

### 5.3 Future Maintenance and Rehabilitation Plan

If the life of plant is considered to be 40 years and the continuation of operation to last until 2025, it is necessary to extend the ash ponds of the 5th and the 6th plants within ten years. Furthermore, in preparation for the increase in demand, it is necessary to arrange a fund necessary for the rehabilitation of 80 MW turbines that cause a lot of failure, future environmental measuring equipment corresponding to environmental regulations and other prolongation-of-life activities, etc. A future repair plan is shown in Fig. 5.3-1.

As these are large-scale rehabilitation works that require foreign financial support, it is necessary to carry out the following:

- First, to implement the rehabilitation work (Phase II) of the 4<sup>th</sup> power plant scheduled for 2001 to 2005
- Second, to implement the rehabilitation work of the equipment selected as Rank A from 2006 to 2010, which is expected to have a high repair effect
- Third, to implement the rehabilitation work of the equipment selected as Rank B from 2011 to 2015, which is expected to be too old for operation.

In parallel to the above mentioned rehabilitation works, it is necessary for TES4 to increase the cost of routine maintenance and repairs from about 7% of the present production cost to 10 - 15% as in Japan. This increased cost covers rehabilitation of the equipment selected as Rank C, which is carried out by TES4 and also proper repair work such as maintenance of equipment and tools as planned.

Because a large amount of money is required to carry out turbine modification for future increasing of demand and ash pond expansion for future continuous plant operation, and subsequently, because TES4 is unable to cover its own repair and maintenance costs, supplemental funding is required for extraordinary rehabilitation works to be financed by foreign support.

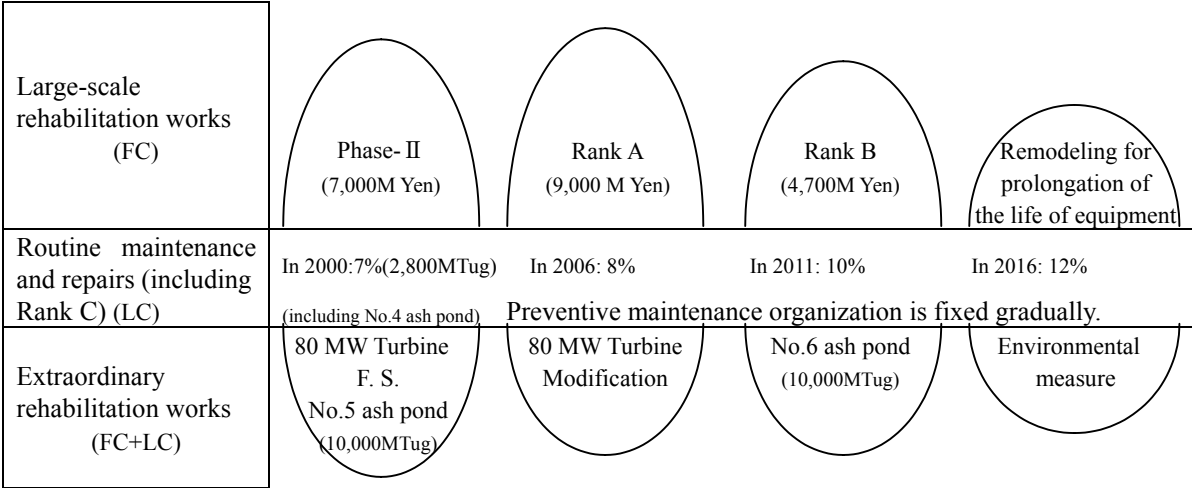


Fig.5.3-1 Future Maintenance and Rehabilitation Plan

### **5.3.1 Implementing Schedule**

The implementing schedule for Rank A equipment from 2005 - 2010 is shown in Fig. 5.3-2 and the schedule for Rank B equipment from 2011 - 2015 is shown in Fig.5.3-3.

The implementing schedule is based on the Phase-II plan. Since equipment common to fuel and chemical equipment has the same implementing schedule as electric and C&I equipment followed by that of boiler and turbine, only the implementing schedule for boiler equipment and turbine equipment was mentioned.

Funding for these plans are prepared by year. In preparation of actually implementing the schedule, it is necessary to consider the operation of the equipment for repair and the seasonal influence.

Concerning Rank C equipment, TES4 is to prepare implementing schedules and to carry them out one by one.

