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The Saudi Arabian Economy

Policies, Achievements and Challenges

Second Edition



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CHAPTER 8

THE ENERGY SECTOR

Overview

- Energy is a **vital input** to economic activity throughout the world. Oil and gas play a key role.
- Saudi Arabia is a dominant force in world oil, producing around 13% of the world's production, and 20% of global exports.
- Saudi Arabia **possesses around 25% of the world's oil reserves** (approximately 260 billion barrels) and has the fourth largest gas reserves.
- Saudi Arabia maintains **over 2 million barrels a day of spare oil capacity** to assist in world demand – the highest such spare capacity.
- The Saudi government is emphasizing **economic diversification**, which includes energy based manufacturing and exploitation of gas and mineral resources.

Oil economies characteristics

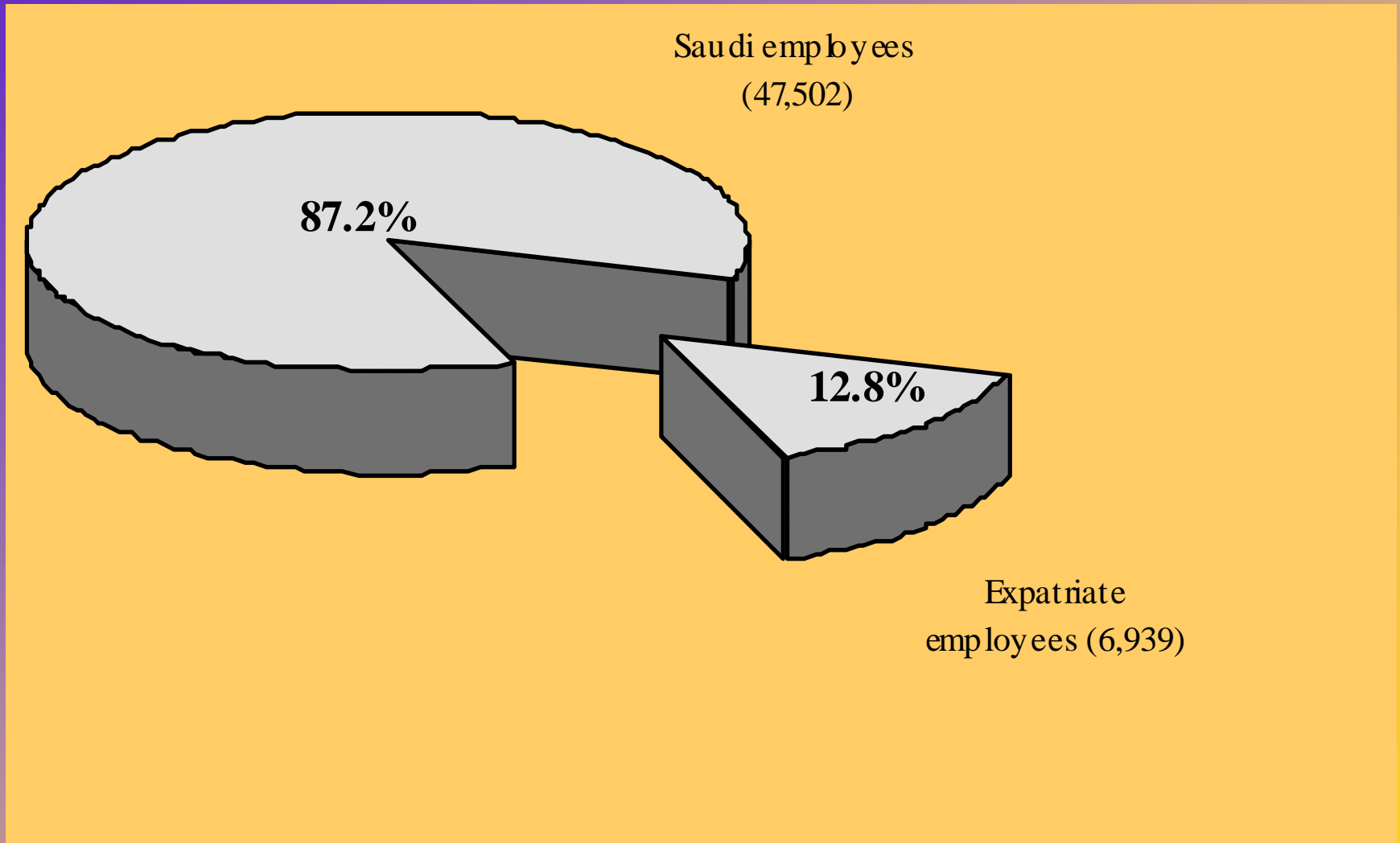
- Oil based economies such as Saudi Arabia face the problem of using the perceived growth-led effect of a modern oil sector to the **benefit of a non-oil traditional sector.**
- Oil though is **exhaustible and a non-renewable** resource that generates a flow of income at the cost of its own depletion, unlike manufacturing enclaves.
- As such, an effective oil based economy needs to translate the **linkages** of the oil sector from just extraction and sales into a value added chain.

The Saudi Petroleum Sector

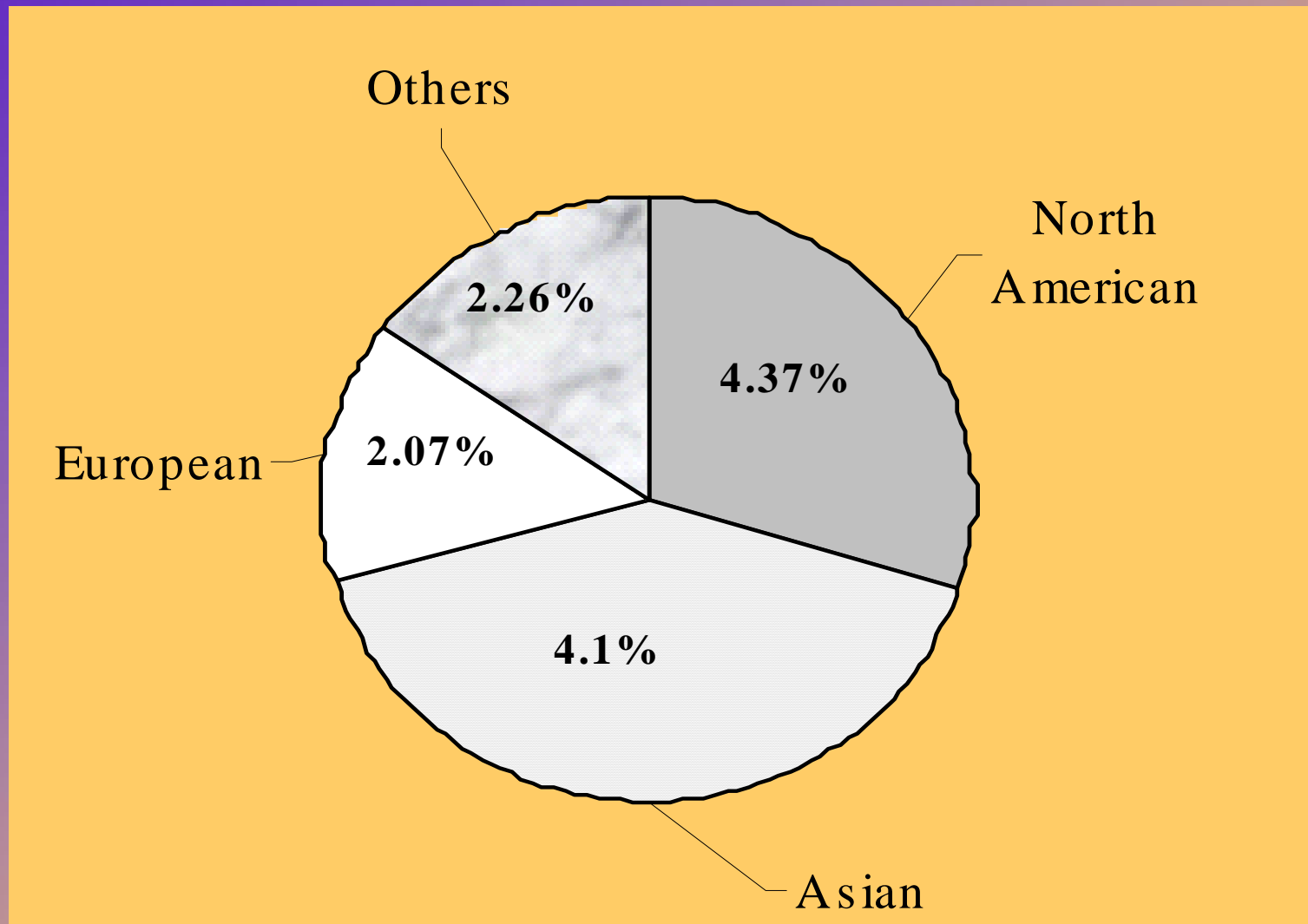
- Oil reserves are controlled by the State owned **Saudi Aramco Company**, the largest oil company in the world. Aramco is governed by a Board of Directors, that includes both Aramco and non-Aramco executives.
- Saudi Aramco claims many **favorable factors** such as massive reserves, low production costs (estimated at around \$ 2 per barrel), high production capacity, a skilled labor force with a high “**Saudization**” ratio of 87%.
- Skilled foreign workers are also a significant element of the estimated 55,000 employees as of 2008.

