Chapter 8
The Energy Sector

Business is like oil. It won't mix with anything but business.
J. Graham

Learning Outcomes

By the end of this section, you would understand:

- *The important role energy plays in Saudi economic development*
- *The centrality of Saudi Arabian petroleum sector to world output and demand*
- *Saudi oil policy and constraints*
- *Saudi oil and GDP contribution*
- *The growing importance of the Saudi gas sector*
- *Saudi petrochemicals and their role in economic diversification*
- *The Saudi mining sector and its future development*
- *Alternative energy solutions*

Introduction

Energy is a necessary and vital input to economic activity throughout the world. Oil plays a key role in this regard; crude oil is today one of the most highly valued commodities in international trade. While some might consider oil as a homogeneous commodity that should carry the same price worldwide, in reality price differentials among regions of the world exist due to market conditions, shipping distance and political factors. Saudi Arabia remains the dominant force in oil, accounting for around 13% of the world's production and 20% of global exports. The country possesses around 25% of the world's reserves at around 260 billion barrels of oil, has the fourth largest gas reserves in the world and enjoys the largest spare production capacity at more than 2 million barrels a day (mbd). Saudi Arabia has indeed been called the "central bank" of world oil, or its oil warehouse. Oil fuels the Saudi economy by financing the government budget as well as large infrastructure projects,

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providing the country with ample liquidity and driving its robust consumption. The surplus generated by the oil industry has also allowed the country to accomplish an ambitious development of its industrial sector, and to capitalize on the synergies and subsidies available to sectors such as the petrochemicals. While the hydrocarbon sector has brought about undoubted material benefits to the Kingdom over the past 30 years, it has also brought great responsibilities and limitations on how far Saudi Arabia can go in pursuing its own energy interests, unlike marginal oil producers that wish to optimize on current revenues, knowing that their reserves will run out in the short run.

The government's recent emphasis on *economic diversification* encompasses energy-based manufacturing and the exploitation of gas and mineral resources, both for domestic consumption and for the establishment of a new export market. However, despite efforts at diversification away from oil, the hydrocarbon sector will continue to be at the heart of the Kingdom's economic well-being for some time. Given the Kingdom's low-cost production, which gives it a comparative advantage estimated at between $1 and $3 per barrel for extraction compared to other high-cost energy producers, it is not unreasonable to assume that future private sector-led economic diversification will somehow be associated with energy-related products.

Oil-Based Economies: A Theoretical Analysis

One major characteristic of developing economies is the so-called "dualistic" nature of their economic structure whereby a modern industrial base sits alongside a traditional sector. Dualistic models of economic development analyse the differences and structural relationships between the two sectors to explain the development process and the obstacles faced, especially by the traditional sector as it copes with the challenges of the modern sector and its needs. According to some economists (Ranis and Fei, 1988), the main focus is on how to shift the overall economy's "centre of gravity" from traditional-based economic production such as agriculture to the modern industrial sector, and, in the process, the traditional sector becomes an appendage of the modern sector.

The result is that dualistic economies are soon characterized by modern "industrial enclaves." Oil-based economies such as Saudi Arabia, which depend to a large extent on this natural resource, are different from the above model. The basic problem for economies like Saudi Arabia is not one of shifting the economy's centre of gravity from a traditional static sector (non-oil) to a dynamic (oil) sector, but using the growth-led effects of the dynamic sector throughout the traditional non-oil sector. The key factor here is that the dynamic sector for oil producers represents an exhaustible and non-renewable finite resource that generates flows of income at the cost of its own depletion unlike manufacturing enclaves. This type of development model creates a dilemma for oil producers: conserve oil resources and grow at your own pace, or deplete at a faster rate and develop the traditional sector built around a dynamic sector. In the latter, the dynamic sector acts as the leading sector and growth

engine contributing to the entire economy, but unlike generally accepted Western models of economic development, the oil-based dynamic new sector is essentially an alien sector superimposed on the traditional sector and how the two interact will be the measure of success or failure in the future. For all practical purposes, the linkage between the traditional and oil-based dynamic sector is the indirect capital flows derived from resource sales in the short run, which can be translated to effective direct linkages in the long run if the output of this sector is widened from just extraction and sales into a value-added chain. Should such linkages become strong over time, the dynamic sector may ultimately become integrated into the domestic economy and lose its dominant position to the static sector (Yamani, 1994). For this to be successful, a government of an oil-based economy must be willing to channel the receipts from the dynamic sector into development projects in which the country enjoys a comparative advantage, made possible by the low-cost supply of raw materials input by the dynamic sector.

The above encapsulates the current Saudi energy policy and its diversification into high-value petrochemical projects to create and integrate the dynamic sector into the traditional sector of the Saudi economy. Under such a model, the government's fiscal and expenditure role plays a predominant role, unlike traditional Western development models where the generating force of development is provided by private sector entrepreneurs. The benefit of an entrepreneurial led economic development is that they can act quickly, unlike governments which can influence the pace and tempo of innovation assimilation, capital formation and consequently the flow of resources from the dynamic to the static sector and thus affect the pace of development (Yamani, 1994). As examined in earlier chapters, the Saudi government has quickened the pace and tempo of the major causative factors that promote economic development.

The Saudi Petroleum Sector

Oil reserves of Saudi Arabia are controlled by the state-run Saudi Aramco company. Saudi Aramco has maintained its first ranking for the consecutive 23rd year to 2010, as the largest oil company in the world according to Petroleum Intelligence. As of 2010, the Saudi Aramco Board of Directors were Oil Minister Ali Al Naimi, Minster of Finance Dr. Ibrahim Al Assaf, Dr. Abdulrahman Al Tuwaijri (Chairman, CMA), Dr. Khaled Al Sultan (Rector KFUPM), Dr. Mohammed Al Suwaiyel (President of KACST), Mr. Peter Woicke (former Managing Director of the World Bank), Sir Mark Moody-Stuart (former Chairman of Royal Dutch/Shell), David O' Reilly (former Chairman of Chevron) and from Saudi Aramco, Mr. Khaled Al Falih (CEO), Mr. Salim Ayedh (SVP), Amin Nasser (SVP) and Abdulaziz Al Khayyal (SVP).

When it surveys the future of the oil market, Saudi Aramco can claim many favourable factors, including massive reserves, low production costs, high production capacity and a well-skilled labour force that has one of the highest *Saudization* ratios in the entire Kingdom. According to Saudi Aramco, the total number of the petroleum sector employees stood at just under 55,000, 87% of which were Saudis.

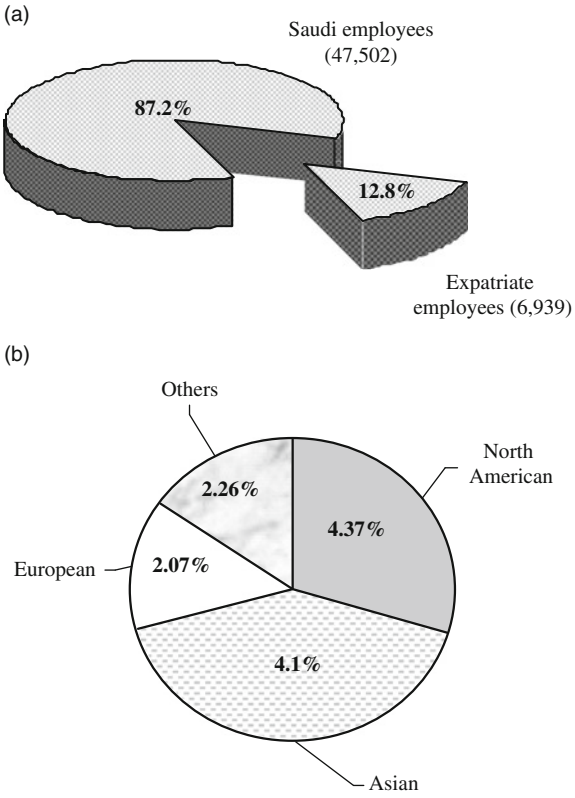

Fig. 8.1 Saudi Aramco: number of employees in the year-end 2008; (**a**) Saudi and expatriate employees, (**b**) Expatriates by major global regions (Source: Saudi Aramco)

This is illustrated in Fig. 8.1, which also gives the breakdown of the expatriate labour by nationality.

There is a historical explanation for the relatively high number of North American expatriates working for Aramco in comparison with other nationalities. The Saudi company enjoyed a close relationship with the founding US oil companies which had formed the Arabian American Oil Company (Aramco) that was later renamed Saudi Aramco when it was nationalized by the Saudi government. The high percentage of skilled technical and administrative Saudi staff in the most economically critical and sensitive of Saudi industries is reassuring, especially if some foreign workers decide not to renew their contracts with Saudi Aramco due to the wave of domestic terrorism in Saudi Arabia which particularly targeted Western expatriates during 2004.

According to Saudi Aramco, the Kingdom contains 259.9 billion barrels of proven oil reserves including 2.5 billion barrels in the Saudi-Kuwait "neutral" zone (Saudi Aramco, 2009). This represents one quarter of proven, conventional world oil reserves. Around two thirds of Saudi reserves are considered "light" or "extra light" grades of oil, commanding a higher pricing premium, with the rest either

"medium" or "heavy." Although Saudi Arabia has around 80 oil- and gas-fields (and over 1,000 wells), more than half of its oil reserves are contained in only eight fields, including the giant *Ghawar*, the world's largest oilfield, with estimated remaining reserves of 70 billion barrels, and *Safaniya*, the world's largest offshore oilfield with an estimated reserve of 35 billion barrels.

By 2010, Saudi Arabia had raised its production capacity to 12.5 million barrels per day (mbpd) but was producing around 8.5 mbpd in 2010 compared with 9.5 mbpd in 2008 at the height of the global oil price rise to nearly $147 pb, as illustrated in Fig. 8.2.

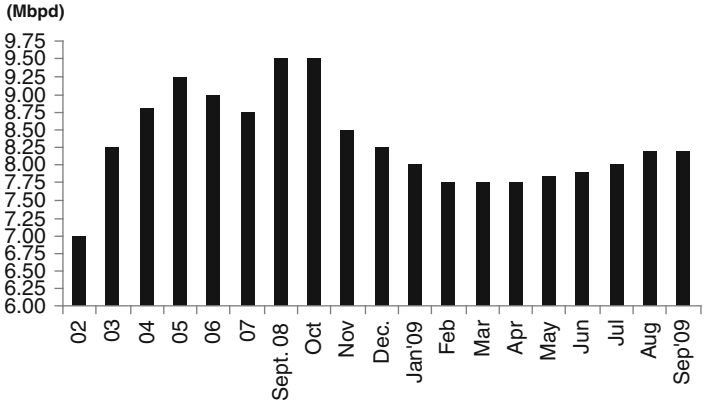

Fig. 8.2 Saudi crude oil production (2002–2009) (Source: Saudi Aramco)

A key challenge for Saudi Arabia in maintaining a high production level is the estimated "decline rate" for existing fields, which, as some have conservatively estimated, is at between 2 and 10% for the major fields (Petroleum Intelligence Weekly). The implication is that Saudi Arabia needs to add around 500,000 to 1 million bpd in new capacity each year to compensate for the declared decline rates, which some analysts like US-based Simmons and Company have disputed as being underestimated, leading to an even larger depletion rate and requirement of new reserve finds.

Saudi Arabia's long-term goal is to further develop its lighter crude reserve finds and Saudi Aramco has been successful in this respect, as the number and quantity of new finds summarized below show:

- *Shaybah field* – Located in the empty quarter near the UAE border; is now producing 500,000 bpd of Arabian extra light crude oil and the production capacity is set to rise to 750,000 bpd.
- *Khurais development* – the largest oil project in Saudi Aramco's history is producing 1.2 million bpd of Arabian light crude. To put this new production into perspective, *Khurais* produces as much as all of Angola's production, with

Angola being the latest African country to produce oil in sizeable quantities like Sudan and Chad.

- *Khursaniyah* programme will add another 500,000 bpd of Arabian light crude from the oilfields of *Abu Hadriya, Fadhili* and *Khursaniyah*.
- *Nuayyim* field added another 100,000 bpd of super light crude oil and the offshore *Manifa* project added 900,000 bpd of Arabian heavy crude oil as well as 90 million scfd (standard cubic feet per day) of associated gas.
- The *Haradh* 3 project has already come onstream and added another 300,000 bpd besides producing significant volumes of non-associated natural gas.

