CHAPTER 8

CONSTRUCTION COST AND CONSTRUCTION SCHEDULE

CHAPTER 8 CONSTRUCTION COST AND CONSTRUCTION SCHEDULE

8.1 Panay-Negros-Cebu Power System

8.1.1 Construction Cost

(1) Basic Conditions

i) General

In estimating the construction cost of the Interconnected Power Transmission and Transformation Project in the Visayas, the natural conditions of the overhead transmission line and submarine cable routes, landing points of submarine cables, projected sites of cable terminals (CT), and planned sites of related substations, were taken into consideration along with regional conditions, and calculations were made based on labor costs and commodity prices at the beginning of 1980.

Items procurable in the Philippines were calculated under domestic currency requirements with all other items calculated as requiring foreign currency.

ii) Scope of Construction Cost Calculation

The scope of construction cost estimation is as indicated below, and besides computing the various work quantities based on the preliminary design of the Project, direct costs considering the system of contracting, and indirect costs necessary for proceeding with the Project were calculated.

(a) Scope of Construction Cost Estimation

- 138 kV overhead transmission line: 302 km
  - 1 cct line: 154 km
  - 2 cct line: 148 km
- 138 kV submarine cable: 23.6 km
  - Iloilo Strait: 3.7 km
  - Guimaras Strait: 12.8 km
  - Tañon Strait: 7.1 km
- Related Substations
  - Naga Coal-Fired Thermal Power Plant transmission line outgoing facilities expansion
  - Amlan Diesel Power Plant switchyard expansion
  - Kabangkalan Substation new construction
  - Pulupandan Substation new construction
  - Sta. Barbara Substation transmission line outgoing facilities expansion
- Telecommunications Facilities
  - Telecommunications facilities related to the Project.

(b) Cost of Electrical Equipment

1) It was considered that the principal materials and equipment (steel towers, conductors, insulators, submarine cable, transforming equipment such as main transformers and circuit breakers, telecommunications equipment) would all be manufactured in a foreign country and supplied and the cost of these items imported under the foreign currency portion were calculated based on internationally competitive FOB prices in Japan to which ocean freight, insurance, unloading costs, overland transportation costs in the Philippines, and field installation costs were added.
2) Regarding the 138 kV submarine cable works, deliveries were considered as being based on installation and adjustment, and all of the costs were included in the foreign currency portion, except that costs of site development for cable terminals (CT) and terminal buildings were considered under the domestic currency portion. As for transportation and laying of the submarine cables, it was considered that the cables would be loaded directly on the cable-laying vessel for transportation and that cable-laying work would be done continuously selecting a period of the best conditions of marine phenomena at the three straits involved in the Project.

(c) Engineering Fee and Administrative Expenses

Regarding the engineering fee and administrative expenses, the costs of the definite design (DS) for the Project and supervision of work (SV) to be provided by a foreign consultant were included under the foreign currency portion while the expenses required for administration by NAPOCOR of construction work were included under the domestic currency portion.

(d) Contingency

As contingency costs, an amount corresponding to 5% of all costs of 138 kV overhead transmission lines, submarine cables, and related transformation stations, and telecommunications facilities for the Project was considered.

(e) Interest During Construction

As interest on funds required for construction of this Project the interest rate was considered as being 3.5% per annum for the foreign currency portion and 10% per annum for the domestic currency portion.

(f) Escalation of Construction Cost

Various commodity prices have been consistently rising since the oil crisis of 1973, and construction funds will become insufficient with the cost estimated at current prices in case of a project of a long construction period. Inflation is seen in all countries of the free world, and with the oil price rise at the end of March 1979 (at the special plenary meeting of the Organization of Petroleum Exporting Countries (OPEC) held in Geneva, the price of Arabian Light, the benchmark crude, was raised from US$13.34/bbl to US$14.54/bbl as of April 1, 1979), and further, toward the end of the same year, oil prices

were again raised (at the OPEC plenary meeting held in Caracas the price was raised from US$14.54/bbl to US$24.00/bbl as of November 1), and compared with the price at the beginning of 1979, the price rose a startling 80%. The escalation in the price of petroleum which has a close relation with commodity prices will accelerate price rises in advanced and developing countries alike.

According to "World Statistics Yearbook, 1978" published by the United Nations, world trends in prices of industrial products from 1970 to 1977 were as indicated below.

Wholesale Price Indices of Industrial Products (1970=100)

	1977 Index	Annual Escalation Rate
Japan	159	6.8%
U.S.A.	164	7.3%
France	170	7.9%
West Germany	144	5.3%
Average	159	6.8%

As for the wholesale prices and consumer price indices in the Philippines, they are the following:

Wholesale Price Indices (1970=100)

Category	Index (1977)	Annual Escalation Rate
Overall	293	16.6%
Raw materials	273	15.4%
Finished goods	336	18.9%
Domestic products	295	16.7%
Imported goods	282	16.0%
Export goods	246	13.7%
Agricultural products	283	16.0%

Consumer Price Indices (1970= 100)

All items	200	10.4%
Foodstuffs	196	10.1%

Meanwhile, a report of the World Bank of March 1975 gives predictions of inflation from 1979 to 1987 according to which it is suggested to apply annual escalation rates of 8 to 7% for equipment and 12 to 10% for civil works.

In view of the above, in estimating the construction cost of the Project, annual rates of 7.0% for the foreign currency portion of direct costs in 1980 and 12.0% for the domestic currency portion (NAPOCOR applies 12.0% for escalation) are to be considered.

(2) Total Construction Cost and Construction Cost by Year

The total construction cost at 1980 prices obtained from the construction schedule, work execution plans and conditions for construction cost estimation will be US$53,788,000 of which the foreign currency portion will be US$41,797,000 and the domestic currency portion US$11,991,000.

The construction period for the Project is to be 4 years, and the payment terms for the foreign currency and domestic currency portions were assumed as indicated below and the abovementioned total construction cost was distributed.

	At award of contract	FOB	On completion
Foreign Currency Portion			
Transmission line materials and submarine cable	10%	60%	30%
Transforming and telecommunications equipment	10%	80%	10%
Domestic Currency Portion			
Materials and labor costs	Work accomplished basis		

The total amount of indirect costs consisting of engineering fee, administrative expenses, contingency, and interest during construction will be US$8,134,000 and the ratio to direct costs will be 17.8%. If negotiations for financing of the Project proceed smoothly, and the Project is completed at the end of 1984, the escalation in the construction cost due to inflation during this period is expected will have been 26.9% compared with the total construction cost at 1980 prices.

In effect, the total construction cost in case escalation is considered will be US$68,256,000, of which the US$51,247,000 will consist of the foreign currency portion and US$17,009,000 the domestic currency portion.

8.1.2 Construction Schedule

The construction schedule is shown in Fig. 8-1. If economical work execution is considered for the interconnecting transmission lines and the submarine cables, a period of approximately 4 years will be required from the time of starting preparation