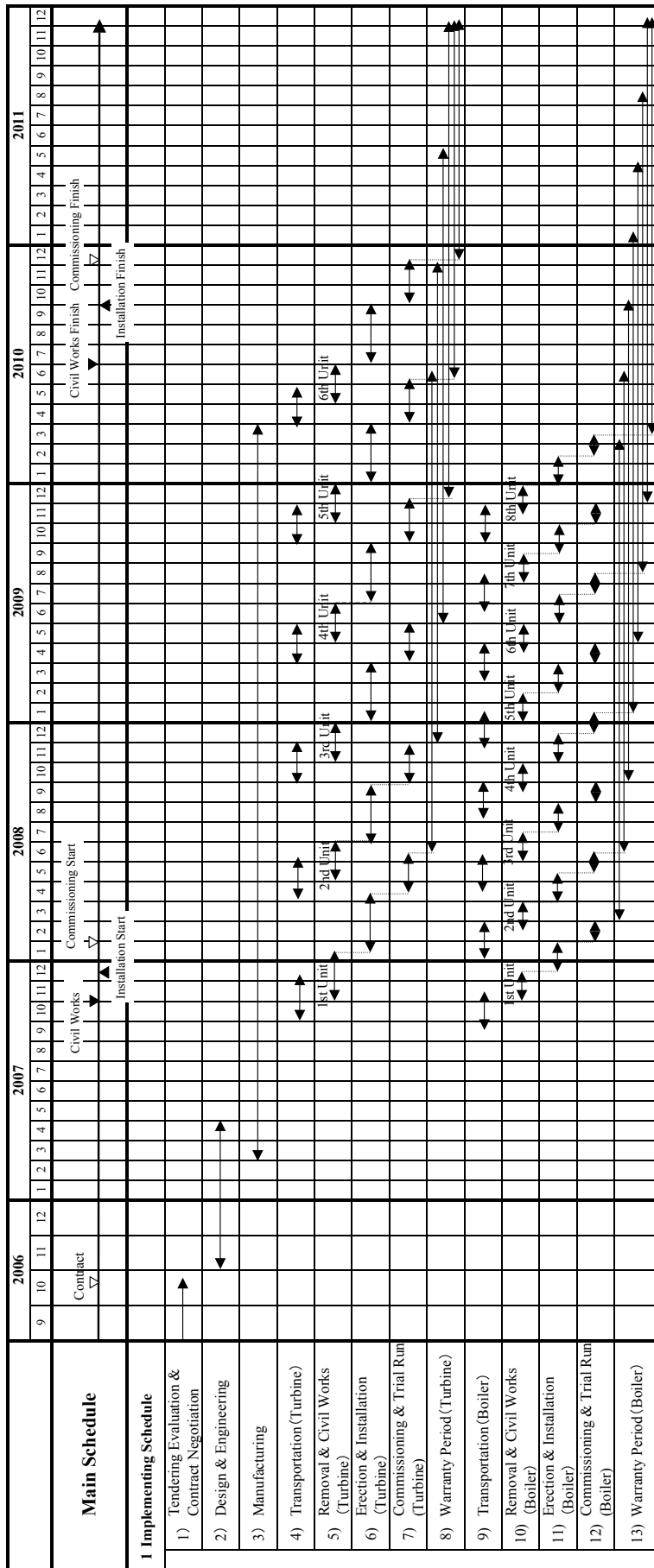


Fig. 5.3-2 Implementing Schedule (Rank A)



### 5.3.2 Cost Estimation for Rehabilitation Work

Among the equipment selected for rehabilitation in this report, the cost estimation of rehabilitation work for Rank A and Rank B equipment is shown in Table 5.3-1 and Table 5.3-2, respectively. The total cost of Rank A equipment is about 9,000 million Yen. And that of Rank B equipment is about 4,700 million Yen.

**Table 5.3-1 Cost Estimation of Rehabilitation Work (Rank A)**

(Unit : Million Yen)

	Item	Set	Total		
			Sum	F.C	L.C
1)	Aux. Steam Temp. and Press Reducing Control Valves for Plant Start-Up	1	58	-	-
2)	Feed Water Pumps and Motors	6	1,328	-	-
3)	Condenser Pumps and Motors	6	343	-	-
4)	Expansion Joint	6	113	-	-
5)	Valves for Vacuum Equipment	6	227	-	-
6)	Ejector Equipment	6	60	-	-
7)	HP/LP Feed Water Heaters	6	790	-	-
8)	Mechanical Filters at Condenser Inlet	3	241	-	-
9)	Control and Instrumentation for Turbines	1	1,527	-	-
10)	Electric Motors for FDF and IDF	8	1,261	-	-
11)	H.V. Switchgears (6.6 kV)	89	659	-	-
12)	L.V. Switchgears (0.4 kV)	1	434	-	-
13)	Generator Protection System	6	325	-	-
14)	10.5 kV Switchgears for Generators	6	531	-	-
15)	Switchgears for Generator Transformer	1	81	-	-
16)	Coal Amount Measurement for Conveyers	2	14	-	-
17)	Coal Analyzer	1	102	-	-
18)	Conveyor No.3 and No.4 TV Monitoring System	1	22	-	-
19)	Firefighting System	1	7	-	-
20)	Dissolved Oxygen Monitoring	24	12	-	-
21)	Control and Instrumentation for Water Treatment	1	111	-	-
22)	Spot Cooler	8	2	-	-
23)	Erection work	1	800	-	1,237
24)	Base Cost TOTAL (1~23)	1	8,248	7,011	0
25)	Price Escalation	1	0	0	1237
26)	SUB TOTAL (23~25)	1	8,248	7011	62
27)	Physical contingency	1	412	351	1,299
28)	SUB TOTAL (26~27)	1	8,660	7,361	0
29)	Consulting Service	1	340	340	0
30)	Tax & Duties	1	0	0	0
31)	Interests during construction	1	58	58	1,299
32)	TOTAL	1	9,058	7,759	

**Table 5.3-2 Cost Estimation of Rehabilitation Work (Rank B)**

(Unit : Million Yen)

Item	Set	Total		
		Sum	F.C	L.C
1) Repair work for leakage from ESP	8	504	-	-
2) Boiler Soot Blowers	8	2,621	-	-
3) Aux Steam Temp. and Press Reducing Control Valves	1	29	-	-
4) Wet Dust Collector	4	69	-	-
5) Bulldozers	18	864	-	-
6) Erection work	1	800	-	-
7) Base Cost TOTAL (1~6)	1	4,087	3,474	613
8) Price Escalation	1	0	0	0
9) SUB TOTAL (7~8)	1	4,087	3,474	613
10) Physical contingency	1	204	174	31
11) SUB TOTAL (9~10)	1	4,291	3,648	644
12) Consulting Service	1	340	340	0
13) Tax & Duties	1	0	-	0
14) Interests during construction	1	30	30	0
15) TOTAL	1	4,661	4,018	644

**5.3.3 Funding Plan by Year**

Among the Rank A and Rank B equipment selected for rehabilitation in this report, the funding plan by year according to each implementing schedule is shown in Table 5.3-3 and Table 5.3-4, respectively.

**Table 5.3-3 Funding Plan by Year (Rank A)**

Year	2006	2007	2008	2009	2010	2011	Total
Ratio	10%	5%	30%	35%	15%	5%	100%
Fund (Million Yen)	906	453	2,717	3,170	1,359	453	9,058

**Table 5.3-4 Funding Plan by Year (Rank B)**

Year	2011	2012	2013	2014	2015	2016	Total
Ratio	10%	5%	30%	35%	15%	5%	100%
Fund (Million Yen)	466	233	1,398	1,631	700	233	4,661

## 5.4 Economic and Financial Evaluation

An economic and financial evaluation was made of A-ranked plan of rehabilitation based on the rehabilitation effects and its plan mentioned in the previous sections 5.2 and 5.3.

### 5.4.1 Economic Evaluation

#### (1) Assumptions

The cost-benefit analysis by alternative method was adopted as the evaluation method with a discount rate of 9%, proximate to 8.6%, weighted average rate of interest of the bonds issued in 2000 by Bank of Mongolia, government bond equivalence.

The evaluation covers the period of 20 years from 2006, the first year of the rehabilitation plan, through 2025, about 40 years (service life of a thermal power plant adopted in a long-term plan of Mongolia) after the completion of the first unit of TES4. The evaluation considers the following rehabilitation effects.

