

Chapter XI

Energy

CHAPTER XI

Energy

I. INTRODUCTION

11.01 The development of energy resources has significantly contributed to the expansion of the Malaysian economy. Apart from providing energy resources, it has contributed substantially to enhancing export earnings and increasing public sector revenue as well as widening the industrial base of the economy. A major development in the sector during the Fifth Malaysia Plan period has been the attainment of a rapid diversification in the supply as well as demand of the nation's energy resources.

11.02 For the Sixth Malaysia Plan period, with the Malaysian economy envisaged to sustain a high growth momentum, the energy sector is expected to further enhance its contribution to the economy. In addition to its traditional role in providing sufficient supply of energy resources to other sectors of the economy, the sector will provide greater raw material input for the rapid expansion of the industrial sector.

II. PROGRESS, 1986-90

11.03 The development thrusts of the sector during the Fifth Plan continued to be focussed on the diversification of the energy mix with the view to maintaining self-sufficiency, reducing dependence on oil as well as optimizing the utilization of the nation's indigenous resources, such as gas and hydropower. Apart from this, efforts were made to increase efficiency in the use of energy through fuel substitution and conservation measures.

Energy Supply

11.04 Significant progress had been made during the period 1986-90 in supplying energy input to support the nation's economic development.

The supply of primary commercial energy expanded by 7.3 per cent per annum, as shown in *Table 11-1*. In terms of diversification, a notable feature had been the rapid decline in the share of oil in total primary energy supply. As a source of energy, oil had been replaced by the greater use of gas and coal. The share of gas increased from 19.0 per cent in 1985 to 27.2 per cent in 1990 while that of oil declined from 70.9 per cent to 59.3 per cent. The share of coal increased from 2.7 per cent to 7.8 per cent, largely on account of its usage in electricity generation. The reduction in the dependence on oil for domestic energy requirements has not only contributed to the achievement of the energy diversification objective, but also enabled the nation to increase its oil export to earn additional foreign exchange as well as reduce oil imports. These had contributed towards the improvement of the nation's external trade position.

Oil and gas

11.05 During the period, 25 Production Sharing Contracts (PSCs) were signed between *Petroleum Nasional Berhad* (PETRONAS) and foreign oil companies. The significant increase in the number was a direct consequence of the liberalization of PSC terms to encourage exploration and development activities in the upstream sector. These were with respect to the provisions for accelerated cost recovery, elimination of bonuses payable to PETRONAS and introduction of a sliding scale for the sharing of profit oil which also encouraged production from marginal fields.

11.06 In the upstream sector, crude oil production increased from an average production of about 446,400 barrels per day (bpd) in 1985 to about 622,470 bpd in 1990. The production level in 1990 was relatively higher in response to additional demand from several of the nation's trading partners, arising from the Gulf crisis. The additional crude oil production came from existing fields, such as Seligi, Guntong, St. Joseph and Bokor. Natural gas production, net of reinjection and flaring, also increased from an average of 946 million cubic feet per day (mmcf) in 1985 to 1,377 mmcf in 1990, mainly due to increased demand by the liquefied natural gas (LNG) plant in Bintulu.

11.07 In the downstream sector, a major project undertaken during the Fifth Plan was the construction of a catalytic reformer at the Kertih refinery. The reformer, which has a production capacity of 6,500 bpd, produces reformat used in the blending of motor gasoline. With the completion of this project in early 1990, PETRONAS was able to overcome the problem of limited supply of imported reformat and the attendant problem of rising cost.

TABLE 11-1
PRIMARY COMMERCIAL ENERGY SUPPLY¹ BY SOURCE,
1985-95

	1985		1990		1995		Average Annual Growth Rate (%)	
	PJ ²	%	PJ	%	PJ	%	5MP	6MP
Crude Oil & Petroleum Products	406.3	70.9	482.7	59.3	603.7	52.2	3.5	4.6
Hydro	42.6	7.4	46.5	5.7	50.9	4.4	1.8	1.8
Gas ³	109.0	19.0	221.4	27.2	452.5	39.1	15.2	15.4
Coal & Coke	15.1	2.7	63.3	7.8	49.1	4.3	33.2	-5.0
Total	573.0	100.0	813.9	100.0	1,156.2	100.0	7.3	7.3

Notes:

- ¹ Refers to the supply of commercial energy that has not undergone a transformation process to produce energy. Non-commercial energy, such as firewood and biomass, have been excluded.
- ² Joule is the unit of energy used to establish the equivalent physical heat content of each energy form
1 petajoule (PJ) = 10¹⁵ joules
- ³ Excludes flared gas, reinjection and liquefied natural gas export.

Coal

11.08 During the period, two coal mining companies were in operation at Silantek and Merit-Pila in Sarawak. The total production capacity of the two mines was about 410,000 tonnes per year. Their initial production, however, amounted to only 120,000 tonnes per year, of which all were exported.

