Chapter-5

GCC Petrochemical Case Studies

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In this chapter, the country case studies of GCC are presented. The purpose of these case studies is to evaluate the status and structure of petrochemical industries, current and future production capacities; the competitiveness of petrochemical companies and review of major petrochemical investment projects.

The following structure for case study has been followed in all case studies, so that it can be easy for comparative analysis presented in subsequent chapter.

Overview

It covers the current status and characteristics of petrochemical industry in particular country

Petrochemical industry organization

The administrative organizations related to petrochemical industry in particular country has been discussed along with policy decision process and control. Wherever felt necessary, the prominent petrochemical organization has been discussed in detail considering their role and influence in petrochemical industrial projects like in Saudi Arabia- SABIC, in Kuwait- PIC, in Qatar-QP and in case of UAE-ADNOC.

Petrochemical infrastructure

Infrastructure facilities and support for development of petrochemical industry available in the country had been discussed. It also covers the major petrochemical companies/ complexes and their location.

Petrochemical products & production capacities

This section carries the detail basic petrochemical products and their derivatives with their historical and future production capacities.

Petrochemical demand & supply analysis

In this section petrochemical demand / supply balance of Ethylene, Propylene and Methanol and their derivatives are analyzed for the period of 2005-2010. The major capacity expansion and new petrochemical projects, those are going to support the demand and supply balance, have been discussed.

Major petrochemical projects & investment

This section highlights the major petrochemical projects and the size of the investment committed for those projects with their funding sources.

There are six GCC countries petrochemical industry case studies listed in this section.

5.1 SAUDI ARABIAN PETROCHEMICAL INDUSTRY

5.1.1 Overview

The Saudi Arabian petrochemical journey started with creation of Saudi Basic Industries Corporation (SABIC) in 1976 to develop the downstream sector in petrochemicals, fertilizers, iron and steel and industrial gases. Saudi Arabia, with its background of vast oil and gas reserves, is actively continuing to expand its petrochemical production base with aim of effectively utilizing those resources and diversifying its industry. As at the end of 1999, ethylene production in the country was 3.4 million tons (ranked 7th in the world or 3.9% share). In 2005, capacity had risen to 7.33 million tons (6.2% share of world production) ranking Saudi Arabia 3rd after US and Japan. The *characteristics* of Saudi Petrochemicals are:

- Low cost associated gas feedstock especially methane, ethane and propane are used
- Joint ventures with the world's leading oil and chemical enterprises are established and large-scale plants are built using the latest technology and general purpose petrochemical products are mass produced at low cost.
- Majority of petrochemical products are dependent on export because of insignificant domestic demand.

Saudi Arabia's majority of petrochemical exports are shipped to Asia (58% of exports go to Asia, 20% to the US, 12% to Europe, 5% to the Middle East and 5% to Africa). In future, as large joint venture petrochemical projects are due to be completed in China and Middle East by turn of this decade which has potential of changing balance of demand and supply for petrochemical products in Asia including Middle East.

5.1.2 Petrochemical Industry Organization

The administrative organizations related to petrochemical industry in Saudi Arabia are following:

a. Ministry of Commerce & Industry
b. Saudi Basic Industries Corporation (SABIC)
c. Saudi Arabia General Investment Authority (SAGIA)
d. Royal Commission of Jubail & Yanbu
e. Ministry of Petroleum & Mineral Resources
f. Saudi Aramco

Ministry of Commerce & Industry (MCI) is the in-charge of Saudi Arabia's over all industrial policy which has jurisdiction over petrochemical industry since 2003. Prior to that Ministry of Industry & Electricity was controlling authority. MCI is responsible for mapping out the basic policy framework for the petrochemical industry. Previously, the government's basic policy for petrochemicals was implemented through SABIC but recently Saudi Aramco and other private sector firms have started participating in the sector.

Saudi Basic Industries Corporation (SABIC) was setup in September 1976, after first oil crisis, to manufacture and distribute chemicals, fertilizers and steel. At the time of its establishment, it was 100% government owned state enterprise. Later in accordance with the privatization policy, 30% of the shares were sold in 1984 to Saudi and GCC member nationals, therefore, government's present equity is reduced to 70%. In August 2004, SABIC announced its intention to reduce the equity share of the government to 25%. Being particularly important, SABIC has been discussed in detail in Section 5.1.2.1

Saudi Arabia General Investment Authority (SAGIA) proposes policy and basic principles for the preparation of an investment environment with the objective of promoting investment in Saudi Arabia. SAGIA screens the investment projects and issues investment licenses and strengthen relationship with international economic organization. SAGIA was established in 2000, as a one –stop- shop for investment approval and authorization work. At the same time a new foreign investment law was approved.

Royal Commission of Jubail & Yanbu (RCJY) was established in 1975, with the aim to preparing the required infrastructure for development of basic and secondary industries. Today, RCJY is also responsible for controlling the operation and maintenance of the two large industrial cities of Jubail & Yanbu. As of Dec 2006, RCJY was constructing the second industrial parks in Jubail & Yanbu.

Ministry of Petroleum & Mineral Resources (MPMR) As Saudi Arabia is the world's leading oil producing country, the ministry is highly influential domestically and internationally. In January 2000, Supreme Council for Petroleum & Mineral Affairs (SCPM) was established to decide on important oil and gas policy for the country which includes Saudi Arabia will give priority to gas development to cope the ever growing domestic demand especially, for the petrochemical industry, utilization of natural gas was its starting point and is still the essential factor for the cost competitiveness.

Saudi Aramco, owned by the Saudi Arabian Government, is a fully-integrated petroleum enterprise, and a world leader in exploration and producing, refining, distribution, shipping and marketing. The company manages proven reserves of 260 billion barrels of oil, the largest of any company in the world, and manages the fourth-largest gas reserves in the world. At present, five refineries are owned and operated by Saudi Aramco

and two are joint venture with foreign oil majors with total refining capacity of 2.1 million barrels/day. Company is at the final stage of formulating the understanding with Dow Chemical to build a $15 billion refinery and petrochemicals complex at Ras Tanura. Saudi Aramco exclusively supplies hydrocarbon feedstock to the petrochemical industry in the country.

SABIC

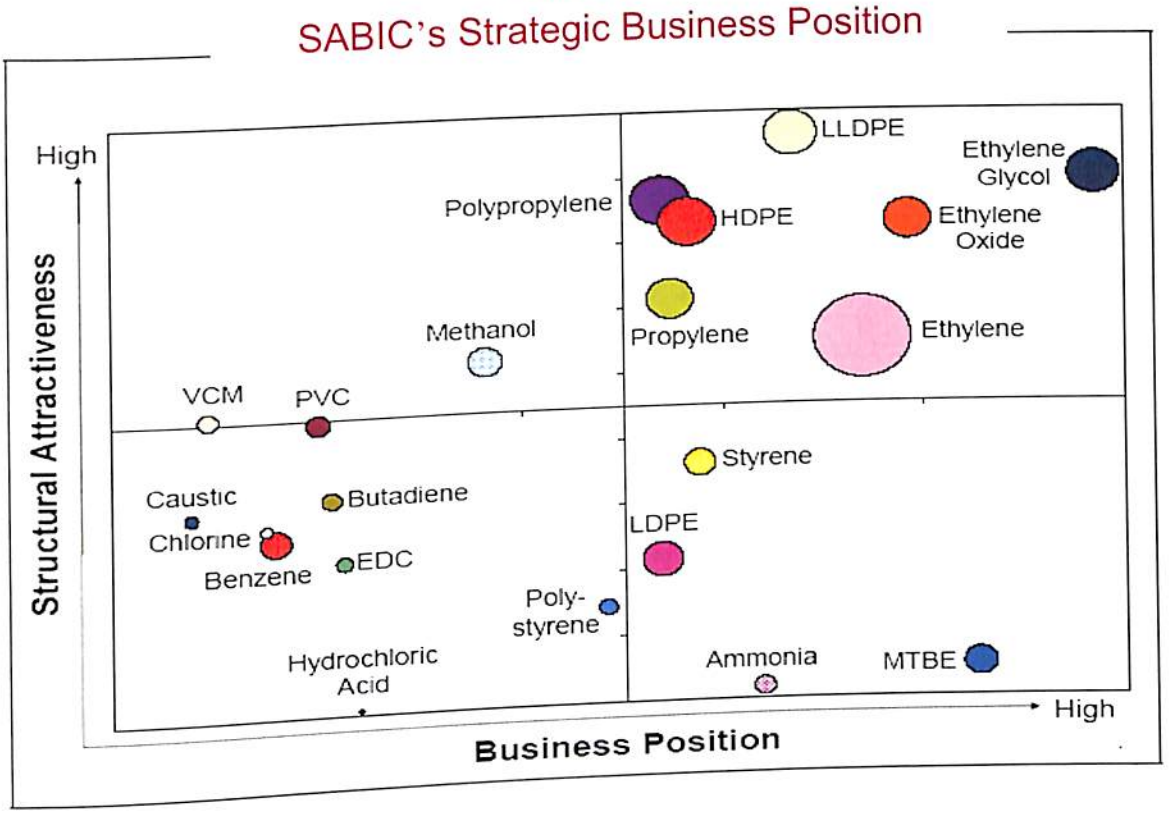
SABIC is the largest petrochemical company in the Middle East and ranks among the top ten global chemical producers. SABIC has competitive advantage of access to hydrocarbon resources in Saudi Arabia vis-à-vis their competitors in other regions. This allows SABIC to build world-scale, state-of-the-art petrochemical complexes. Currently, SABIC is involved in three wholly owned subsidiaries and 18 joint ventures on a worldwide basis with two additional joint ventures starting up operations in 2008-2010.

Basic chemicals constitute 40% of SABIC's production volume. Products derived from olefins unit constitute the majority of materials in this segment, with ethylene being in the lead in which SABIC ranks third in the world. Efforts to diversify from base commodity chemicals into specialties, such as ethanolamine, polycarbonates and ethoxylate will create a more balanced product portfolio. SABIC's product portfolio analysis is presented in Figure 5.1.1

Over the past 15 years, SABIC's chemical production capacity quadrupled and now it is 49.1 million metric tons in 2006. This constitutes an annual average growth rate of almost 10%. Plans to invest over US$20 billion over the next three years are aimed at increasing SABIC's production capacity to about 100 million metric tons by 2015. This would make SABIC the second largest petrochemical producer behind Dow Chemical.

Figure 5.1.1

SABIC's Strategic Business Position



Source: Chemical Company Analysis, Jan 2007, CMAI

Joint ventures with major global petrochemical producers such as ExxonMobil, Shell and Mitshubishi among others; facilitate access of technology, know-how, and a global customer base; while lowering the risk and capital investment cost. With acquisitions of DSM and Huntsman facilities in West Europe, SABIC broaden its geographic reach. As a part of future expansion strategy, now wants to establish a presence in India by building an ethylene plant that will also produce derivative products. The company is also seeking partners in China. The two potential cracker partners in China are Sinopec at Tianjin and the privately-owned Dalian Shide at Dalian (the PVC major). SABIC is planning to bid for the plastics unit of General Electric Co. in a deal that could be valued at up to $12 billion in April 2007. GE Plastics makes plastics for automotive parts, computer enclosures, compact disks, telecom equipments and construction materials.

SABIC's capital expenditure for petrochemical projects fluctuated between $500 and $2,200 million since the year 2001. In 2005, SABIC occupied the top position with over 20% higher capital expenditures than BASF and Dow Chemicals. As a percentage growth SABIC's capital expenditure have remained between 6-18% which higher than industry average which is around 5%. In 2006, SABIC's petrochemical assets amounts to over $ 40 billon putting SABIC in second place behind Dow Chemical and ahead of BASF.

5.1.3 Petrochemical Infrastructure

The petrochemical production facilities in Saudi Arabia are mostly concentrated at two sites; **Al-Jubail** on the east coast and **Yanbu** on the Red Sea coast (Figure 5.1). As of now in 2006, five ethylene complexes existed in Saudi Arabia – four in Jubail (SADAF, PETROKEMYA, KEMYA and JUPC) and one in Yanbu (YANPET). Furthermore, SAFCO's ammonia and urea plants have operated at Dammam since 1969.

In order to promote industrialization, the Government has developed massive industrial parks that provide roads, ports, industrial water, utilities and other infrastructure through RCJY The government has invested $25 billion for the development of these industrial locations and companies have invested around $42 billion so far. These industrial cities are designed and constructed by Bechtel, USA.

In 2002, *Al-Jubail-2* announced and now is at construction stage in four phases through an investment of 3.7 billion. Completion of first phase is schedule for 2008, and the final phase in 2022. Private sector investments totaling $5.6 billion is expected in Al-Jubail-2. This includes ethylene complex of SIPCHEM Phase -3 and new petrochemical investment worth $2 billion by

Shell. In 2005, *Yanbu-2's* development work started with expected investment of $30.7 billion. The two major plants located in Yanbu-2, YanSab (45 billion) and Gas ($2 billion), are on their rapid completion.

The national oil company, Saudi Aramco, supplies feedstock for all the petrochemical projects. The site between Yanbu and Jeddah along the Red Sea coast, is home of Saudi Aramco's largest refinery (400,000 b/d). Rabigh Refining & Petrochemical Co. (Petro- Rabigh), a joint venture between Saudi Armaco and Sumitomo Chemical, is implementing a modernization of its oil refinery and integration of the refinery with new petrochemical complex.

