



# SUSTAINABLE ENERGY DEVELOPMENT

# 19

## I. INTRODUCTION

19.01 During the Eighth Plan period, the development of the energy sector was focused on ensuring a secure, reliable and cost-effective supply of energy, aimed at enhancing the competitiveness and resilience of the economy. Efficient utilisation of energy resources as well as the use of alternative fuels, particularly renewable energy, was encouraged. Energy-related strategies were streamlined to moderate the impact of escalating oil prices on the economy.

19.02 In the Ninth Plan period, the energy sector will further enhance its role as an enabler towards strengthening economic growth. In this regard, the sources of fuel will be diversified through greater utilisation of renewable energy. A market-based approach will be promoted to ensure efficient allocation of resources. Emphasis will be given to further reduce the dependency on petroleum products by increasing the use of alternative fuels. In ensuring efficient utilisation of energy resources and minimisation of wastage, the focus will be on energy efficiency initiatives, particularly in the industrial, transport and commercial sectors as well as in government buildings. Rural electricity coverage, especially in Sabah and Sarawak, will also be improved. A more integrated planning approach will be undertaken to enhance sustainable development of the energy sector.

## II. PROGRESS, 2001-2005

19.03 The energy sector performed favourably in improving energy supply security to meet the increased demand. The long-term sustainability of the energy sector was enhanced with the implementation of measures on efficient utilisation of resources and the adoption of demand-side management initiatives.

## Energy Demand

19.04 During the Plan period, final commercial energy demand increased from 1,244 petajoules (PJ) to 1,632 PJ, as shown in *Table 19-1*. The elasticity of energy demand to gross domestic product (GDP) was 1.3. There was a marginal increase in the energy intensity<sup>1</sup> from 5.9 gigajoules (GJ) in 2000 to 6.2 GJ in 2005. Although petroleum products was the main energy consumed, its share to total demand continued to decline while that of natural gas increased, in line with the Fuel Diversification Policy.

TABLE 19-1  
FINAL COMMERCIAL ENERGY DEMAND<sup>1</sup> BY SOURCE,  
2000-2010

Source	Petajoules <sup>2</sup>			% of Total			Average Annual Growth Rate (%)	
	2000	2005	2010	2000	2005	2010	8MP	9MP
Petroleum Products	820.0	1,023.1	1,372.9	65.9	62.7	61.9	4.5	6.1
Natural Gas <sup>3</sup>	161.8	246.6	350.0	13.0	15.1	15.8	8.8	7.3
Electricity	220.4	310.0	420.0	17.7	19.0	18.9	7.1	6.3
Coal and Coke	41.5	52.0	75.0	3.4	3.2	3.4	4.6	7.6
<b>Total</b>	<b>1,243.7</b>	<b>1,631.7</b>	<b>2,217.9</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>5.6</b>	<b>6.3</b>
Per Capita Consumption (gigajoules)	52.9	62.2	76.5				3.3	4.2

Source: Ministry of Energy, Water and Communications and Economic Planning Unit

Notes: <sup>1</sup> Refers to the quantity of commercial energy delivered to final consumers but excludes gas, coal and fuel oil used in electricity generation.

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

<sup>3</sup> Includes natural gas used as fuel and feedstock consumed by the non-electricity sector.

19.05 The transport sector was the largest consumer of energy, accounting for 40.5 per cent of the total final commercial energy demand in 2005. This was followed by the industrial sector at 38.6 per cent and the residential and commercial sector at 13.1 per cent, as shown in *Table 19-2*.

<sup>1</sup> Energy intensity is the ratio of total domestic primary energy consumption or final energy consumption to gross domestic product or physical output.

TABLE 19-2  
FINAL COMMERCIAL ENERGY DEMAND BY SECTOR,  
2000-2010

Source	Petajoules			% of Total			Average Annual Growth Rate (%)	
	2000	2005	2010	2000	2005	2010	8MP	9MP
Industrial <sup>1</sup>	477.6	630.7	859.9	38.4	38.6	38.8	5.7	6.4
Transport	505.5	661.3	911.7	40.6	40.5	41.1	5.5	6.6
Residential and Commercial	162.0	213.0	284.9	13.0	13.1	12.8	5.6	6.0
Non-Energy <sup>2</sup>	94.2	118.7	144.7	7.6	7.3	6.5	4.7	4.0
Agriculture and Forestry	4.4	8.0	16.7	0.4	0.5	0.8	12.9	15.9
<b>Total</b>	<b>1,243.7</b>	<b>1,631.7</b>	<b>2,217.9</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>5.6</b>	<b>6.3</b>

Source: Ministry of Energy, Water and Communications and Economic Planning Unit

Notes: <sup>1</sup> Includes manufacturing, construction and mining.

<sup>2</sup> Includes natural gas, bitumen, asphalt, lubricants, industrial feedstock and grease.

## Energy Supply

19.06 Total supply of energy increased from 2,003 PJ in 2000 to 2,526 PJ in 2005, as shown in *Table 19-3*. The main sources of supply were crude oil and petroleum products as well as natural gas. The share of crude oil and petroleum products declined while that of coal and coke increased, indicating the reduced dependence on a single source of supply.