Figure 8.1 Saudi Aramco: Numbers of employees year-end 2008

(a) Saudi and expatriate employees



(b) Expatriates by major global regions

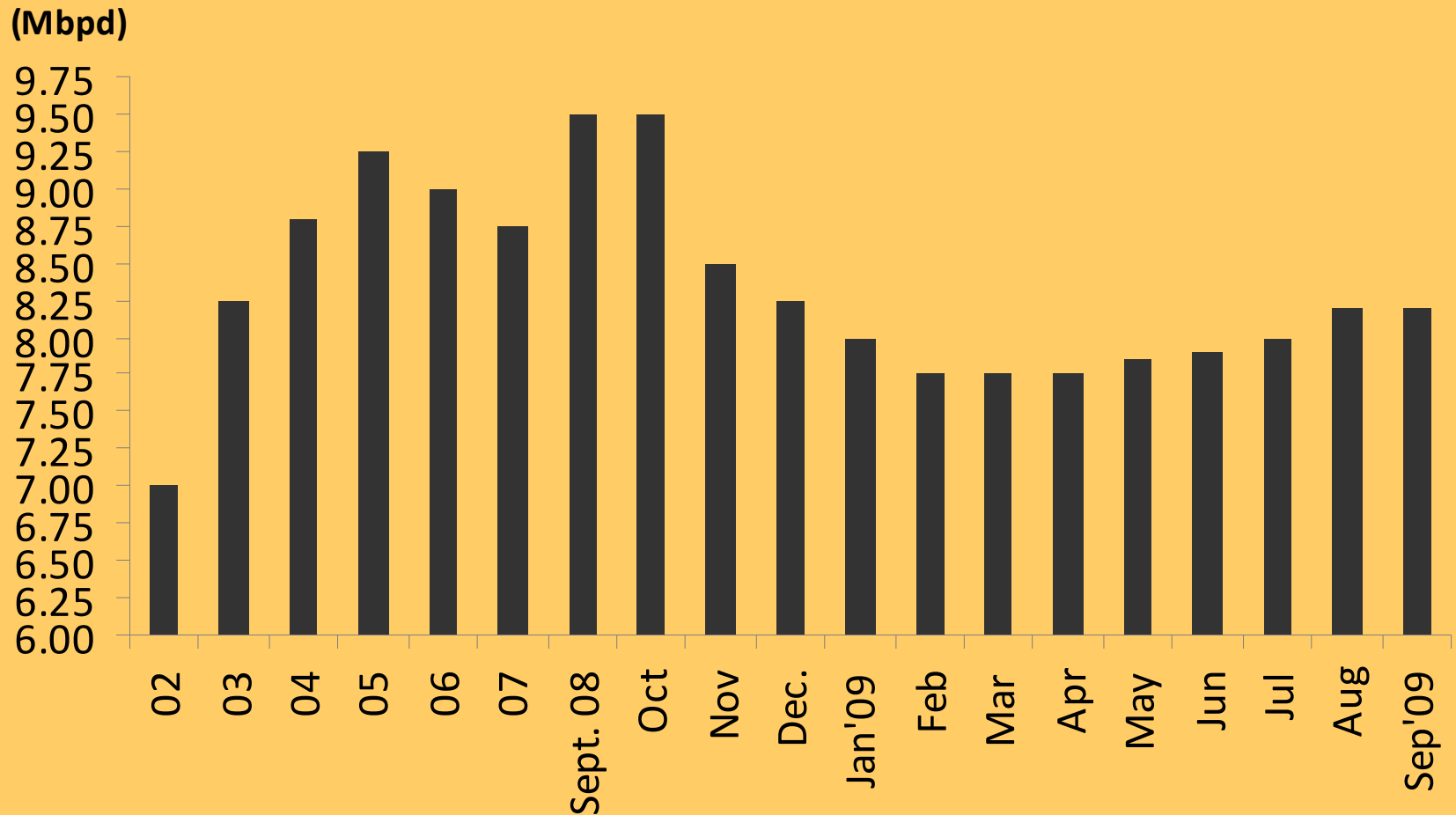


•Source: *Saudi Aramco*

Fluctuating Saudi crude oil production: a key problem

- **Oil production** has dropped to around 8.2 million barrels a day in 2010 ,compared with a peak of 9.5 million barrels a day during September and October 2008, when oil prices reached \$ 147 a barrel.
- Around two third of Saudi oil reserves are considered “light” or “extra-light” grades, commanding a higher pricing premium, with the rest either “medium” or “heavy”.
- Although Saudi Arabia has 80 oil and gas fields, more than **half** of its oil reserves are contained in eight fields including the giant **GHAWAR** the world’s largest oil field with estimated reserves of 70 billion barrels, and **SAFANIYAH** the world’s largest offshore oilfield with reserves of 35 billion barrels.

Figure 8.2 Saudi crude oil production 2002-2009

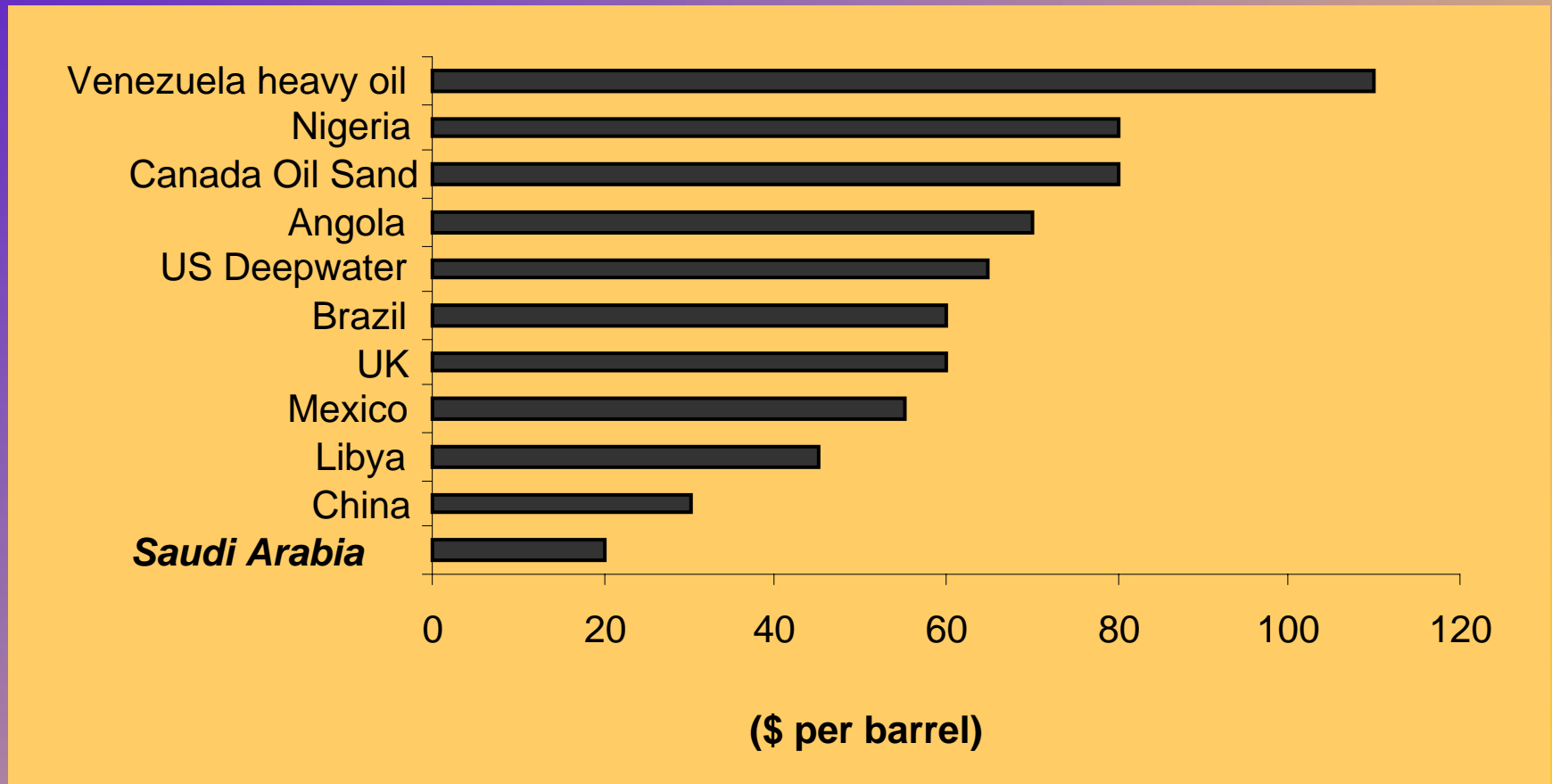


Source: Saudi Aramco

Saudi cost of production is a key advantage

- **Saudi Arabia and Iraq have the lowest cost of production amongst the major oil producers.**
- **This affects the cost of embarking on new oil projects, with Saudi Arabia's new oil project benchmark around \$20 per barrel, while Venezuela needing around \$ 114 per barrel to achieve break-even profitability for new projects.**

Figure 8.3 Minimum oil price benchmark needed for new oil project profitability. Selected oil producers.