Table 5.1.1 Major Petrochemical Complexes in Saudi Arabia:

JUBAIL PETROCHEMICAL COMPLEX

Company	Ownership	Activity
Petrokemya (Arabian Petrochemical Co)	100 % SABIC	Olefins, benzene, PS
Sadaf (Saudi Petrochemical Co)	50/50 SABIC/Shell Oil (Pecten Arabia)	Ethanol , Olefins, EDC, Styrene
Kemya (Al-Jubail Petrochemical Co)	50/50 SABIC/ExxonMobil	Ethylene, polyethylene, Glycol
Sharq (Eastern Petrochemical Co.)	50/50 SABIC/Saudi DC (Mitsubishi led Consortium	Polyethylene, ethylene
Ibn Zahr (Saudi European Petrochemical Co)	70 percent SABIC JV with Neste and APRICORP	Polypropylene, MTBE
Jubail United Petrochemical Co.(JUPC)	100% SABIC	Ethylene, EG LAO
Ar-Razi (Saudi Methanol Co)	50/50 SABIC/Saudi DC (Mitsubishi led Consortium	Methanol
Saudi Polyolefins Co.	Tasnee (75%) Basell (25%)	Propylene, PP

YANBU PETROCHEMICAL COMPLEX

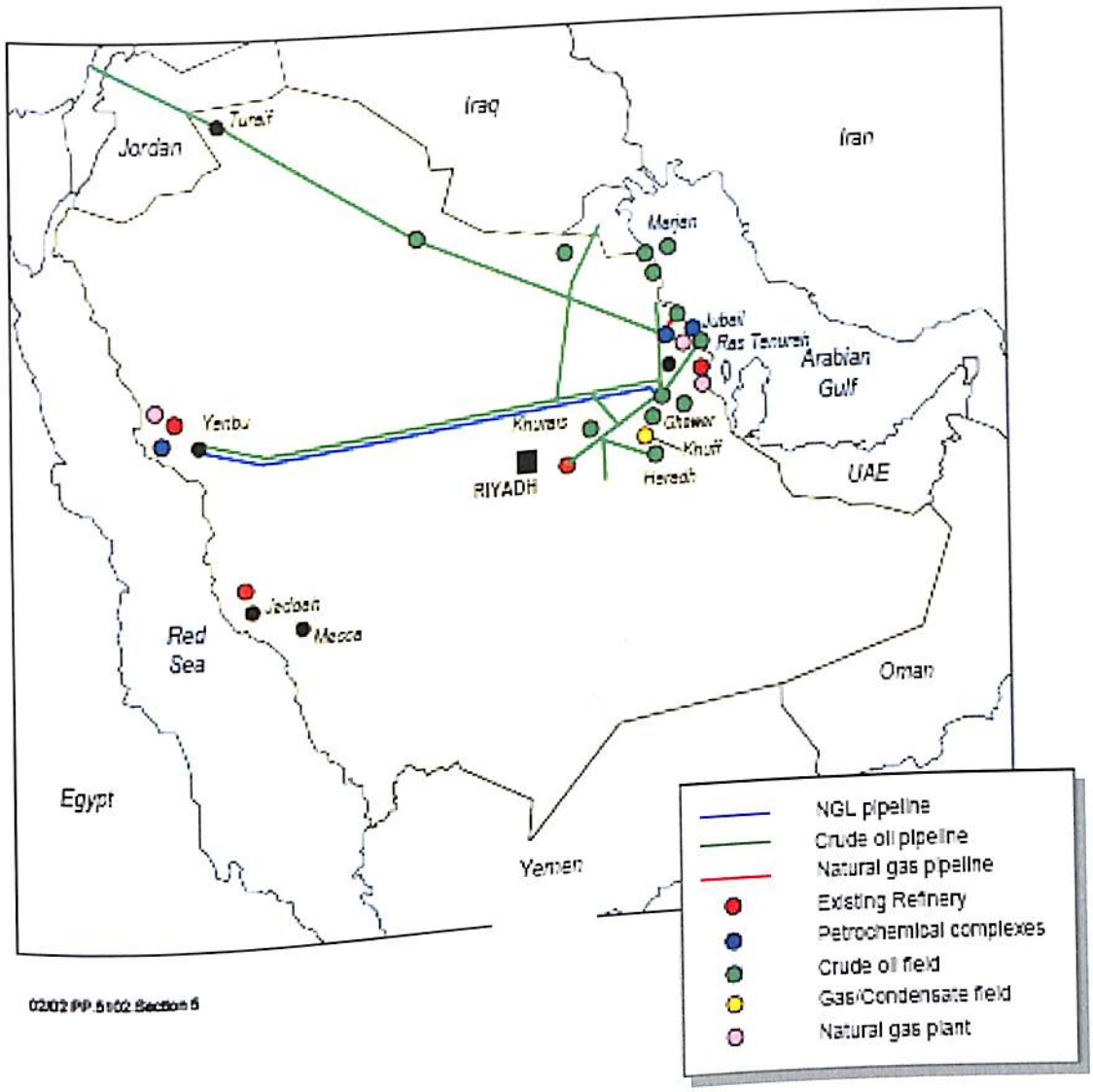
Company	Ownership	Activity
Yanpet (Saudi Yanbu Petrochemical Co)	50/50 SABIC/ExxonMobil	Olefins, polyethylene, ethylene glycol
Samad (Al-Jubail Fertiliser Company)	50/50 SABIC/Taiwan Fertiliser Company	Oxo alcohols/plasticisers, fertilizers
Ibn Sina (National Methanol Co)	50 percent SABIC and Hoechst-Celanese with Panhandle Eastern (25% each)	Methanol, MTBE
Ibn Rushd (Arabian Industrial Fibre Co)	52 percent SABIC with48 percent private local partners	Aromatics, Polyester, PTA
Arabian Chemical Co (**Latex**) Co	50/50 Juffali Bros/Dow Europe	SB Latex
Saudi Chevron	Chevron Phillips, Saudi Industrial Investment Group	Aromatics

RABIGH PETROCHEMICAL COMPLEX

Company	Ownership	Activity
Petro Rabigh (announced)	Saudi Aramco (50%) Sumitomo Chemical (50%)	Ethylene, Olefins

Source: SABIC Annual Report, 2006, ICIS News, Royal Commission of Jubail & Yanbu website

Figure 5.1.2: LOCATION OF REFINERIES & PETROCHEMICAL COMPLEXES IN SAUDI ARABIA



Source: SAGIA & Royal Commission of Jubail & Yanbu

5.1.4 Petrochemical Products & Production Capacities

The development of Saudi Arabian petrochemical industry can be measured by ethylene capacity. During 1984-1985, production of ethylene was started by three companies in Jubail by PETROKEMYA (100% SABIC equity), SADAF (SABIC –Shell JVs) and in Yanbu by YANPET (SABIC-Mobil JVs). Later, from 1993 to 1997, expansions were subsequently completed by PETROKEMYA and SADAF and Saudi Arabia's ethylene production capacity reached 3.4 million tons/ year (7th in the world).

By 2011, JCP/ NCP, YanSab, SHARQ, Petro-Rabigh, Tasnee/Sahara/SIPCHEM/ Basell and Saudi Kayan will start up in total an additional six ethylene complexes, which will push total ethylene production capacity to 16.25 million tons/year. (Saudi Arabian Ethylene capacities are listed in Table 5.1.3).

In 1985, almost at the same time, three companies SHARQ, KEMIYA and YANPET started producing Polyethylene. SHARQ produces only LLDPE and KEMIYA produces mainly LLDPE and YANPET produces mostly HDPE. In addition, SHARQ and YANPET completed large scale expansions at the end of 2000, while KEMIYA started high pressure LDPE production for the first time in Saudi Arabia and from around June 2001, all the new facilities were operating at full capacity.

A large number of new polyethylene projects are to be completed by 2010 in Saudi Arabia by YabSab, SHARQ, Petro-Rabigh, SEPC and Saudi Kayan. Production capacity for polyethylene in Saudi Arabia is expected to reach 8.5 million tons/ year (2.2 times the 3.9 million tons/year as of 2005).

Table 5.1.2 list the current historical and forecast production capacities of major petrochemical products in Saudi Arabia.

Table 5.1.2 PETROCHEMICAL PRODUCTS & PRODUCTION CAPACITIES:

Products	2000	2005	2010
Ethylene	5,700	7,335	14,620
Propylene	1,015	1,	5,605
Butadiene	130	130	130
Butene -1	120	250	450
Benzene	1,420	1,420	1,870
Para Xylene (Px)	375	375	375
Styrene monomer (SM)	1,050	1,050	2,365
Cyclohexane	220	280	280
Ethylene Glycol (EG)	2,110	2,825	5,950
Purified Terephthalic Acid (PTA)	350	350	350
Dimethyl Terephthalte (DMT)			
Acetic		30	490
Vinyl Acetate Monomer (VAM)			300
Methanol	4,150	5,107	8,607
Ethanol	330	330	330
Methyl Tertiary Butyl Ether (MTBE)	2,980	2,980	2,980
2-Ethyl Hexanol (2EH)	150	150	150
Dioctyl Phthalate (DOP)	50	50	50
PAH			
MAH		85	85
Polyethylene (PE)	2,940	3,900	8,500
Polypropylene (PP)	900	1,350	5,070
Polyvinyl Chloride (PVC)	324	404	404
Polystyrene (PS)	135	135	135
Expanded polystyrene (EPS)	25	25	25
Polyethylene Terephthalate (PET)	140	140	140
n-paraffin			120
Linear Alkyl Benzene (LAB)			70
Ammonia	2,091	2,174	4,164
Urea	2,680	2,680	4,753

Source: SABIC Annual Reports, ICIS News, CMAI & NEXANT Reports

5.1.5 Petrochemical Demand & Supply Analysis

5.1.5.1 Ethylene and Derivatives: Demand & Supply

Supply

There are currently seven ethylene crackers in operation in Saudi Arabia, with potentially three more during the next five years. At the beginning of 2005, the total ethylene capacity of Saudi Arabia was 6.7 million tons/ year (the third largest in the world). In 2005, YANPET, JUPC and Kemiya have expanded its existing ethylene plants. The current total capacity stands at around 7.8 million tons per year in 2006. Table 5.1.3 presents the current and planned ethylene capacities in Saudi Arabia. Jubai Chevron Phillips (JPC), Petrokemya expansion, Peto-Rabigh, Saudi Kayan PC, SEPC (Tasnee PC/ SaharaPC/ Basell JV) and National Chevron Phillips are all promoting ethylene projects and aiming to compete them in 2008-2010.

Table 5.1.3 Saudi Arabia- Ethylene Capacities

Thousand metric tons /year)

COMPANY	LOCATION	2005	2006	2007	2008	2009	2010	2011
Jubail Chevron Phillips	Al Jubail	0	0	0	300	300	300	300
JUPC	Al Jubail	1000	1175	1350	1350	1350	1350	1350
Saudi Kayan	Al Jubail	0	0	0	0	331	1325	1325
KEMYA	Al Jubail	700	810	810	810	810	810	810
Nat'l Chev/Phil	Al Jubail	0	0	0	0	0	0	1300
Petro-Rabigh	Rabigh	0	0	0	0	1300	1300	1300
Petrokemya	Al Jubail	800	800	800	800	800	800	800
	Al Jubail	1000	1080	1250	1250	1250	1250	1250
	Al Jubail	850	850	850	850	850	850	850
SADAF	Al Jubail	1280	1280	1280	1280	1280	1280	1280
SHARQ	Al Jubail	0	0	0	300	1200	1200	1200
SIPCHEM	Al Jubail	0	0	0	0	0	0	750
Tasnee/Sahara	Al Jubail	0	0	0	375	1000	1000	1000
YANPET	Yanbu	875	875	875	875	875	875	875
	Yanbu	830	950	980	980	980	980	980
Yansab	Yanbu	0	0	0	650	1300	1300	1300
TOTAL		**7,335**	**7,820**	**8,195**	**9820**	**13,626**	**14,620**	**16,670**

Source: SABIC Annual Reports, ICIS News, CMAI & NEXANT Reports

When all these new facilities will complete, Saudi Arabia ethylene capacity will reach to more 16 million tons in 2011. This new capacity expected to result in even greater influence on the Asian market. The Saudi Arabian ethylene cost at $110-120/ ton is overwhelmingly competitive in the world. This represents the defining characteristic of Saudi Arabian petrochemical industry. Ethylene produced in Saudi Arabia is used for domestic production of ethylene derivatives like POLYETHYLENE, EO/EG, EDC/VCM, EB/SM, ethanol, butane-1 and surplus about 200,000 tons/year at the end of 2005 in terms of production capacity exported.

PETROKEMYA, SADAF, KEMYA AND YANPET are among the existing producers of ethylene derivatives in Saudi Arabia besides Jubail United Petrochemical Company (JUPC). KEMYA was originally a joint venture between Exxon with SABIC, while YANPET involved Mobil as the joint venture partner with SABIC. The merger of Exxon and Mobil has provided ExxonMobil with an advantage of having ethylene and polyethylene production on both the east and west coasts of Saudi Arabia.