TABLE 19-3  
PRIMARY COMMERCIAL ENERGY SUPPLY<sup>1</sup> BY SOURCE,  
2000-2010

Source	Petajoules			% of Total			Average Annual Growth Rate (%)	
	2000	2005	2010	2000	2005	2010	8MP	9MP
Crude Oil and Petroleum Products	988.1	1,181.2	1,400.0	49.3	46.8	44.7	3.6	3.5
Natural Gas <sup>2</sup>	845.6	1,043.9	1,300.0	42.2	41.3	41.6	4.3	4.5
Coal and Coke	104.1	230.0	350.0	5.2	9.1	11.2	17.2	8.8
Hydro	65.3	71.0	77.7	3.3	2.8	2.5	1.7	1.8
<b>Total</b>	<b>2,003.1</b>	<b>2,526.1</b>	<b>3,127.7</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>4.7</b>	<b>4.4</b>

Source: Ministry of Energy, Water and Communications and Economic Planning Unit

Notes: <sup>1</sup> Refers to the supply of commercial energy that has not undergone a transformation process to produce energy.

<sup>2</sup> Excludes flared gas, reinjected gas and exports of liquefied natural gas.

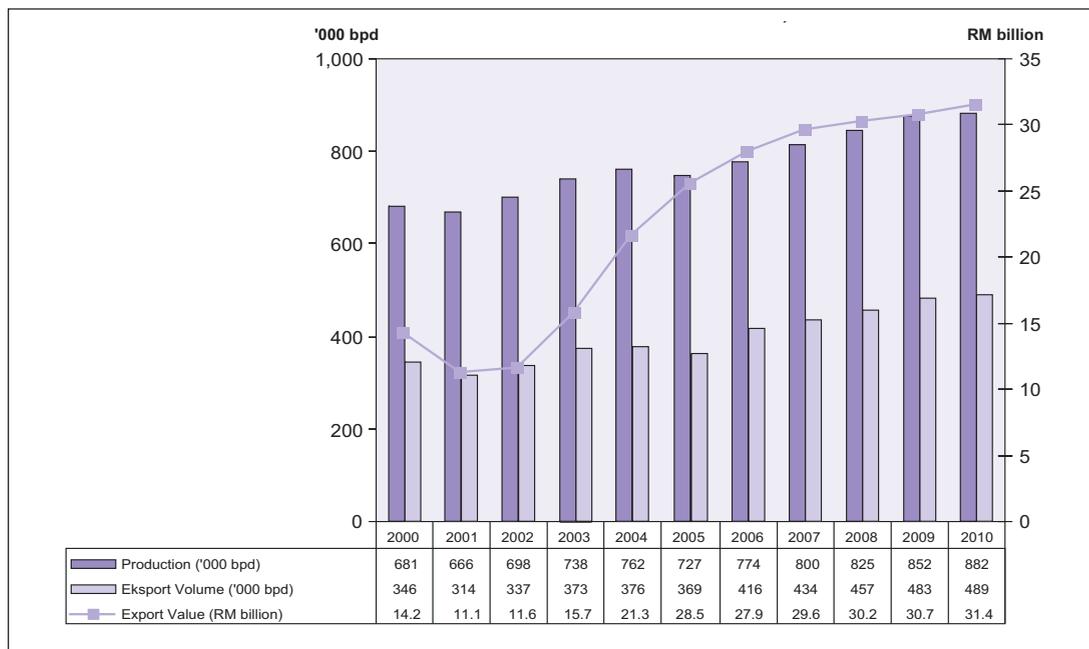
## Crude Oil

19.07 Crude oil and condensate reserves increased from 4.5 billion barrels in 2000 to 5.3 billion barrels in 2005. The average production of domestic crude oil and condensate increased from 681,000 barrels per day (bpd) in 2000 to 727,000 bpd in 2005. Based on this production level, which is in line with the National Depletion Policy, the reserves are projected to last for 19 years. Although the total refining capacity declined from 591,000 bpd to 546,500 bpd, it was sufficient to meet the demand for petroleum products.

19.08 The export of crude oil and condensate increased to 369,000 bpd with a value of RM28.5 billion in 2005, as shown in *Chart 19-1*. Major export destinations were Australia, Thailand, India and the Republic of Korea.

