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MALAYSIA

STAFF APPRAISAL REPORT

OF THE

NINTH POWER PROJECT

(BERSIA AND KENERING HYDROELECTRIC DEVELOPMENT)

February 15, 1980

Projects Department  
East Asia and Pacific Regional Office

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### CURRENCY EQUIVALENTS

US\$1.00 = M\$ 2.20  
M\$1.00 = US\$0.455

### UNITS AND EQUIVALENTS

1 cubic meter (cu m)	=	35.31 cubic feet (cu ft)
1 hectare (ha)	=	2.47 acres (ac)
1 meter (m)	=	3.28 feet (ft)
1 kilometer (km)	=	0.62 miles (mi)
1 square kilometer (sq km)	=	0.386 square miles (sq mi)
1 kilogram (kg)	=	2.205 pounds (lb)
1 metric ton	=	1,000 kilograms (kg)
1 cubic meter per second (cms)	=	35.31 cubic feet per second (cfs)
1 kilovolt (kV)	=	1,000 volts (V)
1 Megavolt-ampere (MVA)	=	1,000 kilovolt-amperes (kVA)
1 kilovolt-ampere (kVA)	=	1,000 volt-amperes (VA)
1 kilowatt (kW)	=	1,000 watts (W)
1 Megawatt (MW)	=	1,000 kilowatts (kW)
1 Gigawatt hour (GWh)	=	1 million kilowatt hours (kWh)
1 Kilocalorie (kcal)	=	3.968 British thermal unit (Btu)

### ABBREVIATIONS AND ACRONYMS

CDC - Commonwealth Development Corporation, U.K.  
CIDA - Canadian International Development Agency  
KED - Kinta Electric Distribution Co., Ltd.  
NEB - National Electricity Board of the States of Malaya  
OECF - Overseas Economic Cooperation Fund, Japan  
PCR - Preece Cardew & Rider, Brighton, England  
PRHE - Perak River Hydroelectric Power Company, Ltd.  
SEB - Sabah Electricity Board  
SECO - Shawinigan Engineering Company, Ltd., Canada  
SESCO - Sarawak Electricity Supply Corporation

### FISCAL YEAR (FY)

NEB: September 1 - August 31

Government: January 1 - December 31

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**MALAYSIA: NINTH POWER PROJECT**

**(BERSIA AND KENERING HYDROELECTRIC DEVELOPMENT)**

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This report was prepared by Messrs. K. C. Ling (Power Engineer) and A. Mejia (Financial Analyst) on the basis of an appraisal conducted in January/February 1978.

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## 1. THE SECTOR

### Energy Resources

1.01 The principal sources of energy in Malaysia are petroleum, natural gas and hydroelectric potential. No significant deposits of coal or uranium have yet been found. The proven commercial energy reserves are estimated to be  $32 \times 10^{15}$  Btu; of which about 78% are natural gas, 19% petroleum and 3% hydropower.

1.02 Natural gas and oil have been found off the coast of Sabah and Sarawak and, more recently, off the east coast of Peninsular Malaysia. In 1978, domestic crude production was 78.8 million barrels (about 216,000 barrels per day) and domestic consumption, 48.6 million barrels. Malaysia has been a net exporter of petroleum products since 1973. It is expected that in 1980 petroleum output would average 116 million barrels a year (317,000 barrels per day). The country is endowed with a sizable amount of natural gas estimated at about  $25 \times 10^{15}$  Btu or  $0.71 \times 10^{12}$  cu m. The export of liquified natural gas is estimated to reach about 6.4 million tons a year (22.7 million cu m a day) after 1983.

1.03 The hydro potential in Malaysia at 13 economically exploitable sites is estimated at about 1.9 million kW in capacity and 7,669 GWh in energy, equivalent to 13 million barrels of oil a year (Annex 1).

### Role of the Sector in the Economy

1.04 Electricity revenue accounts for only about 1.8% of GDP. However, electricity provides motive power to the manufacturing and mining industries which amount to 20% and 5% of GDP and 21% and 13% of merchandise exports respectively.

1.05 The growth of the power sector has kept pace with Malaysia's economic development. Between 1970 and 1978, when GNP grew at an average rate of about 7.5% in real terms, total electricity consumption grew at an average rate of about 13.4%. The elasticity coefficient of 1.8 is reasonable and comparable to those for countries at a similar stage of development.

### History of Bank Group Involvement in the Sector

1.06 The Bank has made eight loans to the National Electricity Board of the States of Malaya (NEB), aggregating US\$236.2 million (net of cancellations). The first loan (210-MA) of US\$28.6 million was made in 1958 for the first stage of the Cameron Highlands Hydroelectric Scheme. A second loan (350-MA) of US\$51.1 million made in 1963 financed the second stage of the Cameron Highlands Scheme, the first stage of the Prai Thermal Station and the

expansion of transmission facilities. In 1966, a third loan (458-MA) of US\$27.7 million was made for the first stage of the Port Dickson Thermal Station, the installation of additional generating units at the Cameron Highlands Scheme, the second stage of the Johore Bahru Thermal Station, and the expansion of transmission facilities. The fourth loan (579-MA) of US\$8.5 million in 1969 was for the second stage of the Port Dickson and Prai Thermal Stations and for further expansion of transmission facilities. In 1970, a fifth loan (700-MA) of US\$20.0 million financed the third stage of the Port Dickson Station, together with transmission facilities and the sixth loan (1031-MA) of US\$43.3 million in 1974 provided funds for transmission facilities associated with the Temengor Hydroelectric Development (4 x 87 MW), a load dispatching center and an extension of the transmission and distribution system. The seventh loan (1178-MA) of US\$35.0 million, made in 1975, covered the final extension of the Prai Thermal Station (3 x 120 MW), the expansion of transmission and distribution facilities to two rural areas and consulting services for a rural electrification study. The eighth loan (1443-MA) of US\$22.0 million was made in 1977 for the construction of a new thermal power station at Pasir Gudang (2 x 120 MW), together with the further expansion of transmission facilities.

1.07 The projects under the first six loans have been completed and are operating satisfactorily. The first unit of 120 MW under the seventh loan was commissioned in September 1979; the project construction is on schedule. Works financed under the eighth loan are presently in the early stage of construction and no difficulties in project execution are expected.

1.08 A project performance audit report, made in 1979 for the fifth loan, indicated that the project was completed with a cost overrun of about 15% and about three months behind schedule.

1.09 The primary objectives of the proposed project are: to assist NEB in expanding its generation facilities through the development of indigenous hydro resources; to connect the western network of Peninsular Malaysia to the east coast for regional development and the Government's program of rural electrification in the northeast provinces; to continue the Bank's role in institution building; and to assist NEB in obtaining funds from other sources including commercial banks through co-financing arrangements.

#### Sector Organization

1.10 Power in Malaysia is supplied principally by autonomous Government-owned entities. The largest of these is NEB, serving Peninsular Malaysia with the exception of part of the State of Perak which is supplied by the Perak River Hydroelectric Power Company (PRHE). The two states on the island of Borneo are supplied by Government-owned statutory authorities - the Sabah Electricity Board (SEB) and the Sarawak Electricity Supply Corporation (SESCO).

1.11 NEB was established in 1949 under the Electricity Act of that year to:

- (a) generate, transmit, transform, distribute and sell energy in bulk or to individual consumers in any part of the states of Malaya;
- (b) purchase, construct, reconstruct, maintain and operate supply lines, generating stations, transformer stations, buildings and works;
- (c) acquire electrical plant and property; and
- (d) assemble or manufacture electrical equipment and fittings.

1.12 PRHE and its distribution subsidiary, Kinta Electric Distribution Co., Ltd. (KED), generate and distribute electricity within their concession area in the State of Perak to some 85,700 customers; the bulk of the output being sold to the mining industry. PRHE is a profitable operation. The company is incorporated in the United Kingdom and operates under a concession granted by the State of Perak in 1926 for a term of 80 years with a break clause after 50 years. The Government has acquired all the ordinary shares and is now the sole owner of PRHE. The General Manager of NEB is a director on the board of PRHE. The final integration of PRHE with NEB is scheduled to take place in 1980. This will improve NEB's operation.

#### Supply and Demand of Electric Power

1.13 The generating capacity installed by the various entities as of end-FY78 is as follows:

<u>Entity</u>	<u>Installed Capacity (MW)</u>
NEB	1,439.8
PRHE	103.0
SED	127.0
SESCO	133.0
<u>Total</u>	<u>1,802.8</u>

Of this total, 379.4 MW is hydro (21.0%); 1,046.0 MW (58.0%) steam; 20 MW (1.1%) gas turbine; and 357.4 MW (19.9%) diesel. In addition, there are a total of 19.5 MW of diesel units and 1 hydro plant of 2 MW owned by 65 small electric companies which supply power on a licensed basis. The total number of captive generating units was about 116 at end FY78.

1.14 For Peninsular Malaysia, total energy generated in FY78 was 7,432.1 GWh, of which 7,106.8 GWh was generated by public utilities, 44.2 GWh by mining installations and 281.1 GWh by private industries. Hydro-electric plants produced 831.8 GWh or 11.2%; steam power plants, 6,061.8 GWh or 81.6%; diesel units, 538.5 GWh or 7.2%. Per capita generation was 663 kWh.

1.15 Consumption per capita in FY78 was 570 kWh. Of the total energy consumption of 6,384 GWh in FY78, 1,276.9 GWh or 20.0% were used by residential consumers; 4,175.3 GWh or 65.4% by commercial and industrial consumers; and 931.8 GWh or 14.6% by mining installations.

#### Access to Electricity

1.16 In FY78, NEB had 1,012,830 consumers, of which 274,954 were located in the central region; 316,278 in the northern region; 272,975 in the southern region; and 148,623 in the eastern region. In addition, PRHE had about 85,700 consumers and other licensed public suppliers had about 27,700. Access to electricity is estimated to be about 52% in Peninsular Malaysia. The degree of electrification by regions is shown in Annex 2.

1.17 Access to electricity is about 72% for the central region, 74% for the northern and southern regions, 66% for the eastern region, 34% for the PRHE area and only 8% and 14% respectively for the areas served by the isolated rural stations and other licensed suppliers. These rural stations and licensed public suppliers are scattered all over the Peninsula and are distributed by regions as follows:

	<u>Rural Stations</u>	<u>Licensed Public Suppliers</u>
Central region	6	4
Northern region	14	36
Southern region	16	22
Eastern region	98	5
<u>Total</u>	<u>134</u>	<u>67</u>

#### Rural Electrification

1.18 Rural electrification in Malaysia began in the 1950s when a large number of the rural population was concentrated in villages during the emergency. These villages were electrified from diesel generators to provide perimeter lighting for security reasons. Originally, the installations were operated by NEB's predecessor organization (the Central Electricity Board) on the basis of cost reimbursement from the Government. After the emergency, the majority of the small systems were sold to private licensees as they were uneconomic on a full NEB service basis; 65 such licensees still exist.

1.19 Rural electrification as a social objective began in 1957 and by the end of FY78, 4,600 villages covering 370,000 consumers had been electrified. These rural consumers represented about 40% of NEB's domestic consumers. The number of villages newly electrified was 205 in FY75, 310 in FY76, 400 in FY77, and 1,150 in FY78.

1.20 While it is the Government's intention to electrify rural Malaysia to the greatest extent possible, the current program is unplanned. Villages make application to the State Governments for supply; state administrators



select villages from these applications on a rather arbitrary basis for recommendation to the Federal Government; and the Federal Government approves the program according to the availability of funds. The capital cost of the program was financed 1/3 by NEB and 2/3 by the Federal Government. From FY80, the Government will finance 100% of capital expenditures for rural electrification.

1.21 Under the Seventh Power Project (Loan 1178-MA), a rural electrification study was included in the loan package in order to formulate a comprehensive rural electrification plan and to review its technical, economic and financial implications. The study was completed in August 1978 by the Middle West Service Company of Chicago in association with the Perunding Bersatu Sdn. Bhd. of Kuala Lumpur and is being used by the Government in formulating the rural electrification program for the Fourth Malaysia Plan (FY81-85).

1.22 Due to NEB's staff constraints, difficulties in obtaining wayleaves and shortage of materials, there has been a considerable backlog of rural electrification projects, especially in the northeast states of Kelantan and Trengganu. NEB launched a crash program by setting up a rural electrification department in its head office under the charge of a chief engineer and by organizing a task force to coordinate staff mobilization, material supply and wayleave compensation. The progress has been satisfactory.

## 2. THE BORROWER

2.01 The Borrower will be the National Electricity Board of the States of Malaya (NEB), an autonomous Government-owned corporation established in 1949. NEB reports to the Ministry of Energy, Telecommunications and Post and operates in Peninsular Malaysia.

### Organizational Structure

2.02 NEB is both a regulatory and operating agency and gives advice to the Ministry on all matters relating to the generation, transmission, distribution and use of energy. NEB has the legal power to set tariffs and to grant licenses to independent electricity works.

2.03 All members of the Board of Directors are appointed by the Minister of Energy, Telecommunications and Post who establishes their terms. The Chairman of the Board is the Chief Secretary of the Cabinet and the Deputy Chairman is the General Manager. In addition, there are ten /1 principal members, of which three are public officers, one is a representative of the National Union of Plantation Workers and the remaining six come from the private sector.

2.04 The organization is divided into four departments: Corporate Planning, Major Projects, Operation and Administration. In addition, there are a Special Services Unit, the Chief Accountant, the Chief Electrical Inspector and the Chief Engineer for Rural Electrification, reporting directly to the General Manager. NEB's operation is organized in four regional areas, with 4 to 6 districts in each, totaling 20 districts. Each area is responsible for operation and maintenance activities within its boundaries, the remaining functions being centralized in Kuala Lumpur.

