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STAFF APPRAISAL REPORT

FIJI

SECOND POWER PROJECT

May 1, 1980

Projects Department
East Asia and Pacific Regional Office

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CURRENCY EQUIVALENTS

| | | |
|----------|---|----------|
| US\$1.00 | = | F\$0.835 |
| F\$1.00 | = | US\$1.20 |

UNITS AND EQUIVALENTS

| | | |
|----------------------------|---|--------------------------------|
| 1 cubic meter (cu m) | = | 35.31 cubic feet (cu ft) |
| 1 hectare (ha) | = | 107,639 square feet (sq ft) |
| 1 meter (m) | = | 3.28 feet (ft) |
| 1 kilometer (km) | = | 0.6214 miles (mi) |
| 1 square kilometer (sq km) | = | 0.386 square miles (sq mi) |
| 1 kilogram (kg) | = | 2.205 pounds (lb) |
| 1 metric ton (mt) | = | 1,000 kilograms (kg) |
| 1 liter (l) | = | 0.0061 barrels |
| 1 kilovolt (kV) | = | 1,000 volts (v) |
| 1 kilovolt-ampere (kVA) | = | 1,000 volt-amperes (VA) |
| 1 megavolt-ampere (MVA) | = | 1,000 kilovolt-ampere (kVA) |
| 1 megawatt (MW) | = | 1,000 kilowatts (kW) |
| 1 gigawatt hour (GWh) | = | 1 million kilowatt hours (kWh) |

ABBREVIATIONS AND ACRONYMS

| | | |
|-------|---|--|
| ADAB | - | Australian Development Assistance Bureau |
| ADB | - | Asian Development Bank |
| CDC | - | Commonwealth Development Corporation |
| EGM | - | Emperor Gold Mine |
| EIB | - | European Investment Bank |
| ENEX | - | ENEX of New Zealand Incorporated; Engineering Export Association of New Zealand (erstwhile) |
| FEA | - | Fiji Electricity Authority |
| FIT | - | Fiji Institute of Technology |
| FNPF | - | Fiji National Provident Fund |
| FSC | - | Fiji Sugar Corporation |
| Gibb | - | Sir Alexander Gibb and Partners |
| ICB | - | International Competitive Bidding |
| IERR | - | Internal Economic Rate of Return |
| M/M | - | Merz and McLellan |
| PWD | - | Public Works Department |
| RE | - | Rural Electrification |
| SBC | - | Special Board of Consultants |
| SCC | - | Suva City Council |
| SCCED | - | Suva City Council Electricity Department |
| SPD | - | Special Project Division (of FEA) |
| TPC | - | Tavua Power Company |

FEA's FISCAL YEAR (FY)

January 1-December 31

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MAP

No. IBRD-13266R

1. THE ENERGY SECTOR

Setting

1.01 Fiji is a small country comprising about 300 islands in the South Pacific. Most of them are uninhabited. About 70% of the total population of about 600,000 resides on the main island - Viti Levu. Annual per capita income is estimated at US\$1,440./¹ Sugar and tourism are the mainstays of the economy. The country has a good natural and human resource base and political stability. Economic growth during the next few years is predicted at about 5%.

1.02 The electricity sector is fairly well developed; per capita consumption being about 500 kWh per annum. The development is concentrated in Viti Levu which accounts for over 95% of the national total. The sector serves predominantly commercial, small industrial (tourism) and domestic users. Electricity tariffs are high (F9.4¢ per kWh, 1979 average) and imports of fuel oil constitute a heavy drain on the country's foreign exchange reserves (para. 1.03).

Energy Resources and Government Policy

1.03 Fiji has no known indigenous sources of commercial energy other than its hydroelectric potential (para. 1.04). All commercial energy is derived from imported fuel. The largest single category of petroleum fuel used at present is industrial diesel oil used for electricity generation. At late 1979 prices, these purchases amount to F\$16.0 million annually (about 30% of total net imports). Apart from the high cost, Fiji has also recently begun to experience shortages of fuel supplies.

Hydroelectric Resources

1.04 Substantial water-power resources exist in the Nandrau plateau of Viti Levu, a virtually uninhabited area of about 600 sq km lying at an average altitude of 1,000 m and subject to annual rainfall varying from 2,700 mm to 4,000 mm (see map). Investigations carried out since 1973 have shown that the available potential in Viti Levu is about 2,000 GWh (annual) of which about 80% could be economically developed. Compared to this the total electricity production is 300 GWh growing at an average rate of 6-7% per year. The country's available water-power resources could be depended upon to sustain growth of electricity supply until about the end of the century. Attempts to harness this potential commenced in 1977 (para. 1.05). Systematic investigations of identified potential sites are being carried out actively according to their economic priorities.

¹ 1979 World Bank Atlas - preliminary estimate for 1978.

1.05 Based on the recommendations of an Alternative Fuels Technical Committee in 1973, the Government adopted an energy policy, inter alia, of utilizing domestic rather than imported energy resources for electricity generation. Investigations and studies started at that time culminated in 1977 in identification of the 40 MW Monasavu-Wailoa Hydroelectric Project as the most appropriate first step in implementing this policy. It is now being constructed with the assistance of Loan 1596-FIJ of 1978. The studies also outlined a 25-year all hydroelectric development program as most appropriate for the long-term. Subsequent increases in oil prices have confirmed these conclusions and emphasized the urgency of replacing diesel generation as early as possible. Commissioning of Fiji's first hydroelectric station is expected by end 1981, on schedule. The development program would largely eliminate the use of diesel oil for electricity generation in Viti Levu as early as 1983.

1.06 The program described in para. 1.05 above requires (a) investment on an unprecedented scale for Fiji especially during the first five years when the diesel generation system is being replaced; and (b) a sound institutional and financial framework. In 1978, the Government reiterated the high priority it accorded to its energy policy by: (a) approving the Fiji Electricity Authority (FEA)'s development program in principle; (b) integrating the electricity sector into a single and more efficient operation under the FEA (paras. 1.07 and 2.04); and (c) allowing tariffs to be increased about 40% in the Suva metropolitan area. A number of development finance institutions apart from the Bank - the Australian Development Assistance Bureau (ADAB), the European Investment Bank (EIB), the Commonwealth Development Corporation (CDC) of the UK, and the Asian Development Bank (ADB) indicated their support both for the Monasavu-Wailoa (Power I) project and the long-term program by joining in an extensive co-financing operation in 1978. Progress on construction of the first Bank project has been satisfactory (para. 2.21 and Annex 4). It augurs well for the success of the entire program.

The Electricity Sector

1.07 Structure. Until 1978, there were two public supply agencies in the country - the Suva City Council and the FEA. Integration of these two agencies had been under consideration for several years and it was brought about during discussions of the Bank's loan 1596-FIJ (para. 2.04). The FEA is now the sole public supply authority in Fiji. It has an aggregate generating capacity of 85 MW and accounts for about 75% of the total electricity production in the country. The balance is generated by two auto-generation plants viz. the Tavua Power Company (TPC) - a subsidiary of the Emperor Gold Mine (EGM) company and the Fiji Sugar Corporation (FSC).

1.08 Privately-Owned Systems. The TPC operates an old 10.5 MW diesel power station at Vatukoula which supplies the gold mine, company houses and a sawmill. Half of the generating capacity has already operated well over 100,000 hours. TPC generates about 40 GWh annually.

1.09 FSC has plant installations aggregating 11.8 MW at four separate mills located at Lautoka, Ba, Raki Raki and Lambassa (Vanua Levu). They operate mainly on cane waste (bagasse) with back-pressure steam turbines and some diesel generation to meet out of season requirements. The total annual generation is about 30 GWh.

1.10 Access to Service. Out of Viti Levu's population of 425,000, about half live in urban or suburban areas in some 35,000 households. They are concentrated in Suva-Nausori area (65%) and eight other townships around the island. It is estimated that about half the population has access to electricity. In most areas of the country which have been electrified, supply is presently adequate. Reliability of supply is satisfactory. Transmission and distribution losses are reasonable (about 9%). Early extension of electricity supply to other islands than Viti Levu and rural areas is an important sector objective.

1.11 Rural Electrification. Rural electrification (RE) is being undertaken both by FEA and by the Public Works Department (PWD) of the Ministry of Communications, Works and Tourism.

1.12 FEA's role in the field of RE has been to provide electricity to customers outside its established area of supply through extensions from its grid and to establish public supplies in new areas only where this is proven to be economic. The prospective community or customer is required to deposit 40% of the estimated capital cost of the connection initially which FEA retains for five years. The customer has to guarantee a minimum annual revenue equal to 20% of the total capital cost; if this takes place the deposit is refunded. If the use is less than the minimum revenue over a five-year period the deposit is forfeited in full. In the past, FEA's average annual connection rate of rural customers has been about 350. It increased to about 1,000 last year.

1.13 The PWD RE program tries to reach rural dwellings in remote areas where connections would be entirely unprofitable for FEA. Supply is arranged through isolated diesel generating sets. Prospective customers have to provide one-sixth of the estimated capital cost on a non-refundable basis and the Government contributes the balance as a grant. The operating charge to the customer consists of an annual fee of F\$100 per dwelling for maintenance plus the actual cost of fuel. After a slow start in 1974/75, PWD's program has recently gained some momentum and so far about 600 dwellings have been electrified, but increasing costs of imported fuel seriously limit expansion of this program.

1.14 Fiji's Seventh Development Plan (1976-80) recognizes the need for rural electrification and stresses the importance of utilizing local energy resources including small-scale hydroelectric potential, organic waste, solar and wind energy. It allocated US\$420,000 for research and US\$1.1 million for implementation of rural electrification schemes. Larger amounts are expected

to be allotted for these purposes under the Eighth Development Plan (1981-85). Implementaton of the Second Power Project will enable further acceleration in the pace of rural electrification in the country.

Bank's Role and Sector Lending Strategy

1.15 The Bank's role in the sector aims to: (i) enable Fiji to meet its electricty requirements from hydro sources thus stabilizing electricity costs and achieving valuable savings in foreign exchange expenditures; (ii) assist in building up a sound national entity; and (iii) ensure that the benefits from these actions are extended as rapidly as possible to rural and other areas hitherto beyond reach of electricity supply. The proposed Second Power Project would enable the Bank to support a sound energy policy and continue its institution-building role, particularly in strengthening FEA's management and training, improvement of its financial statements and accounts and establishing appropriate financial performance targets.

2. THE BORROWER

Legislative Background

2.01 The Borrower, FEA, was established as a statutory authority by an ordinance (No. 20 of 1966) under the Electricity Act in order to ensure development of electricity supply at reasonable prices. FEA has sole responsibility for electricity supply in Fiji, which it can discharge either by setting up and operating its own installations or through issue of licenses over which it has complete control. The ordinance ensures FEA's autonomy in all matters including determination of its tariffs, raising financial resources and employment of staff. The basic weaknesses in the legislation are that it does not: (a) provide the general manager with any statutory functions or powers (para. 2.02); and (b) establish the principle of a rate-of-return objective for its financial operations.

2.02 During discussions of the First Power Project, the Board of the FEA resolved that the then general manager should exercise administrative control over the officers, employees and affairs of the Authority, in accordance with such guidelines as are laid down from time to time by the Board. The chairman then authorized the general manager to do so. Recent changes in incumbency of both the posts of the chairman and the general manager have reversed this arrangement. The Bank informed FEA and the Government that transfer of adequate powers for day-to-day administration and control of staff by the present chairman of FEA to the general manager would be crucial for successful implementation of the project. In the long-term, the situation can be corrected only by appropriate changes in the Act, which Government had originally agreed and is expected to make soon as part of more comprehensive revisions which include incorporation of a financial rate-of-return

revisions which include incorporation of a financial rate-of-return requirement. An assurance was obtained that FEA will take appropriate steps by September 30, 1980 to grant necessary authority to the general manager over the officers, employees and day-to-day affairs of the FEA.

Facilities

2.03 FEA started its first diesel power station at Lautoka, in 1966, with a nucleus of staff transferred from the PWD. Later, it took over and expanded three privately-owned power stations at Singatoka, Nandi and Lambassa and established some new stations. Addition of a major station at Vunda in 1977 increased FEA's generating capacity to 32 MW. Its transmission (33/11 kV) and distribution (11/0.4 kV) systems cover the western areas of the Viti Levu island (Map IBRD 13266R) and the other smaller islands.

2.04 In 1978, FEA took over the electricity department of the Suva City Council (SCCED). This Council had introduced electricity supply in Fiji in 1920 and gradually built up a total installed generating capacity of 53 MW with a compact distribution system in the metropolis and its environs. In recent years, however, SCCED suffered from bad management, poor maintenance of equipment, inadequate training, and little forward planning. The takeover by FEA in mid-1978 was recommended by the Bank (para. 1.07). It was orderly and swift and most of the deficiencies noted above have since been substantially remedied reflecting considerable credit on FEA's management.

2.05 FEA's generating facilities are listed in Annex 1. Its ten diesel power stations have an aggregate effective capacity of about 85 MW. About half of these installations will have outlived their normal utility by the mid-eighties. FEA serves about 35,000 consumers through a fairly extensive 33 kV and 11 kV transmission and distribution system (see map). By mid-1980, a 132 kV transmission line, currently under construction with financial assistance of the ADB, will link the eastern and western areas of the country and it will be the main transmission route conveying hydroelectric energy to the demand centers.

Organization and Management

The Authority

2.06 The Authority consists of a chairman, a deputy chairman, and five members, all of whom are appointed by the Minister of Communications, Works and Tourism to whom FEA reports. The senior partner of a commercial firm in Fiji presently functions as chairman. The permanent secretary of the Ministry of Communications, Works and Tourism and the deputy secretary, Ministry of Finance are the two official members; others are drawn from the private sector. The chairman and members work on a part-time basis.

The Staff

2.07 Day-to-day management is performed by staff appointed by the FEA and headed by a general manager. Since the Bank appraised the first power project, FEA's staff has increased from about 500 to 1,350 due to: (a) takeover of SCCED on July 24, 1978; and (b) the Government's decision in March 1978, agreed to by the Bank to construct the Monasavu Dam and project infrastructure by force account. The deployment of staff is shown below:

| | |
|--------------------------|-----|
| Administration | 38 |
| Engineering - Planning | 31 |
| Generation | 231 |
| Distribution | 432 |
| Power Systems | 71 |
| Finance | 104 |
| Special Project Division | 415 |
| Training | 28 |

2.08 The increase in staff has not been accompanied by any major reorganization of FEA's top management structure although the post of chief engineer in Suva was abolished in 1978. Management is aware that there is a degree of overstaffing mainly on generation and distribution in the Suva area. Steps are being taken to reduce the staff particularly in areas where the development of hydroelectric generation will make them redundant.

