Report R78/2009

DEVELOPMENTS IN THE ECONOMIC CONTRIBUTION OF HYDROCARBONS, NATURAL GAS AND COAL

DIRECTORATE: MINERAL ECONOMICS

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

REPORT 78/2009

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THIS, THE 4TH EDITION, PUBLISHED IN MARCH 2009.

ISBN: 978-1-920448-15-8

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ABBREVIATIONS AND SYMBOLS

A$	Australian dollar
bbl	barrel
bbl/d	barrels per day
BCF	billion cubic feet
Bcm	billion cubic metres
Btu	British Thermal units
CTL	coal-to-liquid
EIA	Energy Information Administration
EU	European Union
ha	hectares
IDC	Industrial Development Corporation
km	kilometre
kt	kiloton
kt/a	kiloton per annum
M^3	cubic metre
Mbbl	million barrels
Mbbl/d	million barrels per day
MS.ton	million short tons
Mt	million tons
Mt/a	million tons per annum
OECD	Organization for the Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
pa	per annum
R	rand (South African currency)
RBCT	Richards Bay Coal Terminal
S.ton	Short ton
SA	South Africa
SAPIA	South African Petroleum Industry Association
TFR	Transnet Freight Rail
t	metric ton
t/a	tons per annum
Tbbl	thousand barrels
Tbbl/d	thousand barrels per day
TCF	trillion cubic feet
Tcm	trillion cubic metres
UAE	United Arab Emirates
UK	United Kingdom
US	United States
US$	United States dollar

1. Introduction

The Petroleum Industry (Fuel Industry) in South Africa is comprised of BP, Sasol Oil, Chevron, Shell, Engen, Total and PetroSA which collectively, are known as the South African Petroleum Industry Association (SAPIA). SAPIA's objective is to represent the common interests of the petroleum industry and promote an understanding of the industry's contribution to economic and social progress in South Africa.

In 2006, SAPIA members contributed about 2 percent to South Africa's GDP. SAPIA supply about 18 percent of South Africa's primary energy and manufactures more than 90 percent of South Africa's petroleum products. SAPIA supports employment for over 100 000 people directly or indirectly.

This report briefly discusses some of the major developments in the hydrocarbon industry, globally and in South Africa:

- Global oil production, reserves, consumption, demand, prices and revenue.
- Natural gas reserves, production, consumption, demand, prices and revenue.
- Coal reserves, production, consumption, prices and revenue.
- Regional refinery capabilities.
- South African Hydrocarbon industry developments.
- Outlook in the hydrocarbon industry will be discussed. The outlook is based mainly on the International Energy Outlook 2008 (IEO2008) which gives forecasts of up to the year 2030.

2. Global Fuel Markets

2.1 Oil

- **Supply / Production**

At the end of 2007, proved world oil reserves were estimated at 1237,9 billion barrels. Sixty one percent of the proved oil reserves are located in the Middle East. Among the top 20 reserve holders in 2007, 11 are Organization Of The Petroleum Exporting Countries (OPEC) member countries (Algeria, Indonesia, Iran, Iraq,

Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE and Venezuela) that, together, accounted for 75,5 percent of the world's total reserves (Table 1). Non-OPEC member countries accounted for 14,1 percent, while Former Soviet Union 10,4 percent, Organization for Economic Co-operation and Development (OECD) 7,1 percent and European Union 0,5 percent of the world's total reserves.

Global oil production fell by 0,2 percent or 130 000 b/d (Table 1), the first decline since 2002. OPEC production dropped by 350 000 b/d due to the cumulative impact of production cuts implemented in November 2006 and February 2007. Among the 10 members participating in production cuts, crude oil output fell by 900 000 bbl/d.

Table 1- World Oil Reserves and Production, 2007

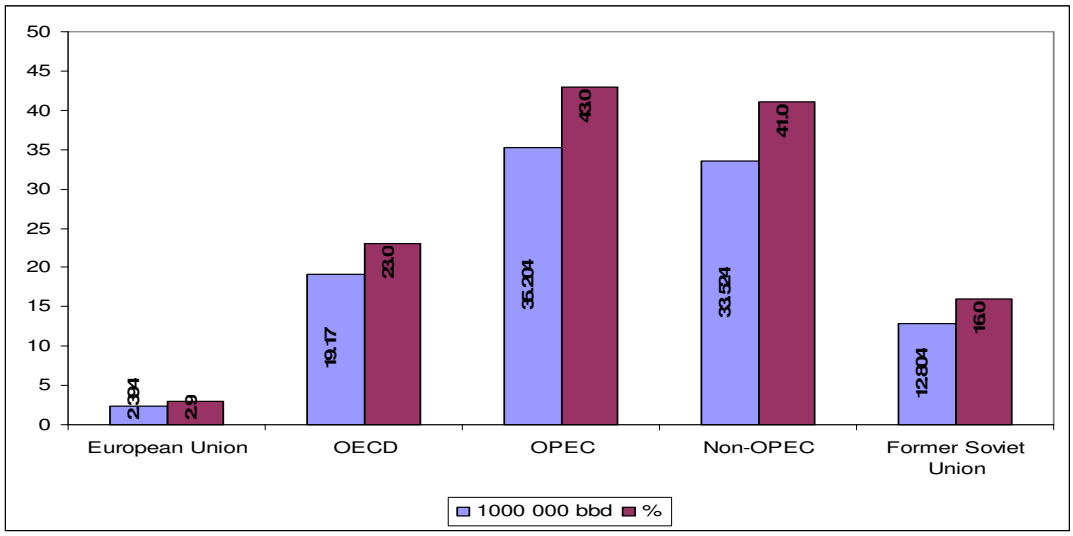
	Oil Reserves / billion barrels				Oil Production / 1000 b/d			
Country	2006	2007	Change 2007 over 2006 / Percent	2007 Share of Total / Percent	2006	2007	Change 2007 over 2006 / Percent	2007 Share of Total / Percent
Saudi Arabia	264,3	264,2	0,0	21,3	10853	10413	-4,1	12,6
Canada	27,7	27,7	0,0	2,2	3208	3309	3,6	4,1
Iran	138,4	138,4	0,0	11,2	4388	4401	0,4	5,4
Iraq	115,0	115,0	0,0	9,3	1999	2145	7,3	2,7
Kuwait	101,5	101,5	0,0	8,2	2682	2626	-2,1	3,3
United Arab Emirates	97,8	97,8	0,0	7,9	2971	2915	-2,3	3,5
Venezuela	87,0	87,0	0,0	7,0	2808	2613	-7,2	3,4
Russia	79,3	79,4	0,1	6,4	9769	9978	2,2	12,6
Libya	41,5	41,5	0,0	3,4	1834	1848	0,5	2,2
Nigeria	36,2	36,2	0,0	2,9	2474	2356	-4,8	2,9
Kazakhstan	39,8	39,8	0,0	3,2	1426	1490	3,9	1,8
United States	29,4	29,4	0,0	2,4	6841	6879	0,4	8,0
China	15,6	15,5	-0,6	1,3	3684	3743	1,6	4,8
Qatar	27,9	27,4	-1,8	2,2	1110	1197	5,3	1,4
Algeria	12,3	12,3	0,0	1,0	2003	2000	-0,1	2,2
Brazil	12,2	12,6	3,3	1,0	1809	1833	1,4	2,3
Mexico	12,8	12,2	-4,7	1,0	3683	3477	-5,5	4,4
Angola	9,0	9,0	0,0	0,7	1421	1723	20,7	2,2
Azerbaijan	7,0	7,0	0,0	0,6	654	868	31,7	1,1
Norway	8,5	8,2	-3,5	0,7	2779	2556	-7,7	3,0
Others	76,3	75,8	-0,7	6,1	13263	13163	-0,8	16,1
World Total	1239,5	1237,9	-0,1	100,0	81659	81533	-0,2	100,0

Source: BP Statistical Review of World Energy, June 2008 pp. 6, 8

* Includes crude oil, shale oil, oil sands, NGLs (the liquid content of natural gas where this is recovered separately). Excludes liquid fuels from other sources such as biomass and coal derivatives.

