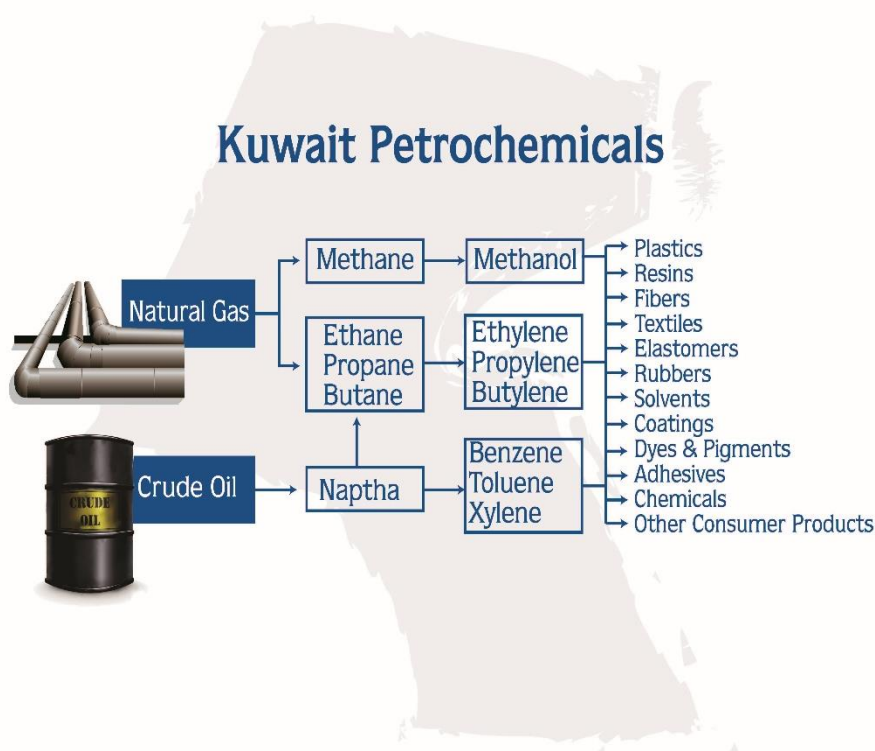


Marmore Industry Reports 2015

Kuwait Petrochemicals

Waning low cost advantage



Research Highlights

Analysis of Kuwait's petrochemical sector highlighting growth drivers, trends, investments, challenges and future outlook for the industry

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1. Executive Summary

PIC's goal is to prove its efficiency and capabilities in the Petrochemical sector through Joint ventures.

Petrochemicals Industries Company (PIC) is the major player in Kuwait petrochemicals sector. Petrochemicals Industries Company (PIC) was established in 1963 by the orders of Amiri decree. PIC is one of the few low cost manufacturers of petrochemicals in the world owing to cheap feedstock costs. Located in the GCC region with excellent port facilities and its geographic location being a strategic advantage, PIC enjoys competitive advantage over other players in the world.

PIC's goal is to prove its efficiency and capabilities in the Petrochemical sector through Joint ventures and construction of mega integrated refining and petrochemical projects in Kuwait and in other countries. PIC plays a major role in the effort of the Kuwait government to diversify its exports from Oil and Natural Gas.

Petrochemical projects worth USD 337.7¹ Bn are planned to be executed in Kuwait between 2009 and 2017.

Petrochemical projects worth USD 337.7¹ Bn are planned to be executed in Kuwait between 2009 and 2017. The Olefins-III project in Shauiba Complex of Kuwait worth USD 7,000 Mn is the major project of PIC and is expected to become operational from 2017 or 2018. Al Zhor refinery project worth USD 30 Bn was signed in October 2015 which will help in capacity addition of Naphtha feedstock for petrochemical plants after its expected commencement in 2018.

Petrochemicals demand deteriorated during 2008-2009 due to the global financial crisis. Demand recovered after 2010 when the economic growth rates increased, especially in the emerging Asian markets like India and China.

Increased demand forecasts for paints, electronics and fertilizers in India and China during the period 2015 to 2018 is going to be a key driver for the Petrochemical companies in Kuwait as petrochemicals are the major raw material for the manufacture of paints, electronics and fertilizers.

Chinese self-reliance in the production of petrochemicals is a cause of concern for PIC as China is the major export destination for Kuwait's

¹ Zawya

The shift to heavier feedstock like Naphtha eliminates the cost advantage.

petrochemicals. To mitigate the risk, PIC entered into joint venture in China for the construction of the China Integrated plant at Zhanjiang province which is expected to become operational from 2017.

The domestic demand for oil and natural gas is increasing due to increasing population and increased demand for electricity. The shift to heavier feedstock like Naphtha eliminates the cost advantage PIC enjoyed with the subsidized supply of Ethane. Increasing feedstock costs will eliminate the competitive advantage enjoyed by PIC over other petrochemical players outside the GCC region.

PIC is working towards realizing its Horizon plan –III from the year 2000.

PIC has carved out three Horizon plans for the development of the petrochemicals sector in Kuwait. PIC is working towards realizing its Horizon plan –III from the year 2000.

Streamlining investments into refining and petrochemical integration, entering into more number of joint ventures and diversifying the product portfolio with the help of timely government initiatives will help PIC to handle the challenges and achieve its goals set as a part of the Horizon plans.

2. Sector Overview

Kuwait owns 7% of the global oil reserves and stood as the fourth largest oil exporter in OPEC in 2014.

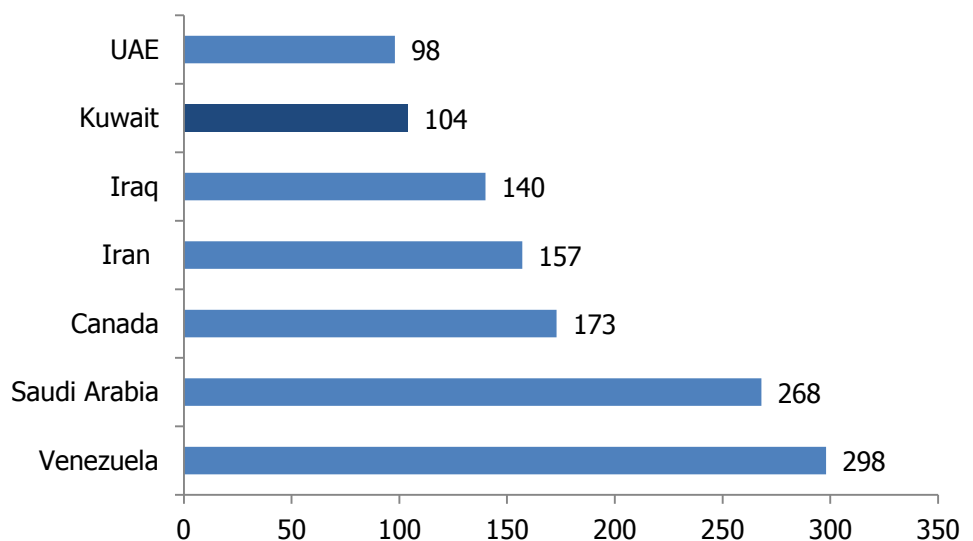
Petrochemical Industries Company (PIC) established in the year 1963 is the major petrochemical company in the region under the control of Kuwait Petroleum Corporation. Major developments in Kuwait's petrochemical sector took place after 1993 when a MoU was signed to set up an Olefins plant and a joint venture EQAUTE was set up in 1995.

Kuwait owns 7%² of the global oil reserves and stood as the fourth largest oil exporter in OPEC in 2014. Kuwait, like its neighbors in the GCC, is dependent on oil to fuel its economic growth.

Kuwait has 104 bbls (Billion barrels)³ of oil reserves and 63.5 trillion cubic feet of gas reserves as of 2014. Despite having small area among the GCC countries, Kuwait exported oil and gas worth USD 97.53 bn in 2014 which is the third largest after Saudi Arabia and Qatar.

Kuwait exported oil and gas worth USD 97.53 bn in 2014.

Figure 2.1: Oil Reserves (in bbls), 2014

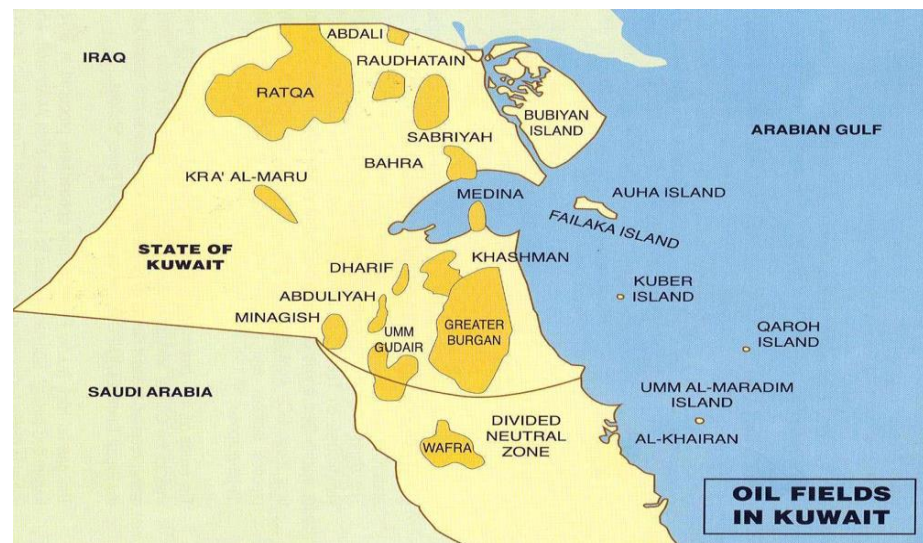


Source: Energy Information Administration

² OPEC

³ Energy Information Administration

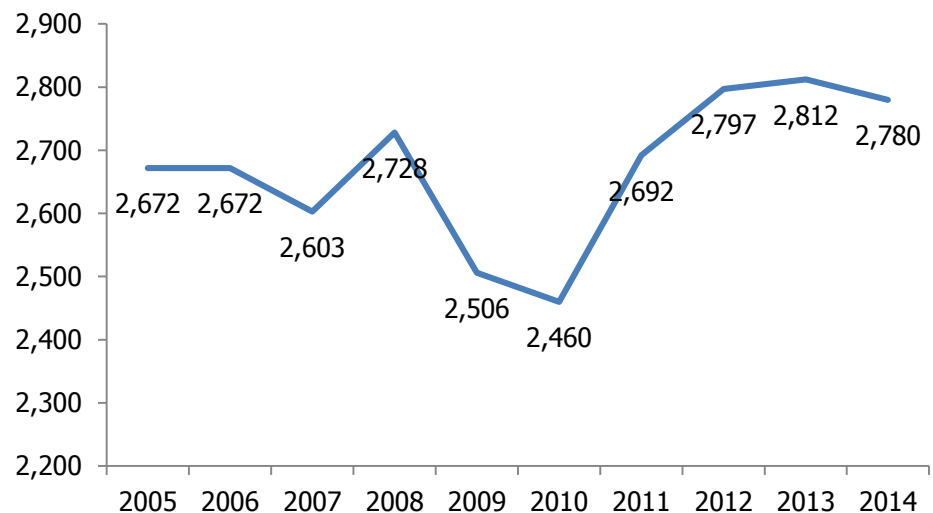
Figure 2.2: Oil Fields in Kuwait



Source: Ministry of Oil, Kuwait

Oil was first identified in Kuwait at The Greater Burgan Oil field in 1938. Kuwait then ventured into identifying other places from where it could drill oil. The Greater Burgan oil field still remains the largest oil field in Kuwait. Other famous oil fields in Kuwait are in the Wafra and Ratqa region.

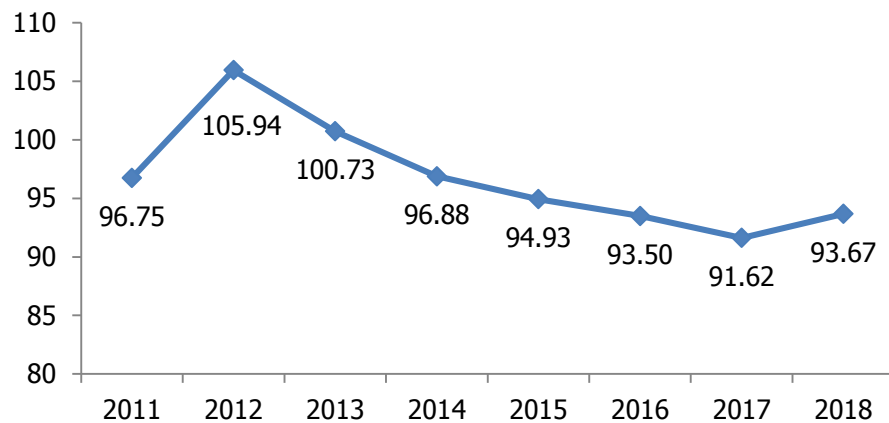
Figure 2.3: Oil Production in Kuwait (in thousand barrels per day)



Source: EIA, Markaz Research

China imported fertilizers worth USD 2.6 Bn in 2015.

Figure 2.4: Oil Exports from Kuwait (in bn USD)

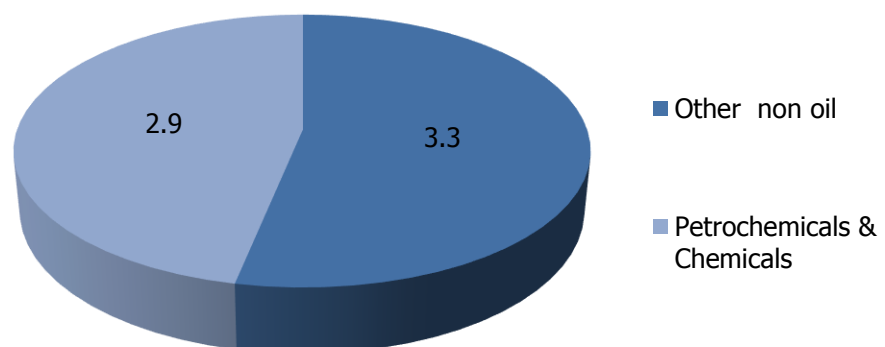


Source: IMF, Markaz research

Kuwait has huge market available in India and China especially with its low cost production advantage.

Kuwait earned 93%⁴ of its revenue from oil exports in the year 2014. Petrochemical industry is one of the downstream operations of the oil industry. Petrochemicals, also being the raw material for fertilizers, provide a huge market especially in the Asian countries which are fast emerging and mainly agriculture driven economies. China imported fertilizers worth USD 2.6 Bn in 2015 which was approximately 20% of the total demand of 225 million metric tonne demand⁵. India imported 17.4⁶ mn tons of fertilizers in 2014-2015. With export opportunities for petrochemicals and allied products in Asian economies, Kuwait has huge market available in India and China especially with its low cost production advantage.

Figure 2.5: Non-oil exports by value (in USD bn), 2014



Source: GCC National Statistical authorities

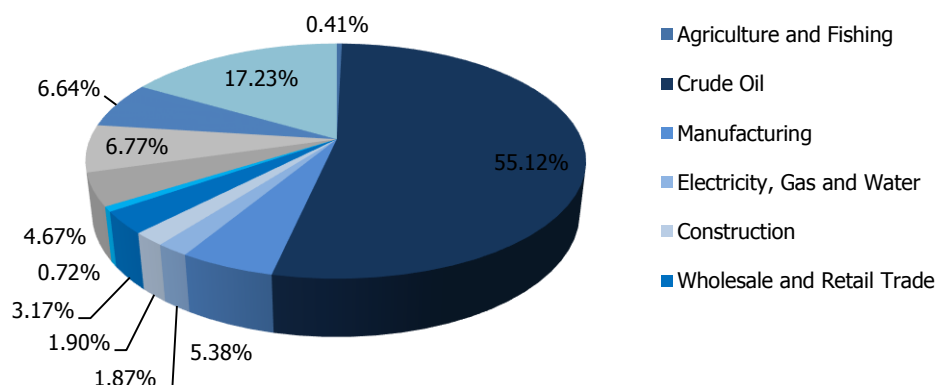
⁴ OPEC

⁵ Freedonia

⁶ Ministry of Petroleum and Chemicals, Government of India

Chemicals and Petrochemicals contributed 43% of the total non-oil exports in Kuwait in 2014. The total exports accounted for USD 97.51 bn⁷ of which USD 6.2 bn came from non-oil and USD 2.9 bn came from chemicals and petrochemicals.

