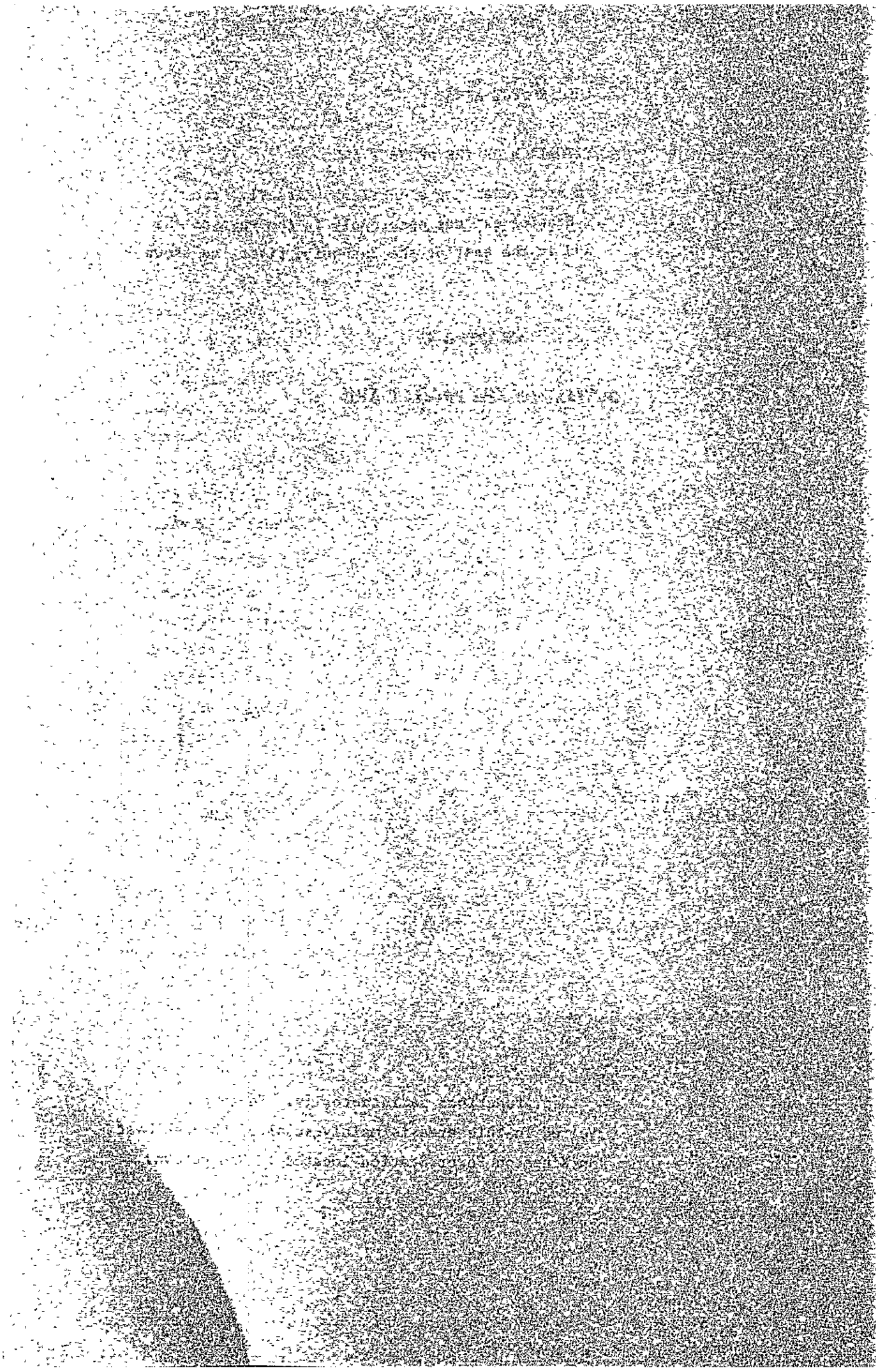
CHAPTER 4

OUTLINE OF THE PROJECT AREA



CHAPTER 4 OUTLINE OF THE PROJECT AREA

4-1 SOCIO-ECONOMIC SITUATION OF THE PROJECT AREA

The west Demerara area receiving electricity directly from Versailles Power Station extends spaciously in the west of the Demerara river and in the east of the Essequibo river, as shown in the General Map of this report. The population of this area is approximately 50,000, and most of them live on the coastlines of the Atlantic Ocean and along the banks of the two rivers.

Georgetown, the capital of Guyana, is situated on the opposite bank of the Demerara river. The traffic to and from the capital is made by ferry-boat available near the estuary of the Demerara river or through a floating bridge, about 10 km downstream of the estuary. The ferry service is mainly used by children going to and from school and also by local folks for their commutation between the west Demerara area and Georgetown.

In this area sugar and rice are planted, and 45.7 km^2 of rice lands and 141.6 km^2 of sugar cane lands stretch extensively. There are silo centers for heating unmilled rice in places and significant areas of vegetable and live-stock farms. Besides, more than fifteen (15) water supply facilities are in operation for pumping water to communities in the said area. There are two (2) hospitals and seventy-one (71) schools in the area.

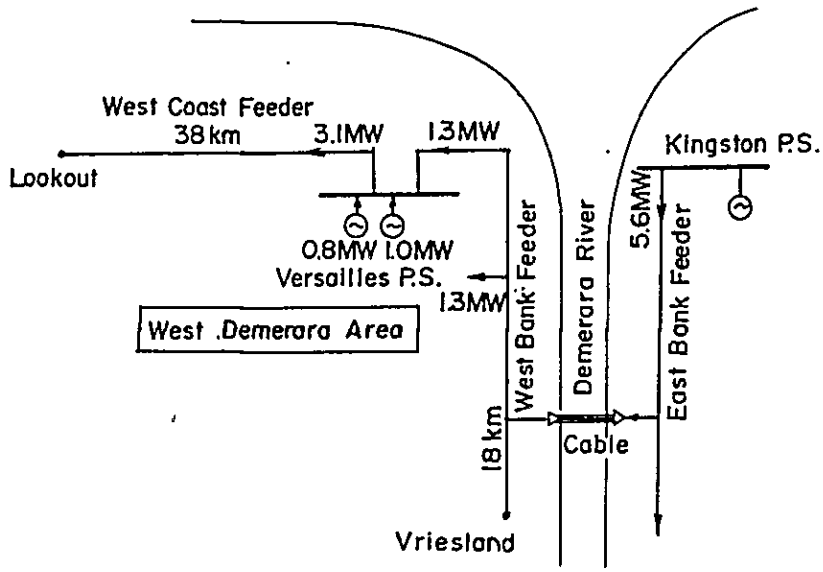
4-2 PRESENT ELECTRICITY DEMAND AND SUPPLY IN THE PROJECT AREA

4-2-1 Present Electricity Demand and Supply

The Versailles Power Station was originally built in 1972 as an 8 MW (2 MW x 4 units) Power Station intended to operate as an isolated station to serve the needs of the west Demerara area. Electricity supply from this power station commenced through two 11 kV distribution lines; West Coast Feeder (38 km long) and West Bank Feeder (18 km long). As of September 1983, only two (2) of the four units at the power station are in operation but are far from fulfilling their functions satisfactorily. Therefore, electricity required in this area is mainly supplied through East Bank Feeder from Kingston Power Station located in Georgetown.