Saudi Arabia's output dropped by 440 000 bbl/d. Increased output in Angola and Iraq, and growing supply of condensates/natural gas liquids (NGLs), partially offset that decline. Oil production growth outside OPEC remained weak, rising by 230 000 bbl/d in 2007. The Organization for Economic Co-operation and Development (OECD) output declines moderated, but nonetheless fell for a fifth consecutive year. Production in both Norway and Mexico declined by more than 200 000 bbl/d. Former Soviet Union output rose by nearly 500 000 bbl/d, with Azerbaijan and Russia growing by more than 200 000 bbl/d each. Of the total production, the European Union accounts for 2,9 percent, OECD 23,3 percent, OPEC 43,0 percent, Non-OPEC 41,0 percent, and Former Soviet Union 16,0 percent (Fig 1).

Figure 1- Regional Oil Production, 2007



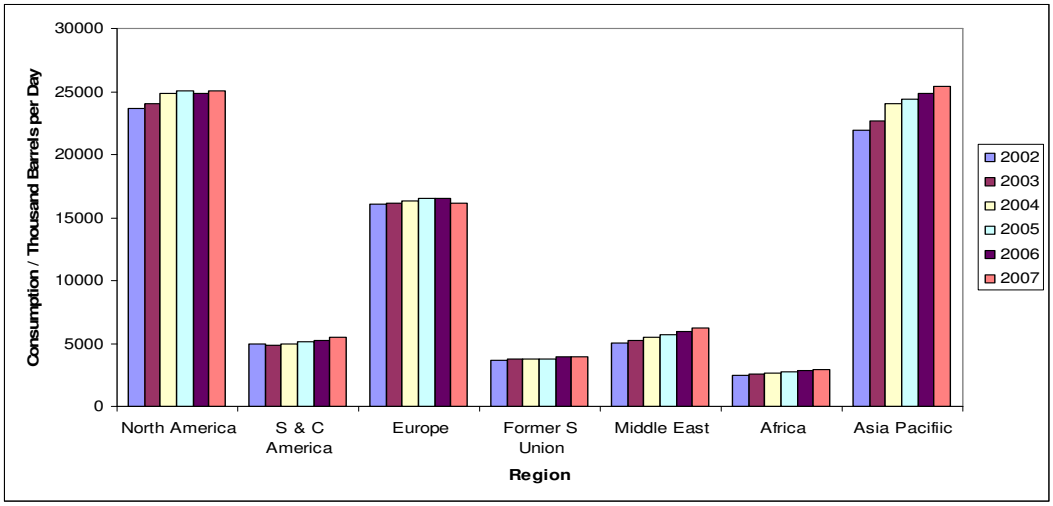
Source: BP Statistical Review of World Energy, June 2008

- **Demand**

World demand for oil reached 85,7 Mbbl/d in 2007, one percent higher than in 2006. Consumption in the oil exporting regions of the Middle East, South and Central America, and Africa accounted for two-thirds of the world's growth (Fig. 2). The Asia-Pacific region grew by 2,3 percent, even though growth in China and Japan was below average, with strong growth in a number of emerging economies. OECD consumption fell by 0,9 percent or nearly 400 000 bbl/d. The sector-by-sector oil consumption data for many countries is unavailable hence; a detailed analysis of world consumption is beyond the scope of this report. The major demand markets of oil in descending order include: transport (Petrol, Diesel and

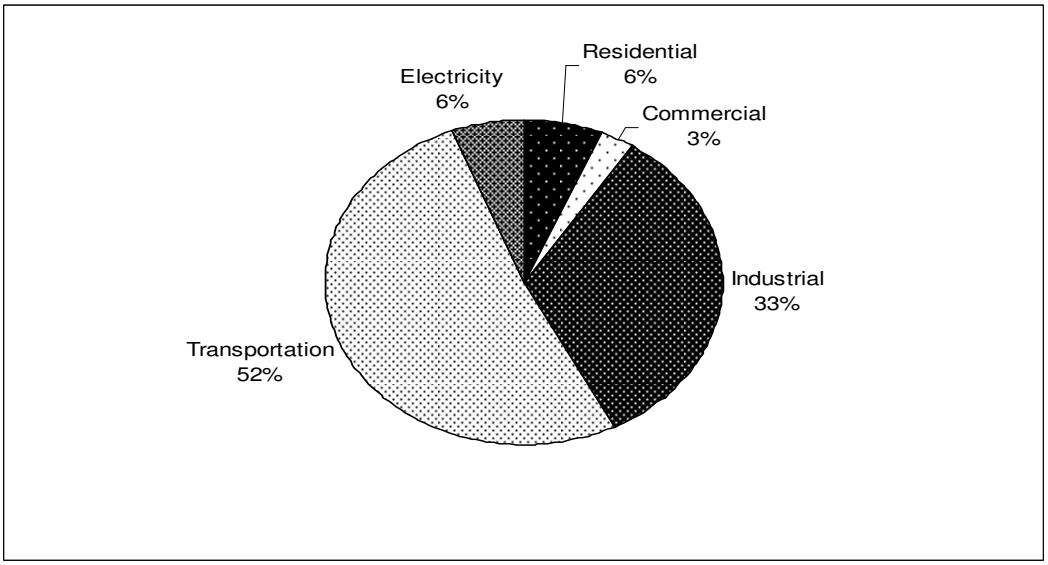
Jet Fuel), industrial, electricity generation, residential and commercial applications (Fig. 3).

Figure 2- Regional Oil Consumption (Thousand Barrels Per Day), 2002 - 2007.



Source: BP Statistical Review of World Energy 2008

Figure 3- World Oil Consumption Structure by September 2008.