Source: CERA

World oil reserves and demand and supply factors

- Despite issues of **oil reserve data transparency**, the Middle East region has by far the largest reserves to production ratios in the world of 90 years, compared with under 11 years for the USA, and 37 years for Latin America.
- The **reserves to production ratio (R/P)** is one measurement for estimating the **remaining life of oil reserves at current production rates**, and indicates when oil production is *peaking*.
- At present production levels, the R/P ratio for the world is **46** years and seemed to have increased from 33 years in 1970 due to technological advances and new oil field discoveries in current oil producers, and emerging new producers (eg. Chad, Sudan, Angola).

Table 8.1 World Reserve to Production ratio by Region, 1970-2007

<i>Region</i>	<i>Years</i>				
	<i>1970</i>	<i>1980</i>	<i>1990</i>	<i>2000</i>	<i>2007</i>
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
<i>Total World</i>	<i>32.9</i>	<i>30.2</i>	<i>45.4</i>	<i>45.2</i>	<i>46</i>

Source: *OPEC Annual Statistical Bulletin*, 2007.

Saudi Arabia, OPEC and a “fair” oil pricing policy

- The **Organization of Petroleum Exporting Countries (OPEC)** was established in 1960, and in 2009 accounted for around 33 million barrels of oil out of around 84 million barrels of world oil production.
- Major oil consumers are the **Organization for Economic Cooperation and Development (OECD)**, which includes the USA, who accounted for around 47 million barrels per day of total world demand in 2009 , while Asia’s demand was around 10 million barrels a day .
- China accounts for around 18% of the global energy demand and forecasted growth in demand is expected to come from **Asia, Latin America and the Middle East in 2010**, with other regions showing modest increases.

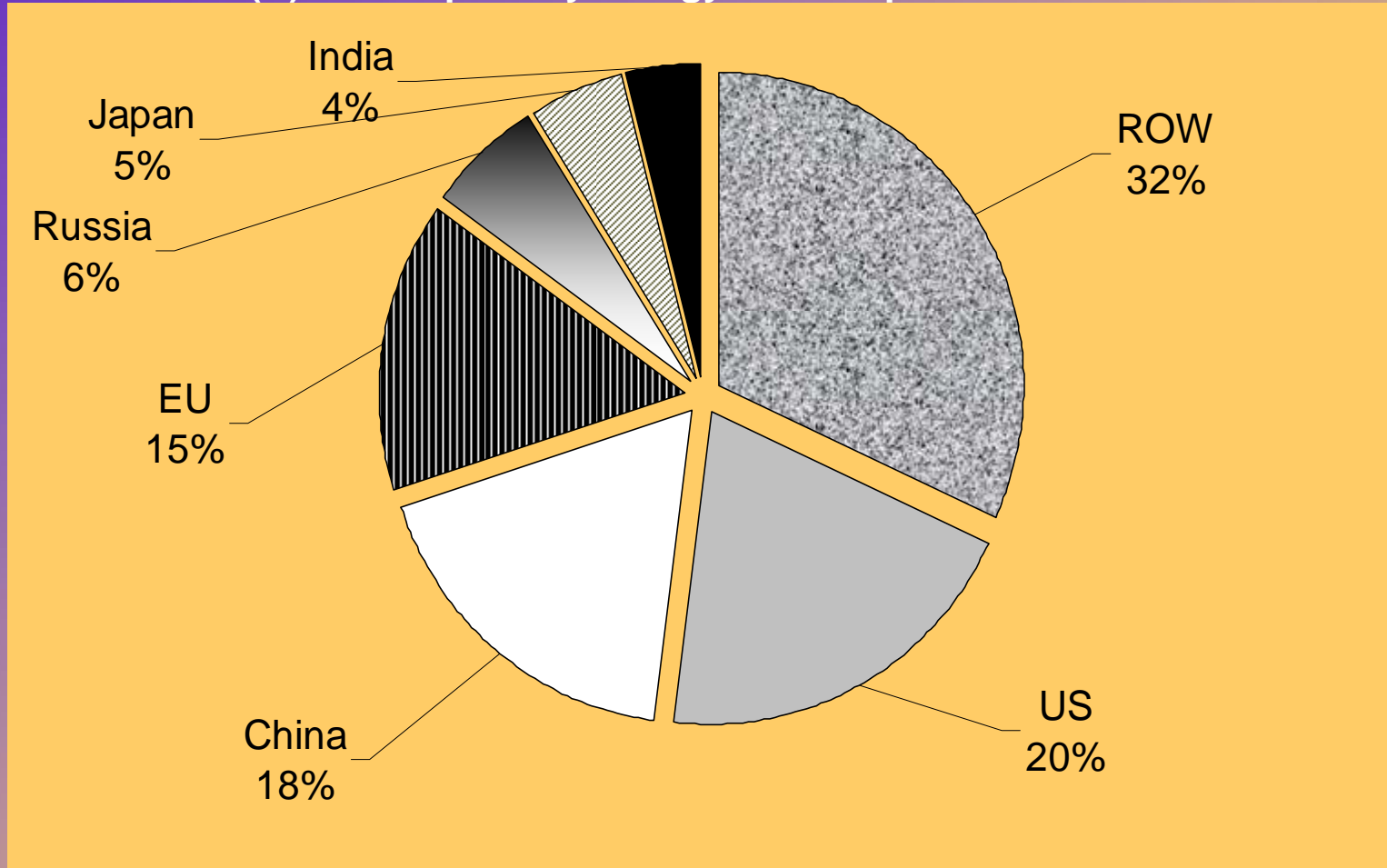
Table 8.2 Average world demand and supply of crude oil (2006-2009)

	(Million barrels per day)			
	2006	2007	2008	2009Q1
<u>(A) DEMAND</u>				
• 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
<u>(B) SUPPLY</u>				
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

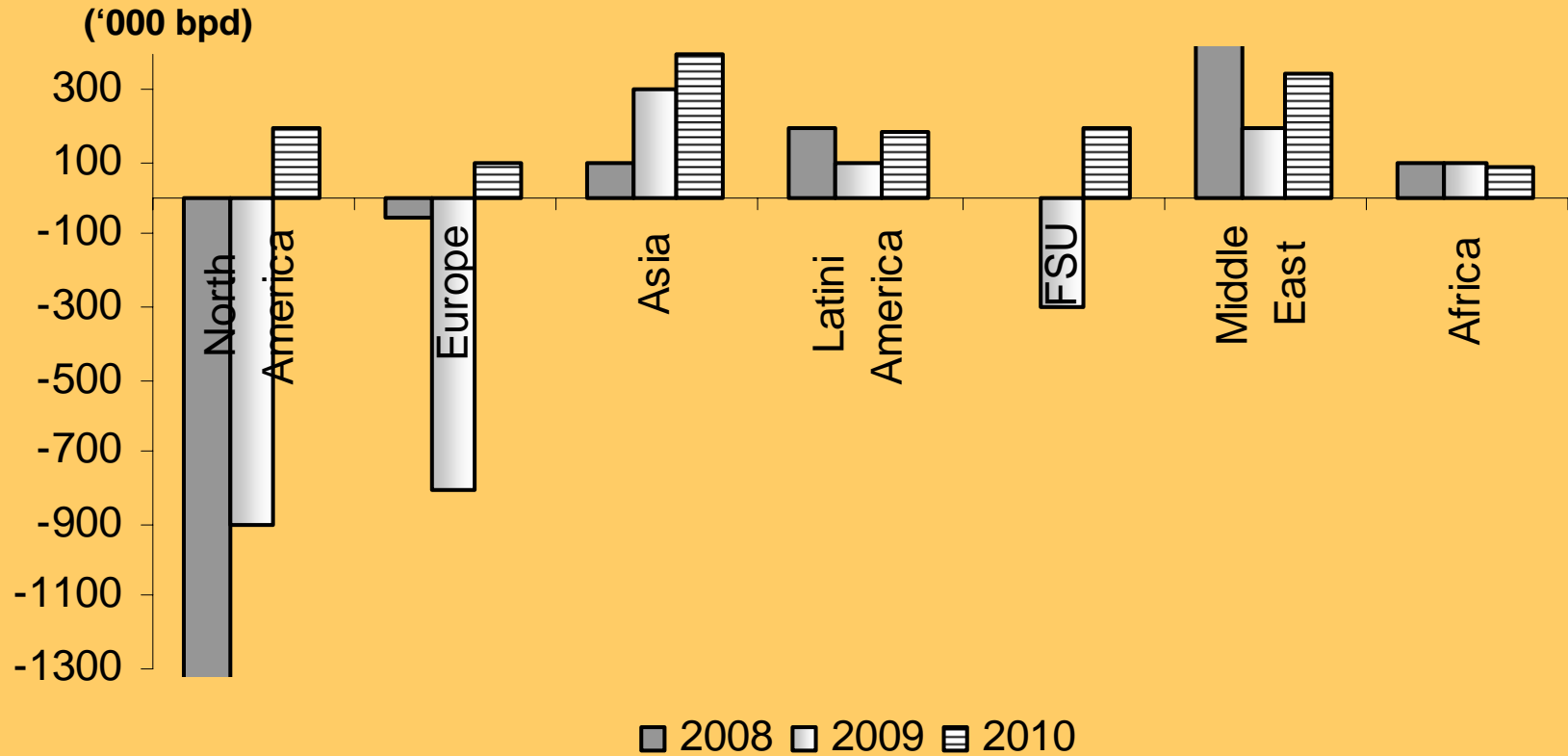
Figure 8.4 Global primary energy consumption by region 2008 and global demand growth forecast by region 2010

