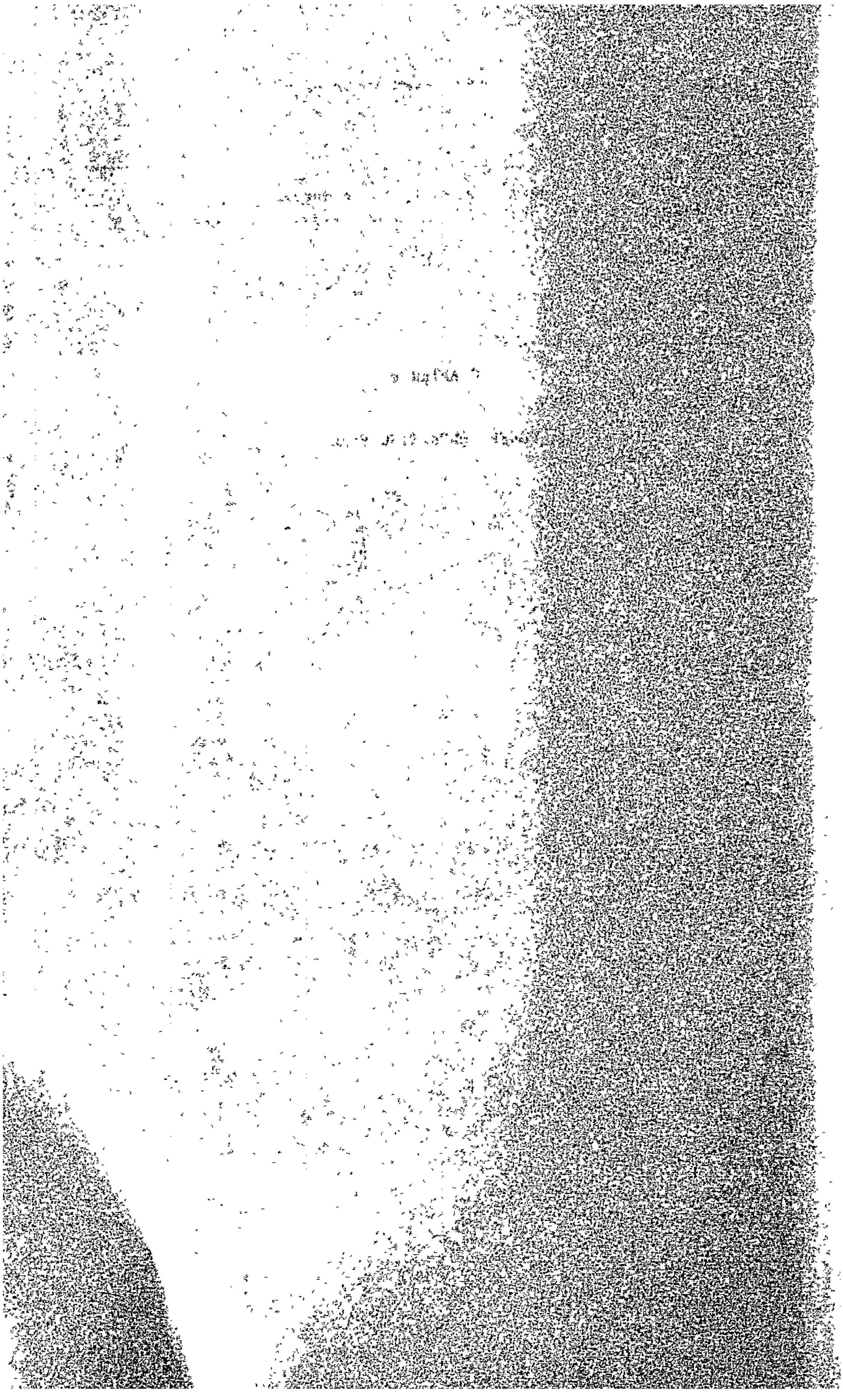
CHAPTER 6

POWER GENERATING PLAN



CHAPTER 6 POWER GENERATING PLAN

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6.1 Determination of Installed Capacity for Huanzala Hydro-Electric Power Station

The maximum power demand combining power for the mine purpose and for public use in Huallanca and La Union in 2006, the twentieth year after start of operation of the hydro-electric power station will be 5,600 kW and the average power demand be 3,600 kW. If the runoff and hydraulic head at the power station site are adequate, it would suffice to construct a power station of installed capacity of 5,600 kW for the said demand. This site has adequate runoff in the high-water season, but the runoff is small during 3 to 4 months of the low-water season. At the time of minimum runoff, there will be a power generating capability of only 1,600 kW. Consequently, in order to meet all of the demand a combination operation with the hydro-electric power station and the diesel plants would be required.

(1) Since a large head is available at the power station site, power discharge of 2 or 3 cu.m/sec only is allowed for the required capacity. Therefore the site is characterized by that the civil works will not be greatly changed in its cost if the power discharge increases or decreases.

(2) The Project will be more economical when the operation of the existing diesel plants can be made as short as possible because fuel cost will become higher and higher in future.

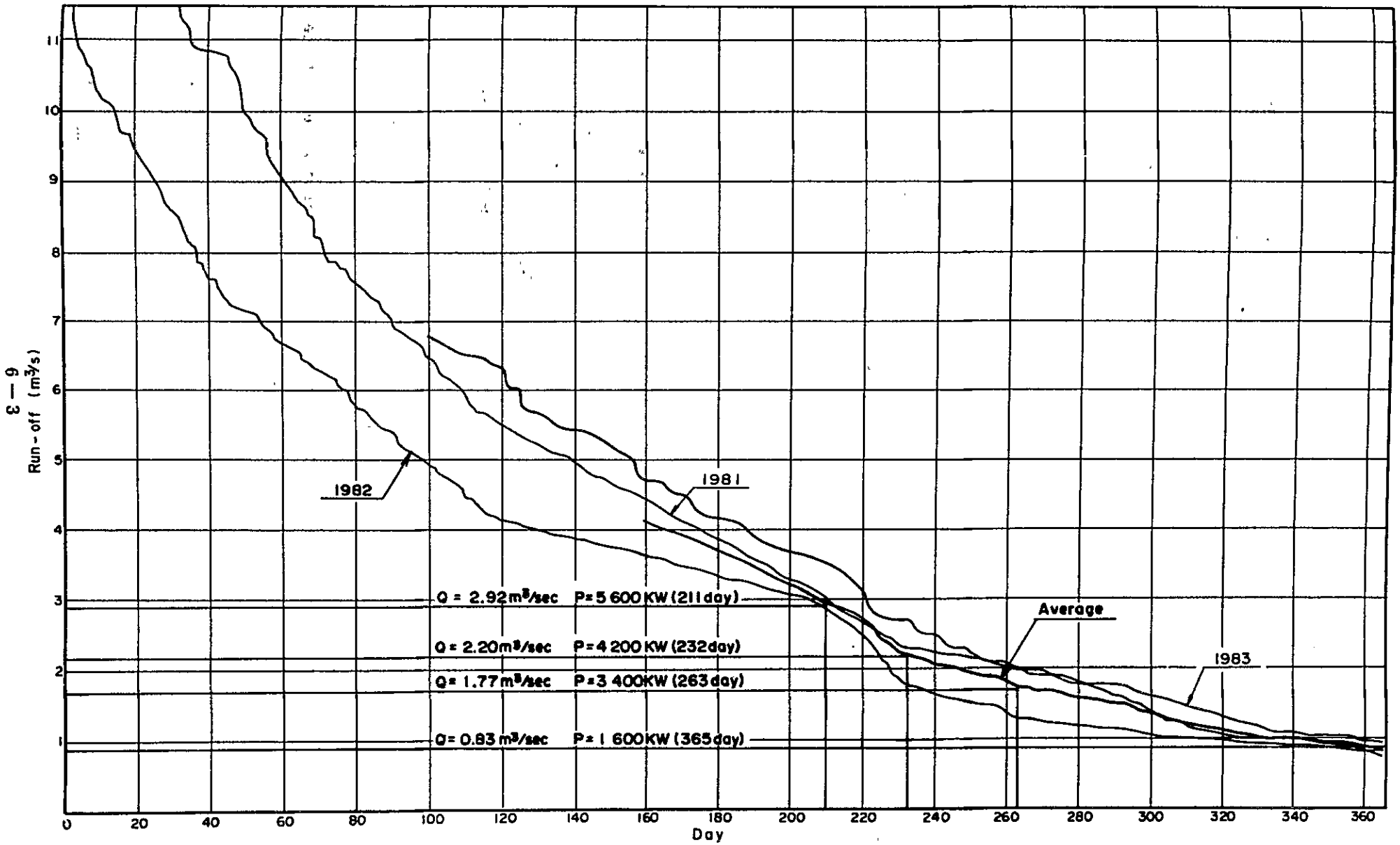
(3) It will be economical to build a hydropower station with approximately 5,000 kW so that the diesel plants are not necessary to operate for a period of 8 - 9 months during the high water seasons in at least 10 years after the completion of the proposed power station.

However, since the wishes of Santa Luisa are that in order to hold the investment amount to a minimum, the scale is to be the necessary minimum, and it would even be considered to adjust production of the mine

to match the capacity of the power station depending on the case, the installed capacity is designed to be 4,200 kW which will not be less than the capacity of the existing diesel generating facilities. Any shortage is to be filled by firing of diesel.

As for the existing diesel generating facilities, it will become a supplementary facility after completion of the Huanzala hydro power station. Renewal of the diesel units should be made so that the total generating capacity with the hydro station and the diesel plants in the lowest-water period can meet the estimated demand (kW).

Fig. 6-1-1 Flow-duration Curve of Rio San Juan



6.2 Renewal Plan for Diesel Power Plant

The facilities of the present diesel power plant will be used by renewing equipment in step with the increase in demand. The basic conditions for this equipment renewal are as follows:

(1) The existing diesel plants consist of 11 units totalling 4,050 kW, the service lives of the individual units are as illustrated in Fig. 6-2-1.

(2) The service life of a diesel generator is generally 15 years. But taking into account the circumstances at Huanzala it is considered as being 20 years in the Project study.

(3) A diesel plant requires overhauling and periodic inspection at 8,000 hr and 24,000 hr of operation. In case the hydro power station is not constructed (the final capacity of diesel plants of 5,670 kW for mine's purpose), since the entire demand meets with diesel power generation, there will be one reserve unit considered for overhauling. In the other cases, the rate of operation of diesel will be greatly lowered during the high-water season, and it will be possible for overhauling to be done during this time so that reserve units are not considered.

(4) From the standpoint of maintenance and operation, it is desirable for diesel plants to have large unit capacities minimizing the number of units running parallel as much as possible. In the case of the Project, replacements are to be made with diesel plant of 1,400-ps (output at high elevation 630 kW).

(5) It is assumed that the residual value of a diesel generator will be offset by its dismantling cost.

The renewal schedule of diesel plants are considered in accordance with the above conditions. (Fig. 5-4-1)

Fig. 6-2-1 Durable Years of Existing Diesel Plant of Huanzala Mine

Diesel Plant	power kW \ year	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5
N – 1 (Niigata)	450																							
N – 2 〃	450																							
N – 3 〃	450																							
C – 1 (Cat.)	300																							
C – 2 〃	300																							
C – 3 〃	350																							
C – 4 〃	350																							
C – 5 〃	350																							
C – 6 〃	350																							
C – 7 〃	350																							
C – 8 〃	350																							
Total 11 units	4050																							

durable years (15 years)
span of life (15+5=20 years)

6.3 Outline of Hydro-electric Power Generation Project

The installed capacity of the hydro-electric power station to be constructed in this Project is 4,200 kW. Santa Luisa, with the aim of constructing a hydro-electric power station, has from several years ago been carrying out investigations in advance on runoff, topography, geology, etc.

The project site is at Huallanca 10 km away from Huanzala Mine, and structures of intake, headrace penstock and powerhouse will be constructed at the right-bank side of the Rio San Juan. The intake is to be at a point approximately 6 km upstream of Huallanca. There is no alternative site to this point which is immediately upstream of Pte. Arequipa. Regarding the powerhouse site, as described in the following section, the three alternatives of A (upstream site), B (midstream site), and C (downstream site) were selected, and comparison studies were made.

6.4 Comparisons of Powerhouse Sites

With regard to the powerhouse site, comparison study was made of the alternatives A, B, and C as below.

Alternative A: Since this site is located the most upstream of the three, the head is the lowest, with the powerhouse to be provided immediately upstream of the intake of the existing Huallanca Power Station. There is a fault running parallel to the penstock, and in addition, the topography and geology of the powerhouse site are adverse. Construction of an access road to the powerhouse is difficult, and the construction itself is also difficult at the site. Since there is no adverse effect at all on the existing power station, in the event the consent of Electro-Peru cannot be obtained regarding Alternatives B and C, this alternative will necessarily be adopted.

Alternative B: This site is located between the sites of Alternatives A and C. The powerhouse would be provided at the upstream edge of Huallanca, at the opposite bank from the existing power station. The

topography of the penstock route is very good. A bridge at the center of the village was washed away in a flood in 1981. As may be seen in the photograph, the revetments at both banks are presently washed away. Work to restore the bridge is now going on.

Alternative C: This site is the most downstream and the powerhouse would be provided at the downstream edge of Huallanca. The headrace and penstock will both be the longest of three alternatives.

The field conditions were carefully reconnaissanced with regard to the above-mentioned three alternatives, and as a result of studies, it was decided to adopt Alternative B for the reasons given below.

(a) Even if the construction cost of revetments of Rio San Juan is taken into account, the construction cost will be the lowest of the three alternatives. The revetment work will contribute to the growth of the town.

(b) ElectroPeru desires to abandon the existing power station (156 kW) upon completion of the proposed power station.

(c) The topographies and geologies of the penstock and powerhouse sites are the most favorable, and accessibility is good.

(d) There is comparatively little land being used for agriculture and grazing. It is thought acquisition of land will be easy for the Project.

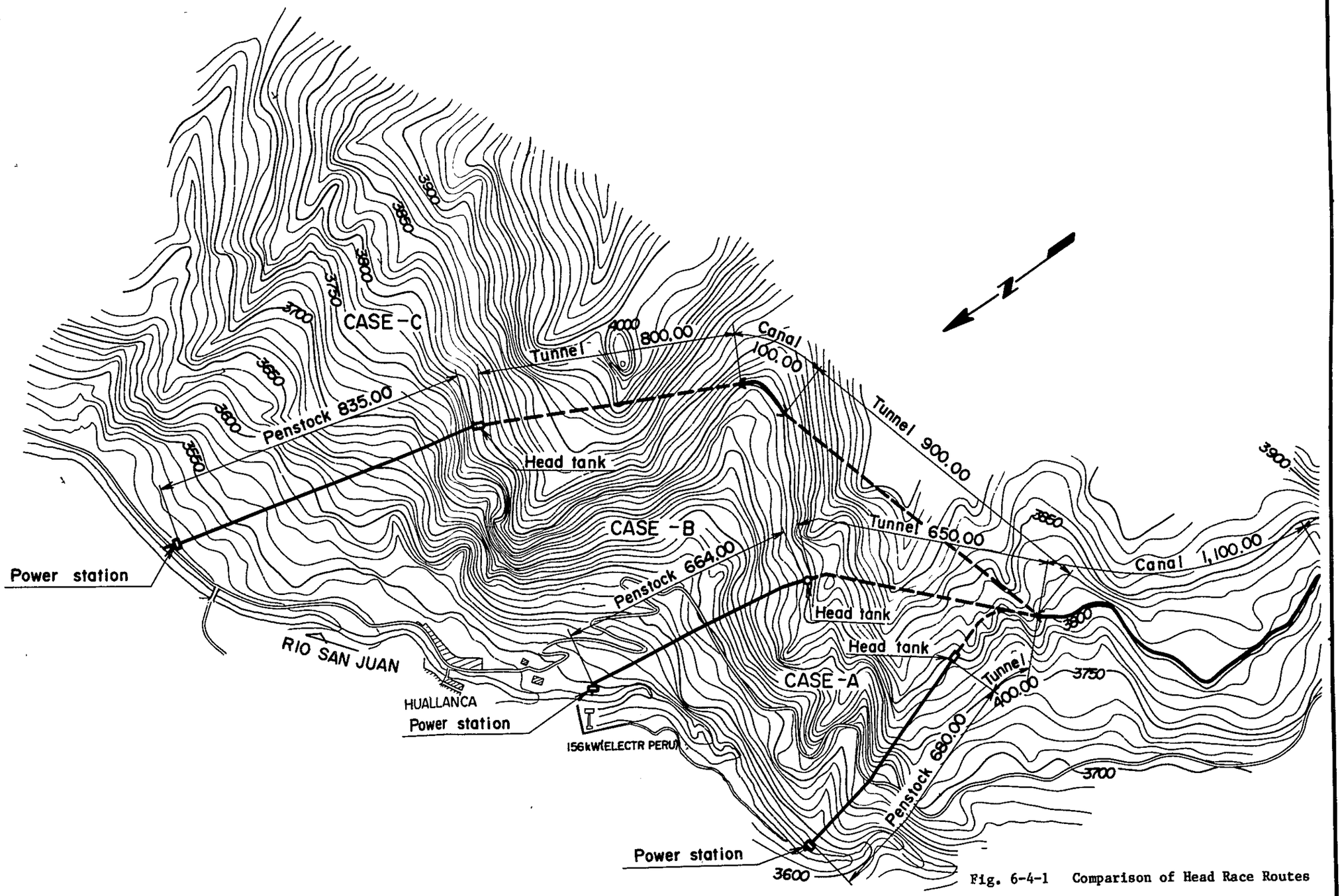
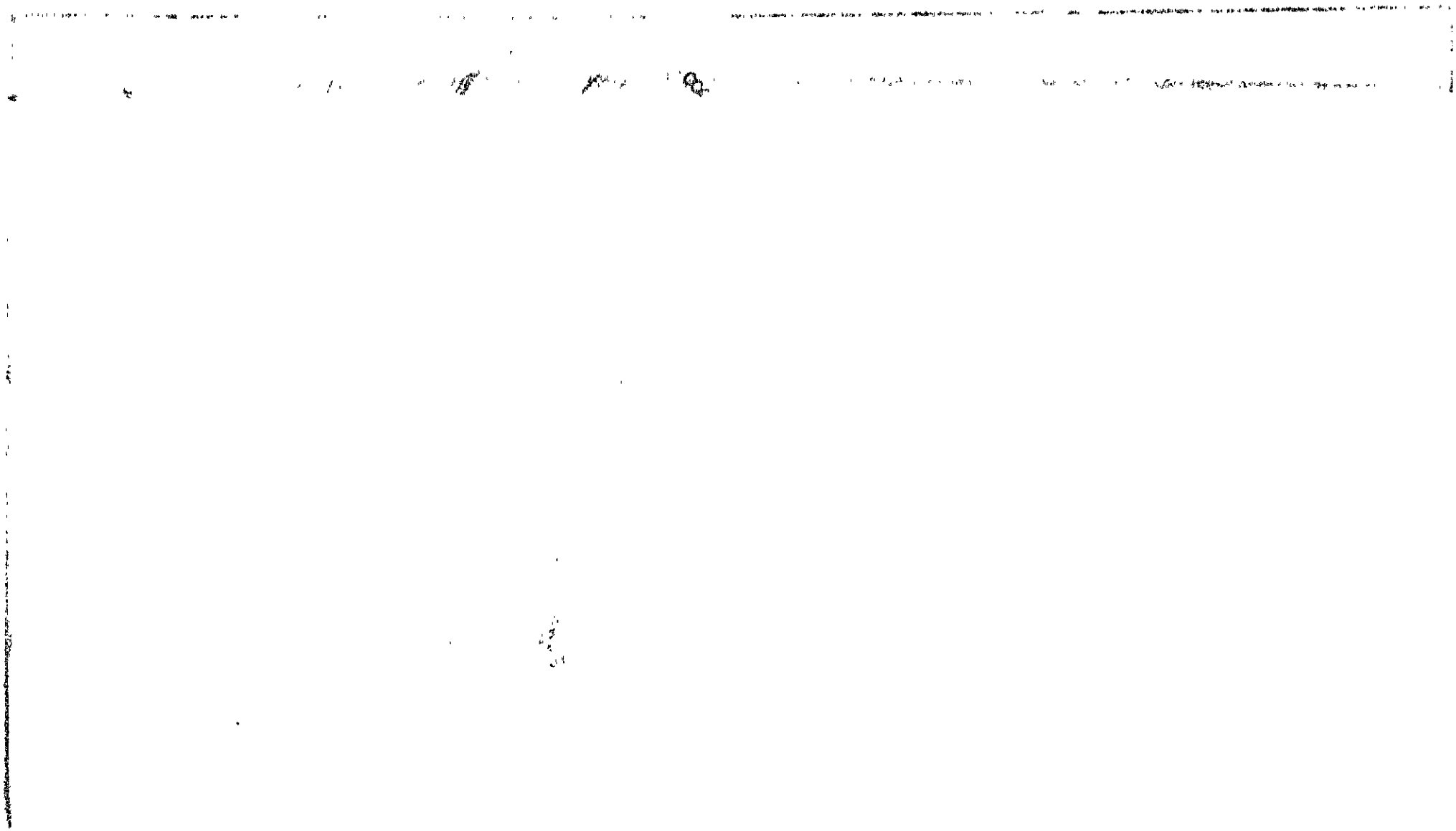


Fig. 6-4-1 Comparison of Head Race Routes



6.5 Case of Constructing Hydro-electric Power Station for Mining (Installed Capacity 3,400 kW, No Supply for Public Use)

The another case ia also assumed in addition to the one described in the previous section for the study on economic evaluation of the Project. That is, a hydro-electric power station will be of 3,400 kW deducting 800 kW for public use from the installed capacity of 4,200 kW of the proposed hydro power station to be built by the Project

In this case, a combination operation with the diesel power plants will be required in step with the increasing of the motive power demand of the Mine.

