

# **Chapter XVII**

## **Energy**



## CHAPTER XVII

# Energy

### I. INTRODUCTION

Energy is being supplied to users in either primary form, such as crude oil, natural gas, coal and hydropower, or in converted or secondary form, such as petroleum products and electricity. Energy sector development is closely related to the economic development of the country. To a large extent, sustained socio-economic development of the country is dependent on adequate development of the energy sector. Planning, policy formulation, and decision making for the development of the energy sector are geared to meeting the main task of supplying energy, sufficient to support the various energy users of the economy.

During the Fourth Plan period, the overall growth of the energy sector was satisfactory. Emphasis was placed on reducing the dependence on oil for power generation, diversifying energy resources, increasing the coverage of electricity supply to rural areas as well as promoting efficiency in energy use and conservation. Under the Fifth Plan, these strategies will continue to be pursued. Attention will also be directed to integrated energy planning with a view to ensuring systematic and optimal development of the sector.

### II. PROGRESS, 1981-85

An overall energy policy, formulated in 1979, established the broad guidelines on long-term energy objectives and strategies. Specific policies were formulated for the oil sector to guide the petroleum industry in line with national development objectives.

During the Fourth Plan period, the above policies continued to guide the development of the energy sector. The focus was on the four-fuel diversification strategy, namely, oil, hydro, gas, and coal, aimed at ensuring reliability and security of supply, while reducing the dependence on oil in energy consumption. The objective of this strategy was primarily to utilize non-oil domestic energy resources, particularly gas and hydropower, which resulted in increasing self-reliance with respect to energy supply and savings in foreign exchange. Progress

was achieved in the substitution of oil in the diversification of energy resources, both with respect to supply and demand. Energy conservation was also recognized as an important issue and received particular attention.

#### Energy supply and diversification

Primary supply of energy, as shown in Table 17-1, grew at 8.7 per cent per annum from 447.8 petajoule (PJ) in 1980 to 679.6 PJ in 1985. Although declining in terms of share in the total primary energy supply, crude oil and petroleum products remained a significant source of energy, accounting for 61.9 per cent of the total primary energy supply in 1985 compared with 76.9 per cent in 1980. The share of natural gas was 0.5 per cent in 1980, and it increased to 18.1 per cent by 1985.

The increased share of gas in total primary supply of energy was primarily attributed to the timely development of the gas resource as part of the multi-fuel strategy to facilitate industrialization and reduce dependence on oil. The share of coal and coke grew as a result of increased usage in foundries and cement plants while the share of hydropower and biomass declined slightly due to the impact of gas penetration in the energy sector.

**TABLE 17-1**  
**MALAYSIA: PRIMARY SUPPLY<sup>1</sup> OF ENERGY,**  
**1980, 1985 AND 1990**

Source	1980		1985		1990		Average annual growth rate (%)		
	PJ <sup>2</sup>	%	PJ	%	PJ	%	1981-85	1986-90	1981-90
Crude oil	246.9	55.1	360.2	53.0	360.2	41.7	7.8	0.0	3.8
Petroleum products	97.4	21.8	60.7	8.9	102.0	11.8	-9.0	10.9	0.5
Natural gas <sup>3</sup>	2.3	0.5	122.8	18.1	179.5	20.8	121.5	7.9	54.6
Hydropower	16.2	3.6	19.4	2.9	20.7	2.4	3.7	1.3	2.5
Coal and coke	2.2	0.5	19.3	2.8	74.9	8.7	54.4	31.2	42.3
Charcoal <sup>4</sup>	3.0	0.7	—	—	—	—	—	—	—
Fuelwood	53.5	11.9	58.9	8.7	78.0	9.0	1.9	5.8	3.8
Palm oil mill wastes	26.3	5.9	38.3	5.6	47.8	5.6	7.8	4.5	6.2
Total	447.8	100.0	679.6	100.0	863.1	100.0	8.7	4.9	6.8

Source: The National Energy Planning Study, 1985.

Notes:

<sup>1</sup> Primary supply of energy refers to those that has not undergone a conversion process.

<sup>2</sup> Joule is the unit of energy or single common accounting unit to establish the equivalent physical heat content of each energy form.

1 petajoule (PJ) = 10<sup>15</sup> joule (J).

<sup>3</sup> Excluding flared gas and export of gas products (condensates, methanol and LNG).

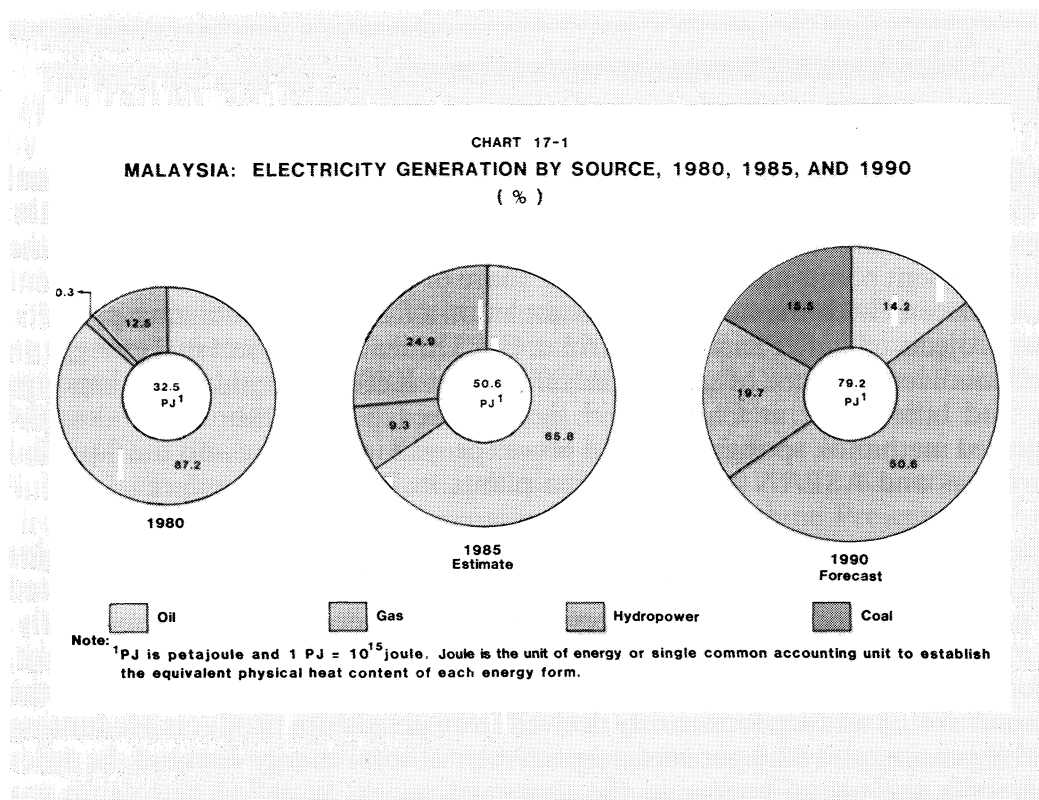
<sup>4</sup> Part of the fuelwood is converted to charcoal which is accounted for under secondary supply.