In addition to these expansions announced by these plants, the private sector is also taking a keen interest in developing ethylene and derivative projects. Among the new projects announced Yanbu National Petrochemical Co.(YANSAB) is constructing an ethane/ propane based 1.3 million tons/ year ethylene, 0.4 million tons/ year, propylene plant, a 0.5 million tons /year HDPE plant, 0.4million tons/ year LLDPE plant, 0.4 million tons/year PP plant and a 0.7 million tons/ year EG plant with completion schedule for mid 2008.

Chevron Phillips has proposed an olefins project based on pentanes and C7+ feedstock and will include world scale ethylbenzene and styrene plants. The ***Jubail Chevron Phillips Co. (JCP)*** project will be located in Al-Jubail next to the ***Saudi Chevron Phillips (SCP)*** aromatics complex, with start-up planned for 2007. In addition, Chevron has a cracker plan that will utilize the

ethane feedstock. The production company ***National Chevron Phillips (NCP)*** is expected to complete a 1.2 million tons/ year ethylene plant in 2010.

Petro-Rabigh, a joint venture project between Saudi Aramco and Sumitomo Chemical proposing a 1.3 million tons/year ethylene, 0.9 million ton/ year polyethylene, 0.7 million, 0.6 million ton/year polypropylene, EG and propylene oxide plants among others. This is an integrated petrochemical complex with an existing 400,000 barrel /day oil refinery (to be modernized by adding a DCC unit) and currently at the construction stage. The project is expected to be completed by the end of 2008 and operational in 2009.

Saudi Ethylene & Polyethylene Company (SEPC) is a joint venture project among asnee/Sahara/ Basell for 1.2 million tons ethylene plant in Jubail with expectation of completing it by 2009.

Saudi Kayan Petrochemical, a SABIC and Kayan Petrochemical's joint venture complex is scheduled to come online in August 2009. This will produce more than 4 million tonnes /year of diversified chemicals. Over 80% of the output is expected to be exported with China and India being the company's major targets. SABIC and Kayan Petrochemical hold 35% and 20% stakes in the joint venture respectively while the remaining 45% is floated through an initial public offering (IPO).

Saudi Aramco, in partnership with Dow Chemical Company is proposing a petrochemical complex at Ras Tanura named as ***Ras Tanura Petrochemicals Company***. The unit will be established with an estimated capital investment of more than $15 billion. The project will involve the biggest investment for Saudi Aramco in this sector and the second after its partnership with Sumitomo Chemicals. The project expected to start any time between2008-09 and begin production in 2011.

Demand

Production of polyethylene (PE) and ethylene glycol (EG) currently consumes around 80 percent of the total ethylene produced in Saudi Arabia. This proportion is expected to increase to around 90 percent by the end of this decade. The bulk of the demand increase has resulted from the polyethylene plants. This trend is expected to further strengthen in the future, as more HDPE/LLDPE capacity is brought on-stream in the Kingdom.

Supply/Demand Balance

At Al-Jubail ethylene capacity exceeds ethylene derivative capacity and this surplus ethylene is exported out of Saudi Arabia's only ethylene export terminal (15 thousand tons storage) at Jubail where as Yanbu is essentially a balanced site.

Table 5.1.4 Saudi Arabia- ETHYLENE Supply/ Demand Balance
Thousand metric tons /year)

	2005	2006	2007	2008	2009	2010	2011
SUPPLY							
Ethane	4658	5186	5350	6192	8634	9085	10035
Propane	1441	1172	1204	1565	2321	2429	2830
Butane	314	88	89	91	91	506	897
Naphtha	737	737	736	1023	1026	1038	1334
Gas Oil	0	0	0	0	0	0	0
Others	0	0	0	0	135	137	133
Total Production	**7150**	**7183**	**7380**	**8870**	**12207**	**13194**	**15230**
DEMAND							
Alpha Olefins	93	95	107	178	218	231	309
Ethylbenzene	329	310	313	486	516	520	527
EDC	310	308	307	303	302	298	300
Ethylene Oxide	2009	2192	2293	2651	3654	3909	3974
HDPE	1863	1827	1840	2318	3420	3739	4982
LDPE	213	202	202	302	810	989	1147
LLDPE	1785	1764	1838	2175	2800	3008	3450
Vinyl Acetate	0	0	0	0	0	22	89
Others	84	85	31	7	86	102	103
Total Demand	**7018**	**7166**	**7380**	**8870**	**12207**	**13194**	**15230**

Source: SABIC Annual Reports, ICIS News, CMAI & NEXANT Reports

The Sadaf cracker has surplus ethylene after meeting the demand from its own derivatives. This surplus is transferred to Kemya. The Petrokemya crackers also have a net surplus of ethylene, despite meeting the needs of Kemya, Sharq and its own Butene-1 plant. The bulk of this surplus is exported, mostly to South-East Asia (Thailand, Indonesia) and to India. In the future ethylene capacity will match new derivative capacity, and therefore exports are expected to almost diminish. Table 5.3 presents the ethylene supply/demand balance for Saudi Arabia.

5.1.5.2 Propylene and Derivatives: Demand & Supply

Demand

Saudi Arabia is the major consumer of propylene in the Middle East region, mainly for the production of polypropylene. The other use is for the 150,000 tons /year 2-ethylhexanol plant of SAMAD at Al-Jubail. PMD/SABIC is planning for a cumene /phenol/ acetone plant including bisphenol –A (BPA) which will start up in 2010.

Supply

With most existing crackers ethane based, propylene capacity in Saudi Arabia is relatively small compare to ethylene capacity. Saudi Arabia already operates two PDH units, with two others under construction. Sahara Petrochemical along with Basell is building a 450,000 tons/ year PDH unit to feed a new polypropylene unit. National Petrochemical Industries Co. is constructing a 400,000 tons/ year PDH unit to provide feedstock to a new polypropylene unit in Yanbu. Both plants are targeting the start up in late 2008.

Propylene supply is forecasted to increase significantly over the next five years from both steam cracker and on-purpose units. These projects have heavier mixed feeds and thus will produce a broader slate of propylene derivatives than just polypropylene.

Supply/Demand Balance

Table 5.4 presents the propylene supply/demand balance for Saudi Arabia. Saudi Arabia will remain a small exporter of propylene.

Table 5.1.5 Saudi Arabia- PROPYLENE Supply/ Demand Balance
Thousand metric tons /year)

	2005	2006	2007	2008	2009	2010	2011
Supply							
Steam Crackers	750	942	1069	1403	1889	2189	2765
FCC Splitters	0	0	0	0	0	0	0
Others	405	405	405	528	2220	2716	2853
Total Production	**1155**	**1347**	**1474**	**1931**	**4109**	**4906**	**5618**
Demand							
Cumene	0	0	0	0	18	66	83
Isopropanol	0	0	0	0	0	0	0
2-Ethyl Hexanol	126	126	127	161	198	198	199
Butanols	0	0	0	0	0	0	34
Polypropylene	1046	1231	1328	1701	3760	4472	5087
Propylene Oxide	0	0	0	0	80	112	176
Total Demand	**1172**	**1356**	**1455**	**1861**	**4056**	**4849**	**5579**

Source: SABIC Annual Reports, ICIS News, CMAI & NEXANT Reports

5.1.4.3 Methanol and Derivatives: Demand & Supply

Demand

The use of methanol in the production of MTBE accounts for about 85% of demand in Saudi Arabia. Consumption of methanol into acetic acid and formaldehyde is small as compare to most Asian countries where these sectors account for a larger percentage of consumption. This situation is expected to continue, as there is no production of plywood and other wood products in the kingdom, nor there is sizable manufacturing base which might utilize methanol solvent.

Supply

Ar-Razi (joint venture of SABIC and Mitsubishi Gas Chemicals) accounts for approximately 60% of the total methanol capacity in Saudi Arabia. The firm

is adding a 1.7 million ton/ year methanol plant, scheduled for start up in the first quarter of 2008 which will raise its capacity to 5 million tons/ year. Saudi Formaldehyde (SFCCL) has plan o built a 230,00o ton /year plant to start up in 2009.

Supply/Demand Balance

Table 5.5 presents the methanol supply/demand balance for Saudi Arabia. Saudi Arabia, already a large exporter of methanol, is expected to increase its net export position in 2009 when the 3.5 million tons /year of additional capacity will come on stream.

Table 5.1.6 Saudi Arabia- METHANOL Supply/ Demand Balance
Thousand metric tons /year)

	2005	2006	2007	2008	2009	2010	2011
Supply							
Natural Gas	4806	4650	4900	4900	6300	6300	6300
Total Production	**4806**	**4650**	**4900**	**4900**	**6300**	**6300**	**6300**
Demand							
Formaldehyde	84	89	95	100	106	111	116
Acetic Acid	0	0	0	0	165	231	231
MTBE/TAME	1216	1089	1024	1134	1166	1374	1458
Solvents	21	23	25	27	29	32	34
Domestic Demand	**1321**	**1201**	**1144**	**1261**	**1466**	**1748**	**1839**
Exports	3460	3449	3757	3639	4834	4552	4461
Total Demand	**4781**	**4650**	**4901**	**4900**	**6300**	**6300**	**6300**

Source: SABIC Annual Reports, ICIS News, CMAI & NEXANT Reports

5.1.5 Major Petrochemical Projects & Investment

Recognizing the importance of the cost competitiveness of ethane based petrochemical products and of Saudi Arabia, the country with the largest oil reserves in the world, major American and European oil and chemical companies are actively investing in Saudi Arabia's petrochemical projects. The leading oil and chemical majors like ExxonMobil & Chevron have as a result of restructuring over the past several years focused on core businesses

and as a part of their global strategy, begun to invest in large scale expansions of their petrochemical business in Saudi Arabia.

Major examples of investments by global oil and chemical firms are ExxonMobil (YANPET, SAMRAF and KEMIYA), Chevron (SCP, JCP, NCP) Shell (SADAF, SASREF), Finland's Neste Oil (IBN ZHAR, withdrawn in March 2006) and Italy's ECofuel (IBN ZHAR). Dow Chemical invested in PETROKEMIYA initially. Sumitomo Chemical decided in August 2005 to participate in the integrated oil refinery and petrochemicals complex of Petro- Rabigh, which is expected to start in 2008.

Table 5.1.7 shows the FDI status in Saudi Arabia till 2005 as estimated by SAGIA. Japan and USA are leading investors in the country. The share of petroleum and chemical sector is the largest which 88% of the total.

Table 5.1.7 Foreign Direct Investment in Saudi Arabia by Country

Rank	Country	Total Investment ($ billion)
1.	Japan	12.91
2.	USA	4.98
3.	France	4.03
4	Bahrain	3.93
5.	Germany	3.35
6.	Lebanon	1.28
7.	Canada	1.07
8.	Bermuda	1.04
9.	Cayman Island	0.98
10.	UK	0.78
	Total 82 countries	**23.44**

Source: SAGIA, 2005

5.2 KUWAITI PETROCHEMICAL INDUSTRY

5.2.1 Overview

Kuwait's hydrocarbon wealth is limited to crude oil and associated gas. Despite repeated exploration efforts, no non-associated gas reserves have been found. However, currently owing to the limited availability of non-associated gas, Kuwait has had to rely on burning valuable associated gas for fuel purposes. It has also had to use crude oil and diesel for power generation projects, in order to fulfil its commitment to provide gas to Equate Petrochemical plant. The recent plan to import gas from Qatar is clearly aimed towards making Kuwait more self-sufficient in gas for power and desalination projects.

The Kuwaiti Government is promoting a policy of diversification of industrial structure, privatization, and introduction of foreign capital. In particular, the petrochemical industry is a promising sector for adding value to oil and gas, and exporting the products thus derived. Given its international competitiveness, it is being actively fostered.

The development of Kuwait's petrochemical industry is being led by Petrochemical Industries Co. (PIC). In 1995, PIC established a joint venture called Equate Petrochemical Co. (EQUATE) with US firm UCC (now Dow Chemical) and a local private investment company, and in 1997, an ethylene cracker and PE and EG plants started operation. From 1997, PIC has also been producing and marketing PP independently using FCC propylene as feedstock. Moreover, PIC is moving ahead with N0. 2 olefins project and an aromatics project and is working towards starting the production in 2009. As of March 2006, EQUATE's actual production capacity of ethylene was 800,000 tons/year, LLDPE/HDPE 600,000 tons/year and EG 400,000 tons/year. EQUATE's cracker feedstock is ethane supplied from LPG plant of adjacent Ahmadi refinery. Being particularly important, PIC has been discussed in detail in Section 5.2.2.1

5.2.2 Petrochemical Industry Organization

The administrative organization that has jurisdiction over Kuwait's petroleum and petrochemical industries is the Ministry of Energy. In 1975, the Kuwaiti Government separated the Ministry of Economy & Oil and set up the Ministry of Oil to specialize in petroleum matters. Ministry of Energy was created by merging Ministry of Oil & Ministry of Electricity & Water in July 2003.

In 1980, the Kuwait government reorganized the petroleum industry and established Kuwait Petroleum Corporation (KPC). KPC is affiliated to the Ministry of Energy. KPC is managed by the Board of Directors, which in turn report to the Supreme Petroleum Council chaired by Kuwait's Minister of Energy.