Fig. 6-5-1 Hydro-electric Power Station Exclusively for Mine (3,400 kW)

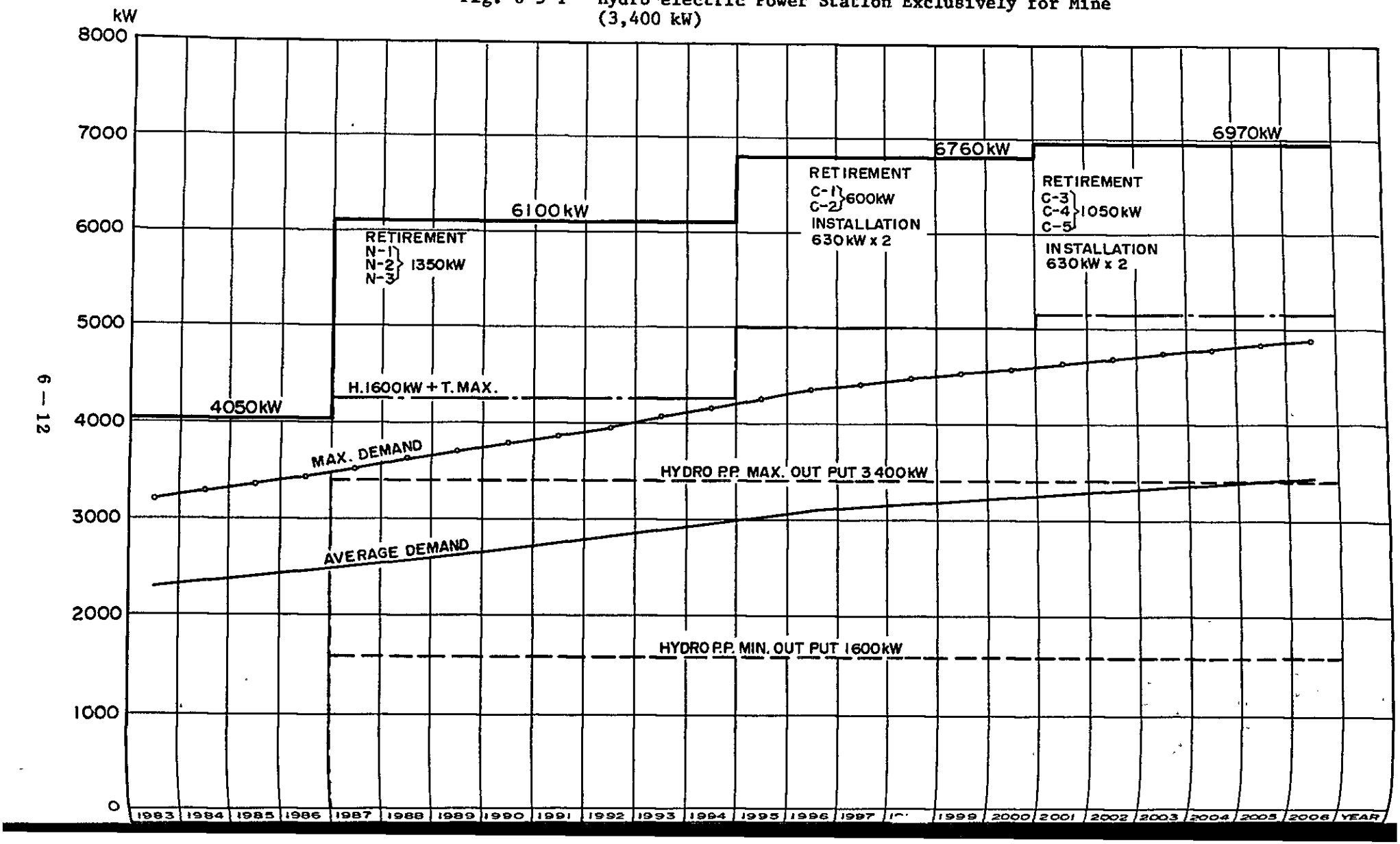


Table 6-5-1 Energy Balance of Huanzala Power System
[CASE-III 3,400 kW Hydro P.P.]

Year	Max. Power Demand (kW)	Average Demand (kW)	Energy Demand (MWh)	Supply by Diesel P.P. Wet Season (MWh)	Dry Season (MWh)	Total (MWh)	Supply by Hydro P.P. (MWh)	Notes
1983	3,200	2,281	20,000					
1984	3,267	2,337	20,475					
1985	3,354	2,394	20,962					
1986	3,434	2,450	21,463					
1987	3,516	2,509	21,977	16	780	796	21,181	Commission-ing of
1988	3,601	2,569	22,503	49	872	921	21,582	
1989	3,687	2,631	23,045	100	969	1,069	21,976	Hydro P.P.
1990	3,777	2,694	23,601	172	1,072	1,244	22,357	
1991	3,868	2,759	24,171	265	1,179	1,444	22,727	
1992	3,961	2,826	24,757	380	1,293	1,673	23,084	
1993	4,057	2,895	25,359	522	1,414	1,936	23,423	
1994	4,157	2,966	25,978	693	1,543	2,236	23,742	
1995	4,258	3,038	26,613	890	1,684	2,574	24,039	
1996	4,362	3,112	27,265	1,119	1,839	2,958	24,307	10th year
1997	4,402	3,141	27,515	1,214	1,899	3,113	24,402	
1998	4,443	3,171	27,775	1,315	1,964	3,279	24,496	
1999	4,487	3,201	28,045	1,428	2,031	3,457	24,586	
2000	4,532	3,234	28,326	1,549	2,103	3,652	24,674	
2001	4,578	3,267	28,618	1,677	2,179	3,856	24,762	
2002	4,627	3,302	28,922	1,820	2,261	4,081	24,841	
2003	4,678	3,338	29,238	1,974	2,346	4,320	24,918	
2004	4,730	3,375	29,566	2,138	2,436	4,574	24,992	
2005	4,785	3,414	29,908	2,319	2,532	4,851	25,057	
2006	4,842	3,455	30,264	2,514	2,633	5,147	25,117	20th year
Total	-	-	533,446	22,154	35,029	57,182	476,263	
Average	-	-	26,672	1,108	1,751	2,859	23,813	

Year	Population (est.)	Housing Units	Persons per Household	Vacancy Rate (%)
1984	3,260	2,291	2.84	5.1
1985	3,287	2,312	2.84	5.0
1986	3,354	2,358	2.84	4.9
1987	3,452	2,429	2.84	4.8
1988	3,516	2,474	2.84	4.7
1989	3,601	2,534	2.84	4.6
1990	3,697	2,601	2.84	4.5
1991	3,772	2,654	2.84	4.4
1992	3,858	2,715	2.84	4.3
1993	3,951	2,780	2.84	4.2
1994	4,057	2,854	2.84	4.1
1995	4,152	2,921	2.84	4.0
1996	4,259	2,996	2.84	3.9
1997	4,362	3,069	2.84	3.8
1998	4,463	3,140	2.84	3.7
1999	4,587	3,227	2.84	3.6
2000	4,732	3,329	2.84	3.5
2001	4,878	3,432	2.84	3.4
2002	4,977	3,502	2.84	3.3
2003	5,094	3,584	2.84	3.2
2004	5,210	3,666	2.84	3.1
2005	5,325	3,747	2.84	3.0
Total				

CHAPTER 7

PRELIMINARY DESIGN AND CONSTRUCTION COST

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1. General

River :

Catchment area :

2. Power Generation

Intake pond level : m

Head tank water level : m

Centre of turbine : m

Normal head : m

Effective head : m

Maximum discharge : m³/sec/unit

Output : MW

Annual energy generation : GWh + GWh

3. Intake Weir

Type : Concrete gravity

Crest elevation : m

Overflow length : m

Height : m

CHAPTER 7 PRELIMINARY DESIGN

7.1 Features of Power Station

The design features of the power station to be constructed (called Huanzala Hydro-electric Power Station) are as shown in Table 7-1-1.

Table 7-1-1 Project Feature

1. General

River	;	Rio San Juan
Catchment area	;	153.7 km^2

2. Power Generation

Intake water level	;	3802.5 m
Head tank water level	;	3796.5 m
Center of turbine	;	3547.3 m
Normal head	;	249.2 m
Effective head	;	242.0 m
Maximum discharge	;	2.2 cu.m/sec
Output	;	4200.0 kW
Annual energy production	;	32187 x 10^3 kWh

3. Intake Dam

Type	;	Concrete gravity
Crest elevation	;	3802.5 m
Overflow length	;	15.0 m
Height	;	3.5 m

4. Sedimentation Basin

Width	;	3.5 m
Length	;	40.0 m
Height	;	1.7 ∿ 3.5 m

5. Head Race

(1) Canal

Type	;	Trapezoidal stone pitching (Type I), concrete rectangular (Type II) or concrete culvert (Type III)
Length	;	3000 m
Width × height	;	Type I : 1.2 × 1.8 (1:0.3) m Type II : 1.2 × 1.8 m Type III: 1.2 × 1.7 m
Slope	;	1:1000

(2) Tunnel

Type	;	Lined (Type II) or unlined (Type I) top-round, bottom-rectangular type
Length	;	1650 m
Width × height	;	Type I : 2.0 × 2.3 m Type II : 1.6 × 2.1 m
Slope	;	1:1000

6. Head Tank

Type	;	Cylindrical type
Diameter	;	9.0 m
Height	;	5.5 m

7. Penstock

Type	;	All welded steel pipe, exposed type
Length	;	664.0 m

Diameter ; 1.10 m 0.55 m

8. Powerhouse

Type ; Surface type

Length width height ; 23.0 m 10.0 m 8.3 m

9. Electrical Equipment

Installed Capacity ; 4,200 kW

Turbine

Type ; Horizontal shaft 1-runner, 2-nozzles, pelton turbine

Number of Unit ; 1

Effective Head ; 242.0 m

Maximum Discharge ; 2.2 cu.m/sec

Revolving Speed ; 450 r.p.m.

Generator

Type ; Horizontal shaft 3-phase, alternating current synchronous generator

Number of Unit ; 1

Output ; 5,200 kVA

Voltage ; 6.6 kV

Power Factor ; 0.82 (lagging)

Frequency ; 60 Hz

Main Transformer

Type ; Outdoor, 3-phase, oil immersed transformer

Number of Unit ; 1

Capacity ; 5,200 kVA

Voltage ; 6.6/33 5% kV

10. Transmission Line

Number of Circuit	;	1
Conductors	;	A.C.S.R. 120 mm^2
Insulators	;	250 mm suspension type, 4 for 1 string
Ground Wire	;	38 mm^2 GSC, 1 line
Support	;	Concrete poles
Voltage	;	33 kV
Length	;	10 km

11. Huanzala Mining Side Substation

Transformer

Type	;	Outdoor, 3-phase, oil immersed transformer
Number of Unit	;	1
Capacity	;	5,200 kVA
Voltage	;	33 ± 5%/2.2 kV

7.2 Construction Cost

The construction cost of the 4,200-kW hydro-electric power station to be built in this Project and that of a hydro-electric power station (3,400 kW) which would be for exclusive use of the mine are shown in Table 7-2-1. The difference in these construction costs is the additional construction cost required for supplying electric power for public use.

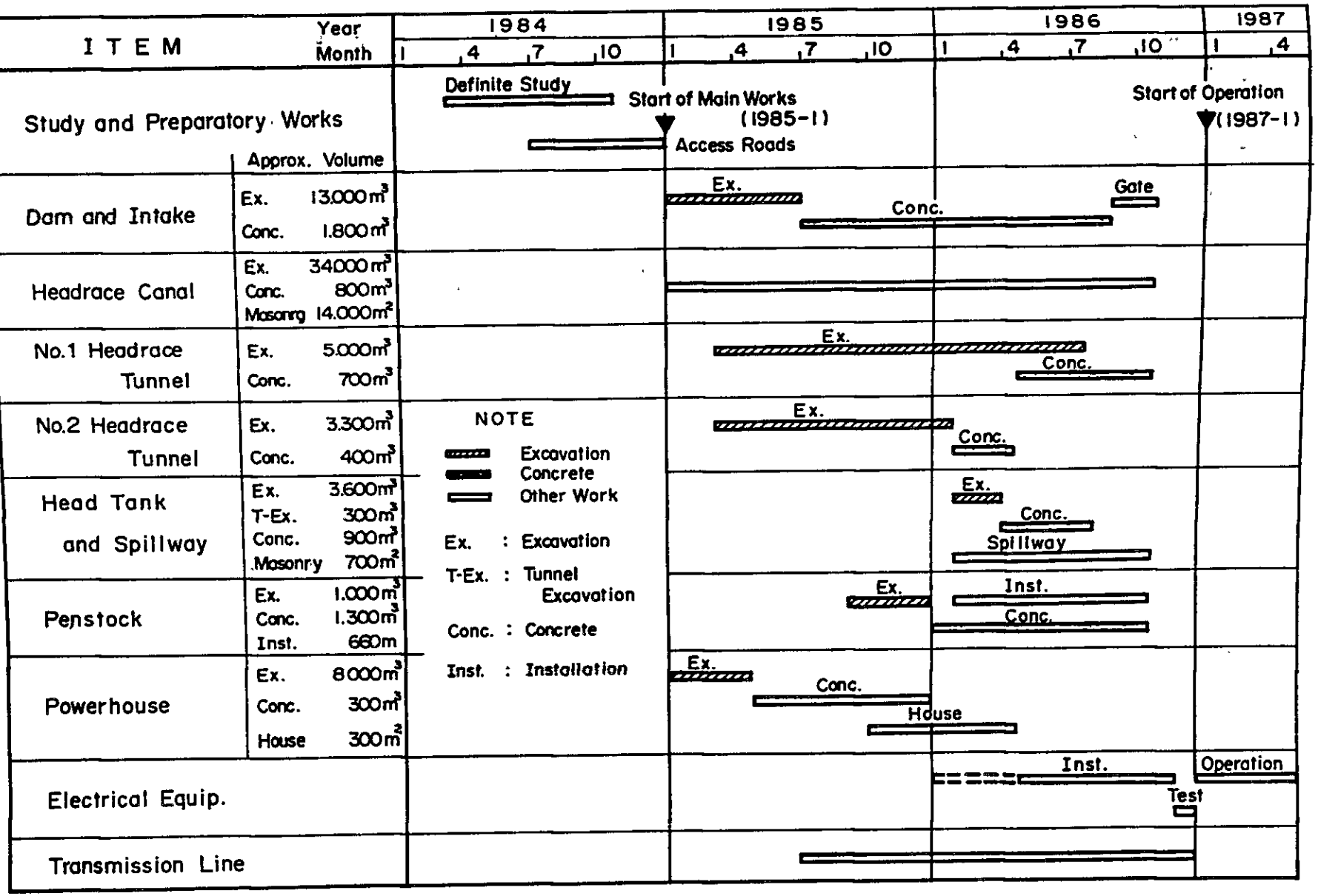
Table 7-2-1 Construction Cost

	US10^3
Civil works	
Intake dam	578
Headrace canal	1,057
Headrace tunnel	1,765
Head tank & spillway	517
Penstock	1,040
Power station	504
Reveting & road	557
Sub-total	6,018
Electric works	
Turbine & generator	4,000
Hanzala substation	287
Transmission line	417
Sub-total	4,704
Other works	
Compensation cost	304
Engineering fee	1,218
Administration cost	435
Contingency	304
Sub-total	2,261
Interest during Construction	585
Grand Total	13,565

7.3 Construction Schedule

The construction schedule was prepared taking into consideration the desire of Santa Luisa to start detail design and preparation works immediately upon the JICA loan becoming definite. In essence, assuming that the JICA loan is decided in the first half of 1984, preparatory works and detail design would be done in parallel during the latter half. The start of the main work would be in January 1985 and the commissioning in January 1987 for a construction time required of 2 years.

Fig. 7-3-1 Construction Schedule for Huanzala Hydro-power Project



7.4 Technical Issues for Consideration at Detail Design Stage

The Feasibility Study will be of higher degree of accuracy than an ordinary one because 1/500 topographical maps are available. Consequently, drastic changes in design will not be required at the stage of detail design. However, careful examinations will be needed at that stage regarding the following issues.

(a) With regard to the accuracies of the 1/5,000 and 1/500 topographical maps that Santa Luisa had prepared, rechecks collating with actual topography will be required at the detail design stage.

(b) Since this is a run-of-river power station, the head tank must play an important role at all times because of load adjustments. It will be necessary for a reexamination concerning spillway route.

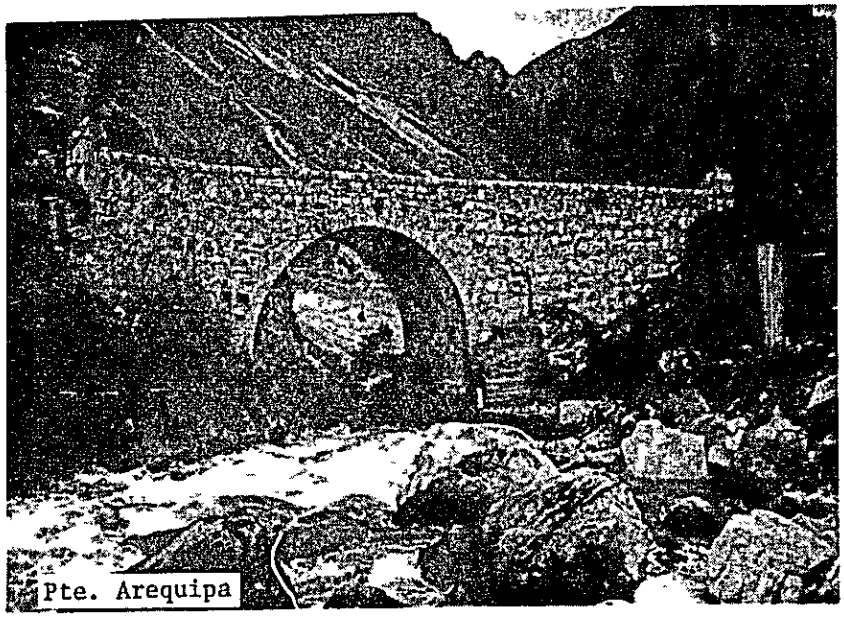
(c) At the present stage, the penstock is designed to be of welded-joint steel pipes. Since the geology of the foundation consists of a sand-grael layer, it is advisable to make comparison of studies of the cases of adopting mechanically-jointed steel pipe and glass fiber pipe presently being developed in Japan in order to increase the degree of safety.

(d) It is necessary for discussions regarding the disposition of the existing power station of ElectroPeru and the method of supplying electric power for public use.

(e) It will be necessary for discussions with the town authorities regarding the necessity for revetment works downstream of the power station.

7.5 Matters for Future Study

At Huanzala Power Station, contrasted to the maximum power discharge of 2.2 cu.m/sec, the discharge at extreme low water will be greatly reduced to approximately 0.8 cu.m/sec. If it were possible to supplement the discharge required for generation in the low-water season, it would be possible for fuel to be further conserved since the operation of the diesel power station would be greatly reduced. Therefore, it is thought to be of significance to study the idea of utilizing water resources of upstream lakes in the future for supplementation in the low-water season.



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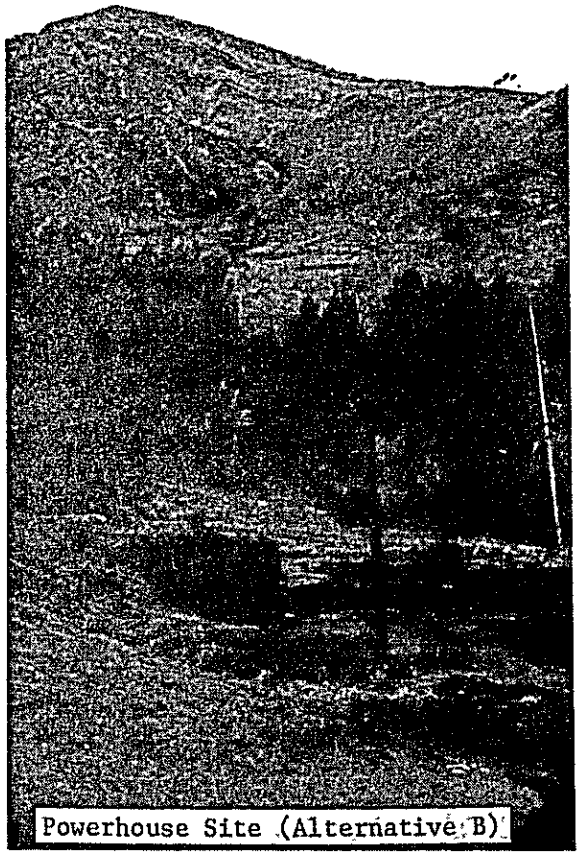

Powerhouse Site (Alternative B)

CHAPTER 8

FINANCIAL ANALYSIS

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8.1 Conception of Financial Analysis

Performing a financial analysis of a project begins with estimating revenue and expenditures of the project. If it is an ordinary hydro-electric project, the revenue would be calculated based on sales of electric power, while expenditures would be expenses required for investment, and maintenance and operation. However, the Huanzala Hydro-electric Project has a character which differs from that of an ordinary electric power project. An approach differing from that of an ordinary case will be necessary regarding the method of measuring revenue and expenditures.

To elaborate, this Project will supply a part of the power generated to neighboring communities through ElectroPeru, but the greater part of the electric energy will be consumed privately within Huanzala Mine. With regard to the former, the electricity revenue from the public use can be considered as revenue of the Project, with respect to the latter, the revenue cannot be grasped in the form of electricity revenue. The reason is that the hydro-electric power station is what might be said to be one of the various cost items in the mining activity of Huanzala Mine, and there is no such thing as electric energy sales.

Under such circumstances, it is thought reasonable to consider as follows with regard to the benefit brought about by Huanzala Hydro-electric Power Station (installed capacity of 4,200 kW for mining and for public use) to be constructed under the program for the infrastructure of Huanzala Mine. It is to be noted that the same fundamental thinking applies to the economic analysis in this Report.

(a) With regard to the electric energy supplied for public use, the revenue from energy sales to consumers is considered as benefit.

(b) With regard to electric energy used within the mine, that is, privately consumed electric energy, the increase in profit of

the mine due to construction of the hydro-electric power station over the case of not constructing the hydro-electric power station and using only diesel power generation as the source of motive power is considered as the benefit brought about by the hydro-electric power station. In other words, the various expenses which were saved by constructing the hydro-electric power station (with Project) compared with the case of not constructing (without Project) may be considered as the benefit.

(c) Meanwhile, the investment cost contrasted to the benefit of this Project does not consist of the amount invested in construction of the hydro-electric power station, but consist of the differences in the amounts invested in the two cases below.