Table 8-1 Fund Requirement in Each Year

Unit: $x10^3$ US$

Item	Construction cost			1st year		2nd year		3rd year		4th year	
	F.C.	D.C.	Total	F.C.	D.C.	F.C.	D.C.	F.C.	D.C.	F.C.	D.C.
A. Transmission line											
i) Overhead cable line											
Steel tower, insulator, conductor and others	13,407		13,407								
Installation cost		6,931	6,931								
ii) Submarine cable line											
Submarine cable and others	10,069		10,069								
Installation cost	5,142	231	5,373								
(Sub-total)	28,618	7,162	35,780	1,342		5,545	2,035	13,281	2,985	8,450	2,142
B. Substation											
Naga Power Plant	448	80	528								
Amlan Power Plant	1,707	506	2,213								
Kabangkalan Substation	2,738	885	3,623								
Pulupandan Substation	1,583	466	2,049								
Sta. Barbara Substation	317	57	374								
(Sub-total)	6,793	1,994	8,787			1,698	638	4,211	997	884	359
C. Telecommunication Facilities											
Naga Power Plant	136	25	161								
Liloan Cable Terminal Point	81	16	97								
Jilocon Cable Terminal Point	31	8	39								
Amlan Power Plant	103	20	123								
Kabangkalan Substation	185	34	219								
Pulupandan Substation	103	20	123								
Pagayon Cable Terminal Point	31	8	39								
Barcabana Cable Terminal Point	40	9	49								
Guimaras Repeater Station	41	31	72								
Salag Cable Terminal Point	39	9	48								
Jaro Cable Terminal Point	31	7	38								
Sta. Barbara Substation	65	14	79								
(Sub-total)	886	201	1,087		—	59	36	608	101	219	64
Total of direct cost (A + B + C)	36,297	9,357	45,654	1,342		7,302	2,709	18,100	4,083	9,553	2,565
D. Engineering fee											
Definite study	266		266	266							
Supervision	1,295		1,295			518		518		259	
(Sub-total)	1,561		1,561	266	—	518		518		259	
E. Administration expenses		594	594				198		198		198
F. Contingency	1,814	468	2,282	109		199	56	1,179	328	327	84
G. Interest during the construction	2,125	1,572	3,697	30		200	148	686	526	1,209	898
Total of indirect cost (D + E + F + G)	5,500	2,634	8,134	405	—	917	402	2,383	1,052	1,795	1,180
H. Total construction cost in 1980 prices	41,797	11,991	53,788	1,747	—	8,219	3,111	20,483	5,135	11,348	3,745
I. Escalation	9,450	5,018	14,468	122		1,191	791	4,610	2,079	3,527	2,148
J. Total construction cost required (H + I)	51,247	17,009	68,256	1,869	—	9,410	3,902	25,093	7,214	14,875	5,893

Conversion rate : 1 US$ = P7.5 = 250.0 Yen

Table 8-2 Summary of Estimated Construction Costs for Leyte-Samar Interconnection as of 1980

Unit: 10^3 US$

Item	Foreign currency	Domestic currency	Total	Remarks
A. Overhead transmission line	3,088	2,185	5,273	
B. Substation	1,289	368	1,657	
C. Telecommunication facilities	156	16	172	
Direct cost (A + B + C)	4,533	2,569	7,102	
D. Engineering, administration and other costs	355	154	508	
E. Contingency	227	128	355	
F. Interest during construction	263	432	695	
Indirect cost (D + E + F)	845	714	1,559	
G. Total construction cost in 1980 prices	5,378	3,283	8,661	Without escalation

of specifications for equipment purchasing and installation for ordering the work until completion of construction.

Regarding substation works, since it is thought normally adequate if a period of 30 months from award of contract until completion is taken into account, it will be possible for them to be completed during the period of transmission line construction.

The basic matters considered in determining the construction shedule are as described below.

(1) 138 kV Overhead Transmission Line Works

The transmission line construction is to be done dividing the entire length into the two construction sections of Panay-Negros, (2-cct section, 148 km; 1-cct section 44 km) and of Cebu (1-cct section 110 km) with work on the two sections carried out simultaneously.

i) Work Quantities

The work quantites are as indicated below.

	1 ctt section	2 ctt section	No. of steal towers
138 kV line in Panay and Negros	44 km	148 km	630
138 kV line in Cebu	110 km	—	360
Total	159 km	148 km	990

ii) Construction Schedule

As a result of study of the construction schedule, if advances are made at the rate of 8 km per month, 24 months will be required for construction of the Panay-Negros Transmission Line, while 15 months will be required for the Cebu Transmission Line.

iii) Period for Transporting Materials and Equipment

Materials such as steel towers, conductors and insulators are all to be imported and it was considered that 1.5 months each would be required for marine transportation and overland transportation.

iv) Steel Tower Fabrication Capacity

It will require approximately 2.5 months from the time a steel tower manufacturer receives an order until fabrication is started. During this 2.5 month period, arrangements would be made for materials, model erection performed, and testing of models done.

The amount of steel required is estimated to be approximately 7,500 tons. Assuming fabrication of an average two towers per day (15 ton/day), 17 months will be required as the fabrication period at the factory.

(2) Submarine Cable Construction Schedule

Construction of the 138 kV submarine cables, as described in Chapter 6, "Preliminary Design", will consist of a special type of work, and the final cable-laying work and schedule will be determined based on the results of detailed investigations of the sea-bottom geology.

However, an approximate investigation of the marine phenomena and sea-bottom geologies at cable-laying sites are to be completed by NAPOCOR.

i) Detailed Investigations of Sites and Final Design

The contractor for the submarine cables, after being awarded the contract, is to carry out detailed investigations of the cable-laying sites in accordance with NAPOCOR specifications, and is to make final designs for the works. Also, test pieces of the cable are to be manufactured and the approval of NAPOCOR obtained. The period required for this was considered to be 10 months. As a note, it will be desirable for sea-bottom geological investigations to be carried out from the last third of April to the first third of June in consideration of marine phenomena and meteorological conditions.

ii) Cable Manufacturing Schedule

The cable is to be manufactured in unit lengths of 2,000 m, and the numbers of joints required according to the lengths of the cable-laying routes are to be made. The number of joints per phase is as indicated below, and since one unit cable length is 2,000 m, the total number of units required will be 13 per phase.

	Guimaras	Length	Cable unit	Number of joints
Panay	— Guimaras	3.7 km	2/ø	1/ø
Guimaras	— Negros	12.8 km	7/ø	6/ø
Negros	— Cebu	7.1 km	4/ø	3/ø
Total		23.6 km	13/ø	10/ø

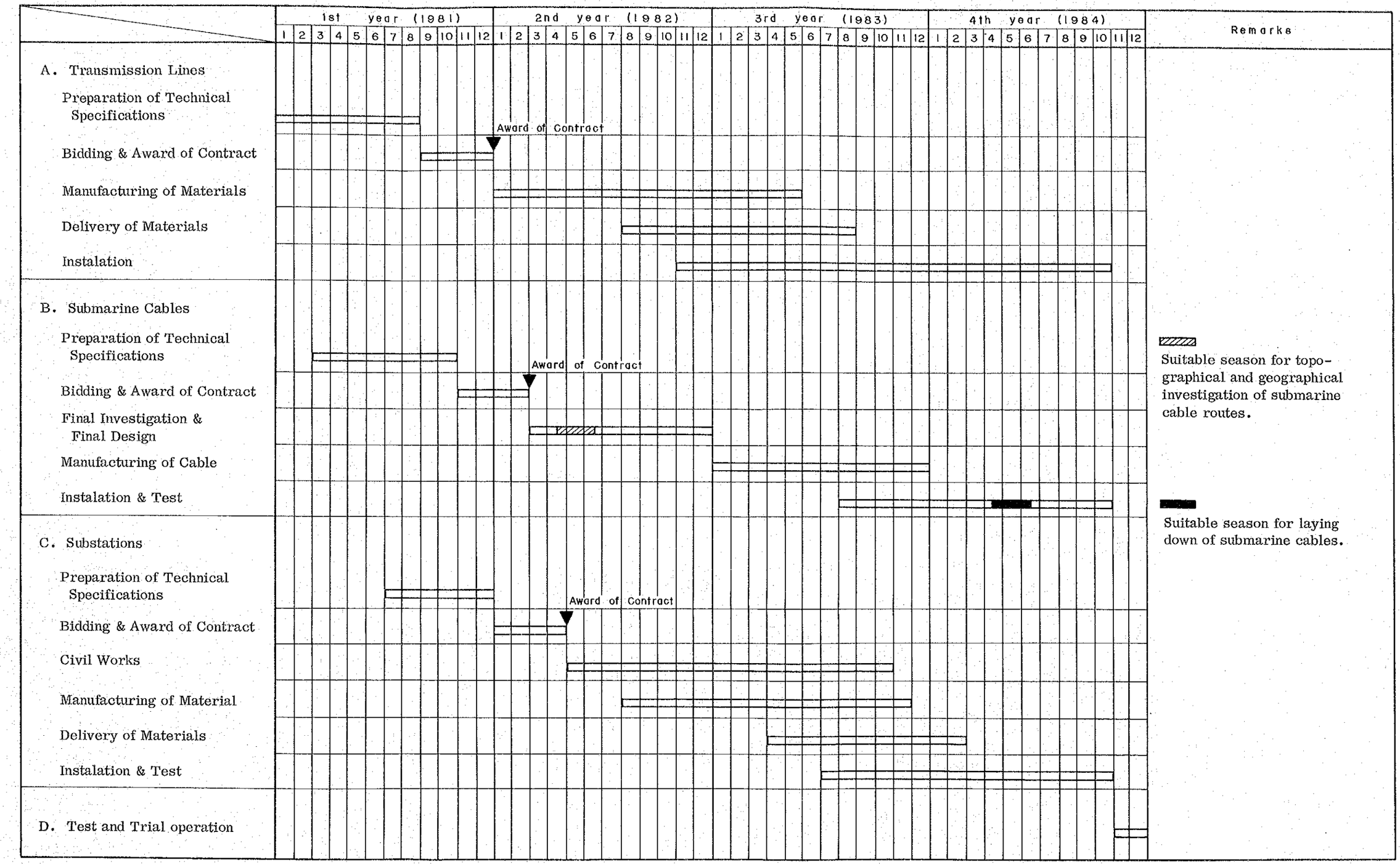
Assuming that 7 days will be required for joining at one location, and 3 single-core cables are laid, the period required for joining at the factory will be 7 months.