(A) Global primary energy consumption 2008



Source: BP

(B) Global demand growth



Source: IEA

“Peak” oil and world reserves

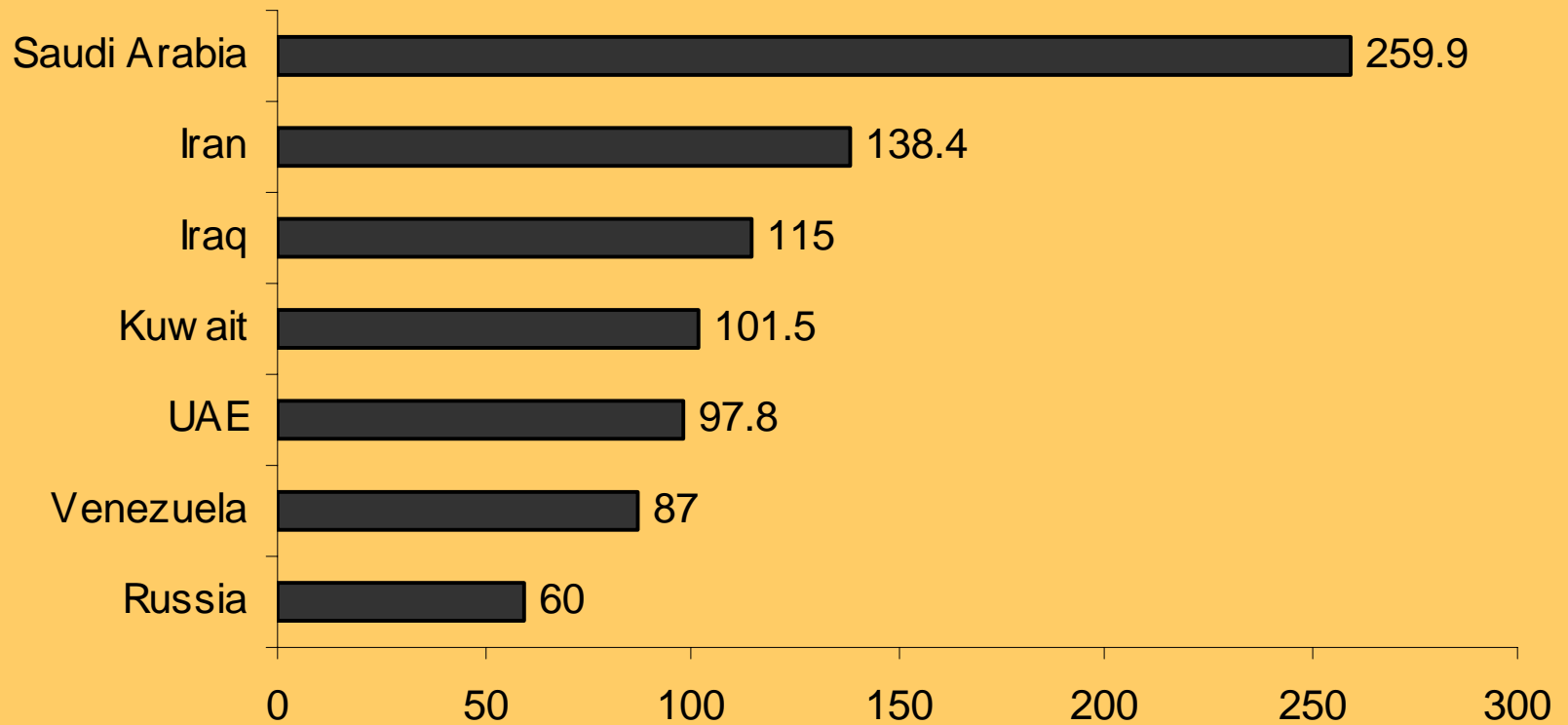
- Despite fears that the world is running out of oil and has reached a “**peak**” in **proven oil reserves**, the evidence is that estimated world reserves have been **increasing** over time.
- In 2008, the world’s **proven oil reserves stood at 1,024 billion barrels** compared with 548 billion barrels in 1970.
- The **Middle East accounts for 62%** or 741 billion barrels of oil compared, with 2% for North America.
- Of the seven largest oil reserve countries of the world, **Saudi Arabia ranks as the largest**, followed by Iran with 138 billion barrels of oil and Iraq at 115 billion. Venezuela has the sixth largest reserves of 87 billion barrels. These do not include the new mega offshore finds that could make **Venezuela** the second largest reserve country after Saudi Arabia.

**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*

**Figure 8.5 Conventional crude oil reserves (billion of barrels)
seven largest reserve countries. (January, 2009)**



Source: Saudi Aramco, Oil and Gas Journal.

Saudi production and OPEC

- Saudi **share** of world oil production has emerged at around 10% over recent years, compared with a low of 6% in mid-1980's.
- Saudi **share of OPEC production** has risen to around 28% compared with 20% in earlier periods.
- This is despite a reduction in OPEC's share of world production to around 34% levels for 2009, compared with 40% - 42% levels when oil prices rose sharply during 2006-2008 . OPEC has the **spare capacity** to produce more oil to meet increased world demand.
- The **global financial and credit crisis of 2008-2010** reduced economic growth in many countries, excluding China, India and Brazil, and hence accounted for a reduction in OPEC's share of world oil production.

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

<i>Year</i>	<i>World Production</i>	<i>OPEC Production</i>	<i>Saudi Production</i>	<i>Saudi Share of World</i>	<i>Saudi Share of OPEC</i>	<i>OPEC as % of world production</i>
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%

Source: SAMA, IEA.

(E) Estimate.

OPEC: A cartel or not a cartel?

- OPEC is often accused of acting like a “**cartel**” to fix prices and control output.
- The evidence today suggests that OPEC, unlike the mid-1970’s period, **does not have the characteristics of a full cartel and basically sets its output level based on global demand and supply conditions.**
- The one cartel condition it meets is that OPEC **has a small number of members**, but these vary from small producers such as Qatar (500,000 barrels per day), to Saudi Arabia’s 11.5 million barrels per day.
- In terms of **spare capacity**, OPEC has around 7.1 million barrels per day ,of which **Saudi Arabia currently holds 4.4 million barrels per day spare capacity.**

Table 8.5 Cartel characteristics and OPEC: A score sheet

<i>Characteristic</i>	<i>OPEC Reality</i>	<i>Comment</i>
• 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

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

<i>mb/d</i>	<i>Sustainable production capacity</i>	<i>Spare capacity v. supply</i>	<i>OPEC quota</i>
<i>Saudi</i>	<i>12.5</i>	<i>4.4</i>	<i>8.01</i>
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	na
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%

Source: IEA, December 2009

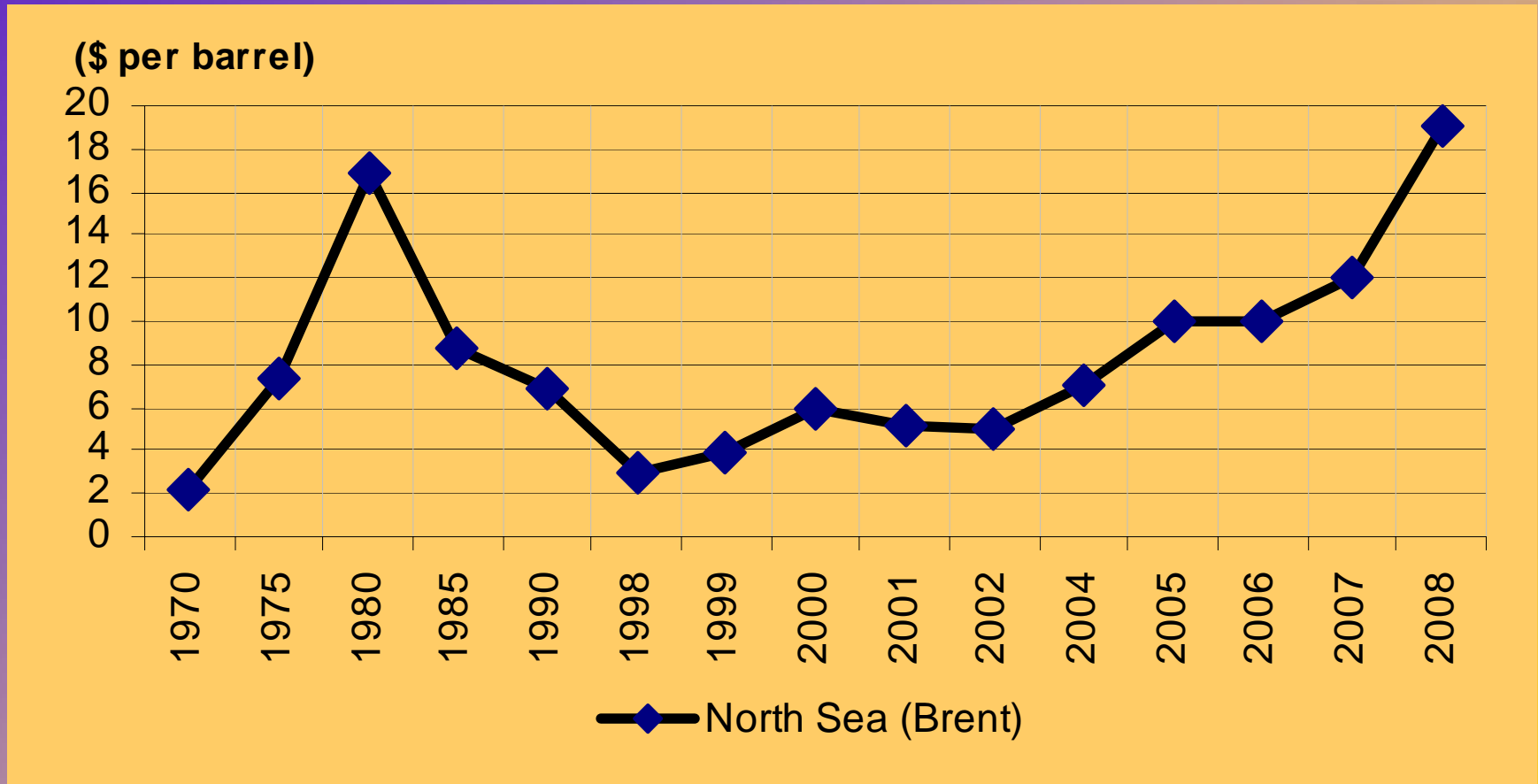
Saudi oil policy-explicit and implicit objectives