**Table 5.4-1 Annual Effects of Rehabilitations**

Effects	Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1 Reduction of Auxiliary Power	GWh	NA	NA	8.8	17.6	26.3	35.1	35.1	35.1	35.1	35.1
2 Vacuum Increase & Coal Saving	Coal/ton	NA	NA	6300	12600	18900	25200	25200	25200	25200	25200
3 Heavy Oil Saving	Oil/ton	NA	NA	262.5	525	787.5	1050	1050	1050	1050	1050
4 Increase Power Production	GWh	NA	NA	136	136	408	544	544	544	544	544

Effects	Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
1 Reduction of Auxiliary Power	GWh	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
2 Vacuum Increase & Coal Saving	Coal/ton	25200	25200	25200	25200	25200	25200	25200	25200	25200	25200
3 Heavy Oil Saving	Oil/ton	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
4 Increase Power Production	GWh	544	544	544	544	544	544	544	544	544	544

The exchange rate of foreign currencies into Tug is assumed at 1,100 Tug to dollar (shown in a local newspaper of October, 2001) and 9.07 Tug to Yen based on the exchange rate on the same day of dollar to Yen 121.26 Yen/dollar.

In calculating the cost and benefit, the standard conversion factor was calculated at 0.98 to be used to convert the foreign currency portion to economic prices. That standard conversion factor was applied to the currency portion of the amount of each capital investment (85% of capital investment) and to fuel prices.

The assumptions for cost and benefit calculation are given below.

#### 1) Benefit Setting

A coal-fired power plant with an equivalent capacity to the increase in plant factor was adopted as the alternative, so that the installed capacity was assumed at 100 MW.

That installed capacity was calculated considering the installed capacity of 62 MW calculated by dividing the increase in power production of 544G Wh/year by 8,760 hours and 10% of station use and 70% of plant factor.

The construction cost of the above alternative power plant and its cost of maintenance and operation were adopted as benefit. The construction cost was assumed at 150 thousand Yen/kW and 12 billion Yen in total (equivalent to 109 billion Tug at the exchange rate of October 2001) and the construction period was assumed to be 3 years. The maintenance and operation cost was assumed at 4% of the construction cost.

Furthermore, the increase in power sales due to the rehabilitation plan would reduce the power import from Russia and contribute to reduction in outflow of Mongolian foreign reserves. These factors were evaluated by multiplying the increase in power sales due to the increase in plant factor and decrease in station use by the unit price for import from Russia. The unit price for import from Russia was assumed at 25 US\$/MWh for 2000 because no data was available on the unit price for 2001.

#### 2) Cost Setting

The cost was assumed to comprise the investment amount of the rehabilitation plan and 2% of the investment amount as maintenance and operation cost. The assumed cost considered the following effects of rehabilitation: the decrease in coal consumption due to vacuum improvement and decrease in heavy oil consumption due to decrease in the number of stops and starts resulting from the decrease in the number of forced outages.

The unit prices for fuel were taken from the data for 2001 of TES4: 8,708 Tug/ton, weighted average of 8,050 Tug/ton for Baganuur coal and 5,405 Tug/ton for Shivee-Ovoo coal at the ratio of 7:3 of actual consumption plus 20% as transportation cost. Heavy oil price was assumed at 159,242 Tug/ton resulting from conversion of 21.57 US\$/barrel shown in a local



newspaper of October 2001 because the data on 2000 price (156,494 Tug/ton) was only available.

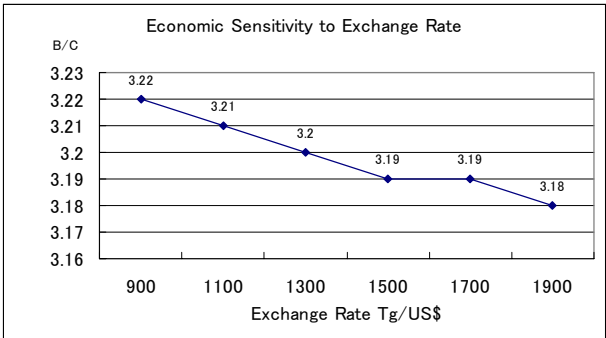
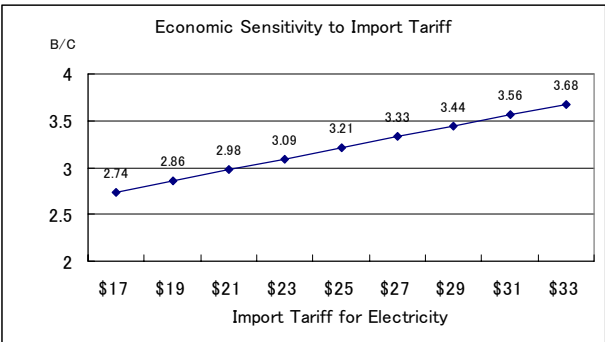
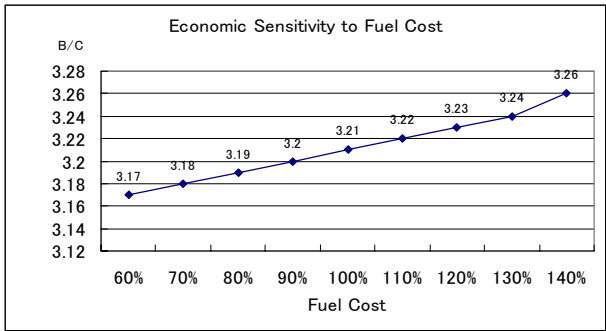
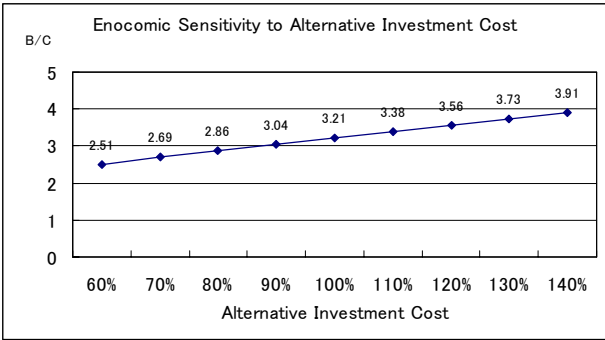
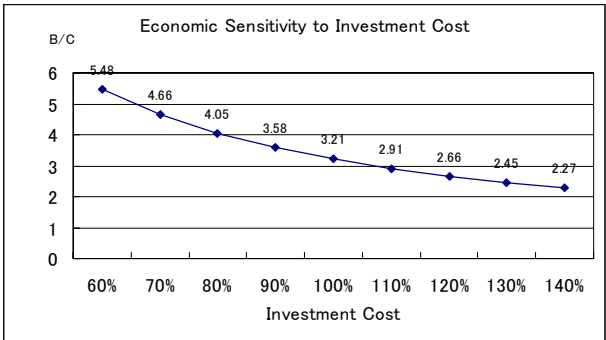
## (2) Evaluation

EIRR was not possible to calculate and B (alternative power plant)/C (rehabilitation) was 3.21. It follows that the rehabilitation plan is viable from the standpoint of the national economy of Mongolia. (See Table 5.4-2)

## (3) Sensibility Analysis

In order to ascertain the robustness of the above viability, sensibility analysis was made with the investment amount of the plan, that of the alternative, the fuel cost, the unit price of import from Russia and the exchange rate of Tug to the dollar as parameters.