The above new Saudi finds, as well as reports of massive new offshore and onshore oil finds in Brazil and Venezuela, have not settled the so-called "oil peak" debate, which will be discussed in detail later in the chapter. According to a US assessment of Venezuela's oil reserves, the new finds could give that country double the reserves of Saudi Arabia or an additional 500 billion barrels of "technically recoverable" oil in the Orinoco belt, based on oil recovery rates of 40–45% (BBC News, 23 Jan 2010). Others remained more sceptical about the new find and doubted if the Venezuelan recovery could exceed 24% levels and that much of the new find would not be economic to produce; however, Venezuela holds the largest oil reserves outside the Middle East.

By all accounts, Saudi Arabia and possibly Iraq have the lowest cost of production amongst the major producers for oil extraction and Fig. 8.3 illustrates the relevant estimated "oil price benchmark" for new oil projects to be viable for selected producing countries.

As noted from Fig. 8.3, Venezuela's oil industry threshold barrier is around $114 fully loaded costs per incremental barrel compared with around $20 for Saudi Arabia.

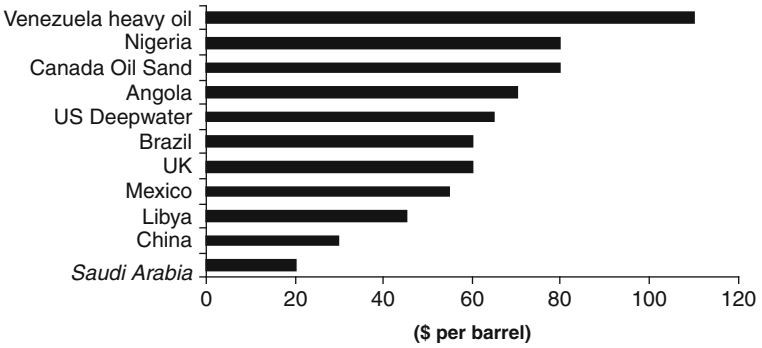

Fig. 8.3 Minimum oil price benchmark needed for new oil project profitability. Selected oil producers (Source: CERA)

The Opportunity Cost of Maintaining Spare Capacity

Saudi Aramco has planned to invest around $130 billion during the period 2008–2012 to expand the production capacity to 15 million bpd by end of 2012 from the current 12.5 mbpd. This new capacity will bolster what is already the largest excess capacity in the world, and position the Kingdom to any increases in demand without any lag in supply.

Following the slump in oil prices in 2009, the Organization of Petroleum Exporting Countries (OPEC) agreed on production cuts designed to halt further falls in oil prices, and Saudi Arabia reduced its production to around 8.1 million bpd from peaks of 9.5 million bpd in 2008. Sustaining such an idle capacity entails a very high opportunity cost for the Kingdom in terms of lost revenues and ongoing investment upkeep and oilfield maintenance. Some analysts estimate the income foregone from such an idle capacity in 2009/2010 at around $53 billion a year based on current oil prices of $70–75 pb (BSF, 2009).

Ironically, the reduced oil prices and slowdown in global demand will carry positive implications for Saudi Arabia in the medium term. The scarcity of financing and low oil prices in the current conditions will discourage further oil explorations and efforts to find alternative sources of energy, the two factors that were fast becoming a concern for the oil producers in the recent high-oil-price environment. At the same time, as demand picks up in the future, Saudi Arabia will find itself best-positioned to meet the increases based on its largest excess capacity and the cheapest cost base. Aramco estimates that 70% of the projected global demand growth will be met by capacity expansion in Saudi Arabia alone. As such, the dominance of Saudi Arabian oil in the global economy will continue in the upcoming years.

"Oil Peak" Debates: Sooner or Later?

Peak oil is the simplest label for rapid energy resource depletion without compensating new oil reserves, leading to a peak in global oil production. The rate of oil production is a function of its derived demand. Those supporting peak theories extrapolate rising demand levels with known reserves, and a peak in production is arrived at. According to many researchers, the world reached its oil peak in the 1970s, the 1990s, a range between 2000 and 2010 and so forth. Such gloomy scenarios fail to take into account the evolving advances in oil engineering technology, environmental pressures, the exploration of new areas and the fact that demand for oil need not be a linear projection exercise. Perceived scarcity, economic cycles and taxation policies could alter such forecasts, and appropriate energy pricing will allow market forces to produce a solution. In the short term, a seeming "peak-oil" problem is with us – world demand went from 79 million barrels a day in 2002 to 84.5 million in 2009. At the same time, the world needs to open up enough new fields to pump an additional 6–8 million barrels a day – at least 2 million to meet rising demand and 4 million to compensate for the declining production of existing fields.

The bone of contention lies in the reliability and availability of oil industry statistics or "data transparency." Some accuse National Oil Companies (NOCs) of not being transparent, and that a lot of reserves are merely "phantom reserves" that have been jacked up for a variety of economic and geopolitical reasons (Alsahlawi, 2009).

Estimating oil reserves involves political manipulation and bargaining by either OPEC or/and major consumers such as the United States. OPEC reserves estimates are used to negotiate quota allocation among the members. On the other hand, the United States tends to overestimate the world oil reserves to imply lower oil price. The most reliable reserve estimates were usually provided by International Oil Companies (lOCs) in the past and for the areas they are currently developing. The reserves-to-production (R/P) ratio is one measure for estimating the remaining life of oil reserves and it indicates when oil production is peaking. As presented in Table 8.1, the R/P ratio for the world is 46 years; it increased by 40% from 1970 to 2007.

Table 8.1 World reserves-to-production ratio by region (1970–2007)

	Years				
Region	1970	1980	1990	2000	2007
North America	12.4	10.1	10.1	10.2	10.9
Latin America	13.8	36.3	48.6	35.8	37.5
Eastern Europe	23.1	15.1	14.2	34	29.4
Western Europe	37.4	16.6	11.3	8.3	9.5
Middle East	66.51	54.3	112.2	88.6	90
Africa	23.1	25.1	26.7	37.8	36
Asia and Pacific	31.4	18.8	14.8	14.9	14.3
Total world	32.9	30.2	45.4	45.2	46

Source: OPEC Annual Statistical Bulletin, 2007

Table 8.1 also indicates that on current production levels, it is only the Middle East region that has the longest R/P ratio of 90 years, making it the strategic energy reserve centre for the world, and the fastest depletion rate for traditional oil reserves being North America and Western Europe, of around 10 years.

What is interesting though from Table 8.1 is that despite an increase in the absolute total of world oil demand, the world average of R/P ratio has been going up rather than down.

The differences between the "peak oil" optimists and the pessimists seem to centre on the type of assumptions they are each making. Most pessimists seem to assume that technology will not advance by much to tap more difficult or currently uneconomic oil reserves, that oil demand management does not take place under increasing price pressures and that nuclear energy might not play an increasingly important role. Optimists believe that economic growth is unbounded for all nations and for all times, and, finally, that environmental taxes are not introduced.

Disagreements occur because maybe it is truly impossible to fully measure oil with extreme precision, as it is a liquid and it moves.

The above disagreements do not take into account discontinuities, or events that beat the trend. These discontinuities make face value predictions and forecasting extremely difficulty. Examples of discontinuities include the 1974, 1979 and 2008 shocks, the nuclear accidents of Three Mile Island in the USA and Chernobyl in Russia, the nationalization of oil sectors and, on a more mundane but significant level, the introduction of the combined gas cycle turbine technology which reduced energy production costs. Future discontinuities could very well be privatization of the same national oil sector, leading to desired oil reserve data transparency, and an advance in technology to ensure that non-conventional renewable energy plays a more dominant role.

Such discontinuities seem to postpone reaching peak oil – the facts seem to indicate otherwise. Recovery rates of oil have increased from 22% in 1980 to 35% today, thanks to new technology. The ratio between proven oil reserves and current production has been constantly adjusted upwards as seen in Table 8.1 despite erratic and sometimes low oil prices, when conventional wisdom dictates that the search for proven oil reserves should have declined.

Maybe it is not that important to discuss when a peak may happen as much as a realization that a peak *will eventually happen*. There will never be 100% accurate oil data.

Saudi Arabia, OPEC and "Fair" Pricing

The history of oil, specifically that relating to the formation of the so-called "oil cartel," the Organization of the Petroleum Exporting Countries (OPEC), in 1960, has been extensively reviewed elsewhere (Johany, 1982, Newberry, 1981, Parra, 2004, Kuwaiz, 1986, Farsi, 1982). However, it is relevant to examine the negotiating strength of the oil cartel and assess whether OPEC contributes to oil price stability in the world markets. Based on basic economic principles of demand and supply, if OPEC is to affect the price of oil, it must affect the quantity. Table 8.2 illustrates the latest world demand and supply for oil.

In 2002, world demand for crude oil was just under 80 million bpd, with the Organisation for Economic Co-operation and Development (OECD) countries consuming around 50 million bpd or over 63%. By 2009, this had fallen to around 55% or 46.7 million bpd due to production efficiency and alternative energy uses. In the interim, demand from China and Asia grew, and today they represent around 22% of global consumption as illustrated in Fig. 8.4, which also shows in the estimated global demand growth in Fig. 8.4(b) that demand growth forecasted for 2010 will primarily come from Asia, the Middle East and some African countries, with smaller recovery in demand from the other regions.

Table 8.2 also illustrates the supply of global crude oil by major producers and by OPEC. The share of OPEC in world production has fluctuated around 36–39% levels since 1987, and was at 39% for 2009, but is coming down substantially from

Table 8.2 Average world demand and supply of crude oil (2006–2009)

	2006	2007	2008	2009Q1
	Million barrels per day			
(A) Demand				
• North America	25.4	25.5	24.3	23.7
• Western Europe	15.7	15.3	15.2	14.7
• Pacific Countries	8.5	8.3	8.0	8.3
OECD countries	*49.6*	*49.1*	*47.5*	*46.7*
Non-OECD				
- Foreign USSR	4.1	4.1	4.2	3.9
- China	7.2	7.5	7.9	7.7
- Eastern Europe	0.7	0.8	0.8	0.8
- South America	5.3	5.6	5.9	5.8
- Other Asian	9.0	9.3	9.4	9.4
- Middle East	6.2	6.5	6.9	6.9
- Africa	3.0	3.1	3.1	3.2
Total non-OECD	35.5	36.9	38.2	37.8
Total world demand	85.1	86.0	85.7	84.5
(B) Supply				
OPEC	*34.34*	*35.41*	*36.92*	*33.02*
OECD	19.97	19.85	19.33	19.42
Other major non-OPEC producers				
- Former USSR	12.25	12.77	12.75	12.69
- USA	7.34	7.47	7.54	7.82
- China	3.67	3.73	3.79	3.89
- Canada	3.19	3.32	3.24	3.35
- Mexico	3.68	3.48	3.17	3.05
- UK	1.66	1.66	1.56	1.48
- Norway	2.78	2.56	2.47	2.35
Total world supply	85.43	85.55	86.08	83.91

Source: SAMA, Aramco

the 60% levels seen in the mid- and late 1970s (Perra, 2004). The Middle East has by far the world's largest known and proven oil reserves, representing around 62% of global reserves as illustrated in Table 8.3.

What is noticeable from Table 8.3 is that while world proven oil reserves have increased over time, somewhat contradicting imminent peak theory depletions, there has been a noticeable decline in North American proven reserves but substantial new reserves found in Africa, Latin America and the Middle East. The 2007 Latin American figures do not include the new large finds discovered in Venezuela discussed earlier. Table 8.3, however, masks the world's largest proven oil reserve countries and this is illustrated in Fig. 8.5, which demonstrates the significance of Saudi Arabia's oil reserves amongst the seven largest oil reserve countries of 2009.