KPC manages following eight major subsidiaries:

Domestic and overseas exploration and development companies:

- Kuwait Oil Company (KOC),
- Kuwait Foreign Petroleum Exploration Co. (KFPC) and
- Kuwait Santa Fe for Engineering and Petroleum Projects CO. (KSFEC),

Oil refining and marketing companies:

- Kuwait National Petroleum Co. (KNPC),
- Kuwait Aviation Fuelling Co. (KAFCO) and
- Kuwait Petroleum International (KPI),

Oil Transportation Company:

- Kuwait Oil Tanker Co. (KOTC)

Petrochemical company:

- Petrochemical Industries Co. (PIC).

In less than two decades, KPC has become a truly international entity offering a fully integrated portfolio of services. KPCs' ambitious plans for expansion include a crude oil production target of 3 million barrels per day.

5.2.2.1 Petrochemical Industries Company (PIC)

Petrochemical Industries Company (PIC), established by an Amiri Decree issued on July 23, 1963, to develop the ammonia and nitrogen fertilizers industry in Kuwait. Over the years, PIC's plants have undergone expansion and new plants have been installed for the production of liquid ammonia with total capacity of 858,000 metric tons/year and three urea plants with total capacity of 792,000 metric tons/year.

In July 1995, PIC, Dow and Boubyan Petrochemical Company formed a joint venture called EQUATE Petrochemical Company to build a new US $ 2 billion state-of-art petrochemical complex at Shuaiba Industrial Area which was commissioned in late 1997 and the Company started a polypropylene plant with an annual capacity of 100,000 metric tons.

EQUATE 's ethane cracker produces 800,000 tons of ethylene per annum utilizing feedstock supplied by National Petroleum Company's LPG plant, located close to the industrial complex. This ethylene in turn supplies three plants: EQUATE's polyethylene unit (600,000 tons/year); EQUATE's ethylene glycol unit (400,000 tons/year) AND PIC owned polypropylene plant, operated by EQUATE.

At present PIC and Dow Chemical are working to construct a new ethylene and derivatives complex in Kuwait, referred to as the Olefins II project. Following the groundbreaking ceremony in March 2005, the Olefins II project is being constructed on the site adjacent to EQUATE. EQUATE will manage, operate and maintain the Olefins II facilities.

In addition to Olefins II, PIC and Dow are building an Ethylbenzene/Styrene Monomer unit of 450,000 metric ton per annum. This plant, owned by The Kuwait Styrene Company (TKSC), will be supplied with Ethylene from Olefins II and Benzene from the Aromatics complex. The Aromatics complex is being built by Kuwait Aromatics Company.

5.2.3 Petrochemical Infrastructure

Currently there are two petrochemical complexes and three refineries in Kuwait (Figure 5.1). PIC was the first company among the GCC countries to start production of ammonia (in 1966) and Urea (1967). As of March 2006, production capacity was 880,000 tons/year for ammonia and 1.04 million ton/ year for Urea.

The Kuwaiti Government is promoting a policy of diversification of industrial structure, privatization and introduction of foreign capital. Al-Qurain Petrochemical Industries Company (QPIC) was setup in 2004 as part of a countrywide effort to allow more private companies to operate in the domestic and regional petrochemical industry. The company is Kuwait's second private sector share holding company for petrochemicals after Boubiyan Petrochemical Company was established in the mid-1990s.

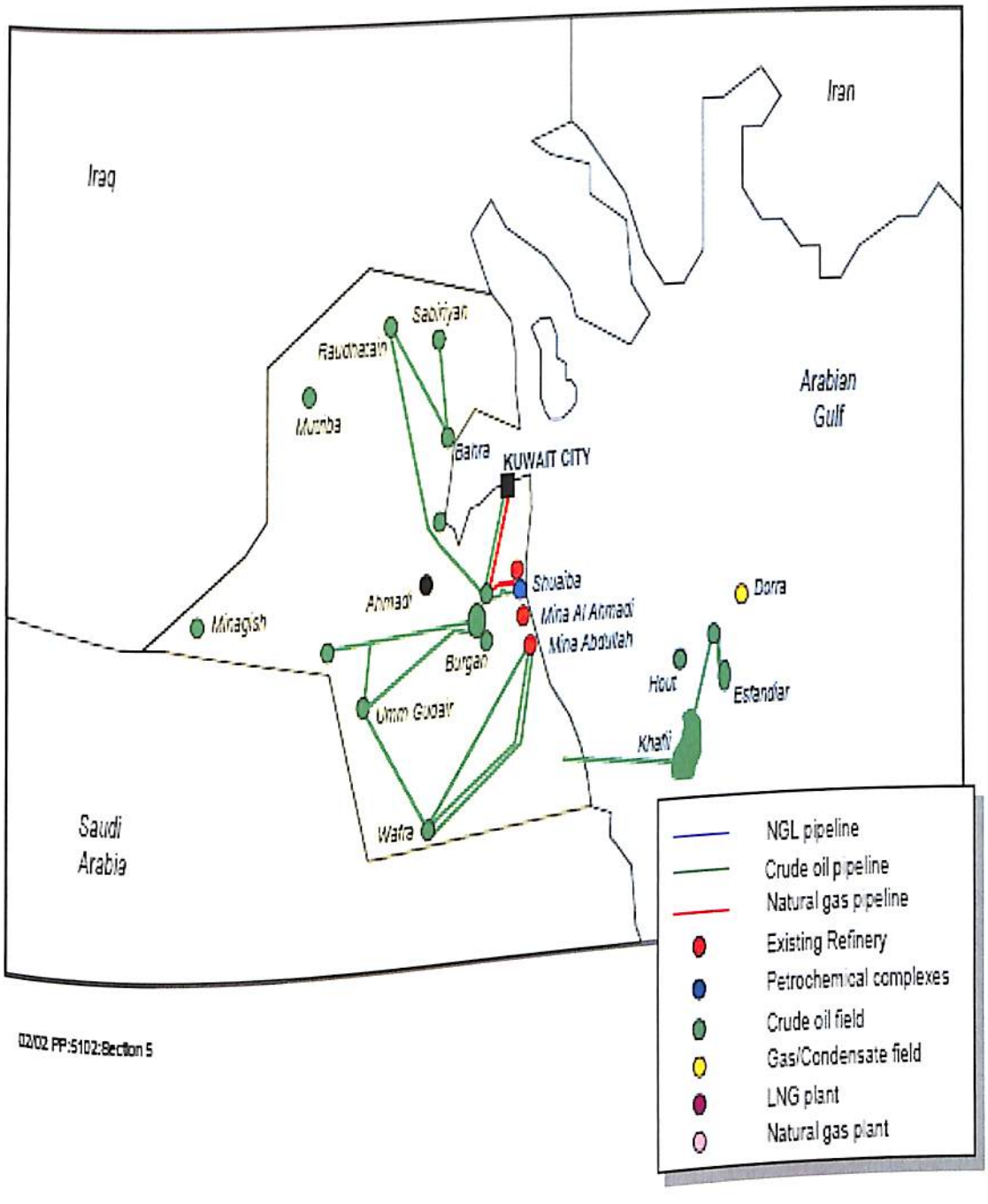
QPIC owns a 6% share of the Equate Petrochemical Company and a 6% share of a joint venture project between Petrochemical Industries Company of Kuwait and Dow Chemical. Referred to as the Olefins II project it will comprise of a new ethylene and derivatives complex in Kuwait. Table 5.2.1 lists the major petrochemical companies in Kuwait.

Table 5.2.1 Major Petrochemical Companies in Kuwait:

Company	Ownership	Activity
EQUATE	PIC (42.5%), Dow Chemical (42.5%) Boubiyan (9%) and QPIC 6%	Ethylene, LLDPE/ HDPE EG, Butene-1
PIC	KPC (100%)	PP, Ammonia, Urea, Chlorine, Caustic soda
TKOC (The Kuwait Olefin Co.) EQUATE -II)	PC (47), Dow Chemical (47%) QPIC 6%	Ethylene Propylene and EG
TSKC (The Kuwait Styrene Co.)	Kuwait Aromatic Co. (57.5%) and Dow Chemical (42.5%)	Ethylbenzene, Styrene
KARO (Kuwait Aromatic Co.)	PIC (80%) and QPIC (20%)	Benzene, p-Xylene
Equipolymers	PIC (50%), Dow Chemical (50%)	PTA

Source: PIC & KPC

Figure 5.2: LOCATION OF PETROCHEMICAL PLANTS IN Kuwait



Source: PIC & Ministry of Energy, Kuwait

5.2.4 Petrochemical Products & Production Capacities

PIC's promoted EQUATE started the ethane cracker in 1997, with ethylene capacity of 650,000 tons/year. In 2000, EQUATE expanded the capacity through de-bottlenecking and now its ethylene capacity is 800,000 ton/year, LLDE/HDPE capacity is 600,000 tons/year and EG capacity is 400,000 tons/year.

As of December 2006, petrochemical projects promoted by PIC included EQUATE –II ethylene project, aromatic project and styrene project. As ethane is in short supply in Kuwait, naphtha was initially considered as a feedstock for the project but as the natural gas pipeline project to transport gas from Qatar was agreed in 2001, the feedstock will now primarily be ethane. The plan was to employ ethane recovered from associated gas as a feedstock for

TSKC's ethylene production and use imported gas from Qatar as fule for electricity generation. In 2006, due to opposition from Saudi Arabia, gas pipeline project was suspended. Now alternatives have been developed, it is suggested to import LNG via pipeline from Iran /Iraq which is not considered practical.

PIC's aromatic project will utilize reformats from KNPC's Ahmadi Oil Refinery to produce benzene and p-xylene with production start up in 2008. All the benzene produced will be used as an intermediate in the manufacture of styrene. The investment in this operation of $320 million is envisaged with the plant due to be competed in 2009. The plan is to export all styrene produced and the setting up of a private sector company to handle the styrene derivative polystyrene is being also considered.

For p-xylene the plan is to use this as feedstock for PTA production but it is not announced yet. Table 5.2.2 list the current historical and forecast production capacities of major petrochemical products in Kuwait.

Table 5.2.2 PETROCHEMICAL PRODUCTS & PRODUCTION CAPACITIES:

Products	2000	2005	2010
Ethylene	650	800	1,650
Propylene	100	125	195
Butadiene			
Butene -1	20	20	30
Benzene			325
Para Xylene (Px)			770
Styrene monomer (SM)			450
Ethylene Glycol (EG)	350	400	1,000
Polyethylene (PE)	450	600	900
Polypropylene (PP)	100	120	120
n-paraffin			80
Linear Alkyl Benzene (LAB)			80
Ammonia	858	884	884
Urea	825	1,156	1,156

Source: PIC, KPC, CMAI and NEXANT Reports

5.2.5 Petrochemicals Demand & Supply Analysis

5.2.5.1 ETHYLENE AND DERIVATIVES: Demand & Supply

Supply

The only ethylene and derivatives plant is operated by Equate at Shuaiba. The plant has a capacity to produce 780 thousand tons per year of ethylene, although the nameplate capacity of the plant is mentioned as 650 thousand tons per year. Feedstock is ethane provided from the Kuwait National

Petroleum Company (KNPC) NGL plant located close to the nearby Kuwait Petroleum Company's (KPC) refinery at Mina Al Ahmadi.

Dow (formerly Union Carbide) has repeatedly mentioned this plant as being one of the most profitable ventures in its portfolio, and has been trying to undertake an expansion for some time but the availability of ethane (or gas) has been the limiting factor till date.

Subsequent to the development of plans to transport Qatari gas to Kuwait, a new olefins project has been approved by KPC. This project will use ethane which is currently used as fuel owing to the lack of alternate non-associated gas availability in Kuwait. This project has been dubbed as Equate-II, and will be slightly larger than the existing Equate project as it includes a larger glycol plant. The ethane cracker will have a nameplate capacity of 850 thousand tons per year of ethylene and downstream plants will include 450 thousand tons per year of polyethylene and 650 thousand tons per year of ethylene glycol. EQUATE –II is expected to come on stream by 2009. Table 5.2.3 summarises the ethylene capacities in Kuwait.

Table 5.2.4 Kuwait- ETHYLENE Supply/ Demand Balance

Thousand metric tons /year)

	2005	2006	2007	2008	2009	2010	2011
Supply							
Ethane	845	845	837	1322	1725	1773	1747
Production	**845**	**845**	**837**	**1,322**	**1,725**	**1,773**	**1,747**
Demand							
Alpha Olefins	22	22	22	32	32	31	31
Ethylbenzene	0	0	0	55	124	133	133
Ethylene Oxide	276	276	260	462	617	646	613
HDPE	286	284	290	400	512	513	515
LDPE	0	0	0	0	0	0	0
LLDPE	260	261	265	373	440	450	456
Total Demand	844	843	837	1,322	1,725	1,773	1,747

Source: PIC, KPC, CMAI and NEXANT Reports

Demand

Ethylene demand in Kuwait by end-use is 66% for polyethylene namely HDPE and LLDPE. The other major use is ethylene oxide/ MEG production, at around 30%. Alpha olefin production (used in LLDPE) consumes around 20,000 tons /year of ethylene. Additional demand will come from EQUATE's 300,000 tons/year LLDPE and 600,000 tons /year MEG plans which will start in 2008.