Power flow during peak hours in the west Demerara area is as shown below:

Fig. 4-2-1 Power Flow during Peak Hours in West Demerara Area



4-2-2 Estimation of Maximum Demands

Maximum demand in the west Demerara area as of September 1983 is composed of 3.1 MW on West Coast Feeder and 1.3 MW on West Bank Feeder totalling 4.4 MW, as given in Fig. 4-2-1.

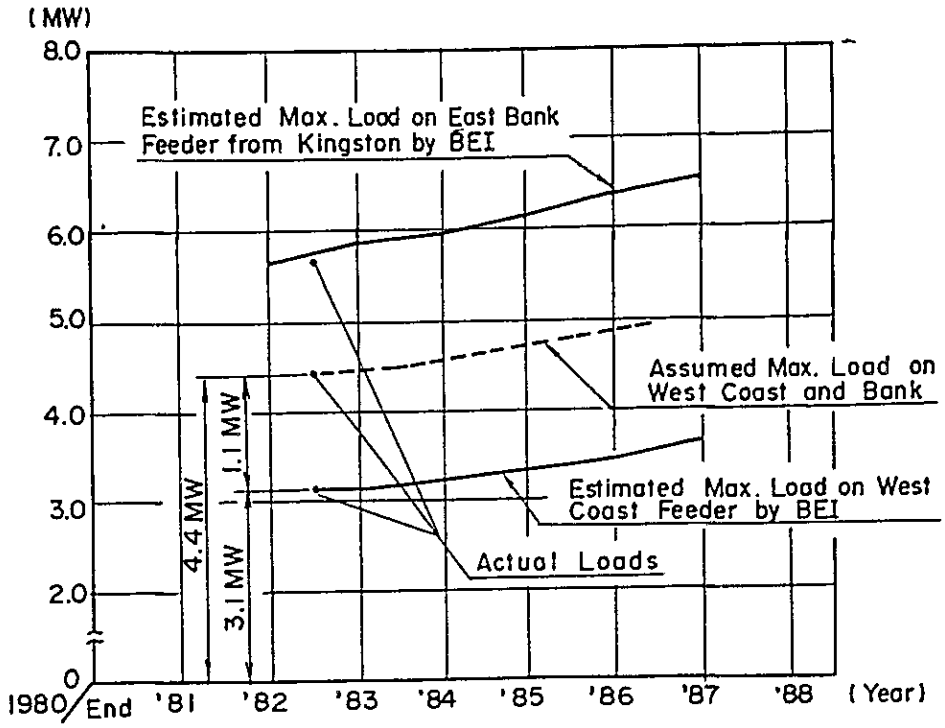
A BEI report enumerates estimated maximum demands during the period from 1982 to 1987 on West Coast Feeder and on East Bank Feeder which supplies electricity from Kingston Power Station in Georgetown to the west Demerara area as follows:

Table 4-2-2 Estimates of Maximum Demands in West Demerara Area

Year / Name of Feeder	1982	1983	1984	1985	1986	1987
West Coast Feeder (MW)	3.1	3.1	3.2	3.3	3.4	3.6
East Bank Feeder (MW)	5.6	5.8	5.9	6.1	6.3	6.5

The average annual increase rate of the estimated maximum demand on each Feeder represents around 2.5%. Of the estimates given above, the value of West Coast Feeder is identical with the actual record of maximum demand in 1983. Therefore, it will be possible to make estimation of maximum demands in this area during the period from 1984 onward as per Fig. 4-2-2.

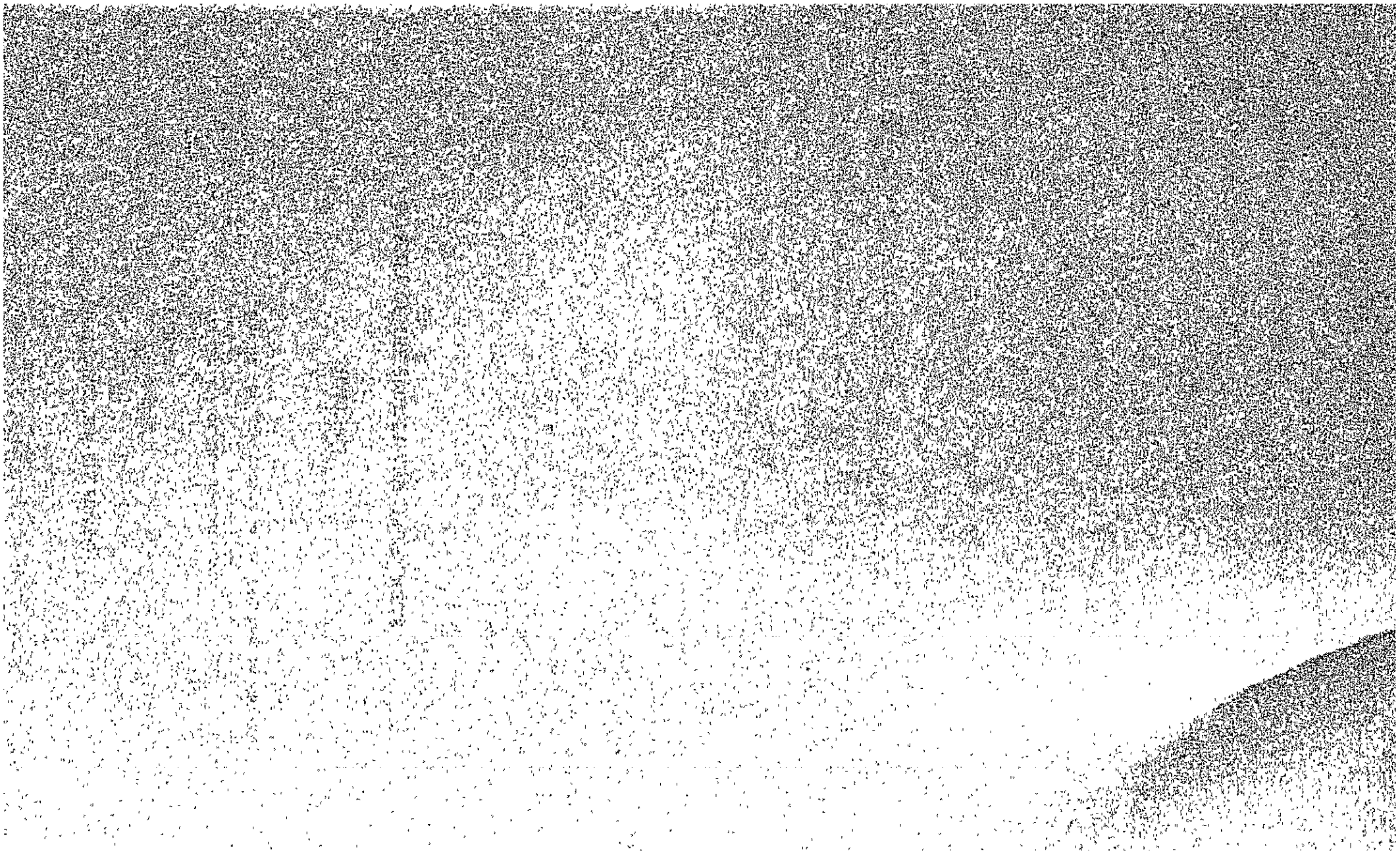
Fig. 4-2-2 Estimates of Maximum Demands in West Demerara Area



As given in the above Fig. 4-2-2, if maximum demands in the west Demerara area are to increase at an annual rate of 2.5% from an actual value of 4.4 MW, it is projected that maximum demands will reach 4.6 MW, 4.7 MW and 4.8 MW, respectively in 1984, 1985 and 1986.