Figure 2.6: Contribution of various sectors to Kuwait's GDP, 2014



Petrochemicals sector contributed 1.2% to Kuwait's GDP which was USD 20.43 bn in 2013.

Source: Kuwait Central Bank

Petrochemicals sector contributed 1.2⁸% to Kuwait's GDP which was USD 20.43 bn in 2013.

Petrochemicals sector in Kuwait employed 5,622 people in 2011, representing 7% of the total number of employees in the GCC petrochemicals sector and 5% of the workforce in Kuwait's manufacturing sector⁹.

As Kuwait is keen to diversify its export portfolio from oil, petrochemicals sector is expected to get the thrust from the government strategy and policies. The recent agreement to develop the Al Zhor refinery is a major step in that direction as feedstock for petrochemicals industry such as Naphtha will be produced once the plant becomes operational in 2018.

The Petrochemicals sector in Kuwait is poised to see growth with increased contribution to the country's GDP through increased investments, better technology usage, and increased participation of private players in the development of world-class integrated refining

⁷ GPCA Report, 2012

⁸ GPCA Report

⁹ GPCA Report 2012

and petrochemical plants. However, the challenges of volatile price of oil and petrochemical products, prolonged low oil price situation after H2 2014, increasing self-sufficiency in India and China and tough competition from the major producers in GCC like SABIC will be challenges to PIC in the future.

Ethane costs USD 0.75/mmbtu in the gulf and it is priced at around UDS 3.2/mmbtu in US and Europe.

Refining and Petrochemical Integration

Petrochemical industry is mainly dependent on oil for feedstock. The GCC region has 35%¹⁰ of the total reserves oil and natural gas reserves in the world. The GCC countries also enjoy the advantage of being the region with the lowest cost of feed stock as it is subsidized by the government. Feed stock, primarily Ethane costs at USD 0.75/mmbtu in the gulf and it is priced at around UDS 3.2/mmbtu in US and Europe.

The integration of refining and petrochemical is the recent trend world over and Kuwait does follow the same.

Integration Projects done by PIC

Kuwait has awarded projects worth USD 30bn¹¹ in 2015 for downstream integration of the oil refining sector. These projects are focused mainly towards the downstream integration of the Petrochemical plants especially the Olefins crackers.

The Horizon III plan of the Kuwait government aims to build mega integrated refining and petrochemical plants. As a part of the plan, the olefins III, an integrated refining and Petrochemical plant is under construction. It is constructed at the Shuiaba industrial area in Kuwait and is expected to be operational from the year 2017.

PIC with its excellence in the execution of Petrochemical projects obtained the contract for the construction of The China integrated refinery at Zhanjiang province in China. The refinery under construction is an integrated project sharing all infrastructure facilities between the refinery and the petrochemical plant. It is expected to be operational from 2017-2018.

PIC obtained the contract for the construction of The China integrated refinery at Zhanjiang province.

¹⁰ OPEC

¹¹ MEED

GCC countries have taken steps over the last decade to lay foundations for a strong upstream petrochemical industry.

Asia and Europe remain the largest importers of plastic resins from the GCC region.

Diversification into allied sectors

There has been a constant urge in the GCC to diversify its source of income from oil to non-oil sectors as they are exposed to the threat of economic instability owing to its increased dependence on revenues from the Oil and Gas industry. The oil sector in the GCC countries contributes to a very large portion of their respective GDPs and minor variations in price could adversely affect their revenues.

In order to overcome this excessive dependence, GCC countries have taken steps over the last decade to lay foundations for a strong upstream petrochemical industry. Currently, GCC countries have started to concentrate on downstream petrochemicals as well so that it would boost the production of plastic resins.

The major beneficiary from this diversification drive would be the plastic processing industry which is largely fragmented in the GCC region. Acrylonitrile butadiene styrene (ABS), polycarbonates and also ethyl vinyl acetate (EVA) are few of the high value plastics whose capacity is expected to increase in the upcoming years.

Asia and Europe remain the largest importers of plastic resins from the GCC region. Especially countries like India and China have seen a growth in demand for downstream petrochemicals. Currently, China is the largest importer of these downstream chemicals and they are also expected to import huge quantities in future as well. Singapore, Turkey, Belgium are the other major importers of petrochemicals from the GCC region.

3. Sector Analysis

The Petrochemical Industries Company has a number of joint ventures through which it carries out the production activities.

The production of petrochemicals in Kuwait is mainly done by the Petrochemical Industries Company, a subsidiary of the Kuwait Petrochemical Corporation. The Petrochemical Industries Company has a number of joint ventures through which it carries out the production activities. There are no major private sector companies in Kuwait.

Kuwait petrochemical sector's production comprises mainly of fertilizers, olefins and aromatics.

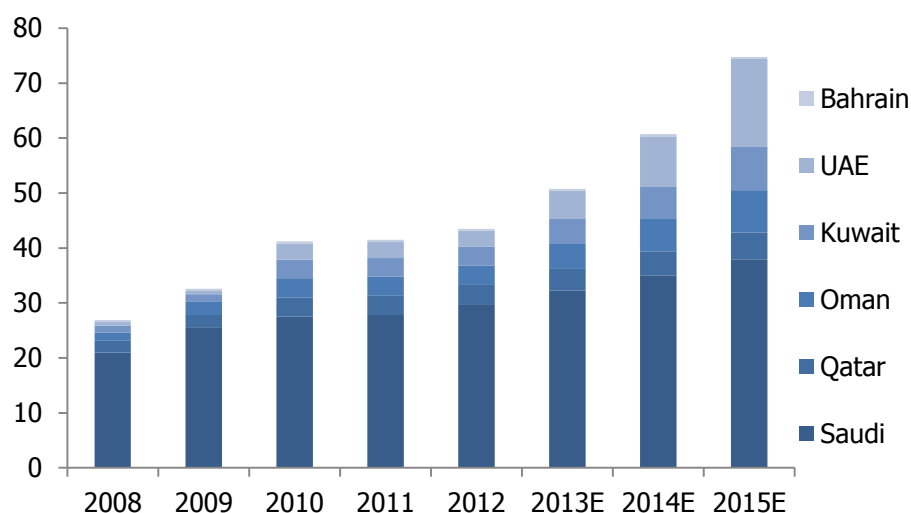
The sector can be analyzed in terms of capacity of production, efficiency in terms of capacity utilization, the profitability of the companies in the sector and the revenue it receives through exports.

Number of companies, production in terms of volume, value

KSA accounts for 68% of the volume of petrochemicals produced in GCC.

The capacity of basic petrochemicals production in GCC is completely dominated by Saudi Arabia which accounted for 68% in terms of volume in 2012. Qatar and Oman have a capacity share of 8% followed by Kuwait and UAE with 7% in GCC. Basic petrochemicals include Ethylene, Propylene, Butadiene, Benzene, Toluene etc.

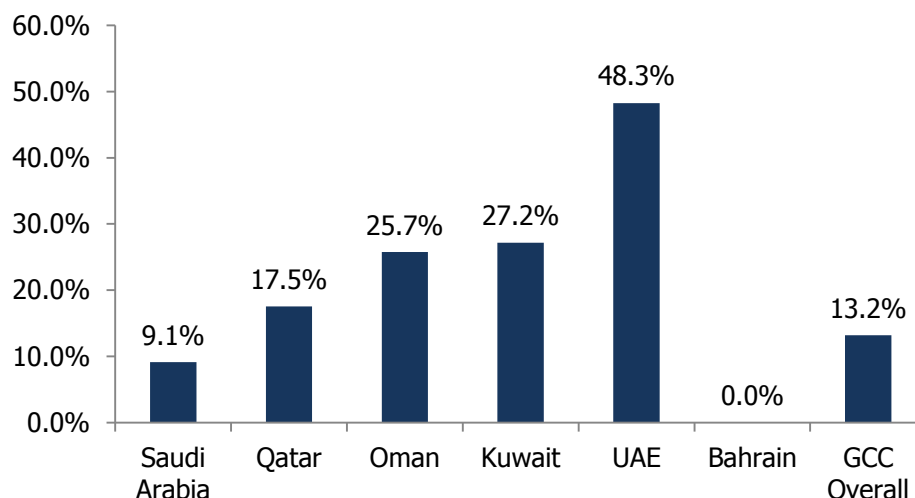
Figure 3.1: Capacity of Basic Petrochemical production (in mn tons)



Source: GPCA

Kuwait's capacity addition increased at a CAGR of 27.2% from 2008-2012.

Figure 3.2: Compounded Annual Growth Rate (Capacity addition in Mn tons) from 2008-2012*



Source: GPCA, Markaz Research

*Note: Bahrain did not have any Capacity addition from 2008-2012

In terms of compounded annual growth rate of capacity addition Kuwait has a CAGR of 27.2% from 2008-2012. UAE has CAGR of 48.3% during 2008-2012, which is almost twice as that of Kuwait. The GCC average during the same period is 13.2%.

The capacity addition in Kuwait can be expected to be the highest in the GCC region after 2017-2018.

Capacity additions in Kuwait were mainly focused on Ethane and Aromatics production in Shauiba Olefins-II complex during the years 2008 and 2009. Contracts worth 1,200 mn USD and 550 mn USD¹² were signed in 2005 for the capacity addition of Ethane and Aromatics respectively.

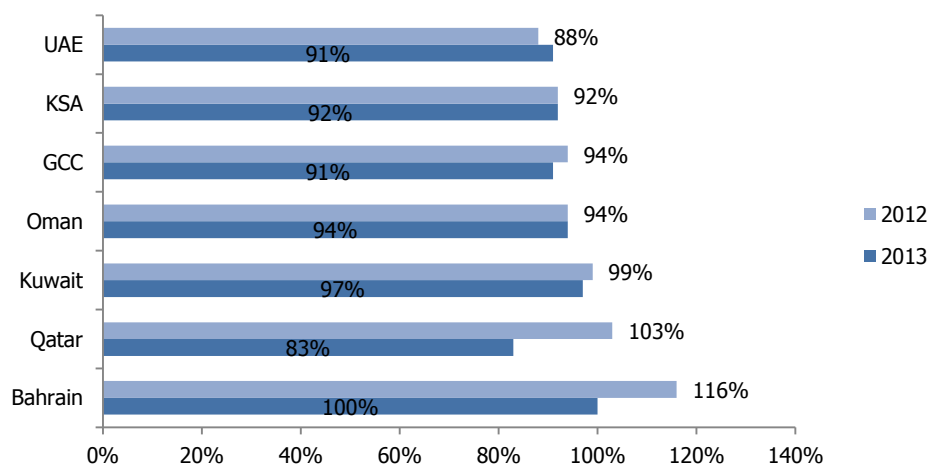
The Kuwait Styrene Company (TKSC) started producing Styrene in the year 2009 in the Shauiba complex which another major project that was completed in the period.

The capacity addition in Kuwait can be expected to be the highest in the GCC region after 2017-2018 when olefins-III and Al Zhor plants are expected to become operational.

¹² MEED

Bahrain and Qatar operated with capacity of 116% and 103% respectively.

Figure 3.3: Capacity Utilization in petrochemicals sector, 2012 -2013

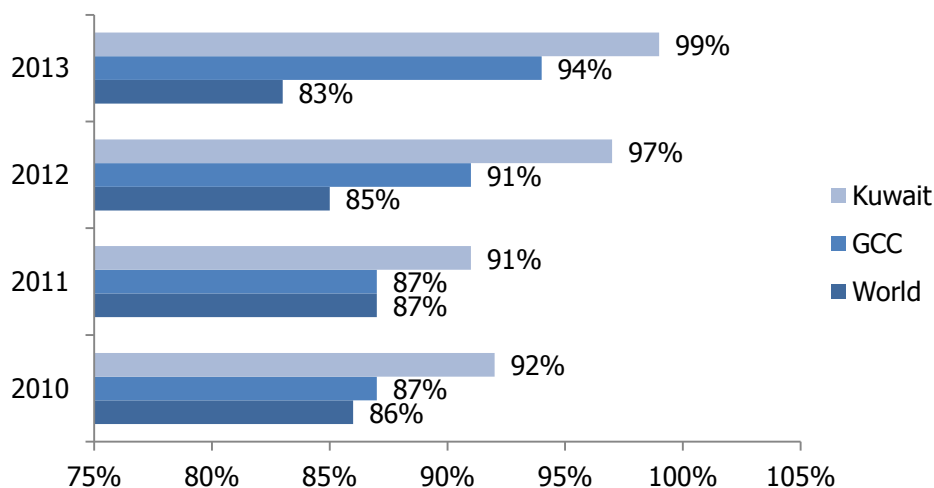


Source: GPCA

Kuwait has one of the highest capacity utilization among the GCC countries with the plants improving the utilization rate by 2% in 2013 compared to 2012. Bahrain and Qatar operated with capacity of 116% and 103% respectively. Overall capacity utilization in GCC increased by 3% in 2013 compared to 2012.

The capacity utilization in petrochemical sector has been higher in both GCC and Kuwait compared to the world average.

Figure 3.4: Capacity Utilization of petrochemicals sector from 2010-2013



Source: American Chemistry Council, GPCA, Markaz Research

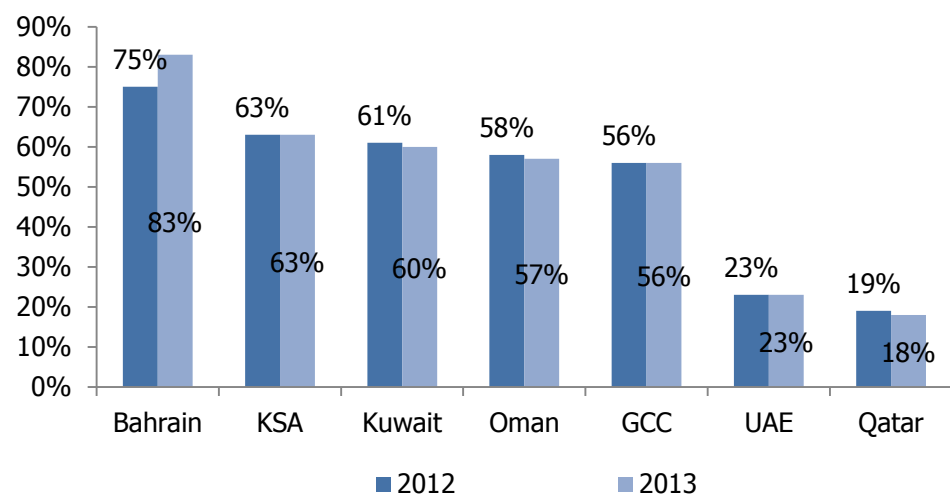
The capacity utilization in petrochemical sector has been higher in both GCC and Kuwait compared to the world average. The capacity utilization of the Kuwait petrochemical plants are almost close to 100% mainly due to the integrated refineries in Kuwait as well as the low cost advantage enjoyed by the Kuwait petrochemical companies.

Figure 3.5: Kuwait's production capacity of petrochemical products (in mn tons) in 2010

Product	Type	Capacity
Fertilizers	Urea	1,050
	Ammonia	660
Olefins	Ethylene	1,650
	Polyethylene	900
	Ethylene glycol	1,000
	Polypropylene	150
Aromatics	Paraxylene	830
	Benzene	400
	Styrene monomer	450
Total		7,090

Source: Kuwaiti Authorities

Figure 3.6: Work Force Nationalization in Chemical Industry 2012-2013 (in %)



Source: GPCA 2013

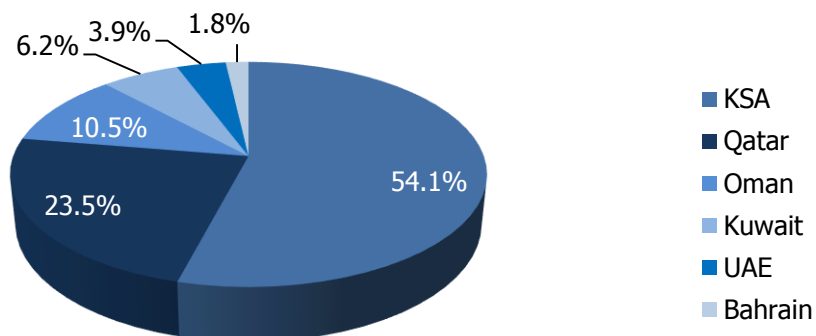
Workforce nationalization is the process of increasing the number of nationals in the country's work force. The above graph gives the percentage of employees employed in that particular sector belonging to the home state. In Kuwait's chemical sector, 60% of the people employed are nationals, which is above the GCC average of 56%.