iii) Cable-Laying Schedule

Prior to cable laying, preparatory works at cable landing points and terminal sites will require 3 months for each cable route. If such work were to be done in series for the three cable sections, the preparatory works for cable laying will require 9 months.

Cable-laying operations will be carried out concentratedly from the last third of April through the first third of June, but considering the number of days requir-

Fig. 8-1 Construction Schedule Panay-Negros-Cebu Interconnected Transmission Lines Project



ed by the cable-laying vessel to travel between the three islands and other factors, the cable-laying period was set at two months.

It was assumed that a period of 4 months would be required after cable laying for protection of cables, connections of ends to transmission lines and overall testing of cables. Consequently, 15 months will be required as the cable-laying schedule.

(3) Construction Schedule for Substations

The period required for substation construction will be shorter than for construction of the interconnecting transmission lines.

The substation works may be divided into civil works (including construction of main substation buildings), electrical works, and overall testing works. Also, telecommunications facilities works were considered as being included in substation electrical works.

The substation works are to be executed simultaneously for all of the sites. Furthermore, acquisition of substation lots must be completed at the responsibility of NAPOCOR before start of works.

8.2 Leyte-Samar Power System

8.2.1 Construction Cost

(1) Scope of Estimation

The basic consideration in estimation of construction costs for the 138 kV overhead transmission line (Tongonan Geothermal Power Plant - Wright Substation) and new construction of Wright Substation for the Leyte-Samar Power System is the same as described in 8.1 on the Panay-Negros-Cebu Power System, and based on the results of preliminary design, work quantities were computed and the construction cost estimated. The scope of construction cost estimation covers the following:

i) 138 kV overhead transmission line (Tongonan Geothermal Power Plant - Wright Substation): 115 km
ii) Wright Substation new construction: 30 MVA
iii) Related telecommunications facilities
Tongonan Geothermal Power Plant
Wright Substation

(2) Total Construction Cost

As shown in Table 8-2, the total construction cost at 1980 prices of the overhead transmission line between Tongonan Geothermal Power Plant and Wright Substation, including the steel towers for crossing San Juanico Strait and construction of Wright Substation, will be US$8,661,000 of which US$5,378,000 would comprise a foreign currency portion and US$3,283,000 a domestic currency portion.

Escalation is not included in the construction cost for the Project.

8.2.2 Construction Schedule

As previously stated, financing from Japan of construction of the 138 kV transmission line from Tongonan Geothermal Power Plant to Wright Substation and of construction of Wright Substation is already definite, while the feasibility of this project has already been established, and it is scheduled for this to be completed in 1983.

The time that a second circuit will become necessary for this section will be 1990 or later, and thus it will be difficult at this time to decide on a construction schedule for the 138 kV transmission line designed by the Survey Team, and it will not be dealt with here.

CHAPTER 9

ECONOMIC ANALYSIS

CHAPTER 9 ECONOMIC ANALYSIS

The Project consists of primary transmission lines and primary substations among the various facilities of an electric power system, and in effect, is a project for providing basic facilities for distribution of electric power. The essential point in making an analysis of the economic value of a project lies in determining whether it is possible for more effective utilization of capital than an alternative plan. In case of an ordinary power transmission and transformation scheme, the evaluation of effective utilization of funds means formulation of the most economical power transmission and transformation plan with transmitting voltage, transmission line route and type of support, etc. as parameters, but the economic analysis described in this chapter is not such an economic comparison in a narrow sense, and is an evaluation from the standpoint of the entire electric power system based on interconnection of three islands. Consequently, from a fundamental viewpoint, the evaluation would be made according to the difference between the three-island interconnection of Panay, Negros and Cebu (original plan) and a plan for isolated, individual development of the three islands without any interconnection. As for the economic analysis of the two-island system of Leyte-Samar, as stated in "Objectives and Scope of Investigations" in Chapter 1, "Introduction", of this Report, the timing of construction will be for 1990 or later, and therefore, with regard to the economic effect, it will be evaluated based on a comparison of the fuel cost at Tongonan Geothermal Power Plant and the fuel cost of an alternative diesel power plant.

9.1 Three-Island Interconnection of Panay, Negros and Cebu

The effects obtained from an interconnection generally consist of the following:

a) Savings in reserve supply capacity
b) Economy of scale of power generating facilities
c) Regional wide-area power development
d) Comprehensive power system operation
e) Improvement in power system stability (spinning reserve interchange effect)
f) Reduction in frequency and voltage fluctuations during normal situation
g) Mutual assistance effect at times of abnormal conditions such as natural disasters
h) Other

In making evaluations of these effects, there are those which must be evaluated from a long-range viewpoint regarding their economic effects such as, for example, economy of scale of power generating facilities and savings in reserve capacity (these benefit will indicate a trend of increase as the three-island electric power system is expanded), and those which require judgments of values to be made although evaluations in terms of monetary amounts will be difficult, such as alleviation of frequency drops during faulting, reduction in frequency and voltage fluctuations during normal times, and the mutual assistance effect at times of abnormal conditions such as natural disasters. That is, in the final evaluation of the effect of interconnec-

tion, all of these effects must be comprehensively considered. However, in the economic analysis to be made in this chapter, the studies will be limited under present conditions to benefit which can be evaluated in terms of monetary figures such as savings in reserve supply capacity and regional wide-area power development (development of geothermal power on Negros and the coalfired thermal power on Panay, Negros and Cebu).

9.1.1 Benefit of Savings in Reserve Supply Capacity

As stated in Chapter 7, "Power System Analysis", the savings to be made in reserve supply capacity through the three-island interconnection will be the following in 1985 and 1990.

1985	53.5 MW
1990	69.3 MW

As previously mentioned, the benefit of savings in reserve capacity must be evaluated from a long-range viewpoint, but under present circumstances, it is difficult to make a forecast beyond 1990. However, seen from the capacity of the submarine cables, it may be surmised that savings in reserve capacity in 1990 of 69.3 MW will be increased further after 1990.

The benefit of savings in reserve capacity will be evaluated in this chapter based on the 69.3 MW expected as of 1990. In this case, the monetary evaluation of the savings in reserve capacity will be based on the construction cost of the power barges which is the lowest per kW of the electric power development projects in the Visayas.

Benefit of Savings in Reserve Capacity

$$69{,}300\,\text{kW} \times \text{US\$}508/\text{kW} = \text{US\$}35{,}204{,}000$$

Note: According to a report prepared by NAPOCOR in December 1979, the construction cost by power generating plant and the construction cost per kW of each are as indicated below.