CHAPTER 5

NECESSITY OF THE PROJECT AND ITS FEATURES



CHAPTER 5 NECESSITY OF THE PROJECT AND ITS FEATURES

5-1 NECESSITY OF THE PROJECT

5-1-1 Present Condition of Versailles Power Station

The present condition of the generating units (Ruston 16 CSV MK III) of Versailles Power Station built in 1972 is as follows:

(1) Present Condition of Each Unit

Unit No. 1: The crankshaft was broken in July 1982, which has made this unit in-operative. Parts taken out of this unit was utilized for repair of Unit No. 4.

Unit No. 2: Likewise as Unit No. 1, the crankshaft was broken in 1979. Not only parts of the engine but also the generator itself were dismantled. These were used for repair of Unit Nos. 3 and 4. Unit No. 2 is almost scrapped at present.

Unit No. 3: The fuel pump and injector provide poor performance. It is impossible to replace old parts with new ones. Therefore, this unit is very obsolete as a whole, and generates only 1 MW as the maximum capacity.

Unit No. 4: The performance of the pumps for fuel and cooling systems is poor. This unit is also superannuated as obvserved in Unit No. 3 and provides only 0.8 MW as its maximum capacity.

(2) Records of Operation Hours

The actual records of operation hours of the respective units from 1977 until the end of August 1983 are as given in the following table.

Table 5-1-1 Operation Records

Year	Operation Hours				Total Energy Generated (kWh)
	#1	#2	#3	#4	
1977	Nil	5479	5918	174	20,170,527
1978	4165	6631	Nil	3615	14,561,373
1979	3646	1958	Nil	5360	9,835,012
1980	4383	Nil	4984	3755	15,144,324
1981	5498	Nil	7049	Nil	12,902,898
1982	3274	Nil	7211	233	9,249,159
1983	Nil	Nil	3720.2	3110.4	-

Data on operation hours of each unit during the period from 1972 until 1976 had been disposed and were not available. However, it is judged from the operation records that any unit has never been operative satisfactorily since 1977. It is understood that three of the four units stopped for sometime in 1981 and 1982. On September 17, 1983 when the survey team visited this Power Station for re-confirmation of the Project area, the team observed that Unit No. 4 was inoperative because of urgent minor overhaul work thereof.

(3) Reasons for Breakdown

It is judged that maintenance of this Power Station was made properly in overall consideration of information on the number of operators and repair staff obtained from Manager of this power station with whom the survey team met during the site survey. It can be presumed that a reason for breakdown of the generating units was attributable to the scarcity of foreign exchange for purchase of parts for repair of the units and to the unavoidable necessity of use of parts dismantled from other units.

(4) Possibility of Rehabilitatin of Units

As far as Unit Nos. 1 and 2 are concerned, replacement of crankshafts with new ones for both units is needed and furthermore, auxiliary equipment and devices have already been used for repair of other units. Therefore, expenditures almost close to costs of purchasing new sets will be incurred in complete rehabilitation of the units. Even if each of Unit Nos. 3 and 4 is recovered so as to generate 2 MW even temporarily by obtaining parts of poor performance, obsoleteness has progressed so remarkably on the said units. It is not considered that these units will be able to fulfill their functions satisfactorily for a long time. The generating units at Versailles Power Station have been designed for supply at a frequency of 50 Hz. Since GEC is trying to change this power station from a 50 Hz to 60 Hz supply system, it will be inproper to make a large outlay for rehabilitating the generating units.

5-1-2 Present Electricity Supply in the Project Area

In the west Demerara area to which Versailles Power Station supplies electricity directly, load shedding is performed due to the shortage of electricity supply as a whole in the supply areas of the Georgetown Electric Power System as stated in 4-2-1. However, the quantity of electricity to receive from Kingston Power Station further increases when one of the two operational units at Versailles Power Station stops due to its failure or overhaul. In this case, voltage drops on West Coast Feeder become significant and make it impossible to transmit electricity. Besides, the reliability of the two operational units at Versailles Power Station is low, and it takes a great deal of time to repair the said unit(s). Therefore, residents in the west Demerara area supplied with electricity through West Coast Feeder are compelled to suffer from long hours of black-outs in addition to the load shedding. Accordingly, the west Demerara area is placed in the worst situation in terms of electricity supply among the supply areas of the Georgetown Electric Power System.

5-1-3 Impacts Caused by Shortage of Electricity Supply

The poor reliability and shortage of electricity supply of Versailles Power Station have caused the following unfavorable impacts upon residents in the west Demerara area.

(1) Impediment to Education

Because of the chronical black-outs, school radio programs and audio visual aids cannot be used effectively, and children are in no situation of preparing their lessons for the following day and going over their lessons at homes well, which greatly impedes advancement of their study.

(2) Impediment to Medical Services

Residents in the west Demerara area can hardly undergo or receive necessary operations and/or medical services in extraordinary emergencies because of power stoppage. On the other hand, hospitals and clinics in this area refrain from extending their medical facilities and equipment due to the shortage of electricity supply, which adversely affects sufficient medical services to residents in this area.

(3) Inconvenience for Potable Water Supply

In the west Demerara area, water is pumped up from wells by means of electric pumps and delivered to homes. In most cases there are no storage facilities of potable water at pumping stations. Even if available, such storage capacity is limited and insufficient for storage of water. Once power is switched off, housewives of families receiving potable water from pumping stations either without storage facilities or with limited storage capacity of water must visit other pumping stations having larger capacities of water storage to bring home potable water. This job takes much time and toil for housewives, which provides a great obstacle to the normal household routine.

(4) Inconvenience in Drainage

The west Demerara area is below sea level at high tide. This means that when the tide is high, gravity drainage is not possible. Thus, standing water inundates farms, houses and work-places, and causes damages to them on each occasion of such inundation. Especially, agricultural crops are greatly damaged. Besides, the inundation affects children going to and from school and workers at work and going to and coming from work.

In order to find a way out of this difficulty, the Ministry of Agriculture plans to construct a 350 horse power drainage pump station in the west Demerara area. Nonetheless, the load shedding in this area makes it difficult to put this scheme into reality.

(5) Obstacle to Security

Load shedding at nights causes increase in the number of pilferage, and homes, farms and work-places suffer great damage from stealing therefrom. The west Demerara area is an agricultural area where rice, sugar and vegetables are planted. In particular, production of vegetables is mainly done by small scaled farmers of weak position. Stealing from these farmers provides serious damage to them, disrupting their production activities to a great extent.

5-2 CONTENTS OF THE PROJECT AND COMMENTS THEREON

5-2-1 Contents of the Project

GEC intends to standardize the frequencies and voltages in the Georgetown Electric Power System simultaneously with installation of new generating units at Versailles Power Station as a means of terminating the chronical black-outs in the west Demerara area.