Out of the seven countries with the largest conventional crude oil reserves, five are to be found in the Middle East region, and all five are members of OPEC, as

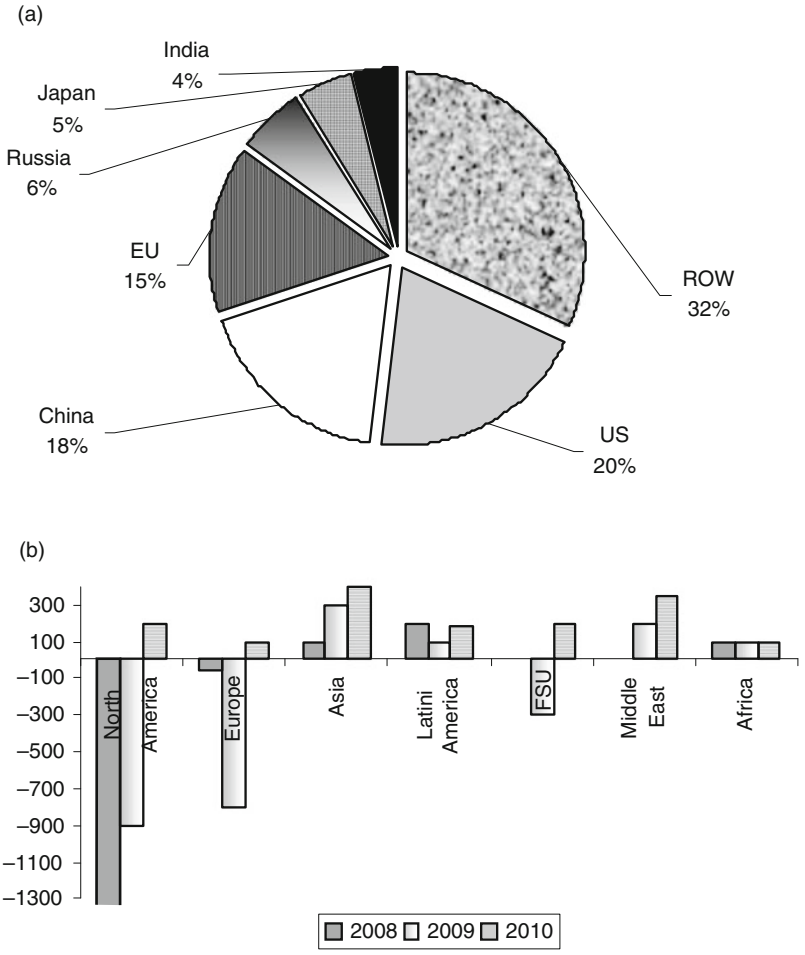

Fig. 8.4 Global primary energy consumption by region 2008 and global demand growth forecast by region 2010. (**a**) Global primary energy consumption 2008; (**b**) Global demand growth ('000 bpd) (Source: BP and IEA)

well as Venezuela, which is a non-Middle East OPEC member, while Russia is not an OPEC member but an observer in the organization. Table 8.4 illustrates the current contribution of OPEC to world oil production and its relative share, which has ranged between 31 and 40% of total world production. Saudi Arabia's production level has ranged from a low of 6.6% in 1987 to around 10% of the world's total production and around 27–28% of the total OPEC production.

OPEC has often been loosely termed a "price cartel." According to the above data, characterizing OPEC as setting the price of oil without regard to market forces needs some further explanation. To label OPEC a "cartel" does not really convey much economic information. The world "cartel" implies that OPEC members cooperate to restrict output and generate higher world oil prices. But cartels come in

Table 8.3 World proven oil reserves by region: 1970–2007 (Billion barrels)

Region	1970	1975	1980	1985	1990	1995	2000	2007
North America	49.8	39.78	36.61	34.2	31.84	27.25	26.9	25.41
Latin America	26.2	36.07	74.03	118.53	122.8	132.47	122.23	134.7
Eastern Europe	61.01	61.9	66.9	64.6	58.92	58.36	95	124.05
Western Europe	6.93	19.5	15.31	14.7	16.9	21.12	19.02	15.11
Middle East	336.22	387.1	365.24	431.43	662.1	655.4	694.6	741.6
Africa	51.12	59.1	56.01	56.22	58.6	70.97	93.4	119.3
Asia and Pacific	17.26	33.31	33.9	37.1	34.1	35.54	39.52	38.3
Total world	548.45	636.7	656.73	756.7	985.03	1,011.10	1,090.62	1,204.20

Source: OPEC/Annual Statistical Bulletin, 2007

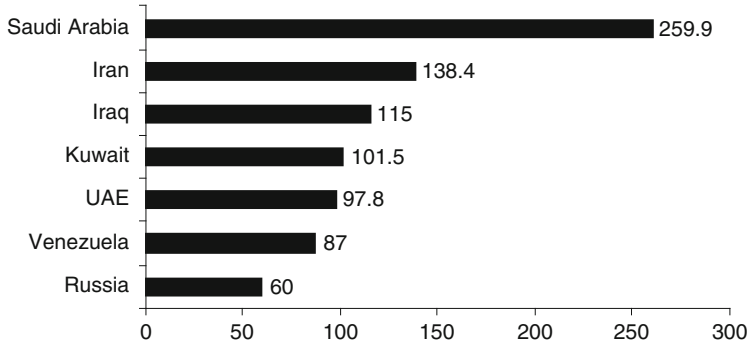

Fig. 8.5 Conventional crude oil reserves (billion of barrels) of seven largest reserve countries (January, 2009) (Source: Saudi Aramco, Oil and Gas Journal)

Table 8.4 Saudi oil production as share of world and OPEC oil production (Million barrels/day)

Year	World production	OPEC production	Saudi production	Saudi share of world (%)	Saudi share of OPEC (%)	OPEC as % of world production (%)
1987	62.4	19.7	4.1	6.6	20.9	31.5
1994	68.6	27.4	8.1	11.7	29.4	39.9
1999	74.1	29.4	7.6	10.2	25.7	39.6
2004	83.7	32.9	8.9	10.6	27	39.3
2006	85.4	34.8	9.21	10.8	26.8	40.1
2008	86.6	36.9	9.2	10.6	24.9	42.3
2009(E)	84.5	28.7	8.1	9.6	28.2	33.9

(E) Estimate
Source: SAMA, IEA

different forms and change form over time. Others characterize OPEC as a "loosely co-operating oligopoly" (Adelman, 1995). According to this viewpoint, OPEC has tended to move between two different modes of operation. The first is a "full cartel" mode, in which all members operate together to change output so as to control a

share of the market. The second is a "residual supplier" mode, in which only certain key producers take responsibility for controlling the market price by playing a "balance wheel role."

The history of OPEC from 2000 to 2004 seems to confirm both modes of operation. The period 2000–2003 was characterized by OPEC's greater determination to stick to agreed-upon production quotas, while in 2004 and again in 2008, Saudi Arabia acted as the price "balancing wheel" by producing more oil to counteract higher oil prices, which touched over $147 per barrel in June 2008.

For OPEC to operate like a cartel and control prices, a number of conditions must be met (Johany, 1982). These are summarized in Table 8.5, where it is clear that OPEC does not meet a "full cartel" characterization.

Table 8.5 Cartel characteristics and OPEC: A score sheet

Characteristic	OPEC reality	Comment
• Small number of members	• Meets the condition	• Members vary from smaller producers (Qatar 500,000 b/d to Saudi Arabia 11.5 million b/d)
• Secret price cuts observable	• Does not meet	• Difficult to monitor "discounts"
• Offending members subject to punishment	• Does not meet	• Voluntary membership in OPEC
• Entry barriers must exist	• Does not meet	• Other oil producers enter the market outside OPEC
• Market demand and cost conditions stable	• Does not meet	• Cost conditions change with technological advances outside OPEC's control

If OPEC wished to expand its market share, theoretically it should not have any problem based on its oil reserves. While OPEC's share of the world's output is under 40% as seen earlier, this becomes less significant when compared with the size of the reserves of OPEC member countries in relation to the rest of the world.

What is of interest is that OPEC does have a sustainable production capacity of around 36.4 million barrels per day compared to current production levels of 28 million barrels per day as illustrated earlier in Table 8.4. OPEC's sustainable production capacity and spare capacity is set out in Table 8.6.

Clearly, OPEC nations in general are using their proven reserves much less intensively than other countries that are producing the 60% of world output from 25% world reserves. Some suggest that these OPEC output restraints are meant to maintain "cartel-like" high oil prices, rather than reflect a lack of "need" for revenue or a conservationist concern about future energy supplies (Mettale, 1987, Gelb et al., 1998). However, this is another generalization, for different OPEC members have different needs and some smaller OPEC members exhibit higher production-to-reserves ratios than others. While Iraq's current production is around 2.6 million bpd, there were reports that Iraq was aiming to produce 10 million bpd by 2020, adding significant capacity to OPEC production.

Table 8.6 OPEC crude production sustainable production capacity and spare capacity (2009)

mb/d*	Sustainable production capacity	Spare capacity vs. supply	OPEC quota
Saudi	*12.5*	*4.4*	*8.01*
Nigeria	2.6	0.7	1.7
UAE	2.85	0.56	2.23
Kuwait	2.65	0.38	2.22
Iran	4	0.35	3.33
Libya	1.77	0.22	1.47
Angola	2.1	0.19	1.5
Venezuela	2.4	0.16	2.01
Algeria	1.4	0.16	1.2
Iraq	2.6	0.13	N/A
Qatar	0.9	0.12	0.73
Ecuador	0.5	0.04	0.43
Total	36.37	7.11	24.83
GCC	19.0	5.46	13.19
GCC % of total	52	73	53

*Million barrels per day
Source: IEA, December 2009

Saudi Oil Policy

The Kingdom has never expressed a single unified policy statement regarding its crude oil. This is probably wise, given the complex and changing external issues affecting world oil markets (Ali Sheikh, 1976, Mettale, 1987). What has been noticeable however in 2009 and 2010 is Saudi Arabia becoming more explicit about what was considered to be a "fair" price for oil in the international markets at $70–75 levels, first announced by King Abdullah and then reiterated by Oil Minister Ali Al Naemi. This explicit price statement has had a significant impact on market sentiment as will be discussed later.

Table 8.7 sets out Saudi Arabia's *implicit* and *explicit* oil policy objectives as announced by the relevant authorities in the Kingdom.

The information in Table 8.7 confirms that, overall, Saudi oil policy has been a relative success. The primary concern, however, has been to ensure oil prices which provide the Kingdom with "sufficient" income to meet its revenue needs. As discussed in earlier chapters, with the exception of a few years during which oil prices were driven higher than budgeted, the Kingdom had run persistent budget deficits, which were only reversed in the period 2003–2008 but then fell back to a deficit. Of greater concern is the fact that, despite record oil prices of $45–50 per barrel during 2004 and $147 in 2008 in *real terms*, the purchasing power of the Kingdom's oil prices has fallen due to inflation and depreciation of the dollar's value. The historical decline in the real value of Saudi oil export prices has not been fully compensated by recent higher world oil prices, as illustrated in Fig. 8.6.

Table 8.7 Implicit and explicit Saudi oil policy objectives

Policy objectives	Observations
• Reasonable oil prices which give producer sufficient income	(a) OPEC price band of $22–28 per barrel has been maintained until 2003/2004 when it overshot the range, and again in 2008 when prices reached $147 per barrel and then fell to $40. The Kingdom called for a price range of $70–75 pb in 2009 as a "reasonable" level for consumers and producers (b) In real terms, the price of oil exports per barrel has fallen sharply
• Sufficient supplies to satisfy market needs at all times, including maintenance of excess capacity	(a) Achieved to a large extent; Saudi Arabia increased output to 11 million b/d in 2004 to meet world demand and 9.5 mb/d in 2008 and expanded capacity to 12.5 mbd
• High level of cooperation among oil producers	(a) Achieved to a large extent during the period 2000–2004, and 2008/2009 including non-OPEC members such as Russia, Norway and Mexico
• Close communication with oil-consuming nations	(a) Achieved to a large extent with dialogue at highest national levels
• Recognition that oil is important to the health of the world economy	(a) High oil prices can cause rise in inflation, restrict economic growth and cause political damage in oil-consuming nations (b) Saudi Arabia argues for conciliatory approach in OPEC
• Commitment to protect the environment	(a) Kingdom applying latest world environment protection standards
• Maintaining a robust oil industry ready and able to supply future energy needs	(a) Saudi Aramco investing in future capacity and new energy fields both onshore and offshore and committing around $190 billion in new investments over the period 1998–2012
• Stability and predictability in the oil market to ensure Saudi and global economic growth	(a) Saudi Arabia's investment plans are known as they involve large number of foreign oil service companies in exploration and drilling. Oil production is used to smooth market forces as exemplified by Saudi 300,000 bpd increase in 2008 to meet global needs
• Promoting concept of "reciprocal security" among producers and consumers	(a) Consumers are assured of a steady and uninterrupted supply of oil at reasonable market prices and producers to be given open and free access to markets without discriminatory taxation against oil

As can be seen from Fig. 8.6, it was only over the period 2004–2008 that the average real price of North Sea Brent oil rose to reach the level of 1980 and partly compensated oil producers for the losses incurred in the purchasing power of their dollar revenues.

