CHAPTER 11 - ENERGY

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11 ENERGY

I. INTRODUCTION

11.01 During the Seventh Plan period, the focus of the energy sector was on the sustainable development of depletable resources and the diversification of energy sources. The policy to reduce dependence on oil resulted in the rapid development and usage of natural gas. For the electricity subsector, the main thrust was ensuring adequacy of generating capacity as well as expanding and upgrading the transmission and distribution infrastructure. The use of new and alternative energy sources was encouraged and measures were also undertaken to utilize energy in an efficient manner.

11.02 For the Eighth Plan period, concerted efforts will be undertaken to ensure the sustainable development of energy resources, both depletable and renewable, in meeting the energy demand of the economy. The energy sector will be further strengthened to support the development of Malaysia into a knowledge-based economy, thereby enhancing its resilience and competitiveness. Efforts will be intensified to ensure adequacy, quality and security of energy supply, encourage greater utilization of gas and renewable energy as well as provide adequate electricity generating capacity. In addition, the development of industries that produce energy-related products and services will be supported for both the domestic and export markets.

II. PROGRESS, 1996-2000

11.03 In line with the National Energy Policy, the energy sector developed new approaches and facilities to meet the diversified needs of the economy during the Seventh Plan period. Efforts were undertaken to ensure adequate and reliable supply of energy and at the same time increase efficiency and enhance productivity of the sector.

Energy Demand

11.04 *Commercial Energy*. Expansion in the manufacturing and transport sectors increased the final consumption of commercial energy, which grew at an average annual rate of 4.7 per cent, from 928.2 petajoules (PJ) in 1995 to 1,167.1 PJ in 2000, as shown in *Table 11-1*. This led to a marginal increase of the energy intensity of the economy from 5.6 gigajoules (GJ) in 1995 to 5.7 GJ in 2000. The per capita energy consumption increased at a lower rate of 2.5 per cent to 50.1 GJ in 2000, compared with 44.3 GJ in 1995.

11.05 In terms of energy mix, there was a shift in consumption from oil and petroleum products to alternative sources of energy especially natural gas, thus demonstrating the success of the National Depletion Policy and the Four-Fuel

TABLE 11-1

FINAL COMMERCIAL ENERGY DEMAND[1] BY SOURCE, 1995-2005

Source	*1995*		*2000*		*2005*		*Average Annual Growth Rate (%)*	
	PJ[2]	*%*	*PJ*	*%*	*PJ*	*%*	*7MP*	*8MP*
Petroleum Products	676.0	*72.8*	804.3	*68.9*	1,139.1	*67.0*	*3.5*	*7.2*
Natural Gas[3]	81.1	*8.8*	120.0	*10.3*	184.8	*10.9*	*8.2*	*9.0*
Electricity	141.3	*15.2*	205.0	*17.6*	320.0	*18.8*	*7.7*	*9.3*
Coal & Coke	29.8	*3.2*	37.8	*3.2*	55.9	*3.3*	*4.9*	*8.1*
Total	**928.2**	***100.0***	**1,167.1**	***100.0***	**1,699.8**	***100.0***	***4.7***	***7.8***
Per Capita Consumption (gigajoules)	44.3		50.1		66.4		*2.5*	*5.8*

Notes:

[1] Refers to the quantity of commercial energy delivered to final consumers but excludes gas, coal and fuel oil used in electricity generation.

[2] Joule is the unit of energy to establish the equivalent physical heat content of each energy form. One megajoule = 10^6 joules, one gigajoule (GJ) = 10^9 joules and one petajoule (PJ) = 10^{15} joules and one PJ = 0.0239 million tonnes of oil equivalent (mtoe). One toe = 7.6 barrels.

[3] Includes natural gas used as fuel and feedstock consumed by the non-electricity sector.

Diversification Policy. In particular, the final consumption of gas, electricity as well as coal and coke grew at 8.2 per cent, 7.7 per cent and 4.9 per cent per annum, respectively. However, the country's overall energy mix was continuously reviewed to ensure the long-term reliability and security of energy supply. Concurrently, the possibility of developing other sources of energy, such as renewable energy, to supplement the conventional sources of energy was also considered.

11.06 The industrial sector was the largest energy consumer, utilizing 37.1 per cent of the total final commercial energy demand in 2000, followed by the transport sector at 36.2 per cent and the residential and commercial sector at 12.7 per cent, as shown in *Table 11-2*. Industries that contributed to the increase in energy consumption included rubber, wood, glass, cement and food processing. In the transport sector, the increase in private and commercial vehicles as well as the expansion in the national road network contributed to higher energy usage. In addition, developments in the railway system, particularly the light rail transit in the Klang Valley and the inter-city commuter train service, also increased electricity consumption.

TABLE 11-2

FINAL COMMERCIAL ENERGY DEMAND BY SECTOR, 1995-2005

Sector	*1995*		*2000*		*2005*		*Average Annual Growth Rate (%)*	
	PJ	*%*	*PJ*	*%*	*PJ*	*%*	*7MP*	*8MP*
Industrial[1]	337.5	*36.4*	432.9	*37.1*	650.0	*38.2*	*5.1*	*8.5*
Transport	327.8	*35.3*	422.8	*36.2*	642.5	*37.8*	*5.2*	*8.7*
Residential & Commercial	118.8	*12.8*	147.8	*12.7*	213.2	*12.5*	*4.5*	*7.6*
Non-Energy[2]	125.4	*13.5*	142.8	*12.2*	165.2	*9.7*	*2.6*	*3.0*
Agriculture & Forestry	18.7	*2.0*	20.8	*1.8*	28.9	*1.8*	*2.2*	*6.8*
Total	**928.2**	***100.0***	**1,167.1**	***100.0***	**1,699.8**	***100.0***	***4.7***	***7.8***

Notes:

[1] Includes manufacturing, construction and mining.

[2] Includes natural gas, bitumen, asphalt, lubricants, industrial feedstock and grease.

Energy Supply

11.07 The total supply of energy during the Plan period increased by an average of 5.3 per cent per annum, from 1,293.7 PJ in 1995 to 1,674 PJ in 2000, as shown in *Table 11-3*. The main sources of energy supply were crude oil and petroleum products at 53.1 per cent of total energy supply in 2000, followed by natural gas at 37.1 per cent, coal and coke at 5.4 per cent and hydro at 4.4 per cent. During the Plan period, the share of crude oil and petroleum products declined, while that of natural gas increased, thus indicating the success in reducing further the overall dependence on a single source of energy and developing alternative sources of supply.

TABLE 11-3

PRIMARY COMMERCIAL ENERGY SUPPLY[1] BY SOURCE, 1995-2005

Source	*1995*		*2000*		*2005*		*Average Annual Growth Rate (%)*	
	PJ	*%*	*PJ*	*%*	*PJ*	*%*	*7MP*	*8MP*
Crude Oil & Petroleum Products	702.2	*54.3*	888.4	*53.1*	1,205.2	*50.8*	*4.8*	*6.3*
Natural Gas[2]	459.5	*35.5*	622.2	*37.1*	948.4	*39.9*	*6.3*	*8.8*
Hydro	64.5	*5.0*	73.0	*4.4*	81.6	*3.4*	*2.5*	*2.3*
Coal & Coke	67.5	*5.2*	90.4	*5.4*	139.6	*5.9*	*6.0*	*9.1*
Total	**1,293.7**	***100.0***	**1,674.0**	***100.0***	**2,374.8**	***100.0***	***5.3***	***7.2***

Notes:

[1] Refers to the supply of commercial energy that has not undergone a transformation process to produce energy. Non-commercial energy such as biomass and solar have been excluded.