(1) Installation Program for Versailles Power Station

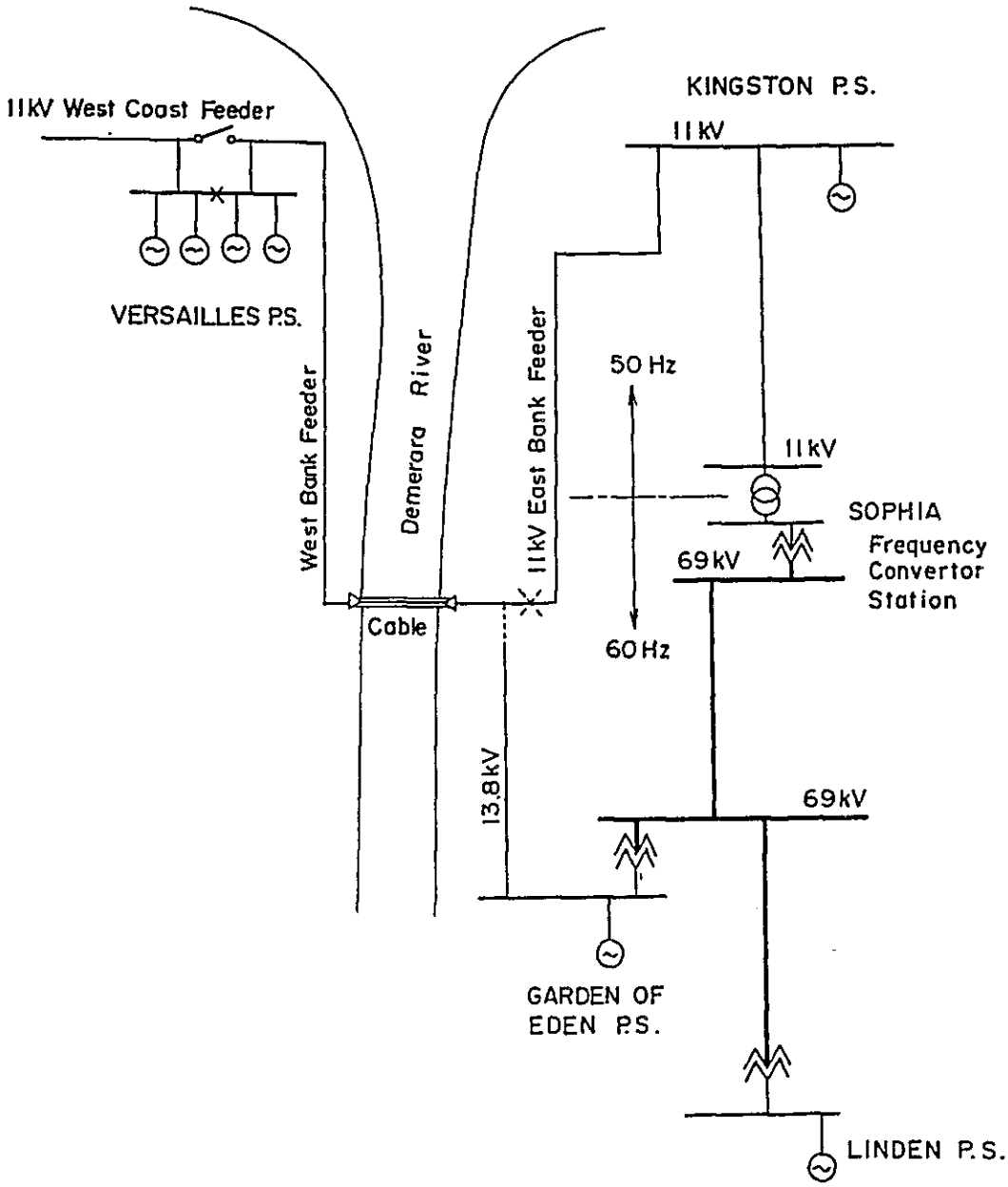
For ending the chronical black-outs due to the shortage of supply capability and deterioration in the reliability of existing generating units at the power station as described

in 5-1-2, GEC plans to install new generating units with an installed capacity of 4.6 MW or more at the power station on the assumption that maximum demand in the west Demerara area at the end of 1984 is to reach 4.6 MW as stated in 4-2-2.

(2) Program for Standardization of Frequencies and Voltages

As described in 3-2-2 of Chapter 3, there exist 60 Hz and 50 Hz systems in the Georgetown Electric Power System. For the economical operation of electricity, GEC has been conducting standardization of all the frequencies of the said Electric Power System into 60 Hz for these years. Up to present, 20% of GEC's standardization program has been completed. GEC plans to change the existing 50 Hz generating facilities installed at Versailles Power Station to 60 Hz facilities. Thus, GEC has worked out the following plan as shown in Fig. 5-2-1 for finally turning all the west Demerara area, the supply area of Versailles Power Station, into a 60 Hz system area.

Fig. 5-2-1 System Diagram for Frequency Conversion



GEC is scheduled to undertake the following work simultaneously for turning the present frequency of the generating sets of Versailles Power Station to a 60 Hz supply system.

(a) Change 50 Hz, 11 kV/220 V pole-transformers mounted on West Coast Feeder (38 km long) and West Bank Feeder (18 km long) to 60 Hz, 13.8 kV/220 V pole-transformers

(b) Change all existing apparata of consumers in the west Demerara area for 60 Hz use

(c) Construct new distribution lines for connection between existing 60 Hz, 13.8 kV distribution lines and 50 Hz, 11 kV distribution lines (West Bank Feeder)(as shown in dot line on Fig. 5-2-1)

(d) Perform separation work between West Bank Feeder and East Bank Feeder (portions given in dot line on Fig. 5-2-1)

According to GEC, they estimate that the costs to be incurred in the performance of the work enumerated above will be approximately 500 million yen (at a price level in 1980).

If this Project is realized, about 35% of GEC's frequency standardization program in the Georgetown Electric Power System will be accomplished.

5-2-2 Comments on the Project

In case of merely enhancing electricity supply capability, it is possible to decide on the type, capacity and installation year of generating facilities in accordance with present electricity demand and the results of electricity demand forecast. On the contrary, further economic and technical studies will be required when realization of the change of a frequency and enhancing electricity supply capability are simultaneously done as this Project.

(1) Place for Installing Generating Units

With regard to electricity supply to the west Demerara area placed in the worst situation of electricity demand and supply among the supply areas of Georgetown Electric Power System, GEC's plan for installation of generating units at Versailles Power Station is believed to be most economical and reasonable in due consideration of transmission losses, constraints as stated in 5-2-1 related to the implementation of the frequency standardization program, and a possibility of utilizing existing building.

(2) Installed Capacity

GEC considers that the installed capacity of the new generating units should be at least 4.6 MW (60 Hz) as explained in 5-2-1(1). Since the particulars of the quipment for this Project are 60 Hz/50 Hz usable for both of 60 Hz and 50 Hz as stated in 5-3-2, the power station will be compelled to be operated at a frequency of 50 Hz if there should be any delay in the frequency conversion work which is to be carried out on the responsibility of GEC. In case of operating 60 Hz designed generating units, their maximum capacity will decrease to be 80%. Therefore, it is desirable that the capacity of the generating units be more than 5.8 MW. For the unit capacity, 2 MW is most appropriate as the existing building and foundations can be used, which results in the most economical construction cost and the shortest implementation period. Therefore, the number of units to be installed should be three (3).

5-3 BASIC DESIGN

5-3-1 Contents of Basic Design

(1) A list of equipment and associated devices as requested by the Government of Guyana is as follows:

(a) Generator 3 sets

Voltage	:	13.8 kV insulation Class B
Frequency	:	60 Hz
Rated Capacity	:	2,000 kW
Power Factor	:	0.8
Exciter	:	Brushless

(b) Engine 3 sets

Radiator	:	Remotely mounted
Instrument Panel	:	Mounted on engine sub-frame
Fuel Oil Service Tank	:	Remotely mounted
Battery	:	DC 30 V
Fuel	:	Gas oil or high qualitied heavy oil

(c) Protective Device 3 sets

Various Meters :
Protective Relay:
Indicator :
Regulator :

(2) Modifications of Particulars of Equipment

GEC's program is judged to be most appropriate. However, the problem is that GEC will have to raise an enormous amount of foreign and local funds for the performance of work for the frequency conversion and complete them simultaneously with the completion of the Diesel Power Generator Supply Project.