2.09 There were significant changes in the top management of the FEA during 1979 due to: (a) the replacement of the former Minister (Finance) as chairman FEA and (b) localization of the post of general manager on the termination of the contract of the former general manager. The new general manager is a former deputy secretary of the Ministry of Communications, Works and Tourism and has administrative experience. However, in view of his limited experience in the field of electricity development and utility practice and the magnitude of the ongoing development program, the Bank felt that the general manager should be assisted by a director (hydro projects), experienced in all aspects of implementation of such a program. The FEA Board and Government agreed and appointed a director acceptable to the Bank.

2.10 The appointment of a chief financial executive which has also been recently advertised internationally is equally important. It was in fact a condition of an Asian Development Bank loan that the post would be filled by about end-1979. The position is urgently required to improve FEA's financial management and to represent FEA in its approaches to international lenders. Since negotiations FEA have made an appointment to this position.

2.11 FEA has recently appointed management consultants, Price Waterhouse and Co. to review its management accounting and reporting systems. The study is being financed by FEA and is expected to be completed and implemented before the end of 1981. In addition to the main task, the consultants will

review the working of the Special Project Division (SPD) of the FEA (paras. 3-5, Annex 4) and make recommendations on the delegation of power to the general manager on a long-term basis. Finally, they are expected to comment on the adequacy of the FEA's organization to meet its needs after the first hydro power station is commissioned. FEA agreed to review the consultants' recommendations on its management accounting and reporting systems with the Bank.

FEA Enquiry Committee

2.12 Arising out of criticisms of FEA's training program in April 1979 (para. 2.14) the Government set up an enquiry committee with comprehensive terms of reference covering FEA's organizational structure and management, its autonomy and responsiveness to the public, its construction program and its operations. It is not expected that the committee's enquiry would result in any radical organizational changes. The Government agreed to review with the Bank the recommendations of the enquiry committee.

Training

2.13 In 1976, FEA established its own training program, with facilities for in-house and on-the-job training. It concentrated on the requirements at subprofessional level up to that of assistant engineer and aimed at training about 130 technicians and about 25 assistant engineers by 1986. Over the last three years, FEA has established an excellent training capability for providing the specialized orientation, retraining and upgrading programs made necessary by the expansion of the power system and the move from diesel to hydro generation.

2.14 During 1979, FEA's training program was reviewed at high governmental level when it was felt that it could be integrated with the Fiji Institute of Technology's (FIT's) ongoing programs to better utilize the facilities established at Ba and achieve economies in expenditure. The enquiry committee appointed by Government (para. 2.12) suggested that FEA's training center be moved in its entirety to Ba. As this would have been a retrograde development, an alternative that was suggested by the Bank was that equipment on order for FEA's proposed mechanical training workshop be installed at FIT's center at Ba and that these facilities be used by FEA for this part of its training program. This has been accepted.

2.15 Although Bank financing has not previously been requested to assist with FEA's training efforts, the time is now opportune for such support, particularly as it applies to the foreign exchange requirement associated with training abroad of Fijian nationals for operating and maintaining the new Wailoa generating station; upgrading and equipping the FEA's linemen's school to enable staff to work on the new 132 kV transmission system, and training of selected staff in FEA in computer programming, simple systems analysis and the

operation of a new accounting system. A sum of US\$300,000 is included in the proposed loan to meet these training requirements. A detailed program was discussed and finalized during negotiations.

Accounts and Audit

2.16 About November each year, the FEA prepares its annual budget for the approval of the Board of Directors. It also prepares financial statements at the end of each fiscal year which are subsequently included in its annual report to the Minister. Under the Act, the FEA is required to present its audited accounts to the Board as soon as practicable.

2.17 FEA is making good progress in transferring its basic accounting function to a computer bureau based in Suva. Customer billing, payroll and job costing are already computerized while plans are in hand to transfer the general ledger, inventory control and the SPD's functions to the computer. Although FEA's basic bookkeeping appears to be good, the form of presentation of its accounts makes it difficult to establish a figure for operating income (for calculation of FEA's rate of return) for the following reasons:

- (a) non-operating income and expenditure is not separated from operating items;
- (b) procedures for allocation of overheads between capital, operations and work carried out for Government do not appear to be consistently applied and need to be reviewed;
- (c) material adjustments made after calculating the profit for the year are not apportioned between capital, operations and work carried out for Government thus further distorting the results for the year.

2.18 During the appraisal FEA indicated that the above matters would be reviewed by its consultants Price, Waterhouse and Co. as part of their study (para. 2.11). This was confirmed during negotiations.

2.19 In the first power loan (Loan 1596-FIJ), FEA agreed to submit its audit report to the Bank within six months of the end of the fiscal year. Its auditors, Messrs. Peat, Marwick, Mitchell and Co. have completed the audit for 1978 but it was not signed until December 1979. The delay was due to FEA's wish to make adequate provision for any contingency which might arise out of the dispute over ownership of land on which the Kinoya power station is located. This dispute was considered by the Privy Council and a decision favorable to FEA was given in mid-December 1979. While the auditor's reports have been comprehensive and are generally appropriate, they do not include an income statement which clearly shows FEA's operating income and expenditures. In addition, FEA's balance sheets do not show the accumulated depreciation; only net fixed asset values are exhibited therein. At

negotiations, FEA agreed to submit its annual financial statements to the Bank (including an income statement and in the case of the balance sheet identifying the provision for depreciation) audited by Peat, Marwick, Mitchell and Co. or other independent auditors satisfactory to the Bank within six months of the end of its fiscal year. The undertakings to submit an income statement and to identify the provision for depreciation are recorded in a supplemental letter.

Insurance

2.20 FEA has arranged a comprehensive insurance program through Bowring Burgess an international firm - for which in 1979 it paid F\$200,000 to cover its operating risks and F\$157,000 to cover works under construction. The main coverage is for fire on buildings, plant and stock and for workers' compensation. FEA is presently considering the insurance company's advice that it should additionally cover fire following earthquakes or caused by riots or strikes, which are now excluded. FEA is also considering other recommendations to reduce its risks. FEA will also need to review its coverage on its diesel power stations which would mostly be shut down after 1982. During negotiations, FEA undertook to take appropriate action on the above by December 31, 1980 and this undertaking was also recorded in a supplemental letter.

Performance on the First Power Project

2.21 The Borrower's performance during the period 1977-1979 has been up to the high expectations at appraisal. On the institution building aspect, the smooth, efficient, and speedy takeover of the SCCED has been remarkable. In regard to project implementation FEA management has been sensitive to both timing of activities and costs. The SPD was built up from scratch to an organization which all concerned, including the SBC, now feel can accomplish the original objective of completing the dam by end 1981. This must also be recognized as a very good effort.

3. THE MARKET AND SUPPLY

Consumption Trends

3.01 Several power market surveys have been carried out and updated since 1973. They were initiated by ENEX of New Zealand Incorporated (ENEX) and continued during 1977 by Merz and McLellan (M/M) who have been associated with Sir Alexander Gibb and Partners (Gibb) - the main consulting engineer for FEA's development program and the hydroelectric projects. The latest update was carried out during mid-1979.

Past

3.02 During the period 1969 to 1978, the demand for electricity in Viti Levu grew at an average annual rate of about 10% as seen from the table

below. The growth in domestic consumption and industry (small and medium) and commerce has been similar, with the latter showing a marginally higher growth rate:

GROWTH OF CONSUMPTION

| | Domestic sales | Commercial and industrial sales | Total sales /a (GWh) | Total sent out | Losses |
|------|----------------|---------------------------------|----------------------|----------------|-------------|
| 1970 | 20.1 | 61.6 | 81.7 | 88.8 | 7.1 (8.0%) |
| 1971 | 23.8 | 69.9 | 93.7 | 101.8 | 8.1 (8.0%) |
| 1972 | 28.1 | 80.3 | 108.4 | 117.6 | 9.2 (7.8%) |
| 1973 | 32.1 | 89.7 | 121.8 | 132.3 | 10.5 (7.9%) |
| 1974 | 32.1 | 92.7 | 124.8 | 135.6 | 10.8 (8.0%) |
| 1975 | 35.3 | 103.7 | 139.0 | 150.8 | 11.8 (7.8%) |
| 1976 | 38.5 | 116.6 | 155.1 | 168.9 | 13.8 (9.9%) |
| 1977 | 41.8 | 125.6 | 167.4 | 182.3 | 14.9 (8.2%) |
| 1978 | 43.8 | 138.6 | 182.4 | 198.0 | 15.6 (7.9%) |

/a Average annual sales growth 10.5%.

3.03 The average rate of growth was significantly higher (13%) during the earlier period (1969-72). It was virtually halted during 1974 when sharply rising oil prices resulted in corresponding electricity tariff increases but the growth continued thereafter at a reduced rate of about 8%. The 40% tariff increase in the metropolitan area (Suva) during 1978 had a similar effect for a few months but demand growth was restored to normal by early 1979.

3.04 Major industrial consumption has not been included in the above figures. Presently this demand is met by the self-generating establishments viz. the EGM and the FSC whose energy production is currently about 70 GWh annually. FSC has an interchange agreement with FEA and it is unlikely to require significant supply from FEA in view of the ample availability of cane waste which it uses as fuel for its plant. The gold mining industry faced a declining trend until mid-1979 when substantial gold price increases and the resolution of local labor problems have revived it. The mine is now expected to continue production for about 15 years and investigations for expansion are under way. It could be an important customer for FEA in the future. Fiji also has prospects for copper mining which have been under investigation for over six years (para. 3.07).

Forecast of Electricity Requirements

3.05 Forecasts of future growth of demand have been made for Viti Levu both by analyzing historical trends and the current situation and by regression analysis of economic growth in Fiji and comparisons of trends in similarly situated countries of the region and elsewhere. Short-term forecasts for the period 1979-83 have also been made by detailed market surveys, identifying the major consumers.

3.06 For the period 1979 to 1983 the analysis of historical trends and the current situation indicates a growth rate of 5%, whereas the detailed power market survey suggests an average annual increase of 7%. Regression analysis by relation with a modest (3%) growth of GDP indicates a growth rate of about 6.3%. During this period factors such as oil supply and prices and electricity tariffs will have a determining effect on demand growth. FEA and the consultants have jointly reviewed the situation and adopted an anticipated growth trend for generation, which follows the lower growth rate (5%) during the period up to 1983 (by which time hydroelectric generation would be adequate) and about 7% thereafter. This forecast is depicted in Annex 3. A range of high and low projections has also been indicated therein.

3.07 Annex 3 indicates separately the likely additional demand of the proposed Viti Copper Mine project at Namosi based on tentative plans of the Viti Copper Company. For some years feasibility studies have been in progress for exploitation of copper and other ores near Namosi. If this development goes ahead it would call for a considerable amount of electricity - about 55 MW of demand and 328 GWh of energy. The demand is of the same magnitude as that expected for the rest of the Viti Levu system by 1988 and it could have a dramatic effect on FEA sales if it is met by that system. FEA's current construction program does not assume that this demand would actually materialize, but its program of investigations of alternative schemes of expansion of electricity generation is based on ensuring preparedness to meet this possibility. A decision on the development of this mining project is expected within the next year or two.

3.08 The anticipated growth curve also does not assume that the EGM demand would be transferred to the FEA system. With prevailing oil price trends this is likely by 1985. The anticipated growth projection is considered the minimum rate of growth of FEA's sales, with the high rate of growth a clear possibility, even without the Viti Copper Project.

Load Factors

3.09 The prevailing annual load factor is of the order of 65%. There are no marked seasonal variations. This is representative of the tropical environment. The annual load factor could decline slightly in the future if the proportion of domestic consumption (now about 20%) should increase due to the strong demand for more low-cost housing. By 1983 the proportion is expected to increase to about 25%; the corresponding load factor would then be about 62%.

Supply

3.10 FEA's aggregate effective installed capacity would be about 120 MW by end-1981 when the Wailoa power station is commissioned. From the standpoint of meeting the peak demand, the effective generating capacity available in the FEA system (allowing for retirement of old diesel generating installations) would be adequate until about 1985 on the basis of anticipated demand growth. However, the firm hydro energy potential of the Monasavu-Wailoa scheme being only 159 GWh, there would be need for substantial diesel energy generation varying from about 75 GWh in 1982 to 150 GWh in 1985. Valued at October 1979 oil prices, this would cost F\$3.75 million and F\$7.5 million respectively. The justification for expediting construction of the project earlier than 1985 when additional capacity would be required arises from the economic advantage of increasing the output of hydroelectric generation as early as is physically possible for fuel saving purposes (para. 6.02).

4. THE PROJECT AND THE PROGRAM

4.01 Description. The project comprises:

- (a) heightening Monasavu dam by 15 m to double its storage; the original dam (70 m high) is a part of the First Power Project (For details see Annex 4);
- (b) construction of two small diversion weirs and about 4.0 km of concrete-lined tunnels of 2.75 m diameter to divert the flow of two neighboring streams, Wainambua and Wainaka;
- (c) extension of civil works of the Wailoa power station (also part of the First Power Project) to its ultimate capacity (80 MW);
- (d) installation of the third and fourth generating sets, 20 MW each, and associated electrical equipment at Wailoa power station; and
- (e) a provision for overseas training of operators and extension of training facilities.

4.02 A description of the ongoing First Power Project, special arrangements for its construction, and the present status of construction are covered in Annex 4. The Second Power Project will increase the firm energy potential of Wailoa power station by 88 GWh annually.

Project Formulation and Status

4.03 Investigations carried out during 1973-78, initially by ENEX and later by Gibb, identified the 40 (2x20) MW Monasavu-Wailoa scheme utilizing the waters of the Nanuku river as the first step in the least cost development

program (para. 1.05). Preliminary studies indicated that development of the potential of the neighboring Wainisavulevu river at two power stations located in that valley would be the next step in the sequence. However, detailed field surveys, hydrological observations, geological investigations and studies carried out by Gibb during 1978 and 1979 led to the conclusion that the cost of the development program could be greatly reduced by the alternative of diverting flows of the Wainisavulevu (and other high-lying intermediate streams draining the Nandrau plateau) on a run-of-the-river basis into an enlarged Monasavu reservoir and increasing the generating capacity at Wailoa power station. It was possible to make the necessary changes in features and design of the Monasavu-Wailoa scheme without changing the target of commissioning of the power station by end-1981 (Annex 6).

4.04 No significant changes were involved in the design of the water conductor system and power station arrangements of the Monasavu-Wailoa scheme as they had been designed for an ultimate capacity of 80 MW. The changes were mainly in the features of the Monasavu dam. The basic design of the dam has remained unchanged but the quantity of fill has increased to more than double the original (1.65 m cu m). This required a detailed review of the construction program. The modifications in design and the revised stage-construction program of the Monasavu Dam (Annex 4), with regard to the mode of construction and safety aspects (para. 4.18), have been reviewed and approved by the Special Board of Consultants (SBC), appointed to oversee the engineering of the First Power Project.