- Saudi Arabia has **never expressed a single unified policy statement regarding its oil policy.**
- What has been noticeable during 2009/2010 is Saudi Arabia becoming **more explicit** about what is considered to be a “***fair***” oil price for the benefit of **both** oil consumers and producers.
- This was stated by King Abdullah bin Abdul-Aziz as **being \$ 70-75 per barrel.** The markets seemed to accept this as an **explicit benchmark** to avoid the oil price fluctuations seen during the period 1970-2008 in ***nominal*** terms, but the price remain extremely low in ***real terms*** using 1970 as a base year.

Table 8.7. Implicit and explicit Saudi oil policy objectives

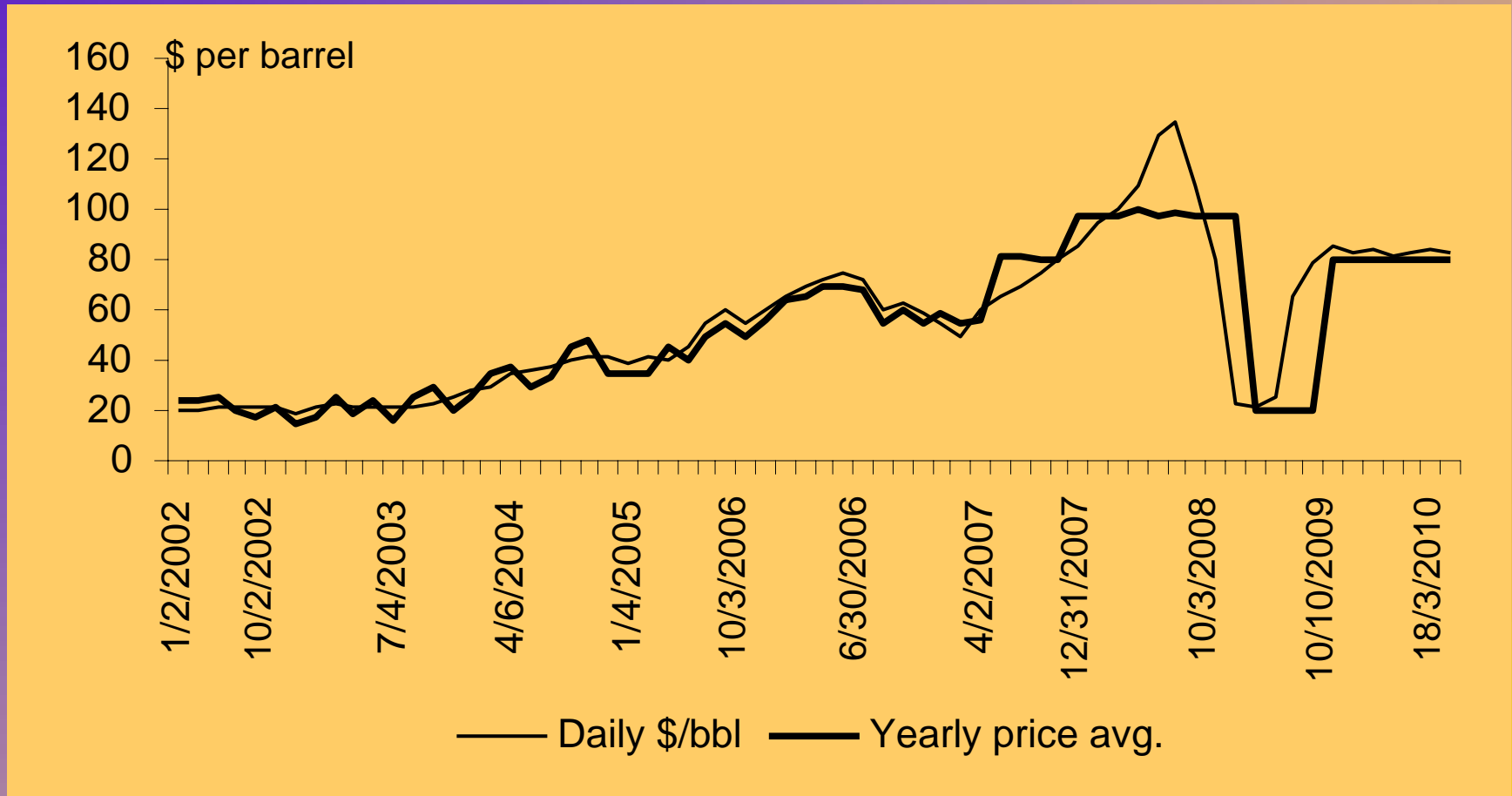
<i>Policy Objectives</i>	<i>Observations</i>
• Reasonable oil prices which gives producer sufficient income	(a) OPEC price band of \$22-28 per barrel has been maintained until 2003/2004 when it overshot the range, and again in 2008 when prices reached \$147 per barrel and then fell \$40. The Kingdom 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 2008/09 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.

**Figure 8.6 Real oil prices (Base year: 1970)
(1970-2008)**



Source: SAMA

Figure 8.7. OPEC reference basket price 2002-2010



Source: Bloomberg

“Fiar” price stability and impact on oil consumers and producers

- The more explicit Saudi oil price benchmark of \$70-75 per barrel is aimed to achieve the following **objectives**:
 - Allowing oil consumers to focus on **reliable** and **affordable** oil supply, and
 - Allowing oil producers to focus on **stable** and **remunerative** markets.
- Empirical evidence suggests that oil **consumers** are differently affected by higher oil prices and have different coping potentials. **Oil producers** are disproportionately affected by oil price volatility and the share of petroleum taxes in their budget revenues, as illustrated for average oil prices of \$ 94-97 per barrel CIF and FOB for oil consumers and producing countries.

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

<i>2008 Estimates</i>		<i>IEA Countries</i>	<i>OPEC Countries</i>	<i>Saudi Arabia</i>
Average oil prices (\$/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*

Global energy consumption mix is changing

- Over time **energy consumption to GDP ratios change**, with **reductions** seen in advanced economies due to an energy efficiency rise, eg. around 15% in the 1970's to 7% in 2010 for the advanced economies.
- The trend has also been noticeable for the **emerging global economic superpowers** such as China and even Russia.
- There is also **growing environmental pressure** to utilize more **“environmentally friendly” energy sources**.
- There is fear that the **share** of oil in total world energy consumption will fall, to be replaced by nuclear and other renewable energy sources.

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

	<i>1985</i>	<i>1995</i>	<i>2003</i>	<i>2006</i>	<i>2008</i>
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*

Saudi Arabia: the hydrocarbon sector's importance

- The hydrocarbon sector still plays a significant role in Saudi economic development, whether it is in crude oil exports, refined production or through gas and Natural Gas Liquid (NGL) production.
- The oil sector's contribution to GDP is very **significant**, ranging from 58% to 45% , depending on the level of oil prices.
- **Refined and value-added** oil and gas exports are now increasing in both volume and value terms, and are more **stable** than crude oil sales.