Fig. 5.4-1 shows the results of the sensibility analysis. In any case B/C did not go below 2. Furthermore, even in the combined case of 20% increase in the investment amount of the plan, 20% decrease in investment amount of the alternative, 4 US\$/MWh drop of the unit price of import from Russia, and devaluation of Tug to the dollar to 1,900 Tug/US\$, B/C was 2.16, showing sufficient economics of the plan.



**Fig. 5.4-1 Economic Sensibility Analysis**

## 5.4.2 Financial Evaluation

### (1) Assumptions

The cost-benefit analysis was adopted as the evaluation method with the increase in sales and decrease in expenses due to the rehabilitation plan as benefit and the investment amount and maintenance and operation cost as cost. The evaluation criteria and discount rate should originally be the capital cost of a company. However, appropriate capital cost cannot be calculated partly because TES4 has so far been state-owned and partly because the country's financial and capital market is immature. Therefore, 9% was assumed, proximate to 8.6%, weighted average rate of interest of Bank of Mongolia bonds as in the economic evaluation.

The evaluation covers the same period as in the economic evaluation, for 20 years from 2006 through 2025. The financial evaluation considered the same effects of rehabilitation as in the economic evaluation.

The assumptions for cost and benefit are given below.

#### 1) Benefit Setting

The benefit was assumed to be the sales of power and heat. The unit price was assumed to be the wholesale prices for TES4: 22.23 Tug/kWh for power and 3,450.1 Tug/Gcal for heat. The sales volume was assumed to be the increase in sales volume due to increase in plant factor brought by the rehabilitation plan. The rehabilitation would also reduce the power station use so that the corresponding increase in power sales volume was added to the sales volume. As for heat, the increase in production capacity would be latent until 2018 because of suppressed demand of Ulaanbaatar.

#### 2) Cost Setting

The variable cost for 2001 was calculated by multiplying the variable cost from the actual of 2000 by 15%, increase of coal price in 2001. The variable cost for 2000 was calculated for power by dividing some 11.9 billion Tug of fuel cost by some 1,500 GWh of sales volume, resulting in 7.8 Tug/kWh and for heat by dividing some 7.1 billion Tug of fuel cost by some 2,500 Tcal of sales volume, resulting in 2.804 Tug/Gcal. Then, multiplying the above unit prices for 2000 by the price increase rate of coal resulted in 8.97 Tug/kWh for power and 3,225 Tug/Gcal for heat to be used as 2001 variable cost.

The assumed cost also considered the decrease in coal consumption due to vacuum improvement and the decrease in heavy oil consumption due to decrease in the number of

stops and starts brought by decrease in the number of forced outages. Additional cost for maintenance and operation was assumed at 2% of the investment amount for the newly installed facilities in the rehabilitation plan.

## (2) Evaluation

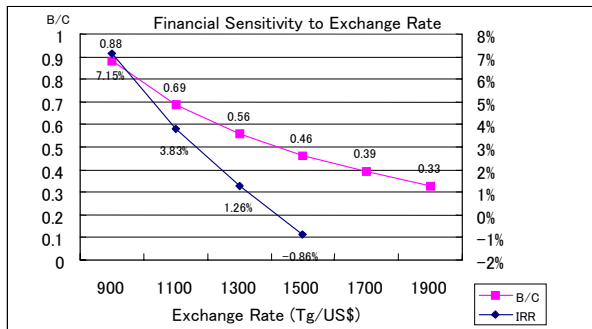
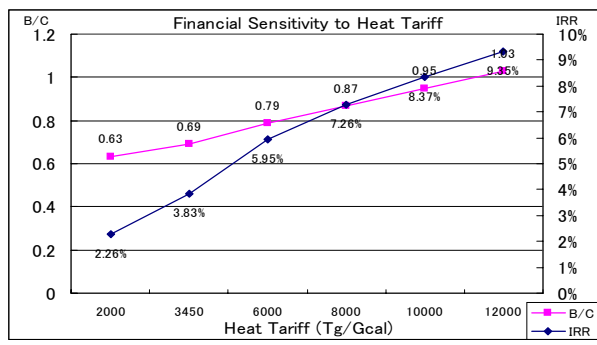
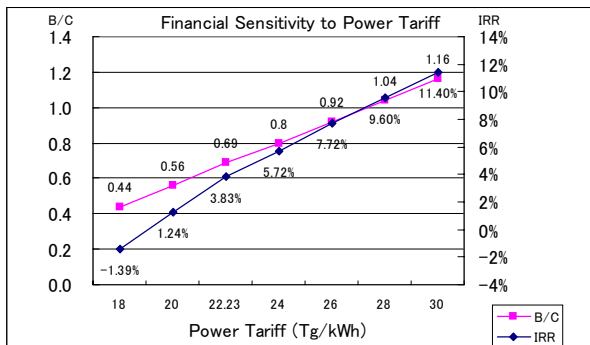
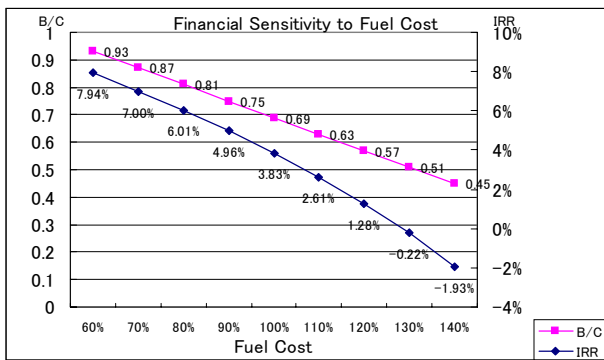
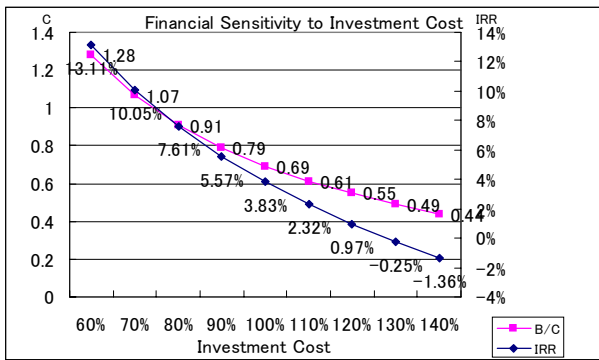
FIRR was 3.83%, well below 8% of the rate of the Bank of Mongolia bonds. B/C was 0.69. Those evaluation criteria show that the plan should be discarded from the standpoint of an enterprise. Nevertheless, the economic evaluation justifies the plan as worth implementing. This result suggests that the unfavorable financial evaluation was due to low level of the wholesale prices and that some raise in the wholesale prices should be made.

