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STAFF APPRAISAL REPORT

BELIZE

SECOND POWER DEVELOPMENT PROJECT

JUNE 13, 1994

**Department III
Trade, Finance, Industry and Energy Operations Division
Latin America and the Caribbean Region**

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CURRENCY EQUIVALENTS

Currency Unit = Belizian Dollar (BZ\$)

BZ\$1.00 = US\$0.51

US\$1.00 = BZ\$1.98

UNITS AND MEASURES

1 kilovolt (kV)	=	1,000 volts (V)
1 kilowatt (kW)	=	1,000 watts (W)
1 megawatt (MW)	=	1,000 kilowatts (kW)
1 kilowatt hour (kWh)	=	1,000 watt hours (Wh)
1 gigawatt hour (GWh)	=	1,000,000 kilowatt hours (kWh)
1 megavolt ampere (MVA)	=	1,000 kilovolt ampere (kVA)
1 meter (m)	=	3.28 feet (ft)
1 kilometer (km)	=	0.62 mile (mi)
1 square kilometer (km ²)	=	0.386 square mile (sq. mi.)
1 barrel (bbl)	=	42 US gallons = 159 liters

ABBREVIATIONS AND ACRONYMS

BEB	Belize Electricity Board
BEL	Belize Electricity Limited
BECOL	Belize Electrical Company Limited
BOT	Build, Operate and Transfer
BTL	Belize Telecommunications Limited
CARICOM	Caribbean Community
CDB	Caribbean Development Bank
CDC	Commonwealth Development Corporation
CFE	Comisión Federal de Electricidad (Mexico)
EIB	European Investment Bank
EMS	Energy Management System
GDP	Gross Domestic Product
GOB	Government of Belize
LPG	Liquified Petroleum Gas
MEC	Ministry of Energy and Communications
PIU	Project Implementation Unit
SCADA	Supervisory Control and Data Acquisition System

GOVERNMENT OF BELIZE AND BELIZE ELECTRICITY LIMITED FISCAL YEAR

April 1 - March 31

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Map IBRD No. 25745

This report is based on the findings of an appraisal mission that visited Belize January 24 to February 4, 1994. Mission members were Messrs./Mmes. Eduardo Zolezzi (Task Manager), Teresa Serra (Environmental Specialist), and Eric Greenwood (Financial Analyst, Consultant). It also incorporates the findings of earlier preparation work by Ms. Paivi Koljonen (Economist) and Mr. Bekir Onursal (Environmental Specialist). Messrs. Yoshiaki Abe, Krishna Challa and Robert Crown, are respectively the responsible Department Director, Division Chief and Project Advisor.

BELIZE**SECOND POWER DEVELOPMENT PROJECT (POWER II)****Loan and Project Summary**

- Borrower:** Government of Belize
- Beneficiary:** Belize Electricity Limited
- Amount:** US\$11.5 million equivalent
- Terms:** Repayment over 17 years, including 5 year grace period at the Bank's standard variable interest rate.
- Relending Terms:** 17 years, including 5 year grace period, at the Bank's standard variable interest rate. BEL would bear the interest and the foreign exchange currency pool risk.
- Project Description:** The proposed project would cover BEL's medium-term (1997-2005) power and transmission requirements. The proposed project would comprise: (a) the construction of a 115 kV interconnection transmission system running from the border with Mexico to Belize City; (b) the integration of San Pedro (the major tourist area of the country) to the system; (c) the integration of Dangriga (the principal area of the citrus industry) to the system; (d) a dispatch center, supervisory control, data acquisition and communications for system operations; (e) an environmental mitigation program for the existing diesel plants; and (f) consulting services to assist BEL in engineering and project management, and technical assistance and training.
- Benefits:** The proposed project would result in overall improvement in the generation and supply of electricity that would reduce cost of electricity to consumers and increase reliability and cost-effectiveness of the supply of electricity in Belize.
- Risks:** Apart from the dispatch center and a Supervisory Control and Data Acquisition System, all the other components of the project are standard electric utility facilities with very well known technologies; therefore technology risk during project implementation is very low. During project operation the major risk is BEL's financial performance. If Macal river hydrology is significantly less favorable than expected, obligations under the power purchase contract with Mollejon developers could affect negatively BEL's financial condition in some years. To mitigate this potential risk, contractual provisions allow for a

compensation mechanism ("energy bank") and the elimination of the pay-or-take obligation after the tenth year of operation of Mollejon.

Project Cost:

		(in Millions US\$)		
		<u>L.C.</u>	<u>F.C.</u>	<u>Total</u>
Group 1:	115 kV interconnection to Mexico	0.47	6.15	6.62
Group 2:	115 kV substations and Dangriga connection	0.94	3.59	4.53
Group 3:	Submarine cable connection to Ambergris Cay	0.52	5.93	6.45
Group 4:	SCADA and communication systems	0.23	2.78	3.01
Group 5:	O&M vehicles, equipment and tools	0.00	0.65	0.65
	Environmental Mitigation in Diesel Plants	0.00	0.70	0.70
	Subtotal	2.16	19.80	21.96
	Engineering, Project Management and PIU	0.46	2.07	2.53
	Cost of Service and Tariff Study	0.00	0.19	0.19
	Diesel Plants Environmental Mitigation Scope Study	0.00	0.18	0.18
	Monitoring Implementation of Environmental Action Plan	0.00	0.18	0.18
	Training and Technical Assistance	0.00	0.70	0.70
	Subtotal	0.46	3.32	3.78
	Total Base-Line Cost	2.62	23.12	25.74
	Physical Contingencies	0.41	2.31	2.72
	Base-Line Cost plus Ph. Contingencies	3.03	25.43	28.46
	Price Contingencies	0.15	1.12	1.27
	Total Project Cost	3.18	26.55	29.73
	Estimated Financial Cost (IDC)	0.00	3.25	3.25
	Total Estimated Project Cost	3.18	29.80	32.98

Financing Plan:

		US\$ million		
		<u>L.C.</u>	<u>F.C.</u>	<u>Total</u>
	IBRD	0.0	11.5	11.5
	CDB	0.7	6.8	7.5
	CDC	1.2	4.0	5.2
	EIB	0.0	3.2	3.2
	BEL	<u>1.3</u>	<u>4.3</u>	<u>5.6</u>
	Total	3.2	29.8	33.0

Disbursements:

	<u>FY95</u>	<u>FY96</u>	<u>FY97</u>	<u>FY98</u>
Annual (US\$ million)	2.87	3.45	4.60	0.58
Cumulative (US\$ million)	2.87	6.32	10.92	11.50
Cumulative (%)	25	55	95	100

Estimated Economic Rate of Return: 21.7%

BELIZE

SECOND POWER DEVELOPMENT PROJECT

PART I: THE ECONOMY

Background

1.1 Belize, located south of Mexico's Yucatan Peninsula on the Caribbean coast of Central America, attained independence from the United Kingdom in September 1981. With a population estimated at 199,000 in 1992, occupying an area of about 22,000 km², the population density is low, about 9 people per km². Belize compares well with neighboring Central American and some Caribbean countries in regard to income distribution, education and health. Belize's population is predominantly young (about 50 percent below the age of fifteen) and quite literate. About one-fourth of the population lives in Belize City, the country's largest city. The country is endowed with abundant and fertile land, literate urban labor, proximity to North America and a stable currency (i.e., its exchange rate has been pegged to the US dollar at a fixed rate since 1976), all of which make it attractive to foreign investment. Belize's small, open and private sector led economy is based on agricultural exports and tourism. Belize achieved a per capita GNP of US\$2,200 in 1992.

1.2 The country's economy has historically been based primarily on export agriculture. Agriculture accounts for almost one-fifth of GDP. In recent years, however, diversification away from excessive reliance on sugar into other economic activities has been taking place. In 1992, the share of sugar in total exports (goods and non-factor services) fell to 15% from over 40% in 1980. The rest of Belize's agriculture comprises citrus and banana production and fishing, mainly oriented to the export market, and the production of corn, rice, beans, and livestock for domestic consumption. Industry (including construction and electricity) accounts for about one-quarter of GDP. In manufacturing, the major commodities are export oriented: citrus processing and garments. Tourism, which became a major foreign exchange earner during the 1980s, accounts for 25% of exports; citrus, bananas and fish products currently contribute to 10%, 4% and 5% of exports, respectively.

Recent Economic Developments

1.3 Since the mid-1980s, Belize has experienced rapid economic growth in response to good economic management and a favorable external environment. During 1986-90, real GDP growth exceeded 9% per annum on average, with strong contributions from all sectors. Sugar export receipts grew by 80%, production and exports of citrus nearly doubled and exports of bananas tripled. Tourism arrivals more than doubled and receipts tripled. Construction boomed, led by public infrastructure investments and tourism-related construction. This, in turn, boosted trade and transport-related activities. Belize's performance since the mid-1980s contrasts with the economic difficulties the country faced during the early-1980s, a period during which sharp declines in export earnings and government efforts to stimulate the economy through expansionary demand management policies led to domestic and external imbalances.

1.4 Following the rapid economic expansion of the mid to late 1980s, growth continued at a steady but somewhat lower rate in the early 1990s. In 1991 and 1992, real GDP increased by 5.4% and 5%, respectively. Inflation averaged 4% per year. Domestic imbalances emerged as a result of large increases in the public sector investment program (PSIP) and in public sector wages, and of reduced privatization proceeds. In 1991 and 1992, the overall public sector deficit (after external financing) reached 1.2% and 5% of GDP, respectively. These deficits were financed by the Central Bank, domestic borrowing and commercial loans (suppliers credit). Foreign exchange reserves decreased to 2.1 months of import equivalent at the end of 1992.

1.5 The new administration that took office in June 1993 declared that its immediate priority would be to reestablish a sound fiscal position. New fiscal measures were aimed at sharply reducing the FY93/94 public sector deficit from the projected 8% of GDP. Further fiscal measures to reduce the deficit are expected to be included in the FY94/95 budget.

Development Issues and Growth Prospects

1.6 Belize is vulnerable to changes in the global economy. This stems from its dependency on a few export commodities and a high degree of openness, with both exports and imports representing about 60% of GDP. Economic development in industrial countries as well as changes in the demand for specific export commodities impact directly on the Belize economy. However, Belize has been able to reduce its excessive dependency on exports of sugar and to diversify into other agricultural commodities (mainly citrus and bananas, agro-processing and fisheries) and tourism. In 1992, the share of sugar in total exports (goods and non-factor services) had fallen to 15% from over 40% in 1980. Citrus, bananas and fish products currently contributed to 10%, 4% and 5% of exports respectively, while services including tourism and the expenditure of British troops accounted for 25% and 8% of exports, respectively.

1.7 Although the economy is diversifying, Belize still remains exposed to changes in market access for key agricultural export commodities and to fluctuations in commodity prices. About 60% of Belize's sugar exports benefit from preferential trade arrangements with the U.S. sugar quota, the duty-free entry of citrus from Mexico to the U.S. under the North American Free Trade Agreement (NAFTA), and the erosion of preferences in the EU currently accorded to banana producers from the African, Caribbean and Pacific (ACP) countries. The gradual erosion of these arrangements expected over the medium-term underscores the need to further reduce dependency on these main export crops. The withdrawal in a year's time of British troops whose collective expenditures are equivalent to 4% of GDP, will also have a dampening effect on growth.

1.8 The successful completion of the recent GATT rounds is likely to provide significant opportunities for Belize to diversify its exports into nontraditional "niches". Similarly, the new NAFTA agreement can affect Belize's trade patterns as Mexico (a country with which Belize shares a long border) gradually liberalizes its economy and aligns its domestic prices closer to world levels.

Bank Lending Strategy

1.9 Belize's development strategy supported by the Bank, calls for the public sector to concentrate on three broad policy fronts: (i) continuation of prudent fiscal and monetary policies, with particular emphasis on expenditure restraint, to maintain price stability and provide a stable environment for private sector development; (ii) improvement of economic and social infrastructure to eliminate bottlenecks and improve economic efficiency (i.e. urban and rural infrastructure, water and sewerage, electricity and health); and (iii) rationalization of the incentive framework to ensure efficient resource allocation and provide an enabling environment for further export diversification and improvement of the competitiveness of the economy. The proposed Project is consistent with this strategy and would assist in the improvement of Belize's infrastructure.

1.10 Belize has pursued a prudent external debt strategy. It has benefited from grants and concessional loans from bilateral and multilateral sources and, thus, has maintained its debt indicators at low and manageable levels. During the 1980s, grant financing averaged about 4% of GDP. This financing is expected to decline as donors gradually reduce their aid flows to the Caribbean countries. In 1992, medium- and long-term external debt outstanding and disbursed amounted to US\$158 million (35% of GDP). Bilateral loans -- largely from the U.K. and the U.S. -- represented about US\$70 million; and multilateral loans amounted to about US\$590 million -- mainly from the Caribbean Development Bank (CDB) (US\$27 million) and IBRD. In 1992, Belize became a member of the Inter-American Development Bank (IDB). Over the medium term, the Government is expected to rely on multilateral and bilateral sources and on moderate amounts of commercial financing and of suppliers credit to finance its investment needs. The Bank's exposure in Belize is low; debt outstanding and disbursed stood at US\$19 million in 1992 and IBRD debt service at 1% of exports of goods and nonfactor services. Belize is considered creditworthy for Bank lending.

PART II: THE ENERGY SECTOR

Organization of the Energy Sector

2.1 The Ministry of Energy and Communications (MEC) is responsible for formulating the overall energy policy. The Ministry of Natural Resources is responsible for petroleum exploration activities through its Geology and Petroleum Office, while biomass energy issues fall under the jurisdiction of the Forestry Section. Petroleum pricing and importation issues are handled by the Ministry of Trade and Commerce. Under the 1992 Electricity Act, the Minister of Energy and Communications, assisted by a Director General of Electricity Supply, is in charge of all matters concerning electricity supply in Belize.

2.2 At present, Belize Electricity Limited (BEL), a company whose major shareholder is the Government, is the only commercial generator, transmitter and distributor of electricity in Belize. Since BEL's current distribution system does not cover the whole country, captive power generation is common. A private developer is building a hydroelectric power plant on a BOT based arrangement to sell electricity to BEL.

2.3 The importation and bulk handling of petroleum products is currently in the hands of Esso. The distribution of petroleum products is undertaken by three local affiliates of international oil companies (Esso, Shell and Texaco). Liquefied Petroleum Gas (LPG) is imported and distributed by private companies under a licensing system.

Primary Energy Resources

2.4 Belize's energy resources are limited. The two primary resources are biomass and hydro energy. The biomass resources consist of wood (about 93 percent of Belize's land area is classified as forest) and agricultural residues, mainly bagasse. The hydropower potential of the Macal River only, where the 25 MW hydro plant is being constructed, is estimated at about 60-80 MW. In addition to the Macal River, there are several other rivers that might offer viable hydro power sites.

2.5 Geological studies indicate a good possibility that Belize has deposits of oil and gas, both on-shore and off-shore; estimates range from 19 million barrels to 130 million barrels of oil. Since 1955, 40 wells totalling 250,000 ft have been drilled and about 6,000 line miles of seismic surveys have been conducted by several companies. Presently there are 13 independent companies carrying out oil exploration. Various findings have been reported but so far there have been no reports of discoveries of either oil or gas in commercial quantities. Belize has no known coal resources of commercial quantities.

Energy Supply and Consumption

2.6 Petroleum Products. All petroleum products are imported, mainly from the U.S.A and Mexico. Domestic consumption of oil products was about 27,463,000 gallons (650,000 bbl), in 1992. In addition, about 16,830,000 lbs of liquefied petroleum gas (LPG) was imported. The following table gives a breakdown of domestic consumption of petroleum products in 1992.

Table 2.1. Domestic Consumption of Petroleum Products in 1992 ^{1/}

Product Name	Quantity	Unit
Gasoline	9,671,000	Gallons
Diesel Oil	15,298,000	Gallons
Fuel Oil	481,000	Gallons
Kerosene/Jet Fuel	1,140,000	Gallons
Aviation Spirit	873,000	Gallons
TOTAL OIL PRODUCTS	27,463,000	Gallons
Liquefied Petroleum Gas (LPG)	16,830,000	Pounds

Note: Imports of lubricating oils are not included in the table. Gasoline is unleaded.

^{1/} Sources: Ministry of Finance, Central Statistical Office.

2.7 Of total diesel oil consumption, about 60 percent (9,184,000 gallons) was used by BEB for electricity generation. Fuel oil was used mainly in the sugar and citrus processing industries for steam production. Official statistics do not provide a breakdown of the usage of petroleum products by economic sector. In order to improve information availability, it is recommended that MEC's Energy Unit start collecting energy end-use data.

2.8 Petroleum Products Prices. Petroleum product prices are controlled by the government, but vary from place to place depending on transportation costs. The Government's objective is to minimize price fluctuations. This is implemented through a stabilization mechanism called "the revenue replacement duty", to compensate for increases and decreases in international prices. Although the Government's policy does not allow subsidy of petroleum product prices, the stabilization mechanism prevents the fluctuations in the international prices to be fully reflected in the pump prices. Annex 2.1 provides the breakdown of petroleum products prices in Belize City as of June 1993, and the prices of LPG in various locations in Belize. BEL imports its fuel requirements directly from Mexico and is not affected by Government petroleum pricing policy.

2.9 Electricity. With the exception of the Corozal/Orange Walk system, which is supplied with electricity from Mexico, Belize relies primarily on individual, isolated diesel generating plants. These plants use imported diesel oil purchased exclusively from Mexico. Belize Electricity Limited (BEL) operates 9 individual electrical systems. In FY93, the combined net electricity generation totalled 139 GWh and sales to about 33,000 customers were 120 GWh. Sales have increased on the average by 12 percent per year in the period FY87-92. Rapid economic growth; rural electrification programs; and connection of industries and hotels, which previously generated their own electricity, to the BEL system have been the main reasons for the high demand growth. This increase contrasts sharply with the low demand increases during the early 1980s. The aggregate peak demand reached about 25 MW in FY93, following increases on average of 13 percent per year during the period FY87-93. According to the 1991 population census, about 70 percent of all households have electricity, but access varies greatly between districts (about 90 percent of households in Belize district have electricity, while the portion is only about 25 percent in the Toledo district in southern Belize 2/.)

2.10 In addition to BEL, electricity is generated by private industries, such as sugar, dairy and citrus processing, and by timber mills, and hotels. It is estimated that there is about 20 MW of privately owned generation capacity, although no reliable data exists on how much electric energy is generated by these captive diesels. Two privately owned small scale hydro plants (150 kW and 60 kW) are in operation.

2.11 Biomass. About 93 percent of Belize's land area is classified as forest. Woodfuel consumption is relatively limited; about 30 percent of households used firewood for cooking in 1991. According to a limited survey conducted in 1982, the average household used about 10 pounds of dry firewood per day. Based on these figures, the total consumption can be estimated at about 40 million pounds of dry firewood per year. Although estimates on the sustainable supply of wood are not available, the limited use of wood for cooking is not considered to

2/ Belize is divided into six administrative districts.

endanger the forests. Firewood is mostly cut free of cost in the neighborhood of the dwelling. In addition, Belize has biomass resources in the form of sugar cane bagasse, which is mainly used for producing process steam and electricity in the sugar industry. The feasibility of using surplus bagasse for power generation by BEB was studied in 1989 by Canadian International Power Services (CI Power). The study concluded that bagasse generation would be economically attractive to complement the supply in the Corozal/Orange Walk area. The consultants also carried out an evaluation of the feasibility of using wood and sawmill residues for power generation; this option was not considered economic due to the relatively small quantities of residue available.

2.12 Other Renewable Energy. Solar photovoltaic energy is exploited on a very limited scale, mainly in tele- and radio communications, navigation lighting and in tourist attractions far away from BEL's power lines. Solar is also used on a limited scale for water heating. At the privately owned resort on St. George's Caye, wind turbines are used to generate electricity for the resorts' own needs. Occasional wind powered water pumps can also be observed at private farms. Based on the results of the feasibility study mentioned above, neither solar nor wind are economic alternatives for medium or large scale electricity generation. However, the technical and economic feasibility of using solar energy to complement energy supplies, especially in hotels and other tourist developments on the environmentally sensitive barrier islands, should be studied further.

2.13 Energy Consumption by Households. The following table provides a picture of energy consumption by households.

Table 2.2. The Main Energy Sources Used by Households for Cooking and Lighting

Type of Energy Used by Household for Cooking and Lighting	Cooking %	Lighting %
LPG	62 %	1 %
Wood	29 %	0 %
Kerosene	5 %	29 %
Electricity	1 %	67 %
Other	3 %	3 %
TOTAL	100 %	100 %

Source: Ministry of Finance, Central Statistical Office: 1991 Population Census.

2.14 As shown in Table 2.2 above, almost 70 percent of households use electricity for lighting. Nevertheless, electricity is seldom used for cooking. Instead, households prefer LPG since electricity as a cooking thermal energy source is about 3 times more expensive than LPG ^{3/}. Wood for cooking and kerosene for lighting is the combination for most rural households without

^{3/} *Cost of LPG used for cooking is estimated at US\$20/GJ, and of electricity at about US\$55/GJ. The efficiency of a gas cooker is assumed at 60 percent, and of an electric cooker at 75 percent.*

access to electricity, the majority of the rural population. The share of households using wood for cooking has decreased from about 40 percent in 1981 to less than 30 percent in 1991.

Energy Conservation and Demand Management

2.15 Although energy conservation has not been a high priority policy in Belize's energy sector, high energy prices provide incentive for energy conservation and efficiency. The only demand management effort on the side of the BEL has been the ongoing replacement of low-efficiency street lighting by higher efficiency sodium lamps to reduce peak load. The tariff study to be financed under the proposed project will analyze potential load management options through tariffs. This is a necessary first step before pursuing other more specific measures aimed at demand side management in BEL system.

Government's Energy Sector Objectives and Policy

2.16 In 1990 the Belize Government established its Development Plan for 1990-1994, setting out an ambitious energy policy aiming to: (a) reduce Belize's dependency on imported energy; (b) develop indigenous energy resources; (c) reduce the cost of energy; (d) provide electricity to rural communities; and (e) secure a reliable and sustainable electricity supply across the country. The following actions in the electricity sub-sector, set out in the plan, have been implemented:

- (i) granting a franchise to a group of private investors to build, own and operate a run-of-river 25 MW hydro-power plant at the Mollejon site on the Macal river, in order to develop Belize indigenous hydropower (construction of the plant is in progress and commissioning is expected by early 1995);
- (ii) enactment of the Electricity Act of 1992, restructuring the electricity industry, introducing private participation and competitiveness in the sector;
- (iii) incorporation of Belize Electricity Limited as the successor company of the state-owned electric utility, BEB, through the public sale of shares and debentures; and
- (iv) a rural electrification program totalling about BZ\$19.2 million during FY91-93 (approximately US\$10 million), increasing electrification to more than 80% nation-wide.

2.17 The position of the new Government, that took office in June 1993, is to move forward and improve its policy in the energy sector by:

- (i) improving the contractual arrangement with the developers of the Mollejon hydroelectric plant;
- (ii) supporting the proposed Second Power Development Project; and
- (iii) expanding the electricity imports from Mexico, interconnecting the electrical systems of both countries.

2.18 In the last three years, the previous and the new GOB have moved clearly and strongly in the direction of reform and private participation in the power sector, basically in line with Bank's policy in the sector. Although, the initial public offering of BEL's shares was only partially successful, the present GOB is open to consider additional private participation in BEL. The implementation of the proposed project, combined with the expected improvement of BEL's operations as a commercial corporation, will extend BEL's attractiveness to the private sector.

PART III: THE ELECTRICITY SUB-SECTOR

Reform of the Power Sector

3.1 The Belize power sector was reformed in 1992 under the Electricity Act of 1992. The new Electricity Act provides for: (a) the regulation and provision of electricity services; (b) the issuing of licenses for the generation, transmission and distribution of electricity; (c) the powers etc. of license holders; (d) transfer of the assets of BEB to a successor company, Belize Electricity Limited (BEL); and (e) miscellaneous other matters dealing with the use of meters, preservation of amenities and fisheries, financial provisions, electricity tariffs, equipment installation, etc. An important feature of the new Electricity Act is the establishment of a mechanism for the granting of licenses authorizing any person or company to generate, transmit or distribute electricity in a specified "authorized area". The new Electricity Act moves away from the exclusive supply rights provided for BEB in the previous Electricity Ordinance, and provides instead an environment for competition under a licensing system.

3.2 Another new feature in the law is the establishment of a high level position, that of Director General for Electricity Supply, to assist the Minister of Energy and Communications in administering the licencing mechanism, enforcing regulations, and participating in all other matters concerning the implementation and application of the Electricity Act. The Director General's main duties are: (1) to ensure that all reasonable demands of electricity are satisfied; (2) to ensure that license holders are able to finance the provision of services they are authorized to carry on; (3) to promote competition in the supply of electricity; (4) to protect the interests of the consumers; (5) to promote efficiency and economy of electricity supply and use; and (6) to control safety regulations and standards. The Director General is also authorized to establish by-laws with respect to electricity supply activities. He is assisted by staff from the Public Services Commission.

3.3 In accordance with the new Electricity Act, the assets and liabilities of the former Belize Electricity Board, a Government agency, were transferred to the Belize Electricity Limited, a private company incorporated under the Companies Act of Belize. The Government granted BEL a 15 year license to generate, transmit and distribute electricity in all the areas where the former BEB operated, covering about 3/4 of the country.

3.4 In August 1992, the Government published a Prospectus offering for sale 49 percent of the shares and all the debentures of BEL to the general public in Belize. The offer was opened

on October 5, 1992 and closed on January 15, 1993. The general public was only moderately interested in investing in BEL, however. As a result, only 37.5 percent of the shares were sold. The remaining 11.5 percent were therefore purchased by the state owned Social Security Board. As the holder of a Special "Golden Share", the Government has the right to appoint two of BEL's Directors, and as long as the Government is the holder of the "Golden Share" and of at least 25 percent of the issued share capital, it may appoint the Chairman of the Board. Of the current nine directors in the BEL's Board, six have been nominated by the Government. However, three of the Government nominees come from the private sector while one represents BEL employees.

3.5 The Government has indicated that as a policy, during the transition period to a private majority or fully private ownership of BEL, it will deal with its shares in BEL as an investor and not as a manager. It has already made significant progress in restructuring the electricity sector and introduced private participation in the ownership of BEL and in power generation. The Government is currently considering options (see also para. 2.18) to transfer its remaining 51% shares in BEL to the private sector. This most probably should occur in 1997/1998, when the debentures sold in conjunction with ordinary shares in the first offering can be redeemed or converted into equity, the Mollejon plant will be in operation and the proposed project would be substantially completed. Completion of this expansion program will put BEL on much better footing, improving its revenue position and making for a more attractive private investment candidate.

3.6 The primary objective of the sale of the Government's remaining shares in BEL would be to place the majority of shares in the hands of investors with the experience necessary to successfully manage an electric utility. The interests of Government and the public will be protected through Government retention of the "Golden Share" with rights limited to approval of subsequent sales of shares, and the implementation of the regulatory framework, established in the Electricity Act of 1992, charged with responsibility for monitoring BEL's compliance with service standards as defined in its operating license and the management of transparent electricity pricing setting.

Electricity Demand and Supply

3.7 BEL's sales of electricity amounted to 120 GWh in FY93 and was supplied by 124 GWh of own thermal generation and 15 GWh of purchases from Mexico. Electricity sales have increased on the average by 12 percent per year during FY87-93. The coincident (97% coincidence factor) maximum peak increased concurrently at an average yearly rate of 13 percent and was about 25 MW in FY93. The rapid economic growth, rural electrification programs (especially in San Ignacio, Corozal and Dangriga), the promotion of San Pedro as a major tourist center, and connection of industries and hotels which previously generated their own electricity, have been the principal causes for the high sales growth. The recent high sales growth compares favorably with sales growth during the early 1980s of about 5 percent per year.

3.8 Of the total sales of 120 GWh in FY93, 38 percent were to residential consumers, 34 percent to businesses and industries, and the balance to statutory and government offices. The following table summarizes the consumption of electricity by consumer category by BEL's customers.

**Table 3.1. Consumption of Electricity by Consumer Category
(BEL's Supply)**

Consumer Category	Percent of total electricity used by respective consumer category	Percent of customers in each category
Residential	36.0 %	83.6 %
Business and Industries	41.8 %	13.6 %
Statutory Bodies	8.5 %	0.7 %
Government of Belize	13.7 %	2.1 %
TOTAL	100 %	100 %
Total Annual Consumption and Number of Customers, FY92	107 MWh	32,995

Source: BEL, December 1993 billing records.

3.9 The average monthly consumption by residential consumers was about 145 kWh, and by business and industrial consumers about 800 kWh, while the statutory bodies and the Government of Belize consumed on the average about 3,000 kWh per month. The relatively low average consumption figures for businesses and industries result mainly from the fact that the larger industries, such as the citrus and sugar companies, have their own generation facilities and are not accounted for in BEL's statistics.

Electricity Prices

3.10 Electricity in Belize is expensive compared to most countries in the LAC region, although it should be recognized that the market is very small and too dispersed to take advantage of economies of scale and more efficient generating technologies. BEL's current electricity tariff, in effect since 1989, consists of three increasing blocks:

<u>Block</u>	<u>Belize Cents</u>	<u>US cents</u>
0-70 kWh per month	31	15.5
71-150 kWh	35	17.5
more than 150 kWh	41	20.5

3.11 There is no demand charge or distinction between customer categories. The average revenue per kWh sold was 38 Belize cents in FY92 (equivalent to US cents 19) compared to the average generating cost of about 27 Belize cents. The current tariff rates have provided BEB with a rate of return on (historically valued) net fixed assets of around 10 percent during the recent years.

3.12 As part of the CDB loan in 1980, a tariff study was prepared by consultants in 1982. The study recommended substantial rate increases to meet the financial covenants of the CDB loan. In addition, the study recommended that a separate tariff be established, comprising both an energy and a demand charge, for large industrial customers. The recommendations of the

study were however never implemented. In view of the future changing structure of supply sources (hydro-power, imports from Mexico and diesel generation), a new tariff study is required. Agreement was reached during negotiations that BEL would furnish to the Bank, not later than March 31, 1995, the Government's and BEL's recommendations based on the results of a tariff study carried out by consultants (Annex 5.8) and that, after consultation with the Bank, would promptly implement such recommendations. The study would analyze the options for tariffs which more effectively reflect the cost of supply, the regulatory requirements, and provide consumers with price signals for efficient use of electricity.

3.13 Regarding the tariff setting and approval process, the 1992 Electricity Act reflects the previous Ordinance with no specific provisions provided for price regulation. The License granted to the BEL sets out only general guidelines for tariff determination, such as: (1) the rates should reflect the cost of generation, transmission and distribution; (2) the Licensee should obtain a reasonable rate of return; and (3) the interest of the customers should be taken into account. In this regard, complementary and subsidiary price regulations to the Electricity Act are required. The Government agreed during negotiations that, by March 31, 1995, it would establish specific regulations to define transparent procedures for tariff setting and approval, acceptable to the Bank. Technical assistance from the proposed project will be used to assist the Government in this matter.

Rural Electrification

3.14 Following the arrangement between the Government and the former BEB, BEL undertakes electrification of rural villages on behalf of the Government and receives reimbursement for investment costs. Between September 1989 and May 1993 the Government provided about BZ\$26 million for the electrification of 131 villages.

3.15 The policy of the new Government, that took office in July 1993, is to reduce the pace of its financial support in rural electrification due to financial constraints and considering that nation-wide electrification has already reached more than 80%.

Existing Power Sector Facilities

3.16 Generation Facilities. At present, BEL operates 12 diesel plants with units varying in size from 100 kW to 3.5 MW. The total available capacity is about 38.3 MW and the firm capacity is estimated at about 27.4 MW. The table in Annex 3.1 summarizes available and firm generating capacity by location. The plants at Belize City and Ladyville, those at Belmopan and San Ignacio, and those at Corozal and Orange Walk are interconnected. The newest additions to the generating capacity are two units at Belize City and two units at Belmopan, commissioned in mid 1993 as part of the Power I project.

3.17 In addition to its own thermal generation, BEL has, since 1990, also purchased small amounts of electricity from the Commission Federal De Electricidad (CFE) in Mexico (about 13.8 GWh in FY92) to supply the Corozal/Orange Walk area. The present contract between BEL and CFE allows continuous purchase of up to 5 MW at 34.5 kV. This supply has been very reliable.

3.18 **Transmission and Distribution Network.** The major distribution voltages in Belize are 6.6 kV, 11 kV, 22 and 34.5 kV. The 11 kV distribution voltage is limited to Belmopan. The 34.5 kV voltage in the Corozal/Orange Walk area, constructed as part of the Power I project in 1991, is presently a transmission voltage and an extension of the line interconnecting the Mexican grid to the Belize system at Santa Elena. BEL plans to maintain this line primarily as a sub-transmission when the planned 115 kV national grid system is constructed. The developers of the Mollejon hydroelectric plant are constructing a 115 kV transmission line, as part of their project, from the plant site to Belize City, via Belmopan. This line will be part of the planned national grid.

