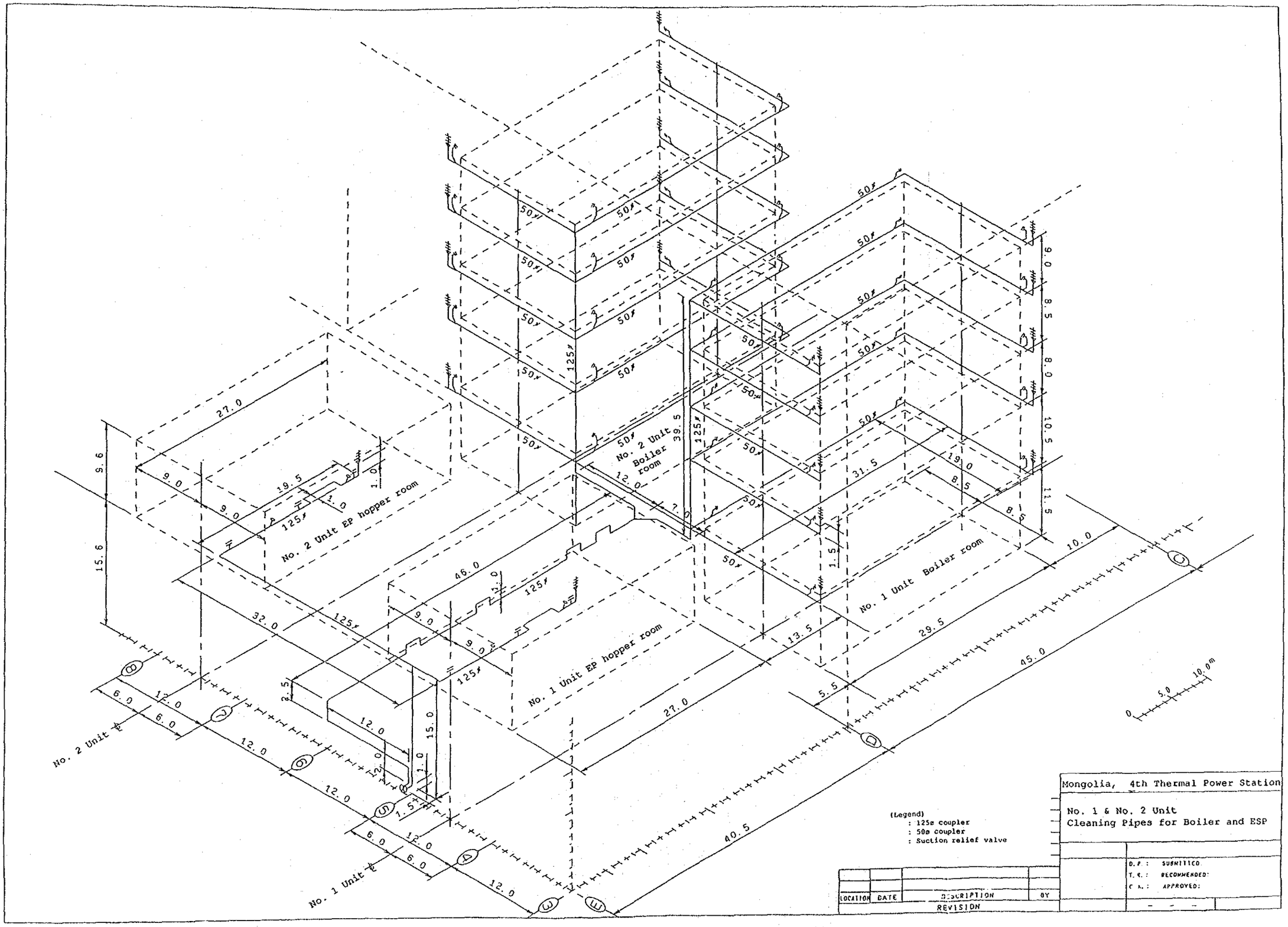

No. 2 Unit EP hopper room
No. 2 Unit Boiler room
No. 1 Unit EP hopper room
No. 1 Unit Boiler room
No. 2 Unit
No. 1 Unit
125A
50A
27.0
9.6
15.6
9.0
9.0
19.5
1.0
1.0
46.0
32.0
2.5
12.0
15.0
1.5
6.0
6.0
12.0
39.5
31.5
19.0
8.5
8.5
1.5
13.5
27.0
5.5
9.0
8.5
8.0
10.5
11.5
10.0
29.5
45.0
40.5
0
5.0
10.0m
(Legend)
: 125ø coupler
: 50ø coupler
: Suction relief valve
Mongolia, 4th Thermal Power Station
No. 1 & No. 2 Unit
Cleaning Pipes for Boiler and ESP
D.F. : SUBMITTED
T.E. : RECOMMENDED
C.M. : APPROVED
LOCATION
DATE
DESCRIPTION
BY
REVISION

5.4 Implementation Plan

5.4.1 Implementation Policy

The work will be executed according to the following policies:

(1) All executions will be done under full responsibility of the Mongolian side. No Japanese experts will be sent. However, guidance may be given at times by Japanese experts for certain equipment or material usage.

(2) All materials and machinery will be supplied from Japan. The Mongolian side, however, may be requested to make arrangements for a limited amount of machinery and materials necessary for execution.

(3) The engineer of Consultant will be sent periodically, to provide the Mongolian side with assistant supervisory service should there be any problem, and to assure the completion of execution within the specified period of the rehabilitation project.

5.4.2 Precaution to be Observed in the Status of the Site and Implementation

(1) Investigation will be conducted on the adaptability to Russian devices and parts upon the procurement of materials and machinery as far as possible as well as upon the implementation. However, such an investigation can never be exhaustive. Of the 8 boilers, the later ones are found to have signs of minor improvements and the dimensions of each device are different. Some equipment has already been repaired by Mongolian personnel as usual maintenance. The extent of repairs having been made are different by each boiler, and no data has not been put in order for implementation, showing what extent is available. As of February 1992, No. 8 boiler was still being under complete Russian control in trial operation so that an investigation was impossible. So, there is no choice other than to tackle it with field fitting.

(2) A ventilator with duct, one of the supplies, will be installed to bring out the vapor generated from adhesive for ceramic bonding, and operated effectively while the work is ongoing. Some of the adhesive or agent may cause dermatitis, etc. so that such material shall never be handled with bare hands.

(3) Since the station load reaches its peak in the winter season, the maintenance work is normally performed in summer. It would be desirable if materials and machinery were to arrive from Japan during the summer season and then the execution could be commenced. Even though most of the work will be executed inside the buildings, work efficiency will unavoidably decline during the coldest period in winter. Therefore, execution should be avoided as far as possible from December to February.

(4) As for the bonding of ceramic tiles and the handling of the primary fan, an explanation has already been given on specific working procedures and precautions (translated into Mongolian and already submitted) during the measures taken for the winter of 1991. They will be strictly observed.

In the bonding work, in particular, one should recognize the surface pre-treatment is most important.

5.4.3 Management Plan for Implementation

(1) Implementation structure of rehabilitation project

The Mongolian side shall have the responsibility, as the executing agency, to prepare the management plan and to complete the work within planned period using materials and machinery, supplied under the Project from Japan. Japan will send Consultant and in addition, necessary experts of manufacturers for ttechnical transfers for the purpose of smooth implementation of the project.

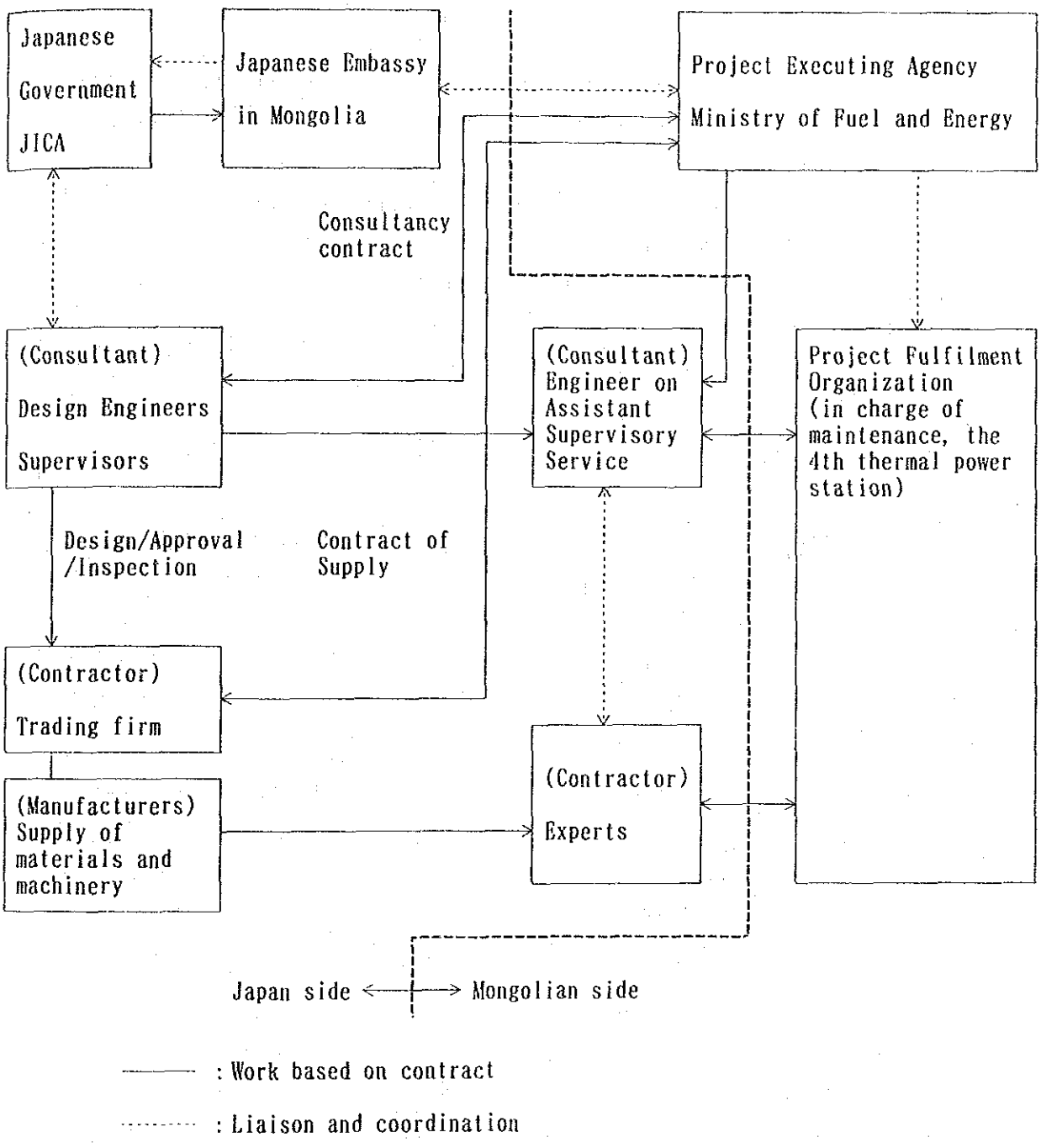


Fig. 5-4-1 Project Implementation System

(2) Implementation structure on Mongolian side

With respect to the implementation structure on the Mongolian side, the relevant sections and posts in the maintenance and operation systems of the present 4th thermal power station shall execute respective work according to their responsibilities since the rehabilitation project can be properly executed by them, as viewed on the contents and the manpower, as described in Chapter 4, Paragraph 4.2.5.

(3) Adjustment of schedule

To accelerate smooth execution of the work, the Consultant as the coordinator, will enter into consultation with the Monoglian side for finding solutions to problems and for the timely completion of work within the specific period, giving their utmost efforts.

(4) Technical transfer plan

For individual specific devices supplied, manufacturer's experts will provide technical transfer for the purpose of giving guidance mainly on handling methods. Items of technical transfer will be as shown below:

Table 5-4-1 Items Requiring Technical Transfer

Devices	Particulars	No. of persons and duration
Vacuum car	Instruction on their handling	1 expert x 2 weeks
Motor-driven reducer for collection/ discharge electrodes	Investigation of installing method and guidance	1 expert x 2 weeks
Air slider canvas	Guidance on setting pressure condition after installation	1 expert x 2 weeks
Dust measuring instrument	Instruction on handling and guidance for measurement	2 experts x 2 weeks
Coal scale for conveyor	Guidance on adjustment and calibration of meter	1 expert x 2 weeks
Primary fan	Instruction on handling of fan rotor	1 expert x 2 weeks
Level gauge	Instruction on handling	1 expert x 2 weeks

(5) Transport plan

Table 5-4-2 shows a comparison of transport plans of Japanese materials and machinery to Ulaanbaatar. There is the China route and the Russian Republic route. The China route will be adopted since the transportation cost and other conditions cannot be easily determined due to confusion in the Russian Republic for the latter route.