5.2.5.2 PROPYLENE DERIVATIVES: Demand & Supply

Supply

As the current cracker is based on ethane, only the refineries in Kuwait produce propylene (PP). A propylene splitter at the Kuwaiti National Petroleum Company refinery at Shuaiba provides the propylene to the downstream PIC polypropylene project.

Demand

Petrochemical Industries Company (PIC)'s polypropylene plant is Kuwait's only propylene consumer. The 100 thousand tons per year unit, which uses the *Unipol* process, came on stream in 1997. The plant was subsequently de-bottlenecked to 120 thousand tons per year in 1999. This venture marked Union Carbide's (now Dow) entry into Kuwait.

Recently PIC has announced that it is considering an expansion of this facility tied up with the EQUATRE II project. The capacity will depend on the amount of propylene produced from the cracker.

Table 5.2.5 Kuwait- PROPYLENE Supply/ Demand Balance

Thousand metric tons /year)

	2005	2006	2007	2008	2009	2010	2011
Supply							
Steam Crackers	30	31	31	49	64	66	65
FCC Splitters	89	85	88	88	90	85	83
Production	**119**	**116**	**119**	**137**	**154**	**151**	**148**
Demand							
polypropylene	114	116	119	137	154	151	148
Total Demand	**114**	**116**	**119**	**137**	**154**	**151**	**148**

Source: PIC, KPC, CMAI and NEXANT Reports

Supply/Demand Balance

As Kuwait does not have a propylene export or import terminal, the Kuwait Petroleum Company's (KPC) propylene splitter operates at a rate enough to satisfy the demand of PIC's Propylene unit, resulting in an overall balanced position.

5.2.5.3 Methanol and Derivatives: Demand & Supply

Currently there are no methanol (or MTBE) units in operation in Kuwait. However, PIC was planning converting one of the ammonia plants to produce 660 thousand tons per year of methanol. This project was to provide methanol to KNPC who have also been planning a 100 thousand tons per year MTBE plant at Mina Al-Ahmadi since 1996-97. However, recently PIC announced that it has cancelled these plans considering the global demand slowdown of methanol and MTBE, but will be proceeding with the ammonia unit to support further urea expansion.

5.2.6 Major Petrochemical Projects & Investment

Kuwait switched from a policy of 100% national capital for its petrochemicals business after Gulf War, and established the joint venture EQUATE with US company UCC (now Dow Chemical) in 1993 with a capital of $2 billion.

PIC' own petrochemical business comprises production of PP using FCC propylene through a $120 million investment. PP plant employs the Unipol process of UCC and Japan's Toyo Engineering (TEC) constructed the plant which began operation in 1997.

Kuwait Aromatics Co. set up as joint venture between PIC (80%) and QIPC (20%) and investment of $1.3 billion I the venture is envisaged.

Kuwait Styrene Co. a joint venture between KARO and Dow Chemical has estimated a $320 million worth of investment in the project.

Among foreign investment PIC established MEGlobal and Equipolymers as large scale equal-share joint ventures with Dow Chemical. MEGlobal manufacture and sells MEG and DEG. In addition to PIC is also buying half of the business assets in MEGlobal, Canada.

PIC also set up Gulf Petrochemical Industries Co. (GPIC) as an equally held joint venture with Government of Bahrain and SABIC, Saudi Arabia at total construction cost of $400 million in 1979.

5.3 QATARI PETROCHEMICAL INDUSTRY

5.3.1 Overview

Qatar has reserves of 15.2 billion barrels of crude oil and 25.8 trillion cubic meters of natural gas. Qatar is not endowed with significant crude oil reserves compared with other oil producing nations in the Arabian Gulf, but its natural gas reserves is third in the world. On this account, Qatar was first among GCC countries in starting up its petrochemical industry based on this low cost feedstock in 1980.

The exploitation of hydrocarbon resources in Qatar started in the 1970s with the establishment of a fertilizer production facility by the Qatar Fertilizer Company (QAFCO), a joint venture between Qatar Petroleum (QP) and Norsk Hydro of Norway.

Methane, ethane and butane feedstock for Qatar's petrochemical industry have traditional been obtain from country's NGL plants that process associated gas from the Dukhan oilfield and associated and non-associated gases from offshore fields. Beside starting fertilizer pant in 1973, methanol and MTBE in 1999 using methane and start up of ethylene and LDPE production using ethane in 1980, predated other GCC countries.

Petrochemical developments in Qatar centred around an ethylene cracker operated by Qatar Petrochemical Company (QAPCO) at Mesaieed (renamed from Umm Said). QP is at the completion of major investment programme ($25 billion) over five years (between 2003 and 2007). This includes $8.1 billion in North Field related projects such as LNG, $6.7 billion in petroleum refining activities, $2.4 billion in petrochemicals and $3.1 billion in crude oil related investments.

5.3.2 Petrochemical Industry Organization

The organization that has jurisdiction over Qatar's petrochemical industry is QP, a subsidiary enterprise of the Ministry of Energy & Industry. In 2000, Qatar General Electricity and Water Corporation was spun off from the Ministry to realize its current status. The Department of Industrial Development (DID) of the Ministry of Energy & Industry has established industrial complexes, devised investment proposals, and invited companies in its efforts to promote small and medium scale enterprises. I n 2002, the DID identified 15 promising investment proposals, including ethylene diamine and HDPE pipe and announced them both in Qatar and abroad.

QP was established in 1974 as Qatar General Petroleum Corporation (QGPC) a state owned enterprise that assumed full control over petroleum and gas related industries in terms of planning, management and administration. Its name changed to QP in January 2001. The Chairman of QP is the Ministry of Energy & Industry.

Sales at QP in 2003 were $10.7 billion and profit stood at 3.3 billion, a 43% increase from 2002. This was largely contributed the sales of shares to public through Industries Qatar (IQ). With this strong financial power, QP carried out development strategies of energy and petrochemical sectors aggressively and systematically. At the same time incentives for promotion of public investment and Qatarization have been implemented. In addition foreign investments are also actively accepted to boost development and good relationships are being built.

5.3.2.1 Qatar Petroleum (QP)

QP leads promotion of Qatar's petrochemical industry together with its affiliate companies. Project and major companies related to petrochemicals and feedstock supply are following:

- QAPCO (Qatar Petrochemical company): Ethylene, LDPE and sulphur production
- QAFCO (Qatar Fertilizer company): Ammonia and Urea production
- QAFAC (Qatar Fuel Additive company): Methanol and MTBE production
- QVC (Qatar Vinyl Company): EDC, VCM, chlorine and sodium hydroxide production
- Q-Chem (Qatar Chemical Company): Ethylene, HDPE, MDPE and Hexene-1 production
- QPR (Qatar Petroleum Refinery): operation of petroleum refinery (2 trains in Masaieed) and distribution of petroleum products (NLG supply)
- NGL Projects: NGL , LPG and ethane production (NLG1-4)
- GFC (Gulf Formaldehyde company): Urea resin production

QAPCO is a joint venture between QP, IQ and Total Petrochemical. QAPCO was the first ethylene manufacturer in the GCC countries. It was established in 1974 and started production of ethylene from the end of 1980 with production capacity of 280,000 tons /year using KTI process and constructed by Technip (France). Now, expansion of QAPCO's ethylene capacity through a $220 million investment to 720,000 tons/ year is under way with completion schedule for 2007.

Q-Chem was established in 1998 as joint venture between QP and Phillips Petroleum (now Chevron Phillips) with investment of $ 1.1 billion. The feedstock is ethane rich gas (875,000 tons/year) from NGL-4 project. The ethylene plant employs Kellogg Brown & Root (KBR) process and Technip furnace. The production capacities are ethylene 500,000 tons/ year and 453,000 tons/year HDPE/MDPE and 47,000 tons/year for hexane-1. There was plan to increase the production of ethylene by 75,000 tons/year through constructing more furnace if the supply volume of ethane increases but this has not yet materialized.

QVC was established in 1998 to produced EDC and VCM with total investment of $675 million. The foreign participants in QVC projects are Norway's Norks Hydro (now Hydro Polymers), and Elf Atochem (now Total Petrochemicals). In response to increased ethylene capacity at QAPCO, a project to expand the production capacities of EDC and VCM by 633,000 tons/year and 340,000 tons/year respectively, through plant modifications in 2007 is underway. In addition, a study started in 2005, on possibility to expand EDC production capacity three fold by 2010.

QAFCO is Qatar's first petrochemical related company started its production in 1973. QAFCO has expanded its capacity twice (1979 and 1996) and now its capacity stands at 2.04 million tons/year for ammonia and 2.76 million tons/ year for Urea. The main buyer of QAFCO's ammonia is India (80%) and for Urea export destinations are USA (24%), Thailand (14%) and Australia (13%).

QAFAC was established in 1990 to produce methanol and MBTE at Mesaieed Industrial Area with total cost of $680 million. Its current capacity stands at 773,000 tons/year for methanol and 572,000 tons/year for MTBE. As the domestic market for these products is practically non-existent, the products are exported to Asia, Europe and USA. QAFAC is currently implementing the Phase –II project. A 2.2 million tons/year methanol plant using Lurgi process and 340,000 tons/year ammonia plant using the Topsoe process are expected to be completed in 2008. A scale of investment of $ 800 million is expected.

5.3.3 Petrochemical Infrastructure

QP has started next phase of petrochemical development that will centre on an ethane cracker. The project will actually proceed into two phases. For Phase-I Plan, Q- Chem- II and Qatofin (a joint venture of QP(1%), QAPCO

(63%) and Total Petrochemicals (36%) have been established , Ras Laffan Ethylene Co., a joint venture of Q-Chem –II (53.3%) and Qatofin (45.7%) and QP(1%) was established and an ethylene cracker of 1.3 million tons/year production capacity is scheduled for start up in late 2008 through an investment of $800 million. Table 5.3.1 lists the major petrochemical companies in Qatar and their locations are show in Figure 5.3.1.

Table 5.3.1 Major Petrochemical Companies in Qatar:

Company	Ownership	Activity
QAPCO	Industries Qatar (80%) Total Petrochemicals (20%)	Ethylene, LDPE
QAFAC	Industries Qatar (50%), Chinese Petroleum Corp. (Taiwan) (20%), Lee Chang Yung Chem. Ind. Co.,Taiwan (15%), International Octane Ltd, Canada (15%)	MeOH MTBE
QAFCO	Industries Qatar (75%) Yara International, Norway (25%)	Ammonia, Urea
QVC	QP (25.5%), QPCO (31.9%) Hydro Polymers (29.7%) Total Petrochemicals (12.9%)	NaOH, Chlorine, EDC, VCM
Q-Chem	QP (51%) Chevron Philips Chemical (49%)	Ethylene, HDPE, MDPE, Hexene-1
GFC	QAFCO (70%), Qatar Industrial Manufacturing Co (15%) United Development Co (10%), Amwal (5%)	UF resins

Source: QP Annual Reports, CMAI and NEXANT Reports

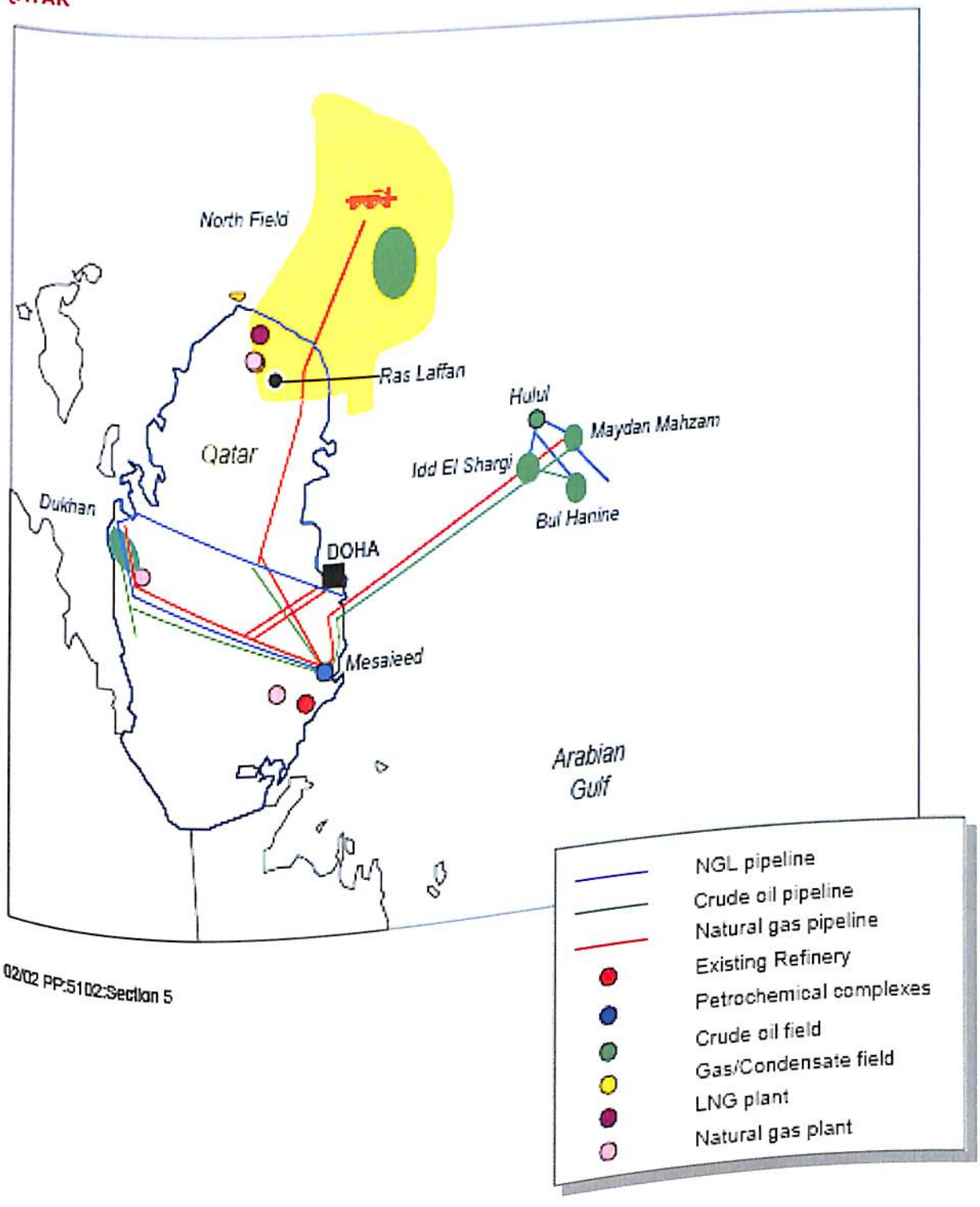
The produced ethylene is planned to be delivered to Mesaieed via an approximately 140 km pipline to produce derivatives products. Among derivatives products Q-Chem-II plans to start up a 350,000 tons/ year HDPE plant plus a 350,000 ton/year linear alfa Olefins (LAO) plant, while Qatofin plans to start up a 450,000 tons/year LLDPE plant. In total, Q-Chem –II will invest $ 1 billion while Qatofin will invest $550 million. In addition, there are plans for ethylene capacity to be expanded by 300,000 tons year and HDPE capacity by 200,000 tons/year in the future.