Name of Plant	Installed Capacity (MW)	Construction Cost (10^6 Peso)	Construction Cost (10^6 US$)	Construction Cost (US$/kW)
Talvera Diesel	52 (3x18 MW)	352	48.2	927
Power Barge	62 (8x 8 MW)	230	31.5	508
Dingle Diesel	29.2 (3x 7.3 MW)	122.7	16.8	575
Cebu Coal Ther.	55 (1x55 MW)	460.2	63.0	1,146
Amlan Diesel	11 (2x 5.5 MW)	41.7	5.7	519
Tongonan Geo.	112.5 (3x37.5 MW)	491.8	67.4	598

9.1.2 Benefit of Regional Wide-Area Power Development

NAPOCOR, in order to be released as much as possible from power generation using oil, on the predication of three-island interconnected development, has already gone ahead with construction of a coal-fired thermal power plant on Cebu with start of operation targeted for the end of 1980, and further, has scheduled construction of coal-fired thermal plants on Negros and Panay also. On Negros, works for construction of the two geothermal power plants of Palimpinon and Mambucal are also going ahead. Seen from the sizes of demands on the individual islands, it will not be possible for the energy produced at these power plants to all be consumed on each's island and the economic effects of these power plants will be secured only by power transmission to other islands. This will be true particularly of the geothermal power plants to be constructed on Negros.

Based on the electric power development plan of NAPOCOR up to 1990, the energy exchanges among the three islands from 1985 to 1990 will be as shown in Table 9-1. The electric power development plans by year are given in Appendix A-3.

As shown in Table 9-1, interchange between islands of power generated with non-petroleum fuel can be expected from 1986, and from 1988, it will become possible to transmit the geothermal energy of Negros to the other islands.

Table 9-1 Energy Exchange among Islands

Unit: GWh

	1985				1986				1987			
	Panay	Negros	Cebu	Total	Panay	Negros	Cebu	Total	Panay	Negros	Cebu	Total
(1) Energy demand	283	1,301	1,123	2,707	299	1,375	1,221	2,895	315	1,450	1,322	3,087
Energy production												
Hydro	0	5	0	5	0	5	0	5	0	115	0	115
Geothermal	0	755	0	755	0	755	0	755	0	755	0	755
Coal	0	337	735	1,072	337	337	735	1,409	337	337	735	1,409
(2) Sub-total	0	1,097	735	1,832	337	1,097	735	2,169	337	1,207	735	2,279
Diesel	247	447	798	1,492	247	447	798	1,492	247	447	798	1,492
Power barge	0	196	196	392	0	196	196	392	0	196	196	392
(3) Sub-total	247	643	994	1,884	247	643	994	1,884	247	643	994	1,884
(4) Total	247	1,740	1,729	3,716	584	1,740	1,729	4,053	584	1,850	1,729	4,163
(5) Energy flow (5) = (1) - (2)	P ← N → C: 36 (Diesel); 0				P → N → C: 38 (Coal); 0				P → N → C: 22 (Coal); 0			

(P): Panay
(N): Negros
(C): Cebu

	1988				1989				1990			
	Panay	Negros	Cebu	Total	Panay	Negros	Cebu	Total	Panay	Negros	Cebu	Total
(1) Energy demand	332	1,521	1,431	3,284	350	1,598	1,543	3,491	366	1,674	1,664	3,704
Energy production												
Hydro	0	115	0	115	0	115	0	115	44	115	0	159
Geothermal	0	755	0	755	0	1,000	0	1,000	0	1,245	0	1,245
Coal	337	674	735	1,746	337	674	735	1,746	337	674	735	1,746
(2) Sub-total	337	1,544	735	2,616	337	1,789	735	2,861	381	2,034	735	3,150
Diesel	247	447	712	1,406	247	447	712	1,406	247	405	712	1,364
Power barge	0	196	196	392	0	196	196	392	0	196	196	392
(3) Sub-total	247	643	908	1,798	247	643	908	1,798	247	601	908	1,756
(4) Total	584	2,187	1,643	4,414	584	2,432	1,643	4,659	628	2,635	1,643	4,906
(5) Energy flow (5) = (1) - (2)	P → N → C: 5 (Coal); 28 (Geo)				P ← N → C: 13 (Geo); 178 (Geo)				P → N → C: 15 (Coal); 375 (Geo)			

Such regional wide-area power development can be evaluated by the differences between the fuel cost when generating power with petroleum as fuel and the fuel costs of coal-fired thermal and geothermal which use non-petroleum fuels.

(1) Price of Coal

It is said that the reserves of coal in the Philippines amount to 1.3 billion tons. It is also said that the economically extractable coal is approximately 2 million tons per year. Consequently, it will be possible to meet the requirements of the coal-fired thermal power plants presently planned by NAPOCOR for the Visayas with domestic Philippine coal. However, it is difficult under present conditions to know at what prices the coal can be purchased delivered at the various power plant sites. Meanwhile, as is well known, coal is an internationally-traded commodity and ordinary coal (calorific value 6,300 kcal/kg) is said to be around US$40.00 CIF. The fuel cost per kWh in case such coal is used will be the following:

$$\frac{6,300 \times 0.32}{860} = 2.34\ \text{kWh/kg}$$

$$\frac{40 \times 10^{-3}}{2.34 \times 0.93} = \text{US\$0.0184/kWh}$$

where, the thermal efficiency of a 55 MW coal-fired thermal power station at the transmitting end is 32%, and moisture content of imported coal is 7%.

(2) Price of Geothermal Energy

As stated in 3.2, "Electric Power Situation of Visayas Region", in Chapter 3, "Electric Utility Industry in the Philippines", geothermal development in the Visayas is being carried out by the Energy Development Corporation, which is one of the government agencies of the Philippines, and at present there have already been a total of 8 exploratory steam wells (estimated at 40 MW in terms of electricity output) dug at the Palimpinon and Mambucal sites on Negros, while on Leyte, exploratory digging is going on at Tongonan and Burauen, with 20 trial wells dug already at Tongonan. It has been confirmed that the electricity output of the 10 steam wells for which evaluations have been completed will reach a total of 79 MW.

Only the pilot plant (1×3.0 MW) at Tongonan is now generating power utilizing geothermal energy in the Visayas but a pilot plant (2×1.5 MW) at Palimpinon on Negros Island will be completed by the end of 1980, while at Tongonan on Leyte, a practical-scale geothermal power plant (3×37.5 MW) will be completed in 1982.

The Energy Development Corporation is directly selling the geothermal steam it develops to NAPOCOR for power generating purposes, and the unit price at which NAPOCOR is purchasing geothermal steam at Tongonan is US$0.0137 per kWh (0.10 Peso/kWh).

Although it will be a fairly difficult problem to predict the unit price of geothermal energy in the future, the depth of drilling for a steam well at the Tongonan site is an average of 1,600 m, while the depths of drilling for steam wells at Palimpinon are also 1,500 to 1,600 m, and it may be considered that direct costs of digging steam wells will be roughly the same for Tongonan and Palimpinon. The recorded average digging cost at Tongonan at well heads of steam wells was between US$600,000 to US$700,000 (including 10% for access roads, etc.) as direct cost, and assuming indirect costs of 40% and annual cost factor of 15%, the geothermal steam costs at well heads at Palimpinon and Mambucal were calculated to be as follows:

$$\frac{700 \times 10^3 \times 1.4 \times 0.15}{5{,}000 \times 8.760 \times 0.7} = \text{US\$0.0048/kWh}$$

where, electricity output per steam well is 5,000 kW
and the utility factor per steam well is 70%.

The geothermal steam collected at each steam well would be piped to a steam reservoir at the geothermal power plant. Distances between steam wells and the steam reservoir would vary between several hundred meters to several thousand meters, while costs would differ depending on topography. Meanwhile, at both the Palimpinon and Mambucal sites, explorations are still under way for steam well sites, and it will thus be difficult to predict the cost of steam transportation pipes.