- Case of Constructing a Hydro-electric Power Station having an Installed Capacity of 4,200 kW with the Purpose of Supplying Electric Power for Mining and Public Use ... In this case, there will be a period when supply capability of hydro will be insufficient, and supplemental power generation is to be done with the existing and renewed diesel generating facilities.

- Case of Not Constructing a Hydro-electric Power Station having the Above Purpose ... In this case, diesel generating facilities are increased in step with the increase in demand for motive power exclusively for use by the mine and the ultimate diesel capacity will be 5,670 kW.

The above is the most fundamental conception for performing financial and economic analyses. In the actual calculation processes of financial and economic analyses, firstly, the 20-year cash flows of Santa Luisa as a whole are respectively estimated for the cases of constructing (with Project) and not constructing (without Project) the hydro-electric power station. Next, after estimating the amounts of costs and benefit of the Project according to the conceptions of (a), (b) and (c), the profitability is studied based on the benefit and cost thus calculated.

In relation to analysis of profitability, there are the financial internal rate of return method (IRR Method), benefit-cost ratio method (B/C Ratio Method) and present value method (NPV Method). The IRR Method will be adopted from among these in analysis of the Project. The reason for this is that the main purpose of this Report is to study whether or not the Huanzala Hydro-electric Project is appropriate as an object of financing by JICA. In case of the FIRR Method, it is possible for the profitability of the Project to be expressed in terms of percentages so that it will be convenient for judging the qualifications for JICA financing. The B/C Ratio Method and NPV Method are acceptable in a case such as studying the optimum proposal from among a plural number of projects, but are not necessarily suitable from the point of view of the proposition to examine qualifications for receiving financing.

8.2 Examination of cost of Electric Power from Diesel Generation

As described in detail in Chapter 4, three diesel generators (total output 1,350 kW) manufactured by Niigata Engineering and eight diesel generators (total output 2,700 kW) manufactured by Caterpillar, a total of 11 units (total output 4,050 kW), are presently installed at Huanzala Mine. Of these, the three units manufactured by Niigata Engineering are roughly at the ends of their service lives, and the time has been reached when it must almost immediately be started considering their replacement. In this section, several considerations from financial standpoints will be made regarding the cost of electric power from diesel generation using these eleven units.

The first point in financial considerations concerning diesel power generation at Huanzala Mine is with regard to generating cost. Table 8-2-1 gives the composition of costs in the power generation of Huanzala Mine. As can be seen from this table, the major part of the power generation cost is made up of fuel costs, namely, light oil and lubricating oil costs. The weight of the fuel costs in the overall generating cost is overwhelmingly large, having been 76.0% in 1981 and 80.3% in 1982. In other words, it may be said that the power generation cost at Huanzala Mine is governed by the fuel cost.

The next matter of importance is that the unit price of the fuel itself, the cost of which makes up such a large part of the generating cost, has risen greatly in recent years. Table 8-2-2 shows the transitions in the unit price of fuel oil (light oil) in recent years, and it is seen that escalation of unit prices has been severe especially since 1977.

The unit cost of power generation has risen extremely in recent years due to the steep rise in the unit fuel price and the resulting large increase in fuel cost. Table 8-2-3 shows this trend. The unit generating cost which was US$0.026/kWh in 1973 had jumped to US$0.091/kWh in 1982, to approximately quadruple.

The second point regarding the cost of electric power from diesel generation is the relation between power generating cost and production cost of the mine. Table 8-2-4 shows the shares of the costs of various sectors making up the production cost of the mine to look at this relationship. Because of its nature as a mine, it is natural for the ore-extracting cost to have the greatest weight, but the cost of the electric power sector also makes up a fairly large share having been 15.7% in 1982. It should be noted that with the rise in fuel cost the proportion of the production cost made up by the electric power cost, or that of the production cost made up by the fuel cost has risen sharply in recent years. As can be seen in Table 8-2-5, the weight of fuel cost in the production cost increased prominently from 4.0% in 1973 to 12.2% in 1982 to vividly prove this fact.

Based on the above considerations, it may be said that the power generation cost of Huanzala Mine is fundamentally governed by the variation in fuel cost. Since the fuel cost has risen sharply in recent years, this has not only caused the generating cost to rise, but also it has contributed greatly to increasing the production cost of the mine. Consequently, the trend in generating cost is an important factor in management of the mine.

Table 8-2-1 Energy Cost by Category of Expenses

(Unit: Thousand Soles, %)

	1981		1982	
	Amount	Share	Amount	Share
Labour Cost	22,132	4.2	51,667	3.9
Commodity Cost	475,309	90.0	1,160,603	88.6
(Fuel Cost)	(401,425)	(76.0)	(1,052,196)	(80.3)
General	30,633	5.8	97,789	7.5
Total	528,074	100.0	1,310,059	100.0

Table 8-2-2 Trend of Fuel Cost

(Unit: Soles, %)

	Fuel Cost	Escalation
1973	6.38	-
1974	6.41	4.7
1975	6.98	8.9
1976	8.87	27.1
1977	16.40	84.9
1978	50.63	87.2
1979	90.44	78.6
1980	125.46	38.7
1981	259.44	67.9
1982	535.08	106.2

Table 8-2-3 Energy Cost

(Unit: Cent/KWh)

	Energy Cost
1973	2.6
1974	4.2
1975	3.4
1976	4.2
1977	5.4
1978	4.4
1979	7.0
1980	8.5
1981	8.4
1982	9.1

(Depreciation cost is not included.)

Table 8-2-4 Production Cost by Department

(Unit: Soles, %)

	1981		1982	
	Amount	Share	Amount	Share
Mining	1,443,020	37.9	3,414,620	41.0
Concentrating	544,239	14.3	1,037,239	12.5
Maintenance	346,872	9.1	745,235	9.0
Administration	758,081	19.9	1,338,151	16.1
Energy	528,073	13.9	1,310,059	15.7
Miscellaneous	186,843	4.9	476,287	5.7
Total	3,807,128	100.0	8,321,591	100.0

Table 8-2-5 Fuel Cost and Production Cost

(Unit: Thousand Soles, %)

	Fuel Cost (A)	Production Cost (B)	A/B x 100
1973	9,404	234,758	4.0
1974	10,576	284,717	3.7
1975	16,072	388,048	4.1
1976	17,553	411,720	4.3
1977	30,861	722,252	4.3
1978	86,259	1,037,330	8.3
1979	154,015	1,731,214	8.9
1980	190,777	2,862,011	6.7
1981	401,425	3,897,227	10.3
1982	1,052,196	8,633,644	12.2

8.3 Economic Significance of Hydro-electric Power Station Construction

The purpose of constructing the hydro-electric power station is to make possible stable supply of the motive power for Huanzala Mine over a long term. At the same time, this would help to give the image that Huanzala Mine is a first-class mine as previously mentioned. In addition, if by constructing the hydro-electric power station the proportion of electric power cost making up the production cost is lowered, there would be a great impact on the finances of Santa Luisa.

As mentioned above, the electric power cost of Huanzala Mine based on the existing diesel generating plant exceeds 9 U.S. cents per kilowatt-hour, and the weight of this in the production cost is more than 15%. Since Huanzala Mine is at a highland at an altitude of 4,000 m above sea level, the combustion efficiency of fuel is decreased by approximately 30% and the maintenance cost will be higher than the normal expenditure level. It is unavoidable for the electric power cost to be comparatively higher. However, the products of Huanzala Mine are internationally traded commodities, and their prices are not decided on the basis of cost plus margin, but demand and supply in the international market. Consequently, it is impossible from the standpoint of competitiveness of production price to add the various costs exceeding the normal level due to the special circumstances of Huanzala Mine. In order to withstand fluctuations in the product price, it is necessary for efforts to be made at all times to lower the production cost. In this sense, it is an important matter to aim for reduction of the electric power cost which makes up at least 15% of the production cost.

Incidentally, to look at Kamioka Mine owned by Mitsui M&S, one of the companies investing in Santa Luisa, the generating cost there is 3.4 US cents per kWh (1982 performance). To make a simple comparison of the electric power costs of the Kamioka and Huanzala mines is slightly rash, but the difference of as much as 5.7 US cents per kWh must be considered as too large.

Another major reason for promotion of hydro-electric power generation is the rising trend of fuel costs. The main factor for determining

the power cost is the fuel cost, and a sharp rise in fuel cost will act to push up the electric power cost described in detail. It is felt that this trend of rise will continue in the future, which has a relation with the petroleum situation in Peru. In Peru, in recent years, production of approximately 200,000 bbl/day of petroleum has been going on, and approximately 60,000 bbl/day is being diverted to exports. The revenue from export of petroleum exceeded US$700 million in 1982 to make up 22% of total exports, and this was the primary product for gaining foreign exchange. However, it is said that the production level has dropped to 170 to 180 thousand bbl/day at present because of flood damage in 1983, and together with poor performance in exploration activities. There is danger of Peru being transformed into an oil-importing country several years from now. With the future outlook for petroleum production in Peru, there will be not only the problem of price escalation of fuel oil, but also there will be concern about the problem of securing quantity. When this is considered, to keep relying on diesel generation only will be the basis for further pushing up the electric power cost which is a major component of production costs.

8.4 Fund Requirement and Funding Plan

8.4.1 Fund Requirement

(1) Case of Constructing Hydro-electric Power Station (Installed Capacity 4,200 kW, for Mining and Public Use)

The amount of investment may be divided into investments for electric power and non-electric power sectors. The electric power sector may be further divided into hydro-electric power station construction cost and diesel generating facilities replacement cost. The construction cost of the hydro-electric power station will be US$13,568,000 in terms of 1983 constant prices, or US$14,604,000 in terms of current prices (Table 8-4-1, details in Table 6-5-1). The investment for Huanzala hydro-electric power station will be made during the two years of 1985 and 1986. The investments for replacement of diesel generating facilities, in step with aging of the existing diesel facilities and the growths in demands at Huanzala

Mine and the neighboring communities, are scheduled for the two times of the middle of 1991 and the beginning of 1996 as contemplated in Section 5.4. The amount of investment required for these two electric power sectors in 20 years in US$14,468,000 in terms of 1983 constant prices and US$15,840,000 in terms of current prices. (Table 8-4-2)

On the other hand, investments in the non-electric power sector will be on items such as company housing, school, tailing disposal area, etc., the amount of investment required being US$5,149,000 in terms of 1983 constant prices and US$5,933,000 in terms of current price. (Table 8-4-2)

In computation of current price, an inflation rate of 3% annum was assumed in accordance with the dollar-basis inflation rate in Peru in recent years.

(2) Case of Not Constructing Hydro-electric Power Station (Ultimate Installed Capacity of Diesel Plant 5,670 kW for Mine Only)

The investment amount may be divided into investments for the electric power and non-electric power sectors similarly to (1) above. In case the hydro-electric power station is not constructed, the investments for replacement of existing diesel generators would be made four times, in 1986, 1992, 1995 and 1998 in the electric power sector. The total amount of investment in terms of 1983 constant prices will be US$2,700,000 and US$3,556,000 in terms of current prices. (Table 8-4-3)

On the other hand, the investment for the non-electric power sector will be the same as in the case of (1) above, US$5,149,000 in terms of 1983 constant prices, and US$5,933,000 in terms of current price. (Table 8-4-3)

8.4.2 Funding Plan

The following conditions were assumed in the study of procurement of funds necessary for construction of the hydro-electric power station.

70% of funds required: Interest 3%/yr, repayment period 20 years including 5-year grace period

30% of funds required: Interest 8%/yr, repayment period 7 years, no grace period

Regarding investments other than for hydro-electric power generation (investments for replacement of diesel generating facilities and for non-electric power sector), it was assumed that these would be covered with the company's own funds in both cases of constructing and not constructing the hydro-electric power station, and external borrowings will not be utilized.

Table 8-4-1 Construction Cost of Huanzala Power Station

(Unit: US Thousand $)

	Cost in 1983 Price Level	Current Price Level
Civil Works	6,018	6,480
Electrical Equipment	4,704	5,065
Miscellaneous	2,261	2,435
Sub-total	12,983	13,980
Interest during Construction Period	585	625
Total	13,568	14,605

Table 8-4-2 Capital Expenditure

(In the Case that Hydro-power Plant with 4,200 KW is constructed)

(Unit: US Thousand $)

	Expenditure in 1983 Price Level		Expenditure in Current Price Level	
	Power Sector	Non-Power Sector	Power Sector	Non-Power Sector
1983		150		150
1984		1,159		1,194
1985	6,930	590	7,352	626
1986	6,638	250	7,253	273
1987				
1988				
1989				
1990		3,000		3,690
1991	300		380	
1992				
1993				
1994				
1995	600		855	
1996				
1997				
1998				
1999				
2000				
2001				
2002				
2003				
2004				
2005				
2006				
Total	14,468	5,149	15,840	5,933

Fig. 8-4-1 Diesel Plant Exclusively for Mine

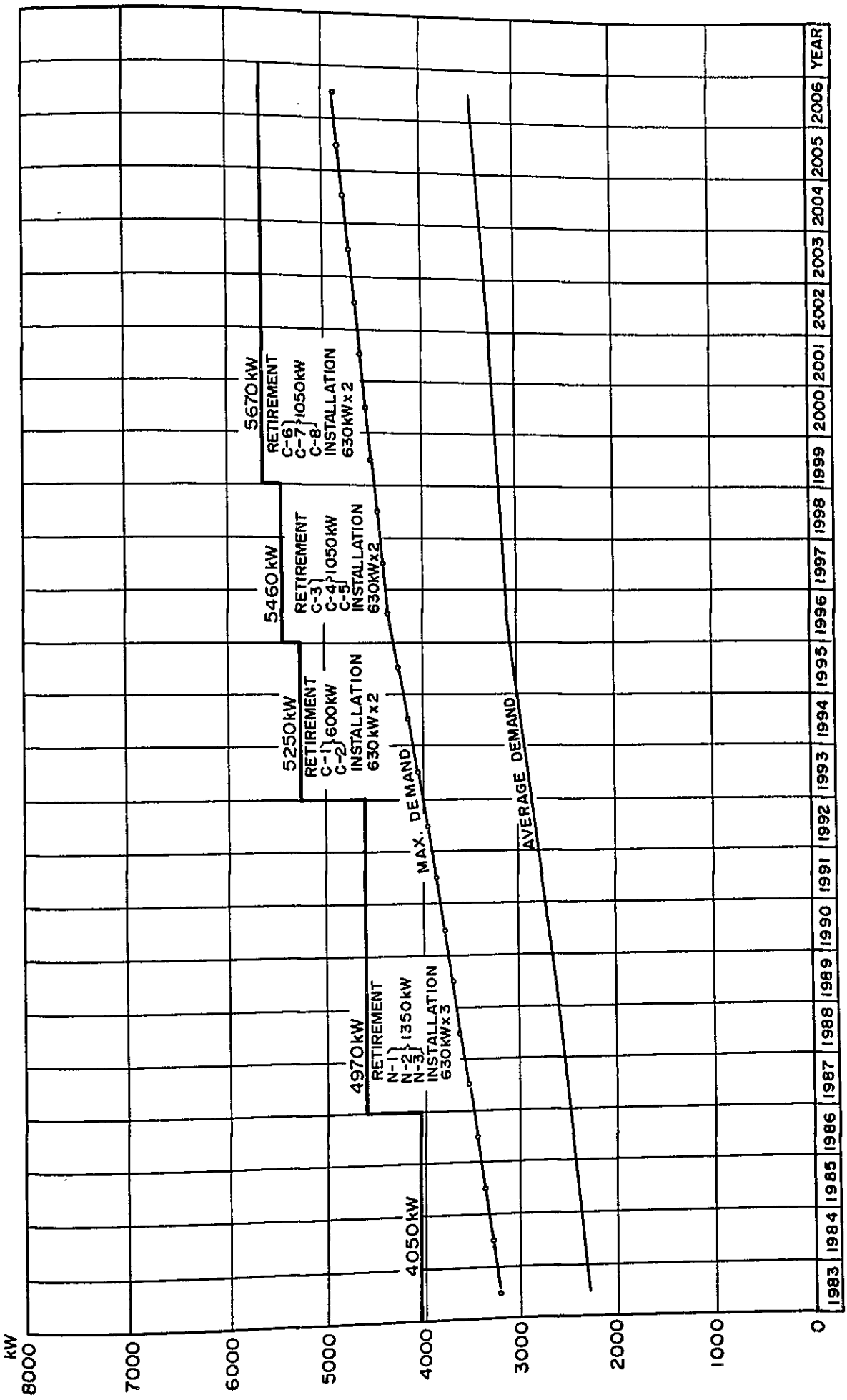


Table 8-4-3 Capital Expenditure

(In the Case that Hydro-power Plant is not constructed, but Diesel-power Plant is accordingly installed.)

(Unit: US Thousand $)

	Expenditure in 1983 Price Level		Expenditure in Current Price Level	
	Power Sector	Non-Power Sector	Power Sector	Non-Power Sector
1983		150		150
1984		1,159		1,194
1985		590		626
1986	900	250	983	273
1987				
1988				
1989				
1990		3,000		3,690
1991				
1992	600		783	
1993				
1994				
1995	600		855	
1996				
1997				
1998	600		935	
1999				
2000				
2001				
2002				
2003				
2004				
2005				
2006				
Total	2,700	5,149	3,556	5,933

8.5 Expenses

8.5.1 Case of Constructing Hydro-electric Power Station (Installed Capacity 4,200 kW, for Mining and Public Use)

In calculation of expenses, the principles of the financial statements of Santa Luisa were followed and the total expenses were divided into the nine items below.

(a) Fuel Cost
(b) Maintenance and Operation Cost
(c) Personnel Cost
(d) Depreciation Cost
(e) Transportation Cost
(f) Shipping Cost
(g) General Administrative Expenses
(h) Interest
(i) Other Expenses

The preconditions used for calculation of the expenses under the individual items were as described below.

(a) Fuel Cost

Regarding light oil, the consumption was taken to be 79.9 gal/MWhand the unit price US$0.80/gal based on performances from July 1982 through June 1983. On the same basis as for light oil, the consumption of lubricating oil was taken to be 1.80 gal/MWh with the unit price being US$3.76/gal. The electric energy taken for computing the total fuel consumption was the energy for supplemental firing of thermal given in Table 5-4-1.

(b) Maintenance and Operation Cost

The maintenance and operation cost was calculated divided into three, those are maintenance and operation cost of diesel generating facilities, maintenance and operation cost of hydro-electric power generating facilities, and maintenance and operation cost of other facilities. Regarding the maintenance and operation cost of the diesel generating facilities, this was further divided into portions

for existing diesel facilities and for newly purchased diesel facilities. In calculation of expenses, the maintenance and operation costs of diesel plants recorded at Huanzala Mine in recent years were used as the bases. In effect, on looking at the costs recorded at the mine, the annual maintenance and operation cost is 17.8% of the asset amount for the existing diesel portion, and 9.2% for the newly purchased diesel portion. Therefore, in case the hydro-electric power station is constructed, the maintenance and operation costs for diesel general facilities are considered as being 50% of the above ratios since on start of operation of the hydro-electric power station the operating time of the diesel power station will be greatly reduced, and the annual maintenance and operation costs were taken to be 8.9% of asset amount for the existing portion and 4.6% for the newly purchased portion.

Regarding the hydro-electric generating facilities, the conditions of location were taken into consideration and 2% of the asset amount was taken as the annual maintenance and operation cost.

With respect to the maintenance and operation cost of other facilities, 40.9% of asset amounts was taken as the annual maintenance and operation cost based on performances at Huanzala Mine in recent years.

(c) Personnel Cost

The number of employees at Huanzala Mine as of the end of 1982 consisted of 6 Japanese, 39 Peruvian administrative personnel, 66 Peruvian staff, 563 obrero, and 25 teachers, or a total of 699 persons. with regard to subsequent increases, it was assumed based on the plans of Santa Luisa that there would be net increases of six persons in 1983, two in 1984, two in 1985, two in 1986, and four in 1987, with no net increases from 1988.

With regard to wages, they were based on the actual figures for 1982, with US$5,700 per person annually for obrero who can be considered to be semi-skilled laborers, and US$8,800 per person annually for skilled laborers.

The personnel cost of Santa Luisa, besides wages for regular employees, includes subcontractor wages, which consist of payments to daily laborers (non-employees). The amount for these wages was estimated to be US$978,700 taking into account figures for 1982.

(d) Depreciation Cost

Regarding periods for depreciation, the accounting standards of Santa Luisa were followed to set the periods below.

Table 8-5-1 Depreciation Period and Service Life

	Depreciation period (yrs)	Service Life (yrs)
Hydro-power station	20	Over 20
Structures	10	Over 20
Machinery	5	20
Vehicles	3	4
Bulldozer	2.5	5

In accounting rule in Peru, depreciation periods for equipment are set considerably shorter than service lives. Accordingly, ending of depreciation does not necessarily mean there is a necessity for the equipment to be renewed. Therefore, the service lives of various kinds of equipment were set as shown in the column "Service Life" in the above table, and renewal of equipment is to be done at the ends of the service lives. However, with regard to the service life of diesel generating facilities to be included in the category of Machinery, the 11 units were separately investigated for service lives and renewal times. As for scrap values of equipment, zero values were taken for all items according to the accounting rules of Santa Luisa. (Fig. 6-2-1)

(e) Transportation Cost

It was considered that transportation cost would be proportionate to quantity transported, and the cost per ton was taken as US$32 based on the actual transportation costs in 1982.

(f) Shipping Cost

Shipping cost will consist of trading company commissions, payments to MINPECO, sales taxes, etc. According to agreement, 3% of sales amount and US$9.3 per ton of sales quantity would be required, and these were taken into account.

(g) General Administrative Expenses

The general administrative expenses comprise the cost of running the Lima Office of Santa Luisa, and consists of personnel cost, supplies cost, and miscellaneous costs. In this case it was assumed the general administrative expenses of US$750,900 would be required based on the records for 1982.

(h) Interest

The interest on loans to be received for construction of the hydro-electric power station and interest on the existing loans were listed up. The conditions for the loans for hydro-electric power station construction are as assumed in the funding plan in Section 8.4.2. As regards interest on the existing loans such as loans from JICA and from commercial banks, interest calculations were made based on the terms and conditions of the respective loans.

Further, in case a necessity should arise to obtain short-term loans (to be borrowed when a shortage occurs in the cash flow), interest was calculated at a rate of 10% annum.