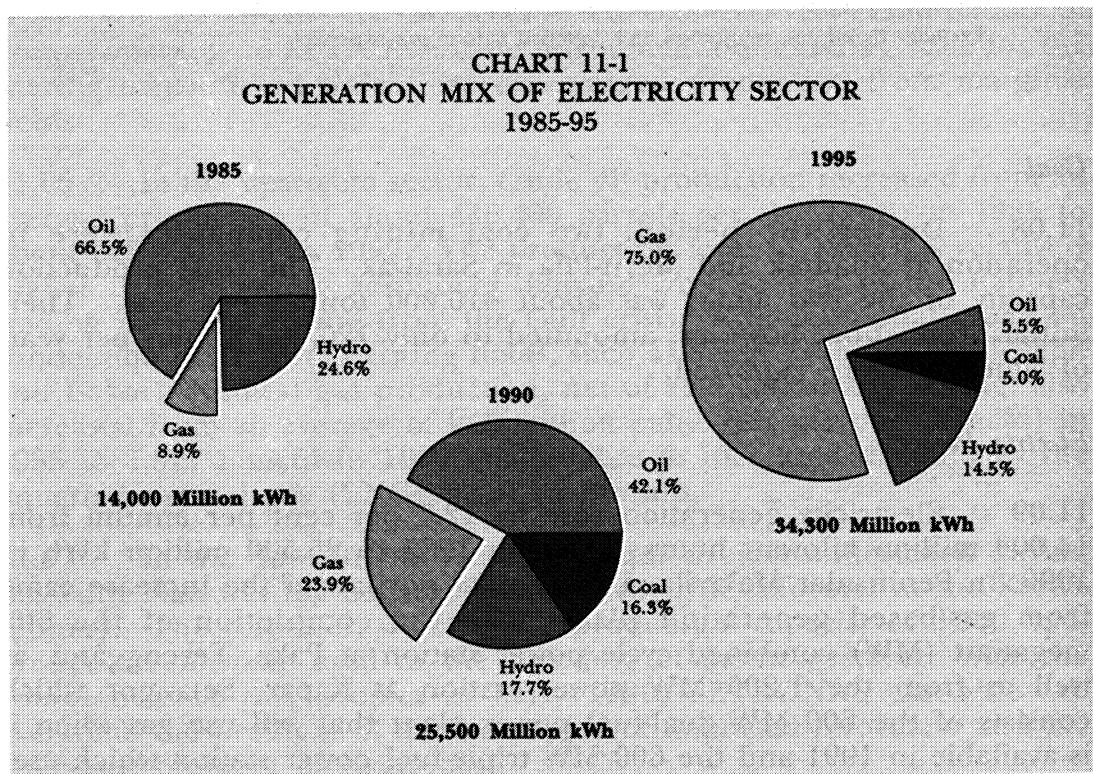
Electric Power

11.09 Electricity generation rose by 12.7 per cent per annum from 14,000 million kilowatt hours (kWh) in 1985 to 25,500 million kWh in 1990. In Peninsular Malaysia, a substantial portion of the increase came from gas-based generation plants with the completion of the 900 megawatt (MW) combined cycle power station at Paka, Terengganu, as well as from the 1,200 MW power station at Kapar, Selangor which consists of the 600 MW dual-fuel power plant that will use gas when it is available in 1991 and the 600 MW triple-fuel power station which uses

coal as the primary fuel. In addition, the hydropower plant at Kenyir, Terengganu, which has an installed capacity of 400 MW, was fully commissioned in 1986.

11.10 As a result of these diversification programmes, the success of fuel switching was remarkable in electricity generation. The over-reliance on oil was reduced tremendously from 67 per cent in 1985 to 42 per cent in 1990, as shown in *Chart 11-1*. In contrast, the share of gas increased markedly from 9 per cent to 24 per cent. Coal, which became a source of electricity generation since 1988, accounted for 16 per cent of the generation mix in 1990.

11.11 During the Fifth Plan period, the transmission and distribution network was further expanded. This expansion further strengthened system reliability and stability, resulting in improvements in the quality of electricity supply to consumers. In Peninsular Malaysia, the transmission line from the Kenyir hydropower station to Tanah Merah with a total length of 154 kilometres was completed, thus establishing a 275 kilovolt (kV) ring, inter-connecting the major power stations in the West Coast to those in the East Coast. In Sarawak, the grid linking



the Batang Ai hydropower station to load centres was implemented in stages. The first stage which connected Batang Ai and Kuching was completed in 1985. This was followed by the extension to Sibul, Sri Aman and Sarikei. In Sabah, a 132 kV transmission line extending to Keningau and a line inter-connecting Labuan Island and Beaufort in Sabah were commissioned in 1990. The latter enabled the transfer of excess electricity generated by the gas combined cycle plant of the Sabah Gas Industries (SGI) in Labuan to meet the demand in Sabah and vice versa.