4.05 Considering the possibility of staged development which the scheme of river diversions described in para. 4.03 affords, and the need to keep borrowing commitments at this stage to a minimum, FEA and Government decided to divide the river diversions scheme into two stages, which will enable the first phase (the Second Power Project) to be committed now and completed by May 1983, and the second phase will be committed in FY82 for completion by about the end of 1984. This phase will comprise construction of four diversion weirs and 7.0 km of lined tunnels varying in diameter from 2.25 m to 2.5 m and will increase the firm energy generation at Wailoa power station by 152 GWh. Engineering and construction of access roads will be carried out so as to achieve the above targets. The Bank agrees with this approach.

4.06 The scheme has been investigated in detail. Preparation of detailed designs and specifications of the diversion weirs and tunnels is under way. The critical step in project implementation is the construction of a 5 km access road from Monasavu dam to Wainambua weir site to enable start of construction of the two tunnels by October 1980. Construction on this roadwork will start in May 1980 to ensure its timely completion. The rest are extensions of the ongoing First Power Project and present no particular difficulties.

Project Cost Estimate

4.07 The estimated cost of the project is summarized in the table below and is detailed in Annex 5.

| | Foreign --- (F\$ million) | Local ----- | Total ----- | Foreign --- (US\$ million) | Local ----- | Total ----- |
|--|------------------------------|----------------|----------------|-------------------------------|----------------|----------------|
| (i) Monasavu Dam | | | | | | |
| Additional work | 3.11 | 7.08 | 10.19 | 3.73 | 8.50 | 12.23 |
| (ii) Wainambua and Wainaka | | | | | | |
| Diversions | 0.41 | 2.35 | 2.76 | 0.49 | 2.82 | 3.31 |
| Preliminaries | | | | | | |
| Roads | 0.53 | 0.94 | 1.47 | 0.64 | 1.12 | 1.76 |
| Tunnels/weirs | 5.76 | 3.10 | 8.86 | 6.91 | 3.72 | 10.63 |
| (iii) Generating plant and electrical equipment | 4.47 | 0.44 | 4.91 | 5.36 | 0.53 | 5.89 |
| (iv) Engineering | 2.78 | 1.29 | 4.07 | 3.34 | 1.55 | 4.89 |
| (v) Insurance | - | 1.00 | 1.00 | - | 1.20 | 1.20 |
| (vi) Training | 0.25 | 0.03 | 0.28 | 0.30 | 0.04 | 0.34 |
| <u>Total (base costs)</u> | <u>17.31</u> | <u>16.23</u> | <u>33.54</u> | <u>20.77</u> | <u>19.48</u> | <u>40.25</u> |
| Contingencies | | | | | | |
| Physical | 1.82 | 1.26 | 3.08 | 2.19 | 1.51 | 3.70 |
| Price | 2.95 | 2.09 | 5.04 | 3.54 | 2.51 | 6.05 |
| <u>Total project cost</u> | <u>22.08</u> | <u>19.58</u> | <u>41.66</u> | <u>26.50</u> | <u>23.50</u> | <u>50.00</u> |

4.08 Cost estimates have been prepared separately for the additional works (including modifications) to be carried out at the Monasavu-Wailoa and the Wainisavulevu diversion sites reflecting the arrangements made for their construction.

4.09 Provisions have been made under the item "land and related costs" (Annex 5) for purchase of additional land, royalties and clearing costs based on recent experience of FEA and government forestry officers. The cost of extensions to the diversion tunnel have been estimated from rates under the ongoing tunnelling contract. The additional cost of raising the Monasavu embankment dam have been estimated by calculating the total cost for the dam as heightened and deducting the cost for the original dam height. The estimating procedures adopted by the SPD have been followed for direct costs and allocation of overheads. For estimating the direct costs of the spillway a revised total bill of quantities was prepared. Substantial reductions in rock excavation and some increase in concrete work resulted in a lower base

cost estimate. The cost estimate for the power station extension civil works has been projected from the estimate for similar works under the First Power Project.

4.10 Recent experience of road construction for the First Power Project has been used for estimating the cost of roads for the diversion works. Road routes have been selected and preliminary grade lines and bills of quantities prepared. The rates are based on contract rates applicable for the poor soil and difficult weather conditions expected. Tenders for the Monasavu tunnels constitute the principal basis for the estimates of cost of the diversion tunnels. Indirect costs, e.g., of accommodation, are based on experience with SPD camp costs at Monasavu.

4.11 The cost estimate for generating plant is based on option prices on the third 20 MW generating set at Wailoa, offered by the successful bidder for the supply and installation of the first and second 20 MW sets through international competitive bidding under the First Power project. FEA has negotiated the same price for the fourth generating set, as for the third set, on the basis of concurrent supply and erection of both sets. This is the most economic procedure under these circumstances for this kind of equipment (which has to be specially designed for each application) and it has been accepted by the Bank. The total cost of engineering services for the works of the project including design, procurement and construction supervision is estimated at US\$4.89 million for a total input of about 550 man-months over the period 1979-83. The average base man-month cost is US\$8,890. This includes salaries, costs, fees, international and local travel and subsistence. About 75% of these costs are for foreign expenditures on expatriate staff and overseas disbursements.

4.12 Physical contingencies have been allowed for. These vary for different items from 5% for the dam, where quantities involved have been established with unusual accuracy because of good foundation conditions (as expected during appraisal of the First Power Project), to 20% for the tunnel. Base prices are at late 1979 levels. Reflecting the arrangements made for construction of the project and purchase of major equipment, and the relatively low rate of inflation expected in Fiji during the construction period, price contingencies have been allowed for at 8% per year on both foreign and local costs. FEA is exempt from duties and taxes.

Unit Costs

4.13 The base cost per kW installed under this project works out to about US\$1,000; including physical contingencies and price escalation it would be \$1,214.

Project Financing

4.14 The project is proposed to be financed as follows:

| | <u>US\$ million</u> |
|--------------------------|---------------------|
| IBRD | 15.50 |
| EIB | 16.60 |
| CDC | 4.80 |
| Government contributions | 11.16 |
| Tokai Bank | 1.94 |
| <u>Total</u> | <u>50.00</u> |

4.15 The financing plan envisages similar arrangements to those made under the first power loan (Loan 1596-FIJ) with the Bank, the European Investment Bank (EIB) and the Commonwealth Development Corporation (CDC) participating in a cofinancing package. In addition, a foreign commercial Bank syndicate will be lending to FEA for the first time. The proposed Bank loan of US\$15.5 million will finance about 30% of the cost of the project, and provide for all the foreign costs of training (US\$300,000). It will cover 66% of the total costs of contracts for: (a) tunnels and weirs; and (b) generating plant and associated equipment. The loan would be for 15 years with a 3-year period of grace. FEA would bear the foreign exchange risk of the Bank loan and finance interest during construction of about US\$5.75 million from its own sources of funds.

4.16 The EIB loan of US\$16.6 million equivalent (11.5 million units of account) would, under a joint cofinancing arrangement with the Bank, meet the balance of the costs (i.e. 34%) of items (a) and (b) financed by the Bank (para. 4.15). It will also cover part of the costs of heightening the Monasavu dam and roads. The EIB loan would be repayable over 11-1/2 years, after a 3-1/2 year period of grace, at an interest rate of about 8%. It was negotiated with FEA and Government in March 1979. The signing of the EIB loan would be a condition of effectiveness of the proposed Bank loan. Since the Bank and EIB are jointly financing the total costs of (a) and (b) above, they are considered to be financing both the local and foreign costs of these items in proportion to their respective contributions. In view of the very considerable demands of this project on Fiji's limited resources, its good overall performance in the mobilization of resources (which finance about 70% of public development expenditures) and the crucial importance of replacing existing diesel generation which will produce expected annual foreign exchange savings at the rate of at least US\$16 million from 1982 at existing oil prices, local cost financing is considered to be fully justified.

4.17 With respect to the equity contributions, Government has agreed to contribute F\$9.3 million (US\$11.16 million equivalent) as equity on a specific timetable to be agreed with FEA and the Bank as it did for the first power loan. The CDC would participate in the financing of the additional work on the dam by providing about US\$4.8 million of a total loan to FEA of about STG £ 5 million. The CDC loan would be repayable over 16 years after a 4-year period of grace with interest at 8.75%. It is expected to be approved in May 1980. In addition, a syndicated commercial loan of US\$5.0 million which has been arranged by FEA from the Tokai Bank of Japan primarily to meet the costs of the ongoing First Power Project would be used to provide the balance of funds required. The Tokai Bank and CDC have requested that their loans be incorporated in the co-financing package so as to include the usual protective cross-default provisions. The CDC and Tokai Bank co-financing arrangements will be completed after the proposed Bank loan is signed. In the event of a cost overrun, the Government has agreed to make arrangements to provide any additional funds required to complete the project.

Engineering and Construction

4.18 Gibb, in association with M/M of Australia, is the consulting engineer for engineering and supervision of construction of the First Power Project and will continue to be responsible for implementation of the proposed project. Initially its construction supervision was weak, but this defect has been remedied (para. 4.20). Gibb's performance so far has been generally satisfactory. Continued employment of consultants for the project under terms and conditions satisfactory to the Bank is required under the proposed loan.

4.19 The SBC (para. 4.04) comprises Mr. I.S. Pinkerton of Australia; Dr. P.R. Vaughan of the UK, Dr. Mueller of Austria, and Mr. S. Balasubramanian of India/Zambia. This Board has functioned satisfactorily and has made valuable contributions to the work of preconstruction investigations, designs and construction supervision. It will continue with the same members and responsibilities on the proposed project.

4.20 Heightening of Monasavu dam and powerhouse extensions will be carried out by force account by FEA's SPD, under Gibb's supervision (Annex 4). Gibb has a resident engineer at Monasavu dam (Mr. N. Worner) who has wide experience of dam construction in Australia and is providing the leadership which SPD requires. SPD itself is headed by a competent group of enthusiastic engineers selected by FEA and Gibb during 1978, who have already given a good account of themselves under extremely difficult conditions of work at site during the past two years.

4.21 Construction of the roads, tunnels, shafts and diversion weirs of the project will be carried out by a contract let after ICB. The modifications to the tunnel works and steel lining (extensions) will be carried out by the contractor for these works under the First Power Project as an extension of the contract. Supply and erection of the third and fourth generating sets will be arranged on the lines explained in para. 4.11. The implementation program is summarized in Annex 6.

Procurement and Disbursement

4.22 Procurement of goods and services will be handled separately for those sections of the project being constructed by force account and through contract. Bank guidelines will be followed for procurement by contract through ICB. Contractors for Bank-financed civil works will be prequalified in consultation with the Bank.

4.23 The proceeds of the proposed Bank loan would be disbursed against normal documentation, on the basis of: (a) 66% of the total cost of civil works contracts for construction of tunnels and weirs; (b) 66% of the total cost for the supply and erection of the generating plant and associated electrical equipment; and (c) 100% of foreign expenditures for training. The estimated schedule of disbursements of the Bank loan is shown in Annex 7. The closing date would be December 31, 1983.

Environment

4.24 Surveys carried out by Gibb in consultation with the environmental adviser to the Fiji Government and the University of South Pacific have revealed no significant adverse effect as a result of the project. There is no habitation in the project area nor are there any artifacts of any significance which will be affected. The Department of Health has expressed the opinion that there are no diseases existing in the rest of Fiji which do not exist in the area adjacent to the project sites. The environmental effects of the project are therefore minimal and within the capacity of the Fiji authorities to cope.

Risks

4.25 The risks associated with the proposed project are the uncertainties inherent in all hydroelectric projects, such as possible geological problems, hydrological complexities, and similar matters. However, the thorough and competent preparatory work undertaken by FEA and the consultants, as well as the precautions taken in organizing and supervising the construction work (such as the establishment of the Special Board of Consultants), are expected to keep the risks to a minimum.

FEA's Development Program

4.26 FEA's development program (para. 1.05) envisages an investment of about F\$182 million during the period 1980-86 as summarized below and detailed in Annex 8.

| | <u>Foreign</u> ---- (US\$ million) ---- | <u>Local</u> million) | <u>Total</u> ---- | <u>F\$ million</u> |
|-----------------------|--|--------------------------|----------------------|--------------------|
| (a) Generation | 80.4 | 68.4 | 148.8 | 124.0 |
| (b) Transmission | 24.5 | 12.7 | 37.2 | 31.0 |
| (c) Distribution | 9.3 | 9.4 | 18.7 | 15.6 |
| (d) Other investments | 7.0 | 7.0 | 14.0 | 11.7 |
| <u>Total</u> | <u>121.2</u> | <u>97.5</u> | <u>218.7</u> | <u>182.3</u> |

4.27 The program is based on a sound energy policy and is appropriate. If the Viti Copper project (para. 3.07) materializes or if demand growth were to follow the high growth indications as a result of the demand of industry the program would need to be revised bringing forward the implementation of the next major hydro-electric power station. This would only affect the investment program during the last three years of the 1980-86 period, and there is sufficient time to review the program in the context of future trends in demand growth.

5. FINANCIAL ASPECTS

Past Performance and Present Position

5.01 Following the takeover of SCCED in July 1978 (para. 2.04) FEA changed its fiscal year from August 1 to July 31, to the calendar year. FEA's operating results for the fiscal year ended July 31, 1978 and for the remaining five months to December 31, 1978 are shown in Annexes 9-11. Both sets of statements reflect the consolidation of SCCED's accounts with those of FEA. The accounts for the five-month period include the results from the supply of electricity to all FEA's consumers including those formerly supplied by the SCCED. While the takeover did significantly change FEA's financial position, its impact had largely been taken into account when preparing the financial forecasts for the first power project. The change in its fiscal year has also made comparison of the results for 1978 and 1979 less meaningful.

5.02 Electricity sales increased about 4.8% in the year ended July 31, 1978 and sales for CY79 were about 6% higher than those for CY78. Compared to the forecast when the first power project was appraised, the actual sales growth was lower than expected. However, FEA's financial performance has improved despite little change in the average revenue per unit sold because average costs per unit sold declined initially following the takeover of the SCCED. The reduction in costs was achieved through economies made following the takeover of the SCCED and the capitalization of costs of repairing the plant acquired from SCCED which had been inadequately maintained. For the five-month period ending December 31, 1978, FEA earned a rate of return on

average net fixed assets in service (after revaluation) of about 4%. Net income increased from F\$139,000 in FY78 to F\$985,000 for the five-month period to December 31, 1978. However, in 1979 net income fell to F\$325,000 as interest payments on funds borrowed for Monasavu increased. Despite the fall in net income, operating income provided about the same return on assets as for the five-month period ending December 31, 1978.

5.03 In 1979, FEA carried out a valuation of all of its fixed assets after taking over the SCCED assets in accordance with procedures agreed with the Bank prior to the signing of the first power loan in 1978. Pertinent points were:

- (a) all assets would continue to be recorded in FEA's books at historical or acquisition values;
- (b) revaluation of assets would be on a notional basis and used only for the purpose of calculating FEA's financial performance; and
- (c) operating income would be adjusted to take account of higher depreciation based on revalued gross fixed assets for the same purpose as in (b).

5.04 The valuation was undertaken to establish a suitable rate base and a method for annual revaluations of FEA's assets on which an appropriate agreed rate of return could be achieved.