CHART 19-1

### CRUDE OIL AND CONDENSATE<sup>1</sup> PRODUCTION, EXPORT VOLUME AND VALUE, 2000-2010



Source: *Petroleum Nasional Berhad* and Economic Planning Unit

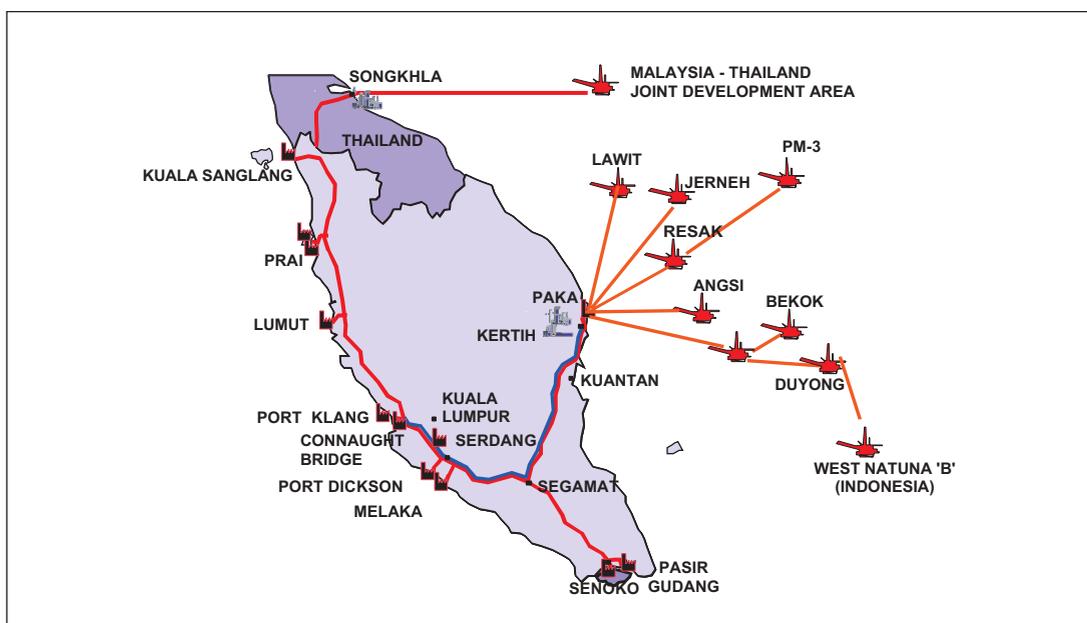
Notes: <sup>1</sup> A crude oil component derived from natural gas streams, comprising pentane and heavier hydrocarbons.

## Natural Gas

19.09 The discovery of new gas fields contributed to the increase in reserves from 84.3 trillion cubic feet (tcf) in 2000 to 85.2 tcf in 2005 and is expected to last for 33 years. The average natural gas production increased from 4,367 million standard cubic feet per day (mmscfd) to 5,800 mmscfd. Natural gas was also imported from West Natuna, Indonesia beginning 2002 and the Malaysia-Thailand Joint Development Area (MTJDA) in 2005, as shown in *Map 19-1*.

MAP 19-1

### GAS SUPPLY NETWORK, 2005-2010



Source: *Petroleum Nasional Berhad*

19.10 The average demand for natural gas in Peninsular Malaysia increased from 1,643 mmscfd in 2000 to 2,141 mmscfd in 2005. The power sector continued to be the major consumer accounting for 66 per cent, followed by the non-power sector at 28 per cent. The remaining 6.0 per cent was exported to Singapore. To meet the increasing demand from the non-power sector, the Natural Gas Distribution System (NGDS) was expanded from 455 kilometres to 1,365 kilometres.

19.11 Exports of liquefied natural gas (LNG) increased from 15.4 million tonnes in 2000 to 21.9 million tonnes in 2005, mainly to Japan, the Republic of Korea and Chinese Taipei. In 2005, total export earnings from LNG amounted to RM20.8 billion compared with RM11.4 billion in 2000.

## Electricity

19.12 In line with the strategy to ensure security and reliability of electricity supply as well as reduce the high dependence on gas, the sources of fuel for power generation was further diversified with the increased use of coal. In this regard, two coal-based plants were commissioned by *Tenaga Nasional Berhad* (TNB) while the Sejingkat plant was expanded by *Syarikat SESCO Berhad* (SESCO). During the Plan period, a total of 6,420 megawatts (MW) of new generation capacity was installed.

19.13 In consonance with the growth of the economy, peak demand increased from 10,657 MW in 2000 to 13,779 MW in 2005, as shown in *Table 19-4*. With the expansion in the installed capacity from 14,291 MW to 19,217 MW, the reserve margin increased from 34.1 per cent to 39.5 per cent, which was more than adequate to meet demand. To enable the sharing of costs for maintaining the reserve margin, the concept of demand risk sharing was introduced in power purchase agreements (PPAs).

TABLE 19-4  
**INSTALLED CAPACITY, PEAK DEMAND AND  
RESERVE MARGIN, 2000-2010**

Year	Generation By System <sup>1</sup>	Accumulated Installed Capacity (MW)	Peak Demand <sup>2</sup> (MW)	Reserve Margin <sup>3</sup> (%)
2000	TNB	12,645	9,712	30.2
	SESB	785	391	100.8
	SESCO	861	554	55.4
	<b>Total</b>	<b>14,291</b>	<b>10,657</b>	<b>34.1</b>
2005	TNB	17,622	12,493	41.1
	SESB	639	543	17.7
	SESCO	956	743	28.7
	<b>Total</b>	<b>19,217</b>	<b>13,779</b>	<b>39.5</b>
2010	TNB	22,802	18,187	25.4
	SESB	1,100	802	37.2
	SESCO	1,356 <sup>4</sup>	1,098	23.5
	<b>Total</b>	<b>25,258</b>	<b>20,087</b>	<b>25.7</b>

Source: *Tenaga Nasional Berhad, Sabah Electricity Sdn. Bhd. and Syarikat SESCO Berhad*

Notes: <sup>1</sup> System refers to utilities and the respective IPPs.

<sup>2</sup> Peak demand is the maximum power demand registered by the system in a stated period of time.

<sup>3</sup> Reserve margin equals accumulated capacity minus peak demand, all of which divided by peak demand and multiplied by 100.

<sup>4</sup> Including supply from the Bakun Hydroelectric Project.

19.14 Efforts were undertaken to reduce the high dependence on natural gas in the generation mix by increasing the use of coal. As a result, the share of coal to the total generation mix increased from 8.8 per cent in 2000 to 21.8 per cent in 2005 while that of natural gas decreased from 77.0 per cent to 70.2 per cent, as shown in *Table 19-5*. A burden-sharing concept was implemented in the sharing of cost between *Petroleum Nasional Berhad* (PETRONAS), TNB and independent power producers (IPPs) for the use of alternative fuels during the gas supply constraint in 2002 and 2003.