Energy Demand

11.12 Energy demand increased by about 7.7 per cent per annum during the Fifth Plan period, as shown in *Table 11-2*. In terms of energy mix, the share of petroleum products declined from about 77 per cent to 71 per cent while that of gas increased from 7 per cent to 10 per cent. The demand for gas during the period expanded rapidly by 15.4 per cent per annum, brought about mainly by higher levels of offtake from SGI and the ASEAN Bintulu Fertilizer (ABF) plants. The demand for electricity also expanded rapidly, at 11.8 per cent per annum, largely from increased demand by the industrial and commercial sectors. The

TABLE 11-2
FINAL DEMAND¹ FOR COMMERCIAL ENERGY BY SOURCE,
1985-95

	1985		1990		1995		Average Annual Growth Rate (%)	
	PJ	%	PJ	%	PJ	%	5MP	6MP
Petroleum Products	282.7	76.8	376.1	70.6	480.0	57.3	5.9	5.0
Electricity	45.1	12.3	78.6	14.8	138.5	16.5	11.8	12.0
Coal & Coke	15.1	4.1	26.6	5.0	34.4	4.1	12.0	5.3
Gas ²	25.0	6.8	51.2	9.6	184.6	22.1	15.4	29.2
Total	367.9	100.0	532.5	100.0	837.5	100.0	7.7	9.5

Notes:

¹ Refers to the quantity of commercial energy delivered to final consumers. Gas, coal and fuel oil used in electricity generation are included under 'electricity'.

² Includes both gas used as fuel and feedstock consumed by the non-power sector.

demand for coal by industrial consumers increased at 12.0 per cent per annum. The total consumption of coal in 1990 amounted to about two million tonnes, of which about 60 per cent was for electricity generation. The other large coal user was the cement industry. The consumption of coal was almost entirely met by imports.

11.13 On account of greater industrialization and urbanization, the manufacturing and transport sectors were the major energy consumers. Together, they accounted for about 70 per cent of total final energy consumed. The transport sector was the largest single consumer of final energy, accounting for about 43 per cent of total energy consumed in 1990, as shown in *Table 11-3*. Energy demand in the sector increased by 7.6 per cent per annum during the period. In terms of rate of growth, the manufacturing sector registered the highest rate of increase, at 13.2 per cent per annum. The significant increase was on account of the upsurge in manufacturing activities, particularly during the later part of the Fifth Plan period.

TABLE 11-3
FINAL DEMAND FOR COMMERCIAL ENERGY BY SECTOR,
1985-95

	1985		1990		1995		Average Annual Growth Rate (%)	
	PJ	%	PJ	%	PJ	%	5MP	6MP
Agriculture & Forestry	35.3	9.6	37.9	7.1	42.8	5.1	1.4	2.5
Mining & Quarrying	15.1	4.1	21.3	4.0	23.0	2.7	7.1	1.5
Manufacturing	74.0	20.1	137.3	25.8	286.4	34.2	13.2	15.8
Construction	12.0	3.3	15.6	2.9	22.4	2.7	5.4	7.5
Transport	158.3	43.0	228.4	42.9	343.8	41.1	7.6	8.5
Commercial & Services	20.5	5.6	28.9	5.4	43.6	5.2	7.1	8.6
Residential	36.6	9.9	41.3	7.8	49.2	5.9	2.4	3.6
Non-energy ¹	16.1	4.4	21.8	4.1	26.3	3.1	6.2	3.8
Total	367.9	100.0	532.5	100.0	837.5	100.0	7.7	9.5

Note:

¹ Use of energy by-products, such as asphalt or bitumen, lube or grease and refinery gas, for non-energy purposes.

III. PROSPECTS, 1991-95

11.14 Concerted efforts will be undertaken to ensure that the development of energy resources will continue to contribute to the nation's economic expansion. Towards this end, policy focus will be on the main task of supplying energy efficiently and on a least-cost basis to all energy users. In addition, in line with the continued pursuance of the diversification policy, the nineties will mark the nation's entry into an era of greater gas utilization. Consequently, the use of gas in the supply of energy resources, particularly for electricity generation, will be significantly augmented. Apart from this, its increasing importance as industrial feedstocks will also be seen during the period.

Energy Supply

11.15 While the nation has achieved substantial progress in diversifying its energy resources, oil still remains an important source of energy, accounting for about 60 per cent of the total supply of primary energy. If consumption of petroleum products is allowed to grow at high rates, Malaysia's favourable status as a net exporter of oil could be reversed in the future. In the light of this, policy measures will be undertaken to ensure a timely schedule for the transition away from reliance on oil and prepare the economy for the final depletion of oil resources in the long term. The substitution of oil and the diversification of energy supply based on available indigenous resources will, therefore, be central to the objectives of energy supply policies and strategies. Research and development efforts in the area of non-conventional energy will also be encouraged.