Thorough transportation service into Mongolia is getting under way in cooperation with the External Railway Service Corporation of China. Container transportation and cold zone specification for packing will be desirable though the cost will beocme slightly higher, considering the unavoidable of transshipment at Erhlien.

Delivery will be made to the Mongolian side at the Ulaanbaatar Freight Station FOR. In case the vacuum car travels by itself from the Tien-tsin port, however, the delivery will be made at the power station or the freight station and the decision will be made then.

Table 5-4-2 Comparison of Transport Routes

	China route	Russian Republic route
Route and distance	Marine transportaion from Yokohama or Kobe to Tien-tsin. Railway transportation from Tien-tsin to Ulaanbaatar (Approximately 2,500 km)	Marine transpotation from Niigata to Nakhodka. Railway transportation from Nakhodka to Ulaanbaatar (Approximately 6,000 km)
No. of days for transport (day)*	40 - 50	30 - 80
Transportation cost ratio**	1.0	1.0
Remarks	. Desirable if all items, except pipings, were transported by containers. . Transshipment of pallets will become necessary between Mongolia and China becasue of the difference in railway gage. . Vacuum cars for dust removal will have to travel by themselves since their transportation by rail is impossible. (Approximately 2,500 km) . No past experience of transporting large cargos.	. Avoid transportation in winter season. . Desirable if all items, except pipings, were transported by containers. . No transshipment is required between the Russian Republic and the Mongolia since the railway gages are the same. . Unknown about the transportation of vacuum cars for dust removal. . Experienced in transportation of large cargos.

** Though the China route was set to be the same as the Russian Republic route as the cost of the former is determined by the cost of the latter, both are still in a state of liquidity.

* The number of days necessary for unloading at Tien-tsin port and customs clearance for import into Mongolia were assumed to total about 8 days.

5.4.4 Procurement Plan of Materials and Machinery

Based on the study result in Mongolia, in the procurement of materials and machinery for the project, all required items will, in principle, be imported from Japan. Since the materails and machinery are intended for the maintenance of the power station, it would be desirable if they could be imported from the ex-Soviet Union who designed and manufactured facilities thereof. However, the delivery date and prices are unstable due to the confusion of its market economy so that all items will be imported from Japan.

Table 5-4-3 shows the Procurement plan of materials and machinery from Japan, based on the foregoings. The second figure of delivery priority column "1" means those items which should preferably be delivered in the beginning even if the quantity is small, and which could be purchased in a very short term, while "2" represents most of materials and machinery delivered and "3" denotes those, delayed delivery of which can be permissible or preferable for the completion of the project. The first figure in the column "1" means first phase execution, and "2" means the second phase execution.

Classification	Item
1	Measures against pluggage in ash treatment system
1.1	ESP ash hopper discharge equipment (replacement and new installation)
1.2	Air supply facilities (new installation)
1.3	ESP reducer (replacement)
1.4	Slurry pit level control equipment (new installation)
1.5	Slurry valves for ash slurry pump outlet (replacement)
1.6	Feedwater line (new installation)
1.7	Pipe cleaner for ash treatmetn water supply line (supply)
1.8	Mobile vacuum cleaning equipment (supply)
1.9	Miscellaneous for ash treatment system (replacement)
1.10	Piping system for dust cleaning (new installation)
2	Measures against wear of pulverized coal feed system
2.1	Alumina ceramics tiles (new installation)
2.2	Ceramics tile lined 90° bend of pulverized coal pipe (replacement)
2.3	Ceramics tile lined primary fan outlet flow control damper (new installation)
2.4	Ceramics tile lined primary fan rotor (replacement)
2.5	Magnet separator (new installation)
3	Atmospheric pollution measurement
3.1	Measurement forenvironmental pollution (supply)
4	Supplemental measures for plant maintenance
4.1	Pumps (replacement)
4.2	Valves (replacement)
4.3	Level gage (replacement)
4.4	Coal scale (replacement)
4.5	Measuring instruments (supply)
4.6	Materials and machinery for rehabilitation work (supply)
4.7	Materials and machinery for general plant maintenance (supply)
4.8	Lighting equipment (new installation and supply)

Table 5-4-3 Procurement Plan for Machinery and Materials

Classification	Particulars of machinery and materials	Principal specification	Delivery priority	Date of delivery (Month)
1.1	Canvas for air slider For 13.5m 60 sheets For 10.5m 60 sheets For 6.0m 50 sheets	Perforated plate (wire gauze) made of aramid 220mm wide, 6mm thick For 13.5m/10.5m 36 sheets each	1.2	6
		For 6m 24 sheets		
		For 13.5m/10.5m 24 sheets each For 6m 26 sheets	2.2	
	Rubber pad of ash level sensor (with spring for fine adjustment)	Silicone rubber 1m x 2m x 5mm thick 5 sheets	1.1	1 - 6
		10 sheets	1.3	
		5 sheets	2.1	
	Air hammer	Made of stainless steel, non-lubricated type Adjustable impact force (maximum 10kgm/s) 144 pieces	1.2	3 - 5
		56 pieces	2.2	
1.2	Air supply facility	Package air compressor Approx. 1.1m^3/min., 7-8.5kgf/cm^2 3 units	1.2	5 - 7
		Air pipe and header 350mm dia. x 10m x 3 pieces	1.2	2
		Pressure resistant hose, and others	1.2	2
1.3	ESP reducer for collecting and discharge electrodes	Motor reduction gear with 0.4kV motor reduction ratio 1/1000 60 units	1.2	8 -10
		60 units	1.3	
		40 units	2.2	

Classification	Particulars of materials and machinery	Principal specification	Delivery priority	Date of delivery (Month)
1.4	Slurry pit water level control equipment	.200mm dia. level control valves 2 pieces .200mm dia. feed water valve 4 pieces .Others 2 sets	1.3	12
1.5	Ash slurry pump outlet slurry valve	Gate type, 10kgf/cm^2, made of high chrome steel 400mm dia. 11 pieces 300mm dia. 7 pieces	1.2 2.2	8 -12
1.6	Feed water line (pipe, valve) (including support steel frame)	.Pipe 350mm/65mm dia. 1 set .Gate valve 350A 10 pieces .Others 1 set 60% 40%	2.1 2.2	6 -12
1.7	Pipe cleaner	Motor-driven Variable speed type 380V, 50Hz For large diameter and for medium diameter 1 unit each	2.2	5
1.8	Mobile vacuum cleaning equipment (11-ton car)	Diesel-driven, 450-740mmHg 900-100m^3/min 2 units	2.2	8
1.9	Gland packing for ash slurry pump	Aramid fiber each 20 rolls 27mm x 27mm x 3m/roll 20mm x 20mm x 3m/roll	2.1	3
	Pressure gage	Diaphram type, -1.0-15kgf/cm^2 for inlet and outlet 15 units each total 30 units	2.2	3

Classification	Particulars of materials and machinery	Principal specification	Delivery priority	Date of delivery (Month)
1.10	Piping system (including relief intake valve, support steel frame, etc.)	20%	2.1	3 - 5
		80%	2.2	
2.1	Alumina ceramic tile (together with silicone based adhesive 3,000kg and primer 100 liters)	Tiles for 1,000m^2 Alumina 92% Apparent density 3.6g/cm^3 10%	1.1	2 -10
		50%	1.2	
		15%	1.3	
		25%	2.1	
2.2	90° bend of pulverized coal pipe (Alumina ceramic tile lined)	Pipe diameter 450/500/550mm Setting adhesion in heating 42 pieces	1.2	6 - 8
		14 pieces	2.2	
2.3	Primary fan outlet Flow control damper (Alumina ceramic tiles lined) (for test)	Setting adhesion in heating 444mm dia. 4 497mm dia. 8 for 1 boiler Total 12 units	2.2	5 - 7
2.4	Primary fan rotor (Alumina ceramic tile lined) (Silicone nitride ceramic are used for blade tips only)	Setting adhesion by in normal temperature Thickness of main plate/side plate 16/12mm 12 pieces	1.2	8 -14
		6 pieces	2.2	
2.5	Magnetic separation	Automatic discharge type Magnet force over 25kg 2 units	2.2	8 -10

Classification	Particulars of materials and machinery	Principal specification	Delivery priority	Date of delivery (Month)
3.1	Instruments for measurement of dust concentration	Equal velocity suction type 2 sets	1.2	4
4.1	Phosphate injection pump for boiler	250kgf/cm^2 x 25 l/h Piston or diaphragm type 6 units	1.2	7 - 9
		8 units	2.2	
	Lubricant oil pump for mill	6kgf/cm^2 x 70 l/min Gear type 6 units	1.2	6
4.2	Sluice valve for steam	25kgf/cm^2 x 250-300°C Diameter 800, 500mm (6 pieces each) 12 pieces	1.3	12
		Diameter 400mm 18 pieces	2.2	
	Sluice valve for feed water	25kgf/cm^2 x 160-200°C Diameter 200, 100, 80mm (2 piece each) n 6 pieces	2.2	10 -12
4.3	Boiler drum level gage	Dual color type, multi-port model 150kgf/cm^2 saturation 6 units	1.2	4
		2 units	2.2	
	Low pressure level gage	Reflection type (10kgf/cm^2) 2 units	2.2	4
4.4	Coal scale	For installation on conveyor (Load cell type) Maximum measurement 1000t/h 2 sets	2.2	6

Classification	Particulars of materials and machinery	Principal specification	Delivery priority	Date of delivery (Month)
4.5	Portable clamp meter	For 0.4kV 10 units	2.1	1
	Ohm meter (megger)	For 500V and 1000V 10 units	2.1	1
	Dial calipers	Maximum measurable dimension 200mm 2 sets	2.1	1
	Ultra-sonic thickness gauge (with battery charger)	Digital type 2 units	2.1	
	Multimeter (digital type)	For calibration of measuring instruments 56 units	1.2	3 - 6
	Portable calibrator	For calibration of measuring instruments 2 units	1.2	3 - 6
4.6	Grinder	Single phase 220V, 50Hz, 100mm dia. and 180mm No-load revolution approximately 12,000rpm 180 & 100mm Dia. 5 units each	1.1	1
		100mm Dia. 30 units 180mm Dia. 10 units	1.2	3
	Grind stone disc	100 and 180mm dia., resinoid type 4,000 pcs	1.1	
		8,000 pcs	1.2	1 - 6
	Chain block	For 800kgf, 2.5m lift 3 units	1.1	1

Classification	Particulars of materials and machinery	Principal specification	Delivery priority	Date of delivery (Month)
4.6 (cont'd)	Wire for construction works	1/2", 3/4" 500m/roll 2 rolls each	1.1	1
	Can type surface cleaner	Agent for surface pre-treatment for bonding ceramic tiles, non-combustible, 800 l	1.1	1 - 3
		2,200 l	1.2	
	Spray type surface cleaner	ditto 2,000 pcs. 400-500g/pcs.	1.1	1 - 3
	Auxiliary devices for work	Lever type lift 6 pcs. Slinger 10 pcs. Ventilator with hose 4 pcs.	1.1	1
	Plasma cutting machine	380V, 50Hz, air-cooled type, approx. 11kV 3 units	1.2	3
	AC welding machine	380V, 50Hz, Approx. 43kVA Rated 500A 5 units	2	3
	Dust-proof goggles and masks	25 pieces each	1.2	1
	Paper for vibrometer	For VIBRO PORT30 5 packages	1.3	1
	Welding electrode	4 mm dia. For carbon steel 1,000kg	1.1	1 - 4
		For carbon steel 3,000kg	1.2	
		For harden surfacing 1,000kg	1.2	