This indicates that Kuwait's petrochemical sector needs to improve the employment opportunities for nationals at par with the leaders like Bahrain and Saudi Arabia where 75% and 68% of the workforce in petrochemicals sector respectively are nationals. For instance, Saudi Arabian Government has implemented the 'Saudization' plan which aims to improve the number of nationals in their workforce. The Saudi

Kuwait accounts for 6.2% of the exports of petrochemicals by value in 2013.

Arabian government also aims to train 3,000 more chemical engineers by 2020 to improve the employability of the nationals in the Petrochemical industry. As of writing this report the Kuwait Government has not implemented any plans like Saudi Arabia.

Figure 3.7: Export Share by value in 2013(in %) in GCC

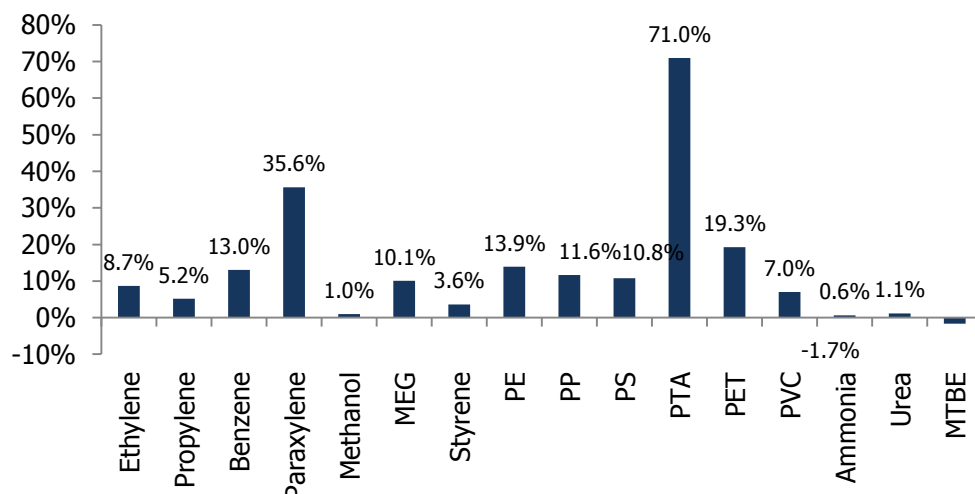


Source: GPCA, Markaz research

KSA accounts for 54.1% of the petrochemical exports by value.

KSA accounts for 54.1% of the petrochemical exports by value followed by Qatar with 23.5% in the year 2013. Kuwait accounts for 6.2% of the exports of petrochemicals by value in 2013 from GCC which was 300 bps higher than 2012.

Figure 3.8: Exports CAGR from GCC (2009-2015)



Source: Chemical Management Authorities, GPIC, Markaz research

The market share of GCC countries are expected to increase as the exports of Petrochemicals from GCC was estimated to grow at an average of 7%¹³ from 2009-2015.

¹³ Source: Chemical Management Authorities, GPIC

Consumption of petrochemicals in the GCC region has remained stagnant.

However, declining prices of petrochemicals and lower imports in Asian markets are challenges to GCC nations.

Market Share

Sales of producers in the GCC represented 2% of the global chemicals sales in 2012.

Table 3.1: Revenues of Petrochemical Sector (in bn USD) - Region Wise

Region	2011	2012	2012 Sales Growth
China	1,043.5	1,223.8	17.3%
Asia (excluding China and GCC)	895.8	910.4	1.6%
Europe	903.5	864.6	-4.3%
NAFTA	669	675.6	1.0%
Latin America	188.9	185.6	-1.8%
GCC	81.7	81.7	0.0%
Rest of the World	75.3	76.3	1.4%
Total	3,857.7	4,017.8	4.2%

Source: Cefic Facts and Figures, GPCA Analysis 2013

The revenue from GCC region has not increased in 2012 in comparison with 2011 whereas China has seen an increase of 17.3% during the same period. This shows that the domestic consumption has remained stagnant in this region.

4. Major Players

PIC ventured into downstream sectors like resins, plastics and polymers, realizing the long-term potential of these products.

Government companies

PIC is the major petrochemical company in Kuwait established in the year 1963. PIC is under the control of Kuwait Petrochemical Corporation (KPC). PIC has driven the growth of Petrochemicals industry in Kuwait from its inception. In the 1990s, PIC ventured into downstream sectors like resins, plastics and polymers, realizing the long-term potential of these products and the need to diversify its product portfolio.

The fertilizers plant of PIC in Shauaiba industrial area produces ammonia and Urea. This was the biggest fertilizer plant in the GCC till 1990.

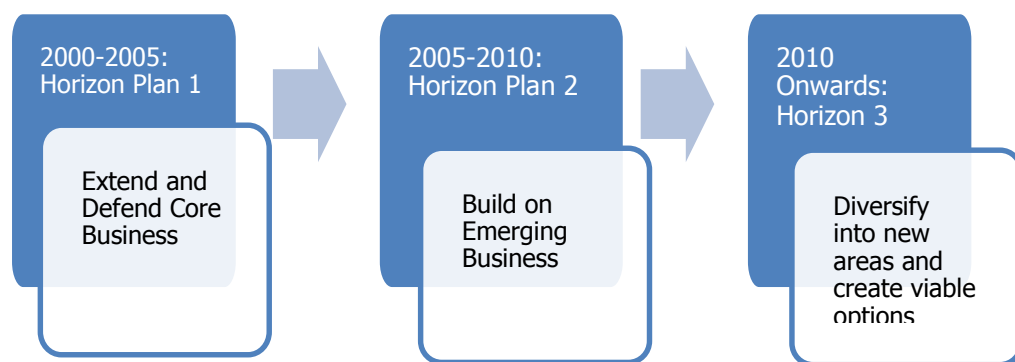
World-scale Olefins Complex was set up by PIC in 1993. The project, one of the largest of its kind in the world, went on stream during the second half of 1997.

Kuwait Petroleum Corporation and PIC build on Kuwait's abundant hydrocarbon resources. PIC intends to increase the turnover of its parent company through increased sale in petrochemicals.

The growth plan of PIC can be divided into 3 stages.

PIC intends to increase the turnover of its parent company through increased sale in petrochemicals.

Figure 4.1: PIC's Growth Plan



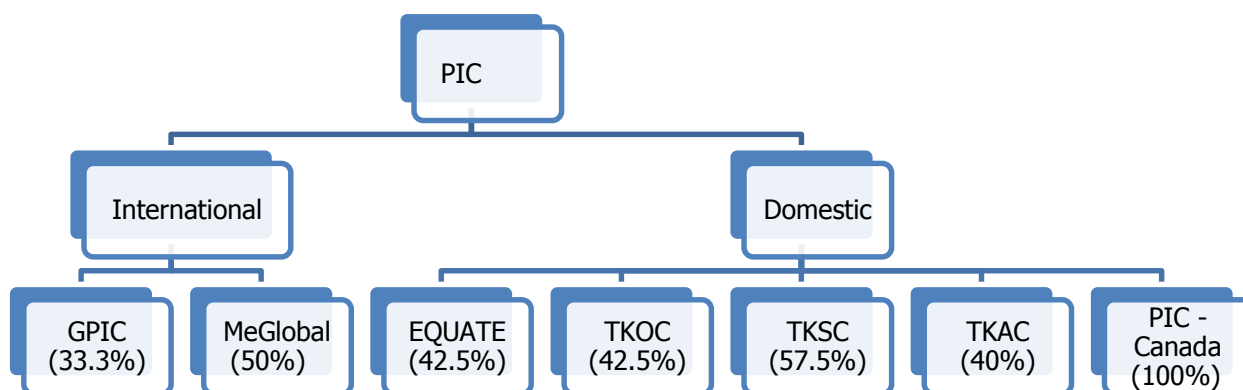
Source: PIC Website

PIC is constantly working on its targets set during each Horizon. In the Horizon-3, PIC has ventured into many new projects. PIC awarded new contracts worth USD 13,464 mn¹⁴ from 2000 all of which are planned to be completed before 2018.

¹⁴ MEED

PIC is keen about growing in the domestic as well as global markets by diversifying geographically as well as diversifying its products. To achieve this PIC has made investments in Kuwait as well as in other countries.

Figure 4.2: PIC's Investments in various companies



Source: PIC Website

Strategic Business Units (SBUs) of PIC

Aromatics SBU

The Aromatics SBU is one of the region's largest marketers of Paraxylene, which is manufactured at the state-of-the-art Aromatics complex of Kuwait Paraxylene Production Company (KPPC). The Aromatics Complex produces a total of 780,000 metric tons of Paraxylene (PX) and 370,000 metric tons of Benzene (BZ) annually¹⁵. KPPC is a wholly owned subsidiary of Kuwait Aromatics Company (KARO), a joint venture between PIC, Kuwait National Petroleum Company and Qurain Petrochemical Industries Company.

Olefin – III SBU

The first olefin cracker began operations in the Al Shuaiba Industrial Area in 1997. It is a part of a state-of-the-art petrochemical complex owned and operated by PIC's joint venture, EQUATE. In 2009, it was joined by a second cracker, owned by The Kuwait Olefin Company (TKOC) and operated by EQUATE. The economic pre-feasibility study for Olefins III was completed in 2009 and a detailed feasibility study was completed in 2011. The plant is expected to become operational

¹⁵ PIC, Kuwait

KPC signed a MoU to jointly build the 300,000 barrels per day (bpd) refinery and petrochemical complex in Guangdong province.

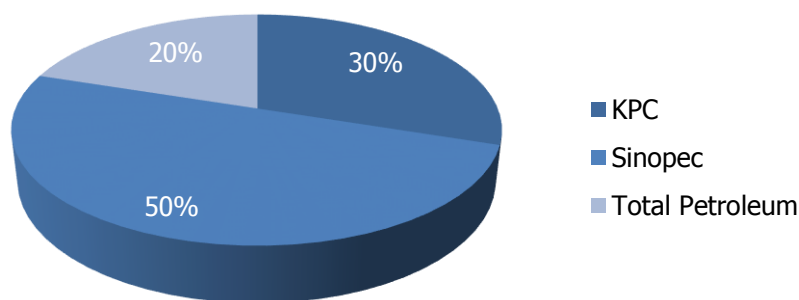
MEGlobal is a world leader in the manufacture and marketing of merchant Monoethylene Glycol.

from 2017. It will produce polyethylene (1 mn tons/year) and polypropylene (400,000-600,000 tons/year)¹⁶. The primary market will be the Asian countries.

China Integrated Refinery/Petrochemical Project SBU

Sinopec and Kuwait Petroleum Corporation (KPC) signed a memorandum of understanding in 2009 to jointly build the 300,000 barrels per day (bpd)¹⁷ refinery and petrochemical complex in Guangdong province. In 2013, KPC brought Total Petroleum into the project as a minor stakeholder. Under the plan, KPC would have 30 percent, Total Petroleum 20 percent, and Sinopec 50 percent. PIC is weighing involvement in the petrochemicals complex that would be integrated with the refinery. The project was expected to start its operations by 2015, though delays have caused postponement of the operations to commence by the end of 2017.

Figure 4.3: Shareholding in China Integrated Project



Source: PIC, Markaz Research

Joint Ventures

PIC has a number of joint ventures with companies within and outside Kuwait that help in its growth and expansion.

Alliances are:

MEGlobal

MEGlobal is a world leader in the manufacture and marketing of merchant Monoethylene Glycol (MEG) and diethylene glycol (DEG), collectively known as Ethylene Glycol (EG). Established in July 2004, the

¹⁶ PIC, Kuwait

¹⁷ PIC, Kuwait

EQUATE is the sole operator of a fully integrated world-scale manufacturing facility.

QPIC is a private company sourcing investments in petrochemicals and the related sectors.

company is a joint venture between The Dow Chemical Company and PIC. It is headquartered at Dubai.

Equipolymers

Equipolymers is a 50/50 global joint venture for the manufacture and marketing of Polyethylene Terephthalate (PET) resins and the production of Purified Terephthalic acid (PTA). Equipolymers was formed in 2004 by The Dow Chemical Company and PIC, and is a fully owned subsidiary of MEGlobal. It is headquartered in Dubai.

EQUATE

EQUATE is an international joint venture between PIC, The Dow Chemical Company, Boubayan Petrochemical Company and Qurain Petrochemical Industries Company established in the year 1995. Commencing production in 1997, EQUATE is the sole operator of a fully integrated world-scale manufacturing facility that produces more than 5 million tonnes (annually) of high-quality petrochemical products, which are marketed throughout the Middle East, Asia, Africa and Europe. The joint venture is headquartered in Kuwait.

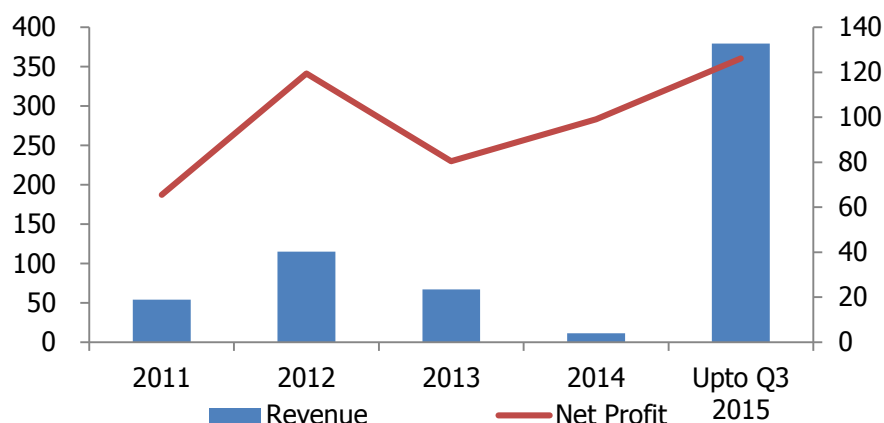
Gulf Petrochemical Industries Company (GPIC)

Gulf Petrochemical Industries Company (GPIC) was established in 1979 as a joint venture between three Gulf Cooperation Council member states for the manufacture of fertilizers and petrochemicals. Located in Bahrain, the joint venture is equally owned by the Government of the Kingdom of Bahrain; Saudi Basic Industries Corporation, the Kingdom of Saudi Arabia; and PIC.

Qurain Petrochemical Industries Company (QPIC)

Qurain Petrochemical Industries Company (QPIC) is part of the KIPCO Group - one of the largest diversified holding companies in the Middle East and North Africa. QPIC is a private company sourcing investments in petrochemicals and the related sectors. It was established by PIC to encourage more private-sector engagement in major petrochemical projects in Kuwait and the rest of the world. Its goal is to utilize available wealth to set up local industries that add value to Kuwait's economy and provide job opportunities for the people of Kuwait.

Figure 4.4: Revenue and Net Income of Qarain Petrochemical Industries Corporation (in USD mn)



Source: Reuters

QPIC's income from its core business activity has remained stagnant.

The net income of the company has been fluctuating mainly because of the global financial crisis. The company has earned positive net incomes during both pre-crisis and post-crisis times. The revenue of Qarain Petrochemicals increased from USD 11.4 Mn to USD 379.3 Mn till Q3 2015 owing to the reclassification of the revenue from one its investment companies SADFACO (Saudi Dairy and Foodstuff Company) after July 2014. Though the investment income of QPIC has increased over the years, the income from its business has remained stagnant over the years due to the low price environment and increasing competition globally among the petrochemical producers.