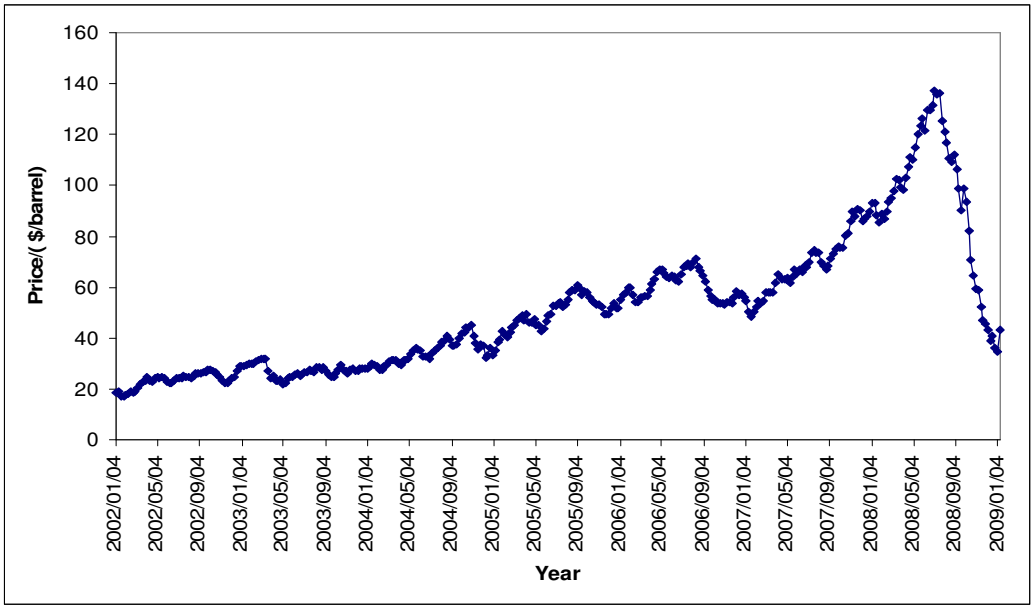
Source: Energy Information Administration

- **Prices**

The price of oil has been on an upward trajectory since the US-led invasion of Iraq which caused political instability. Other OPEC members which experienced political instability are Nigeria (pipeline sabotage, kidnappings of foreign workers and other risks) and Algeria (terrorist attacks). Also, demand for crude oil eclipsed supply since non-OPEC producers shrunk output and the artificial supply tightness

caused by OPEC's production reduction. Moreover, the continued economic growth of the Middle East and Asia, particularly China, has resulted in high demand and exerted some further upward pressure on prices. Brent crude oil price averaged US$72,39 per barrel in 2007, more than triple the average price in 2002 (Fig. 4). Towards the end of 2007, the price of crude oil breached the US$ 100 per barrel mark, reaching US$ 120 per barrel in May 2008.

Figure 4 - World Oil Prices, January 2004 to January 2009



Source: http://tonto.eia.doe.gov

- **Revenue**

Using the data from the BP Statistical Review of World Energy 2008, the revenue generated by oil in 2007 is estimated at US$2 251 billion (Table 2). Over the past five years (2003 to 2007) oil revenue grew by 169,9 percent to US$2 551 billion. This growth can be attributed to world's increasing energy demand as the world population grows.

Table 2 - World Oil Revenues, 2003 - 2007

Year	Consumption / 1000 bbl/d	Revenue / US$ billion
2003	79296	834
2004	82111	1146
2005	83317	1657
2006	84230	2002
2007	85220	2251

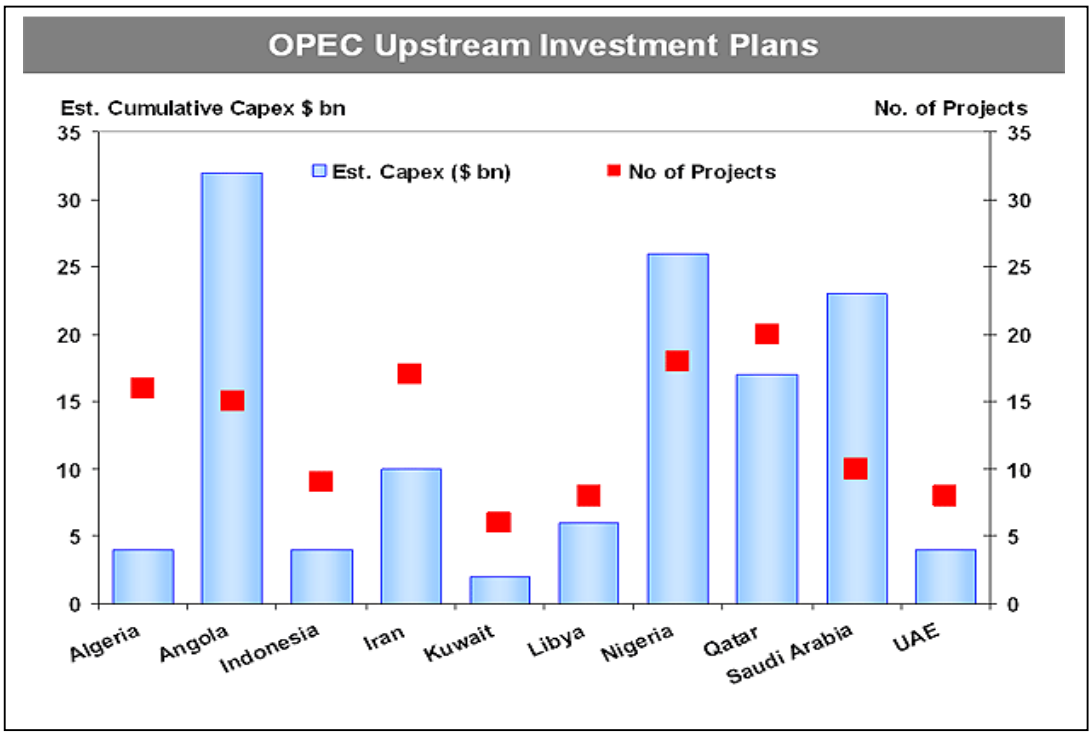
Source: BP Statistical Review of World Energy, June 2008

- **Developments**

From 2003 to 2007, world oil consumption grew at the rate of 7,5 percent to 85220 Tbbl/d. From 2003 to mid-2008, oil prices climbed by 320 percent in dollar terms. Africa's consumption averaged 2955,2 Tbbl/d of oil in 2007, 3,49 percent of the world total. The Energy Information Administration (EIA) reports that world crude oil production fell from 73,8 Mbbl/d in 2005 to 73,2 Mbbl/d in the first 10 months of 2007, that can be attributed to unfavourable geological conditions and political instability, particularly in Iraq and Nigeria.

OPEC announced plans to invest US$ 130 billion in expanded production between 2007 and 2012. Excluding Iraq, production is forecast to increase from 35,7 Mbbl/d to 39,7 Mbbl/d in 2010.

Figure 5 - Number of New Projects in OPEC Countries



Source: http://www.opec.org

Between 2013 and 2020 OPEC plans to spend a further US$ 500 billion provided biofuels do not change economics. Saudi Arabia alone is investing US$ 50 billion to increase crude production capacity from 10.5 Mbbl/d in 2007 to 12 Mbbl/d in 2009 and 15 Mbbl/d after 2025. Figure 5 shows the number of new projects in OPEC.