Classification	Particulars of materials and machinery	Principal specification	Delivery priority	Date of delivery (Month)
4.6 (cont'd)	Holder for welding electorde	20 pieces	1.1	1
	Hot air dryer	3kW, single phase, 200V 5 units	1.2	3 - 4
	Drill	Max. ø16mm, single phase, 220V 20 units	1.2	3 - 4
	Transformer	3-phase, 380V -> 3-phase 220V, 15kVA 6 units	1.2	3 - 4
	Motor-driven cutter	Max.3.2mm, single phase, 220V 5 units	1.2	3 - 4
4.7	Transceiver for in-house communication	Multichannel, rechargeable type 20 units 40 units	2.1 2.2	2 - 4
	Insulating tape	Silicone rubber type, 15m x 30 rolls Adhesive vinyl type, 20m x 10 rolls 1 set 60% 1 set 40%	2.1 2.2	1
	Copying machine (with papers, A2: 5,000 sheets and A4: 20,000 sheets)	Indirect electrostatic image transfer For A4 2 units For A2 1 unit	2.1 2.2	1 - 8
	Graphite packing (for multipurpose use)	Square type, 12-36mm heat resistant Total 200kg 1 set 40% 1 set 60%	2.1 2.2	1 - 6

Classification	Particulars of materials and machinery	Principal specification	Delivery priority	Date of delivery (Month)
4.7 (cont'd)	Sealing putty (Insulating material based, or silicone rubber based)	Non-liquid, heat resistant, noncorrosive 600kg 700kg	2.1 2.2	1 - 4
	Portable electric vacuum cleaner (industrial use)	Approx. $5m^3$/min., vacuum 2,000mmAq Single phase 220V, 50Hz 8 units	2.2	6
	Portable flashlights	Rechargeable type 40 pieces 60 pieces	2.1 2.2	1
	Small size pipe cleaner (electric motor driven)	For bores ranging from 15 to 100mm Single phase, 220V With 3 sets of cutters and stand 4 units	2.2	4 - 6
	Submerged pump (electric motor driven)	Aprox. $50m^3$/h x 10mh 3-phase, 380V With a 40m long hose and base 5 units	2.1	2 - 4
	Forklift	Capacity, 3 tons Battery driven 2 units	1.2	3 - 5

Classification	Particulars of materials and machinery	Principal specification	Delivery priority	Date of delivery (Month)
4.8	Lighting equipment	1,000W fixtures, 48 pcs., 400W fixtures 98 pcs. 250W fixtures 68 pcs. The above are mercury lamps		
		For mercury lamp 50 pcs.	1.1	
		" 100 pcs.	1.2	
		" 64 pcs.	2.1	
		Spare bulb, ditto 100 pcs.	1.2	
		" 200 pcs.	1.3	
		" 128 pcs.	2.1	
		Spare bulb for incandescent lamp 200 pcs.	1.1	
		" 200 pcs.	1.3	1 - 6

5.4.5 Implementation Schedule

(1) Preparatory work to be done by the Mongolian side

The main work is as follows. This preparation should be finished before arrival of the materials and machinery for the rehabilitation project.

- Arrangement of the work site
- Calibration and adjustment of major instruments for boiler
- Arrangement for good situation of existing equipment and materials related to the replacement, new installation and supply of the materials and machinery of Japan
- Arrangement of the stock yard for the materials and machinery sent from Japan
- Establishment of structure required for implementation of the project

(2) Delivery and so on of materials and machinery to be done by the Japanese side

The materials and machinery required for the rehabilitation project will be collected in a specified warehouse in Yokohama port or Kobe port, and after inspection, are to be transported by sea to Tientsin Port in China, and then transported to Ulaanbaatar by rail. Note that the mobile vacuum cleaning equipment (truck) run to the site because the equipment cannot be transported by rail as its large dimension.

Arrival time of the materials and machinery sent from Japan will be in the following 5 events "Contract" means verification date of contract on supply by Japanese Government.

The first phase execution		The second phase execution	
.The first	- about 2 months after contract	.The first	- about 2 months after contract
.The second	- about 8 months after contract	.The second	- about 8 months after contract
.The third	- about 12 months after contract		

The most of the materials and machinery sent from Japan will arrive in the second event of each execution.

The experts of manufacturers will be sent in accordance with the progress of site work or the use at the Site. Consultant will provide assistant supervisory service in accordance with the progress of site work.

(3) Schedule of implementation to be carried out by the Mongolian side

The schedule of implementation to be carried out by the Mongolian side, which was prepared taking into account their periodical boiler shut-down schedule, is probably as shown in Fig. 5-4-2. To carry out the necessary work the following matters should be taken into consideration.

1) Work during winter should be reduced as much as possible.

As the every demand becomes higher during winter, it will be necessary to run 3 or 4 boilers. Because the number of boilers available for carrying out the rehabilitation project is limited, and in addition, workers there will be very busy for emergency services.

Although the work for rehabilitation is done indoors, work efficiency will become extremely lower because the site is in an extremely cold district.

2) Because of the importance of the 4th thermal power station, the highest priority should be placed on operation of the

power station. Operation of each boiler and other facility should not be stopped forcibly for the purpose of carrying out the rehabilitation work for the power station. Taking into account the circumstance that, in the implementation stage, the schedule will be variable for many reasons, the work in each step should be carried out, if possible, even before the date fixed or assumed in the schedule.

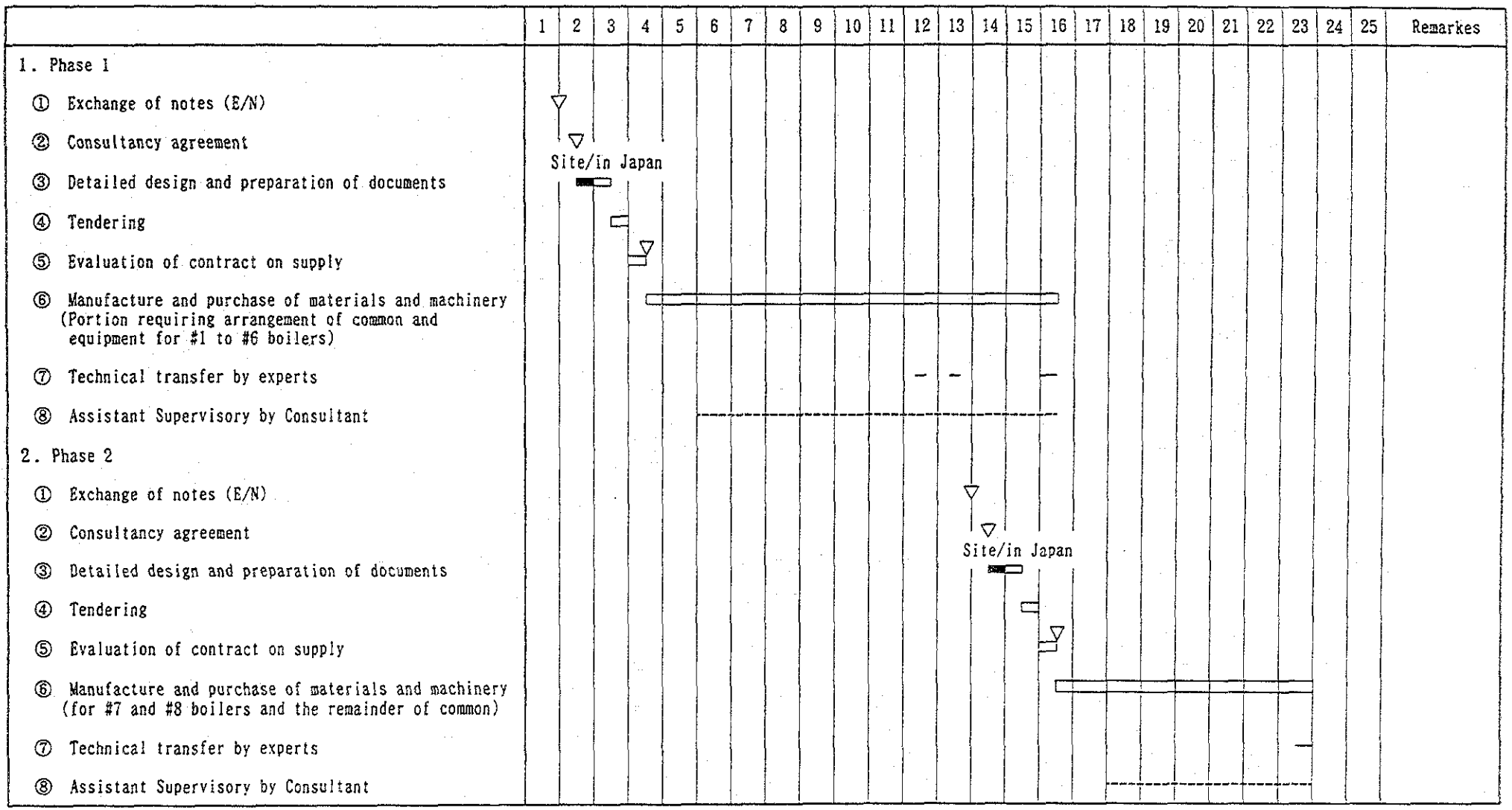


Fig. 5-4-2 Rehabilitation project work schedule for the 4th Thermal Power Station in Mongolia

5.5 Operation and Maintenance Management Plan

In order to establish a management plan required for the future, it is necessary to investigate the current management plan now being operated for finding out items requiring corrections or amendments to be done by Mongolian people after the present rehabilitation plan has been carried out. As the result of investigation, the specific recommendation is detailed herein to assist the Mongolian people in preparation of their management plan.

(1) Current operation and maintenance management plan

1) Ash treatment system

(a) ESP and related sections

a) Inside the ESP:

Scheduled inspection and maintenance is to be done twice a year, and also the result is as planned.

b) Associated equipment of the ESP:

Scheduled inspection and maintenance for devices of the ESP, No. 1 to No. 4, run for a relatively long time, is done twice a year, while those of ESP, No. 5 to No. 7, which run for a relatively short time, is done once a year.

(b) Scheduled inspection and maintenance of ash treatment system and related equipment (The air slider is included in the category of ESP.)

a) Ash slurry pump:

Twice a year for each pump

b) Ash treatment water supply pump

Once a year for each pump

c) Ash treatment water supply booster pump

Once a year for each pump

d) Scheduled inspection schedule for pumps actually executed in 1991

a. Ash slurry pump No. 1

-1 ..... 3/5 - 3/12, 7/1 - 7/17

-2 ..... 5/10 - 5/17, 9/10 - 9/17

-3 ..... 6/1 - 6/8 , 10/5 - 10/12

b. Ash slurry pump No. 2

-1 ..... 4/1 - 4/15, 10/20 - 10/27

-2 ..... 2/2 - 2/9, 8/2 - 8/9

-3 ..... 2/7 - 2/14, 9/1 - 9/9

c. Ash treatment water supply booster pump No. 1

-1 ..... 1/11 - 1/18

-2 ..... 3/21 - 3/28

-3 ..... 8/20 - 8/24

d. Ash treatment water supply booster pump No. 2

-1 ..... 5/1 - 5/5

2) Pulverized coal feed system

(a) Pulverized coal pipe and related sections

a) Scheduled

Scheduled inspection and maintenance of the pulverized coal pipe and related sections is done every year in the same period when periodical inspection of each boiler is performed. Sections heavily worn are cut to measure the thickness, and if wear is too heavy, the section and the area around it are completely replaced with new ones.

b) Periodical (except above scheduled inspection)

Periodical inspection is not performed. However, general inspection is made when the section is in maintenance.

c) Daily

Patrol inspection is performed every day on each shift (3 times a day). Also in the central control room, a check is made for any abrnomality by oxygen density meters which are installed in places.

(b) Primary fan

a) Scheduled

Scheduled inspection and maintenance of the primary fan is made in the same period when periodical inspection and maintenance of the boilers is performed (once a year). All sections including bearings are disassembled and inspected, and if wear is too heavy, the section may be welded or replaced with a new one, if necessary.

b) Periodical

In case of the replacement of fan rotor, in 20 days after its operation, the manhole is opened for inspection. The same operation is repeated once every 20 days.

In this inspection and maintenance, balance adjustment or that after welded is performed. The rotors are replaced with new ones once for every 5 or 6 months.

c) Daily

The operator checks such items as vibration, abnormal noise, and temperature once a shift (totally 3 times a day), and additionally, daily experts responsible for measurement of vibration carry out the measurement for the entire system. If the vibration is 80 micron or more (in its full amplitude), the daily experts notify the operator of it to stop the system and then to adjust the balance to suppress the vibration to the target value of 30 to 40 micron or below.

(c) Magnetic separator

a) Daily

Daily inspection of the magnetic separators is done once a shift (3 times a day) by an operator of the coal handling system by visually checking the appearance. The magnetic separator No. 3 is fully manually operated so that cleaning is made at the same frequency to remove foreign materials.

(2) Recommended operation and maintenance management plan for the future

It can be recommended to improve the current management plan taking into account the following points.