Table 4.1: Key Ratios, 2011-Q3 2015

Liquidity	2011	2012*	2013	2014	9m 2015
Cash Cycle (Days)	20.40	-	252.80	175.10	72.70
Profitability	2011	2012	2013	2014	9m 2015
Gross Margin	-	-	9.4%	-7.7%	29.0%
EBITDA Margin	92.8%	-	-46.0%	-45.6%	8.5%
Operating Margin	126.6%	-	878.0%	898.3%	34.4%
Net Margin	121.40%	-	850.90%	871.10%	33.30%
Du Pont analysis	2011	2012	2013	2014	9m 2015
Tax Complement (NI/EBT)	0.97	-	0.95	0.95	0.84
EBT Margin (EBT/Sales)	125.6%	-	878.0%	898.3%	34.4%
Asset turnover (Sales/Assets)	0.07	-	0.01	0.01	0.24
Financial Leverage (Assets/Equity)	1.01	1.04	1.05	1.21	1.62
ROE	9.10%	-	8.30%	9.40%	10.00%

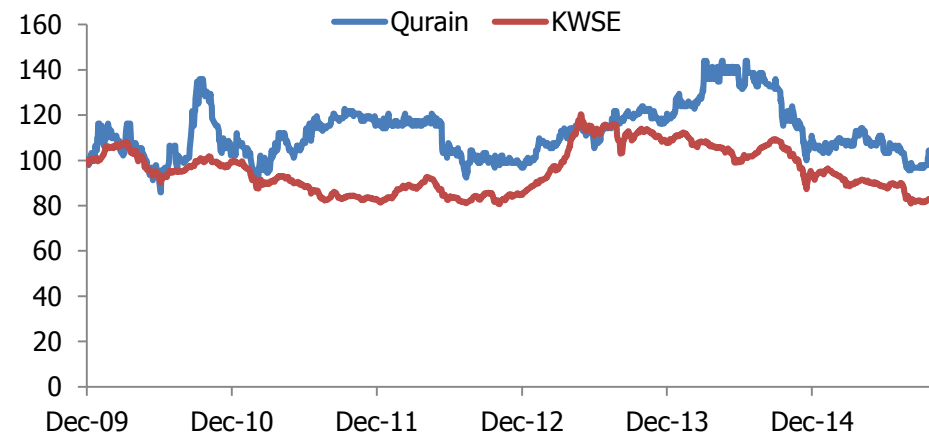
Source: Reuters; *Data for 2012 is not available

The ROE of Qurain has been consistent over the period at an average of 10%.

Apart from the changes in the accounting standards of Qurain Petrochemical Industries Company to IFRS for the reporting period in 2012, the increased inventory and average receivables to 4.75 in 2013 from 3.5 in 2012 and the decline in average accounts payable from 4.65 in 2012 to 1.25 in 2013 were the major reasons for the huge jump in the cash cycle. The inventories in Qurain petrochemicals declined after H2 2014 with the increasing demand for petrochemicals due to which cash cycles declined in 2014 and 2015.

The company's net margins have been high during the period 2011-Q3 2015 mainly due to its robust investment income. The ROE of Qurain has been consistent over the period at an average of 10%. The net margin declined drastically in 2015 mainly due to the sudden increase in revenue in 2015 due to the reclassification of the revenue from its subsidiaries and investments.

Figure 4.5: Share Analytics of Qurain Petrochemicals, 2010-Oct 2015



Source: Reuters; Prices rebased to 100 as of Jan, 2010

Qurain's stock has outperformed the Kuwait index registering annualized return of 1.6%

Qurain's stock has outperformed the Kuwait index registering annualized return of 1.6% during the period 2010- Oct 2015 whereas the Kuwait index generated an annualized negative return of -2.4%.

The Kuwait Olefins Company (TKOC)

It is a joint venture between PIC and Dow Chemical's holding 42.5% of the shares each and Boubyan Petrochemical Company and Al-Qurain Petrochemical Industries Company holding 9% and 6% of the shares respectively. It owns the Olefins-II complex and produces Ethylene Glycol.

The presence of private players is only through the various joint ventures that Kuwait's PIC has with them.

The Kuwait Aromatics Company (TKAC)

It is a joint venture between PIC, KPC and Al-Qurain Petrochemical Industries Company each holding 40%, 40% and 20% stake respectively. It owns the Kuwait Paraxylene Production Company (KPPC) which produces Paraxylene and Benzene.

The Kuwait Styrene Company (TKSC)

It is a joint venture between The Kuwait Aromatics Company (TKAC) which owns 57.5% of the shares and Dow Chemicals which owns the remaining 42.5%. It produces Styrene monomer.

PIC-Canada Company

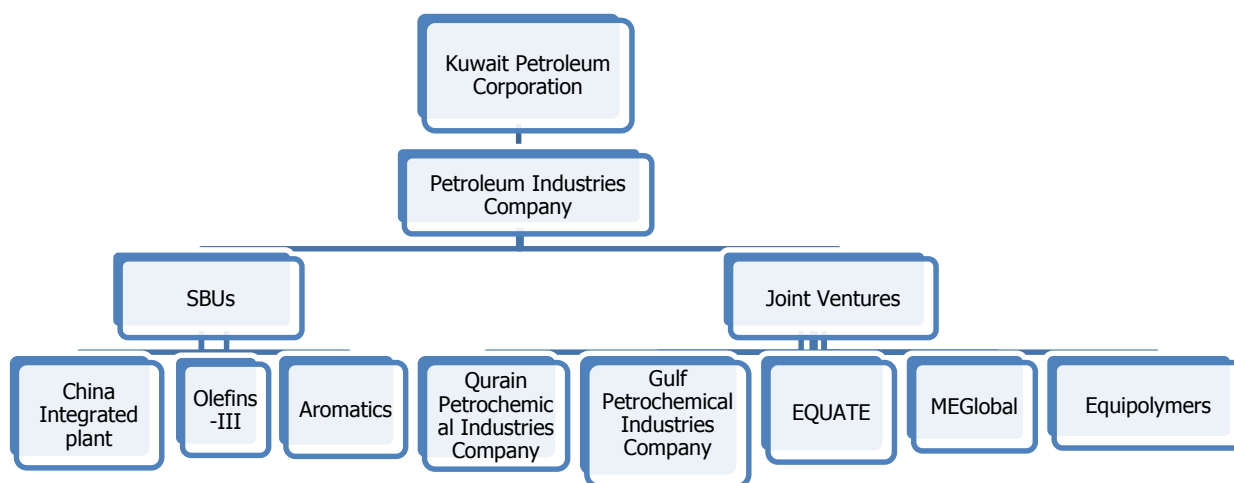
It is completely owned by PIC and takes care of the investments for MEGlobal. The company is based in Canada.

Private Players

The presence of private players is only through the various joint ventures that Kuwait's PIC has with them. Currently the private players are restricted to the logistics and transportation of petrochemicals other than the joint ventures.

The ambitious policies of Kuwait government and the strategy laid out for 2020 in petrochemical sector can be achieved through increased participation of private players in the petrochemical sector. The recent policies like 100% FDI also favor the private sector participation. Hence, the Kuwait petrochemical industry will see private sector participation in the next five to ten years.

Figure 4.6: Overview of Kuwait Petrochemicals Sector



Source: PIC website

5. Key Trends

A diversification scheme is planned with major government spending of KD 30 Billion as a part of the Kuwait development plan.

The Kuwait petrochemical sector is moving towards achieving the target set through the strategic plan of 2002-2020. It is in a growth phase but also faces stiff competition from within the region. The future outlook will be determined mainly by factors like the feed stock shift, competition from within the region and mainly the increasing investments that will be streamed into developing better technology for large scale integrated plants.

Use of Technology from foreign countries

A diversification scheme is planned with major government spending of KD 30 Billion (c.USD 100 Bn) as a part of the Kuwait development plan which aims to make Kuwait a well-diversified economy and a financial and business hub in the GCC region¹⁸. This investment plan is expected to stimulate the private sector in the medium to long term. Kuwait needs to use high end technology and enablers for the integration of refining and petrochemicals sector. Use of Information technology is a major factor for achieving the targets set in the vision for 2020.

The R&D spending of PIC has been very less at 1% of their revenue compared to that of around 3% of the revenues at Dow chemicals.

Integration of refining and petrochemical for mitigation of risk

The integration of refining and petrochemical requires R&D and also obtaining the technology from abroad. The R&D spending of PIC has been very less at 1% of their revenue compared to that of around 3% of the revenues at Dow chemicals and many other players in Europe and US. The integration and downstream expansion for the petrochemical sector of this region will be the critical factor in the mitigation of risks. Local players are losing on the cost advantage they obtain from Ethane as they are moving towards heavier feedstock owing to the non-availability of Ethane. The feedstock costs incurred by the Petrochemical companies in GCC was 15% lesser than the feedstock costs incurred by Petrochemical companies elsewhere in the world. The cost of transportation of raw materials can be reduced by a minimum of 30% if the GCC region had a well-developed rail network¹⁹.

¹⁸ PIC Investor Presentation

¹⁹ Frost & Sullivan

Al Zhor Refining Project

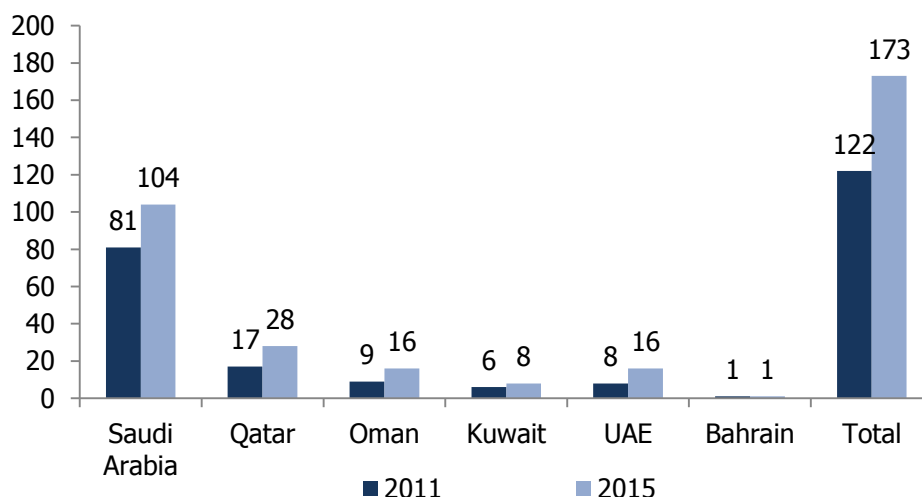
Kuwait has signed the USD 30 bn worth refining project in Al Zhor area, one of the largest refining complex in the world to be completed by the end of 2018. The refinery is expected to add 615,000²⁰ barrels/day with naphtha to be the main by-product produced. With the shift of many petrochemical plants in Kuwait to heavier feedstock like Naphtha, the addition of Naphtha to Kuwait's production capacity will help in easy procurement of the raw material for the petrochemical companies in Kuwait. The Al-Zhor refinery once operational will become the 6th largest refining complex in the world after the India, Venezuela and South Korea²¹. The Al-Zhor plant will be beneficial for Kuwait to compete with the other major petrochemical producers in GCC like Saudi Arabia.

Competition within GCC

GCC countries are the major exporters of Petrochemicals in world and major markets for all these countries are the Asian countries especially China which accounted for 15% of their exports in 2012.

The competition among the GCC companies comes in terms of capacity addition, number of plants, exports and attracting investments.

Figure 5.1: GCC Petrochemicals & Chemicals capacity (Million Tons per Annum - MTPA)



Source: GPCA, Markaz Research

²⁰ MEED

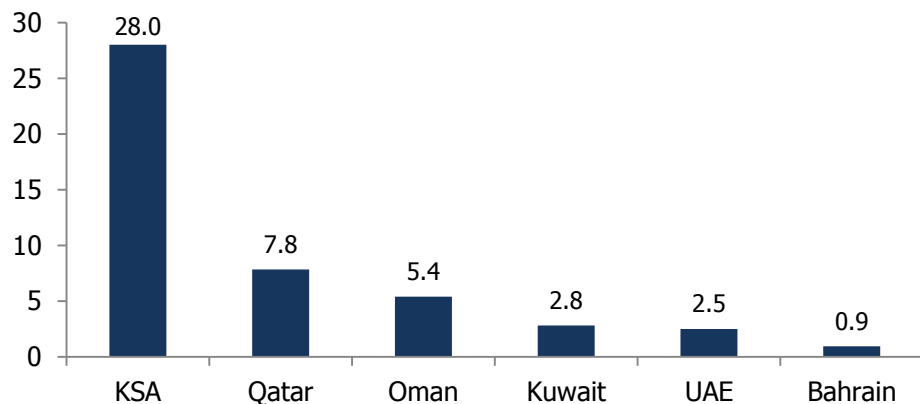
²¹ Institute of Chemical Engineers

Kuwait's capacity addition is less when compared to the market leaders like Saudi and Qatar as well as small players like UAE.

Kuwait contributed to 10% of the exports from GCC.

Out of the 173 MTPA²² capacity estimated to be operating in GCC in 2015, 104 MTPA²³ will be from Saudi Arabia alone and Kuwait is expected to have a capacity of 8MTPA. This will mean that 60% of the petrochemical capacity in GCC will be in Saudi Arabia. Saudi Arabia is the leader in capacity addition followed by Qatar. With increasing demand from the Asian markets, Saudi Arabia's capacity addition will help it to tap the market at a very early stage. Kuwait's capacity addition is less when compared to the market leaders like Saudi and Qatar as well as small players like UAE. UAE has only 52 bbls of Oil Reserves but has planned for a capacity addition of its chemicals and Petrochemicals from 8 MPTA in 2011 to 16 MPTA in 2015. Kuwait with 104 bbls of Oil reserves has planned only to increase its capacity from 6 MPTA in 2011 to 8 MPTA in 2015. The capacity additions planned for 2017-2018 will boost the market share of Kuwait, though it would be late starter compared to Saudi Arabia and UAE in increasing its petrochemicals market share.

Figure 5.2: Petrochemical Exports (in USD bn) from GCC in 2012



Source: GPCA, Markaz Research

In terms of value of petrochemical exports Saudi alone contributed to 58.9% of the exports from GCC in 2012. Kuwait contributed to 10% of the exports in the same year.

Kuwait will have to increase the number of plants as well as develop mega projects in petrochemicals in order to meet the increasing competition from players within the GCC region.

²² GPCA Report 2012

²³ MTPA-Million tons per annum

GCC countries are facing increasing shortage of ethane supply.

KOC has developed an aggressive gas exploration program in order to increase availability of gas feedstock.

Shift towards heavier feed stock

Gulf faces an increasing shortage of ethane supply. Scarcity of gas, coupled with inapplicability of ethane to yield higher-value products, is driving petrochemicals producers away from it. Expansion and development of downstream operations necessitate diversification of the feedstock mix. Ethane can be cracked to produce only basic olefins such as ethylene, whereas naphtha can be cracked to produce diversified products including aromatics and intermediates and advanced chemical products. Heavier feedstock such as propane or butane is sometimes used along with the small proportion of ethane. This trend is expected to continue as it is in line with the government policies of moving towards production of high value chemicals and plastics rather than the conventional polyethylene and ethylene glycol.

New plants in the GCC are predominantly world scale and often integrated into refinery operations. The capacity of the new crackers in the Gulf are usually well over 1 million tons per year of ethylene, compared to veteran European cracker capacities often less than half that size. Additionally, public and private finance is generally more freely available for Middle East projects, with greater tolerance for risk at the strategic and financial level. The production of heavier feedstock chemicals and their conversion into semi-finished and finished end-products is employment-intensive. Hence this move towards heavier stock is expected to create more employment opportunities in the petrochemical sector in the Gulf.

Kuwait Oil Company (KOC) has developed an aggressive gas exploration program in order to increase availability of gas feedstock. Similarly, Kuwait National Petroleum Company (KNPC) has devised a major plan to modernize and expand its refining sector. The move towards heavier petrochemicals feedstock in the light of gas shortage offers Kuwait a unique opportunity to integrate its refineries and petrochemical plants. The success of the initiatives requires new technologies and capabilities and a new way of thinking about public-private partnerships.

FDI inflow into Kuwait has increased from USD 1,304 mn in 2010 to USD 2,329 in 2013.

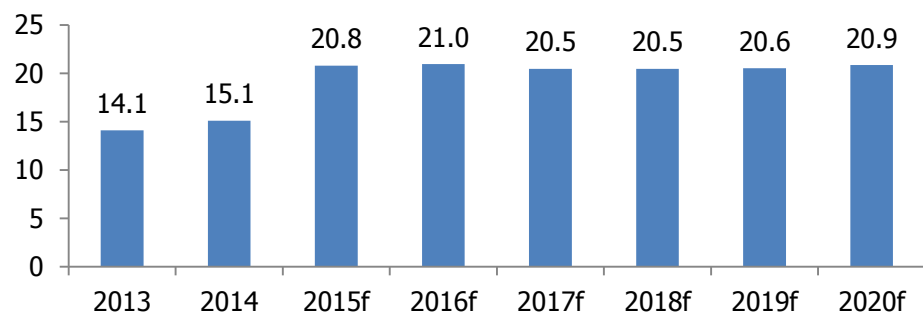
IMF predicts investments to increase from 15.6% in 2011 to 25.5% in 2018 as percentage of GDP.