The share of oil in electric power generation in 1980 was 87.2 per cent compared with 12.5 per cent for hydropower and 0.3 per cent for gas, as shown in Chart 17-1. By 1985, the share of oil in the electric power generation mix declined to 65.8 per cent, while hydropower and gas increased to 24.9 per cent and 9.3 per cent, respectively. This is in line with the strategy of the sector to diversify away from high cost fuel oil to cheaper domestic gas and hydro resources.

**Energy demand and diversification.**

Energy demand comprises both primary energy and secondary forms that have gone through conversion processes. The conversion of oil or gas to electricity involves losses in power generation, with thermal losses typically in the order of 60-70 per cent, and power transmission. The production of petroleum products in refineries will also incur some consumption of energy.

Accompanying the accelerated growth in industrialization and urbanization, energy demand, as shown in Table 17-2, increased by 7.4 per cent per annum from 333.4 PJ in 1980 to 476.7 PJ in 1985. In terms of energy mix in the total demand, the share of petroleum products was 69.6 per cent in 1980 and 66.8 per cent



cent in 1985, while the share of gas was 0.3 per cent and 2.4 per cent, respectively. The contribution of biomass, which includes fuelwood and palm oil wastes, remained at about 16 per cent and electricity at about 9.3 per cent during the period 1981-85.

**TABLE 17-2**  
**MALAYSIA: ENERGY DEMAND<sup>1</sup> BY SOURCE,**  
**1980, 1985 AND 1990**

Source	1980		1985		1990		Average annual growth rate (%)		
	PJ	%	PJ	%	PJ	%	1981-85	1986-90	1981-90
Petroleum products	232.2	69.6	318.5	66.8	432.8	64.7	6.5	6.3	6.4
Electricity	30.9	9.3	44.1	9.3	65.8	9.8	7.4	8.3	7.9
Coal and coke	0.9	0.3	18.1	3.8	39.0	5.8	82.3	16.6	45.8
Charcoal	8.8	2.6	8.5	1.8	8.3	1.2	-0.7	-0.5	-0.6
Gas	0.9	0.3	11.6	2.4	18.4	2.8	66.7	9.7	35.2
Fuelwood	33.4	10.0	37.6	7.9	57.2	8.6	2.4	8.8	5.5
Palm oil wastes	26.3	7.9	38.3	8.0	47.4	7.1	7.8	4.4	6.1
Total	333.4	100.0	476.7	100.0	668.9	100.0	7.4	7.0	7.2

Source: As in Table 17-1.

Note: <sup>1</sup> Energy demand refers to energy delivered to final energy users.

In contrast with the decline in the use of petroleum products, the share of coal and coke escalated from 0.3 per cent in 1980 to 3.8 per cent in 1985 due to the increase in demand for coal and coke as principal sources of primary energy by the existing cement plants and foundries. The share of gas increased from 0.3 per cent to 2.4 per cent with the accelerated completion of major gas-utilizing projects. These projects include Phase I Peninsular Gas Utilization Project in Terengganu which involved delivery of gas to the refinery at Kerteh, the integrated sponge iron, and billet plant at Chukai and the gas-fired power station at Paka; the integrated methanol, sponge iron, and power project in Labuan; and the liquefied natural gas and ASEAN ammonia-urea plants in Bintulu.

The manufacturing and transport sectors and households were the major energy consumers. By 1985, as shown in Table 17-3, these consumers constituted 34.0 per cent, 17.5 per cent and 25.0 per cent of total energy demand, respectively. The manufacturing sector was the largest consumer of electricity, coal and coke, charcoal, gas, and biomass. Consumption of energy by households and the transport sector was predominantly derived from petroleum products accounting for 80.8 per cent and 98.8 per cent, respectively, of total energy demand. In order to diversify the use of energy in the transport sector, liquefied petroleum gas (LPG) as autofuel was introduced in 1983. By the end of 1985, about 500 vehicles were fitted with LPG conversion kits.

TABLE 17-3

## MALAYSIA: ENERGY DEMAND BY SECTOR, 1980, 1985, AND 1990

Sector	1980		1985		1990		Average annual growth rate (%)		
	PJ	%	PJ	%	PJ	%	1981-85	1986-90	1981-90
Agriculture	28.8	8.7	35.3	7.4	40.7	6.1	4.2	2.9	3.5
Mining and quarrying	19.2	5.8	15.3	3.2	18.6	2.8	-4.4	4.0	-0.3
Manufacturing	109.5	32.8	162.2	34.0	242.5	36.2	8.2	8.4	8.3
Construction	8.8	2.6	14.7	3.1	21.9	3.3	10.8	8.3	9.5
Transport and communications	51.3	15.4	83.3	17.5	110.9	16.6	10.2	5.9	8.0
Trade and banking	25.1	7.5	33.4	7.0	44.1	6.6	5.9	5.7	5.8
Services	9.8	2.9	13.2	2.8	17.0	2.5	6.1	5.2	5.7
Households	80.9	24.3	119.3	25.0	173.2	25.9	8.1	7.7	7.9
Total	333.4	100.0	476.7	100.0	668.9	100.0	7.4	7.0	7.2

Source: As in Table 17-1.

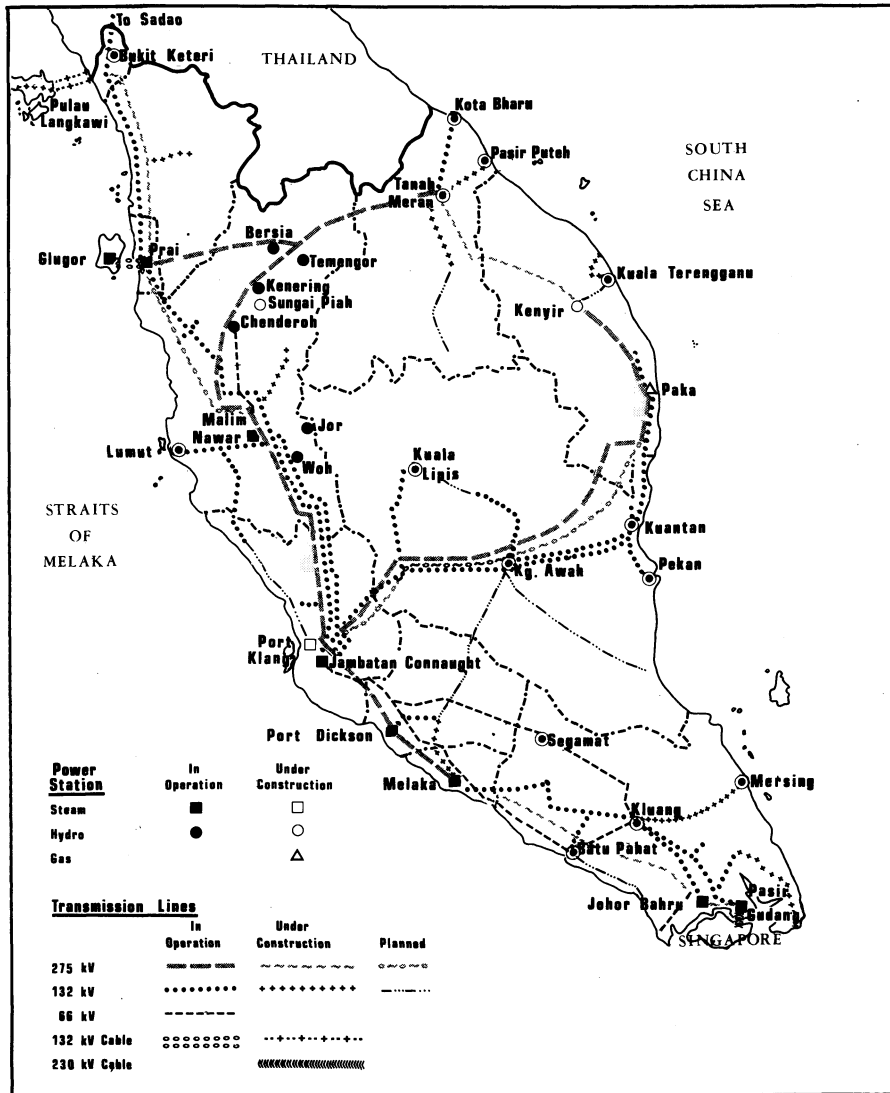
#### Electric power generation programmes