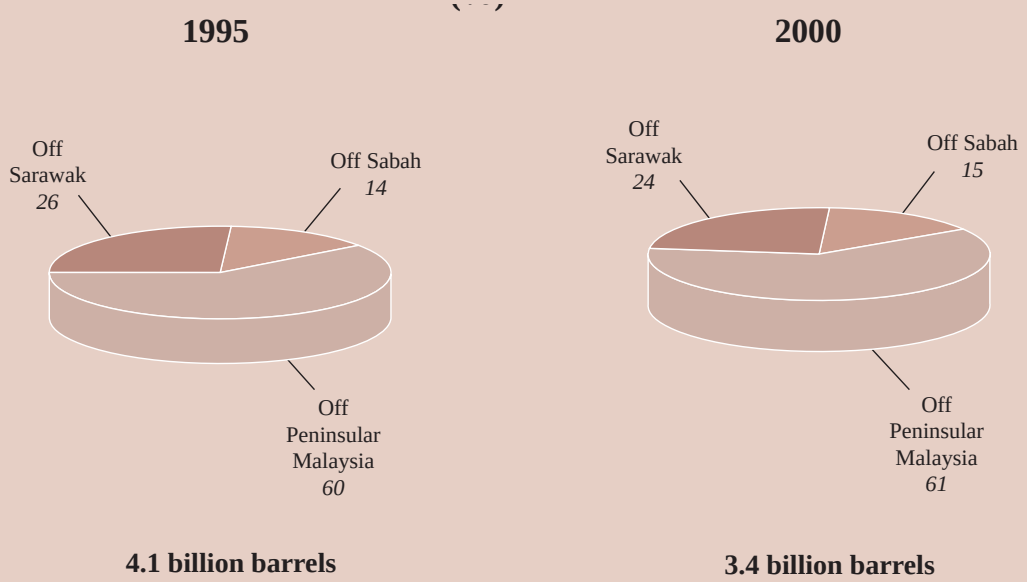
[2] Excludes flared gas, reinjected gas and exports of liquefied natural gas.

Crude Oil

11.08 *Reserves, Exploration and Production*. Malaysia's reserves of crude oil declined by 17 per cent, from 4.1 billion barrels to 3.4 billion barrels during the Plan period, as shown in *Chart 11-1*. The decline was mainly due to sustained production and the maturity of existing fields. Although new fields were discovered, they were smaller in size with less deposits. In view of the need to increase reserves, *Petroliam Nasional Berhad* (PETRONAS) ventured into upstream activities abroad by securing several exploration acreages in Algeria, Angola, Chad, Gabon, Indonesia, Iran, Libya, Myanmar, Pakistan, Sudan, Syria, Tunisia, Turkmenistan and Vietnam.

CHART 11-1

CRUDE OIL RESERVES, 1995 AND 2000
(%)

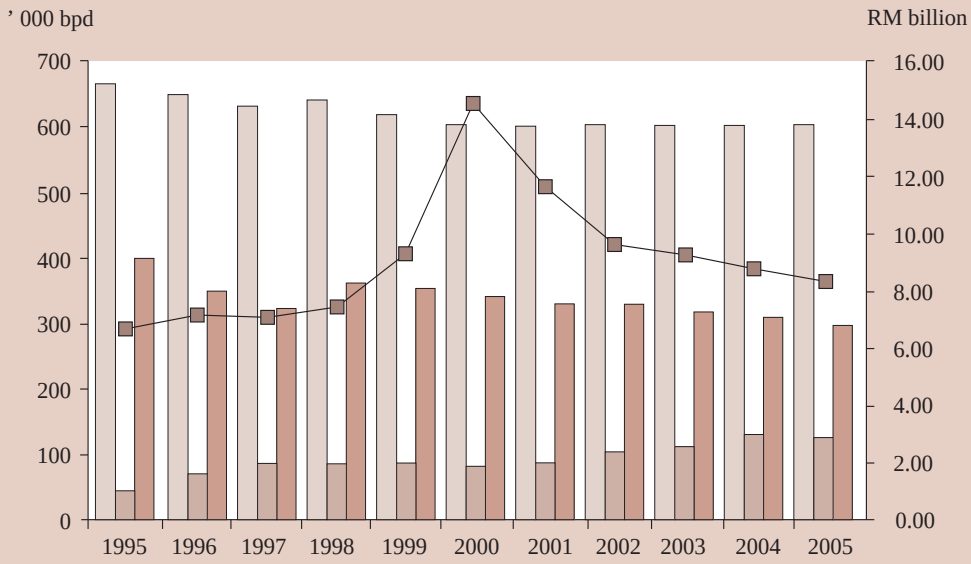


11.09 Average production of domestic crude oil declined from 663,000 barrels per day (bpd) in 1995 to 606,000 bpd in 2000, as shown in *Chart 11-2*. During the Plan period, the production averaged 627,000 bpd, of which 63 per cent was from Peninsular Malaysia, 23.2 per cent from Sarawak and 13.8 per cent from Sabah. The production of condensate, however, increased from 42,000 bpd in 1995 to 74,000 bpd in 2000.

11.10 *Utilization.* Domestic crude oil was largely exported due to its premium quality. The export of crude oil decreased from 399,000 bpd in 1995 to 345,000 bpd in 2000, as shown in *Chart 11-2*. However, with the increase in world oil prices, the export value of crude oil increased by an average annual rate of 16.3 per cent from RM6.7 billion in 1995 to RM14.2 billion in 2000. With the commissioning of the refinery in Melaka in 1997, Malaysia has six refineries with a total capacity of 520,000 bpd for domestic consumption and export. These refineries supplied more than 80 per cent of the total domestic demand for

CHART 11-2

CRUDE OIL AND CONDENSATE[1] PRODUCTION, EXPORT VOLUME AND VALUE, 1995-2005



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Crude Oil ('000 bpd)	663	647	629	640	612	606	600	600	600	600	600
Condensate ('000 bpd)	42	70	85	85	83	74	82	105	110	128	102
Export Volume ('000 bpd)	399	364	330	375	369	345	332	331	319	313	302
Export Value (RM billion)	6.70	7.21	7.07	7.51	9.31	14.24	10.62	9.60	9.13	8.82	8.39

Note: [1] A crude oil component derived from natural gas streams, comprising pentane and heavier hydrocarbons

petroleum products, thus reducing the import of petroleum products such as diesel, fuel-oil and bitumen and increasing the export of certain products such as kerosene, liquified petroleum gas (LPG) and aviation-fuel.

11.11 *Price*. The price of crude oil stabilized in 1996 within the range of US$18 to US$22 per barrel. However, prices weakened in 1998 due to decline in demand and an increase in supply, to reach a historic low of US$10 per barrel.

Subsequently, the significant production curtailment by members of the Organization of Petroleum Exporting Countries (OPEC) lifted oil prices. At the same time, the earlier than expected recovery from the Asian economic crisis, reversed the trend and by June 2000, crude oil prices rose above US$30 per barrel. Consequently, the average price of Malaysian crude oil increased to US$29.58 in 2000 as compared with US$18.34 per barrel in 1995.

Natural Gas

11.12 *Reserves, Exploration and Production.* Natural gas reserves declined marginally from 84.7 trillion cubic feet (tcf) in 1995 to 84.2 tcf in 2000 but remained four times the size of oil reserves, as shown in *Chart 11-3*. Most of the total reserves in 2000 were found off Peninsular Malaysia and Sarawak. This figure, however, does not include the 8.6 tcf of gas reserves discovered in the Malaysia-Thailand Joint Development Area in 1998. Gas production increased to 4,951 million standard cubic feet per day (mmscfd) in 2000 from 3,551 mmscfd in 1995, as shown in *Table 11-4*. The 39.4 per cent increase was mainly due to the higher consumption by the electricity and industrial sectors.

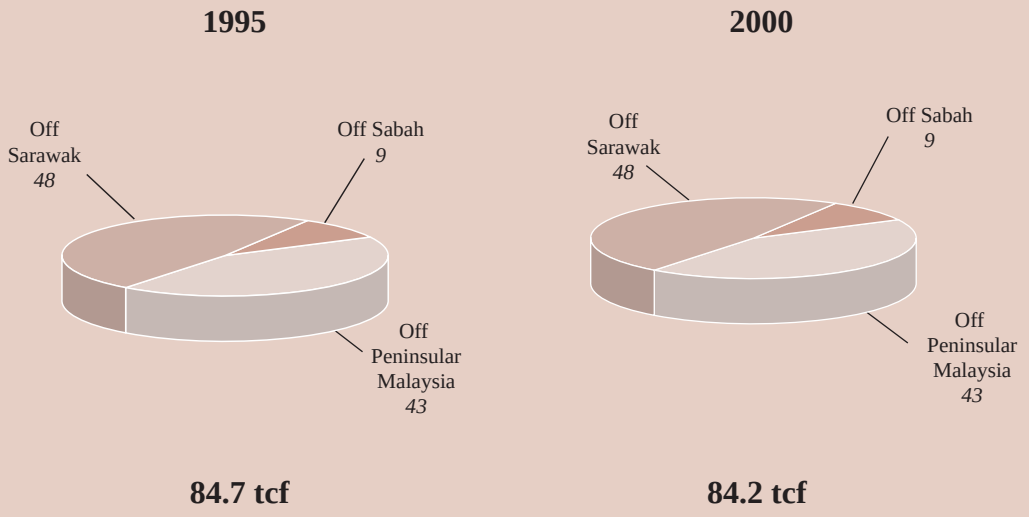
11.13 *Utilization.* The power sector continued to be the main consumer of gas accounting for 80.7 per cent of total gas utilization in 2000. The expansion in gas utilization was contributed, *inter alia*, by the increased application of the combined cycle gas turbine (CCGT) technology in Peninsular Malaysia.