1) General

(a) Inspection of instruments

It is necessary to inspect all control and monitoring instruments and to check whether they indicate correct values or not. If they do not give correct values, adjust them so that they give correct values, and keep records concerning their adjustment or calibration.

(b) More perfect control of the coal quality

With the recognition that the receiving coal includes lots of stones and metal pieces (which in most cases are invisible) which substantially influence the maintenance of a power station in a bad way, at very least visible foreign material should be removed upon coal reception. In the future, a coal washing system should be installed at each mine. The analyzed values of coal at the reception should be compared to those of pulverized coal at the mill outlet once a month. Weight of the removed foreign material by magnetic separator should be measured.

(c) Thorough inspection of the equipment which are not targeted in this rehabilitation project

We consider that thorough inspection and maintenance of the equipment not targeted for this rehabilitation project shall be done by the Mongolian side, but it is necessary to take into account the following points.

. Fatigue due to thermal stress (Operation of the 4th thermal power station is often stopped and started. The frequency of accidents because of fatigue is the highest among thermal power stations for utilities in Japan.)

. Water treatment (Internal corrosion progresses gradually during operation for a long time, which may cause a big accident.)

. Erosion of blades in the induced draft fan and gas circulation fan (As the charge to the electrostatic precipitators is inadequate, the quantity of ash in the gas may be large.)

. Discharge of slug ash

. Maintenance of the mill

(d) Preparation of an instruction for patrols

Patrols for checking are very important, so an instruction for patrols concerning the following items should be prepared. Results of each patrol should be recorded in a specified form in each power station.

. Boiler (pressure parts, piping, gas and air duct, combustion system, equipment for measurement and control, equipment for water quality control etc.)

. Turbine (main body, make up water line, condensate water line, supply water line, bearing cooling water line, oil line, main cooling water line etc.)

. Electricity (Generator, associated devices to generator, transformer, cable, power center etc.)

. Outdoors (Water feed line, steam feed line, coal handling system, ash disposal system, cooling tower etc.)

(e) Confirmation of prohibition of cleaning with water and performance of dry cleaning

It can be considered that, with the use of putty and vacuum cleaner, cleaning with water will not be done in the future, but checking is required periodically.

On the recognition that cleaning is important for maintenance, an instruction for cleaning work should be prepared.

2) Motor-driven reducer for collection and discharge electrodes for rapping in the ESP

(a) Disassembly, inspection and repair of the device should be done at least once a year.

(b) The safety device for overload currently being used is incomplete. The possibility of a device based on the "share pin type" should be investigated.

3) Air slider canvas

The following inspections and maintenance should strictly be checked in maintenance work after replacement with a new one.

(a) The slider should be disassembled for inspection and repair at least once every 2 years.

(b) The slider must be selectively disassembled and inspected, and if the damage is found to be heavy, the canvas should be replaced with a new one.

(c) If pluggage with fly ash or any hole is discovered in the daily inspection, the canvas shall be replaced with new one as soon as possible. Never thrust the canvas with a rod.

(d) In the daily inspection, the ash flow shall be chekced to confirm that the distribution of air pressure over the canvas is normal. If not, adjust the air pressure as soon as possible.

(e) Generally ash deposits locally just when boiler shut-down due to an accident or for some other reason. Be sure to operate to purge the ash.

(f) When starting operation of a boiler, be sure to start the air slider (only for feeding air into it) before starting the boiler.

4) Ash level sensor rubber bellow pad

For maintenance after replacement, be sure to check the following items in the scheduled inspection.

(a) To disassemble the bellow for inspection and repair at least once a year.

(b) If solidification or other deterioration is discovered in the daily inspection, to be sure to replace them with new ones as soon as possible.

5) Pumps for the ash treatment system

Depending on the general operating conditions, the cycle of periodical switching of each pump should be around one week.

6) Scale measurement of the ash slurry pipe and water supply pipe for ash treatment

Qualitatively check the operating state periodically, and keep records. Prepare the instruction for switching to the spare line.

7) Primary fan

(a) It is recommended to continue the current cycle of scheduled inspection and the current frequency of daily inspection as well as to continue with their contents. After grasping the general situation concerning wear of the primary fan and know what countermeasures are required, the interval between scheduled or periodical inspections should be made longer by and by. The scheduled inspection should be done at least once a year.

(b) To check adjustment results of the primary fan's outlet flow control damper opening and to verify the effect.

8) Instruments for dust concentration measurement

(a) Be sure to replace the oil in the flue gas suction vacuum pump according to the instructions in the operation manual. It is necessary to study the technique together with the methods for checking the measuring instruments during the period of technical transfer.

(b) As measurement is not directly related to improvement in the boiler availability factor (reduction in the fre-

quency of power failures), it is strongly feared that such work may be neglected. This measurement should be done at least once a year upon prior notice to the National Environment Management Committee, and also the result should be publicly announced.

9) Replacement of lighting equipment and lamps

(a) Inspect lighting equipment during patrol, and check for causes when the lamps do not turn on. (Life of a mercury lamp is about 10,000 hours, while incandescent one is about 1,000 hours)

(b) Replace a failed lamp with a new one as soon as possible. (Even the supply would be of no use if they are not used.)

10) Follow-up for supplied materials and machinery

At present, management of spare parts in the power station may be inadequate.

All of the materials and machinery supplied from Japan attach a number tag so that each may be checked for their use or not. If any component is replaced with a new one, it is necessary to keep a record as to how long the old one was used. Also it is necessary to make clear how many spare parts are for one component, and the quantity should be checked once a year. As for ceramics tile of lining, it is necessary to open selectively some of the portions of it in one year and to check its status.

11) Others

In Japan, in order to prevent scale on ash disposal pipe or water supply pipe (or to control scale formation), if it is recognized as effective, scale preventive dispersant is poured in. The dispersant is expensive, and as operation for a long time requires identification of the effect, deliberate countermeasures are required for that purpose.

Also the Mongolian side should investigate this problem. An example in Japan is described below.

Customer: Wastes incineration station
(Processing capacity: 600 ton/day)

Applicable section: Water piping for dust collection

Problem: The efficiency to collect dust becomes lower due to scale deposits on the inner surface of the piping. (Scale: $CaCO_3$)

Dispersing feed rate: 5 to 20 ppm

Processing effect: To keep the dust collection efficiency at a constant level, it was necessary in the past to periodically clean the piping once or twice a week. However, after the dispersant was poured in, deposition of scale deposits were prevented and it has become possible to continuously run the system.

(Note) In case of the No. 1 slurry pit in the 4th thermal power station, its cost about 15 - 20 million yen/year if the 5 ppm of dispersant is poured in.

CHAPTER 6 EFFECTS AND CONCLUSION OF PROJECT

CHAPTER 6 EFFECTS AND CONCLUSION OF PROJECT

6.1 The Effects of Measures against Pluggage in Ash Treatment System

What are expected to be the effects of the measures consist of less ash clogging, assured operation of electrostatic precipitators while boilers are in operation, improvement of charge factor and the reduction in the amount of ash discharged from the power plant stack. Their results are as shown in Table 6-1-2.

Namely, by introducing various types of countermeasures, it can be expected that a quantity of ash discharged from the stack of the power station will be reduced to 22% of the expected total quantity of ash by the end of 1994, the completion of the Project.

(1) Records in 1990

1) Charge factor availability factor of ESP

The current charge factor (a value indicating what percent of load is being charged to the entire ESP) is about 40% as described in Chapter 4. Characteristics of the ESP made in the ex-Soviet Union are still not clear, but we assumed that the collection efficiency was 65%. Also the availability factor of the ESP is as shown in Table 4-2-1.

2) Total quantity of discharged ash

The total quantity of discharged ash was obtained by multiplying the consumption rate of coal by 0.15, assuming that the wet coal base ash content of Baganuur coal was 15%. Ash of the Baganuur coal is hard to deposit on a furnace wall because of its characteristics, so that the percentage of ash generated as slug ash is relatively small. As records of the actual measurement are not available, we assumed that the percentage would be 10%, and we think that assuming from the actual operation records of boilers in Japan this value is rational.

The total quantity of discharged ash is divided into the quantity of ash released into the atmosphere as ESP outlet fry ash from the stack, and the quantity of ash flowing into an ash disposal pond as slurry.

(2) Estimated operating values in 1994

1) Consumption rate of coal

Kinds of coal used in each power station and the consumption rate of coal are as shown in Table 6-1-1.

The hours for each boiler to be run is as shown in Tables 6-2-4 and 6-2-9. The consumption rate of coal can be calculated from boiler operation hours, assuming that an average load to each boiler is same as that of 1990.

2) Charge factor of ESP

The charge factor after the rehabilitation project is complete is expected to improve from the current level of 40% to 80% assuming that the current maintenance organization also will also be improved. Consequently, it can be estimated that the collection efficiency or the dust collection efficiency of the ESP would be 90%. If the charge factor is 100%, it is estimated that the dust collection efficiency would be 97%, but we consider that, even if the maintenance organization in the Mongolia is substantially improved, 100% loading as done in Japan would be difficult in the country.

Although the date when the document was prepared is not clear, the following records concerning the results of the test conducted by the ex-Soviet Union when the ESP was taken over to the Mongolia are kept in the power station. And based on the records, we can consider that, if 100% loading is done, the collection efficiency (dust collection efficiency) would be as estimated.

Ash rate at inlet (g/m^3) :	29.8	29.6	23.2	19.6	24.3
Ash rate at outlet (g/m^3) :	0.2	0.2	0.3	0.2	0.3
Dust collection efficiency (%):	99.3	99.3	98.7	99.0	98.8

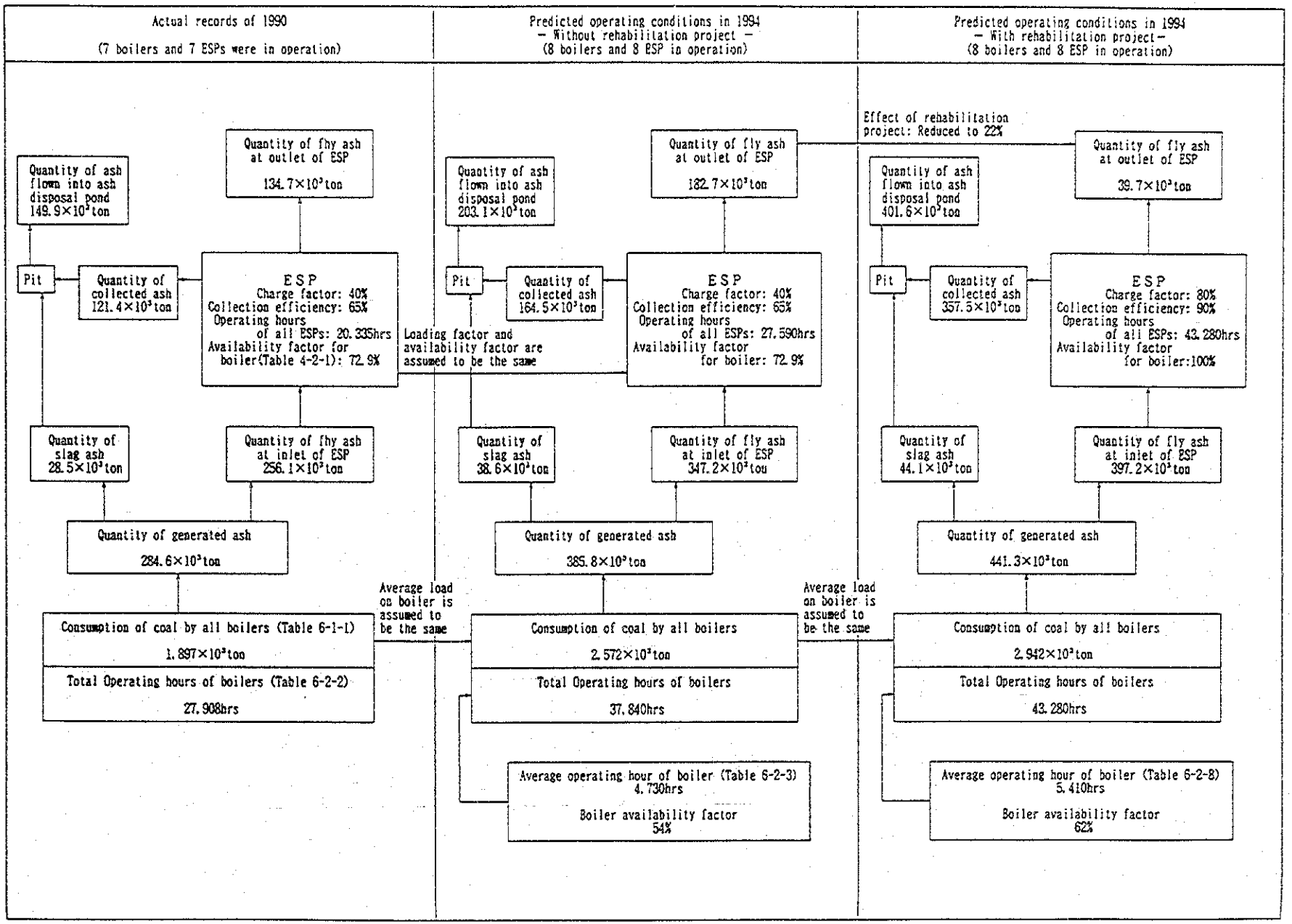
3) ESP availability factor

The desired availability factor of ESP against a boiler operation is 100%. This assumes that the current situation of maintenance work and awareness for the necessity of maintenance will be substantially improved.