2.05 The present organization has demonstrated that it is efficient and well managed. However, the Internal Auditing Unit, which now reports to the Chief Accountant lacks the necessary independence and a broader scope which it would acquire if it were to report to the General Manager. During negotiations, assurances were obtained that by December 31, 1981, NEB's internal auditing unit will be placed directly under the General Manager. The present organizational structure is shown in Annex 3.

### Staff and Training

2.06 By the end of FY78, NEB had a total of 15,590 employees; the average growth rate for the past five years has been 9.0%. The top and middle level managerial and technical staff are experienced and well qualified. Nevertheless, in recent years, the need for a more equitable distribu-

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/1 Two members not yet appointed.

tion of job opportunities among different races, the competition from the private sector, and the Government policy of retirement at age 55, are making it increasingly difficult for NEB to hire and retain qualified personnel. Shortage of key personnel is felt mainly in the financial and technical areas.

2.07 NEB operates a training program which includes scholarships in Malaysia and overseas, as well as on-the-job training. Since 1960, NEB has sponsored about 1,260 students, of which about 572 are still studying, 183 of them overseas. NEB has also given opportunities for on-the-job training to almost 2,025 technicians, fault finders, linesmen and draftsmen. In 1978, NEB completed the construction of a training institute which is now in full operation. To ease the shortage of linesmen arising from intensification of the rural electrification program, a crash training program was undertaken and 270 trainees completed their training.

2.08 Assurances were obtained during negotiations that NEB will (i) recruit sufficient qualified and experienced staff to meet its immediate manpower requirements; and (ii) continue its vigorous training program for long-term needs.

#### Management Systems

2.09 For several years, NEB has been using budgetary systems for capital and operating expenditures. The budgets are prepared on a yearly basis and their execution is monitored on a regular monthly basis.

2.10 There is a well-staffed and equipped Data Processing Center. Payroll, inventory control and billing for one district are computerized. The computer is also used for engineering studies. NEB plans to expand computer billing to other districts and to introduce additional accounting and financial applications.

2.11 Accounting systems are well designed and provide adequate information, but there have been some delays recently in the preparation of financial reports as a result of shortage of experienced personnel. NEB is taking steps to reduce and eliminate these delays.

#### Audit and Internal Control

2.12 NEB accounts are audited by Price Waterhouse and Co. and a local firm, Hanafiah, Raslan, Mohamad and Partners. Both firms have been accepted by the Bank in previous loans to NEB. During negotiations, assurances were obtained that NEB will continue to employ independent auditors acceptable to the Bank and to send its audited financial statements to the Bank within six months of the end of each fiscal year.

2.13 Internal control is performed by the Internal Audit Unit under the Chief Accountant. The unit now covers only some of the financial operations. It has been agreed that the unit will report directly to the General Manager and that the scope of its work will be expanded to cover other areas of operations (see para. 2.05).

### Taxation

2.14 Since 1970, NEB has been paying corporate tax and development tax. For the past five years, after the application of a complex capital allowance system, these taxes averaged 19% of NEB's pretax income. In addition, it had to pay import duties on certain equipment and materials such as structural steel, switchgear, conductors and cables, 5% surtax on all imports, 5% sales tax on both local and foreign purchases and a fuel tax of M\$17 per ton. Effective from January 1, 1980, the Government, as a part of a set of measures aimed to improve NEB's financial position (see para. 5.05) has exempted NEB from payment of corporate tax, development tax, custom duties and other taxes.

### Billing and Collections

2.15 Billing is made monthly by district offices. In all districts, except the one computerized, the meter readers themselves prepare bills on-the-spot and hand them to customers. This procedure, although placing some burden on the internal control, accounts for the comparatively low level of receivables outstanding (38 days at the end of FY78). Collections are made through district offices, post offices and collection agents. Overdue accounts from Government and large consumers are reported to the central office where procedures are followed to accelerate collections.

### Dividends

2.16 NEB pays dividends to the Government on the equity invested. The amount paid is decided every year by the Board of Directors. The Electricity Act, 1949 set a limit of 6% on NEB's equity as the maximum dividend payout. Actually, NEB has been paying 5% since 1963.

### Insurance

2.17 NEB has taken insurance policies to cover the most common risks related to the operation of a utility. Coverage is periodically reviewed and updated. Present arrangements are satisfactory.

### Tariffs

2.18 NEB's basic tariffs have not been changed since 1958. A fuel cost variation charge was introduced in 1975. In FY78, NEB's average tariff per kWh was US\$4.70 which compares with Thailand (US\$3.90), Korea (US\$4.60) and Indonesia (US\$4.40). Domestic consumers are subsidized by the exemption of the first 150 kWh/month from the fuel cost variation charge. The tariff structure was however cumbersome involving 23 categories, but has since been rationalized following a recommendation made by Electrowatt (Swiss consultants) by consolidating the number of categories of consumers to seven. In the last power loan (1443-MA), NEB agreed to exchange views with the Bank on any changes proposed in its tariff structure, and that covenant will be continued in the proposed loan.

### Industrial Investment

2.19 NEB has a 60% investment participation in a cable factory. Operation started more than two years ago and the current cable production rate is over 300 km a year. The transformer factory will be put into operation in 1980. NEB is now organizing a meter factory in which it would have similar participation. To avoid overstretching of NEB's cash resources the last loan to NEB included a covenant that limits investment in industrial activities to a maximum of 1% of its gross fixed assets as revalued each year. This covenant will be repeated in the proposed loan.

### Facilities of NEB

2.20 NEB's total generating capacity as of end-FY78 was 1,439.8 MW, made up of 352.4 MW of hydroelectric plant, 970 MW of steam plant, 97.4 MW of diesel plant and 20 MW of gas turbine. Details of the existing plant are given in Annex 4.

2.21 By the end of FY78, NEB's transmission system consisted of about 372 km of 275 kV, 1,545 km of 132 kV, 541 km of 66 kV and 887 km of 33 kV overhead lines, as well as 34 km of 132 kV, 4 km of 66 kV and 206 km of 33 kV underground cables. Distribution is carried out at 22 kV and 11 kV by 471 km of overhead lines and 6,593 km of underground cables, as well as 483 km of lines and cables at lower voltages. 5,264 substations with a total capacity of about 8,146 MVA are in commission.

### 3. THE MARKET AND GROWTH OF SUPPLY

#### Past Trends

3.01 NEB's consumers can be categorized into five major categories: residential, commercial, industrial, mining and bulk supply to PRHE, representing about 14.3%, 30.1%, 36.4%, 5.2% and 14.0% respectively, of the total consumption for FY78.

3.02 The power market served by NEB has had a long history of steady growth, average annual increase in total sales from FY70-78 being 13.4%. Even during the years of the energy crisis, the growth remained substantial, being 13.6% in FY73 and 11.5% in FY74. Shown below is the past trend of NEB's power consumptions:

<u>Year</u>	<u>Consumption</u> (GWh)	<u>Growth Rate</u> (%)
1970	2,178	12.3
1971	2,401	10.2
1972	2,766	15.2
1973	3,141	13.6
1974	3,502	11.5
1975	3,982	13.7
1976	4,543	14.1
1977	5,297	16.6
1978	5,934	12.0

#### Load Forecast

3.03 The energy forecast for the period up to FY85 has been prepared by an analysis of trends of sales to different major consumer groups - residential, commercial, industrial, mining and bulk supply to PRHE over the past ten years and through market surveys. The growth rates vary in each category. The actual and forecast sales of energy are given in Annex 5. On aggregate, the growth is likely to continue at an average rate of about 10.0% p.a. up to FY85.

3.04 NEB system's maximum demand in FY78 was 1,082.4 MW. Should PRHE's generation demand be included, the total would be 1,162 MW. The estimated maximum demand by regions is given in Annex 6. It is forecast to increase to 2,215 MW by FY85, with an average growth rate of about 9.5% p.a.

3.05 NEB reviews and revises, as required, its load forecast each year. As a result of the recent increases in oil prices and world economic situation, the actual energy sales in FY78 and 79 are lower than original forecast. A further review of the load forecast will be carried out by NEB shortly in the light of latest development both on a macro and micro basis.

Growth of Supply

3.06 In order to meet the increasing load growth, the system has to be expanded continuously. NEB's policy is to:

- (a) ensure a proper balance between the demand and supply of power with a reasonable amount of reserve capacity;
- (b) promote the use of locally available energy resources; and
- (c) use hydroelectric plants to meet the system's peaking requirements and oil/gas-fired thermal plants to meet base-load requirements.

3.07 The balance of system load requirements and the capabilities available to meet these demands are given in Annexes 7 and 8. The development program is discussed in detail in Chapter 4. The system's available reserve margin and firm energy are tabulated below:

<u>Year</u>	<u>Maximum demand</u> (MW)	<u>Dependable peaking capacity</u> (MW)	<u>Available reserve margin</u> (MW) (%)		<u>Minimum reserve required</u> (MW)	<u>Energy requirements</u> (GWh)	<u>Available firm energy /a</u> (GWh)
1978	1,184	1,340	156	13.3	150	7,303	7,621
1979	1,306	1,650	344	26.3	240	8,041	8,257
1980	1,428	1,890	462	32.3	240	8,787	9,334
1981	1,617	2,090	473	29.2	240	9,887	10,534
1982	1,757	2,210	453	25.8	240	10,735	11,378
1983	1,902	2,280	378	19.9	240	11,612	11,968
1984	2,055	2,400	345	16.8	240	12,538	12,308
1985	2,215	3,000	785	35.4	420	13,505	13,308
1986	2,380	3,200	820	34.4	420	14,503	16,308
1987	2,552	3,400	848	33.2	420	15,542	16,943

/a Firm energy of hydro plants is defined as the annual energy output that would be available 95% of the time; firm energy of thermal units is calculated at a capacity factor of 75%.

3.08 Because of the delays of about one year in the implementation of Bersia, Kenering and Trengganu hydroelectric projects, the system will be short of firm energy in FY84 and 85. The retirement of Penang (40 MW), Malacca (40 MW) and Sultan Ismail (30 MW) thermal plants would therefore have to be deferred to FY85 after commissioning of Port Klang No. 2 unit (300 MW), or some additional gas turbines would be required.

3.09 The reserve capacity is based on the criteria that the system will maintain supply to consumers with the two largest units of 120 MW out of service (one for scheduled maintenance and the other for forced outage). After installation of the first 300 MW unit at Port Klang power station in 1985, this criterion will be modified to allow a margin covering outage of one 300 MW unit and one 120 MW unit elsewhere. After the completion of Temengor reservoir, with four units of 87 MW in operation, the system is now more flexible to operate and the reliability level improves substantially.



#### 4. THE PROGRAM AND THE PROJECT

##### The Program

4.01 NEB's development program, 1975 through 1983, is based on the least cost sequence of development following extensive studies of the generation and transmission system made by Preece, Cardew and Rider (PCR) of UK. This study has now been reviewed and refined by NEB's own staff and extended to FY85 using computer programs available in-house (IAEA's WASP package and CEGB's General Purpose Generation Scheduling Program).<sup>/1</sup>

##### Generation

4.02 NEB's generation development program has been planned to provide reserve margins consistent with sound utility practices (see Annex 7 and para. 3.07). The program following Port Dickson Stage III (3 x 120 MW) up to FY85 is given in chronological order as follows:

- (a) to develop Temengor Hydroelectric project (4 x 87 MW) which was already completed in FY79;
- (b) to extend the Prai Thermal Power station by installing three additional 120 MW units for completion in FY80,
- (c) to develop a new thermal power station in the south at Pasir Gudang with 2 x 120 MW units for completion in FY81;
- (d) to develop Bersia (3 x 24 MW) and Kenering (3 x 40 MW) hydro sites on the Perak river downstream of Temengor for completion in FY83 and FY84 respectively,
- (e) to establish a new high-efficiency base-load thermal power station at Port Klang near the load center with the first and second units for completion in February and August 1985 respectively; and
- (f) to develop Trengganu multipurpose project on the east coast (4 x 100 MW), scheduled for completion in FY86.

4.03 The Temengor hydroelectric project consists of a rock-fill dam approximately 114 m high which will create a reservoir of 5,680 million cu m in gross storage capacity. It is financed by the Overseas Economic Cooperation Fund (OECF) of Japan for the civil works and electrical and mechanical equipment, and by the Canadian International Development Agency (CIDA) for the engineering services. The Bank is financing the 275 kV Temengor-Prai transmission line under the eighth power loan. The civil works were completed in FY78 and all four units were installed by FY79 as scheduled.

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<sup>/1</sup> IAEA: International Atomic Energy Agency; CEGB: Central Electricity Generating Board, WASP: Wien Automatic System Planning.

### Transmission

4.04 The proposed expansion plan for transmission lines and substations is based on PCR's report "Transmission System Studies, 1976-85" of October 1976 and more recent, "Extension of Supply to the East and Northeast of Peninsular Malaysia, 1978-85" of October 1977. It includes construction of about 687 km of 275 kV, 826 km of 132 kV transmission lines and 1,905 MVA of transformers in about 15 substations. The major transmission lines included in the program are as follows (see Map for locations):

275 kV double-circuit lines   Prai-Temengor (119 km)  
                                  Temengor-Tanah Merah (136 km)  
                                  Trengganu-Paka (145 km)  
                                  Woh-Rawang (120 km)  
                                  Kuala Lumpur (North)-Kg Awah (130 km)  
                                  Kuala Lumpur (North)-Port Klang (37 km)

132 kV double-circuit lines   Tanah Merah-Kota Bahru (38 km)  
                                  Tanah Merah-Kuala Trengganu (129 km)  
                                  Trengganu-Kuala Trengganu (40 km)  
                                  Trengganu-Dungun-Kemaman-Tg Geland (173 km)  
                                  Tie line with Thailand (47 km)

4.05 Thus, the entire Peninsula will be interconnected into one network by 1984/85. One of the objectives of the above program is to establish the backbone transmission system throughout the Peninsula to facilitate regional development and initiate rural electrification program for less developed areas, particularly the east coast. The 115/132 kV tie line between Malaysia and the southern part of Thailand will be completed in FY80. NEB is currently importing 18 MW of power via two 22 kV cables from Singapore.