Increasing Investments in Kuwait

With the Kuwait Government keen on implementing policies like the PPP law and 100% FDI law, investments into Kuwait are expected to increase in the future. The law has been amended several times, the latest being in June 2013. After 2010 amendment, the law provided investor friendly regulations as a result of which FDI inflow into Kuwait has increased from USD 1,304 mn in 2010 to USD 2,329 in 2013²⁴. The inward FDI to Kuwait is expected to grow at rate of 1% annually from 2014-2016²⁵. As there are also initiatives to diversify the export portfolio of Kuwait from Oil, it is predictable that these investments will be streamed into sectors like petrochemicals. The feed stock for petrochemicals is easily available in Kuwait and hence more investments can lead to better development of the sector especially in terms of integration of refineries and petrochemical plants.

Investments can be encouraged by providing tax holidays and lower tax rates, favorable conditions for expatriate labor, the duty-free import of equipment, guarantees against expropriation without compensation, the right to repatriate profits and laws that protect the investor's Intellectual Property and proprietary information. The incentives must be designed to compete with countries such as China and other GCC members which have already been successful in attracting foreign direct investment because of its market size and growth.

Figure 5.3: Total Investments in Kuwait as % of GDP, 2013-20



Source: IMF, Markaz research

IMF predicts investments to increase from 15.6% in 2011 to 25.5% in 2018 as percentage of GDP.

²⁴ IMF

²⁵ IIF

6. Price Trends

Naphtha prices dropped significantly with decline in oil prices to USD 428.64 per metric tonne.

Prices of feed stock

The prices of feed stock are the most important cost factor that determines the profitability of the Petrochemical industry. Naphtha prices dropped significantly with decline in oil prices to USD 428.64 per metric tonne²⁶. The Naphtha prices in USD/mt was at 650 during April 2011 and came down to around 450 during May 2012 and increased to around 550 in April 2013 which again declined after the second half of 2015. Hence naphtha based crackers will have to mitigate the risk from volatility in naphtha prices. Ethane prices remain almost constant in the region as they are subsidized. Ethane based plants thus enjoy the advantage of low and stable price of feedstock. In the current scenario, Ethane based crackers will be in better position compared to the heavier feedstock based crackers. The increasing pressure on GCC countries to cut the energy subsidies and measures taken by UAE in deregulating fuel prices, might result in Kuwait adapting a similar approach towards subsidy in future.

Price losses in the global petrochemical markets often reflect price declines in world crude oil markets.

Prices of Petrochemicals

Price losses in the global petrochemical markets often reflect price declines in world crude oil markets. Naphtha, a primary raw input for petrochemicals also tends to establish the value of olefins, polymers and other products. The Platts Global Petrochemical Index (PGPI) declined by 43% from USD 1,384 in September 2014 to USD 786 in September 2015 mainly due to the fall in prices of major petrochemicals with reduction in cost of production. The PGPI is a benchmark basket of seven widely used petrochemicals and is published by Platts, a leading global energy, petrochemicals and metals information provider and a top source of benchmark price references. The PGPI reflects a compilation of the daily price assessments of physical spot market ethylene, propylene, benzene, Toluene, Paraxylene, low-density Polyethylene (LDPE) and PolyPropylene and is weighted by the three regions of Asia, Europe and the United States.

²⁶ As of 26th October, Platts

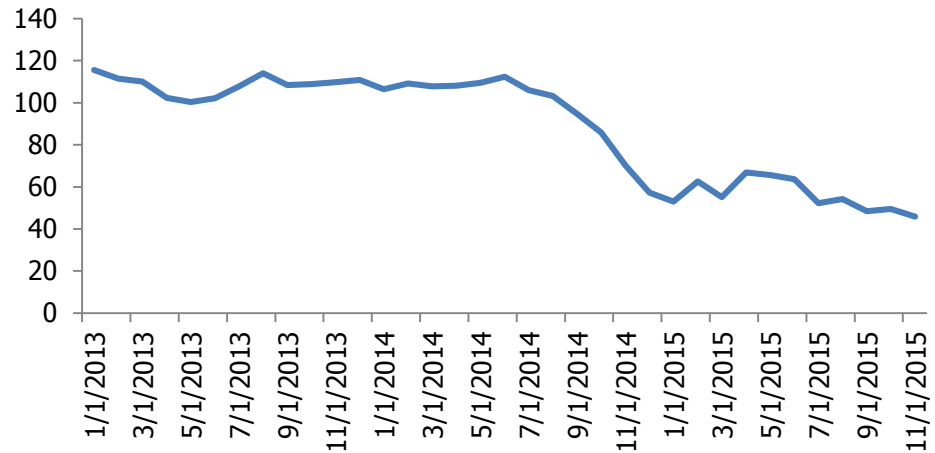
Table 6.1: Price in US Dollars/Million Tons

Petrochemical	Average daily price on March 2014	Average daily price on September 2015	% change
Ethylene	1,287	761	-40.87
Polyethylene	1,622	1,239	-23.61
Propylene	1,406	559	-60.24
Polypropylene	1,622	1,143	-29.53
Paraxylene	1,173	765	-34.78
Benzene	1,353	586	-56.69

Source: Platts

7. Declining Oil Price and its impact on the Petrochemical sector

Figure 7.1: Price of Brent Crude, 2013-2015



Source: Reuters

After the fall in oil prices in the 2nd half of 2014 by more than 50%, global petrochemical prices dropped as the cost of the important raw material declined drastically. The European and US petrochemical companies cut the market price of the petrochemicals, especially Ethylene, Propylene and Benzene by more than 40%. The decline in oil prices on the other hand increased the demand in major markets like India and China as oil price decline could shift the spending towards consumer durables, creation of assets which are likely to increase the demand for plastics, paints and fertilizers²⁷. The new demand supply pattern and the low price market condition would be favorable to the European and US producers however the Middle East petrochemical companies will see adverse impact as the cost advantage enjoyed with subsidized fuel will diminish.

In the low cost scenario, major integration projects in Kuwait may incur losses during the initial years as the prices of petrochemicals globally are expected to remain low for the next 12-18 months. This may also encourage the emerging economies like India and China to reopen some of their petrochemical plants closed earlier due to cost overruns.

In the low cost scenario, major integration projects in Kuwait may incur losses during the initial years.

²⁷ Platts

Kuwait petrochemicals industry will have to face the pressure of increasing competition from the global players in the low price regime as the cost differential would be less and with decreasing oil revenues, budgetary pressures on expansionary plans are also expected.

8. Growth Drivers

Recovery from the Global crisis

China and India will drive the increase in petrochemical demand.

Various global players, especially the petrochemical plants in Europe and the US were adversely hit by the global crisis of 2008 and were forced to close down their production units. As a result their profits decreased and these major players faced financial distress due to increasing debt obligations. The petrochemical companies in Kuwait were able to manage the crisis as they were mainly funded by the government. This led to a trend of global players starting joint ventures with Petrochemical companies in GCC. With a steady global recovery on the cards, Kuwait petrochemical units are expected to reap the benefits.

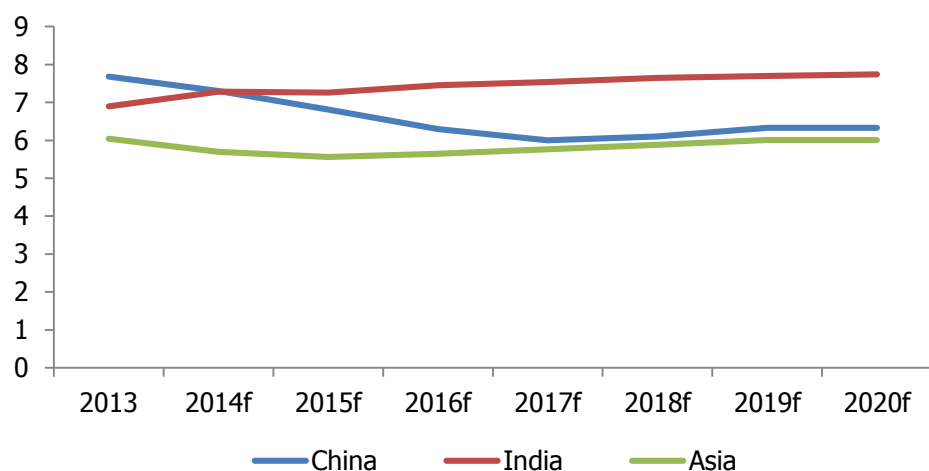
Increased demand from Asian Markets

The recovery from global crisis especially in the developed economies like China and India will drive the increase of petrochemical demand since petrochemical demands are positively correlated to the GDP growth.

Petrochemicals are the major raw material for both paints and plastics.

As the GDP growth in India and China increase, they will witness increasing urbanization, increased demand for housing and growth in automobiles and electronics sector. Increasing housing will result in increased demand for paints. Urbanization and growth in electronics and automobiles sector will increase the demand for plastics. Petrochemicals are the major raw material for both paints and plastics.

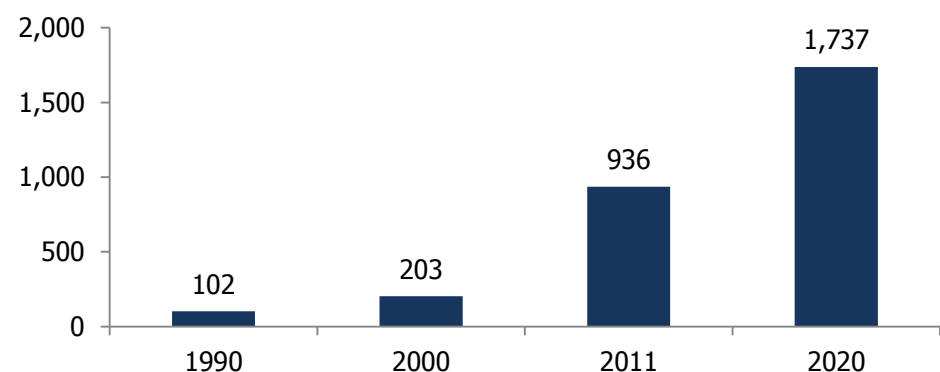
Figure 8.1: Real GDP Growth Rate in China , India and Asia (in %)



Source: IMF, Markaz Research

Government ownership of the petrochemical companies provides them with various other advantages including feedstock allocation.

Figure 8.2: Demand for Chemicals and Petrochemicals in China by value (in USD bn)



Source: Mckinsey, Markaz Research

Cost Advantage

Petrochemical companies in GCC are able to procure feedstock at a lower price compared to other global players as the production cost of these feedstock (Ethane) are low due to the fact that they are by-products of the upstream operations.

Feed stock, primarily Ethane costs USD 0.75/mmbtu in the gulf and it is priced at around UDS 3.2/mmbtu in US and Europe. The government allows selling of feedstock at a lower price to domestic companies in order to improve their competitiveness.

Government Initiatives

Government ownership of the petrochemical companies provide them with various other advantages including feedstock allocation, subsidized raw materials' cost and a greater advantage of consistent funding by the government. It also reduces various bureaucratic problems which others would face. As the industry provides double benefits of diversification and employment generation, the support is expected to continue.

Kuwait government has recognized the need to diversify the exports portfolio. From 2006, the government has involved in activities like increasing joint ventures in PIC to develop the petrochemical sector which will be the key in export diversification, as it contributed around 10.8% of the non-oil exports in 2012. The government is also keen to achieve the Strategy plan 2002-2020 which will definitely help in the development of the petrochemical sector.

China is a huge market and the major importer of petrochemicals in the ASEAN region.

Global demand for paints and coatings is estimated to increase by 5.4% during 2015-2017.

Emergence of Joint Ventures in Kuwait

Although Kuwait is blessed with an abundance of oil and gas reserves, lack of technical expertise has been a growing challenge for the petrochemical industry. The Kuwait government has taken steps for the promotion of joint ventures which will help them to bring the latest technology and best practices in the production process. Global players like Dow Chemical Company also agreed to set up industries collaborating with PIC as they could enjoy the benefits offered by the Kuwait government such as the low cost fuel.

PIC has a number of joint ventures that operate on different petrochemical products. PIC has also initiated integrated petrochemical refining plant projects in China, one of PIC's first overseas plants. Such joint ventures are expected to continue. The China integrated project will be very advantageous for Kuwait as China is a huge market and the major importer of petrochemicals in the ASEAN region. As Kuwait has entered this market earlier than any of its competitors like Saudi or Qatar it can capture a good proportion of the Chinese market which is expected to grow.

Increased markets for the by-products - Paints

Global demand for paints and coatings is estimated to increase by 5.4%²⁸ per year to 45.6 million metric tons in 2015. Advances will be driven by a strong acceleration in world building construction spending, particularly residential construction. Paint is heavily dependent on the petrochemical industry for its input. Hence increase in demand for paints is good for the petrochemical industry.

Table 8.1: Paints Demand growth (in %)

	2007-2017
Global	5.2
Asia	6.9
Europe	2.0
North America	4.2
Others	4.0

Source: Freedonia, Markaz Research

²⁸ Freedonia Research

The volume of global construction output is estimated to grow by a staggering 70% till 2025.

An estimated 270 million²⁹ new homes will be needed in China and India alone by 2025 to meet the needs of a growing population. The volume of global construction output is estimated to grow by a staggering 70% from USD 8.7 trillion in 2012, to USD 15 trillion by 2025³⁰. The growth in dollar terms is expected to come from just three countries: China, India and USA.

China is promoting and undergoing a process of continuous urbanization with more than 50% of the population now living in urban centers and an expected 70% doing so by 2020³¹. With the ageing strata of the population increasingly seeking their own living quarters, the demand for new and better houses is expected to rise in the near future.

The paint industry in India is expected to grow at 12-13% over the next five years.

In India, demand for residential buildings has grown at a CAGR of 19%³² between 2010 and 2014. This demand was mainly driven by 3 Tier-I cities namely Delhi, Mumbai and Bangalore. The demand forecast for the next five years estimates a CAGR of 12%³³ in the construction industry due to construction activities in Tier-II and Tier-III cities. FDI inflow in the construction sector is expected to increase from USD 4 bn in 2013 to USD 25 bn in 2023 registering a CAGR of 22.58%.

Owing to the growth of construction sector in China and India, there would be a rise in demand for paints as well. The paint industry in India is expected to grow at 12-13% over the next five years (2013-2018). The revenue is expected to increase from Rs. 280 bn (USD 4.5 Bn) in 2013 to Rs. 500 bn in 2018 (USD 8 Bn*). Currently only 1.5%³⁴ of the chemical exports from GCC region to Asian markets comprises of specialty chemicals including paints and inks. Although this isn't a substantial amount compared to other petrochemical products, fertilizers etc., there is a very good opportunity to tap this market up either by export of paint or petrochemical raw materials for paint.

²⁹ Rider Levett Bucknall Research

³⁰ Rider Levett Bucknall Research

³¹ EUSME Report on China

³² Indian Brand Equity Foundation

³³ Market Research, India

³⁴ Ibef.org

*Conversion: 1USD = Rs.60

Yield of the agriculture sector is majorly dependent on petrochemical sector.

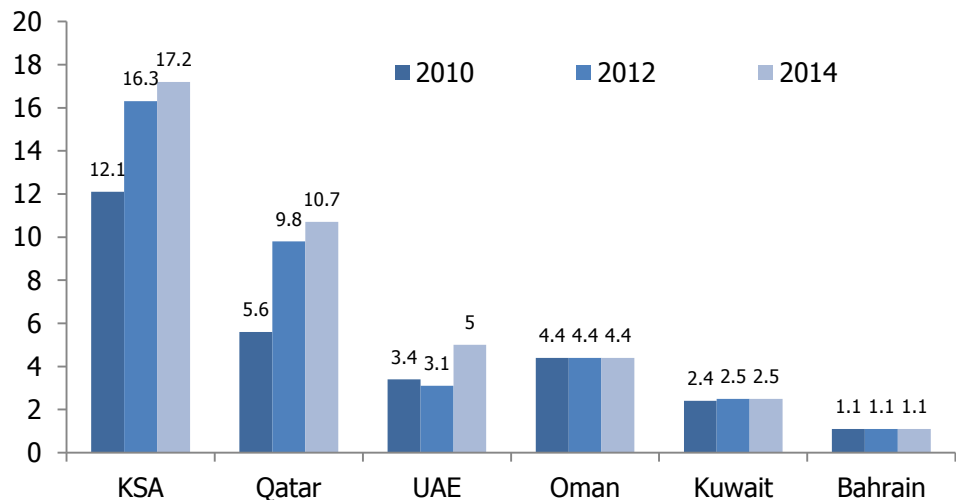
Kuwait has a fertilizer production capacity of 2.5 mn tons which is lower when compared to KSA, Qatar, UAE and Oman.

