | |
| Industry regulatory environment | Subjective evaluation against BMI-defined criteria. Evaluates predictability of operating environment. |
| **Country Risks** | |
| 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 | |
|---|---|
| | **Rationale** |
| 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 | |
|---|---|
| **Component** | **Weighting, %** |
| Rewards | 70, of which |
| - Industry Rewards | 65 |
| - Country Rewards | 35 |
| Risks | 30, of which |
| - Industry Risks | 40 |
| - Country Risks | 60 |

*Source: BMI*