### Subtransmission and Distribution

4.06 The program provides for the extension of 66 kV and 33 kV subtransmission lines to distribute power to various load centers, and the extension of overhead lines and underground cables at medium (22 kV and 11 kV) and low voltages for general distribution.

### The Project

4.07 The project includes the Bersia and Kenering hydroelectric developments located in the upper reaches of the Perak river, about 20 km and 70 km respectively downstream of the Temengor project and 136 km of 275 kV and 38 km of 132 kV transmission lines and associated substations to link the western network from Temengor to the east coast. The project involves construction of the following works (Annex 9 provides project detail):

- (a) Bersia. A concrete gravity dam, 32 m high, consisting of a gated spillway section and an integral intake and powerhouse section. The dam will be about 244 m long at its crest with a total concrete volume of about 150,000 cu m. The powerhouse is a conventional above-ground type with three generating units (3 x 24 MW) and associated electrical and mechanical equipment.

- (b) Kenering. A concrete gravity dam with earth embankments, 41 m high, consisting of a gated spillway section and an integral intake and powerhouse section. The dam will be about 610 m long with a concrete volume of approximately 300,000 cu m and an earthfill volume of 450,000 cu m. The powerhouse is also a conventional above-ground type with three generating units (3 x 40 MW) and associated electrical and mechanical equipment.
- (c) Associated Transmission and Substation Facilities. Temengor-Tanah Merah, 275 kV D/C transmission line (136 km); Tanah Merah-Kota Bahru, 132 kV D/C transmission line (38 km); Tanah Merah substation equipped with 2 x 180 MVA 275/132 kV, 2 x 30 MVA 132/33 KV and 2 x 7.5 MVA 33/11 kV transformers; and Kota Bahru substation equipped with 2 x 45 MVA 132/33 kv and 2 x 30 MVA 132/11 kV transformers.
- (d) Consultancy services of a study for optimizing development and use of domestic energy resources.

Project Cost Estimate

4.08 The estimated cost of the project is summarized in the table below and is detailed in Annex 10.

	Foreign --- (M\$ million)	Local -----	Total ----	Foreign --- (US\$ million)	Local ---	Total ---
Land acquisition and resettlement	-	11.5	11.5	-	5.2	5.2
Preliminary works	-	11.1	11.1	-	5.1	5.1
Civil works	84.1	82.2	166.3	38.2	37.4	75.6
Turbines and generators	52.5	7.1	59.6	23.9	3.2	27.1
Associated mechanical and electrical works	58.6	5.2	63.8	26.6	2.4	29.0
Transmission and substation facilities	40.0	15.0	55.0	18.2	6.8	25.0
Engineering, supervision and administration	19.5	13.0	32.5	8.9	5.9	14.8
Consultancy services	4.5	-	4.5	2.0	-	2.0
Base costs	<u>259.2</u>	<u>145.1</u>	<u>404.3</u>	<u>117.8</u>	<u>66.0</u>	<u>183.8</u>
Contingencies						
Physical	18.7	12.4	31.1	8.5	5.6	14.1
Price	31.4	45.6	77.0	14.3	20.7	35.0
<u>Total Project Cost</u>	<u>309.3</u>	<u>203.1</u>	<u>512.4</u>	<u>140.6</u>	<u>92.3</u>	<u>232.9</u>

4.09 The cost estimate is at end-1979 price levels, based on bid prices already available for civil works and major equipment. Physical contingencies were estimated at 10% for civil works and 3.5% for associated mechanical and electrical works and transmission and substation facilities. These are considered reasonable given the known site geological conditions and the fact that the project design has already evolved to an advanced stage. The price contingencies for items already tendered were based on terms and conditions quoted in the respective bids. For items yet to be tendered, the following annual escalation rates were used both for foreign and local costs: 10.5% for 1980, 9% for 1981, 8% for 1982 and 7% for 1983-85.

#### Financing Arrangements

4.10 The proposed Bank loan of US\$50.0 million will finance the foreign exchange costs of associated electrical and mechanical works, transmission and substation facilities and consultancy services. The civil works and turbines are proposed by the Government to be financed by the Overseas Economic Cooperation Fund (OECF), Japan using Yen Credits. The generators will be financed by bilateral or suppliers' credits. CIDA will finance the major part of the foreign cost of engineering services. The Commonwealth Development Corporation (CDC), has offered a loan of US\$13.0 million equivalent to finance any contracts under the project. The financing gap of about US\$7.5 million would be met by loans from commercial banks. Based on experience with previous loans, NEB will have no difficulty in obtaining commercial bank loans at reasonable terms.

4.11 The proposed financing arrangements are as follows.

Financing parties	Foreign --- (US\$ million) ---	Local	Total ---	
IBRD	Associated electrical and mechanical works, transmission and substation facilities and consultancy services	50.0	-	50.0
OECF	Civil works for Bersia	17.6	-	17.6
OECF (proposed)	Civil works for Kenering and turbines	34.5	-	34.5
Bilateral or suppliers' credits	Generators	11.2	-	11.2
CIDA	Engineering and supervision	6.8	-	6.8
CDC	Any contracts or any parts thereof not financed by the above parties	13.0	-	13.0
Commercial banks	Same as CDC	7.5	-	7.5
NEB	All local costs	-	92.3	92.3
	<u>Total</u>	<u>140.6</u>	<u>92.3</u>	<u>232.9</u>

#### Procurement

4.12 All equipment and materials financed under the proposed Bank loan will be procured on the basis of international competitive bidding in accordance with the Bank's Procurement Guidelines. All equipment will be procured on a supply and erect basis.

#### Disbursement

4.13 Disbursements on equipment and materials will be made against 100% of foreign exchange costs of directly imported items; 100% of local expenditures (ex-factory) for items manufactured locally; and 70% of total expenditures for imported items procured locally. Disbursements are expected to be completed by August 31, 1985. The estimated disbursement schedule is given in Annex 11.

#### Engineering and Supervision

4.14 The feasibility report on the Upper Perak Hydroelectric Development was first prepared by the Shawinigan Engineering Company Limited (SECO) of Canada in 1966 and later updated in 1976 in a report entitled "Preinvestment Study - Bersia and Kenering Hydroelectric Developments". In 1976, NEB engaged SECO, financed by CIDA, for the engineering study, detailed design, preparation of tender documents and evaluation of bids for the main civil works and mechanical and electrical equipment and for the construction supervision of the project. As SECO performed well at Temengor and is familiar with local conditions, this arrangement is acceptable. Services for engineering and detailed design were estimated at US\$5.0 million for about 835 man-months. The average man-month cost (including salary, costs and fees) is US\$6,000. Services for construction supervision were estimated at US\$3.9 million for about 355 man-months of expatriate staff and 2,500 man-months of local staff. The average expatriate man-month cost is US\$6,400 (including in addition international travel and subsistence) and the average local man-month cost is US\$650.

#### Consultancy Services

4.15 The Government asked the Bank to finance under the project a study for optimizing development and use of local energy resources. The study will require about 90 man-months of services and have an estimated total cost of US\$1.5 million. The average man-month cost, including salary, costs, fees, international travel and subsistence, is expected to be about US\$9,000. In addition to these personnel costs, the contract cost will include the cost of vehicles, equipment, field survey and investigation. It was agreed during negotiations that the Government will furnish to the Bank for review and comments not later than July 31, 1982, a report prepared by consultants whose terms of reference and qualifications should be satisfactory to the Bank.

4.16 NEB uses PCR to provide the consultancy services for design, procurement and supervision of transmission lines and substations at a negotiated lump sum price of about US\$0.5 million, 2.2% of the estimated construction cost of these facilities.

#### Engineering Safety

4.17 Geological investigations have indicated that the bedrock at both sites will provide adequate foundations with no evidence of significant structural weakness. No unusual difficulties in construction are foreseen as the physical site conditions have been well investigated and the conceptual design and scope of construction are straightforward.

4.18 For the 400 MW Trengganu multipurpose project on the east coast, NEB is in the process of forming a panel of experts to review project designs and make periodic inspections during construction. This panel will also be used for the proposed project. Assurances were obtained during negotiations that NEB will maintain the panel of experts for reviewing project designs and problems which may arise during construction.

4.19 During negotiations, it was also agreed that NEB will implement a program of inspection and maintenance of the works satisfactory to the Bank, throughout the operational period of the project.

#### Implementation Schedule

4.20 Tenders for main civil works were opened in October 1979; and those for turbines and generators in April 1979. Contracts are expected to be awarded in early 1980. Construction of civil works will start first on Stage I river diversion in mid-1980 with the reservoirs ready for impounding by March 1983 (30 months) for Bersia and January 1984 (40 months) for Kenering. The project is expected to be completed by August 1984. Detailed implementation schedule is shown in Annex 12.

4.21 Bids for transmission lines and transformers were opened in November and December 1979 respectively with awards to be made in early 1980 and completion in 1982.

#### Environment

4.22 Bersia and Kenering are low-head developments with relatively small reservoir capacity. The surface area of the reservoir is only 570 ha for Bersia and 2,430 ha for Kenering, compared to 15,500 ha for Temengor. In the Bersia reservoir area, virtually no lands are presently in use, although evidence of historical use probably by illegal squatters for single-crop tobacco growing exists on some of the less steep banks. There are only few settlers at present in the proposed Kenering reservoir area. No more than 400 ha of agricultural land will be flooded, with 80 ha being cultivated as rubber plantations.

4.23 A comprehensive resettlement program has been carried out for the 124 families in the Temengor reservoir area. They have been settled in the Air Ganda area along the Perak River about 13.5 km south of Grik. Each family has been provided a house, 4 ha of land planted with rubber and 1.6 ha of bare land for fruit trees and grazing. Common facilities such as roads, water supply and electricity services, school, clinic, community hall and mosque have also been provided. Resettlement of families residing in the Bersia and Kenering hydroelectric development areas will also be carried out in the Air Ganda area under the same program. The number of families involved in these areas would be much less.

4.24 Important recommendations made by SECO regarding the ecological aspects are:

- (a) A topographic survey should be undertaken to confirm whether a full supply level of 111.3 m might affect the sanitary condition of villages situated in the lower reaches of Sungai Kendrong by liquid waste from settled areas around Grik./1
- (b) In order to prolong the life of the Kenering reservoir, measures should be taken to reduce the sediment load from the Klian Intan tin mine located on the tributary of Rui, more than 50 km upstream of the Kenering reservoir.
- (c) Sanitary waste control, careful application of fertilizers and good agricultural practice should be implemented to minimize the effect on aquatic growth; and
- (d) An archaeological reconnaissance of the limestone cliffs in the Kenering reservoir should be carried out during the early stages of the project.

4.25 There appears to be no single ecological consequence or combination of consequences of significant importance to preclude construction of the project. During negotiations, assurances were obtained that NEB will carry out the recommendations proposed by the consultants.

#### Risks

4.26 The project does not present any unusual technical risk. Some terrorist activities took place during the early stage of construction of the Temengor project, but no further disturbances have been experienced since December 1974. Since the Bersia and Kenering sites are further downstream from Temengor, closer to the main road, and NEB has gathered the support of local residents by developing a mutually satisfactory resettlement program, it is believed that no difficulties will arise during project execution.

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/1 The survey was completed; further study is being carried out by the Institute of Medical Research. It is not expected that the full supply level of Kenering project would be affected.

5. FINANCIAL ANALYSIS

Past Finances

5.01 A summary of the salient features of NEB's financial performance for the period FY73 through FY78 is given below:

	FY73	FY74	FY75	FY76	FY77	FY78
	----- (M\$ million) -----					
Operating revenue	253	292	370	501	586	666
Operating expenses	144	210	318	391	474	518
Net income	109	82	52	110	112	148
Taxes	25	20	7	11	25	15
Dividends	8	5	5	5	6	7
Net fixed assets (revalued)	989	1,145	1,245	1,527	1,705	2,195
Rate of return (after taxes) (%)	9.9	6.3	4.1	7.8	5.9	7.3
Annual debt service coverage (times)	2.7	2.4	1.9	2.8	2.4	2.5
Debt/equity ratio (%)	47/53	46/54	48/52	50/50	50/50	47/53

Since FY73, NEB's earnings have been erratic with the rate of return on revalued net fixed assets fluctuating between almost 10% in FY73 and 4% in FY75. The disallowance in FY74 and FY75 by the Government (as an anti-inflationary measure) of the application of NEB's fuel adjustment charge to industrial and commercial consumers affected NEB's profitability. The need to make retroactive salary adjustments in FY75 and FY77 in compliance with Government decrees entailed payments of M\$25.3 and M\$32.0 million respectively in those years.

5.02 The following table shows NEB's investments during the period FY73-77 and the related sources of finance; for comparison purposes, the forecasts made at the time of appraisal for Loan 700-MA (1970) are also given.



	FY73 through FY77 (M\$ million)			
	Appraisal	%	Actual	%
Investments in fixed assets	<u>493</u>		<u>1,110</u>	
<u>Sources</u>				
Internally generated funds	278	56	447	40
Government contributions	13	3	69	6
Borrowing	182	37	434	39
Decrease in working capital	20	4	160	15
<u>Total</u>	<u>493</u>	<u>100</u>	<u>1,110</u>	<u>100</u>

5.03 NEB's investment during the period FY73-77 was more than double the appraisal forecasts for the fifth power project. This higher level of investment was met from better than expected internal cash generation, higher Government contributions, larger additional borrowing and a heavy reduction in working capital.