As a conclusion, the Survey Team took a conservative viewpoint, and since it could be surmised that the unit price at which the Energy Development Corporation is selling geothermal steam to NAPOCOR is one which would amply pay for the Energy Development Corporation when geothermal power generation is done on a full scale, this price was used. That is,

Unit Price of Geothermal Steam:

US$0.0137/kWh (P0.100/kWh)

(3) Price of Petroleum

The prices of crude oil set by OPEC at Caracas, the capital of Venezuela, at the end of 1979 ranged between US$24 to US$30 per barrel (159 liters) to result in a multiple-level price structure. Although the Philippines is an oil-producing country, only 12% of domestic requirements can be met whith the production, and all of the remainder depends on imports of crude from other countries.

Under such circumstances, the Philippine Government made large changes in the prices of secondary products of petroleum. That is, from February 1980, the price of gasoline was raised 50% (P3.0/liter to P4.5/liter), and those of diesel oil and bunker C oil used as fuels for power generation by 42% and 36%, respectively.

The fuel used at diesel power generating plants in the Visayas is mainly bunker C oil, and although prices differ somewhat depending on the location of

the power plant site, it is an average of US$0.214/liter (P1.564/liter). Therefore, the fuel cost when bunker C oil is used will be the following:

$$\frac{9,600 \times 0.38}{860} = 4.24\,\text{kWh/liter}$$

$$\frac{0.214 \times 1.1}{4.24} = \text{US\$0.0555/kWh}$$

where, lubricating oil correction factor is 1.1, and the transmitting end thermal efficiency of a 5.0 MW diesel unit is 38% (calorific value of heavy oil: 9,600 kcal/liter).

The benefit of regional wide-area power development calculated based on the fuel costs per kWh of various fuels and the energy interchanges between the three islands will be as shown in Table 9-2.

Table 9-2 Merit due to Regional Wide-Area Power Development

Year	Interchanged energy		Cost difference *		Merit		
	by Coal (GWh)	by Geo. (GWh)	Coal (US$/kWh)	Geo. (US$/kWh)	Coal (10^3 US$)	Geo. (10^3 US$)	Total (10^3 US$)
1985	0	0	0.0371	0.0418	0	0	0
1986	38	0	0.0371	0.0418	1,410	0	1,410
1987	22	0	0.0371	0.0418	816	0	816
1988	5	28	0.0371	0.0418	186	1,170	1,356
1989	0	191	0.0371	0.0418	0	7,984	7,984
1990	15	375	0.0371	0.0418	557	15,675	16,232
Total	80	594	—	—	2,969	24,829	27,798

Note * Coal : 0.0555 — 0.0184 = 0.0371

Geothermal : 0.0555 — 0.0137 = 0.0418

Using a discount factor of 10%, the benefit of the various years converted to present worth as of the beginning of 1985 when the Project will have been completed will be the following:

Benefit of Regional Wide-Area Power Development:

US$16,808,000

In effect, the benefit of US$27,798,000 converted to the benefit at the

9.1.3 Benefit of Interconnection and Conclusions

As already described, as benefit of interconnection which can be evaluated in terms of monetary amounts, those of savings in reserve supply capacity and difference in costs between petroleum and non-petroleum fuels taken advantage of through regional wide-area development were calculated. The aggregate of these figures is given below.

Benefit of Savings in Reserve Capacity:	US$35,204,000
Benefit of Regional Wide-Area Power Development:	US$16,808,000
Total:	US$52,012,000

On the other hand, the total construction cost (not including escalation since the economic analysis is to be made based entirely on 1980 prices) of the Project will be US$53,788,000 of which the construction cost required for the three-island interconnection will be US$34,229,000. The breakdown is as indicated in the table below.

Table 9-3 Construction Cost Required for Interconnection

	Panay - Negros (56 km)	Negros - Cebu (122 km)	Total (178 km)
Overhead lines	1,819	6,338	8,157
Submarine cables	10,711	4,731	15,442
Out-going facilities	2,423	2,741	5,164
Telecommunication facilities	448	297	745
Direct cost	15,401	14,107	29,508
Indirect cost	2,297	2,424	4,721
Total	17,698	16,531	34,229

On obtaining the benefit-cost ratio (B/C) from the above, it will be as follows:

$$B/C = US\$52,012 \times 10^3 / US\$34,229 \times 10^3 = 1.52$$

In effect, the economics of the interconnection facilities alone out of the Project will be very good.

Meanwhile, regarding the 138 kV, 2-cct transmission line from Pulupandan

Substation to Amlan Diesel Power Plant on Negros Island, seen from the results of power system analysis, it has very much the nature of a trunk transmission line within Negros Island, but not much the nature of a transmission line for three-island interconnection. However, it has also been made clear by the power system analysis that a firm power system for the three-island interconnection cannot be composed unless this transmission line exists. Consequently, in the economic analysis in this chapter, if an evaluation were to be made deducting 50% of the construction cost of 138 kV, 2 cct transmission line between Pulupandan and Amlan from the total construction cost of transmission lines (including submarine cables) and substations which were the objects of study by the Survey Team, the evaluation would be the following:

$$B/C = US\$52,012 \times 10^3 / US\$46,439 \times 10^3 = 1.12$$

Based on the above conclusions, it may be judged that this Project is economically advantageous, with this advantageous nature further enhanced if the benefit of interconnection which cannot be expressed in monetary terms are also considered.

9.2 Leyte-Samar Interconnection

The economic effect of the Project will be determined by the size of demand on Samar Island and the steam cost of Tongonan Geothermal Power Plant which supplies power for the demands of the two islands. If it were to be assumed that the two islands would not be interconnected, it may be considered that power generating facilities to be built on Samar would be diesel in view of the scale of power demand on that island. In effect, in the economic comparison for the interconnected transmission line, it may be considered that the economic nature is good if the difference between the steam cost of Tongonan Geothermal Power Plant and the cost of bunker C oil used as fuel by the diesel power plant multiplyed by the electric energy passing through the transmission line is larger than the annual cost of the transmission line. In this case, however, it is assumed that the construction cost per kW of the geothermal generating facility and that of the diesel facility are equal, and therefore, the fixed costs per kWh are the same.

As described in 8.2.1, the total construction cost at 1980 prices of this two-island interconnecting transmission line including Wright Substation, the receiving-end substation, will be US$8,661,000.

Calculating annual cost rates based on discount factor of 10%/yr, service life of transmission line of 50 years, service life of substation of 25 years and operation and maintenance costs 2.5% of the respective construction costs, the results will be the following:

Transmission Line Annual Cost Rate: $0.101 + 0.025 = 0.126$

Substation Annual Cost Rate: $0.110 + 0.025 = 0.135$

The annual cost of the Leyte-Samar interconnection facilities will be the following:

Transmission line:	US$6,220 \times 10^3 \times 0.126 =	US783×10^3
Substation:	US$2,441 \times 10^3 \times 0.135 =	US329×10^3
Total		US$1,112 \times 10^3$

The amount of electric energy passing through the transmission line to make the benefit-cost ratio equal 1.0 will be as follows:

(Diesel Fuel Unit Price — Geothermal Steam Unit Price)
× (1 — Transmission Loss Rate) × Receiving End Annual Energy
= Annual Cost of Two-Island Interconnected Facilities

$$(0.0555 - 0.0137) \times 0.94X = US\$1,112 \times 10^3$$

$$X = \frac{1.112 \times 10^3}{0.0418 \times 0.94} = 28.3 \times 10^6 \text{ kWh}$$

In effect, if electric energy of more than 28.3 million kWh were to be transmitted annually through the two-island interconnecting transmission line to Wright Substation, the benefit-cost ratio of the line will be higher than 1.0.