The total demand for electricity grew at an annual rate of 7.4 per cent during the period 1981-85. In meeting this demand, the total electricity generated increased by 57.0 per cent from 9,022 Gigawatthour (Gwh) in 1980 to 14,061 Gwh in 1985. Out of the total electricity generated in 1985, the National Electricity Board (NEB) supplied 89.9 per cent, while the Sabah Electricity Board (SEB) 5.1 per cent, and the Sarawak Electricity Supply Corporation (SESCO) 5.0 per cent.

In Peninsular Malaysia, the total energy generated by the NEB increased by 53.0 per cent from 8,265 Gwh in 1980 to 12,648 Gwh in 1985. Among the major projects undertaken by NEB were the 900 Megawatt (MW) gas-fired Paka Power Station of which 500 MW was installed, Kenyir Hydroelectric Project (400 MW), oil/gas-fired Phase I Port Klang Power Station (300 MW out of 600MW), Sultan Iskandar Power Station at Pasir Gudang (240 MW), Kenering Hydroelectric Project (120 MW), Connaught Bridge Gas Turbine Project (180 MW), and Bersia Hydroelectric Project (72 MW).

With the increase in the generating capacity of NEB, the transmission and distribution networks were also expanded. Transmission lines were increased from 2,823 kilometres in 1980 to 4,439 kilometres in 1985, while distribution lines expanded from 11,513 kilometres to 17,840 kilometres, respectively. The National Grid, as shown in Map 17-1, was further expanded to improve the reliability of the system and flexibility of electricity supply. During the Fourth Plan period, the Temenggor - Tanah Merah and Temerloh - Paka 275 kilovolt (kV) transmission lines and the extension of the 275 kV line from Prai to Alor Setar were completed.

**MAP 17-1  
PENINSULAR MALAYSIA: THE NATIONAL GRID, 1985**





In addition, the first 275 kV consumer cable to the steel mill at Chukai, Terengganu, the 132 kV transmission line linking Kuantan and Kemaman, and the 132 kV submarine cables linking Pulau Langkawi to the mainland were completed. Another main feature of transmission development was the power interconnections with neighbouring countries. The first 132 kV interconnection with the Electricity Generating Authority of Thailand was realized in 1981, with a transmission capacity of 50 MW. A 275/230 kV interconnection, with a capacity of 200 MW between NEB and the Public Utilities Board of Singapore, was also completed.

Several feasibility studies were undertaken by NEB on the development of hydroelectric projects, such as those for Tekai, Ulu Jelai, Nenggiri, and Maran. These studies were aimed at detailed assessment of the hydroelectric power potentials of the country.

In response to the need to assist heavy and export-oriented industries as well as the tourist industry, several changes were made to the existing electricity tariffs. These included the provision of off-peak rates and increased discount rates for large power industrial consumers, namely, heavy industries in 1980, textiles industries in 1983, and rubber-based industries in 1984. The decline in the cost of electricity generation due to reduced fuel prices and increased efficiency also led to a reduction of tariffs in 1985, ranging from 4 to 15 per cent for medium and high-voltage commercial, industrial, and mining sectors as well as off-peak tariff rates which were 50 to 53 per cent lower. The new rates were aimed at accelerating industrialization and tourism. These changes were also made to promote better use of the present capacity and to avoid the purchase of expensive generating units to meet peak demands.

The SEB, formerly a State authority, was made a Federal agency in 1984. The total energy generated by SEB expanded from 403 Gwh in 1980 to 709 Gwh in 1985, an increase of 75.9 per cent. Among the major projects completed were the Tenom Pangi Hydroelectric Project of 66 MW capacity and the installation of diesel generating sets of various sizes at several power stations. In complementing the increased generating capacity, transmission and primary lines were expanded from 214 kilometres in 1980 to 1,624 kilometres in 1985. The first 66/132 kV transmission system in Sabah, installed as part of the Tenom Pangi Hydroelectric Project, was commissioned in 1984. With the expansion in the power system, SEB undertook a masterplan power study, outlining the optimum long-term development of the power system in Sabah. A complementary study on the financial implications of the future power expansion programmes commenced in 1985.

In Sarawak, major power generation projects, such as the development of the Batang Ai Hydroelectric Project of 108 MW capacity and the installation of gas turbines and diesel generating sets in several power stations, were implemented.

With the commissioning of these projects, the total energy generated by SESCO expanded from 355 Gwh in 1980 to 704 Gwh in 1985, an increase of 98.3 per cent. Accordingly, transmission lines were increased from 214 kilometres in 1980 to 2,110 kilometres in 1985. The power system in Sarawak comprised isolated networks. A major system development was the 275 kV line connecting the Batang Ai Hydroelectric Power Station to Kuching. In line with the targeted growth in the power sector, a masterplan for power system development was carried out. This masterplan subsequently led to further feasibility studies being undertaken on the Pelagus and Bakun hydroelectric projects, the high voltage direct current (HVDC) transmission link between Sarawak and Peninsular Malaysia, and the high voltage alternating current (HVAC) transmission link between Sarawak and Sabah. The studies indicated that the development of these projects is feasible.

During the Fourth Plan period, emphasis was given to the implementation of the rural electrification programmes to improve the socio-economic conditions of the rural areas. The programmes benefitted about 449,400 additional households in Malaysia, consisting of 387,200 in Peninsular Malaysia, 24,500 in Sabah, and 37,700 in Sarawak. In terms of total coverage, approximately 68 per cent of the rural population were supplied with electricity by 1985 compared with 48 per cent in 1980. In line with the high priority given to the implementation of minihydro projects to provide electricity to isolated areas, a total of 18 projects was implemented in the country.

#### **Energy conservation.**

Energy conservation in Malaysia was directed towards more efficient use of energy. The Working Committee on Energy Conservation was established with the objective of planning, co-ordinating, monitoring, and reviewing activities or programmes pertaining to energy conservation. Programmes undertaken included the launching of the Conservation Campaign in 1980 to instil a sense of awareness among the public on the need to conserve energy through more efficient energy usage. This was done through lectures, dialogues, and seminars; distribution of pamphlets; and publicity campaigns over television and radio. Studies relating to energy conservation undertaken included energy audit studies on high-rise buildings and small and medium-scale industries, and an energy conservation study in street lighting. Effective from 1982, firms were permitted to generate power for their own use from industrial wastes. In addition, fiscal measures, such as accelerated depreciation allowance for energy-saving industrial machines and equipment, were introduced to encourage more efficient utilization of energy.