Present Position

5.04 NEB's financial position as of the end of FY78 is summarized as follows:

	<u>M\$ million</u>
Net fixed assets (revalued)	2,195
Work in progress	478
Investment in industry	5
Current assets	334
<u>Total Assets</u>	<u>3,012</u>
Equity and consumers' contributions	1,655
Consumers' deposits	50
Current liabilities	403
Long-term debt	904
<u>Total Equity and Liabilities</u>	<u>3,012</u>

As of August 31, 1978, NEB's debt/equity ratio of 47/53 was adequate. However, its current ratio of 0.8 resulting from a large reduction in working capital (para. 5.03) was unsatisfactory. Provision for improvement in the current ratio has been made in the financing plan for FY80-85.

### Earning Requirements

5.05 To help improve NEB's future financial position, the Government approved in September 1979 a set of measures that include: implementation of a more rational tariff structure, exempting NEB from corporate tax, development tax, import duties and other taxes; Government subsidy for losses incurred in the operation of rural and diesel stations; financing by Government of the rural electrification investment programs; and Government equity injection. In addition, the Government authorized NEB effective since November 1, 1979 a tariff increase of M¢2.6 per kWh to reflect the higher fuel cost incurred by NEB in FY79. The application of this fuel cost variation charge had been withheld by Government since June 1979.

5.06 Under Loan 1443-MA, NEB was required to earn an 8% (after tax) rate of return on revalued assets. This is equivalent to a before tax rate of about 10%. NEB's rate of return in FY78 was 7.3%. However, the Government requested the Bank to adopt a self-financing ratio as a measure of financial control for the project in lieu of a rate of return. The Government maintains that for a dynamic organization like NEB where the asset base is constantly expanding, the concept of self-financing is a better indicator of financial performance than the rate of return measure. A recent loan approved by the Asian Development Bank for a hydropower project in Malaysia also contains a self-financing covenant. Since the Bank's objective is to ensure the financial strength of NEB and its ability to finance a reasonable proportion of its expansion program, the self-financing ratio is an acceptable substitute for a rate of return measure as it directly reflects the level of cash generation. Besides, NEB's investment program is not expected to have wide variations from one year to another, thus eliminating the "lumpiness" problem associated with the self-financing ratio. During negotiations, it was agreed that NEB will earn revenues adequate to meet at least the following self-financing ratios on the basis of a three-year sliding investment average: 15% in FY80, 25% in FYs 81-84 and 30% in FY85 and thereafter. These percentages are satisfactory in comparison with other power utilities with large expansion programs. During negotiations, it was also agreed that the Government and NEB will review, at least three months before the end of each fiscal year, the adequacy of NEB's revenues to produce, on the basis of a realistic forecast, the agreed self-financing ratio for the following fiscal year. On the basis of this review, the Government and NEB will determine the measures required to achieve these ratios and will implement them before the beginning of the following fiscal year. The financial projections (para. 5.12) show that with a small 2% increase in tariffs in FY80 and implementation of the fuel adjustment clause (para. 5.05), NEB will achieve its agreed self financing ratio.

### Financing Plan

5.07 A summary of NEB's investment requirements for the period FY80-85 and the sources from which they will be met is presented below:

	M\$	US\$	%
	-- (Millions) --		
<u>Requirements</u>			
Bersia and Kenering	512.4	232.9	13
Other capital works	2,700.0	1,227.3	70
Interest capitalized during construction	179.3	81.5	5
Investment in industry	19.8	9.0	1
Increase in working capital	403.1	183.2	11
<u>Total Requirements</u>	<u>3,814.6</u>	<u>1,733.9</u>	<u>100</u>
<u>Sources</u>			
Internal cash generation	3,000.1	1,363.7	
Less Debt service (excluding IDC)	(1,878.1)	(853.7)	
Dividends	(194.8)	(88.5)	
Net cash generation	927.2	421.5	24
Borrowings	2,161.6	982.6	57
Government's equity contributions	505.0	229.5	13
Consumer contributions	220.8	100.3	6
<u>Total Sources of Funds</u>	<u>3,814.6</u>	<u>1,733.9</u>	<u>100</u>

5.08 About 57% of NEB's financing requirements for 1980-85 will be met from borrowing and its own internal cash generation will provide about 24%. The remaining 19% will come from Government equity contribution (13%) and from consumer's contribution (6%). About half the amount to be borrowed has been already contracted and the balance corresponds to future projects (Trengganu, Port Klang and major transmission lines) for which borrowing will be arranged in due course.

5.09 The financing plan is reasonable. It assumes that NEB will achieve the covenanted self-financing ratios of 15% in FY80, 25% in FY81 to 84 and 30% in FY85 and onwards. During negotiation the Government agreed that it will provide adequate funds to help finance NEB's development program including an equity contribution of M\$150 million (US\$68 million) in FY80.

5.10 The financing plan includes US\$140.6 million in borrowing for the proposed project (see para. 4.12); inclusive of the proposed Bank loan of US\$50 million which would be for 17 years with 4 years of grace at the Bank's current lending rate.

5.11 Apart from the investment in the proposed Bank-financed project, NEB's program includes US\$1.2 billion for other investments and US\$183 million for additional working capital.

Future Performance

5.12 A summary of NEB's financial indicators for FY79 through FY84 is given below. Further details are presented in Annexes 13 through 16.

	FY79	FY80	FY81	FY82	FY83	FY84
	----- (M\$ million) -----					
Average revenue per kWh (cents)	12.6	13.9	14.2	14.3	14.6	14.9
Total revenues	849	1,065	1,252	1,385	1,550	1,724
Total operating expenses	719	863	981	1,099	1,247	1,420
Net revenue (before interest)	130	202	271	286	303	304
Dividends	9	21	26	30	35	40
Rate of return (%)	5.9	7.5	7.9	7.0	6.6	6.2
Operating ratio (%)	85	81	78	79	80	82
Current ratio (times)	0.8	0.8	1.0	1.0	1.0	1.1
Debt/equity ratio (%)	53/47	47/53	48/52	46/54	43/59	41/59
Debt service coverage (times)	2.3	2.3	2.1	1.5	1.3	1.3
Contribution to construction (%)		19	32	36	34	36

5.13 The financial projections show that NEB's financial performance over the period FY79-84 will be satisfactory. NEB's liquidity is expected to improve, although the improvement will not obviate the need for short-term borrowing from time to time which would be available from local banks. Debt service coverage would be satisfactory, remaining above 1.3 during the projected period.

Debt Limitation

5.14 Loan 1443-MA requires NEB to maintain a debt/equity ratio not greater than 60/40. This covenant will be continued for the proposed loan. However, in order to clarify the application of the covenant, the following definitions will be used for the proposed loan:

- (a) the term "total debt" shall mean all debt contracted by NEB to be repaid after one year of the date it is incurred; it shall exclude the current maturities of that debt; and
- (b) the term "equity" shall include NEB's paid-in capital (Government contributions) and earned surplus; it shall exclude surplus from revaluation of fixed assets.

5.15 Loan 1443-MA also requires NEB to limit short-term debt to not more than 5% of long-term debt. In order to improve monitoring of NEB's current position, this covenant would be amended for the proposed loan by requiring that from FY81 onwards, NEB's current liabilities will not exceed 33% of its cash operating expenses for the preceding 12 months. For this purpose, the following definitions will be used:

- (a) the term "current liabilities" shall include accounts payable to suppliers of goods and services (except those related to capital expenditures), accrued interest on loans, declared dividends, provisions for taxation, bank overdrafts and short-term loans maturing on demand or within 12 months after the date they are incurred; and
- (b) the term "cash operating expenses" shall include purchase of fuel and electricity, personnel costs, maintenance and administrative expenses, interests, taxes and dividends.

6. ECONOMIC ANALYSIS

Least Cost Solution

6.01 The Bersia and Kenering hydroelectric developments will have the following contributions:

	<u>Installed capacity</u> (MW)	<u>Dependable peaking capacity</u> (MW)	<u>Firm energy</u> (GWh)	<u>Average annual energy</u> (GWh)
Bersia	72	70	190	238
Kenering	120	120	340	456
<u>Total</u>	<u>192</u>	<u>190</u>	<u>530</u>	<u>694</u>

6.02 Investigations for other hydro projects have not been advanced to a stage that such projects could be completed in FY83/84 when additional capacity and energy is required. After completion of the Temengor reservoir, the next logical step is to develop the downstream potentials to fully utilize the regulated flow from Temengor. The only realistic alternative would be a thermal development, consisting of an oil-fired unit of 120 MW and a gas turbine of 70 MW, the capabilities of which are comparable with those of the Bersia and Kenering developments. The two alternative programs with and without the project are:

	<u>Program A</u>		<u>Program B</u>	
1983	Bersia	(72 MW)	Thermal	(120 MW)
1984	Kenering	(120 MW)	Gas turbine	(70 MW)
1985	Port Klang	(300 MW) No. 1	Port Klang	(300 MW) No. 1
1986	Trengganu	(200 MW) Nos. 1 & 2	Trengganu	(200 MW) Nos. 1 & 2

6.03 The comparison was made on a constant price basis by comparing the total present worth of investment, operation and maintenance and fuel costs. Generation scheduling computer program (COSTOL) of the Central Electricity Generating Board of England was adopted to calculate the fuel costs by merit-order operation on a system basis. Efficiency prices were used as follows:

- (a) taxes and duties were excluded;
- (b) there was no shadow pricing for foreign exchange costs as the standard conversion factor is approximately equal to 1 in Malaysia; and
- (c) the conversion factors for the skilled labor and unskilled labor were assumed to be 1.0 and 0.5 respectively.

6.04 Program A with Bersia and Kenering developments was found to be the least cost solution for discount rates up to 17% (Annexes 18 and 19). The present worth of these two alternative programs at different discount rates are as follows:

<u>Discount rate</u> (%)	<u>Program A</u> (M\$ million)	<u>Program B</u> (M\$ million)
8	373	757
10	349	587
12	330	470
14	314	387
16	301	326

6.05 Sensitivity tests for variations in capital costs and fuel costs give the following results:

	<u>Equalizing discount rate</u>
(a) On basic assumption	17.3%
(b) Project cost increased by:	
10%	15.7%
20%	14.4%
(c) Fuel cost increased by:	
10%	18.3%
20%	19.3%

#### Internal Economic Rate of Return

6.06 The internal economic rate of return of the project (IERR) is the discount rate which equalizes the economic costs and benefits attributable to the project. The project costs and benefits streams are shown in Annex 20. The costs are net of taxes and include the full costs of the associated transmission facilities (275 kV line was recommended by PCR to accommodate future hydroelectric developments in the northeast region). Ideally, the benefits should be measured in terms of consumers' willingness to pay, but since this is practically impossible to evaluate, the incremental revenue of the project was used as a proxy for total benefits. This is a minimum measure of the benefits as consumers' surpluses and additional peaking contribution of the project are ignored in the analysis. On this basis, the IERR is 13.8%.

7. AGREEMENTS AND RECOMMENDATIONS

7.01 During negotiations, agreement was reached on the following:

(a) With the Government

- (i) Government will submit to the Bank, not later than July 31, 1982, a report on optimizing development and use of domestic energy resources (para. 4.15); and
- (ii) Government will provide adequate funds to finance NEB's development program (para. 5.09);

(b) With the Government and NEB

- (i) Government and NEB will review at least three months before the end of each fiscal year measures necessary to comply with the requirements of the financial covenants (para. 5.06);

(c) With NEB

- (i) NEB will exchange views with the Bank on any proposed changes in its tariff structures (para. 2.18);
- (ii) NEB will limit its industrial investment to a maximum of 1% of gross fixed assets as revalued each year (para. 2.19);
- (iii) NEB will maintain the panel of experts to review project designs and problems which may arise during construction (para. 4.18);
- (iv) NEB will implement a satisfactory program of periodical inspection and maintenance of the dam and associated civil works of the Project (para. 4.19);
- (v) NEB will carry out the recommendations proposed by the Consultants on ecological investigations (paras. 4.24 and 4.25);
- (vi) NEB will continue to produce funds from internal sources of not less than 15% for FY80, 25% for FY81-84 and 30% for FY85 and thereafter (para. 5.06);



- (vii) NEB will maintain a debt/equity ratio not greater than 60/40 (para. 5.14); and
- (viii) NEB will agree to a change in the present covenant for the short-term debt limitation to a covenant that will limit current liabilities to a maximum of 33% of NEB's cash operating expenses for the preceding 12 months (para. 5.15).

Recommendations

7.02 Subject to agreement being reached on the above, the Project constitutes a suitable basis for a Bank loan of US\$50 million for a period of 17 years including a grace period of 4 years, with the guarantee of the Government.