Although there was some marginal gains in terms of trade for the US dollar, the impact of the dollar's depreciation on the real value of OPEC's export earnings are

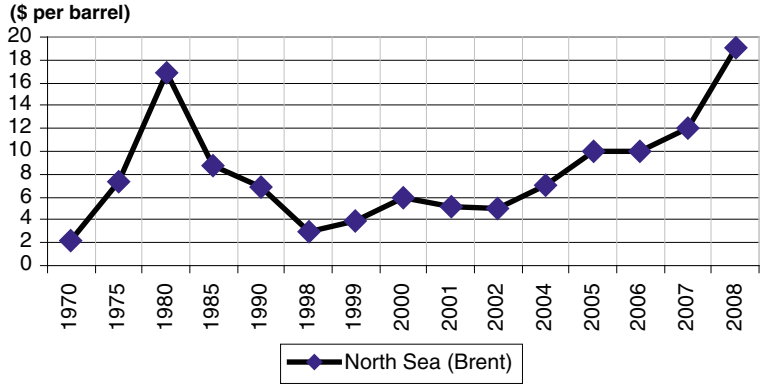

Fig. 8.6 Real oil prices (base year: 1970) (1970–2008) (Source: SAMA)

evident as illustrated in Fig. 8.6. This has caused the issue of pricing oil in US dollars or alternative currencies to be subject of debate (Alsahlawi, 2009), although Saudi official policy has been adamant about remaining pegged to the US dollar and continuing to denominate oil export revenues in dollars (SAMA, 2008). Despite Saudi Arabia's adamance on this matter, other non-Middle East and Middle East OPEC members, such as Venezuela and Iran, have discussed the issue of whether to continue pricing oil in US dollars, as several factors seem to be at work in determining oil prices and dollar movements. These include inflation, the dynamics of oil supply and demand, the role of OPEC in setting oil prices (especially during the l970s and 1980s), capital flows and the development of the oil futures markets. Yet, the interaction among those factors cannot be ignored and might offset each other. For example a dollar depreciation is going to reduce the oil price in domestic currencies – if those currencies are not pegged to the dollar – and to increase their demand for oil, which contributes eventually to a long-run rise in oil prices.

This process would be operated by the dynamics of oil demand and supply through price and income elasticities. Furthermore, dollar depreciation will increase inflation and decrease the purchasing power of oil-exporting countries that are linked to the dollar, and oil supply will decline as a result of reductions in investments in exploration and production because of lack of required capital. However, it is found empirically that oil prices are affected by inflation more than by the movements in the value of the dollar (Dailami, 1982, Alsahlawi, 1995, Beck and Kamps, 2009). On the other hand, the demand and supply of oil are influenced by the price, world economic growth, the institutional framework and geopolitical risks in the oil-exporting areas. Another important development that reshaped the oil market and complicated the dollar and oil price relationship is the emergence of the futures market for oil since the early 1980s (Bassan Fattouh, 2010).

Considerable debate remains over the impact of financial sector "investors" on oil prices. The analysis of recently released disaggregated oil trading data from the US Commodities Futures Trading Commission (CFTC) is not conclusive, but has been

used by some to argue that such activity has a major bearing on price developments, especially the spike in mid-2008. Certainly there appears to be a consensus that prices during 2009 have been considerably buoyed by investment in the oil futures markets and OPEC has argued that a major component of high oil prices was due to financial investor speculation.

Pricing oil in US dollars is a key element in supporting the value of the dollar and, ultimately, US economic and political power. However, the current (2009) US fiscal debt and its high government budget deficit, along with the global financial crisis, have raised some doubts about the sustainability of the US dollar as an international reserve currency although the 2010 euro crisis provided some relief for the dollar.

The alternatives have varied from pricing oil in a basket of currencies, such as SDRs, to euro pricing as a potential world currency. The decision to change or not to change the dollar-dominated pricing depends, to a large extent, on strategic implications and trade relations, which indicate that the United States remains a major oil importer and, moreover, a special political alliance with key OPEC oil states in the Middle East, especially Saudi Arabia. Furthermore, the decision to move away from the dollar will have an impact on the foreign assets of oil exporters, which are denominated in US dollars as we have analysed earlier. Recognition of the historical and functional relationship between oil price and the dollar will not lessen the direct trade and capital impacts of such a relationship. Any pricing scheme of a single currency or dual currencies or a basket of currencies based on trading patterns necessarily will need to assess the importance of the traded crude and of the future value and distribution of foreign assets.

Dilemma of High and Low Prices

OPEC and Saudi Arabia face dilemmas in facing both high and low oil prices as follows:

(a) higher oil prices creates a dilemma: should they defend higher oil prices with no growth in production volumes or revenues year after year, or
(b) should they let prices drop to discourage non-OPEC oil production in order to capture a larger market share for future years?

Both options have negative revenue implications for Saudi Arabia. Defending higher oil prices means gradually increasing government deficit in the long run, while non-OPEC producers benefit from higher prices and continue to produce more oil, potentially causing a market share loss for the Kingdom. The second option might bring substantial short-term revenue shortfalls and growing deficits, in the hope of capturing a higher market share and greater future revenues.

In the face of new production realities from non-members, OPEC decided to shift its strategy from strict price fixing, which could not be defended without massive "production balancing wheel" scarifies by countries such as Saudi Arabia, to an

OPEC strategy of quantity fixing and trying to defend a wider price band (Oweiss, 1990, Parra, 2004, Cordesman, 2003). OPEC members have bitterly complained that high oil prices were the result of forces other than supply and demand, and of new players in the oil market that had not been a factor only a decade earlier. The developing countries' nationalization of oil resources at the upstream stage – the production or recovery stage – meant that the "oil majors" who had controlled such upstream production no longer controlled large volumes of petroleum within vertically integrated channels, from production to refining to distribution. The oil majors were transformed into major buyers of oil, and an active spot and forward commodities market was developed by oil brokers.

By the 1990s, the spot and futures oil market accounted for over 60% of oil sales, compared with less than 5% in the 1960s (Parra, 2004, Oweiss, 1996). These new market players were reactive to day-to-day variations in demand and supply, supported or exaggerated by real events or rumours in the market. Figure 8.7 provides a snapshot at how oil prices have performed over a short period of time from 2002 to 2010, rising from $20–25 levels to $140, before falling to $30 levels in 2009, and becoming steady again at the $70–75 per barrel.

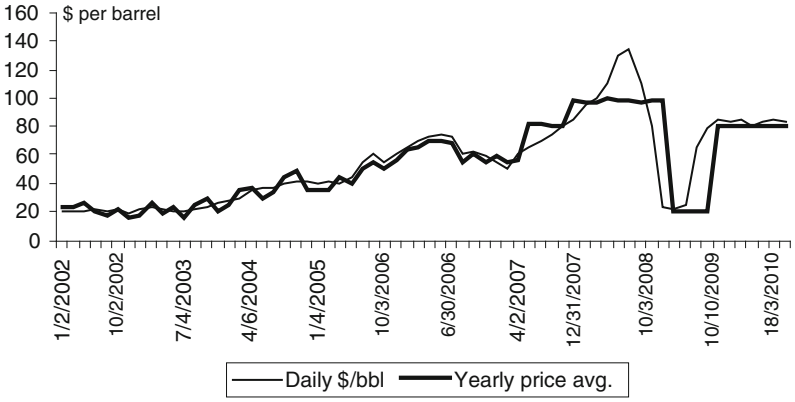

Fig. 8.7 OPEC reference basket price 2002–2010 (Source: Bloomberg)

The relative price stability around the $70–75 range has been somewhat remarkable, as it represented a new paradigm recognition of the global nature of energy security and growing interdependence between various stakeholders – consumers and producers, both of whom seemed to accept King Abdullah's proposition that the $70–75 range for oil was a "fair price" that met the following objective:

- oil consumers focusing on *reliable* and *affordable* supply and
- oil producers focusing on stable and *remunerative* markets.

The new emerging consensus on what is deemed to be a "fair price" for both producers and consumers may undercut the economic asymmetry between the two groups evidenced in the past and translated into the erratic oil price movements

illustrated in Fig. 8.6. Until 2009, explicit oil prices ranges or targets have not been announced; rather implicit targets have caused tensions between the two groups.

Empirical evidence suggests that oil consumers are differently affected by higher oil prices and have different coping potentials. This may explain why, as a group, they have been intentionally vague about their price preferences. In contrast, and as examined further below, the producers have been forthcoming in revealing their own preferences, following Saudi Arabia's statement on what constitutes an acceptable price. This is probably due to their relative economic similarities and disproportionate vulnerability to international oil prices.

Table 8.8 explores these differences between consumers' and producers' coping potentials.

Table 8.8 IEA and OPEC macroeconomic coping potentials on similar oil price ranges

2008 estimates		IEA countries	OPEC countries	Saudi Arabia
Average oil prices ($/bbl)	($/bbl)	97.19 cif	94.45 fob	
Share of energy imports in total energy	%	20.5	1.4	0.3
Share of energy exports in total exports	%	10.1	84.5	95.9
Share of energy trade in GDP	%	6.8	43.7	63.5
Share of petroleum taxes in budget revenues	%	7.1	72.3	89.7

Source: APICORP Research (2009)

At the heart of the economic asymmetry between producers and consumers are several macroeconomic anomalies related to the structures of trade, GDP and budget receipt, which is explored in Table 8.8. In the International Energy Agency (IEA) countries, for instance, energy imports represented about 21% of total imports in 2008, and energy trade (both imports and exports) represented some 7% of aggregate GDP. By stark contrast, in OPEC countries, petroleum exports (crude oil, oil products, natural gas and NGLs) represented about 85% of total exports and petroleum trade represented some 44% of aggregate GDP. Similarly, despite the fact that the IEA countries get much more revenues from taxing final petroleum consumption than OPEC countries get from taxing primary production, the share of these respective revenues in total budget resources was 7% for the IEA and 72% for OPEC. For Saudi Arabia, the impact was much higher than the average for OPEC on petroleum revenues and share of energy in total exports and share of energy trade in GDP.

Looking forward, it is more than likely that Saudi Arabia will continue with its current oil-pricing strategy within OPEC, while at the same time trying to ensure that new production capacity is added to the oil industry, through using the latest technology and lowering costs. Saudi Arabia unquestionably has always had very low *recovery costs*, at $0.30 per barrel in the 1960s to between $1.80 and $2.80 a barrel in the 1990s (Johany, 1986, Cordesman, 2003) and around $8–15 for current

new fields. This gives the Kingdom a comparatively large advantage over other high-cost oil producers. Industry experts attribute this advantage to the high pressure of oil wells in Saudi Arabia, which eliminates the need for pumps to bring oil to the surface, as well as to the high production "flow" rate of these wells. By way of comparison, fewer than 1,500 wells in Saudi Arabia yield current production levels of 8.2 million barrels per day, in contrast to a US production of 6.4 million barrels per day from around 590,000 wells (IEA, 2008).

In the long term, relatively "fair" oil prices are needed to compensate oil producers in real terms for their current production. It is to its credit that Saudi Arabia continues to invest billions of dollars to expand capacity in today's dollar's real terms, to produce oil that will give them less and less in future real oil prices. "High" oil prices are needed to sustain the massive level of future investments needed to develop existing and new oil reserves. Global figures of $900 billion are said to be needed by 2013 to develop existing fields, and some estimates reach levels of $250 billion a year that need to be spent by 2030 for exploration and production costs. Producer countries are faced by volatile oil prices, large population growth and managing expectations – all of which adds pressure on their fiscal position in the long term. "High" oil prices might affect the developing countries in the short run, but in the long term both they and the advanced economies will learn to conserve on energy costs.