11.16 In the implementation of the energy diversification strategies, emphasis will be placed on the utilization of domestic resources. In this respect, the nation is well-placed as it continues to be endowed with abundant energy resources and options. These include gas, hydropower, coal and to some extent, other forms of renewable energy, such as solar and biomass. Among these, natural gas is ideal for oil substitution in view of the size of its proven reserves and the premium it commands in terms of cleaner environment, higher efficiency and relatively lower economic costs. As a cleaner fuel, gas has virtually no sulphur and has significantly lower carbon intensity compared with fuel oil and coal. In terms of cost and fuel efficiency, gas combined cycle plants have considerable advantage over generation plants based on fuel oil and coal. In the light of this, natural gas and gas products are envisaged to replace substantially petroleum products in the power, commercial, industrial and transport sectors. By 1995, gas is expected to account for about 39 per cent of

primary commercial energy supply compared with 27 per cent in 1990, while the share of oil will be reduced further from 59 per cent to 52 per cent.

Hydropower

11.17 Malaysia has abundant hydropower resources assessed at some 29,000 MW, with a potential energy of 123,000 million kWh per annum. However, some 70 per cent of these resources are located in Sarawak. This substantial energy resource represents not only an important long-term development alternative for electricity generation and a significant opportunity for diversification but more importantly, a considerably cheaper source of energy option. In the long term, these renewable hydropower potential will be required to meet the growing power demand of the nation, complementing thermal generation capacity.

11.18 The uneven distribution of hydropower potential, with the bulk of the potential hydropower supply far away from the major load centres, will require inter-regional transmission facilities. While large-scale hydroelectric power development promises economies of scale, its development with its long gestation period faces critical issues of timing, finance and environmental impact. Since the development of such resources is characterized by high capital and major load requirements, it can only be justified with considerable electricity demand which at the moment exists only in Peninsular Malaysia. In the light of this and as a medium-term option, the development of medium-sized hydropower resources in Sarawak as a potential source of energy supply to meet the electricity requirements of Sabah and Sarawak will be considered. Towards this end, the feasibility of inter-connecting the Sabah and Sarawak power grids will be investigated.

Coal

11.19 Malaysia has significant coal resources, particularly in Sarawak, which could be mined at competitive costs. The penetration of coal in the energy market will not only ensure partial self-sufficiency in coal supply but also induce spin-off effects on downstream activities. For the electricity sector, its share in the generation mix is expected to decline. Notwithstanding this, efforts will be undertaken to test the technical suitability of blending Sarawak coal with imported coal used by the existing power plant. Apart from this, the feasibility of developing mine-mouth electricity generation will be explored in Sarawak, initially to meet localized demand.

11.20 As coal is a favourable fuel for large kilns in the cement and brick industries as well as for industrial boilers, the prospects for greater industrial applications will be explored. Apart from being price competitive compared with fuel oil, the quality and suitability of local coal have been proven for industrial and steaming purposes. In order to promote greater exploitation and utilization of local coal, several incentive schemes are being considered, including provision of infrastructure as well as fiscal measures. Efforts will be undertaken to formulate safety standards and regulations for mining operations as well as measures to minimize environmental pollution.

Oil

11.21 The focus of the upstream sector during the Sixth Plan period will be on exploration and development activities, particularly in the new PSC areas. However, since such activities require relatively long duration to finalize, increase in crude oil production is anticipated to be marginal during the period. Notwithstanding this, there will be new oil fields which will begin production during the period. These include the Dulang and D35, offshore Terengganu and Sarawak, respectively. PETRONAS will also offer for bidding, blocks in the deeper water areas offshore Sabah and Sarawak to encourage deep-sea oil search. In addition, further oil development projects, such as platform installation, development drilling and sub-sea pipeline network installation, are expected to be undertaken at existing fields. These developments will enable the nation to sustain oil production at some 630,000 bpd during the period.

11.22 The thrust in the downstream sector is to ensure that the nation is self-sufficient in the supply of petroleum products. The 100,000 bpd sweet unit refinery in Melaka is expected to be on-stream by early 1994 while the proposed sour unit is expected to be completed by the end of 1994. The sweet unit will process local crude to meet increasing domestic demand for petroleum products while the sour unit will process imported sour crude, mainly for export markets.

Non-conventional energy

11.23 Although solar panels are being increasingly used for domestic heating in urban areas, non-conventional sources of energy are virtually untapped in Malaysia. There is potential for solar, wind, wave, biogas and biomass energy for domestic and small-scale industry, particularly in isolated areas. In the light of this, research and development will be encouraged to develop their potential.