According to GEC, a considerable number of pole-transformers have already been procured and no difficulty would be encountered in respect of the above-mentioned constraint. However, it is feared that generating units to be procured for this Project under Japanese Grant Aid might not be utilized in the event that there should be any delay on the part of GEC in completing the frequency conversion works which will be undertaken under the deteriorating balance of international payments of Guyana.

For the above reason, the particulars of the equipment and associated devices requested by GEC have partially been modified so that such equipment and devices may be used at both frequencies of 60 Hz and 50 Hz.

Description		Quantity
(a) Generator		3 sets
Voltage	: 11 kV/13.8 kV	
Frequency	: 50 Hz/60 Hz	
Rated Capacity	: 2,000 kW(at 60 Hz Operation)	
Power Factor	: 0.8	
Exciter	: Brushless	

(b) Diesel Engine — 3 sets

Countinuous Use
Two Speed
Fuel Oil Service Tank Equipped

(c) Control Panel — 3 sets

Metering Instruments
Protection Relays
Indicators

(d) Transformer for Generator — 3 sets

(e) Station Use Transformer — 2 sets

(f) Circuit Breaker — 7 sets

(g) Other Necessary Devices — 1 lot

(h) Spare Parts (To be agreed with GEC) — For 3 years

5-3-2 Design Conditons

(1) Installation Place and Geographical Situation

The equipment and devices are to be installed at Versailles Power Station located about 30 km south-west of Georgetown and around 3 km from the ferry boat station on the west bank of the Demerara river. Since this power station is situated close to the coastline, it will be necessary to take counter-measures against salt-contamination for outdoor equipment.

(2) Meteorological Condition

Temperature : Yearly Average Maximum Temperature: 30.8 °C
Yearly Average Minimum Temperature: 23.2 °C

Atmospheric Pressure: 1,013.9 mbar

Humidity : 78%

Precipitation : 2,538 mm

The meteorological data covering 10 years from 1970 through 1979 are as per Annex-10. Any consideration need not be given to earthquakes in respect of design.

(3) Condition of Foundations

Piling has been placed on the concrete foundations for the main equipment of engines. No abnormality of the foundations was observed during the site survey. It is judged that these existing foundations can be used for new engines to be procured. Accordingly, it is found desirable to design the base of an engine adjustable to existing anchor bolts. Foundations for devices other than engines should be newly laid.

(4) Analysis of Fuel

The composition of gas oil presently used for Versailles Power Station is as follows:

Specific Gravity	:	0.9741
Viscosity	:	33 seconds 104°F Red wood No.1
Flashing Point	:	170°F
Heat Value	:	19,324 BTU/lb
Sulphur	:	0.489%
Moisture	:	less than 0.05%
Deposit	:	0.229% M

(5) Cooling Water

The temperature of cooling water presently used for Versailles Power Station is 30 °C, and the composition of the said water is as follows:

P.H.	:	6.5
M Alkalinity	:	55 ppm
Electrical Conductivity	:	110 M Mho/cm
Chloride	:	13 ppm
Hardness	:	20 ppm
Silica	:	5.8 ppm

5-3-3 Applicable Standards

The Japanese Standards as listed below are to be applied to design of the equipment and devices for the Project, but application of international standards equivalent to the said standards may be allowed for design purposes.

- Japan Industrial Standards (JIS)
- Standard of the Japanese Electrotechnical Committee (JEC)
- The Standard of the Japan Electrical Manufacturer's Association (JEM)
- Japanese Cable Maker's Association Standard (JCS)

5-3-4 Equipment Planning

(1) Generator

Open Air Cooling Type

Rated Capacity	:	2,000 kW (at 60 Hz Operation)
Voltage	:	11 kV/13.8 kV
Frequency	:	60 Hz/50 Hz
Power Factor	:	0.8
Excitor	:	Brushless

(2) Engine

4 (four) Cycle Stationary Diesel Engine

Rated Output	:	3,000 Breaking Horse Power (at 60 Hz Operation) Continous Rating
Cooling System	:	Closed Circuit Water Cooling System

(3) Switchboard

Indoor Cubicle Type

Meters, Protective Relays, Switches, Indicators, and Other Necessary Devices

(4) Transformer

Oil-immersed Air Cooling (Self-Cooled) Type

Voltage	:	13.8kV/11kV/6kV, 13.8kV/11kV/230V
Rated Output	:	2,500 kVA, 500 kVA
Frequency	:	60 Hz/50 Hz

5-4 PROJECT COST

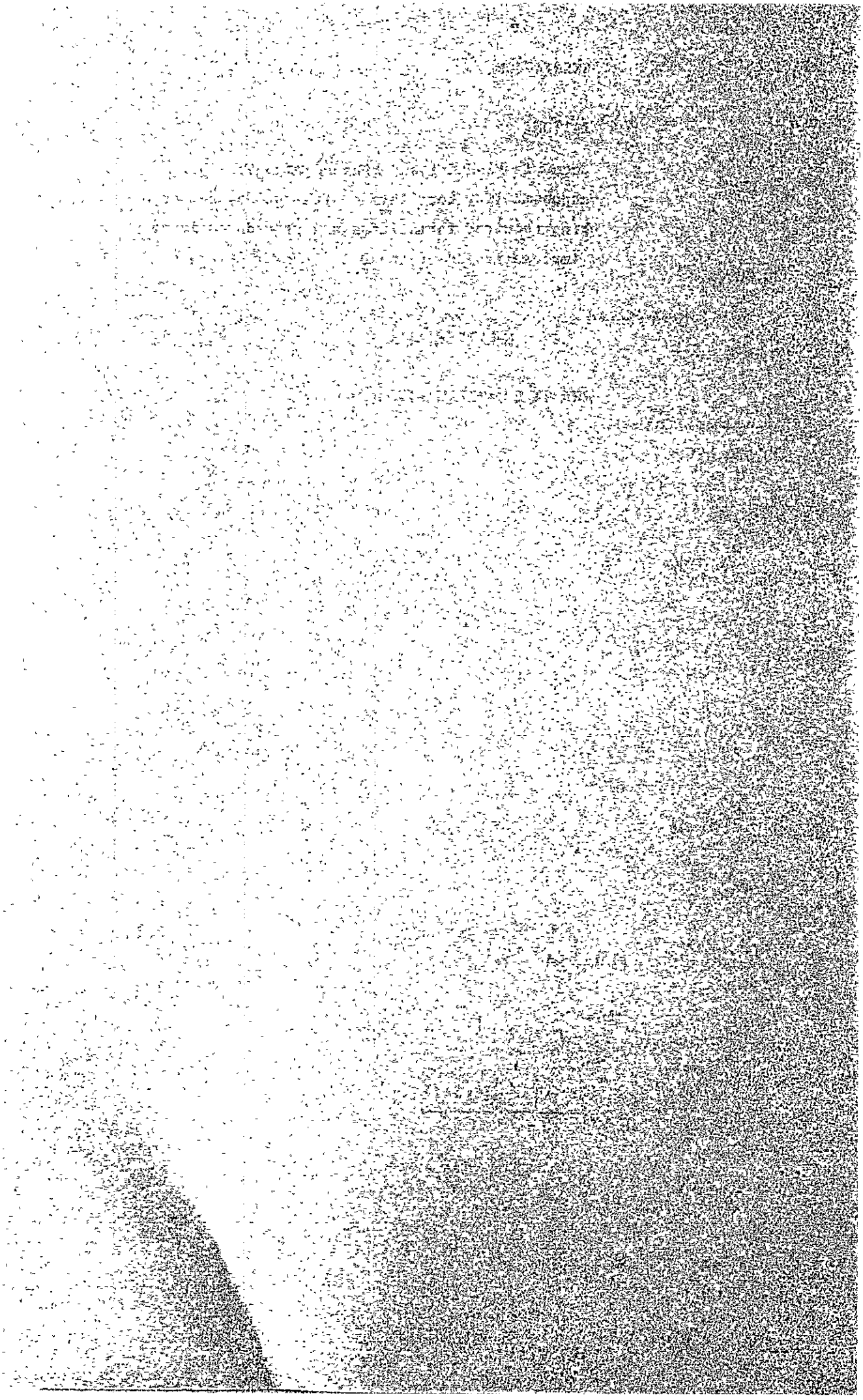
In implementing this Project, estimated costs to be borne by the Government of Guyana are as follows:

(In Japanese Yen)

1. Cost of Removing Existing Generating Sets (3 sets of diesel engine generators of 2,000 kW each)	:	2,000,000
2. Cost of Repairing Present Building (if the necessity arises)	:	0
3. Cost of Undertaking Work of Conversion of Frequency and Voltages	:	512,000,000
(Replacement of pole-transformers on distribution lines in the west Demerara area)		
(Replacement of apparata of consumers in the west Demerara area)		
Total		514,000,000

CHAPTER 6

PROJECT IMPLEMENTATION



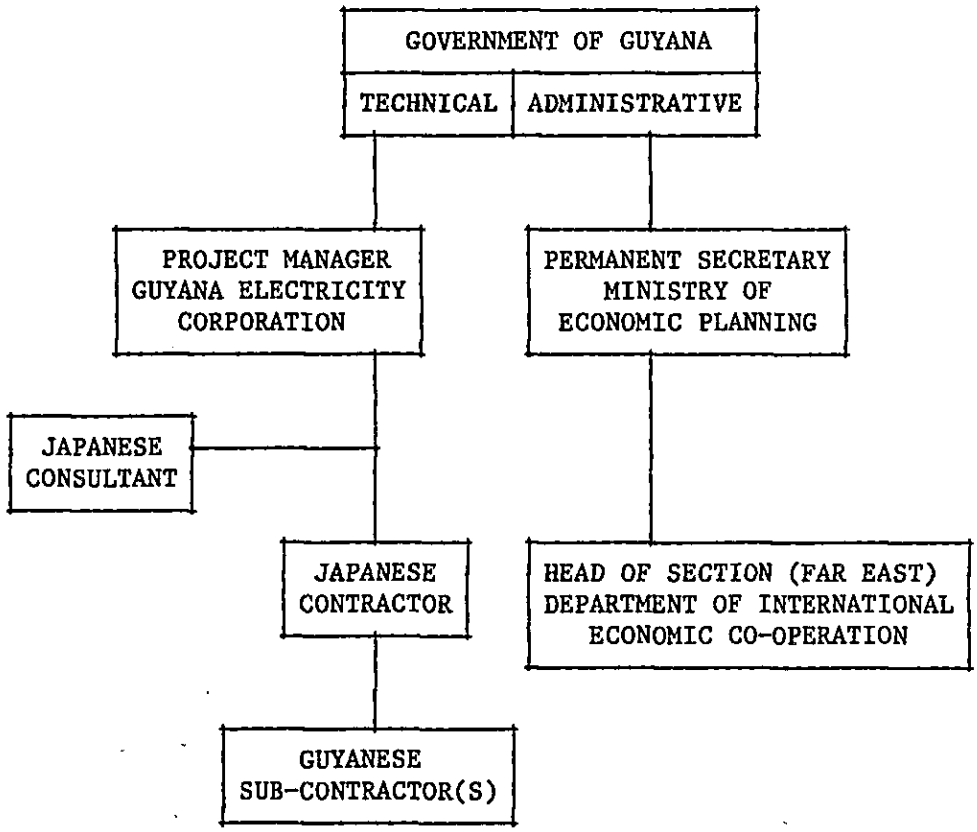
CHAPTER 6 PROJECT IMPLEMENTATION

6-1 EXECUTING ORGANIZATION

The Ministry of Economic Planning and Finance of Guyana will assume overall responsibility for liaison with the Government of Japan and for taking required formalities and procedures in connection with the implementation of the Diesel Power Generator Supply Project while the Guyana Electricity Corporation will be the implementing agency of directly dealing with technical matters, such as detailed design for the Project and installation work thereof.

The supervisory work for installation of the generating units and related devices is to be undertaken by a Japanese Consultant with the assistance of GEC personnel.

The organization chart for the implementation of the Project is as shown below.



6-2 SCOPE OF WORK

The demarcation of work between the Government of Guyana and the Goverment of Japan for the implementation of the Project is as given hereunder.

(1) Scope of Work to be Done by the Government of Japan

(a) Manufacture of equipment and devices as listed in 5-3-1(2)

(b) Marine and inland transportation of the equipment and devices ans stated in (a) hereinabove

(c) Foundation work for auxiliary equipment

(d) Installation and commissioning tests of the said equipment and devices

(2) Scope of Work to be Done by the Government of Guyana

(a) Removal of existing three (3) generating units and associated devices

(b) Repair of existing building for the generating units, if necessary

(c) Any and all work required for and in relation to conversion of the frequencies and voltages

The advising commission of Authorization to Pay (A/P) and payment commission as well as exemption of Japanese goods and/or services from all custom duties, taxes and levies are as per the Minutes of Discussions dated September 17, 1983. (Refer to Appendix-3)

6-3 IMPLEMENTATION PLAN AND SCHEDULE

6-3-1 Implementation Plan

This Project is to be implemented by consulting services, manufacture and installation by a contractor and work done by the Government of Guyana after the signing of Exchange of Notes.

The outline of those services and work to be done by the respective parties is as follows:

Services to be Rendered by a Consultant

(1) Site surveys and discussions needed for detailed design

(2) Detailed design

(3) Preparation of tender documents and performance of preparatory work for calling a tender

(4) Attendance of briefing meeting(s) of tendering

(5) Attendance of opening of tender proposals

(6) Check and review of contractor's shop drawings and design calculation sheets

(7) Inspections of shop tests

(8) Supervision of installation works

Work to be Undertaken by a Contractor of Manufacturing and Installing Grant Aid Equipment and Devices

(1) Manufacture and shop tests of Grant Aid equipment and devices

(2) Marine and inland transportation of Grant Aid equipment and devices

(3) Installation and commissioning tests of Grant Aid equipment and devices

(4) Taking-over of equipment and devices successfully installed under Grant Aid to the Government of Guyana or its designated authority after installation work and commissioning tests of the equipment and devices are completed.