(i) Other Expenses

Other expenses include items such as depreciation of deferred charges handled in accounting practices of Santa Luisa as a non-operating expense.

Of these, with regard to exchange losses, future occurrence is not taken into account for the following reasons. The first of the reasons is that it will be difficult to predict trends in foreign exchange rate over such a long period as 20 years. The second

reason is as follows. Santa Luisa possesses foreign claimable assets which are factors for occurrence of exchange profits and at the same time it has foreign currency debts which are factors for exchange losses. It might be thought the claimable assets and debts will be balanced in the long range.

(j) Taxes

According to the current tax system of Peru, the taxable amount is the "profit" after deduction of reserve for investment, and profit-sharing with the communidad (employees' union) from the profit before taxes. the rate of deduction is currently 51.5%, and the same rate was used for calculations. As for corporate income tax, 55%, the same as the current rate was used.

Based on the preconditions above, the total operating cost of Santa Luisa in case of constructing the hydro-electric power station (with Project) will be as shown in Table 8-5-2.

Table 8-5-2 Production Cost Statement (with Project)..... (3 sheets)

*** HUANZALA POWER PROJECT ***
PRODUCTION COST STATEMENTS
- WITH CASE -

(USD 1000)

YEAR	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
FUEL COST	1414	1467	1482	1517	64	72	78	86	94	104
DIESEL OIL	1278	1309	1340	1372	58	65	71	78	85	94
LUBRICANT	135	139	142	145	6	7	7	8	9	10
OPERATING & MAINTENANCE COST	4311	4373	4847	5068	5344	5344	5344	5344	6578	6585
DIESEL(NEW)	0	0	0	0	0	0	0	0	7	14
DIESEL(EXISTING)	260	260	260	260	154	154	154	154	154	154
HYDRO	0	0	0	0	260	260	260	260	260	260
GENERAL EQUIPMENT	4051	4113	4587	4808	4930	4930	4930	4930	6157	6157
VARIABLE COST	5725	5840	6329	6585	5408	5415	5422	5430	6672	6689
LABOUR COST	5437	5456	5473	5490	5516	5516	5516	5516	5516	5516
DIRECT FIXED COST	5437	5456	5473	5490	5516	5516	5516	5516	5516	5516
CASH FACTORY COST	11162	11275	11801	12095	10924	10932	10938	10946	12188	12205
PLANT COST (HYDRO)	0	0	0	0	649	649	649	649	649	649
PLANT COST (DIESEL)	275	223	223	160	71	42	42	0	30	60
DIESEL 191	0	0	0	0	0	0	0	0	30	60
DIESEL 195	0	0	0	0	0	0	0	0	0	0
DIESEL(EXISTING)	233	181	141	137	28	0	0	0	0	0
DIESEL(BUILDING)	42	42	42	42	42	42	42	0	0	0
GENERAL EQUIPMENT	851	851	995	995	1138	287	287	143	143	143
PILING	0	0	0	0	0	0	0	0	300	300
INTEREST DURING CONSTRUCTION	0	0	0	0	29	29	29	29	29	29
VEHICLE & BULLDOZER	200	200	200	200	200	200	200	200	200	200
DEPRECIATION AND AMORTIZATION	1326	1274	1412	1374	2087	1207	1207	1021	1351	1381
TOTAL FACTORY COST	12488	12549	13219	13469	13011	12139	12145	11967	13539	13586
TRANSPORTATION COST	2189	2189	2189	2189	2189	2189	2189	2189	2189	2189
SHIPPING COST	1228	1228	1228	1228	1228	1228	1228	1228	1228	1228
SALES EXPENSES	3417	3417	3417	3417	3417	3417	3417	3417	3417	3417
GENERAL ADMINISTRATIVE EXP.	751	751	751	751	751	751	751	751	751	751
OPERATING EXPENSES	16656	16717	17386	17637	17179	16306	16313	16135	17706	17754
INTEREST ON LONG TERM DEBT B	0	0	0	0	336	288	240	192	144	96
INTEREST ON LONG TERM DEBT A	0	0	0	0	281	281	281	281	281	281
INTEREST ON LONG TERM DEBT EX	79	53	18	6	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT	79	53	18	6	617	569	521	473	425	377
INTEREST ON SHORT TERM DEBT	0	148	127	48	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT EX	269	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	269	148	127	48	0	0	0	0	0	0
NON-OPERATION EXPENSES	1013	1013	1013	499	499	499	499	499	499	499

HUANZALA POWER PROJECT
PRODUCTION COST STATEMENTS
- WITH CASE -

(USD 1000)

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
FUEL COST	116	130	145	163	172	181	191	203	218	228
DIESEL OIL	105	117	131	147	155	164	173	183	197	206
LUBRICANT	11	12	14	16	16	17	18	19	21	22
OPERATING & MAINTENANCE COST	6585	6585	6585	6596	6596	6596	6596	6596	6596	6596
DIESEL(NEW)	14	14	14	41	41	41	41	41	41	41
DIESEL(EXISTING)	154	154	154	137	137	137	137	137	137	137
HYDRO	260	260	260	260	260	260	260	260	260	260
GENERAL EQUIPMENT	6157	6157	6157	6157	6157	6157	6157	6157	6157	6157
VARIABLE COST	6701	6714	6730	6759	6768	6777	6787	6798	6814	6824
LABOUR COST	5516	5516	5516	5516	5516	5516	5516	5516	5516	5516
DIRECT FIXED COST	5516	5516	5516	5516	5516	5516	5516	5516	5516	5516
CASH FACTORY COST	12217	12230	12246	12275	12284	12293	12303	12315	12330	12340
PLANT COST (HYDRO)	649	649	649	649	649	649	649	649	649	649
PLANT COST (DIESEL)	60	60	60	150	120	120	120	120	0	0
DIESEL #91	60	60	60	30	0	0	0	0	0	0
DIESEL #95	0	0	0	120	120	120	120	120	0	0
DIESEL(EXISTING)	0	0	0	0	0	0	0	0	0	0
DIESEL(BUILDING)	0	0	0	0	0	0	0	0	0	0
GENERAL EQUIPMENT	143	143	143	143	0	0	0	0	0	0
PILING	300	300	300	300	300	300	300	300	0	0
INTEREST DURING CONSTRUCTION	29	29	29	29	29	29	29	29	29	29
VEHICLE & BULLDOZER	200	200	200	200	200	200	200	200	200	200
DEPRECIATION AND AMORTIZATION	1381	1381	1381	1471	1298	1298	1298	1298	878	878
TOTAL FACTORY COST	13597	13611	13627	13746	13582	13591	13601	13612	13208	13218
TRANSPORTATION COST	2189	2189	2189	2189	2189	2189	2189	2189	2189	2189
SHIPPING COST	1228	1228	1228	1228	1228	1228	1228	1228	1228	1228
SALES EXPENSES	3417	3417	3417	3417	3417	3417	3417	3417	3417	3417
GENERAL ADMINISTRATIVE EXP.	751	751	751	751	751	751	751	751	751	751
OPERATING EXPENSES	17756	17779	17795	17914	17749	17759	17769	17780	17376	17386
INTEREST ON LONG TERM DEBT B	48	0	0	0	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT A	262	243	225	206	187	169	150	131	112	94
INTEREST ON LONG TERM DEBT FX	0	0	0	0	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT	310	243	225	206	187	169	150	131	112	94
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT FX	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
NON-OPERATION EXPENSES	499	499	499	499	499	499	499	499	499	499

*** HUANZALA POWER PROJECT ***
PRODUCTION COST STATEMENTS
- WITH CASE -

(USD 1000)

YEAR	2003	2004	2005	2006
FUEL COST	242	258	275	293
DIESEL OIL	219	233	249	265
LUBRICANT	23	25	26	28
OPERATING & MAINTENANCE COST	6596	6596	6596	6596
DIESEL(NEW)	41	41	41	41
DIESEL(EXISTING)	137	137	137	137
HYDRO	260	260	260	260
GENERAL EQUIPMENT	6157	6157	6157	6157
VARIABLE COST	6838	6854	6871	6889
LABOUR COST	5516	5516	5516	5516
DIRECT FIXED COST	5516	5516	5516	5516
CASH FACTORY COST	12354	12370	12387	12406
PLANT COST (HYDRO)	649	649	649	649
PLANT COST (DIESEL)	0	0	0	0
DIESEL 191	0	0	0	0
DIESEL 195	0	0	0	0
DIESEL(EXISTING)	0	0	0	0
DIESEL(BUILDING)	0	0	0	0
GENERAL EQUIPMENT	0	0	0	0
PILING	0	0	0	0
INTEREST DURING CONSTRUCTION	29	29	29	29
VEHICLE & BULLDOZER	200	200	200	200
DEPRECIATION AND AMORTIZATION	878	878	878	878
TOTAL FACTORY COST	13232	13247	13265	13283
TRANSPORTATION COST	2189	2189	2189	2189
SHIPPING COST	1228	1228	1228	1228
SALES EXPENSES	3417	3417	3417	3417
GENERAL ADMINISTRATIVE EXP.	751	751	751	751
OPERATING EXPENSES	17400	17415	17433	17451
INTEREST ON LONG TERM DEBT S	0	0	0	0
INTEREST ON LONG TERM DEBT A	75	56	37	19
INTEREST ON LONG TERM DEBT EX	0	0	0	0
INTEREST ON LONG TERM DEBT	75	56	37	19
INTEREST ON SHORT TERM DEBT	0	0	0	0
INTEREST ON SHORT TERM DEBT EX	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0
NON-OPERATION EXPENSES	499	499	499	499

8.5.2 Case of Not Constructing the Hydro-electric Power Station (Ultimate Installed Capacity of Diesel Plant 5,670 kW, for Mining Only)

(a) Fuel Cost

With regard to fuel consumption per megawatt-hour, and unit price of fuel, they are as described in Section 8.5.1. The electric energy for calculating total fuel consumption is assumed to be equal to the energy demand in Table 5-7-2.

(b) Maintenance and Operation Cost

The maintenance and operation cost was divided into the maintenance and operation cost for diesel facilities and maintenance and operation cost for other facilities. Further, the maintenance and operation cost of diesel facilities was subdivided into portions for the existing diesel plants and for newly purchased diesel plants. In accordance with the conception described in Section 8.5.1, the annual maintenance and operation costs were respectively taken to be 17.8% and 9.2% of asset amounts.

With regard to other facilities, 40.9% of asset amounts was taken as the annual maintenance and operation costs similarly to Section 8.5.1.

(c) Personnel Cost

With regard to employees, it was assumed there would be net increases of six persons in 1983, two in 1984, two in 1985, and two in 1986 according to plans of Santa Luisa, with no subsequent net increases. In Section 8.5.1, an increase of four persons in 1987 is taken into account, which is caused by an increase in employees accompanying the start of operation of the hydro-electric power station. As for unit wages, they are the same as in Section 8.5.1.

(d) Depreciation Cost

Depreciation cost was calculated in accordance with the same conception as in Section 8.5.1.

(e) Transportation Cost

The same amount as in Section 8.5.1 was calculated as the transportation cost.

(f) Shipping Cost

The same amounts as in Section 8.5.1 were calculated as shipping cost.

(g) General Administrative Expenses

The same amount as in Section 8.5.1 was calculated for the general administrative expenses.

(h) Interest

In the case of not constructing the hydro-electric power station, there will be no long-term borrowing needed for investment in new diesel generating plants. Therefore, the interest on the existing loans and interest in case of obtaining a short-term loan were taken into account.

(i) Other Expenses

The same amount as in Section 8.5.1 was taken into consideration with respect to other expenses.

(j) Taxes

Taxes were calculated according the same conception as in Section 8.5.1.

Based on the above preconditions, the total operating cost in case the hydro-electric power station is not constructed (without Project) is as shown in Table 8-5-3.

Table 8-5-3 Production Cost Statement (without Project)... (3 sheets)

*** HUANZALA POWER PROJECT ***
PRODUCTION COST STATEMENTS
- WITHOUT CASE-

(USD 1000)

YEAR	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
FUEL COST	1414	1447	1482	1517	1554	1591	1629	1668	1709	1750
DIESEL OIL	1278	1309	1340	1372	1405	1438	1473	1509	1545	1582
LUBRICANT	135	139	142	145	149	152	156	160	164	168
OPERATING & MAINTENANCE COST	4311	4373	4447	5018	5248	5248	5248	5248	6475	6475
DIESEL(NEW)	0	0	0	0	83	83	83	83	83	83
DIESEL(EXISTING)	260	260	260	260	234	234	234	234	234	234
HYDRO	0	0	0	0	0	0	0	0	0	0
GENERAL EQUIPMENT	4051	4113	4587	4623	4930	4930	4930	4930	6157	6157
VARIABLE COST	5725	5820	6329	6605	6801	6838	6877	6916	8183	8225
LABOUR COST	5437	5455	5473	5490	5490	5490	5490	5490	5490	5490
DIRECT FIXED COST	5437	5455	5473	5490	5490	5490	5490	5490	5490	5490
CASH FACTORY COST	11162	11275	11801	12095	12291	12328	12367	12406	13673	13715
PLANT COST (HYDRO)	0	0	0	0	0	0	0	0	0	0
PLANT COST (DIESEL)	275	223	223	180	251	222	222	180	180	0
DIESEL '86	0	0	0	0	180	180	180	180	180	0
DIESEL '92	0	0	0	0	0	0	0	0	0	0
DIESEL '95	0	0	0	0	0	0	0	0	0	0
DIESEL '93	0	0	0	0	0	0	0	0	0	0
DIESEL(EXISTING)	253	191	181	147	28	0	0	0	0	0
DIESEL(BUILDING)	42	42	42	42	42	42	42	0	0	0
GENERAL EQUIPMENT	851	851	995	995	1138	287	287	143	143	143
PILING	0	0	0	0	0	0	0	0	300	300
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0
VEHICLE & BULLDOZER	200	200	200	200	200	200	200	200	200	200
DEPRECIATION AND AMORTIZATION	1426	1274	1418	1374	1588	709	709	523	823	643
TOTAL FACTORY COST	12588	12549	13219	13469	13880	13037	13075	12929	14496	14357
TRANSPORTATION COST	2189	2189	2189	2189	2189	2189	2189	2189	2189	2189
SHIPPING COST	1228	1228	1228	1228	1228	1228	1228	1228	1228	1228
SALES EXPENSES	3417	3417	3417	3417	3417	3417	3417	3417	3417	3417
GENERAL ADMINISTRATIVE EXP.	751	751	751	751	751	751	751	751	751	751
OPERATING EXPENSES	16756	16717	17386	17637	18047	17205	17243	17096	18664	18525
INTEREST ON LONG TERM DEBT EX	79	53	15	6	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT	79	53	15	6	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	148	127	48	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	269	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	269	148	127	48	0	0	0	0	0	0
NON-OPERATION EXPENSES	1013	1013	1013	499	499	499	499	499	499	499

*** HUANZALA POWER PROJECT ***
PRODUCTION COST STATEMENTS
- WITHOUT CASE-

(USD 1000)

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
FUEL COST	1793	1836	1881	1927	1945	1965	1982	2002	2023	2044
DIESEL OIL	1621	1661	1701	1743	1759	1775	1793	1811	1829	1849
LUBRICANT	172	176	180	185	186	188	190	192	194	196
OPERATING & MAINTENANCE COST	6497	6477	6497	6496	6496	6496	6406	6406	6406	6406
DIESEL(NEW)	138	138	138	193	193	193	248	248	248	248
DIESEL(EXISTING)	202	202	202	145	145	145	0	0	0	0
HYDRO	0	0	0	0	0	0	0	0	0	0
GENERAL EQUIPMENT	6157	6157	6157	6157	6157	6157	6157	6157	6157	6157
VARIABLE COST	8290	8334	8379	8423	8441	8459	8388	8408	8429	8450
LABOUR COST	5490	5490	5490	5490	5490	5490	5490	5490	5490	5490
DIRECT FIXED COST	5490	5490	5490	5490	5490	5490	5490	5490	5490	5490
CASH FACTORY COST	13780	13824	13869	13913	13931	13949	13878	13898	13919	13940
PLANT COST (HYDRO)	0	0	0	0	0	0	0	0	0	0
PLANT COST (DIESEL)	120	120	120	240	240	120	240	240	120	120
DIESEL 186	0	0	0	0	0	0	0	0	0	0
DIESEL 192	120	120	120	120	120	0	0	0	0	0
DIESEL 195	0	0	0	120	120	120	120	120	0	0
DIESEL 198	0	0	0	0	0	0	120	120	120	120
DIESEL(EXISTING)	0	0	0	0	0	0	0	0	0	0
DIESEL(BUILDING)	0	0	0	0	0	0	0	0	0	0
GENERAL EQUIPMENT	143	143	143	143	0	0	0	0	0	0
PILING	300	300	300	300	300	300	300	300	0	0
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0
VEHICLE & BULLDOZER	200	200	200	200	200	200	200	200	200	200
DEPRECIATION AND AMORTIZATION	763	763	763	883	740	620	740	740	320	320
TOTAL FACTORY COST	14543	14586	14631	14796	14670	14569	14618	14638	14238	14260
TRANSPORTATION COST	2189	2189	2189	2189	2189	2189	2189	2189	2189	2189
SHIPPING COST	1228	1228	1228	1228	1228	1228	1228	1228	1228	1228
SALES EXPENSES	3417	3417	3417	3417	3417	3417	3417	3417	3417	3417
GENERAL ADMINISTRATIVE EXP.	751	751	751	751	751	751	751	751	751	751
OPERATING EXPENSES	18710	18754	18799	18963	18838	18737	18786	18806	18406	18428
INTEREST ON LONG TERM DEBT EX	0	0	0	0	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
NON-OPERATION EXPENSES	499	499	499	499	499	499	499	499	499	499

HUANZALA POWER PROJECT
PRODUCTION COST STATEMENTS
- WITHOUT CASE-

(USD 1000)

YEAR	2003	2004	2005	2006
FUEL COST	2067	2093	2114	2139
DIESEL OIL	1869	1890	1912	1934
LUBRICANT	198	200	202	205
OPERATING & MAINTENANCE COST	6406	6406	6406	6406
DIESEL(NEW)	248	248	246	248
DIESEL(EXISTING)	0	0	0	0
HYDRO	0	0	0	0
GENERAL EQUIPMENT	6157	6157	6157	6157
VARIABLE COST	8473	8496	8520	8545
LABOUR COST	5490	5490	5490	5490
DIRECT FIXED COST	5490	5490	5490	5490
CASH FACTORY COST	13963	13986	14010	14035
PLANT COST (HYDRO)	0	0	0	0
PLANT COST (DIESEL)	120	0	0	0
DIESEL '86	0	0	0	0
DIESEL '92	0	0	0	0
DIESEL '95	0	0	0	0
DIESEL '98	120	0	0	0
DIESEL(EXISTING)	0	0	0	0
DIESEL(BUILDING)	0	0	0	0
GENERAL EQUIPMENT	0	0	0	0
PILING	0	0	0	0
INTEREST DURING CONSTRUCTION	0	0	0	0
VEHICLE & BULLDOZER	200	200	200	200
DEPRECIATION AND AMORTIZATION	320	200	200	200
TOTAL FACTORY COST	14282	14185	14210	14235
TRANSPORTATION COST	2189	2189	2189	2189
SHIPPING COST	1228	1228	1228	1228
SALES EXPENSES	3417	3417	3417	3417
GENERAL ADMINISTRATIVE EXP.	751	751	751	751
OPERATING EXPENSES	18450	18363	18377	18403
INTEREST ON LONG TERM DEBT EX	0	0	0	0
INTEREST ON LONG TERM DEBT	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0
NON-OPERATION EXPENSES	499	499	499	499

8.6 Income

8.6.1 Case of Constructing Hydro-electric Power Station (Installed Capacity 4,200 kW, for Mining and Public Use)

(a) Product Sales

The product sales of Santa Luisa were calculated divided into sales of lead concentrate and zinc concentrate. With regard to the volume of production and sales, the plans of Santa Luisa in the future were considered, and ore production was taken to be 285,000 ton annually, with sales quantities 18,200 ton annually for lead concentrate and 50,200 ton annually for zinc concentrate. The unit prices are to be US$585.0/ton for lead and US$181.0/ton for zinc. These sales volume and unit sales prices were all estimated based on the performance records of Santa Luisa in recent years.

(b) Electric Power Sales

The electric energy sales to Huallanca and La Union are considered to be equal to the demand of public use in the load forecast of Table 5-3-2. Meanwhile, with regard to the unit price of electric power, the average electricity charge paid as of June 1983, that is, US$0.0284/kWh was used.

8.6.2 Case of Not Constructing Hydro-electric Power Station (Ultimate Installed Capacity of Diesel Plant 5,760 kW, for Mining Only)

(a) Product Sales

Product sales will be exactly the same as in Section 8.6.1.

(b) Electric Power Sales

In the case of not constructing the hydro-electric power station (without Project), there will be no necessity to supply electric power for public use. the entire electric energy produced with the electric power facilities will be consumed privately as motive power for mining. Accordingly, there will be no electric power sales generated.

8.7 Fund Repayment Schedule

As described in the funding plan of Section 8.4.2, construction of the hydro-electric power station is predicated on the entire fund requirement being covered with borrowings. The loan terms to be applied are 70% (US$9,362,000) of the investment amount (1983 values) at interest rate of 3%, with repayment in 20 years including a grace period of 5 years, and the remaining 30% (US$4,206,000) at interest rate of 8%, repayment in 7 years with no grace period. The respective interest amounts and repayment plans are shown in Tables 8-7-1 and 8-7-2.

Next, it is necessary to verify whether payment of this interest and repayment of principal are possible for Huanzala Mine. Verification of the possibility of repayment can be made by a cash flow projection. If it were an ordinary project, revenue would be produced from the project itself through implementation of the project, so that by examining the revenues and expenses, it will be possible to examine the possibility of repaying the funds borrowed. However, the hydro-electric power station in this study is one element in the costs of operating Huanzala Mine, and the power station itself will not produce revenue. Therefore, the possibility of repaying the funds borrowed must be verified in the cash flow of Santa Luisa as a whole. A detailed study on this issue is given in the cash flow analysis of Section 8.10. As a result of the study, it may be concluded that repayment of the loan is possible.