MALAYSIA

NATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYA

NINTH POWER PROJECT

Potential Hydroelectric Sites

	Location	Catchment Area (sq.km)	Designed Head (m)	Installed Capacity (MW)	Output at MOL/a (MW)	Firm Energy (GWh)	Average Energy (GWh)
1.	Bersia Perak	3,601	26.5	72	70	190	283
2.	Kenering Perak	5,545	34.7	120	120	340	456
3.	Trengganu Trengganu	2,600	124.5	400	324	1,450	1,600
4.	Upper Trengganu Trengganu	420	145.0	200	-	310	370
5.	Tembeling Pahang	2,840	48.0	110	-	311	441
6.	Tekai (upper & lower) Pahang		90,21	64+14	-	279	370
7.	Lower Telom Group Pahang		149,367,352	6+12+82	-	200	475
8.	Maran Pahang		10.0	130	-	273	663
9.	Nenggiri Kelantan		103.6	310	-	763	1,090
10.	Lebir Kelantan		30.5	38	-	140	200
11.	Dabong Kelantan		28.0	125	-	396	660
12.	S. Kelantan Group Kelantan			95+40			525+230
13.	Pergau Kelantan	184	1,612.0	100	-	242	331
	Total			1,918			7,669

/a Minimum operating level

MALAYSIANATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYANINTH POWER PROJECTAccess to Electricity (End FY78)

Region	Population <u>/a</u>	No. of domestic consumers <u>/b</u>	Access to electricity <u>/c</u>	Consumption (GWh)	kWh per Capita
NEB					
Central	1,949,872	232,916	72%	2,411.1	1,236
Northern	2,165,886	266,950	74%	1,421.4 <u>/d</u>	656
Southern	1,864,506	230,135	74%	991.5	532
Eastern	1,027,794	114,256	66%	273.7	266
Isolated rural stations	1,448,142	19,583	8%	5.0	43
Subtotal	<u>8,456,200</u>	<u>863,840</u>	<u>61%</u>	<u>5,102.7</u>	<u>603</u>
PRHE & KED	1,513,800	85,736	34%	-	-
Other licensed suppliers	1,245,000	27,748	14	-	-
<u>Total</u>	<u>11,215,000</u>	<u>977,324</u>	<u>52%</u>	<u>6,384.0</u>	<u>570</u>

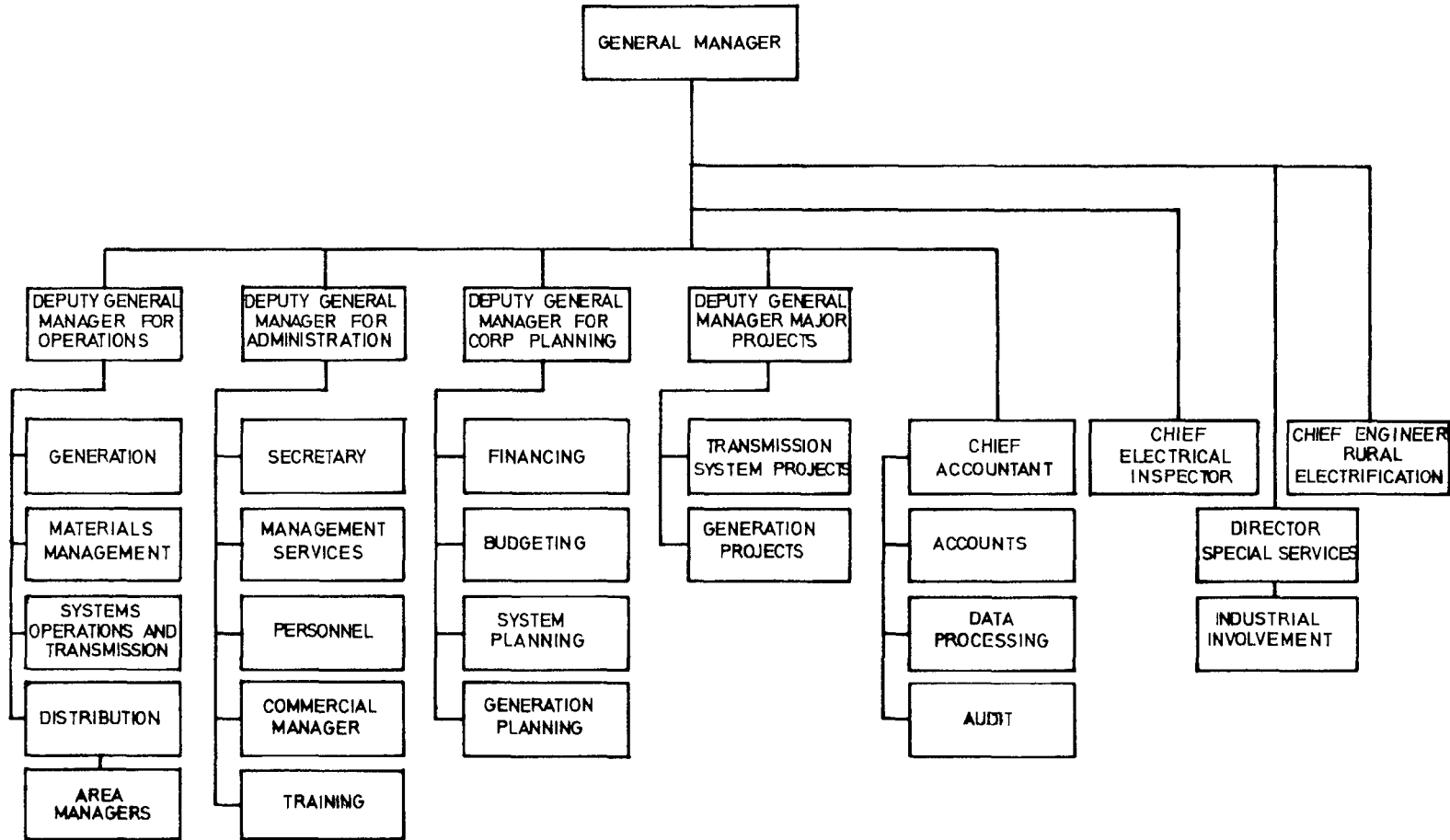
/a Population taken from 1979 World Bank Atlas and NEB's 1978 Annual Report.

/b 85% of total customers

/c Population electrified is calculated by assuming 6 persons per domestic consumer

/d Excluding bulk supply of 831.4 GWh to PRHE.

**MALAYSIA - NATIONAL ELECTRICITY BOARD  
ORGANIZATION CHART**



MALAYSIANATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYANINTH POWER PROJECT

Generating Facilities - NEB  
(as of August 31, 1978)

Plant	Type	No. of		Year in service
		Units	Capacity (MW) Total Installed	
1. Sultan Yussuf	Hydro	4 x 25	100.0	1963
2. Habu	Hydro	2 x 2.75	5.5	1963
3. Sultan Idris II	Hydro	3 x 30	150.0	No. 1&2 No. 3 1967 1960
4. Odak	Hydro	3 x 1.5	4.2	No. 3 1967
5. Robinson Falls	Hydro		2.2	1959
6. ULU Langat	Hydro		2.3	-
7. Raub	Hydro		1.2	-
8. Temengor	Hydro	1 x 85	87.0	No. 2 1978
Subtotal			<u>352.4</u>	
8. Connaught bridge	Thermal	4 x 20	80.0	No. 1&2 No. 3&4 1953 1955
9. Malacca	Thermal	4 x 10	40.0	No. 1&2 No. 3 No. 4 1959 1960 1966
10. Sultan Ismail	Thermal	3 x 10 3 x 30	30.0 90.0	No. 1-3 No. 4 No. 5 No. 6 1963 1967 1971 1976
11. Prai	Thermal	3 x 30	90.0	No. 1&2 1967
12. Tuanku Jaafar (Port Dickson)	Thermal	4 x 60 3 x 120	240.0 360.0	No. 1&2 No. 3&4 No. 5&6 No. 7 1969 1974 1976 1977
13. Glugor	Thermal	4 x 10	40.0	No. 1-4 1957
Subtotal			<u>970.0</u>	
14. Diesel Stations	Diesel		97.4	
15. Gas Turbine Stations	Gas Turbine		20.0	No. 1 1978
<u>Total</u>			<u>1,439.8</u>	

MALAYSIA

NATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYA

NINTH POWER PROJECT

Actual and Forecast Sales of Energy, FY69-87

Year ending Aug 31	Residential			Commercial			Industrial			Mining			Bulk supply to PRHE			Total	
	GWh	% Increase over previous years	% of total sales	GWh	% Increase over previous years	% of total sales	GWh	% Increase over previous years	% of total sales	GWh	% Increase over previous years	% of total sales	GWh	% Increase over previous years	% of total sales	GWh	% Increase over previous years
<u>Actual</u>																	
1969	249	10.7	12.8	577	8.9	29.8	496	14.5	25.6	362	(3.5)	18.7	255	24.4	15.1	1,939	9.7
1970	268	7.6	12.3	629	9.0	28.9	576	16.1	26.4	352	(2.8)	16.2	353	38.4	16.2	2,178	12.3
1971	291	8.6	12.1	688	9.4	28.7	672	16.7	28.0	350	(0.6)	14.6	400	13.3	16.6	2,401	10.2
1972	322	10.7	11.6	775	11.2	28.0	848	26.2	30.7	346	(1.1)	12.5	475	18.8	17.2	2,766	15.2
1973	369	14.6	11.7	899	16.0	28.6	1,079	27.2	34.4	313	(9.5)	10.0	481	1.3	15.3	3,141	13.6
1974	408	10.6	11.7	1,015	12.9	29.0	1,297	20.2	37.0	297	(6.3)	8.5	485	0.8	13.8	3,502	11.5
1975	474	16.2	11.9	1,153	13.6	29.0	1,481	14.2	37.2	303	2.0	7.6	570	17.5	14.3	3,982	13.7
1976	580	22.4	12.8	1,323	14.6	29.1	1,758	18.7	38.7	296	(2.3)	6.5	586	2.8	12.9	4,543	14.1
1977	702	21.0	13.3	1,529	15.6	28.9	1,969	12.0	37.2	320	4.7	5.8	787	34.3	14.8	5,297	16.6
1978	848	20.7	14.3	1,784	16.7	30.1	2,160	9.7	36.4	311	0.2	5.2	831	5.6	14.0	5,934	12.0
1979	987	16.4	15.1	2,038	14.2	31.2	2,448	13.3	37.4	295	(5.1)	4.5	773	(7.0)	11.8	6,541	10.2
<u>Forecast</u>																	
1980	1,068	12.5	13.9	2,254	12.5	29.3	2,853	12.0	37.0	320	-	4.2	1,200	9.1	15.6	7,695	11.2
1981	1,196	12.0	14.0	2,524	12.0	29.6	3,181	11.5	37.3	320	-	3.8	1,300	8.3	15.3	8,521	10.7
1982	1,334	11.5	14.2	2,814	11.5	29.6	3,531	11.0	37.6	320	-	3.4	1,400	7.7	14.9	9,399	10.3
1983	1,481	11.0	14.4	3,123	11.0	30.3	3,884	10.0	37.7	320	-	3.1	1,500	7.1	14.5	10,308	9.7
1984	1,629	10.0	14.5	3,435	10.0	30.6	4,234	9.0	37.7	320	-	2.9	1,600	6.7	14.3	11,218	8.8
1985	1,792	10.0	14.7	3,779	10.0	31.0	4,615	9.0	37.8	320	-	2.6	1,700	6.3	13.9	12,206	8.8

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MALAYSIANATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYANINTH POWER PROJECTEstimated Maximum Demand (MW)

<u>Year ending</u> <u>August 31</u>	<u>Central</u>	<u>East-</u> <u>ern</u>	<u>South-</u> <u>ern</u>	<u>North-</u> <u>ern</u>	<u>Perak</u> <u>hydro</u>	<u>Penang</u>	<u>Total</u> <u>demand</u>	<u>% increase</u> <u>over pre-</u> <u>vious years</u>	<u>Annual load</u> <u>factor (%)</u>
<u>Actual</u>									
1976	489	11	66	126	170	51	913	-	67.6
1977	552	21	76	151	168	56	1,024	12.2	68.9
1978	636	29	78	169	190	60	1,162	13.5	70.8
1979	696	32	88	196	213	72	1,297	11.7	-
<u>Forecast</u>									
1980	709	88	122	192	245	72	1,428	10.1	-
1981	775	161	134	208	260	79	1,617	13.2/a	-
1982	844	180	148	224	275	86	1,757	8.7	-
1983	914	201	162	242	290	93	1,902	8.2	-
1984	989	223	177	260	305	101	2,055	8.0	-
1985	1,066	246	194	279	320	110	2,215	7.8	-

/a Due to high increase of eastern load.