CHAPTER 10

FINANCING PLAN AND FINANCIAL ANALYSIS

CHAPTER 10 FINANCING PLAN AND FINANCIAL ANALYSIS

10.1 Fundamental Considerations

As is well known, huge investments are required for electric power facilities (power generating, transmitting and transforming facilities). And even if the investment is made, a construction period of several years is required, and income in return for the investment does not begin to come in until several years later. The statutory service lives of the completed facilities are comparatively long compared with durable goods in general. Such a situation means that repayment of principal and interest with the income obtained upon making the investment will of necessity be over a long period.

Consequently, it may be said to be an indispensable condition for construction of electric power facilities to procure funds of low interest rates, and long deferment and repayment periods. Procuring such funds within the Philippines is thought to be fairly difficult in view of the amount of investment required for the Project, the necessity for a low interest rate and a long repayment period. Generally speaking, however, the international cooperation with regard to financing of electric power development projects in developing nations is limited to government-to-government development aid or loans from international financing institutions such as the World Bank and the Asian Development Bank for covering foreign currency requirements, while for domestic requirements, it is normal for procurement to be done within the particular country by the owner himself.

Judging by the interest rates on time deposits at city banks in the Philippines, the rates for prime customers are estimated to be around 12 to 14%. Further, it is estimated that the lending rates of Philippine Government financial institutions (Development Bank, others), are about 2% lower than those of city banks.

On the other hand, the income as return against investment would come from electricity charges, and the prevailing electricity rates of the Visayas are higher than on Luzon and Mindanao as stated in 3.2.2, but even with these rates, in the Visayas which mainly has diesel power generating facilities, the revenue is only sufficient to cover fuel costs and equipment operation and maintenance costs, and they are far from being able to cover depreciation of facilities and interest on borrowings. This is thought to be because investment for electric power facilities in the Visayas has only been started, and as generating facilities which can cope most quickly with demand, diesel power plants were constructed and their completion times happened to coincide more or less with the Second Oil Crisis, as a result of which the sharp rises in fuel costs greatly increased generating costs, while the rises in generating costs have not been reflected in the electricity rates.

The Survey Team will study a financing plan for the Project and make a financial analysis, taking into overall account the fund requirements for the Project, the current electricity rates system, financing terms in the Philippines, lending conditions of international financing institutions, and the loan terms conceivable in case of government-to-government development aid.

10.2 Financing Plan

Investment by NAPOCOR in the Visayas for expansion of electric power facilities has only just begun, and the necessary investments for these facilities including the investment for Dingle Diesel Power Plant on Panay Island and Naga Diesel Power Plant on Cebu Island and their related power transmission and transforming facilities, as indicated in Table 9-1, will be as much as US$1,189.2 million at 1980 prices from 1976 to 1993. Of this amount, the foreign currency portion is estimated at US$824.7 million and the domestic currency portion at US$364.5 million.

The construction cost required for these projects, including escalation, is estimated to be a total of US$68,256,000 up to 1984, of which US$51,247,000 would comprise the foreign currency requirement, and US$17,009,000 the domestic currency requirement. The direct construction cost, indirect cost, escalation, and the total construction cost will be as follows:

Unit: 10^3 US$

	Foreign currency	Local currency	Total
Direct const. cost	36,297	9,357	45,654
Indirect const. cost	5,500	2,634	8,134
Escalation	9,450	5,018	14,468
Total const. cost	51,247	17,009	68,256

These projects consist of a power transmission and transforming scheme, and of the total investment of US$133.6 million for power transmission and transforming projects to be constructed in the Visayas during the 18-year period from 1976 to 1993 indicated in Table 9-1, it will take up 34% in terms of ratio of direct construction cost. This verifies the importance of these projects from the aspect of funding in the power transmission and transforming plan of the Visayas. (Of the total investment up to 1993, the proportion for power generating facilities will be large at 89%, but of the power generating facilities of the Visayas most of the 69kV transmission lines and power-receiving substations were built at the responsibilities of electric cooperatives. Consequently, this is the reason that the investment ratios for power generating facilities of NAPOCOR are high compared with the amounts of investment for transmission and transformation facilities.)

Of the total investment amounts up to 1993, 89% will be for power generating facilities, while these projects are necessary and indispensable for the effective utilization of power generating facilities of this region, and the nature of it is that of a major artery for power transportation. The power transmission facilities of these projects consist of overhead transmission lines and submarine cables, the service lives of these being long at 50 years. On the other hand, seen from the results of financial analyses, the net income of NAPOCOR in the Visayas will not be in the black until after 1985 when the three-island interconnection will have been completed. This is due chiefly to the fact that up to 1984 the generating cost will be

high because of the power generation structure of diesel being main.

When the nature of the Project is evaluated for the Visayas as a whole, it is thought necessary for application of a soft loan conceivable in case of government-to-government development aid for the Project which would fulfill the role of a trunk line for distribution of electric power for effective utilization of power generating facilities which will take up as much as 89% of the total investment amount.

10.3 Financial Analysis

NAPOCOR adopts the cost method of power system and sets electricity rates separately for each system. That is, electricity rates are determined separately for the three power systems of Luzon, Visayas and Mindanao. The Luzon and Mindanao power systems cover practically all of their respective islands with grids of 69 kV or higher, and therefore, electricity rates are the same throughout their respective power systems. On the other hand, the Visayas still does not have an interconnected grid and the present situation is that the islands of Panay and Cebu, being supplied only by diesel generating facilities, are of the same rates. The islands of Negros and Bohol have small-scale hydros, and taking this into consideration, the rates are the same for these two. For the islands of Leyte and Samar, there is only the pilot plant geothermal facility on Leyte with no other generating facility of NAPOCOR so that electricity rates have not been set.

NAPOCOR, because of the rises in prices of imported oil due to the Second Oil Crisis, revised its electricity rates from February 27, 1980, with rates increased 32.6% for Luzon Island, and 11.8% for the Visayas Region and Mindanao Island. The power generating facilities making up the Visayas Power System, even when Naga Coal-Fired Thermal Power Plant on Cebu Island is completed, will mainly consist of diesel generating facilities until around 1985 when geothermal power plants will begin to go into full-scale operation. To consider the fuel cost in case of diesel power generation, it actually would be necessary to raise the electricity rates of the Visayas about 20% more over the new rates. That this is not done may be from the consideration that the deficit of the Visayas Region is to be covered by NAPOCOR as a whole (resulting in the customers of Luzon and Mindanao bearing part of the generating costs in the Visayas).

As described above, in the financial analysis, evaluations will be made based on the cost of power generating facilities to be invested in the Visayas from 1976 to 1993 considering that from the electricity charge revenue of the Visayas as a whole, the cost will be correspondent to this revenue.

10.3.1 Preconditions

(1) Electricity Rate

It is thought that electricity rates will be made uniform by NAPOCOR when the Panay-Negros-Cebu interconnection and the Leyte-Samar interconnection have been completed, but at the present stage, it will be difficult to forecast the new rates, and the financial analysis will be made based on the electricity rates applicable from February 27, 1980, while for Leyte-Samar, the electricity rates at which Tongonan Geothermal Power Plant is presently selling electricity will be

used. These electricity rates are all for cases of NAPOCOR selling wholesale to electric utilities.

	P/kWh	US$/kWh	US$/MWh
Cebu & Panay Grids	0.443	0.0591	59.1
Negros & Bohol Grids	0.348	0.0464	46.4
Leyte & Samar Grids	0.300	0.0400	40.0

(2) Total Investment Amount for Electric Power Facilities

The electric power facilities of the Visayas, with the exception of Amlan Hydroelectric Power Plant (800 kW) on Negros and Loboc Hydroelectric Power Plant (1,200 kW) on Bohol which have existed for many years, are all power generating facilities which were completed in the last two or three years. Consequently, the Survey Team will make the financial analysis considering all of the power generation facilities, power transmission facilities and power transformation facilities comprising the electric power facilities expansion program from 1976 to 1993. In such case, the construction cost (direct construction cost) of the Project used will be that estimated for this Report, but for the Leyte-Samar Interconnected Power System, since financing from Japan has already been decided on, that construction cost will be used.