(See Table 5.4-3)

## (3) Sensitivity Analysis

Sensitivity analysis was made on the above evaluation with the investment amount of the rehabilitation plan, the fuel prices, and the wholesale prices for power and heat as parameters. The result is shown in Fig 5.4-2.

In order to achieve 9% of FIRR to allow the adoption of the plan, the parameters must be independently as follows: 26% reduction in the investment amount, 52% drop of fuel prices and raise in the wholesale prices to 27.4 Tug/kWh for power and 11,250 Tug/Gcal for heat. In a combined case of raise in the wholesale prices for power and heat, considering that heat actually recovers half the cost so that heat price is increased 2 times, 9% of FIRR can be achieved with 25 Tug/kWh for power and 7,000 Tug/Gcal for heat.



**Fig. 5.4-2 Financial Sensibility Analysis**



Table 5.4-2 Economic Evaluation

	1	2	3	4	5	6	7	8	9	10
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
I Alternative Coal-fired Power Plant										
1. Investment Cost	26,810,761	53,621,522	26,810,761							
2. O&M Cost				4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280
3. Alternative Cost Stream	26,810,761	53,621,522	26,810,761	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280
II Reduction of Import from Russia	0	0	3,981,313	7,962,625	11,943,938	15,925,250	15,925,250	15,925,250	15,925,250	15,925,250
III Benefit Stream (I+II)	26,810,761	53,621,522	30,792,074	12,316,905	16,298,218	20,279,530	20,279,530	20,279,530	20,279,530	20,279,530
IV Rehabilitation Cost										
1. Investment Cost	8,034,943	4,017,472	24,104,830	28,122,302	12,052,415	4,017,472				
2. Increase in O&M Cost		241,048	723,145	1,285,591	1,606,989	1,606,989	1,606,989	1,606,989	1,606,989	1,606,989
3. Decrease in Oil Consumption			41,072	82,144	123,215	164,287	164,287	164,287	164,287	164,287
4. Turbine Efficiency Increase			54,859	109,718	164,577	219,437	219,437	219,437	219,437	219,437
5. Rehabilitation Cost Stream	8,034,943	4,258,520	24,732,044	29,216,031	13,371,611	5,240,737	1,223,265	1,223,265	1,223,265	1,223,265
Annual Cash Flow	18,775,818	49,363,002	6,060,029	-16,899,126	2,926,607	15,038,793	19,056,265	19,056,265	19,056,265	19,056,265
<b>EIRR</b>	<b>N/A</b>									
<b>B/C</b>	<b>3.21</b>									

	11	12	13	14	15	16	17	18	19	20
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280
4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280	4,354,280
15,925,250	15,925,250	15,925,250	15,925,250	15,925,250	15,925,250	15,925,250	15,925,250	15,925,250	15,925,250	15,925,250
20,279,530	20,279,530	20,279,530	20,279,530	20,279,530	20,279,530	20,279,530	20,279,530	20,279,530	20,279,530	20,279,530
1,606,989	1,606,989	1,606,989	1,606,989	1,606,989	1,606,989	1,606,989	1,606,989	1,606,989	1,606,989	1,606,989
164,287	164,287	164,287	164,287	164,287	164,287	164,287	164,287	164,287	164,287	164,287
219,437	219,437	219,437	219,437	219,437	219,437	219,437	219,437	219,437	219,437	219,437
1,223,265	1,223,265	1,223,265	1,223,265	1,223,265	1,223,265	1,223,265	1,223,265	1,223,265	1,223,265	1,223,265
19,056,265	19,056,265	19,056,265	19,056,265	19,056,265	19,056,265	19,056,265	19,056,265	19,056,265	19,056,265	19,056,265

Table 5.4-3 Financial Evaluation

	1 2006	2 2007	3 2008	4 2009	5 2010	6 2011	7 2012	8 2013	9 2014	10 2015
I Revenue										
1. Incremental Power Revenue										
(1) Power Output with Project	1,726	1,726	1,862	1,998	2,134	2,270	2,270	2,270	2,270	2,270
(2) Power Output without Project	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726
(3) Incremental Power Output	0	0	136	272	408	544	544	544	544	544
(4) Unit Average Power Tariff	22.23	22.23	22.23	22.23	22.23	22.23	22.23	22.23	22.23	22.23
(5) Unit Variable Cost	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97
(6) Unit Marginal Income	13.26	13.26	13.26	13.26	13.26	13.26	13.26	13.26	13.26	13.26
(7) Incremental Gross Power Revenue	0	0	1,803,360	3,606,720	5,410,080	7,213,440	7,213,440	7,213,440	7,213,440	7,213,440
(8) Increase in O&M Cost		244,676	734,028	1,304,938	1,631,173	1,631,173	1,631,173	1,631,173	1,631,173	1,631,173
(9) Decrease in Oil Consumption			41,801	83,602	125,403	167,204	167,204	167,204	167,204	167,204
(10) Incremental Net Power Revenue	0	-244,676	1,111,133	2,385,383	3,904,310	5,749,471	5,749,471	5,749,471	5,749,471	5,749,471
2. Turbine Efficiency Increase			54,859	109,718	164,577	219,437	219,437	219,437	219,437	219,437
3. Incremental Heat Output										
(1) Heat Output with Project	3,059	3,192	3,310	3,474	4,150	4,279	4,412	4,547	4,686	4,828
(2) Heat Output without Project	3,059	3,192	3,310	3,474	4,150	4,279	4,412	4,547	4,686	4,828
(3) Incremental Heat Output	0	0	0	0	0	0	0	0	0	0
(4) Unit Average Heat Tariff	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1
(5) Unit Variable Cost	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225
(6) Unit Marginal Income	225.50	225.50	225.50	225.50	225.50	225.50	225.50	225.50	225.50	225.50
(7) Incremental Heat Sales	0	0	0	0	0	0	0	0	0	0
4. Reduction of Station Use			195,068	390,137	585,205	780,273	780,273	780,273	780,273	780,273
Total Revenue	0	-244,676	1,361,060	2,885,238	4,654,092	6,749,180	6,749,180	6,749,180	6,749,180	6,749,180
II Expenditure										
1. Investment Cost	8,155,866	4,077,933	24,467,597	28,545,529	12,233,798	4,077,933				
Annual Cash Flow	-8,155,866	-4,322,609	-23,106,536	-25,660,291	-7,579,706	2,671,247	6,749,180	6,749,180	6,749,180	6,749,180