3.19 BEB's system losses have been high. In 1984, when BEB first introduced loss reduction measures, the total losses were about 26.5 percent of net generation. As a result of the implementation of the Power I project, losses were reduced to some 14 percent in FY91, however, the reduction was not sustained and in FY92 losses increased to about 16 percent. A supplementary program of loss reduction was therefore started in March 1992, based on targets established in consultation with Bank supervision mission. This program has achieved a reduction of losses to about 10.5 percent by December 1993.

Electricity Sales and Peak Demand Forecast

3.20 A review of the several existing electricity demand forecasts was carried out by Bank consultants, in cooperation with BEB, in June and November 1992 ^{4/}. The forecast was updated in September 1993 to take into account the latest figures of generation and sales for FY93 and the new country economic projections (Bank's most recent GDP growth forecast is 4.4 percent per year during 1994-2004).

3.21 Demand projections have been desegregated, for each load center, into residential, industrial/commercial and street lighting. In the short-term, sales growth will remain strong due to the expected connections to BEL's system of large industries and communities, which currently use their own diesel generation. In the longer-term, after the connections have been made, the sales growth rate is forecast to decline to reflect the historical long-term elasticity of electricity consumption to GDP. For residential demand, the forecast also considers new connections based on an annual population growth of 3 percent and increased access to electricity. Table 3.2 below summarizes the base case forecast and Annex 3.2 provides the detailed forecasts for the different load centers.

^{4/} BEB prepared forecasts in 1991 as basis for their five year FY92-97 development plan, and BEL revised these projections in 1993 as basis for its long-term expansion plan. According to BEL's 1993 projections, electricity sales are expected to grow at an annual rate of about 12 percent between 1994-1997. BEL bases its forecast on the Government's GDP projections of about 7.4 percent a year and prepares only an aggregated forecast for each load center.

Table 3.2 Actual Sales, Generation and System Peak FY90-FY93 and Forecast FY94-FY2004

	FISCAL YEARS ¹⁾							ANNUAL GROWTH RATES %			
	90	92	93 ²⁾	94	98	2000	2004	87-93	93-97	97-2004	93-2004
CONSUMPTION (GWh)											
Residential	29	40	45	50	63	69	84	12.6	7.5	4.9	5.8
Industrial/Commercial/ Street Lighting	52	67	75	85	115	127	154	11.6	9.9	5.1	6.8
TOTAL (GWh)	81	107	120	135	178	197	238	12.0%	9.0%	5.0%	6.5%
LOSSES (GWh)	14	18	19	20	19	21	25	-	-	-	-
% of net generation	15%	14%	14%	13%	10%	10%	10%	-	-	-	-
NET GENERATION (GWh)	95	125	139	155	197	218	263	11.4%	7.8%	4.9%	6.0%
SYSTEM PEAK LOAD (MW) 97% coincidence factor	15.6	22.7	24.8	28.1	34.7	38.3	46.4	13.4%	7.5%	4.9%	5.9%

¹⁾ BEL's fiscal year is from April to March.

²⁾ FY93 sales estimated from actual sales in April and December 1993.

3.22 Two demand forecasts for the period FY93-FY2004 have been considered in the evaluation of the technical and economic feasibility of the proposed project: a base case forecast and a low-growth scenario. The base case forecast projects BEL's electricity sales to rise at an average annual rate of 6.5 percent, with a corresponding 5.9 percent annual increase in peak demand. This reflects the expected slowdown in economic growth and a reduction in incorporating new areas to BEL's system, compared to the average annual sales growth in FY87-93 of about 12 percent. For sensitivity analysis the low-growth scenario has been assumed to be 20% lower than the base case.

3.23 According to the base case forecast, the system peak will increase from 24.8 MW in FY93 to 46.4 MW in FY2004. The corresponding electricity generation will increase from 139 GWh in FY93 to 262 GWh in FY2004. The forecast assumes a reduction in transmission and distribution losses from about 13 percent of net generation in FY96 (including 2.5% estimated transmission system losses in the new 115 kV system) to 10 percent in FY2004. The increase in sales is expected to be particularly strong in Dangriga and San Pedro as a result of the incorporation of existing citrus processing industries (Dangriga) and existing hotels (San Pedro), as well as new developments, such as hotels and a desalination and a sewerage facility in San Pedro. Detailed demand forecast was prepared only for 10 years (up to 2004). From 2005 to 2010 the demand growth was kept equal to the 1997-2004 annual average. Beyond 2010 it is assumed that the demand will grow at 4% per year.

Current Sector Problems and Issues and the Second Power Development Project

3.24 There are two major issues in the power sector of Belize. First, electricity is expensive because generation capacity is dispersed in small local systems with relatively high investment

and production cost requirements (all generation is thermal based and use imported diesel oil). Second, the quality and reliability of electricity supply is low because the small size of the systems cause relatively large voltage and frequency fluctuations, and reserve capacity is limited in each local place (back-up generation cannot be shared).

3.25 Clearly, expansion of electricity generation cannot continue in the same manner as before if Belize wants to adequately address these two issues. World-wide experience has shown that integration and interconnection of electrical systems is the best solution to cope with the problems just mentioned. The Mollejon hydroelectric development and the Second Power Development Project would serve this purpose.

3.26 BEL's generation expansion plan shows that, if the existing isolated systems are not interconnected, new diesel units would be required as early as 1996 in San Pedro (1 MW), followed by 4 MW in Belize City-Ladyville in 1997 and 1.5 MW in Dangriga in 1998. Furthermore, another 22 MW of new units would be required in the medium-term (till year 2004) to cover the expected electricity demand. The studies carried out during preparation of the Second Power Development Project have shown that the interconnection line with Mexico is a better solution than continuing with diesel expansion. This interconnection will provide the Belize power system with a large, reliable and relatively cheap source of electricity supply, and integration of the major load centers, by creating a national trunk transmission system.

3.27 How these new sources are combined to supply the required capacity and energy is shown in the table and charts of Annex 3.3. The table shows the capacity (power) and energy balance for the interconnected system from 1993 to 2004 and the charts illustrate the expected annual dispatch by sources of electricity, a typical monthly dispatch (for year 2000), and a typical daily dispatch (for a weekday of January 2000).

PART IV: THE BORROWER AND THE BENEFICIARY

The Borrower

4.1 The Borrower of the proposed IBRD loan of US\$11.5 million equivalent would be the Government of Belize, who would onlend the proceeds of the loan to Belize Electricity Limited on the same terms and conditions (para 6.8).

Belize Electricity Limited

4.2 Legal Status and Capital Structure. BEL was incorporated under the Belize Companies Act in October 5, 1992 as a public company empowered to issue shares. BEL has an authorized share capital of BZ\$100,000,000 comprised of 38,000,000 Ordinary Shares of BZ\$2 per share, 12,000,000 Preference Shares of BZ\$2 each, and one Special Share (Golden Share) of BZ\$1. On January 7, 1993, the Government transferred the assets and liabilities of the BEB to BEL at book value as of March 1992, in return for shares and debentures valued at BZ\$57,750,001 as follows:

	BZ\$	%
	<u> </u>	<u>of Total</u>
6,930,000 ordinary shares of BZ\$2	13,860,000	24
11,191,950 convertible preference shares of BZ\$2 each	22,383,900	39
1 Special Rights Redeemable preference share (Special Share) of BZ\$1	1	0
282,975 12% convertible debentures of BZ\$76	<u>21,506,100</u>	<u>37</u>
Total	57,750,001	100

4.3 In October 1992, the Government offered 49 percent of the Ordinary Shares and all the 12% Convertible Debentures for sale to the general public in Belize in units of BZ\$100 consisting of 12 ordinary shares, and one debenture. After the closing of the offering in January 1993, 37.5 percent of the ordinary shares were bought by private interests while the remaining 11.5 percent were sold to the State Social Security Board. The Government retained the Convertible Preference Shares, the Special Rights Preference Shares, and 51 percent of the Ordinary Shares.

4.4 The debentures are convertible at the holders option into Ordinary Shares at any time prior to December 31, 1997 at a ratio of 38 ordinary shares per debenture. The holders may also purchase additional Ordinary Shares for BZ\$2 each up to December 31, 1997. BEL's Articles of Association provide that each time Debentures are converted into Ordinary Shares, the same amount of Preference Shares will automatically be converted into Ordinary Shares.

4.5 Organization and Management. Under BEL's Articles of Association, the company is to be managed by a Board of Directors consisting of not less than three and not more than twelve directors. Presently, the Board has nine members; seven, including the Chairman, are nominated by the Government and two represent private sector shareholders. Currently, of the Government nominees, three are private businessmen. The Chairman of BEL is also the Chairman of Belize Telecommunications Limited (BTL), a former Government enterprise successfully privatized in 1988. BEL took over the management and staff of BEB, including the positions of Chief and Deputy Chief Executive Officer. BEL's CEO is a professionally qualified accountant with more than seven years of experience in the power industry. The Deputy Chief Executive Officer is a qualified engineer who has been on BEB's staff for more than 20 years.

4.6 BEL's organizational structure (see Annex 4.1) is satisfactory. In the years prior to its dissolution, BEB's institutional performance considerably improved. Its staff was strengthened by the employment of additional professionally qualified engineers. BEL is a small company and its activities are organized into two principal departments: (i) engineering; and (ii) finance and administration. Each is headed by a general manager who reports to the Chief Executive Officer. In addition, the Manager for Customer Services, the Manager for Data Processing and the Manager for Human Resource Management report directly to the Chief Executive Officer. Twelve District Managers report to three Area Superintendents who report to the General

Manager F&A. The eight senior officials of BEL are dedicated professionals, many of whom have post graduate degrees in engineering or business administration from overseas universities.

4.7 Staffing and Manpower Development. BEL employs about 394 people of which 14 (e.g. 3.5%) are professionally qualified engineers. The number of customers and MWh sold per employee are, in round figures, 83 and 300 respectively. This profile compares favorably with utilities with similar characteristics in the region. Under IBRD financed Power I Project, the following manpower development and training needs were carried out: seven engineers completed advanced courses in engineering, system operation and maintenance, computerized planning, and business administration; one employee received training as Training Officer; and a number of supervisory level staff completed courses in electrical and mechanical diesel operation and maintenance. As a result, BEL's institutional performance improved considerably.

4.8 The implementation of the proposed Second Power Development Project would require additional skills and qualifications in new areas, such as operation and maintenance of transmission lines and submarine cables, in load dispatching and environmental issues. Additionally, the downscaling of the diesel plants may result in some staff becoming redundant. As part of the project implementation plan, BEL will prepare, and thereafter carry out, a program for the training of staff required to implement, operate and maintain the proposed project, according to an agreed project implementation plan and schedule. The proposed project will finance this training and also training in cost of service calculations and tariffs, another area of increasing importance to BEL.

4.9 Financial Organization and Accounting. BEL produces monthly financial statements which are compared with budgets. BEL's accounting is largely computerized although parts of the system, such as accounts receivable and payroll, are not integrated with the general ledger. A data processing specialist, financed from funds from the IBRD Loan No. 2749 (Power I project), reported inadequacies in BEL's computer systems, including accounting applications, and a pressing need to integrate all BEL's computer systems and to purchase required hardware and software. As part of the project implementation plan, BEL will submit to the Bank and thereafter carry out an action plan for the integration of its data processing systems and the purchase of the required hardware and software, according to an agreed project implementation plan and schedule. EIB is considering financing this program. In an effort to strengthen the company's financial management, BEL appointed a new General Manager for Finance and Administration in June 1993. The new Manager was previously the General Manager for Engineering. He has an MBA, private sector experience, and, prior to his appointment, played a significant role in recent successful efforts to improve BEL's financial and investment planning.

4.10 Billing and Collection. On March 31, 1993, accounts receivable were at a very good level equal to 36 days of sales. The Government has met its agreement under Loan 2749-BEZ to ensure that public sector bills are paid within 60 days. This has been an important factor in keeping receivables at a low level.

4.11 Auditing. The annual financial audits of BEL will be carried out by independent auditors satisfactory to the Bank, who also audited the accounts of BEB. BEL agreed during negotiations that it would engage independent auditors, satisfactory to the Bank, and that BEL's audited

accounts, including SOE's and the Special Account, will be submitted to the Bank not later than four months after the end of its fiscal year. BEB's past record in this matter has not been fully satisfactory but it has improved in recent years. It is expected that performance will further improve by the recent appointment of a new qualified General Manager for Finance and Administration.

4.12 Income Taxes. Unlike BEB, which as a Government statutory body was exempt from income taxes, BEL has to pay income taxes. The Government has indicated, however, that it will take steps to make sure that BEL will be liable for income taxes on its taxable income only from April 1, 1993 and that, for the first three fiscal years thereafter, BEL will be liable at a 10% rate. The rate will be increased by 5% annually thereafter to a maximum rate of 35%, beginning on April 1, 2000. 35% level of taxation is standard for private companies in Belize. BEL will also be permitted to offset the accumulated losses of BEB against its taxable income.

4.13 Insurance. BEL carries insurance coverage for all its assets in operation, general plants and buildings. Renewal of insurance for transmission and distribution lines and substations is becoming extremely difficult in the Caribbean region due to substantial losses caused by hurricane Andrew. BEL is using its best efforts to secure adequate insurance. BEL is also studying the viability of establishing a reserve fund to deal with this problem.

PART V: THE PROJECT

Background

5.1 Participation of the Bank in Belize's Power Sector development dates back to 1986 when a US\$7.5 million loan (2749-BEZ) was approved to assist in meeting the sector's immediate needs, specially to strengthen institutionally the Belize Electrify Board (BEB) and to reduce the substantial level of distribution losses. The Power I Project was part of BEB's 1987-1993 investment program and comprised five major components, namely: (i) distribution expansion and improvements; (ii) installation of new diesel-electric generating sets; (iii) technical assistance and training; (iv) pre-investment studies; and (v) consultant services for engineering and construction supervision.

5.2 As the Power I Project was on schedule and progressing satisfactorily, the Government and BEB informed the Bank in late 1991 of their interest in having the Bank's financial assistance in developing an interconnection with the Mexican Power System in the State of Quintana Roo. Subsequently the Bank assisted in the preparation of a power project - a Second Power Development Project (Power II) - which would continue the institutional strengthening of Belize's Power Sector and structure its main trunk transmission system around the interconnection with Mexico. The proposed project is part of the medium-term expansion program (1995-2004) of Belize's Power System.

Rationale for Continued Bank Involvement

5.3 The Power I Project was successfully completed, on schedule, at the end of 1993. The objectives of this project were achieved, both tangible physical works as well as for institutional strengthening. The Government of Belize has moved firmly in the direction of economic reform and private participation in government owned enterprises. The electricity sector has been reformed, the private sector is developing a hydroelectric scheme and, as indicated in paragraphs 3.3 to 3.6, the Government has established BEL as an independent corporation. Furthermore, the Government has already sold part of its interest in BEL to private investors. Necessary conditions for continuing the Bank's support of Belize power sector have been met. The proposed project constitutes a strategic component of the long-term plan to develop an interconnected system that will provide a reliable and economical electricity supply to Belize.

Objectives and Description

5.4 The main purpose of the proposed project is to integrate Belize's five major load centers, hitherto isolated, into an integrated national power system and tap new supply sources of relatively cheap electricity. This would be achieved by means of the interconnection with Mexico and the transmission system associated with the 25 MW BOT hydroelectric scheme at Mollejon on the Macal River. When completed, the Belize trunk transmission system will encompass 286 km of 115 kV lines and associated substations, and will tie-in the main populated areas of the country.

5.5 A subsidiary purpose is to continue support of the current re-structuring of the power sector to increase efficiency and expand private investment in the sector. Additionally, the proposed project aims at strengthening BEL through provision of technical assistance and training.

5.6 As agreed with GOB and BEL, the proposed project will consist of eight major components, namely:

- (i) 136 km, 115 kV interconnection transmission line with Mexico (Group 1);
- (ii) 115 kV substations and Dangriga connection to the Mollejon line (Group 2);
- (iii) Interconnection of San Pedro (Ambergris Cay) to the 115 kV transmission from Mexico (Group 3);
- (iv) Energy Management System (EMS) and Supervisory Control and Data Acquisition (SCADA) and communication systems (Group 4);
- (v) Operation and Maintenance Vehicles, Equipment and Tools (Group 5);
- (vi) Environmental Clean Up of BEL's Diesel Power Plants;
- (vii) Consultant Services for:

- Engineering and Project Management;
- Cost of Service and Tariff Study;
- Diesel Plant Environmental Mitigation Study;
- Monitoring of Implementation of Environmental Action Plan

(viii) Training & Technical Assistance

A detailed description of the physical components of the proposed project is presented in Annex 5.1. TORs for consultancy services are included in Annexes 5.7, 5.8 and 5.10. The physical components of the Project are illustrated in IBRD Map No. 25745.

5.7 Two other components of the expansion plan are the Mollejon hydroelectric power plant and the expanded power supply from Mexico. These two components will be completed and fully operational when the Second Power Development Project is completed. When all components of the expansion plan are in place, Belize's electricity demand will be covered from three sources, the Mollejon hydroelectric plant, the supply from Mexico and the local diesel units, mainly for peak load and as local generation reserve.

The Mollejon Hydroelectric Development

5.8 The Mollejon hydroelectric development is a run-of-river 25 MW hydroelectric power plant (three Francis units of 8.4 MW each) at Mollejon in the Macal river (a tributary of the Belize river); its associated 139 km, 115 kV transmission line from the plant site to Belize City; and three intermediate substations. The average yearly energy production has been estimated at 110 GWh. From historical records, in a dry year, production could be as low as 72 GWh and, in a wet year, as high as 137 GWh. The plant has a small reservoir with a live storage of 845,000 cubic meters for daily regulation. Annex 5.2 shows the basic technical characteristics of the Mollejon plant and the expected power and energy production (derived from 10-year hydrological historical information).

5.9 The Mollejon project is being implemented by a private group of developers under BOT and power purchase agreements with the Government and BEL (price terms and other conditions are explained in paras. 6.4 and 6.5). Construction of the hydroelectric plant and its associated transmission system is underway. Completion of the first unit is expected by December 1994 and all three units will be completed by March 1995. The estimated total cost of the project is US\$ 59 million, including about US\$ 6 million of financing costs. IFC and CDC will be part of the financing package of Mollejon, once a Master Financial Agreement is signed. Due to the interrelation of Mollejon and the proposed project, IFC and IBRD have work in close coordination during project preparation.

The Mexican Power Supply

5.10 The power and energy output of the Mollejon plant is highly variable. To firm up the capacity of Mollejon, and supply additional power and energy for the interconnected system, a key component of the proposed project is a long-term electricity supply contract with Mexico. BEL, with the support of the Government, has pursued actively this matter. The Comision

Federal de Electricidad (CFE), CFE has answered positively the request of BEL to supply up to 25 MW at 115 kV at the Mexican border.

5.11 Power and energy are presently being purchased from the CFE and being utilized in the Corozal-Orange Walk area. The power is delivered at 34.5 kV. The present contract allows the purchase of up to 5 MW at 34.5 kV. CFE has indicated that this level can be increased to 6 MW without additional installations. In order to effect the larger supply requested by BEL to cover its 10-year demand requirements, the CFE plans to construct a second 115 kV transmission line between CFE's Ticul and Xul Ha Substations. Once that is completed in 1998, CFE will provide BEL with additional 12 MW, for a total of 18 MW. Additional installations would be required to allow BEL to purchase the maximum 25 MW requested. CFE estimates that these installations would be available in 2003 (price terms and other conditions are explained in para. 6.6).

Status of Project Preparation

5.12 Project preparation is well advanced. For the transmission components, an electrical system design and cost estimate have been made^{5/}. In addition, a generation dispatch simulation and production costing on the interconnection with Mexico and the supplies to Dangriga and San Pedro^{6/} have been completed. A line route selection and environmental impact assessment has been carried out for the interconnection with Mexico^{7/}. The final route has been determined as part of the EIA. An economic technical and environmental impact analysis has also been done of the submarine link to Ambergris Cay^{8/}. Work is presently underway on route survey for the 115 kV line to Mexico and the 34.5 kV line to Dangriga. Plan and profile drawings for these lines will be available by December 1994. These drawings will be accompanied by a soils investigation analysis. As a condition for disbursements for the 115 kV transmission line goods and works (Group 1), BEL should have completed all Project transmission line and substation land surveys, identified all rights-of-way, and completed easements and land acquisition procedures, as required for the first year of project construction.

5.13 BEL will engage a consulting firm to perform final engineering design of the physical components of the Project and provide project management services during implementation. The firm will also carry out the basic designs and specifications for the dispatch center, the Supervisory Control and Data Acquisition System (SCADA) and associated communication

^{5/} *Power II Study for The Belize Electricity Board, prepared by NEI Electric Power Engineering, Inc., Arvada, Colorado, U.S.A., December 1992.*

^{6/} *Power II Project - Interconnection Transmission Line to Mexico, Generation Dispatch Simulation and Production Costing, prepared by E. Indacochea and I. Aragon, November 1992.*

^{7/} *Belize Power II - 115 kV Mexico Interconnection Transmission Line, Line Environmental Impact Assessment, prepared by CI Power, December 1993.*

^{8/} *Power II Project: Economic, Technical and Environmental Analysis of 34.5 kV Submarine Cable Link to San Pedro, prepared by ELSAMPROJEKT, Denmark, December 1993.*

system. It is expected that the consulting firm will be engaged by June 1994 and complete its services for final engineering design by January 1995. The services for project management and supervision will start in January 1995 and will extend for a period of approximately 30 months.

Project Cost Estimate

5.14 The project cost at December 1993 prices, including physical and price contingencies, and excluding taxes and duties, is estimated at the equivalent of US\$29.7 million, of which US\$26.5 million (89%) would be the foreign cost. Total financing requirements, including US\$3.3 million interest during construction, would be US\$33 million. Annex 5.4 shows a detailed cost estimate, while a project cost summary is given in the following table:

		(in Millions US\$)		
		<u>L.C.</u>	<u>F.C.</u>	<u>Total</u>
Group 1:	115 kV interconnection to Mexico	0.47	6.15	6.62
Group 2:	115 kV substations and Dangriga connection	0.94	3.59	4.53
Group 3:	Submarine cable connection to Ambergris Cay	0.52	5.93	6.45
Group 4:	SCADA and communication systems	0.23	2.78	3.01
Group 5:	O&M vehicles, equipment and tools	0.00	0.65	0.65
Environmental Mitigation in Diesel Plants		0.00	0.70	0.70
Subtotal		2.16	19.80	21.96
Engineering, Project Management and PIU		0.46	2.07	2.53
Cost of Service and Tariff Study		0.00	0.19	0.19
Diesel Plants Environmental Mitigation Scope Study		0.00	0.18	0.18
Monitoring Implementation of Environmental Action Plan		0.00	0.18	0.18
Training and Technical Assistance		0.00	0.70	0.70
Subtotal		0.46	3.32	3.78
Total Base-Line Cost		2.62	23.12	25.74
Physical Contingencies		0.41	2.31	2.72
Base-Line Cost plus Ph. Contingencies		3.03	25.43	28.46
Price Contingencies		0.15	1.12	1.27
Total Project Cost		3.18	26.55	29.73
Estimated Financial Cost (IDC)		0.00	3.25	3.25
Total Estimated Project Cost		3.18	29.80	32.98

5.15 Engineering and project management costs have been estimated at about 10% of direct project costs plus physical contingencies, which is in line for projects of the nature of the proposed project. Physical contingencies of about 15% have been estimated for local costs, which are essentially labor costs and local transport. For foreign costs, which represent mainly

materials and equipment, a contingency allowance of about 10% has been added. For price contingencies, a 5% overall allowance has been considered adequate, given the fact that very little inflationary pressure is foreseen in the next coming years that would affect the construction cost of the proposed project.

5.16 The project cost estimate has been established using prudent cost estimation both for substation equipment and for transmission line construction, as of December 1993. For instance, the 115 kV transmission line single circuit wood pole-mounted has been estimated at US\$45,000 per km and for 34.5 kV line at US\$25,000 per km. These unit costs are well within recent historical and current cost levels. For substation equipment, the consultants have used pro-forma price quotations and catalog prices, which are generally higher than prices obtained in ICB. On the other hand, the cost for environmental clean up of diesel plants should be considered as a preliminary estimate derived from a general, non-detail, spot checks in the field. An environmental mitigation study (Annex 5.10) will determine detailed scope and costs.

Project Financing Plan

5.17 The project financing plan is shown in the table below, and details of the agreed packages are given in Annex 5.4. In this project funding scheme the IBRD loan would be US\$11.5 million equivalent, all of it for foreign currency project items.

Financing	Allocation of Funds	(in Millions US\$)		
		L.C.	F.C.	Total
IBRD	- Foreign cost of Groups 1 and 5	0.0	6.9	6.9
	- Diesel Plants Environmental Clean Up	0.0	0.8	0.8
	- Engineering and Project Management	0.0	2.4	2.4
	- Cost of Service and Tariff Study	0.0	0.2	0.2
	- Environmental Mitigation Scope Study	0.0	0.2	0.2
	- Monitoring of Environmental Action Plan	0.0	0.2	0.2
	- Training and Technical Assistance	0.0	0.8	0.8
	Subtotal	0.0	11.5	11.5
CDB	- Local and Foreign Costs of Group 3	0.7	6.8	7.5
CDC	- Local and Foreign Costs of Group 2	1.2	4.0	5.2
EIB	- Foreign Cost of Group 4	0.0	3.2	3.2
BEL	- Mexican Supply Investment	0.0	1.1	1.1
	- Local Costs of Groups 2 and 4	0.8	0.0	0.8
	- Project Implementation Unit (PIU)	0.5	0.0	0.5
	- Interest During Construction	0.0	3.2	3.2
	Subtotal	1.3	4.3	5.6
Grand Total Funding Provided		3.2	29.8	33.0

Project Implementation

5.18 Actual project implementation would start with land surveys and final engineering design early in 1994 and be completed towards mid-1997. The following table sets forth the implementation schedule for the different project components. A Project implementation Gantt chart is shown in Annex 5.5.

	Project Bidding Process		Implementation	
	Tender Documents Issued		Starts	Completed
	Contracts Awarded			
Group 1	12/94	4/95	5/95	12/96
Group 2	12/94	4/95	5/95	4/97
Group 3	4/95	8/95	9/95	9/96
Group 4	6/95	12/95	2/96	6/97
Group 5	12/94	4/95	5/95	4/96
Environmental Clean Up	6/95	9/95	10/95	10/96
Consultant Services:				
- Eng. & Project Management	5/94	8/94	8/94	6/97
- Cost of Ser. & Tariff Study	6/94	9/94	9/94	3/95
- Environmental Mitig. Scope	1/95	3/95	3/95	9/95
- Environmental Monitoring	6/94	9/94	9/94	12/96
Training & Tech Assistance			1/95	12/96

5.19 BEL has established a Project Implementation Unit (PIU), properly staffed and funded; and has appointed a Project Coordinator-Manager in charge of the unit, having qualifications and experience satisfactory to the Bank. The Project Coordinator will be accountable to BEL's Chief Executive Officer. Project management, preparation of detailed engineering design, preparation of tender documents, evaluation of bids, supervision of construction and implementation of the environmental mitigation action plan, as well as the project's accounting required for the execution of the physical components of the Project would be performed by the PIU with the assistance of an international consulting firm. Annex 5.6 shows the planned organization chart of the PIU. During negotiations BEL agreed to maintain during project implementation the PIU properly staffed and funded; and that it would carry out the project according to an agreed implementation plan and schedule (Annex 5.5).

5.20 Project management will require an overall coordination of project engineering design; preparation of bidding documents, bids evaluation and contracting; procurement, storage and handling of materials and equipment for the transmission lines; and supervision of project's works. Construction of project components will be done by competent foreign contractors.

Consultant Services

5.21 The proposed project includes consultancy services to be engaged by BEL following the Bank's guidelines and under terms of reference acceptable to the Bank for the following tasks:

- (i) Engineering design, technical specifications, project management and construction supervision, for an estimated total of about 150 man-months. Terms of reference for the engagement of these consultants appear in Annex 5.7;

- (ii) Cost of service and tariff study, for which about 12 man-months are required. Terms of reference for the engagement of these consultants appear in Annex 5.8;
- (iii) Clean-up scope study of diesel-electric power stations and supervision of mitigation measures, for which about 12 man-months are required. Terms of reference for the engagement of these consultants appear in Annex 5.10; and
- (iv) Monitoring of Environmental Action Plan (EAP), for which about 12 man-months are required. Terms of reference for the engagement of these consultants appear in Annex 5.11.

Institutional Strengthening, Training and Technical Assistance

5.22 A comprehensive two-year training and technical assistance program would continue the program developed during the Power I Project and would aim at further strengthening BEL's administrative and technical capabilities. Training will be given, inter alia, in the following areas (A specific program will be prepared for this matter; see also paras. 4.7 and 4.8):

- (i) Operation and Maintenance of high voltage transmission lines and substations. (This program will be prepared in coordination with the suppliers of equipment and the contractors);
- (ii) System operations and dispatch;
- (iii) Cost of Service and Tariffs;
- (iv) Commercialization (meter reading, billing, customer services, etc.);
- (v) Distribution Planning and Mapping; and
- (vi) Environmental Impact Evaluation and Monitoring.

5.23 In addition, the following technical assistance, inter alia, will be provided:

- (i) Electrical System Operation Studies (load flow, short circuit and stability). Consultants will provide and install a PC network analysis software package and train BEL's personnel on its use.
- (ii) Generation Dispatch and Production Costing Simulation. Consultants will provide and install a PC generation dispatch and production costing simulation package, adapted to BEL's system conditions. Consultants will train BEL's personnel on its use.

- (iii) Consultant will train BEL's personnel in the use of CAD to produce and update engineering drawings, plans, profiles, substations layouts, single-line diagrams, etc. BEL's PC mapping system will be used for this training.

5.24 Technical assistance will also be provided to advise the Government in establishing complementary price regulations to the Electricity Act.

Procurement

5.25 A country procurement assessment was carried out in May/June 1993. Although the assessment concluded that the country does not have comprehensive procurement regulations, BEL personnel involved in the Power I Project are knowledgeable on Bank procurement procedures. Additionally, BEL's PIU will be supported by qualified international consultants on all bidding and procurement process.

5.26 The following table summarizes the procurement arrangements for the project:

<u>Project Items</u>	<u>Procurement Method</u>			<u>TOTAL</u>
	<u>ICB</u>	<u>OTHER</u> (US\$ Million)	<u>NBF</u>	
<u>Goods</u>				
115 kV transmission line	3.0 (3.0)			3.0 (3.0)
Submarine cable, substations, SCADA			9.5	9.5
Operation & Maintenance vehicles and tools ¹		0.7 (0.7)		0.7 (0.7)
<u>Works</u>				
115 kV transmission line	3.7 (3.2)		1.2	4.9 (3.2)
Submarine cable, substations, SCADA			6.5	6.5
Environmental clean up of diesel plants	0.8 (0.8)			0.8 (0.8)
<u>Consultants and Technical Assistance²</u>				
Engineering & Project Management		2.4 (2.4)	0.5	2.9 (2.4)
Cost of Supply and Tariff Study		0.2 (0.2)		0.2 (0.2)
Environmental Clean-Up Scope Study		0.2 (0.2)		0.2 (0.2)
Environmental Monitoring		0.2 (0.2)		0.2 (0.2)
Technical Assistance, Training and Materials		0.8 (0.8) ³		0.8 (0.8)
Totals	<u>7.5</u> (7.0)	<u>4.5</u> (4.5)	<u>17.7</u>	<u>29.7</u> (11.5)

Notes: Figures in parentheses to be financed by the Bank; NBF=Not Bank Financing

^{1/} Through Limited International Bidding (LIB).

^{2/} Selection of consultants according to Bank guidelines.

^{3/} Training equipment and materials procured through international and local shopping.

5.27 Contracts for the supply and construction of the 115 kV transmission line component of the project, including all necessary civil works, will be procured through International Competitive Bidding (ICB), in accordance with Bank's procurement guidelines. Operation and maintenance vehicles, equipments and tools will be procured through LIB in accordance with Bank guidelines. Both ICB and LIB will use Bank standard bidding documents.

5.28 The environmental clean up of BEL's diesel plants will be procured through international competitive bidding (ICB). Since this component involves a number of jobs of relatively limited scope in widely separated localities, it is foreseen that foreign contractors would need to use as much as possible local subcontractors.

5.29 Consultant services will be contracted following Bank guidelines for selection of consultants. Individual consultants for technical assistance and training will be hired following Bank guidelines for selection of consultants. Small quantities of training materials and equipment which could not be packaged in contracts of US\$25,000 or more, and not exceeding an aggregate amount of US\$50,000, will be procured through international and local shopping, following Bank procurement guidelines.

5.30 Bank prior review of proposed invitations, award recommendations, and final contracts will be required for: (i) all contracts for works and goods procured under ICB and LIB; and (ii) all contracts for consulting services except those with consulting firms estimated to cost below US\$25,000. For consulting services from firms estimated to cost below US\$25,000, the Bank will review ex-ante the terms of reference and ex-post, relevant supporting documentation on selective basis during supervision. As a result of these procedures, the Bank's prior review will cover about 95% of the contracts financed by the Bank.