Work to be Done by the Government of Guyana

(1) Removal of existing generating sets and associated devices

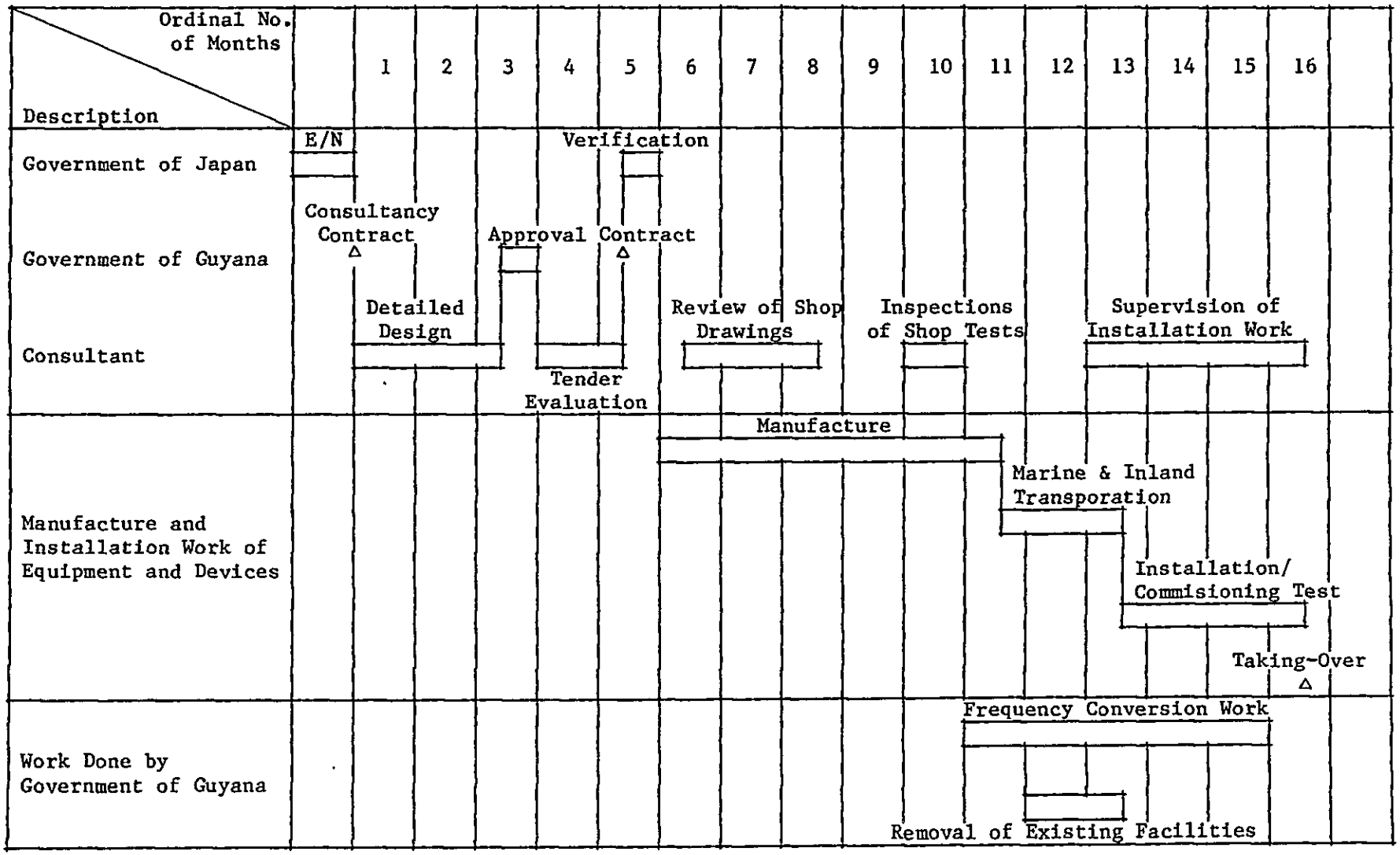
(2) Repair of existing building

(3) Work related to conversion of frequency and voltages

6-3-2 Implementation Schedule

The implementation f this Project is to commence with detailed design to be performed in accordance with the Guidelines for Japan's Grant Aid Program following the signing of Exchange of Notes between the two Governments. The period for performance of detailed design is estimated to be around three (3) months. There should be approximately another two (2) months at least from the completion of detailed design up to selection of a contractor. Thereafter, around eleven (11) months will be required for manufacture, transportation, installation and commissioning tests and taking-over of equipment and devices. The implementation schedule worked out on the basis of the above-mentioned requirements is as given in Fig. 6-3-1. Approximately sixteen (16) months in total will be needed from the signing of Exchange of Notes until the completion of installation work.

Fig. 6-3-1 Implementation Schedule



6-4 PROCUREMENT

All equipment and devices for the Project will be manufactured at factories of a Japanese contractor and shop tests of the said equipment and devices are also to be conducted therein. Accordingly, no local equipment and devices will be procured in Guyana. It has been confirmed during the site survey that materials and supplies needed for placing concrete for foundations for auxiliary devices are locally available. The Government of Guyana has agreed to procure Japanese-made equipment and devices thereof from Japan under Japanese Grant Aid.

6-5 OPERATION AND MAINTENANCE PLAN

6-5-1 Operation and Maintenance Set-up of GEC

As of September 1983, GEC deploys its maintenance staff composed of 1 supervisor, 5 mechanics and 1 electrician along with the operation staff comprising 5 operating supervisors and 9 operators (one shift is composed of 3 persons) totaling 14 persons under the direction of Manager of Versailles Power Station for operation and maintenance of the said power station. According to GEC, overhaul for maintenance of the power station is classified into two categories; "Top Overhaul" and "Major Overhaul". The "Top Overhaul" denotes an overhaul which is made every 10,000 hours of operation while the "Major Overhaul" indicates a big overhaul done after an elapse of 30,000 hours of operation of plant(s). These overhauls are carried out in accordance with inspection standards recommended by manufacturers of equipment. It seems that daily inspections of equipment are thoroughly made at Versailles Power Station.

It is considered that the present operation and maintenance set-up taken by GEC will be sufficient for operation and maintenance of three sets of diesel engine generators with a rated capacity of 2,000 kW each which will be procured under the Diesel Power Generator Supply Project.

However, a period from one overhual to another seems to be slightly longer than a period between overhauls commonly practised in Japan. It is, therefore, recommended that GEC follow

inspectin standards of Japanese manufacturer(s) who make the generating equipment. It would also be arranged by GEC that its technical personnel expected to be engaged in the operation and maintenance of Versailles Power Station may participate in the installation of the generating equipment and devices in order that they may acquire necessary techniques from a consultant or installation supervisors to be dispatched by Japanese manufacturer(s) through "on-the-job training" thereof.

6-5-2 Operation and Maintenance Cost

The following is the operation and maintenance cost of Versailles Power Station upon completion of the Diesel Power Generator Supply Project.

(1) Depreciation Cost

The annual depreciation cost of the diesel engine generators and associated devices will be calculated at 60.5 million Yen according to GEC's practice.

(2) Operation and Repair Cost

The average annual operation and repair cost including personnel expenses of the power station during the serviceable life of the diesel engine generators and associated devices will be calculated at 15.7 million Yen.

(3) Fuel Cost

The annual energy production of Versailles Power Station will be subject to an overall operation of generating facilities forming the Georgetown Electric Power System and rely upon an economical operation practice of total electric power systems from 1986 onward after the Georgetown Electric Power System is interconnected with other electric power systems. However, in the event all electricity demand arising from the west Demerara area is met solely by Versailles Power Station, the annual energy production of this power station will reach 26,722 MWh at the end of 1984 as indicated in the following table. Therefore, the annual fuel cost will amount to 542.86 million Yen.