FIRR 3.83%

B/C 0.69

	11 2016	12 2017	13 2018	14 2019	15 2020	16 2021	17 2022	18 2023	19 2024	20 2025
	2,270	2,270	2,270	2,270	2,270	2,270	2,270	2,270	2,270	2,270
	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726	1,726
	544	544	544	544	544	544	544	544	544	544
	22.23	22.23	22.23	22.23	22.23	22.23	22.23	22.23	22.23	22.23
	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97	8.97
	13.26	13.26	13.26	13.26	13.26	13.26	13.26	13.26	13.26	13.26
	7,213,440	7,213,440	7,213,440	7,213,440	7,213,440	7,213,440	7,213,440	7,213,440	7,213,440	7,213,440
	1,631,173	1,631,173	1,631,173	1,631,173	1,631,173	1,631,173	1,631,173	1,631,173	1,631,173	1,631,173
	167,204	167,204	167,204	167,204	167,204	167,204	167,204	167,204	167,204	167,204
	5,749,471	5,749,471	5,749,471	5,749,471	5,749,471	5,749,471	5,749,471	5,749,471	5,749,471	5,749,471
	219,437	219,437	219,437	219,437	219,437	219,437	219,437	219,437	219,437	219,437
	4,943	5,061	5,180	6,542	6,657	6,657	6,657	6,657	6,657	6,657
	4,943	5,061	5,180	5,185	5,185	5,185	5,185	5,185	5,185	5,185
	0	0	0	1,357	1,472	1,472	1,472	1,472	1,472	1,472
	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1	3,450.1
	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225	3,225
	225.50	225.50	225.50	225.50	225.50	225.50	225.50	225.50	225.50	225.50
	0	0	0	306,004	331,936	331,936	331,936	331,936	331,936	331,936
	780,273	780,273	780,273	780,273	780,273	780,273	780,273	780,273	780,273	780,273
	6,749,180	6,749,180	6,749,180	7,055,184	7,081,116	7,081,116	7,081,116	7,081,116	7,081,116	7,081,116
	6,749,180	6,749,180	6,749,180	7,055,184	7,081,116	7,081,116	7,081,116	7,081,116	7,081,116	7,081,116



### 5.4.3 Funding Plan

TES4 will need maintenance and rehabilitation funds to continue its operations up to 2025 including not only Rank A rehabilitation plan discussed in the previous section but also Rank B rehabilitation necessary for age deterioration, Rank C routine maintenance, turbine replacement of Units 1, 5 and 6, and addition of ash ponds.

Table 5.4-4 shows yearly fund requirements for the above work. Before implementation of each work, detail investigations should be conducted to determine the cost and timing of implementation because the amount and year of implementation shown in the table below are only indications.

Forecasted financial statements were prepared to identify financial problems in fund procurement. The following assumptions were established to prepare those documents. After the field survey, the financial statements for 2001 were obtained and the forecast was made based on those financial statements. It is to be noted that the values of the financial statements for 2001 were not reconciled with TES4. The total sum of the interests for Phase-I Yen credit is recorded as interest liability in 2001 but this accounting treatment is not appropriate and that amount has been tentatively entered in allowance of long-term liability.

#### (1) Funding Plan

- 1) Loan conditions for Phase-II were taken as basis: Yen credit 85% (interest 1.11%, repayment period 20 years, grace 7 years) and local funding 15% (interest 35%, repayment period 5 years, grace for construction time)
- 2) Interest during construction was assumed to be paid by own fund.
- 3) Interest rate for local funding was assumed at 35% because the prime rate was 2-3%/month although there was no long-term commercial lending beyond 1 year according to a hearing from the Bank of Mongolia at the time of the survey.
- 4) The following 7 cases were established with different loan and other conditions.
  - Case 1: with the same conditions as Phase-II Yen credit
  - Case 2: No borrowing except for the arranged Phase-II Yen credit (It should be noted that this case is not realistic because the foreign currency portion must be borrowed from abroad because of shortage of Mongolian foreign reserves)
  - Case 3: Interest rate for foreign currency 30% (average rate for short-term lending in 2000 according to the Bank of Mongolia statistics) and the remaining conditions unchanged from Case 1

- Case 4: Modifying Case 3 by changing the foreign interest rate to 10%, allowable rate to make cashflow for each year positive
- Case 5: More realistic loan conditions for foreign currency with 5 years repayment period and (grace for construction time) and 30% interest rate
- Case 6: Modifying Case 5 by changing the foreign interest rate to 5.5%, allowable rate to make cashflow for each year positive
- Case 7: Modifying Case 5 by changing the sales prices to: power 33.35 Tug/kWh and heat 6,900 Tug/Gcal, minimum level to make cashflow for each year positive and to avoid capital deficiency

## (2) Balance Sheet

- 1) The whole sum of cashflow for each year is entered in cash.
- 2) Short-term investment is kept at 2001 level.
- 3) Receivables are kept at 2001 level.
- 4) Inventories are kept at 2001 level.
- 5) The current accounting practice of TES4 is followed regarding depreciation on a straight-line method with 10% of depreciation rate. In this way, 10% of the book value in 2000 was entered as depreciation cost, while the amount of rehabilitation cost for each year (except for C-ranked routine maintenance) was entered in "Construction in Progress" and the same amount was transferred to "Fixed Asset" in the following year. It is to be noted that the fixed asset as of 2000 has 30% of accumulated depreciation rate and would become fully depreciated in 2007, so that those assets would be retired in 2008.
- 6) Payables are kept at 2001 level.
- 7) Other short-term payables are kept at 2001 level.
- 8) As for long-term borrowing, the amount of repayment for external fund procurement related with the rehabilitation plans (except routine C-rank) were entered.
- 9) As for the owner's equity account, a considerable capital reduction was made in 2001 but beyond that year there was assumed to be no change.