#### **Research and development**

Non-conventional alternative energy resources did not contribute significantly towards overall energy development due to economic and technical limitations.

Nevertheless, active research and development on non-conventional alternative energy resources were pursued primarily by the power utilities, the Palm Oil Research Institute of Malaysia (PORIM), the Standards and Industrial Research Institute of Malaysia (SIRIM), and local universities. Two pilot projects using rice husk for power generation at Teluk Kechai and Jerlun in Kedah were implemented. In addition, rural electrification pilot schemes utilizing solar energy were developed at Kampong Telok Apau, Pulau Langkawi in Kedah, Kampung Hulu Tembeling in Pahang and Pulau Sibu in Johor. The National University of Malaysia undertook a feasibility study on the potential of establishing a solar research centre. SIRIM was active in promoting biogas technology for the rural areas and PORIM in developing diesel from palm oil. Research in nuclear energy was primarily confined to its applications in medicine, agriculture, and industries. The Nuclear Energy Unit was established in 1982 to co-ordinate and oversee research and development in nuclear technology.

#### **Energy planning**

The National Energy Planning Study (NEPS) was initiated in November 1983 with the objective of developing a comprehensive energy planning approach. This included the development of tools and data base for planning, policy formulation, and decision making as well as concepts to institutionalize energy planning as a continuous exercise. The results of the NEPS, completed in 1985, formed the basis for formulating more comprehensive national energy policies and decision making. In addition to the NEPS, the Power Sector Investment Study (PSIS) was undertaken in 1985. The PSIS examined the magnitude of national power sector investments over a time frame of up to the year 2010 for selected key energy sector strategies.

### **III. PROSPECTS, 1986-90**

Efforts will continue to be made to pursue energy diversification objectives by further reducing reliance on oil, while increasing the role of natural gas, hydro-power, and coal. In ensuring that the development of energy diversification programmes is consistent with the phased development of energy supplies, an optimum energy mix will be formulated, with continued focus on the utilization of domestic resources. Energy resource utilization options in the short term will include natural gas, domestic and imported coal, and hydro. In the medium to long term, the options are extended to include non-conventional energy, while the nuclear option will continue to be reviewed. Future energy diversification will depend primarily on gas utilization options, the price of gas in comparison with other fuel prices as well as developments in the power, oil, and coal sectors.

#### **Energy supply and diversification**

The total primary supply of energy, as shown in Table 17-1, is expected to increase by 4.9 per cent per annum, from 679.6 PJ in 1985 to 863.1 PJ in 1990. The

supply from crude oil is expected to remain constant at 360.2 PJ, while that from petroleum products will increase at a rate of 10.9 per cent, from 60.7 PJ in 1985 to 102 PJ in 1990. During the period, the supply from coal and coke, natural gas, and hydropower will increase at the rates of 31.2 per cent, 7.9 per cent and 1.3 per cent, respectively.

The share of oil and petroleum products in total energy supply is expected to decrease from 61.9 per cent in 1985 to 53.5 per cent in 1990, with the continuation of energy diversification programmes. The decline in the supply from oil is compensated by the increase in the supply of other energy resources. Natural gas will continue to play a more important role in the energy sector. The shares of gas, coal and coke, and biomass in total energy supply are projected to increase to 20.8 per cent, 8.7 per cent, and 14.6 per cent, respectively.

Further progress in the diversification of energy resources in electric power generation, as shown in Chart 17-1, is expected during the Fifth Plan period. The share of oil in the generation mix will decline from 65.8 per cent in 1985 to 14.2 per cent in 1990, while that of gas will increase from 9.3 per cent to 50.6 per cent, respectively, primarily due to the proposed conversion of oil-fired power stations at Pasir Gudang, Port Klang, Connaught Bridge, and Port Dickson to gas-fired stations. The share of coal of 15.5 per cent in 1990 is attributed to the commissioning of the coal/gas/oil-fired Phase II Port Klang Power Station.

#### **Energy demand and diversification**

Energy demand, as shown in Table 17-2, is targetted to grow at 7.0 per cent per annum from 476.7 PJ in 1985 to 668.9 PJ by 1990. Demand for petroleum products will increase from 318.5 PJ in 1985 to 432.8 PJ in 1990, while that for electricity from 44.1 PJ to 65.8 PJ. Similarly, there will be increases in the demand for coal and coke from 18.1 PJ in 1985 to 39.0 PJ in 1990 and gas from 11.6 PJ to 18.4 PJ.

With respect to energy diversification, the share of petroleum products in total energy demand is expected to decline from 66.8 per cent in 1985 to 64.7 per cent in 1990, due to the anticipated substitution of fuel oil by gas and coal, and petrol by LPG. With the increasing access to electricity supply in both the urban as well as rural areas, the share of electricity will rise slightly from 9.3 per cent in 1985 to 9.8 per cent in 1990. The share of coal and coke will increase from 3.8 per cent in 1985 to 5.8 per cent in 1990, arising from the increasing industrial demand, particularly in the cement and iron and steel plants. Similarly, the share of gas is anticipated to increase from 2.4 per cent in 1985 to 2.8 per cent in 1990 with the completion of the second stage of the transpeninsular gas pipeline from Terengganu to the Klang Valley and extended to Johor and Singapore by 1989.

In terms of demand by sector, as shown in Table 17-3, manufacturing will constitute the largest share at 36.2 per cent in 1990. This reflects the growing importance of the sector in industrialization and economic growth. The household and transport and communications sectors will account for 25.9 per cent and 16.6 per cent of total energy demand, respectively. In the household sector, LPG utilization will be enhanced with the implementation of the reticulated gas piping system that will make possible the supply of piped LPG to households. In the transport sector, the use of LPG as a substitute to petrol will be further encouraged. In addition, the possibility of introducing compressed natural gas (CNG) as transport fuel will be considered. Towards this objective, the National Oil Corporation (PETRONAS) will establish pilot CNG refuelling stations at Kerteh in Terengganu and Bintulu in Sarawak.

#### **Electric power generation programmes**

During the Fifth Plan period, the total energy generated will amount to about 22,000 Gwh in 1990, an increase of 56.0 per cent from the 1985 level of 14,100 Gwh. Out of this total, NEB will account for 19,300 Gwh or 87.7 per cent in 1990, while SEB will generate 1,200 Gwh or 5.2 per cent, and SESCO 1,600 Gwh or 7.1 per cent.

Major projects to be implemented by NEB include the completion of Paka Power Station (900MW), Phase I Port Klang Power Station (600MW), coal/gas/oil-fired Phase II Port Klang Power Station (600 MW) and Sungai Piah Hydroelectric Project (60 MW). With the completion of the transpeninsular gas pipeline, some oil-fired power stations will be converted to use gas. In addition, a number of feasibility studies will be completed, including studies for the Raub-Bentong, Maran, Ulu Jelai, Nenggiri, Lebir, and the Pergau hydroelectric projects. The ongoing Hydropower Ranking Study will provide a rational basis for selecting hydropower projects to be evaluated as part of the future generation development programme of NEB.

The transmission network of 275 kV and 132 kV lines, that makes up the National Grid, as shown in Map 17 - 1, will be further expanded to cover the whole of the east coast from north to south connecting the States of Kelantan, Pahang and Terengganu. The major project to be completed is the 156-kilometre Kenyir-Tanah Merah 275 kV line. With its completion, the interstate connection of the National Grid will be fully completed, linking among others, power stations at Paka, Temengor, and Kenyir with the load centres in both the east and west coasts.