Over time, the energy consumption-to-GDP ratios of advanced countries have reduced due to energy efficiency. While they stood at around 15% levels during the l970s, they are now in the range of 7%. At the same time, the per capita income of most of the industrialized countries is more than that during the 1970s. Even the Chinese are expected to follow the pattern of the OECD, as their industries become energy-conscious. Who will bear the future costs of investment in the energy industry? This is where interdependence and partnerships between National Oil companies (NOCs) and International Oil Companies (IOCs) will become more important. Already the oil producers of the Middle East are allowing the IOCs more exploration concessions in return for joint venture investment partnerships.

The oil producers are also having to face up to the growing environmental pressures to utilize more "environmental friendly" energy sources, and there has been a perceptible reduction in the share of oil in total energy consumption worldwide as illustrated in Table 8.9.

Table 8.9 Share of oil in total energy consumption (%)

	1985	1995	2003	2006	2008
World	*37.9*	*39.8*	*37.2*	*35.8*	*34.8*
OECD	42.8	43.0	41.1	40.7	39.6
USA	40.2	39.0	39.7	40.4	36.5
Japan	55.1	54.6	49.3	45.2	43.7
Russia	32.5	23.4	19.0	18.2	18.2
China	13.8	19.3	22.1	20.6	18.8

Source: SAMA

The combination of more energy efficiency use and alternative energy utilization to oil is also of some concern, especially to countries such as Saudi Arabia, which is undertaking substantial long-term capital investment in oil capacity expansion. The issue of alternative energy and its potential impact on Saudi Arabia is discussed later on in this chapter.

Oil and Saudi GDP Contribution

The oil and energy sector is still a significant contributor to the Saudi GDP as illustrated in Table 8.10, which sets out a snapshot of key energy indicators.

Table 8.10 Saudi Arabia: Hydrocarbon sector indicators (1972–2008)

Index	1972	1982	1992	2002	2008
• Oil production (Million barrels)	2,201	2,366	3,049	2,588	3,366
• Oil exports (Million barrels)	1,992	2,058	2,408	1,928	2,672
• Oil revenues (SR billion)	13.4	186.0	128.8	166.1	983.3
• World export market share (%)	2.6	4.7	3.25	2.57	4.2
• Refined production (Million barrels)	222	310	541	582	722
• Refined export (Million barrels)	208	195	473	362	386.3
• Natural gas liquids (Million barrels)	19.8	156.7	227.7	292.4	402.2
• Nominal oil prices ($/barrel)	3.61	33.42	19.33	25.03	97.3
• Real oil prices (at 1970 prices $/barrel)	3.28	12.19	4.79	4.93	16.69
• GDP at current prices (SR billion)	38.3	524.2	510.4	705.8	1,758.0
• Oil sector GDP at current prices (SR billion)	22.4	254.7	199.8	261.8	1,001.7

Source: SAMA

The oil sector contributes on average around 40% of Saudi GDP, but this rose sharply to around 55% in 2008 due to exceptionally strong oil prices as seen in Table 8.10. Non-oil GDP growth has been on a steady increase since 1982/1983 and the Saudi government is encouraging this trend, but oil revenue and oil-related products continue to be the major source of government revenue. What has been noticeable though is the increased capacity for refined oil products, which more than tripled from 222 million barrels in 1972 to over 720 million barrels in 2008. The amount of natural gas liquids (NGLs) has also risen sharply, as will be discussed later.

While the composition of the Saudi GDP was changing over time, so too were the trading links of Saudi Arabia's petroleum and other energy export sectors. Today, the Far East, South East Asia and emerging economies of Africa are the prime customers of Saudi petroleum products, as Fig. 8.8 demonstrates.

It is interesting to note from Fig. 8.8 how few refined products are imported by European and US markets from Saudi Arabia, with around 9% of total exports in this category. The existence of domestic petrochemical refining industries in Europe and the USA coupled with accusations of "unfair" or low-priced Saudi feedstock inputs has ensured that Saudi Arabia seeks alternative markets in the Far East. China is fast becoming a major trading partner for Saudi Arabia. As Fig. 8.9 shows, China today

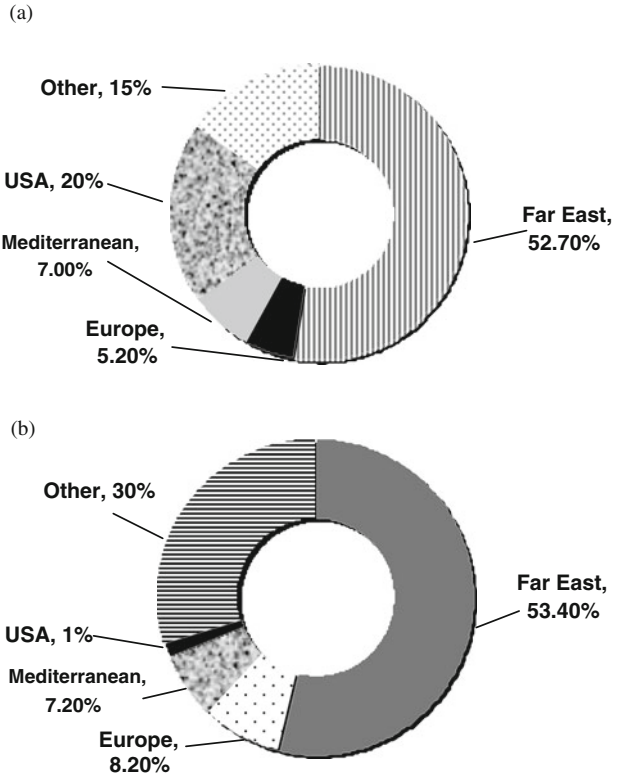

Fig. 8.8 Saudi petroleum and other hydrocarbon exports by destination (2008): (**a**) crude oil; (**b**) refined products (Source: Aramco)

is the third largest importer of oil, after the USA and Japan. Chinese economic growth rates of around 7–9% p.a. over the past few years have kept commodity prices – including oil – relatively high in the face of weaker European and US economic growth rates during 2003/2004 and the global economic crisis of 2008/2009.

Figure 8.9 shows the falls experienced in some countries worst affected by the global economic and financial crisis of 2008/2009, namely the USA, Europe, Japan and South Korea to some extent. The worsening oil market demand has hinged on the hope that China's demand will offset any slowdown elsewhere, but even China's growth forecast for 2010 is minimal at around 50,000 barrels per day according to IEA forecasts.

The disproportionate energy consumption of the USA, relative to its population size, together with the expected depletion of domestic oil reserves in around 11 years at current production levels, highlights future problems for the USA. Identifying and securing a stable source of oil is paramount for the USA, as is the search for alternative fuel sources. Saudi exports of oil to the USA account for around a quarter of all

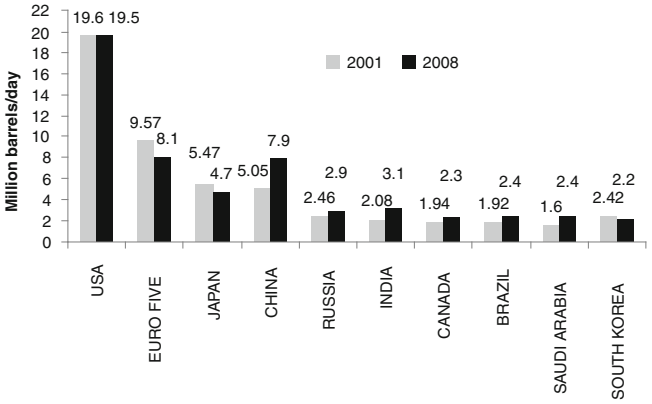

Fig. 8.9 Top ten oil-consuming countries (Million barrels/day), 2001, 2008 (Source: SAMA, Saudi Aramco)

daily US oil imports and underlines the close economic and strategic relationship between the two countries in terms of energy policies.

What is interesting from Fig. 8.9 is that Saudi Arabia has become a major oil-consuming nation, with an average 2.4 million barrels used in domestic consumption. An increased population, a speeding up of domestic projects' hydrocarbon and non-hydrocarbon base as well as a continued subsidy on refined gasoline has led to this increased demand, which is consuming around 30% of total Saudi daily oil production and diverting this production output to domestic as opposed for export revenue generation. At some stage, Saudi Arabia has to reconsider its domestic subsidy policy on gasoline and other consumer fuels, but given the high level of inflation seen in the Kingdom during 2007 and 2008, there is little likelihood that a substantial increase in domestic gasoline prices will be introduced by the government.

Maintaining the Far East Pricing Premium

The Far East energy market is not only becoming a larger volume player, but is also a more profitable one for Middle East producers.

It is not generally known that different regions of the world have different pricing formulas for the same crude oil exports. Saudi Arabia adopted "formula pricing" since the late 1980s, which involves the use of three indices for sales of Saudi and other Middle East oil to various regions around the world. These indices or "markers" are as follows:

- West Texas Intermediate (WTI) as a benchmark for sales to the North American markets (until November 2009), thereafter ASCI or Argus Sour Crude Index.
- IPE Brent crude prices for sales to Europe.
- Dubai and Oman averages for sale to the Asian markets.

The selling price formula is then calculated applying a discount or premium to the price of the "marker" indexes. The cost of freight is an essential element in the calculation of the final pricing. Currently the Saudi market prices the different regions through the following formulas:

European market = IPE Brent – Discount
American market = WTI–Discount (from November 2009 ASCI–discount)
Asian market = Average Oman/Dubai + Premium

This explains the steady growth in sales of Saudi crude to the Far East as it enjoys a premium, while sales to the European and US markets suffer a discount to the "marker price." Further, Russia's proximity to the European market has ensured that Russian oil export strategy in the short term will concentrate on obtaining a greater European market share at the expense of Middle East producers. In the long term, Russia could also pose a potential competitive threat to Saudi's Far East oil exports, as Russian oil companies are planning to commission different pipeline systems through Central Asian and Far East countries to reach the main Chinese and Japanese markets. Should this be successfully completed, the current Saudi Arabian premium on Far East sales could be eroded. Given the logistics of building these pipelines, crossing many different nations, it could take the Russians some time. The main worry for Saudi Arabia in the short term is further loss in the already-discounted European market.

In November 2009, Saudi Arabia announced its decision to switch away from West Texas Intermediate (WTI), the key US benchmark oil blend that is traded at the New York Mercantile Exchange (NYMEX) futures exchanges as US Light Sweet Crude, to Argus Sour Crude Index or ASCI, a price index of Gulf of Mexico crudes published by Argus (Aramco, 2009). The reasons were many, but seem to be based on the fact that Saudi crude exports to the USA have been declining, and that Saudi physical crude is not actually traded on the NYMEX, but carried out separately through contracts between countries and oil companies, and Saudi Arabia had based its North America prices on the WTI index. The Kingdom had been voicing its concern for a number of years that global oil prices are not properly reflected. Of more significance, Saudi Arabia wanted oil to be treated as a tangible and physical commodity reacting to fundamental demand and supply forces and not a paper product or index for financial traders in the USA hedging against a weak US dollar as highlighted earlier in this chapter. The new Argus ASCI is based on a weighted average of actual prices paid for three crudes pumped out of the Gulf of Mexico – Mars, Poseidon and Southern Green Canyon – and these are primarily "sour" or high sulphur crudes, more like Saudi Aramco's Arab light, and thus a better price match. Venezuela has indicated that it might follow Saudi Arabia's move to switch to ASCI.

The Saudi decision to drop WTI was one sign of the consequences of the global financial and economic turmoil of 2008/2009.

It is also a sign that after years of dominance of the established oil benchmarks – the WTI in the Americas, Brent in Europe and Africa and Dubai and Oman in Asia

– changes are now on the horizon. The backing of the world's biggest oil exporter gave new clout to the ASCI benchmark, and to the Mexican Gulf Coast market where the oil tracked in the Argus index is delivered.

Aramco's move may also well be an indication that further changes in the world's oil benchmarks, and indeed in the overall crude markets, could well be in the offing. A potentially more critical yardstick change is likely to take place in East Asia. Virtually all crude sold from the Middle East Asian markets, including China, is benchmarked from two Middle East crudes: Dubai and Oman. The Argus and Oman benchmarks also bring some diversity to the oil market by tracking sour crude.