TABLE 19-5

**FUEL MIX IN ELECTRICITY GENERATION, 2000-2010**

	Year	Oil	Coal	Gas	Hydro	Others	Total (GWh)
		% of Total					
Malaysia	2000	4.2	8.8	77.0	10.0	0.0	69,280
	2005	2.2	21.8	70.2	5.5	0.3	94,299
	2010	0.2	36.5	55.9	5.6	1.8	137,909
TNB	2000	2.3	8.7	79.6	9.4	0.0	63,634
	2005	0.5	22.5	71.9	4.9	0.2	86,242
	2010	0.1	38.1	56.8	3.4	1.6	126,718
SESB	2000	47.3	-	31.4	21.3	-	2,299
	2005	42.6	-	43.0	13.6	0.8	3,447
	2010	0.5	18.5	47.2	26.5	7.3	4,808
SESCO	2000	11.2	15.1	59.4	14.3	-	3,347
	2005	4.7	25.0	58.9	11.4	-	4,610
	2010	3.0	21.2	44.1	31.7	-	6,383

Source: *Tenaga Nasional Berhad, Sabah Electricity Sdn. Bhd. and Syarikat SESCO Berhad*

19.15 The electricity transmission system was further expanded with the completion of new transmission projects to link new generation plants to the main grids as well as provide connections to new industrial and commercial areas. These included the Manjung-Air Tawar line in Peninsular Malaysia as well as the East Coast Grid and the Northern Grid in Sabah. The distribution network was also expanded to provide greater access and enhance the quality of electricity supply to consumers.

19.16 During the Plan period, the supply of electricity to rural areas was further improved, as shown in *Table 19-6*. The implementation of rural electrification projects benefited 59,960 housing units, mainly in Sabah and Sarawak.

TABLE 19-6

**RURAL ELECTRIFICATION COVERAGE<sup>1</sup> BY REGION,  
2000-2010**  
(%)

<i>Region</i>	<i>2000<sup>2</sup></i>	<i>2005</i>	<i>2010</i>
Peninsular Malaysia	97.5	98.6	98.8
Sabah	67.1	72.8	80.6
Sarawak	66.9	80.8	89.6
<b>Malaysia</b>	<b>89.5</b>	<b>92.9</b>	<b>95.1</b>

Source: Economic Planning Unit and Ministry of Rural and Regional Development.

Notes: <sup>1</sup> This refers to rural housing units served as a percentage of total rural housing units.

<sup>2</sup> This refers to Census 2000 data excluding housing units served with private individual generators.

19.17 There was an overall improvement in the productivity and efficiency of electricity supply services. TNB and SESCO recorded improved performance in terms of units sold per employee and reduction in the number of interruption incidences, as shown in *Table 19-7*.

TABLE 19-7

**PERFORMANCE INDICATORS OF THE ELECTRICITY  
SUPPLY SYSTEMS<sup>1</sup>, 2000 AND 2005**

<i>Indicator</i>	<i>2000</i>			<i>2005</i>		
	<i>TNB</i>	<i>SESB</i>	<i>SESCO</i>	<i>TNB</i>	<i>SESB</i>	<i>SESCO</i>
System Losses <sup>2</sup> (%)	10.3	16.8	12.6	10.5	19.5	14.5
Units Sold per Employee <sup>3</sup> (GWh)	2.43	0.94	1.40	3.05	1.29	1.93
Interruption Incidences (number)	46,896	14,543	8,145	23,213	20,385	4,489
SAIDI <sup>4</sup> (minute/customer/year)	351	2,791	860	147	4,109	310

Source: Tenaga Nasional Berhad, Sabah Electricity Sdn. Bhd. and Syarikat SESCO Berhad

Notes: <sup>1</sup> This comprises utilities only.

<sup>2</sup> This refers to losses in generation, transmission and distribution stages as well as own-use.

<sup>3</sup> This refers to the total unit of electricity sold divided by the total number of employees.

<sup>4</sup> System Average Interruption Duration Index (SAIDI).

## Renewable Energy

19.18 Efforts were continued to promote the utilisation of renewable energy (RE) resources. Under the Small Renewable Energy Power Programme (SREP), two projects with a combined grid connected capacity of 12 MW were implemented. A roadmap for the development of solar, hydrogen and fuel cells was formulated during the Plan period. To promote the wider application and utilisation of photovoltaic technology in buildings, the Malaysia Building Integrated Photovoltaic Technology Application Project (MBIPV) was also launched.

## Energy Efficiency

19.19 To promote the efficient use of energy, focus was given to the design and installation of energy efficient features in government buildings such as in the Ministry of Energy, Water and Communications. In this regard, new guidelines for energy efficient designs for government buildings such as clinics and schools were formulated. Energy audits were also undertaken in eight energy-intensive industries under the Malaysian Industrial Energy Efficiency Improvement Project (MIEEIP) to identify potential energy savings.