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

<i>Index</i>	<i>1972</i>	<i>1982</i>	<i>1992</i>	<i>2002</i>	<i>2008</i>
• 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*,

Saudi hydrocarbon exports: Asia predominates

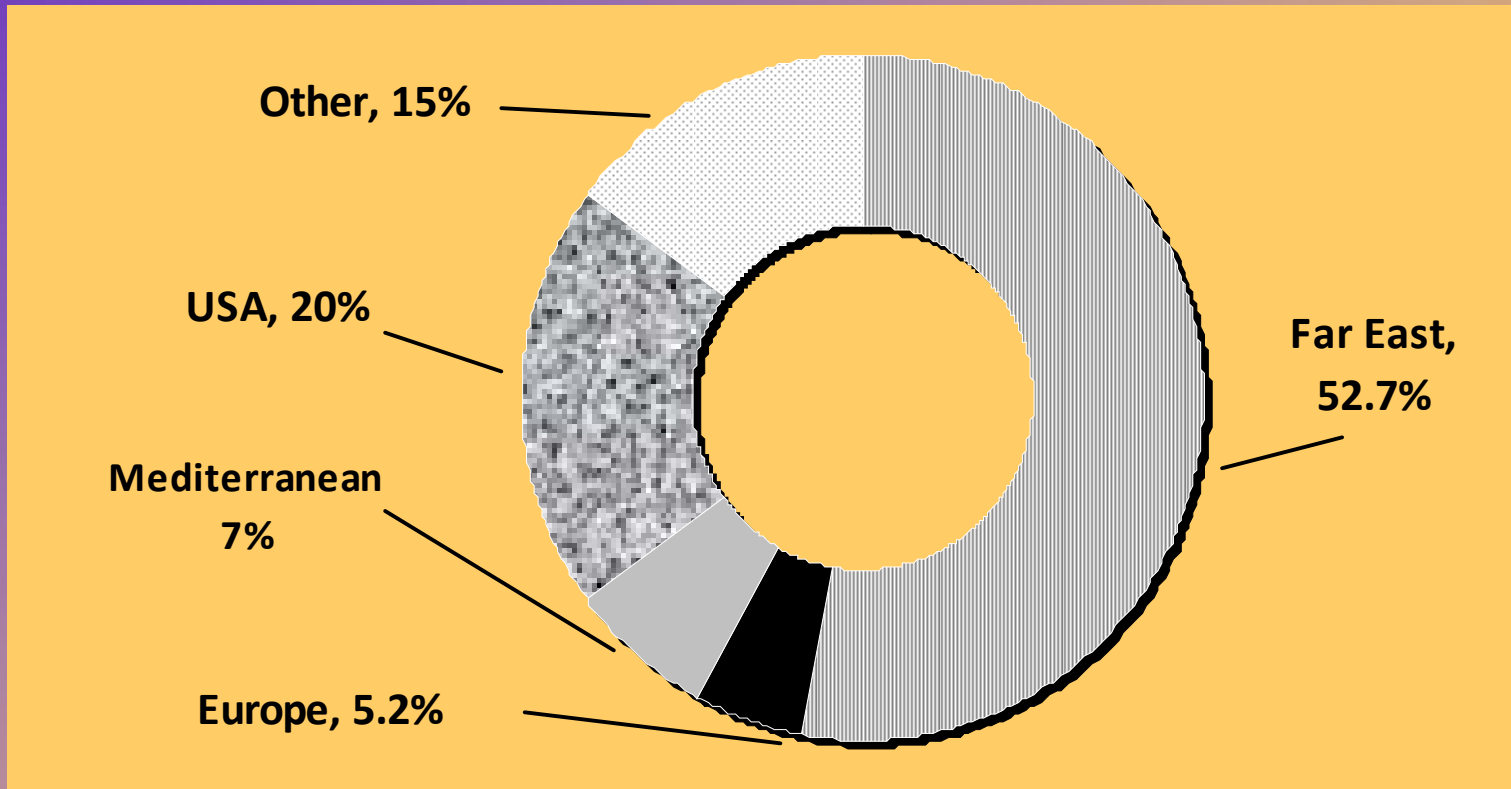
- Today, the **Far East, South East Asia** and emerging economies of Africa are the prime customers of Saudi petroleum products, whether crude oil or refined products.
- The USA, Mediterranean and Europe account for around 33% of crude oil exports, and 16% of refined exports.

(Contd....)

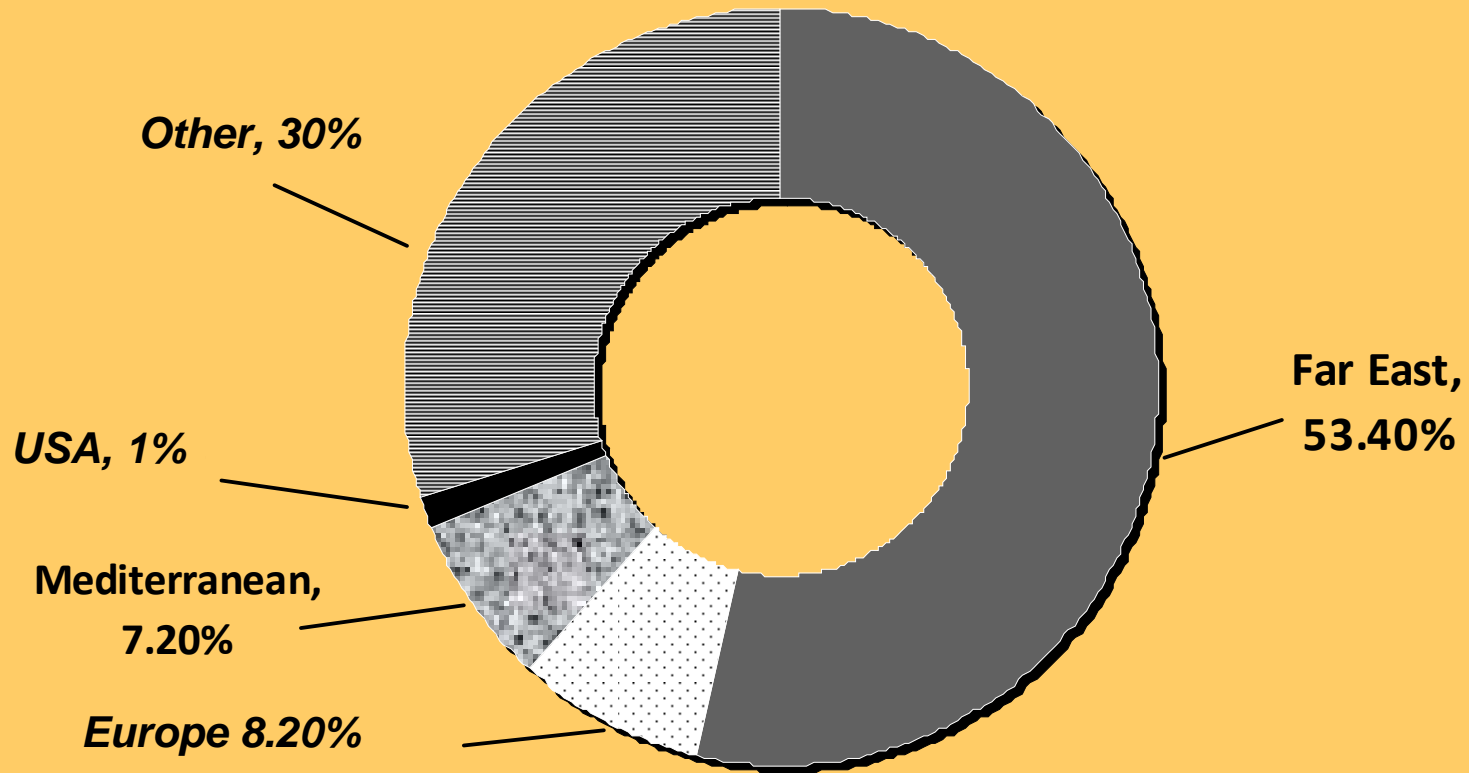
- There has been a growing demand from China, Russia, India, Canada and Brazil for higher oil consumption, but Saudi Arabia is the **NINTH** largest oil consuming nation in the world, accounting for **2.4 million barrels a day in 2008**, compared with 1.6 million barrels a day in 2001, despite a smaller population than Brazil's.
- Saudi Arabia's demand is **unsustainable in the long run** as it will divert oil production domestically rather than to exports.

Figure 8.8. Saudi petroleum and other hydrocarbon exports by destination (2008)