5.05 The valuation put FEA's fixed assets at F\$52.8 million or about 86% higher than values recorded in its books as at December 31, 1978. Of the total fixed assets, 45% is generating plant which is expected to be displaced once the Monasavu-Wailoa hydro project is fully commissioned early in 1983.

5.06 The takeover of the SCCED increased FEA's net fixed assets by F\$9.4 million, its current assets and liabilities by F\$1.9 million and it assumed SCCED's long-term debts amounting to F\$6.9 million. FEA agreed to pay SCC F\$200,000 annually for 87 years (F\$6.1 million @ 3%), to provide 5 years free streetlighting to Suva (at a total cost of F\$300,000) and to meet the costs of reconditioning diesel plant, formerly owned by the SCCED, at a cost of F\$1.5 million. The net effect of the takeover in FEA's books was that FEA paid F\$3.5 million as goodwill. It plans to amortize this amount after Monasavu is commissioned.

5.07 After the takeover, FEA's balance sheet reflected a higher level of long-term debt because of its acquisition of SCCED and its long-term debt. Its debt/equity ratio which increased from 57/43 as of July 1977 to 71/29 a year later. By December 31, 1978 it improved to 67/33 as the Government increased its equity contributions for financing the Monasavu project but by the end of 1979 it was again above 70/30; the level at which under the first power project (Loan 1596-FIJ), it was agreed that FEA should not undertake

additional borrowing without the concurrence of the Bank. Accordingly, during 1979 it has consulted with the Bank on its planned borrowings. However, now that FEA's assets have been revalued, its financial performance and debt/equity ratio should be determined after taking account of the effects of the assets revaluation. Thus if the debt/equity ratio is adjusted to include the reserve arising from revaluation of assets it would be about 49/51. This figure indicates that FEA can afford to incur additional debt in financing its future expansion.

5.08 The current ratio position has declined since July 1978, as the FEA's commitments to lenders and for the Monasavu construction increased. In the latter part of 1978 and in 1979, FEA has resorted to short-term borrowing prior to entering into longer-term commitments. The 1979 commitment was arranged through the Government's Central Monetary Authority to prevent FEA's plans for foreign commercial borrowing from competing with the Government's borrowing program. FEA has since arranged its own commercial borrowing through the Tokai Bank (Japan) and a loan of US\$5.0 million equivalent is expected to be contracted under a co-financing arrangement with the Bank.

5.09 Since the end of fiscal year ended July 31, 1978, FEA's debt service coverage from internal sources has improved from 1.6 times to 2.7 times for the period to December 31, 1978 and was sufficient to provide 1.8 times coverage for FY79. This is an adequate level of coverage.

Financing Plan

5.10 Following the Bank's October 1979 appraisal of the proposed Project FEA acted quickly by firming up its financing needs for fiscal 1980 and for the project and as a result has already been able to obtain the remaining funds needed to complete its financing plan for the Project. It arranged two local bond issues; one in December 1979 for F\$2.5 million and the other in January 1980, for F\$3.0 million. In addition, the Fiji National Provident Fund (FNPF) is lending FEA F\$10 million in the form of a 20-year loan with interest at 9.75%. Also, as mentioned previously (para. 5.08), FEA has secured a commitment for a loan of US\$5.0 million from the Tokai Bank of Japan and a loan of STG £ 5 million from CDC is expected to be approved shortly. The proposed financing plan for FEA's system development program during the construction period of the project (1979-83) is given in the following table:

FINANCING PLAN FOR FEA'S SYSTEM DEVELOPMENT PROGRAM 1979-83

| | Project construction period FY79-83 | | |
|------------------------------------|--|--------------|------------|
| | F\$ | US\$ | % |
| | million | million | |
| <u>Sources of Funds</u> | | | |
| <u>Internal Sources</u> | | | |
| Gross internal sources | 56.2 | 67.4 | 31 |
| Less: Debt service | (43.0) | (51.6) | (24) |
| Net variations in working capital | (15.6) | (18.7) | (8) |
| <u>Net internal sources</u> | <u>(2.4)</u> | <u>(2.9)</u> | <u>(1)</u> |
| <u>External Sources</u> | | | |
| Government equity contributions | <u>32.2</u> | <u>38.7</u> | <u>18</u> |
| <u>Borrowing</u> | | | |
| Proposed second power loan | 12.9 | 15.5 | 7 |
| IBRD - Loan 1596 | 12.5 | 15.0 | 7 |
| EIB | 28.5 | 34.2 | 16 |
| ADB | 13.5 | 16.2 | 8 |
| CDC | 18.7 | 22.4 | 10 |
| Tokai Bank loan | 4.2 | 5.0 | 2 |
| Local loans | 22.5 | 27.0 | 13 |
| Loans (to be arranged) | 36.0 | 43.2 | 20 |
| <u>Total borrowings</u> | <u>148.8</u> | <u>178.5</u> | <u>83</u> |
| <u>Total sources of funds</u> | <u>178.6</u> | <u>214.3</u> | <u>100</u> |
| <u>Applications of Funds</u> | | | |
| Proposed Second Power Project | 41.7 | 50.0 | 23 |
| Other investments | 122.5 | 147.0 | 69 |
| Interest during construction | 14.4 | 17.3 | 8 |
| <u>Total investments</u> | <u>178.6</u> | <u>214.3</u> | <u>100</u> |
| <u>Total applications of funds</u> | <u>178.6</u> | <u>214.3</u> | <u>100</u> |

5.11 The plan shows FEA would finance its total investment needs (including interest charged to construction) from equity contributions by Government (15%) and borrowings (85%). The Bank's contribution to the financing plan comprising the first power loan and the proposed loan represents about 14% of the total requirement. Local lenders are already providing 13% but the figure could increase since it is likely they will provide a portion of the loans to be arranged (about 20% of the total). As was the case under the Power I project, FEA is unlikely to be able to contribute funds from its own sources for financing expansion during the project construction period. The fuel price increases in 1979 have placed a severe burden on FEA's consumers at the time when its construction expenditures are at their peak.

5.12 The proposed financing plan would enable FEA to see its way through an expansion phase in which its funding needs will be exceptionally high. The plan depends heavily on continued Government equity contributions particularly through 1982. One of the significant risks is the possibility of delay in the commissioning of the Wailoa generating units which would slow the improvement in FEA's cash flow which is forecast to begin in 1982 as its use of diesel fuel for generation is phased out. FEA and Government are aware of this risk and are making every effort to avoid any delay.

Tariffs

5.13 Although FEA has made modifications since 1978 to its rate structure to reduce the number of blocks in its domestic and commercial tariffs, it still uses declining block tariffs. This type of tariff structure is no longer favored by most power utilities since it encourages electricity consumption and is inappropriate when fuel costs are rising rapidly. Its continued application is not suited to the current situation in Fiji as existing rates are not sufficient to cover the expected increased marginal costs of supply from the diesel plant. After the hydro plant is commissioned in 1983 this latter position may be reversed. FEA is currently reviewing its tariffs with the assistance of consultants (Electrowatt Engineering Services, Ltd. of Switzerland) financed under a technical assistant agreement with the ADB. The consultants commenced their work in November 1979 and a report is expected about mid-1980. The consultants terms of reference provide for a review of the level and structure of FEA's tariff rates taking account of the marginal costs of supply to each consumer category. They will also look at FEA's financial viability in the context of its ability to carry out Fiji's long-range power development program and to review the provisions of the Electricity Act relating to tariffs.

5.14 At negotiations, FEA agreed to inform the Bank of any changes proposed to its rates and to make available to the Bank the results of the tariff study at least one month prior to taking any action and furnish the Bank any proposals for major modifications to its tariff structure.

5.15 FEA's average tariff in 1979 was about Fc9.4 per kWh (USc11.3 equivalent) as compared to Fc9.2 per kWh (USc10.1 equivalent) in 1978.^{/1} Although it would appear from these average rates that no change in the level of tariff rates has occurred since 1978, this is not the case. In July 1978, following the takeover of the SCCED, consumers in the Suva area were subjected to FEA's rates which at that time were about 40% higher than those being paid by SCCED consumers. Despite this increase the average revenue contributed by Suva consumers was less than FEA's existing market due to the larger number of domestic consumers in Suva who were charged rates lower than those of commercial customers. In addition, rates were uniformly increased for all FEA's customers by 7% in August 1979 and by a further 12% in October 1979. These latter increases served to partially offset the increased cost of diesel fuel which escalated from a level of about F\$127 a tonne in January 1979 to F\$238 a tonne at the end of 1979 (an increase of 87% for the year). Tariffs were increased by a further 10% effective April 1, 1980.

Future Financial Position and Covenants

5.16 FEA's hydro development program, which began in 1978, will result in the replacement of almost all of its existing generating plant by 1983. The cost of replacing this plant over a short period is placing a considerable financial burden on FEA, its consumers, and the Government. Following the large and unexpected increases in oil prices, FEA's consumers are facing substantial tariff increases in 1980 which will result in average rates being about 60% higher than in 1979 making them about USc18 per kWh, which would put Fiji's rates 2-3 times higher than those paid in most other countries. As a result some consumers are already turning to alternative fuels such as imported bottled gas for cooking and FEA's forecast market growth is expected to be low at least through 1983 (about 5%). The FEA and Government are in these circumstances reluctant to push rates any higher to provide funds for construction from its consumers. The Government is meeting its share of the cost of the hydro expansion by contributing US\$32 million as equity or 15% of FEA's needs during the construction period of this project.

5.17 The financial forecasts in Annexes 9-11 show FEA's expected financial performance through 1986. The assumptions used for preparing the forecasts are given in Annex 12. During appraisal, the Bank informed the Fijian authorities that it would wish to agree on a specific rate of return objective in accordance with the agreement reached in the loan agreement for the First Power Project. The Bank also suggested that FEA adopt an automatic tariff rate adjustment mechanism because FEA was reluctant to pass on rising fuel costs to its consumers. At negotiations, FEA asked for more time to establish a suitable method for future revaluation of its assets. On the question of fuel costs, both the Government and FEA wished to avoid an automatic tariff rate adjustment mechanism because they considered the rates

^{/1} US\$1 was equivalent to F\$0.91 in May 1978 but has since declined to about US\$ = F\$0.835.

were already too high. Furthermore, any adjustment mechanism would be irrelevant to FEA after 1981 when the first hydro units would be commissioned and oil consumption would begin to decline. Accordingly, the Bank agreed to defer implementation of a rate or return objective until 1982, and instead agreed with FEA that it would set tariffs to provide internally generated funds of F\$1.5 million in the years 1980 and 1981. This level of cash generation corresponded to that being planned by FEA in its 1980 budget and financial projections for 1981. Although no automatic tariff adjustment mechanism has been agreed, FEA's agreement to a specific level of cash generation based on tariffs will ensure recovery of fuel costs in the next two years. After 1981, FEA agreed to maintain tariffs to produce an annual rate of return on its revalued net fixed assets in operation of 8% beginning in 1982. For this purpose the Bank and FEA will agree on a method for revaluation of assets by December 31, 1981.

5.18 The financial forecasts shown in Annex 9-11 reflect the agreed level of cash generation for 1980 and 1981 and the effects of applying an 8% rate of return on revalued assets after 1981. FEA's plant is assumed to be revalued annually to reflect an increase in the current price level of 10%. The forecasts shows FEA's operating ratio would improve from 90% in 1979 to 41% in 1986, reflecting the lower costs of operations and maintenance of hydro plant compared to diesel and the almost complete elimination of the use of diesel fuel. FEA's debt/ equity ratio after taking account of the surplus arising from revaluation of assets will rise to 64/36 in 1982 but after the proposed project is commissioned will improve rapidly to 45/55 in 1986. This would represent a healthy position. The current ratio would be above 2 in all years except 1981 when it would be about 1.6. These levels will provide FEA with adequate liquidity to meet its commitments during the forecast period.

5.19 With an 8% rate of return beginning in 1982, debt service coverage and cash generation would be low. Debt service will remain low (between 1 and 1.2 times coverage) through 1986. However, the contribution to investment will improve in 1985 and 1986 to 12% and 72% respectively as the hydro development and the strengthening of the 132 kV transmission are completed. Since the hydro system will have a life in excess of 50 years and it is being financed by loans repayable over 10-16 years, it would be reasonable for FEA to roll over some of its debt repayments. The forecasts are not based on this assumption but in practice FEA would be able to follow this procedure especially as its projected level of debt/equity will be well below the 70/30 limit agreed under the first power loan. Debt rollover would also improve FEA's cash generation.

6. JUSTIFICATION

Least Cost Solution

6.01 Studies which led to formulation of FEA's 25-year development program (1977-2001) in 1977 had established that the most economic sequence of expansion of generating capacity for Fiji's Viti Levu island until the turn of the century was a series of hydroelectric projects, interconnected to provide a mixed diesel-hydroelectric operating system. Existing diesel stations would be operated as peak load stations to the extent of their normal utility and the timing of new hydroelectric capacity determined accordingly. The program has been reviewed in the context of the prevailing oil prices and the updated electricity demand forecast.

6.02 The following alternatives were considered during the review:

- (a) no further hydroelectric projects would follow the Monasavu-Wailoa project, maximum use would be made of existing diesel capacity and new diesel installations would be added as required;
- (b) same as (a) above except that the thermal additions would be through a combination of steam (coal-fired) and diesel installations;
- (c) the 1977 development program (para. 6.01) modified to incorporate results of field investigations during 1977-79 (para. 4.03); and
- (d) earliest practicable development of an all-hydroelectric operating system, with existing diesel installations either retired or used only as system standby.

Alternative (d) was found to be the most economic alternative for discount rates up to 11% using end 1979 oil prices even for the lowest anticipated demand growth rate. If oil prices are assumed to increase at 3% annually the conclusion would be valid for discount rates up to 13%. On this basis, the timing of construction of the project for completion by 1983 is appropriate.

Internal Economic Rate of Return

6.03 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 benefit streams are shown in Annex 13. The costs are net of taxes and include those associated directly with the project. The project includes some features e.g., storage, water-conductor system capacity, relevant to the project which will follow. To that extent costs are overstated. No additional investments on transmission or distribution are needed for this project. Ideally the benefits should be measured in terms of the consumers' willingness to pay, but since this is

practically impossible to evaluate, the incremental revenue (based on the average price per unit sold in 1979) of the Project during the estimated life of the plant was used as a proxy for total benefits in addition to fuel savings in the early years. This is a minimum measure of the project benefits as consumers surpluses are ignored in the analysis. On this basis, the IERR is at least 15%.