11.14 The non–power sector accounted for 19.3 per cent of total gas consumption in Peninsular Malaysia in 2000, out of which 45 per cent was by the petrochemical industry. Gas from the Peninsular Gas Utilization (PGU) is being supplied to small industrial, commercial and residential consumers through the Natural Gas Distribution System. An average volume of 65 mmscfd of gas was supplied to consumers in the Klang Valley, Pasir Gudang, Kluang, Gebeng and Kemaman. In the residential sector, piped gas was connected to 22,000 homes.

11.15 With the implementation of the natural gas for vehicles (NGV) programme, a total of 18 public NGV refueling stations and two private NGV outlets were built, while 3,700 vehicles were converted to operate on natural gas. In 1998, PETRONAS was given the approval to import in stages 1,000 monogas taxis, of which 300 were in operation.

CHART 11-3

NATURAL GAS RESERVES, 1995 AND 2000
(%)



11.16 The use of gas was further diversified during the Plan period with the introduction of the gas district cooling (GDC) system. The GDC, which utilizes gas to produce chilled water for air-conditioning and waste heat for power generation, helps to lower the peak load demand and reduces investment for peaking capacity. Three GDC plants at the Kuala Lumpur City Centre (KLCC), Kuala Lumpur International Airport (KLIA) and Putrajaya started operation during the Plan period.

11.17 Export of liquefied natural gas (LNG) increased from 9.9 million tonnes in 1995 to 15.5 million tonnes in 2000. Japan remained the largest market at 72.4 per cent of total LNG export, followed by Taiwan at 14.5 per cent and South Korea at 13.1 per cent. Malaysia's export earnings from LNG in 2000 were RM11.3 billion, a three-fold increase compared with RM3.1 billion in 1995. In terms of its contribution to the country's total export earnings, the LNG share increased from 1.7 per cent in 1995 to 2.9 per cent in 2000.

TABLE 11-4

NATURAL GAS PRODUCTION[1], 1995-2005
(mmscfd)

Exploration Area	*1995*	*2000*	*2005*
Off Peninsula	1,440	2,100	2,800
Off Sabah	230	220	354
Off Sarawak	1,881	2,631	3,888
Malaysia	**3,551**	**4,951**	**7,042**

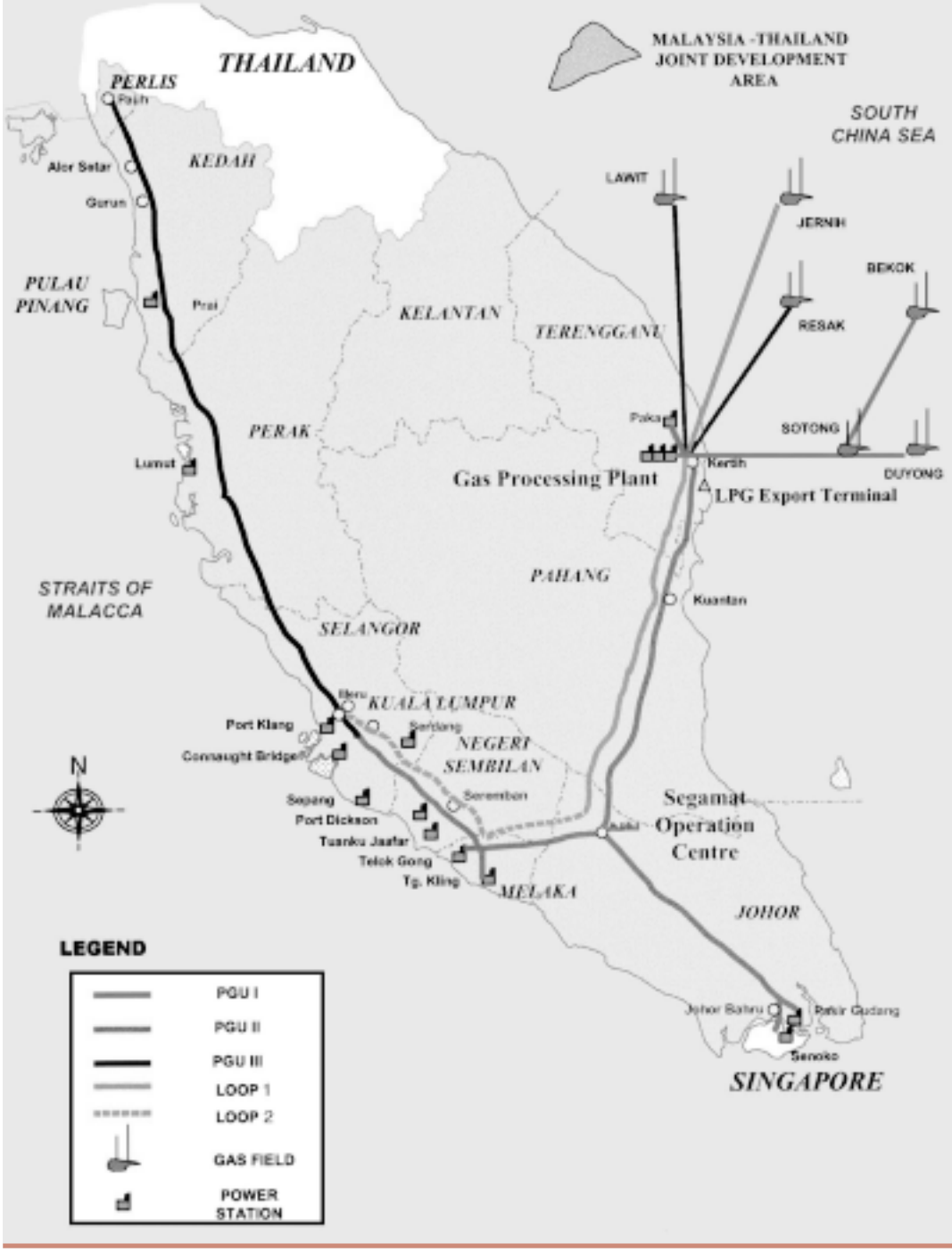
Note: [1] Total gas produced at wellhead.

11.18 *Price*. The gas price for the power generation sector in Peninsular Malaysia was fixed at RM6.40 per million British Thermal Unit (mmBTU) for the period May 1997 to December 2000. For the non-power sector, the gas price was derived from the average price of competing fuels and pegged to the medium fuel oil (MFO) price index. For small industrial, commercial and residential customers using less than two mmscfd, the price was based on a regulated tariff.

11.19 *Investment.* During the Plan period, RM35.4 billion was spent for exploration and development of petroleum activities, of which RM12.9 billion was expended by PETRONAS, through its subsidiaries. For oil-related downstream activities, a total of RM5.3 billion was spent on the construction of an oil refinery in Melaka and a multi-product pipeline stretching from Melaka to the Klang Valley. A total of RM8.0 billion was invested mainly for the gas infrastructure and related facilities. The commissioning of the fifth and sixth gas processing plants and the third dew point control unit in 1999, with an investment of RM2.7 billion, increased total gas processing capacity to 2,000 mmscfd, with a standby capacity of 750 mmscfd. Phase III of the PGU pipeline project, which covered 450 kilometres, involving an investment of RM3.5 billion, was also completed. To enhance the security of supply, PETRONAS undertook the PGU Loop 1 and 2 projects with pipelines running parallel to the existing PGU I and II from Kerteh to Meru, as shown in *Chart 11-4*. The PGU Loop 1 project was completed

CHART 11-4

GAS SUPPLY NETWORK, 2001-2005



in 1999 with an expenditure of RM680 million. In addition to the PGU system, a 379-kilometre gas reticulation network, with an investment of RM164 million, was constructed in Peninsular Malaysia to provide a constant supply of gas to industrial, commercial and residential consumers. In addition, RM946 million was incurred in the construction of the three GDC plants at the KLCC, KLIA and Putrajaya.

11.20 The gas sector underwent structural changes from being primarily a source of fuel to becoming an important input for the production of value-added manufactured products for domestic as well as the export markets. A total of RM14.7 billion was invested by the petrochemical companies, including PETRONAS, for the production of aromatics, ethylene and its derivatives in Kerteh and Pasir Gudang, propylene and its derivatives in Gebeng as well as ammonia and urea in Gurun.