In Sabah, the energy generation capacity of SEB is expected to increase from 709 Gwh in 1985 to 1,200 Gwh in 1990. Among the major projects to be undertaken are the third phase of the Tenom Pangi Hydroelectric Project of 74 MW capacity and the installation of additional diesel generating sets for the Kota

Kinabalu, Tawau, Lahad Datu, Semporna, and Ranau power stations. In line with the Government's privatization policy in making the electricity sector more business-oriented, privatization of the power station at Sepangar Bay, Kota Kinabalu of 48 MW capacity will be considered. Feasibility studies planned to be undertaken by SEB will include studies on geothermal power generation in the Semporna peninsula, hydroelectric power generation for the Liwagu and Padas river basins, and the power interconnection between Labuan and the mainland of Sabah.

The energy generation capacity of SESCO will reach 1,600 Gwh by 1990 compared with 704 Gwh in 1985. The main project that will be implemented is the Ulu Ai Hydroelectric Project with a capacity of 54 MW. In identifying potential projects for implementation, several feasibility studies are planned to be undertaken, and these will include studies on small hydro projects for Sri Aman, Kapit, Sarikei, and Limbang, and major hydro projects at Murum, Baleh, and Belaga. As the single most capital-intensive component of the power sector development plan, which requires large capital outlay, the Bakun Hydroelectric Project will be carefully assessed in terms of financial affordability and its impact on balance of payments prior to decision of its implementation.

During the Fifth Plan period, the rural electrification programme will be expanded. The programme will supply electricity to about 261,100 additional households in Malaysia, comprising 203,100 in Peninsular Malaysia, 33,100 in Sabah and 24,900 households in Sarawak, thus benefitting about 77 per cent of the rural population by 1990. In ensuring effective implementation of the programmes, various measures will be considered, including resettling villages to a centralized location, developing growth centres, diversifying energy resources, and prioritizing projects in conformity with specific guidelines. Emphasis will continue to be given to the development of minihydro projects and 105 minihydro projects are expected to be completed during the Plan period.

#### **Energy conservation**

A comprehensive policy on energy conservation as well as adequate institutional arrangements with respect to co-ordination, manpower, and dissemination of information on energy conservation to various users will be formulated. In this regard, the possibility of establishing the National Energy Conservation Centre aimed at promoting energy conservation, providing technical assistance and training, developing conservation policies, and establishing an efficient data bank, will be considered. In addition, detailed studies will be undertaken to set conservation targets that will serve as a basis for monitoring and evaluating the effectiveness of energy conservation. Appropriate pricing of energy resources will also play an important role in energy demand management during the Plan period. In addition, incentives will be provided to those adopting energy conservation measures. In the transport sector, services will be improved to encourage

travel by public transport instead of private vehicles. The use of sodium-filled lamps in public lighting will be increased to conserve electricity. There are also plans to formulate a building control regulation that will emphasize energy conservation.

#### **Research and development**

Research activities on non-conventional energy resources will be continued, particularly in the agriculture sector to make effective use of post-harvest wastage. The National University of Malaysia and the University of Science Malaysia will conduct further research on solar energy. The potential in co-generation systems will be studied, particularly in isolated biomass power plants with a view to increasing the overall efficiency in energy use. In ensuring effective and meaningful research and development in non-conventional energy sources, the Government will take steps to strengthen the existing efforts in co-ordinating and providing feedback information on energy research and development. Research on energy-saving methods for buildings will also be carried out.

#### **Energy planning**

In order to ensure the successful continuation of the energy planning efforts, which was initiated under the NEPS, future energy planning will focus on the immediate issues of institutionalizing energy planning, training of energy planning personnel, and establishing an energy data bank. In view of the absence of a centralized organization within the existing institutional framework of the energy sector that is responsible for integrated energy planning, the establishment of an energy planning and co-ordination section within an existing agency will be considered in the Plan period. It is intended that this section be involved in the overall integrated energy sector planning. An analysis of training needs of key task areas of energy planning will be undertaken, followed by an intensive formal training programme for energy planners. Steps will also be taken towards a comprehensive compilation of energy statistics.

### **IV. ALLOCATION**

The development allocation and estimated expenditure during the period 1981-85 and the allocation for the period 1986-90 for energy are as shown in Table 17-4.

### **V. CONCLUSION**

During the Fourth Plan period, the energy sector witnessed a significant progress in energy supply, transmission, and diversification. Energy diversification, together with energy conservation, will be the focus during the Fifth Plan period, with a view to further increasing efficiency in energy use and optimizing available energy utilization options. The sector will continue to provide the

impetus and support to industrialization and overall economic development. Integrated energy planning has, therefore, emerged as an important discipline and is viewed as an integral part of the overall management of the national economy.

**TABLE 17-4**  
**MALAYSIA: PUBLIC DEVELOPMENT EXPENDITURE FOR**  
**ENERGY<sup>1</sup> PROGRAMMES, 1981-90**  
**(\$ million)**

<i>Programme</i>	<i>Fourth Plan allocation, 1981-85</i>	<i>Estimated expenditure, 1981-85</i>	<i>Fifth<sup>2</sup> Plan allocation, 1986-90</i>
Hydropower	994.00	896.24	1,531.50
Thermal and gas	696.26	620.22	2,145.94
Rural electrification	617.18	617.18	469.20
Transmission and distribution	79.02	87.47	1,711.53
Others	237.67	379.88	527.15
Total	2,624.13	2,600.99	6,385.32

*Notes:*

<sup>1</sup> Expenditure for electric power generation only.

<sup>2</sup> Under the Fifth Plan, the public sector has been redefined to include the NFPEs which previously were treated as belonging to the private sector.



# **Chapter XVIII**

## **Public Utilities**



## CHAPTER XVIII

# Public Utilities

### I. INTRODUCTION

The development of public utilities, namely, water supply, sewerage, and urban drainage and flood mitigation programmes, helps to promote economic growth and improve the quality of life. During the Fourth Malaysia Plan period, the implementation of water supply programme was given priority to meet the increasing water requirements, both for domestic and industrial consumption. The public sector investment in the other subsectors was aimed at the completion of projects and major components of ongoing schemes as well as the initiation of a number of new projects.

The strategies for the development of public utilities during the Fourth Plan period will continue to be adopted in the Fifth Malaysia Plan. In order to meet the rapidly increasing domestic and industrial water demands as well as to reduce conflict in water uses, an integrated and comprehensive approach towards the planning, development, and the management of water resources will be introduced. In addition, the source development for several water supply projects involving interstate and interbasin water transfer will be undertaken as an integral part of multipurpose water projects. Greater private sector involvement in the construction as well as operation and maintenance of water supply and sewerage projects will be encouraged to reduce public sector investment.

### II. PROGRESS, 1981-85

During the Fourth Plan period, the development of public utilities was accorded priority to help promote economic growth and improve the standard of living. Emphasis was also given to the implementation of water supply programme to meet the increasing water requirements, for domestic and industrial consumption, as well as to optimize the utilization of available water resources. With regard to sewerage development, the implementation of centralized sewerage projects in several state capitals and major towns was completed.