Table 6-1-1 Kinds of Coal Used and Consumption Rate at Each Power Station in 1990 in Ulaanbaatar City

Power station	Type of coal	Percentage (%)	Consumption rate of coal (10^3 ton)
No. 2	Naraiha Baganuur Sharingol Imported coal	38.0 43.8 17.3 0.9 100.0	157.5
No. 3	Naraiha Baganuur Sharingol Imported coal	11.3 18.3 70.2 0.2 100.0	891.0
No. 4	Baganuur	100.0	1,896.8
Total			2,945.3

Table 6-1-2 Prediction of Effects of Implementation of Rehabilitation Project of the 4th Thermal Power Station on Improvement of ESP Factor



6.2 The Effects of Measures against Wear of Pulverized Coal Feed System

Table 6-2-1 through 6-2-8 were prepared, and based on these tables, Table 6-2-9 was prepared. Namely, by carrying out the countermeasures for wear, it can be expected that the availability factor of the boilers would raise by 7%, from 54% to 61%. Accompanying this, the supply capability will reach the level of 2,272,670 MWh as of 1994, which will yield a surplus power amouting to 149,970 MWh as opposed to the estimated net system energy demand of 2,112,800 MWh.

(1) Records in 1990

1) Demand for electric energy

We used the data concerning demand for electric power in 1990 as a base for estimation on the improvement of availability factor. It is doubtful that the operating data in the year represents a representative of the 4th thermal power station, but there is no other way of estimation.

2) Auxiliary power ratio

The auxiliary power ratio in a power station was 15.6% (in 1990) of the total power generated in the power station. Also in the latest records on actual operation in September 1991, the minimum value was 14.3% and the maximum value was 20.6% with the average of 15% (the target value: 13%). Then, we consider that this value is a representative one.

(2) Estimated operating values in 1994

1) Demand for electric energy

Our estimation on the demand for electric power in the future is based on the results in 1990 along with our discussions with the Mongolian side. We think that the estimation is rational because it is based on data concerning the actual results.

Demand for electric power growth rate over the previous year (%) imposed on the 4th thermal power station is as follows.

1990 - 1991 : 0
1991 - 1992 : 5
1992 - 1993 : 5
1993 - 1994 : 0

In brief, the estimated demand for electric power to be generated by the 4th thermal power station is $(1.05)^2 = 1.103$ times.

2) Auxiliary power ratio

We assumed that the auxiliary power ratio in the power station was 15% of the total power generated in the power station. By the reason described in (1) 2) above, it may be said that the estimation is rational. Also we assumed that the value after completion of the rehabilitation projec would be 16%. We employed this value because we took into account an increase of the auxiliary power ratio due to improvement in the availability factors of the boilers and in the availability/charge factors of the ESP is 1%.

3) Availability factors of turbine·generator

We assumed that, if the rehabilitation project is not carried out, the availability factor would be at the same level as 1990. The value in 1990 might be a little lower than the due value because of an accident in the No. 5 turbine, but as this type of turbine trouble may often occur for every other turbine too, we employed the value.

We employed, 72% the average result of operation from January to June in 1991 (as shown in Table 6-2-1), as a value when the rehabilitation is carried out. The rehabilitation project is carried out for the boilers, but we expect that workers' consciousness concerning the necessity of maintenance will become higher through this project, and that

such trouble as that in turbine No. 5 in 1990 will not occur in the future.

4) Surplus electric energy

If the rehabilitation project is not carried out, even when operation of boiler No. 8 and turbine No. 6 is started, the shortage of required electric energy will not be overcome. Then, the electric energy of 8,430 MWh is still lacked.

If the average load of 71.5 MW to the turbine and generator can be maintained, surplus electric energy as shown in Table 6-2-9 will be generated in 1994 when the rehabilitation project is carried out.

5) Forced outage ratio of boilers and their availability factors

The estimated forced outage time assuming that the rehabilitation project is not carried out is 1.140 hours annually, which was the annual average value from the start of each boiler's operation until the end of Decmeber 1990 (Table 6-2-6). As the forced outage ratio substantially varies from year to year, we employed the average value from the start of each boiler's operation. The boiler operation hour is based on the same thinking way. When calculated by this value, the availability factor of each boiler is 54% (Table 6-2-3).

The availability factor calculated from the operational records from January to June 1991 is 52.1%, and we consider that our estimation may be rational or a little higher than the practical value. We employed this value, because it can be anticipated that, if parts required for maintenace of the boilers is not imported from the ex-Soviet Union smoothly, the availability factor will become lower year by year in the future.

6) Improvement of boiler's availability factor after completion of the rehabilitation project

Statistics concerning the hour of forced outages from the start of each boiler's operation is collected to obtain the annual average value.

Table 6-2-1 The Annual Changes of the Availability Factors and Capacity Factors of Boilers and Turbine Generators of the 4th Thermal Power Station

Year	Boilers			Turbine/Generators		
	Operating time (h/year)	Annual average of boiler evaporation (t/h)	Availability factor/ Capacity factor (%)	Operating hour (h/year)	Electric energy output transmission electric energy (10^3MWh)	Availability factor/ utilization factor (%)
1988	28,300	316 - 360	53.8 / 32-54	25,807	2,000.8 / 1,717.2	73.7 / 60.1
1989	28,318	320 - 363	53.9 / 32-59	27,356	2,074.8 / 1,774.1	78.1 / 62.3
1990	27,908	323 - 351	46.1 / 34-50	26,303	2,018.9 / 1,703.3	61.7 / 51.3
Remarks	The possible operating hour of the No. 7 boiler was considered to be 8,000 hours in 1990, since the boilder started operation on February 7, 1990.			The possible operating time of the No. 5 turbine generator was considered to be 7,600 hours in 1990, since the generator started operation on February 17, 1990.		

Table 6-2-2 The 4th Thermal Power Station: Turbine Generator Operation Records in 1990

Unit	Operation hour (hour/year)	Electric energy generated (MWh)	Electric energy (MWh) transmitted	Availability factor (%)	Average load (MWh)
N1	6,400	348,528	-	73.1	54.5
N2	7,281	602,400	-	83.1	82.7
N3	5,179	387,728	-	59.1	74.9
N4	7,443	596,343	-	85.0	80.1
N5	1,993	83,922	-	26.2	42.1
Total	28,247	2,018,921	1,703,266	66.2	71.5

Table 6-2-3 The 4th Thermal Power Station:
Boiler Operation Records in 1990

Unit	Operation hour (hour/year)	Quantity of generated steam (ton)	Availability factor (%)	Average load (t/h)
N1	671	226,127	7.7	337
N2	4,971	1,680,198	56.7	338
N3	4,590	1,611,090	52.4	351
N4	4,956	1,600,788	56.6	323
N5	3,806	1,233,144	43.4	324
N6	4,140	1,453,140	47.3	351
N7	4,774	1,675,674	54.5	351
Total	27,908	9,480,161	46.1	340

Table 6-2-4 The 4th Thermal Power Station:
Boiler Operation Records and Estimated Hour of Boiler Operation in 1994
(In case that the rehabilitation will not be carried out)

Unit	Boiler operation hours (10^2 hours) from the start of operation until the end of 1990	Number of years from the start of operation until the end of 1990
N1	315.5	7.3
N2	335.4	6.9
N3	322.2	6.1
N4	248.9	5.0
N5	166.7	4.0
N6	151.3	3.2
N7	47.3	0.9
Total	1,588.6	33.4

Average availability factor from the start until the end of 1990

$$1{,}588.6 \times 10^2 / 33.4 \times 8{,}760 = 0.543$$

So, assuming that the average availability factor in 1994 will be 54% (The data in Table 6-2 indicates that the annual value will not become lower)

$$0.54 \times 8{,}760 = 4{,}730 \text{ hours}$$

Table 6-2-5 The 4th Thermal Power Station:
Boiler Forced Outage Records
(Shut dowm hours due to accidents from the start of each boiler's operation until the end of 1990)

Troubled Section	N1	N2	N3	N4	N5	N6	N7	Total
Pressure parts of boiler	845	1,191	3,186	1,075	1,412	3,362	130	11,201
Furnace explosion	-	-	-	114	-	-	-	114
Coal handling system	22	90	69	44	11	20	-	256
Pulverized coal feed system	7,856	5,023	916	3,568	3,632	979	1,394	22,378
Combustion	7	11	15	3	15	1,408	4	1,463
FDF IDF Other fan	11	266	88	96	3	9	42	514
Ash treatment system	277	-	127	967	94	195	-	1,660
Boiler controls	15	33	23	37	4	10	28	150
Piping and valves related to boilers	7	1	41	13	-	21	3	86
Total	9,040	5,614	4,465	5,917	5,171	6,004	1,601	37,822

Table 6-2-6 The 4th Thermal Power Station:
Boiler Accident Records Estimated Hours of Forced Outage in 1994
(In case that the rehabilitation will not be carried out)

	Item	Unit	Value	Article
1	Boiler shut down hour due to accidents in the boilers from the start of each boiler's operation until the end of 1990	hr	37,822	See Table 6-2-4.
2	Boiler operation hour from the start of operation until the end of 1990	hr	33.4 x 8,760	See Table 6-2-3.
3	Forced outage ratio of boilers from the start of operation until the end of 1990	%	12.9	(1)/(2) x 100
4	Estimated forced outage ratio of boilers in 1994 (No annual decrease assumed)	%	13	
5	Estimated shut down hour due to boiler accidents in 1994	hr	1,140	0.13 x 8,760

(Note) The annual average shut down hours of each boiler from the start of operation until the end of 1990 is: 37,882/33.4 = 1,132 hours

Table 6-2-7 The 4th Thermal Power Station:
Actual Availability Factors Records of Boilers and Turbines from January to June in 1991

(Unit: hrs)

		Available operation hour		Forced outage hours		Shut down hours for inspection	Availability factor (%)
		Operation hour	Waiting hour	Shut down	Automatic stop		
Boilers	N1	2,007	38	2,107	18	192	46.2
	N2	1,448	97	1,167	-	1,632	33.3
	N3	1,653	5	1,822	1	864	38.1
	N4	2,514	16	1,334	44	480	57.9
	N5	3,497 (3,197)	39	708	1	-	80.5
	N6	2,139	24	2,181	4	-	49.2
	N7	2,587	135	598	3	1,024	59.6
	Total	15,845					52.1
Turbines and generators	N1	3,832	-	252	-	180	88.2
	N2	3,359	31	522	-	432	77.3
	N3	4,161	40	-	9	111	95.8
	N4	1,282	96	1,526	-	1,440	29.5
	N5	3,004	180	1,107	19	-	69.2
	Total	15,638					72.0

(Note) When calculated from the data shown in the above table, the total available hour is 181 days x 24 = 4,344 hours. However, the value provided by the Mongolian side is from 4,245 to 4,362 hours for boilers and from 4,264 to 4,344 hours for turbine·generator. The total hour for boiler No. 5 is fairly small; 3,945 hours, so we added 200 hours to the operating hour referring to the records on boiler operation.