Energy Demand

11.24 With the economy envisaged to sustain its high growth momentum during the Sixth Plan period, the demand for energy is expected to remain at a relatively high level, growing at 9.5 per cent per annum, as shown in *Table 11-2*. In consonance with the efforts towards the greater utilization of natural gas, the demand for gas is anticipated to increase significantly to partially replace petroleum products. The increase in demand for gas will be formidable, at some 29 per cent per annum. With this rapid increase, it is estimated to account for more than one-fifth of total energy demand by 1995, compared with less than one-tenth in 1990. On the other hand, the share of petroleum products is expected to decline from about 71 per cent to 57 per cent during the period.

11.25 The transport sector will remain as the largest single consumer of energy. For the manufacturing sector, in line with the growth in value added, energy demand in the sector will increase by 15.8 per cent per annum compared with 8.5 and 8.6 per cent per annum in the transport, and commercial and services sectors, respectively. Some 70 per cent of the energy demand in the manufacturing sector will be for gas, particularly as feedstocks for the petrochemical industry.

Gas Development

11.26 The production of gas is expected to increase significantly. It is anticipated that at the turn of the century, gas production is likely to reach 3,755 mmcf/d, almost triple the current level. The major demand for gas will be predominantly for electricity generation and to some extent, to meet the feedstock requirements of the petrochemical industry. In addition, apart from promoting its direct usage in the industrial, commercial and residential sectors, its potential for greater exports will also be exploited.

Gas Transmission

11.27 The infrastructure for gas transmission has already being laid. The completion of the Peninsular Gas Utilization II (PGU II) project in 1991 will enable the transmission network to reach the growth centres in the western and southern regions of Peninsular Malaysia. The PGU II project comprises 730 km of natural gas pipeline, two additional gas processing plants, an upgraded export terminal as well as other associated facilities. Costing some \$2,400 million, the project will have an initial capacity to transmit 700 mmcf/d of gas. The transmission capacity can,

however, be enhanced to some 1,000 mmcf/d with the addition of gas compressors. The two additional gas processing plants, equipped with ethane extraction facilities as well as propane and butane recovery capabilities, will have a total capacity of 500 mmcf/d. Initially, the bulk of the gas supply from the transmission pipeline will meet the gas requirements of electric power plants, as shown in *Chart 11-2*. The completion of the pipeline will also mark the beginning of gas exports to Singapore to meet its power generation requirements.