Fertilizers

Yield of the agriculture sector is majorly dependent on petrochemical sector and remains to be one of the chief demand drivers for petrochemicals. Fertilizers are organic or inorganic substances that are added to the soil to improve its nutrient value. About 30-50% of the crop yields are attributed to them. Fertilizers are a product of petrochemicals.

China and India import fertilizers from Kuwait. As there is always a need to feed the growing population in these emerging markets, the demand for fertilizers is expected to remain high. There have been studies going on to improve the productivity of crops by using different varieties of fertilizers which will favor the rise in demand for fertilizers in the future. Considering all these factors there is a very good possibility of demand growth for fertilizers and in turn petrochemicals.

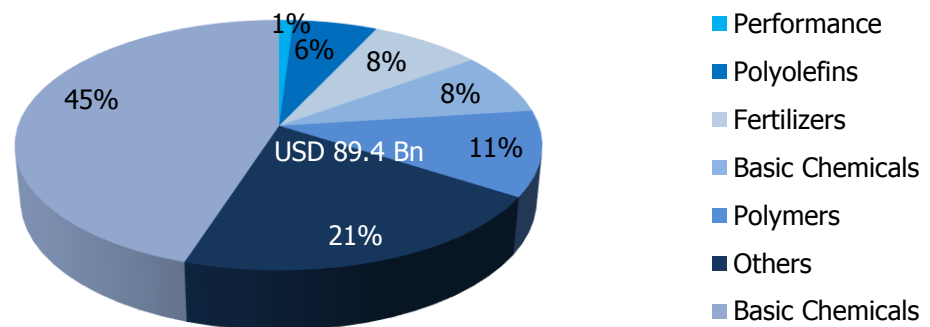
Figure 8.3: Fertilizers Production Capacity of GCC countries in 2010 - 2014 (in million tons)



Source: Gulf Petrochemicals and Chemicals Association (GPCA), 2014

Kuwait has a fertilizer production capacity of 2.5 mn tons which is lower when compared to KSA, Qatar, UAE and Oman. The overall growth of fertilizer industry in the GCC has been good with a CAGR of 9% during 2010 and 2014.

Figure 8.4: GCC Chemicals Sales Revenue by Segment, 2013 (%)



Source: Gulf Petrochemicals and Chemicals Association, 2013

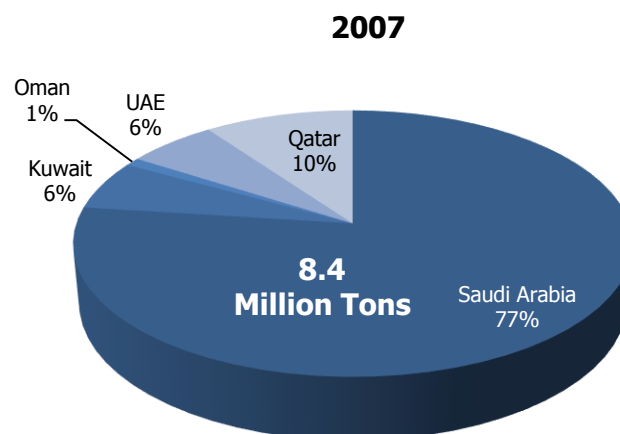
Recovery in the US construction market will boost plastics demand by 9.8% annually.

In terms of revenue, fertilizers alone contributed 8% of the total chemical revenue in the GCC during the year 2013. This accounts to USD 6.6 bn out of USD 7.15 bn which is the total chemical sales revenue in this region.

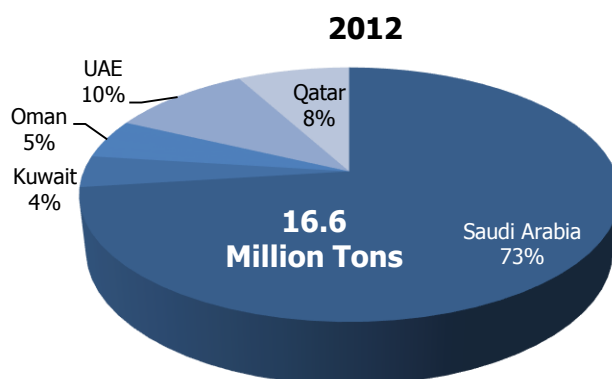
Plastics

Recovery in the US construction market will boost an annual increase in US demand of 9.8% until 2017, compared to a decrease of 7.1% between 2007 and 2012. Global demand for plastic pipe is forecasted to rise 6.2% annually through 2017 to 23 mn metric tons, improving significantly from growth recorded between 2007 and 2012. Polymer exports in the GCC have also increased over the years from 8.4 million tons in 2007 to 16.6 million tons in 2012. Kuwait's share in the total exports of polymer from GCC was 4% in 2012.

Figure 8.5: GCC Polymer Exports by Country in 2007 & 2012 (%)



Performance Chemicals are mainly used in automobile, textile, leather and mining sectors.



Source: GPCA Petrochemical Database

Increasing urbanization in the emerging economies like India and China are also increasing the need for plastics. The demand is predicted to be on the upward trend till 2050³⁵. Plastics demand will provide an excellent market for the petrochemical industries.

The demand is predicted to be on the upward trend till 2050.

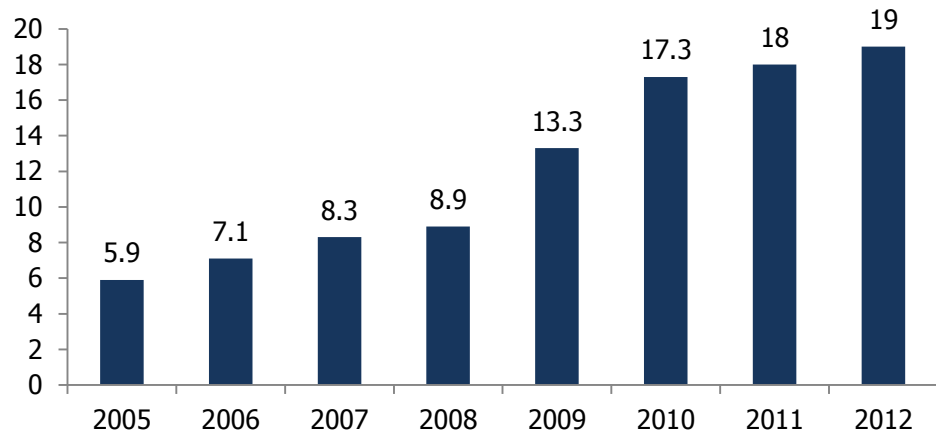
Performance Chemicals

Performance Chemicals are mainly used in automobile, textile, leather and mining sectors. They are used as absorbents, flocculants, detergents, acrylic sheets, coatings, molding compounds, impact modifiers, adhesives, textiles, etc. Automobile sector is one of the major consumers of performance chemicals.

Automobile sector is seen as one of the major demand drivers of the performance chemicals in the near future. Markets like China and India, who are major importers of petrochemicals from Kuwait, have seen a steady growth in automobile demand over the years and the trend is expected to continue.

³⁵ IHS Insights

Figure 8.6: Greater China Light Vehicle Sales (2005-2012 in Millions of Units)



Source: IHS Auto Insight April 2013

Greater China has seen an increase in the number of automobile units sold in that region with a CAGR of 18.1% between 2005-2012.

Greater China has seen an increase in the number of automobile units sold in that region with a CAGR of 18.1% between 2005-2012. Greater China is now one of the largest automobile markets in the world. Although it is predicted that the growth rate might reduce in the next few years, China is expected to touch 30 million units by 2020. Some of the major drivers for this demand are the rise in income and urbanization in China.

Similarly, India is also one of the fastest growing automobile markets in the world with many of the international players setting up manufacturing hubs in India. The industry is estimated to grow at a CAGR of 13 per cent during 2012–2021. In addition, the industry recorded exports worth USD 9.3 bn in 2012–13 and is projected to touch USD 30 bn by 2020–21, according to data from Automotive Component Manufacturers' Association (ACMA).

The increasing demands for automobiles from markets like China and India which constitute a major chunk of the petrochemical exports from Kuwait provide a major opportunity for the growth in demand of petrochemicals and performance chemicals in specific. A variety of performance petrochemicals are used in automobile sector for a variety of purposes.

Petrochemicals are used as diesel catalysts in many diesel engines. They are also used in automobile paints, insulation material, car

interiors and also in safety glasses. With growth in demand for automobiles, a proportional growth in demand for petrochemicals used in them is expected. Efforts are also being taken to make lightweight engines using certain petrochemical products which can replace metal with renewably sourced material that can withstand high temperature. There are also developments concerned with alternate fuels involving the use of certain petrochemical products. If these efforts are successful, the petrochemical demand will shoot up further.

9. Challenges

Kuwait has historically been at the forefront of investing in the chemical and petrochemical industry.

GCC has petrochemical projects worth USD 337.60 bn under execution.

Competition from Saudi Arabia and Qatar

Saudi Arabia and Qatar dominate the exports from GCC accounting for 74.6% in 2012. Kuwait occupies the 4th position after KSA, Qatar and Oman accounting for 11.4% of the total petrochemical exports from GCC in 2012.

Kuwait has historically been at the forefront of investing in the chemical and petrochemical industry, but its leading position in the sector was eclipsed due to stronger investments in Saudi Arabia and Qatar. Clear sector strategy backed by significant government investment designed to monetize gas availability has helped them to diversify, achieve economic growth and create employment opportunities.

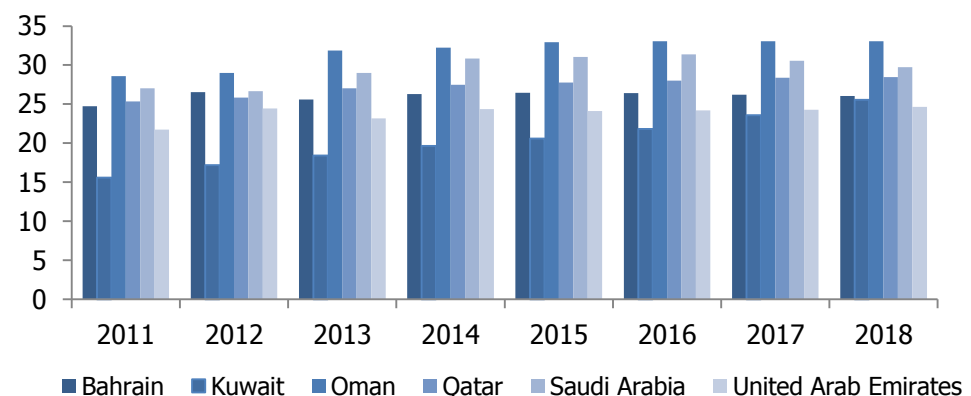
GCC has petrochemical projects worth USD 337.60 bn³⁶ under execution and Saudi Arabia will see largest capacity addition by volume and UAE will see a 50% growth in the period 2011-2015. Kuwait clearly lags behind all GCC countries except Bahrain in capacity addition.

Table 9.1: GCC Petrochemicals & Chemicals capacity (MTPA)

Country	2011	2015
GCC	122	174
Saudi Arabia	81	104
Qatar	17	28
Oman	9	16
UAE	8	16
Kuwait	6	8
Bahrain	1	1

Source: GPCA, Markaz Research

Figure 9.1: Total Investments as a percentage of GDP in GCC



Source: IMF, Markaz research

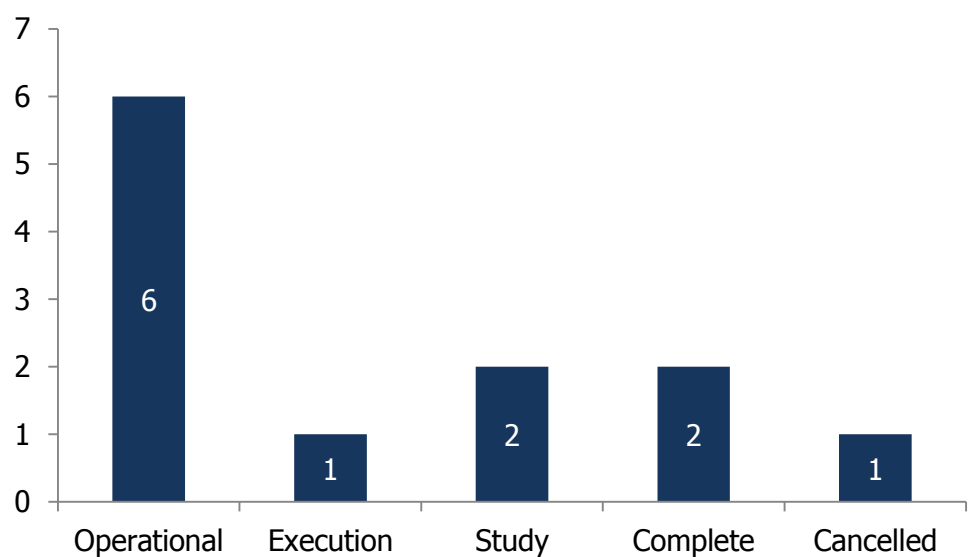
³⁶ GPCA Report 2012

Kuwait has 6 Petrochemical projects that are currently operational.

Kuwait clearly lags behind in investments when compared to all other GCC countries. Their investment is only 20.8% of the total GDP in 2015. Saudi Arabia leads the GCC countries in terms of investment with total investments amounting to 29.6% of GDP in the same year.

In 2020, IMF estimates Oman's investment to be 31.8% of the GDP, the highest in the GCC region whereas it is estimated to be 20.9% for Kuwait in the same year.

Figure 9.2: Number of Petrochemicals Projects Status in Kuwait, 2014



Source: MEED, Markaz research

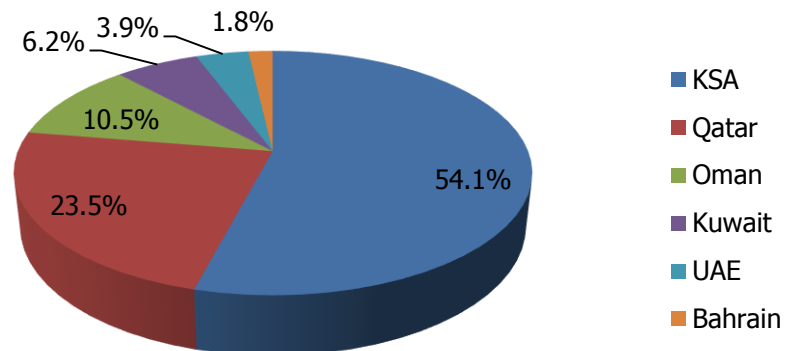
2 projects are in the completed stage and are expected to become operational from 2017-2018.

Kuwait has 6 Petrochemical projects that are currently operational and 2 more projects that are in the completed stage are expected to become operational from 2017-2018. Various Petrochemicals contracts were sanctioned in Kuwait during the period 2009-2015 amounted to USD 337.39 bn³⁷, few of which are already completed and the petrochemical plants are operational. Saudi Arabia has contracts worth USD 413.28 bn³⁸ under execution in Petrochemicals sector during the same period.

³⁷ Zawya

³⁸ Zawya

Figure 9.3: Revenue share from petrochemicals in 2012 among GCC Countries



Source: GPCA, Markaz research

An anti-dumping charge imposed by India is a major threat to the GCC petrochemical industry.

Saudi Arabia's share amounted to 54.1% of the total USD 45.79 bn revenue generated in GCC during the year 2013. Kuwait's share was 6.2% of the total revenue from petrochemicals from GCC which amounted to USD 2.83 bn.

Anti-Dumping charges

The Kuwait Petrochemical industry, like all other major petrochemical exporters like KSA in the GCC region, faces a threat from the anti-dumping charges levied in key markets such as India and China. Although there has been very little damage so far because of anti-dumping measures imposed, this is seen as an important potential threat as they could set the scene for action by other countries.

In spite of India lifting its anti-dumping duty on polypropylene imports later in 2012, there is always a risk that it may come back again.