(A) Crude Oil

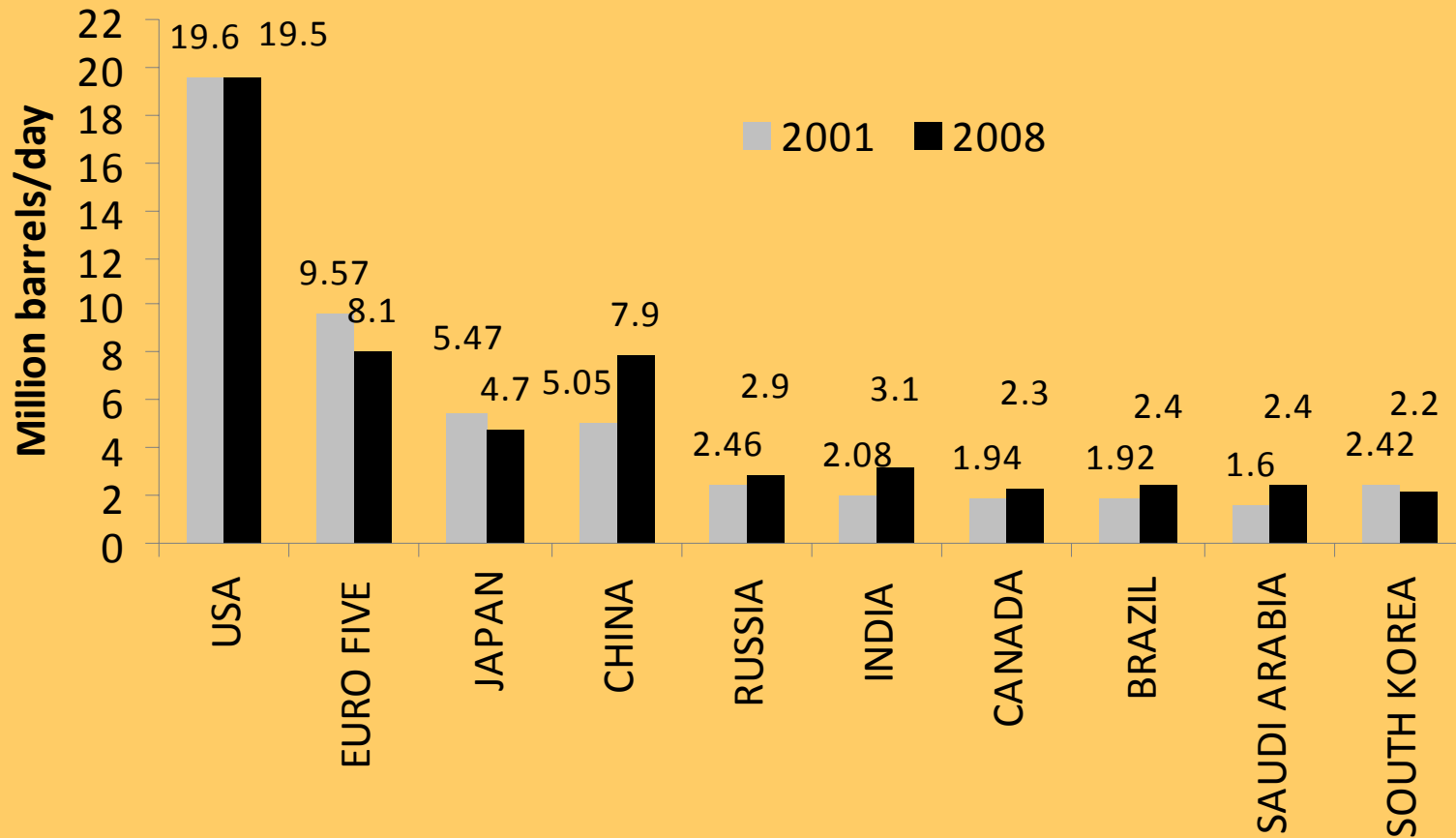


(B) Refined Products



Source: Aramco

**Figure 8.9 Top ten oil-consuming countries
(Million barrels/day), 2001, 2008**

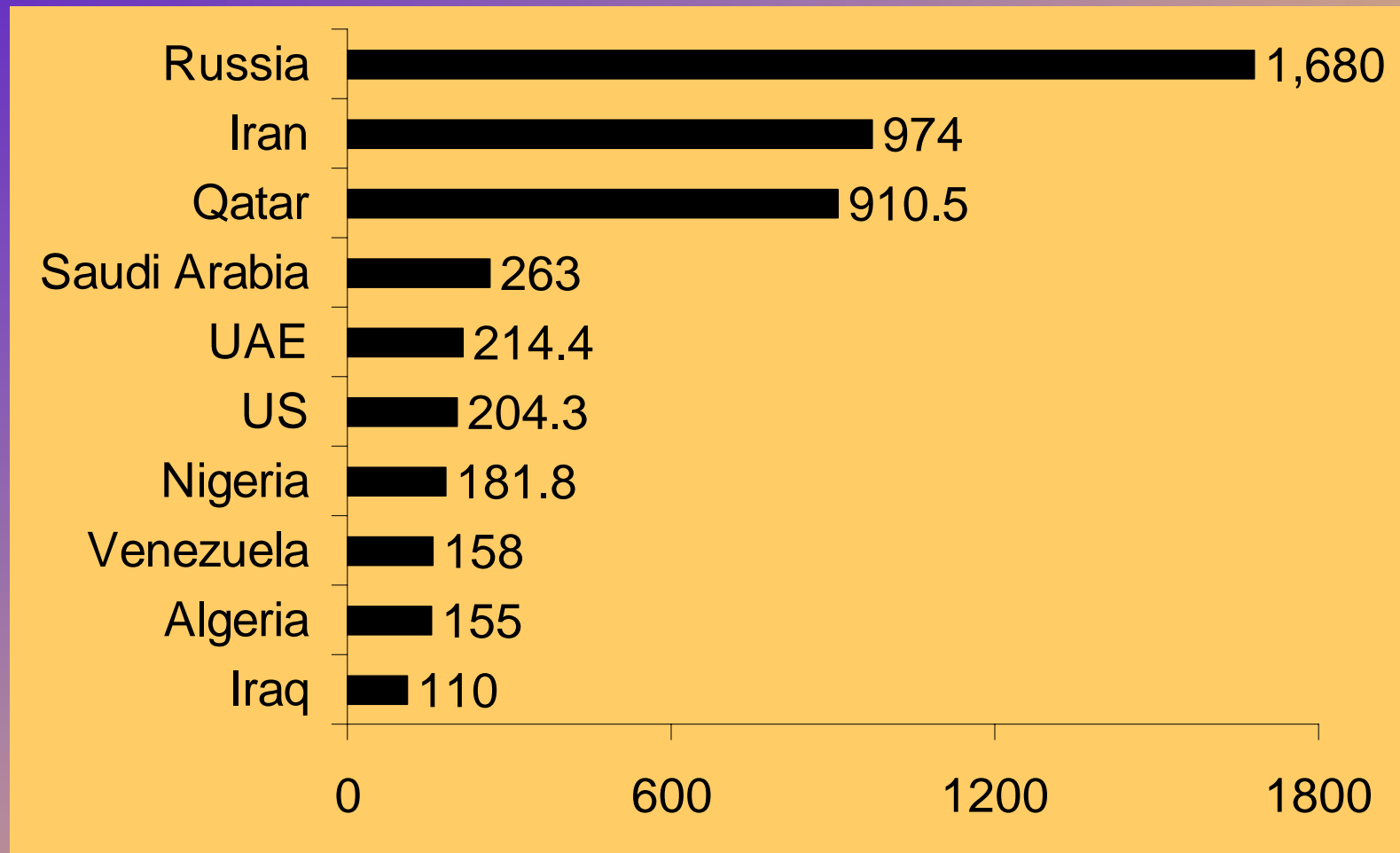


Source: SAMA, Saudi Aramco

The Saudi gas sector

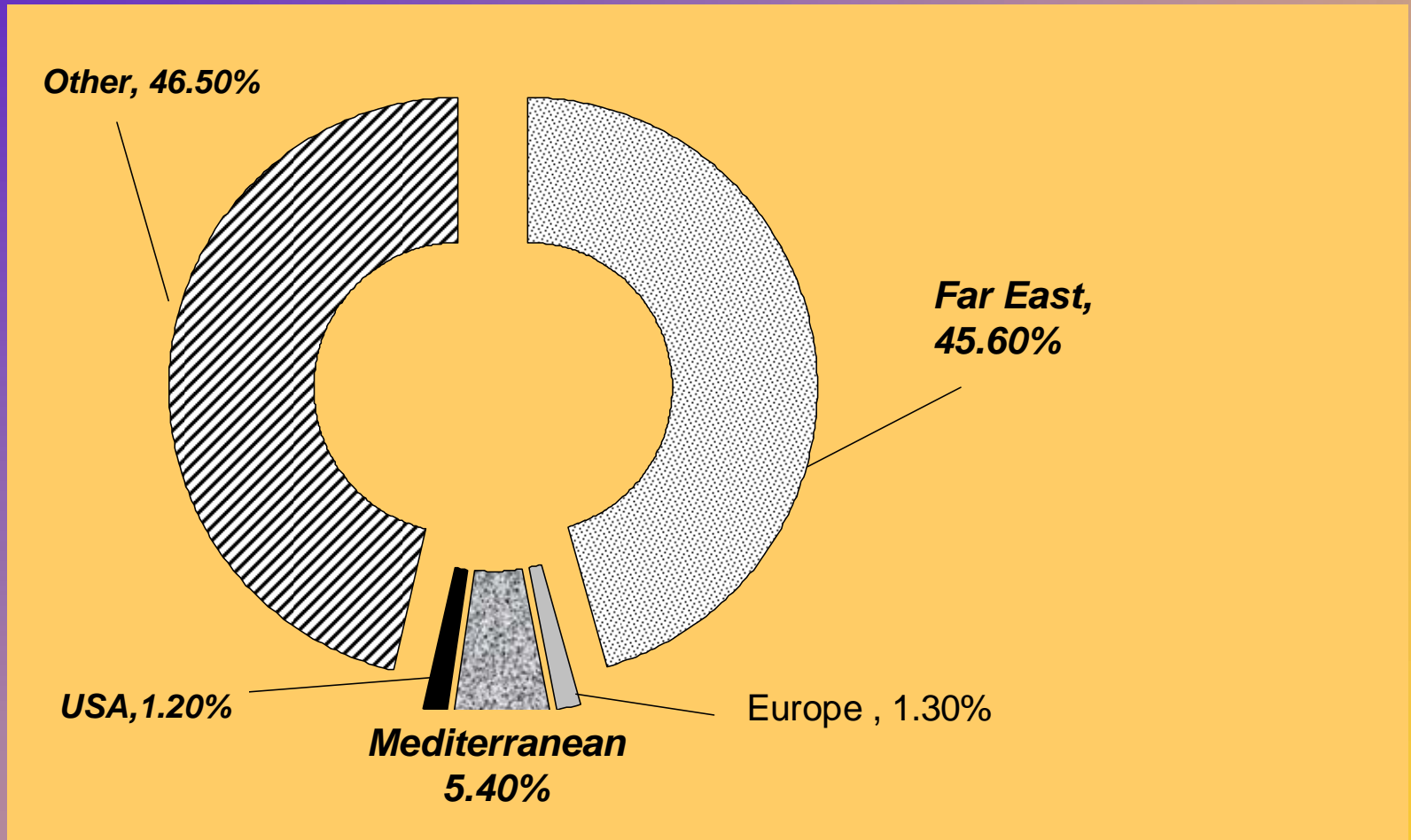
- Saudi Arabia has the world's **fourth** largest gas reserves, estimated at around **263 trillion of cubic feet** of gas, after Russia, Iran and Qatar.
- Unlike Qatar where gas production is “**non-associated**” i.e. extracted **without** oil production, nearly two-thirds of Saudi gas is “**associated**”.
- Saudi Arabia has completed a master gas system costing around \$ 13 billion to meet domestic demand and most of the 0.7 million barrels of NGL per day.
- Most gas sales are to the **Far East** (around 46%).