## Water supply

In line with the policy of the Government to provide safe water to all as well as to support the industrial development of the country, the implementation of water supply programme was accelerated during the Fourth Plan period. Arising from this, the total treatment plant production capacity was increased by 59.7 per cent, from 2,641.7 million litres per day (mld) in 1980 to 4,218.6 mld in 1985, compared with 63.8 per cent increase in water demand, from 2,281.3 mld to 3,737.3 mld, as shown in Table 18-1. The excess capacity in certain states was mainly attributed to the completion of several water supply schemes with greater treatment plant production capacity initiated during the Third and Fourth Plan periods and the development of other available resources. In terms of distribution by state, substantial increases in total production capacity were recorded in Johor, Kelantan, Melaka, Sabah, and Terengganu. The development of water supply in Kedah, Perlis, and Selangor, however, was unable to match the increase in demand due to various constraints such as lack of suitable water sources and rapid urbanization, industrialization, and migration in the Klang Valley region.

**TABLE 18-1**  
**MALAYSIA: WATER SUPPLY AND DEMAND, 1980-90**  
(mld.)

State	1980		1985		1990	
	Treatment plant production capacity	Demand	Treatment plant production capacity	Demand	Treatment plant production capacity	Demand
Johor	212.0	236.6	426.5	398.6	810.1	703.9
Kedah	142.9	162.9	260.0	287.1	569.0	534.3
Kelantan	51.9	51.9	113.0	103.7	201.4	180.1
Melaka	79.2	79.6	232.7	140.6	240.7	237.0
Negeri Sembilan	118.3	97.8	213.0	182.0	387.8	325.6
Pahang	113.8	113.8	221.7	199.3	622.5	315.4
Perak	441.4	318.5	526.7	468.2	830.5	696.1
Perlis	15.0	6.8	19.3	25.0	66.9	41.2
Pulau Pinang	291.2	268.5	464.1	342.6	631.9	551.0
Sabah <sup>1</sup>	124.6	106.9	318.0	188.0	556.8	362.8
Sarawak	157.0	101.5	267.0	233.0	532.2	334.0
Selangor <sup>2</sup>	854.9	707.8	1,037.0	1,098.4	1,895.1	1,768.0
Terengganu	39.5	28.7	119.6	71.4	332.1	229.2
Malaysia	2,641.7	2,281.3	4,218.6	3,737.3	7,677.0	6,278.6

Sources: Ministry of National and Rural Development.  
Water Supply Division, Public Works Department.

Notes:

<sup>1</sup> Includes the Federal Territory of Labuan.

<sup>2</sup> Includes Federal Territory of Kuala Lumpur.

Although most states had surplus supply of water, shortages occurred in certain parts of the country, particularly in pockets of urban areas and in areas where there were constraints in treatment and storage capacities and distribution system, and where there were shortages of surface and groundwater sources. The restricted transfer of excess water among states further aggravated this problem. The completion of several urban water supply projects, initiated during the Third and Fourth Plan periods, however, had overcome the water shortages previously encountered in several localities, such as Muar and Segamat in Johor as well as Machang, Pasir Mas, Pasir Puteh, Tanah Merah, and Tumpat in Kelantan.

Consistent with the efforts of the Government to enable more rural populace to have access to water supply, about 2,300 rural water supply schemes were implemented. These projects with a total production capacity of 370 mld benefitted 1,800,000 people, representing 60 per cent achievement of the Fourth Plan target. In addition, improvements were also made in the level of service to existing consumers.

During the Fourth Plan period, a number of non-surface water schemes were implemented in remote areas to supplement the rural water supply system based on surface water sources and to enable more people to benefit from water supply facilities. A total of 5,600 wells fitted with hand-pumps to tap groundwater potentials were implemented, mainly in Kedah, Kelantan, Perak, and Terengganu. In addition, 420 wells with house connections were constructed in Peninsular Malaysia, while 14,300 rain water collection system were completed, mainly in the remote and coastal areas of Sabah and Sarawak. About 850 gravity water supply schemes and wells with reticulation systems were also developed throughout the country. The implementation of these programmes benefitted an additional 745,000 consumers.

Water supply development was expanded to new land schemes under the Federal Land Development Authority (FELDA) and the regional development authorities (RDAs) areas. During the 1981-85 period, 25 projects with a total treatment plant capacity of 38 mld in 55 FELDA schemes were implemented to provide 25,500 settler families with direct water supply facilities, compared with the target of 74 projects with a production capacity of 45 mld in 116 FELDA schemes, benefitting 30,000 settler families. In addition, standpipes and other forms of temporary supplies were provided in 19 FELDA schemes, benefitting an additional 4,500 settler families. In RDA areas, seven projects were constructed to provide treated water to an additional 46,800 families.

In 1980, 58.7 per cent of the total population were served with safe water. In the urban and rural areas, the coverage achieved were 89 per cent and 42.9 per cent, respectively, as shown in Tables 18-2 and 18-3. By 1985, the coverage for the urban population increased to 93.1 per cent, while that of the rural population was 57.6 per cent, giving a total population coverage of 70.9 per cent. This represented

**TABLE 18-2**  
**MALAYSIA: URBAN WATER SUPPLY COVERAGE,**  
**1980-90**

State	1980		1985		1990	
	Persons	%	Persons	%	Persons	%
Johor	508,520	87.0	669,779	91.6	865,152	96.0
Kedah	146,250	90.0	174,705	95.0	203,742	98.0
Kelantan	145,058	58.0	198,705	65.0	283,500	75.0
Melaka	107,310	98.0	114,400	100.0	120,400	100.0
Negeri Sembilan	163,618	86.8	207,890	89.3	263,083	92.7
Pahang	194,948	92.0	241,205	95.0	300,076	98.0
Perak	566,208	96.0	624,652	98.0	677,853	99.0
Perlis	11,880	90.0	15,252	93.0	20,090	98.0
Pulau Pinang	441,544	97.0	555,072	98.0	677,457	99.0
Sabah <sup>1</sup>	208,494	99.0	289,400	100.0	388,300	100.0
Sarawak	207,234	87.0	281,580	95.0	358,974	98.0
Selangor <sup>2</sup>	1,354,860	90.0	1,876,109	94.5	2,505,468	98.0
Terengganu	175,350	75.0	254,150	85.0	364,420	95.0
Malaysia	4,231,274	89.0	5,502,899	93.1	7,028,515	96.5

Source: Water Supply Division, Public Works Department.

Notes:

<sup>1</sup> Includes the Federal Territory of Labuan.

<sup>2</sup> Includes the Federal Territory of Kuala Lumpur.

**TABLE 18-3**  
**MALAYSIA: RURAL WATER SUPPLY COVERAGE,**  
**1980-90**

State	1980		1985		1990	
	Persons	%	Persons	%	Persons	%
Johor	296,912	28.0	688,276	61.3	847,325	72.9
Kedah	502,044	52.4	592,579	57.7	835,138	76.4
Kelantan	110,109	17.0	216,180	30.0	410,972	51.6
Melaka	249,970	70.0	308,907	81.7	383,420	95.6
Negeri Sembilan	255,684	66.0	294,450	75.0	353,512	90.7
Pahang	277,441	47.0	484,120	65.0	889,586	94.9
Perak	672,375	55.0	972,900	75.0	1,092,959	80.6
Perlis	61,020	45.0	74,350	50.0	112,015	68.7
Pulau Pinang	392,340	78.0	410,890	85.0	392,680	87.5
Sabah <sup>1</sup>	152,010	18.0	376,238	38.0	614,607	54.4
Sarawak	222,580	20.0	411,312	33.0	656,186	47.3
Selangor <sup>2</sup>	648,180	65.0	722,262	73.0	792,085	82.1
Terengganu	77,325	25.0	135,120	40.0	329,719	89.8
Malaysia	3,917,990	42.9	5,687,584	57.6	7,710,204	72.8

Sources: Ministry of National and Rural Development.  
Water Supply Division, Public Works Department.