## MALAYSIA

## NATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYA

## NINTH POWER PROJECT

## Balance of System Load Requirements and Capabilities /a

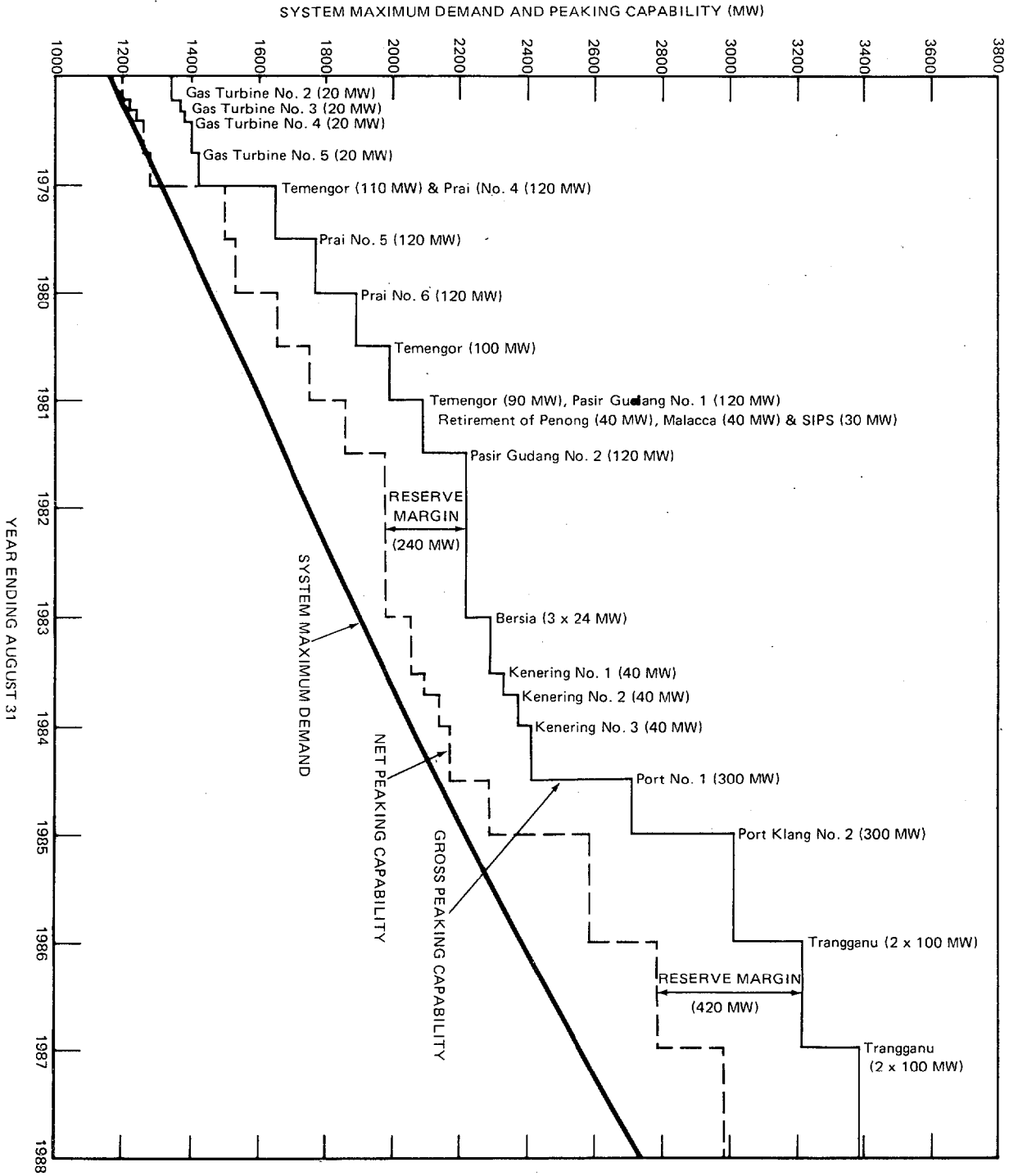
Year ending Aug 31	Plant addition	Power (MW)						Energy (CWh)						
		Maximum demand	Increase in capacity	Retirement	Cross peaking capability	Reserve margin	Net peaking capability	Requirement (sent-out)	Increase in energy	Retirement or revised	Available/b firm energy			
1978	Temengor Gas turbine	No. 2 No. 1	1,184	40 20		1,340	150	1,190	7,303	PD 7 TC	400 112	JOP & WOH 200	7,621	
1979	Gas turbines Temengor Prai	No 2-5 No 1,3&4 No. 4	1,306	80 110 120		1,650	150	1,500	8,041	GT TC	248 388		8,257	
1980	Prai	No 5 No 6	1,428	120 120		1,890	240	1,650	8,787	PR 4 5	800 400		9,334	
1981	Pasir Gudang Temengor	No 1	1,617	120 190	Penang 40 SIPS 30 Malacca 40	2,090	240	1,850	9,887	PR 5 6	400 800		10,534	
1982	Pasir Gudang	No 2	1,757	120		2,210	240	1,970	10,735	PC 1 2 TG	800 400 248	Pen Mal SIPS	252 252 104	11,378
1983	Bersia	No 1-3	1,902	70		2,280	240	2,040	11,617	PC 2 Ber	400 190		11,968	
1984	Kenering	No 1-3	2,055	120		2,400	240	2,160	12,538	Ken	340		12,308	
1985	Port Klang	No. 1,2	2,215	600		3,000	420	2,580	13,505	PKI	1,000		13,308	
1986	Trengganu	No 1,2	2,380	200		3,200	420	2,780	14,503	PK 1 2	1,000 2,000		16,308	
1987	Trengganu	No 3,4	2,552	200		3,400	420	2,980	15,542	TR	635		16,943	

/a Load requirements and capabilities include those of Perak Hydro System

/b Firm energy of hydro plants is defined as the annual energy output that would be available 95% of the time, firm energy of thermal units is calculated at a capacity factor of 75%



MALAYSIA  
 NATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYA  
 SYSTEM DEMAND AND CAPABILITY



MALAYSIA

NATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYSIA

NINTH POWER PROJECT

Pertinent Data of Bersia and Kenering Hydroelectric Projects

Location	<u>Bersia</u>	<u>Kenering</u>
	20 km downstream of Temengor dam in the State of Perak	50 km downstream of Bersia
Drainage area (sq km)	3,600	5,542
Average annual rainfall (mm)	2,530	2,410
Full supply level (m above mean sea level)	141.4	111.0
Tailwater elevation (m)	114.6	76.2
Gross head (m)	25.3-27.7	34.4-36.3
Storage capacity (million cu m)		
Gross	70.0	324.0
Net	8.5	68.0
Surface area (sq km)	5.7	24.3
Net rate head (m)	26.5	34.1
Installed capacity (MW)	3 x 24	3 x 40
Dependable capacity (MW)	70	120
Continuous output (MW)	21.7	38.7
Firm energy (GWh)	190	340
Average energy (GWh)	238	456
Annual capacity factor (%)	30	43
Dam		
Foundation rock	Massive crystalline tuff	Schist
Type	Concrete gravity	Concrete gravity with dikes to abutments
Height (m)	32.0	41.1
Crest elevation (m)	143.9	113.7
Crest length	244.0	610.0
Spillway		
Shape	Ogee section	Ogee section
Design flood (at 10,000-yr recurrence)	5,240.0 cu m/sec	13,940.0 cu m/sec
Gates	3-13.7 m x 16.1 m	6-13.7 m x 17.4 m
Penstock		
Diameter (m)	5.0	5.5
Powerhouse		
Type	Outdoor	Outdoor
Turbine	3 - Kaplan @ 32,800 hp	3 - Francis @ 55,000 hp
Discharge per unit (cms)	102.0	133.2

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MALAYSIANATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYSIANINTH POWER PROJECTProject Cost Estimate

	Foreign --- (M\$ million) ---	Local million	Total ----	Foreign --- (US\$ million) ---	Local million	Total ----
1. <u>Land Acquisition and Resettlement</u>	-	<u>11.5</u>	<u>11.5</u>	-	<u>5.2</u>	<u>5.2</u>
2. <u>Preliminary Works</u>						
Access roads and bridges	-	4.0	4.0	-	1.8	1.8
Site clearing and development	-	2.7	2.7	-	1.3	1.3
Reservoir clearing	-	4.4	4.4	-	2.0	2.0
Subtotal	-	<u>11.1</u>	<u>11.1</u>	-	<u>5.1</u>	<u>5.1</u>
3. <u>Civil Works</u>						
Bersia	34.8	25.5	60.3	15.8	11.6	27.4
Kenering	49.3	56.7	106.0	22.4	25.8	48.2
Subtotal	<u>84.3</u>	<u>82.2</u>	<u>166.3</u>	<u>38.2</u>	<u>37.4</u>	<u>75.6</u>
4. <u>Turbines &amp; Generators</u>						
Turbines	31.1	3.3	34.4	14.2	1.5	15.7
Generators	21.4	3.8	25.2	9.7	1.7	11.4
Subtotal	<u>52.5</u>	<u>7.1</u>	<u>59.6</u>	<u>23.9</u>	<u>3.2</u>	<u>27.1</u>
5. <u>Associated Electrical &amp; Mechanical Works</u>	<u>58.6</u>	<u>5.2</u>	<u>63.8</u>	<u>26.6</u>	<u>2.4</u>	<u>29.0</u>
6. <u>Transmission and Substation Facilities</u>	<u>40.0</u>	<u>15.0</u>	<u>55.0</u>	<u>18.2</u>	<u>6.8</u>	<u>25.0</u>
7. <u>Engineering &amp; Supervision and Administration</u>	<u>19.5</u>	<u>13.0</u>	<u>32.5</u>	<u>8.9</u>	<u>5.9</u>	<u>14.8</u>
8. <u>Consultancy Services</u>	<u>4.5</u>	-	<u>4.5</u>	<u>2.0</u>	-	<u>2.0</u>

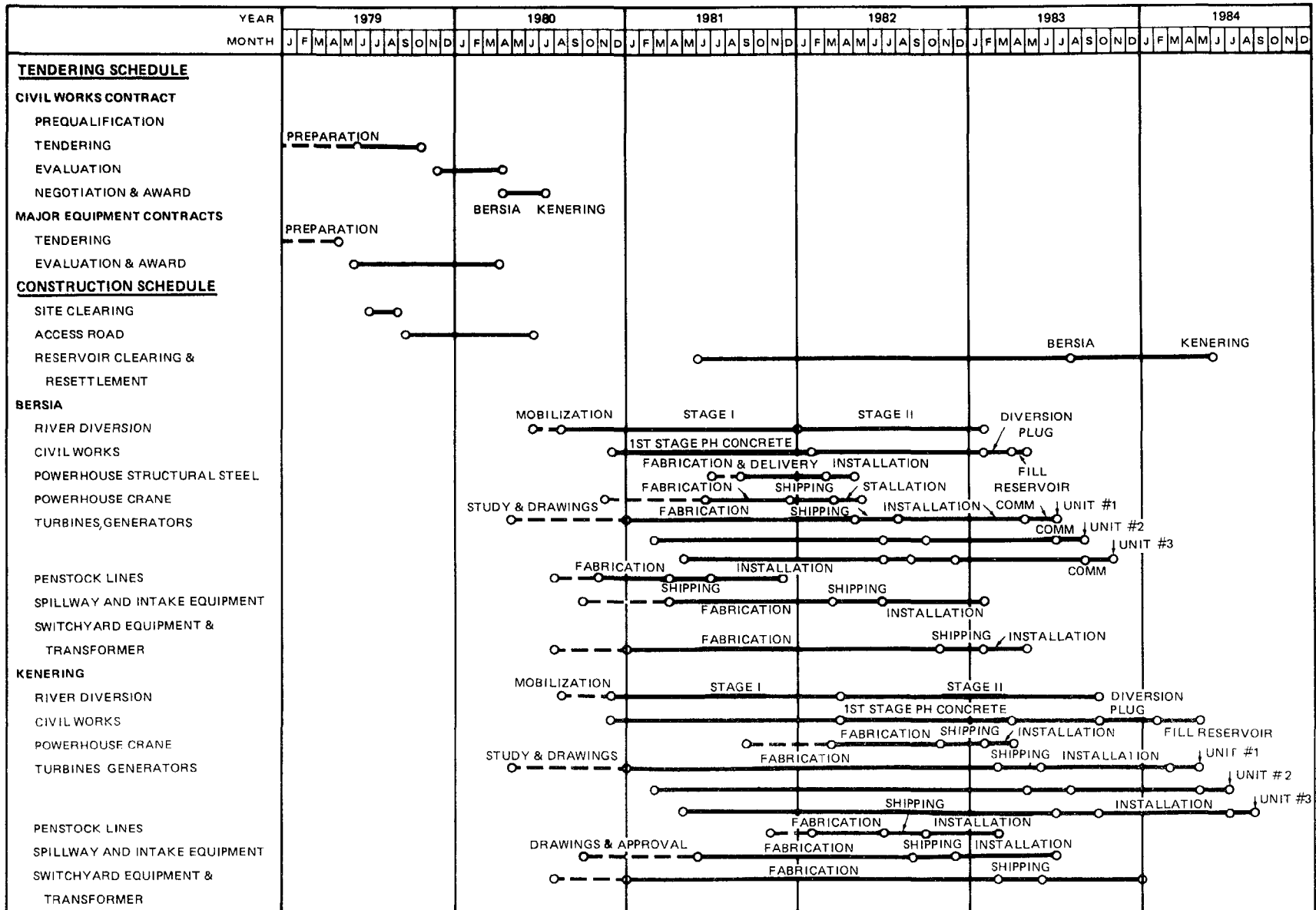
	Foreign	Local	Total	Foreign	Local	Total
	--- (M\$ million)	----	----	--- (US\$ million)	----	----
<b>9. Contingencies</b>						
<u>Physical</u>						
Civil works						
Bersia	3.9	3.0	6.9	1.7	1.3	3.0
Kenering	6.3	6.8	13.1	2.9	3.1	6.0
Turbines & generators	2.6	0.4	3.0	1.2	0.2	1.4
Associated electrical & mechanical works	2.1	0.2	2.3	1.0	0.1	1.1
Transmission & substa- tion facilities	1.4	0.5	1.9	0.6	0.2	0.8
Engineering & supervision & administration	2.1	1.5	3.6	1.0	0.7	1.7
Consultancy services	0.3	-	0.3	0.1	-	0.1
Subtotal	<u>18.7</u>	<u>12.4</u>	<u>31.1</u>	<u>8.5</u>	<u>5.6</u>	<u>14.1</u>
<u>Price</u>						
Civil works						
Bersia	-	13.4	13.4	-	6.1	6.1
Kenering	-	23.9	23.9	-	10.8	10.8
Turbines & generators	3.7	1.5	5.2	1.7	0.7	2.4
Associated electrical & mechanical works	14.5	1.3	15.8	6.6	0.6	7.2
Transmission & substa- tion facilities	9.2	3.0	12.2	4.2	1.4	5.6
Engineering & supervision & administration	3.5	2.5	6.0	1.6	1.1	2.7
Consultancy services	0.5	-	0.5	0.2	-	0.2
Subtotal	<u>31.4</u>	<u>45.6</u>	<u>77.0</u>	<u>14.3</u>	<u>20.7</u>	<u>35.0</u>
Total	<u>309.3</u>	<u>203.1</u>	<u>512.4</u>	<u>140.6</u>	<u>92.3</u>	<u>232.9</u>

MALAYSIANATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYSIANINTH POWER PROJECTLoan Disbursement Schedule  
(US\$ million)Assumptions:

Loan Signing: April 1980  
 Effectiveness Date: July 1980  
 Closing Date: August 1985

<u>IBRD fiscal year and semester</u>	<u>Disbursements during semester</u>	<u>Cumulative disbursements at the end of semester</u>
<u>1981</u>		
December 31, 1980	0.7	0.7
June 30, 1981	2.3	3.0
<u>1982</u>		
December 31, 1981	6.8	9.8
June 30, 1982	11.4	21.2
<u>1983</u>		
December 31, 1982	13.6	34.8
June 30, 1983	9.1	43.9
<u>1984</u>		
December 31, 1983	2.7	46.6
June 30, 1984	1.1	47.7
<u>1985</u>		
December 31, 1984	0.9	48.6
June 30, 1985	0.8	49.4
<u>1986</u>		
August 31, 1985	0.6	50.0

**MALAYSIA  
BERSIA AND KENERING HYDROELECTRIC PROJECT  
IMPLEMENTATION SCHEDULE**



## MALAYSIA

## NATIONAL ELECTRICITY BOARD (NEB)

Historical and Forecast Income Statements FY78-85 (millions of MS)  
(Fiscal Year September 1 - August 31)

	---- Actual ----		-----Forecast-----					
	1978	1979	1980	1981	1982	1983	1984	1985
<u>Sales (GWh)</u>	5,934	6,527	7,375	8,521	9,399	10,308	11,218	12,206
Average price per KWh (cents)	10.8	12.6	13.9	14.2	14.3	14.6	14.9	15.0
<u>Operating Revenues</u>								
From electricity sales	643.32	821.60	1,028.70	1,209.56	1,341.80	1,500.60	1,674.30	1,834.60
Other	22.62	27.20	36.60	42.40	43.20	49.10	50.00	51.10
<u>Total Revenues</u>	<u>665.92</u>	<u>848.80</u>	<u>1,065.30</u>	<u>1,251.96</u>	<u>1,385.00</u>	<u>1,549.70</u>	<u>1,724.30</u>	<u>1,885.70</u>
<u>Operating Expenses</u>								
Administrative, operations & maintenance	120.80	166.40	179.00	198.60	212.00	230.00	251.70	274.40
Fuel & purchased power	303.50	440.80	547.10	611.10	682.70	780.80	911.60	982.90
<u>Total Operating Expenses</u>	<u>424.30</u>	<u>607.20</u>	<u>726.10</u>	<u>809.70</u>	<u>894.70</u>	<u>1,010.80</u>	<u>1,163.30</u>	<u>1,257.30</u>
Income before depreciation	241.62	241.60	339.20	442.26	490.30	538.90	561.00	628.40
Depreciation	94.07	112.36	137.63	170.93	204.47	235.92	257.17	288.93
	<u>147.55</u>	<u>129.24</u>	<u>201.57</u>	<u>271.33</u>	<u>285.83</u>	<u>302.98</u>	<u>303.83</u>	<u>339.47</u>
<u>Net Operating Income</u>								
Interest charged to operation	48.49	60.90	73.00	83.30	85.80	105.50	104.00	111.50
Corporate & development taxes	15.00	-	-	-	-	-	-	-
<u>Net Earnings</u>	<u>84.06</u>	<u>68.34</u>	<u>128.57</u>	<u>188.03</u>	<u>200.03</u>	<u>197.48</u>	<u>199.83</u>	<u>227.97</u>
Allocation of net earnings:								
Dividends	7.10	8.70	20.90	26.20	30.50	34.80	40.00	42.40
Retained earnings	76.96	59.64	107.67	161.83	169.53	162.68	159.83	185.57

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MALAYSIANATIONAL ELECTRICITY BOARD (NEB)Historical and Forecast Sources and Applications of Funds FY78-85 (Millions of M\$)  
(Fiscal Year September 1 - August 31)

	---- Actual ----		----- Forecast -----					
	1978	1979	1980	1981	1982	1983	1984	1985
<u>Sources of Funds</u>								
Income before depreciation	241.62	241 60	339 20	442.26	490.30	538 90	561 00	628.40
Consumers' contributions & deposits	44 74	63 47	39 29	27.61	38.50	38 00	38.50	39.00
Equity contributions	-	130.00	150 00	85.00	55.00	125 00	90.00	-
Borrowings								
IBRD loan present project	-	-	1 50	25.00	55.00	26 00	2.50	-
Other	248.53	269 99	347.52	472.98	305.50	386 90	380 50	158.17
<u>Total Sources of Funds</u>	<u>534 89</u>	<u>705.06</u>	<u>877.51</u>	<u>1,052.85</u>	<u>944 30</u>	<u>1,114 80</u>	<u>1,072.50</u>	<u>825.57</u>
<u>Application of Funds</u>								
Investment in projects	-	-	28 80	103.60	148 60	130.90	68.30	32 20
Other construction	372 95	546 20	622.60	527.70	331 60	484.80	413.10	320.20
Interest during construction	8.00	20.00	31 60	38.70	40.10	25.00	27.90	16 00
<u>Total Investment</u>	<u>380.95</u>	<u>566 20</u>	<u>683.00</u>	<u>670.00</u>	<u>520.30</u>	<u>640.70</u>	<u>509.30</u>	<u>368.40</u>
Debt service								
Loan amortization	37 12	41.50	71.70	121.90	251.48	302.76	329 45	237 72
Interest charged to operation	48.49	60.90	73.00	83 30	85 80	105 50	104 00	111 50
<u>Total Debt Service</u>	<u>85 61</u>	<u>102.40</u>	<u>144 70</u>	<u>205 20</u>	<u>337 28</u>	<u>408 26</u>	<u>433.46</u>	<u>349 22</u>
Dividends	7 10	8.70	20.90	26 20	30 50	34.80	40 00	42 40
Investment in industry	1 20	1 20	12.30	7 50	-	-	-	-
Increase (decrease) in working capital	45 03	26.56	16.61	143.95	56 22	31 04	89 75	65.55
Taxes	15 00	-	-	-	-	-	-	-
<u>Total Application of Funds</u>	<u>534 89</u>	<u>705.06</u>	<u>877.51</u>	<u>1,052.85</u>	<u>944 30</u>	<u>1,114.80</u>	<u>1,072.50</u>	<u>825 57</u>



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## MALAYSIA

## NATIONAL ELECTRICITY BOARD (NEB)

Historical and Forecast Balance Sheets FY78-85 (millions of M\$)  
(Fiscal Year September 1 - August 31)

	---- Actual ----		----- Forecast -----					
	1978	1979	1980	1981	1982	1983	1984	1985
<u>Assets</u>								
Fixed assets in operation								
- revalued	3,167.51	3,642.03	4,699.45	5,659.92	6,732.21	7,566.04	8,020.01	9,490.71
Less								
Accumulated depreciation	972.20	1,142.89	1,349.10	1,600.98	1,901.51	2,251.52	2,643.78	3,091.33
Net fixed assets in operation	<u>2,195.30</u>	<u>2,499.13</u>	<u>3,350.35</u>	<u>4,058.94</u>	<u>4,830.71</u>	<u>5,314.52</u>	<u>5,376.23</u>	<u>6,399.38</u>
Work in progress	478.27	760.00	604.10	585.60	383.20	594.00	1,103.30	482.20
Investment in industries	5.10	6.30	18.60	26.10	26.10	26.10	26.10	26.10
<u>Current assets</u>								
- Cash in banks	2.47	1.80	2.60	5.00	7.00	9.00	11.00	13.00
- Receivables from sales (net)	66.21	84.40	107.00	124.00	141.00	160.00	179.00	196.00
- Other receivables	92.07	78.50	83.45	87.62	92.00	96.60	101.43	106.50
- Inventories	172.63	231.80	206.00	242.00	274.00	317.00	393.00	436.00
<u>Total Current Assets</u>	<u>333.38</u>	<u>396.50</u>	<u>399.05</u>	<u>458.62</u>	<u>514.00</u>	<u>582.60</u>	<u>684.43</u>	<u>751.50</u>
<u>Total Assets</u>	<u>3,012.05</u>	<u>3,661.93</u>	<u>4,372.10</u>	<u>5,139.26</u>	<u>5,754.01</u>	<u>6,517.23</u>	<u>7,190.06</u>	<u>7,659.18</u>
<u>Equity and Liabilities</u>								
<u>Equity</u>								
- Paid in capital	236.70	366.70	516.70	601.70	656.70	781.70	871.70	871.70
- Retained earnings	560.16	619.20	726.86	888.69	1,058.22	1,220.90	1,380.73	1,566.31
- Surplus from revaluation	681.71	813.42	963.37	1,164.39	1,407.93	1,697.77	2,016.64	2,339.22
- Consumers' contributions	176.27	233.47	259.47	290.47	320.47	349.47	378.47	407.47
<u>Total Equity</u>	<u>1,654.84</u>	<u>2,032.79</u>	<u>2,466.40</u>	<u>2,945.25</u>	<u>3,443.32</u>	<u>4,049.84</u>	<u>4,647.54</u>	<u>5,184.70</u>
Consumers' deposits	50.36	61.20	75.89	72.50	81.00	90.00	99.50	109.50
Long-term debt (net of current maturities)	876.43	1,058.34	1,285.47	1,656.85	1,715.77	1,798.91	1,818.43	1,733.19
Other liabilities	26.80	22.83	21.43	21.43	21.43	21.43	21.43	21.43
<u>Current Liabilities</u>								
- Accounts payable	202.05	245.90	281.44	191.76	186.22	219.88	226.77	226.29
- Taxes & dividend payable	77.79	70.50	20.90	26.20	30.50	34.80	40.00	42.00
- Bank's short-term loans and overdrafts	82.28	98.67	98.67	98.67	98.67	98.67	98.67	98.67
- Current maturities	41.50	71.70	121.90	126.60	176.70	203.70	237.72	243.40
<u>Total Current Liabilities</u>	<u>403.62</u>	<u>486.77</u>	<u>522.91</u>	<u>443.23</u>	<u>492.49</u>	<u>557.05</u>	<u>603.16</u>	<u>610.36</u>
<u>Total Equity and Liabilities</u>	<u>3,012.05</u>	<u>3,661.93</u>	<u>4,372.10</u>	<u>5,139.26</u>	<u>5,754.01</u>	<u>6,517.23</u>	<u>7,190.06</u>	<u>7,659.18</u>

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MALAYSIANATIONAL ELECTRICITY BOARD (NEB)Monitoring Indicators

	1980	1981	1982	1983	1984	1985
<b>A. <u>Debt Indicators</u></b>						
Debt equity ratio <u>/a</u>	47:53	48:52	46:54	43:57	41:59	40:60
Debt service coverage	2.3	2.1	1.5	1.3	1.3	1.8
<b>B. <u>Performance Indicators</u></b>						
Contribution to construction (%) <u>/b</u>	19	32	36	34	36	-
Rate of return (%) <u>/c</u>	7.5	7.9	7.0	6.5	6.2	6.4
Operating ratio <u>/d</u>	81	78	79	80	82	82
Receivables in billings (no. of days)	38	37	38	39	39	39
Rate base	2,684	3,407	4,088	4,657	4,869	5,350
<b>C. <u>Investment (Growth) Indicators</u></b>						
Increase in gross plant (%)	29	20	19	12	6	18
<b>D. <u>Liquidity Indicators</u></b>						
Net working capital (M\$ million)	(123.9)	15.4	21.5	25.6	81.3	141.2
Current ratio (times)	0.8	1.0	1.0	1.0	1.1	1.2

/a Long-term debt equity net of current maturities as a percentage of long-term debt (net) plus equity (excluding surplus from revaluation).

/b On three-year sliding investment average.

/c Including depreciation charges.

/d On net revalued assets in operation.

MALAYSIANINTH POWER PROJECTAssumptions in Financial ForecastsIncome Statement

1. Revenues from Electricity Sales. It has been assumed that the fuel cost variation charge will be implemented automatically to recover any increase in fuel cost. No increase in basic tariff is expected except about 2% resulting from the implementation of the new tariff structure in FY80.
2. Other Operating Revenues. Include reconnection fees, repairs, interest received and government subsidy toward losses in rural and diesel stations.
3. Operating Expenses. The forecast considers the requirements for a larger scale of operations plus price escalation.
4. Depreciation. NEB uses straight-line depreciation. An average of 3.3% per year on revalued assets was used.
5. Corporate and Development Taxes. Starting with FY80 NEB was exempted from corporate taxes (40%) and development taxes (5%). Due to large deductions allowed on the basis of the investments made, no provision for taxes was required in FY79.

6. Dividends. Represents the forecast prepared by NEB following the practice of previous years.

Statement of Sources and Applications of Funds

7. Consumers' Contribution and Deposits. Include expected contributions from consumers, both in urban and rural areas, according to the cost to NEB for supplying the service.

8. Equity Contributions. The Government agreed during negotiations to increase NEB's paid-in capital in M\$150.0 million in FY80.

9. IBRD Loan. The proposed Bank loan of \$50.0 million was assumed with a repayment period of 17 years including 4 years of grace, an interest of 8.25%, and a commitment fee of 3/4 of 1%.

10. Investment in Industry. It was assumed that no additional investment in industry will be made after FY82 when the cable, transformers and meter factories are expected to be fully operational.