## Energy Prices

19.20 The international price of crude oil was volatile, increasing from an average of US\$30.18 per barrel in 2000 to US\$55.70 in 2005. In the domestic market, the prices of selected petroleum products such as gasoline, diesel and liquefied petroleum gas (LPG) were moderated through the Automatic Pricing Mechanism (APM). However, the prices of petroleum products were periodically reviewed to reflect the cost of supply while remaining affordable to consumers. For gas, the Government continued to set the downstream prices to mitigate the effects of increasing energy prices.

## Participation in Energy-Related Industries and Services

19.21 In line with efforts to develop new sources of growth in the energy sector, Malaysian companies continued to venture in energy-related industries and services abroad. These included RM29 billion investments by PETRONAS in 35 countries both in upstream and downstream activities. TNB also invested in the development of a power plant in Pakistan and extraction of coal in Kalimantan, Indonesia.

### III. PROSPECTS, 2006-2010

19.22 For the Ninth Plan period, the energy sector will continue to focus on sustainable development to enable it to support economic growth, enhance competitiveness as well as contribute towards achieving balanced development. In line with the thrust of the National Mission to improve the standard and sustainability of the quality of life, emphasis will be directed towards efficient production and utilisation while meeting environmental objectives. Towards this end, the strategies of the energy sector are as follows:

- ❑ *ensuring sufficiency, security, reliability, quality and cost-effectiveness of energy supply;*
- ❑ *improving the productivity and efficiency of energy suppliers and promoting market-based approach in determining energy prices;*
- ❑ *reducing the high dependence on petroleum products by increasing the use of alternative fuels;*
- ❑ *promoting greater use of renewable energy for power generation and by industries;*
- ❑ *intensifying energy efficiency initiatives in the industrial, transport and commercial sectors as well as in government buildings;*
- ❑ *expanding rural electricity coverage, particularly in Sabah and Sarawak; and*
- ❑ *developing new sources of growth in the energy sector including participation of local companies in energy-related industries and services abroad.*

#### **Energy Demand**

19.23 The overall demand is expected to increase at an average rate of 6.3 per cent per annum during the Ninth Plan period to 2,218 PJ in 2010, as shown in *Table 19-1*, due to the higher GDP growth expected for the period. The energy intensity of the economy is projected to increase to 6.3 GJ in 2010. With the expected improvement in the quality of life of the population, there will be an increase in energy consumption due to, among others, the increased use of electrical appliances and more frequent travels. In this regard, per capita consumption of energy is expected to increase from 62.2 GJ in 2005 to 76.5 GJ in 2010. However, the elasticity of energy demand to GDP is projected

to decrease to 1.0. Efforts to benchmark energy consumption with that of other countries such as Denmark, Germany and the Republic of Korea will be undertaken to improve energy efficiency. In addition, initiatives will be intensified to ensure efficient energy utilisation and minimisation of wastage, thus contributing towards the sustainable development of the energy sector. In line with the Fuel Diversification Policy, the share of petroleum products to total commercial energy demand is expected to decline to 61.9 per cent while that of natural gas is projected to increase to 15.8 per cent in 2010.

19.24 The transport and industrial sectors will continue to be the major energy consumers during the Plan period constituting 41.1 per cent and 38.8 per cent of the total energy demand in 2010, respectively, as shown in *Table 19-2*. The growth in demand by the transport sector, among others, is due to the increased requirement for transportation services by the manufacturing and agriculture sectors as well as the tourism industry. For the industrial sector, energy-intensive industries such as chemical, cement and ceramic, iron and steel as well as food processing are expected to remain the major consumers.

### Energy Supply

19.25 The security, reliability, quality and cost-effective supply of energy will be enhanced through an optimal energy mix predominantly from domestic sources. To meet the energy requirements of the country, total supply is projected to reach 3,128 PJ in 2010, of which the share of crude oil and petroleum products is expected to decline to 44.7 per cent while coal will increase to 11.2 per cent. The price of crude oil in the international markets is expected to remain high in the Plan period. In this regard, efforts will continue to be undertaken to reduce dependence on petroleum products while utilising them efficiently. In addition, efforts will be intensified to increase the supply and use of alternative fuels including RE. By 2010, RE is expected to contribute 350 MW to total energy supply.

#### *Crude Oil*

19.26 To ensure a sustainable supply of oil and gas, appraisal wells will continue to be drilled in small oil fields offshore as well as deepwater areas, especially in Sabah and Sarawak. Continuous efforts will also be undertaken to attract international oil companies to invest in exploration activities, particularly in deepwater of more than 200 metres and ultra-deepwater of more than one kilometre to increase domestic petroleum reserves. In addition, collaboration with production sharing contractors will continue to be undertaken to identify opportunities to maximise reserves recovery. During the Plan period, the crude oil production level is expected to average 695,000 bpd.

19.27 PETRONAS will continue to review its international upstream and downstream operations to meet the challenges in the global oil market. Efforts will also be undertaken to secure more reserves and increase production from its offshore investments as well as to expand its downstream operations.

#### *Natural Gas*

19.28 Efforts will be intensified to develop domestic resources as well as secure supplies from abroad to sustain the long-term supply of natural gas. To meet the increasing domestic demand in Peninsular Malaysia, natural gas supply from West Natuna, Indonesia and the MTJDA is expected to increase to 250 mmscfd and 390 mmscfd, respectively, constituting about 20 per cent of the total gas supply in 2010.