Some have argued that one possible non-dollar oil-pricing alternative is crude benchmarking with indexes other than WTI, as this is denominated in US dollars only (Noreng, 2006, Samii et al., 2004). For example Brent is more traded in Europe and Africa or through the London International Petroleum Exchange (IPE). Brent offers pricing information alternatively in Euros based on the physical trading of oil by spot or futures. Dubai crude also can be the price marker in Japanese yen for the Middle East and Asia. On the other hand, OPEC's reference basket of crudes could be an oil-pricing benchmark, even though WTI and Brent affect its price. The current basket, introduced in June 2005, is composed of 12 crudes: Algeria's Sahara blend, AngoIas Girassol, Ecuador's Oriente, Iran's heavy, Iraq's Basra light, Kuwait's export, Libya's Es Sider, Nigeria's Bonny light, Qatar's Marine, Saudi Arabia's Arab light, United Arab Emirate's Murban and Venezuela's Merey. However, a currency mix reflects the currencies of these crudes, some of which are dollar-pegged, but it might be considered suitable if the mix would satisfy the internationalization, stability and neutrality requirements for any designed oil-pricing currency. The Saudi Arabia move has certainly caused many to consider long-term non-dollar oil-pricing alternatives that reflect more truly the physical output and actual market demand.

A New Energy Star: The Gas Sector

The Kingdom's gas sector made the headlines during 2003 and 2004, first for the announcement of the cancellation of major gas projects and then for the signing of replacements with new partners of choice. As noted earlier, Saudi Arabia has the world's fourth largest gas reserves of around 263 trillion cubic feet and is also a significant exporter of natural gas liquids (NGLs). Figure 8.10 illustrates the top ten largest gas reserve countries as of 2008.

Unlike nearby Qatar, whose gas is mostly "non-associated" – extracted without producing oil – roughly two thirds of Saudi Arabia's proven gas reserves consist of "associated" gas, mainly from the onshore *Ghawar* field and offshore *Safaniya* and *Zuluf* fields. Most of Saudi Arabia's natural gas was flared or burned off, when oil was produced prior to the start-up of the Kingdom's master gas system, which was completed in 1982. This system cost some $13 billion and was created to meet domestic demand and to provide most of the 0.7 million barrels per day of NGL. By

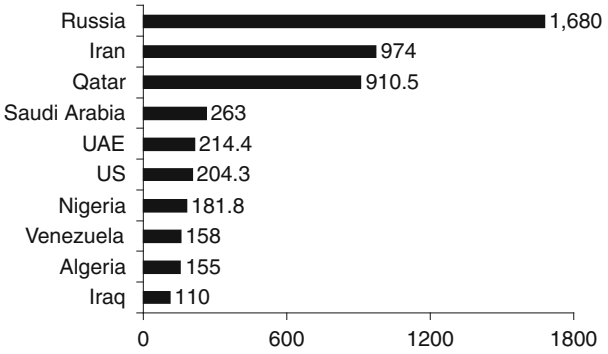

Fig. 8.10 Natural gas reserves (trillions of cubic feet) in top 10 countries (2008) (Source: Saudi Aramco)

all accounts, gas production has done much to meet domestic energy needs and to reduce domestic demand for oil, which is easier and more economical to export than liquefied natural gas. Gas requires large onshore investments for gas liquefaction and then it requires transportation in specialized container vessels. Domestic oil consumption is not insignificant, and accounted for around 25% of total Saudi oil production in 2002 as seen earlier in Table 8.9.

Foreign Interest in Gas Projects

Unlike crude oil production, the Kingdom of Saudi Arabia signalled its intention early on to invite foreign companies to participate in the development of its large gas sector. In 2000, ten International Oil Companies (IOCs) noted their interest in participating in the ambitious plan to develop upstream gas and processing facilities. Plans for three integrated gas projects were submitted by the Saudi government: the *Haradh* gas development project, the *Rabigh* integrated refinery and petrochemical projects and the *Kidan* and *Shaybah* gas development projects. Saudi Aramco was to be a partner in all three projects. In May 2001, Saudi Arabia selected a mix of eight IOCs to participate in the huge $25 billion "Saudi gas initiative," as it was to be called. This Saudi gas initiative was to develop an *integrated* gas sector comprising upstream gas development (production), with "downstream" (processing) petrochemicals, power generation and desalination plants. The IOCs involved in the bidding were the elite of the energy industry, including Exxon Mobil, Royal Dutch Shell, BP and Conoco Phillips. It is useful to closely examine the major factors that drove the great gas initiative, as well as the reasons for the breakdown of discussions with the initial group of IOCs.

First, the initiative was launched during a time when oil prices were falling, sharply reducing Saudi oil revenues. The need for outside investment was probably felt more severely than during a period of higher oil prices, such as the years

2003 and 2004. The IOCs probably sensed this earlier Saudi need and held out for more concessions in terms of a larger gas acreage.

Second, it is not always true that foreign investors will bring a cheaper source of capital to Saudi Arabia. Saudi Arabia can still borrow on relatively good terms in its own name, as the reaffirmation of its long-term credit rating of AA by Standard & Poor's in 2009 confirms. Moreover, there is no guarantee that a foreign IOC will pass on the full benefit of such cheaper international borrowing to Saudi Arabia; in fact, it might add an additional country risk premium for carrying out Saudi projects.

Third, some argued that foreign companies would transfer appropriate technology to Saudi Arabia. This is not a convincing argument (Mabro, 2002, Cordesman, 2003). There is no technology for upstream development that Saudi Aramco does not possess or is unable to acquire from sources other than IOCs. The irony is that, by their own admission, IOCs are *not* specialists in power generation or water desalination plants, which were one of the key components of the "great gas initiative."

Fourth, the management aspects of these large integrated projects were put forward as justification for IOC participation. There is some merit to this argument, if an IOC itself was to handle all the integrated components through upstream development and transmission infrastructure, as well as constructing and running plants of different sizes for final users of gas. As it stands, this challenge can probably not be met with the present resources of Saudi Aramco. However, the alternative is to break the project into smaller parts and subcontract to industry specialists, with Saudi Aramco retaining overall project management control.

In the final analysis, what the IOCs were really seeking was an involvement in Saudi Arabia's upstream *oil* industry and this clashed with Saudi Aramco's desire to remain in total control of this strategic sector (Mabro, 2002).

In short, the oil companies wanted an involvement in a sector that Saudi Arabia does not really want to grant, even if it agreed on some concessions, while Saudi Arabia wanted IOC investment in sectors which were not of real interest to the oil companies, even when they had expressed a conditional interest to do the job. There was no commonality of interest, so it was no surprise the talks broke down.

New Partners Step In

Given Saudi Arabia's energy position in the world, it was not surprising that other international oil companies would step in to replace the consortiums that withdrew. In March 2004, Saudi Oil Minister Ali Al Naimi announced the signing of gas exploration contracts with companies from Russia (Lukoil), China (China Petrochemical Company Sinopec), Italy (ENI) and Spain (Repsol YPF) (Hassan, 6 March 2003). Under the agreements, nearly 122,000 km^2 of land was assigned for gas exploration to these foreign companies. Saudi Aramco maintained a partnership in all the ventures planned, and held 20% of the stake in each of the three projects.

According to press reports, the contracts will run for a maximum of 40 years and are expected to generate around 35,000 additional high-value jobs for Saudis in this new energy sector. The entry of the Chinese into the Saudi hydrocarbon sector attracted much positive interest and seemed to further cement growing trade relations between the Kingdom and China. The Russian participation was also significant, as it may herald a closer relationship between the world's two largest oil producers, raising the possibility of joint ventures inside and outside the Kingdom. This was discussed during the historic visit of the then Crown Prince Abdullah to Russia, mentioned earlier, when the two countries signed a 5-year oil and natural gas agreement, which Russian officials said could lead to deals worth up to $25 billion (Saudi Press Agency, Reuters, 27 January 2004).

The strategic move towards the East seems to have paid off as Saudi Arabia currently exports nearly 46% of its natural gas liquids (NGLs) to the Far East as illustrated in Fig. 8.11, mirroring the crude oil sales to the Far East.

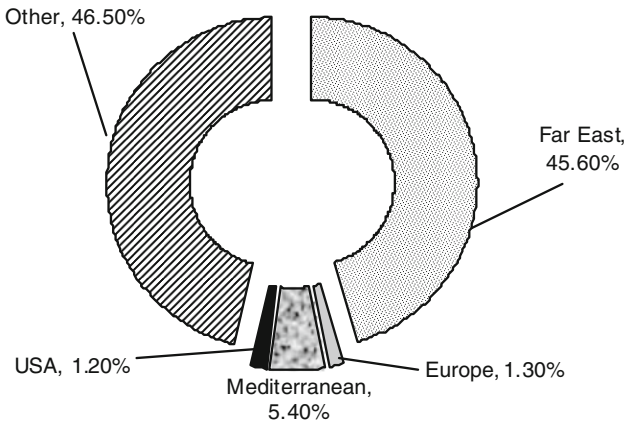

Fig. 8.11 Saudi natural gas liquid sales by region (2008) (Source: Aramco)

Outlook for Saudi Gas Sector

Saudi natural gas is processed to produce several types of feedstock. These range from clean fuel (methane or sales gas) to feedstock (methane, ethane, propane, butane and natural gasoline). Both methane and ethane are consumed entirely in the Kingdom's utilities and petrochemical industries and the excess propane, butane and natural gasoline (also known as natural gas liquids or NGLs) that are not used in Saudi petrochemical projects are exported as set out in Fig. 8.11. Saudi Aramco estimates that the Kingdom's demand for gas will continue to grow at around 5% per year given the Kingdom's ongoing industrial diversification programme, as well as generating electricity, fuel gas and feedstocks for petrochemicals, desalination and supporting oil and gas operations. Aramco's plan calls for increasing gas processing capacity to 12.5 billion standard cubic feet per day (SCFD) from 9.3 billion SCFD.

The expansion will come from the following operations:

- *Hawiyah* NGL Recovery Plant – capacity to process 4 billion SCFD of sales gas to yield 310,000 NGL bpd.
- *Khursaniyah* Gas Plant – processing capacity of 1 billion SCFD of associated gas.
- *Hawiyah* Gas Plant – 800 million SCFD of non-associated gas additional raising capacity to 2.4 billion SCFD.
- *Karan* Gas Field – Saudi Arabia's first non-associated offshore gas field with projected output of 1.8 billion SCFD by 2012.

These developments in the Saudi gas sector augur well for the Kingdom, as not only does it allow for energy diversification so as to compete with other gas producers, but also it enables entry into the more environmentally friendly energy sector which gas represents.

Petrochemicals: Adding Value

Only a couple of decades ago, Saudi Arabia seemed a most unlikely location for a major industrialization drive. The great "oil shocks" of the mid-1970s opened up vast new opportunities for the Kingdom's planners to deploy large revenue sources for industrial and economic diversification and to move away from being a primary energy supplier. Industrialization, especially in hydrocarbon energy-related industries where Saudi Arabia enjoys comparative cost advantages, remains at the heart of Saudi development plans and strategies. The earlier emphasis on state ownership and expenditure might be giving way, in the new millennium, to public–private partnerships or pure private sector initiatives, but the petrochemical sector remains one of the more promising ones for the future.

Petrochemicals are certainly making their impact felt worldwide. The scope of products manufactured from petrochemicals is broad, ranging from insulators, cable wraps, sockets, tires, plastic and rubber parts, to everyday items such as home furnishings, bedsheets, typewriters, ribbons, book covers, clothes, soap and detergents. The modern world's mass consumption of goods would be greatly hindered without the final output of the petrochemical industries.

Today, Saudi Arabia is home to 21 large, modern petrochemical complexes located in the two industrial cities of *Jubail* (on the eastern coast of Saudi Arabia) and *Yanbu* (on the western coast). Eighteen of these complexes are owned by affiliates of the Saudi Basic Industries Corporation (SABIC). The remaining three are private sector joint ventures with international companies such as Shell and Exxon Mobil. Of the eighteen SABIC petrochemical affiliates, two are wholly owned by SABIC, five are SABIC partnership with Saudi private investors and the remaining eleven complexes are joint ventures with international companies. *Jubail* hosts fourteen of the SABIC-owned complexes, three are in *Yanbu* and one is in *Dammam*

in the Eastern Province. The engineering projects to transform the desert to their current status have been on a monumental scale. As an illustration, some 270 million cubic meters of earth was moved to prepare the *Jubail* site alone, which is enough to build a road around the world at the equator 1 m deep by 7 m wide (Royal Commission for Jubail and Yanbu, 2004).