Table 9.2: Impact of Anti-Dumping charges on imports in India (Value and Volume of Petrochemicals import to India)

Year	2009	2010	2011	2012	2013	2014
Value (in Bn USD)	15.6	16	19.5	24	18.4	6.2
Volume (in Mn Metric Tonne)	3.25	3.77	2.95	1.37	4.30	4.63

Source: CCI

During the period when anti- dumping charges were imposed the exports in terms of volume and the oil imports in terms of value have reduced and rebounded when the charges were after 2012.

Though Kuwait has not faced these charges, developing countries like India and China use them to discourage imports from any particular

Availability of gas feedstock remains one of the key challenges in the growth of the Petrochemicals sector.

country in accordance with political factors and relationship between the countries. Hence net exporters like Kuwait always have the threat of being affected by such charges especially in oil and petrochemicals as these increase the import bill of China and India causing their current account deficits to increase.

Reducing Availability of gas feed stock

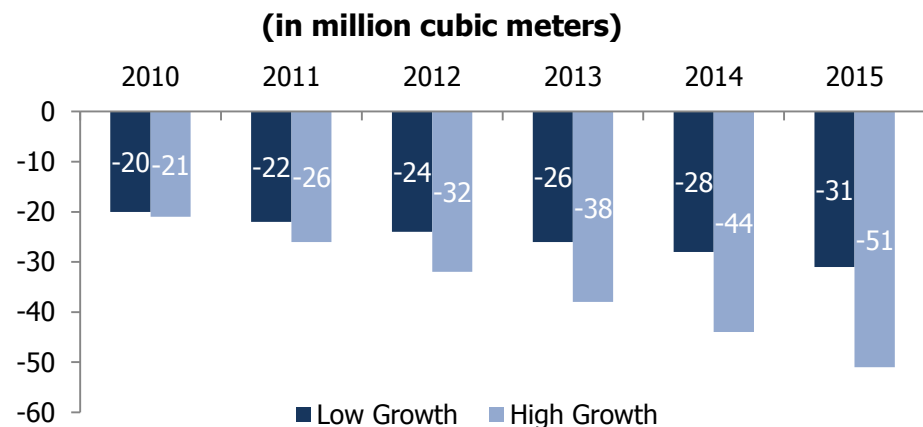
Availability of gas feedstock remains one of the key challenges in the growth of the Petrochemicals sector in the Middle East and also in Kuwait.

Feedstock is the first stage input for production of all petrochemicals products and is available in two forms: gas (primarily ethane) and liquids (mainly naphtha or Natural gas liquids (NGLs) such as butane and propane). Ethane is derived from associated or non-associated gases and naphtha is one of the by-products of crude oil refining. Other NGLs are derived from the associated gas – by-product of the crude oil production process.

The petrochemicals production in the Gulf is based on comparatively cheap ethane supply.

The petrochemicals production in the Gulf is based on comparatively cheap ethane supply. There is a clear preference for ethane owing to the region's significant cost advantage in procurement. GCC supplies ethane at USD 0.75/mmbtu, compared with a minimum USD 3.20/mmbtu in Europe and the US. Gulf faces an increasing shortage of ethane due to demand side factors.

Figure 9.4: Estimated reduction in Gas feed stock availability in GCC



Source: GPCA, Markaz research

The gas demand is expected to rise by 145% in MENA by 2020.

The availability of gas feed stock, which is the main raw material in Ethylene based Petrochemical plants, is estimated to decrease continuously over the years in the GCC region. If the GCC region witnesses' lower growth compared to the previous years the Gas availability in the region is expected to decrease by 11 mn cubic meters from 2010 to 2015. If the region witnesses' higher growth which is most likely, then the availability of gas will decrease 30 mn cubic meters from 2010 to 2015.

Usage of naphtha based feedstock will reduce the cost advantage the gulf players enjoy over their global competitors.

Scarcity of gas, coupled with inapplicability of ethane to yield higher-value products, is driving petrochemicals producers away from it. Gas reserves in Kuwait are estimated at 63.5 trillion cubic feet whereas in Saudi Arabia it is 287.84 trillion cubic feet³⁹. There are an increasing number of petrochemicals plants and rising demand for natural gas for electricity generation is resulting in declining ethane availability in the region. According to International Energy agency the gas demand will rise by 145% in MENA by 2020. Gas demand in the Gulf is estimated to grow at 6.6% per annum compared with 2.2% projected for oil⁴⁰.

As a result, petrochemicals producers have begun shifting to naphtha-based feedstock. Unlike ethane, naphtha prices are sensitive to crude oil prices which make it more volatile. Usage of naphtha based feedstock will reduce the cost advantage the gulf players enjoy over their global competitors.

Moreover, expansion and development of downstream operations necessitate diversification of the feedstock mix. Ethane can be cracked to produce only basic olefins such ethylene, whereas naphtha can be cracked to produce diversified products including aromatics and intermediates and advanced chemical products.

Hence these nations are moving towards lighter feed stock such as naphtha, propane and butane.

³⁹ Energy Information Administration, Bbls – Billions barrel

⁴⁰ International Energy Agency, Annual Report 2012

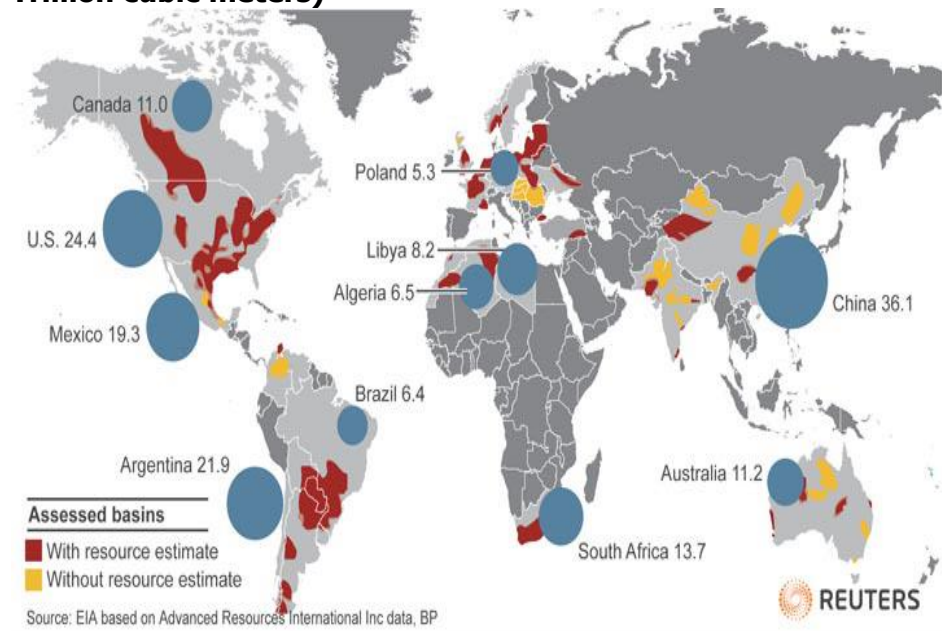
Shale Gas has the potential to be a game changer in the petrochemical industry.

Natural Gas Liquids which are by-products of Shale gas extraction include hydrocarbons such as ethane, butane, and propane.

Development of Shale Gas Technologies

Shale Gas has the potential to be a game changer in the petrochemical industry. Natural Gas Liquids which are by-products of Shale gas extraction include hydrocarbons such as ethane, butane, and propane. These gases are the raw materials for various petrochemical industries. If economical ways of extraction could be developed, then it will result in reduction of natural gas prices across the world and thereby nullifying the cost advantage enjoyed by the GCC Petrochemical Industries.

Figure 9.5: Top Shale Gas Reserve holders in the World (in Trillion cubic meters)



Source: Reuters

Implementation problems in Integration of Refining and petrochemicals

Though many countries in GCC including Kuwait have focused on the integration of refining crude oil and producing petrochemicals and have commenced many projects like Olefins-III, implementation challenges exists.

The complexity and size of the plants have increased. This leads to operational inflexibility in the already existing plants. The planning and operational objectives have been conflicting in some cases as there has been a lack of coordination.

Plants were operational at different stages and integrating them is difficult. The plants that were built after the synergies were developed alone could be integrated.

The lack of use of information technology and implementation of such enablers is a challenge in the implementation process. The GCC region as a whole and Kuwait have failed to capitalize on the use of technology. This has led to delay and problems in integration whereas plants in the Europe and US are already integrated.

Lack of Clear Strategy of the Kuwait Government

The Kuwait government had laid down a strategy for export diversification as well as for the development of Petrochemical sector as a part of Strategy 2002-2020, but the implementation faced few challenges. Meanwhile, major players in the region like Saudi Arabia and Qatar started developing strategies and attracted investments from the beginning of 2000. Kuwait's clear strategy towards petrochemical sector started only after 2006 when plans for diversification and integration of refining and petrochemical sector were envisioned.

The late start proved disadvantageous to Kuwait as market share in exports were captured by Saudi Arabia and Qatar.

It also lost in the 'Ease of Doing Business Index' where it ranked 86 whereas Saudi Arabia ranked 49th and UAE ranked 22nd in the year 2015.

Table 9.3: Ease of Doing Business Index in the year 2015

Rank	Country
1	Singapore
2	New Zealand
3	Hong Kong
49	Saudi Arabia
53	Bahrain
22	UAE
50	Qatar
66	Oman
86	Kuwait

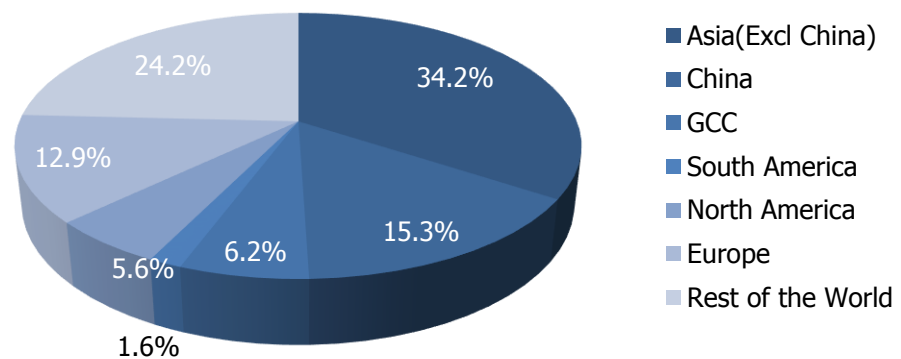
Source: World Bank

Kuwait ranked 86 in 'Ease of doing Business index' whereas Saudi Arabia ranked 49th and UAE ranked 22nd in the year 2015.

Reduced imports in China and India

China still remains the major net importer of petrochemicals in the Asian region as countries like Malaysia, Thailand and Singapore have become self-sufficient over the years in order to reduce their imports. All the other countries in the region have become self-sufficient and countries like South Korea⁴¹ have become net exporters from 2000.

Figure 9.6: 2012 Petrochemical exports from Kuwait by value (%) – region wise



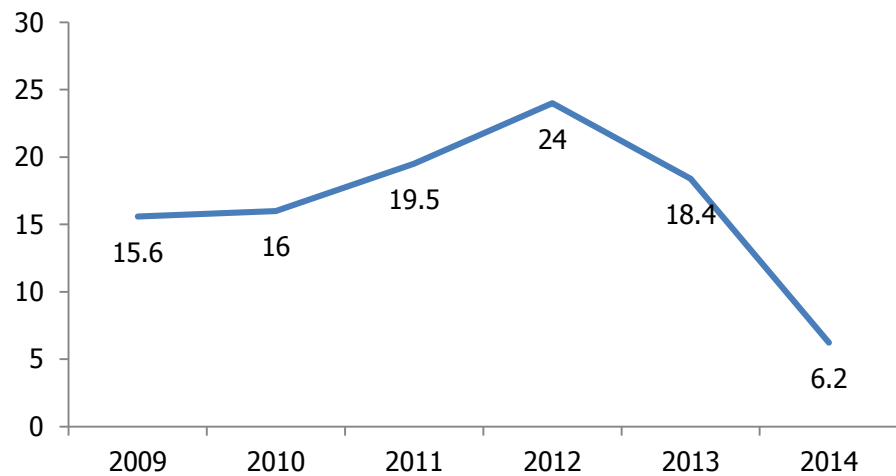
The Chinese government has started implementing policies for the self-sufficiency in petrochemicals sector.

Source: GPCA, Markaz Research

China alone accounts for 15.3% of the petrochemical exports from Kuwait in the year 2012. The Chinese government has started implementing policies for the self-sufficiency in petrochemicals sector realizing the fact that its demand will increase in the future. The twelfth five year plan of the Chinese government (2011-2015) clearly lays down plans to focus on 'national champions' in chemical industry which will make them self-sufficient in this sector. If a major importer like China will become self-sufficient in the future, it may negatively impact the exports from Kuwait.

⁴¹ GPCA

Figure 9.7: Chemicals and Petrochemicals Import by India (in USD bn)



Source: CCI

The value of petrochemicals import in India has declined after 2012 and has drastically declined in 2014 mainly due to the drop in prices in the second half as well reduced imports from India. India has increased its production capacity especially in case of synthetic fibers, aromatics and olefins, the major imports from Kuwait previously.

10. Regulatory Aspect

Environmental Regulations

OPEC countries reiterated its commitment to the issues relating to climate change.

OPEC countries in the United Nations climate change convention - Conference of Parties (CoP 19) held at Warsaw in Poland reiterated its commitment to the issues relating to climate change. It was also made clear that they require investments to develop high end technologies in sectors like petroleum refining and petrochemicals to reduce pollution. These developments clearly indicate that OPEC countries are committed to the already signed agreements on environment like the Kyoto protocol. OPEC also has ambitions to set targets for 2020 to reduce greenhouse gas emissions.

Voluntary initiatives in these areas are being carried in carbon capture and storage, reducing gas flaring, developing hybrid solar-gas power stations and solar-powered desalination units, and producing cleaner petroleum products.

The greatest success in Kuwait has been the strategy to increase investment in downstream oil industries.

The countries have spoken in favor of implementation of Kyoto protocol and technology transfer and increased investments from the developed nations. As their economies are completely dependent on oil, they require investments to adapt high end technologies and to diversify into other sectors.

A growing need to follow the Kyoto protocol (European Union directive on chemicals and environmental campaigns for reducing greenhouse gas emissions) has added costs for petrochemicals producers. Their government policies will also be aligned to their commitment to UNCCC.

Regulations in Kuwait

The government has sought to reduce the economy's dependence on oil revenues by promoting investment in other sectors. The greatest success has been the strategy to increase investment in downstream oil industries, including refining and petrochemical production. There are ten petrochemical plants in Kuwait. Most of the production is exported and hence petrochemicals contribute to 43% of the non-oil exports.

The Supreme Petroleum Council (SPC) is the highest policy making body for oil and gas sector.

Kuwait government has taken steps that will have an impact on the functioning of the sector.

Regulator of the Petrochemical Sector

The Ministry of Petroleum supervises all aspects of policy implementation in the upstream and downstream portions of both the oil and natural gas sectors.

The Supreme Petroleum Council (SPC) is the highest policy making body which oversees Kuwait's overall petroleum and gas sector. The Ministry of Oil is the main regulator of the oil and gas sector in Kuwait and exercises policy-making powers in conjunction with the SPC. The Minister of Petroleum oversees the Kuwait Petroleum Corporation (KPC). PIC, the Petrochemical Company under which all other joint venture companies operate comes under the control of KPC. Ministry of Petroleum, Kuwait decides about the safety and environment regulations for oil and Petrochemical companies in Kuwait.

A foreign direct investment law was enacted in 2001, allowing for 100% ownership of businesses for the first time.

FDI Law in Kuwait

A foreign direct investment law was enacted in 2001, allowing for 100% ownership of businesses for the first time. Foreign investors were also allowed to own shares of domestic companies listed on the local stock exchange with a new portfolio investment law introduced in 2000. The law faced many challenges in the Kuwait parliament due to which it could not be implemented till 2010.

The law went through many amendments and the final draft of the law was published on 16th June 2013. The new amendment came into force during January 2014. The amendment has strengthened the framework for public private partnerships and also has established the Kuwait Authority for Partnership Projects (KAPP) which will spearhead the private partnership in various upcoming projects in Kuwait.

The main features of the law are:

- Establishment of a public authority with the mandate of promoting foreign investments
- Investors can hold 100% equity when establishing a company in Kuwait

Stringent regulations in Kuwait discourage the private sector from entering into PPP.