In addition a plan to invest $15 billion upto 2012 was also announced in 2006, which is targeted for leveraging abundant gas reserves from North Field.

As the bulk of the gas in Qatar is non-associated, recovery of the requisite quantities of ethane results in production of large amounts of by-products i.e. methane, LPG, condensates and sulphur. It is important to utilise these streams economically to achieve good returns on the gas plant, and also deliver ethane at relatively attractive rates. QP has followed an excellent strategy of developing projects that make use of the major product i.e. methane by converting it to LNG, fertilizers and methanol.

Future projects include pipeline projects to move the gas to Qatar's neighbouring countries and Gas to Liquids (GTL) projects. There are two major LNG projects, which currently share almost 14 million tons per year of LNG between them. The first one is Qatargas, which operates three LNG trains with a total capacity of 7.5 million tons. The bulk of the production from this plant is exported to Chubu Electric in Japan with any surplus LNG sold on a short term basis to others (e.g. Turkey, Spain).

Figure5.3.1: LOCATION OF PETROCHEMICAL PLANTS IN QATAR



Source: Ministry of Energy & Industry, Qatar

The other project is Ras Laffan LNG (Rasgas), which currently operates two lines capable of producing 6.6 million tons per year of LNG. Rasgas has been able to secure two major long term supply agreements which will require a further addition of two lines with a combined capacity of around 9.0 million tons. The first agreement is with PetroNet in India for the supply of 7.5 million tons per year for 25 years starting in 2003, and the second one was signed with Edison in Italy for the supply of 3.5 million tons per year for 25 years starting in 2005.

5.3.4 Petrochemical Products & Production Capacities

Qatar's plans are for rapid expansion of the petrochemical industry, and of particular note is the plan to expand ethylene capacity around 2.8 million by 2008. This is over two times the capacity existing in 2005. However, feedstocks for petrochemical industry are limited to methane and ethane and forecasts point to continued production o limited product selection. There are also plans to produce styrene as part of an integration project for petroleum refining and petrochemicals. Table 5.3.2 list the current historical and forecast production capacities of major petrochemical products in Kuwait.

Table 5.3.2 PETROCHEMICAL PRODUCTS & PRODUCTION CAPACITIES:

Products	2000	2005	2010
Ethylene	525	1,025	3,720
Propylene			700
Ethylene Dichloride (EDC)		368	633
Vinyl chloride monomer (VCM)		230	340
Methanol	825	825	3,025
Methyl Tertiary Butyl Ether (MTBE)	610	610	610
Polyethylene (PE)	360	813	1,613
n-paraffin			80
Linear Alkyl Benzene (LAB)			100
Ammonia	1,340	2,040	3540
Urea	1,630	2,760	3,900

Source: QP Annual Reports, CMAI and NEXANT Reports

5.3.5 Petrochemical Demand & Supply Aanalysis

5.3.5.1 Ethylene and Derivatives: Demand & Supply

Supply

Currently QAPCO's ethane fed ethylene cracker and LDPE autoclave plant are the only operating olefin/polyolefin plants. These plants have been in operation since 1977, when the 280 thousand tons per year cracker and 140 thousand tons per year LDPE plant were started up. Both the cracker and the downstream LDPE plant have been expanded to 525 thousand tons per year and 365 thousand tons per year, respectively in stages.

Q-Chem II is being constructed at Ras Laffan by Q-Chem and Qatofin to provide ethylene to derivatives unit in Mesaieed.

Table 5.3.1 Qatar- Ethylene Capacities
Thousand metric tons /year)

COMPANY	LOCATION	2005	2006	2007	2008	2009	2010	2011
Q-Chem	Mesaieed	500	500	500	500	500	500	500
QAPCO	Umm Said	525	525	625	720	720	720	720
QP/ ExxonMobil	Ras Laffan	----	----	----	----	----	----	----
QP/Shell	Ras Laffan	----	----	----	----	----	----	----
Ras Laffan Ethylene Co.	Ras Laffan	----	----	----	----	975	1,300	1,300
TOTAL		1,025	1,025	1,125	1,220	2,195	2,520	2,520

Source: QP Annual Reports, CMAI and NEXANT Reports

Demand

QAPCO's LDPE plant and Qatar Vinyls Company's (QVC) EDC plant are the current ethylene consumers in Qatar. Prior to the start-up of the QVC project early in 2001, there was a surplus of around 100 thousand tons per year of ethylene, which was exported. The project located at Mesaieed, also includes a 290 thousand tons per year caustic soda plant.

Qatar's ethylene demand stands at around 1 million tons in 2006. Demand is forecast to grow significantly during 2008-2010, as new derivatives plants (integrated with new cracker) come on stream. Q-Chem plans to have a 350,000 ton/ year HDPE plant start up in 2008.

Qatofin is planning a 450, 000 tons/ year plant to come on stream in 2009. QAPCO will start up its 250,000 tons /year LDPE plant in 2009 with ethylene supplied from Qatofin's new cracker.

Supply/Demand Balance

Qatar has integrated ethylene derivative capacity, and thus has a balance position in ethylene. Operating rates have been high in the recent year due to strong demand for polyethylene and are expected to remain as high 90% through 2015.

Table 5.3.2 Qatar- ETHYLENE Supply/ Demand Balance

Thousand metric tons /year)

	2005	2006	2007	2008	2009	2010	2011
Supply							
Ethane	1037	1014	1098	1131	2011	2403	3010
Propane	0	0	0	0	0	0	0
Butane	0	0	0	0	0	0	0
Naphtha	0	0	0	0	0	0	0
Production	**1037**	**1014**	**1098**	**1131**	**2011**	**2403**	**3010**
Demand							
Alpha Olefins	47	38	55	53	213	291	368
EDC	167	173	180	180	170	178	191
HDPE	332	385	410	446	763	845	1055
LDPE	367	365	368	367	541	593	594
LLDPE	0	0	0	0	240	421	610
Total Demand	**914**	**961**	**1013**	**1046**	**1926**	**2328**	**2960**

Source: QP Annual Reports, CMAI and NEXANT Reports

5.3.5.2 Propylene and Derivatives: DEMAND & SUPPLY

Demand

Currently there is no demand for propylene in Qatar. QP and Honam are planning to built a steam cracker with metathesis unit and 700,000 per year polypropylene capacity. The complex is expected to come on stream in 2010.

Supply

Propylene capacity will be added in 2010 with start up of Qatar Petroleum/Honam complex in Masaieed.

5.3.5.3 Methanol and Derivatives: Demand & Supply

Demand

The demand for methanol into MTBE is expected to exhibit relatively little growth in the forecast period in Qatar, as there have been no announcements of capacity additions. Other methanol end uses in the country are quite small.

Table 5.3.3 Qatar- METHANOL Supply/ Demand Balance

Thousand metric tons /year)

	2005	2006	2007	2008	2009	2010	2011
Supply							
Natural Gas	919	800	800	800	800	1750	2150
Total Production	**919**	**800**	**800**	**800**	**800**	**1750**	**2150**
Demand							
Formaldehyde	14	14	15	16	17	18	19
MTBE/TAME	252	218	218	218	218	218	218
Domestic Demand	**266**	**232**	**233**	**234**	**235**	**236**	**237**
Exports	653	568	567	566	565	1514	1913
Total Demand	**919**	**800**	**800**	**800**	**800**	**1750**	**2150**

Source: QP Annual Reports, CMAI and NEXANT Reports

Supply

Qatar Fuel Additives Co.(QAFCO) is expected to commission a 2.3 million tons/year methanol plant by 2009, which will also co-produce some ammonia. QAFCO's current methanol production is for captive us for its downstream 610,000 tons/ year of MTBE unit at the same site.

Due to its low cost position, methanol plants in Qatar have been and are forecast to continue to run at operating rates of 90%-95% which is above the global average. Most methanols made in Qatar are exported to Asia, with more limited export volumes destined for Europe.

5.3.6 Major Petrochemical Projects & Investment

Petrochemical developments in Qatar centred around an ethylene cracker operated by QAPCO. QP is at the completion of major investment programme ($25 billion) over five years (between 2003 and 2007). This includes $8.1 billion in North Field related projects such as LNG, $6.7 billion in petroleum refining activities, $2.4 billion in petrochemicals and $3.1 billion in crude oil related investments.

At the end of 2006, approximately, $ 8 billion has been invested in the petrochemical project in Qatar. Among the new projects announced the prominent one is the expansion of QAPCO's ethylene capacity through a $220 million investment to 720,000 tons/ year is under way with completion schedule for 2007.

Q-Chem –II will invest $1 billion and QAtofin will invest $550 million in their projects. QAFCO is currently implementing the Phase –II project and a scale of investment of $ 800 million is expected. A refinery / petrochemical integration in Mesaieed has been announced by Qatar Holding intermediate Industries Co. with the investment of $2.6 billion.

Another Ethylene plant in Ras Laffan is proposed by Shell with investment worth of $2 billion to commence the production by 2011-2012. In total, petrochemical investment projects worth $8.5 billion are at different stages of execution in Qatar with production schedule of 2010 or beyond which has been discussed earlier in section 5.3.2

5.4 UAE PETROCHEMICAL INDUSTRY

5.4.1 Overview

The UAE possesses the world's fourth largest oil reserves and fifth largest natural gas reserves, but its entry into petrochemicals has been somewhat slow. Other than the ammonia/urea unit in Abu Dhabi, which has been operating for the last 19 years and the MTBE unit started by Dubai Gas in 1994, no basic petrochemical industry existed in the Emirates until 2001.

Recently, the development of natural gas has become active, and entry into the petrochemical business, led by Abu Dhabi National Oil Company (ADNOC), is expanding in full scale. By the end of 2001, Abu Dhabi Polymers Co. (Borouge), the joint venture of ADNOC and Borealis, had complete its ethane cracker and polyethylene plant at the Ruwais industrial area. In addition to this complex, ADNOC is also considering a number of other projects including aromatics. The Ruwais refinery, operated by ADNOC has almost doubled its capacity. As a result of this expansion, ADNOC now has enough naphtha to justify building a world-scale continuous catalytic reformer that could produce around 900 thousand tons per year of aromatics. Long term plans include addition of petrochemical units to the refinery in Sharjah and Borouge Phase –III ethylene cracker by 2010. Borouges III will produce 540,000 tons/year of ethylene and 800,000 tons/year propylene using olefin disproportionation process Derivatives to be produced are PE (540,000 tons/year) and PP (800,000 tons/year).

As of December 2006, other operational petrochemical plants included the ADNOC/Total petrochemical joint venture FERTIL ammonia and urea facilities and the MTBE joint venture of Dubai's DUGAS and Scimitar Oils.

5.4.2 Petrochemical Industry Organization

In UAE, policies related to oil and gas and petrochemicals come under the jurisdiction of respective Emirate governments and the Ministry of Energy of Federal Government handles OPEC and other external affairs. Therefore, each emirate is independently processing with plans for petrochemical related businesses.

In Abu Dhabi, policies concerning to oil, gas and petrochemical industries are decided by Supreme Petroleum Council (SPC) and promoted by ADNOC.

UAE Offset Group (UOG) is a government based organization established in 1990. The major project promoted by UOG is Dolphin Energy project, which is aiming to bring 2.5 billion cubic feet per day of dry gas from Qatar.