19.29 The consumption of natural gas in Peninsular Malaysia is expected to increase at an average rate of 4.3 per cent per annum to reach 2,647 mmscfd in 2010. The power sector is expected to remain the major user of natural gas with consumption expected to reach 1,653 mmscfd in 2010. In the non-power sector, gas consumption by industries is expected to increase to 779 mmscfd due to the competitive gas prices as well as the development of new industrial sites and expansion of existing industries.

19.30 The NGDS network will be further expanded by about 640 kilometres to 2,005 kilometres by the end of the Plan period with an investment of RM640 million. The average annual growth of gas supplied by the NGDS network is projected to increase at 8.2 per cent per annum to reach 267 mmscfd by 2010.

19.31 To promote greater utilisation of natural gas for vehicles (NGV) in the transportation sector, an additional 54 NGV stations will be constructed to total 94 by the end of the Plan period. Measures will be undertaken to promote greater utilisation of NGV, including the development of dedicated NGV stations, financing packages for NGV conversion as well as intensification of R&D programmes. In addition, incentives will be reviewed to encourage transport operators to convert their vehicles to NGV.

19.32 A total of RM43.8 billion is expected to be invested by PETRONAS during the Plan period. Of this, RM13.1 billion or 30.0 per cent will be expended on oil and gas exploration as well as development and production activities to enhance the long-term supply of oil and gas. The balance of RM30.7 billion will be utilised to upgrade the oil and gas supply infrastructure, increase the number of service stations as well as expand the petrochemical industry.

## Coal

19.33 The consumption of coal for power generation and industrial use is expected to reach 19.0 million tonnes and 2.2 million tonnes, respectively, in 2010, due mainly to the commissioning of two new coal-based generation plants in Peninsular Malaysia. Efforts will be continued to enhance the security of supply by exploring the potential of developing local sources, particularly in Sarawak as well as securing long-term supplies from abroad.

## Electricity

19.34 In line with the positive outlook of the national economy, peak demand for electricity is expected to grow at an average rate of 7.8 per cent per annum to reach 20,087 MW in 2010, as shown in *Table 19-4*. By the end of the Plan period, the accumulated installed capacity is expected to increase to 25,258 MW. As a result, the overall reserve margin is expected to decline to a more efficient level of 25.7 per cent. The reserve margins for Peninsular Malaysia at 25.4 per cent, Sabah 37.2 per cent and Sarawak 23.5 per cent are adequate to meet the expected increase in demand.

19.35 In an effort to gradually reduce the reserve margin to 20 per cent in the long term, the implementation of approved projects in Peninsular Malaysia will be deferred and new plant-up will only be implemented in the next Plan period. In addition, the concept of demand risk sharing will be extended to new PPAs to enable sharing of costs for maintaining the reserve margin between the utility companies and IPPs. In addition, a review will be undertaken on the modes of privatization and fuel pass-through arrangement for future PPAs to ensure optimal utilisation of resources, allocation of risk between the utility companies and IPPs as well as minimisation of cost to the utility companies. These initiatives are expected to further enhance the efficiency and viability of both the utility companies and IPPs and consequently improve the security, reliability, quality and cost-effectiveness of supply to customers. In this regard, efforts will also be undertaken to benchmark the performance of utility companies with that of other countries.

19.36 Two new coal-based IPP plants at Tanjung Bin, Johor and Jimah, Negeri Sembilan with a combined installed capacity of 3,500 MW will be commissioned during the Plan period. These plants will utilise electrostatic precipitators and flue gas de-sulphurisation process to meet environmental standards. As part of efforts to promote the optimal utilisation of municipal waste for electricity generation, a pilot project on waste-to-energy will be implemented in Peninsular Malaysia.

19.37 In Sabah, a new gas-based plant with a capacity of 100 MW will be commissioned while a 120 MW open-cycle plant will be converted to a 190 MW combined-cycle plant in 2006. In addition, a gas-based plant with a capacity of 190 MW will also be commissioned in 2008. To meet demand as well as improve the reliability of supply in the east coast, a 300 MW coal-based plant will be constructed for operation in 2009/2010. In Sarawak, the generation capacity will also be expanded with the commissioning of new power plants, including the 100 MW Bintulu gas-based plant in 2006. The Bakun Hydroelectric project with an installed capacity of 2,400 MW will be commissioned in 2009/2010.

19.38 To achieve greater system security, a planning horizon of 10 to 15 years will be considered to facilitate the long lead time required to develop coal-based and hydroelectric plants. To enhance efficient utilisation of resources, future power generation projects will be considered through a bidding process. This will also enable the Government to pre-determine the capacity, fuel type and location of generation projects based on system requirement. Other sources of supply, particularly from hydropower, will be explored to further enhance the security of electricity supply, minimise generation cost as well as meet environmental objectives.

19.39 During the Plan period, the fuel mix for power generation will mainly comprise coal and natural gas. With the operation of the Tanjung Bin and Jimah coal-based plants, the share of coal in the generation mix will increase to 36.5 per cent in 2010, as shown in *Table 19-5*. The share of gas in the fuel mix is expected to decline to 55.9 per cent while oil and hydro below 10.0 per cent.

19.40 The performance of the transmission system will continue to be enhanced to ensure security and reliability of electricity supply. In this regard, operation and maintenance of the system will be improved. In addition, a transmission system that transcends national boundaries such as the Peninsular Malaysia-Sumatera Interconnection Grid will be explored to facilitate the implementation of the Trans-ASEAN Power Grid project (TAPG).