Disbursements

5.31 The proceeds of the Bank loan are expected to be disbursed over a four-year period. The disbursement schedule reflects a careful evaluation during project preparation of the intervals needed to perform the different tasks included in the proposed project. Proceeds of the proposed Bank loan would be used to finance:

- (i) 100% of foreign expenditures for purchase of equipment and materials for the 115 kV Mexico Border-Belize City transmission line, and purchase of vehicles, equipment and tools for transmission system operation and maintenance;
- (ii) 100% of foreign expenditures for construction works for the 115 kV Mexico Border-Belize City transmission line;
- (iii) 100% of foreign and local (ex-factory) expenditures for purchase of equipment and materials for (a) environmental clean up at diesel power stations; and (b) training equipment and material; and 85% of locally procured imported items;
- (iv) 100% of total expenditures for works for the environmental clean up at diesel power stations; and

- (v) 100% of total expenditures for engineering services, technical assistance and training.

Retroactive financing, up to US\$500,000, for expenditures incurred after January 31, 1994, for consultancy services necessary for the final detailed engineering design of the project, a tariff study, and technical assistance to GOB for electricity pricing regulations, would be included.

5.32 Disbursement requests would be fully documented except for payments against contracts whose value is less than US\$25,000 equivalent. Claims for expenditures of these lesser amounts would be subject to presentation of a statement of expenditures for which the supporting documentation would be kept by the borrower for Bank review, on selective basis, during supervision. A Special Account would be established in the Central Bank of Belize with a deposit of US\$750,000, representing three months of estimated expenditures. Periodic replenishment would be made to this special account against withdrawal applications received from BEL and supported by such documents as the Bank would require. The Borrower would be required to have annual audits for the project accounts, Special Account, and withdrawals based on statement of expenditures. The closing date of the loan would be December 31, 1997, six months after estimated completion of the Project.

Environmental Considerations

5.33 During project preparation, environmental assessments (EAs) of the 115 kV transmission line and of connection to Ambergris Caye were carried out. In the latter case the study included evaluation of several supply alternatives (i.e., submarine cable crossing, overhead line crossing, expansion of local diesel generation). The submarine cable was the preferred solution from both economic and environmental viewpoints. Consultants concluded that with proper precautions in routing and construction only minimal environmental impact would occur. The right of way for the overland segments will require very limited clearance of trees and bushes. No natural reserves will be affected. For the submarine cable, care will be taken during construction to limit dredging activity and sediment fouling. A study of baseline conditions in the channel between the mainland and Ambergris Caye will be conducted prior to construction (see para. 5.35). Monitoring and evaluation are foreseen during construction (see para. 5.36). Annex 5.9 describes in more detail the environmental issues and the recommendations of the EAs.

5.34 On the basis of land surveys which are underway, a plan to secure land for the ROW and the final siting of substations will be established. BEL will also interact with the appropriate agencies (e.g., Ministries of Tourism and Environment - MTE, Natural Resources - MNR, and Housing and Urban Development - MHUD) to secure the necessary reviews, clearances and licenses, ensuring compatibility of the ROW with other land use development proposals, avoidance of protected areas and sites of archaeological interest, the right to fell trees and clear mangroves as needed. Surveys of the ROW by the Department of Archaeology/MTE and the Forestry Department/MNR will be carried out.

5.35 Baseline data on current patterns and water quality in the San Pedro crossing will be collected during a four-week period through a study to be financed by the CDB. The study will also define a monitoring and evaluation plan for the marine environment in the area of influence

of the submarine cable and will establish parameters against which monitoring results will be evaluated during construction.

5.36 During the pre-construction phase, an international consulting firm will be employed to prepare an integrated monitoring plan for the project. It will also provide orientation to BEL's Environmental Unit and carry out monitoring and evaluation activities in order to verify contractors' compliance with the environmental safeguards and mitigation measures foreseen in the EIAs and incorporated into tender documents.

5.37 During project preparation, a preliminary evaluation was carried out of environmental problems in BEL's major diesel plants. Terms of reference were prepared for a pollution mitigation program to be financed under the proposed project (see Annex 5.11). Consultants will be employed to carry out environmental audits and design clean-up plans for seven of BEL's thermal power plants (i.e., Belize City, Ladyville, Belmopan, which are expected to provide base-load power, and San Pedro, Dangriga, Corozal and Orange Walk, which are expected to operate on a stand-by basis after implementation of the Second Power Development Project).

Project Risks

5.38 There are three types of physical risks that could affect the transmission lines and substations included in the proposed project, namely: hurricanes, salt-fouling of insulation, and corrosion of conductor and line hardware. Due to potential for tropical storms and hurricanes in Belize, a high wind factor will be taken into consideration in all line designs. It has been determined that winds of 240 km per hour (150 mph) with gusts to 265 km per hour (165 mph) will have to be used as the design standard in order to ensure the structural integrity of the lines. Salt fouling of insulation and corrosion of conductor and line hardware are phenomena likely to affect transmission lines and substations sited near the sea coast, particularly if there is a long dry season which allows accumulation of salt on surfaces, as is the case in Belize. A special study will be done on these problems (see Annex 5.7) to minimize their impact on the transmission and substation facilities included in the Project. Design of insulation, selection of conductor and line hardware will be governed by the result of this study.

5.39 The project cost estimate has been established in a prudent manner by reputable consultants, with appropriate contingency allowances, so that there is little risk of cost overruns. The type of facilities included in the project are not subject during implementation to unusual construction risks, on the contrary these are straightforward jobs for which minimal obstacles can be foreseen both with supply of materials and equipment, and with labor. Delays in project execution could arise due to BEL's lack of experience with the type of power facilities included in the project, such as 115 kV transmission lines and substations, and submarine cable. To minimize this risk, provision has been made to engage engineering consultants to assist BEL in the implementation of the proposed project. BEL's staff will also be assisted by Bank's staff in matters related to Bank procedures.

5.40 During project operation the major risk is BEL's financial performance. If expected sales do not materialize, and BEL cannot take the available energy from Mollejon, or Macal river hydrology is less favorable than expected, obligations under the power purchase contract for

Mollejon could affect negatively BEL financial condition. If this should occur BEL would postpone its planned non-project expending and, if necessary, make temporary use of bank overdraft facilities.

PART VI: FINANCIAL ANALYSIS

BEL's Past Operating Results and Present Financial Position

6.1 BEL's Sales and Generation forecast and Investment Plan are presented in Annexes 6.1 and 6.2, respectively. BEB and BEL's past and projected 1990-2003 income statements, balance sheets and cash flow statements are presented in Annex 6.3. The assumptions used in the preparation of the financial projections are included also as part of Annex 6.3.

6.2 After being unable to service its debt and sustaining operating losses for many years, BEB's finances began to improve in FY85 as a result of tariff increases, the conversion of debt to equity by Government, lower fuel prices and efficiency improvements. BEB's financial performance has since been good despite a 7.5% tariff reduction in FY89. The growth in kWh sales has been strong and the average annual growth rate between FY89 and FY93 was about 12.8%. Operating costs per kWh sold were about 34 BZ cents in FY93 compared to 38.5 BZ cents in FY85. Rates of return for the five year period FY89 to FY93 range from 3% in 1989 to 10.6%. BEL's 1993 net operating income was BZ\$7.6 million compared to BZ\$5.0 million in FY92.

6.3 BEL's audited balance sheet at March 31, 1993 is summarized below. BEL's financial position was satisfactory with a debt/equity ratio of 54:46, and a current ratio of 1.4.

	BZ\$ millions	US\$ millions	%
<u>ASSETS</u>			
Net fixed assets	76.78	38.77	76
Construction in Progress	8.57	4.33	8
Current assets	15.95	8.05	16
Total	<u>101.30</u>	<u>51.15</u>	<u>100</u>
<u>LIABILITIES & EQUITY</u>			
Equity	41.05	20.73	41
Debentures	21.50	10.85	21
Long-term debt	27.58	13.93	27
Current liabilities	11.17	5.64	11
Total	<u>101.30</u>	<u>51.15</u>	<u>100</u>

Franchise and Power Purchase Agreement for the Mollejon Plant

6.4 In April 1991 Government granted a franchise to a joint venture of two US companies to construct and operate a 20 MW run of river hydroelectric plant on the Macal river as well as a 139 kilometer 115 KV transmission line to Belize City, Ladyville and other load centers. The Franchise Agreement provides that, forty years after the commercial operation date of the plant, the ownership of the hydroelectric plant will be transferred to the Government or such parties as the Government may designate. After the construction of the transmission line and associated substations, the Agreement also provides for ownership to be transferred to BEL with a nominal charge of US\$1.00.

6.5 A 40 year power purchase agreement, dated April 19, 1991, between BEB (subsequently assigned to BEL) and Belize Electricity Company Limited (BECOL, the company formed by the developers) provides for BEL to pay an annual fixed amount, in equal monthly installments, based on energy equal to 110 GWh in FY1996, 115 GWh in FY1997 and 1998, and 120 GWh up to FY2004, at a rate of 8.75 UScents per kWh. Excess energy is to be purchased at 7 US cents per kWh. After FY2005, the fixed payments will be eliminated and BEL will pay only for the energy actually supplied, on a take-or-pay basis. BEL is to pay the producers for the operation and maintenance of the hydro facilities an amount equal to five percent of its gross electricity revenues from the resale of the energy purchased^{2/}. Under a Guarantee Agreement, the Government guarantees the timely performance of BEL's obligations.

Power Purchase Agreement with Comisión Federal de Electricidad (Mexico)

6.6 Under an existing agreement between BEL and Comisión Federal de Electricidad (CFE), BEL is entitled to purchase up to 5 MW from CFE. A long-term electricity supply contract providing for larger electricity purchases by BEL is essential for the proposed Power II Project. BEL is negotiating a contract with CFE for the supply of up to 25 MW. CFE has requested that BEL pay US\$1.1 million in order to finance the capacity increase of the Mexican facilities necessary to permit this export of electric power to Belize (mainly a transmission link at 115 kV). BEL will finance this investment out of its internally generated funds or through a commercial bank loan. Power supply to Belize would be charged at the CFE tariff for supplies at 35 to 220 kV to its Peninsular region. The current (December 1993) rates for the Mexican supply vary from US\$0.032 during base load time to US\$0.058 during peak load time (6 p.m to 10 p.m Monday to Saturday), while the monthly peak demand is charged at about US\$8.8 per kW (Annex 5.3 shows the structure of the Mexican tariff). The signing of an extended long-term power supply contract with CFE, Mexico, on terms and conditions satisfactory to the Bank, would be a condition for Loan effectiveness.

6.7 Given that BEL's future system demand will be covered mainly by supplies from Mollejon and Mexico, and that the proposed project is only one part of an expansion plan in

^{2/} *The cost of the Mollejon energy, at delivery points in the high voltage substations, is estimated at about USCents 10/kWh (at 0.95 average power factor), including 5% of the present average retail tariff of USCents 19.2/kWh for operation and maintenance, and 3.5% estimated transmission losses.*

which these supplies are an integral part, an additional event of default that would authorize suspension of disbursements of the Loan would be that either BECOL or CFE fails to supply, under the foregoing agreements, the electricity required by BEL to meet consumer demand, and BEL is unable to meet the deficiency from either CFE or BECOL or any other source.

Financial Plan

6.8 BEL's capital spending and financing plan during the 1995-1998 project disbursement period is as follows:

	<u>BZ\$</u> <u>Million</u>	<u>US\$</u> <u>Million</u>	<u>%</u>
REQUIREMENTS			
<u>Capital Spending</u>			
Proposed Project	58.90	29.75	71
Interest during construction	<u>6.43</u>	<u>3.25</u>	<u>8</u>
Total project financing required	65.33	33.00	79
Other	15.29	7.72	19
Working capital	1.81	0.91	2
Total Requirements	82.43	41.63	100
SOURCES			
Gross Internal Cash Generation	52.88	26.70	64
Less: Debt Service	<u>28.95</u>	<u>14.62</u>	<u>35</u>
Net Internal Cash Generation	23.93	12.08	29
<u>Project Borrowings</u>			
IBRD	22.77	11.50	28
CDB	14.85	7.50	18
CDC	10.30	5.20	12
EIB	<u>6.34</u>	<u>3.20</u>	<u>8</u>
Total Project Borrowings	54.26	27.40	66
Capital Contributions	3.76	1.89	4
Working Capital	0.48	0.26	1
Total Sources	82.43	41.63	100

6.9 In the financing plan, it has been assumed that the US\$11.5 million Bank loan (BZ\$ 22.8 million) to the Government (at variable lending rate, over 17 years, including a five year grace period, and equal annual principal payments) will be available to BEL for the same amount and with the same conditions. Execution of a subsidiary loan agreement between the Government and BEL, satisfactory to the Bank, would be a condition for loan effectiveness.

6.10 It has been assumed that the US\$5.2 million (BZ\$10.3 million) CDC Loan would be made to BEL at an 9.5% interest rate over 10 years, including a grace period of 3 years, with equal annual loan repayments. Subject to prior management approval, CDC expects to conduct its project appraisal in June 1994. Based on this timing, loan approval is expected in July 1994.

As a condition of effectiveness of the proposed Loan, CDC's Board should have approved a loan to finance the cost of the 115 kV substations and the Dangriga connection components of proposed project.

6.11 The CDB loan would be for US\$7.5 million (BZ\$14.8 million) at CDB's standard variable interest rate (currently about 7.5%) with a maturity of 18 years, including 3 years grace period. CDB concluded its appraisal at the same time as the Bank appraisal. Board approval is expected in July 1994.

6.12 The EIB loan would be for US\$3.2 million (BZ\$6.3 million) at a 3% interest rate with a maturity of 18 years, including a 3 year grace period. EIB appraisal will be conducted in March 1994. Board approval is expected in May 1994.

6.13 An additional event of default that would authorize suspension of disbursements of the Loan would be that the CDB or CDC or EIB loan agreements shall have failed to become effective by March 31, 1995.

Electricity Rates

6.14 To help finance its capital spending program during the 95-98 project construction period and maintain a sound financial position, during negotiations it was agreed that BEL would maintain its electricity rates at a level sufficient to earn a rate of return on its average net fixed assets in operation, revalued from time to time when required by the Bank, of not less than 7% in FY96 and thereafter. This would repeat the rate of 7% under Loan 2749-BEZ. It was also agreed that (i) before January 1 of each fiscal year, BEL would furnish to the Bank a preliminary estimate of the rate of return for the current fiscal year and for the next fiscal year and (ii) if the estimates indicate that BEL would not meet the rate of return requirements, it will promptly take all necessary measures to meet such requirements. The Government agreed to promptly take such measures, as may be required, to enable BEL to comply with the foregoing rate of return requirements.

Financial Forecast

6.15 As a consequence of the transfer of BEB's assets and liabilities to BEL (para. 4.2) in return for debentures and shares, the revenues from electricity operations will be required to meet additional cash outlays for debenture interest and dividends declared on the preference and ordinary shares as well as income taxes. However, BEL's (formerly BEB) cash flow from operations increased about 2.5 times between FY90 and FY93 as a result of strong sales growth. BEL is expected to be able to finance about 38% of its total investment needs between FY94 and FY98, the project implementation period. The debt service ratio is forecast to stay at or above a strong level of 1.86 during this period. After project completion, BEL is expected to be able to completely finance from internally generated funds a much smaller investment program in the succeeding years to FY2003.

6.16 To protect BEL's financial viability BEL would not incur any new debt (other than for the Project) without the prior approval of the Bank unless its future debt service coverage ratio

is 1.5 or higher. It was also agreed that BEL would not undertake any investments in excess of US\$500,000, until completion of the Second Power Development Project, without the approval of the Bank.

Project Monitoring

6.17 Project execution would be monitored against target dates as shown in the implementation plan and schedule of Annex 5.5 and BEL's operational, financial and managerial performance would be monitored through performance indicators (Annex 6.4).

PART VII: PROJECT JUSTIFICATION AND ECONOMIC ANALYSIS

General

7.1 The proposed project, which is a follow-up to the recently completed Power I project (Loan No 2749-BEZ) comprises three components: (1) a 136 km, 115 kV overhead transmission line from the Mexican border to Belize City, creating, together with the transmission line from the Mollejon hydro plant currently under construction, a national grid system connecting Belize's main cities; (2) the incorporation of Dangriga load center to the national grid through a 56 km, 34.5 kV overhead transmission line; and (3) the incorporation of San Pedro load center to the national grid through a 21 km, 34.5 kV submarine cable.

7.2 The proposed project would, together with the Mollejon line, interconnect all the main economic centers (95% of total demand) and provide electricity supply which would be more cost-effective, reliable and environmentally clean, than the current system composed of small-scale independent diesel generation in all the load centers. The project would facilitate the continued economic development of Belize by making electricity available to industrial, commercial and residential customers who are willing to pay for it, and by reducing the need for consumers to purchase and operate private power plants. The proposed project would also provide for the clean up of environmental contamination caused by oil spills from existing diesel plants. Additionally, the project would support the Government of Belize's on-going efforts to increase the efficiency of the power sector, evidenced by the privatization of BEL, through technical assistance and studies. The project is considered economically justified and the estimated economic internal rate of return of about 21 percent is not very sensitive to moderate variations in the key economic parameters. The following paragraphs summarize the Bank's economic evaluation of the proposed project. Further details are provided in Annexes 7.1 to 7.3.

Least-Cost Plan

7.3 In 1990, BEB's foreign consultants, financed under the Power I Project, studied the feasibility of electricity generation from renewable energy sources. The study concluded that hydroelectric development in the Macal river would result in substantial savings over the continued use of diesel generation in the Belmopan and Belize City systems. The study further found that generation from excess bagasse from the sugar factory in the Corozal/Orange Walk area would be more cost effective than using local diesel generation to supply the Corozal/Orange

Walk system unless power could be purchased from the Mexican grid. The study finally concluded that generation from other renewable sources, such as solar and wind, is not economically viable at this time.

7.4 Following the study findings, the Corozal and Orange Walk systems were interconnected with Mexico through a 34.5 kV overhead transmission line, financed under the Power I Project, and the Government negotiated a 5 MW supply contract with Mexico. This system has been operating successfully since June 1991.

7.5 Also in line with the study recommendations, the Government pursued the development of the hydroelectric potential of the Macal river by negotiating a BOT contract with a private investor group (see para 5.9). BEB subsequently signed a 40 year take-or-pay power purchase contract with the developers. The transmission line from the Mollejon hydroelectric plant will link the electrical systems of Belmopan and Belize City and initially displace most of the diesel generation required in this area. However, as demand for electricity grows, given the variability of the Mollejon output, the level of diesel generation capacity needed would start increasing soon after the commissioning of the hydroelectric plant at the beginning of 1995.

7.6 During 1992 and 1993 BEB first, and then its successor company BEL, studied, as part of their expansion planning, the technical and economic feasibility of (1) building a 115 kV overhead transmission line from the Mexican border to Belize City, where it would connect to the Mollejon line, creating national interconnected system; (2) incorporating Dangriga to the interconnected system; and (3) incorporating San Pedro to the interconnected system. Analyses carried out by consultants confirmed that expanded electricity imports from Mexico, facilitated by linking the Belize system with the Mexican grid via a 115 kV transmission line, is the least-cost alternative to firm up the supply from the Mollejon hydroelectric plant and complement the future power and energy requirements of the Belize City-Belmopan systems. The consultants also concluded that the connection of the Dangriga and San Pedro (Ambergris Cay-Island) systems to the national grid, would enable the substitution of diesel generation with cheaper electricity imports from Mexico.

7.7 Equalizing Discount Rate (EDR). The analyses carried out by the Bank, taking account of, *inter alia*, the Bank's November 1993 crude oil price forecast and the updated project cost estimates, confirmed the consultants' findings. Two alternative schemes to meet the balance between the forecast electricity demand and Mollejon supply were analyzed. The EDR was computed for the proposed interconnection scheme, versus the alternative scheme of expanding local diesel generation. In the interconnection scheme the proposed project would complement the hydro supply in Belize City/Belmopan and create a national grid which would allow BEL to displace diesel generation in Dangriga and San Pedro by imports from Mexico. The results show that the proposed interconnection scheme is the least cost supply expansion alternative for Belize. The equalizing discount rate was calculated at about 18 percent, which is higher than the estimated 12 percent opportunity cost of capital.

7.8 The results show that the production cost of the interconnection alternative is about 30 percent lower, on a net present value basis, than the corresponding cost of the diesel alternative, using a real discount rate of 12 percent (calculated over the period FY95-FY2012). The levelized

production cost of the interconnection scheme of about 9.6 US cents/kWh compares favorably with the levelized production cost of the local small-scale diesel operation of approximately 12.2 US cents/kWh. Of the 9.6 US cents/kWh, about 8.9 US cents are attributable to the proposed project (3.9 US cents from investments, 4.8 cents from the purchase price, and 0.2 cents from O&M) and the rest to the operating and maintenance of diesels which would be retained mainly for back-up.

7.9 The choice of the proposed interconnection project as the least-cost alternative remains valid over a range of values for key economic parameters. Even the most pessimistic of the cases tested produce EDRs above the 12 percent estimated opportunity cost of capital. For instance: (1) a 20 percent increase in the capital costs of the proposed project combined with a 20 percent increase in the cost of Mexican imports reduces the EDR to 14 percent; and (2) a 20 percent decline in diesel fuel prices reduces the EDR to some 15 percent.

7.10 EDR for Project Components. To find out whether the three project components are justified independently, the equalizing discount rate was calculated for each of them by comparing the proposed project component with the respective diesel expansion alternative. The results are shown in the table below and detailed in Annex 7.1.

Table 7.1 Estimated Equalizing Discount Rates

Project Component	Equalizing Discount Rate (%)
115 kV interconnection line	18.7 %
Connection of Dangriga	24.1 %
Connection of San Pedro	13.4 %
Proposed Project as a Whole	18.0 %

Economic Analysis

7.11 Economic Internal Rate of Return (EIRR). The EIRR for the proposed project was estimated at about 22 percent, which is above the estimated 12 percent opportunity cost of capital in Belize. The EIRR was computed on the BEL's entire investment program for the proposed interconnected system (ICS) and covers the fiscal years 1994/95 through 2011/2012. Annex 7.2 provides details of calculations and the assumptions used.

7.12 Project Economic Cost. The economic costs used in the analysis comprise: (1) investments, including physical contingencies, required to meet the incremental demand; (2) incremental cost of operation and maintenance of generation, transmission and distribution facilities; and (3) the cost of electricity purchased from Mexico. Since the proposed project would also substitute for more expensive diesel generation, the project economic costs have been adjusted for the corresponding cost savings.

7.13 Project Economic Benefits. The measurable economic benefits of the proposed project stem from increased energy sales in the ICS made possible by the proposed investments. The incremental energy demand served is valued using the current tariffs as a proxy for the consumers willingness to pay for electricity. Additionally, the proposed project would result in some benefits which are difficult to quantify and which the economic analysis consequently does not include. These benefits include the reduced environmental hazards related to the transportation, handling and combustion of diesel fuel. This is particularly the case in the ecologically sensitive Ambergis Caye Island (San Pedro) with its adjacent coral reef, protected wildlife areas, and developing eco-tourism. Furthermore, the project would also help increase the reliability and quality of supply by interconnecting the major load centers via a national grid, hence reducing the additional costs of self-generation, which is currently common among the large consumers, many of which are export oriented agro-processing industries.

7.14 Sensitivity Analysis. The sensitivity of the EIRR was tested for the following four alternative cases: (1) 20 percent increase in the capital cost of BEL's investment program for the ICS; (2) 20 percent increase in the price of electricity purchased from Mexico; (3) 20 percent decrease in the cost of diesel fuel; (4) 20 percent decrease in energy demand forecast; and (5) 20 percent increase in the capital cost of BEL's investment program coupled with a 20 percent increase in the cost of electricity imports. The following table illustrates the results:

Table 7.2 Estimated Economic Internal Rate of Return

Sensitivity Case	EIRR (%)
Base Case	21.7 %
20% increase in investment costs	18.6 %
20% increase in Mexican supply price	19.8 %
20% decrease in diesel fuel prices	20.9 %
20% decrease in annual energy sales	17.0 %
20% increase in investment costs and 20% increase in Mexican supply price	16.9 %

7.15 The results indicate that modest changes in the assumptions do not have a significant impact on project economics. The results are most sensitive to assumptions of energy sales growth, however, the project economics would still be acceptable even if the annual sales growth declined by 40 percent (from the forecast 4.8 percent to 2.9 percent). Thus the conclusion that the proposed project is justified remains valid even under less favorable conditions.

PART VIII: AGREEMENTS REACHED AND RECOMMENDATIONS

8.1 During negotiations the Government and BEL agreed on the following:

The Government would:

- (i) enact, by March 31, 1995, specific regulations in accordance with the Electricity Act of 1992 and satisfactory to the Bank, that define transparent procedures for electricity tariff setting and approval (para. 3.12); and
- (ii) promptly take all measures as may be required to enable BEL to comply with the rate of return requirements of the Project (para. 6.14);

BEL would:

- (iii) employ consultants to carry out a tariff study on terms of reference agreed with the Bank, and not later than March 31, 1995, furnish to the Bank the Government's and BEL's recommendations based on the results of this study, and after consultation with the Bank, promptly implement such recommendations (para. 3.11);
- (iv) engage independent auditors satisfactory to the Bank and submit BEL's audited accounts, including SOE's and the Special Account, to the Bank not later than four months after the end of its fiscal year (para. 4.11);
- (v) maintain the Project Implementation Unit properly staffed and funded; (para. 5.19)
- (vi) carry out the project according to an agreed implementation plan and schedule (5.19);
- (vii) maintain its tariffs at a level sufficient to earn a rate of return on its average net fixed assets in operation, revalued from time to time when required by the Bank, of not less than 7% for FY96 and thereafter (para. 6.14);
- (viii) furnish the Bank before January 1 of each fiscal year with a preliminary estimate of the rate of return for the current fiscal year and for the following fiscal year and, if the estimates indicate that BEL will not meet the rate of return requirements, will promptly take all necessary measures to meet such requirements (para. 6.14);
- (ix) not incur any new debt (other than for the Project) without the prior approval of the Bank unless its future debt service coverage ratio is 1.5 or higher (para. 6.16); and

- (x) not undertake any investment in excess of US\$500,000 without the approval of the Bank, until after completion of the Second Power Development Project, (para. 6.16).

8.2 Conditions of effectiveness of the proposed loan would be that:

- (i) BEL has signed an extended long-term power supply contract with the Comision Federal de Electricidad (CFE), Mexico, on terms and conditions satisfactory to the Bank (para 6.6);
- (ii) a satisfactory subsidiary loan agreement has been executed between the Government and BEL (para 6.9); and
- (iii) CDC's Board should have approved a loan to finance the cost of the 115 kV substations and the Dangriga connection components of the proposed project (para 6.10).

8.3 As a condition for disbursements for Group 1 - 115 kV Transmission Line goods and works, BEL should have completed all Project transmission lines and substations land surveys, identified all right-of-ways, and completed easements and land acquititon procedures, as required for the first year of project construction (para 5.12);

8.4 An additional event of default that would authorize suspension of disbursements of the Loan would be that either BECOL or CFE fails to supply, under the agreements referred to in paras. 6.5 and 8.2 (i), the electricity required by BEL to meet consumer demand, and BEL is unable to meet the deficiency from either CFE or BECOL or any other source (para. 6.7).

8.5 An additional event of default that would authorize suspension of disbursements of the Loan would be that the CDB or CDC or EIB loan agreements shall have failed to become effective by March 31, 1995 (para. 6.13).

8.6 With the above agreements, the proposed project would be suitable for the Bank loan of US\$11.5 million equivalent.

8.7 The documentation employed to process the Project and to prepare this report is listed in Annex 8.1.

ANNEXES

- 2.1 Petroleum Products Prices in Belize City (June 1993)**
- 3.1 BEL's Available and Firm Capacity of Existing Diesel Plants by Location**
- 3.2 BEL's Sales and Peak Demand Forecast 1994-2004**
- 3.3 BEL's Capacity (Power) and Energy Balances**
- 4.1 BEL's Organization Chart**
- 5.1 Detailed Project Description**
- 5.2 Mollejon Hydroelectric Plant Characteristics**
- 5.3 Mexican Power Supply Tariffs**
- 5.4 Detailed Project Cost Estimate and Funding Allocation**
- 5.5 Project Implementation Plan and Schedule**
- 5.6 Project Implementation Unit Organization Chart**
- 5.7 TORs Engineering and Project Management Consultant Services**
- 5.8 TORs Cost of Service and Tariff Study**
- 5.9 Environmental Issues and Summary Environmental Impact Assessment Studies**
- 5.10 TORs Environmental Mitigation at BEL's Existing Diesel Plants**
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- 5.12 Estimated Loan Disbursement Schedule**
- 6.1 BEL's 10 -Year Sales and Generation Forecast and Assumptions**
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- 6.3 BEL's 10-Year Financial Forecast**
- 6.4 BEL's Key Performance Indicators**
- 7.1 Cost-Effectiveness Analysis of Project Components**

7.2 Project Economic Evaluation (NPV and EIRR)

7.3 Assumptions Used in Economic and Equalizing Discount Rate Analyses

8.1 Project File

BELIZE

SECOND POWER DEVELOPMENT PROJECT

Petroleum Products Prices in Belize City in June 1993

	Premium	Regular	Diesel	Kerosene
FOB price (US\$/gal)	0.6141	0.5839	0.6436	0.6719
Freight	0.0610	0.0612	0.0696	0.0660
Marine Insurance	0.0004	0.0004	0.0004	0.0004
CIF Price (US\$/gal)	0.6755	0.6455	0.7135	0.7383
CIF price Bz\$/gallon	1.3628	1.3023	1.4395	1.4895
Government Charges:				
Port Duties	0.0173	0.0169	0.0199	0.0190
Foreign Exchange Tax	0.0169	0.0161	0.0178	0.0185
Stamp Duty	0.1616	0.1544	0.1710	0.0000
Import Duty	0.4496	0.4496	0.2665	0.0000
Revenue Replacement Duty	1.7618	1.7707	0.3153	0.1796
Total Government Charges	2.4072	2.4077	0.7905	0.2171
Esso's charges				
Handling	0.1300	0.1300	0.1300	0.1300
Delivery	0.0500	0.0500	0.0400	0.0400
Gross margin	0.3300	0.3200	0.2800	0.2334
Total Esso	0.5100	0.5000	0.4500	0.4034
Commercial Charges:				
Gross Margin	0.3500	0.3100	0.2800	0.3300
Total	0.3500	0.3100	0.2800	0.3300
Government Controlled Pump price	4.6300	4.5200	2.9600	2.4400

Note: According to the Ministry of Finance, the FOB prices are based on Esso's actual purchase prices for each shipment. BEB is exempt from import taxes. Industries may obtain a partial exemption from import taxes.

The maximum retail prices for LPG are fixed by the government, and vary, due to transportation cost, from 43.50 BZ\$ (Corozal Town) to 56.50 BZ\$ (Punta Gorda Town) per 100 lbs cylinder (in October 1992). These prices include a stamp duty of 10 percent of the import value and an import duty of 3 Belize cents per pound. The current world market bulk price for LPG is around US\$0.12 per kilogram. The Belizian price of about US\$0.48 per kilogram (in Corozal Town, including taxes) should guarantee at least a reasonable margin for handling, delivery and other commercial fees.

BELIZE

**SECOND POWER DEVELOPMENT PROJECT
BEL's Available and Firm Capacity of Diesel Plants by Location in 1993**

Plant	Available Capacity MW	Firm capacity ¹⁾ MW	Comments
1. Belize City	13.0	13.9 for the Belize/Ladyville system	10 units, including 3 mobile units in Belize City and 1 in Ladyville
2. Ladyville	7.2		
3. Belmopan	4.2	3.9 for the Belmopan/San Ignacio system	5 units in Belmopan and 2 units in San Ignacio
4. San Ignacio	1.0		
5. Dangrida	2.7	1.7	6 units, including 2 mobile unit
6. Corozal	1.3	3.9 for the Corozal/Orange Walk System	2 units at Corozal and 4 units at Orange Walk (all stand- by)
7. Orange Walk	2.6		
8. San Pedro	3.2	2.0	4 units
9. Punta Gorda	1.1	0.8	6 units
10. Caye Caulker	0.3	0.2	3 units
11. Independence	1.3	0.7	4 units, including one mobile unit
12. Sarteneja	0.4	0.3	3 units
TOTAL	38.3	27.4	49 units

1) Firm capacity for the larger systems is defined as the total available capacity less the capacity of the two largest units; for the smaller systems the firm capacity is the total available capacity less the capacity of the largest unit.