Abu Dhabi National Oil Company (ADNOC) was established in 1971 during the formation of federation and is general petroleum company in-charge of all petroleum, gas and petrochemical industries inside and outside.

ADNOC carries out development, production, sales and refineries of oil and gas, production and distribution as well as production and distribution of petrochemical products within the Abu Dhabi emirates in accordance with the policies set by SPC. These business activities are carried out through affiliated companies or the operating companies that are joint venture with foreign companies. ADNOC is proceeding with full scale participation in the petrochemical industry with the following objectives:

- The necessary of economic diversification
- Improvement of value added by processing feedstock into secondary products
- Creation of employment for nationals and
- Support of the Government's privatization policy through promotion of the downstream industry.

In the past ADNOC was not aggressive in businesses other than the exports of crude oil and LNG, so its participation in the petrochemical business fell behind other oil producing countries. It was at the end of 1995 that it participation in the polyethylene business was decided. Borealis was selected in 1996 to be the joint venture partner and in 1998 a joint venture company called Borouge (Abu Dhabi Polymers Co. Ltd.) was formed.

ANDOC subsidiary Abu Dhabi Gas Industries (GASCO) supplies the feedstock ethane from the NLG fractionation plants in Ruwais and ethane recovery plant in Habshan. GASCO is also involved in the development, production and distribution of an onshore gas field in Abu Dhabi and with regards to petrochemical feedstock.

In addition, ADNOC is operating ammonia and urea businesses through the urea from FERTIL (joint venture with Total Petrochemicals) at Ruwais industrial zone. It is also looking into increase in FERTIL's capacity, and construction of new melamine and p-xylene plants.

SPC decides on oil, gas and petrochemical industry policies of Abu Dhabi and directs ADNOC on important matters but the project related to overseas investment in oil and petrochemical businesses in not under control of ADNOC but carried out by the state owned **International Petroleum Investment Co. (IPIC)**. IPIC raised its stake in Europe's Broealis (Borouge's joint venture partner) to 65% in 2005. In addition, it has also acquired 50% share of AMI (Agrolinz, its joint venture partner in the melamine business plan).

5.4.3 PETROCHEMICAL INFRASTRUCTURE

The Government of Abu Dhabi, as part of its diversification plan, has begun work in 2006, to create an industrial giant Abu Dhabi Basic Industries Corporation (ADBIC) that mirrors Saudi Basic Industries Corporation. (SABIC), and which will develop industries such as steel, aluminium and petrochemicals to spur foreign investment. ADBIC has received its official license to operate and absorbed its first asset, Emirates Steel Industries, from the government-owned General Holding Com (GHC). Emirates Steel's 650,000 metric ton a year plant in the emirate's Mussafah industrial area is undergoing an estimated $ 950 million expansion to raise output to nearly 2 million tons annually by the end of 2010. ADBIC is owned by the Abu Dhabi government through GHC, will be run as if it were a private sector business.

The Emirate is also planning to make major investments in its energy and industrial sectors. This will include expanding crude oil production to 3.5 million barrel per day (bpd) from the current 2.5 million bpd, and building of refineries, gas processing plants and petrochemical complexes. The creation of ADBIC is integral to a government initiative aimed at restructuring the Abu Dhabi economy to encourage greater private sector participation as the government tries to move away from hydrocarbon-based industries and to expand the industrial base of Abu Dhabi by attracting foreign investment.

The project involves laying a 350-kilometre sub-sea pipeline running from Ras Laffan in Qatar to Taweelah in the UAE, gas-receiving and metering facilities at Taweelah and Jebel Ali in the UAE.

The Dolphin Energy project, promoted by UOG, is expected to start-up in the 2007, as the company is currently testing its gas receiving and distribution facilities at Taweelah, Abu Dhabi. Availability of this gas will allow ADNOC to divert some of the wet gas (rich in natural gas liquids like ethane and LPG),

that is being consumed as fuel and for re-injection into the crude oil wells, for petrochemical purposes.

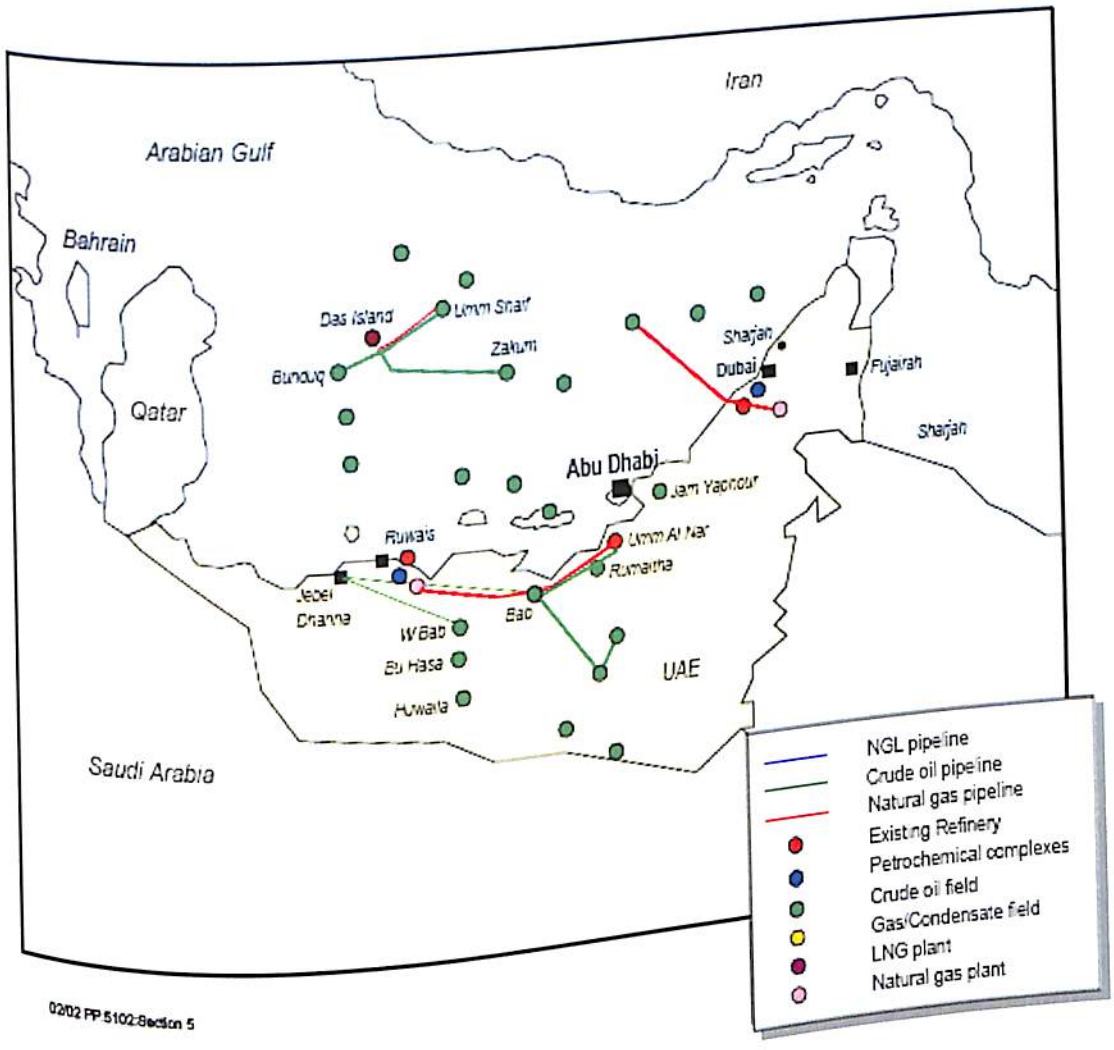
In 2005, the Abu Dhabi government created Abu Dhabi National Energy Co. (TAQA), an energy investment firm, by transferring government-owned power generation and water desalination assets and then selling 24.9% of its shares. Table 5.4.1 lists the major petrochemical companies in UAE and their locations are show in Figure 5.4.1.

Table 5.4.1 Major Petrochemical Companies in UAE:

Company	Ownership	Activity
Abu Dhabi Polymers Co. (Borouge)	ADNOC (60%) and Borealis (40%)	Ethylene, LLDPE/ HDPE (expansion) Butene-1 **Phase-III** Ethylene, Propylene, PP, PE
Abu Dhabi Oil Refining Co. (Takreer)	ADNOC (100%)	Benzene, p-Xylene
Ruwais Fertilizer Industries (FERTIL)	ADNOC (67%) and Total petrochemical (33%)	Ammonia, Urea
Abu Dhabi Melamine Industry	ADNOC (60%) and AMI Agrolinz (40%)	Melamine
SPIC Fertilizers and Chemicals	Southern Petrochemical Industries Corporation (SPIC) (51%) Emirates Trading Association (49%)	Ammonia, Urea
DUGAS JV	Dubai National Gas Co. (DUGAS) Scimitar Oils	MTBE
Ras Al Khaimah (RAK) Petroleum Co.	Ras Al Khaimah investment Authority (RAKIA) NPC (Iran)	EG
PET JV	JBF Industries RAKIA	PET Resin

Source: ADNOC, CMAI and NEXANT Reports

Figure 5.4.1: LOCATION OF PETROCHEMICAL PLANTS IN UAE



Source: ADNOC, Ministry of Energy

5.4.4 Petrochemical Products & Production Capacities

In December 2001, the ethylene and LDPE/HDPE complex of Abu Dhabi Polymers was completed in Ruwais. The production capacity was increased in February 2005 and current production capacity is 600,000 tons/year for ethylene and 580,000 tons/year for LLDPE/HDPE. Other petrochemical products being produced were ammonia (470,000 tons/year) and Urea (650,000 tons/year) at FERTIL and MBTE 500,000 tons/year at DUGAS.

In addition, a plan to build a 1.4 million tons/year ethylene in 2010 is under consideration. In this plan, an olefin disproportionation process will be adopted to consume ethylene and produce propylene (800,000 tons/Year) with polyethylene (540,000tons/ year) and polypropylene (800,000 tons /year). Table 5.4.2 list the current historical and forecast production capacities of major petrochemical products in UAE.

Table 5.4.2 PETROCHEMICAL PRODUCTS & PRODUCTION CAPACITIES:

Products	2000	2005	2010
Ethylene		600	2,000
Propylene			800
Butene -1		27	27
Methyl Tertiary Butyl Ether (MTBE)	500	500	500
Polyethylene (PE)		580	1,120
Polypropylene (PP)			800
Linear Alkyl Benzene (LAB)			30
Ammonia	432	472	472
Urea	610	650	650

Source: ADNOC, CMAI and NEXANT Reports

5.4.5 Petrochemical Demand & Supply Analysis

5.4.5.1 Ethylene and Derivatives: Demand & Supply

Supply

The Abu Dhabi Polymers Company (Borouge) ethylene cracker is the only ethylene producer in the UAE. This new company was formed in 1996 and is a joint venture between ADNOC and Borealis. The project was commissioned in December 2001. Ethane feedstock is being provided by Atheer (formerly GASCO, a gas marketing company established by ADNOC) from the recent expansion of its gas separation capacity under the OGD-II Plan.

Table 5.4.2 UAE- Ethylene Capacities
Thousand metric tons /year)

COMPANY	LOCATION	2005	2006	2007	2008	2009	2010	2011
Abu Dhabi Polymers Co. (Borouge)	Abu Dhabi, Ruwais	600	600	600	600	600	600	600
Borouge Phase-III	Abu Dhabi, Ruwais	----	----	----	----	----	1,050	1,400
TOTAL		**600**	**600**	**600**	**600**	**600**	**1,650**	**2,000**

Source: ADNOC, CMAI and NEXANT Reports

Demand

Borouge's HDPE/LLDPE plant is based on Borealis' *Borstar* bimodal technology. It is expected that most of the polyethylene produced from the 450 thousand tons per year plant will be destined for Far Eastern markets. It can be assumed that Borouge would prefer to convert more of the surplus ethylene into polyethylene, therefore a 150 thousand tons per year de-bottleneck/expansion has been considered in 2005.

Table 5.4.3 UAE- ETHYLENE Supply/ Demand Balance
Thousand metric tons /year)

	2005	2006	2007	2008	2009	2010	2011
Supply							
Ethane	545	594	603	603	606	1447	1798
Production	545	594	603	603	606	1,447	1,798
Demand							
Alpha Olefins	20	22	25	24	23	301	452
HDPE	279	308	310	313	322	737	873
LLDPE	214	214	267	266	262	266	268
Domestic Demand	513	544	603	603	606	1,447	1,798
Exports	82	0	0	0	0	0	0
Total Demand	**596**	**544**	**603**	**603**	**606**	**1,447**	**1,798**

Source: ADNOC, CMAI and NEXANT Reports

5.4.5.2 Propylene and Derivatives: Demand & Supply

The ethylene cracker uses an ethane feedstock and hence will not yield significant amounts of propylene or butadiene. There have been discussions on the possibility of propane dehydrogenation plants considering the large amounts of gas in the region.

5.4.5.3 Methanol and Derivatives: Demand & Supply

Currently, Dubai Gas operates the only MTBE plant in the UAE. The 500 thousand tons per year plant was started up in 1994 and is based on imported methanol and local LPG. There were plans to build the first methanol plant in Sharjah, but little progress has been made to date.