With regard to other construction costs, the figures used in the electric power expansion program formulated for the Visayas by NAPOCOR were used, and these figures are thought to be reasonable. These construction costs used in the financial analysis are all at 1980 prices, and escalations in construction costs expected from future inflation are not taken into consideration. In effect, the electricity charge revenue in return for the investment will be based on the prevailing electricity rate system, while the necessary investment amount is based on 1980 prices, and so an evaluation ignoring escalation in construction cost due to inflation will suffice. The investment requirements by year for power generating, transmitting and transforming facilities are indicated in Appendix A-4.

10.3.2 Method of Calculation

(1) Capital Cost

Of the total amount of investment from 1976 to 1993 the foreign currency portion will be US$824.7 million, of which 50% was considered to consist of government-to-government development aid loans and the remaining 50% loans from international financing institutions such as the World Bank, while regarding the domestic currency portion of US$364.5 million, all would be procured by NAPOCOR within the Philippines, and the following figures were obtained:

Foreign Currency Portion

Interest rate: 6% per annum

Repayment period: 25 yr (including 5 yr deferment)

Repayment method: Principal in equal installments

Domestic Currency Portion

Interest rate: 10% per annum

Repayment period: 13 yr (including 3 yr deferment)

Repayment method: Principal in equal installments

provided that the foreign currency portion is a composite of the following:

Government-to-Government Development Aid

Interest rate: 3.5% per annum

Repayment period: 25 yr (including 5 yr deferment)

Repayment method: Principal in equal installments

World Bank

Interest rate: 8.0% per annum

Commitment charge: 0.75% per annum

Repayment period: 20 yr (including 4.5 yr deferment)

Asian Development Bank

Interest rate: 8.7% per annum

Commitment charge: 0.75% per annum

Repayment period: 25 yr (including 5 yr deferment)

The investment requirements for the power generating facilities, power transmitting facilities and power transforming facilities programs indicated in Appendix A-4 were worked out by year, and further, interest amounts during construction for the period were calculated based on the above interest rates. With regard to repayment of principal, calculations were made based on repayment in equal installments from 5 years later in case of the foreign currency portion and 3 years later in case of the domestic currency portion in accordance with the funds invested each year.

(2) Operation and Maintenance Costs

Regarding annual operation and maintenance costs, calculations were made using the coefficients below for the direct construction costs of the various projects. These coefficients are recognized by electric utilities in most countries of the world and will include indirect costs (general administrative expenses, enterprise tax, insurance, etc.).

Generating Facilities		
Coal-fired	Direct Construction Cost	× 0.040
Diesel	"	× 0.030
Geothermal	"	× 0.030
Hydro	"	× 0.015
Transmitting Facilities		
Overhead line	"	× 0.025
Submarine cable	"	× 0.005
Transforming Facilities (incl. Telecommunications)	"	× 0.025

(3) Depreciation of Facilities

The facilities of all of the projects are to be depreciated by the straight line method, and calculations were made based on the service lives of various facilities set by NAPOCOR.

	Service Life
Generating Facilities	
Coal-fired	30 yr
Diesel	18 yr
Geothermal	20 yr
Hydro	50 yr
Transmitting Facilities	
Overhead line (steel tower)	50 yr
" (wooden pole)	30 yr
Submarine cable	50 yr
Transforming Facilities	
Transformer, etc.	25 yr

10.4 Results of Financial Analysis

The prevailing electricity rates are those resulting from revisions made after the Second Oil Crisis and effective as of February 27, 1980. If the funds invested in the Visayas are to be recovered based on the cost method, raises in electricity rates of 10% will need to be made in 1982 and 1984.

The net income shown in Table 10-2 predicated on such rate increases will turn to a surplus from 1985 when the three-island interconnection will have been completed, and in 1992, a surplus of US$77.6 million can be anticipated. As for

cash flow, although it will turn to black ink in 1984, the cumulative cash flow will not turn to a surplus until 1991.

As seen from the above, undertaking of the electric power facilities expansion program for the Visayas Region will be fairly severe on NAPOCOR, and it may be said that procurement of funds of low cost will be the linchpin in development of the electric utility industry in the region.

Table 10-1 Investment Schedule for Visayas Region

Unit : 10^6 US$

No.	Year	Generation projects			Transmission line projects			Transformation projects			Total		
		F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total	F.C.	L.C.	Total
1	1976	17.3	3.2	20.5	1.0	1.0	2.0	0.3	0.1	0.4	18.6	4.3	22.9
2	1977	9.5	3.3	12.8	1.8	2.3	4.1	1.2	0.6	1.8	12.5	6.2	18.7
3	1978	34.9	13.8	48.7	1.9	2.4	4.3	2.6	1.6	4.2	39.4	17.8	57.2
4	1979	42.3	15.6	57.9	3.3	3.7	7.0	3.3	1.6	4.9	48.9	20.9	69.8
5	1980	67.8	18.6	86.4	4.9	5.0	10.8	2.9	0.7	3.6	75.6	25.2	100.8
6	1981	60.9	21.8	82.7	5.6	6.1	11.7	1.8	0.7	2.5	68.3	28.6	96.9
7	1982	85.6	31.2	116.8	10.4	7.1	17.5	4.1	1.2	5.3	100.1	39.5	139.6
8	1983	66.3	32.9	99.2	13.9	4.9	18.8	2.0	0.7	2.7	82.2	38.5	120.7
9	1984	48.5	29.3	77.8	8.5	3.1	11.6	5.7	1.8	7.5	62.7	34.2	96.9
10	1985	40.6	27.1	67.7	1.0	1.4	2.4	0.5	0.1	0.6	42.1	28.6	70.7
11	1986	40.9	25.9	66.8	1.2	1.6	2.8	1.6	0.3	1.9	43.7	27.8	71.5
12	1987	18.9	10.7	29.6	0.7	1.0	1.7	0.3	0.1	0.4	19.9	11.8	31.7
13	1988	19.8	8.4	28.2	0.1	0.1	0.2	0.5	0.3	0.8	20.4	8.8	29.2
14	1989	43.0	16.3	59.3	0	0	0	1.4	0.7	2.1	44.4	17.0	61.4
15	1990	59.4	22.0	81.4	0	0	0	0	0	0	59.4	22.0	81.4
16	1991	60.6	23.2	83.8	0	0	0	0	0	0	60.6	23.2	83.8
17	1992	25.9	10.1	36.0	0	0	0	0	0	0	25.9	10.1	36.0
18	1993	0	0	0	0	0	0	0	0	0	0	0	0
	Total	742.2	313.4	1,055.6	54.3	40.6	94.9	28.2	10.5	38.7	824.7	364.5	1,189.2