BELIZE
SECOND POWER DEVELOPMENT PROJECT
BEL's Sales (MWh) and Peak Demand (MW) Forecast 1994-2004
Planned Interconnected System

ESTIMATE FORECAST ----->

	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/2000	2000/1	1/2	2/3	3/4
BELIZE CITY SYSTEM													
Residential	22,705	24,831	27,050	28,691	30,140	31,617	32,957	34,228	35,421	36,779	38,186	39,643	41,343
Commercial	42,166	45,590	49,186	53,441	58,536	60,570	63,310	65,868	68,526	71,326	74,251	77,315	80,545
Total Sales	64,871	70,421	76,237	82,132	88,676	92,187	96,267	100,096	103,947	108,105	112,438	116,958	121,888
Net Generation	76,430	83,732	89,270	94,405	100,768	103,581	106,964	111,218	115,497	120,117	124,931	129,953	135,431
BELMOPAN SYSTEM													
Residential	5,862	6,838	7,973	8,562	9,212	9,896	10,623	11,383	12,177	12,974	13,806	14,674	15,634
Commercial	9,239	10,650	12,798	13,625	14,646	15,622	16,525	17,477	18,481	19,532	20,642	21,815	23,066
Total Sales	15,101	17,488	20,771	22,188	23,858	25,519	27,148	28,860	30,657	32,506	34,448	36,489	38,699
Net Generation	16,853	19,283	22,900	24,382	26,218	28,042	29,833	31,714	33,689	35,720	37,855	40,098	42,527
COROZAL/ORANGE WALK SYSTEM													
Residential	6,544	7,676	8,455	9,038	9,588	10,102	10,634	11,182	11,691	12,216	12,757	13,315	13,922
Commercial	6,778	7,734	9,289	10,374	11,400	12,156	12,941	13,824	14,847	16,206	17,029	17,904	18,843
Total Sales	13,322	15,410	17,744	19,412	20,988	22,258	23,575	25,006	26,538	28,422	29,787	31,219	32,765
Net Generation	16,057	18,037	20,164	21,569	23,319	24,731	26,194	27,785	29,486	31,580	33,096	34,688	36,405
DANGRIGA SYSTEM													
Residential	1,620	2,045	2,356	2,563	2,811	3,075	3,356	3,653	3,966	4,229	4,504	4,794	5,089
Commercial	1,900	2,314	3,662	4,068	4,333	5,461	5,951	6,320	6,718	7,131	7,577	8,061	8,584
Total Sales	3,520	4,359	6,019	6,631	7,144	8,535	9,307	9,974	10,684	11,359	12,082	12,855	13,674
Net Generation	4,068	5,003	6,839	7,450	7,938	9,484	10,341	11,082	11,871	12,622	13,424	14,283	15,193
SAN PEDRO SYSTEM													
Residential	1,105	1,291	1,354	1,417	1,482	1,549	1,616	1,684	1,754	1,825	1,897	1,970	2,048
Commercial	4,556	5,244	6,492	7,854	9,210	9,884	10,558	11,232	11,907	12,581	13,255	13,930	14,604
Total Sales	5,661	6,535	7,846	9,271	10,692	11,432	12,174	12,917	13,661	14,406	15,152	15,900	16,652
Net Generation	6,582	7,185	8,622	10,188	11,749	12,563	13,378	14,194	15,012	15,831	16,651	17,472	18,299
GRID TOTALS													
Sales MWh	102,475	114,213	128,616	139,634	151,358	159,931	168,471	176,852	185,487	194,798	203,906	213,421	223,678
Net Generation MWh	119,990	133,240	147,795	157,994	169,992	178,401	186,710	195,992	205,555	215,869	225,956	236,494	247,855
System Peak MW (97% coincidence factor)	22	23	26	28	30	31	32	34	30	38	39	41	43

BELIZE
SECOND POWER DEVELOPMENT PROJECT
BEL's Sales (MWh) and Peak Demand (MW) Forecast 1994-2004
Isolated Systems

ESTIMATE FORECAST ----->

	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/2000	2000/1	1/2	2/3	3/4
INDEPENDENCE													
Residential	352	520	651	696	745	797	837	879	923	969	1,018	1,068	1,122
Commercial	511	754	945	1,011	1,082	1,158	1,215	1,276	1,340	1,407	1,477	1,551	1,629
Total Sales	863	1,274	1,595	1,707	1,827	1,955	2,052	2,155	2,263	2,377	2,495	2,620	2,751
Net Generation	897	1,300	1,628	1,742	1,864	1,995	2,094	2,199	2,309	2,425	2,546	2,673	2,807
SARTENEJA													
Residential	133	204	266	282	299	318	333	350	368	386	405	425	446
Commercial	50	77	100	106	112	119	125	131	138	145	152	160	168
Total Sales	183	281	367	388	412	437	459	481	506	531	558	585	614
Net Generation	198	286	374	396	420	446	468	491	516	542	569	597	627
CAYE CAULKER													
Residential	436	512	589	678	779	896	977	1,065	1,160	1,265	1,379	1,503	1,638
Commercial	335	394	453	521	599	688	750	818	892	972	1,059	1,155	1,259
Total Sales	771	906	1,042	1,198	1,378	1,585	1,727	1,883	2,052	2,237	2,438	2,657	2,897
Net Generation	835	934	1,074	1,235	1,420	1,634	1,781	1,941	2,116	2,306	2,513	2,740	2,986
PUNTA GORDA													
Residential	672	803	966	1,099	1,249	1,399	1,519	1,625	1,739	1,861	1,991	2,130	2,279
Commercial	1,792	2,140	2,577	2,930	3,330	3,730	4,050	4,334	4,637	4,962	5,308	5,680	6,078
Total Sales	2,464	2,943	3,544	4,028	4,579	5,129	5,568	5,959	6,375	6,822	7,299	7,811	8,357
Net Generation	2,677	3,416	4,027	4,501	5,032	5,636	6,119	6,548	7,006	7,497	8,021	8,583	9,184
TOTALS FOR ISOLATED CENTERS													
Sales MWh	4,281	5,404	6,548	7,322	8,195	9,105	9,806	10,478	11,196	11,967	12,790	13,673	14,619
Net Generation MWh	4,607	6,936	7,103	7,874	8,736	9,710	10,462	11,179	11,947	12,770	13,649	14,593	15,604
Coincident Peak MW (97 % coincidence factor)	1.0	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.8	3.0	3.2

BELIZE

SECOND POWER DEVELOPMENT PROJECT

BEL's Capacity (Power) and Energy Balances

BEL's Capacity (Power) Balance FY93-FY2004 (MW)

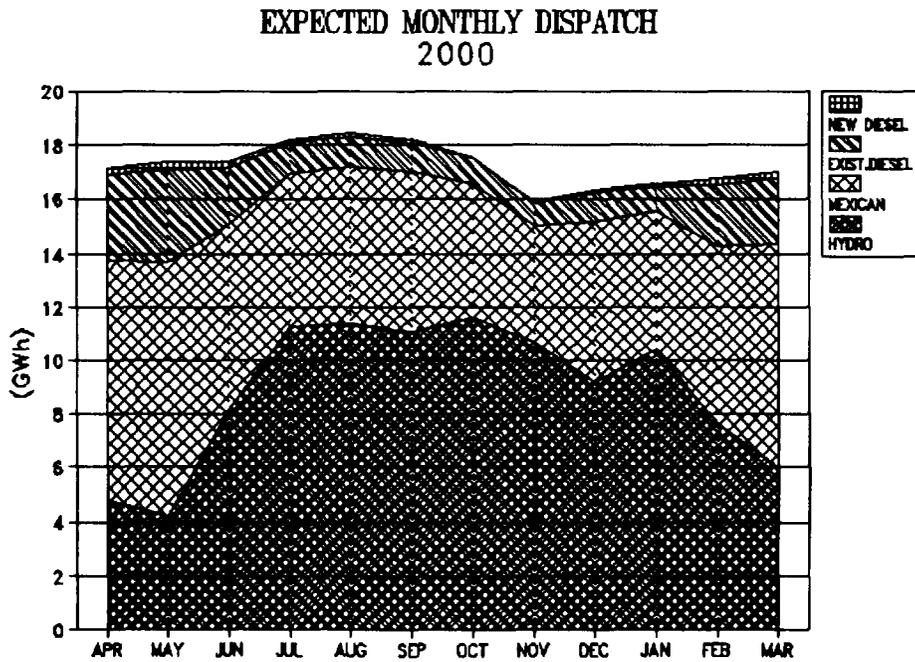
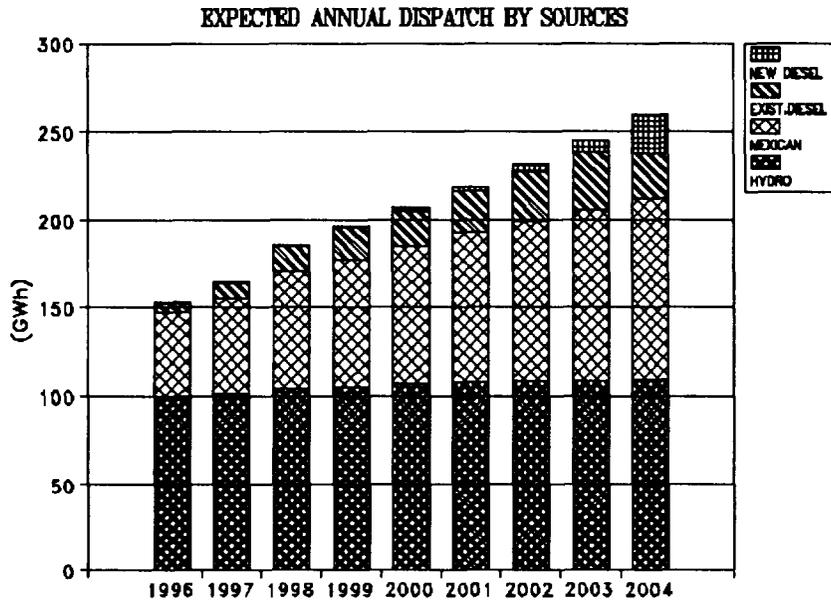
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Peak Demand MW (Base Case)	24.8	28.1	29.6	31.6	33.2	34.7	36.5	38.3	40.3	42.2	44.2	46.4
Diesel Units	21	23.6	3	4.9	4.8	5.8	7	8	9.1	10	10.6	12.2
Hydro			21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
Imports from Mexico	4	4.5	4.8	4.9	6.6	7.1	7.7	8.5	9.4	10.4	11.8	12.4
TOTAL	24.8	28.1	30	31.6	33	34.7	37	38.3	40.3	42.2	44.2	46.4
Available Capacity MW	43.3	43.3	55.1	80.1	80.1	76.9	76.9	76.9	76.9	76.9	76.1	76.1
Capacity Reserve MW	8.5	5.2	25.5	23.5	46.9	45.4	40.4	38.6	36.6	34.7	31.9	29.7

Notes: Imports from Mexico FY93-96 are to Corozal/Orange walk area only.
After 1994, capacity reserve during dry seasons is about 16 MW lower than shown in table.

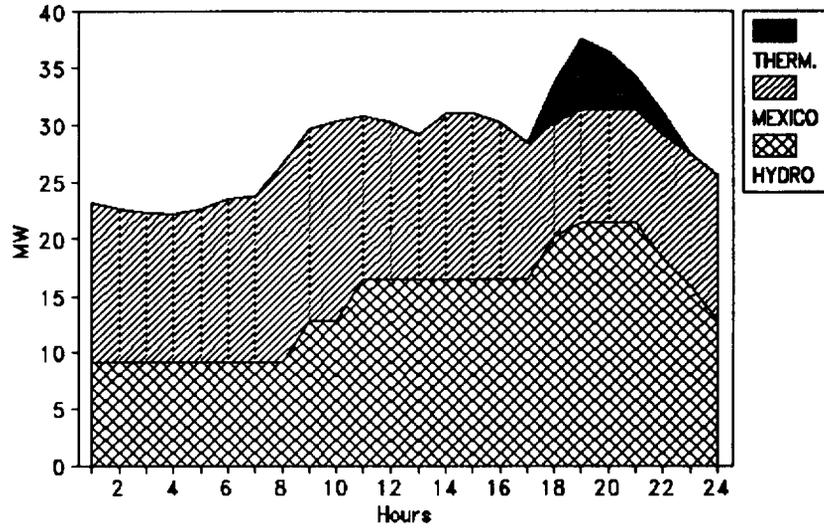
Energy Balance FY93-FY2004 (GWh)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Generation requirement GWh (Base Case)	139.2	155	166	179	188.1	197.2	207.2	217.5	228.6	239.6	251.1	263.5
Diesel Units	121.2	135	61.5	22.5	24.8	27.1	29.2	31.1	33.2	35.4	37.6	39.9
Hydro Purchases			82.8	100	101.5	102.6	103.8	105	106	107	107.6	108.2
Imports from Mexico	18	20	21.7	56.5	61.8	67.5	74.2	81.4	89.4	97.3	105.9	115.4
TOTAL	139.2	155	166	179	188.1	197.2	207.2	217.5	228.6	239.6	251.1	263.5

Note: Imports from Mexico FY93-96 are to Corozal/Orange Walk area only.

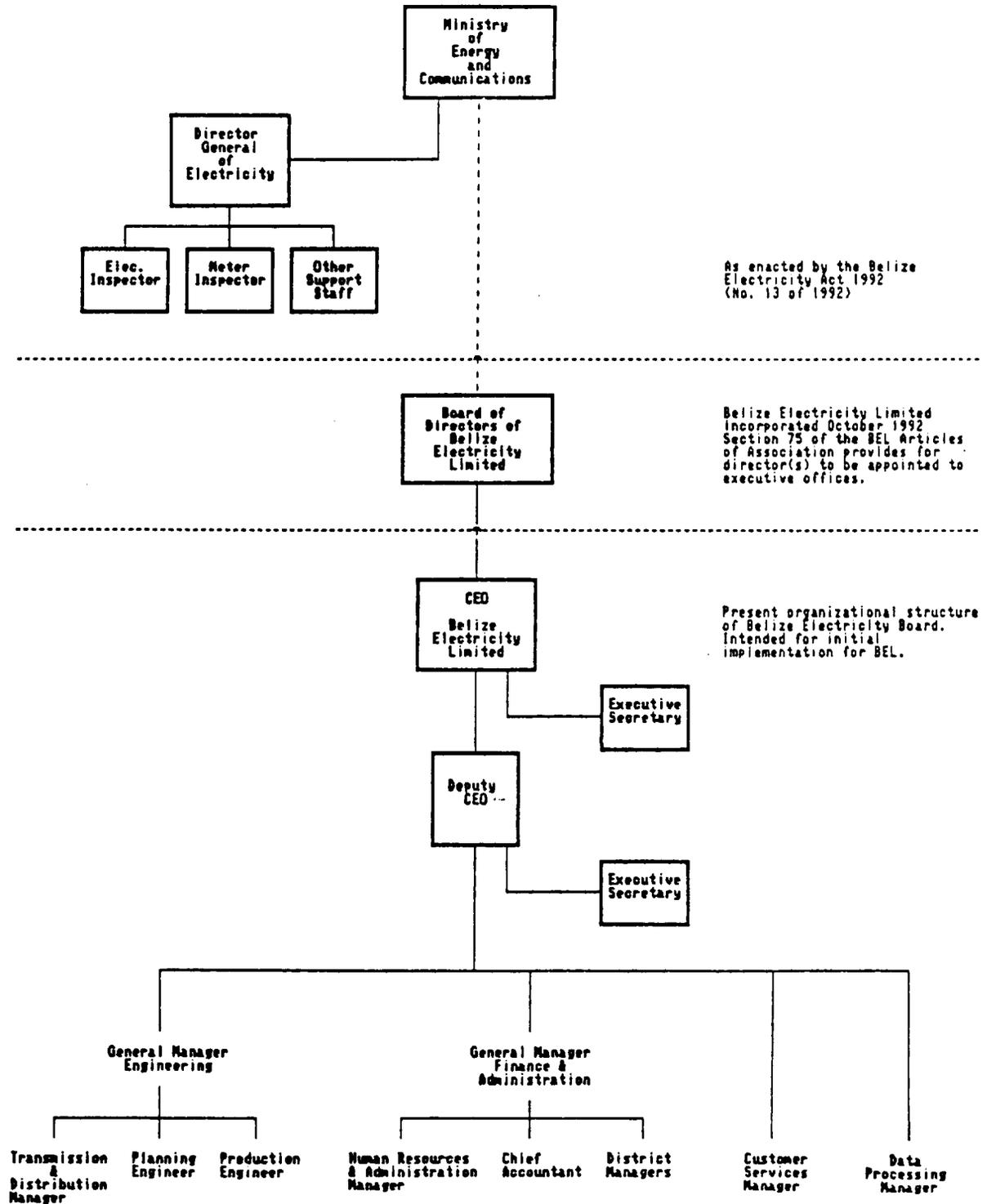


TYPICAL DAILY DISPATCH – JAN.2000



BELIZE

**SECOND POWER DEVELOPMENT PROJECT
Belize Electricity Limited Organization Structure**



BELIZE

SECOND POWER DEVELOPMENT PROJECT

Detailed Project Description

Introduction and Background

1. The Belize Second Power Development Project involves the implementation of a 115 kV transmission line from the border of Mexico to Belize City, its associated substations and the establishment of an integrated power system that will interconnect the main load centers and the electric generating sources of the Country. The Project will also incorporate the Dangriga area by means of a 56 km (35 miles) long 34.5 kV subtransmission line as well as the Ambergris Cay (San Pedro) through a 35 km (21.5 miles) long mainland overhead transmission line, a submarine cable section and an inland overhead line connection to the San Pedro power plant.

2. The 115 kV transmission line from Mexico, to be constructed under the proposed project, will be interconnected with the 115 kV transmission line from the Mollejon hydroelectric plant to Belize City, under construction. The Mollejon Hydroelectric Plant on the Macal River (25 MW run-of-river) is being built by a private consortium (Belize Electricity Company Ltd. - BECOL) on a BOT (build, operate and transfer) basis. Commercial operation is expected to start in December 1994. The 115 kV Mollejon transmission system is also being built by BECOL and ownership will be transferred to BEL after construction. BEL has undertaken to purchase, on a take-or-pay basis, 120 GVAh per year, on average, from the Mollejon hydroelectric plant.

3. Since the Mollejon hydroplant is a run-of-river plant with only very limited storage, the power and energy outputs of the plant will be very variable from dry to wet seasons and from year to year. The required power and energy complement to serve the demand would be met by imports from Mexico and BEL's own diesel-electric generation. The integrated 115 kV trunk transmission system would extend 286 km from the Xu La substation in Mexico to the Mollejon power plant substation.

Physical Scope of the Project

4. The proposed project comprises the following facilities:

Transmission Lines:

- 115 kv single-circuit transmission line, 136.5 km (85.5 miles) long from Mexican border to km 13.5 Western Highway Substation.

This line will be built on wood H-frame poles using a conductor equivalent to 477 MCM ACSR, which is similar to the Mollejon transmission line. Construction standards of the US Rural Electrification Administration (REA) will be used and the design will be made for winds speeds of 240 km per hour (150 mph) with gusts to 265 km per hour (165 mph).

Special precaution will be taken to ensure against insulators fouling by salt fog and corrosion of conductor and line hardware caused by proximity to the seashore. Protection of the line will be done by high-speed distance relaying for single-phase tripping of breakers at both ends of the line.

- 34.5 kV overhead subtransmission line 56 km (35 miles) long from km 48 Western Highway to Dangriga. This line will be fed from a substation on the 115 kV line from Mollejon to Belize City.
- 34.5 overhead subtransmission line 8 km (5 miles) long from km 48.3 of the Old Northern Highway to the coast. This line will be fed from a substation located at Maskall on the 115 kV transmission line from Mexico.
- 34.5 kV submarine cable section of 21 km (13 miles) long from the coast to a substation located south of San Pedro on Ambergris Cay. The submarine cable will traverse an area of moderate to low depths, and constitutes the middle section of the Ambergris Cay connection to the trunk transmission system.
- 34.5 kV overhead subtransmission line 5.6 km (3.5 miles) long from the substation south of Ambergris Cay to the San Pedro power plant. This line constitute the final section of the Ambergris Cay feed system.

Substations

- 115/34.5 kV, 7.5/9.5-10.5 MVA transformer substation will feed the Dangriga subtransmission line.
- 34.5/22 kV, 5/6.25-7 MVA auto-transformer substation at Dangriga.
- 115/34.5 kV, 7.5/9.5-10.5 MVA transformer substation at Maskall to feed the Ambergris Cay subtransmission connection.
- 34.5/22 kV, 10.5 MVA transformer substation at Ambergris Cay substation.
- 115 kV switching substation at the Mexican Border.

- 115/34.5 kV, 7.5/9.5-10.5 MVA transformer substation at Buena Vista km 120 of the Northern Highway.
- Two 115 kV circuit bays at km 13.5 of the Western Highway substation. This substation is being constructed by BECOL as part of its commitment with BEL.

Supervisory Control and Data Acquisition System

BEL will construct a Central Dispatch Center with supervisory control and data acquisition facilities (SCADA system), capable of generation control, frequency control, active and reactive power flow control, data acquisition, basic state estimation and fault recording and location. The SCADA system will be capable of economic dispatch of local generation and supply from Mexico. SCADA features will be installed in all dispatchable generating stations and main substations. An adequate telecommunication system will be set up to carry protection signals, data and voice communications.

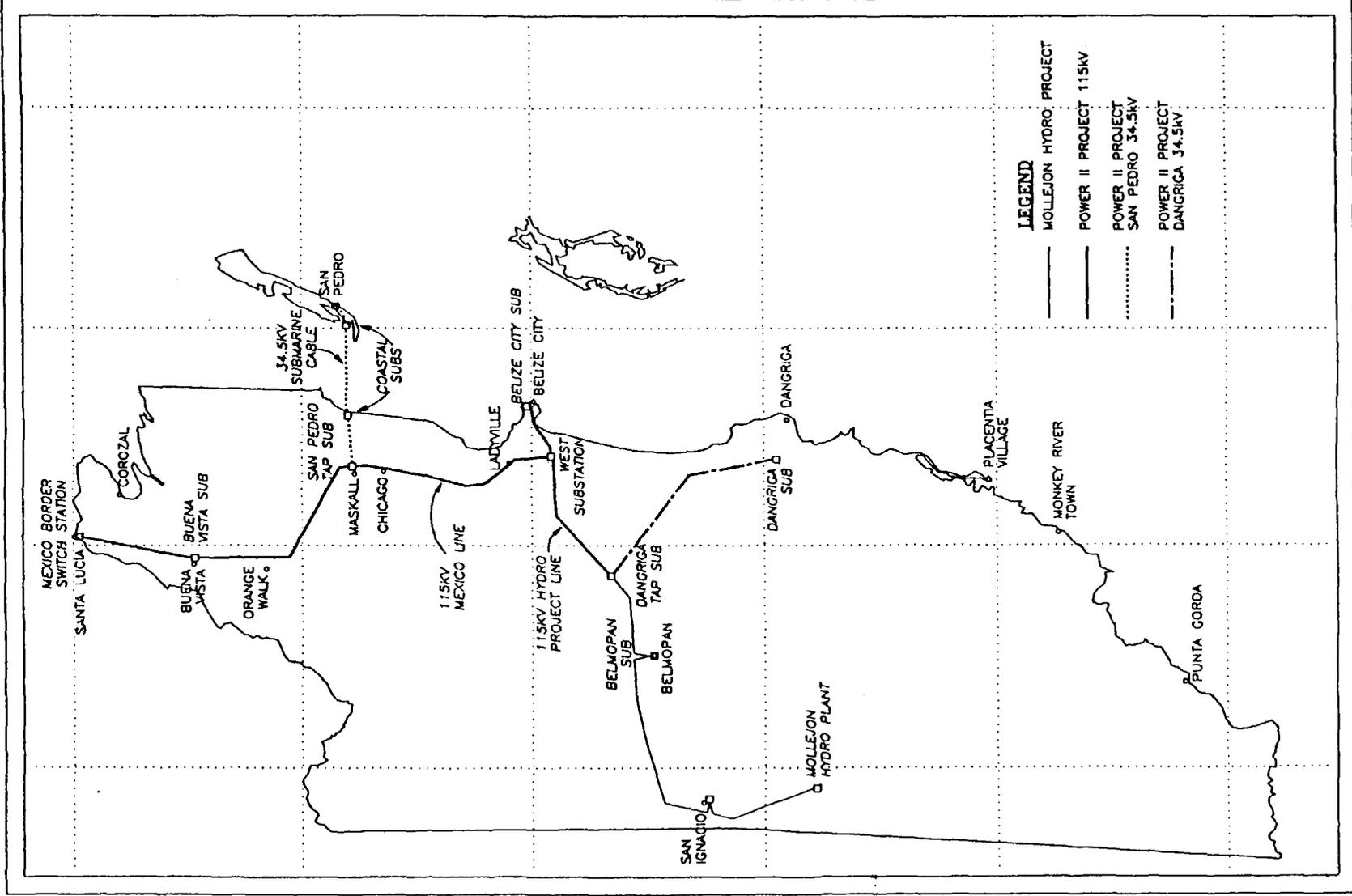
Environmental Mitigation in BEL's Diesel Plants

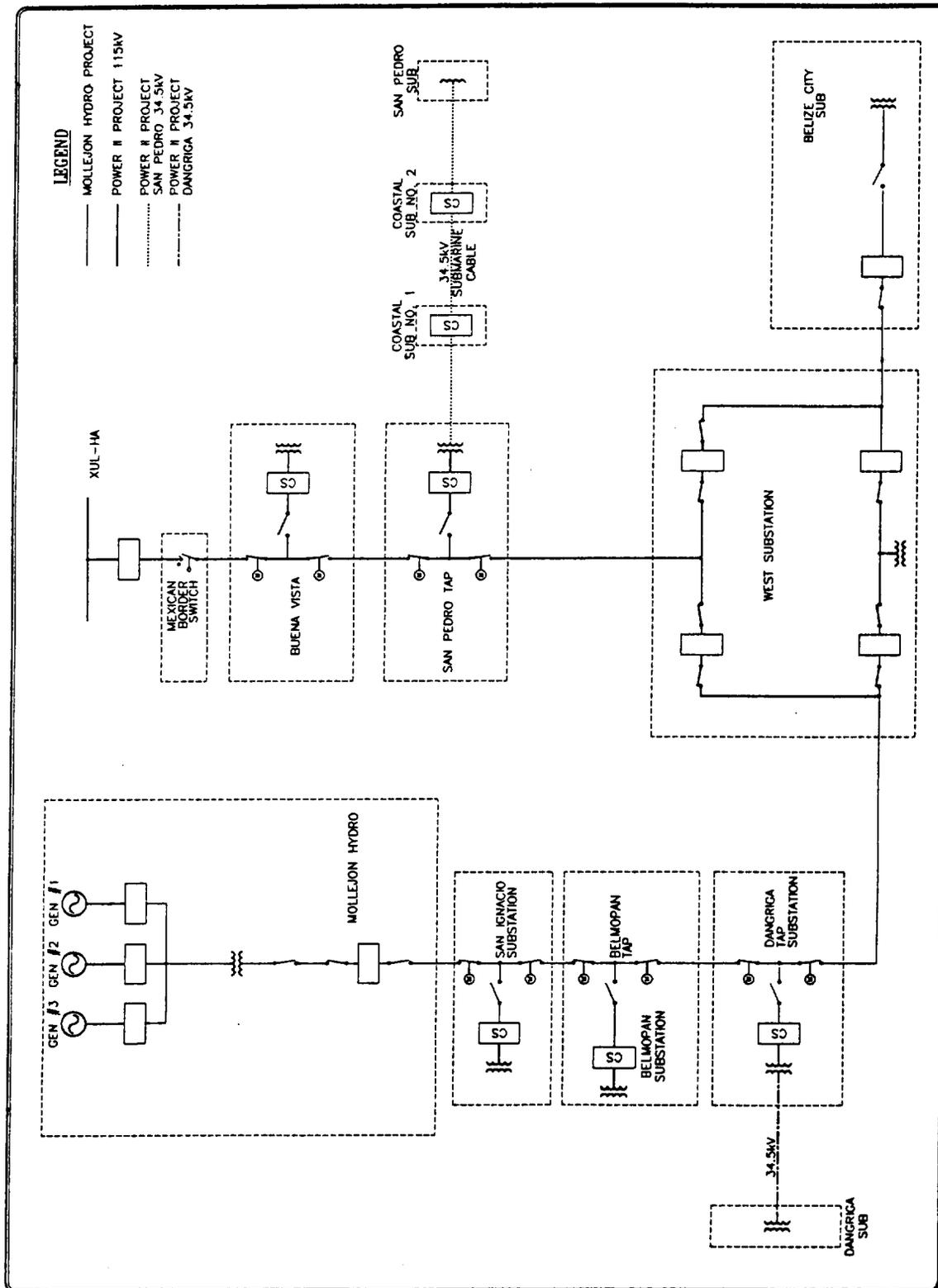
Consistent with BEL's environmental stewardship, BEL is seeking to conduct various environmental activities associated with seven of its power plants, with the assistance of a foreign contractor. These are the Belize City, Ladyville, Belmopan, San Pedro, Dangriga, Corozal, and Orange Walk Power Plants. With the implementation of the Second Power Development Project, the Belize City, Ladyville, and Belmopan Power Plants are expected to provide peak-load power; and the remaining four power plants are expected to supply stand-by power.

The following is the scope of services expected from this component of the project:

- Task 1 - Spill Prevention, Control, and Countermeasure
- Task 2 - Noise Pollution Control
- Task 3 - Mitigation of Smoke Emissions
- Task 4 - Remedial Investigation and Planning for Decontamination of soil

More details of the expected services for the environmental mitigation can be found in Annex 5.10.





LEGEND

- MOLLEJON HYDRO PROJECT
- POWER II PROJECT 115KV
- POWER II PROJECT
- SAN PEDRO 34.5KV
- POWER II PROJECT 34.5KV
- DANGRIGA 34.5KV

BELIZE ELECTRICITY LIMITED
115KV TRANSMISSION LINE
PROPOSED ONE-LINE DIAGRAM

Drawn By K. JONES
Designed By J. NELSON
Approved By
Job No. 82-1223
Date SEPT. 13, 1983

Drawing Number
ONELINE

BELIZE

**SECOND POWER DEVELOPMENT PROJECT
Mollejon Hydroelectric Power Plant
Technical Characteristics**

PARAMETER	MAGNITUDE	UNITS	COMMENTS
Installed Capacity	3x8.4	MW	
Total	25	MW	
Gross head	122.0	m	
Net head	112.0	m	friction and entrance losses
Powerhouse Design Flow	3x8.475	m ³ /s	
Efficiencies:			
Turbine	93.2	%	
Generator	97.0	%	
Transformer	99.0	%	
Plant availability	98.0	%	(assumed)
Production:			
Power/cubic meter/s	993.2	kW/cumec	
Energy/cubic meter	0.276	kWh/m ³	
Daily Storage:			
Live storage	845,000	m ³	
Equivalent peak energy	235.2	MWh	
Mean peak power	23.5	MW	based on 10 hours peak
Implementation schedule:			
. First Unit		Oct. 94	
. Second Unit		Jan. 94	
. Third Unit		Apr. 94	

Source : Belize Electricity Board

BELIZE

SECOND POWER DEVELOPMENT PROJECT

**Mollejon Hydroelectric Power Plant
Expected Average Monthly Power and Energy Production**

MONTHLY MEAN POWER (MW)

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	AVG.
1981						12.64	25.20	25.20	21.93	23.38	10.45	7.35	
1982	6.51	6.61	6.38	4.42	3.88	11.01	13.62	12.87	14.06	11.98	4.01	6.34	8.47
1983	3.55	3.55	4.29	7.33	12.26	8.53	18.76	18.07	18.93	23.71	21.61	6.66	12.27
1984	16.79	15.14	7.29	4.00	5.71	15.62	17.38	19.19	24.27	16.62	16.20	14.58	14.40
1985	15.83	9.24	7.30	7.93	5.12	5.36	6.96	17.05	6.91	16.63	24.58	17.00	11.66
1986	16.61	16.08	16.72	17.27	7.79	21.12	21.75	16.08	18.19	14.91	14.40	6.86	15.65
1987	5.25	4.78	4.64	3.64	3.60	7.02	16.24	13.67	15.92	8.53	7.95	7.57	8.24
1988	20.07	9.65	5.87	4.76	3.80	13.09	11.24	17.50	17.69	14.30	20.43	16.26	12.89
1989	11.96	10.38	6.17	5.35	3.91	9.63	9.47	9.79	12.33	21.16	21.21	22.01	11.95
1990	24.29	15.78	13.29	7.37	6.44	13.54	19.83	12.10	14.45	14.00	21.91	20.32	15.28
1991	25.20	24.51	11.31	5.16	5.36	11.66	15.03	8.81	12.12	19.84	9.27	25.20	14.45
1992	22.05	13.31	8.55	7.74	5.71								
AVG.	15.28	11.73	8.35	6.82	5.78	11.66	15.03	14.51	15.48	16.17	16.16	14.28	12.60

MONTHLY ENERGY PRODUCTION (GWH)

	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	TOTAL YEAR
1981						9.10	18.75	18.75	15.79	17.39	7.52	5.47	
1982	4.85	4.44	4.74	3.18	2.89	7.93	10.14	9.57	10.12	8.91	2.89	4.72	74.38
1983	2.64	2.38	3.19	5.27	9.12	6.14	13.96	13.45	13.63	17.64	15.56	4.96	107.94
1984	12.50	10.18	5.43	2.88	4.25	11.25	12.93	14.28	17.47	12.36	11.66	10.85	126.03
1985	11.78	6.21	5.43	5.71	3.81	3.86	5.18	12.68	4.97	12.37	17.69	12.65	102.34
1986	12.36	10.81	12.44	12.44	5.80	15.20	16.18	11.96	13.10	11.10	10.36	5.10	136.84
1987	3.91	3.21	3.45	2.62	2.68	5.05	12.08	10.17	11.46	6.35	5.73	5.64	72.35
1988	14.93	6.48	4.37	3.43	2.83	9.43	8.36	13.02	12.73	10.64	14.71	12.09	113.04
1989	8.90	6.98	4.59	3.85	2.91	6.93	7.05	7.28	8.88	15.75	15.27	16.38	104.75
1990	18.07	10.60	9.89	5.31	4.79	9.75	14.75	9.00	10.40	10.41	15.78	15.12	133.87
1991	18.75	16.47	8.41	3.72	3.99	8.39	11.18	6.55	8.73	14.76	6.67	18.75	126.37
1992	16.41	8.94	6.36	5.57	4.25								
AVG.	11.37	7.88	6.21	4.91	4.30	8.39	11.18	10.80	11.15	12.03	11.63	10.62	109.79

BELIZE

**SECOND POWER DEVELOPMENT PROJECT
Mexican Power Supply Tariffs**

Applicable to 115 kV Supply

REGION: Peninsular (Yucatan peninsula)

CHARGES:

Item	Mexican Pesos	Equiv. U.S.\$
kW monthly peak demand	27,763.00	8.8330
kWh consumption at peak hour	181.04	0.0576
kWh consumption at base hour	100.77	0.0320

GENERAL CONDITIONS:

1. Charges to be paid monthly.
2. Peak hours : 18 to 22 hours from monday to saturday.
3. Minimum monthly charge: 20 times the peak demand tariff; applicable only when monthly charges are below $20 * 8.833$, equivalent to US\$ 176.66/month.
4. Peak demand is charged to the maximum demand at peak hour plus $1/5$ the difference between the maximum at base hour and maximum at peak hour, if these difference is grater than zero.
5. Penalty for Power factor less than 90% (lag)
 $3/5 ((90/PF) - 1) x 100$.
no more than 120.0%
6. Discount for Power Factor over 90%
 $1/4 (1 - (90/PF)) x 100$.
no more than 2.5%

Note: Exchange rate 3143.20 Mex.pesos/US\$

Source: Secretaría de Hacienda y Crédito Público de Mexico.
Acuerdo de ajuste y restructuración Tarifaria para el suministro y venta de energía eléctrica. Oct. 1992.