7. AGREEMENTS REACHED AND RECOMMENDATION

Agreements Reached

7.01 During negotiations, agreements were reached with the Government and FEA on the following:

- (a) FEA will take appropriate steps by September 30, 1980 to grant necessary authority to the general manager over the officers, employees and day-to-day affairs of the FEA (para. 2.02);
- (b) FEA will review the consultants' recommendations on its management and reporting systems with the Bank (para. 2.11);
- (c) Government will review with the Bank the recommendations of the enquiry committee (para. 2.12);
- (d) FEA will submit its annual financial statements to the Bank within six months of the end of its fiscal year (para. 2.19);
- (e) FEA will take appropriate action by December 31, 1980 to improve its insurance coverage and to reduce risks on the basis of the recommendations of its insurance consultants (para. 2.20);
- (f) Government would contribute F\$9.3 million as equity on a specific timetable to be agreed with FEA and the Bank and would make arrangements to provide any additional funds required to complete the project in the event of a cost overrun (para. 4.17);
- (g) FEA would continue to employ consultants for the project under terms and conditions satisfactory to the Bank (para. 4.18);
- (h) FEA will inform the Bank of any changes it proposes to make to its rates and to make available to the Bank the results of its tariff study at least one month prior to taking any action and to furnish the Bank any proposals for major modifications to its tariff structure (para. 5.16);

7.02 The signing of the EIB loan would be a condition of loan effectiveness (para. 4.17).

Recommendation

7.03 With the above agreements, the project is suitable for a Bank loan of US\$15.5 million for 15 years, including a three year period of grace.

FIJI

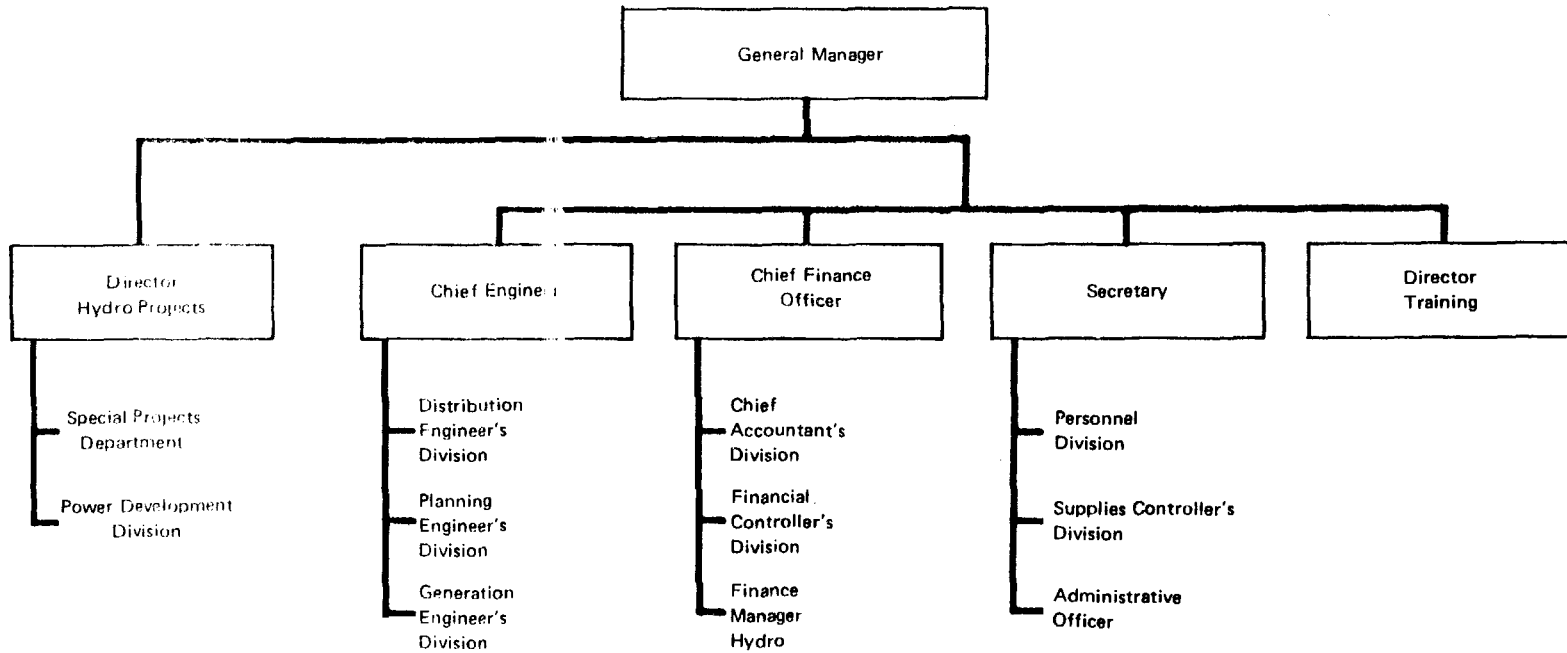
SECOND POWER PROJECT

FFA's Diesel Generating Facilities (Viti Levu) /a

| Station and machine no. | Machine make | Type | Site rating (kW) | Total capacity (kW) | Speed (rpm) | Year first commissioned | Present age of units (years) | Operating hours | Retirement (after 20 yrs) | |
|-------------------------|--------------|--------------------|------------------|---------------------|-------------|-------------------------|------------------------------|-----------------|---------------------------|------|
| Suva: | No. 3 | English Electric | 5L | 410 | 375 | 1946 | 33 | 53,188 | - | |
| | " 5 | Ruston - Hornsby | 6VLBX | 740 | 375 | 1953 | 26 | 88,568 | - | |
| | " 6 | English Electric | 6SRL | 735 | 375 | 1956 | 23 | 124,001 | - | |
| | " 7 | English Electric | 6SRL | 735 | 375 | 1955 | 24 | 128,525 | - | |
| | " 8 | Ruston - Hornsby | 8VLBX | 1,060 | 375 | 1958 | 19 | 114,603 | 1981 | |
| | " 9 | Ruston - Hornsby | 8VLBX | 1,060 | 375 | 1958 | 19 | 118,385 | 1981 | |
| | " 10 | Ruston - Hornsby | 8VLBX | 1,060 | 375 | 1961 | 18 | 100,536 | 1982 | |
| | " 11 | Ruston - Hornsby | 8VLBX | 1,060 | 375 | 1961 | 18 | 111,888 | 1982 | |
| | " 12 | Ruston - Hornsby | 8VLBX | 1,900 | 428 | 1962 | 17 | 69,063 | 1983 | |
| | " 13 | Ruston - Hornsby | 8VLBX | 1,900 | 428 | 1964 | 15 | 95,504 | 1985 | |
| | " 14 | Mirrlees | KVSS16 | 2,842 | 13,502 | 428 | 1966 | 13 | 56,497 | 1987 |
| Kinoya: | No. 1 | Mirrlees | AVSS16 | 5,000 | 375 | 1970 | 9 | 30,697 | | |
| | " 2 | Mirrlees | AVSS16 | 5,000 | 375 | 1971 | 8 | 12,182 | | |
| | " 4 | Mirrlees | kV16 Major | 5,070 | 500 | 1972 | 7 | 39,142 | | |
| | " 5 | Mirrlees | kV16 Major | 5,070 | 500 | 1972 | 7 | - | | |
| | " 6 | Crossley Pielstick | 14PC3V | 9,500 | 428 | 1977 | 2 | 9,003 | | |
| | " 7 | Crossley Pielstick | " | 9,500 | 39,140 | 428 | 1977 | 2 | 10,286 | |
| Vunda: | No. 1 | Mirrlees | kV16 Major | 5,700 | 500 | 1977 | 2 | 10,447 | 1998 | |
| | " 2 | Mirrlees | kV16 Major | 5,700 | 11,400 | 500 | 1977 | 2 | 8,806 | 1998 |
| Nandi: | No. 5 | Blackstone | EVS8 | 365 | 600 | 1959 | 20 | 68,211 | 1986 | |
| | " 6 | Blackstone | EVS8 | 365 | 600 | 1963 | 16 | 51,606 | 1984 | |
| | " 7 | Mirrlees | K6 Major | 1,620 | 500 | 1969 | 10 | 36,213 | 1990 | |
| | " 8 | Mirrlees | K6 Major | 1,620 | 500 | 1969 | 10 | 32,604 | 1990 | |
| | " 9 | Mirrlees | K7 Major | 2,200 | 500 | 1971 | 8 | 25,733 | 1992 | |
| | " 10 | Mirrlees | Ky Major | 2,200 | 8,370 | 500 | 1973 | 7 | 23,609 | 1993 |
| Lautoka: | No. 1 | English Electric | 5SRL | 533 | 375 | 1951 | 28 | 64,887 | - | |
| | " 2 | English Electric | 5SRL | 533 | 375 | 1951 | 28 | 62,650 | - | |
| | " 3 | English Electric | 5SRL | 533 | 375 | 1951 | 28 | 58,934 | - | |
| | " 4 | Ruston | 6ATC | 1,144 | 600 | 1972 | 7 | 30,512 | 1993 | |
| | " 5 | Ruston | 6ATC | 1,144 | 600 | 1973 | 6 | 14,312 | 1994 | |
| | " 5 | Ruston | 6ATC | 1,144 | 600 | 1974 | 5 | 16,184 | 1995 | |
| | " 6 | Ruston | 6ATC | 1,144 | 6,175 | 600 | 1974 | 5 | 14,295 | 1995 |
| Singatoka: | No. 1 | English Electric | 5SRL | 535 | 375 | 1951 | 28 | 62,444 | - | |
| | " 2 | English Electric | 5SRL | 535 | 375 | 1951 | 28 | 66,780 | - | |
| | " 3 | Ruston | 6ATC | 1,144 | 375 | 1973 | 6 | 22,922 | 1994 | |
| | " 4 | Ruston | 6ATC | 1,144 | 3,358 | 600 | 1974 | 5 | 15,549 | 1995 |
| Deumba: | No. 1 | Ruston | 7VEB | 248 | 500 | 1955 | 24 | 93,438 | - | |
| | " 2 | Ruston | 7VEB | 248 | 500 | 1954 | 25 | 94,144 | - | |
| | " 3 | Ruston | 7VEB | 248 | 500 | 1961 | 18 | 77,274 | 1982 | |
| | " 4 | Ruston | 6VEBC | 508 | 600 | 1964 | 15 | 33,312 | 1985 | |
| | " 5 | Ruston | 6VEBC | 508 | 600 | 1966 | 13 | 49,290 | 1982 | |
| | " 6 | Nigata | | 400 | 600 | 1979 | 0 | 445 | 2000 | |
| | " 7 | Nigata | | 400 | 2,560 | 600 | 1979 | 0 | 527 | 2000 |
| Rakiraki: | No. 1 | Caterpillar | 3406 | 155 | 1,500 | 1977 | | | | |
| | " 2 | Caterpillar | 3406 | 155 | 310 | 1,500 | 1977 | | | |

/a total effective capacity in 1980 about 85 MW.

**FIJI
FIJI ELECTRICITY AUTHORITY (FEA)
ORGANIZATIONAL STRUCTURE**



FIJI
SECOND POWER PROJECT

Growth of FEA's Power Market in Viti Levu
(in GWh)

| Year (Ending Dec. 31) | Anticipated | | Low | | High | |
|-----------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | Excluding Viti copper | Including Viti copper | Excluding Viti copper | Including Viti copper | Excluding Viti copper | Including Viti copper |
| 1980 | 212 <u>/a</u> | - | 212 | - | 232 | - |
| 1981 | 223 | - | 223 | - | 247 | - |
| 1982 | 234 | - | 234 | - | 262 | - |
| 1983 | 249 | - | 249 | - | 279 | - |
| 1984 | 265 | 280 | 261 | 277 | 297 | 313 |
| 1985 | 284 | 328 | 275 | 319 | 315 | 359 |
| 1986 | 303 | 593 | 288 | 578 | 335 | 625 |
| 1987 | 325 | 630 | 303 | 608 | 356 | 661 |
| 1988 | 347 | 693 | 318 | 664 | 379 | 725 |
| 1989 | 372 | 723 | 334 | 685 | 403 | 754 |
| 1990 | 398 | 757 | 350 | 709 | 428 | 787 |
| 1991 | 426 | 790 | 368 | 727 | 455 | 814 |
| 1992 | 455 | 824 | 386 | 745 | 484 | 843 |
| 1993 | 487 | 861 | 406 | 780 | 515 | 889 |
| 1994 | 521 | 905 | 426 | 810 | 547 | 931 |
| 1995 | 558 | 944 | 447 | 833 | 582 | 968 |
| 1996 | 597 | 974 | 469 | 846 | 619 | 996 |
| 1997 | 639 | 1,017 | 493 | 871 | 658 | 1,036 |
| 1998 | 683 | 1,065 | 518 | 900 | 699 | 1,081 |
| 1999 | 731 | 1,121 | 544 | 934 | 744 | 1,134 |

/a Corresponds to 28% capacity factor on the available 85 MW diesel capacity.

FIJI

SECOND POWER PROJECT

Status of Construction of Monasavu-Wailoa (Power I)
Hydroelectric Project

Description

1. The project, as originally authorized involved the following works:
 - (a) a 70 m high, zoned embankment dam across the Nanuku stream in the upper reaches of the Wainivondi River (Rewa basin) upstream of Monasavu Falls. The dam was to be about 200 m long at its crest with an impervious core of locally available red clay (residual soil), surrounded by filters and rock fill shells. The total volume of fill (rock and earth fill) was estimated at about 750,000 cu m. A 5 m diameter concrete-lined diversion tunnel, 325 m long, on the left bank was proposed to deal with river flows during construction, and an ungated, reinforced concrete chute spillway (50 m wide at the top narrowing down to 30 m) on the right bank to deal with overflows after construction of the dam;
 - (b) a water conductor system comprising:
 - (i) a concrete-lined, 2.5 m diameter, low pressure tunnel, 2,400 m long;
 - (ii) a vertical, concrete-lined surge shaft 6.5 m in diameter and 75 m high; and
 - (iii) a steel lined pressure shaft, 1.8 m, in diameter, with a sloping (40 degrees) section 850 m long, and a horizontal length of 2,000 m. The steel lining will vary between 20 and 35 mm in thickness; and
 - (c) an overground power station on the left bank of the Wailoa River designed for an ultimate installation of four 20 MW generating sets of which only two sets were to be installed initially.
2. The commissioning of Wailoa power station was scheduled for end-1981. The cost of the project was estimated at F\$49.36 million (para. 14). The average annual energy generation expected was 200 GWh of which 180 GWh would be firm. After a recent review of the hydrology of the project in July 1979 the corresponding figures are now 180 GWh and 159 GWh respectively.

Method of Construction

3. Considering (a) the serious financial consequences of any delay in dam construction; (b) the remoteness of Fiji from the main industrial economies; and (c) problems of cost overruns and delays experienced in Fiji when relying solely on foreign contractors on an earlier Bank-assisted project the Bank accepted the Fiji Government's decision to construct the project infrastructure, the embankment dam, spillway, intake and powerhouse civil works (which account for about 25% of the cost of the project) by force account. The work was to be carried out through an autonomous Special Project Division (SPD) set up as part of FEA under terms and conditions laid down by the Bank (para. 4). The fact that grant financing from ADAB was available to finance goods and services required by SPD ensured overall economy to Fiji. The construction of the tunnels and supply and erection of the generating sets was to be done by contracts arranged through ICB.