Coal

11.21 The use of coal as an energy source in electricity generation was aimed at ensuring system security and reliability. Total coal reserves, which are mainly in Sabah and Sarawak, increased from 974 million tonnes in 1995 to 1,050 million tonnes in 2000. However, the development of local coal resources was not aggressively pursued because most of the deposits were located in the interior areas, which lack infrastructure, and therefore uneconomical to be fully exploited. Coal production increased from 114,100 tonnes in 1995 to 310,000 tonnes in 2000, which was utilized by the Sarawak Electricity Supply Corporation's (SESCo) power station at Sejingkat, with a capacity of 100 megawatts (MW). The total coal requirement of this plant was 300,000 tonnes per annum. Another coal-fired power plant completed was the Phase III, *Tenaga Nasional Berhad's* (TNB) *Sultan Salahuddin Abdul Aziz Shah* power station in Kapar, with an additional capacity of 1,000 MW. The new plant started its trial run towards the end of the Plan period by utilizing imported coal.

Electricity

11.22 The electricity supply industry experienced major changes during the Plan period, particularly the restructuring of the three major utilities, namely TNB, Sabah Electricity Sdn. Bhd. (SESB) and SESCo, which took place consequential to the privatization programme. These included further streamlining

of TNB's operations, divestment of its thermal plants as well as the privatization of *Lembaga Letrik Sabah* (LLS), which was subsequently known as Sabah Electricity Sdn. Bhd. With the operation of the Independent Power Producers (IPPs), the major utilities were relieved of the need to provide capital investments for new power plants to meet the nation's increasing electricity demand.

11.23 *Generation*. TNB's share of total generation in Peninsular Malaysia was maintained at 63 per cent with the remainder contributed by the IPPs. The IPPs contributed 40 per cent in Sabah and 36 per cent in Sarawak. However, towards the end of the Plan period, the share of TNB's total generation was reduced by 2,750 MW as a result of the divestment of its thermal plants in Tanjung Kling and Kapar. A total of 3,849 MW of new capacities was installed by the three main utilities as well as the IPPs, as shown in *Table 11-5*. This comprised a total of 3,233 MW for Peninsular Malaysia, 298 MW for Sabah and 318 MW for Sarawak.

11.24 Peak demand increased from 7,212 MW in 1995 to 10,673 MW in 2000, averaging 8.2 per cent per annum, as shown in *Table 11-6*. However, peak demand in Peninsular Malaysia was affected by the economic crisis and registered a lower average growth of 8.1 per cent per annum. Following the recovery, demand grew by 10.1 per cent, peaking at 9,712 MW in 2000 compared with 8,819 MW in 1999. With an overall reserve margin of 32.2 per cent, the supply of electricity was adequate to meet the demand of the economy.

11.25 Following the economic recovery, demand for power is expected to increase resulting in the need for additional capacity from the year 2008 onwards. To meet this demand, the Government revived the Bakun Hydroelectric Project and entrusted Sarawak Hidro Sdn. Bhd., a company under the Minister of Finance Incorporated, to be the project implementing agency. By the end of the Plan period, the construction of the project's river diversion tunnels was 95 per cent completed.

11.26 *Generation Mix*. The increased utilization of CCGTs, particularly by the IPPs, and the continued conversion of TNB thermal plants to gas, contributed to the increasing number of gas-fuelled power plants in Peninsular Malaysia. As a result, the share of gas as a generating fuel increased from 67.8 per cent in 1995 to 78.7 per cent in 2000, as shown in *Table 11-7*. This was in line with the policy to promote the utilization of a more environment-friendly fuel. The preference for gas technology was also due to its higher thermal conversion rate. In Sarawak, gas also remained the biggest component in the generation mix

TABLE 11-5

NEW GENERATION CAPACITY, 1996-2005

Plant	*Commercial Operation Date*	*Installed Capacity (MW)*	*Fuel*
IPP Lumut	1996	1,303	Gas
IPP Kuala Langat	1996	720	Gas
IPP Telok Gong	1996	440	Gas
IPP Port Dickson	1996	440	Gas
IPP Tawau	1996	36	Diesel
IPP Kota Kinabalu	1998	120	Gas
IPP Sandakan	1998	60	Diesel
IPP Batu Sapi, Sandakan	1998	32	Diesel
IPP Melawa	1999	50	Gas
IPP Tg. Kling	1999	330	Gas
IPP Sejingkat	2000	100	Coal
IPP Bintulu	2000	218	Gas
Sub-total		**3,849**	
TNB Kapar (Phase III)	2001	1000	Coal
TNB Gelugor (conversion)	2002	110	Gas
IPP Sepang			
• open cycle	2002	460	Gas
• conversion	2003	250	Gas
IPP Lumut Block 3			
• open cycle	2002	430	Gas
• conversion	2003	210	Gas
IPP Telok Gong (new)			
• open cycle	2002	430	Gas
• conversion	2003	290	Gas
TNB Pasir Gudang	2002	220	Gas
IPP Prai	2003	350	Gas
TNB Port Dickson	2003	1,500	Gas
TNB Manjung	2003	700	Coal
	2004	1,400	Coal
IPP K. Sanglang	2004	650	Gas
IPP Sabah	2004	100	Gas
IPP Pulau Bunting	2005	700	Coal
Sub-total		**8,800**	
TOTAL		**12,649**	

TABLE 11-6

INSTALLED CAPACITY, PEAK DEMAND AND RESERVE MARGIN, 1995-2005

Year	*Generation By System*[1]	*Accumulated Installed Capacity (MW)*	*Peak Demand*[3] *(MW)*	*Reserve Margin*[4] *(%)*
1995	TNB	9,655	6,572	*46.9*
	LLS[2]	590	298	*98.0*
	SESCo	590	342	*72.5*
	Total	**10,835**	**7,212**	***50.2***
2000	TNB	12,479	9,712	*28.5*
	SESB	785	410	*91.5*
	SESCo	846	551	*53.5*
	Total	**14,110**	**10,673**	***32.2***
2005	TNB	20,819	15,380	*35.4*
	SESB	880	615	*43.1*
	SESCo	1,046	839	*24.7*
	Total	**22,745**	**16,834**	***35.1***

Notes:

[1] System refers to utilities and the respective IPPs.

[2] LLS was privatized and became SESB in 1998.

[3] Peak demand is the maximum power demand registered by the system in a stated period of time.

[4] Reserve margin equals accumulated capacity minus peak demand divided by peak demand multiplied by 100.

contributing 58.8 per cent. As a result of the commissioning of the Sejingkat power plant, coal for the first time contributed 17.1 per cent of the total mix while the share of hydro and oil stood at 13.2 per cent and 10.9 per cent, respectively. In Sabah, oil contributed 50.2 per cent of the generation mix in 2000, followed by gas at 32.8 per cent and hydro at 17 per cent.

11.27 *Transmission***.** During the Plan period, the National Load Dispatch Centre commissioned the supervisory control and data acquisition (SCADA) system, energy management system and automatic generation control. This further improved the load frequency control during normal and emergency operations. The transmission network was further strengthened with the completion of the first phase of the 500 kilovolt (kV) transmission project covering seven substations

TABLE 11-7

FUEL MIX IN ELECTRICITY GENERATION, 1995-2005
(%)

	Year	Oil	Coal	Gas	Hydro	Others	Total (gigawatthour)
MALAYSIA	1995	*11.0*	*9.7*	*67.8*	*11.3*	*0.2*	**41,813**
	2000	*5.3*	*7.9*	*78.7*	*8.0*	*0.1*	**69,371**
	2005	*3.0*	*30.3*	*61.0*	*5.4*	*0.3*	**102,340**
TNB	1995	*9.2*	*10.7*	*70.3*	*9.6*	*0.2*	**38,091**
	2000	*3.3*	*7.8*	*81.4*	*7.4*	*0.1*	**63,684**
	2005	*1.3*	*32.6*	*61.0*	*5.0*	*0.1*	**93,649**
LLS/SESB	1995	*47.1*	-	*25.7*	*27.2*	-	**1,763**
	2000	*50.2*	-	*32.8*	*17.0*	-	**2,348**
	2005	*41.3*	-	*47.3*	*11.4*	-	**3,525**
SESCo	1995	*13.0*	-	*57.3*	*29.7*	-	**1,959**
	2000	*10.9*	*17.1*	*58.8*	*13.2*	-	**3,339**
	2005	*7.6*	*10.6*	*67.4*	*9.0*	*5.4*	**5,166**

and a total length of 885 circuit kilometres (cct-km), as shown in *Table 11-8*. This comprised the Gurun-Ayer Tawar-Kapar sector in the north and Pasir Gudang-Yong Peng sector in the south. The second phase of the project covering a total of 64 cct-km from the Manjung power station to the Ayer Tawar substation began towards the end of the Plan period. In addition, 275 kV submarine cables with a carrying capacity of 250 MW were laid from Juru to Bayan Lepas to cater for the growing electricity requirement of Pulau Pinang.