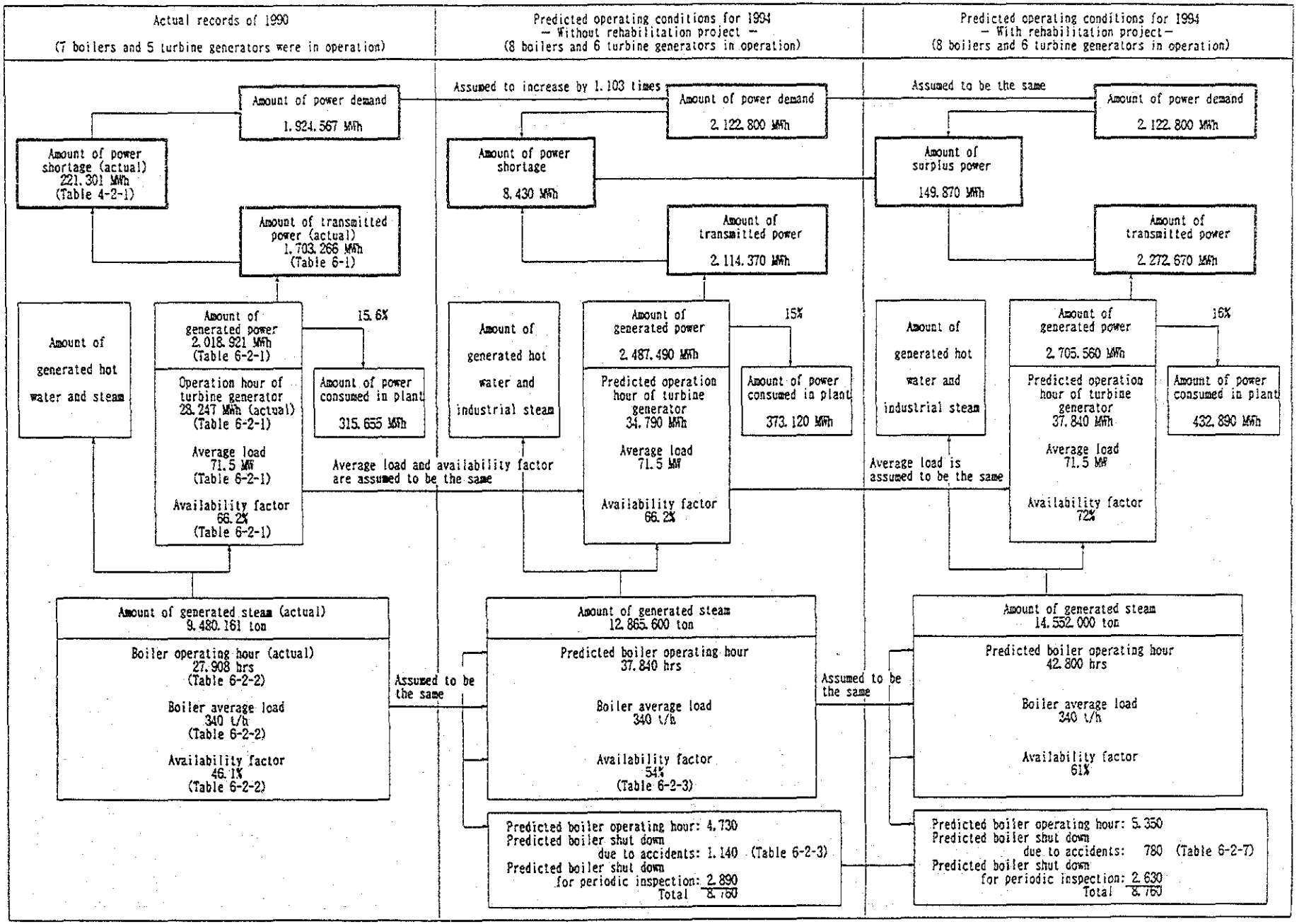
Even if the total operating hour varies a little, any big difference cannot be expected. So we obtained the availability factor by dividing the operating hour by 4,344.

Table 6-2-8 The 4th Thermal Power Station: Estimated Shut Down Hours of Boilers in 1994 (Assuming that the rehabilitation project will be carried out)

Item	Records concerning Forced Outages due to Boiler Accident	
	From the start of each boiler's operation until the end of 1990	Percentage
Pressure parts of boiler	11,201	28.7
Furnace Explosion	114	0.3
Coal handling system	265	0.7
Pulverized coal feed system (including the primary fan)	22,378	57.3
Combustion	1,463	3.7
FDF, IDF, Other fan	514	1.3
Ash treatment system	1,660	4.3
Boiler controls	150	3.7
Piping and valves related to boilers	86	
Others	1,232	
Total	39,054	100

Estimated Shut Down Hours Due to Boiler Accident after Completion of the Rehabilitation project (in 1994)

Item	Percentage	Reduction Ratio (%)	Reduction (%)	Required measures
Pulverized coal feed system				
Primary fan	13.8	90	12.4	Measures
Explosion	16.3	70	11.4	against wear
Wear	4.2	100	4.2	
Sub-total			28.0	
Mill	62.5	15	9.4	Replacement
Others	3.2	0	0	of mill oil
Total	100.0	-	37.4	pumps
Pulverized coal feed system	57.3	37.4	21.4	Measures against wear
Pulverized coal feed system	57.3	10	5.7	Supplementary
Pressure parts of boiler	28.7	10	2.9	measure for
Furnace explosion	0.3	10	-	maintenance
Ash treatment system	4.3	40	1.7	Measures for
Others	9.4	0	-	ash treatment
Total	100.0		31.7	
1,140h x (1 - 0.317) ≒ 780h				


Actual records of 1990
(7 boilers and 5 turbine generators were in operation)
Predicted operating conditions for 1994
— Without rehabilitation project —
(8 boilers and 6 turbine generators in operation)
Predicted operating conditions for 1994
— With rehabilitation project —
(8 boilers and 6 turbine generators in operation)
Amount of power demand
1,924,567 MWh
Assumed to increase by 1.103 times
Amount of power demand
2,122,800 MWh
Assumed to be the same
Amount of power demand
2,122,800 MWh
Amount of power shortage (actual)
221,301 MWh
(Table 4-2-1)
Amount of power shortage
8,430 MWh
Amount of surplus power
149,870 MWh
Amount of transmitted power (actual)
1,703,266 MWh
(Table 6-1)
Amount of transmitted power
2,114,370 MWh
Amount of transmitted power
2,272,670 MWh
Amount of generated hot water and steam
Amount of generated power
2,018,921 MWh
(Table 6-2-1)
15.6%
Amount of power consumed in plant
315,655 MWh
Operation hour of turbine generator
28,247 MWh (actual)
(Table 6-2-1)
Average load
71.5 MW
(Table 6-2-1)
Availability factor
66.2%
(Table 6-2-1)
Amount of generated hot water and industrial steam
Amount of generated power
2,487,490 MWh
15%
Amount of power consumed in plant
373,120 MWh
Predicted operation hour of turbine generator
34,790 MWh
Average load
71.5 MW
Availability factor
66.2%
Average load and availability factor are assumed to be the same
Amount of generated hot water and industrial steam
Amount of generated power
2,705,560 MWh
16%
Amount of power consumed in plant
432,890 MWh
Predicted operation hour of turbine generator
37,840 MWh
Average load
71.5 MW
Availability factor
72%
Average load is assumed to be the same
Amount of generated steam (actual)
9,480,161 ton
Boiler operating hour (actual)
27,908 hrs
(Table 6-2-2)
Boiler average load
340 t/h
(Table 6-2-2)
Availability factor
46.1%
(Table 6-2-2)
Assumed to be the same
Amount of generated steam
12,865,600 ton
Predicted boiler operating hour
37,840 hrs
Boiler average load
340 t/h
Availability factor
54%
(Table 6-2-3)
Assumed to be the same
Amount of generated steam
14,552,000 ton
Predicted boiler operating hour
42,800 hrs
Boiler average load
340 t/h
Availability factor
61%
Predicted boiler operating hour: 4,730
Predicted boiler shut down due to accidents: 1,140 (Table 6-2-3)
Predicted boiler shut down for periodic inspection: 2,890
Total 8,760
Predicted boiler operating hour: 5,350
Predicted boiler shut down due to accidents: 780 (Table 6-2-7)
Predicted boiler shut down for periodic inspection: 2,630
Total 8,760

Summary of boiler trouble is shown in Fig. 4-2-15.

Estimation of the boiler shut down hour due to accidents in 1994 based on estimation of reduction of accidents after completion of the rehabilitation project is as shown below (See Table 6-2-8).

(a) Pulverized coal feed system:
21.4% (mainly through enhancement of wear resistance and addition of supplementary maintenance)

(b) Pulverized coal feed system and boiler pressure parts:
8.6% (mainly through addition of supplementary maintenance)

(c) Ash treatment system:
1.7% (through completion of measures for ash treatment system)

Total: 31.7%

Namely, the estimated boiler shut down hour due to accidents is 780 hr:1,140 x (1 - 0.317).

It is difficult to estimate shut down hour of each boiler for scheduled inspection and maintenance after completion of the rehabilitation project. Trouble will certainly decrease after completion of the rehabilitation project, so that needs for scheduled maintenance will also decrease, but if the items described in the Chapter 5 "Management Plan" centering on preventive maintenance are carried out, it would take more time than in the past, but in this Report we assume that the reduction rate would be 9%,

Namely, Estimated boiler shut down hour due to accidents:
780 hours
Estimated shut down hour for scheduled inspection and maintenance of boilers:
2,630 hours (2,890 x 0.91)

So, the estimated operating hour of each boiler will be 8,760 - (780 + 2,630) = 5,350 hours.

Summary of the above estimation are shown in Table 6-2-9.

It is expected that the execution of the project will improve the availability factor of the boiler from 54% to 61%. According to calculations the resultant power transmission output will fully cover any power shortages that were to occur if the project were not executed and will yield surplus energy of approximately 150,000 MWh.

6.3 Expected Population Receiving the Benefits

Number of people benefitting from this rehabilitation project is as shown in the table below. The data in 1994 is calculated from the real number of people in 1990.

(Unit: 10^4 people)

Benefitting population	Ulaanbaatar City		Erdenet City		Darhan City		Other areas		Total	
	1990	1994	1990	1994	1990	1994	1990	1994	1990	1994
Measures against pluggage in ash treatment system (Improvement of availability and charge factor of electrostatic precipitator)	57.0	62.9	-	-	-	-	-	-	57.0	62.9
Measures against wear in pulverized coal feed system (Improvement of each boiler's availability factor)			5.8	6.4	9.1	10.0	2.0	2.2	73.9	81.5

The total population of Mongolia at the beginning of 1990 is estimated to be in the range from 2.09 to 2.19 millions though no accurate population statistics are available. According to the "Outline of development plans" published by the Ministry of National Development at the end of 1991, the population will increase to 2.4 millions by 1995 with an annual population growth rate of 2.5%.

Assuming the total population of Mongolia in 1994 after the completion of the project will be 2.35 millions from the above figures, the bene-

ficiary population of the measures against pluggage of ash treatment system will equal to the population of Ulaanbaatar City, which is equivalent to 27% of the total population of Mongolia while the same of the measures against wear of pulverized coal firing system will equal to the population in areas covered by the power network of the central energy system, or 35%.

6.4 Conclusion

The materials and machinery supplied in relation to this rehabilitation project are largely divided into two groups; one for measures against pluggage in the ash treatment systems and the other for measures against wear of the pulverized coal feed system. In addition to them, materials and machinery for maintenance which are required to make the above two measures more effective and those which are hardly procured in the country will be supplementarily supplied.

As for the ash treatment system, now it can be considered that 134.7 x 10^3 tons (estimated value for 1990) of fly ash was released from the outlet of the ESP through the stack to the atmosphere. Depending on this current situation, and assuming that the availability and charge factor of ESP is the same as in 1990, if one more new boiler starts its operation, in 1994, 182.7 x 10^3 tons of fly ash will be released to the atmosphere. However, if the rehabilitation project is carried out, the quantity of fly ash will decrease to 39.7 x 10^3 tons, namely 22% of the current level.

For the boilers, it can be expected that, by carrying out the measures against wear, boiler shut down hour due to accidents of the pulverized coal feed system will decrease by 21.4%, or totally by 31.7% when all other measures are taken into account, while it is expected that the availability factor will increase from 54% to 61%.

That will bring about a surplus in the amount of transmitted power amounting to about 150,000 MWh. The above mentioned effects would continue for another three years (until around 1997) if the ex-Soviet Union made maintenance parts arranged for at present could be obtained somehow and the management plan including the recommendation detailed

in Chapter 5, 5.5 (2), were properly put into practice by the Mongolian side. The effects in subsequent years would largely depend on the supply of maintenance parts from ex-Soviet Union and the load on boilers. The followings are the beneficiary population predicted from implementation of the project:

Measures against pluggage in ash treatment system
..... Approx. 63 x 10^4 (1994)

Measures against wear of boilers ..... Approx. 82 x 10^4 (1994)

It can be concluded from the foregoings that the Japanese grant aid for the rehabilitation project is significant and reasonable.