In the case of not constructing the hydro-electric power station, there will be no borrowing of long-term funds for investment in equipment and plants. It was assumed that the investment required for renewal of diesel generating facilities would be covered with internal own funds. Consequently, it is not necessary to study a fund repayment plan in particular.

Table 8-7-1 Long Term Debt - A
(with Project)

HUAN/ALA POWER PROJECT
LONG TERM DEBT A
- WITH CASE -

(USD 1000)

AMOUNT OF DEBT 9362
INTEREST RATE 3.000 PER CENT/YEAR
REPAYMENT 15 YEAR-EQUAL-INSTALLMENT-REPAYMENT (ANNUAL REPAYMENT)

YEAR	SER.NO	PRINCIPAL	INTEREST	DEBT SERVICE	BALANCE AFT. PAYMENT
1983	1	0	0	0	0
1984	2	0	0	0	0
1985	3	0	0	0	9362
1986	4	0	0	0	9362
1987	5	0	281	281	9362
1988	6	0	281	281	9362
1989	7	0	281	281	9362
1990	8	0	281	281	9362
1991	9	0	281	281	9362
1992	10	624	281	905	8738
1993	11	624	262	886	8113
1994	12	624	243	868	7489
1995	13	624	225	849	6865
1996	14	624	206	830	6241
1997	15	624	187	811	5617
1998	16	624	169	793	4993
1999	17	624	150	774	4369
2000	18	624	131	755	3745
2001	19	624	112	736	3121
2002	20	624	94	718	2496
2003	21	624	75	699	1872
2004	22	624	56	680	1248
2005	23	624	37	662	624
2006	24	624	19	643	0
TOTAL		9362	3651	13013	0

Table 8-7-2 **Long Term Debt - B**
(with Project)

HUANZALA POWER PROJECT
LONG TERM DEBT B
- WITH CASE -

(USD 1000)

AMOUNT OF DEBT 4206

INTEREST RATE 8.000 PER CENT/YEAR

REPAYMENT 7 YEAR-EQUAL-INSTALLMENT-REPAYMENT (ANNUAL REPAYMENT)

YEAR	SER.NO	PRINCIPAL	INTEREST	DEBT SERVICE	BALANCE AFT. PAYMENT
1983	1	0	0	0	0
1984	2	0	0	0	0
1985	3	0	0	0	2181
1986	4	0	0	0	4206
1987	5	601	336	937	3605
1988	6	601	288	889	3004
1989	7	601	240	841	2403
1990	8	601	192	793	1803
1991	9	601	144	745	1202
1992	10	601	96	697	601
1993	11	601	48	649	0
1994	12	0	0	0	0
1995	13	0	0	0	0
1996	14	0	0	0	0
1997	15	0	0	0	0
1998	16	0	0	0	0
1999	17	0	0	0	0
2000	18	0	0	0	0
2001	19	0	0	0	0
2002	20	0	0	0	0
2003	21	0	0	0	0
2004	22	0	0	0	0
2005	23	0	0	0	0
2006	24	0	0	0	0
TOTAL		4206	1346	5552	0

8.8 Financial Internal Rate of Return (FIRR)

The result of FIRR obtained based on the fundamental conception of Section 8.1 is shown in Table 8-8-1. As a result of these calculations, the FIRR will be 10.76% before deducting taxes and 8.91% after deducting taxes.

Table 8-8-1 Financial Rate of Return (in current price)

*** HUANZALA POWER PROJECT ***
FINANCIAL RATE OF RETURN (IN CURRENT PRICE)
(USD 1000)

YEAR	FIXED CAPITAL EXPEND.	CHANGE IN WORKING CAPITAL	(1) GROSS CAPITAL EXPENDITR	OPERATING PROFIT	DEPRECIATN	(2) GROSS CASH IN-FLOW	(3) INCOME TAX (INCL. COCOMI)	(4) BFR-TAX NET IN-FLOW (2)-(1)	(5) AFT-TAX NET IN-FLOW (4)-(3)
1983	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0
1985	6491	0	6491	0	0	0	0	-6491	-6491
1986	5591	0	5591	0	0	0	-0	-5591	-5591
1987	0	-48	-48	839	498	1337	74	1385	1312
1988	0	-2	-2	916	498	1414	115	1416	1301
1989	0	-2	-2	949	498	1447	142	1449	1307
1990	0	-2	-2	981	498	1480	169	1481	1313
1991	300	0	300	980	528	1508	184	1208	1024
1992	-600	10	-590	805	738	1543	142	2133	1991
1993	0	-10	-10	960	618	1578	216	1588	1372
1994	0	-2	-2	999	618	1618	251	1619	1368
1995	0	-2	-2	1030	618	1648	267	1650	1383
1996	0	-2	-2	1076	588	1664	289	1667	1378
1997	0	-2	-2	1116	558	1675	308	1677	1368
1998	-600	6	-594	1015	678	1693	281	2287	2006
1999	0	-2	-2	1047	558	1606	298	1608	1310
2000	0	-0	-0	1059	558	1618	308	1618	1310
2001	0	-0	-0	1066	558	1625	317	1625	1308
2002	0	-1	-1	1079	558	1638	327	1638	1311
2003	0	-0	-0	1089	558	1648	337	1648	1311
2004	0	6	6	986	678	1664	309	1658	1350
2005	0	-0	-0	988	678	1667	316	1667	1351
2006	-0	52	52	997	678	1676	325	1624	1299
	11183	0	11183	19979	11767	31747	4974	20564	15590

INTERNAL RATE OF RETURN

ON (4) BFR-TAX NET IN-FLOW (2)-(1) 10.76 PER CENT

ON (5) AFT-TAX NET IN-FLOW (4)-(3) 8.91 PER CENT

8.9 Case of Constructing Hydro-electric Power Station for Mining (Installed Capacity 3,400 kW, No Supply for Public Use)

8.9.1 Outline

In the previous sections, the economic nature of the Project was studied from the standpoint of constructing a hydro-electric power station of a scale of 4,200 kW and supplying the electric power produced to Huanzala Mine and neighboring communities. In contrast, in this section, a hydro-electric power station (exclusively for mining, installed capacity 3,400 kW) having only a capacity matching the future demand of Huanzala Mine is considered. The objective of this study is to see what degree of economic difference there will be in case that Santa Luisa constructs the hydro-electric power station only for motive power required by the mine compared with the case of this Project of constructing the hydro-electric power station to supply of electric power for the mine and public use. For measuring the economics of the private hydro-electric power station, FIRR is computed by exactly the same procedure as in the preceding section.

8.9.2 Outline of Hydro-electric Power Station Exclusively for Mine

(a) Scale

As studied in Section 6.5, the scale of the power station for exclusive use by the mine is to be 3,400 kW.

(b) Fund Requirement and Funding Plan

The fund requirement for construction of the hydro-electric power station, as shown in Table 8-9-1, will be US$12,406,000 on the basis of 1983 constant prices and US$13,351,000 in terms of current prices.

Table 8-9-1 Fund Requirement

(Unit: Thousand US dollars)

	Price in 1983	Current Price
Civil Works	5,535	5,960
Electrical Equip.	3,735	4,022
Miscellaneous	2,217	2,387
Sub-total	11,487	12,369
Interest during Const.	919	982
Total	12,406	13,351

With regard to the funding plan, the same conditions for procuring funds as for the case of constructing a hydro-electric power station of 4,200 kW which supplies electric power for the mine and for public use will apply: 70% of total fund requirement at interest rate of 3%, repayment of loan in 20 years including 5-year grace period, and 30% at interest rate of 8%, repayment in 7 years with no grace period.

(c) Expenses

The method estimating personnel cost, fuel cost, and maintenance and operation cost is to be completely the same as for the case of constructing the hydro-electric power station of installed capacity of 4,200 kW. The energy production which is to be the basis for computing the fuel cost is the same as the quantity of electric energy shown in Table 6-5-1.

(d) Sales

With regard to sales of ore, there is nothing different from the case of constructing the hydro-electric power station with installed capacity of 4,200 kW. However, there will be no electricity energy revenue since there would be no supply of electric power to neighboring communities.

8.9.3 Financial Internal Rate of Return (FIRR)

The FIRR in case of the hydro-electric power station exclusively for the mine may be determined from the differences in investment and return in the two cases of construction of the power station for exclusive mine use and of not constructing the power station and meeting the power demand of the main through renewal of diesel facilities only. The results obtained in this manner are shown in Table 8-9-2. According to examinations of the results, the FIRR for the case of the hydro-electric power station for exclusive use by the mine was 12.52% before taxes and 10.17% after taxes.

In the case of constructing a hydro-electric power station of installed capacity of 4,200 kW which supplies electric power to surrounding communities for public use, the FIRR was 10.76% before taxes and 8.91% after taxes. Consequently, there are differences between the two of 1.76 percentage points before taxes and 1.26 percentage points after taxes. In other words, by constructing a hydro-electric power station having sufficient installed capacity for supplying electric power to surrounding communities for public use, Santa Luisa will be forced to make an investment more than one percentage point lower in profitability that the case of constructing a hydro-electric power station for the exclusive use of the mine.

In the calculations above, the current electricity rates at Huallanca were used to compute the electricity revenues produced from supply of electric power for public use. Actually, however, in discussions with ElectroPeru, to whom the electric power would be sold wholesale, there is a strong possibility that the electricity rates will be held down to even lower levels. In such case, the above-mentioned difference in profitability will be still larger.

Table 8-9-2 Financial Rate of Return (in current price)

*** HUANZALA POWER PROJECT ***
FINANCIAL RATE OF RETURN (IN CURRENT PRICE)
(USD 1000)

YEAR	FIXED CAPITAL EXPEND	CHANGE IN WORKING CAPITAL	(1) GROSS CAPITAL EXPENDTR	OPERATING PROFIT	DEPRECIATN	(2) GROSS CASH IN-FLOW	(3) INCOME TAX (INCL. COCOM!)	(4) BFR-TAX NET IN-FLOW (2)-(1)	(5) AFT-TAX NET IN-FLOW (4)-(3)
1983	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0
1985	5743	0	5743	0	0	0	0	-5743	-5743
1986	4843	0	4843	0	0	0	-0	-4843	-4843
1987	0	-54	-54	931	420	1351	128	1405	1277
1988	0	-2	-2	1012	420	1432	169	1433	1265
1989	0	-2	-2	1040	420	1460	192	1461	1269
1990	0	-1	-1	1067	420	1487	215	1488	1273
1991	0	-1	-1	1093	420	1513	238	1514	1276
1992	-600	9	-591	948	600	1548	204	2140	1936
1993	0	-9	-9	1097	480	1577	273	1586	1313
1994	600	-1	599	1127	480	1608	303	1009	706
1995	-600	7	-593	1009	600	1609	269	2202	1933
1996	0	-8	-8	1147	480	1627	320	1636	1315
1997	0	-0	-0	1162	480	1642	331	1642	1312
1998	-600	6	-594	1055	600	1655	301	2249	1948
1999	0	-2	-2	1083	480	1564	316	1566	1250
2000	600	-7	593	1205	360	1565	361	972	610
2001	0	14	14	965	600	1565	287	1550	1263
2002	0	-0	-0	956	600	1556	290	1556	1266
2003	0	-0	-0	961	600	1561	297	1562	1264
2004	0	6	6	853	720	1573	267	1567	1300
2005	0	-0	-0	851	720	1571	271	1571	1300
2006	-0	47	47	969	600	1569	316	1522	1206
	9987	0	9987	20529	10504	31033	5348	21046	15698

INTERNAL RATE OF RETURN

ON (4) BFR-TAX NET IN-FLOW (2)-(1) 12.52 PER CENT

ON (5) AFT-TAX NET IN-FLOW (4)-(3) 10.17 PER CENT

8.10 Profit and Loss Projection and Cash Flow Projection

The profit and loss projections for the cases of constructing the hydro-electric power station (4,200 kW, for mining and for public use) and not constructing the hydro-electric power station (ultimate diesel capacity 5,670 kW, only for mining) are given in Table 8-10-1 and Table 8-10-2. According to these tables, the accounts of Santa Luisa will show a surplus every term with respect to profit and loss for both cases. However, as can be predicted from the previously-mentioned FIRR figures, the surplus will be larger for the case of not constructing the hydro-electric power station, and the difference will become greater the farther into the future.

Taking profit after taxes as an example, the difference between the two cases will be US$210,000 in 1987, but this will become US$1,056,000 ten years later in 1996, expanding to US$1,611,000 twenty years later in 2006. Even when looking only at the case of constructing the hydro-electric power station, the profitability improves more the farther into the future during the life of the Project. For example, examined on the basis of ratio of profit after taxes to sales amount, what was 5.6% in 1987, and 5.1% in 1996, will rise to 6.0% in 2000, and 7.3% in 2006.

Meanwhile, the cash flow during the life of the Project for the case of constructing the hydro-electric power station is given in Table 8-10-3. In this projection, consideration is given to covering any deficits produced in cash flow during the life of the Project with introduction of short-term funds. However, as can be seen by examining the cash flow projection, borrowing of short-term funds will be unnecessary during the project life, and there will be no shortage in the cash flow. In effect, even if the entire amount of the funds for construction of the hydro-electric power station were to be borrowed under the conditions described in Section 8.7, there will be no obstacles to repayment of principal and interest.

Table 8-10-1 Income Statement
(with Project) ..... (3 sheets)

HUANZALA POWER PROJECT
INCOME STATEMENTS (FOR ENDING DECEMBER 31)
- WITH CASE -
(USD 1000)

YEAR	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
OPERATING INCOME	19733	20325	20935	21563	22230	22898	23586	24295	25025	25778
TOTAL SALES REVENUE (1)	19733	20325	20935	21563	22210	22876	23562	24269	24997	25747
OTHER OPERATING INCOME(2)	0	0	0	0	21	22	24	26	28	30
COST OF SALES	12433	12871	13495	14577	14466	13989	14334	14562	16834	17467
VARIABLE COST	5725	5995	6714	7218	6074	6265	6461	6664	8437	8713
DIRECT FIXED COST	5437	5619	5806	5999	6208	6395	6586	6784	6988	7197
DEPRECIATION AND AMORTIZATION	1326	1260	1433	1496	2175	1302	1309	1126	1541	1586
(LESS)INC.IN PRODUCT INVENTORY	55	22	58	36	-9	-27	22	12	131	29
GROSS PROFIT ON SALES	7300	7454	7040	6986	7764	8910	9252	9733	8192	8311
SALES EXPENSES	3417	3519	3625	3734	3846	3961	4080	4202	4328	4458
GENERAL ADMINISTRATIVE EXP.	751	773	797	821	845	870	897	924	951	980
OPERATING PROFIT	3132	3162	2619	2432	3074	4078	4276	4607	2912	2873
NON-OPERATING INCOME	0	0	0	0	0	0	0	0	0	0
NON-OPERATING EXPENSES	1362	1229	1189	595	1226	1191	1156	1123	1089	1056
INTEREST ON LONG TERM DEBT	79	53	18	6	664	615	561	509	458	406
INTEREST ON SHORT TERM DEBT	269	148	127	44	0	0	0	0	0	0
NON-OPERATION EXPENSES	1013	1028	1044	545	561	576	595	613	632	651
NET PROFIT OR (LOSS) BEFORE TAX	1771	1933	1430	1837	1848	2887	3119	3484	1823	1816
INCOME TAX	473	516	382	490	493	771	833	930	487	485
(LES) COGENI	-115	-126	-93	-119	-120	-188	-203	-226	-118	-118
NET PROFIT OR (LOSS) AFTER TAX	1183	1202	947	1224	1234	1929	2084	2328	1218	1213
DIVIDENDS	386	421	312	400	403	629	680	760	397	396
RETAINED EARNINGS	797	860	635	824	831	1299	1404	1568	820	817

Note : (1) Production sales
(2) Energy sales

*** HUANZALA POWER PROJECT ***
INCOME STATEMENTS (FOR ENDING DECEMBER 31)
- WITH CASE -
(USD 1000)

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
OPERATING INCOME	26553	27351	28175	29020	29893	30792	31718	32673	33656	34669
TOTAL SALES REVENUE	26520	27315	28135	28979	29848	30743	31666	32616	33594	34602
OTHER OPERATING INCOME	33	36	38	42	45	49	53	57	62	67
COST OF SALES	17969	18487	19024	19723	20115	20684	21283	21901	22036	22662
VARIABLE COST	8990	9278	9579	9909	10219	10541	10873	11218	11582	11946
DIRECT FIXED COST	7413	7636	7865	8101	8344	8594	8852	9117	9391	9672
DEPRECIATION AND AMORTIZATION	1594	1602	1610	1752	1572	1581	1590	1600	1070	1080
(LESS)INC.IN PRODUCT INVENTORY	28	29	30	39	21	32	33	34	6	36
GROSS PROFIT ON SALES	8583	8863	9149	9298	9779	10108	10436	10771	11620	12006
SALES EXPENSES	4592	4730	4872	5018	5168	5323	5483	5648	5817	5992
GENERAL ADMINISTRATIVE EXP.	1009	1039	1071	1103	1136	1170	1205	1241	1278	1317
OPERATING PROFIT	2982	3094	3207	3177	3474	3615	3748	3883	4524	4698
NON-OPERATING INCOME	0	0	0	0	0	0	0	0	0	0
NON-OPERATING EXPENSES	1004	952	953	954	956	958	962	965	970	975
INTEREST ON LONG TERM DEBT	334	262	242	222	202	181	161	141	121	101
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
NON-OPERATION EXPENSES	670	690	711	732	754	777	800	824	849	874
NET PROFIT OR (LOSS) BEFORE TAX	1978	2142	2254	2223	2518	2657	2786	2917	3554	3723
INCOME TAX	528	572	602	594	672	709	744	779	949	994
(LES) CODIMI	-120	-139	-146	-145	-164	-173	-181	-190	-231	-242
NET PROFIT OR (LOSS) AFTER TAX	1321	1431	1505	1485	1682	1775	1861	1949	2374	2487
DIVIDENDS	431	467	491	485	549	579	607	636	775	812
RETAINED EARNINGS	890	964	1014	1000	1133	1196	1254	1313	1599	1675

HUANZALA POWER PROJECT
INCOME STATEMENTS (FOR ENDING DECEMBER 31)
- WITH CASE -

(USD 1000)

YEAR	2003	2004	2005	2006
OPERATING INCOME	35712	36787	37895	39036
TOTAL SALES REVENUE	35640	36709	37811	38945
OTHER OPERATING INCOME	72	78	84	91
COST OF SALES	23346	24052	24785	25543
VARIABLE COST	12331	12729	13144	13575
DIRECT FIXED COST	9983	10261	10569	10886
DEPRECIATION AND AMORTIZATION	1091	1101	1112	1124
(LESS)INC.IN PRODUCT INVENTORY	58	39	40	42
GROSS PROFIT ON SALES	12366	12735	13110	13493
SALES EXPENSES	6171	6356	6547	6744
GENERAL ADMINISTRATIVE EXP.	1356	1397	1439	1482
OPERATING PROFIT	4839	4981	5124	5267
NON-OPERATING INCOME	0	0	0	0
NON-OPERATING EXPENSES	981	988	996	1004
INTEREST ON LONG TERM DEBT	81	60	40	20
INTEREST ON SHORT TERM DEBT	0	0	0	0
NON-OPERATION EXPENSES	901	928	956	984
NET PROFIT OR (LOSS) BEFORE TAX	3857	3993	4128	4263
INCOME TAX	1030	1066	1102	1138
(LESS) COGNMI	-251	-260	-268	-277
NET PROFIT OR (LOSS) AFTER TAX	2577	2667	2757	2848
DIVIDENDS	841	871	900	929
RETAINED EARNINGS	1736	1797	1858	1918

Table 8-10-2 Income Statement
(without Project) ..... (3 sheets)

*** BUANZALA POWER PROJECT ***
INCOME STATEMENTS (FOR ENDING DECEMBER 31)
- WITHOUT CASE- (USD 1000)

YEAR	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
OPERATING INCOME	19733	20325	20945	21563	22210	22876	23562	24269	24997	25747
TOTAL SALES REVENUE	19733	20325	20945	21563	22210	22876	23562	24269	24997	25747
OTHER OPERATING INCOME	0	0	0	0	0	0	0	0	0	0
COST OF SALES	12433	12871	13695	14577	15425	15078	15507	15822	18142	18636
VARIABLE COST	5725	5995	6714	7216	7652	7922	8203	8494	10352	10714
DIRECT FIXED COST	5437	5619	5806	5999	6179	6365	6556	6752	6955	7163
DEPRECIATION AND AMORTIZATION	1326	1230	1433	1396	1641	768	775	595	969	780
(LESS)INC.IN PRODUCT INVENTORY	55	22	58	36	47	-23	26	17	134	21
GROSS PROFIT ON SALES	7300	7454	7040	6986	6785	7798	8055	8447	6856	7111
SALES EXPENSES	5417	5519	5025	5734	5846	4961	4080	4202	4328	4458
GENERAL ADMINISTRATIVE EXP.	751	773	797	821	845	870	897	924	951	980
OPERATING PROFIT	3132	3162	2619	2432	2094	2967	3079	3321	1576	1673
NON-OPERATING INCOME	0	0	0	0	0	0	0	0	0	0
NON-OPERATING EXPENSES	1362	1229	1189	595	561	578	595	613	632	651
INTEREST ON LONG TERM DEBT	79	53	15	6	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	269	148	127	44	0	0	0	0	0	0
NON-OPERATION EXPENSES	1013	1028	1044	545	561	578	595	613	632	651
NET PROFIT OR (LOSS) BEFORE TAX	1771	1933	1430	1837	1533	2389	2483	2708	944	1023
INCOME TAX	474	516	382	490	409	638	663	723	252	273
(LES) COGMI	-116	-128	-93	-119	-100	-155	-161	-176	-61	-66
NET PROFIT OR (LOSS) AFTER TAX	1183	1242	947	1224	1024	1596	1659	1809	631	683
DIVIDENDS	386	421	312	400	334	521	541	590	206	223
RETAINED EARNINGS	797	820	635	824	690	1075	1118	1218	425	460

INCOME STATEMENTS (FOR ENDING DECEMBER 31)

MANZALA POWER PROJECT

- WITHOUT CASE-

(USD 1000)