(4) Operation and maintenance Cost Viewed from Electricity Sales Revenue

The quantity of salable energy a year out of the annual energy production of Versailles Power Station will reach 20,309 MWh in case an overall loss rate of 24% is taken up, according to the records of the Georgetown Electric Power System. On the other hand, if an average electricity charge per kWh of 46 yen is adopted, based on GEC's energy sales revenue as of 1982, they will be able to earn 934 million Yen. As per the following table, the total of depreciation cost, operation and repair cost and fuel cost to be incurred annually will reach 619 million Yen.

Even if GEC bears allocated overhead cost, taxes and levies and the operation and maintenance cost of transmission and distribution facilities in addition to the above-mentioned sum, it is judged that they will be able to appropriate the operation and maintenance cost of Versailles Power Station amply out of the energy sales revenue.

Description	Amount (In Thousand Yen)	Remarks
(1) Depreciation Cost	60,501	
(2) Annual Operation and Repair Cost	15,700	
(3) Annual Fuel Cost	542,863	Annual Energy Demand at Sending End: 4.6 MW x 8,760 hrs. x 0.63 = 25,386 MWh Load factor: 63% Annual Energy Production: 25,386 MWh x 1/0.95 = 26,722 MWh Station use: 5% Fuel per kWh: Gas oil : 0.246ℓ Lubricant: 0.016ℓ Annual Fuel Consumption: Gas oil : 0.246ℓ x 26,722 MWh = 6,573,612ℓ Lubricant: 0.0016ℓ x 26,722 MWh = 42,755ℓ Unit price per liter: Gas oil : ¥80 Lubricant: ¥397 Annual Fuel Cost: Gas oil : ¥80 x 6,573,612ℓ = ¥525,888,960 Lubricant: ¥397 x 42,755ℓ = ¥16,973,735
Total	619,064	

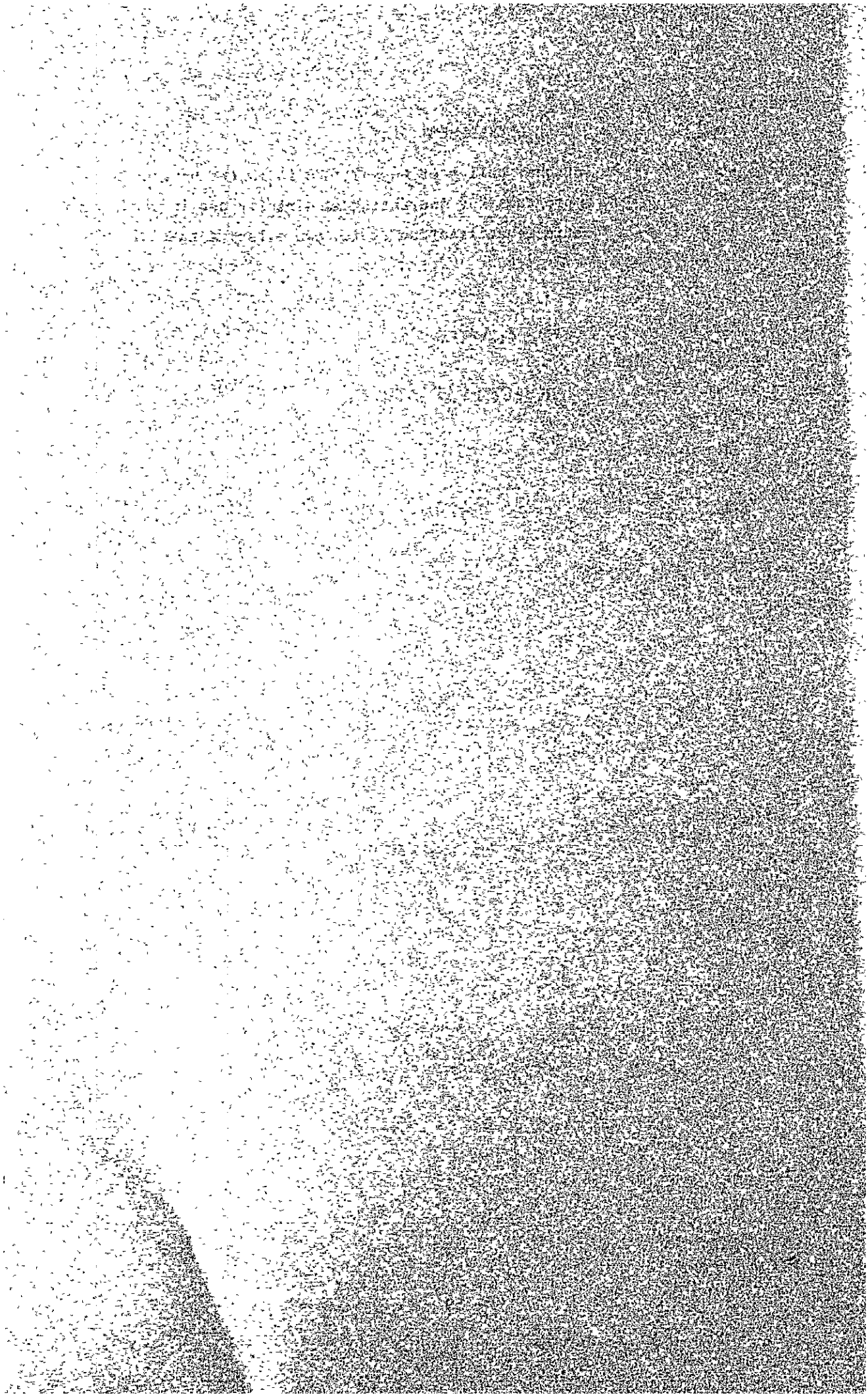
6-5-3 Ensured Supply of Fuel

Importation of petroleum is controlled mutually by the Ministry of Trade and the Guyana National Energy Authority. Special agreement is concluded between GEC and the two higher authorities regarding importation of fuel for GEC-owned thermal power stations including Versailles Power Station. Accordingly, there will be no problems with supply of fuel for keeping Versailles Power Station operational at least.

Guyana is a member of the Caribbean Community and Common Market. Fuel needed for operation of GEC's power stations is imported from Trinidad and Tobago composing its membership of the inter-regional organization. There are arrangements for paying for this importation of fuel through the CARICOM multilateral clearing facility.

CHAPTER 7

PROJECT EVALUATION



CHAPTER 7 PROJECT EVALUATION

7-1 EFFECTS UPON NATIONAL DEVELOPMENT PLAN

In line with a national policy of Guyana, GEC is in the course of carrying out its programs for increasing electricity supply capability by systematic rehabilitation of its own existing thermal power generating facilities and for frequency standardization on a nation-wide scale. Consequently, it is believed that the implementation of this Project will be of help to the promotion of the said programs being implemented by GEC and will make great contributions to the materialization of the national development plan.

7-2 SOCIAL BENEFITS AND EFFECTS

If the Diesel Power Generator Supply Project is realized, the west Demerara area will be set free from various inconvenience and obstacles that the chronical load shedding causes, as described in 5-1-3; impediment to education and medical services and adverse impact upon potable water supply and preservation of public security, etc. Thus, all the social dislocation, inconvenience and irritation confronting residents in the west Demerara area will be terminated. Besides, it will be possible to safely operate the drainage pump of which installation is being promoted by the Ministry of Agriculture. Farms, workplaces and houses will be protected from dangers caused by water inundation therein. Amelioration in the reliability of electricity supply by Versailles Power Station will prevent the loss of valuable human lives caused by black-outs from taking place. Improvement of medical services to patients at hospitals and expansion of their medical facilities could be guaranteed.

CHAPTER 8

CONCLUSIONS AND RECOMMENDATIONS