BELIZE

**SECOND POWER DEVELOPMENT PROJECT
Detailed Project Cost Estimate and Funding Allocation
(in thousands US\$)**

PROJECT DESCRIPTION	PROJECT COST			PROPOSED FINANCING PLAN				
	LOCAL	FOREIGN	TOTAL	IBRD	ADB	CDC	EIB	BEI
GROUP I								
115 KV MEX-BELIZE CITY LINE, 84 MILES	320	5,050	5,370	5,050				320
LINE SURVEY FOR 115 KV LINE TO MEXICO	150		150					150
INVESTMENT CONTRIBUTION TO MEXICAN SIDE		1,100	1,100					1,100
TOTAL GROUP I	470	6,150	6,620	5,050				1,570
GROUP II								
DANGRIGA 115-34.5 KV SUBSTATION	127	710	838			838		
DANGRIGA 34.5 KV LINE, 35 MILES	527	700	1,227			1,227		
DANGRIGA 34.5-22 KV SUBSTATION	69	552	621			621		
MEXICAN BORDER SWITCH	31	231	262			262		
BUENA VISTA 115-34.5 KV SUBSTATION	128	904	1,029			1,029		
WEST SUBSTATION 115 KV ADDITION	61	493	554			554		
TOTAL GROUP II	940	3,590	4,531			4,531		
GROUP III								
MASKALL-COAST 34.5 KV LINE, 5 MILES	38	113	150		150			
34.5 KV SUBMARINE CABLE TO SPO, 13 MILES	223	4,222	4,445		4,445			
34.5 KV LINE TO SPO SUBSTATION	44	78	123		123			
SPO 34.5-22 KV SUBSTATION	93	617	709		709			
SAN PEDRO TAP 115-34.5 KV SUBSTATION	124	897	1,022		1,022			
TOTAL GROUP III	522	5,927	6,448		6,448			
GROUP IV								
BELIZE CITY DISPATCH CENTER, 3600 SQ F	148	164	312				164	148
COMMUNICATIONS INTERFACE		1,469	1,469				1,469	
SCADA SYSTEM	82	1,152	1,234				1,152	82
TOTAL GROUP IV	230	2,785	3,015				2,785	230
GROUP V								
OPERATIONS, MAINT., VEHICLES, EQPT & TOOLS		650	650	650				
ENVIRONMENTAL CLEAN UP OF DIESEL PLANTS		700	700	700				
SUB-TOTAL	2,162	19,802	21,964	6,400	6,448	4,531	2,785	1,800
CONSULTANTS, PROJECT MANAGEMENT, STUDIES, TRAINING & TECHNICAL ASSISTANCE								
ENGINEERING AND TECHNICAL STUDIES	230	932	1,162	932				230
SUPERVISION AND PROJECT MANAGEMENT	230	1,138	1,368	1,138				230
TARIFF STUDY		182	182	182				
CLEAN-UP- STUDY		182	182	182				
ENVIRONMENTAL MONITORING OF EAP		182	182	182				
TRAINING AND TECHNICAL ASSISTANCE		700	700	700				
TOTAL CONSULTANTS, STUDIES, ETC.	460	3,316	3,776	3,316				460
BASE COST	2,622	23,118	25,740	9,716	6,448	4,531	2,785	2,260
PHYSICAL CONTINGENCIES	410	2,310	2,720	972	788	547	278	135
SUB-TOTAL	3,032	25,428	28,460	10,688	7,236	5,078	3,063	2,395
PRICE CONTINGENCIES	151	1,119	1,270	534	249	135	110	242
TOTAL PROJECT COST	3,183	26,547	29,730	11,222	7,485	5,212	3,173	2,637
FEES AND INTEREST DURING CONSTRUCTION		3,250	3,250					3,250
GRAND TOTAL ESTIMATED PROJECT COSTS	3,183	29,797	32,980	11,222	7,485	5,212	3,173	5,887

BELIZE

SECOND POWER DEVELOPMENT PROJECT

PROJECT IMPLEMENTATION PLAN AND SCHEDULE

Project Implementation Plan

<u>Activity</u>	<u>Execution Responsability</u>	<u>Milestones¹</u>	
		<u>Start</u>	<u>End</u>
1. Environmental Impact Assessment approval	BEL/MTE	1/94	9/94
2. Lines and substations land surveys	BEL	6/94	3/95
3. Land easements/purchase process	BEL/MNR	6/94	3/95
4. Establishment and operation of BEL's Environmental Unit	BEL	6/94	6/97
5. Establishment of electricity pricing regulations	MEC/Consultants	10/94	3/95
6. Cost of Service and Tariff Study	BEL/Consultants	9/94	3/95
7. Project detail engineering design	BEL/Consultants	9/94	3/95
8. Establishment of a training program	BEL	11/94	1/95
9. Data processing integration plan	BEL/Consultants	9/94	1/95
10. Implementation of training program	Consultants	4/95	3/97
11. Establishment of a technical assistance program	BEL/Consultants	2/95	3/95
12. Implementation of technical assistance	Consultants	4/95	3/96
13. Environmental monitoring plan	BEL/Consultants	9/94	1/95
14. Environmental mitigation scope study	Consultants	3/95	9/95
15. Monitoring of environmental action plan	BEL/Consultants	2/95	6/97
16. Data processing integration	BEL/Consultants	4/95	3/96
17. Bidding, procurement, construction and supervision of physical project components ²	BEL/Consultants	3/95	6/97

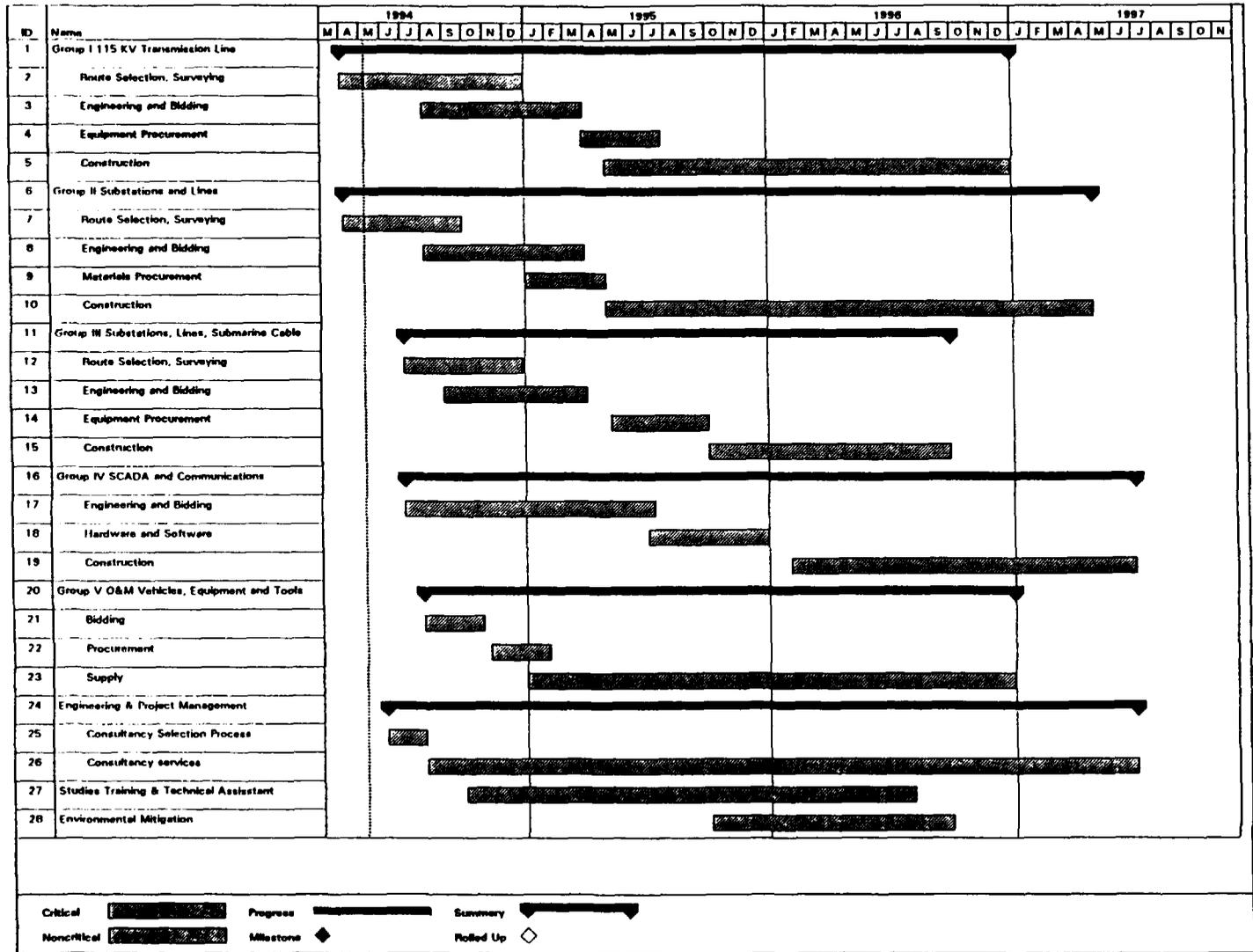
Notes: MTE = Ministry of Tourism and the Environment; MNR = Ministry of Natural Resources.

MC = Ministry of Energy and Communications.

1/ Both, start and end dates will be monitored.

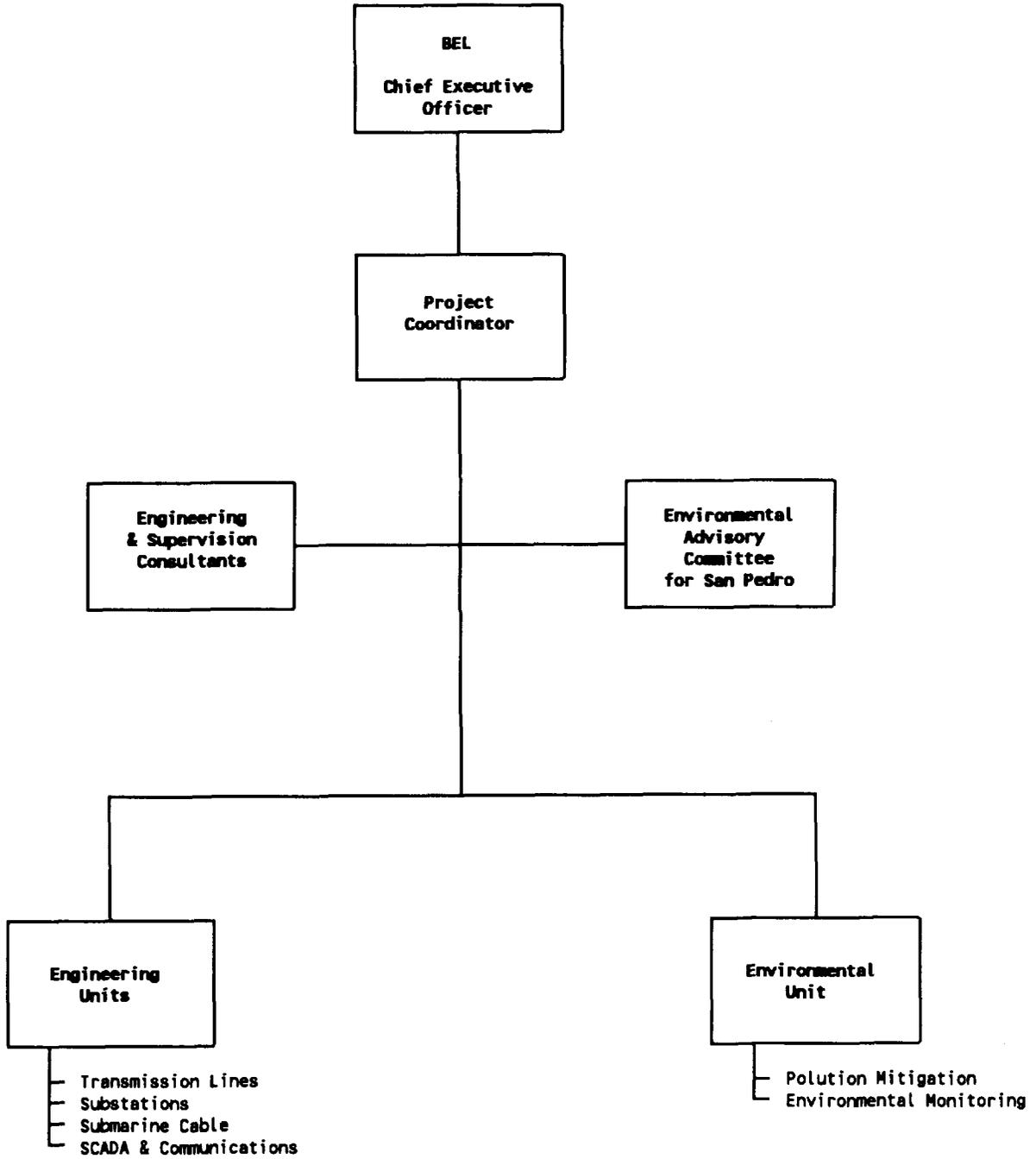
2/ Details included in the project implementation schedule.

BELIZE SECOND POWER DEVELOPMENT PROJECT Project Implementation Schedule



SECOND POWER DEVELOPMENT PROJECT IMPLEMENTATION UNIT

Project Implementation Unit Organization Chart



BELIZE

SECOND POWER DEVELOPMENT PROJECT

ENGINEERING AND PROJECT MANAGEMENT CONSULTANT SERVICES

Terms of Reference

Background

1. BEL currently operates nine isolated electrical systems, all of them supplied by diesel thermal units. The total installed capacity is 42 MW. In FY92 the combined demand of all the nine centers was about 23 MW, with sales of about 107 GWh. Two of the electrical systems were interconnected in 1991 (Corozal and Orange Walk load centers), and are supplied from Mexico through a 34.5 kV line, from Chetumal in the Yucatan Peninsular.

2. With the objective of diversifying the sources of electricity supply, the Government of Belize and BEL signed an agreement with a private consortium, the Belize Electricity Company Ltd (BECOL), to construct and operate a 25 MW run-of-river hydropower plant at the Mollejon site in the Macal River. The hydro plant will be connected to the BEL distribution systems at Belmopan and Belize City by a 115 KV transmission line. Construction of the plant and the transmission line started in January 1993 and it is expected to be completed by the end of 1994.

3. As a further means of diversification, the BEL is planning to interconnect its electrical system with the Mexican system through the construction of an 84 mile 115 kV transmission line from Chetumal in Mexico through the Corozal/Orange Walk system, to Belize City, where it will join the transmission line coming from the Mollejon hydro station. The planned interconnection would thus form the basic structure of a national grid linking the main load centers of Belize. Additionally, BEL is planning to link the load centers at Dangrida and San Pedro (Ambergris Cay) to the grid, thereby extending the national system to comprise all the major load centers of the country (Corozal/Orange Walk, Belize City/Ladyville, Belmopan/San Ignacio, Dangrida and San Pedro). The San Pedro load center is planned to be interconnected through a 13 mile 34.5 kV submarine cable between the mainland and the Ambergris Cay-island. This transmission system and links, and the associated Supervisory Control, Data Acquisition (SCADA) and Dispatch Center is known as the Second Power Development Project. A detailed project description, a project map and one-line diagram are included in Annex 5.1.

4. Basic engineering, cost estimates, environmental assessment, route selection, economic evaluations, and other technical studies of the project have already being carried out. BEL has contracted field surveys to establish the plan and profile of the 115 kV interconnecting line and the 34.5 kV Dangriga line; it is expected that this work would be finished by December 1994.

5. The World Bank, the Caribbean Development Bank, the Commonwealth Development Corporation and the European Investment Bank are in the process of project preparation for the approval of loans to partially finance the Second Power Development Project.

Objective

6. Consulting services are required to assist BEL in: (i) final engineering design of transmission lines, substations, submarine cable and SCADA and communication systems and preparation of technical specifications; (ii) carry out specialized technical studies; (iii) preparation of bidding documents and assistance in bids evaluation, selection and contracting; (iv) assistance in supervising construction, erection and project management; and (v) inspection of manufacturing equipment and materials.

Basic Information and Studies

7. BEL has conducted a series of studies and analysis of the Power II Project. The Consultant should use this information as the basis for his work and in developing its recommendations. The following documentation, inter alia, is or will be available:

- (i) "Power II Study for the Belize Electricity Board", NEI Electric Power Engineering (U.S.A.), November 1992, and subsequent revisions.
- (ii) "Power II Project - Interconnection Transmission Line to Mexico - Generation Dispatch Simulation and Production Costing", E. Indacochea and I. Aragon, Consultants, November 1992.
- (iii) "Power II Project - Supplement to the Communication Alternatives Assessment", Macro Corp. (U.S.A.), September 1993.
- (iv) "Belize Power II Project - 115 kV Mexico Interconnection Transmission Line - Environmental Impact Assessment", CI Power (Canada), December 1993.
- (v) "Power II Project - Economic, Technical and Environmental Assessment - Electricity Supply to Ambergris Cay (San Pedro)", ElsamProjekt (Denmark), December 1993.
- (vi) "Power II Project - Economic Evaluation", E. Indacochea and I. Aragon, Consultants, December 1993.

- (vii) "Line Route Survey - 115 kV Interconnection Transmission Line to Mexico" (including soils identification and analysis). Survey will be completed by June 1994.
- (viii) "Line Route Survey - 34.5 kV Transmission Line to Dangriga" (including soils identification and analysis). Survey will be completed by June 1994.

Scope of Work

8. Considering the overall project schedule, the services to be provided by the Consultant have been divided in two phases, as follows:

- Phase 1: Studies and Engineering
- Phase 2: Project Management and Construction Supervision

PHASE 1: Studies and Engineering

9. The studies mentioned in paragraph 7 above have determined the basic engineering design conditions and specifications for all project components (line and submarine cable routing, conductors selection, supporting structures, insulation, line hardware, substations layouts, basic electric and mechanical specifications of materials and transformer and switching equipment, single-line diagrams, basic operating conditions, etc.). The Consultant should use all this information in carrying out the final engineering design of the project.

10. The following activities, inter alia, are expected to be carried out by the Consultant (this list of activities is indicative only, the Consultant shall use its experience and knowledge as well as international recognized best practices in carrying out its work):

- A. Transmission Lines
 - (i) Selection of type and section of line conductors and earth wires
 - (ii) Selection of type and characteristics of line insulation and hardware
 - (iii) Selection of type of supporting line structures and preliminary structure spotting along line routes
 - (iv) Determination of transmission line standards and specifications for materials and construction
 - (v) Electrical and mechanical design of the transmission lines

- (vi) Preparation of transmission line plan and profile drawings
- (vii) Preparation of technical specifications for procurement of equipment and materials and for transmission line construction
- (viii) Preparation of detail cost estimates

B. Submarine Cable

- (i) Selection of type and section(s) of cable
- (ii) Determination of cable standards and specification
- (iii) Final route selection and detail sea bottom (depth) survey
- (iv) Preparation of plan and profile drawings
- (v) Preparation of technical specifications for procurement and installation of submarine cable
- (vi) Preparation of cost estimates

C. Substations

- (i) Selection of final sites
- (ii) Preparation of final substation layouts and single-line diagrams
- (iii) Civil engineering designs
- (iv) Specification of power transformers (nominal capacity, voltage relation(s), voltage regulation, insulation, refrigeration, etc.)
- (v) Specification of switching equipment (circuit breakers, switches, lightning arresters, etc.)
- (vi) Design and specifications of busbars and structures
- (vii) Specification of low voltage equipment, switchgear and power supply
- (viii) Specification of transmission line and substation relay protection

(ix) Preparation of technical specifications for procurement of equipment, installation and erection of substations

(x) Preparation of detail cost estimates

D. Dispatch Center, SCADA and Communication Systems

In designing and specifying the dispatch center, the SCADA and the communication systems, the Consultant should take into consideration the limited size and complexity of BEL's generation and transmission system. Simplicity and cost-effectiveness should be the main goals. The use of PC workstations and networks, and standard software, should be seriously considered.

(i) Selection of final site for the dispatch center

(ii) Civil engineering design of the dispatch center, including electromechanical services

(iii) Definition of functional specifications of dispatch and SCADA systems

(iv) Determination of software requirements for dispatch and SCADA

(v) Selection and specification of computer system(s)

(vi) Specification of Remote Terminal Units (RTU's)

(vii) Selection and specification of the communication system(s) (enough capacity for data transmission, protection signaling and voice communication)

(viii) Preparation of technical specifications for procurement of equipment, software and installation for the dispatch and SCADA, and communication systems

(ix) Preparation of detail cost estimates

E. Specialized Technical Studies

In order to complement the work of the Consultant in engineering design and provide the technical basis for the selection and specification of major and critical equipment and materials for the Project, the Consultant will carry out three specialized technical studies in (i) Reactive Power Compensation and Voltage Control; (ii) Insulation and Corrosion; and (iii) Relay Protection. Attachment I describes the purpose, scope of work and output of each study.

The Consultant will prepare a report for each one of the studies, documenting the work done, the analysis carried out, the results obtained, the main findings and the conclusions and recommendations.

PHASE 2: Construction Supervision and Project Management

11. During project execution the Consultant will provide full time on-site support and assistance to the Project Implementation Unit (PIU) in construction supervision and project control and management. The Consultant's permanent team will be constituted by a Project Manager and a Supervision Engineer. Short term support in specialized areas (like the submarine cable) and equipment and materials manufacturing inspection will also be required as needed.

12. The main activities foreseen are, but not limited to, the following:

- (i) Preparation of bidding documents for procurement of materials and equipment, and the construction and erection of transmission lines, substations, submarine cable, and SCADA and communication systems
- (ii) Preparation of work plans and schedules, including timing of tendering, evaluation of bids, negotiation and contracting, delivery of equipment and materials, construction, testing and commissioning
- (iii) Assistance in bid evaluations, selection, negotiation and contracting
- (iv) Assistance in supervision of construction, project control and monitoring contractors performance
- (v) Preparation of project implementation progress reports
- (vi) Review of construction drawings and designs, and reports prepared by contractors
- (vii) Review as built drawings prepared by contractors
- (viii) Assistance, as required, in specialized technical areas during project construction
- (ix) Inspection, as required, of manufacturing equipment and materials

Consultant Inputs

13. The services provided by the Consultant will be carried out over an estimated period of 36 months. Phase 1 will be carried out for a period of about 6-9 months (with activities of part D perhaps extending to 12 months). According to the project implementation schedule, the supervision and project management (Phase 2) will extend for about 30 months. Additionally, about 15 man-months of part-time consultancy will be required for manufacturing inspection and advise in specialized (submarine cable, SCADA and communication systems, etc.) areas, during project construction.

14. An indicative distribution of man-months per Phase follows:

Phase 1:	70 man-months
Phase 2:	80 man-months

Therefore, approximately 150 man-months of consultancy services will be required.

15. BEL will provide the following facilities to the Consultant:

- (i) Permanent office space and furniture for Consultant's personnel.
- (ii) Desktop computers and office equipment (The Consultant will indicate in its proposal the list of recommended equipment to carry out its work. Laptop computers should be provided by the Consultant, if required.)
- (iii) Two motor vehicles.
- (iv) Dedicated office and support personnel (the Consultant will indicate in its proposal the requirements of local office and support personnel for the project. This personnel will be part of the PIU organization).

Technical Proposal

16. The documentation to be presented by the Consultant should be sufficient to allow BEL an objective evaluation of the Consultant's capabilities and experience to carry out the requested services in a professional and efficient way. Experience in engineering design and project supervision and management in recent similar assignments of the key personnel proposed by the Consultant is of primary importance. Availability and working experience on modern information technology methods and tools by the Consultant will be appreciated in the evaluation. Experience in procurement procedures and sample bidding documents used in projects financed by the World Bank will also be considered in the technical evaluation.

17. The evaluation of the Consultant's experience will be based primarily on similar 22 to 138 kV transmission line and substation projects, submarine cables, small scale SCADA and communication systems, electrical network systems studies, construction supervision and project management, and manufacturing inspection and testing; preferable in Latin America and Caribbean countries, carried out by the Consultant in the last five years. The Consultant's proposed personnel experience will be based only in the last ten years experience in similar projects and will be limited to:

For Phase 1:

- (a) Chief Project Engineer
- (b) Submarine cable specialist, in charge of part B
- (c) SCADA and Communication Systems specialist, in charge of part D
- (d) Power Systems Engineer, in charge of part E
- (e) A maximum of other three professionals working more than 50% of their time in the project

For Phase 2:

- (f) Supervision Project Manager (SPM)
- (g) Supervision Engineer, assistant to the SPM
- (h) Three inspection engineers; in the areas of submarine cable installation (could be same person as in b above), SCADA and communication systems (could be the same person as in c above), and transmission lines and substations materials and equipment

18. The technical proposal will contain separate sections for each one of the two Phases; describing in detail, inter alia, the following: (i) the proposed organization of the work, work program, time schedule and activities-time-personnel participation matrix; (ii) engineering design standards, methods, techniques and tools to be used; (iii) the methods and procedures to be used in carrying out the technical studies; (iv) technical specifications extracts and examples of similar projects; (v) examples or extracts of technical specification documents of submarine cables and small EMS, SCADA and communication systems; (vi) examples or extracts of bidding documents of similar projects; (vii) project management and control methods, techniques and tools to be used; (viii) equipment and materials testing and inspection protocols examples of similar projects; (ix) project supervision reporting examples of similar projects; and (x) any other relevant technical information of similar projects carried out by the Consultant.

Economic Proposal

19. Although price will not be a factor in the selection of the Consultant, the estimated human resources requirements, as indicated in paragraph 14, should be taken as a reference in the preparation of the economic proposal. The technical and economic proposals should be presented in separate packages (envelopes). The Consultant should divide its costs in two basic components, professional fees and expenses. The professional fees can be assigned by category but only monthly (for long-term) and weekly (for short-term, less than three months assignments) fees will be allowed. To obtain the total professional fees the Consultant should applying the per unit fees to the activities-time-personnel participation matrix, mentioned in paragraph 18-i. If required by BEL, the Consultant should provide the breakdown of the professional fees.

20. The expenses will be divided into three basic components: (i) travel expenses; (ii) living expenses; and (iii) other or miscellaneous. The Consultant will estimate the number of round-trip tickets and other travel required for each person; these expenses will be reimbursed by BEL against documentation. Living expenses will be paid on fixed rate basis. Consultant's personnel staying in Belize for periods of three or more months (long-term assignments) will be paid US\$3,000/month. Personnel staying in Belize for periods of less than three months will be paid US\$150/day. BEL will recognize the Consultant a monthly fixed amount of US\$250 for miscellaneous expenses (communications, printing, copying, etc.); any other extraordinary expense will be reimbursed against documentation.

21. The costs mentioned in paragraphs 19 and 20 should be presented separate for each one of the Phases of the scope of work. All applicable conditions and form of payment of the services for each one of the Phases should be clearly indicated in the economic proposal.

Contract Award

22. Contract(s) will be awarded for the two Phases to a single consulting company or Phase 1 to one company and Phase 2 to another company; or only Phase 1 could be awarded.

Reporting and Documents

23. The Consultant will be responsible of producing all technical and contractual documentation for the project (specifications, bidding, procurement and contractual documents, drawings, maps, layouts, electrical schemes, computer studies results, studies reports, inspection reports, et.). During project implementation a supervision report should be prepared every quarter, including reporting on the physical, financial and economic status and progress of all components of the project.

24. The Consultant will keep and maintain a complete project file, including all reports prepared by the contractors; as-built drawings, maps, schemes, etc. prepared by the contractors; operating and maintenance manuals prepared by the contractors and equipment suppliers; design

manuals, standards, specifications, etc.; a photographic album recording all stages of project implementation; and any other pertinent document related to the project.

SPECIALIZED TECHNICAL STUDIES

A. Reactive Power Compensation and Voltage Control

Purpose of the Study

1. The study to be carried out by the consultants should determine the required reactive power compensation equipment to maintain stable voltage conditions along the 115 and 34.5 kV transmission system of the Second Power Development Project, as well as the method to be employed in controlling this equipment.

Scope of Work

2. The tasks envisaged in this reactive power compensation study are the following:
- i) Establish the light loading and the peak loading conditions on the transmission system for a 15 year horizon using the medium and the high demand scenarios;
 - ii) Determine the voltage profiles along the transmission system for the conditions developed above;
 - iii) Examine the various alternatives to maintain voltage level at all points of the transmission system within a band of plus/minus 5% of rated voltage; and
 - iv) Device the control system to switch on/off the capacitor banks and reactances incorporate in the transmission system in order to effect proper reactive power compensation. The control system should be designed to make use of the SCADA system which will be implemented in the project. The design of the control system should permit manual and programmed switching of reactive power compensation devices.

Output of the Study

3. The results of the studies indicated above, should be used by the consultants in the preparation of the following documents:
- a) The electric design of the reactive power compensation schemes for each substation of the transmission system;
 - b) The reactive power compensation control system design for programmed switching of reactive power compensation devices; and

- c) Technical specifications for the reactive power compensation equipment and its control system.

B. Insulation and Corrosion

Purpose of the Study

4. The study to be carried by the consultant aims to establish the insulation level and physical characteristics of the insulator units required for the 115 kV interconnection transmission line to Mexico and for the associated substations, considering the proximity of these facilities to the seashore and the likely fouling of insulation by salt fog or/and salt deposits. In addition, the study should determine the type of conductor to use in the transmission system to avoid corrosion problems associated with salt fog or/and salt deposits. The transmission line route will approach the seashore at distances of less than 50 km.

Scope of Work

5. The tasks envisaged for the consultants are the following:
- i) Determine the severity of insulation fouling during the dry season and its impact on the level of insulation to be provided on the transmission line and on the associated substations;
 - ii) Prepare an insulation coordination scheme for the transmission line and substations using data gathered from above and the isoceuranic level in the area which the transmission line traverses, as well as for the locations of the associated substations;
 - iii) Establish the physical characteristics of the insulators and associated hardware. This task shall include indication about insulator skirts shape and diameter, method of attachment (ball and socket, or bolt and clevis) in order to prevent salt collecting on cavities; and thickness of galvanizing on insulators metal elements and on line hardware;
 - iv) Establish the physical characteristics of electrical apparatus' insulation at all substations, and busbars insulation requirements;
 - v) Determine the type of conductor to use in order to minimize corrosion effects that could cause rupture of conductor or high corona losses.

Output of the Study

6. The results of the study indicated above, should be used by the consultants in the preparation of the following documents:

- a) Technical specifications for insulators and line hardware;
- b) Technical specifications for apparatus insulators; and
- c) Technical specifications for line conductors and associated hardware.