YEAR	1995	1996	1995	1996	1997	1998	1999	2000	2001	2002
OPERATING INCOME	26520	27315	28135	28979	29848	30743	31666	32616	33594	34602
TOTAL SALES REVENUE	26520	27315	28135	28979	29848	30743	31666	32616	33594	34602
OTHER OPERATING INCOME	0	0	0	0	0	0	0	0	0	0
COST OF SALES	19398	20025	20665	21484	21992	22496	23207	23907	24117	24832
VARIABLE COST	11118	11587	11912	12327	12716	13119	13389	13814	14254	14709
DIRECT FIXED COST	7375	7600	7826	8063	8304	8553	8810	9074	9347	9627
DEPRECIATION AND AMORTIZATION	944	952	961	1140	998	851	1047	1057	527	537
(LESS)INC.IN PRODUCT INVENTORY	43	14	35	46	27	28	40	38	10	41
GROSS PROFIT ON SALES	7122	7290	7470	7495	7856	8248	8459	8709	9477	9770
SALES EXPENSES	4592	4730	4872	5018	5168	5323	5483	5648	5817	5992
GENERAL ADMINISTRATIVE EXP.	1009	1039	1071	1103	1136	1170	1205	1241	1278	1317
OPERATING PROFIT	1521	1521	1528	1374	1552	1755	1771	1820	2382	2462
NON-OPERATING INCOME	0	0	0	0	0	0	0	0	0	0
NON-OPERATING EXPENSES	670	690	711	732	754	777	800	824	849	874
INTEREST ON LONG TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
NON-OPERATION EXPENSES	670	690	711	732	754	777	800	824	849	874
NET PROFIT OR (LOSS) BEFORE TAX	851	830	817	642	798	978	971	996	1533	1587
INCOME TAX	227	222	216	171	213	261	259	266	409	424
(LES) COCIMI	-55	-54	-53	-42	-52	-64	-63	-65	-100	-103
NET PROFIT OR (LOSS) AFTER TAX	568	555	546	429	533	653	648	665	1024	1060
DIVIDENDS	185	181	178	140	174	213	212	217	334	346
RETAINED EARNINGS	383	374	368	289	359	440	437	448	690	714

*** MANZALA POWER PROJECT ***
INCOME STATEMENTS (FOR ENDING DECEMBER 31)
- WITHOUT CASE -
(USD 1000)

YEAR	2003	2004	2005	2006
OPERATING INCOME	35640	36709	37811	38945
TOTAL SALES REVENUE	35640	36709	37811	38945
OTHER OPERATING INCOME	0	0	0	0
COST OF SALES	25602	26221	27033	27884
VARIABLE COST	15181	15670	16176	16701
DIRECT FIXED COST	9916	10213	10520	10835
DEPRECIATION AND AMORTIZATION	547	371	342	304
(LESS)INC.IN PRODUCT INVENTORY	42	34	45	47
GROSS PROFIT ON SALES	10038	10489	10778	11061
SALES EXPENSES	6171	6356	6547	6744
GENERAL ADMINISTRATIVE EXP.	1356	1397	1439	1482
OPERATING PROFIT	2511	2735	2792	2836
NON-OPERATING INCOME	0	0	0	0
NON-OPERATING EXPENSES	901	928	956	984
INTEREST ON LONG TERM DEBT	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0
NON-OPERATION EXPENSES	901	928	956	984
NET PROFIT OR (LOSS) BEFORE TAX	1610	1808	1836	1852
INCOME TAX	450	413	490	494
(LES) CODIMI	-105	-118	-119	-120
NET PROFIT OR (LOSS) AFTER TAX	1076	1208	1227	1247
DIVIDENDS	351	394	400	404
RETAINED EARNINGS	725	813	826	853

Table 8-10-3 Funds Flow Statement
(with Project) ..... (3 sheets)

*** HUANZALA POWER PROJECT ***
FUNDS FLOW STATEMENTS (FOR ENDING DECEMBER 31)
- WITH CASE - (USD 1000)

YEAR	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
SOURCE OF FUNDS	4358	4031	10317	9923	4073	3845	3953	3963	3216	3205
CASH GENERATED	2857	2762	2525	2670	4073	3845	3953	3963	3216	3205
PROFIT AFT. TAX, BFR INT.	1531	1432	1092	1274	1899	2541	2645	2837	1675	1619
DEPRECIATION AND AMORTIZATION	1326	1330	1433	1396	2175	1302	1309	1126	1541	1586
FINANCIAL RESOURCES	1501	1269	7792	7253	0	0	0	0	0	0
SHARE CAPITAL	0	0	0	0	0	0	0	0	0	0
LONG TERM DEBT	0	0	7352	7253	0	0	0	0	0	0
SHORT TERM DEPT	1481	1269	440	0	0	0	0	0	0	0
OTHER CASH	0	0	0	0	0	0	0	0	0	0
NON-CASH FUNDS	0	0	0	0	0	0	0	0	0	0
USES OF FUNDS	4422	4031	10317	8894	1930	2095	2148	5863	2266	2410
FIXED CAPITAL EXPENDITURE	350	1399	8189	7744	225	231	238	3935	633	260
NON-DEPRECIABLE ASSETS	0	0	0	0	0	0	0	0	0	0
DEPRECIABLE FIXED ASSETS	350	1399	7724	7585	225	231	238	3935	633	260
INTEREST DURING CONSTRUCTION	0	0	465	160	0	0	0	0	0	0
CHANGE IN WORKING CAPITAL	0	22	58	36	-9	-27	22	12	131	29
DEBT SERVICES	3686	2148	1750	713	1511	1259	1208	1156	1104	1724
REPAYMENT OF LONG TERM DEBT	344	506	344	223	647	647	647	647	647	1319
REPAYMENT OF SHORT TERM DEBT	2994	1441	1269	440	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT	79	53	14	6	864	613	561	509	458	406
INTEREST ON SHORT TERM DEBT	269	148	127	44	0	0	0	0	0	0
DIVIDENDS	386	421	312	400	403	629	680	760	397	396
CASH INCREASE OR (DECREASE)	-84	-0	-0	1029	2143	1750	1806	-1900	950	795
BEGINNING CASH BALANCE	84	-0	-0	-0	1029	3173	4923	6729	4829	5779
ENDING CASH BALANCE	-0	-0	-0	1029	3173	4923	6729	4829	5779	6574

HUANZALA POWER PROJECT
FUNDS FLOW STATEMENTS (FOR FIXING DECEMBER 31)
- WITH CASE - (USD 1000)

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SOURCE OF FUNDS	5249	5295	5358	5459	5456	5537	5613	5690	5565	5668
CASH GENERATED	5249	5295	5358	5459	5456	5537	5613	5690	5565	5668
PROFIT AFT. TAX, PER INT.	1655	1693	1747	1707	1884	1956	2022	2090	2495	2588
DEPRECIATION AND AMORTIZATION	1594	1602	1610	1752	1572	1581	1590	1600	1070	1080
FINANCIAL RESOURCES	0	0	0	0	0	0	0	0	0	0
SHARE CAPITAL	0	0	0	0	0	0	0	0	0	0
LONG TERM DEBT	0	0	0	0	0	0	0	0	0	0
SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
OTHER CASH	0	0	0	0	0	0	0	0	0	0
NON-CASH FUNDS	0	0	0	0	0	0	0	0	0	0
USES OF FUNDS	2379	1705	2574	1710	1746	1775	1794	1813	1913	1970
FIXED CAPITAL EXPENDITURE	268	276	1140	293	302	311	320	330	340	350
NON-DEPRECIABLE ASSETS	0	0	0	0	0	0	0	0	0	0
DEPRECIABLE FIXED ASSETS	268	276	1140	293	302	311	320	330	340	350
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0
CHANGE IN WORKING CAPITAL	28	29	30	39	21	32	33	34	6	36
DEBT SERVICES	1652	934	914	994	873	855	853	813	793	773
REPAYMENT OF LONG TERM DEBT	1319	672	672	672	672	672	672	672	672	672
REPAYMENT OF SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT	334	262	242	222	202	181	161	141	121	101
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
DIVIDENDS	431	467	491	485	549	579	607	636	775	812
CASH INCREASE OR (DECREASE)	870	1589	783	1749	1711	1762	1819	1877	1652	1698
BEGINNING CASH BALANCE	6574	7444	9034	9817	11565	13277	15039	16858	18735	20387
ENDING CASH BALANCE	7444	9034	9817	11565	13277	15039	16858	18735	20387	22084

HUANZALA POWER PROJECT
FUNDS FLOW STATEMENTS (FOR ENDING DECEMBER 31)
- WITH CASH -

(USD 1000)

YEAR	2003	2004	2005	2006
SOURCE OF FUNDS	3748	3829	3910	3992
CASH GENERATED	3748	3829	3910	3992
PROFIT AFT. TAX, PER INT.	2657	2728	2798	2868
DEPRECIATION AND AMORTIZATION	1091	1101	1112	1124
FINANCIAL RESOURCES	0	0	0	0
SHARE CAPITAL	0	0	0	0
LONG TERM DEBT	0	0	0	0
SHORT TERM DEBT	0	0	0	0
OTHER CASH	0	0	0	0
NON-CASH FUNDS	0	0	0	0
USES OF FUNDS	1991	2013	2035	2057
FIXED CAPITAL EXPENDITURE	388	371	382	394
NON-DEPRECIABLE ASSETS	0	0	0	0
DEPRECIABLE FIXED ASSETS	388	371	382	394
INTEREST DURING CONSTRUCTION	0	0	0	0
CHANGE IN WORKING CAPITAL	38	39	40	42
DEBT SERVICES	752	732	712	692
REPAYMENT OF LONG TERM DEBT	672	672	672	672
REPAYMENT OF SHORT TERM DEBT	0	0	0	0
INTEREST ON LONG TERM DEBT	81	60	40	20
INTEREST ON SHORT TERM DEBT	0	0	0	0
DIVIDENDS	841	871	900	929
CASH INCREASE OR (DECREASE)	1756	1816	1876	1935
BEGINNING CASH BALANCE	22084	23841	25657	27533
ENDING CASH BALANCE	23841	25657	27533	29468

8.11 Study on Generating Unit Cost in Future

The significance of this Project lies in lowering the power generating cost, and reduction in generating cost will have great meaning in management of Huanzala Mine as already stated. The question will then be how the unit price of electric power will be lowered through implementation of this Project. Unit power generating costs laid out annually in comparison with the case of not constructing the hydro-electric power station are shown in Figs. 8-11-1 through 8-11-4. In calculation of unit generating cost, with the expense disbursements used for calculating FIRR as the bases, expenses other than of the electric power section were deducted to obtain the annual expense incurred for the electric power sector only, and this was divided by the total energy production to determine the unit generating cost. Further, with regard to the funding plan, it was assumed that the entire amount would be borrowed for construction of the hydro-electric power station only, with purchases of the remaining electric power facilities (cost of renewing diesel equipment) to be with the company's own funds. Therefore, the financial expenditure of interest will be incurred only in case of constructing the hydro-electric power station.

According to the unit generating cost projection of Fig. 8-11-1 (case of inflation rate of 3% annum), the unit cost in case of constructing the hydro-electric power station having an installed capacity of 4,200 kW for the mine and public use in this Project will be lowered from US9.3 cent/ kWh in 1987 to US$7.4 cent/kWh in 2006. On the other hand, in case of relying on only diesel generating facilities (ultimate capacity 5,670 kW), the unit cost will rise from US11.2 cent/kWh in 1987 to US$16.0 cent/kWh in 2006. During this period, the difference in unit power generating cost will be magnified from 1.9 cent/kWh to 8.6 cent/kWh. In case of an inflation rate of 5%, this difference will become even greater. (Fig. 8-11-2)

As for Figs. 8-11-3 and 8-11-4, these show the changes in unit generating cost taking the case of inflation rate of 3% annum with fuel costs being respectively 10% and 20% higher than the inflation rate in general. In the case of fuel cost increased 10%, the difference in unit

generating costs between the cases of "constructing" and "not constructing" the hydro-electric power station will be US2.7 cent/kWh in 1987, and US9.9 cent/kWh in 2006. In effect, compared with the basic case of all factors rising at 3% annum, the difference in unit generating cost will be further increased.

Fig. 8-11-1 Energy Cost Projection
(Escalation of 3%)

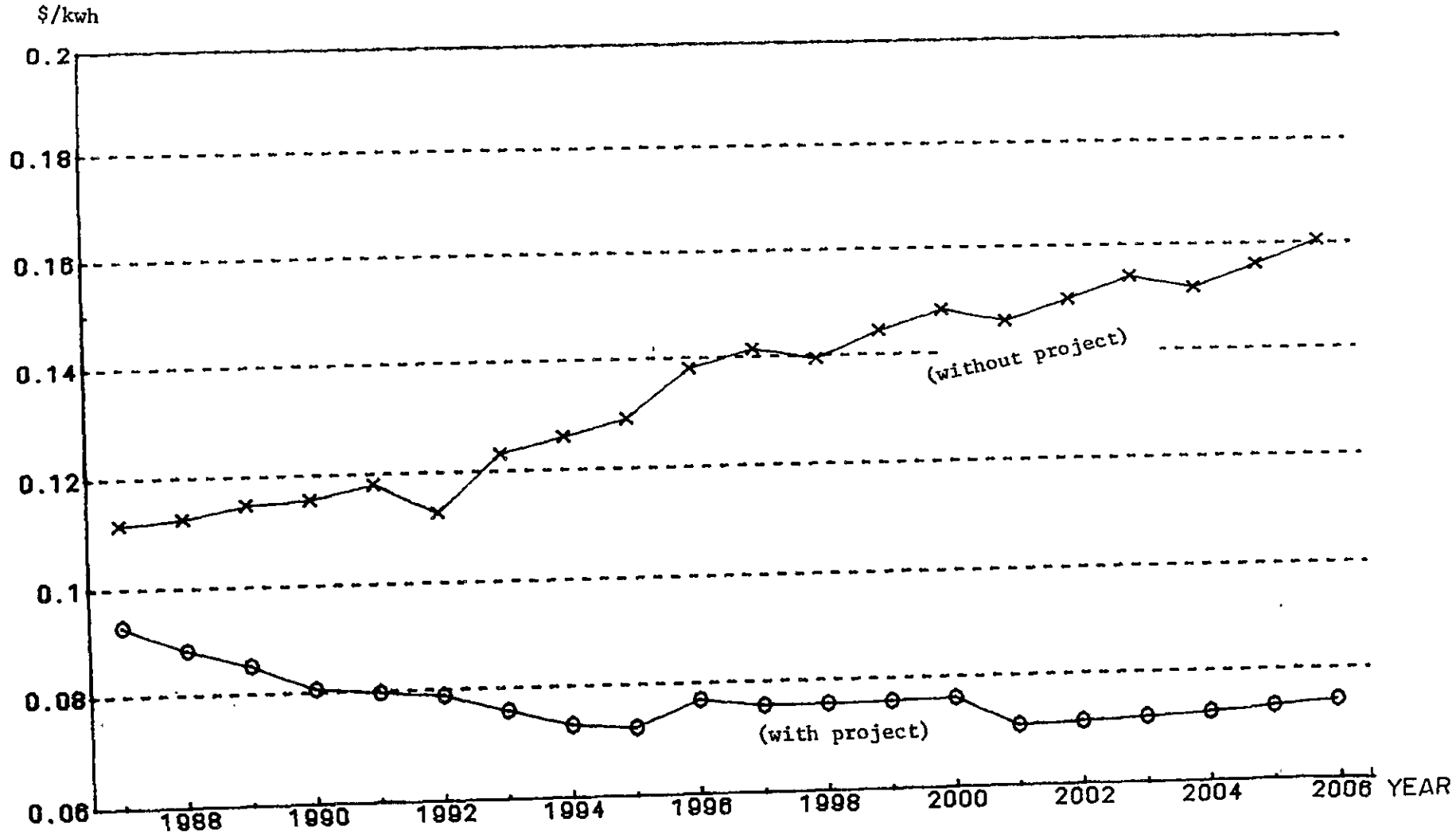


Fig. 8-11-2 Energy Cost Projection
(Escalation of 5%)

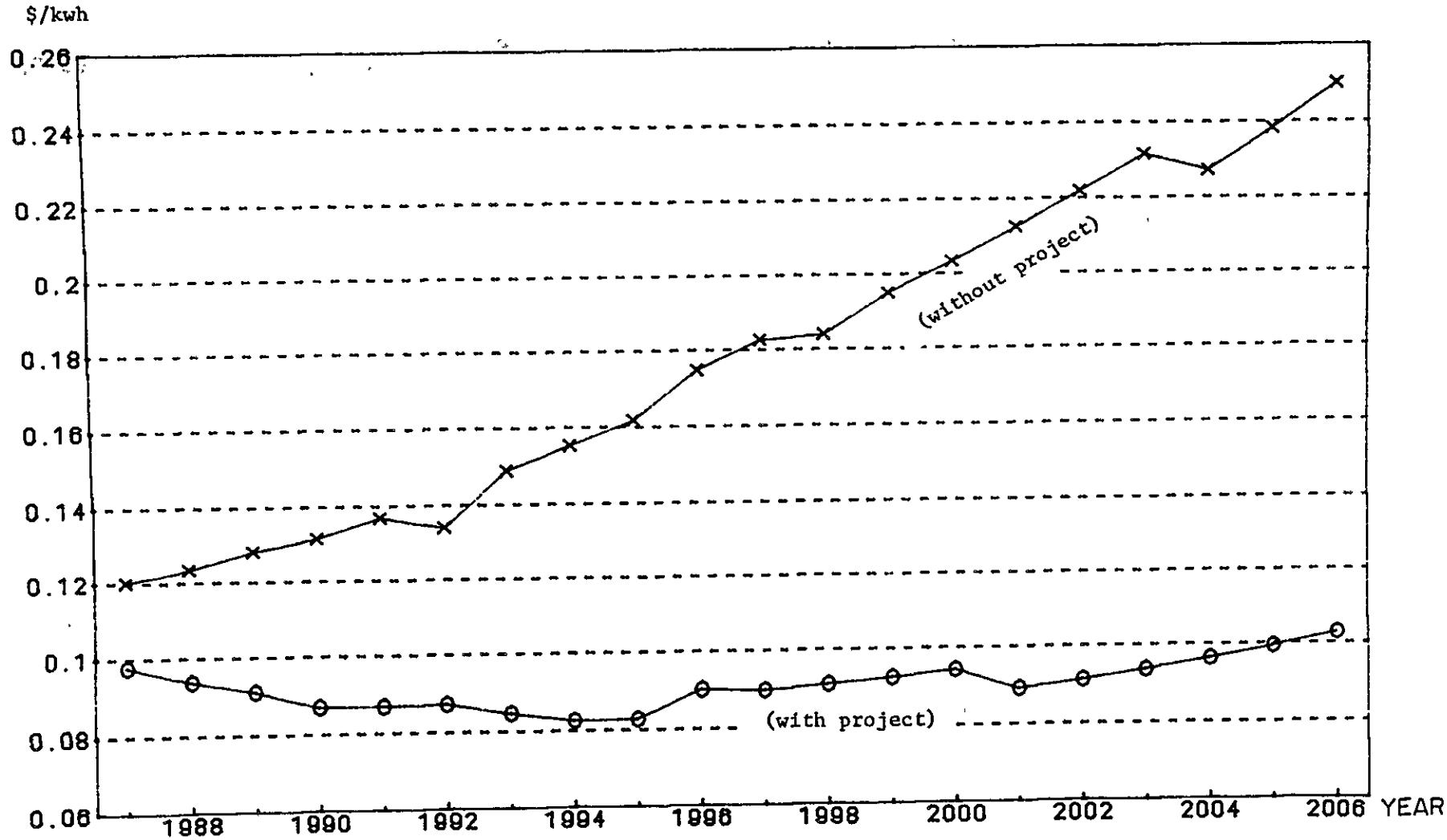


Fig. 8-11-3 Energy Cost Projection
(Fuel cost: 10% up)