In 2002, the then Crown Prince Abdullah bin Abdulaziz inaugurated the cornerstone for further expansion of a second industrial city at *Jubail* at a cost of SR 131 billion. It is forecasted to employ an additional 55,000, mostly Saudi, workers.

Such petrochemical-based industries create an economic multiplier effect in the Saudi economy. The value chain travels down further rather being exported as natural gas liquids. The associated business opportunities and range of products touch all aspects of modern life ranging from cans, bottles, plastic bags, household goods, toiletries and cosmetics to consumer electronics.

Alongside upstream oil and gas production, the Saudi petrochemical sector was the single largest industrial sector contributor to the Kingdom's GDP, especially in the years when oil prices rallied to new record highs as in 2008. Due to the high correlation of basic petrochemical products such as ethylene prices with oil and natural gas prices, Saudi petrochemicals stand to gain when oil prices rise and this is also reflected in the value of the shares of petrochemicals companies listed on the Saudi TASI *TADAWUL* stock market index. There are 13 listed petrochemical companies on the TASI index with a weighting of about 20% of the total index and the petrochemical sector is the second most important sector in the index in terms of weight. This compares to their combined market capitalization representing about a quarter of the index market capitalization. The 13 listed companies generated close to SR 187 billion ($50 billion) in revenues and a combined market capitalization of around SR 240 billion ($64 billion) in 2009.

The basis of this profitability lies in feedstock advantage for Saudi petrochemical producers. Primary feedstock for manufacturing of petrochemical products is oil and naphtha derivative and natural gas. During a process called "cracking," the feedstock is transformed into so-called olefins and aromatics which are at the core of the petrochemical industry. "Olefins" include products such as ethylene, which represents around 40% of the global petrochemical volume, propylene and butylenes, while "aromatics" are made of benzene, toluene and xylene. Both the olefins and aromatics are then processed to produce the plastics, detergents, synthetic rubber and synthetic fibres that consumers are familiar with.

The capability of the Saudi petrochemical companies to achieve a higher profit margin than their European, US or Asian competitors gives them a global competitive advantage, which is supported by new and substantial capacity expansion programmes. This provides an impetus to expand on a larger global market share as Table 8.11 illustrates for the 2007 installed ethylene capacity and estimated 2012 capacity.

Such a competitive advantage and a healthy profit margin have enabled Saudi Arabia to venture abroad and acquire other petrochemical companies not only to expand geographical market penetration but also to acquire new technology and R&D processes. The acquisition of Dutch group DSM, Huntsman and GE Plastics

Table 8.11 Saudi installed and planned ethylene capacity and global market share (2007, 2012)

	2007	2012 (Forecast)
• Saudi Ethylene Capacity (Mtpa) (Million ton per annum)	7.4	19.7
• Global Ethylene Capacity (Mtpa)	122.9	174.2
• *Saudi Market Share (%)*	*6.0*	*11.3*

Source: SABIC

(both of the USA) are such examples of international acquisitions by SABIC. By 2008, Saudi petrochemical output represented around 55% of the total output of the Middle East North Africa (MENA) region, with SABIC output representing around 85% of the Saudi output and the rest coming from private sector petrochemical companies such as Sahara Petrochemical Company and Saudi International Petrochemical Company (Sipchem).

Not to be outdone by SABIC, Saudi Aramco has also entered the petrochemical high-value supply chain and commissioned the giant "Petro Rabigh" joint venture with Sumitomo Chemical Company of Japan, and marked a first for Saudi Aramco when it listed Petro Rabigh on the Saudi *TADAWUL* Stock exchange by raising SR 4.6 billion ($1.223 billion), with the offering three times oversubscribed. The second Saudi Aramco petrochemical venture is the "Ras Tanura Integrated Project" joint venture with Dow Chemical company, completed in 2008, with an initial public offering also contemplated for the project.

Generating Secondary Industries

Of more long-term importance to the Kingdom is SABIC's ability to promote a second-generation industrial linkage with the rest of the Saudi private sector. To some extent this has been successful, for there are currently 12 secondary industries and 115 light and supporting industries serving the SABIC complexes. Some have argued for more labour-intensive industries, such as textiles and clothing, besides traditional plastics (Wilson, 2004). The emphasis on secondary industries will grow with the completion of the second *Jubail* industrial city, where plans for smaller, more labour-intensive projects are being developed. However, given Saudi labour costs, which tend to be higher than foreign labour, enterprises that might be established must try to achieve comparative cost competitiveness in the international market. This is due to the close proximity and competitively priced feedstock of gas and oil products to Saudi industries. It is no coincidence that the *Jubail* industrial city is located very close to its primary source of energy input in the Eastern Province of the Kingdom, thus reducing the cost of transportation of its feedstock. It is this availability of low-cost feedstock, along with excellent infrastructure support and low utility costs in the industrial cities of *Jubail* and *Yanbu*, that has attracted international joint venture partners to Saudi Arabia's petrochemical industries. The

Saudi government has also extended attractive financing facilities through the Saudi Industrial Development Fund (SIDF) to joint venture operations at low rates. The degree of interest, both Saudi and international, in developing the industrial sector is a far cry from the earlier days of basic industry infrastructure, when it was observed that "no private investors are financially capable of undertaking such basic industries" (Johany, 1986). There were also doubts about the profitability of the hydrocarbon-related basic industries as discussed earlier. Today, petrochemicals make a sizeable contribution to the Saudi GDP.

The results of the Saudi petrochemical industries have been impressive over such a short period of time; today they account for around 10% of the world's total petrochemical output and about 8% of global exports. In composition, about 52% of Saudi petrochemicals are in basic products, 26% in intermediates and 22% in final products. Saudi Arabia is aware that it needs to diversify its production line into a broader mix, preferably in intermediate and final products.

Future Challenges

SABIC success has made it a natural target for domestic and international investment, and the commercial track record could make any further government sales of its share in SABIC an assured success. The Saudi government has already announced that it plans to reduce its current ownership in SABIC from 75 to 25% through sales to the Saudi public. The initial government sale of 25% to the public in 1987 was a success in terms of investor confidence and of market acceptance of such partial privatization moves. However, there are several challenges facing SABIC in the future.

First, SABIC and all those entering the petrochemical sector have to ensure that their future feedstock demand is met. The availability of cheap feedstock derived from gas and NGL will be a main preoccupation for Saudi Aramco, which might have difficulty in meeting supply commitments for the upcoming new projects. Increased production of gas, particularly non-associated gas, is crucial for the petrochemical industry's future prospects and puts into perspective the recent international gas deals signed by the Kingdom. The two go together.

Further, Saudi Arabia had to prepare itself for WTO entry and strategize around how that affects the petrochemical sector. While it was argued that WTO accession for Saudi Arabia could provide greater market access and improved trade security, some members of the WTO, particularly those in the European Union (EU), are likely to resist *Saudi petrochemical* exports to the EU, arguing that Saudi Arabia affords an unfair competitive advantage to its petrochemical industries through cheap or subsidized feedstock. The Kingdom is aware of these issues and is committed to removing subsidies on its feedstock prices. During 2002, the price of feedstock was raised from $0.5 one million British thermal units (MMBTU) to $0.75 MMBTU; that brought Saudi domestic prices into line with others in the Gulf Cooperation Council. However, the problem lies in the domestic market, where

there is a large differential in liquefied petroleum gas (LPG), sold at a nearly 30% discount on international prices. This appears to be in conflict with WTO rules, although Saudi Arabia has now successfully concluded its bilateral trade agreement with the EU.

Another factor is the relative inefficiency of the system for marketing SABIC products. Despite great advances made in this regard over the years, the primary approach seems to have been built around the hope that SABIC's foreign joint venture partners would assure market access to the joint venture products in their home countries. Unfortunately, with the exception of the Japanese and Taiwanese markets, this approach has been disappointing. To address the situation, SABIC is now pursuing a policy of direct sales and of establishing a manufacturing presence in its primary markets or through acquisitions to strengthen its marketing presence as illustrated earlier.

In order to sustain the long-term success of the petrochemical industries, SABIC must remain at the cutting edge of petrochemical research. To achieve this, there needs to be growth in the internal dynamics of SABIC, especially with regard to qualified human resources and to building the internal research and development capability. The establishment of advanced R&D facilities in the Kingdom and in SABIC's Houston-based operations, along with associations with the Kingdom's leading science-based universities, is a step in the right direction.

The Mining Sector: A Hidden Gem

After being assigned a low priority in both government planning and public expenditure in the 1970s and 1980s compared with the hydrocarbon sector, the Saudi mining industry now has a more prominent place in the Kingdom's strategy to diversify its economic base, as evidenced by the privatization of the state-owned mining company *Maaden* in 2008. Following privatization, *Maaden* will be restructured into separate units of gold, phosphate, bauxite, aluminium and minerals.

In terms of its long-term strategic goals, *Maaden* aspires to be a premier global producer and marketer of phosphate fertilizers and has established joint ventures with SABIC in Saudi Arabia to develop the phosphate reserves of the Kingdom's Northern Borders to produce 3 million tons of phosphate fertilizers. *Maaden* is also expanding its aluminium production capability to utilize Saudi Arabia's bauxite to produce aluminium for local and international markets and has established a joint venture with Alcoa, the world leader in the production and management of primary aluminium, with Alcoa taking a 40% stake in 2009, although later reduced to 25.1% in 2010. Table 8.12 illustrates the wide range of mineral ores that are extracted in Saudi Arabia, besides precious metals.

According to *Maaden*, there is an extensive discovery programme for gold and there is an estimated 8 million ounces and confirmed reserves of 2 million ounces of gold in the five previous mines that it owns. The company is planning to raise its gold reserves to 10 million ounces by 2010 (*Maaden,* 2009).

Table 8.12 Saudi Arabia major mineral ore and precious metal extraction (2004–2008)

Types of exploited ores ('000 tons)	2004	2006	2008
(A)			
Limestone	31,000	30,500	35,000
Mud	4,000	3,800	4,000
Salt	1,430	1,752	1,600
Silica sand	592	782	900
Crusher materials (pebbles)	156,000	217,000	248,000
Sand	33,000	34,000	26,000
Iron sands	495	584	642
Gypsum	2,553	2,200	2,300
Marble for industrial purposes	680	810	832
Marble masses	83	85	85
Granite masses	716	962	1,100
Limestone masses	409	308	308
Kaolin	2	4	44
Barite	15	23	30
Feldspar	42	42	73
Basalt	43	53	–
Boslan	277	400	784
Dolomite	532	550	465
Shiest	663	722	608
(B) Precious metals			
Gold ('000 ounces)	265.8	166.6	146.0
Silver ('000 ounces)	466.0	411.2	265.0
Copper (tons)	652.0	730.0	1465.0
Zinc (tons)	–	983.0	3,663.0
Lead (tons)	–	–	347.0
Kaolin (tons)	–	–	22.0

Source: *Maaden*, SAMA

It may come as a surprise that Saudi Arabia is home to a wide and rich resource base of mineral deposits – the largest in the Gulf region.

The Saudi Arabian government, through its privatization of *Maaden*, is moving away from the old policy of mere mineral extraction to a policy aimed at creating a well-integrated mining industry over the next two decades. Some of the Saudi mining industry's current operating framework has been reassessed, however, to bring industry policies in line with international practices (Marboli, 2002, Dabbagh, 2002).

The legal framework has been addressed. The current framework under which the Saudi mining industry operates was established more than 30 years ago with comparatively little expenditure in the mining sector – a total of around SR 9 billion over all these years. Expenditures were mostly for basic surveys, exploration activities, laboratories and basic infrastructure support. The level of government attention did not encourage either domestic or international mining company investment in the mining sector, with local Saudi company participation confined to providing building material, crushers and quarry supplies.

The government concluded that, in order to open up the mining sector, it needed to carry out the following steps:

- Modernize the *mining code*
- Formulate a Saudi geological survey
- Formulate a comprehensive strategy for the mining sector
- Construct a railway network

During 2001, the Ministry of Petroleum and Minerals started discussions with the Ministry of Finance about reviewing the mining code. It forwarded the code to the Council of Ministers for ratification. The Saudi cabinet approved the new mineral investment law in September 2004 (Saudi Press Agency, 14 September 2004). The key point of the mining code ratification was ensuring that the Kingdom was competitive with other international mining investment regimes. According to Article 14 of the Saudi Basic Governing Law, all resources that lay under or over the ground within the perimeter of the land or offshore of the Kingdom belong to the State. The problem for the mining industry in Saudi Arabia is how to reconcile this with the international practice of "licensing concessions" to the private sector. The amendments before the Council of Ministers will allow for such licenses to be issued by the Ministry of Petroleum and Minerals.