11.28 The transmission network was expanded in both Sabah and Sarawak, in an effort to enhance electricity coverage and integration within the respective states. In Sabah, two 132 kV circuits were added to the West Coast transmission grid, covering a distance of 40 cct-km from Penampang to Inanam and Melawa. In Sarawak, a total of 261 cct-km of the 275 kV and 132 kV transmission lines was added to the network.

11.29 TNB and the Electricity Generating Authority of Thailand (EGAT) further upgraded the link between the two countries with the implementation of the high voltage direct current transmission project, from Gurun in Kedah to Khlong

TABLE 11-8

TRANSMISSION NETWORK CAPACITY, 1995-2005
(circuit-kilometres)

Year	*Utility*	*500 kV*	*275 kV*	*132 kV*	*66 kV*
1995	TNB	-	4,322	8,046	756
	LLS	-	-	479	112
	SESCo	-	569	63	-
	Total	**-**	**4,891**	**8,588**	**868**
2000	TNB	885[1]	5,917	8,606	366
	SESB	-	-	519	116
	SESCo	-	765	128	-
	Total	**885**	**6,682**	**9,253**	**482**
2005	TNB	1,300	8,500	9,500	-
	SESB	-	1,414	867	116
	SESCo	-	765	128	-
	Total	**1,300**	**10,679**	**10,495**	**116**

Note: [1] The lines were energized at 275 kV.

Ngae in Thailand. This line has a power transfer capability of 300 MW and is upgradeable to 600 MW. The project paved the way for the initial establishment of the ASEAN Power Grid.

11.30 *Distribution.* The distribution network in Peninsular Malaysia was expanded and reinforced, increasing the network capacity from 54,050 cct-km in 1995 to 182,133 cct-km in 2000, as shown in *Table 11-9.* Similar expansion and reinforcement works were also undertaken in Sabah and Sarawak, where a total of 3,045 cct-km and 2,464 cct-km were added to the distribution network, respectively. Efforts were focused to reduce the number and duration of supply interruptions to consumers. Under the reduction of disruption programme by TNB, various measures to reduce interruption incidences included analyzing data of breakdown incidences, identifying disruption causes and conducting detailed technical studies.

11.31 In Sabah, the distribution network was further strengthened with the completion of several new substations and distribution lines, which among others, included the 33/11kV substations in Papar and Sandakan, 33kV overhead distribution

TABLE 11-9

DISTRIBUTION NETWORK CAPACITY, 1995-2005
(circuit-kilometres)

Year	*Utility*	*33 kV*	*22 kV*	*11 kV*	*Total*
1995	TNB	4,662	3,710	45,678	54,050
	LLS	105	334	3,110	3,549
	SESCo	1,350	-	3,939	5,289
	Total	**6,117**	**4,044**	**52,727**	**62,888**
2000	TNB	6,656	3,577	171,900	182,133
	SESB	206	441	5,947	6,594
	SESCo	1,995	-	5,758	7,753
	Total	**8,857**	**4,018**	**183,605**	**196,480**
2005	TNB	14,300	-	342,600	356,900
	SESB	362	100	8,921	9,383
	SESCo	2,158	-	6,212	8,370
	Total	**16,820**	**100**	**357,733**	**374,653**

system in Labuan and Tawau as well as 33kV cable interconnection between Labuan and Bangat. In Sarawak, similar efforts were carried out, which included 33/11kV substations in Medan Jaya, Kidjun, Tudan and Tanjung Manis as well as 11kV feeders to Kuala Baram Industrial Estate and Tanjung Manis Timber Processing Zone. Other projects implemented were the laying of the 30 cct-km underground cable in the Samajaya Industrial Estate in Kuching, the ugrading of the 33kV overhead lines from Pulau Keladi to Kanowit and the installation of the 25.5 cct-km of 33kV overhead line to the Kebuluh Agriculture Centre in Bekenu.

11.32 *Rural Electrification*. A total of RM463.6 million was expended in the implementation of the rural electrification programme, which benefited an additional 101,530 rural households in Malaysia during the Plan period. Of this, 30,040 and 53,630 rural households were in Sabah and Sarawak, respectively. In addition, the Electricity Supply Industry Trust Account, funded by the industry, was established in 1997. Through its rural electrification programme, a total of 8,200 households in Peninsular Malaysia was also provided with electricity. By the end of the Plan period, rural electricity coverage in Malaysia was 93 per cent, as shown in *Table 11-10*.

TABLE 11-10

RURAL ELECTRIFICATION COVERAGE[1] BY REGION, 1995-2005
(%)

Region	*1995*	*2000*	*2005*
Peninsular Malaysia	*99*	*100*	*100*
Sabah	*72*	*79*	*85*
Sarawak	*67*	*80*	*90*
Malaysia	***92***	***93***	***95***

Note: [1] Rural households served as a percentage of total rural households.

11.33 *Investment.* A total of RM41.1 billion was invested in the electricity supply industry during the Plan period. This investment was demand-driven with more than one half of it accounted for by generation activity, as shown in *Table 11-11.* Investment in generation was generally made by the IPPs, which spent RM17.6 billion compared with RM5.9 billion by the utilities, resulting in a substantial reduction in capital investment requirements by the utilities. The investments by the IPPs were mostly sourced locally. In order to secure and

TABLE 11-11

INVESTMENTS BY UTILITIES AND IPPs IN ELECTRICITY SUPPLY INDUSTRY, 1995–2000
(RM million)

Activity	*TNB*	*SESB*	*SESCo*	*IPPs*	*Total*	*%*
Generation	5,489.3	331.6	116.5	17,576.2	23,513.6	*57.2*
Transmission	7,600.0	648.6	22.2	-	8,270.8	*20.1*
Distribution	8,566.0	241.7	517.5	-	9,325.2	*22.7*
Total	**21,655.3**	**1,221.9**	**656.2**	**17,576.2**	**41,109.6**	***100.0***
%	*52.7*	*2.9*	*1.6*	*42.8*	*100.0*	

strengthen the grid system, a total of RM17.6 billion was spent on upgrading and constructing transmission lines as well as improving the distribution network.

11.34 *Productivity and Efficiency*. Improvements in productivity and efficiency were recorded in all the three utilities during the Plan period, as shown in *Table 11-12*. In Peninsular Malaysia, units sold per employee increased from 1.65 gigawatthour (GWh) in 1995 to 2.49 GWh in 2000 and similarly for Sabah and Sarawak, from 0.63 GWh to 0.90 GWh and from 0.85 GWh to 1.34 GWh, respectively. Improvements in the transmission and distribution systems also contributed to a significant reduction in interruption incidences from 275,380 in 1995 to 43,846 in 2000 in Peninsular Malaysia. In Sabah, the incidences declined from 26,258 to 11,871, however those in Sarawak increased slightly from 2,084 to 2,991. Nevertheless, the System Average Interruption Duration Index (SAIDI) of the three utilities improved. For TNB, the SAIDI improved from 769 minutes per customer per year in 1995 to 319 minutes per customer per year in 2000, while that of SESB from 3,150 to 2,520 and SESCo from 481 to 314.

TABLE 11-12

PERFORMANCE INDICATORS OF THE ELECTRICITY SUPPLY SYSTEMS[1], 1995 AND 2000

Indicator	*1995*			*2000*		
	TNB	*LLS*	*SESCo*	*TNB*	*SESB*	*SESCo*
System Losses[2] (%)	*12.7*	*19.4*	*19.4*	*14.9*	*15.0*	*15.0*
Unit Sold per Employee[3] (GWh)	1.65	0.63	0.85	2.49	0.90	1.34
Interruption Incidences (number)	275,380	26,258	2,084	43,846	11,871	2,991
SAIDI (minutes/customer/year)	769	3,150[4]	480.7	319	2,520	314.3

Notes:

[1] Comprising utilities only.

[2] Refers to generation, transmission and distribution losses and own use.

[3] Refers to total electrical energy units sold divided by total number of employees.

[4] Refers to 1997/1998 Financial Year.