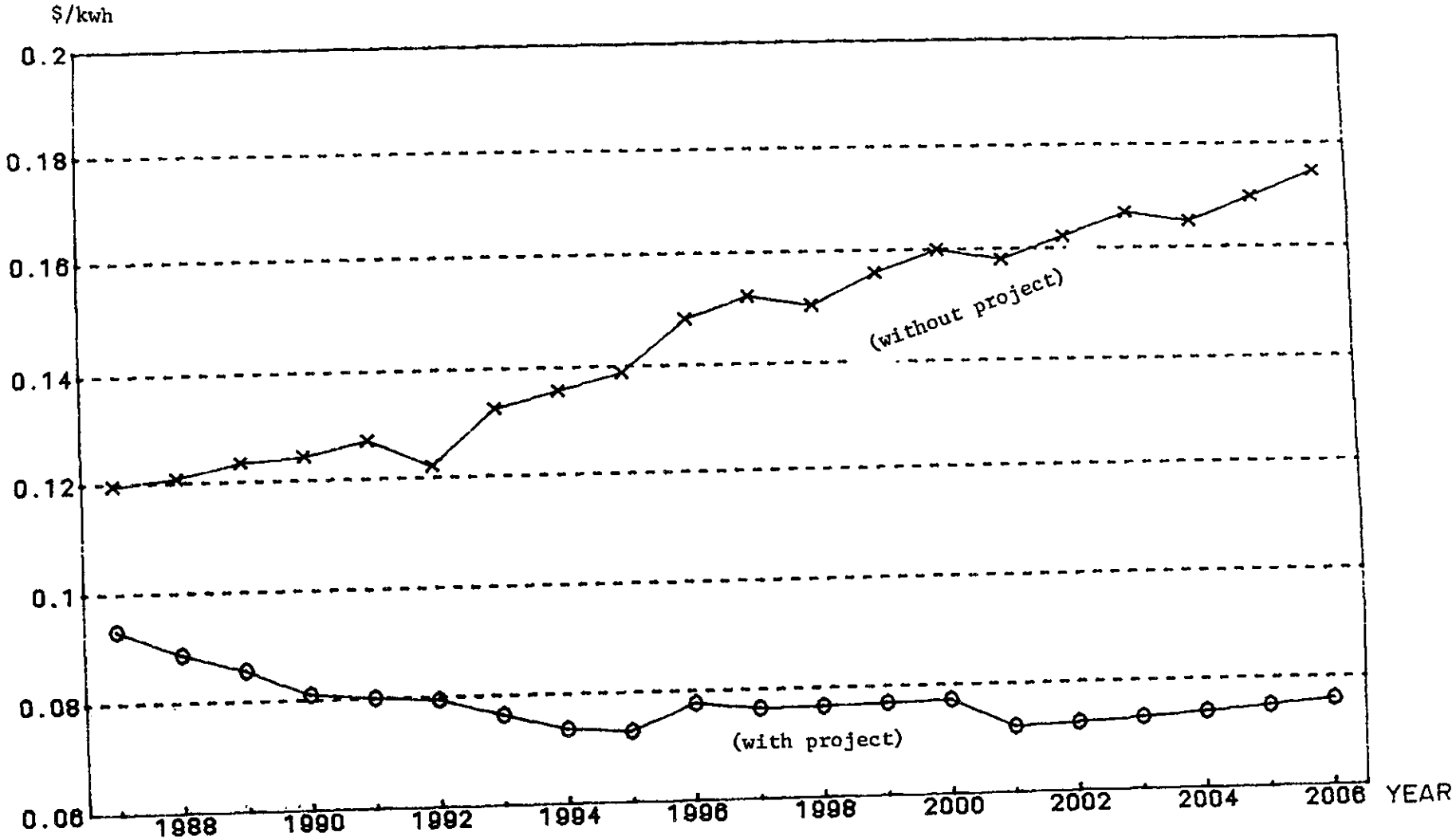
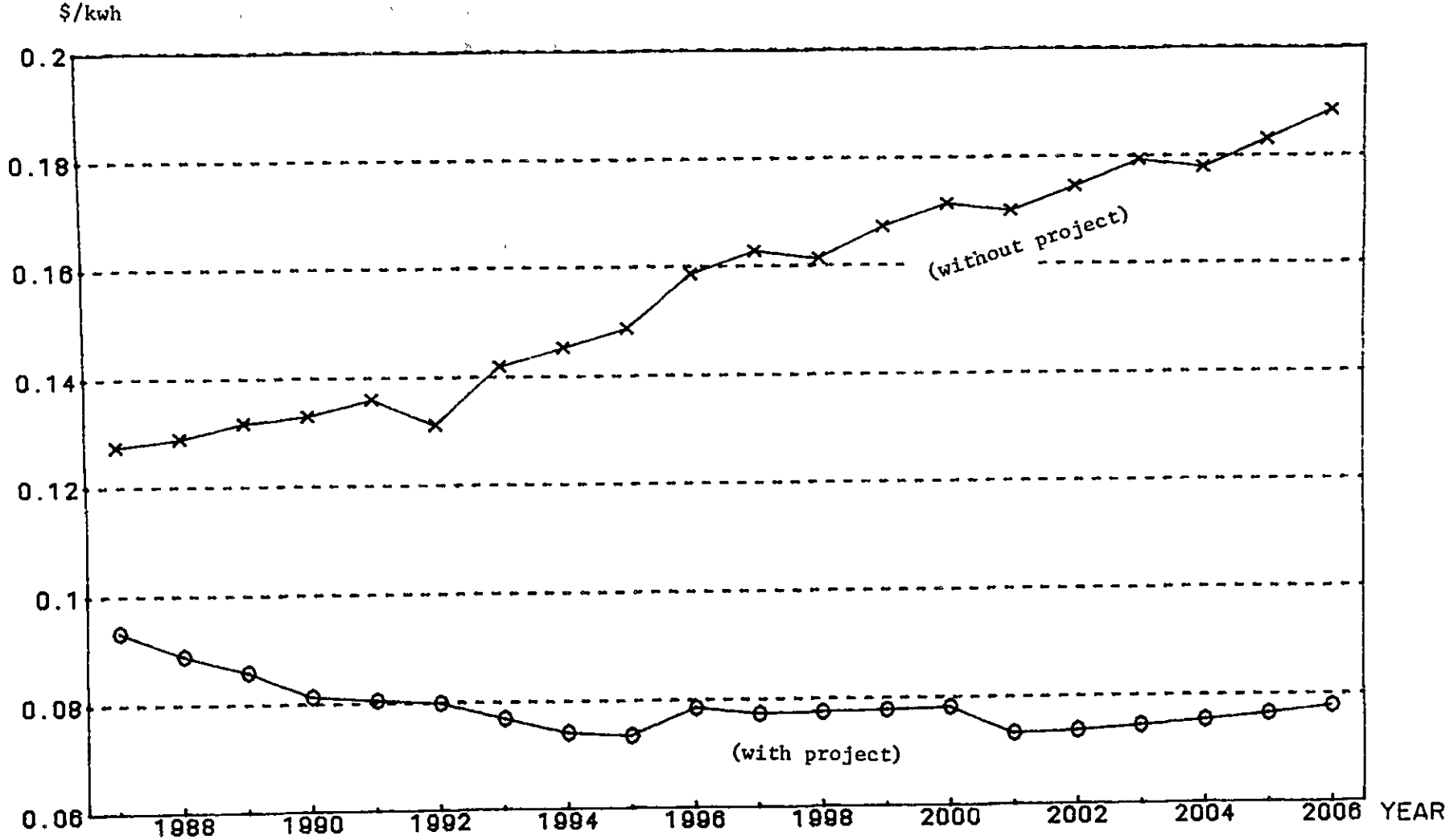


Fig. 8-11-4 Energy Cost Projection
(Full cost: 20% up)



8.12 Sensitivity Analysis

Sensitivity analyses were performed for the following cases:

Table 8-12-1 Sensitivity Analysis

(1) FIRR

	Variation (%)				
Construction Cost	-20	-10	0	+10	+20
Fuel cost	-20	-10	0	+10	+20
Electricity Revenue	-20	-10	0	+10	+20

(2) Cash Flow

(a) Ore Sales

Cases of 5%, 10% and 20% decline in silver prices

(b) Financing Terms

— 50% of Investment Amount: Interest 3%, repayment period 20 yr incl. 5-yr grace period

50% of Investment Amount: Interest 8%, repayment period 7 yr, no grace period

— 30% of Investment Amount: Interest 3%, repayment period 20 yr incl. 5-yr grace period

70% of Investment Amount: Interest 8%, repayment period 7 yr, no grace period

The results of sensitivity analyses concerning FIRR are shown in Fig. 8-12-1. Since electric energy sales are small in terms of monetary amounts, the effects of their variations on the FIRR are small. On the other hand, variations in investment amounts will have great influences on the FIRR. If the investment amount is increased by 10%, the FIRR will be lowered from 8.91% to 7.77%, and the profitability of the Project will

be very adversely affected. Consequently, in a situation where inflation is proceeding at a severe rate, special attention should be paid to the fact that the investment amount will be increased by such matters as delay in starting the Project.

The item having the greatest effect on cash flow is ore sales. It is the price of silver that governs the profitability of Huanzala Mine. As may be seen in Table 8-12-1, the price of silver during the past 10 years has varied between US$4.40 per ounce and US$20.6 per ounce. At present, the price is approximately US$9/TOZ. The effect of variation in the price of silver on cash flow, for example, in the case of the silver price having been brought down 20% was examined and this is shown in Table 8-12-1. In this case, deficits will also continue from the standpoint of profit and loss, there will be difficulties with regard to cash flow, and it will be unavoidable for short-term loans to be relied on.

Next, the effects of variations in financing terms on the Project will be studied. A change in the financing terms will affect the cash flow of the Project. Instead of an analysis by the cash flow projection, evaluation is made by a different approach, that of debt service ratio (D.S.R.). D.S.R. indicates the margin for repayment, and it is calculated by dividing the sum of (profit after taxes + interest + depreciation) by the sum of (principal repaid + interest). On looking at the period from 1987 to 1993 when the burden of repayment is great, in case of constructing the hydro-electric power station of 4,200 kW for mining and for public use in this Project according to the conditions for fund procurement described in Section 8.4.2 (basic case), the D.S.R. is maintained roughly at 3, but in the two cases of (2)-(b) previously mentioned, the values of D.S.R. are approximately one percentage point lower compared with the basic case (Table 8-12-2). So far as seen from this study, it must be said from the viewpoint of safety of repayment that there will be a slight lack of assuredness when the ratio of the high-interest portion exceeds 50%.

Table 8-12-2 Funds Flow Statement
(with Project) ..... (3 sheets)

HUANZALA POWER PROJECT
FUNDS FLOW STATEMENTS (FOR ENDING DECEMBER 31)
- WITH CASE -
(USD 1000)

YEAR	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
SOURCE OF FUNDS	3952	4789	12460	12685	6546	5835	5367	8508	8648	10145
CASH GENERATED	1398	1289	856	1051	2393	2349	2399	2345	1256	1170
PROFIT AFT. TAX, BFR INT.	73	9	-575	-345	218	1047	1090	1219	-285	-416
DEPRECIATION AND AMORTIZATION	1325	1280	1433	1396	2175	1302	1309	1176	1541	1586
FINANCIAL RESOURCES	2554	3501	11602	11634	3953	3484	2968	6163	7392	8975
SHARE CAPITAL	0	0	0	0	0	0	0	0	0	0
LONG TERM DEBT	0	0	7352	7253	0	0	0	0	0	0
SHORT TERM DEBT	2554	3501	4250	4381	3953	3484	2968	6163	7392	8975
OTHER CASH	0	0	0	0	0	0	0	0	0	0
NON-CASH FUNDS	0	0	0	0	0	0	0	0	0	0
USES OF FUNDS	4036	4789	12460	12685	6546	5835	5367	8508	8648	10145
FIXED CAPITAL EXPENDITURE	350	1309	8189	7744	225	231	238	3935	633	260
NON-DEPRECIABLE ASSETS	0	0	0	0	0	0	0	0	0	0
DEPRECIABLE FIXED ASSETS	350	1309	7724	7585	225	231	238	3935	633	260
INTEREST DURING CONSTRUCTION	0	0	465	160	0	0	0	0	0	0
CHANGE IN WORKING CAPITAL	0	22	58	36	-9	-27	22	12	131	29
DEBT SERVICES	3686	3368	4213	4904	6130	5608	5040	4420	7884	9856
REPAYMENT OF LONG TERM DEBT	344	506	344	223	647	647	647	647	647	1319
REPAYMENT OF SHORT TERM DEBT	2994	2554	3501	4250	4381	3953	3484	2968	6163	7392
INTEREST ON LONG TERM DEBT	79	53	18	6	664	615	561	509	458	406
INTEREST ON SHORT TERM DEBT	269	255	350	425	438	395	348	297	616	739
DIVIDENDS	0	0	0	0	0	21	66	141	0	0
CASH INCREASE OR (DECREASE)	-84	0	0	-0	0	0	0	-0	-0	-0
BEGINNING CASH BALANCE	84	-0	-0	-0	-0	-0	-0	-0	-0	-0
ENDING CASH BALANCE	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0

HUANZALA POWER PROJECT

FUNDS FLOW STATEMENTS (FOR ENDING DECEMBER 31)

- WITH CASE -

(USD 1000)

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
SOURCE OF FUNDS	11821	12941	15006	16405	17904	19562	21343	23271	25332	27675
CASH GENERATED	1182	1193	1206	1216	1207	1238	1258	1277	1226	1275
PROFIT AFT. TAX, BFR INT.	-412	-409	-404	-536	-365	-343	-333	-323	156	195
DEPRECIATION AND AMORTIZATION	1594	1602	1610	1752	1572	1581	1590	1600	1070	1080
FINANCIAL RESOURCES	10639	11748	13800	15189	16697	18325	20086	21994	24106	26400
SHARE CAPITAL	0	0	0	0	0	0	0	0	0	0
LONG TERM DEBT	0	0	0	0	0	0	0	0	0	0
SHORT TERM DEBT	10639	11748	13800	15189	16697	18325	20086	21994	24106	26400
OTHER CASH	0	0	0	0	0	0	0	0	0	0
NON-CASH FUNDS	1	0	0	0	0	0	0	0	0	0
USES OF FUNDS	11821	12941	15006	16405	17904	19562	21343	23271	25332	27675
FIXED CAPITAL EXPENDITURE	268	276	1140	293	302	311	320	330	340	350
NON-DEPRECIABLE ASSETS	0	0	0	0	0	0	0	0	0	0
DEPRECIABLE FIXED ASSETS	268	276	1140	293	302	311	320	330	340	350
INTEREST DURING CONSTRUCTION	0	0	0	0	0	0	0	0	0	0
CHANGE IN WORKING CAPITAL	28	29	30	39	21	32	33	34	6	36
DEBT SERVICES	11525	12637	13836	16074	17582	19220	20990	22907	24986	27289
REPAYMENT OF LONG TERM DEBT	1312	672	672	672	672	672	672	672	672	672
REPAYMENT OF SHORT TERM DEBT	8975	10639	11748	13800	15189	16697	18325	20086	21994	24106
INTEREST ON LONG TERM DEBT	334	292	242	222	202	181	161	141	121	101
INTEREST ON SHORT TERM DEBT	897	1064	1175	1380	1519	1670	1832	2009	2199	2411
DIVIDENDS	0	0	0	0	0	0	0	0	0	0
CASH INCREASE OR (DECREASE)	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
BEGINNING CASH BALANCE	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0
ENDING CASH BALANCE	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0

*** HUANZALA POWER PROJECT ***
FUNDS FLOW STATEMENTS (FOR ENDING DECEMBER 31)
- WITH CASE -
(USD 1000)

YEAR	2003	2004	2005	2006
SOURCE OF FUNDS	30190	32933	35926	39205
CASH GENERATED	1290	1303	1312	1318
PROFIT /ET, TAX, PER INT.	199	201	199	194
DEPRECIATION AND AMORTIZATION	1091	1101	1112	1124
FINANCIAL RESOURCES	28900	31630	34614	37887
SHARE CAPITAL	0	0	0	0
LONG TERM DEBT	0	0	0	0
SHORT TERM DEBT	28900	31630	34614	37887
OTHER CASH	0	0	0	0
NON-CASH FUNDS	0	0	0	0
USES OF FUNDS	30190	32943	35928	39205
FIXED CAPITAL EXPENDITURE	360	371	382	394
NON-DEPRECIABLE ASSETS	0	0	0	0
DEPRECIABLE FIXED ASSETS	360	371	382	394
INTEREST DURING CONSTRUCTION	0	0	0	0
CHANGE IN WORKING CAPITAL	38	39	40	42
DEBT SERVICES	29792	32523	35505	38770
REPAYMENT OF LONG TERM DEBT	672	672	672	672
REPAYMENT OF SHORT TERM DEBT	26400	28900	31630	34614
INTEREST ON LONG TERM DEBT	81	60	40	20
INTEREST ON SHORT TERM DEBT	2640	2890	3163	3462
DIVIDENDS	0	0	0	0
CASH INCREASE OR (DECREASE)	-0	-0	-0	-0
BEGINNING CASH BALANCE	-0	-0	-0	-0
ENDING CASH BALANCE	-0	-0	-0	-0

Fig. 8-12-1 Sensitivity Analysis (FIRR)

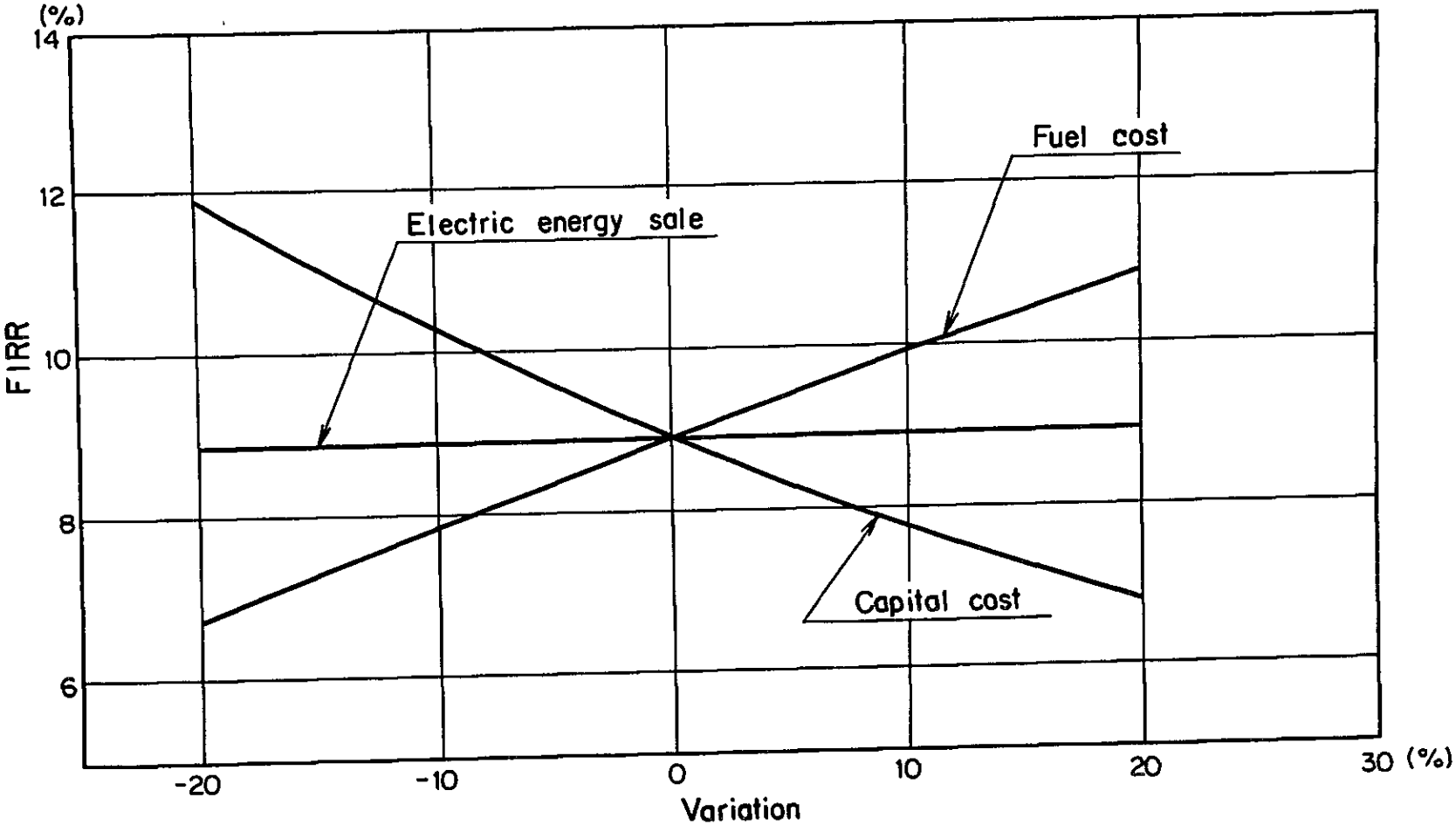


Table 8-12-3 Debt Service Ratio (DSR)

(Unit: %)

	Base Case	Case (2)-(b)-i	Case (2)-(b)-ii
1983	6.11	6.11	6.11
1984	4.68	4.68	4.68
1985	6.62	6.62	6.62
1986	11.48	11.48	11.48
1987	3.11	2.18	1.68
1988	3.05	2.15	1.66
1989	3.27	2.31	1.79
1990	3.43	2.43	1.89
1991	2.91	2.08	1.62
1992	1.86	1.65	1.48
1993	1.97	1.75	1.58
1994	3.53	4.91	8.12
1995	3.67	5.11	8.47
1996	3.87	5.39	8.93
1997	3.96	5.51	9.14
1998	4.15	5.78	9.59
1999	4.34	6.05	10.05
2000	4.54	6.34	10.53
2001	4.50	6.28	10.44
2002	4.75	6.63	11.03
2003	4.98	6.96	11.59
2004	5.23	7.31	12.18
2005	5.49	7.68	12.80
2006	5.77	8.08	13.46

Note: Bare Case : Soft loan 70%
Case (2)-(b)-i : Soft loan 50%
Case (2)-(b)-ii: Soft loan 30%

8.13 Results of Financial Analyses

The results of the financial analyses made up to the preceding sections may be summarized as follows:

(a) In the basic case, the FIRR is 10.76% before taxes and 8.91% after taxes.

(b) It is the variation in the investment amount which has the greatest effect on variation of the FIRR, and with a rise of 10% in the investment amount the FIRR will fall to 7.77%.

(c) Although ore sales do not have a direct relation with the FIRR, variations in sales will have a great effect on the cash flow of Santa Luisa. A drop of 20% in silver price will produce a shortage in the cash flow.

(d) There would be no problem at all in repayment if the terms for borrowing funds for investment were to be the same as in the basic case. However, if the terms should worsen (for example, more than 50% being high-interest funds from commercial banks), then the margin for repayment will almost completely disappear.

(e) If a hydro-electric power station having a power generating capacity of a scale (4,200 kW) allowing supply of electric power not only to Huanzala Mine, but also to neighboring communities for public use is constructed, the FIRR will be lowered about two percentage points compared with the case of constructing a hydro-electric power station exclusively for mining (3,400 kW).

The following conclusions may be drawn from these examination results:

Firstly, the implementation of the Project will have the sure effect of reducing production costs, especially motive power cost, and from a financial point of view this is a feasible project.

Secondly, when the factors for instability in operating Huanzala Mine on fluctuation in product price, etc. are considered, it may be said

that this Project is not one which has such profitability and stability as to allow operation on a completely commercial basis offsetting the factors for instability.

Thirdly, seen from a financial aspect, the profitability is lowered in case supply of electric power to public use done through this Project. However, the expectations of Huallanca and La Union residents for an ample supply of electric power for public use are very great. By meeting these expectations, the contribution to the region of Huanzala Mine will be evaluated highly.