C. Relay Protection

Purpose of the Study

7. The study to be carried by the consultant aims to establish the best protection scheme for the 115 kV interconnection transmission line to Mexico and for the associated substations, the link to San Pedro (Ambergris Cay) and the line to Dangriga. The consultant should also examine the coordination between the protection scheme for the Second Power Development Project and that of the transmission system for the Mollejon hydroelectric plant.

Scope of Work

8. The tasks envisaged for the consultants are the following:
- i) Carry out a complete short circuit study under various load and generating conditions of the system;
 - ii) Determine the higher and lower levels of short circuit currents in all major power plants and substations under single, double and three-phase short circuits;
 - iii) Determine the best scheme of primary and back-up relay protection for the transmission lines, cables and substations; and
 - iv) Determine the necessary relay coordination for the system.

Output of the Study

9. The results of the study indicated above, should be used by the consultants in the preparation of the technical specifications for the relay protection system for the line and substations of the Second Power Development Project.

BELIZE
SECOND POWER DEVELOPMENT PROJECT
COST OF SERVICE AND TARIFF STUDY

Terms of Reference

BACKGROUND

1. The current electricity tariff of the Belize Electricity Limited (BEL), in effect since 1989, consists of three increasing blocks which apply to all consumers in the country:

Block	Belize cents/kWh	US cents/kWh
0-70 kWh/month	31	15.5
71-150 kWh/month	35	17.5
more than 150 kWh/month	41	20.5

2. Neither demand charges nor service fees are levied in addition to the above rates. In FY92^{1/} the average revenue per kWh sold was 38 Belize cents (equivalent to about US\$0.19) compared to the average generating cost of about 27 Belize cents.

3. BEL currently operates nine isolated electrical systems, all of them supplied by diesel thermal units. The total installed capacity is 42 MW ^{2/}. In FY92 the combined demand of all the nine centers was about 23 MW, with sales of about 107 GWh. One of the electrical systems, the in 1991 interconnected Corozal/Orange Walk system, is supplied from the Mexican grid through Chetumal in the Yucatan Peninsular.

4. With the objective of diversifying the sources of electricity supply, the Government of Belize and BEL signed an agreement with a private consortium the Belize Electricity Company Ltd (BECOL) to construct and operate a 25 MW run-of-river hydropower plant at the Mollojon site in the Macal River. The hydro plant will be connected to the BEL distribution systems at Belmopan and Belize City by a 115 KV transmission line to be constructed by BECOL. All the power generated by the Mollejon plant will be sold to BEL on a pay-or-take basis.

^{1/} BEL's fiscal year is from April to March.

^{2/} Total firm capacity is 26.5 MW.

5. As a further means of diversification, the BEL is planning to interconnect its electrical system with the Mexican system through the construction of an 84 mile 115 kV transmission line from Chetumal in Mexico through the Corozal/Orange Walk system, to Belize City, where it will join the transmission line coming from the Mollojon hydro station. The planned interconnection would thus form the basic structure of a national grid linking the main load centers of Belize. Additionally, BEL is planning to interconnect the load centers at Dangrida and San Pedro to the grid, thereby extending the national grid to comprise all the larger load centers (Corozal/Orange Walk, Belize City, Belmopan, Dangrida and San Pedro). The San Pedro load center is planned to be interconnected through a 13 mile 34.5 kV submarine cable between the mainland and the Ambergis Caye-island.

6. The World Bank, the Caribbean Development Bank and the Commonwealth Development Corporation are considering to contribute to the financing of the Mexican interconnection as well as of the Dangrida and San Pedro connections.

7. The power purchase agreement between BEL and BECOL stipulates a base price of US\$0.0875 per kVAh for a supply up to 120 GVAh, which is the minimum supply guaranteed by BECOL. For purchases above 120 GVAh, the unit price will be US\$0.07 per kVAh. The official tariff system for the Mexican peninsular region, which will apply to purchases by the BEL, will have different rates for base and peak energy, charges for maximum demand, and will also include power factor penalty surcharges resp. power factor premium discount. The current (December 1993) rates for the Mexican supply vary from US\$0.032 during base load time to US\$0.058 during peak load time (6 p.m to 10 p.m Monday to Saturday), while the monthly peak demand is charged at about US\$8.8 per kW.

8. In view of the planned changes in the supply options the current tariff structure appears inadequate. Especially the following issues need to be addressed: (1) the tariff does not follow the structure of the costs of future supply; (2) the tariff does not provide customers with adequate signals for efficient use of electricity in particular since rates do not reflect peak and off peak supply costs; (3) generation costs are expected to change when BEL moves from a purely thermal system toward a more diversified system including purchases from the Mollejon hydro-plant and from Mexico.

STUDY OBJECTIVE

9. The objective of the tariff study is to provide the Belize Electricity Limited (BEL) with an efficient rate structure for all categories of customers. The rate structure should reflect the costs of supply and provide incentives for the efficient use of electricity within the financial and operating constraints of the BEL. Additionally, the BEL staff will be given an opportunity to learn utility ratemaking in practice through participation in the tariff study.

SCOPE OF WORK

10. The Consultant shall carry out the following:

A. Analysis of current and future electricity demand

- (1) Analysis of current demand of existing customers including:
 - number of customers per block of consumption
 - sales per block of consumption
 - customer load shapes, seasonality of demand and peak demand
 - power factors
 - billing frequency analysis
 - impact of income of residential customers on electricity consumption
- (2) Analysis of sales and demand forecasts per block of consumption ^{3/}
- (3) Analysis of the potential of connecting customers with captive generators to the BEL system and the possibility of purchasing any excess generation from these generators.
- (4) Analysis of system load profile and coincidence factors
- (5) Analysis of demand-side-management potential by consumer category

B. Cost of Service Computation

The cost of service computation will be based on the estimated long-run marginal cost of the optimal 10-year expansion plan of the interconnected system.

- (1) Production costing for the planned interconnected system
- (2) Estimation of peak and off peak energy and capacity generating costs and seasonal and geographical variations of generation costs
- (3) Analysis of transmission investment program and transmission capacity and O&M costs
- (4) Analysis of distribution investment cost and distribution O&M costs

^{3/} *The consultant is not required to produce new forecasts unless his/her analysis indicates a substantial difference from the existing forecasts. The consultant should however, as indicated in item D(7), analyze the impact of proposed tariff change on demand projections.*

- (5) Analysis of customer connection costs
- (6) Analysis of administrative, overhead and other costs
- (7) Distribution of costs by consumer blocks
- C. Determination of a theoretical optimal rate structure based on A and B above**
- D. Financial simulations based on the current and on the theoretical rate structure, and BEL's financial objectives**
 - (1) Review of established tariff setting principles in Belize
 - (2) Analysis of BEL's financial objectives and covenants
 - (3) Analysis of existing rate structure and discussion of main issues
 - (4) Analysis of BEL revenue requirements
 - (5) Presentation of the financial simulations based on the theoretical rate structure
 - (6) Revenue requirements reconciliation
 - (7) Analysis of the impact of proposed tariff change on various blocks of consumption and likely consequential adjustments to demand projections
- E. Recommendations for an efficient rate structure**
 - (1) Discussion of constraints to be taken into account when designing the new rate structure including:
 - metering problems
 - country-wide uniformity
 - promotion of efficient use of electricity and conservation
 - competitiveness of Belize's industries
 - impacts on low income households
 - simplicity
 - (2) Proposals for an efficient rate structure and/or menu of optional rates taking into account the revenue requirements, the identified constraints and economic efficiency objectives

F. Recommendations for an implementation strategy and adjustment mechanisms

- (1) Time frame for implementation
- (2) Required customer information campaigns
- (3) Investment requirements, such as meters and telecommunication equipment
- (4) Fuel and inflation clauses

G. Provide BEL with the necessary methodology, data base elements and software in order to update the tariff calculations according to changes in circumstances

REPORTING

11. The following reports, all in English, will be submitted by the Consultant to the Belize Electricity Limited (BEL) and the World Bank. The reports will be reviewed by the BEL and the World Bank.

- (1) Interim Report. This report will comprise items A, B and C of the terms of reference and will be submitted within three months after commencement of the study;
- (2) Draft Final Report. This report will detail the consultants' findings and recommendations on items A, B, C, D, E and F of the terms of reference and will incorporate all revisions required on the interim report. It will be submitted within three months from the commencement of phase two; and
- (3) Final Report. This report will incorporate all revisions required by the BEL and the World Bank on the draft final report. It will also provide the documentation required in accordance with item G of the terms of reference. The final report will be submitted within two weeks from the receipt of comments on the draft final report.

CONSULTANCY INPUTS

12. The study will be carried out over a period of eight months. It is estimated that a total of 10 man-months of international consultancy inputs will be required. The study will be carried out in two phases; Phase one will comprise items A, B and C, and should result in an interim report to be completed within three months from the initiation of the study. Comments on the interim report will be provided within two weeks of its submission to BEL. Phase two will

comprise items D, E, and F, and should result in a draft final report to be completed within three months following the receipt by the consultants of the comments on the phase one report. Comments on the draft final report will be provided within a month of its submission to BEL. Upon receipt of comments on the draft final report the consultant should finalize the report within two weeks. The final report should incorporate item G of the terms of reference.

BEL will provide the following facilities to assist carrying out of the study:

- (1) Suitable counterpart staff;
- (2) Data collection assistance (BEL will provide the results of a load research measuring campaign to be carried out separately);
- (2) Office space during field work in Belize; and
- (3) Vehicles including drivers for field work.

13. It is estimated that during each phase, the consultant will spend between one and three weeks in Belize for data collection, analysis, and discussions. The consultant should indicate prior to the field work, on the basis of his/her experience with similar studies, what operational support he/she expects from BEL to collect relevant information.

SUBMISSION OF PROPOSAL

14. The Consultant should submit a proposal stating his/her rates, all applicable conditions, and a brief description of the work steps and proposed methodology to fulfill the terms of reference. The proposal should contain information on the Consultant's professional experience including university degrees and dates for each professional member participating in the study, and experience in similar studies together with a summary of their objectives, scope and results. The economic proposal and the consultants' stated experience in similar studies will be the basis of negotiation between the BEL and the Consultant.

BELIZE

SECOND POWER DEVELOPMENT PROJECT Environmental Issues and Summary of Environmental Impact Assessment Studies

Legal, Institutional and Policy Framework

1. Over the past years, the GOB has been making a very significant effort to create legislation and to develop or strengthen its institutional framework and capacity to promote environmentally sustainable development in the country. Since its creation in 1989, the Ministry of Tourism and the Environment (MTE) has conducted the preparation of a Policy and Strategy Statement (1992). An Environmental Protection Act was enacted in 1993 enabling it to enforce environmental standards and guidelines for environmental assessment of projects. While specific legislation is generally in place for natural resource management (e.g., the National Park System Act, the Forest Reserve Act, the Fisheries Ordinance), detailed regulations for air, water and soil pollution are not yet available. Review and enforcement capabilities are still weak.

2. The GOB is being supported in this effort by several international programs and agencies. The ODA acts as the lead agency in the Tropical Forestry Action Plan of Belize. This is a five-year program which began in 1991 and comprises improvement of land use planning and forest management. The program includes redefinition of boundaries of the country's reserved areas, the installation of a geographic information system, training and institutional strengthening. Under the Natural Resource Management and Protection Project (NARMAP), USAID is providing technical assistance to help develop the monitoring, assessment, and enforcement capabilities of the GOB. The project comprises promotion of sustainable agricultural production methods and forestry development, in conjunction with ODA's efforts. UNDP through the global Environmental Facility (GEF) has been providing support to the Coastal Zone Management Committee. The World Bank's Country Assistance Strategy foresees help in preparation of a National Environmental Action Plan.

3. Non-governmental organizations, both local and international, have had a very active role both in implementing environmental programs, such as the management of forest reserves, and in discussing proposed guidelines and major specific development projects for the country.

Second Power Development Project: Environmental and Social Issues

4. The EA process: Because of Belize's singular natural characteristics and its privileged coastal resources, special care was taken by BEL and the Bank, in preparing the Power II Project, to ensure full consideration of existing environmental legislation in the country, observance of Bank guidelines, and best international practice in dealing with potential environmental and social project impacts. Although the project was rated as category "B" by the

Bank, full environmental assessments (EAs) were conducted for the Mexican 115 kV Inteconnection and for the 34.5 kV San Pedro connection servicing Ambergris Caye. The EAs were conducted by international consultants, who, in both cases, worked with a Belizean NGO during preparation of the baseline studies. In accordance with Bank guidelines, public consultations were carried out: first, a scoping session was held in December 1992 to discuss the proposed terms of reference of the EAs; second, two public forums were convened in December 1993 to discuss findings of the studies. BEL's management has demonstrated great commitment to obtaining effective participation of potentially affected or interested people throughout the EA process. The public forums, originally to be held in Belize City, as was the scoping session, were postponed and transferred to locations along the future transmission line routes, in order to facilitate participation and allow more time for examination of the EA drafts.

5. The Mexican Interconnection: For this line (137 km; 30 meter right-of-way), two alternatives were assessed. (Minor variations along the proposed corridors were also explored but dropped.) The impacts associated with construction and operation of either of the two main alternatives are expected to be low and there is negligible difference between them in terms of factors such as disruption of existing settlements, disturbance of cultivated lands, disturbance to critical wildlife habitats and sanctuaries, visual impact, avoidance of road and stream crossings, and use of existing rights-of-way. Resettlement will not be required in either case. The transmission line alignment along the Old Northern Highway is favored over its alternative, above all, because it facilitates the extension of the transmission grid to Ambergris Caye. In the preferred solution, medium or moderate impacts may occur as a result of vegetation clearing, use of sensitive terrain (e.g., steep slopes at river crossings) and visual presence near towns. Impacts to human settlements, agricultural practices, critical wildlife habitat, sites of archaeological interest, and human health and safety are all rated as low.

6. The Dangriga Line: A formal environmental assessment was not required given the general alignment and physical characteristics of the line, i.e. a single-pole structures, medium voltage, requiring a 10 meter ROW, routed predominantly along existing roadways and areas which have been substantially disturbed by previous projects and agriculture. Guidelines and proposed mitigation measures prepared for the Mexican Interconnection will be followed in the case of this component.

7. Supply of San Pedro: Given the very special natural resources of Ambergris Caye, with the Hol Chan Marine Reserve at its southern tip, Belize's unique barrier reef along its full extension on the east (Gulf of Mexico) side, and mangrove along the west (continent) side of the island, the electricity supply expansion proposal for the caye underwent a thorough consideration of alternatives from economic, technical, social and environmental standpoints. Power market growth projections were revised, taking into consideration the different plans for future development of the island which have been proposed by different agencies (e.g., UNDP). Five supply alternatives were considered: (a) expansion of existing plant; (b) new plant at new site; (c) submarine cable crossing; (d) overhead crossing; and (e) combination of the two previous ones. Within the scope of this overall feasibility study, an assessment of the potential impacts

of these supply alternatives was conducted, including identification of mitigation costs and residual impacts for which feasible solutions are not available. The overall optimal solution was found to be the submarine cable crossing. Although requiring slightly greater initial investment, it was assessed as having the lowest production (O&M) costs, being the most reliable source of supply, and having the smallest residual environmental costs in the long term. In the short term, i.e., during the construction phase, some sediment fouling is to be expected with possible negative but largely reversible effect on the marine environment. These were assessed to be less serious than impacts on bird fauna, risks of collision by ships and airplanes, and aesthetic impacts arising from the second-best alternative, the overhead crossing. (Other alternatives, such as wind and solar power, were also investigated but were not found to be advantageous as compared to conventional electricity supply.)

Environmental Action Plans

8. Environmental protection, avoidance and reclamation measures have been recommended in the EAs of both components. General procedures to be incorporated into the bidding documents for contractors have been proposed for the preconstruction, construction and clean-up phase. Procedures for monitoring and maintenance are also recommended in the EAs. Design of detailed mitigation measures and of a monitoring plan will be prepared according to guidelines, cost estimates and schedules established in the EAP, while detailed engineering, final route alignment, and a land survey of the right-of-way are carried out over the coming months. During this period, a survey of the proposed ROW as regards possible interference with archaeological sites will be carried out by the Department of Archaeology/Ministry of Tourism and the Environment. Minor modifications in positioning and spacing of poles may be expected so as to avoid unexplored or partially explored sites of archaeological interest along the route. Although easement is foreseen as the predominant approach to formation of the ROW, a land acquisition program is to be prepared, comprising valuation of fixed assets and agricultural production and payments of compensation, to be negotiated or fixed in accordance with Belizean legislation (the Electricity Act, the Crown Lands Ordinance and procedures and guidelines established by the Lands and Surveys Department/Ministry of Natural Resources for valuation of property losses, as applicable).

9. In the case of the submarine crossing to Ambergris Caye, specifications to tenders will require minimization of fouling effects from dredging. To supplement current knowledge of wind and current patterns, a data collection program has been designed. Its implementation is to be initiated as soon as possible, prior to detailed project design and construction specifications. Results will also provide information to define a monitoring plan to be used during the construction phase as a controlling mechanism.

10. During project preparation, a preliminary evaluation was carried out of environmental management problems pertaining to Belize's principal diesel power stations. Fires and oil spills have occurred in several of these in recent years. Terms of reference were prepared for a pollution mitigation program to be financed under the proposed project, covering the following

issues: spill prevention, control, and countermeasures; noise pollution; smoke emission control; remediation of contaminated areas; and training for BEL staff. Terms of reference are included in Annex 5.10.

Strengthening of BEL

11. An environmental team will be created within BEL's Project Implementation Unit. In the short term, this team will ensure that all mitigation measures recommended in the EAs are incorporated into the final project design and bidding documents for the transmission lines, and that these are followed during project implementation. It will liaise with government and non-governmental personnel regarding environmental issues. It will also be responsible for supervising and providing support for preparation by consultants of clean-up plans for existing diesel plants. In the long term, the presence of the team will enhance BEL's capability for developing and implementing environmentally sustainable projects, developing environmental policies, guidelines and standards for all of BEL's activities. It will also negotiate proposed regulations as they are developed by the GOB and ensure compliance by BEL once they are approved. The unit will be staffed with one natural resource management specialists and one BEL engineer, to be trained in industrial health and safety practices and procedures. Both will be trained in EIA assessment and monitoring.

12. An international consultant will be contracted to supervise final design of mitigation measures, tender documents, and the monitoring plan during the preconstruction and early construction phase. Monitoring of compliance with the EAP will be carried out by local consultants or NGOs. The supervisor of the environmental staff will report to the Project Coordinator. A training program for the environmental staff and for the local consultants/NGOs entrusted with the environmental monitoring will be carried out during project implementation by the international consultant. TORs for contracting this services are included in Annex 5.11.

13. To support the implementation of the submarine cable connection to Ambergris Cay, it is recommended that a small, ad-hoc, Environmental Advisory Committee be formed to advise on mitigation and monitoring plans, on their implementation, as well as on suitable courses of action in face of unforeseen circumstances which may arise during project implementation. It is recommended that this committee include the following persons: the Project Coordinator, a representative from the Ministry of the Environment/Department of Environment, a representative from the National Social and Economic Council, a representative from the Coastal Zone Management Committee, and a representative from the town of San Pedro, an a marine resource/EIA specialist (preferably an international consultant). The committee should meet regularly through project implementation. The organization chart in Annex 5.6 illustrates the relationship between the environmental unit, BEL's organization, the Ambergris Cay Advisory Committee and the Project Implementation Unit.

BELIZE

SECOND POWER DEVELOPMENT PROJECT

ENVIRONMENTAL MITIGATION
AT BELIZE ELECTRICITY LIMITED'S POWER PLANTS

Terms of Reference

Introduction

1. The Development Plan of the Government of Belize for 1990-1994 sets out an ambitious energy policy aiming at reducing Belize's dependency on imported energy, increase the efficiency of energy use, provide electricity to rural communities, and secure a reliable and sustainable electricity supply across the country. The Government's strategy in the power sector for implementing these objectives include rural electrification, construction of a new hydroelectric plant, expansion of electricity imports from Mexico, and construction of new electrical transmission lines. This strategy will alter some of the current functions of the power plants operated by Belize Electricity Limited (BEL).

2. Consistent with BEL's environmental stewardship, BEL is seeking the services of a qualified consulting firm to conduct various environmental activities associated with seven of its power plants. These are the Belize City, Ladyville, Belmopan, San Pedro, Dangriga, Corozal, and Orange Walk Power Plants (please see Attachment A for background information about these power plants). With the implementation of the Government strategy in the power sector, the Belize City, Ladyville, and Belmopan Power Plants are expected to provide peak-load power; and the remaining four power plants are expected to supply stand-by power.

3. This Terms of Reference gives the background, scope of services, and description of deliverables expected from this project, which will consist of the following five tasks:

- Task 1 - Spill Prevention, Control, and Countermeasure (SPCC) Plan
- Task 2 - Noise Pollution Control
- Task 3 - Mitigation of Smoke Emissions
- Task 4 - Remedial Investigation and Planning for Decontamination of soil
- Task 5 - Environmental Training of the BEL Employees

TASK 1 - Spill Prevention, Control, and Countermeasure (SPCC) Plan:

4. **Background:** A preliminary survey of seven BEL power plants was conducted to identify the environmental issues associated with spill prevention and control, and waste management. This survey has revealed a need for upgrading the existing facilities and improve the current operating procedures. More specifically, the areas listed below were identified for improvement

Belize Power Plant: (i) Vehicle filling station, (ii) tank-truck unloading station, (iii) vehicle maintenance station, (iv) fuel storage, (v) lube oil storage, (vi) waste oil handling, and (vii) drum storage.

Ladyville Power Plant: (i) Tank-truck unloading station, (ii) fuel storage, (iii) waste oil handling, and (iv) drum storage.

Belmopan Power Plant: (i) Tank-truck unloading station, (ii) fuel storage, (iii) waste oil handling, and (iv) wastewater discharge.

San Pedro Power Plant: (i) Fuel storage, (ii) lube oil storage, and (iii) waste oil handling.

Dangriga Power Plant: (i) Fuel storage, (ii) waste oil handling, and (iii) parts cleaning.

Corozal Power Plant: Fuel storage.

Orange Walk Power Plant: Fuel storage.

5. **Scope Of Work:** The consultant will conduct a thorough survey of the seven power plants to evaluate: (i) designs of existing structures and (ii) current operating procedures that may cause environmental discharges (e.g., spills). The scope of this investigation will not be limited to the issues identified in the preliminary survey, but will be more comprehensive. Based on this investigation, the consultant will identify specific areas where environmental discharges occur and prescribe measures for preventing, controlling, and countermeasuring these discharges. These measures may include improvements of existing designs (e.g., paving of an earthen area with concrete), new designs (e.g., diking), or changes in operating procedures (e.g., improved waste drum handling procedures). The consultant will estimate costs associated with each recommended measure. For measures which involve improved or new designs, the consultant will provide all engineering designs for construction. These designs will be compatible with the international standards.

6. The consultant will prepare a SPCC Plan for each of the seven power plants with emphasis given to the Belize City, Ladyville, Belmopan, and San Pedro Power Plants. The SPCC Plan will prescribe measures to prevent and control spills, including designs

(e.g., design of drum storage area) and operating procedures (e.g., procedures for loading and unloading of tanks), identification of responsible facility personnel, inspection, and housekeeping. The consultant will also prescribe spill countermeasures, including initial response procedures, waste containment and disposal, safety considerations, personnel training, notification sequence, arrangement with local authorities, and emergency procedures.

7. Deliverables: The consultant will prepare and submit the following deliverables to BEL. Each deliverable will be finalized by the consultant following review and comment by BEL.

- a. The consultant will prepare a report, which includes detailed descriptions of proposed measures for spill prevention and control, and waste management; and engineering designs of measures which involve structural changes or new structures along with costs of these measures. The report will also include information on the existing designs or procedures as a reference.
- b. The consultant will prepare a SPCC Plan, which includes all the necessary design criteria and operating procedures for preventing spills, and additional procedures to control and countermeasure spills. This Plan will be BEL's base document for the training of its facility personnel in SPCC procedures. The Plan will also be used as a practical document for prevention, control, and countermeasure of spills at BEL's power plants.

8. Schedule: The schedule for Task 1 will be as follows:

- | | |
|----------------------------------|---------------------------------|
| - Submittal of the Draft Report: | 2.0 months after project start |
| - Review Period by BEL: | 0.5 month |
| - Submittal of the Final Report: | 3.0 months after project start |
| - Submittal of Draft SPCC Plan: | 4.5 months after project start |
| - Review Period by BEL: | 0.5 month |
| - Submittal of Final SPCC Plan: | 5.0 months after project start. |

TASK 2 - Noise Pollution Control:

9. Background: Noise levels at work place have been a source of complaints by some BEL employees. In addition, BEL received complaints on the noise levels emanating from a few BEL power plants by some members of the local community. For example, noise levels from the Belize Power Plant have been a source of complaints by the newer members of the community. Near the Belmopan Plant, some complaints have been received from a furniture manufacturing facility (located about 50 meters from the plant; there are no residences nearby the plant area). However, no complaints have been received for the San Pedro Power Plant, although this plant is located in a residential area. To-date, no noise monitoring has been conducted for any of the BEL plants.

10. **Scope of Work:** The consultant will monitor the noise levels within the plant sites (i.e., work places) of the Belize City, Ladyville, and Belmopan Power Plants. In addition, the consultant will monitor day time and night time noise levels at receptor points near the Belize City, Belmopan, and San Pedro Power Plants. If the noise levels are found to be above the World Bank guidelines or other international standards, then the consultant will identify mitigatory measures through an alternatives evaluation study, and provide costs of these measures. Selection of these measures should consider BEL's future business plans (e.g., the San Pedro Power Plant is to provide only stand-by power).

11. **Deliverables:** The consultant will prepare and submit to BEL a report which will contain the results of the noise monitoring studies (along with the description of the methodology, equipment, and data), evaluation of alternatives, and recommendations for mitigatory measures and costs. The report will also include the backup information for all cost estimates.

12. **Schedule:** The consultant will submit to BEL the draft report for Task 2 two months after start of the project. The consultant will finalize the draft report two weeks after receipt of BEL's comments.

TASK 3 - Mitigation of Smoke Emissions:

13. **Background:** Flue gases from the Belize City Power Plant are emitted to the atmosphere about 10 meters above the ground level through a stack located south of the Power Station. Smoke in these emissions is visible by a naked eye and is a source of complaints by community members located about 50 meters southeast of the plant.

14. **Scope of Work:** The consultant will monitor smoke emissions from the Belize Power Plant at discharge and receptor locations. If the levels are found above the international standards, alternative mitigatory measures should be evaluated (with respect to such criteria as effectiveness, implementability, and costs) and recommended solutions should be prescribed.

15. **Deliverables:** The consultant will prepare and submit to BEL a report which will contain the results of the smoke emission monitoring studies (along with the description of the methodology, equipment, and data), evaluation of alternatives, and recommendations for mitigatory measures.

16. **Schedule:** The consultant will submit to BEL the draft report for Task 3 two months after start of the project. The consultant will finalize the draft report two weeks after receipt of BEL's comments.

TASK 4 - Remedial Investigation and Planning for Decontamination:

17. **Background:** Contamination of soil by petroleum products has been identified at the Belize City, Ladyville, Belmopan, San Pedro, and Dangriga Power Plants. At the Belize Power Plant, soil contamination can be observed at: (i) the vehicle maintenance area and discharge canals from this area, and (ii) the waste oil storage area (which is saturated with oil). At the Ladyville Power Plant, the water phase from an oil-water separation well discharges to an area, where it accumulates oily materials, and possibly drains to the Belize River. In addition, some soil contamination can be observed by the fuel and drum storage areas. At the Belmopan Power Plant, about 60 m² of an adjacent lot (which is also owned by BEL) to the plant property are contaminated with oily wastes from the plant. As it rains, this contamination drains to the creek. In addition, soil contamination can be observed at the waste oil storage area, which contains about 20 waste oil drums. Oil from these spills wash away after rain storms and drain into a creek. At the San Pedro Power Plant, about 15 m² of soil are contaminated in the waste storage area. At the Dangriga Power Plant, the fuel storage area (which has a gravel base) is contaminated with oil. In addition, about 40 m² area of the adjacent lot west of the plant site (which is also owned by BEL) is contaminated by oil. Furthermore, about 120 m² of the parts cleaning area of the Dangriga Power Plant and about 50 m² area of the adjacent lot are contaminated with oil.

18. In addition, for many years, the portion of the Belize River Creek and associated lagoon southeast of the Belize City Power Plant site have been used for the disposal of various plant waste materials, including waste oils, used filters, and empty drums. A portion of this contaminated area south of the Belize Refrigeration Limited, covering an area of about 2,000 m², is filled with dirt at a depth of 1.2 m. This area is separated from the Belize River Creek and lagoon areas by means of wooden pilings, although this separation may not prevent flow of oil from the fill area to the adjacent surface waters. The remaining portion of the surface waters southeast of the plant is heavily contaminated (a very rough estimate of this area is 6,000 m², with an average depth of about 1.2 m). This contamination is likely to cause health risk to the members of the community, especially to those who live in the surrounding areas of the lagoon.

19. **Scope of Work:** The consultant will prepare remedial plans for the decontamination of soils at the Belize City, Ladyville, Belmopan Power, San Pedro, and Dangriga Power Plants. In addition, the consultant will prepare remedial plans for the mitigation of the contamination caused by the Belize City Power Plant to the surrounding surface water bodies, soils and sediments. Furthermore, the consultant will investigate the potential of seepage from the Belize City Power Plant's fill area to the surface water bodies; and if found to be the case, the consultant will prepare a mitigation plan through evaluation of alternative measures.

20. The consultant will first prepare a Work Plan, which will describe the existing conditions, a statement of objectives, and plans for the field investigation efforts. The Work Plan will include a list of analyses to be performed and a description of the sampling, sample preservation,

and analytical techniques to be used. The Work Plan will also include health and safety procedure to be followed by team personnel involved in field investigations

21. During field investigations, the consultant will obtain representative samples of soil, water, and sediments for physical examination and chemical analyses necessary to fully characterize the extent of contamination. Sampling and analyses will be performed using techniques outlined in the Work Plan by trained personnel.

22. The consultant, in cooperation with BEL, will develop the cleanup criteria for the contaminated areas. These criteria will be compatible with international standards. The consultant will then identify and screen remedial technologies based on the following criteria:

- a. Effectiveness: How effective is the selected technology in reducing the pollutant concentrations to the target levels? Has the technology been commercially used at other similar sites? Are there adverse environmental impacts associated with the technology?
- b. Implementability: Is the remedial technology easily implementable in Belize?
- c. Costs: Is the remedial technology relatively inexpensive?

23. The consultant will prepare remedial plans for the remediation of the contaminated surface water bodies, soils, and sediments; and, if necessary, for the fill area as well. The remedial plans should include inter alia: extent of contamination at the sites, identification and screening of remedial technologies, and the recommended remedial measures along with their costs and implementation schedules. The remedial plans will include Executive Summaries and will be appended with supporting information such as the Work Plan and field data. The remedial plan should also prescribe the recommended disposal method for wastes generated from remedial measures.

24. Deliverables: The consultant will prepare and submit the following deliverables to BEL. Each deliverable will be finalized by the consultant following review and comment by BEL:

- a. Work Plan
- b. Field Investigations Report(s). These reports will include results of field investigations at the Belize City, Ladyville, and Belmopan Power Plants as well as the Belize River Creek and associated lagoon and the fill area by the Belize City Power Plant. The reports will include the background, environmental setting, methodology, extent of contamination, contaminant characteristics, and potential receptors. Supporting documentation such as analytical results, maps, drawings, etc. will be appended as appropriate.

- c. **Remedial Plans:** For each contaminated area, the consultant will prepare a remedial plan. Each plan will include remedial objectives, identification and screening of remedial technologies, and a detailed remedial plan. The initial section of each plan will be an Executive Summary, which outlines the remedial objectives and highlights the conclusions. Each plan will also include descriptions, designs, environmental impacts, monitoring requirements, implementation schedules, and cost estimates for the recommended remedial measures, including transportation and disposal requirements and costs. Supporting documentation such as bases for cost estimates, preliminary equipment lists, and technical support documentation will be appended as appropriate.

25. **Schedule:** The schedule for Task 4 will be as follows:

- a. The consultant will submit the Work Plan for Task 4 to BEL within two weeks after start of the project. The Work Plan will be finalized within one week after receipt of BEL's comments.
- b. The consultant will submit to BEL all Field Investigation Reports within four months after start of the project. The Reports will be finalized within two weeks after receipt of BEL's comments.
- c. The consultant will submit to BEL all Remedial Plans within six months after start of the project. The Plans will be finalized within two weeks after receipt of BEL's comments.

TASK 5 - Environmental Training of BEL Employees:

26. **Background:** To-date no environmental training has been provided to the BEL employees. However, along with the environmental mitigatory measures to be implemented under this project, a new phase will be initiated at BEL. These mitigatory measures will also be complemented with a training program aimed at protecting the health and safety of BEL employees and the environment.