6.5 Recommendations

The following matters should be taken into account to achieve the full effects of this rehabilitation project.

(1) Completion and putting to practice of the operation and maintenance management plan

It is desired to complete and to put into practice an operation and maintenance management plan suited to the 4th thermal power station according to descriptions in Chapter 5, Section 5.5 (2).

(2) Technical cooperation

In order to carry out appropriate administration of the power stations, in addition to appropriate operation of the system, cultivation and training of personnel for maintenance would be required. In addition to Mongolian people's to participation in the training in Japan, it would be necessary to dispatch experts of Japan for that purpose to Mongolia for step-by-step improvement in the preventive maintenance work at the project site.

(3) Systems for the operation

It would be important to work out and implement an adequate task plan which will secure operating funds and procure consumable and other parts necessary for sound and continuous operation of the power plant through Mongolia's effort to help itself.

APPENDIX

LIST OF STUDY TEAM MEMBERS

Basic design study team (October 1991)

Name	Designation	Organization
Shoji SHIMBO	Leader	Managing Director, Grant Aid Study and Design Department, Japan International Cooperation Agency (JICA)
Masashi FURUYA	Grant aid planner	Grant Aid Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs
Mitsuaki ASAKA	Power generation planner	Assistant Chief in Thermal Power Construction & Operation Section, Electricity Power Generation Div., Public Utilities Department, Agency of Natural Resources and Energy, Ministry of International Trade and Industry
Hidetoshi ISHIOKA	Project coodinator	First Basic Design Study Division Grant Aid Study and Design Department, Japan International Cooperation Agency
Tsuyoshi SHIROMIZU	Interpreter	International Cooperation Service Center
Noboru KIOKA	Power plant maintenance and repair engineer	EPDC International, Ltd.
Yutaka SUGINO	Pulverized coal firing system repair engineer (A)	Electric Power Development Co., Ltd.
Kiminori YAMAZAKI	Pulverized coal firing system repair engineer (B)	EPDC International, Ltd.

Name	Designation	Organization
Yoshio UENO	Electrostatic precipitator and ash treatment system repair engineer	EPDC International, Ltd.
Takeshi KAMADA	Power plant operation engineer	EPDC International, Ltd.
Ryo OOTUKA	Interpreter	International Cooperation Service Center

Basic Design Study Team (February 1992)

Name	Designation	Organization
Takuo KIDOKORO	Leader	Director, First Project Management Division, Grant Aid Project Management Department, Japan International Cooperation Agency (JICA)
Morio NAKAMURA	Grant aid planner	Aid Policy Division, Bureau of Economic Cooperation, Ministry of Foreign Affairs
Hidetoshi ISHIOKA	Project coordinator	First Basic Design Study Division, Grant Aid Study and Design Department, Japan International Cooperation Agency (JICA)
Tsuyoshi SHIROMIZU	Interpreter	International Cooperation Service Center
Noboru KIOKA	Power plant maintenance and repair engineer	EPDC International, Ltd.
Yutaka SUGINO	Pulverized coal firing system repair engineer	Electric Power Development Co., Ltd.
Ryo OOTUKA	Interpreter	International Cooperation Service Center

Itinerary of Study Team

No.	Date	Day of week	Description
1	10/10	Thu.	Leave Tokyo, 10:00 (JAL-781) Arrived at Peking, 13:15
2	10/11	Fri.	Leave Peking, 10:05 (CA-919) Arrive at Ulaanbaatar, 13:00 Courtesy call to Japanese Embassy to explain about schedule, etc. (in attendance of the Ministry of Fuel and Energy and the Ministry of Trade and Industry representatives)
3	10/12	Sat.	Data collection and internal meeting
4	10/13	Sun.	Internal meeting
5	10/14	Mon.	Courtesy call to Trade Ministry (morning, with attendance of Energy Ministry representative) Courtesy call to the Ministry of Fuel and Energy (afternoon, with attendance of the Ministry of Trade and Industry representative)
6	10/15	Tue.	Explanation on inception report (at the Ministry of Fuel and Energy under the presence of the Ministry of Trade and Industry representative)
7	10/16	Wed.	Reply to questionnair from the Ministry of Fuel and Energy, and discussion on contents and others (at the Ministry of Fuel and Energy under the presence of the Ministry of Trade and Industry representative). Receives report on recent operating conditions of the 4th thermal power station.
8	10/17	Thu.	Visit to the 4th thermal power station and investigates conditions of equipment and operation (boiler, pulverized coal firing system, ash disposal pond, ash settling pond, pump room)

No.	Date	Day of week	Description
9	10/18	Fri.	Explanation and consultation on contents of the minutes (morning: the Ministry of Fuel and Energy, afternoon: the Ministry of Trade and Industry). Receives replies to questionnaire
10	10/19	Sat.	Rearrangement of collected data
11	10/20	Sun.	Internal meeting
12	10/21	Mon.	Signing on minutes (Ministry of Trade and Industry, Ministry of Fuel and Energy, JICA) Reporting to Japanese Embassy
13	10/22	Tue.	Official team members return home (Leave from Ulaanbaatar: 13:00, Arrive at Peking 15:50, CA-920) Consultant members visit related facilities of the 4th Thermal Power Station (coal handling equipment, environmental monitoring station, central power dispatching office)
14	10/23	Wed.	Discussion with the Ministry of Fuel and Energy
15	10/24	Thu.	Investigation of the 4th Thermal Power Station (detailed investigation by each person in charge)
16	10/25	Fri.	Investigation of the 4th Thermal Power Station (detailed investigation by each person in charge)
17	10/26	Sat.	Data arrangement
18	10/27	Sun.	Internal meeting
19	10/28	Mon.	Investigation of the 4th Thermal Power Station (detailed investigation by each person in charge)
20	10/29	Tue.	Investigation of the 4th Thermal Power Station (detailed investigation by each person in charge)

No.	Date	Day of week	Description
21	10/30	Wed.	Internal discussion
22	10/31	Thu.	Investigation of the 4th Thermal Power Station (detailed investigation by each person in charge)
23	11/01	Fri.	Investigation of the 4th Thermal Power Station (detailed investigation by each person in charge)
24	11/02	Sat.	Internal discussion and data arrangement
25	11/03	Sun.	Internal meeting
26	11/04	Mon.	Investigation of the 4th Thermal Power Station (detailed investigation by each person in charge)
27	11/05	Tue.	Discussion with persons concerned of the 4th Thermal Power Station
28	11/06	Wed.	Discussion with officials concerned of the Ministry of Fuel and Energy and the Ministry of Trade and Industry
29	11/07	Thu.	Reporting to Japanese Embassy
30	11/08	Fri.	Consultant members return home. Leave from Ulaanbaatar: 13:00 (CA-920) Arrive at Peking: 15:50
31	11/09	Sat.	Leave from Peking: 15:05 (NH-906) Arrive at Tokyo: 20:05

February 27, 1992

Itinerary of Study Team

No.	Date	Day of week	Itinerary	Description
1	02/20	Thu.	Leave Tokyo, 10:25 (NH-905) Arrive at Peking, 13:50	Travel Discussion with China office
2	02/21	Fri.	Leave Peking, 9:55 (CA-919) Arrive at Ulaanbaatar, 13:00	Courtesy call and discussion with Japanese Embassy. Courtesy call to the Ministry of Fuel and Energy, discussion on itinerary and reporting synopsis
3	02/22	Sat.	Ulaanbaatar	Courtesy call to the Ministry of Trade and Industry, and reporting synopsis Visit to the 4th Thermal Power Station, and detailed reporting
4	02/23	Sun.	Ulaanbaatar	Collection of data
5	02/24	Mon.	Ulaanbaatar	Consultation and discussion on project contents at the 4th Thermal Power Station, and confirmation of site
6	02/25	Tue.	Ulaanbaatar	Consultation and discussion on project contents at the 4th Thermal Power Station, and confirmation of site
7	02/26	Wed.	Ulaanbaatar	Consultation and discussion on project contents at the 4th Thermal Power Station

No.	Date	Day of week	Itinerary	Description
8	02/27	Thu.	Ulaanbaatar	Discussion with Ministry of Fuel and Energy. Signing of minutes (MITI, Ministry of Fuel and Energy and JICA) Party sponsored by team leader
9	02/28	Fri.	Leave Ulàanbaatar, 13:00 (CA-920) Arrive at Peking, 14:50	Reporting to Japanese Embassy Travel Reporting to China office
10	02/29	Sat.	Leave Peking, 13:50 (JL-788) Arrive at Osaka, 18:00 Leave Osaka, 20:00 (NH-040) Arrive at Haneda 21:00	Returning home Travel

List of the Representatives of the Government Agency of Mongolia with whom the teams interviewed in both visits

Organization	Name	Title
Japanese Embassy	Shoji SUEZAWA	Ambassador extraordinary and plenipotentiary
	Fumio TOMINAGA	Councilor
	Takenori SHIMIZU	1st Secretary (Returned)
	Minoru KIKUCHI	2nd Secretary (Returned)
	Shinichiro HAYASHI	2nd Secretary
Ministry of Trade and Industry	Doyod	First Deputy Minister
	Tsogt	Manager, Foreign Trade Department
	Yondon	Deputy Manager, Foreign Trade Deparatment
	Nasanboyan	Secretary in charge of Japan, Ditto
	Lkhagbasuren	Secretary in charge of Energy, Ditto
Ministry of Fuel and Energy	Gurjav	Senior Deputy Minister
	Misha	Deputy Minister
	Jigjiddorj	Chief Engineer, Energy Policy Council
	Bathishig	General Director of the Central Energy System
	Sukhbaatar	Head of Department for Technical Innovation and Cooperation
	Sainjargal	Senior Expert Engineer for patent
	Avarzed	Engineer, Energy Policy Council
	Batbayar	Engineer, Technical Inovation and Cooperation Department
The 4th Thermal Power Station	Shatar	Station Superintendent
	Battsend	Chief Engineer (ranked as Deputy Station Superintendent)
	Sodnom	Director, Production Technology
	Bor	Director, Maintenance
	Baasanjav	Director, Safety Control
	Jondongombo	Manager, Boiler Department
	Tseeleesuren	Deputy Manager, Boiler Department
	Lekgtseg	Section Manager, Ash Treatment System, Boiler D.
	Sukhbaatar	Engineer, Primary Fan, Boiler D.
	Batbold	Engineer, Computer, Electric D.
	Baatarbold	Engineer, Pulverized Coal Feed System, Boiler D.
	Samdansharab	Section Manager, Pulverized Coal Feed System, Boiler D.
	Dashipil	Engineer, Illumination, Electric D.
	Jantsanbal	Engineer, Valves, Boiler D.

Organization	Name	Title
The 4th Thermal Power Station	Tsegmid	Deputy Manager, Coal Handling D.
	Sanjmyatav	Engineer, ESP, Boiler D.
	Erdenebat	Engineer, Mill, Boiler D.
	Davaajantsan	Engineer, Ash Treatment System, Boiler D.
	Bayardalai	Engineer, Turbine D.
	Buryaat	Engineer, Boiler Operation, Boiler D.
	Tserenbuted	Engineer, Statistics-Calculation

MINUTES OF DISCUSSION

BASIC DESIGN STUDY ON

THE REHABILITATION PROJECT FOR

IMPROVEMENT OF 4TH THERMAL POWER STATION IN ULAANBAATAR

IN THE MONGOLIAN PEOPLE'S REPUBLIC

In response to the request of the Government of The Mongolian People's Republic, the Government of Japan decided to conduct a Basic Design Study on the Rehabilitation Project for Improvement of 4th Thermal Power Station in Ulaanbaatar (hereinafter referred to as "the Project") and entrusted study to the Japan International Coorperation Agency (JICA).

JICA sent to Mongolia a study team, which is headed by Mr. Shoji Shimbo, Managing Director, Grant Aid Study & Design Dept., JICA and is scheduled to stay in the country from October 12 to October 21, 1991.

The team held discussions with officials concerned of Mongolia and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare a Basic Design Study Report.