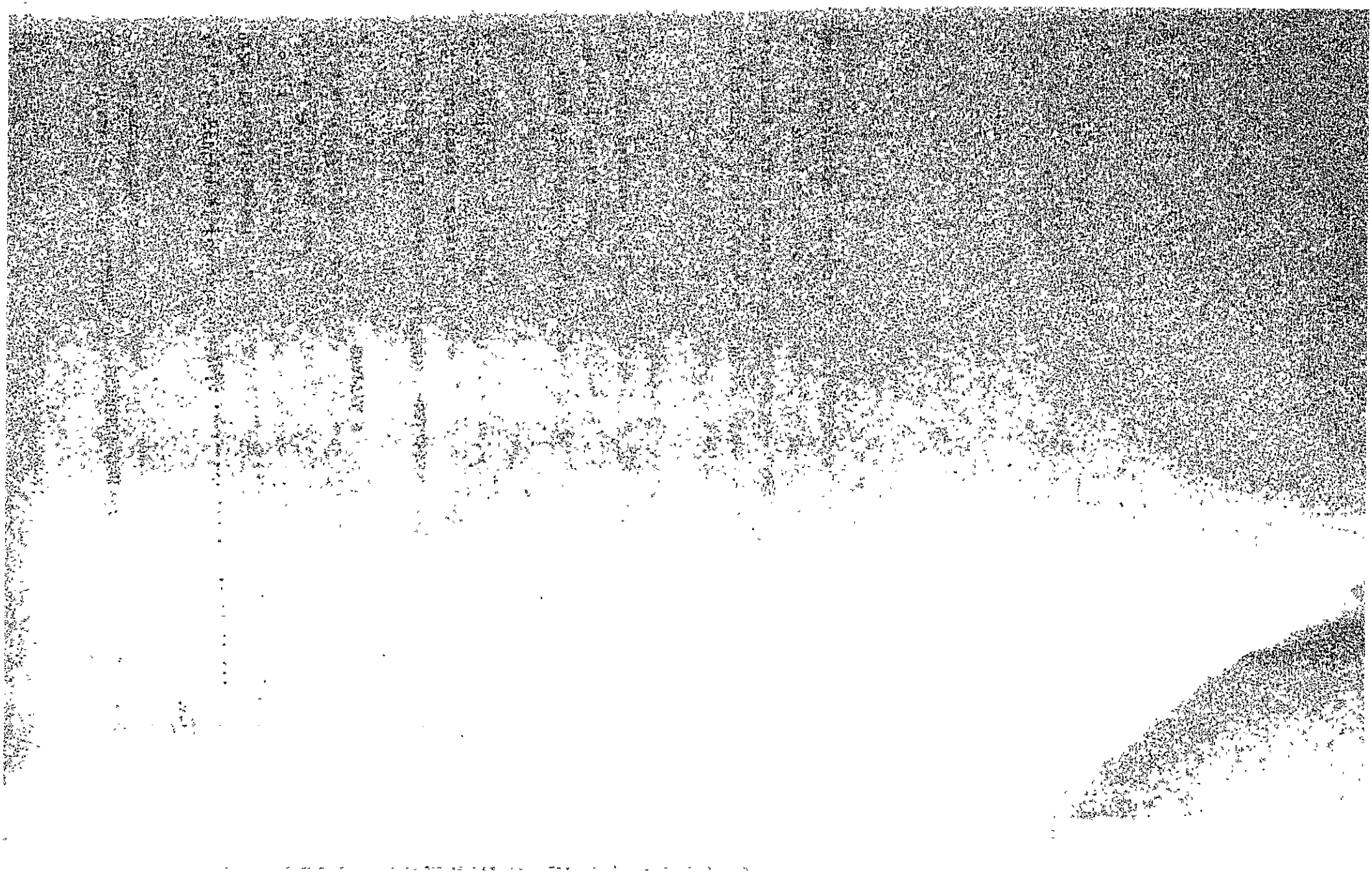
Furthermore, to follow the administrative guidance of the Peruvian electric power authorities concerning "supply of electric power to neighboring communities for public use" will enhance effect of the above-mentioned contribution even more.

In this sense, the construction of Huanzala Hydro-electric Power Station possessing the capacity to supply electric power to neighboring communities in addition to supplying motive power for Huanzala Mine, will be a matter for Santa Luisa to positively promote.

Based on the various results of financial analyses above, it is judged that this Project is indeed suitable as an object of financing by JICA, while at the same time, construction of a hydro-electric power station having a capacity of 4,200 kW for supplying electric power for mining and public use will be difficult unless the low-interest financing system of JICA is utilized.

CHAPTER 9

ECONOMIC ANALYSIS



CHAPTER 9 ECONOMIC ANALYSIS

CHAPTER 9 ECONOMIC ANALYSIS

9.1 Conception of Economic Analysis

Whereas the financial analysis examines the hydro-electric power generation project from the standpoint of the individual enterprise, Santa Luisa, the economic analysis evaluates the project from the standpoint of the national economy as a whole. In the economic analysis, as in the case of financial analysis, evaluating the benefits and costs of the project will be the fundamental requirement also.

As previously described, the hydro-electric power station to be constructed in this Project will have the two characters of supplying motive power for mining as a privately-owned power station of Huanzala Mine and at the same time supplying electric power to neighboring communities for public use. In the economic analysis, it will be necessary to accordingly consider costs and benefits separated for these two. With regard to direct benefits from among various benefits, a similar approach as the conception in the financial analysis may be taken (see Section 8.1). As for indirect benefits, promotion of regional industry and improvements in the living environment may be considered.

On the other hand, using the costs used in financial analysis as the basis and after making modification to economic prices, cost items for economic evaluation are estimated from the viewpoint of cost to the entire national economy.

Since the profitability in the financial analysis has been expressed in terms of financial internal rate of return (FIRR), it was decided that economic evaluation should be examined by the economic internal rate of return (EIRR).

9.2 Economic Benefit

9.2.1 Direct Benefit

The direct benefits of the Project may be divided into benefits produced from supply of electric power to Huanzala Mine as a privately-owned power station, and the benefits from supply of electric power to public use.

(1) Benefit from Private Electric Power Generation Portion used for Mine's Purpose

In general, the methods of evaluating economic benefit may be considered divided according to the three cases:

(i) gross domestic consumption increased,
(ii) gross domestic consumption constant, but export increased or import substitution effect produced,
(iii) gross domestic consumption constant with no effect on foreign trade, but with substitution effect produced regarding inferior domestic facilities.

The significance of Huanzala Mine having Huanzala Hydro-electric Power Station act as its private power station lies in minimizing as much as possible the use of the present high-cost diesel generating facilities. In other words, substitution of the hydro-electric power station for the existing diesel generating facilities as much as possible, which according to the above-mentioned classification in the evaluation method, corresponds to the case of (iii). The amount of the benefit in this case is measured by the economic cost of the facility subjected to substitution. In the case of this Project, however, the existing diesel facilities must be left intact for use in the low-water season and to meet peak loads even after the hydro-electric power station has been completed. Consequently, the amount of the benefit will be savings in expenses such as personnel cost, fuel cost, etc. (expressed by economic prices) through reduction in operating time of the diesel facilities as a result of construction of the hydro-electric power station. The amounts of the various expenses saved

calculated in this way, in effect, the amounts of benefit produced through the private electric power generation portion are shown in Table 9-2-1.

(2) Benefit from Electric Power Supply for Public Use

The supply of electric power to public use will lead to increase in gross consumption of the communities and eventually of the entire country. According to the beforementioned method of evaluating the economic benefit, this corresponds to the case of (i). In this case, it is appropriate for the economic benefit to be measured by the willingness to pay of consumers.

Since there is a part of the benefit called consumer's surplus between the willingness to pay of the consumer and the actual amount of the electricity charge, if the benefit were computed based on the current electricity rate, this consumer's surplus would be ignored. However, since it is close to impossible in reality to measure the willingness to pay of the residents including the consumer's surplus. In the economic analysis the electric energy sales income based on the current rate was considered as the economic benefit produced by supply of electric power to public use. Even though the consumer's surplus is not measured in the benefit, since the weight of the consumer's surplus in the project benefit as a whole will be small, it is judged there will be no influence on the economics of the Project seen from the standpoint of the national economy.

Table 9-2-1 Direct Benefit ..... (3 sheets)

*** HUANZALA POWER PROJECT ***

(USD 1000)

YEAR	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
FUEL COST	0	0	0	0	-1489	-1519	-1551	-1582	-1615	-1646
DIESEL OIL	0	0	0	0	-1346	-1374	-1402	-1431	-1460	-1488
LUBRICANT	0	0	0	0	-143	-145	-148	-151	-155	-158
OPERATING & MAINTENANCE COST	0	0	0	0	87	87	87	87	93	99
DIESEL(NEW)	0	0	0	0	-68	-68	-68	-68	-63	-57
DIESEL(EXISTING)	0	0	0	0	-81	-81	-81	-81	-81	-81
HYDRO	0	0	0	0	236	236	236	236	236	236
GENERAL EQUIPMENT	0	0	0	0	0	0	0	0	0	0
VARIABLE COST	0	0	0	0	-1402	-1432	-1464	-1495	-1522	-1547
LABOUR COST	0	0	0	0	26	26	26	26	26	26
DIRECT FIXED COST	0	0	0	0	26	26	26	26	26	26
CASH FACTORY COST	0	0	0	0	-1376	-1406	-1438	-1469	-1496	-1521
PLANT COST (HYDRO)	0	0	0	0	591	591	591	591	591	591
PLANT COST (DIESEL)	0	0	0	0	-149	-149	-149	-149	-124	50
DIESEL '86	0	0	0	0	-149	-149	-149	-149	-124	50
DIESEL '92	0	0	0	0	0	0	0	0	0	0
DIESEL '95	0	0	0	0	0	0	0	0	0	0
DIESEL '98	0	0	0	0	0	0	0	0	0	0
DIESEL(EXISTING)	0	0	0	0	0	0	0	0	0	0
DIESEL(BUILDING)	0	0	0	0	0	0	0	0	0	0
GENERAL EQUIPMENT	0	0	0	0	0	0	0	0	0	0
PILING	0	0	0	0	0	0	0	0	0	0
INTEREST DURING CONSTRUCTION	0	0	0	0	27	27	27	27	27	27
VEHICLE & BULLDOZER	0	0	0	0	0	0	0	0	0	0
DEPRECIATION AND AMORTIZATION	0	0	0	0	469	469	469	469	494	667
TOTAL FACTORY COST	0	0	0	0	-907	-937	-969	-1000	-1002	-854
TRANSPORTATION COST	0	0	0	0	0	0	0	0	0	0
SHIPPING COST	0	0	0	0	0	0	0	0	0	0
SALES EXPENSES	0	0	0	0	0	0	0	0	0	0
GENERAL ADMINISTRATIVE EXP.	0	0	0	0	0	0	0	0	0	0
OPERATING EXPENSES	0	0	0	0	-907	-937	-969	-1000	-1002	-854
INTEREST ON LONG TERM DEBT EX	0	0	0	0	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT	0	0	0	0	562	518	475	431	387	343
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
NON-OPERATION EXPENSES	0	0	0	0	0	0	0	0	0	0

Direct Benefit

*** HUANZALA POWER PROJECT ***

(USD 1000)

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
FUEL COST	-1677	-1707	-1736	-1764	-1773	-1782	-1791	-1800	-1805	-1816
DIESEL OIL	-1516	-1543	-1570	-1595	-1604	-1612	-1620	-1627	-1632	-1643
LUBRICANT	-161	-163	-166	-169	-170	-171	-171	-172	-173	-174
OPERATING & MAINTENANCE COST	85	85	85	103	103	103	203	203	203	203
DIESEL(NEW)	-103	-103	-103	-125	-125	-125	-171	-171	-171	-171
DIESEL(EXISTING)	-48	-48	-48	-8	-8	-8	137	137	137	137
HYDRO	236	236	236	236	236	236	236	236	236	236
GENERAL EQUIPMENT	0	0	0	0	0	0	0	0	0	0
VARIABLE COST	-1591	-1621	-1650	-1661	-1670	-1679	-1588	-1597	-1602	-1614
LABOUR COST	26	26	26	26	26	26	26	26	26	26
DIRECT FIXED COST	26	26	26	26	26	26	26	26	26	26
CASH FACTORY COST	-1565	-1595	-1625	-1635	-1644	-1653	-1562	-1571	-1576	-1588
PLANT COST (HYDRO)	591	591	591	591	591	591	591	591	591	591
PLANT COST (DIESEL)	-50	-50	-50	-74	-99	0	-99	-99	-99	-99
DIESEL '86	50	50	50	25	0	0	0	0	0	0
DIESEL '92	-99	-99	-99	0	0	99	99	99	0	0
DIESEL '95	0	0	0	-99	-99	-99	-99	-99	0	0
DIESEL '98	0	0	0	0	0	0	-99	-99	-99	-99
DIESEL(EXISTING)	0	0	0	0	0	0	0	0	0	0
DIESEL(BUILDING)	0	0	0	0	0	0	0	0	0	0
GENERAL EQUIPMENT	0	0	0	0	0	0	0	0	0	0
PILING	0	0	0	0	0	0	0	0	0	0
INTEREST DURING CONSTRUCTION	27	27	27	27	27	27	27	27	27	27
VEHICLE & BULLDOZER	0	0	0	0	0	0	0	0	0	0
DEPRECIATION AND AMORTIZATION	568	568	568	543	519	618	519	519	519	519
TOTAL FACTORY COST	-997	-1027	-1056	-1092	-1126	-1035	-1044	-1053	-1057	-1069
TRANSPORTATION COST	0	0	0	0	0	0	0	0	0	0
SHIPPING COST	0	0	0	0	0	0	0	0	0	0
SALES EXPENSES	0	0	0	0	0	0	0	0	0	0
GENERAL ADMINISTRATIVE EXP.	0	0	0	0	0	0	0	0	0	0
OPERATING EXPENSES	-997	-1027	-1056	-1092	-1126	-1035	-1044	-1053	-1057	-1069
INTEREST ON LONG TERM DEBT EX	0	0	0	0	0	0	0	0	0	0
INTEREST ON LONG TERM DEBT	282	222	205	188	171	153	136	119	102	85
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0	0	0	0	0	0	0
NON-OPERATION EXPENSES	0	0	0	0	0	0	0	0	0	0

Direct Benefit

*** HUANZALA POWER PROJECT ***

(USD 1000)

YEAR	2003	2004	2005	2006
FUEL COST	-1824	-1832	-1839	-1846
DIESEL OIL	-1650	-1657	-1663	-1669
LUBRICANT	-175	-175	-176	-177
OPERATING & MAINTENANCE COST	203	203	203	203
DIESEL(NEW)	-171	-171	-171	-171
DIESEL(EXISTING)	137	137	137	137
HYDRO	236	236	236	236
GENERAL EQUIPMENT	0	0	0	0
VARIABLE COST	-1622	-1630	-1636	-1643
LABOUR COST	26	26	26	26
DIRECT FIXED COST	26	26	26	26
CASH FACTORY COST	-1596	-1604	-1611	-1617
PLANT COST (HYDRO)	591	591	591	591
PLANT COST (DIESEL)	-99	0	0	0
DIESEL '86	0	0	0	0
DIESEL '92	0	0	0	0
DIESEL '95	0	0	0	0
DIESEL '98	-99	0	0	0
DIESEL(EXISTING)	0	0	0	0
DIESEL(BUILDING)	0	0	0	0
GENERAL EQUIPMENT	0	0	0	0
PILING	0	0	0	0
INTEREST DURING CONSTRUCTION	27	27	27	27
VEHICLE & BULLDOZER	0	0	0	0
DEPRECIATION AND AMORTIZATION	519	618	618	618
TOTAL FACTORY COST	-1077	-986	-993	-999
TRANSPORTATION COST	0	0	0	0
SHIPPING COST	0	0	0	0
SALES EXPENSES	0	0	0	0
GENERAL ADMINISTRATIVE EXP.	0	0	0	0
OPERATING EXPENSES	-1077	-986	-993	-999
INTEREST ON LONG TERM DEBT EX	0	0	0	0
INTEREST ON LONG TERM DEBT	68	51	34	17
INTEREST ON SHORT TERM DEBT	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0
INTEREST ON SHORT TERM DEBT	0	0	0	0
NON-OPERATION EXPENSES	0	0	0	0

9.2.2 Indirect Benefit

(1) Promotion of Regional Industry

According to the results of investigations through interrogations carried out by the JICA Survey Team, the principal industries of Huallanca and La Union are stock raising and commerce. It is strongly desired locally to hereafter promote cheese factories and lumber mills utilizing natural resources. A three-phase power supply is required for operation of such factories, but for ElectroPeru, it is the limit simply to continue with electric power supply for general household use of the present degree. It is unconceivable that ElectroPeru will come to supply electric power for industrial use.

Under such circumstances, if it were to become possible for industrial electric power to be supplied from the hydro-electric power station of Huanzala Mine, industrialization would be gradually promoted, employment conditions improved, the income level raised. Development of the whole region can accordingly be expected.

(2) Improvement of Living Environment

Since both Huallanca and La Union are located at high altitudes, there are no endemic dieseases peculiar to the tropics. However, construction of municipal water supply and medical facilities has been fairly slow because of inadequate power supply. In comparison, at the company housing camp at Huanzala Mine, both water supply and sewage systems are complete, and medical facilities are fairly well equipped.

At both La Union and Huallanca it is hoped very much to advance to a living environment equal to that of Huanzala Mine. It is thought that if by the construction of Huanzala Hydro-electric Power Station, ample electric power were to be supplied, improvement of the living environment will be greatly pushed forward.

The indirect benefits to be brought about by construction of Huanzala Hydro-electric Power Station will not be limited to the above-mentioned promotion of regional industry, increase in

employment, raising of living standards, and improvement of the living environment.

However, it is difficult to numerically grasp these benefits for the purpose of economic analysis. In calculation of the EIRR, these indirect benefits are not considered, so that it may be said that the benefits of this Project have been estimated rather on the conservative side.

9.3 Economic Expenses

(1) General

An economic expense is an expense measured by a so-called economic price which is determined based on the assumption that the entire economy of the country is in a state of fair competition, and is computed by applying the required correction to the market price obtained in the financial analysis. The correction of the market prices to the economic expenses of this Project and the method of handling the correction items in general are as described below.

(2) Taxes

Taxes are no more than the transfer of resources within a single country and were therefore omitted from the cost of the Project.

(3) Foreign Exchange

A large-scale devaluation is presently going on in Peru. There are great fluctuations in foreign exchange, and it is possible that devaluation in the exchange rate will continue for some time to come. However, there are practically no restrictions on exchange and conversion to foreign currency may be done freely so that a black market does not exist. Consequently, the present devaluation in the exchange rate is occurring more or less in line with market rates, and it may be considered that the exchange rate indicates an appropriate conversion ratio. Therefore, a shadow exchange rate is not used in the calculations here.

(4) Wages

The present economic situation in Peru is adverse and it is said that the unemployment rate in the capital city of Lima is approximately 50%. The economic price of wages is measured by the opportunity cost of labor which is frequently lower than the actual wages paid in general when the unemployment rate is high. Huanzala Mine is located at an altitude of 4,000 m, and the living environment can hardly be said to be favorable, while there is no large city close by. Even though the unemployment rate in Lima may be high, the situation is not such that laborers can freely be gathered to Huanzala Mine at lower than prevailing wages. The ordinary laborers in Santa Luisa are as a rule employed from among those having experience working in mines, while unexperienced men are given technical training by the company.

Consequently, when the special circumstances and actual situation at Huanzala Mine are taken into account, it may be considered that the market price of wages used in the financial analysis indicates the opportunity cost of labor. As the economic price of wages, the market price employed in the financial analysis is to be used unaltered, and a shadow wage rate is not used.

9.4 Capital Expenditure

The amount of capital expenditure of electric power facilities is estimated in terms of the above-mentioned economic price. The result thereof is shown in Table 9-4-1.

Table 9-4-1 Capital Expenditure of Generating Plant (Economic Price)

	Case of Constructing Hydro-power Plant	Case of not having Hydro-power Plant
1983		
1984		
1985	6,311	
1986	6,045	744
1987		
1988		
1989		
1990		
1991	248	
1992		496
1993		
1994		
1995	469	496
1996		
1997		
1998		496
1999		
2000		
2001		
2002		
2003		
2004		
2005		
2006		
Total	13,100	2,232

9.5 Economic Internal Rate of Return (EIRR)

On calculating the economic internal rate of return (EIRR) in accordance with the basic conception and with the various preconditions, EIRR is 11.93%. (Table 9-5-1)

9.6 Sensitivity Analysis

The sensitivity analysis regarding the EIRR was performed based on the following conditions.

Capital Investment Amount:

-20%, -10%, 0, +10%, +20%

Fuel Cost:

-20%, -10%, 0, +10%, +20%

The results of the sensitivity analysis are shown in Fig. 9-6-1. Both factors have fair amounts of effect on the EIRR, but the degree of effect of investment is greater than fuel cost variation. When the investment amount is increased 20% the EIRR falls from 11.93% in the basic case to 8.95%. Conversely, if it were to be decreased by 20%, the EIRR would rise from 11.93% to 16.03%.

Table 9-5-1 Economic Rate of Return (in current price)

*** HUANZALA POWER PROJECT ***
FINANCIAL RATE OF RETURN (IN CURRENT PRICE)

(USD 1000)

YEAR	FIXED CAPITAL EXPEND.	CHANGE IN WORKING CAPITAL	(1) GROSS CAPITAL EXPENDTR	OPERATING PROFIT	DEPRECIATN	(2) GROSS CASH IN-FLOW	(4) NET IN-FLOW (2)-(1)
1983	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0
1985	5911	0	5911	0	0	0	-5911
1986	5167	0	5167	0	0	0	-5167
1987	0	-50	-50	875	469	1344	1394
1988	0	-2	-2	954	469	1423	1425
1989	0	-2	-2	987	469	1456	1458
1990	0	-2	-2	1019	469	1488	1490
1991	248	-0	248	1024	494	1518	1270
1992	-496	-8	-488	885	667	1552	2040
1993	0	-8	-8	1014	568	1582	1590
1994	0	-2	-2	1051	568	1619	1621
1995	0	-2	-2	1082	568	1650	1652
1996	0	-2	-2	1118	543	1661	1663
1997	0	-2	-2	1153	519	1672	1674
1998	-496	5	-491	1071	618	1689	2180
1999	0	-0	-0	1076	519	1595	1595
2000	0	-0	-0	1086	519	1605	1606
2001	0	-0	-0	1093	519	1612	1612
2002	0	-1	-1	1107	519	1625	1626
2003	0	-0	-0	1116	519	1635	1635
2004	0	5	5	1033	618	1651	1646
2005	0	-0	-0	1036	618	1654	1654
2006	-0	55	55	1045	618	1663	1608
	10335	0	10335	20828	10867	31695	21360

INTERNAL RATE OF RETURN

ON (4) NET IN-FLOW (2)-(1) 11.93 PER CENT

Fig. 9-6-1 Sensitivity Analysis (EIRR)