4. The Bank agreed to the force account method of construction on the following stipulated conditions:

- (a) employment of a Special Board of Consultants (SBC) to review project designs before and during construction and to review construction;
- (b) preparation of plans, construction drawings, specifications and detailed cost estimates before undertaking any construction;
- (c) maintenance of separate accounts by SPD;
- (d) consultation with the Bank on the organizational structure of SPD and on the appointment of key personnel; and
- (e) consultation with the Bank before SPD undertakes any additional work other than that specifically agreed.

It was anticipated that in this manner local expertise would be developed to assist FEA in implementing its long-term program and that the SPD would meet the country's need for developing a competent local construction organization.

Progress of Implementation

5. The establishment of the SPD and the construction of the water-conductor system were recognized as the critical steps of a tight 4-year construction program to be implemented under difficult climatic conditions of incessant and heavy rainfall and inaccessible virgin territory. FEA and the Government have done well in quickly building up the SPD and acquiring the necessary construction plant and equipment. Starting from March 1978

SPD was built up to its full strength by mid-1979. While it has been possible to recruit the right calibre of staff for key SPD posts, the experience of obtaining Fijian personnel for construction supervision proved disappointing. More expatriates (8) had to be recruited at this lower level than originally anticipated, but efforts are being made to associate local staff as understudies to achieve long-term objectives. Some 25% more construction equipment had to be procured than Gibb originally estimated. Notwithstanding initial difficulties in building up the SPD and ensuring that its work simulates that of a contractor as far as practicable, it can be recorded at this stage that most of the teething problems have been overcome and that the SPD is now functioning as an effective construction organization.

6. The SBC was constituted early in 1978 with the membership indicated in para. 4.19 of the main report. The Bank greatly appreciates the valuable contributions which have been made by these experts to the rapid progress of preconstruction investigations and evolution of final designs by mid-1978. In regard to progress of construction, early in 1979, the SBC pointed to Gibb's weaknesses in expertise on site supervision. Because of this and the Bank's insistence, Gibb has posted a highly experienced engineer, Mr. N. Worner to the site. His presence has already had a notable effect on leadership and progress of work at site. The site organization of both Gibb and SPD are now quite adequate.

7. Construction of the project infrastructure, in the Koro-Ni-0 construction colony and access roads to the Monasavu dam and Wailoa power station has been completed with delays ranging from 2-6 months, compared to the original targets set in August 1977. The road to Wailoa proved much more difficult to construct than expected and it delayed access to the tunneling contractor at Wailoa (para. 8) by about 4-1/2 months. In general, it appears in retrospect that the work involved in building up the project infrastructure was underestimated by Gibb, supervision by the SPD in the initial stages was not efficient, and weather and soil conditions were extremely unfavorable.

8. The main civil works contract - for the construction of the diversion tunnel for Monasavu dam and the tunnels of the water-conductor system was awarded to Barclays Construction Co. of Australia. Access to the diversion tunnel and the intake end of the low-pressure tunnel was given more or less in time. Construction of the diversion tunnel has been virtually completed. The delay in providing access at Wailoa at the outfall end of the high pressure tunnel (para. 7) and slower than expected progress on the tunnels during the last year, indicate that there may be a delay in completion of the water-conductor system well beyond the contract date viz. July 31, 1981. Construction of the Monasavu dam is proceeding on the basis of impounding commencing October 1, 1981. Attempts are being made, through a combination of improvements in tunnelling methods and some design changes (e.g., in the slope of the pressure shaft), to ensure that completion of the water conductor system is synchronized with the availability of water for testing.

9. The access roads to the dam site, the quarry and other facilities and the haul roads have now been completed as required for smooth progress of dam construction. The diversion tunnel is practically complete except for the downstream extension (para. 10). About 80% of the stripping of the left abutment and about 25% of the excavation of the right abutment have been completed. These have revealed good foundations as expected during appraisal and require a minimum of grouting. The present program of construction drawn up by Gibb and SPD and confirmed by the SBC in December 1979 envisages:

- (a) completion of all works necessary for river diversion by May 1980;
- (b) construction of the dam to El 738 m, to permit commencement of electricity generation by October 15, 1981; and
- (c) completion of the dam to the full height (El 755 m) by June 30, 1982.

Targets (a) and (b) are substantially the same as envisaged during appraisal in 1977.

Modifications to the Project Designs

10. In June 1979, Gibb determined that there would be a saving of about F\$50.0 million (at 1979 prices) if, instead of developing the potential of the Wainisavulevu valley at two separate power stations in that valley, as Gibb had proposed earlier, the waters of that river, and adjoining high lying streams were diverted into the Monasavu river and used at Wailoa. Gibbs' memorandum, "Report on proposal to raise Monasavu dam from full reservoir level (FRL) 738 to FRL 745", details the reasons (Ref. Project File Annex 14). This recommendation was accepted. The more important of the design modifications consequent to the decision taken during mid-1979 to integrate the development of the Nanuku and Wainisavulevu rivers were:

- (a) raising the full reservoir level of the Monasavu from El 735 m to El 745;
- (b) initial provision of four 20 MW generating sets at Wailoa instead of two; and
- (c) modifications to the design of the tunnels, surge tank and the steel liner.

11. The full reservoir level has been fixed at El 745 m due to topographic limitations of the site which make this the upper practical limit. Tests have been carried out to establish that the reservoir would be watertight with the increased top water level. Zoning and cross-section geometry of the embankment dam would be as originally proposed. The spillway

design remains unchanged but it has been moved towards the right bank where foundations are better and the excavation involved has been reduced. Raising the embankment dam changes the location of the upstream and downstream toes of the dam. The upstream toe is clear of the excavation works around the diversion tunnel intakes, but a cut-and-cover extension about 24 meters in length would be needed at the downstream end of the diversion tunnel to be clear of the dam toe. Apart from the need for a review of the construction program (para. 12) in the context of increased embankment volumes from 800,000 cu m to 1,645,000 cu m there were no other design implications on account of the increased dam height.

12. From a construction standpoint it was clearly advantageous to raise the dam to the full height during the present construction phase even though the need for the increased FSL would arise only in 1984. It was imperative, however, that electricity generation at Wailoa should commence at the earliest practicable date close to the end-1981 target. After consideration of several options ranging from (a) increasing the investment on construction plant and equipment to complete the entire work by 1981; (b) staged construction to a full supply level of +720 m in 1981 (with a temporary glory-hole type, vertical shaft spillway introduced through a rock ledge on the left abutment to the diversion tunnel); and (c) staged construction to an intermediate level which would enable use of the permanent spillway during 1981 (eliminating the glory-hole spillway arrangement) it was found that alternative (c) (para. 9) involved the least costs and risks and represented the most practical solution. It has been adopted.

13. Based on using waters of the Nanuku stream, and the two adjoining streams, Wainambua and Wainaka the ultimate capacity of the Wailoa power station had originally been optimized at 80 MW. This would have enabled the power station to be operated ultimately at a low load factor of about 25%, which is appropriate for a mixed hydro-thermal operating system as envisaged in 1977. With the scheme of diversions of Wainisavulevu and other adjoining rivers the energy potential of Wailoa station would increase substantially. The operating load factor of the station would increase to 56%. This is consistent with the latest plans to operate the Viti Levu system as an all-hydro complex until the end of the century - with diesels on cold standby duty (para. 6.02(d) and the expected system load factors. Nevertheless, the question of increasing the ultimate capacity of the station beyond 80 MW at some future date has been examined. Gibb's recommendation is that provision for a future increase in generating capacity up to 140 MW (for future low load factor operation) should be made and that this can be done most economically (minimizing initial investment) by introducing design features at the low pressure intake and the surge tank which could enable future duplication of the water-conductor system, if needed. The remaining hydro sites yet to be developed on Viti Levu Island can be designed for operation at system load factors or lower. In view of this, the need for a further increase in generating capacity beyond 80 MW is not likely to arise until some 20 years. Gibb's recommendations are acceptable. They enable the investment saving

advantages of integrating the development of the two river systems - Nanuku and Wainsavulevu - to be availed of with no major changes in the designs, initial costs, or construction targets of the ongoing Power 1 project.

14. Cost Estimate. The cost of the Power I Project (in F\$ million), as estimated during appraisal, and in June 1979, are summarized in the table below.

| Item | (1977) | | | (1979) | | |
|--|--------------|--------------|--------------|--------------|--------------|--------------|
| | Foreign | Local | Total | Foreign | Local | Total |
| Preliminaries | 1.08 | 1.02 | 2.10 | 0 | 2.32 | 2.32 |
| Monasavu dam and ancillaries | 7.97 | 4.29 | 12.26 | 5.34 | 8.85 | 14.19 |
| Water conductor system | 15.34 | 4.78 | 20.12 | 14.41 | 6.00 | 20.41 |
| Powerstation civil works | 1.20 | 0.99 | 2.19 | 0.92 | 1.43 | 2.35 |
| Electrical and mechanical equipment | 7.99 | 0.70 | 8.69 | 4.90 | 0.55 | 5.45 |
| Engineering | 3.23 | 0.77 | 4.00 | 3.75 | 3.26 | 7.01 |
| <u>Total</u> | <u>36.81</u> | <u>12.55</u> | <u>49.36</u> | <u>29.32</u> | <u>22.41</u> | <u>51.73</u> |

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SECOND POWER PROJECT

Project Cost Estimate

| | Foreign | Local | Total |
|--|--------------|--------------|--------------|
| | ----- | F\$ millions | ----- |
| 1. <u>Monasavu Additions</u> | | | |
| Land and related items | - | 0.45 | 0.45 |
| Steel lining | 0.16 | 0.02 | 0.18 |
| Diversion tunnel | 0.07 | 0.04 | 0.11 |
| Dam | 2.67 | 6.14 | 8.81 |
| Spillway | (0.04) | (0.14) | (0.18) |
| Power station civil works | 0.25 | 0.57 | 0.82 |
| <u>Total</u> | <u>3.11</u> | <u>7.08</u> | <u>10.19</u> |
| 2. <u>Wainambua and Wainaka Diversions</u> | | | |
| Investigations | 0.41 | 2.19 | 2.60 |
| Land | - | 0.16 | 0.16 |
| Roads | 0.53 | 0.94 | 1.47 |
| Tunnels and weirs | 5.76 | 3.10 | 8.86 |
| <u>Total</u> | <u>6.70</u> | <u>6.39</u> | <u>13.09</u> |
| 3. <u>Generating plant</u> | 4.47 | 0.44 | 4.91 |
| 4. <u>Engineering</u> | 2.78 | 1.29 | 4.07 |
| 5. <u>Insurance</u> | - | 1.00 | 1.00 |
| 6. <u>Training</u> | 0.25 | 0.03 | 0.28 |
| <u>Total Base Cost</u> | <u>17.31</u> | <u>16.23</u> | <u>33.54</u> |
| 5. <u>Contingencies</u> | | | |
| Physical | 1.82 | 1.26 | 3.08 |
| Price | 2.95 | 2.09 | 5.04 |
| <u>Total</u> | <u>4.77</u> | <u>3.35</u> | <u>8.12</u> |
| <u>GRAND TOTAL</u> | <u>22.08</u> | <u>19.58</u> | <u>41.66</u> |

FIJI
SECOND POWER PROJECT

| | 79 | 1980 | 1981 | 1982 | 1983 |
|--|-------------|----------------------------------|-----------------------|-------------------|-----------|
| <u>POWER 1 - MONASAVU</u> | | | | | |
| Tunnels | | | | | |
| Monasavu Dam | | | | | |
| Wailoa Power Station | | | Sets <u>1 & 2</u> | ▼ ▼ | |
| <u>POWER PROJECT 2</u> <u>WAINISAVULEVU DIVERSIONS,</u> <u>PHASE 1</u> | | | | | |
| Roads (To Wainabua and Junction) | | Monasavu Wainabua Junction | | 30.6.82 | |
| Tunnels | Pre-qualify | call E&A | Estb | Monasavu-Wainabua | 31.12.82 |
| Wailoa Power Station and Generating Plant | | Order Sets | 3 & 4 | Wainabua-Wainaka | Set No. 4 |
| | | ▼ | | Set 3 | 30.11.82 |
| | | | | ▼ | |

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SECOND POWER PROJECT

Estimated Schedule of Disbursements

| IBRD Fiscal Year and Quarter | Cumulative Disbursement at End of Quarter (US\$'000) |
|---------------------------------|--|
| <u>1980/81</u> | |
| December 31, 1980 | 1,000 |
| March 31, 1981 | 2,000 |
| June 30, 1981 | 3,000 |
| <u>1981/82</u> | |
| September 30, 1981 | 4,500 |
| December 31, 1981 | 6,720 |
| March 31, 1982 | 8,140 |
| June 30, 1982 | 9,500 |
| <u>1982/83</u> | |
| September 30, 1982 | 11,250 |
| December 31, 1982 | 13,000 |
| March 31, 1983 | 14,550 |
| June 30, 1983 | 15,500 |

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SECOND POWER PROJECT

Forecast Investments - FEA /a
(in thousands of F\$)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 19986 | Total 1980-86 |
|--|---------------|---------------|---------------|---------------|---------------|---------------|--------------|------------------|
| <u>Generation</u> | | | | | | | | |
| Monasavu-Wailoa | 23,853 | 16,639 | 1,720 | 404 | - | - | - | 42,616 |
| Wainambua and Wainaka Diversions Scheme | 10,407 | 13,743 | 14,760 | 1,570 | 23 | - | - | 40,503 |
| Wainisavulevu Diversions Scheme | 429 | 2,794 | 7,007 | 10,376 | 10,916 | 36 | - | 31,558 |
| Other generation | 590 | 755 | 810 | 575 | 675 | 520 | 560 | 4,485 |
| Preliminary investigations SPD plant and establishment costs not charged to other schemes | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 3,500 |
| | 1,010 | 279 | - | - | - | - | - | 1,289 |
| <u>Total Generation</u> | <u>36,789</u> | <u>34,710</u> | <u>24,797</u> | <u>13,425</u> | <u>12,114</u> | <u>1,056</u> | <u>1,060</u> | <u>123,951</u> |
| <u>Transmission</u> | | | | | | | | |
| 132 kV Lines | 14,345 | 1,667 | - | 721 | 2,203 | 4,760 | - | 23,696 |
| 33 kV lines | 2,755 | 1,643 | 500 | 540 | 580 | 630 | 680 | 7,328 |
| <u>Total Transmission</u> | <u>17,100</u> | <u>3,310</u> | <u>500</u> | <u>1,261</u> | <u>2,783</u> | <u>5,390</u> | <u>680</u> | <u>31,024</u> |
| <u>Distribution</u> | | | | | | | | |
| Property | 1,602 | 1,980 | 2,110 | 2,250 | 2,395 | 2,555 | 2,720 | 15,612 |
| Plant and equipment | 740 | 1,046 | 102 | 53 | 564 | 665 | 132 | 3,302 |
| Training | 410 | 505 | 460 | 610 | 655 | 700 | 765 | 4,105 |
| Contingencies | 53 | 10 | 11 | 12 | 13 | 14 | 15 | 128 |
| | 749 | - | - | 800 | 850 | 850 | 900 | 4,149 |
| <u>Total Investments</u> | <u>57,443</u> | <u>41,561</u> | <u>27,980</u> | <u>18,411</u> | <u>19,374</u> | <u>11,230</u> | <u>6,272</u> | <u>182,271</u> |

/a Including interest charged to construction.