2.2 Natural Gas

- **Supply / Production**

The world has proven natural gas reserves of 177,36 TCM, a 2.3 percent drop from 181,46 TCM in 2006 (Table 3). Gas production rose by 2,4 percent to 2 940 BCM in 2007. The United States (US) accounted for the largest increment in supply, growing by 4,3 percent, the strongest growth since 1984. The European Union (EU) production on the other hand declined by 6,4 percent while, the United Kingdom (UK) declined by 9,5 percent and this was the world's largest consecutive volumetric decline, 2006 and 2007.

Table 3- World Gas Reserves and Production, 2007

	Natural Gas Reserves / trillion m^3				Natural Gas Production / billion m^3			
Country	2006	2007	Change 2007 over 2006 Percent	2007 Share of Total Percent	2006	2007	Change 2007 over 2006 Percent	2007 Share of Total Percent
Saudi Arabia	7,07	7,17	1,4	4,0	73,50	75,90	3,3	2,6
Canada	1,62	1,63	0,6	0,9	188,40	183,70	-2,5	6,2
Iran	27,58	27,80	0,8	15,7	108,60	111,90	3,0	3,8
Iraq	3,17	3,17	0,0	1,8	n/a	n/a	n/a	n/a
Kuwait	1,78	1,78	0,0	1,0	12,90	12,60	-2,3	0,4
United Arab Emirates	6,11	6,09	-0,3	3,4	47,40	49,20	3,8	1,7
Venezuela	5,10	5,15	1,0	2,9	27,90	28,50	2,2	1,0
Russia	44,60	44,65	0,1	25,2	612,20	607,40	-0,8	20,7
Libya	1,49	1,50	0,7	0,8	14,80	15,20	2,7	0,5
Nigeria	5,22	5,30	1,5	3,0	28,40	35,00	23,2	1,2
Kazakhstan	1,90	1,90	0,0	1,1	24,60	27,30	11,0	0,9
United States	5,98	5,98	0,0	3,4	523,20	545,90	4,3	18,6
China	1,68	1,88	11,9	1,1	58,60	69,30	18,3	2,4
Qatar	25,64	25,60	-0,2	14,4	50,70	59,80	17,9	2,0
Algeria	4,50	4,52	0,4	2,5	84,50	83,00	-1,8	2,8
Brazil	0,35	0,36	2,9	0,2	11,30	11,30	0,0	0,4
Mexico	0,39	0,37	-5,1	0,2	42,80	46,20	7,9	1,6
Azerbaijan	1,26	1,28	1,6	0,7	6,30	10,30	63,5	0,4
Norway	2,89	2,96	2,4	1,7	87,60	89,70	2,4	3,1
Others	27,89	28,27	1,4	15,9	868,50	877,80	1,1	29,9
World Total	176,22	177,36	0,6	100,0	2872.20	2940,00	2,4	100,0

Source: BP Statistical Review of World Energy, June 2008

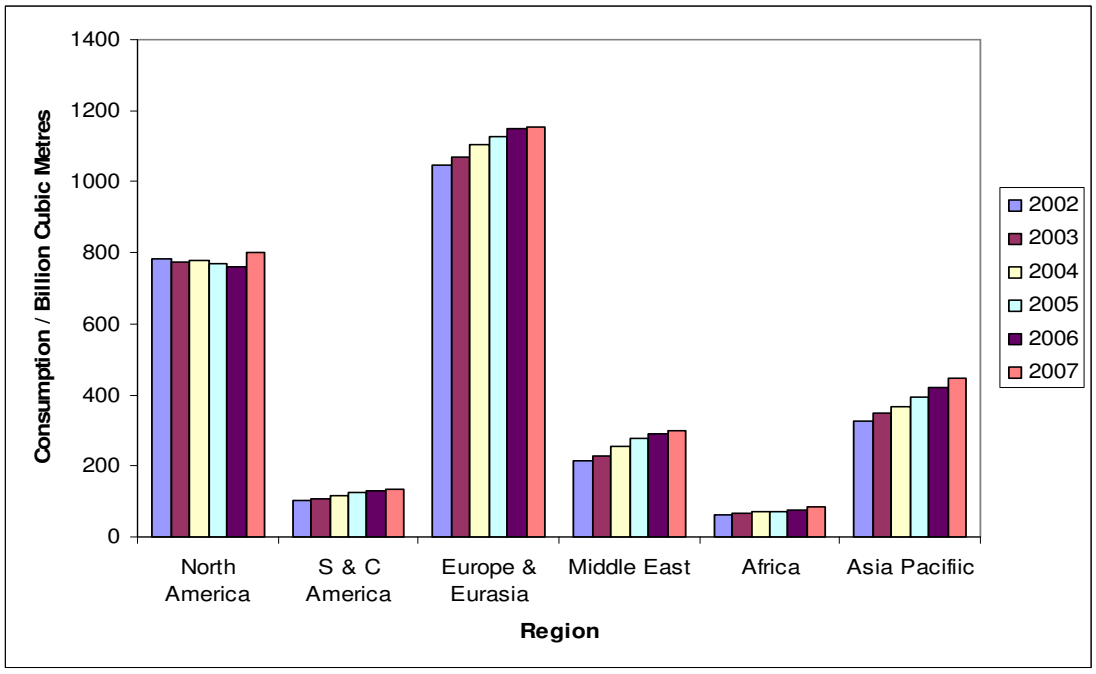
A small decline in Russian production was more than offset by strong growth elsewhere in the Former Soviet Union. China and Qatar recorded the second- and third-largest increments in production, increasing by 18,3 percent and 17,9 percent respectively.

- **Demand**

The world's natural gas consumption grew by an above average 3,1 percent to 2 921,9 BCM in 2007, although only North America, Asia Pacific and Africa recorded above-average growth (Fig. 6). The US accounted for almost half of the world's gas consumption growth. Chinese consumption grew by 19,9 percent and accounted for the second largest increment in global gas consumption. Natural gas accounted for nearly all the growth in US energy consumption, while the EU consumption declined by 1,6 percent.

International trade in natural gas was also weak in 2007, growing by 2,3 percent while global pipeline exports stagnated due to weak European consumption. However, liquefied natural gas (LNG) shipments rose by 7,3 percent, supported by continued growth in shipments from Qatar and Nigeria. More than 40 percent of new electricity capacity worldwide is gas-fired.

Figure 6 - Regional Natural Gas Consumption, 2002 - 2007



Source: BP Statistical Review of World Energy, June 2008

- **Prices**

Natural gas consumption has been growing rapidly, pushing prices to very high levels. In 2007 the natural gas price averaged US$11,95 per million Btu, compared to US$10,66 per million Btu in 2006.

- **Revenue**

BP Statistical Review of World Energy of 2008, reveals that the revenue generated by natural gas in 2007 decreased by 15,6 percent to an estimated US$1 273 billion (Table 4) compared to US$1 101 in 2006, representing a 176 percent increase from 2003 (US$463 billion).

Table 4 - World Natural Gas Revenues, 2003 - 2007

Year	Consumption / Million tonnes	Revenue / US$ billion
2003	2341,1	462
2004	2427,6	614
2005	2496,8	881
2006	2558,3	1101
2007	2637,7	1273

Source: BP Statistical Review of World Energy, June 2008

- **Developments**

Natural gas consumption has grown over the past five years. It is an environmentally friendly fuel, burning cleaner than coal or oil as, it has no particulates, and produces less carbon dioxide for a given amount of heat. According to World Oil Outlook 2008, natural gas demand in developing countries is expected to grow considerably stronger than in other regions, at over 4 percent per annum.