Notes:

<sup>1</sup> Includes the Federal Territory of Labuan.

<sup>2</sup> Includes the Federal Territory of Kuala Lumpur.

a near achievement of the Plan target to provide safe water supply to 72.9 per cent of the total population. Certain states, however, continued to have low rural coverage due mainly to the remoteness of some villages and problems associated with water distribution.

There is currently no uniformity in the water supply administrative system in the country. The operation and maintenance of water supply in various states is managed by either a Water Board, a Water Department or the Public Works Department. In order to increase the efficiency of water supply development and management in the country, efforts had been taken to revamp and improve the existing system. A water supply department was established in Negeri Sembilan, Perak, Selangor, and Terengganu. Johor also initiated efforts towards the establishment of such department. In addition, the commercial accounting system was implemented in Melaka, Pulau Pinang, and Terengganu. Efforts towards its adoption were pursued by Johor, Kelantan, Perak, and Selangor. In view of the increased capital cost of water supply projects and the rising operation and maintenance costs, water rates in all states were revised during the Fourth Plan period to generate additional revenues to meet these costs.

During the 1981-85 period, a number of feasibility studies for specific water supply schemes, such as the Terengganu Water Resources Study, were undertaken. With regard to rural water supply, detailed investigations and preparation of development programmes were carried out and completed in 1984. Feasibility and preliminary engineering studies of the Sungai Johor water resources were initiated in 1984 for the purpose of international water transfer, under the economic co-operation between the Governments of Malaysia and Singapore. This study identified various options for the development of Sungai Johor water resources to meet the future requirements of both countries.

#### **Water resources**

With respect to water resources development, several feasibility studies on water resources development were completed. One of them was the National Water Resources Study which was initiated in late 1979 and completed in 1982. The main objective of this study was to establish a basic framework for the orderly planning, implementation, and the management of water resources development programmes for the country, consistent with the overall national socio-economic development objectives. The study recommended the construction of more storage dams to retain high flows during wet seasons for release in dry seasons.

In line with the recommendations of the National Water Resources Study, feasibility studies for the water stress regions of Kedah, Perlis, and Pulau Pinang as well as Melaka, Negeri Sembilan, and North Johor were completed in 1984. The South Johor Regional Water Resources Study and the updating of the 1980 Klang Valley Water Resources Study were completed in 1985.

#### Sewerage

The problems of pollution of surface and groundwater sources, coastal waters, and beaches has increased as a result of rapid urbanization, industrialization, and overall economic development. Discharge of sewage was identified as a contributor to the high incidence of water-borne communicable diseases as well as the major source of pollution. This problem, however, could be overcome by the provision of centralized sewerage systems and the improvement of existing sanitation systems.

By the end of the Fourth Plan period, centralized sewerage systems were available in Bukit Mertajam, Butterworth, Georgetown, Kota Kinabalu, Kuala Lumpur, and Shah Alam. These systems which were implemented by the local authorities, however, were not fully extended to serve all households within the urban areas. By 1985, about 152,200 households or 5.3 per cent of the total population of the country were provided with centralized sewerage systems, compared with 4 per cent in 1980. In addition, the construction of new housing projects with communal centralized sewerage facilities undertaken both by the private and quasi-government sectors, has benefitted a considerable number of households.

In line with the objective of the Government to provide centralized sewerage systems for state capitals and major towns, detailed designs for the Bangi, Ipoh, Kota Kinabalu, Kuala Terengganu, Sandakan, and Tawau sewerage projects were completed. Feasibility studies and preliminary engineering designs for eight other towns were prepared for future implementation.

With regard to other types of sewerage system, 30.6 per cent of the total population of the country were provided with flush toilets connected to septic and imhoff tanks or other communal centralized sewerage systems in 1985, compared with the Fourth Plan target of 29.1 per cent. In addition, 39.2 per cent of the overall population, mainly in the rural areas, were provided with pour-flush toilets in 1985, compared with 30.3 per cent in 1980.

With the increasing usage of modern methods of sewage disposal, the percentage of the total population using buckets, pits, and hanging latrines declined substantially from 27.5 per cent in 1980 to 14.7 per cent in 1985. The proportion of the population still without any sewage disposal system also decreased from 16.4 per cent in 1980 to 10.2 per cent in 1985.



### **Urban drainage and flood mitigation**

In line with the efforts of the Government to improve the socio-economic conditions and quality of life of the urban dwellers, and considering that a number of urban centres were subjected to frequent floodings, drainage master plans and feasibility studies were undertaken for Alor Setar, Bintulu, Johor Bahru, Kuantan, Melaka, and Port Klang. These studies were mainly aimed at formulating both short and long-term solutions to urban flooding problems. Detailed engineering designs for the Kuala Terengganu and Seremban urban drainage projects were completed in 1985.

The implementation of the Kuala Lumpur Flood Mitigation Project, initiated in 1973, continued into the Fourth Plan. The enlargement of the existing Klang Gates Dam, a component of the project, was completed in 1980 while the construction of the Batu Dam which will also supply water to the Federal Territory of Kuala Lumpur and the canalization and revetment works of the Sungai Batu, Sungai Gombak, and Sungai Klang were carried out during the Plan period.

The construction of Batu Anam Flood Mitigation Project was completed in 1984, while the Klang-Port Klang, Kota Bharu, and Pekan schemes continued to be implemented. In addition, detailed design of the Seremban Flood Mitigation Project was completed in 1983, while that of the Kangar scheme was initiated in 1984.

### **III. PROSPECTS, 1986-90**

The policies and strategies for the development of public utilities adopted in the Fourth Plan will be maintained. Priority will continue to be accorded to the implementation of water supply programme. In addition, an integrated and comprehensive approach towards the planning, development, and the management of water resources will be introduced to optimize the use of available water resources. Where possible, such projects will be developed as multipurpose schemes on an interstate and interbasin basis. The development of centralized sewerage programme will be confined to state capitals, major towns, and popular tourist resorts, while alternative low-cost systems using appropriate technologies will be developed, where feasible. In line with the Government policy to involve the private sector in public sector development programmes and in view of the limited public sector financial resources, active private sector participation will be encouraged in the construction, operation, and maintenance of public utilities.

#### **Water supply**

During the Fifth Plan period, the planning of water supply and water demand will be further co-ordinated. Water supply authorities will be informed of the water requirements of industries as the availability of adequate and reliable water for industrial use is crucial.

In order to meet the increasing water requirements for domestic and industrial uses, which is projected to increase by 10 per cent per annum during the Plan period, the construction of ongoing water supply schemes such as the Ahning Stage I, Johor Bahru Phase IA, Pulau Langkawi, Sungai Semenyih, and the South Coastal Terengganu projects will be completed. In addition, the construction of new schemes, namely, the Bintulu Phase II, Kluang, Labuan, and Muar Phase II will be initiated.