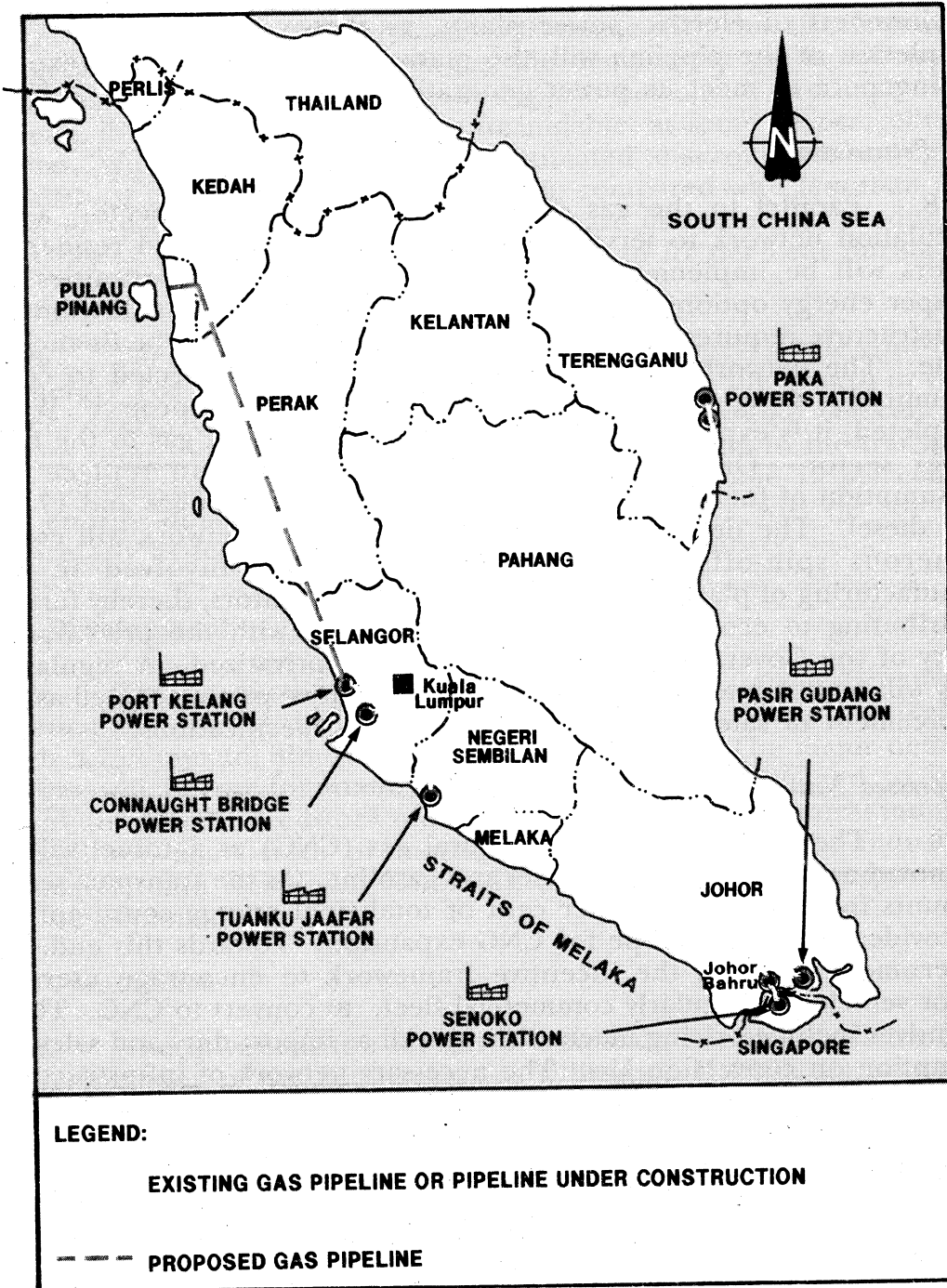
Gas Reticulation

11.28 Parallel to the gas development in the power sector, a gas reticulation network to serve the industrial, commercial and residential sectors will be implemented to provide users with opportunities for cheaper energy options. Although the development of gas distribution infrastructure requires large front-end capital outlay, it will be financially viable. The network, to be developed in phases, is expected to cover communities along the gas pipeline route of the PGU II project. When completed, it is expected to supply about 140 mmcf/d of gas to the non-power sector. Of this, about 52 per cent will be to replace the consumption of fuel oil, 31 per cent liquefied petroleum gas and 17 per cent diesel. The development of a gas reticulation network will create numerous spin-offs in the ancillary industries involved in the manufacturing of plastic pipes, gas meters and regulators, thereby further contributing to economic development. In line with the privatization policy of the Government, the network will be privatized. A regulatory body will be instituted largely to ensure competitive pricing as well as the enforcement of safety standards and technical specifications.

Compressed Natural Gas

11.29 The use of compressed natural gas (CNG) as autofuel will be promoted as an alternative to diesel and gasoline. As the transport sector accounts for more than 40 per cent of total final energy consumption, it provides substantial scope for CNG expansion. Towards this end, the Government has laid the incentive framework to encourage users of motor vehicles, particularly commercial fleet, to convert to CNG. These incentives include pricing mechanism as well as import duty and sales tax exemption on conversion kits. The necessary network of infrastructural facilities to promote the use of CNG, such as conversion as well as servicing and maintenance workshops, will be developed in line with the completion of the PGU II project. These measures, together with the inherent properties of CNG, such as low maintenance cost, greater efficiency and contribution towards a cleaner environment, will provide the impetus towards its greater use.

GAS SUPPLY TO POWER STATIONS, 1991-95



Petrochemical and gas-based industries

11.30 A significant development during the Sixth Plan period will be the coming on-stream of major petrochemical production. The petrochemical industry is expected to play an important role in the nation's efforts towards industrial advancement. Apart from enhancing the value added of natural gas, its development will contribute significantly towards the widening of the industrial base. Furthermore, as some of the products are geared towards the export market, the industry will also provide greater trading opportunities to penetrate and diversify into new international markets.

11.31 Several large petrochemical projects are in various stages of being implemented. Their implementation is largely private sector-led with PETRONAS having equity participation in the joint-venture companies. These include the propylene/methyl tertiary butyl ether (MTBE), polypropylene and ethylene/polyethylene projects. Production is expected to be on-stream during the Sixth Plan period. In Peninsular Malaysia, the propylene/MTBE project is expected to produce 300,000 metric tonnes of MTBE and 80,000 metric tonnes of propylene per year. The polypropylene plant is designed to produce 80,000 metric tonnes per year. The ethylene/polyethylene complex will have a capacity to produce 200,000 metric tonnes of polyethylene of various densities. To meet the annual feedstock requirements of these petrochemical projects, it is expected that 100,000 metric tonnes of propane, 240,000 metric tonnes of butane and 375,000 metric tonnes of ethane will be supplied.