New projects and expansions:

- Exxon-East (Nigeria): invested US$1,3 billion on a 50 000 bbl/d of natural gas liquid (NGL). NGL production began in March 2008.
- Teekay (Canada): to build a Liquefied Natural Gas (LNG) floater. The converted ship will have a production capacity of 500 kt/a of LNG. The project is expected to start LNG operations by 2012.

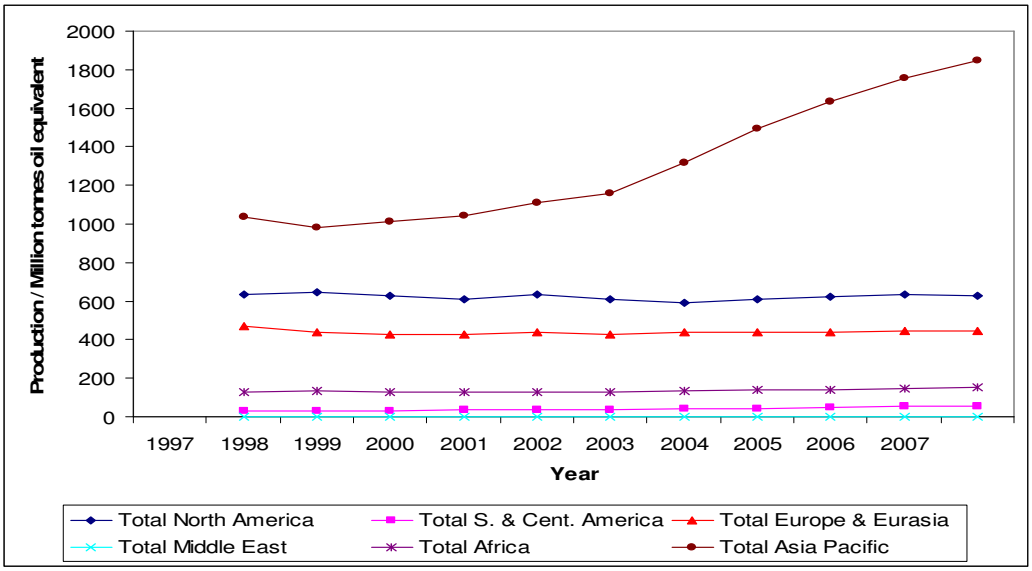
2.3 Coal

- **Supply**

According to the 2008 BP Statistical Energy Survey, world coal production amounted to 3135,6 Mt in 2007. Figure 7 shows the world regional production. The world's largest coal producers are, China (41,1 percent), the USA (18,7 percent), Australia (6,9 percent), India (5,8 percent), South Africa (4,8 percent), Russia (4,7 percent), and Indonesia (3,4 percent).

In 2007 the world had coal reserves of 847 billion tonnes. Europe (and Eurasia) and Asia have just over 32 percent of total reserves. The world reserves are dominated by two countries: Russian Federation (18,5 percent) and US (28,6 percent).

Figure 7 - Regional Coal Production, 2007



Source: BP Statistical Review of World Energy, June 2008

Africa has less than 6 percent of total reserves that are concentrated in the bituminous category and, are dominated by South Africa with an estimated 90 percent of the continent's reserves. Central and South America is the continent with the least coal reserves, representing 1,9 percent of total reserves. The countries with the largest coal reserves are, in order of importance, United States, Russia, China, Australia, India, South Africa, Ukraine and Kazakhstan.

- **Demand**

Coal consumption was the fastest growing in the world for the fifth consecutive year. Global consumption rose by 4,5 percent, above the 10-year average of 3,2 percent. In 2007, coal consumption reached 6 383 Mt, 4,5 percent higher than 2006, despite the strong rise in prices. China, at 2 469 Mt, remained the largest consumer of coal in 2007 followed by the US at 1 020 Mt. Asia's consumption increased by 7,9 percent to 1896,2 Mt in 2007. In 2007, Asia represented 52,6 percent of the world demand and more than 90 percent of the growth of world consumption since 2000. The consumption of OECD increased by 1,2 percent, driven by the Japanese demand (5 percent increase compared to 0,3 percent within the European Union).

- **Prices**

Historically, coal prices have been lower and more stable than oil and gas prices, coal is likely to remain the most affordable fuel for power generation in many developing and industrialised countries for several decades. According to US central Appalachian coal spot price index, the average coal price significantly decreased by 23,2 percent to US$51,12 per ton in 2007, compared with 2006. The prices were influenced by the global financial crisis and the resulting slow-down of economic growth.

- **Revenue**

Data obtained from the BP Statistical Review of World Energy of 2008, reveal that estimated revenue generated by coal was US$162 billion in 2007 (Table 5) showing a 15,2 percent decrease compared with 2006, and a 62 percent increase from 2003 (US$100 billion).

Table 5 - World Coal Revenues, 2003 - 2007

Year	Consumption / Million tonnes	Revenue / US$ billion
2003	2599,7	100
2004	2768,1	178
2005	2892,4	202
2006	3041,7	191
2007	3177,5	162

Source: BP Statistical Review of World Energy, June 2008

Revenue generated by coal has increased from US$100 billion in 2003 to US$162 billion in 2007. The major contributing factor to this increase is growth in global demand for energy that continues to rise as the world population increases.

- **Developments**

Coal remains the major source of energy worldwide. According to the EIA, coal accounted for almost 27 percent of the world energy consumed in 2007, and is expected to increase by 2.6 percent a year until 2015. Even though coal is the most carbon intensive energy resource it remains popular due to the low cost and wide availability in resource rich nations like India, China and the US.

Some new projects, expansions and other investments:

- United States:
  - Consol Energy Inc. and Pittsburg & Midway Coal Co. merged to form Young Creek Mining, located in Sheridan, Wyo., will become operational in 2009.
- Canada:
  - Canadian Teck Cominco proposed to buy its partner in Elk Valley coal mine, Fording Canadian Coal Trust for US$14 billion.
- Australia:
  - Guangdong Yudean Group Co. acquired 7,5 percent interest of Narrabri Coal Project. The mine will start production of thermal and PCI coals in the first half of 2009 at the rate of 2,5 Mt/a.
  - In January 2008, Xstrata acquired Australian Jubilee Mines for US$3 billion and in March 2008 it further acquired all the shares of Resource Pacific Ltd which owns and operates the Newpac No.1 Colliery for US$1 billion.
  - On the 15th July 2008, CITIC Australia Coal Pty Ltd., a subsidiary of CITIC Group of China, bought out additional 2,73 percent shares of Macarthur Coal. As a result, ownership by CITIC of Macarthur Coal shares rose to 20,39 percent from 17,66 percent and CITIC became the top shareholder exceeding ArcelorMittal.
  - Fourteen coal producers in New South Wales such as BHP Billiton, Xstrata Coal, Rio Tinto and others are prepared to supply private loan of 2,400 million

Australian Dollars to expand the main coal loading port of the state Newcastle to 210 million MT per year by 2013.