Table 10-2 Statement of Income

		1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
(A) Energy sales																		
Cebu and Panay	GWh	0	114	135	221	770	972	1,106	1,194	1,293	1,398	1,506	1,622	1,742	1,868	1,972	2,084	2,202
Bohole and Negros	GWh	48	97	148	168	222	438	776	992	1,207	1,277	1,347	1,415	1,487	1,559	1,622	1,689	1,758
Leyte and Samar	GWh	3	3	5	7	10	15	120	240	575	596	690	786	881	1,048	1,145	1,247	1,281
Tariff rate per kWh																		
Cebu and Panay	US$/MWh	50.1	50.1	50.1	59.1	59.1	65.0	65.0	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5
Bohole and Negros	US$/MWh	39.3	39.3	39.3	46.4	46.4	51.0	51.0	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1
Leyte and Samar	US$/MWh	40.0	40.0	40.0	40.0	40.0	44.0	44.0	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4
Gross revenue																		
Cebu and Panay	10^6US$	0	5.7	6.8	13.1	45.5	63.2	71.9	85.4	92.4	100.0	107.7	116.0	124.6	133.6	141.0	149.0	157.4
Bohole and Negros	10^6US$	1.9	3.8	5.8	7.8	10.3	22.3	39.6	55.7	67.7	71.6	75.6	79.4	83.4	87.5	91.0	94.8	98.6
Leyte and Samar	10^6US$	0.1	0.1	0.2	0.3	0.4	0.7	5.3	11.6	27.8	28.8	33.4	38.0	42.6	50.7	55.4	60.4	62.0
Total	10^6US$	2.0	9.6	12.8	21.2	56.2	86.2	116.8	152.7	187.9	200.4	216.7	233.4	250.6	271.8	287.4	304.2	318.0
(B) Operating cost																		
Generation	10^6US$	0.7	0.7	2.0	2.0	6.9	6.9	10.1	14.6	16.9	19.2	20.5	23.5	23 5	23.8	26.4	28.3	33.2
Transmission	10^6US$	0	0.1	0.2	0.3	0.6	0.9	1.3	1.3	1.9	1.9	2.0	2.1	2.1	2.1	2.1	2.1	2.1
Transformation	10^6US$	0	0	0.1	0.2	0.4	0.4	0.6	0.6	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Fuel																		
Diesel	10^6US$	1.7	8.9	12.2	19.2	41.8	65.4	74.8	42.1	52.1	48.8	53.5	43.2	41.4	33.3	32 8	28.3	29.2
Coal	10^6US$	0	0	0	1.1	6.2	6.2	6.2	12.4	18.6	24.8	24.8	31.0	31.0	31.0	31.0	37.2	43.4
Geothermal	10^6US$	0	0	0.1	0.1	0.5	0.5	4.2	13.5	18.8	19.2	18.8	20.2	24.9	30.8	35.6	37.1	37.6
Depreciation	10^6US$	1.1	1.3	3.9	4.3	11.2	11.4	17.8	23.7	26.8	28.8	30.7	33.7	33.7	34.3	38.6	40.2	46.4
Total	10^6US$	3.5	11.0	18.5	27.2	67.6	91.7	115.0	108.2	135.9	143.5	151.2	154.6	157.5	156.3	167.5	174.2	192.9
(C) Operating income: (A) - (B)	10^6US$	-1.5	-1.4	-5.7	-6.0	-11.4	-5.5	1.8	44.5	52.0	56.9	65.5	78.8	93.1	115.5	119.9	130.0	125.1
(D) Financial expenses																		
Interest for F.C.	10^6US$	1.5	3.1	5.8	9.5	13.7	18.6	23.9	27.8	30.4	32.3	33.1	32.9	33.3	34.8	36.6	37.4	36.3
Interest for L.C.	10^6US$	0.7	1.9	3.8	6.2	8.5	11.4	14.5	17.2	19.0	19.8	19.7	18.2	17.0	16.2	16.0	15.0	13.0
(E) Net income: (C) - (D)	10^6US$	-3.7	-6.4	-15.3	-21.7	-33.6	-35.5	-36.6	-0.5	2.6	4.8	12.7	27.7	42.8	64.5	67.3	77.6	75.8

Table 10-3 Amortization Schedule

No.	Year	Borrowing	Foreing currency redemption			Borrowing	Local currency redemption			Borrowing	Total redemption		
		Investment (10^6US$)	Principal (10^6US$)	Interest (10^6US$)	Total (10^6US$)	Investment (10^6US$)	Principal (10^6US$)	Interest (10^6US$)	Total (10^6US$)	Investment (10^6US$)	Principal (10^6US$)	Interest (10^6US$)	Total (10^6US$)
1	1976	18.6		0.6	0.6	4.3		0.2	0.2	22.9		0.8	0.8
2	1977	12.5		1.5	1.5	6.2		0.7	0.7	18.7		2.2	2.2
3	1978	39.4		3.1	3.1	17.8		1.9	1.9	57.2		5.0	5.0
4	1979	48.9		5.8	5.8	20.9	0.4	3.8	4.2	69.8	0.4	9.6	10.0
5	1980	75.6		9.5	9.5	25.2	1.0	6.2	7.2	100.8	1.0	15.7	16.7
6	1981	68.3	0.9	13.7	14.6	28.6	2.8	8.5	11.3	96.9	3.7	22.2	25.9
7	1982	100.1	1.5	18.6	20.1	39.5	4.9	11.4	16.3	139.6	6.4	30.0	36.4
8	1983	82.2	3.5	23.9	27.4	38.5	7.4	14.5	21.9	120.7	10.9	38.4	49.3
9	1984	62.7	5.9	27.8	33.7	34.2	10.3	17.2	27.5	96.9	16.2	45.0	61.2
10	1985	42.1	9.7	30.4	40.1	28.6	14.3	19.0	33.3	70.7	24.0	49.4	73.4
11	1986	43.7	13.1	32.3	45.4	27.8	18.2	19.8	38.0	71.5	31.3	52.1	83.4
12	1987	19.9	18.1	33.1	51.2	11.8	21.6	19.7	41.3	31.7	39.7	52.8	92.5
13	1988	20.4	22.2	32.9	55.1	8.8	24.5	18.2	42.7	29.2	46.7	51.1	97.8
14	1989	44.4	25.3	33.3	58.6	17.0	27.2	17.0	44.2	61.4	52.5	50.3	102.8
15	1990	59.4	27.4	34.8	62.2	22.0	27.5	16.2	43.7	81.4	54.9	51.0	105.9
16	1991	60.6	29.6	36.6	66.2	23.2	26.5	16.0	42.5	83.8	56.1	52.6	108.7
17	1992	25.9	30.6	37.4	68.0	10.1	26.2	15.0	41.2	36.0	56.8	52.4	109.2
18	1993	0	31.6	36.3	67.9	0	25.7	13.0	38.7	0	57.3	49.3	106.6
	Total	824.7	219.4	411.6	631.0	364.5	238.5	218.3	456.8	1,189.2	457.9	629.9	1,087.8

Table 10-4 Statement of Cash Flow

Unit : 10^6US$

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
(A) Cash receipt	16.1	52.1	58.4	83.4	74.5	115.5	101.9	120.1	100.1	105.1	75.1	90.6	137.9	180.2	189.7	153.8	122.2
1) Net income	-3.7	-6.4	-15.3	-21.7	-33.6	-35.5	-36.6	-0.5	2.6	4.8	12.7	27.7	42.8	64.5	67.3	77.6	75.8
2) Depreciation	1.1	1.3	3.9	4.3	11.2	11.4	17.8	23.7	26.8	28.8	30.7	33.7	33.7	34.3	38.6	40.2	46.4
3) Borrowing																	
Foreign currency	12.5	39.4	48.9	75.6	68.3	100.1	82.2	62.7	42.1	43.7	19.9	20.4	44.4	59.4	60.6	25.9	0
Local currency	6.2	17.8	20.9	25.2	28.6	39.5	38.5	34.2	28.6	27.8	11.8	8.8	17.0	22.0	23.2	10.1	0
(B) Cash disbursement	18.7	57.2	70.2	101.8	100.6	146.0	131.6	113.1	94.7	102.8	71.4	75.9	113.9	136.3	139.9	92.8	57.3
1) Construction expenditure (Investment)	18.7	57.2	69.8	100.8	96.9	139.6	120.7	96.9	70.7	71.5	31.7	29.2	61.4	81.4	83.8	36.0	0
2) Repayment of debit																	
Principal of foreign credit					0.9	1.5	3.5	5.9	9.7	13.1	18.1	22.2	25.3	27.4	29.6	30.6	31.6
Principal of governmental credit			0 4	1.0	2.8	4.9	7.4	10.3	14.3	18.2	21.6	24.5	27.2	27.5	26.5	26 2	25.7
(C) Cash balance : (A) - (B)	-2.6	-5.1	-11.8	-18.4	-26.1	-30.5	-29.7	7 0	5.4	2.3	3.7	14.7	24.0	43.9	49.8	61.0	64.9
(D) Accumulated total	-2.6	-7.7	-19.5	-37.9	-64.0	-94.5	-124.2	-117.2	-111.8	-109.5	-105.8	-91.1	-67.1	-23.2	26.6	87.6	152.5

JICA