19.41 In Peninsular Malaysia, initiatives will be undertaken to increase reliability and security of supply in major load centres. These include new transmission lines for the Central Area Reinforcement in the Klang Valley, the Northern Area Reinforcement from Manjung in Perak to Pulau Pinang and the South-Central Reinforcement from Sepang to Puchong. As a result, the transmission network in Peninsular Malaysia is expected to increase to 20,860 circuit kilometres (cct-km) in 2010. For areas where uninterrupted supply of electricity is critical,

an islanding scheme will be implemented to enhance supply security. During the Plan period, the scheme will cover Putrajaya and Cyberjaya.

19.42 The East-West Interconnection Grid in Sabah will be completed in 2006. The integration of this grid with the East Coast Grid and Northern Grid will form a new transmission system backbone that will enable the transfer of electricity supply between the west and east coast as well as contribute towards system security and stability. As a result, the total length of the Sabah Grid will be 2,670 cct-km. In Sarawak, the SESCO Grid will be expanded to cater for additional generation capacity. New transmission lines will also be constructed to supply electricity from the Bakun project to Kemena and Balingian. By the end of the Plan period, the total length of transmission lines in Sarawak is expected to reach 1,620 cct-km.

19.43 During the Plan period, the distribution network in Peninsular Malaysia will continue to be expanded in line with the growth of new industrial estates, townships and residential areas. The distribution network in Sabah and Sarawak will also be upgraded to extend supply to outlying areas as well as enhance reliability. By the end of the Plan period, the distribution network in Peninsular Malaysia will reach 424,190 cct-km, Sabah 9,120 cct-km and Sarawak 25,950 cct-km.

19.44 The implementation of the rural electrification programme will be intensified to improve the quality of life of rural communities, especially in Sabah and Sarawak. Towards this end, about 54,680 housing units will be supplied with electricity using technologies such as solar hybrid and micro-hydro systems. A larger proportion of the Electricity Supply Industry Trust Account will be utilised in the implementation of these programmes. By the end of the Plan period, rural electricity coverage in Sabah and Sarawak is expected to increase to 80.6 per cent and 89.6 per cent, respectively.

19.45 During the Plan period, the productivity and efficiency of the electricity supply system will be further improved with the expansion of the Supervisory Control and Data Acquisition (SCADA) system as well as enhancement of the quality of power supply. Efforts will also be undertaken to improve efficiency in handling customer complaints such as reducing response time in attending to enquiries and improving the delivery of services. In addition, the customer relationship building programme will be expanded to improve quality of supply to major customers, particularly in the industrial sector. The performance of the electricity supply system will also be benchmarked against that of other countries.

## Renewable Energy

19.46 The development and utilisation of RE will be further intensified in the Plan period. Towards this end, efforts will be continued to foster a more conducive environment to support the implementation of SREP projects. In this regard, the review of the terms and conditions of the Renewable Energy Power Purchase Agreement (REPPA) as well as issues related to project viability such as long-term fuel supply security and financing is expected to be completed. The Clean Development Mechanism (CDM) will also be utilised to provide support for the implementation of SREP projects. RE projects utilising municipal waste will also be promoted. By 2010, about 300 MW is expected to be generated and connected to the TNB Grid in Peninsular Malaysia and 50 MW to the *Sabah Electricity Sdn. Bhd.* (SESB) Grid in Sabah. Other RE sources such as stand-alone systems of solar hybrid will be developed while biomass based co-generation will be expanded in the Plan period.

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19.47 New sources of energy such as solar and wind will be developed with emphasis on utilising cost-effective technology as well as strengthening capacity building. In this regard, efforts will be undertaken to coordinate R&D activities of the various energy-related research centres. In addition, activities under the roadmap on solar, hydrogen and fuel cells such as technology development and knowledge sharing will be implemented while financing mechanisms will be explored. Initiatives to enhance local capabilities in the development of indigenous RE-based technologies as new sources of growth will also be supported.

19.48 Efforts to promote the development of biofuel using palm oil as a renewable source of energy will be undertaken during the Plan period in line with the initiative to make the country a world leader and hub for palm oil. Designated pump stations, mainly in the Klang Valley, to supply diesel blended with 5.0 per cent palm olein are expected to commence operation in 2006. For the initial phase, the blended diesel will be utilised by vehicles of selected Government agencies. Regulations for the blending of petroleum diesel and palm olein will be formulated. Efforts will also be undertaken to promote the export of palm-based diesel.

## Energy Efficiency

19.49 The implementation of energy efficiency (EE) programmes will focus on energy saving features in the industrial and commercial sectors. In this regard, EE features such as efficient lighting and air conditioning systems as well as establishing a comprehensive energy management system will be encouraged. In addition, the industrial sector will be encouraged to implement

EE measures including improvements in plant, equipment and processes as well as end use. Towards this end, efforts will be undertaken to introduce the Efficient Management of Electrical Energy Regulations, amend the Uniform Building By-laws (UBBL), label electrical appliances and use high-efficiency motors. Initiatives to develop local expertise in the manufacture of EE equipment and machineries as new sources of growth will also be supported.

19.50 Efforts will be undertaken to enhance awareness on EE. In this regard, suitable courses on RE and EE for institutions of higher education will be developed. In addition, specialised courses on energy planning and management will be introduced to enhance the capacity of professionals in energy-related management. To promote greater EE in Government buildings, good energy practices such as optimal lighting and air-conditioning will be adopted. Energy audits will be conducted in Government buildings to identify additional measures that can be implemented to further improve EE. Under the MIEEIP project, energy audits will be extended to the oleo-chemical, plastic and textile industries to total eleven by the end of the Plan period. To further support the implementation of RE and EE initiatives, existing financial and fiscal incentives such as Accelerated Capital Allowance will be improved during the Plan period.