Incentives provided for the foreign investors are as follows:

- Exemption from income tax or any other taxes for a period not exceeding ten years from the date of the actual commencement of operations of the licensed investment entity.
- The following goods are wholly or partially exempted from taxes, customs duties or any other fees that may be payable on imports required for the purposes of Direct Investment:
 - a. Machinery, tools and equipment and means of transport and other technological devices.
 - b. Spare parts and necessary maintenance supplies.
 - c. Merchandise, raw materials, partially manufactured goods, wrapping materials and packaging.

The law will encourage the development of petrochemical sector as it would attract more foreign investors into Kuwait.

PPP Law in Kuwait

The PPP law in Kuwait last amended in 2014 has bottlenecks on the implementation front.

Some of the impediments in the law:

Project Financing Constraints: The law does not allow for mortgagees or real rights to the land owned by the company. This makes it difficult for the companies to finance their projects when they are in expansion process.

Stiff regulations: Strict regulations are needed to ensure the efficient functioning of the private sector companies but in Kuwait they seem to hinder the functioning of the private sector. For instance, private sector investors must hand back the project to the government without any consideration and compensation, and Non-listed KSE companies and foreign companies will be subject to an extensive prequalification process, preparation of a response to an RFQ, stringent evaluation steps and approval mechanism. Such regulations discourage the private sector from entering into PPP projects.

Vague project approval and bidding process: Each stage of the project involves dealing with numerous entities in the public sector where governance is behindhand. The bureaucratic complexity of the process was a key factor in preventing the rollout of PPP projects.

The bottlenecks in the implementation need to be addressed for increased participation of private players in the petrochemical sector.

11. Appendix

Table 11.1: Kuwait's Trade Statistics

Particulars	2013	2014	2015f	2016f	2017f	2018f	2019f	2020f
Total investment (% of GDP)	14.1	15.1	20.8	21.0	20.5	20.5	20.6	20.9
Volume of Imports of goods (% change)	0.8	8.1	3.0	3.0	3.5	3.5	4.0	4.0
Volume of exports of goods (% change)	-2.3	-3.9	-0.3	2.2	2.0	2.1	2.1	2.1

Source: IMF, Markaz Research

Table 11.2: GCC Chemical and Petrochemical exports in 2012

Country	Total chemical export	Petrochemicals export
Saudi Arabia	35.8	28.03
Qatar	10	7.83
Oman	6.9	5.40
Kuwait	3.6	2.81
UAE	3.2	2.50
Bahrain	1.2	0.93

Source: GPCA, Markaz Research

Table 11.3: Petrochemical Sales (in USD mn)

Country	Market Share in GCC			
	2011	2012	2011	2012
Saudi Arabia	61.43	61.11	75.2%	74.8%
Qatar	9.80	10.29	12.0%	12.6%
Oman	3.92	3.43	4.8%	4.2%
Kuwait	3.43	3.26	4.2%	4.0%
UAE	2.61	3.10	3.2%	3.8%
Bahrain	0.49	0.49	0.6%	0.6%

Source: GPCA, Markaz Research

Table 11.4: Average Capacity of Chemicals and Petrochemical production in GCC(2008-2012)

Country	Avg Capacity (Chemicals)	Avg Capacity (Petrochemicals)
Saudi Arabia	93	87.42
Qatar	99	93.06
Oman	94	88.36
Kuwait	96	90.24
UAE	89	83.66
Bahrain	111	104.34
GCC	97	91.18

Source: GPCA, Markaz Research

Table 11.5: Capacity Addition of petrochemicals in GCC(MTPA)

Country	2008	2009	2010	2011	2012	2013E	2014E	2015E	CAGR
Saudi Arabia	21	25.6	27.5	27.8	29.8	32.29	35.00	37.93	8.38%
Qatar	2.2	2.2	3.5	3.5	3.5	3.91	4.37	4.89	11.82%
Oman	1.4	2.4	3.5	3.5	3.5	4.55	5.91	7.68	30.00%
Kuwait	1.3	1.4	3.4	3.4	3.4	4.49	5.95	7.87	32.31%
UAE	0.6	0.6	2.9	2.9	2.9	5.12	9.05	15.99	76.67%
Bahrain	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.00%

Source: GPCA, Markaz Research

Table 11.6: Income Statement of Qurain Petrochemicals, 2010-Q3 2015

Particulars	2011	2012	2013	2014	Sep - 2015
Revenue	54.00	114.80	66.90	11.40	379.30
Cost of Revenue	--	--	--	12.20	269.30
Gross Profit	--	--	--	0.90	109.90
Total Operating Expense	14.40	9.40	14.60	90.80	248.90
Operating Income	68.30	124.20	81.50	102.10	130.30
Net Income Before Taxes	67.80	123.70	81.50	102.10	130.30
Net Income After Taxes	65.50	119.50	80.50	99.10	126.20
Net Income Before Extra. Items	65.50	119.50	80.50	96.90	108.90
Net Income	65.50	119.50	80.50	96.90	108.90

Source: Reuters

Table 11.7: Petrochemical Projects in Kuwait

Project Name	Project Type	Project Value (In USD Mn)	Status	Completion Date
TKOC Olefins II - Ethane Cracker	Package	3,000	Completed	2008
Olefins II - Offsites and Utilities	Package	150	Completed	2008
TKOC Olefins II - EO/EG Unit	Package	0	Completed	2008
TKSC Olefins II - Styrene Monomer Plant	Package	1,240	Completed	2009
PCIC - Coke Calcination Plant	Standalone	0	Completed	2009
Equate - Olefins II	Master	9,000	Completed	2009
KPPC - Paraxylene and Benzene Plant	Standalone	400	Completed	2009
Olefins II - Polyethylene Expansion	Package	575	Completed	2009
PIC - Kuwait Aromatics Plant	Standalone	150	Ongoing	2018
PIC- Olefins III	Standalone	250	Ongoing	NA
UPC - PTA/PET Complex	Standalone	700	On Hold	NA

Source: Zawya Projects

Primary petrochemicals are divided into three groups depending on their chemical structure: olefins, aromatics and synthesis gas.

12. Glossary

Petrochemicals - Chemical products derived from petroleum. Some chemical compounds made from petroleum are also obtained from other fossil fuels such as coal or natural gas, or renewable sources such as corn or sugar cane. Primary petrochemicals are divided into three groups depending on their chemical structure: olefins, aromatics and synthesis gas.

Refining – An industrial process where crude oil is processed and refined into more useful petroleum products, such as gasoline, diesel fuel, asphalt base, heating oil, kerosene, and liquefied petroleum gas.

Feedstock - Something that is acted upon by industry, for use as the basis to create some product or structure. A refinery feedstock is processed oil destined for further processing other than blending in the refining industry. It is transformed into one or more components and/or finished products.

Ethane – A saturated hydrocarbon which is primarily extracted from natural gas. Ethane is isolated on an industrial scale from natural gas, and as a byproduct of petroleum refining. The largest end use for ethane is as a feedstock for ethylene production.

Naphtha - Gasoline fractions arising from straight-run distillation of crude. Naphtha is used as a feedstock for catalytic reforming and for chemicals manufacture. It is a broad term covering the lightest and most volatile fraction of the liquid hydrocarbons in petroleum.

Associated gas - Natural gas found in association with oil, either dissolved in the oil or as a cap of free gas above the oil.

Non-associated gas - Natural gas which is in reservoirs that do not contain significant quantities of crude oil and production of such gas does not significantly affect recovery of the crude oil.

Shale gas - Shale gas is natural gas found in the shale rock, and is derived from underground shale deposits that are broken up by hydraulic fracturing.

Only about 5% of the oil and gas consumed each year is needed to make all the petrochemical products.

Anti-dumping duty - A penalty imposed on suspiciously low-priced imports, to increase their price in the importing country, so as to protect local industry from unfair competition.

PMI – Purchasing Manager's Index - An indicator of economic health of the manufacturing sector. The PMI index is based on five major indicators: new orders, inventory levels, production, supplier deliveries and the employment environment.

Petrochemicals are non-fuel compounds derived from petroleum (crude oil) and natural gas. Currently, oil and gas are the main sources of the raw materials because they are the least expensive, most readily available, and can be processed most easily into the primary petrochemicals. Only about 5% of the oil and gas consumed each year is needed to make all the petrochemical products.

Typically, the petrochemical plant receives its basic inputs (feedstock) of petroleum gases, naphtha, and light gas oil from an oil refinery. It also receives from natural gas processing plants, such inputs as methane, ethane and LPGs. A closer integration of refining and petrochemical plants will result in better operational efficiency.

There are three main stages in the conversion of refinery feedstock to final product. The first of is the manufacture of basic chemicals. These are produced in high volumes in large facilities. Basic chemicals are then converted into various 'intermediate' products. Lastly, these intermediates are either further processed or converted into goods used directly by consumers or industry.

Basic Petrochemicals:

Basic Petrochemicals include: olefins (ethylene, propylene and butadiene) aromatics (benzene, toluene, and xylenes); and methanol. They are the building blocks for other downstream derivative products.

Technological developments in Refining and Petrochemical Integration:

The technology should be used to integrate all the downstream sectors.

Steps to be taken in process and operations – Integration of Refining and Petrochemical Plants⁴²

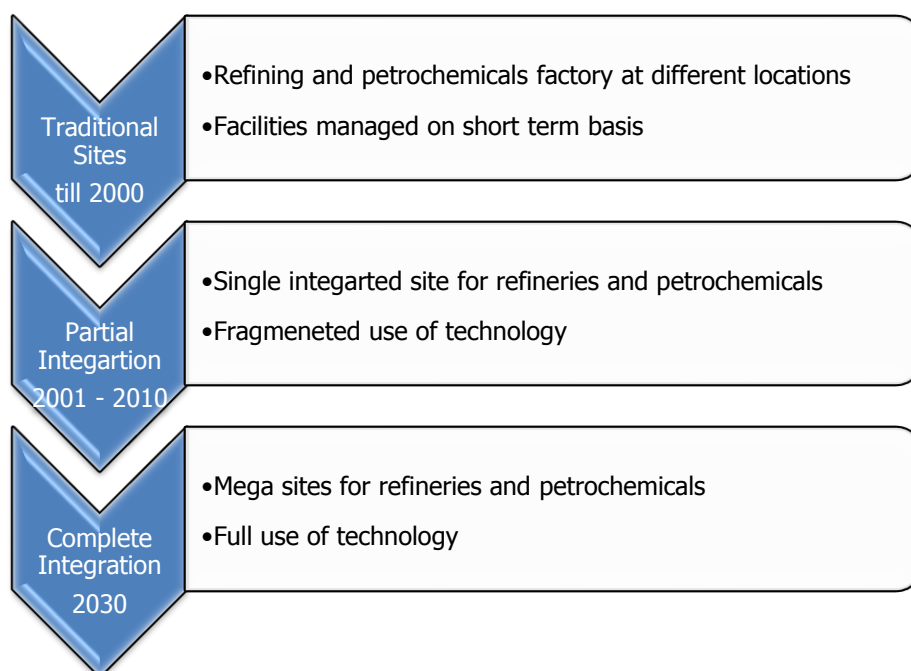
- Design and implement digital libraries that address issues such as crisis conditions, resulting scenarios, operational impacts, and anticipated loss estimates
- Design methods that unify resiliency and emergency-response resources with communication requirements within the incident coordination center, such as video surveillance equipment or real-time procedural information
- Create a standardized, consistent method of evaluating and prioritizing all resources for a resiliency and emergency management program
- Design methods to aggregate current and future communication requirements within a centralized resiliency and emergency-response coordination center
- Develop methods and technologies to acquire and maintain contextual and Meta information (such as location of on-site workers) that can be augmented with various ICT solutions

Guiding principles for implementation of technology

- Choose a single location for integrating downstream refining, petrochemical manufacturing, and other relevant, continuous, high-energy-consumption processes
- Establish smart industrialization as a catalyst for business change, including developing and aligning technology with business architectures
- Develop governance models and adopt real-time technology to enable closer collaboration among landlords and tenants to ensure safety, security, operations, maintenance, and logistics
- Catalyst is the important aspect that needs to be considered while integrating the plants. Hence a catalyst feasibility study needs to be performed before integration.
- The study should focus more on the impact of integration on the production of refinery and less on that of the petrochemical plant. The reason behind the stress on refineries is that it will act as the source of raw material for the downstream petrochemical industry.
- Integration of the plants should not reduce the quality of any of the products. Integration in few instances can lead to the reduction in quality of Hydrowax. Even the slightest reduction in hydrowax quality will affect the quality of Ethylene to greater extents.

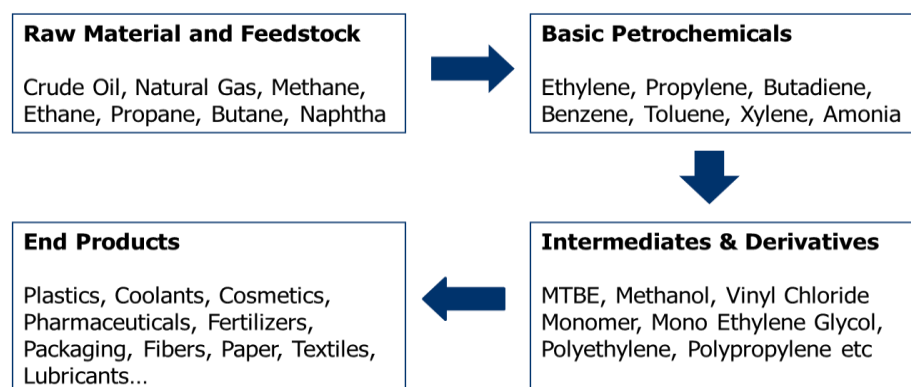
⁴² Smart Industrialisation, CISCO

Figure 12.1: Stages of Technology application in petrochemical industry in Kuwait



Source: Smart Industrialization, CISCO

Figure 12.2: Simplified Petrochemical Product Chain



Source: Smart Industrialization, CISCO

Intermediates and Derivatives:

Petrochemical intermediates are generally produced by chemical conversion of basic petrochemicals to form more complicated derivative products.

Petrochemical derivative products can be made in a variety of ways: directly from primary petrochemicals; through intermediate products which will still contain only carbon & hydrogen and, through intermediates which incorporate chlorine, nitrogen or oxygen in the finished product. Of all the processes used, one of the most important

The main reason for petrochemical – refining integration world over has been the economic benefits.

The petrochemical plants will be mitigated from the risks of non-availability of raw materials.

is polymerization. It is used in the production of plastics, fibres and synthetic rubber.

Synergies for the integration

Reduction of costs

The main reason for petrochemical – refining integration world over has been the economic benefits that are obtained as result of the integrated mega projects. The major cost factor while setting up refineries/Petrochemical plants would be the cost of the land. As these plants will be located in the same complex, the land acquisition cost can be shared. Transportation of raw materials to the petrochemical plants is the second major cost incurred after the cost of raw materials. In case of plants in GCC, transportation is the major cost amounting to 30% of the total production costs. Integrated plants will not need major transportation.

The plants of Pernis and Moerdijk were integrated by Shell in Europe. Post integration the combined revenue from the plants has increased by USD 5 mn per annum.⁴³

Mitigation of risks

The petrochemical plants will be mitigated from the risks of non-availability of raw materials. As the plants will be integrated, production planning can be done as per the needs and capacity of the refineries and the petrochemical plants. Crude oil is the major raw material for the petrochemical industry and if it is made available then production planning would become easier.

Supply chain optimization

Feedstock management is the major aspect of the supply chain management in Petrochemical industry. The by-product from one plant can be used as raw material in another unit of an integrated plant. For instance, in Europe the plants integrated by Shell use the hydrocracker residue obtained from refineries to crack ethylene which is the major feedstock for petrochemicals.

⁴³ Shell Website

Mr. Aslam Moola, Business Development Manager, Shell Corporation in an interview about his views on plant integration has said that "Secondary or by-product streams from refining units may have their highest value as feedstock for chemical units. Hence integration would be the future of the industry".⁴⁴

Reduction in distance and hence the transportation time between the refineries and the petrochemical plants will result in faster completion in the procurement of feed stock. This will reduce the total time in the manufacturing process of the petrochemicals. When the plants are located in the same complex it can pave way for better capacity management and hence a well optimized supply chain.

⁴⁴ Shell Website

Research Library (Complimentary Research)

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