3. Oil Refineries

China achieved the highest growth of 6,6 percent in refinery throughput from 6155 Tbbl/d in 2006 to 6563 Tbbl/d in 2007 and was followed by Africa (4 percent), Other Asia Pacific (3.5 percent), Australasia (2.4 percent) and Europe & Eurasia (1.8 percent) (Table 6).

Table 6 - Regional Oil Refinery Throughputs

Refinery throughputs Thousand barrels daily*	2005	2006	2007	Change 2007 over 2006 / Percentage	2007 share of total /Percentage
US	15220	15242	15148	–0,6	20,1
Canada	1882	1843	1869	1,4	2,5
Mexico	1415	1407	1395	–0,8	1,8
S. & Cent. America	5402	5354	5448	1,8	7,2
Europe & Eurasia	20815	20877	20829	–0,2	27,6
Middle East	5934	6321	6301	–0,3	8,3
Africa	2468	2374	2470	4,0	3,3
Australasia	757	749	767	2,4	1,0
China	5916	6155	6563	6,6	8,7
Japan	4136	4026	3994	–0,8	5,3
Other Asia Pacific	10060	10396	10761	3,5	14,2
TOTAL WORLD	**74005**	**74743**	**75545**	**1,1**	**100,0**

Source: BP Statistical Review of World Energy, June 2008

4. South Africa's Fuel Industry

South Africa is one of the leading economies in Africa and a key player in the African oil industry. Liquid fuels are an important component of the South Africa energy sector. The hydrocarbon fuel industry is dominated by fossil fuels, an abundance of coal reserves that have led to the establishment of a well-developed synthetic fuels industry. Coal and gas together, account for about a third of the country's fuel output. Because of South Africa's abundant supplies of cheap coal, liquid fuels only provide 21 percent of the energy requirements of the country. Oil from coal synfuels plants provides a significant proportion of South Africa's liquid fuels.

4.1 Oil

- **Supply**

According to the Oil and Gas Journal, South Africa had proven oil reserves of 15 million barrels as of January 2008 (Table 7). In 2007 South Africa's total oil production was 199 000 bbl/d, of which about 16 000 bbl/d was derived from crude oil and 160 000 bbl/d was synthetic fuels processed from coal and natural gas.

The major stake holders in the oil production in South Africa include PetroSA and Sasol. PetroSA is responsible licensing as well as the management and promotion of oil and natural gas exploration in the country. These include both onshore and offshore exploration. International oil companies involved in South Africa's upstream oil sector include Anschutz International, BHP Billiton, Forest Oil International, Shell, TotalFinaElf, Caltex and Pioneer Natural Resources.

Table 7- South African Fuel Profile Summary

Petroleum (Thousand Barrels per Day)			
	2006	2007	Rank
Total oil production	204.17	199.07	41
Crude oil production	20.16	16.06	65
Consumption	504.91	503	29
Refinery Capacity	505	488	36
Natural Gas (Billion Cubic Feet)			
Production	78	71	53
Consumption	78	78	74
Proved Reserves	#	318	92
Coal (Million Short Tons)			
Production	270.05	269.37	6
Consumption	193.35	194.61	7

Source: Energy Information Administration (http://tonto.eia.doe.gov)
: Not separately reported

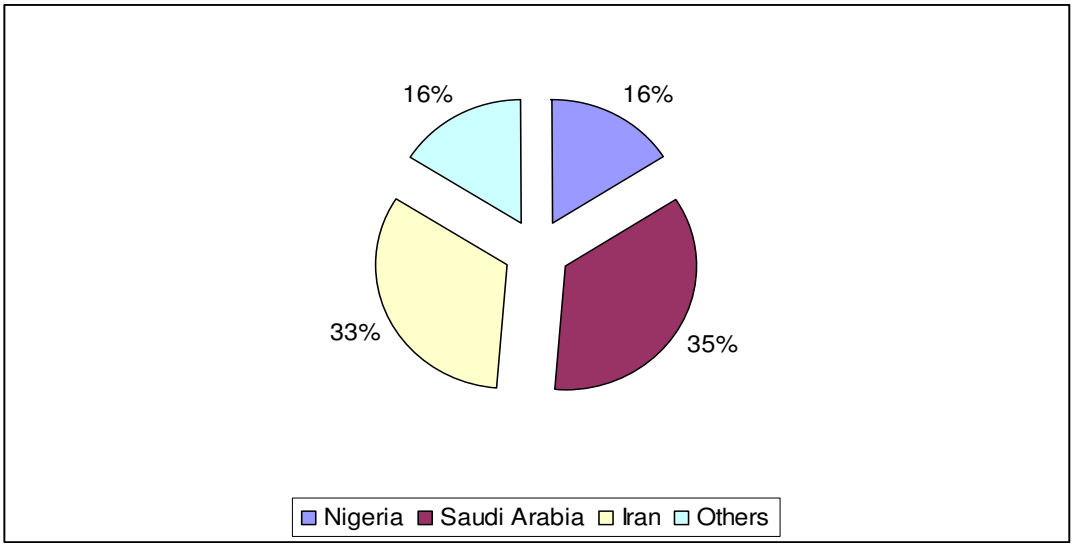
It is important to note that South Africa had 16 Mbbl/d as proven reserves in 2007, globally ranked 80.

- **Demand**

In 2007 61 percent of South Africa's 503 000 bbl/d crude oil consumption was imported. According to the South African Petroleum Industries Association (SAPIA), the majority of crude oil imports destined for South Africa's refineries

come from the Middle East, with Iran and Saudi Arabia being the country's chief suppliers. South Africa also imports crude oil from Nigeria and Angola among others (Fig. 8).

Figure 8 - South Africa Crude Oil Imports, 2006



Source: http://www.eia.doe.gov

In 2007, an estimated 306 000 bbl/d oil was imported into South Africa whereas 7 000 bbl/d was exported to the US.

- **Revenue**

In 2007 oil generated about R1,67 billion, a 5.3 percent decrease from R1,76 billion of 2006 (Table 8). Comparing 2007 revenue to that of 2003 (R767 million), it represents a 117,3 percent improvement in five years.

Table 8 - South Africa's Oil Revenues, 2003 - 2007

Year	Consumption / 1000 bbl/d	Revenue / R Million
2003	3545	767
2004	6157	1612
2005	7155	2401
2006	3938	1760
2007	3442	1667

Source: Department of Minerals and Energy

4.2 Natural Gas

- **Supply**

As of January 2008, South Africa had 318 billion cubic feet of proven natural gas reserves. To compensate for the lack of large natural gas reserves, South Africa developed natural gas supply agreements with neighbouring countries Mozambique and Namibia. PetroSA and Pioneer Natural Resources Co. are developing existing natural gas resources at Sable oil field (95 km off South Africa's southern coast and 150 km from Mossel Bay) and six adjacent undeveloped fields. In 2007 South Africa produced 71 BCF of natural gas (Table 7).