11.35 *Price*. Electricity tariffs amongst the utilities were determined by supply cost and returns to the industry. Average electricity tariff for domestic consumers in Peninsular Malaysia increased by 17.3 per cent from 20.03 sen per kilowatthour (kWh) in 1995 to 23.5 sen/kWh during the Plan period. Sabah maintained its tariff at 24.4 sen/kWh while that in Sarawak was reduced to 27.1 sen/kWh from 28.5 sen/kWh.

Renewable Energy

11.36 Sustainable development of energy resources was undertaken during the Plan period. A holistic approach was adopted in promoting the utilization of renewable resources such as biomass, biogas, municipal waste, solar and mini-hydro. In this regard, a project on the Development of a Strategy for Renewable Energy as the Fifth Fuel was undertaken to assess the renewable energy (RE) potential in the country and consider the legal, regulatory and financial framework in order to encourage the utilization of renewable resources.

11.37 Other efforts undertaken to promote the use of RE included the establishment of the RE data base at *Pusat Tenaga Malaysia*. *Universiti Sains Malaysia* established the Centre for Education and Training in Renewable Energy and Energy Efficiency (CETREEE) to increase public awareness of the positive attributes of RE and energy efficiency (EE) measures. CETREEE conducted training and dissemination activities, which included the designing of RE and EE modules for teaching in schools and universities.

Energy Efficiency

11.38 In line with Malaysia's commitment to moderate the increasing energy intensity trend and avoid wasteful energy usage, EE measures were undertaken during the Plan period. These measures included energy audits in selected industries and commercial complexes as well as the utilization of more energy efficient processes and technologies. A project on the Development of an Energy Efficiency Strategy was carried out to evaluate the legal, regulatory and financial framework with the aim of promoting the efficient utilization of energy. In addition, an industrial energy efficiency improvement programme was implemented to encourage EE measures in eight manufacturing subsectors, namely wood, pulp and paper, iron and steel, cement, rubber, glass, ceramic and food. Other initiatives included

increasing public awareness on EE measures, the potential of energy savings and positive attributes of alternative fuels as well as increasing public access to information on energy efficient technologies.

Regulatory Framework

11.39 To ensure the orderly development of the electricity supply industry, the Electricity Supply Act 1990 was extended to cover Sabah following the privatization of LLS in 1998, while that of Sarawak continued to be regulated by the Sarawak Electricity Ordinance 1992. These legislations provided for the issuance of licences for power generation, transmission and distribution; establishment of performance standards and obligations of the licensees; promotion of competition in the generation and supply of electricity; protection of consumer interest; and safety of electrical installation and equipment.

11.40 The Gas Supply Act 1993, which was enforced during the Plan period, provided for, *inter alia*, the issuance of licences for gas supply activities, regulation of the quality and volume of gas supplied through the pipelines and the promotion of safety and efficiency. This legislation was applicable to the transmission of gas after the city gate station and the supply of gas to residential, commercial and industrial consumers through pipelines, storage tanks or cylinders.

Vendor Development

11.41 During the Plan period, Bumiputera participation in the electricity supply industry was further enhanced through TNB's Entrepreneur Development Programme, which included assistance in the manufacture of selected products used by the industry, extension of advisory services to contractors and dialogues with the relevant Bumiputera trade associations. By the end of the Plan period, there were 42 Bumiputera vendors involved in the manufacturing of transmission towers, transformers, switchgears, feeder pillars, cable slabs and cable accessories, street lighting and accessories as well as meters. The Vendor Development Programme established by PETRONAS benefited 43 Bumiputera vendors engaged in manufacturing and technical service in the oil and gas industry, which mainly comprised the manufacture of heat exchanges, steel gratings, spiral wound gaskets, cable slabs, plastic lubricant containers and wire rope slings as well as the provision of services such as plant/tank maintenance and helicopter charter flights.

Research and Development

11.42 Research and development (R&D) by the utilities focused on the electricity supply industry, such as product innovation, quality assurance and testing services as well as developing leading-edge technologies. Efforts undertaken included a demonstration project of a 3-kW grid-connected solar photovoltaic system, introduction of an integrated computerized monitoring system for gas turbines at the Paka Power station, development of a database programme for power plant components, implementation of a techno-economic study to upgrade the 120 MW steam turbine at the Tuanku Jaafar Power Station and research on coal ash utilization. In the petroleum industry, R&D included hydrocarbon exploration, exploitation and product development, innovations of processes and products as well as development of fuel cell performance and microbial biotechnology.

III. PROSPECTS, 2001-2005

11.43 Sustainable development of the energy sector will continue to be the main thrust of the Eighth Plan, aimed at contributing towards enhancing the nation's competitiveness and resilience. In this regard, the focus of the sector will be on ensuring adequate, secure, quality and cost-effective supply of energy, promoting its efficient utilization and minimizing the negative impact on the environment. The provision of quality supply of electricity will be crucial as the economy becomes more technology and ICT-driven as well as to cater to the manufacturing sector's shift to high-technology. Towards this end, the strategies of the energy sector for the Plan period are as follows:

- ❏ *ensuring adequacy and security of fuel supply as well as promoting the utilization of gas and renewable energy*;
- ❏ *ensuring adequacy of electricity supply as well as improving productivity and efficiency;*
- ❏ *developing the energy-related industries and services as well as increasing local content;*
- ❏ *promoting Malaysia as a regional centre for energy-related engineering services; and*
- ❏ *encouraging efficient utilization of energy, particularly in the industrial and commercial sectors.*

Energy Demand

11.44 *Commercial Energy*. During the Plan period, the overall demand for energy is expected to increase at 7.8 per cent per annum to 1,699.8 PJ in 2005, as shown in *Table 11-1*. The energy intensity of the economy is anticipated to increase marginally from 5.7 GJ in 2000 to 5.9 GJ in 2005. The expected improvement in the quality of life of the population will also result in an increase in energy usage. In this respect, per capita consumption of energy is expected to increase by 5.8 per cent per annum from 50.1 GJ in 2000 to 66.4 GJ in 2005.

11.45 In line with the increased planned capacity in the power sector, the demand for natural gas as well as coal and coke, is expected to grow at 9.0 per cent and 8.1 per cent per annum, respectively. Electricity demand is projected to grow at 9.3 per cent per annum, thereby increasing its share of the total energy demand to 18.8 per cent in 2005. Per capita electricity consumption will also increase at the rate of 7.3 per cent per annum to 3,472.5 kWh in 2005.

11.46 The demand for petroleum products is projected to grow at 7.2 per cent per annum, mainly from the transport and manufacturing sectors. However, in line with the National Depletion Policy and the fuel diversification policy, the share of petroleum products to the total commercial energy demand is expected to decline to 67 per cent in 2005.

11.47 The industrial and transport sectors will continue to be the major energy consumers in line with their anticipated growth during the Eighth Plan period. For the industrial sector, energy demand is expected to grow at 8.5 per cent per annum, accounting for 38.2 per cent of the total energy demand in 2005, as shown in *Table 11-2*. Energy demand by the transport sector is projected to increase at 8.7 per cent per annum and its share of the total energy demand is expected to match that of the industrial sector in 2005. Rapid growth for energy demand by this sector will be due, *inter alia*, to the increasing requirement for transportation and distribution services by the manufacturing and construction sectors. In addition, the growth of West Port of Port Klang as a regional cargo centre, Port of Tanjung Pelepas as a transhipment hub and the KLIA as an aviation hub, will also result in an increase in demand for energy. At the same time, the development of the transportation infrastructure, such as the Express Rail Link from KL Sentral to KLIA and the Rawang-Ipoh double-tracking railway project, will also lead to an increase in energy usage. The usage of energy for the residential and commercial sector is also expected to increase by 7.6 per cent per annum during the Plan period.

Energy Supply

11.48 The security and reliability of energy supply will be ensured through an optimal energy mix predominantly based on domestic resources. To meet the energy requirements of the country, the total supply of energy is expected to reach 2,374.8 PJ in 2005, as shown in *Table 11-3*. The contribution of crude oil and petroleum products is anticipated to decline to 50.8 per cent, while that of natural gas and coal is expected to increase to 39.9 per cent and 5.9 per cent, respectively, by 2005. At the same time, efforts will be intensified to encourage the utilization of renewable resources for the generation of energy. In this respect, the fuel diversification policy, which comprises oil, gas, hydro and coal, will be extended to include RE as the fifth fuel.