Ulaanbaatar , October 21, 1991

Mr. Shoji Shimbo	Mr. Gongoriin Doyod	Mr. Delgeriin Misha
Leader	First Deputy Minister	Deputy Minister
Basic Design Study Team	Ministry of Trade and Industry	Ministry of Fuel and Energy

ATTACHED SHEETS

1. Objective

The objective of the Project is to rehabilitate the 4th Thermal power Station in Ulaanbaatar and thus contributing to the improvement of the inhabitant standard of living of Ulaanbaatar.

2. Project Site

The Project site is located in Ulaanbaatar which appear in Annex I .

3. Responsible Organization, Executive Organization

(1) Responsible organization:

Ministry of Trade and Industry

(2) Executive organization:

Ministry of Fuel and Energy

4. Items Requested by the Government of Mongolia

After Discussions with the Basic Design Study Team, the following items were finally requested by the Mongolian side.

(1) Ash transporting pipes and sluice valves

(2) Feed water pipes and valves for ash treatment

(3) Ash level meter

(4) Vacuum cars for dust removal

(5) Instrument for dust measurement

(6) Ceramics tile

(7) Carbon steel plate lined with wear-resistant material

(8) Primary fan blade welding rod

(9) Wear-resistant steel plate

(10) Magnetic separator for coal conveyor

(11) SO2/NOx meter

(12) Dust-proof/Explosion-proof lighting equipment (for 230 V)

However, the final components of the Project will be decided after

5. Japan's Grant Aid System

(1) The Government of Mongolia has understood the system of Japanese Grant Aid explained by the team.

(2) The Goverment of Mongolia will take necessary measures, described in Annex II for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

(1) The consultants will proceed to further studies in Mongolia until November 7, 1991.

(2) JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around February, 1992.

(3) In case that the contents of the report is accepted in principle by the Mongolian side, JICA will complete the final report and send it to the Government of Mongolia in April 1992.

55

ANNEX II

Necessary measures to be taken by the Government of Mongolia in case Japan's Grant Aid is executed.

1. To undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting in and around the site.

2. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

3. To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the project at the port of desembarkation.

4. To accord Japanese National whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into Mongolia and stay therein for the performance of their work.

5. To maintain and use properly and effectively that the facilities rehabilitated and equipment purchased under the Grant.

6. To bear all the expenses other than those to be borne by the Grant, necessary for rehabilitation of the facilities as well as for the transportation and the installation of the equipment.

MINUTES OF DISCUSSION

BASIC DESIGN STUDY ON

THE REHABILITATION PROJECT FOR

IMPROVEMENT OF 4TH THERMAL POWER STATION IN ULAANBAATAR

IN

THE MONGOLIA

(CONSULTATION ON DRAFT REPORT)

In October 1991 the Japan International Coorperation Agency (JICA) dispatched a basic design study team on the Rehabilitation Project for Improvement of 4th Thermal Power Station in Ulaanbaatar (hereinafter referred to as "the Project") to The Mongolia and through discussions field survey and technical examination on the results in Japan,JICA has prepared a draft report of the study.

In order to explain and consult with Mongolia side on the contents of the report, JICA sent a team to Mongolia which was headed by Mr.Takuo Kidokoro, Director, First Project Management Division, Grant Aid Project Management Department, JICA and scheduled to stay in the country from February 21 to February 28, 1992.

As a result of discussions, both parties confirmed the main items as described on the attached sheets.

Ulaanbaatar, February 27, 1992

Mr. Takuo Kidokoro	Mr. Gongoriin Doyod	Mr. Delgeriin Misha
Leader	First Deputy Minister	Deputy Minister
Draft Report Explanation	Ministry of Trade	Ministry of Fuel
Team JICA	and Industry	and Energy

ATTACHED SHEETS

1. Components of Draft Report

The Government of Mongolia has agreed and accepted in principle the components of the Draft Report proposed by the team.

2. Japan's Grant Aid system

(1) The Government of Mongolia has understood the system of Japan's Grant Aid explained by the team.

(2) The Government of Mongolia will take the necessary measures, described in Annex I , for smooth implementation of the Project, on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

3. Further schedule

The team will make the Final Report in accordance with the confirmed items and send it to the Government of Mongolia in April 1992.

4. Technical Cooperation

The Government of Mongolia requested Japanese side to extend following technical cooperation when Japan's Grant Aid is approved. The team promised to convey the desire to the Government of Japan and JICA suggested Mongolian side to request it officially to the Government of Japan through the embassy of Japan in Mongolia.

(1) Training of Mongolia Personnel in Japan

6 engineers

(2) Dispatch of Japanese Experts in field of

2 electric power specialists (short term)

5. Procurement of Equipments and Spare parts for the Slurry Pumps

The Mongolian side must place the top priority on procurement of the necessary equipments and spare parts which are related to the slurry pumps and must procure them at its own responsibility, as soon as the Government of Mongolia allocates the coming foreign exchanges for their procurement.

T. K T. S Ser.

Necessary measures to be taken by the Government of Mongolia in case Japan's Grant Aid is executed.

1. To undertake incidental outdoor works such as gardening, fencing, gates and exterior lighting in around the site.

2. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

3. To exempt taxes and to take necessary measures for customs clearance of the materials and machinery brought for the Project at the place of disembarkation.

4. To accord Japanese National whose services may be required in connection with the supply of products and the services under the verified contract such facilities as may be necessary for their entry into the Mongolia and stay therein for the performance of their work.

5. To maintain and use properly and effectively that the facilities rehabilitated and machinery purchased under the Grant.

6. To bear all the expenses other than those to be borne by the Grant necessary for rehabilitation of the facilities as well as for the transportation and the installation of the equipment.

7. To execute rehabilitation works speedily as possible with advice of Japanese consultant.

T.K

Form 1

Prepared on _____ 199__

Manager. Supervisory Department	Manager. Document Control Section	Manager. Supervisory Section	Manager. Information Control Section	Manage. Technical Information Section

Data List (Collected Data)

Data on relevant country

Region	Ulaanbaatar	Name of study team or expert	Rehabilitation project of the 4th thermal power station	Type of investigation or subject of instruction		Preparing department or section	
Name of Country	Mongolia	Name of Organization	EPDC 1	Duration of field investigation or duration of dispatch	Year Month Date ~ Year Month Date	Name of person in charge	

No.	Title of data	Form	Size	No. of pages	Original or copy	No. of copies	Name of source or issuing agency	Contribution or purchase (price)	Handling classification	Indication of use	Organization and name of using person	Scheduled turn in date	Column for confirmation of turn-in
Y-1	Pulverized coal pipe diagram (front view)	Russian	A1	1	Copy	1	The 4th thermal power station	Contribution					
2	Ditto (side view)	〃	〃	1	〃	1	〃	〃					
3	Ditto (plan)	〃	〃	1	〃	1	〃	〃					
4	Details of mill inlet pipe (1)	〃	A2	1	〃	1	〃	〃					
5	Details of mill inlet pipe (2)	〃	〃	1	〃	1	〃	〃					
6	Details of mill inlet pipe (3)	〃	A3	1	〃	1	〃	〃					
7	Details of mill outlet pipe	〃	〃	1	〃	1	〃	〃					
8	Cross section of classifier	〃	A1	1	〃	1	〃	〃					
9	Cross section of cyclone	〃	A0	1	〃	1	〃	〃					
10	Pulverized coal pipe piping diagram inside and around furnace	〃	A1	1	〃	1	〃	〃					
11	Pulverized coal firing system diagram	〃	A4	1	〃	1	〃	〃					
12	Furnace gas temperature plan	〃	〃	1	〃	1	〃	〃					
13	Boiler installation level	〃	〃	1	〃	1	〃	〃					
14	Boiler water system	〃	〃	1	〃	1	〃	〃					

Form 1

Prepared on _____ 199__

Data List (Collected Data)

Manager, Supervisory Department	Manager, Document Control Section	Manager, Supervisory Section	Manager, Information Control Section	Manager, Technical Information Section

Region	Ulaanbaatar	Name of study team or expert	Rehabilitation project of the 4th thermal power station	Type of investigation or subject of instruction	..... investigation	Preparing department or section	——
Name of Country	Mongolia	Name of Organization	EPDC I	Duration of field investigation or duration of dispatch	October 10 – November 9, 1991	Name of person in charge	Noboru KIOKA

No.	Title of data	Form	Size	No. of pages	Original or copy	No. of copies	Name of source or issuing agency	Contribution or purchase (price)	Handling classification	Indication of use	Organization and name of using person	Scheduled turn in date	Column for confirmation of turn-in
G – 1	Organization of the Ministry of Fuel and Energy	Mongolian	A 4	2	Copy	1	Ministry of Fuel and Energy						
2	Change in feedwater consumption for power generation	English	A 4	1	Copy	1	No.4 P.S						
3	Monthly change of water pipe (1991)	Mongolian	A 4	1	Copy	1	No.4 P.S						
4	Feedwater and water	English	A 4	1	Copy	1	No.4 P.S						
5	Amount of power shortage	English	A 4	1	Copy	1	No.4 P.S						
6	Amount of hot water and steam	English	A 4	1	Copy	1	No.4 P.S						
7	Specification of major equipment	English	A 4	1	Copy	1	No.4 P.S						
8	EP ash treatment trouble list of causes	Mongolian	A 4	4	Original	1	No.4 P.S	Contribution	—	—			
9	Outline of national development plans	Mongolian	A 4	2	Copy	1	Ministry of Fuel and Energy						
10	〃	English	A 4	1	Copy	1	Ministry of Fuel and Energy						
11	Expert of energy department from the national development plan	Mongolian	A 4	15	Copy	1	Ministry of Fuel and Energy						
12	Ulaanbaatar City Hot water Supplying Organization	Mongolian	A 4	1	Copy	1	Ministry of Fuel and Energy						
13	Organization of central energy system	Mongolian	A 4	1	Copy	1	Ministry of Fuel and Energy						
14	List of materials by U.S. fund in Minitry of Energy	Mongolian	A 4	11	Copy	1	Ministry of Fuel and Energy						
15	Subordinate organizations of central energy system	Mongolian	A 3	1	Copy	1	Ministry of Fuel and Energy						
16	Parts list of improvement of availability factor	Mongolian	A 4	3	Original	1	No.4 P.S						
17	Cooperation with overseas organization in energy sector	English	A 4	2	Copy	1	Ministry of Fuel and Energy						
18	Organization of the 4th thermal power station	English	A 3	1	Copy	1	No.4 P.S						
19	Organization of the Ministry of Trade and Industry	English	A 4	1	Copy	1	Ministry of Trade and Industry						
20	Protection process of major equipment	English	A 4	2	Copy	1	No.4 P.S						
21	Protection process of major equipment	Mongolian	A 4	5	Original	1	No.4 P.S						

Form 1

Prepared on _____ 199__

Data List (Collected Data)

Manager. Supervisory Department	Manager. Document Control Section	Manager. Supervisory Section	Manager. Information Control Section	Manage. Technical Information Section

Region	Ulaanbaatar	Name of study team or expert	Rehabilitation project of the 4th thermal power station	Type of investigation or subject of instruction	..... investigation	Preparing department or section	——
Name of Country	Mongolia	Name of Organization	EPDC 1	Duration of field investigation or duration of dispatch	October 10 — November 9, 1991	Name of person in charge	Noboru KIOKA

No.	Title of data	Form	Size	No. of pages	Original or copy	No. of copies	Name of source or issuing agency	Contribution or purchase (price)	Handling classification	Indication of use	Organization and name of using person	Scheduled turn in date	Column for confirmation of turn-in
G – 22	Boiler operation records	Mongolian	A 3	1	Copy	1	No.4 P.S						
23	Turbine operation records	Mongolian	〃	1	Copy	1	No.4 P.S						
24	Detailed organization of the 4th thermal power station - Boiler	English	A 4	1	Original	1	No.4 P.S						
25	Detailed organization of the 4th thermal power station - Coal processing	Mongolian	〃	1	Original	1	No.4 P.S						
26	Detailed organization of the 4th thermal power station - Electricity	Mongolian	〃	1	Original	1	No.4 P.S						
27	Data on insulation material	English	〃	2	Copy	1	No.4 P.S						
28	Records of accidents involving fan	English	〃	1	Copy	1	No.4 P.S						
29	Records of boiler accidents (by protection relay)	English	〃	1	Copy	1	No.4 P.S						
30	Records of boiler accidents (suspension)	English	〃	1	Copy	1	No.4 P.S						
31	Operation records of EP and slurry pump, 1991	English	〃	1	Copy	1	No.4 P.S						
32	Records of NO^2 and SO_2 dust in atmosphere	Mongolian	〃	3	Copy 2 Original 1	1	Environment Commission						

APPENDIX-21