## (3) Income Statement

- 1) The volume of power and heat sales is based on the supply and demand forecast shown in Figures 3.2-2 (2) and 3.3-1(2). Provided that power production reaches the upper limit of its generating capacity in 2011, so that the volume of power sales becomes constant from the

same year onward and heat production is assumed to increase at the rate of 1.5% from 2021 onward.

- 2) As sector reform is underway and future development of the sector is unpredictable, the unit prices for 2001 was adopted because it was considered that an assessment of change with the unit prices at 2001 level would make funding problems clearer instead of arbitrary presumption of future unit prices.
- 3) Fuel cost was calculated with the ratio to the sales in 2000 because the breakdown of the production cost for 2001 was not clear.
- 4) Depreciation cost from 2002 and thereafter was assumed at 10% of the amount of the rehabilitation cost for each year (excluding C-ranked routine maintenance) to be entered in the following year.
- 5) Repair cost was entered with the amount of C-ranked maintenance cost.
- 6) Personnel cost is kept at 2001 level.
- 7) General and administrative expenses are kept at 2001 level.
- 8) Non-operating expenses only include interest of borrowing related with the rehabilitation plans.
- 9) Corporate tax was assumed at 40%.

#### (4) Evaluation of the established cases

- 1) Case 1 (Yen credit basis: foreign interest 1.11% repayment 20 years)

Each year shows positive cashflow but the current profit is in the red up to 2014 while the retained earnings go into the black in 2025. This means shrinkage of the capital owned by the government up to 2024. Debt ratio is beyond 80% in most years, showing fragile financial structure. On the other hand, ROA goes beyond 6% (composite rate of foreign and local borrowing) from 2021 onward and far below that rate in most of the other years. Working ratio, index approximate to the ratio of expenses and revenues viewed in cashflow basis, goes around 70%, a rather high level. Debt service ratio, which is required to be 1 at least, goes under 1 from 2007 onward. As for self-financing ratio, there is no problem although the ratio is fluctuating because each year has quite a different level of investment and repayment.

A large amount of cashflow accumulated in cash can be used to pay the payables or to make early repayment considering fund requirement in order to improve financial situation.

2) Case 2 (no borrowing except for Phase-II)

Each year shows positive cashflow, while the current profit goes into the black in 2008 and the retained earnings goes into the black in 2018. Shrinkage of the capital owned by the government is seen up to 2017 although shorter than Case 1. Debt ratio reaches 70% until 2010 and thereafter decreases to become 16% in 2025. On the other hand, ROA goes somewhere between 3-4% from 2008 and 2014 and then goes up to over 6% between 2015 and 2019 to reach levels beyond 10% from 2020. Working ratio is at a level between 60% and 70% in most years, showing no problems. Debt service ratio goes beyond 1 in many years and self-financing ratio shows no problems because there is no borrowing.

Similarly to Case 1, cashflow can be used to pay the payables or to make early repayment considering fund requirement in order to improve the financial situation further. Nevertheless, this case is based on the assumption that foreign currency can be procured locally without restraint but the situation of Mongolian foreign reserves do not permit this so this case is not realistic.

3) Case 3 (foreign 30% repayment 20 years)

Cashflow shows deficit from 2005 onward and there is capital deficiency in some years, which means the company goes bankrupt.

4) Case 4 (foreign 10% repayment 20 years)

This case sets the foreign interest rate at such a level as to make cashflow for each year positive but capital deficiency occurs from 2007 onward.

5) Case 5 (foreign 30% repayment 5 years)

This case assumes more realistic conditions for foreign borrowing and sees negative cashflow and capital deficiency from 2005 onward.

6) Case 6 (foreign 5.5% repayment 5 years)

This case assumes a foreign interest rate at such a level as to make cashflow for each year positive with the remaining conditions unchanged but sees capital deficiency mostly from 2008 onward.

7) Case 7 (foreign 30% repayment 5 years tariff: power 33.35 Tug/kWh heat 6,900 Tug/Gcal)

This case modifies Case 5 with such tariff levels as to make cashflow for each year positive. The current profit is in the red in many years until 2014 and goes into the black thereafter, while the retained earnings go into the black in 2021. This leads to shrinkage of the capital owned by the government up to 2020. Debt ratio is beyond 80% in most of the years, showing fragile financial structure, while the ratio shows rapid improvement from 2020 onward. On the other hand, there is 1 year when ROA is beyond 25% but there is no year

when ROA goes beyond 31% (composite rate of foreign and local borrowing). Working ratio goes beyond 70% mostly until 2019 and then goes down to 60% and to 50% levels. As for self-financing ratio, there is no problem although the ratio fluctuates because each year has quite a different level of investment and repayment.

A large amount of cashflow accumulated in cash can be used to pay the payables or to make early repayment considering fund requirement in order to improve the financial situation.

#### (5) Overall Evaluation

Cases 1, 3 and 4 assume 20 years repayment but are not possible without soft conditions as provided by Yen credit with as a low interest rate as 1%. There is uncertainty about whether Yen credit will be provided in future and in the case of future privatization there is no possibility of Case 1. In Case 2, all the funding requirements can be met by its own fund but in reality foreign currency is necessary, so that this case is not possible either. Of the above 7 cases, Case 5 is the most likely to be faced by a corporation facing future privatization. As seen in Case 6, even if an unrealistically low interest rate is applied, capital deficiency occurs and the case becomes impossible, which indicates that a price hike is necessary as in Case 7.

To that effect, the first thing to do is to make accounting treatment appropriate, implement asset revaluation and normalize depreciation period in order to prepare financial statements more properly reflecting the actual financial situation. The next is loan conditions; as there has been no long-term lending in Mongolian financial markets and loan conditions are unclear, improvement of the financial market is essential, while TES4 must make borrowing conditions clear through negotiations for each loan and prepare funding plans considering the size and timing of a price hike and whether to procure a local fund requirement by its own fund.

