Crude Oil

11.49 *Exploration and Production.* The nation's crude oil reserves is anticipated to last at least another 10 years. To sustain the reserves, efforts that will be undertaken include developing potential small fields and enhancing the production of matured fields. In addition, exploration in deep-water areas will be continued, especially in Sabah and Sarawak. This will enable the average production level to be maintained at 600,000 bpd during the Plan period. To attract investments in exploration activities, more favourable terms of the production sharing contracts will be considered. Other efforts to sustain oil production will include the acquisition of state-of-the-art technology in exploration and production as well as intensification of research in oil recovery and reduction of cost. To further enhance the recovery rate, efforts will be directed towards improving productivity and efficiency. Domestic production will be supplemented by the supply of crude oil from PETRONAS' ventures in Africa, Middle East and Asia.

Natural Gas

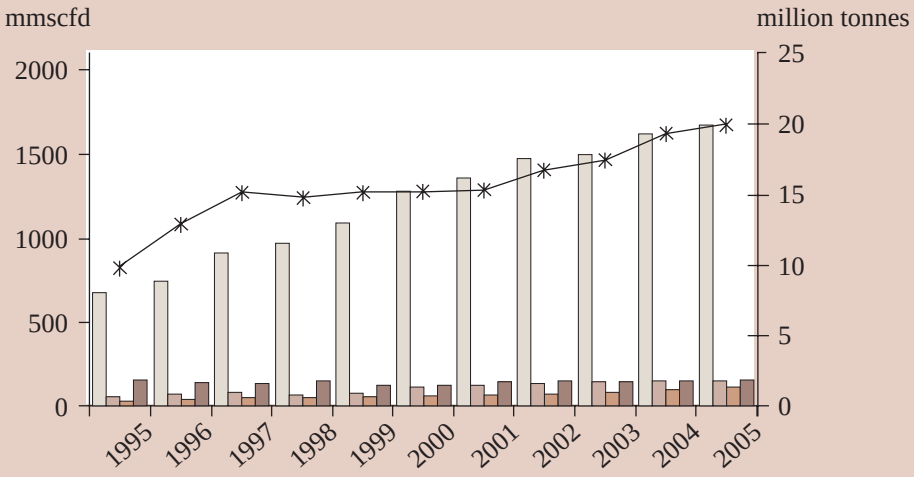
11.50 *Exploration and Production.* To sustain the long-term supply of gas, efforts will be intensified to develop domestic resources and secure supply from PETRONAS' foreign ventures. Gas from the Joint Development Area, managed by the Malaysia-Thailand Joint Authority, is expected to come onstream in 2002, with an initial production of 290 mmscfd, which will increase to 550 mmscfd by the end of the Plan period. The Trans Thailand-Malaysia pipeline project from Songkhla to Changlun, with a capacity of 300-600 mmscfd, is expected to be

completed during the Plan period and this will further enhance the nation's security of gas supply. In addition, gas will also be obtained from West Natuna and South Sumatera while the possibility of importing LNG from PETRONAS' overseas ventures will be explored.

11.51 *Utilization*. By the end of the Plan period, 1687 mmscfd of gas is expected to be used for electricity generation, as shown in *Chart 11-5*. The completion of the two new GDC plants at *Universiti Teknologi* PETRONAS in Perak and Tanjung Langsat Industrial Area in Johor will further diversify gas utilization. In addition, two GDCs will be constructed at *Universiti Malaysia Sarawak* and

CHART 11-5

GAS UTILIZATION, 1995-2005



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Electricity Generation[1]	676	752	914	970	1,097	1,283	1,365	1,497	1,515	1,567	1,687
Industry[1]	59	68	81	67	79	116	126	134	142	151	147
Reticulation[1]	23	41	51	52	60	65	68	73	79	96	108
Export to Singapore[1]	157	140	139	152	123	125	150	150	150	150	150
LNG Export[2]	9.9	12.9	15.2	14.7	15.1	15.5	15.5	16.6	17.7	19.0	20.3

Notes:
1 in mmscfd
2 in million tonnes

Putrajaya. The efficient utilization of gas will be implemented through centralized utility facilities (CUF) that supply electricity, steam, de-mineralized water, oxygen and nitrogen to the petrochemical plants. The completion of the two CUF plants in Gebeng and Kerteh, is expected to enhance the competitiveness of the nation's petrochemical industry.

11.52 To facilitate the greater utilization of NGV, an additional 31 NGV outlets will be constructed and 7,500 vehicles converted to run on dual fuels. In addition, vehicles fitted with the NGV system will be manufactured locally by the end of the Plan period. Promotional programmes to increase public awareness on the benefits of using NGV will be intensified.

11.53 In line with the implementation of the Second Industrial Master Plan (IMP2), the synergy between the gas and petrochemical industries will be further strengthened with the completion of the integrated petrochemical complexes in Gebeng, Kerteh and Tanjung Langsat. The integrated petrochemical complexes will produce feedstock for the petrochemical industry and derivatives required by local industries. The availability of petrochemical derivatives is also expected to serve as a catalyst for further downstream investment, particularly in the manufacture of industrial and consumer products, which are mainly imported, such as engineering-plastics, thermo-plastics, paints, coatings, adhesives, detergents, polyester fiber resins, textiles and cosmetics.

11.54 *Investment*. A total of RM61.5 billion will be invested by the petroleum industry during the Plan period. Of this, RM41.5 billion or 67.5 per cent will be spent for exploration, development and production activities by PETRONAS and its production sharing contractors. Another RM8.1 billion will be expended by PETRONAS to further develop infrastructure and facilities to attract foreign investment in gas-related industries. Of this, RM7.4 billion will be utilized for the Malaysia Liquefied Natural Gas 3 project in Sarawak and the balance of RM700 million for the completion of the 240 kilometres of the PGU Loop 2 pipelines from Segamat to Meru, which is also parallel to a section of the PGU II. PETRONAS will spend another RM2.0 billion to construct support facilities for the efficient operations of the integrated petrochemical complexes, such as centralized tankage facilities, Kuantan-Kerteh railway link, Dungun water supply, Kerteh marine facilities and Kuantan bulk chemical storage and piperack facilities.

11.55 To achieve self-sufficiency in selected petrochemical products, a total of RM6.9 billion will be invested by PETRONAS and other local companies, mainly on a joint-venture basis with leading multinationals. Gebeng and Kerteh

will be the centres for gas-based petrochemical industries producing propylene and ethylene-based feedstocks and derivatives, while Tanjung Langsat will be the centre for naptha-based petrochemical industries. In addition, investments for the production of petrochemical products will also be made in other locations, such as Pasir Gudang, Melaka, Prai and Shah Alam.

Coal

11.56 To meet the objective of the fuel diversification policy, three coal-fired power plants at Kapar, Manjung and Lukut will be commissioned during the Plan period. These plants will utilize 11.2 million tonnes of coal per annum. Clean-coal technology which will include among others, electrostatic precipitators and flue gas de-sulphurization for emission control, will be utilized in these new plants to ensure environmental standards are met.

Electricity

11.57 Demand for electricity is expected to remain robust during the Plan period, spurred by strong growth in most sectors of the economy. Concerted efforts will be focused towards ensuring the availability of sufficient, secure and reliable supply of electricity. The IPPs will increasingly assume a larger share in generation, while the utilities continue to focus on improving transmission and distribution networks. The industry will continue to undertake measures to further improve its productivity and efficiency.

11.58 *Generation*. An additional 8,800 MW of generation capacity will be commissioned during the Plan period, most of which will be installed by the IPPs in Peninsular Malaysia, as shown in *Table 11*-5. These include the gas-fired plants of 1,500 MW in Port Dickson, 640 MW in Lumut, 720 MW in Telok Gong, 220 MW in Pasir Gudang and 710 MW in Sepang. Although the three coal-fired plants in Peninsular Malaysia have a total capacity of 5,100 MW, only 3,800 MW is expected to be commissioned during the Plan period.

11.59 The implementation of the 2,400 MW Bakun Hydroelectric Project will continue during the Plan period. The electricity generated will be mainly utilized to meet the long-term power requirements of Sarawak and Sabah. The completion of this project will not only facilitate the integration of the electricity supply systems of Sabah and Sarawak but also within Sabah. In addition, the project provides the option of exporting electricity to neighbouring countries and this will assist in the establishment of the ASEAN Power Grid connecting Malaysia with Brunei, Indonesia and the Philippines.

11.60 *Transmission*. The transmission systems in Peninsular Malaysia, Sabah and Sarawak will be further strengthened to enhance reliability and efficiency. During the Plan period, a 500 kV transmission project will be completed, which will link the Manjung power station to Ayer Tawar. In Sabah, 275 kV transmission lines of the west coast grid extension project from Kota Kinabalu to Kudat involving a distance of 400 cct-km will be completed and work will commence on the east-west inter-connection from Kota Kinabalu to Sandakan covering a distance of 600 cct-km. In Sarawak, work relating to the upgrading of the transmission system is also expected to commence with the revival of the Bakun Hydroelectric Project.