27. **Scope of Work:** The consultant will train the BEL employees in the areas of SPCC and industrial hygiene. The consultant will use the SPCC Plan as the base material for the SPCC training. With respect to industrial hygiene, the consultant will conduct a survey of the BEL power plants to review the existing work conditions (e.g., temperature, noise levels, availability of industrial hygiene facilities) and industrial hygiene procedures (e.g., use of personal protection equipment by BEL employees), identify deficiencies, and prescribe solutions. The consultant will include these findings in a report, which he will discuss with the BEL management. Subsequently, the consultant will design the training program, which he will discuss again with

the BEL management. The participants to this program will include BEL personnel from BEL headquarters in Belize City and managers and operators from various BEL power plants. The consultant will deliver the training program in Belize.

28. Deliverables: The following deliverables are to be provided to BEL by the consultant:

- a. The Industrial Hygiene Report that the consultant will discuss with the BEL management.
- b. The Outline of the Training Program, which the consultant will discuss with the BEL management.
- c. Delivery of the Training Program to the selected BEL employees. Each participant will receive a hard copy of the training material and a certificate for the Training Program.

29. Schedule: The schedule for Task 5 will be as follows:

- a. The consultant will submit to BEL the Industrial Hygiene Report within two months after start of the project. The Report will be finalized within two weeks after receipt of BEL's comments.
- b. The Outline of the Training Program will be submitted to BEL within 5.5 months after start of the project. The Outline will be finalized within one week of this submittal through discussions with BEL representatives.
- c. The training program will be delivered to the selected BEL employees within 6.5 months after start of the project. Duration of the training program is expected to be two days.

SUBMISSION OF PROPOSAL

30. The Consultant should submit a proposal stating his/her rates, all applicable conditions, and a brief description of the work steps and proposed methodology to fulfill the terms of reference. The proposal should contain information on the Consultant's professional experience including university degrees and dates for each professional member participating in the study, and experience in similar studies together with a summary of their objectives, scope and results. The economic proposal and the consultants' stated experience in similar studies will be the basis of negotiation between the BEL and the Consultant.

POWER GENERATING STATIONS OF BEL

1. **Belize City Power Plant:** The Belize City Power Plant, commissioned in 1957, is located in a residential area near Belize City, by the Belize River Creek and associated lagoon. The Power Plant has a total of 14.45 MW generating capacity, of which 10.45 MW is provided by four base-load diesel engines and 4.05 MW by three stand-by diesel engines. The power plant receives approximately 340,000 gallons/month of diesel fuel oil imported by tank-trucks from Mexico. The fuel is first transferred to three above-ground storage tanks, and then to either the Belize City Power Plant or the barges for shipment to the San Pedro Power Plant or Caye Caulker Power Plant, both located at the cayes. The fuel oil has the following characteristics:

Sulfur:	0.48 % (by weight)
Specific Gravity:	0.843
Ash:	0.0 % (by weight)
Heating Value:	Value not available.

2. **Ladyville Power Plant:** The Ladyville Power Plant, commissioned in the early 1970s, is located near Ladyville. The nearest facility is the Belize International Airport, which is approximately 300 m away. The Belize River flows close to the Power Plant. The Power Plant has a total of 6.1 MW generating capacity provided by two diesel engines. The Plant uses about 170,000 gallons/month of diesel oil imported by truck from Mexico.

3. **Belmopan Power Plant:** The Belmopan Power Plant, located in Belmopan, was commissioned in 1972 and expanded first in 1977 and then in March 1993. The nearest facility to the Power Plant, a furniture manufacturer, is located about 50 m. away. A creek flows near the Power Plant. The Power Plant has a total of 5.98 MW generating capacity, of which 4.90 MW is provided by six base-load diesel engines and 1.08 MW by a stand-by diesel engine. The Power uses about 90,000 gallons/month of diesel oil imported by truck from Mexico.

4. **San Pedro Power Plant:** The San Pedro Power Plant, commissioned in 1978, is located in a highly residential area of the City of San Pedro at Ambergris Caye. The Power Plant has a total of 3.2 MW generating capacity provided by four diesel engines. The Power Plant uses about 54,000 gallons/month of diesel oil imported by truck from Mexico and transported to Ambergris Caye by barge from Belize City. The fuel, unloaded at the barge terminal at a rate of 6 to 10 hours, is conveyed to the San Pedro Power Plant by pipeline.

5. **Dangriga Power Plant:** The Dangriga Power Plant, commissioned in 1965, is located near Dangriga. The nearest resident to the Power Plant is located about 40 m away. There are no nearby surface waters. The Power Plant has a total of 2.3 MW generating capacity, of which 1.2 MW is provided by 5 base-load diesel engines and 1.1 MW by a stand-by diesel engine. The Power Plant uses about 39,000 gallons/month of diesel oil imported by truck from Mexico.

6. Corozal Power Plant: The Corozal Power Plant, located near Corozal, was commissioned in early 1960s and operated to provide base-load power until 1982, when the import of electricity from Mexico was initiated. Since 1982, the power plant has been operating to provide standby power (about once or twice a month, each time for about 30 minutes). In addition, the diesel engines are operated for about 15 minutes to ensure their reliability. The Corozal Power Plant has a total generating capacity of 1.2 MW (total rated capacity is 1.42 MW) with its two identical diesel engines.

The Power Plant uses about 1,000 gallons/year of diesel oil imported by truck from Mexico.

7. Orange Walk Power Plant: The Orange Walk Power Plant, located near Orange Walk, was commissioned in 1967 and operated to provide base-load power until June 1991. Since June 1991, the power plant has been operating to provide standby power (about once or twice a month, each time for about 30 minutes). In addition, the diesel engines are operated for about 15 minutes to ensure their reliability. The Orange Walk Power Plant has a total generating capacity of 2.6 MW with its four identical diesel engines. The Power Plant uses about 1,000 gallons/year of diesel oil imported by truck from Mexico.

BELIZE

SECOND POWER DEVELOPMENT PROJECT

**MONITORING AND EVALUATION
OF ENVIRONMENTAL IMPACTS**

Terms of Reference

Background

1. The Second Power Development Project, to be undertaken by Belize Electricity Limited (BEL) with financing from the World Bank, the Caribbean Development Bank (CDB), and the Commonwealth Development Corporation (CDC), comprises a 115-kV interconnection from the Mexican border to Belize City (85.5 miles), and 35-kV lines to Dangriga (35 miles) and to San Pedro, on Ambergris Caye (22 miles). The latter transmission line will be composed of three segments: a 5-mile overhead section, from Maskall on the Mexican interconnection to the coast; a 13.3-mile submarine crossing from the mainland to Ambergris Caye; and a 3.5-mile overhead section, from the west coast of Ambergris to the town of San Pedro. (See figure.)

2. During project preparation, environmental assessments of the interconnection to Mexico and of the tap to Ambergris Caye were carried out. The studies concluded that, with proper precautions in routing and construction, environmental impact should be minimal. During the detailed engineering phase, two additional environmental planning activities will take place:

- (a) a study financed by CDB will provide baseline data and will propose a monitoring and evaluation plan for the area of influence of the Ambergris submarine cable; and
- (b) the Environmental Unit to be created by BEL will be responsible for preparing a Monitoring and Evaluation (M&E) Plan for the project, comprising:
 - (i) a Project Implementation Manual (based on environmental safeguards and mitigation measures recommended in the EAs); and
 - (ii) a Monitoring and Evaluation Manual providing guidelines for routine inspection of project sites and of contractors' compliance with the project implementation manual.

Objective

Objective

3. BEL is seeking the services of qualified consultants to be employed during the pre-construction and construction phases to undertake the following tasks:
- (a) help the Environmental Unit (EU) prepare the Project Implementation and the M&E manuals for the project components not covered by the CDB study;
 - (b) train the EU to carry out M&E of construction of the Mexican interconnection and the Dangriga and Ambergris lines;
 - (c) assist BEL in ensuring due consideration of environmental issues during preparation of detailed engineering studies and in supervising and carrying out M&E activities; and
 - (d) prepare a post-construction environmental impact report.

Basic Information and Studies

4. The Environmental Assessments carried out for the Mexican Inconnection (Canadian Power International/Monenco/Agra) and the Ambergris Caye Electricity Supply (Danish Power Consultants/Elsamprojekt A/S) constitute the basic references for the Monitoring and Evaluation Plan to be developed under this contract. Other references are the technical and economic analyses of the Power II Project, the environmental legislation of Belize and environmental guidelines of the financing agencies.

Scope of Work

Task 1: Preparation of the Monitoring and Evaluation Plan

5. The consultants will prepare a Monitoring and Evaluation (M&E) Plan, to be applied during the construction and operation phases of the Power II Project to all transmission line segments, including the Dangriga tap. The plan should be based on recommendations of the environmental assessments of the Mexican Interconnection and of the supply alternatives for Ambergris. (It should also incorporate or complement the proposed M&E plan for the Ambergris channel, to be financed by CDB.) The plan should comprise:

- (a) a Project Implementation Manual, consolidating and complementing, where appropriate, the recommendations contained in the EAs for environmental safeguarding and protection of natural environments, population settlements, and cultural heritage, to be carried out by contractors and operations and maintenance teams; and

- (b) an M&E Manual, comprising guidelines and detailed instructions for the routine M&E activities to be carried out by BEL during the construction and operation phases, including critical issues and locations to be inspected; frequency of site inspections; appropriate indicators against which to measure compliance; and reporting.

6. These manuals should provide clear, objective instructions for project implementation and operation. The schedule for preparation of the Project Implementation Manual should be as follows:

draft	1 month after project start
review	0.5 month
final report	2 months after project start

7. Preparation of Monitoring and Evaluation Plan should be as follows:

draft	3 months after project start
review	0.5 month
final report	4 months after project start

Task 2: Training of BEL's Environmental Unit

8. The consultants will prepare and carry out a small (two-week) training program for BEL's Environmental Unit and for staff in other units involved in design, construction and operation of the Power II transmission system. This program should cover two modules:

- (a) For a wider public, including the above-mentioned staff and possibly staff from the Ministry of the Environment and other agencies of the Government of Belize, an introduction and overview of:
- (i) the role of EA during the project cycle (emphasizing issues pertinent to the types of facilities typical of BEL's system);
 - (ii) the Power II Project: Environmental impacts foreseen and proposed mitigation measures; and
 - (iii) the M&E program for the land-based and submarine segments.
- (b) For staff to be directly involved in project implementation, the first module would be followed by instruction on data collection, use of instruments, preparation of reports. This module should be integrated to training proposed to prepare BEL staff to conduct M&E for the Ambergris crossing.

Task 3: Technical assistance to BEL during the detailed engineering and construction phases

9. During the detailed engineering phase, consultants will assist BEL, as needed, in reviewing engineering designs and tender documents to ensure due incorporation of environmental safeguards and mitigation measures, especially with respect to final routing of the lines. During construction, consultants will assist BEL in all issues pertaining to environmental M&E of the Power II Project. Periodic visits and project reviews should be carried out by consultants every three months.

Task 4: Preparation of a post-construction environmental impact report

10. Upon conclusion of the project, consultants will prepare a brief report informing the environmental impacts of the project "as built", the effectiveness of the mitigation measures which were carried out, and the residual impacts observed. The schedule for this task would be as follows

draft	1 month after end of construction
review	0.5 month
final report	2 months after end construction

Submission of proposal

11. The consultant should submit a proposal comprising a brief description of the methodology proposed to fulfill each task of the terms of reference. Rates and professional qualifications of all proposed participants should be presented.

BELIZE

SECOND POWER DEVELOPMENT PROJECT

Estimated Loan Disbursement Schedule

Assumptions
 Loan Signing: July 1994
 Effective Date: September 1994
 Closing Date: December 1997

<u>IBRD Fiscal Year and Semester</u>	<u>Disbursement During Semester US\$ Million</u>	<u>Cumulative Disbursements at End of Semester US\$ Million</u>	<u>%</u>
<u>1995</u>			
December 31, 1994	1.15 *	1.15	10
June 30, 1995	1.15	2.30	20
<u>1996</u>			
December 31, 1995	1.72	4.02	35
June 30, 1996	2.30	6.32	55
<u>1997</u>			
December 31, 1996	2.30	8.62	75
June 30, 1997	2.30	10.92	95
<u>1998</u>			
December 31, 1997	0.58	11.50	100

* Special Account (3 months of estimated expenditures) and reimbursement of Retroactive Financing (US\$0.5 million)

BELIZE

SECOND POWER DEVELOPMENT PROJECT
BEL's 10-Year Sales and Generation Forecast and Assumptions

YEAR ENDED MARCH 31	ACTUAL				ESTIMATED	FORECAST									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
GENERATION (Gwh)															
BEL Net Generation	95,334	108,008	109,437	121,167	132,870	140,868	54,529	14,851	15,678	16,642	17,748	18,821	19,777	21,154	38,856
Mollejon Purchases (including Transmission Losses)					0	0	98,680	103,800	104,700	105,900	106,800	107,600	108,300	108,800	109,000
Mexican Purchases (including transmission losses)			15,160	18,179	22,000	25,000	27,000	73,400	80,500	88,500	97,000	106,500	115,800	125,600	105,510
Total MWH Sent Out	95,334	108,008	124,597	139,346	154,870	165,868	180,209	191,651	200,876	211,042	221,548	232,721	243,877	255,554	253,366
SALES (MWH)															
Commercial & Industrial	48,361	53,491	60,580	66,403	75,132	82,520	91,331	97,014	102,841	108,090	113,921	120,329	128,453	132,898	139,266
Average C&I Tariff (Bz\$/Kwh)															
Residential	29,212	33,942	39,429	44,926	49,635	53,026	58,308	59,649	62,852	66,049	69,198	72,377	75,813	79,390	83,193
Average Res Tariff (Bz\$/Kwh)															
Street Lighting	3,738	5,383	6,747	8,494	10,398	11,410	11,918	12,374	12,784	13,178	13,537	13,878	14,240	14,606	15,306
Average St Lght. Tariff (Bz\$/Kwh)															
Total Sales	81,311	92,816	106,756	119,823	135,163	146,956	159,553	169,037	178,277	187,314	196,656	206,585	213,506	226,894	237,765
% Transmission Losses															
Transmission Losses							1.50%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Distribution Losses	14,023	15,192	17,841	19,523	19,708	18,913	19,178	20,543	20,504	21,610	22,756	23,985	25,205	26,484	13,100
% Distribution Losses	14.71%	14.07%	14.32%	14.01%	12.72%	11.40%	10.73%	10.92%	10.40%	10.43%	10.46%	10.50%	10.53%	10.56%	5.22%
Demand															
	18	17	23	26	29	31	33	34	36	38	39	41	43	46	48
No of Customers Residential															
	21,726	23,887	26,600	29,193	34,732	37,917	41,153	44,484	47,834	51,230	54,879	58,232	61,944	65,770	68,921
No of Customers - Total															
	26,023	28,580	31,806	34,903	39,492	42,797	46,168	49,634	53,119	56,650	60,234	63,922	67,769	71,730	75,167
Increase in Customers															
			3,097	4,589	3,305	3,371	3,467	3,485	3,532	3,583	3,689	3,847	3,960	3,960	3,437
Fuel Requirements															
Fuel Escalation				2.50%	2.50%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Fuel Price				1.59	1.63	1.67	1.72	1.77	1.83	1.88	1.94	1.99	2.05	2.12	
Diesel O&M															
Diesel O&M per KWH GENERATED	2,344	2,654	3,935	3,098	3,395	3,700	1,432	385	412	437	466	489	519	556	1,022
T&D O&M	1,530	1,743	1,243	1,287	1,431	1,575	1,859	2,033	2,190	2,366	2,553	2,757	2,970	3,199	3,295
T&D O&M PER KWH SOLD	0.0188	0.0188	0.0116	0.0107	0.0106	0.0107	0.0117	0.0120	0.0123	0.0126	0.0130	0.0133	0.0137	0.0141	0.0139
INFLATION RATE															
Cumulative inflation factor					1	1.0280	1.0568	1.0884	1.1168	1.1481	1.1802	1.2133	1.2472	1.2821	1.3180
Hydro Equivalent Price per Kwh at purchase point							0.2144	0.2137	0.2118	0.2178	0.2158	0.2141	0.2128	0.2115	0.1942
Mexican Price per KWH at purchase point			0.1121	0.1286	0.1286	0.1322	0.1359	0.0952	0.1007	0.1049	0.1091	0.1126	0.1162	0.1203	0.1234
Diesel Fuel and O&M Cost per Kwh	0.1660	0.1715	0.1587	0.1485	0.1515	0.1554	0.1593	0.1633	0.1674	0.1718	0.1760	0.1805	0.1851	0.1899	0.1948
Mollejon Base Energy Purchases															
Mollejon Power Actually Taken at Purchase Pt (Indacochea Report)							114,000	114,000	114,000	114,000	114,000	114,000	114,000	114,000	114,000
Mollejon Power Paid for and not taken							98,680	100,780	103,870	105,150	108,260	107,220	108,000	108,810	108,610
Contracted Energy Price \$/US							15,320	13,220	10,130	8,850	7,740	6,780	6,000	5,390	5,390
							0.0875	0.0875	0.0875	0.0875	0.0875	0.0875	0.0875	0.0875	0.0875
Mexican Purchases At Purchase Pt (Indacochea Report)															
Expected value US\$/KWH for Mexican Power before inflation (Indacochea Report)								27,000	54,010	68,200	71,760	78,700	85,190	91,380	97,700
									0.0438	0.0451	0.0457	0.0462	0.0464	0.0468	0.0468

BELIZE

SECOND POWER DEVELOPMENT PROJECT
BEL's 10-Year Investment Plan

YEAR ENDED MARCH 31	ACTUAL				ESTIMATED	FORECAST									
	1990	1991	1992	1993		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
General Plant															
Buildings	111	577	82	746	200	50	100	50	100	50	100	50	100	50	100
Information & Off. Systems					33	300	500	300	150	100	50	100	50	100	50
Vehicles	352	42	942	229	0	25	25	25	25	25	25	25	25	25	25
Other	172	203	311	355	503	25	25	25	25	25	25	25	25	25	25
Sub-total	635	822	1,335	1,330	738	400	650	400	300	200	200	200	200	200	200
GENERATION															
Plants (Buildings)		0		0	0	50	50	50	50	50	50	50	50	50	50
Generating Sets		3,000	6,497	875	1800										
Major Spare Parts	1,707	0	6,067	0	0	50	50	50	50	50	50	50	50	50	50
Equipment, Tools & Vehicles					262	50	100	50	100	50	100	50	100	50	100
Sub-total	1707	3000	12564	875	2082	150	200	150	200	150	200	150	200	150	200
TRANSMISSION															
POWER I PROJECT	4,651	4,136	1,873	3,383						0	0	0	0	0	0
POWER II PROJECT					0	6,660	32,618	10,922	2,263						
Bel Component						646	1,106	732	116						
US\$1.1M investment in Mexico							733	733	733						
34.5 & 22 Kv Lines															
Substations															
San Pedro Connection															
Dispatch Center															
Other 34.5 & 22 KV lines & Subs	4033	6135	7132	0	100	994	760	536	556	726	644	668	732	1,262	1,262
Equipment, Tools & Vehicles					0	220	220	240	240	270	270	270	345	345	345
Interest During Construction	973	1,556		342	0	746	2,106	3,510	4	0	0	0	0	0	0
Sub- Total	9,857	11,827	9,005	3,705	100	11,266	37,746	16,673	3,913	996	914	958	1,077	1,607	1,607
DISTRIBUTION		0													
Primary	642	524	468	724	606	424	508	367	489	514	495	497	500	503	503
Secondary	1285	1047	936	1449	1213	849	1015	734	979	1028	989	995	1000	1006	1006
Customer Connections	642	524	468	724	606	424	508	367	489	514	495	497	500	503	503
Equipment, Tools & Vehicles				633	572	220	220	240	240	270	270	270	345	345	345
Sub - Total	2569	2065	1872	3,730	2,997	1,918	2,250	1,709	2,197	2,328	2,249	2,259	2,345	2,357	2,357
OTHER		0													
Training & Tech. Asst.		0		0	0	100	100	100	100	100	100	100	100	100	100
Engineering Services		0		0	150	50	50	50	50	50	50	50	50	50	50
Environmental Mitigation		0		0		50	50	50	50	50	50	50	50	50	50
Studies		0		0	100	50	50	50	50	50	50	50	50	50	50
Sub - Total	0	0	0	0	250	250	250	250	250	250	250	250	250	250	250
TOTAL	14768	17,743	24,776	9,640	6,165	13,984	41,096	19,182	6,860	3,922	3,813	3,817	4,072	4,564	4,614

BELIZE

SECOND POWER DEVELOPMENT PROJECT
BEL's 10-Year Financial Forecast - Balance Sheets

AS AT MARCH 31	ACTUAL					FORECAST									
	1990	1991	1992	1993	ESTIMATED 1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
ASSETS															
Gross Plant	47,616	58,807	98,107	113,310	128,494	130,518	134,798	201,183	207,788	211,581	215,453	219,243	223,253	227,546	232,159
Less Depreciation	24,919	27,496	31,711	36,534	42,185	48,028	54,068	83,077	72,390	81,881	91,557	101,412	111,459	121,706	132,169
Book Value	22,697	31,311	66,395	76,777	84,309	82,493	80,730	138,108	135,399	129,680	123,897	117,831	111,794	105,840	99,991
Work in Progress	24,384	28,807	14,132	8,587	1,549	11,508	48,323	1,122	1,377	1,528	1,446	1,474	1,539	1,809	1,809
NET FIXED ASSETS	47,081	60,118	60,527	85,344	85,858	84,001	129,053	139,228	136,775	131,208	125,343	119,305	113,332	107,649	101,800
GOODWILL				208	197	188	175	184	153	142	131	120	109	98	87
CURRENT ASSETS															
Cash	2,335	2,873	1,930	911	2,983	4,693	1,597	3,565	5,524	7,147	5,968	5,413	5,208	4,822	3,681
Accounts Receivable	2,679	3,299	4,028	4,557	5,129	5,507	6,015	6,398	6,790	7,111	7,356	7,593	7,866	8,142	8,179
Inventories	12,058	12,915	11,362	10,278	9,736	9,238	8,736	8,236	7,736	8,333	8,976	9,650	10,374	11,163	12,836
TOTAL CURRENT ASSETS	17,073	19,087	17,319	15,747	17,828	19,435	16,348	18,197	20,049	22,591	22,299	22,657	23,448	24,127	24,696
TOTAL ASSETS	64,154	79,205	97,846	101,298	103,882	113,622	145,578	157,589	156,977	153,938	147,773	142,082	136,889	131,874	126,583
LIABILITIES AND EQUITY															
CAPITAL AND RESERVE	48,261	51,811	60,225												
ACCUMULATED SURPLUS (DEFICIT)	(8,269)	(5,930)	(2,893)	4,805	8,995	13,318	14,904	18,571	18,941	19,841	18,710	18,017	17,362	16,798	16,285
REVALUATION RESERVE															
PREFERENCE SHARES				22,384	22,384	22,384	22,384	22,384	22,384	22,384	22,384	22,384	22,384	22,384	22,384
SHARE CAPITAL-ORDINARY SHARE				13,860	13,860	13,860	13,860	13,860	13,860	13,860	13,860	13,860	13,860	13,860	13,860
CAPITAL CONTRIBUTIONS						839	1,756	2,731	3,788	4,850	5,971	7,129	8,328	9,589	10,815
TOTAL EQUITY	37,992	45,881	57,532	41,049	45,239	50,400	52,905	57,548	58,951	60,735	60,925	61,390	61,934	62,610	63,344
LONG TERM DEBT	17,631	24,264	29,180	27,575	24,226	28,123	57,300	63,409	60,159	53,203	46,420	40,023	33,627	27,258	23,515
CONVERTIBLE DEBENTURES				21,508	21,508	21,508	21,508	21,508	21,508	21,508	21,508	21,508	21,508	21,508	21,508
CURRENT LIABILITIES															
ACCOUNTS PAYABLE	5,308	4,284	5,244	4,223	4,961	5,471	6,802	6,420	6,679	7,092	7,412	7,749	8,108	8,501	8,575
CONSUMER DEPOSITS	1,521	1,862	2,230	2,739	3,099	3,358	3,623	3,895	4,188	4,448	4,727	5,018	5,318	5,629	5,899
BANK OVERDRAFTS	747	910	209												
CURRENT MATURITIES OF L.T.D.	957	2,003	3,452	4,205	4,851	4,783	3,841	4,813	5,513	6,855	6,783	6,398	6,398	6,368	3,743
TOTAL CURRENT LIABILITIES	8,531	9,060	11,135	11,167	12,911	13,593	13,866	15,128	16,381	18,493	18,923	19,162	19,822	20,499	18,217
TOTAL LIABILITIES AND EQUITY	64,154	79,205	97,846	101,297	103,882	113,622	145,577	157,589	156,977	153,938	147,773	142,081	136,889	131,873	126,582

BELIZE

SECOND POWER DEVELOPMENT PROJECT
BEL's 10-Year Financial Forecast - Income Statements

YEAR ENDED MARCH 31	ACTUAL				ESTIMATED	FORECAST									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
GENERATION (Gwh)															
BEL Net Generation	95,334	108,008	109,437	121,167	132,870	140,868	54,529	14,651	15,676	16,642	17,748	18,821	19,777	21,154	28,856
Mollejon Purchases	0	0	0	0	0	0	98,680	103,600	104,700	105,800	106,800	107,600	108,300	108,800	109,000
Mexican Purchases	0	0	15,160	18,179	22,000	25,000	27,000	73,400	80,500	88,500	97,000	106,500	115,800	125,600	105,510
Total Generation and Purchases (Sent Out)	95,334	108,008	124,597	139,346	154,870	165,868	180,209	191,651	200,876	211,042	221,548	232,721	243,877	255,554	253,366
SALES (MWH)															
Commercial & Industrial	48,381	53,491	60,580	66,403	75,132	82,520	91,331	97,014	102,641	108,090	113,821	120,329	126,453	132,698	139,266
Average C&I Tariff (Bzc/Kwh)	41	41	41	41	41	41	41	41	42	41	41	40	40	39	38
Residential	29,357	34,221	39,651	44,926	49,635	53,026	56,306	59,649	62,852	66,049	69,198	72,377	75,813	79,390	83,193
Average Res Tariff (Bzc/Kwh)	34	33	34	34	34	34	34	34	35	34	34	33	33	33	31
Street Lighting	3,738	5,383	6,747	8,494	10,396	11,410	11,916	12,374	12,784	13,178	13,537	13,878	14,240	14,606	15,306
Average St. Lght Tariff (Bzc/Kwh)	41	41	41	41	41	41	41	41	42	41	41	40	40	39	38
Average Tariff (Bzc/Kwh)	33.67	33.35	33.58	33.65	38.46	38.51	38.74	38.89	39.14	39.01	38.44	37.77	37.34	36.87	35.35
Electricity Sales IN BZ\$															
Commercial & Industrial	19,828	21,931	24,838	27,225	30,804	33,833	37,618	40,110	42,709	44,832	46,551	48,304	50,174	52,077	52,313
Residential	9,885	11,411	13,313	15,119	16,919	18,075	19,282	20,504	21,743	22,776	23,509	24,156	25,010	25,865	25,982
Street Lighting	1,533	2,207	2,766	3,483	4,262	4,678	4,908	5,116	5,320	5,465	5,531	5,571	5,650	5,724	5,750
Other Revenue	343	1,514	1,016	2,413	1,499	839	917	975	1,035	1,084	1,121	1,157	1,199	1,241	1,247
TOTAL OPERATING REVENUE	31,589	37,063	41,933	48,239	53,485	57,426	62,724	66,705	70,806	74,157	78,713	79,189	82,033	84,907	85,291
OPERATING EXPENSES															
FUEL	13,480	15,872	13,431	14,894	16,741	18,192	7,253	2,007	2,212	2,419	2,657	2,871	3,141	3,461	6,547
SALARIES AND WAGES	6,682	7,369	7,828	9,973	10,561	11,353	11,353	11,671	11,998	12,580	13,188	13,818	14,471	15,152	15,859
OPERATIONS AND MAINTENANCE	3,874	4,397	5,178	4,383	4,089	5,275	3,292	2,418	2,602	2,803	3,019	3,246	3,489	3,755	4,318
OTHER	2,579	3,559	4,379	3,975	3,942	4,052	4,052	4,166	4,282	4,402	4,526	4,652	4,783	4,917	5,054
Electricity Purchases															
Mexico	0	664	1,699	2,338	2,829	3,215	3,670	6,985	8,109	9,287	10,578	11,991	13,461	15,105	13,017
Mollejon	0	0	0	0	0	0	21,161	22,139	22,174	23,066	23,053	23,032	23,022	23,006	21,164
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEPRECIATION	3,222	2,764	4,367	5,066	5,662	5,852	6,054	9,019	9,324	9,502	9,687	9,868	10,056	10,258	10,474
TOTAL OPERATING EXPENSES	29,837	34,625	36,880	40,629	43,824	47,940	56,835	58,405	60,701	64,059	66,705	69,475	72,422	75,653	76,433
NET INCOME BEFORE INTEREST	1,752	2,438	5,053	7,610	9,661	9,486	5,889	8,301	10,108	10,098	10,008	9,714	9,610	9,254	8,859
LESS INT. CHARGED TO OPERATIONS	(335)	(161)	(1,919)	(2,320)	(2,774)	(2,341)	(1,920)	(1,534)	(5,083)	(4,755)	(4,297)	(3,713)	(3,185)	(2,673)	(2,166)
LESS INT. ON CONVERTIBLE DEBENTURES	0	0	0	(537)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)
PLUS INT. ON SHORT TERM INVESTMENTS	141	62	103	52	50	237	375	128	285	587	717	767	723	707	676
NET INCOME BEFORE TAXES	1,558	2,339	3,237	4,805	4,356	4,801	1,784	4,314	2,727	3,349	3,846	4,188	4,568	4,706	4,787
INCOME TAX	0	0	0	0	166	480	176	647	545	837	1,154	1,256	1,599	1,647	1,676
NET INCOME AFTER TAXES	1,558	2,339	3,237	4,805	4,190	4,321	1,588	3,667	2,182	2,512	2,692	2,932	2,969	3,059	3,111
DIVIDENDS	0	0	0	0	0	0	0	0	1,812	1,812	3,624	3,624	3,624	3,624	3,624
Earnings per Share Basic	Issued Shares	18,122		0.27	0.23	0.24	0.09	0.20	0.12	0.14	0.15	0.16	0.16	0.17	0.17
Earnings per Share Fully Diluted	Fully Diluted	28,875		0.19	0.23	0.24	0.14	0.22	0.16	0.18	0.18	0.19	0.19	0.20	0.20
Dividends per share				\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.10	\$0.10	\$0.20	\$0.20	\$0.20	\$0.20	\$0.20
Dividend Return on par value				0.00%	0.00%	0.00%	0.00%	0.00%	5.00%	5.00%	10.00%	10.00%	10.00%	10.00%	10.00%

BELIZE

SECOND POWER DEVELOPMENT PROJECT
BEL's 10-Year Financial Forecast - Statements of Cash Flows

YEAR ENDED MARCH 31	ACTUAL				ESTIMATED	FORECAST									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sources															
INTERNAL SOURCES															
NET INCOME BEFORE INTEREST	1,752	2,438	5,053	7,610	9,661	9,486	5,889	8,301	10,106	10,098	10,006	9,714	9,610	9,254	8,859
ADD DEPRECIATION	3,222	2,764	4,367	5,066	5,662	5,852	6,054	9,019	9,324	9,502	9,687	9,866	10,056	10,258	10,474
Interest Income	141	62	103	52	50	237	375	128	285	587	717	767	723	707	676
LESS INCOME TAXES	0	0	0	0	166	480	176	647	545	837	1,154	1,256	1,599	1,647	1,676
LESS INT ON EXP. BONDS	0	0	0	(537)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)	(2,581)
GROSS INTERNAL CASH GENERATION	5,115	5,264	9,523	12,191	12,626	12,514	9,561	14,219	16,589	16,769	16,876	16,511	16,209	15,991	15,752
DEBT SERVICE	678	1,620	3,474	7,537	7,580	7,192	6,683	5,175	9,896	10,268	11,253	10,497	9,581	9,070	8,535
NET INTERNAL CASH GENERATION	4,437	3,644	6,049	4,654	5,046	5,322	2,878	9,044	6,693	6,501	5,423	6,014	6,628	6,921	7,217
BORROWINGS															
Power I Project	5,824	5,692	1,873	3,363	302	0	0	0	0	0	0	0	0	0	0
REP OF CHINA	0	3,000	0	0	0	0	0	0	0	0	0	0	0	0	0
ASHWORTH OVERSEAS LTD	0	0	6,497	0	0	0	0	0	0	0	0	0	0	0	0
POWER 2 PROJECT - IBRD	(9,551)	0	0	0	0	5,500	9,686	5,473	2,263	0	(0)	0	0	0	(0)
POWER 2 PROJECT - CDB						0	12,781	2,189	0						
POWER 2 PROJECT - CDC						3,160	5,229	2,035	0						
POWER 2 PROJECT - EIB						0	5,122	1,224	0						
OTHER	0	0	0	771	1,800	0	0	0	0	0	0	0	0	0	0
Government															
TOTAL BORROWINGS	(3,727)	6,692	8,370	4,134	2,102	8,660	32,818	10,922	2,263	0	(0)	0	0	0	(0)
CAPITAL CONTRIBUTIONS						839	917	975	1,035	1,084	1,121	1,157	1,199	1,241	1,247
RURAL ELECTRIFICATION	3,165	5,950	5,699												
DEBT SERVICING	0	1,542	2,715												
TOTAL SOURCES	3,875	19,828	22,833	8,787	7,148	14,822	36,614	20,941	9,991	7,585	6,544	7,172	7,827	8,162	8,464
APPLICATIONS															
Construction Requirements															
Power I	4,851	4,136	1,873	3,363	302										
BELIZE POWER 2 PROJECT					0	9,306	34,658	12,367	3,113	0	0	0	0	0	0
Generation															
Transmission															
Distribution															
Other	8,944	12,051	22,903	5,934	6,165	3,932	4,330	3,285	3,743	3,922	3,813	3,817	4,072	4,564	4,614
I.D.C. - BELIZE POWER 2 PROJECT	973	1,556	0	342		746	2,108	3,510	4	0	0	0	0	0	0
TOTAL	14,768	17,743	24,776	9,639	6,165	13,964	41,096	19,182	6,860	3,922	3,813	3,817	4,072	4,564	4,614
NON-CASH WORKING CAPITAL	(1,789)	1,994	(1,452)	167	(1,069)	(692)	(1,367)	(209)	(639)	227	287	285	336	360	1,367
Loss on Exchange															
TOTAL APPLICATIONS	12,979	19,737	23,324	9,806	5,096	13,092	39,709	18,973	6,221	4,149	4,100	4,102	4,408	4,924	5,981
INCREASE (DECREASE) IN CASH				(1,019)	2,052	1,730	(3,096)	1,868	3,771	3,436	2,445	3,070	3,419	3,238	2,483
CASH AT BEGINNING	4,578	2,335	2,873	1,930	911	2,963	4,693	1,597	3,565	5,524	7,147	5,968	5,413	5,208	4,822
CASH Before Dividends	2,335	2,873	1,930	911	2,963	4,693	1,597	3,565	7,336	8,959	9,592	9,037	8,832	8,446	7,305
Dividends	0				0	0	0	0	1,812	1,812	3,624	3,624	3,624	3,624	3,624
CASH AT END	2335	2873	1930	911	2963	4693	1597	3565	5524	7147	5968	5413	5208	4822	3681

NOTES AND ASSUMPTIONS FOR FINANCIAL PROJECTIONS

BALANCE SHEETS

Fixed Assets

Fixed assets are at cost less depreciation.