11.32 In Sarawak, two major gas-based projects, the middle distillate synthesis (MDS) and the expansion of the LNG plant, will be implemented in Bintulu. The MDS project, with an annual production capacity of 470,000 metric tonnes and a gas consumption of 100 mmcf, will produce petroleum products such as kerosene, naphtha, diesel as well as wax. The LNG plant will be expanded from the existing three trains to six trains. This expansion programme is expected to be completed by the end of 1996. During the Sixth Plan period, as a result of the expansion programme, five trains will be operational and the gas offtake for LNG will be increased from 980 mmcf in 1990 to 1,394 mmcf in 1995 and the production capacity will be enhanced from 7.5 million tonnes to 12.5 million tonnes.

11.33 In line with the strategy to increase the value added of the gas resources in Sabah and Sarawak, the Government will continue its efforts to identify feasible energy-based and energy-intensive industries for these States. Several projects with encouraging potential which have been

identified include methanol/acetic acid, MTBE, polypropylene and formaldehyde.

Electric Power

11.34 During the Sixth Plan period, in order to adequately meet increased demand for electricity, additional generating capacity will be installed, while the transmission and distribution network will be further strengthened to ensure greater system reliability and efficiency. Efforts will be geared towards the establishment of new gas-based generation plants and conversion of existing oil-fired plants into gas-based ones. In Peninsular Malaysia, *Tenaga Nasional Berhad* (TNB) is expected to add some 3,500 MW of new generating capacity, which will be largely gas-based, representing an increase of about 70 per cent from its existing installed capacity of about 5,100 MW. In addition, the conversion of existing thermal plants into gas-based generation will also be undertaken. The Sarawak Electricity Supply Corporation (SESCO) will commission a total of 240 MW of gas turbines at Bintulu (180 MW) and Kuching (60 MW). The feasibility of increasing gas-based electricity generation in Sarawak as an option to meet the requirements of Sabah will be examined. In terms of generation mix, it is anticipated that by the end of the Sixth Plan period, the share of gas-based electricity generation will reach some 75 per cent.

11.35 With respect to hydro development, a major hydroelectric project located along Sg. Pergau, Kelantan will be implemented. The project, with an installed capacity of 600 MW, is designed to generate about 520 million kWh per year to meet peaking requirements in Peninsular Malaysia. The project is expected to be commissioned by the end of the Sixth Plan period. In Sabah, the Sabah Electricity Board (SEB) will implement the Liwagu hydroelectric project, which has a capacity of 165 MW, to meet its medium-term requirements. In addition, seven mini-hydro projects will be implemented in Sabah and four in Sarawak.

11.36 The transmission and distribution network will be further expanded and upgraded with the view to not only widening the coverage of the grids but also reducing system losses and improving reliability and efficiency. In Peninsular Malaysia, some 1,800 kilometres of transmission lines will be installed. These projects, expected to be commissioned in stages during the period, will reinforce the existing electricity supply system to keep abreast with the expected growth in demand. They are aimed at supplying electricity from the national grid to consumers in new growth centres, new townships as well as bulk purchasers. In Sarawak,

the transmission and distribution projects are geared towards inter-connection between towns, industrial zones of timber-based industries and industrial estates in order to achieve economies of scale of power generation. A 275 kV transmission line will be extended from Sibiu to Bintulu. With these transmission lines, major load centres in Sarawak will be linked together. In Sabah, the state electricity grid will be further extended with the implementation of a 132 kV line, linking Kota Belud with Kudat.

Rural Electrification

11.37 To date, the implementation of the rural electrification programme has benefited about 1.6 million households or about 80 per cent of rural population. The coverage in Peninsular Malaysia at about 90 per cent, is higher than the national average. However, the coverage in Sabah and Sarawak is lower, at 48 per cent and 52 per cent, respectively. Geographical factors, affecting accessibility as well as sparse population distribution, have resulted in higher development costs and hindered the rapid expansion of programmes in Sabah and Sarawak.

11.38 During the Sixth Plan period, programme implementation will aim to achieve full coverage for Peninsular Malaysia and greater coverage for Sabah and Sarawak. By the end of the period, the national coverage is expected to reach 90 per cent, with almost 100 per cent for Peninsular Malaysia, 73 per cent for Sabah and 77 per cent for Sarawak. As the application of suitable technologies is critical for the success of this programme, particularly in remote areas, alternative technologies, such as photovoltaics (solar), micro-hydro plants and hybrid system, will be considered for implementation apart from the proven technologies of grid extensions, mini-hydro stations and diesel engines. In Peninsular Malaysia, the implementation strategy will be to further strengthen the system, especially in the identified rural growth centres to bolster industrial development. In Sabah and Sarawak, programmes will be intensified to cover more isolated villages.