The implementation of ongoing rural water supply projects will be completed during the Plan period. Three new schemes will also be constructed in the *Keselamatan dan Pembangunan* areas (KESBAN). In line with the efforts of the Government to enable more rural populace, especially those in remote areas, to have greater access to water supply, 174 projects will be implemented on a turnkey basis throughout the country. Out of these, 103 are new source works, six are improvements to existing treatment plants, 63 involve laying of pipelines, and the remaining are research schemes involving drilling and exploration for groundwater sources in Perlis and Sarawak. In addition to improving the levels of service to existing beneficiaries, the implementation of these programmes, for which the allocation has been increased fourfold compared with the Fourth Plan provision, will benefit about 2,022,600 new consumers.

The provision of water supply infrastructure in FELDA schemes and the RDA areas will be further expanded. During the Fifth Plan period, 68 water supply projects will be implemented to meet the needs of 30,000 new settler families in 184 FELDA schemes. In addition, six water supply projects with a total production capacity of 75 mld will be constructed in RDA areas to benefit a further 257,000 consumers.

A number of feasibility studies, such as the Johor and Pahang water resources studies, will be carried out during the 1986-90 period, while the joint study of Sungai Johor water resources will be completed in 1986. In addition, investigations on groundwater potentials will be carried out with a view to supplementing surface water resources. A pre-investment study on groundwater development will be initiated in 1986 for the coastal swampy areas of Sarawak where its water sources are affected by saline intrusion. In cognisance of the problem of unaccounted for water, which is as high as 45 per cent in some states, a study on water losses and wastage will be undertaken.

With the accelerated implementation of water supply programme envisaged during the Fifth Plan period, the total treatment plant production capacity will be further increased from 4,218.6 mld in 1985 to 7,677.0 mld in 1990. The water demand is anticipated to increase from 3,737.3 mld to 6,278.6 mld in the respective years, as shown in Table 18-1.

The implementation of water supply projects during the Fifth Plan period will increase the total population with access to safe water by 11.5 per cent. Consequently, 82.4 per cent of the total population will be provided with water by

1990 compared with 70.9 per cent in 1985. The urban water supply coverage is targetted to improve from 93.1 per cent in 1985 to 96.5 per cent in 1990 while the rural coverage from 57.6 per cent to 72.8 per cent.

#### **Water resources**

Water resources in practically all major demand areas has been developed or committed for use. There is, therefore, a need to undertake water resources development on a larger scale in future to meet the rapidly increasing domestic and industrial water demands throughout the country. The development of water resources in future will increasingly be undertaken on a regional basis and where possible, such projects will be designed for multipurpose uses. In order to facilitate the development of water resources, the Government will adopt the principles of sharing water amongst states and emphasize the development of interstate projects. With regard to the uses of multipurpose schemes, the highest priority will be accorded to domestic and industrial uses, followed by agricultural use, water dependent activities, namely, mining, fishing, power generating, and navigating, and lastly, recreational use. In addition, the Government will introduce legislation to improve co-ordination in water resources planning and its relation to landuse planning as well as to enable the smooth and timely development of interstate and multipurpose projects.

#### **Sewerage**

During the Fifth Plan period, the development of centralized sewerage programme will be confined to state capitals, major towns, and popular tourist resorts, while alternative low-cost systems using appropriate technologies will be developed, where feasible. A National Sewerage Policy will be formulated to co-ordinate the planning and implementation of sewerage development. The sewerage projects in Bukit Mertajam, Butterworth, and Labuan will be completed, while construction of the Ipoh, Kota Kinabalu, and the Seremban sewerage schemes will be initiated in 1986. Implementation of Bintulu Sewerage Project is expected to commence in 1987.

The detailed designs for the Johor Bahru, Klang, Kuala Lumpur Phase II, and Melaka sewerage projects as well as the sewerage and drainage master plans and feasibility studies for Kota Bharu, Kuching, and Muar will be carried out. In line with the efforts of the Government to promote tourism, sewerage projects as part of the infrastructure facilities required will be upgraded at two popular tourist resorts, namely, the North Beach in Pulau Pinang and Port Dickson in Negeri Sembilan. During the Plan period, the North Beach project will be implemented while the detailed engineering design of the Port Dickson scheme will be prepared.

The implementation of these projects is expected to provide 6.4 per cent of the total population of the country with centralized sewerage facility by 1990. The

possibility of privatizing the construction, operation, and maintenance of sewerage systems will be considered with a view to reducing public sector involvement.

With the implementation of new sanitation programmes, the proportion of the population using the flush and pour-flush toilets will increase from 35.9 per cent and 39.2 per cent in 1985 to about 42.5 per cent and 48.5 per cent, respectively, by 1990. Efforts will also be taken to phase out the buckets, pits, and hanging latrines, and replace them with acceptable sanitation systems. The total coverage of households using modern methods of sewage disposal is targetted to increase from 75.1 per cent in 1985 to about 91 per cent by 1990.

In view of the high capital cost in implementing centralized sewerage systems, alternative low-cost systems using appropriate technologies will be developed. Towards this end, further studies and research will be carried out. Efforts will be taken to encourage industries to pretreat industrial wastes before channelling to sewerage treatment plants.

#### **Urban drainage and flood mitigation**

The construction of ongoing flood mitigation projects for the Klang, Kota Bahru, Kuala Lumpur, and Pekan will be continued. The implementation of the flood mitigation schemes for Bayan Lepas, Ipoh, Kangar, Kuala Terengganu, and Seremban will be initiated in 1986. An urban drainage and flood mitigation master plan and feasibility study for Cukai in Terengganu will also be carried out.

#### **IV. ALLOCATION**

The development allocation and estimated expenditure during the period 1981-85 and the allocation for the period 1986-90 for public utilities are as shown in Table 18-4.

**TABLE 18-4**  
**MALAYSIA: PUBLIC DEVELOPMENT EXPENDITURE**  
**FOR PUBLIC UTILITIES, 1981-90**  
**(\$ million)**

<i>Programme</i>	<i>Fourth Plan allocation, 1981-85</i>	<i>Estimated expenditure, 1981-85</i>	<i>Fifth Plan allocation, 1986-90</i>
Water supply	2,137.91	1,827.95	3,125.77
Urban	1,791.71	1,510.11	1,695.77
Rural	346.20	317.84	1,430.00
Sewerage	217.41	212.24	178.77
Urban drainage and flood mitigation	15.75	15.52	159.27
Total	2,371.07	2,055.71	3,463.81

## V. CONCLUSION

In pursuance of the objectives of the Government to promote economic growth and improve the quality of life, the development of public utilities, which was accelerated during the 1981-85 period, will continue to be emphasized during the Fifth Plan period. The implementation of the water supply programme will be continued to increase coverage, especially in rural areas, to ensure adequate supply to industries and households, and to improve the levels of service to existing consumers. With respect to sewerage as well as urban drainage and flood mitigation programmes, investment by the public sector will be focussed upon the continuation and completion of existing schemes and the initiation of several urgent projects.

Privatization of the construction, operation, and maintenance of public utilities will be given due consideration. In addition, studies and research on water supply and alternative low-cost sewerage and sanitation systems using appropriate technologies will be carried out.