5.4.6 Major Petrochemical Projects & Investment

The UAE petrochemical projects are being promoted by Abu Dhabi's ADNOC. In addition, the Dubai Government is planning some petrochemical business in Jebel Ali Free Zone.

As of end of 2006, approximately, $ 6 billion has been invested in the petrochemical project in UAE. Among the new projects announced the prominent one is the Borouge's second ethane cracker with expected investment of $ 2.5 billion, the project will be open for bidding in 2007.

Another promising project is Abu Dhabi Melamine Industry (ADMI) promoted by ADNOC JV with total investment of $200 million and plant is scheduled to be completed in 2009.

In total, petrochemical investment projects worth $5.5 billion are at different stages of execution in UAE with production schedule of 2010 or beyond.

5.5 OMANI PETROCHEMICAL INDUSTRY

5.5.1 Overview

Until 2003, in Oman, the usage of natural gas was limited to domestic demand as fuel and LNG exports, other than as gas re-injection into oilfield. Oman's oil & gas reserves are comparatively small compared to neighboring oil producing countries. Government adopted the policy of utilizing their geographically favorable position to promote the oil and natural gas based petrochemical industry with the objective of diversifying, stabilizing national revenue and increasing work opportunities. Petrochemical projects in Oman are promoted through wholly owned investment firm Oman Oil Company (OOC).

5.5.2 Petrochemical Industry Organization

OOC is in charge of Oman's petrochemical industry. OOC was established in 1992 and its Chairman is Minister of Commerce and Industry and Vice Chairman is Minister of Oil & Gas.

OOC's objective is to develop investment opportunities in energy sectors both inside and outside Oman including petrochemicals. Within Oman, its focus is to promote gas-based industrial projects and energy related downstream sectors, as well as operation, construction and development of gas transportation, petrochemical product sales, oil refining, petrochemical and aluminum smelting. OOC pursues to create employment opportunity as well as investment opportunities in private sector.

The oil and gas business of Oman comes under the jurisdiction of Ministry of Oil & Gas and actual operation is exercised by ***Petroleum Development Oman (PDO)*** in which Oman Government: 60% and foreign companies (Shell: 34%, Total:4% and Partex:2%) have stakes. PDO handles mining,

production, development, storage and transportation. PDO has 75 years of oil exploration right upto 2012. In late 2004, PDO constituent company entered a new 23 years oil exploration right agreement from 2013-2044 will Omani Government.

5.5.3 Petrochemical Infrastructure

In Oman, the state owned Oman Refinery Co. (ORC) operates the Mina Al Fahal Refinery. It started operation in 1982, at 80,000 barrel/day and currently has processing capacity of 85,000 barrel/day. Most of the Oman's petroleum products are for domestic consumption.

In Yibal, there is gas processing facility for associated gas with production capacity of 580 million cubic feet/day. The processed natural gas are supplied by domestic pipeline, known as Government Gas System (GGS) and used for domestic consumption (fuel for power generation, desalisation, and industrial consumers). Non associated gas id processed at Saih Rawl, where the processed natural gas are supplied to Oman LNG (OLNG) through pipeline before exported as LNG.

In Oman, three upcoming projects that make use of ethane have been announced, namely the 300,000 tons/year EDC (Ethylene dichloride) project, due for completion in 2008, 820,000 tons/ year EDC project and 1 million tons/ year ethylene project (completion target by 2010). The feedstock ethylene for the two EDC projects will be imported from Iran (National Petroleum Co.) who is the joint stockholder. The ethane quantity required for 1 million ethylene project is estimated at approximately 1.2 -1.3 million tons/year which will be recovered in the form of C2+NLG by NLG recovery facility established near Yibal. Table 5.5.1 lists the major petrochemical companies in Oman.

Table 5.5.1 Major Petrochemical Companies in Oman:

Company	Ownership	Activity
Oman Petrochemicals Industries Co. (OPIC)	Oman Oil Co. (25%) Oman Govt (25%) and Dow Chemical (50%)	Ethylene, LDPE, HDPE and LLDPE
Ethylene P/J	Sohar Refinery Co.	Ethylene, PE
Oman Polypropylene Co. (OPP)	Oman Oil Co. (60%) GIC* Kuwait (20%) and LG international (20%)	PP
Liwa Petrochemical Co.	Oman Oil Co. (33.3%) LG international (33.3%) and NPC Iran (33.3%)	EDC, NaOH
PVC PJ	Oman Oil Co. (33.3%) and NPC Iran (33.3%)	EDC PVC NaOH
Aromatics Oman	Oman Oil Co. (60%) Sohar Refinery Co. (20%) and LG international (20%)	p-Xylene, Benzene
Oman Methanol Co.	Methanol Holdings, Trinidad Tobago (30%), Oman Methanol Holding Co. (50%) and Ferrostaal, Germany (20%)	Methanol
Sohar Methanol Co.	Oman Methanol Co. (100%)	methanol
2nd Methanol	Oman Oil Co. (30%) GTL Resources, UK (30%) Muhadala Development Co., Abu Dhabi (30%) and Vitol, Netherlands (10%)	
Oman India Fertilizer Co. (OMIFCO)	Oman Oil Co. (50%) IFFCO, India (25%) and KRIBHCO India (25%)	Ammonia Liquid Urea
Sohar International Urea & Chemical Industries (SIUCI)	Suhail Bahwan Group (100%)	Ammonia, Granulated Urea

** GIC: Gulf Investment Corporation (owner by 6 GCC member countries)*
Source: PDO, CMAI and NEXANT Reports

5.5.4 Petrochemical Products & Production Capacities

Considering the progress to date, it is most likely that the propylene-polypropylene project in Oman will proceed. Further petrochemical production is not anticipated considering Oman's overall hydrocarbon availability situation. Table 5.5.2 list the current historical and forecast production capacities of major petrochemical products in Oman.

Table 5.5.2 PETROCHEMICAL PRODUCTS & PRODUCTION CAPACITIES:

Products	2000	2005	2010
Ethylene			1,000
Propylene			340
Benzene			210
P-xylene			810
Ethylene Dichloride (EDC)			300
Methanol			1,000
Polyethylene (PE)			900
Polypropylene (PP)			340
Ammonia		1,160	1,820
Urea		1,650	2,850

Source: PDO, CMAI and NEXANT Reports

Ethylene & PE

OOC and British Petroleum (BP) had initially planned to establish a 450,000 tons/year ethylene plant, but this was later terminated due to BP's withdrawal in 1999. In 2004, Dow Chemical joined the project and a new joint venture company OPIC established. Now, there are also plan to produce LDPE, HDPE and LLDPE with capacities of 300,000 tons/year each as derivatives. JV partners will invest $ 2.3 billion in this project and is due o start in 2010.

PP

Oman Polypropylene Co. a two train PP plant is under construction with capacity of 340,000 tons/year at Sohar and is expected to on stream in in late 2007.

PVC and Aromatics

PVC PJ is planning to build an EDC (825,000 tons/year), a PVC (30,000 tons/year) plants.

Aromatics Oman will import naphtha to produce 760,000 tons/year of p-xylene and 210,000 tons/year of benzene. Production is expected to commence in 2009/2010.

Methanol 1& 2

Oman Methanol Co. plans to complete a 1 million ton/year methanol plant construction at Sohar in 2008-2009. OOC is currently implementing the construction project of a 1million ton/year methanol plant in Salalah. The total investment is estimated for $ 400 million.

Ammonia / Urea

Oman India Fertilizer Co. (OMIFCO) constructing two ammonia trains (1.2 million tons/year) and two urea trains (1.6 million tons/year). Plants were built ar Sur and operation started in 2005. Based on contract India's Krishak Bharati Co-operative (KRIBHCO) plans to offtake 250,000 tons/year of ammonia while IFFCO plans to offtake 1.6 million tons/year of urea for 10 years at an FOB price of $100/ton

Private sector Bahwan Trading Co. has established SIUCI and is planning to invest $ 58 million in the construction of one ammonia train (660,000 tons/year) and two urea train (1.2 million tons./year) at Sohar with expected schedule for completion in 2008.

5.5.5 Major Petrochemical Projects & Investment

Oman's long term strategy to 2020 is for the government to provide the framework of a stable macro economy and foster the growth of an efficient and competitive sector. Omani government is aiming to establish a sound basic infrastructure and export oriented industries that use natural gas and resources of the country. Omani Centre for Investment Promotion and Export Development (OCIPED) is established with the objective of introducing foreign investment, promoting industry revitalization and fostering the export industry.

As of March 2006, approximately $8 billion worth of investment in the Omani petrochemical projects have been announced for the further development of the sector. The prominent one is OPIC'S ethylene and HDPE/LDPE plant is Sohar with investment of $ 2.3 billion and project is due to start in 2010.

OOC is currently implementing the construction project of a 1million ton/year methanol plant in Salalah. The total investment is estimated for $ 400 million.

SIUCI promoted by Bahwan Trading Co. planned to invest $ 58 million in fertilizer project at Sohar with expected schedule for completion in 2008.

5.6 BAHRAINI PETROCHEMICAL INDUSTRY

5.6.1 Overview

Bahrain was the first GCC country in which oil was discovered in 1932, and had been an oil dependent economy. However, there are limited reserves and petroleum production volume is gradually declining. As of the end of 2005, oil reserves were 130 million barrels and production was 34,000 barrels /day whereas natural gas reserves were 92 billion cubic meters and production was 11.7 billion cubic meters/ year.

With regards to petrochemicals, the Gulf Petrochemical Company (GPIC) has been producing methanol (425 thousand tons per year) unit and Ammonia (400 thousand tons per year) since 1985 and started producing Urea (560 thousand tons per year) in 1998.

5.6.2 Petrochemical Industry Organization

The Supreme Petroleum Council (SPC) is the decision making body for Bahrain's petroleum and petrochemical industry, while the National Oil & Gas Authority is the management body that has jurisdiction over all activities related to oil and gas in Bahrain.

5.6.3 Petrochemical infrastructure

Due to limited crude oil reserves and decreasing production, Bahrain government is focusing efforts on oil refining business and modernization of Sitrah refinery of Bahrain Petroleum Co. (BAPCO), originally constructed in 1936, is underway. 85% of oil refined at the Sitrah refinery comes from Saudi Arabian oilfields in which BAPCO has 50% share.

Bahrain's petrochemical projects are being carried out by GPIC and BAPCO.

GPIC was established in 1979 to produce basic petrochemical products using Bahrain's natural gas as feedstock. It is joint venture equally owned by three parties – the Bahrain Government, SABIC of Saudi Arabia and PIC of Kuwait. GPIC has been producing methanol (425 thousand tons per year) unit and Ammonia (400 thousand tons per year) since 1985 and started producing Urea (560 thousand tons per year) in 1998.

In addition, ***BAPCO*** is looking into plans for the construction of a naphtha cracker and downstream plants, envisaging production capacities of 460, 000 tons/ year for ethylene, 360,000 tons/year for propylene 400,000 tons/ year polyethylene and 360,000 tons/ year polypropylene.

Meanwhile, private sector company, ***Durratul Bahrain***, is planning to use an ethane cracker to produce 150.000 ton/year of ethylene. Kuwait Finance House (KFH) is investing $1.5 billion in this plan to construct a complex that handles both energy and petroleum. Both of these facilities are to be located in Sitrah. As of December 2005, both of these ethylene projects were moving forward alongside one another. Now BAPCO and KFH are considering merging the two projects. Especially, in the light of the fact that the feedstock gas has to be imported from Qatar, these plans are not expected to be realized before 2010 at the earliest.

Table 5.6.1 Major Petrochemical Companies in Bahrain:

Company	Ownership	Activity
GPIC Gulf Petrochemical Industries Co.	State of Bahrain (33%) SABIC (33%) and PIC (33%)	Methanol, Ammonia, Urea
BAPCO JV	BAPCO, Bahraini Private Investors German Company	Ethylene, PE, PP
Durratul Bahrain	Kuwait Finance House Bahrain (49% owned by Bahrain Govt.)	Ethylene, EDC, LPG,

Source: BAPCO,GPIC, CMAI and NEXANT Reports

5.6.4 Petrochemical Products & Production Capacities

Considering the progress to date, Bahrain has been pursuing a number of petrochemical projects based on naphtha for quite some time, but progress so far has been slow. Table 5.6.2 list the current historical and forecast production capacities of major petrochemical products in Bahrain.

Table 5.6.2 PETROCHEMICAL PRODUCTS & PRODUCTION CAPACITIES:

Products	2000	2005	2010
Ethylene			150
Ethylene Dichloride (EDC)			315
Methanol			396
Ammonia	396	396	396
Urea	561	561	561

Source: BAPCO, GPIC, CMAI and NEXANT Reports

Ethylene, PE & PP

In 2002, BAPCO started studying the feasibility of constructing a naphtha cracker. Around $1.2 billion is expected to be invested in this project through a joint investment involving BAPCO, Bahraini private sector investor and a German Company. As of end of 2006, feasibility study was underway and Linde technology was considered for the production of ethylene.

Ethylene & EDC

Kuwait Finance House Bahrain has established Durratul Bahrain and plans to start up petrochemical business of ethylene and EDC. The plant is due for completion sometime in 2010-2011.