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FIJI ELECTRICITY AUTHORITY (FEA)

SECOND POWER PROJECT

Actual and Forecast Income Statements (1976-86)
(in thousands of F\$)

| Fiscal years ending | Actual | | | | | Forecast | | | | | | |
|---|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | Jul 31 1976 | Jul 31 1977 | Jul 31 1978 | Aug-Dec 1978 | Dec 31 1979 | Dec 31 1980 | Dec 31 1981 | Dec 31 1982 | Dec 31 1983 | Dec 31 1984 | Dec 31 1985 | Dec 31 1986 |
| Sales of electricity (GWh) | 59 | 63 | 66 | 76 | 196 | 202 | 212 | 223 | 236 | 253 | 271 | 289 |
| % increase in sales from previous years | 20.4 | 6.8 | 4.8 | 15.2 | 6.0 | 3.06 | 4.95 | 5.19 | 5.83 | 7.20 | 7.11 | 6.64 |
| Average revenue per KWh sold (Fc) | 8.12 | 8.92 | 9.16 | 9.03 | 9.45 | 14.96 | 15.16 | 11.73 | 11.48 | 13.31 | 13.26 | 14.22 |
| <u>Operating Income</u> | | | | | | | | | | | | |
| Revenue from sales of power | 4,793 | 5,622 | 6,048 | 6,864 | 18,514 | 30,220 | 32,138 | 26,158 | 27,088 | 33,683 | 35,926 | 41,087 |
| Other operating income | 100 | 53 | 94 | 49 | 105 | 91 | 115 | 127 | 134 | 132 | 145 | 163 |
| <u>Total Operating Income</u> | <u>4,893</u> | <u>5,675</u> | <u>6,142</u> | <u>6,913</u> | <u>18,619</u> | <u>30,311</u> | <u>32,253</u> | <u>26,285</u> | <u>27,222</u> | <u>33,815</u> | <u>36,071</u> | <u>41,250</u> |
| <u>Operating Expenses</u> | | | | | | | | | | | | |
| Purchased power | 171 | 143 | 137 | 85 | 186 | 240 | 240 | 240 | 39 | 41 | 43 | 45 |
| Fuel | 1,719 | 2,115 | 2,302 | 2,617 | 9,031 | 15,272 | 17,528 | 6,688 | 284 | 2,430 | 138 | 158 |
| Personnel | 792 | 890 | 1,087 | 827 | 1,862 | 2,139 | 2,336 | 2,184 | 2,337 | 2,500 | 2,675 | 2,862 |
| Operating, maintenance & administration | 769 | 1,024 | 1,209 | 1,213 | 4,383 | 4,028 | 4,178 | 3,661 | 3,985 | 4,320 | 4,656 | 5,012 |
| Depreciation | 464 | 622 | 843 | 615 | 1,347 | 2,810 | 3,265 | 4,861 | 5,885 | 6,635 | 7,758 | 8,952 |
| <u>Total Operating Expenses</u> | <u>3,915</u> | <u>4,794</u> | <u>5,578</u> | <u>5,357</u> | <u>16,809</u> | <u>24,489</u> | <u>27,547</u> | <u>17,634</u> | <u>12,530</u> | <u>15,926</u> | <u>15,270</u> | <u>17,029</u> |
| Net Operating Income | 978 | 881 | 564 | 1,556 | 1,810 | 5,822 | 4,706 | 8,651 | 14,692 | 17,889 | 20,801 | 24,221 |
| Nonoperating Income | 52 | (16) | 241 | 38 | (40) | 58 | 57 | 63 | 67 | 66 | 72 | 81 |
| <u>Interest</u> | | | | | | | | | | | | |
| Gross interest | 260 | 390 | 820 | 743 | 2,981 | 6,800 | 10,160 | 12,490 | 14,410 | 15,590 | 16,480 | 16,440 |
| Less: Interest charged to construction | (49) | (6) | (154) | (134) | (1,536) | (3,794) | (5,718) | (2,486) | (918) | (1,668) | (370) | - |
| Net Interest | 211 | 384 | 666 | 609 | 1,445 | 3,006 | 4,442 | 10,004 | 13,492 | 13,922 | 16,110 | 16,440 |
| <u>Net Income</u> | <u>819</u> | <u>481</u> | <u>139</u> | <u>985</u> | <u>325</u> | <u>2,874</u> | <u>321</u> | <u>(1,290)</u> | <u>1,267</u> | <u>4,033</u> | <u>4,763</u> | <u>7,862</u> |
| Rate of Return % | 17.2 | 10.3 | 5.0 | 7.5 | 4.1 | 11.5 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| Average net fixed assets in service ^{/a} | 5,691 | 8,529 | 11,185 | 20,872 | 44,677 | 50,558 | 58,669 | 108,135 | 183,649 | 223,620 | 260,015 | 302,772 |
| Operating Ratio | 0.80 | 0.84 | 0.91 | 0.77 | 0.90 | 0.81 | 0.85 | 0.67 | 0.46 | 0.47 | 0.42 | 0.41 |

^{/a} From FY79 figures are on a revalued basis.

FIJI ELECTRICITY AUTHORITY (FEA)

SECOND POWER PROJECT

Actual and Forecast Balance Sheets (1976-86)
(in thousands of F\$)

| Fiscal years ending | Actual | | | | | Forecast | | | | | | |
|--|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | Jul 31 1976 | Jul 31 1977 | Jul 31 1978 | Aug-Dec 1978 | Dec 31 1979 | Dec 31 1980 | Dec 31 1981 | Dec 31 1982 | Dec 31 1983 | Dec 31 1984 | Dec 31 1985 | Dec 31 1986 |
| ASSETS | | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | | |
| Gross fixed assets in operation | 8,738 | 16,083 | 26,007 | 27,239 | 58,904 | 71,693 | 84,801 | 183,428 | 252,571 | 283,560 | 349,480 | 397,884 |
| Less: Accumulated depreciation | (2,299) | (2,902) | (3,710) | (4,289) | (10,246) | (14,081) | (18,754) | (25,490) | (33,924) | (43,951) | (56,104) | (70,666) |
| Less: Consumers' contributions | (928) | (1,635) | (1,729) | (1,774) | (2,312) | (2,843) | (3,477) | (4,225) | (5,048) | (5,953) | (6,948) | (8,043) |
| Net fixed assets in operation | 5,511 | 11,546 | 20,568 | 21,176 | 46,346 | 54,769 | 62,570 | 153,713 | 213,599 | 233,656 | 286,428 | 319,175 |
| Work-in-progress | 5,143 | 1,794 | 7,784 | 14,617 | 47,199 | 97,743 | 133,365 | 71,198 | 38,809 | 52,451 | 26,117 | 18,933 |
| Total Fixed Assets | 10,654 | 13,340 | 28,352 | 35,793 | 93,545 | 152,512 | 195,935 | 224,911 | 252,408 | 286,107 | 312,545 | 338,108 |
| Current Assets | | | | | | | | | | | | |
| Cash | 127 | - | 247 | 167 | 3,438 | 3,379 | - | 712 | 533 | - | - | - |
| Inventories | 1,285 | 1,577 | 4,176 | 4,305 | 4,359 | 6,199 | 7,439 | 8,927 | 8,950 | 9,150 | 9,200 | 9,250 |
| Amount receivable - electricity | 929 | 836 | 1,220 | 927 | 1,623 | 2,918 | 3,128 | 2,680 | 2,807 | 3,407 | 3,644 | 4,124 |
| - others | 265 | 381 | 250 | 298 | | | | | | | | |
| Prepayments & deposits | 63 | 59 | 70 | 9 | 101 | 150 | 200 | 250 | 300 | 350 | 400 | 450 |
| Total Current Assets | 2,669 | 2,853 | 5,963 | 5,706 | 9,521 | 12,646 | 10,767 | 12,569 | 12,590 | 12,907 | 13,244 | 13,824 |
| Other Assets | | | | | | | | | | | | |
| Goodwill from SCC for takeover of its assets | - | - | 3,527 | 3,527 | 3,527 | 3,527 | 3,527 | 3,527 | 3,527 | 3,527 | 3,527 | 3,527 |
| TOTAL ASSETS | 13,323 | 16,193 | 37,842 | 45,026 | 106,593 | 168,685 | 210,229 | 241,007 | 268,525 | 302,541 | 329,316 | 355,459 |
| LIABILITIES | | | | | | | | | | | | |
| Equity | | | | | | | | | | | | |
| Capital | 2,869 | 3,667 | 7,543 | 9,293 | 16,502 | 24,532 | 31,532 | 36,132 | 36,132 | 36,132 | 36,132 | 36,132 |
| Retained profits & reserves | 1,403 | 1,905 | 1,874 | 2,859 | 3,778 | 6,652 | 7,020 | 5,730 | 6,997 | 11,030 | 15,793 | 23,655 |
| Revaluation reserve | | | | | 26,310 | 30,944 | 36,421 | 42,678 | 58,049 | 79,609 | 102,775 | 131,418 |
| Total Equity | 4,272 | 5,572 | 9,417 | 12,152 | 46,590 | 62,128 | 74,973 | 84,540 | 101,178 | 126,571 | 154,700 | 191,205 |
| Long-Term Debt | | | | | | | | | | | | |
| Gross long-term debt | 6,738 | 7,642 | 23,267 | 27,556 | 50,974 | 98,112 | 125,967 | 150,219 | 161,849 | 168,775 | 167,952 | 155,831 |
| Current Liabilities | | | | | | | | | | | | |
| Short-term borrowing | 29 | 346 | 402 | - | - | - | 993 | - | - | 964 | 885 | 2,641 |
| Trade creditors | 446 | 832 | 1,358 | 1,338 | 2,070 | 6,083 | 5,644 | 3,226 | 2,076 | 2,409 | 1,557 | 1,160 |
| Other creditors | 129 | 681 | 1,622 | 2,166 | 4,913 | | | | | | | |
| Consumer deposits | 241 | 139 | 85 | 155 | 252 | 227 | 262 | 302 | 342 | 382 | 422 | 462 |
| Total Current Liabilities | 845 | 1,998 | 3,467 | 3,659 | 7,235 | 6,310 | 6,899 | 3,528 | 2,418 | 3,755 | 2,864 | 4,263 |
| Other Liabilities | | | | | | | | | | | | |
| Consumers' advances | 1,468 | 981 | 1,451 | 1,449 | 1,670 | 2,135 | 2,390 | 2,720 | 3,080 | 3,440 | 3,800 | 4,160 |
| Suva street lighting | - | - | 240 | 210 | 124 | | | | | | | |
| Total Other Liabilities | 1,468 | 981 | 1,691 | 1,659 | 1,794 | 2,135 | 2,390 | 2,720 | 3,080 | 3,440 | 3,800 | 4,160 |
| TOTAL LIABILITIES | 13,323 | 16,193 | 37,842 | 45,026 | 106,593 | 168,685 | 210,229 | 241,007 | 268,525 | 302,541 | 329,316 | 355,459 |
| Debt/Equity Ratio /a | 61/39 | 58/42 | 71/29 | 67/33 | 49/51 | 61/39 | 63/37 | 64/36 | 62/38 | 57/43 | 52/48 | 45/55 |
| Current Ratio | 3.2 | 1.4 | 1.7 | 0.9 | 0.7 | 2.0 | 1.6 | 3.6 | 5.2 | 3.4 | 4.6 | 3.2 |

/a From 1979 figures include surplus arising from revaluation of fixed assets and depreciation.

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SECOND POWER PROJECT

Actual and Forecast Sources and Applications of Funds (1976-86)
(in thousands of F\$)