The other major changes to be introduced by the new mining law included:

- All permits, licences and leases classified as "licences"
- Principle of "first come, first served" introduced
- Removal of requirements for technical and financial qualifications of exploration licences
- No limit to number of licences applied
- Introduction of the right to explore all minerals in the licensed area
- Requirement for advance payment removed
- Bank guarantees for exploration licences removed
- Exploration work programme replaced by mining exploration expenditure
- Investment incentives introduced
- Total tax liability not to exceed 25% of profits.

The above, once fully implemented, will supply a major boost to the Saudi mining industry, so that the government can achieve one of its desired objectives: to broaden the economic base of the country and create new employment opportunities through high-value jobs. It has been estimated from mining countries' experiences that for every dollar spent on mining, the net return is $8 to the national economy (Marboli, 2002). The establishment of a viable and integrated Saudi mining industry will also ease Saudi Arabia's *balance of payments*, as today the Kingdom *imports* around 5 million tonnes of raw minerals every year. Import substitution of these minerals could be effective if it is conducted on an economic, cost-efficient and scientific basis. These imports cost Saudi Arabia around SR 8–9 billion per annum (CDS, 2003). One key area that needs addressing, whether by the government or

through a public–private partnership, is the construction of an integrated railway network to service the diverse mineral-producing regions, and in 2008/2009 there was a major initiative taken in starting plans for a trans-Saudi rail network. It has been estimated that such a network will cost around $1.5 billion over a 5-year period and bids from international companies, mostly Japanese, were submitted during 2002 and 2003, but finally signed in 2009.

Establishing a Model for Mining Cooperation

Foreign participation in the Saudi mining sector is considered essential due to the relative lack of experience in this field, in contrast to the petroleum sector where Saudi technical skills exist in all work areas. However, in order to attract foreign investment and concession sales, certain issues will need to be clarified. While the new mineral code law addresses many problems faced by the industry, there are other questions about the timing and process of obtaining mineral concessions, the Saudi government's right to a specified percentage of net profits, the State's rights to participate in private mines management and clarification of the exact role of joint venture equity policies.

Figure 8.12 sets out a model of mining cooperation between the private sector and the government and it incorporates many of the mining law's proposed changes.

Figure 8.12 sets out a vision for the future of mining in Saudi Arabia. There are already expressions of interest from countries with rich mining experience, such as Canada, Australia and South Africa, to become involved with Saudi Arabia's "hidden" treasures. In a couple of decades, mining could be playing a role in the Saudi economy like the one oil played two decades ago.

The Challenge of Alternative Energy

While many would agree that oil as a source of energy still has a substantial future as developing nations expand their economies, there is a growing debate concerning the use of alternative energy sources. Oil producers such as Saudi Arabia argue that more can be done to reduce the level of global greenhouse emissions through increasing oil use efficiency than through using renewable energy sources to conserve oil supplies. The Organization of Arab Petroleum Exporting Countries (OAPEC) has forecasted that by 2030 there will be a 40% increase in energy use, 70% of which would derive from oil fossil fuels, but renewable energy sources in the same period are expected to grow by 58%. OAPEC forecasts that although the share of oil in the energy mix would decrease from 34% in 2007 to 30% in 2030, in absolute terms oil would increase from 85 million barrels a day to 105 million barrels a day in the same period. The majority of increase would come from countries such as China and India, but can this type of assumption hold for the long term?

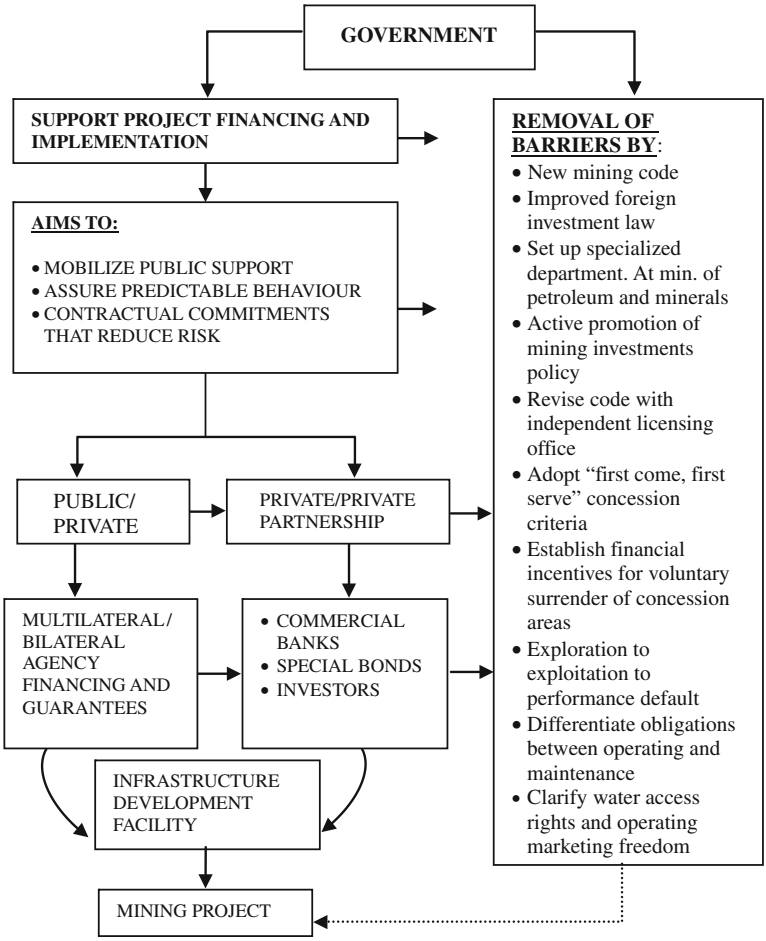

Fig. 8.12 Model for mining cooperation

Will the Chinese and Indian economies continue to grow at phenomenal rates year in, year out? Will their seemingly insatiable demand for oil keep growing at the same rate? Countries will, by necessity, become more energy-conscious, their industries will become more efficient and consumer demand for oil will follow other industrialized country patterns. As countries develop economically, the demand for oil decreases and energy from gas, electricity and piped gas increases. The demand for oil flattens, and China and India will follow the same path. This can bend current oil projections for both countries and cause a discontinuity in oil demand. Both countries could also follow OECD practices and raise energy taxes under a cloak of environmental necessity. Climatic change and ozone depletion could also put both governments under pressure to introduce oil demand management and seek non-oil energy sources such as nuclear fuel. Demand management could be given

Table 8.13 Share of alternative energy consumption in total energy consumption 1980–2008 (%)

Region/energy source	1985	2000	2005	2008
(A) Natural gas				
• *World*	*20.1*	*24.2*	*23.6*	*24.1*
• OECD	19.9	22.7	23.1	24.6
• USA	24.7	26.1	24.5	26.1
• Japan	9.9	13.3	13.6	16.6
• Russia	34.7	43.4	54.2	53.3
• China	1.8	2.9	2.6	3.6
(B) Coal				
• *World*	*30.7*	*23.6*	*27.8*	*29.2*
• OECD	22.5	20.9	21.0	21.3
• USA	24.6	24.6	24.4	24.6
• Japan	19.9	19.2	23.2	25.4
• Russia	26.3	16.7	16.6	17.2
• China	80.3	59.4	69.9	70.2
(C) Nuclear				
• *World*	*4.5*	*6.5*	*5.9*	*5.5*
• OECD	7.4	9.5	9.6	9.4
• USA	5.8	7.8	7.9	8.4
• Japan	9.2	14.0	12.7	11.2
• Russia	2.6	4.6	5.0	5.8
• China	0.0	0.5	0.8	0.8
(D) Hydrogen energy				
• *World*	*6.7*	*6.8*	*6.3*	*6.4*
• OECD	7.4	5.8	5.3	5.2
• USA	4.6	2.7	2.6	2.5
• Japan	6.0	4.5	3.8	3.1
• Russia	3.9	5.9	5.9	5.2
• China	4.1	7.2	5.6	6.6

Source: Aramco

further urgency by perceived oil supply security concerns from their Middle East suppliers, although Saudi Arabia has made it clear that it will honour any long-term commitments made.

There has been a perceptible shift towards alternative energy as illustrated in Table 8.13, and the shift has not been confined to one region of the world only, but seems widespread globally.

What is noticeable from Table 8.13 is the rise in nuclear energy despite the nuclear mishaps of Chernobyl in Russia and Three Mile Island in the USA and public opposition to nuclear energy sites. In 2010, the USA announced its intentions to open up its first new nuclear energy facilities since the 1970s and throughout the world nuclear energy has begun to take on more prominence, not least in the Middle East, which sees this energy sector as meeting domestic needs and releasing fossil oil for exports and revenue generation.

Solar energy is also another environment-friendly source and Gulf countries, including Saudi Arabia, are launching solar power initiatives. The Riyadh-based

King Abdulaziz City for Science and Technology (KACST) has begun building a desalination plant using solar power with a 10 MW capacity, and the newly established King Abdullah University of Science and Technology (KAUST) has established advanced solar energy research centres in collaboration with end-users such as Saline Water Conversion Company (SWCC) and the electricity authorities. Saudi Arabia's domestic energy demand is expected to grow to more than 60,000 MW by 2020 from around 40,000 MW current capacity. A strategic decision was taken through the establishment of the King Abdullah City for Atomic and Renewable Energy in 2010 to embark on a civilian nuclear programme.

Conclusion

The hydrocarbon and mineral industries will remain at the heart of the Saudi economy for a long time to come, despite diversification attempts into non-hydrocarbon areas. Saudi Arabia is blessed by an abundance of oil, gas and mineral resources and, with luck and far-sighted planning, it can position itself to become a major player in all three sectors. Economic cycles will mean that as demand for one diminishes, it will rise for the other. The Kingdom must also continue to pursue its current policy to add value, whenever possible, to its exploration of these raw resources, rather than settling with mere extraction and sale. The Kingdom has applied both vertical integration and horizontal integration and both need to be constantly reviewed and amended as circumstances change. The vertical integration has been the expansion of the petrochemical sector, which implies lower government fiscal revenues from oil but a more stable long-term revenue factor from the primary and secondary processing of petrochemicals and employment generation in subsidiary industries. The Saudi horizontal integration has centred around involving more industry clusters and increasing local content and transfer of technology. It is only through this economic approach that economic integration, diversity and skill-building can be achieved in order to shield the Kingdom from fluctuations in basic commodity prices.

Summary of Key Points

- *The petroleum sector has played a significant role in Saudi Arabia's economic development. Rising world oil prices and Saudi Arabia's response to meet world demand by increasing its output levels have once again demonstrated the Kingdom's importance as the world's leading oil supplier.*
- *Saudi oil policy attempts to meet national goals while taking into consideration consumers and environmental interests. At the same time, Saudi Arabia plays an important moderating influence within OPEC and tries to establish working relationships with non-OPEC oil producers.*
- *The oil sector currently contributes around 45% of GDP compared with 60% levels in the early 1970s. The majority of oil and oil products are currently*

exported to the Far East, with the North American and European markets next in importance.

- *Saudi Arabia has the world's fourth largest gas reserves and is the world's largest exporter of natural gas liquids (NGLs). Most Saudi gas is "associated" (gas-produced when oil is produced), but new "non-associated" gas fields are being developed with foreign partners.*
- *The petrochemical industries are located in the industrial cities of Jubail and Yanbu and Saudi Arabia is a major petrochemical producer accounting for around 10% of the world output. Plans are underway to expand the petrochemical production base through international acquisitions by SABIC and the establishment of secondary and support industries in Jubail and Yanbu. These are expected to be carried out by the private sector, be more labour-intensive and create value-added products and jobs for the Saudi market.*
- *The mining industry has a lot of future potential, as Saudi Arabia holds large quantities of mineral resources which have not yet been exploited. The passing of new mining laws, opening this sector to domestic and international investments, should enable further economic diversification to the economy.*
- *Alternative energy usage worldwide will create a challenge for Saudi Arabia's fossil oil exports, and the Kingdom is also trying to develop alternative energy sources such as solar and nuclear energy in order to conserve on its oil resources.*