South Africa has numerous government agencies and companies involved in the natural gas industry, including iGas, PetroSA, Sasol, Petroleum Agency of South Africa and Petronet. The companies and agencies work to promote and develop natural gas exploration and production in South Africa.

- **Demand**

In 2007 South Africa consumed 78 billion cubic feet (Table 7) of natural gas, which represent a 3,2 percent decrease (80,5 billion cubic feet in 2003) over the past five years. In 2006, 7 billion cubic feet of natural gas was imported to complement the availability of resources.

- **Revenue**

In 2007, all the 1 413 457 t natural gas (including natural gas condensate) produced in South Africa was sold locally, and generated a revenue of R2,4 billion (Table 9) which is a 10,2 percent increase compared with 2006. The R2,4 billion represents an increase of 183,4 percent in five years (R849 million in 2003).

Table 9 - South Africa's Natural Gas Revenues, 2003 - 2007

Year	Consumption / kt	Revenue / R Million
2003	1022	849
2004	1599	1397
2005	1693	1943
2006	1472	2183
2007	1413	2406

Source: Department of Minerals and Energy

4.3 Coal

- **Supply**

In 2007 South Africa had 48 000 Mt (5,7 percent of the world's total) of proved coal reserves. According to the Eskom Primary Energy Division, the South African production growth has been effectively zero over the last three years. South Africa produced 269,37 MS.tons of coal in 2007 and it was ranked 6th in the world.

- **Demand**

In 2007 South Africa consumed 194,61 MS.tons of coal whereas 1 890 MS.tons were exported. With increased demand, global coal prices are following the escalating oil price and the South African coal export price at the Richards Bay Coal Terminal (RBCT). Recently, the latter broke through US$115 per ton, up from US$53 per ton at the beginning of 2007. This puts pressure on Eskom's short-term coal price and volumes. However, these prices do not correlate with the global ones which decreased in 2007. This is because the South African coal export market was not yet affected by the global financial crisis.

- **Revenue**

The revenue generated by coal in 2007 was R11 billion which is 16,6 percent increase from the R9 billion generated in 2006 (Table 10). This 65,3 percent revenue increase from 2003 (R6,7 billion) is attributable to the growth in the South African energy demands as the country's economy has grown in the past five years.

Table 10 - South Africa's Coal Revenues, 2003 - 2007

Year	Consumption / kt	Revenue / R Billion
2003	240499	6,68
2004	246621	7,03
2005	244879	9,01
2006	245796	9,47
2007	250445	11,04

Source: Department of Minerals and Energy

4.4 Oil Refining and Downstream operations

South Africa has the second largest refining capacity in Africa (708 000 bbl/d), surpassed only by Egypt (726 250 bbl/d). South Africa's refined products are sold in the local market. Major refineries include Sapref (180 000 bbl/d), Enref (125 000 bbl/d), Chevref (100 000 bbl/d), Natref (108 000 bbl/d), PetroSA (45 000 bbl/d) and Sasol (150 000 bbl/d).

In January 2006, the Department of Minerals and Energy promulgated the Cleaner Fuels 1 legislation that compelled oil-refining companies to invest on the process, resulting in shrinking of plant capacity during 2006 to 2008 period. In terms of this legislation oil companies may no longer add lead to petrol and sulphur levels in diesel should be reduced. All oil companies except for Sasol, went for the lower-cost investment options, which saw capacity taken out in favour of quality, resulting in the country having to rely increasingly on imports. Consequently, oil companies with refineries can expect to be required to make investments of R5 billion to R8 billion with effectively no return to meet the possible requirements of Cleaner Fuels 2 (the second phase of the legislation).

4.5 South African Developments

- **Oil**

Over the past five years (2003 to 2007), oil revenue has increased by 117,3 percent. This growth was expected as South Africa is a developing country and its energy demands are also growing.

SASOL and the Industrial Development Corporation (IDC) are studying a 80 000 bbl/d CTL Mafutha project that could generate R9.5 billion in annual operating profit (as at September 2008). This project is likely to generate 26 000 jobs during peak construction and a further 15 000 permanent jobs on plant and mine establishment. The economic importance of this project permits South Africa to retain foreign exchange earnings on oil exports. Three potential sites with abundant coal reserves are being considered, namely the Free State, Limpopo and Mpumalanga provinces. Sasol is also increasing its synfuels (CTL) production in

South Africa by 20 percent over the next eight years. This will add the equivalent of 30 000 bbl/d to production volumes. The expansion will mainly be fuelled by natural gas, with the added environmental benefit of this feedstock releasing fewer emissions.

PetroSA is to build an oil refinery at the Coega Industrial Development Zone, 15 km outside Port Elizabeth. Dubbed Project Mthombo, the proposed crude oil refinery is expected to produce about 400 000 barrels of fuel per day and is set to be operational by 2014. The project will generate about 5 000 jobs directly and 20 000 indirectly. It encompasses logistic infrastructure at Coega, at a cost of $11-billion. Located in Coega, the project will also provide an alternative to the congested and vulnerable Durban supply chain, which accounts for 75 percent of South Africa's crude imports. The refinery will maximise the use of heavy, sour acid crudes. Diesel-to-petrol ratio will be 70:30, and the facility will generate its own power, independent of ESKOM.

Both the projects Mthombo and Mafutha are expected to add approximately 24 to 25 billion litres a year, essentially doubling the current capacity.

- **Natural gas**

There has been an increased usage of natural gas in the recent years as an energy resource throughout the world. Natural gas is the least carbon intensive energy source among the fossil fuels thereby making it attractive for governments in trying to reduce green house gas emissions.

The state-owned PetroSA announced a R5 billion extensive well-drilling programme (Project Jabulani) to develop indigenous gas feedstock for the gas-to-liquid refinery in Mossel Bay.

South Africa is also set to have two new pipelines in 2009 and 2010. Petroline is building one out of Maputo, which is set to be commissioned at the end of 2009 and carry 3,5 billion litres a year into Witbank. Transnet is building a new multiproduct pipeline with a capacity of 8,8 billion litres a year, which will come on stream in the fourth quarter of 2010.

- **Coal**

Although coal revenue has increased by about 40 percent in the period 2003 to 2007, its growth was lower than that of oil and natural gas. In South Africa, coal is mainly used for electricity generation.

SASOL is earmarked to invest more than R6-billion in two new coal mines in Secunda, namely Thubelisha and Impumulelo. Sasol estimates that it will be investing R3 052 million in Thubelisha and R2 991 million in Impumulelo.