Figure 8.10 Natural gas reserves (trillions of cubic feet))
Top 10 countries (2008)



Source: Saudi Aramco

Figure 8.11. Saudi natural gas liquid sales by region (2008)



Source: Aramco

Saudi Petrochemicals – adding value

- Saudi Arabia is a **major petrochemical producer** and a hub for new international joint projects (eg. Dow, Total, Sumitomo, Exxon Mobil).
- There are 21 large modern petrochemical complexes in Jubail and Yanbu. 19 of these are affiliates of the **Saudi Arabia Basic Industries Corporation (SABIC)**.
- Alongside upstream oil and gas production, the Saudi petrochemical sector is the **single largest industrial sector** contributor to Kingdom's GDP.
- There are **13 listed petrochemical companies** on the Saudi stock exchange and represent 20% of the TASI index.
- Saudi installed and planned petrochemical capacity has captured a large segment of world market share.

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

	2007	2012 (<i>Forecast</i>)
<ul style="list-style-type: none"> • Saudi Ethylene Capacity (Mtpa) (Million ton per annum) 	7.4	19.7
<ul style="list-style-type: none"> • Global Ethylene Capacity (Mtpa) 	122.9	174.2
<ul style="list-style-type: none"> • <i>Saudi Market Share (%)</i> 	6.0%	11.3%

Source: *SABIC*

Saudi Petrochemicals- generating secondary industries and jobs

- Saudi petrochemical industry is competitive due to the **comparative advantage of feedstock** location in Kingdom.
- This supports SABIC and others to add new capacity and produce final product derivatives in Saudi Arabia and encourages **domestic supply-chain enterprises**.
- The Saudi petrochemical sector has brought about 12 secondary industries and 115 light and supportive industries .
- More are planned for JUBAIL II and JUBAIL III expansions which emphasize **more labor intensive industries** and Saudi job opportunities.

The Saudi mining sector: A hidden gem

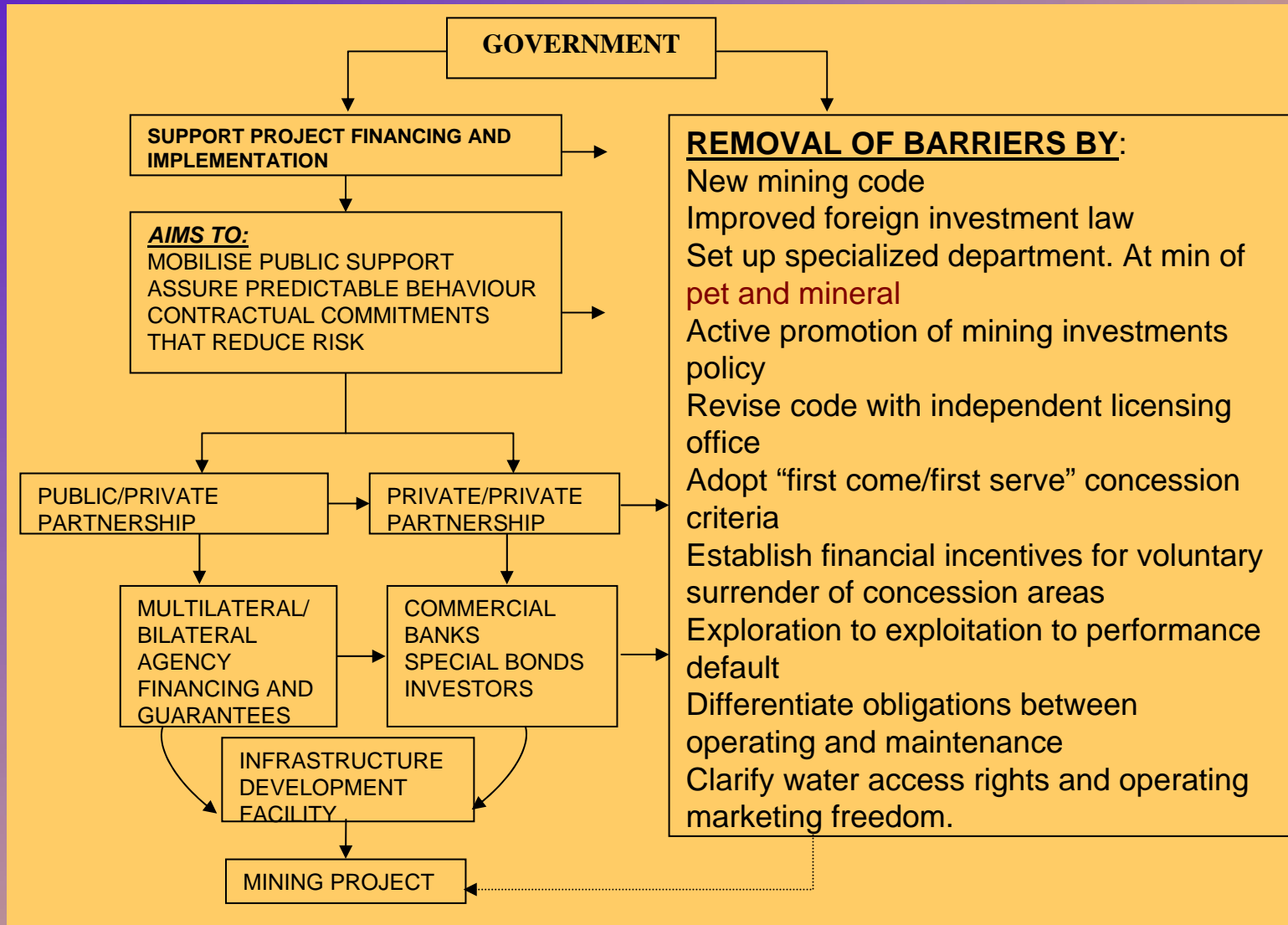
- The mining sector has now assumed a greater visibility with the establishment and privatization of the state mining company **MAA'DEN** in 2008.
- The Kingdom aspires to be a premier global producer and marketer of **phosphate fertilizers** and has established joint ventures with SABIC and foreign companies to expand aluminum production.
- The Kingdom has a **wide range of mineral deposits**, including precious metals with gold estimated at 8 million ounces.
- In order to tap these mineral resources, a new mining code has been established and foreign investment in the sector is encouraged, with **reduction in prohibited mining sectors and easing of license granting.**

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

<i>Types of exploited ores ('000 tons)</i>	<i>2004</i>	<i>2006</i>	<i>2008</i>
<u>(A)</u>			
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
Crushers 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
<u>(B) Precious Metals</u>			
Gold ('000 ounces)	265.8	166.6	146.0
Silver ('000 ounces)	466.0	411.2	265.0
Copper (ton)	652.0	730.0	1465.0
Zinc (ton)	-	983.0	3,663.0
Lead (ton)	-	-	347.0
Kaolin (ton)	-	-	22.0

Source: *Maaden, SAMA*

Figure 8.12. Model for mining cooperation



Adopted from *Marboli, 2002*.

The challenge of alternative energy

- While oil as a source of energy still has a substantial future to play, **other energy sources are now competing with oil** which could pose a **dilemma for Saudi Arabia** as it continues to increase oil production capacity.
- Global energy consumption trends indicates that both **natural gas and nuclear energy are making advances** at the expense of oil.
- The trend will be accelerated as **industrial efficiency** in some countries such as China and India also increases.
- Saudi Arabia is also embarking on renewable alternative energy, including **solar and nuclear**, and the establishment of the **King Abdullah City for Nuclear and Renewable Energy** in 2010 is one indication of this strategy.

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

<i>Region/Energy Source</i>	<i>1985</i>	<i>2000</i>	<i>2005</i>	<i>2008</i>
<u>(A) Natural Gas</u>				
• <i>World</i>	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
<u>(B) Coal</u>				
• <i>World</i>	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
<u>(C) Nuclear</u>				
• <i>World</i>	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
<u>(D) Hydrogen Energy</u>				
• <i>World</i>	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*