11.61 *Distribution*. The distribution network in Peninsular Malaysia will be expanded by almost two-fold to 356,900 cct-km, as shown in *Table 11-9*. In addition, 133 new main intake substations and 185 main distribution substations will be constructed and commissioned for the primary pupose of injecting additional capacity to meet the projected demand growth as well as enhancing network security, power quality and voltage conversion for specific distribution systems. The SESCo system will also be upgraded to a total capacity of 8,370 cct-km with the addition of 617 cct-km to the distribution network and 33 kV substations to improve coverage, reliability and customer services. Similarly, with the implementation of the east-west inter-connection and the west coast grid extension projects, Sabah's distribution network will also be upgraded and expanded by an additional 2,789 cct-km.

11.62 *Rural electrification*. Rural electrification programmes, especially in Sabah and Sarawak, will be enhanced during the Plan period. These involve grid extension and the provision of stand-alone system generators comprising solar photovoltaic, mini-hydro and hybrid systems. A total of RM856.6 million will be allocated by the Federal Government for rural electrification programmes, which are expected to benefit 103,126 rural households. In Peninsular Malaysia and Sabah, rural electrification programmes will also be partly financed through their respective electricity supply industry trust funds. Electricity coverage for Sabah is expected to increase to 85 per cent, while that of Sarawak will reach 90 per cent by the end of the Plan period, as shown in *Table 11-10*. In Peninsular Malaysia where universal coverage has been achieved, improvements will continue to be made to extend the duration of supply in remote areas.

11.63 *Industry Restructuring*. The restructuring of the electricity supply industry will be continued during the Plan period. However, a gradual approach will be adopted in introducing a market mechanism in order to attract investments as

well as ensure an adequate and reliable supply of electricity. This will involve the establishment of an appropriate infrastructure and regulatory framework. An independent entity will be incorporated to initially assist the Government in system planning for the industry. In addition, an Energy Commission with the responsibility covering both the technical and economic regulation of the industry will be established to replace the Department of Electricity and Gas Supply.

Renewable Energy

11.64 Utilization of RE as the fifth fuel will be intensified during the Plan period to supplement the supply from conventional energy sources. RE resources that will be promoted in terms of priority, are biomass, biogas, municipal waste, solar and mini-hydro. Of these, biomass resources, such as oil palm and wood residues as well as rice husks, will be used on a wider basis for the purpose of heat and electricity generation.

11.65 Biomass-based co-generation system for the production of electricity and usable energy will be encouraged. In this respect, the generation of energy mainly for in-house consumption will be promoted. The supply of excess energy generated by the biomass-based generating system to the local community and to the grid will be considered, depending on its technical and commercial viability.

11.66 In promoting greater utilization of RE resources, initiatives that will be considered include demonstration projects and commercialization of research findings as well as extension of financial and fiscal incentives for RE-related activities. Under the Budget 2001, biomass-based generating companies that apply for incentives by 31 December 2002 will be granted exemption of income tax on 70 per cent of the statutory income for five years or a tax allowance of 60 per cent of qualifying capital expenditure incurred within five years. The allowance can be utilized to set off up to 70 per cent of the statutory income. In addition, import duty and sales tax exemption on machinery and equipment that are not produced locally will also be granted. Co-operation between government agencies and private institutions in the development of RE resources will also be promoted.

Energy Efficiency

11.67 During the Plan period, the implementation of EE programmes will focus on the industrial and commercial sectors being the major consumers of energy. Measures to promote the efficient utilization of energy include the enforcement of the Energy Efficiency Regulation, extension of financial and fiscal incentives and demonstration projects. In this respect, the establishment of new integrated complexes and townships that are managed on an energy-efficient manner will be encouraged. The implementation of demand-side management will be intensified during the Plan period, which includes retrofitting and district cooling programmes, changing the energy usage pattern and appliance labelling.

Development of Energy-related Industries and Services

11.68 In developing energy-related industries and services, various initiatives will be considered including the assessment of the capabilities of local companies, prioritization of potential areas that local companies could participate and provision of organizational support. Operation and maintenance, contract management, refurbishment, testing laboratories and services, manufacture of auxiliary equipments as well as RE technologies related to bio-mass, will be further developed as strategic niches. Besides increasing the participation of local companies, these efforts will also contribute towards enhancing manpower development for the energy sector. This will be in line with the promotion of the export of energy-related products and services by Malaysian entities and Malaysia as a regional centre for energy-related engineering services.

Research and Development

11.69 R&D programmes are important to encourage the usage of alternative sources of energy as well as promote efficient and safe utilization of energy resources. In this regard, methyl ester from palm oil, also known as palm diesel, has been identified as a viable potential fuel for the transport sector. Research efforts show that no modification of engines is required and fuel consumption of palm diesel by engines is comparable to petroleum diesel. In addition, palm diesel is technically superior to petroleum diesel in terms of ignition and engine performance as well as lower emission of hydrocarbon and toxic gases. Other alternative sources of energy that will be considered include fuel cell, hybrid cell and hydrogen fuel. *Pusat Tenaga Malaysia* will continue its role in co-ordinating and managing energy-related R&D programmes.

11.70 In the power sector, TNB through its subsidiary, TNB Research Sdn. Bhd., will continue to focus its R&D activities on the improvement of quality of supply; reliability, efficiency and optimization of equipment, plant and system; and environmental protection. In facing challenges such as operating in smaller and deeper water areas, aging facilities and declining production, innovative and creative technological solutions to enhance profitability and competitiveness are essential. R&D efforts in the petroleum sector will, therefore, focus in areas such as recovery improvement; process reliability and efficiency; production enhancement; materials and product development and improvement; and plant optimization and rationalization.

TABLE 11-13

DEVELOPMENT ALLOCATION/INVESTMENTS AND EXPENDITURE FOR ENERGY SECTOR PROGRAMMES, 1995-2005
(RM million)

Programme	*7MP Expenditure*			*8MP Allocation*		
	Federal Government	*NFPEs*[1]	*Total*	*Federal Government*	*NFPEs*	*Total*
Electricity Sector	**2,543.6**	**23,563.6**	**26,107.2**	**2,601.6**	**22,565.1**	**25,166.7**
Generation (hydro and thermal)	1,389.9	5,937.4	7,327.3	986.5	6,943.7	7,930.2
Transmission	437.6	8,270.8	8,708.4	494.7	6,275.4	6,770.1
Distribution	246.2	9,325.2	9,571.4	239.3	9,346.0	9,585.3
Rural Electricity	463.6	-	463.6	856.6	-	856.6
Others	6.3	30.2	36.5	24.5	-	24.5
Oil & Gas Sector	**-**	**30,400.0**	**30,400.0**	**-**	**27,638.0**	**27,638.0**
Upstream	-	12,900.0	12,900.0	-	12,800.0	12,800.0
Downstream	-	11,000.0	11,000.0	-	10,600.0	10,600.0
Manufacturing	-	5,300.0	5,300.0	-	2,200.0	2,200.0
Others	-	1,200.0	1,200.0	-	2,038.0	2,038.0
Total	**2,543.6**	**53,963.6**	**56,507.2**	**2,601.6**	**50,203.1**	**52,804.7**

Note: [1] Refers to TNB, SESCo, LLS/SESB and PETRONAS.

IV. ALLOCATION

11.71 The expenditures by the Federal Government and investments by the Non-Financial Public Enterprises (NFPEs) for the Seventh Plan totalled RM56.5 billion, as shown in *Table 11-13*. The expenditure of the electricity as well as the oil and gas sectors amounted to about RM26.1 billion and RM30.4 billion, respectively. For the Eighth Plan period, the Federal Government will provide an allocation of RM2.6 billion for the development of energy programmes, while the investment expenditure by the NFPEs will total RM50.2 billion.

V. CONCLUSION

11.72 Productivity and efficiency improvements will remain the focus of the energy sector so as to enhance the nation's competitiveness and resilience. In line with the objective of developing Malaysia into a knowledge-based economy, greater efforts will be directed towards meeting the consumers' requirement in terms of reliable, secure, quality and cost-effective supply of energy. Sustainable development of the energy sector will include the efficient utilization of energy and the promotion of RE as a new alternative source of fuel. Local capabilities in the energy-related industries and services will be further developed to strengthen participation in the energy industry in both the domestic and overseas markets.