Other key developments are:

- Anglo coal announced the establishment of Anglo Inyosi coal valued at US$975 million. Anglo Inyosi Coal will incorporate Kriel colliery, Elders, Zondagsfontein, New Largo and Heidelberg projects. Anglo Coal will hold 73 percent of this project. The Department of Minerals and Energy has already assured Anglo Coal that all requirements for granting of renewed mining licences have been met.
- West Australian-based Centralian Minerals will buy 70 percent of Constantia Energy Witbank's coal project. The deal comprises of 152 Mt of reserves and is worth US$16,713 million.
- Miranda Holdings is exploring and will mine coal on 3 253 ha in the Klipriver coalfield's Uithoek project. This is an area of coking coal. The total resource is estimated at 22 Mt, of which 600 kt are recoverable. The project will have a production of 40 kt per month.
- Central African Mining and Exploration Company (CAMEC) has an agreement to acquire prospecting rights for coal over 20 500 ha. The farms are located within the Waterberg, Soutpansberg and Springbokflats coalfields with more than 300 Mt of potential coal resources.
- Sentula Mining Company and BEE Merafe Resources have announced plans to form a joint venture to produce coal in Mpumalanga. The companies have 25 Mt of measured resources. They plan to begin production by 2009.
- Coal of Africa (formerly GVM) announced that the Mooiplaats coal project near Ermelo is near production. The Camden power station has indicated coal

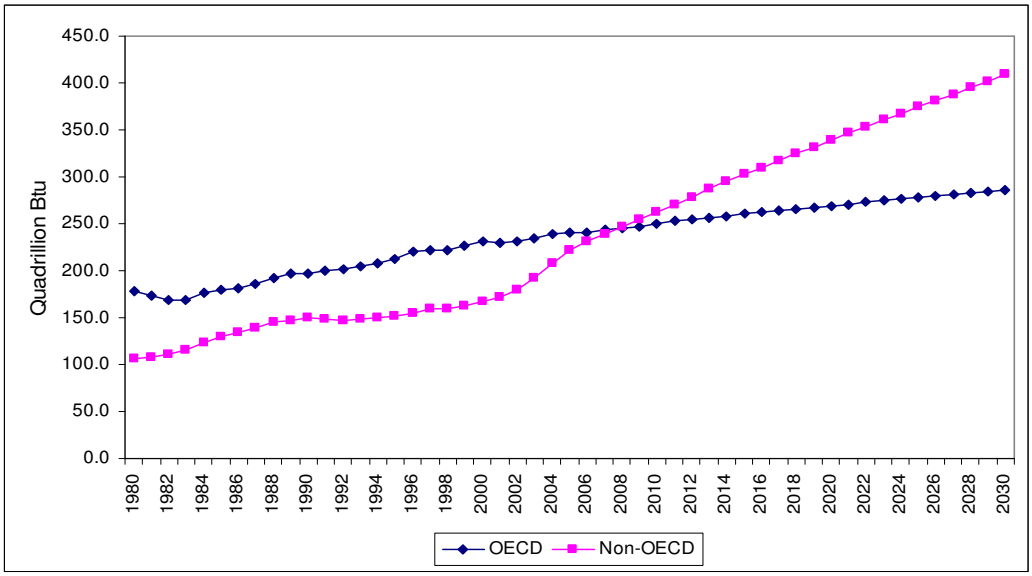
requirements of 6,1 Mt/a and Mooiplaats is being ramped up to produce 6 Mt/a for Camden and 2 Mt/a of anthracite and export coal.

- BHP Billiton disposed of Optimum to a BEE group and approved investment of approximately US$1,5 billion in Klipspruit and Douglas Middelburg Optimisation (DMO).
- The Richards Bay Coal Terminal (RBCT) is expanding its capacity from 72 Mt/a to 91 Mt/a. The expansion is on track and due for conclusion on the second quarter of 2009. However, the fact that the rail capacity to RBCT is not growing at the same pace means that it will take years before the RBCT reaches 91 Mt/a.
- Transnet Freight Rail (TFR) currently has a 78 Mt/a capacity. TFR is finalising a feasibility study to increase its capacity to 81 Mt/a. At the same time, the feasibility study for a further increase to 91 Mt/a is expected to be concluded in the first half of 2009.

5. Outlook

World energy consumption is projected to increase by 50 percent between 2005 and 2030 (Fig. 9). Total energy demand in the non-OECD countries increased by 85 percent, compared with an increase of 19 percent in the OECD countries (International Energy Outlook 2008 (IEO2008)).

Figure 9 - Projected World Energy Consumption



Source: Energy Information Administration

Although high prices for oil and natural gas are expected to continue throughout the period, the slow growth of energy demand in the long term is anticipated.

World energy consumption is projected to continue increasing strongly as a result of robust economic growth and expanding populations in the world's developing countries. OECD member countries are, for the most part, more advanced energy consumers. Energy demand in the OECD economies is expected to grow slowly over the projection period, at an average annual rate of 0,7 percent, whereas energy consumption in the emerging economies of non-OECD countries is expected to expand by an average of 2,5 percent per year with China and India being the fasted growing non-OECD economies.

According to the IEO2008, world liquid hydrocarbons consumption is anticipated to increase from 84 million barrels per day in 2005 to 99 million barrels per day in 2030, while production will increase by 28 million barrels per day. Both OPEC and non-OPEC countries are planning expansion and establishment of new operations to improve capacity to satisfy hydrocarbon demand. About 47 percent of the total world increase in liquids supplies is expected to come from OPEC member countries. Thus, in 2030, OPEC production is projected to total 49 Mbbl/d and non-OPEC production 63 Mbbl/d. World oil prices are forecast to remain high.

Worldwide, the total natural gas consumption is projected to increase from 104 TCF in 2005 to 158 TCF in 2030. This increase is driven by the fact that natural gas produces less carbon dioxide on combustion compared with coal or petroleum, which encourages many governments to increase its consumption. The non-OECD nations are forecast to account for 90 percent of the world's total increase in natural gas production. Non-OECD natural gas production will grow by an average of 2,5 percent per year, from 63 TCF in 2005 to 116 TCF in 2030. Over the same period, production in the OECD countries will grow by only 0,3 percent per year, from 39 TCF to 42 TCF.

World coal consumption is expected to increase by 65 percent over the 2005 to 2030 period, from 122,5 quadrillion (1000 billion) Btu to 202,2 quadrillion Btu. Between 2005 and 2015, coal consumption will grow at the rate of 2,6 percent per

year and slow down to a rate of 1.7 percent until 2030. Regionally, increased use of coal in non-OECD countries accounts for 91 percent of growth over the entire period. South Africa currently accounts for 90 percent of the coal consumed in Africa and is expected to increase over the projection period in both the electricity and industrial sectors.

6. Conclusion

Global fuel industry contributed approximately US$3,7 trillion in revenue as per estimations in this report. Distribution of the revenue by commodity, oil contributes 61 percent, natural gas 35 percent and coal 4 percent. Coal consumption has seen the highest growth (from 2006 to 2007) of 4,5 percentage followed by natural gas at 3,1 percent and oil consumption grew by only 1,1 percent.

In 2007, South Africa's fuel industry contributed approximately R15 billion in revenue that is equivalent to 1 percent of the GDP (in 2006 the industry contributed 2 percent to South Africa's GDP). To this 1 percent coal account for 73 percent, natural gas 16 percent and oil 11 percent.

The information above clearly shows that South Africa depends mainly on fossil fuels and mainly coal for its total energy needs. This also means that coal has a role in providing secure energy supply and therefore it must remain a part of sustainable energy systems in the future. However there is a need also to improve coal technology to reduce its environmental impact. Carbon capture and storage is an important tool in addressing the climate change concerns. Eskom's research project on Underground Coal Gasification is at the piloting stage. The project has so far confirmed excellent environmental performance.

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