Table 5.4-11 Funding Plan Case 7 (unit: million Tug.)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>A. Asset</b> <b>1. Current Asset</b> Cash 616 23,041 41,291 50,235 55,493 58,197 58,093 64,523 67,173 74,898 82,618 71,127 59,036 54,088 51,276 42,678 51,883 62,427 76,490 82,434 101,121 122,259 144,422 167,812 201,863 Short-term investment 0 Accounts receivable 14,048 Allowance for doubtful accounts Inventory 6,833 Fuel 1,738 Spare parts & others 5,095 Prepaid expenses <b>Total Current Assets 21,497 49,922 62,172 71,116 76,374 79,076 79,974 85,404 88,054 95,779 103,499 92,009 79,917 74,969 72,157 63,559 72,764 83,308 97,371 103,315 122,002 143,140 165,303 188,693 222,744</b> <b>2. Non-current Asset</b> 2.1 Tangible asset Gross Fixed Assets 169,386 170,197 176,977 206,847 236,887 240,927 255,397 290,887 320,158 367,628 418,068 384,068 346,647 299,917 195,097 169,367 159,677 170,597 161,127 137,097 124,857 111,467 91,417 76,367 72,057 Accumulated Depreciation -52,386 -69,416 -87,113 -107,798 -131,487 -155,539 -181,079 -207,776 -234,538 -261,338 -288,155 -315,022 -341,912 -368,827 -395,776 -422,764 -449,792 -476,860 -503,968 -531,116 -558,304 -585,532 -612,809 -640,136 -667,513 Construction in process 811 6,780 29,870 30,040 3,640 14,970 7,080 27,470 28,540 12,240 13,390 20,050 15,050 4,310 4,310 4,510 18,000 18,000 4,510 0 0 0 0 0 0 Livestock 0 <b>Total tangible asset 117,801 107,561 119,733 129,089 109,040 99,957 81,399 96,852 110,629 105,253 100,236 100,621 94,679 79,480 66,853 54,359 56,392 57,332 46,729 32,020 19,534 8,387 -765 -8,391 -15,597 207,147</b> 2.2 Intangible asset Goodwill Patent Copyright Organizational cost Other intangible asset <b>Total intangible asset 0</b> 2.3 Investment and other asset <b>Total Non-current Asset 117,801 107,561 119,733 129,089 109,040 99,957 81,399 96,852 110,629 105,253 100,236 100,621 94,679 79,480 66,853 54,359 56,392 57,332 46,729 32,020 19,534 8,387 -765 -8,391 -15,597</b> <b>Total Asset 139,298 151,484 181,905 200,205 185,414 178,936 160,372 182,256 198,683 201,031 203,735 192,629 174,598 154,448 139,010 117,918 128,156 140,640 143,100 135,334 151,527 164,548 180,302 207,147</b> <b>B. Liabilities and Owners' Equity</b> <b>1. Liabilities</b> Accounts payable 17,802 Social and health insurance payable 235 Other payable 80 Short-term loan 846 Allowance for short-term liabilities <b>Total short-term liabilities 18,963</b> Long-term loan 38,071 44,851 74,721 102,431 101,741 112,281 113,361 132,111 150,131 153,851 158,721 155,611 145,501 126,451 107,401 79,951 82,301 86,651 77,511 54,861 30,261 18,541 6,821 4,101 Long-term bond payable Other long-term payable 1,979 Allowance to long-term liability 13,762 12,742 11,722 10,722 9,772 8,892 8,052 7,282 6,572 5,912 5,312 4,772 4,292 3,872 3,512 3,202 2,962 2,702 2,632 2,562 2,552 2,552 2,552 2,552 2,552 <b>Total long-term liabilities 53,812 59,572 86,422 115,132 113,492 123,142 123,392 141,372 158,662 161,742 168,012 163,382 151,772 132,302 112,892 85,132 87,232 91,392 82,122 59,402 46,512 34,792 23,072 11,362 8,632</b> <b>Total Liabilities 72,775 78,535 107,385 134,095 132,455 142,105 142,355 160,335 177,645 180,705 184,975 181,325 170,735 151,235 131,855 104,085 106,195 110,355 101,085 78,385 65,475 53,755 42,035 30,315 27,595</b> <b>2. Owners' Equity</b> a) state 69,998 b) private c) Treasury stock <b>Total equity 69,998</b> Paid in capital Revaluation surplus Other parts of owner's equity <b>Retained earnings (loss) -3,475 2,951 4,523 -3,887 -17,038 -33,166 -51,980 -48,076 -48,959 -49,871 -51,237 -56,693 -66,136 -66,814 -62,843 -56,174 -47,037 -39,713 -27,882 -13,028 6,083 21,775 52,516 79,889 109,555</b> Current period -3,475 6,426 1,572 -8,410 -13,151 -16,128 -18,814 3,904 -884 -712 -1,566 -7,456 -7,443 -678 3,971 6,668 9,138 7,324 11,731 14,954 19,091 21,712 24,741 27,474 29,566 Carried over from previous period -3,475 2,951 4,523 -3,887 -17,038 -33,166 -51,980 -48,076 -48,959 -49,871 -51,237 -56,693 -66,136 -66,814 -62,843 -56,174 -47,037 -39,713 -27,882 -13,028 6,083 21,775 52,516 79,889 109,555 <b>Total Equity 66,523 72,950 74,521 66,111 52,960 36,832 18,018 21,929 20,927 18,761 11,305 3,862 3,165 7,156 13,924 22,929 30,268 42,016 56,970 70,962 97,779 122,514 149,889 179,554</b> <b>C. Total Liabilities and Equity 139,298 151,485 181,908 200,206 185,415 178,937 160,373 182,257 198,684 201,032 203,736 192,630 174,597 154,449 139,011 117,919 128,157 140,641 143,101 135,335 151,528 164,549 180,303 207,148</b> Debt ratio 52% 52% 53% 54% 55% 56% 57% 58% 59% 60% 61% 62% 63% 64% 65% 66% 67% 68% 69% 70% 71% 72% 73% 74% 75% ROA -2.5% 7.1% 1.4% -4.2% -7.1% -9.0% -11.7% 3.6% -0.4% -0.4% -0.8% -3.9% -4.3% -0.4% 4.8% 9.4% 11.8% 8.7% 13.7% 18.4% 22.5% 23.9% 25.1% 25.4% 23.8% Working ratio 71% 61% 73% 84% 86% 90% 92% 78% 83% 87% 84% 88% 87% 83% 78% 74% 72% 74% 70% 68% 64% 62% 59% 57% 55% Debt-service ratio 0.004 7.3 1.5 0.4 0.2 0.1 -0.003 0.2 0.07 0.2 0.2 0.2 -0.2 -0.1 -0.1 -0.2 0.3 0.3 0.4 0.2 0.2 0.8 1.0 1.3 1.6 12.1 Self-financing ratio -2% 331% 61% 30% 144% 18% -1% 23% 9% 63% 58% -57% -80% -115% -65% -191% 51% 59% 312% 312% 312% 312% 312% 312% 312% 312%																									

Assumptions  
 1) Loan conditions  
 Foreign: 30% interest/ 5 yrs. repayment  
 Local: 35% interest/ 5 yrs. repayment  
 2) Tariff  
 Power: 33.35 Tug/kWh  
 Heat: 6900 Tug/Gcal