Energy Pricing

11.39 Pricing policies will be directed at ensuring that energy prices will reflect the economic or true cost of supply, be able to raise sufficient revenues for the sector's development as well as remain competitive to encourage diversification of energy resources into greater utilization of indigenous resources, such as gas. In the electricity sector, as fuel cost represents the single most important element in the operation of power utilities and given the policy emphasis on the diversification of power generation mix away from fuel oil, a competitively-priced gas supply will

be adopted. In the industrial, commercial, residential as well as the transport sectors, prices will also be determined on the basis of competitiveness with alternative fuels. A competitive price will not only provide consumers with alternative options but also facilitate the penetration of gas in these sectors.

11.40 With regard to electricity pricing, the availability of electricity in adequate quantity and quality and at reasonable prices are necessary for the promotion of industrial development. Towards this end, efforts will continue to be made to ensure stability in electricity tariffs at acceptable and internationally competitive levels, while at the same time, taking into account the needs of power utilities to generate sufficient revenues for their future development plans.

IV. ALLOCATION

11.41 In the light of the rapid expansion in the energy sector envisaged during the Sixth Plan period, substantial investments are required to finance the sector's development. Public sector agencies are expected to invest some \$26,264 million, more than double the previous Plan period, as shown in *Table 11-4*. Given the rapid expansion envisaged to meet increasing electricity demand, more than half of this investment will be made in the power sector. In the oil and gas sector, PETRONAS is expected to invest some \$10,815 million in both upstream and downstream activities. A significant proportion of the investment will be for the development of gas-based industries as well as gas-related activities.

11.42 The huge investment requirements provide potential opportunities for greater private sector initiative and participation in the development of the nation's energy resources. As the involvement of the private sector in the energy sector is relatively new, they will need to expand and broaden their scope of operations as well as mobilize their resources to participate in the vast opportunities.

11.43 In the power sector, with the corporatization of the National Electricity Board, the power utility in Peninsular Malaysia is already in the process of being privatized. The privatization of *Tenaga Nasional Berhad* is expected to be completed during the Sixth Plan period through the divestment of its equity ownership to the private sector. Apart from this, private sector participation will also be promoted to encourage competition in the sector. Towards this end, the concept of *build - operate - transfer*, particularly in power generation will provide avenues for private sector participation.

TABLE 11-4
DEVELOPMENT ALLOCATION FOR ENERGY PROGRAMMES,
1986-90 AND 1991-95
(\$ million)

<i>Programme</i>	<i>Federal Government</i>		<i>NFPEs¹</i>		<i>Total</i>	
	<i>Expenditure 5MP</i>	<i>Allocation 6MP</i>	<i>Expenditure 5MP</i>	<i>Planned Expenditure 6MP</i>	<i>5MP</i>	<i>6MP</i>
Power Sector						
Hydro	167.8	103.5	258.2	2,980.9	426.0	3,084.4
Thermal & Gas	143.6	77.9	1,901.2	5,097.4	2,044.8	5,175.3
Rural						
Electrification	569.6	764.6	156.0	0.0	725.6	764.6
Transmission & Distribution	28.4	18.9	3,426.3	5,233.5	3,454.7	5,252.4
Others	9.0	14.1	353.6	1,158.1	362.6	1,172.2
Sub-total	918.4	979.0	6,095.3	14,469.9	7,013.7	15,448.9
Oil & Gas Sector						
Upstream	-	-	658.0	2,120.9	658.0	2,120.9
Downstream	-	-	1,879.2	5,488.0	1,879.2	5,488.0
Manufacturing	-	-	239.0	3,159.6	239.0	3,159.6
Others	-	-	146.9	46.3	146.9	46.3
Sub-total	-	-	2,923.1	10,814.8	2,923.1	10,814.8
Total	918.4	979.0	9,018.4	25,284.7	9,936.8	26,263.7

Note:

¹ Refers to TNB, SESCO, SEB and PETRONAS.

11.44 In the upstream activities of the oil and gas sector, private sector involvement has been dominant and is anticipated to remain so. In the downstream sector, however, a more predominant participation of the private sector will be promoted, with PETRONAS as supplier of oil and gas, playing a supportive and complementary role. PETRONAS will, as far as possible, restrict itself to upstream activities and leave business opportunities in the downstream sector for the private sector, particularly local entrepreneurs.

V. CONCLUSION

11.45 The development of the energy sector has progressed significantly towards attaining the objectives of diversification as well as the development of indigenous resources to meet domestic requirements. The achievements have indeed been remarkable. The prospects during the Sixth Plan period will be even more challenging. The development of energy resources will not only have to be in tandem with the rising demand from anticipated strong economic performance, but also the acceleration of the nation's industrial growth, particularly the growing emphasis on the development of energy-intensive and energy-based industries. As a supplier of energy resources to the economy, the task is not only to meet sufficiently the nation's energy requirements, but more importantly, to ensure an efficient development of energy resources based on a least-cost option.