| Fiscal years ending | Actual | | | | | Forecast | | | | | | |
|---|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | Jul 31 1976 | Jul 31 1977 | Jul 31 1978 | Aug-Dec 1978 | Dec 31 1979 | Dec 31 1980 | Dec 31 1981 | Dec 31 1982 | Dec 31 1983 | Dec 31 1984 | Dec 31 1985 | Dec 31 1986 |
| SOURCES OF FUNDS | | | | | | | | | | | | |
| Internal Sources | | | | | | | | | | | | |
| Net operating income | 978 | 881 | 564 | 1,556 | 1,810 | 5,822 | 4,706 | 8,651 | 14,692 | 17,889 | 20,801 | 24,221 |
| Depreciation | 463 | 602 | 809 | 579 | 1,477 | 2,810 | 3,265 | 4,861 | 5,885 | 6,635 | 7,758 | 8,952 |
| Consumers' contributions | 188 | 707 | 94 | 45 | 538 | 300 | 350 | 400 | 400 | 400 | 400 | 400 |
| Other income (net) | 52 | (16) | 241 | 38 | (40) | 58 | 57 | 63 | 67 | 66 | 72 | 81 |
| Total Internal Sources | 1,681 | 2,174 | 1,708 | 2,218 | 3,785 | 8,990 | 8,378 | 13,975 | 21,044 | 24,990 | 29,031 | 33,654 |
| External Sources | | | | | | | | | | | | |
| Government contributions | 800 | 798 | 3,876 | 1,750 | 7,209 | 13,446 | 7,000 | 4,600 | - | - | - | - |
| Borrowing | | | | | | | | | | | | |
| IBRD - Power I | - | - | - | - | 1,395 | 7,514 | 3,437 | 154 | - | - | - | - |
| IBRD - Proposed Power II | - | - | - | - | - | 833 | 4,767 | 5,233 | 2,084 | - | - | - |
| ADB | 1,810 | 563 | - | - | 4,907 | 8,397 | 196 | - | - | - | - | - |
| CDC | - | - | 761 | - | 3,043 | 7,383 | 3,443 | 2,740 | 2,122 | 80 | - | - |
| EIB | - | - | - | - | 955 | 10,744 | 10,799 | 5,227 | 744 | 40 | - | - |
| Bond issues | - | - | - | - | 6,500 | 3,000 | - | - | - | - | - | - |
| AMP Society | - | - | 100 | - | - | - | - | - | - | - | - | - |
| Tokai | - | - | - | - | - | 4,167 | - | - | - | - | - | - |
| National Bank of Fiji | - | 500 | - | - | - | - | - | - | - | - | - | - |
| Fiji National Provident Fund | - | 300 | 1,900 | 2,000 | 3,000 | 10,000 | - | - | - | - | - | - |
| Interim Borrowing | - | - | - | 2,500 | 6,800 | (6,800) | - | - | - | - | - | - |
| Loans taken over from SCCED | - | - | 6,917 | - | - | - | - | - | - | - | - | - |
| Loan from SCCED | - | - | 6,157 | - | - | - | - | - | - | - | - | - |
| Other borrowing (to be arranged) | - | - | - | - | - | 4,000 | 6,000 | 14,000 | 12,000 | 18,000 | 10,000 | - |
| Total Borrowing | 1,810 | 1,363 | 15,835 | 4,500 | 26,600 | 49,238 | 28,642 | 27,354 | 16,950 | 18,120 | 10,000 | - |
| TOTAL SOURCES OF FUNDS | 4,291 | 4,335 | 21,419 | 8,468 | 37,594 | 71,674 | 44,020 | 45,929 | 37,994 | 43,110 | 39,031 | 33,654 |
| APPLICATIONS OF FUNDS | | | | | | | | | | | | |
| Construction Expenditures (including interest charged to construction) | | | | | | | | | | | | |
| Power I Project | - | 1,246 | 6,036 | 6,660 | 12,017 | 23,853 | 16,639 | 1,720 | 404 | - | - | - |
| Power II Project | - | - | 160 | 930 | 4,160 | 10,407 | 13,743 | 14,760 | 1,570 | 230 | - | - |
| Other construction | 3,221 | 2,750 | 13,246 | 475 | 17,038 | 23,183 | 11,179 | 11,500 | 16,437 | 19,144 | 11,230 | 6,272 |
| Total Construction | 3,221 | 3,996 | 19,442 | 8,065 | 33,215 | 57,443 | 41,561 | 27,980 | 18,411 | 19,374 | 11,230 | 6,272 |
| Debt Service | | | | | | | | | | | | |
| Amortization | 374 | 438 | 380 | 211 | 682 | 716 | 787 | 3,102 | 5,320 | 11,194 | 10,823 | 12,121 |
| Gross interest | 260 | 390 | 820 | 743 | 2,981 | 6,800 | 10,160 | 12,490 | 14,410 | 15,590 | 16,480 | 16,440 |
| Gross Debt Service | 634 | 828 | 1,200 | 954 | 3,663 | 7,516 | 10,947 | 15,592 | 19,730 | 26,784 | 27,303 | 28,561 |
| Less: Interest charged to construction | (49) | (6) | (154) | (134) | (1,536) | (3,794) | (5,718) | (2,486) | (918) | (1,668) | (370) | - |
| Net Debt Service | 585 | 822 | 1,046 | 820 | 2,127 | 3,722 | 5,229 | 13,106 | 18,812 | 25,116 | 26,933 | 28,561 |
| Net variation in working capital and other assets & liabilities | 477 | (39) | 740 | (739) | (3,519) | 3,768 | 1,649 | 3,138 | 950 | 117 | 789 | 577 |
| Increase (decrease) in cash | 8 | (444) | 191 | 322 | 5,771 | 6,741 | (4,419) | 1,705 | (179) | (1,497) | 79 | (1,756) |
| TOTAL APPLICATIONS OF FUNDS | 4,291 | 4,335 | 21,419 | 8,468 | 37,594 | 71,674 | 44,020 | 45,929 | 37,994 | 43,110 | 39,031 | 33,654 |
| Debt service coverage | 2.9 | 2.6 | 1.6 | 2.7 | 1.8 | 2.4 | 1.6 | 1.1 | 1.1 | 1.0 | 1.1 | 1.2 |
| Contribution to investment (%) | 19 | 35 | - | - | - | 3 | 4 | - | 7 | - | 12 | 72 |

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FIJI ELECTRICITY AUTHORITY (FEA)
SECOND POWER PROJECT

Assumptions Adopted For Financial Forecasts

The following assumptions were adopted when preparing FEA's financial forecasts:

A. Income Statements

1. Electricity sales are based on the anticipated growth trend shown in Annex 3 and discussed in para. 3.06.
2. Revenue from sales of power have been calculated by assuming internally generated funds of F\$1.5 million in 1980 and 1981 and an 8% rate of return on average net fixed assets in operation (after revaluation) in 1982 and thereafter.
3. Other Operating Income comprises fees for reconnection, inspection and licenses. It also includes receipts from minimum guarantee accounts and for maintenance of streetlights.
4. Fuel costs have been estimated in 1980 using the January 1980 prices of F\$238 a tonne, plus 15% for escalation in 1980. Prices in future years have been estimated to increase by 15% annually.
5. Personnel expenses comprises salary, wages, provident fund contributions, workers' compensation, leave and sick pay and allowances for generation, distribution and administration personnel (those for commercial and training functions are excluded). It is expected that the personnel component for generation costs will be reduced by about 25% in 1982 when the first hydro units are commissioned. After 1982 costs are assumed to increase at 7% annually while the level of staff is expected to remain constant (as staff previously in training for the hydro operations and those restreamed from diesel plants should be sufficient to meet increased staffing needs).
6. Operation, maintenance and administration were based on FEA's estimates furnished during project appraisal in October 1979 (after excluding personnel costs). Recurrent costs of training are also included under this head.
7. Depreciation expense calculations were made using FEA's current depreciation rates as follows:

| | |
|-------------------------------|--------|
| Diesel plant | 5% |
| Transmission and distribution | 3% |
| Hydro 60% | 1-1/4% |
| Hydro 40% | 2% |
| Properties | 2% |
| Furniture and equipment | 10% |
| Vehicles | 20% |
| Training | 10% |

8. Non-operating income comprises profits/losses on commercial works undertaken on behalf of the Government, rents received, realized foreign exchange gains/losses and profits/losses on the sale of assets.

9. Interest expenses have been calculated using the following rates:

| | |
|------------------------------|---------------|
| IBRD - Loan 1596-FIJ | 7.25% |
| Proposed IBRD Loan | 8.25% |
| EIB existing Loan | 5.15% |
| Proposed EIB loan | 8.0% |
| ADB - Loan 345-FIJ | 7.7% |
| CDC | 8.75% |
| Tokai Bank loan | 15.0% |
| Bond issues | 7.5% to 8.5% |
| Fiji National Provident Fund | 9.0% to 9.75% |
| CMA Interim Loan | 8.25% |
| Loans (to be arranged) | 10.0% |

Each year during which drawdown of loans is made, interest has been calculated on the amounts drawdown in that year for 6 months only.

10. Interest charged to construction was calculated up to the date of commissioning of major hydro and transmission projects. The commissioning dates used were:

| | |
|--|-----------------|
| Monasavu-Wailoa | - December 1981 |
| Wainambua/Wainaka Diversions Scheme | - March 1983 |
| Wainisavulevu | - December 1984 |
| Transmission 132 kV - Phase I | - December 1981 |
| " " Phase II | - December 1985 |

B. Balance Sheet/Funds Statement

11. Fixed assets are valued at historical cost or in the case of those acquired from the SCCED at acquisition cost. In 1979 the accounts have been adjusted to take account of the FEA's 1978 revaluation (para. 5.03). Each year of the forecasts gross fixed assets and depreciation have been revalued at 10% per annum. No allowances have been made for the possible disposal, retirement or scrapping or currently existing fixed assets.

12. Equity contributions from Government have been assumed to be:
(in thousands of F\$S):

| <u>Fiscal year ending</u> | <u>Power I</u> | <u>Power II</u> | <u>Total</u> |
|---|----------------|-----------------|---------------|
| July 31, 1977 | 730 | | 730 |
| December 31, 1978 (17 months period) | 5,500 | | 5,500 |
| December 31, 1979 | 7,200 | | 7,200 |
| December 31, 1980 | 7,030 | 1,000 | 8,030 |
| December 31, 1981 | 3,300 | 3,700 | 7,000 |
| December 31, 1982 | | 4,600 | 4,600 |
| December 31, 1983 | | | |
| December 31, 1984 | | | |
| | <u>23,760</u> | <u>9,300</u> | <u>33,060</u> |

13. Amortization payments have been based on the following grace
and repayment periods:

| | |
|------------------|--|
| IBRD loans | - 15 years including 3 years grace |
| EIB loans | - 15 years including 3-1/2 years |
| ADB loans | - 20 years including 4 years grace |
| CDC loans | - 20 years including 4 years grace |
| Commercial loans | - 12 years including 4 years grace |
| FEA Bonds | - 5-20 years (Sinking fund provisions to be made after 4 years grace) |
| FNPF | - 20 years including 3 years grace |

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SECOND POWER PROJECT

Cost & Benefit Streams for Internal Economic Rate of Return Calculation
(in F\$ million)

| Year | <u>Construction costs</u> | | O&M | Benefits <u>/c</u> (Incremental revenues) | Net benefits |
|-------|---------------------------|-------------------|------|--|--------------|
| | <u>Foreign/a</u> | <u>Domestic/b</u> | | | |
| 1979 | 0.954 | 1.910 | - | - | -2.86 |
| 1980 | 3.951 | 2.980 | - | - | -6.93 |
| 1981 | 7.130 | 5.090 | - | - | -12.22 |
| 1982 | 9.260 | 8.350 | - | - | -17.61 |
| 1983 | 0.980 | 0.880 | 0.10 | +4.42 | + 2.46 |
| 1984 | - | - | 0.10 | +4.42 | + 4.32 |
| 1985 | - | - | 0.10 | +6.13 | + 6.03 |
| 1986 | - | - | 0.10 | +8.32 | + 8.22 |
| 1987 | - | - | 0.10 | +8.32 | + 8.22 |
| 1988- | - | - | 0.10 | +8.32 | + 8.22 |
| 2024 | - | - | 0.10 | +8.32 | + 8.22 |

/a Shadow rate of 1.20 applied.

/b Shadow rate of 0.90 applied.

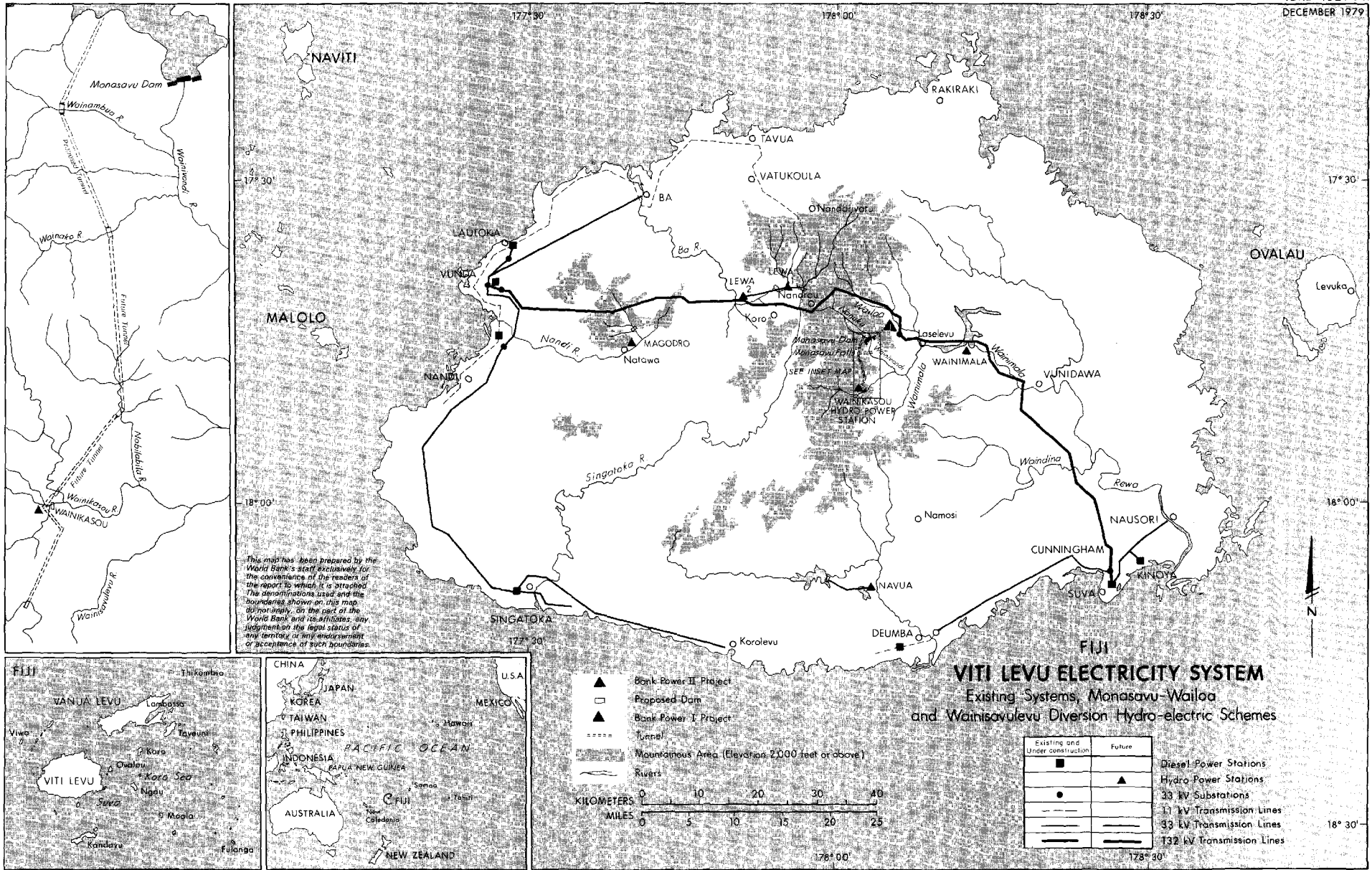
/c Based on average FEA tariff of Fç 9.45 kWh and 88 GWh of energy from 1983 onwards; estimates of benefits for 1983-85 are based on partial fuel savings.

FIJI

SECOND POWER PROJECT

Documents Available in Project File

| | <u>Year</u> |
|---|-----------------|
| 1. FEA Act (Ordinance 20 of 1966) | 1966 |
| 2. Fiji Electric Power Study (Vol. I-VII) by ENEX of New Zealand | 1972 1972-76 |
| 3. Consulting Engineering Agreement with Gibb | 1976 |
| 4. Power Development Program (1977-2001) - Inception Report by Gibb (Vol. I-VIII) | 1977 |
| 5. Power Development Program (1977-2001) (Vol. I-III) Project Report by Gibb | 1977 |
| 6. Establishment, Conditions of Operation and Standing Instructions - Special Project Division | 1977 |
| 7. Staff Appraisal Report (No. 1857-FIJ) on the Monasavu- Wailoa (Power I) Project | 1978 |
| 8. Power Development Program (Vol. I-III) - Draft Report by Gibb | 1979 |
| 9. Power Development Program - Supplementary Report by Gibb | 1979 |
| 10. Report on Proposal to Raise Monasavu Dam from FRL 730 to FRL 745 - by Gibb | 1979 |
| 11. Report on Risk Management - Bowring Burgess Group | 1979 |
| 12. Wainisavulevu Diversions Project - Project Report by Gibb | 1980 |
| 13. FEA Financial Projections (1979-88) | 1980 |
| 14. Asset Revaluation as of December 31, 1978-FEA | 1980 |



This map has been prepared by the World Bank's staff exclusively for the convenience of the readers of the 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 affiliates, any judgment on the legal status of any territory or any enlargement or acceptance of such boundaries.