11. Increase in Working Capital. It was assumed that in the future NEB will be able to improve its liquidity position from a negative net working capital of M\$124 million in 1980 to reach a positive net working capital of M\$141 million in FY85.

MALAYSIANATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYANINTH POWER PROJECT

Cost Streams - Program A  
(Shadow priced: M\$ million)

Bersia and Kenering Developments

Year	Capital costs /a			Operation and maintenance /b	Fuel	Total costs
	Foreign	Local /c	Total			
1980	16.0	7.5	23.5	-	-	23.5
1981	56.0	27.0	83.0	-	-	83.0
1982	80.5	38.8	119.3	-	-	119.3
1983	71.0	34.1	105.1	-	-	105.1
1984	37.0	17.8	54.8	-	-	54.8
1985	17.4	8.7	26.1	1.0	-	27.1
1986	-	-	-	2.2	-	2.2
1987-2016	-	-	-	2.2	-	2.2
2017	54.0	13.4	67.4	2.2	-	69.6
2018	63.0	14.7	77.7	2.2	-	79.9
2019	30.7	5.3	36.0	2.2	-	38.2
2020-2029	-	-	-	2.2	-	2.2

/a Includes full cost of associated transmission facilities and interim replacement for equipment.

/b O&M is estimated at about M\$8.00 for kW for hydro stations and 1% of investment for transmission lines and substations.

/c Unskilled labor cost is assumed to be 30% of the local cost; adjusted factor for local cost by shadow pricing =  $(30\% \times 0.5 + 70\% = 0.85)$ .

MALAYSIANATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYANINTH POWER PROJECTCost Streams - Program B  
(Shadow priced: M\$ million)Alternative Thermal

Year	Capital costs				Total	Operation and maintenance /b	Fuel /c	Total costs
	120 MW thermal		70 MW gas turbine					
	Foreign	Local /a	Foreign	Local /a				
1980	-	1.0	-	-	1.0	-	-	1.0
1981	12.0	16.0	-	-	28.0	-	-	28.0
1982	24.0	21.0	-	-	45.0	-	-	45.0
1983	60.0	10.5	4.0	1.9	76.4	-	-	76.4
1984	12.0	4.0	33.6	1.9	51.5	-	-	51.5
1985	-	-	4.0	0.3	4.3	1.0	7.2	12.5
1986	-	-	-	-	-	3.5	42.0	45.5
1987	-	-	-	-	-	3.5	63.6	67.1
1988	-	-	-	-	-	3.5	63.6	67.1
1989	-	-	-	-	-	3.5	65.0	68.5
1990	-	-	-	-	-	3.5	65.6	69.1
1991	-	-	-	-	-	3.5	65.6	69.1
1992	-	-	-	-	-	3.5	66.0	69.5
1993-1998	-	-	-	-	-	3.5	70.5	74.0
1999	-	-	4.0	1.9	5.9	3.5	70.5	79.9
2000	-	-	28.0	1.9	29.9	3.5	70.5	103.9
2001	-	-	4.0	-	4.0	3.5	70.5	78.0
2002-2004	-	-	-	-	-	3.5	70.5	74.0
2005	10.8	-	-	-	10.8	3.5	70.5	84.5
2006	25.0	6.5	-	-	31.5	3.5	70.5	105.5
2007	39.5	12.5	-	-	52.0	3.5	70.5	126.0
2008	10.8	-	-	-	10.8	3.5	70.5	84.5
2009-2012	-	-	-	-	-	3.5	70.5	74.0
2013	-	-	4.0	1.9	5.9	3.5	70.5	79.9
2014	-	-	28.0	1.9	29.9	3.5	70.5	103.9
2015	-	-	4.0	-	4.0	3.5	70.5	78.0
2016-2029	-	-	-	-	-	3.5	70.5	74.0

/a Unskilled labor is assumed to be 10% of local cost; adjusted factor for local cost by shadow pricing =  $(10\% \times 0.5 + 90\% = 0.95)$ .

/b O&M is estimated at about M\$19.00 and M\$7.00 per kW for the fixed component of thermal unit and gas turbines and 1.3 mills and 1.9 mills per kWh respectively for the variable component.

/c Fuel cost is calculated by merit-order operation on a system basis.

MALAYSIA

NATIONAL ELECTRICITY BOARD OF THE STATES OF MALAYA

NINTH POWER PROJECT

Internal Economic Rate of Return  
(In M\$ million)

Year	Costs			O&M	Benefits	
	Foreign	Local /b	Total		Incremental revenue /c	Fuel savings
1980	16.0	7.5	23.5	-	-	-
1981	56.0	27.0	83.0	-	-	-
1982	80.5	38.8	119.3	-	-	-
1983	71.0	34.1	105.1	-	-	-
1984	37.0	17.8	54.8	-	-	-
1985	17.4	8.7	26.1	1.0	-	10.0
1986	-	-	-	2.2	-	45.6
1987	-	-	-	2.2	85.2	-
1988-2016	-	-	-	2.2	85.2	-
2017	54.0	13.4	67.4	2.2	85.2	-
2018	63.0	14.7	77.7	2.2	85.2	-
2019	30.7	5.3	36.0	2.2	85.2	-
2020-2029	-	-	-	2.2	85.2	-

/a Includes full cost of associated transmission facilities.

/b Shadow rate of 0.85 applied.

/c Based on NEB's average basic tariff of M¢12.56 at end-FY79 and fuel variation charge of M¢4.97 (corresponding to an oil price of M\$373 per ton) and deducted a system operating cost (including financing costs for distribution) of M¢2.9 per kWh sold.

MALAYSIA

NINTH POWER PROJECT

Related Documents and Data Available in the Project File

A. General Reports and Documents Related to the Sector and the Borrower

1. Electricity Act, 1949 (Revised 1973) with Amendments in 1976, 1977
2. Economic Report, Ministry of Finance, 1977/78
3. NEB's Tariff Booklet (Revised July 1969)
4. NEB's Annual Report (1975/76)
5. NEB's Annual Account (1976/77)
6. Electricity Tariff Survey by Electro-watt, June 1977
7. Auditor's Report as of August 3, 1976 by Price Waterhouse & Co.
8. Load Forecast (1978-85)
9. Financial Forecast (1978-85) by NEB
10. Progress Report on Previous Loans
11. Progress Report on Training Center at Bangi
12. The Opportunity Cost of Labor in Peninsular Malaysia
13. Statistical Data Through August 31, 1977
14. The Application of the CEGB's General Purpose Generation Scheduling Computer Program

B. General Reports and Documents Related to the Project

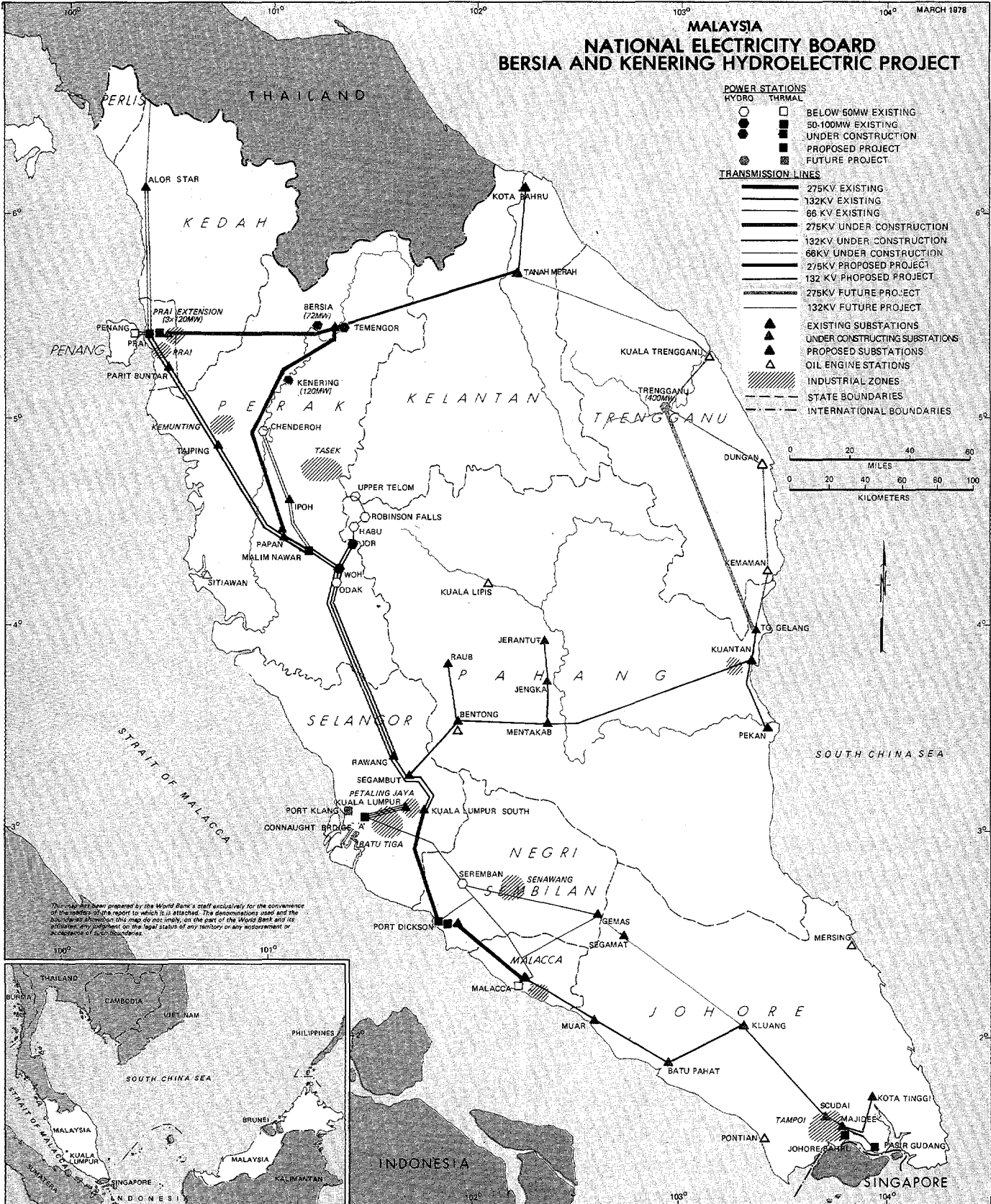
1. Summary Report on the Generation and Transmission Development Optimization Studies by NEB, December 1977
2. Transmission System Study (1976-85) by PCR, October 1976
3. Transmission Developments - Extension of Supply to East and North-east of Peninsular Malaysia (1978-85) by PCR, October 1977,  
Vol. 1 - Report (Asia File MA-257)  
Vol. 2 - Drawings and Tables
4. Transmission Developments - from Temengor to Tanah Merah and K.L. North to K.G. Awah, by PCR, June 1977
5. Preinvestment Study by SECO, October 1976
6. Field Investigation Program 1975/76  
Resident Engineer's Report with 4 volumes of appendix by SECO, August 1976
7. Revised Project Cost Estimate by SECO, October 1977
8. Consulting Engineering Agreement, November 1976
9. Background Information on Air Ganda Resettlement (with photographs)
10. Status Report of Temengor Hydroelectric Project, December 1977

C. Appraisal Working Papers

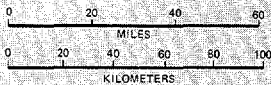
1. Detailed Calculation of Price Contingencies
2. Computer Printouts for Least Cost Solution and IERR Calculations
3. Worksheets for Financial Forecast



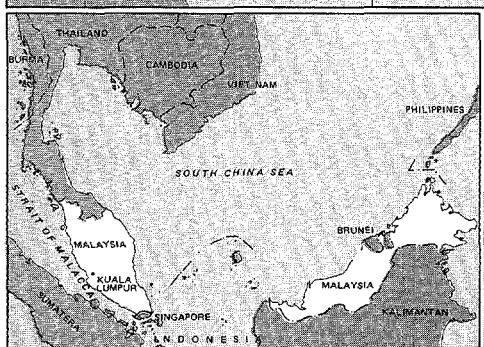
# MALAYSIA NATIONAL ELECTRICITY BOARD BERSIA AND KENERING HYDROELECTRIC PROJECT



- POWER STATIONS**
- |   |   |                     |
|---|---|---------------------|
| ○ | □ | BELOW 60MW EXISTING |
| ● | ■ | 50-100MW EXISTING   |
| ○ | ■ | UNDER CONSTRUCTION  |
| ○ | ■ | PROPOSED PROJECT    |
| ○ | ■ | FUTURE PROJECT      |
- TRANSMISSION LINES**
- |   |                          |
|---|--------------------------|
| — | 275KV EXISTING           |
| — | 132KV EXISTING           |
| — | 66 KV EXISTING           |
| — | 275KV UNDER CONSTRUCTION |
| — | 132KV UNDER CONSTRUCTION |
| — | 66KV UNDER CONSTRUCTION  |
| — | 275KV PROPOSED PROJECT   |
| — | 132 KV PROPOSED PROJECT  |
| — | 275KV FUTURE PROJECT     |
| — | 132KV FUTURE PROJECT     |
- ▲ EXISTING SUBSTATIONS  
 ▲ UNDER CONSTRUCTING SUBSTATIONS  
 ▲ PROPOSED SUBSTATIONS  
 ▲ OIL ENGINE STATIONS  
 ▨ INDUSTRIAL ZONES  
 - - - STATE BOUNDARIES  
 - - - INTERNATIONAL BOUNDARIES



*This map has been prepared by the World Bank's staff exclusively for the convenience of the recipient of this report to which it is attached. The denominations used and the boundaries shown on this map do not imply, on the part of the World Bank and its associates, any judgment on the legal status of any territory or any assessment or acceptance of such boundaries.*







Tax comparison in 2.18.

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