### **Energy Prices**

19.51 During the Plan period, initiatives will be undertaken to review the energy pricing structure to reflect market prices of various alternative energy sources and encourage greater efficiency in the utilisation of energy while discouraging wasteful consumption. A review will be undertaken to gradually reduce subsidies on energy prices. In addition, the energy demand-side management will be emphasised to ensure optimal and efficient use of scarce and depletable energy resources.

### **Regional Cooperation on Energy**

19.52 At the regional level, Malaysia will continue to support the ASEAN Plan of Action for Energy Cooperation (APAEC). The APAEC covers four areas of cooperation, namely the TAPG Project; Trans-ASEAN Gas Pipeline Project (TAGP); Sustainable Utilisation of Coal, Energy Efficiency and Conservation Programme; and Renewable Energy and Regional Energy Policy and Planning Programme. In this regard, the interconnected network of electricity grids and gas pipelines will offer significant benefits in terms of energy security and sustainability. In addition, issues of energy security will also be given emphasis under the cooperation of ASEAN Plus Three as well as the Asia Pacific Economic Cooperation (APEC).

## IV. INSTITUTIONAL SUPPORT AND ALLOCATION

19.53 The overall planning for the sustainable development of the energy sector towards ensuring sufficiency, security, reliability and cost-effectiveness of energy supply will continue to be coordinated by the Economic Planning Unit (EPU). In addition, the implementation of future power generation projects through a bidding process and a pilot plant on waste-to-energy will also be coordinated by EPU. Meanwhile, the development of RE and enhancement of EE initiatives will be spearheaded by the Ministry of Energy, Water and Communications. The development of biofuel will be led by the Ministry of Plantation Industries and Commodities while rural electrification programmes by the Ministry of Rural and Regional Development. Programmes related to the provision of secure, reliable and cost-effective supply of energy will be undertaken by PETRONAS, TNB, SESB and SESCO.

19.54 The expenditures by the Federal Government and investments by the Non-Financial Public Enterprises (NFPEs) for the Eighth Plan totaled RM76.2 billion, as shown in *Table 19-8*. The expenditure of the electricity supply as well as oil and gas industries amounted to RM27.9 billion and RM48.3 billion, respectively. For the Ninth Plan period, the Federal Government will provide an allocation of RM1.8 billion for the development of the energy sector while the investment expenditure by the NFPEs will total RM71.7 billion.

TABLE 19-8

### DEVELOPMENT EXPENDITURE AND ALLOCATION/INVESTMENT FOR ENERGY SECTOR PROGRAMMES, 2000-2010 (RM million)

Programme	8MP Expenditure			9MP Allocation		
	Federal Government	NFPEs <sup>1</sup>	Total	Federal Government	NFPEs	Total
<b>Electricity</b>	<b>2,386.90</b>	<b>25,574.00</b>	<b>27,960.90</b>	<b>1,828.80</b>	<b>27,955.10</b>	<b>29,783.90</b>
Generation	664.00	12,138.70	12,802.70	-	9,506.60	9,506.60
Transmission	632.50	5,121.40	5,753.90	302.60	6,781.90	7,084.50
Distribution	357.00	8,313.90	8,670.90	334.00	11,666.60	12,000.60
Rural Electrification	560.20	-	560.20	1,025.30	-	1,025.30
Others	173.20	-	173.20	166.90	-	166.90
<b>Oil &amp; Gas</b>	<b>-</b>	<b>48,300.00</b>	<b>48,300.00</b>	<b>-</b>	<b>43,800.00</b>	<b>43,800.00</b>
Upstream	-	16,700.00	16,700.00	-	13,100.00	13,100.00
Downstream	-	31,600.00	31,600.00	-	30,700.00	30,700.00
<b>Total</b>	<b>2,386.90</b>	<b>73,874.00</b>	<b>76,260.90</b>	<b>1,828.80</b>	<b>71,755.10</b>	<b>73,583.90</b>

Source: Economic Planning Unit

Note: <sup>1</sup> Refers to Tenaga Nasional Berhad, Sabah Electricity Sdn. Bhd., Syarikat SESCO Berhad and Petroliam Nasional Berhad.

## V. CONCLUSION

19.55 During the Eighth Plan period, energy security was enhanced with the increase in electricity generation capacity as well as recoverable reserves of oil and gas. Measures were undertaken to further improve the supply of energy and minimise possible supply disruption. The focus during the Ninth Plan period will be to further enhance the sustainable development of the energy sector to enable it to contribute towards strengthening economic growth. Towards this end, greater emphasis will be given to ensure security, reliability and cost-effectiveness of supply as well as enhance the quality of service delivery to consumers. A market-based approach in determining energy prices will be gradually adopted to ensure efficient allocation of energy resources. Efforts will be intensified to promote greater utilisation of RE, especially for power generation, and the use of biofuel in the transportation sector. EE initiatives will be undertaken to ensure efficient utilisation of energy resources and minimisation of wastage. The reserve margin will be gradually reduced to 20 per cent in the long term and no new plant-up will be implemented during the Plan period.