Work in Progress

Capital expenditures are included in fixed assets in operation as follows:

- (i) Fifty percent (50%) of transmission and distribution expenditures are capitalized in the year the expense is incurred and the remaining fifty percent in the following year.
- (ii) Second Power Development Project expenditures are substantially capitalized in FY97. The final costs in FY98 are capitalized in that year.
- (iii) All other capital expenditures are capitalized in the year the expense is incurred.

Accounts Receivable

Accounts receivable are calculated at the equivalent of 35 days sales.

Inventories

As a consequence of the decline in power generation by BEL and the increase in power purchases, inventories are assumed to decline by BZ\$500,000 annually until 1999 and then to follow the ratio of inventories to operation and maintenance expenditures.

Accounts Payable

Payables are projected at 13% of operating expenses, excluding depreciation.

Consumer Deposits

Consumer deposits are projected to increase proportionally with the increase in customers connections.

Share Capital

BEL's issued and fully paid share capital consists of 6,930,000 ordinary shares of BZ\$2 each and 11,191,950 convertible redeemable preference shares of BZ\$2 each. The preference shares rank equally with the ordinary shares with regard to cash dividends paid by BEL.

Capital Contributions

From FY95, capital contributions are projected at 1.5% of electricity sales.

INCOME STATEMENTS

Generation and Sales Forecast

The generation and sales forecast are detailed in Annex 3.3.

Other Revenue

This is projected as 1.5% of electricity sales based on past experience.

Fuel

Fuel consumption is proportional to BEL's net generation. Fuel prices has been assumed to increase by 2.5% annully until 1995 and by 3% thereafter.

Salaries and Wages

Salaries and wages are kept constant in 1994 and 1995, and increased thereafter in proportion to the number of persons employed.

Operation and Maintenance (O&M)

Diesel related O&M has been adjusted proportional to changes in diesel generation. Other O&M components have been increased in proportion to sales.

Mexican Electricity Purchases

The expense is based on the tariff schedule shown in Annex 5.3.

Purchases from Mollejon Hydroelectric Plant

It has been assumed that under the terms of the purchase contract, BEL will be required to pay for 110 GWh in FY96, 115 GWh in FY97 and 120 GWh in FY98 up to the end of the projection period in FY2003, at a rate of 0.0875 US\$/kWh. In addition BEL would be required to pay 5% of revenues from energy sold from Mollejon purchases.

Depreciation

Depreciation has been calculated at an annual rate of 4.45% of gross fixed assets, based on past experience.

Income Taxes

Income taxes are calculated at 10% of taxable income in FY94, 95 and 96, 15% in FY97, 20% in FY98, 25% in FY99, 30% in FY2000 and 35% in FY2001 and thereafter. The accumulated losses of BEB will be offset againts BEL's taxable income.

Dividends

Dividends on ordinary and preference shares are assumed at 10 BZ cents per share in FY98 and FY99 and 20 BZ cents thereafter.

CASH FLOW PROJECTIONS

Second Power Development Project

Loans are assumed to be on the following terms:

Source	Amount In millions of		Terms Years	Int %	Grace Period Years
	US \$	BZ \$			
IBRD	11.50	22.77	17	7.5	4
CDC	5.20	10.30	10	9.5	3
CDB	7.50	14.85	17	7.5	3
EIB	3.20	6.14	18	3	3

Exchange Rates

The US\$ and BZ\$ exchange rates used are: selling rate 1 US\$ = 2.015 BZ\$ and buying rate BZ\$1.9825 = 1 US\$.

BELIZE

SECOND POWER DEVELOPMENT PROJECT
BEL's Key Performance Indicators

	ACTUAL				ESTIMATED	FORECAST									
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
MARKET															
GWh Sold - Total															
- Commercial & Industrial	48,361	53,491	60,580	66,403	75,132	82,520	91,331	97,014	102,641	108,090	113,921	120,329	126,453	132,898	139,266
- Residential	29,212	33,942	39,429	44,926	49,835	53,026	56,306	59,649	62,852	66,049	69,198	72,377	75,613	79,390	83,193
- Street Lighting	3,738	5,383	6,747	8,494	10,398	11,410	11,916	12,374	12,784	13,178	13,537	13,878	14,240	14,606	15,306
Avg No. of Customers - Total(000)	28,023	28,560	31,808	34,903	39,492	42,797	46,168	49,634	53,119	56,650	60,234	63,922	67,769	71,730	75,167
- Residential	21,726	23,867	26,600	29,193	34,732	37,917	41,153	44,484	47,834	51,230	54,679	58,232	61,944	65,770	68,921
EFFICIENCY															
Number of Employees	380	385	483	507	511	511	500	500	500	510	520	530	540	550	560
Customers/Employees	88	74	66	69	77	84	92	99	108	111	116	121	125	130	134
Mwh sold/Employee	214	241	221	236	265	288	319	338	357	387	378	390	401	413	425
Losses (% net generation)	14.71%	14.07%	14.32%	14.01%	12.72%	11.40%	10.73%	10.14%	9.58%	9.58%	9.57%	9.57%	9.56%	9.56%	9.56%
Avg. Thermal Generating Efficiency (Kwh/US Gal)	13.13	13.37	13.46	13.59	13.59	13.59	13.59	13.59	13.59	13.59	13.59	13.59	13.59	13.59	13.59
FINANCIAL INDICATORS															
Rate of Return	7.95	9.03	10.34	10.63	11.79	10.80	7.01	7.01	7.01	7.02	7.02	7.05	7.04	7.06	7.06
Current Ratio	2.00	2.11	1.56	1.41	1.38	1.43	1.18	1.20	1.23	1.22	1.18	1.18	1.18	1.18	1.36
Long Term Debt as % of total assets	28.97	33.16	33.35	31.37	27.89	28.94	41.86	43.29	41.84	39.08	36.00	32.67	29.24	25.50	21.53
Debt service ratio	7.54	3.25	2.74	1.55	2.03	2.17	1.84	3.37	1.99	1.97	1.81	1.94	2.13	2.23	2.34
Receivables (days)	30.98	32.49	35.06	34.48	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Self Financing ratio	0.30	0.21	0.24	0.48	0.82	0.38	0.07	0.47	0.98	1.68	1.42	1.58	1.83	1.52	1.56
Normal Tariff Increase (%)						0.00%	0.46%	0.38%	0.64%	-0.32%	-1.48%	-1.76%	-1.16%	-1.24%	4.14%
STRUCTURE OF OPERATING EXPENSES															
Fuel	45.18	45.84	36.42	36.66	38.20	37.95	12.76	3.44	3.64	3.78	3.98	4.13	4.34	4.57	8.57
Salaries & Wages	22.40	21.28	21.22	24.55	24.10	23.68	19.98	19.98	19.77	19.64	19.77	19.89	19.98	20.03	20.75
Purchase from Mexico	0.00	1.92	4.61	5.75	6.48	6.71	6.48	11.98	13.36	14.50	15.86	17.26	18.59	19.97	17.03
Purchase from Mollejon	0.00	0.00	0.00	0.00	0.00	0.00	37.23	37.91	36.53	36.01	34.56	33.15	31.79	30.41	27.69
Operaton & Maintenance	12.98	12.70	14.04	10.79	9.33	11.00	5.79	4.14	4.29	4.38	4.53	4.67	4.82	4.96	5.65
Depreciation	10.80	7.98	11.84	12.47	12.92	12.21	10.65	15.44	15.36	14.83	14.52	14.20	13.88	13.58	13.70
Other	8.64	10.28	11.87	9.78	9.00	8.45	7.13	7.13	7.06	6.87	6.78	6.70	6.60	6.50	6.61
Revenues per KWH sold	0.3885	0.3993	0.3928	0.4026	0.3957	0.3908	0.3931	0.3946	0.3972	0.3959	0.3901	0.3833	0.3785	0.3742	0.3587
Salaries and wages per kwh sold	0.0822	0.0794	0.0733	0.0832	0.0781	0.0773	0.0712	0.0690	0.0673	0.0672	0.0671	0.0669	0.0668	0.0668	0.0667
Fuel per kwh sold	0.1658	0.1710	0.1256	0.1243	0.1239	0.1238	0.0455	0.0119	0.0124	0.0129	0.0135	0.0139	0.0145	0.0153	0.0275
Operations and Maintenance per kwh sold	0.0478	0.0474	0.0485	0.0366	0.0303	0.0359	0.0208	0.0143	0.0146	0.0150	0.0154	0.0157	0.0161	0.0165	0.0182
Other expenses per kwh sold	0.0317	0.0383	0.0410	0.0332	0.0292	0.0276	0.0254	0.0246	0.0240	0.0235	0.0230	0.0225	0.0221	0.0217	0.0213
Purchased power per Kwh sold	0.0000	0.0072	0.0159	0.0195	0.0209	0.0219	0.1556	0.1723	0.1699	0.1727	0.1710	0.1695	0.1685	0.1680	0.1438
Depreciation per Kwh sold	0.0366	0.0296	0.0409	0.0423	0.0419	0.0398	0.0379	0.0534	0.0523	0.0507	0.0493	0.0478	0.0464	0.0452	0.0441
Total Expenses per KWH Sold	0.3669	0.3730	0.3455	0.3391	0.3242	0.3262	0.3562	0.3455	0.3405	0.3420	0.3392	0.3363	0.3345	0.3334	0.3215
Operating Margin	0.0215	0.0263	0.0473	0.0635	0.0715	0.0645	0.0369	0.0491	0.0567	0.0539	0.0509	0.0470	0.0444	0.0408	0.0373

BELIZE

SECOND POWER DEVELOPMENT PROJECT
Cost-Effectiveness Analysis of Project Components

Method

1. The Bank's evaluation of the cost effectiveness of the proposed project was carried out using local diesel generation expansion as the reference expansion plan. The proposed project was evaluated first as a unity, comprising all three components. Thereafter, each of the three major physical components (i.e. the 115 kV interconnecting line from Mexico to Belize City; the Dangriga connection to the system; and the San Pedro connection to the system) were evaluated independently to find out their cost effectiveness, following the same methodology as used for the proposed project as a whole.

2. The economic comparison of the proposed project, and the next best expansion alternative comprising diesel generation, were carried out by calculating the present value in FY 1994/95 of annual economic costs through the year 2012. It was considered unreliable to extend the analysis beyond that period, and in any case, an extension would only have a marginal impact on the results. The remaining economic life of the investments was taken into account by residual values. Economic costs were defined as incremental investments, operating and maintenance of generation and transmission facilities, fuel, and the cost of electricity imports from Mexico. The table at the end of this annex provides a summary of the available capacity and generation in the two alternatives, and also the cost streams and the calculated equalizing discount rates (EDR) for each project component. Annex 7.2 provides the assumptions used in the analysis. The following paragraphs provide details of the evaluation of the three project components.

115 kV Transmission Line from Mexico to Belize City

3. Belize City is the commercial center of Belize, whereas Belmopan is its administrative capital. In the year 1997, the Mollejon hydro plant would, under average hydrology, provide about 80 percent of the energy needs of the Belmopan and Belize City systems. In 2005 the Mollejon plant would cover only about 55 percent of the demand. Additionally, the Mollejon supply would need to be complemented with other sources during dry seasons when its capacity is limited.

4. The economic evaluation of this project component was carried out by comparing the present values of the economic costs of the proposed Mexican interconnection and the alternative diesel expansion program to meet the balance between the forecast demand and the hydro supply. The results show that the proposed interconnection is the least-cost alternative to meet the additional energy and power demands of the Belmopan/Belize City systems. The equalizing discount rate was calculated at 19 percent.

Connection of Dangriga to the Grid

5. Dangriga is located south of Belize City in the heart of Belize's citrus and banana district. The sales growth in Dangriga is expected to be strong due to, inter alia, the incorporation to the BEL system of the large citrus companies, which currently operate their own generation. As a result, BEL would need to expand the generation capacity of the Dangriga power plant to meet the energy, power and reliability requirements.

6. The economic evaluation of the Dangriga connection was made by comparing the present values of the incremental economic costs of the proposed scheme (a tap 34.5 kV overhead transmission line from the Mollejon transmission line), with the economic costs of the alternative in which BEL would install new local small-scale diesel units to meet incremental loads and to increase supply reliability^{1/}. Comparison of the present value of the costs of these two alternatives shows that the proposed interconnection would be cost-effective, resulting in a calculated equalizing discount rate of about 23 percent. On a net present value basis, the interconnection would lower the production costs by almost 50 percent compared to local diesel generation.

Connection of San Pedro to the Grid

7. Located on the Ambergris Cay-Island, San Pedro is Belize's major tourist center. The major electricity consumers in San Pedro comprise small and medium size hotels, resorts and tourist related service enterprises. BEL has during the past years increased its generation capacity in San Pedro in order to facilitate for existing hotels to switch from private generation to BEL supply, and also to supply new tourist service businesses. The current power plant is located in the center of the town and it is very difficult to expand it at the current location. To able to increase diesel capacity, BEL would need to build a new power plant on a new site. According to BEL a new site can be found, but due to the tourist development potential of the island, BEL would most likely have to pay a substantial compensation for the land.

8. The EDR for the proposed incorporation of San Pedro into the national grid, via a 34.5 kV, 13.3 mile submarine cable, versus the continued use of diesels was calculated at about 14 percent^{2/}. This project component is sensitive to variations in assumptions regarding the key

^{1/} *The incremental cost of the proposed Dangriga connection comprise: (1) investment in and operation of the 34.5 kV transmission system; and (2) energy purchased from the interconnected system. Additionally, it is assumed that BEL will maintain the existing diesel units as a local emergency capacity reserve.*

^{2/} *The proposed San Pedro connection to the national grid will result in the following incremental costs: (1) investment in and operation of an 34.5 kV transmission system (overhead lines, submarine cable section and substations); (2) energy purchase from the interconnected system; and (3) operation and maintenance of existing diesel units for emergencies.*

economic parameters. Any of the following sensitivity cases would reduce the equalizing discount rate to about 12 percent: (1) a 20 percent increase in project investment cost; (2) a 20 percent increase in the Mexican tariff; (3) 20 percent decline in annual sales growth; and (4) 20 percent decline in diesel prices. However, the proposed project would help Belize to improve the environmental quality of San Pedro by eliminating the burning of diesel oil in close proximity to hotels and residential areas, and reduce the risk of oil spills at sea during transportation in an environmentally sensitive area. The submarine cable would also provide a reliable electric link to San Pedro.

SECOND POWER DEVELOPMENT PROJECT
Cost-Effectiveness Analysis
Comparison of Interconnections with Diesel Alternatives

	Fiscal Year												Residual Value	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 →		2012
Forecast Energy Sales + Distribution Losses GWh	0	0	0	55	62	70	78	87	96	106	116	126	201	
Grid system peak MW	28	30	31	32	34	36	38	39	41	43	45	46	58	
Available firm hydro capacity MW	11	11	11	11	11	11	11	11	11	11	11	11	11	
Existing Mexico to Corozal link MW	5	5	5	5	5	5	5	5	5	5	5	5	5	
Peak capacity to be supplied MW	0	0	0	16	18	20	22	23	25	27	29	30	42	
Energy to be supplied GWh (demand forecast - hydro supply, incl distribution losses)	0	0	0	55	62	70	78	87	96	106	116	126	201	
DIESEL ALTERNATIVE														
Available Capacity MW														
Diesel MW	29	27	27	26	23	29	27	28	30	32	34	36	48	
Generation (incl system losses) GWh														
Diesel Generation GWh	0	0	0	56	64	72	81	90	99	109	119	130	207	
Investment, Fuel, and O&M Costs														
Total Cost Belize/Belmopan US\$ '000	0	0	0	3,540	3,663	5,255	5,777	6,321	7,194	8,110	9,494	10,605	17,481	0
Total Cost San Pedro US\$ '000	0	0	0	1,602	1,668	1,874	1,949	2,219	2,294	2,516	2,584	2,679	3,895	0
Total Cost Dangriga US\$ '000	0	0	0	1,190	1,245	1,768	1,634	1,701	1,953	2,028	2,047	2,321	3,393	0
Total Cost Diesel Alternative US\$ '000	0	0	0	6,331	6,576	8,898	9,360	10,241	11,441	12,654	14,126	15,605	24,768	0
INTERCONNECTION														
Available Capacity MW														
Diesel MW	29	27	27	24	21	21	19	19	18	17	13	10	5	
Mexico MW	0	0	0	25	25	25	25	25	25	25	25	40	40	
Energy Supply Mix (incl system losses) GWh														
Diesel Generation GWh	0	0	0	1	1	1	1	2	2	2	2	2	3	
Purchase from Mexico GWh	0	0	0	55	62	70	79	87	96	106	116	126	202	
Investment, Power Import, O&M and Fuel Costs														
Total Cost Belize/Belmopan US\$ '000	2,891	8,296	2,749	3,429	2,257	2,576	2,905	3,250	3,594	3,968	4,295	4,636	8,282	(5,957)
Total Cost San Pedro US\$ '000	942	4,934	1,796	1,357	807	847	887	927	967	1,002	1,051	1,103	1,450	(6,943)
Total Cost Dangriga US\$ '000	555	2,239	424	758	623	662	658	698	740	784	836	892	1,309	(1,902)
Total Cost of Interconnection Alt. US\$ '000	4,388	15,469	4,970	5,545	3,686	4,084	4,450	4,874	5,301	5,754	6,182	6,631	11,040	(14,802)
DIFFERENTIAL CASH FLOW (Interconnection-Diesel) '000 US\$	4,388	15,469	4,970	(787)	(2,889)	(4,814)	(4,909)	(5,367)	(6,140)	(6,900)	(7,943)	(8,974)	(13,727)	(14,802)
ACCUMULATED CASH FLOW '000 US\$		19,857	24,826	24,040	21,150	16,336	11,427	6,060	(80)	(6,981)	(14,924)	(23,898)	(95,268)	(110,071)

Equalizing Discount Rate (EDR)

18.0%

	US cents/kwh	Present Value of Costs US\$ '000 @ 12 %
Production Cost Diesel Alternative :	12.17	58,773
Production Cost Interconnection :	9.63	46,534

SENSITIVITY ANALYSIS:

	EDR
Investment Cost +20%	15.4%
Mexican price +20%	15.8%
Annual sales growth -20%	15.1%
Diesel price -20%	15.3%
Investment cost & Mexican price +20%	13.5%

EDRs FOR INDIVIDUAL SCHEMES (BASE CASE):

115 kV transmission line from Mexico to Belize City	18.7%
Interconnection of Dangriga	23.4%
Interconnection of San Pedro (Ambergris Caye Island)	13.8%

BELIZE

SECOND POWER DEVELOPMENT PROJECT
Project Economic Evaluation (NPV and EIRR)

FY	Benefits				Investment Costs				Incremental O&M Costs			Cost Savings			Total Incremental Costs	Net Cash Flow
	Sales Without the project	Sales With the project	Incremental Sales	Unit Benefit	Total Benefits	Power II Project	Distribution	Other Investment	Mexican Imports	O&M Power II	O&M Other	Cost of diesel investment & O&M Without the project	Cost of diesel investment & O&M With the project	Diesel fuel investment & O&M cost savings		
	MWh	MWh	MWh	BZc/kWh	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$	'000 BZ\$
93/94	128616															
94/95	139634					8777									8,777	(8,777)
95/96	151358					30936									30,936	(30,936)
96/97	159931					10758	1488	1155							13,401	(13,401)
97/98	159931	168471	8,540	38.5	3,284	2628	1859	1097	5395	531	78	13071	112	-12959	(1,372)	4,656
98/99	159931	176852	16,921	38.5	6,508		1913	1107	6219	531	157	13511	112	-13399	(3,472)	9,980
99/00	159931	185487	25,556	38.5	9,829		1797	1050	7151	531	232	7056	124	-6932	3,829	6,000
00/01	159931	194798	34,867	38.5	13,410		1754	1016	8216	531	305	12776	124	-12652	(830)	14,240
01/02	159931	203906	43,975	38.5	16,913		1769	1114	9129	531	380	7056	124	-6932	5,992	10,920
02/03	159931	213421	53,490	38.5	20,572		1728	1434	10146	531	461	8816	248	-8568	5,732	14,840
03/04	159931	223678	63,747	38.5	24,517		1679	1429	11271	531	540	11236	248	-10988	4,462	20,055
04/05	159931	234091	74,160	38.5	28,522		1627	1386	12427	531	616	13808	245	-13563	3,024	25,498
05/06	159931	244391	84,460	38.5	32,483		1627	1386	13593	531	693	14468	245	-14223	3,607	28,876
06/07	159931	255144	95,213	38.5	36,619		1627	1386	14868	531	770	16008	245	-15763	3,418	33,201
07/08	159931	266370	106,439	38.5	40,936		1627	1386	16241	531	846	18648	4768	-13881	6,751	34,185
08/09	159931	278090	118,159	38.5	45,444		1627	1386	17671	531	923	6988	368	-6621	15,518	29,926
09/10	159931	290326	130,395	38.5	50,150		1627	1386	19174	531	999	6988	368	-6621	17,097	33,053
10/11	159931	303101	143,170	38.5	55,063		1627	1386	20755	531	1076	6988	368	-6621	18,754	36,309
11/12	159931	316437	156,506	38.5	60,192	(29,604)	-10050	-6743	22396	531	1076	-25239	-3468	21771	(624)	60,816
PVs @12%					146,961										58,919	45,686

Economic Internal Rate of Return (EIRR):

21.7%

NPV @ 12%:

45,686

Sensitivity Analysis

	EIRR
Investment cost + 20 %	18.6%
Mexican price + 20 %	19.8%
Diesel fuel cost - 20%	20.9%
Annual energy sales growth - 20%	17.0%
Investment cost & Mexican price + 20 %	16.9%

Notes: Economic costs in constant 1994 BZ\$

Sales: energy sales in the interconnected System (Belize City, Belmopan, Corozal, Dangriga and San Pedro)

Unit Benefit: BEL's FY94 average tariff rate per kWh

Investments: BEL's investment program excl studies and TA. ICS only. Investment cost includes physical contingencies but not price contingencies.

BELIZE

SECOND POWER DEVELOPMENT PROJECT
Assumptions Used in Economic and Equilizing Discount Rate Analyses

Assumptions

The following were the major assumptions used in the economic evaluation of the Project:

- | | | |
|-----|--|---|
| (a) | <u>Discount Rate:</u> | 12% |
| (b) | <u>Economic Life</u> | |
| | Diesel sets: | 15 years |
| | Transmission lines (wood poles): | 20 years |
| | Substations: | 25 years |
| | Submarine cable: | 40 years |
| | SCADA: | 15 years |
| (c) | <u>Mexican Electricity Price</u> | |
| | Base energy: | 0.032 US\$/kWh |
| | Peak energy: | 0.0576 US\$/kWh |
| | Capacity charge: | 8.833 US\$/kW/month |
| (d) | <u>Mollejon Energy Price</u> | 0.0875 US\$/kWh |
| (e) | <u>Operation and Maintenance Costs</u> | |
| | Fixed existing diesels: | 40 US\$/kW/year |
| | Fixed new diesels: | 20 US\$/kW/year |
| | Variable exist. diesels: | 0.04 US\$/kWh |
| | Variable new diesels: | 0.02 US\$/kWh |
| | Fixed transmission system: | 1% of cummul. invest. costs/yr |
| | Annual distribution: | 3% of cummul. invest. costs/yr |
| | Other investments: | 2% of cummul. invest. costs/yr |
| | Diesel fuel consumption: | 260-290 gr/kWh |
| (f) | <u>System Losses</u> | |
| | Transmission energy losses: | 2% |
| | Transmission power losses: | 2% |
| | Diesel auxiliary losses: | 3% |
| (g) | <u>Diesel Plants Investment Cost</u> | |
| | | 1,100-1,200 US\$/kW of output installed (1 to 4 MW units) |

- (h) Physical Contingencies 5%
- (i) Economic Cost of Diesel Fuel
(Based on WB crude oil projections, November 2, 1993)
- | | |
|---------------------------------------|----------------------|
| Crude oil (1994): | 16.7 US\$/bbl |
| | 0.11 US\$/litre |
| No. 2 Diesel (crude oil price x 1.3): | 0.14 US\$/litre |
| Transp. & handling: | 0.02-0.04 US\$/litre |
| CIF price | 0.16-0.18 US\$/litre |
- (j) Economic Costs in constant 1993 US\$

BELIZE

SECOND POWER DEVELOPMENT PROJECT

Project File

A. Selected Reports on the Economy of Belize

- Belize, Country Economic Memorandum (IBRD Report No. 10403-BEL)
- Belize Country Assistance Strategy (in preparation)

B. Selected Papers on the Belize's Power Sector

- Electricity Act 1992 (No. 13, August of 1992)
- Memorandum of Association of Belize Electricity Limited (BEL)
- BEL Certificate of Incorporation
- Articles of Association of BEL
- BEL's License under Electricity Law, including the Authorized Area
- BEL, Prospectus: Offer for Sale Relating to Shares and Debentures, October 1992
- BEB's Five Year Investment Plan, June 1992

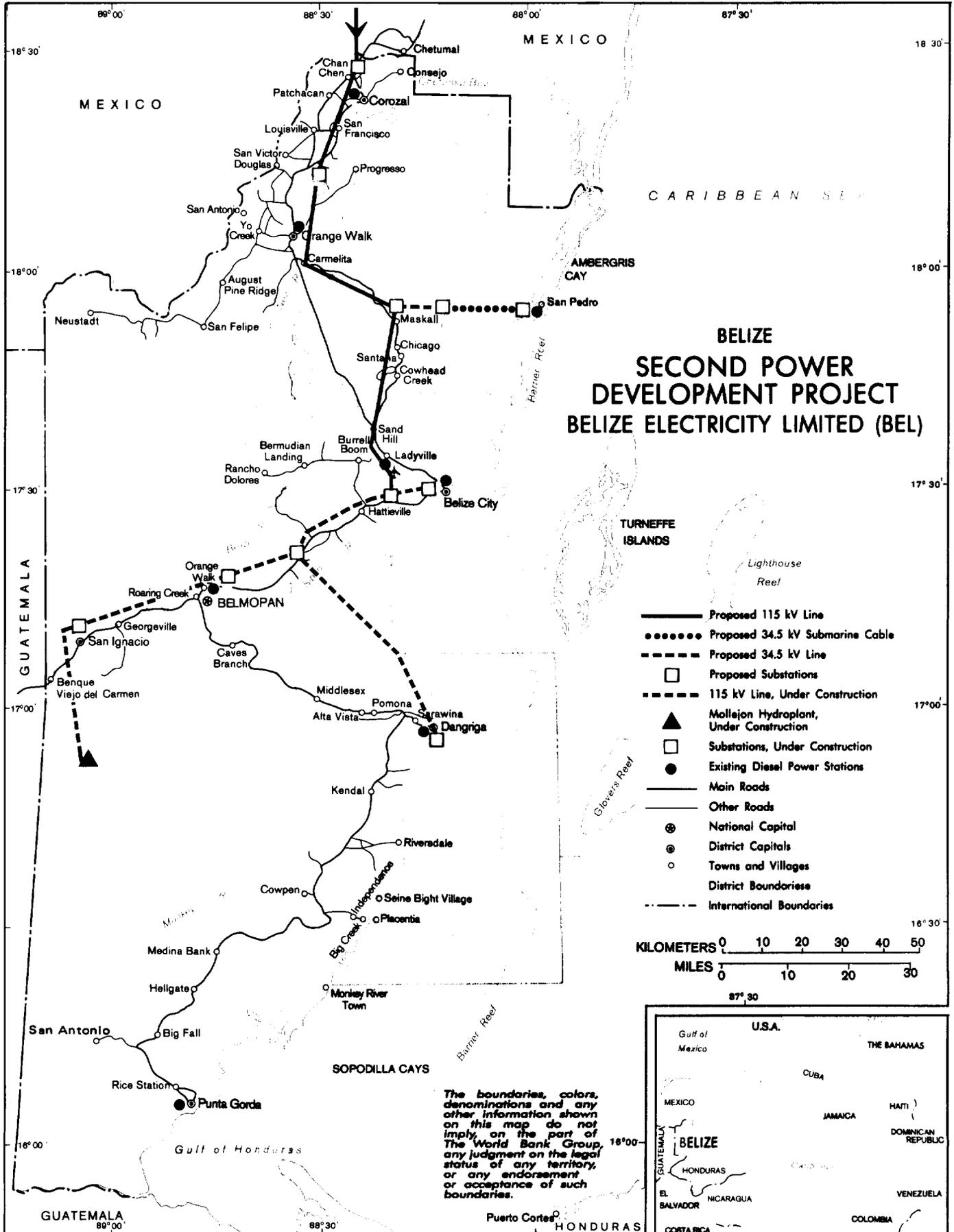
C. Selected Documents on the Mollejon Hydroelectric Development Project

- Macal River Hydroelectric Development Feasibility Study, prepared by CI Power Services Inc, February 1992
- Report by Mr. A. Stevens (Consultant) on sediment yield in the Macal River
- Report by Mr. A. Stevens (Consultant) on hydrology of the Macal River and energy production at the Mollejon hydroelectric project
- Review by Mr. A. Posada (Consultant) of the Feasibility Study the Mollejon hydroelectric project
- Franchise Agreement Mollejon Hydroelectric Project
- Joint Development Agreement Mollejon Hydroelectric Project
- Power Purchase Agreement between BEB and Belize Electricity Limited Company, Ltd. (BECOL)
- Guaranty Agreement related to Mollejon Power Purchase Agreement
- Legal Opinions on above by Belize's Solicitor General
- IFC Report on Mollejon Hydropower Plant

D. Selected Reports on Power II Project

- Renewable Energy Study, CI Power Services, Inc., March 1990
- System Load and Transmission Study, S&J Consultants, P.C., February 1992

- Transmission System Study, Electricas Reunidas de Zaragoza S.A., June 1992
- Power II Study for BEB, NEI Electric Power Engineering, Inc, December 1992
- Power II Project, Interconnection Transmission Line to Mexico, Generation Dispatch, Simulation and Production Costing, by E. Indacochea and I. Aragón (consultants), November 1992
- Power II Project, Supplement to the Communication Alternatives Assessment, Macro Corp., September 1993
- Belize Power II Project, 115 kV Mexico Interconnection Transmission Line, Environmental Impact Assessment, CI Power Services, Inc., December 1993
- Power II Project, Economic, Technical and Environmental Assessment, Electricity Supply to Ambergris Cay (San Pedro), ElsamProjekt A/S, December 1993
- Power II Project, Final Economic Analysis of Alternatives, by E. Indacochea and I. Aragón (consultants), December 1993
- Back-to-Office Report, Identification Mission, by E. Zolezzi (LA3TF), July 10, 1992
- Back-to-Office Report, Preparation Mission, by E. Zolezzi, December 15, 1992
- Back-to-Office Report, Preparation Mission, by E. Zolezzi, June 25, 1993
- Back-to-Office Report, Pre-Appraisal Mission, by E. Zolezzi, October 1993



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