CHAPTER 3 IMPLEMENTATION PLAN

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3-1 Implementation Plan

3-1-1 Implementation Concept

The Project will be implemented within the framework of Japan's grant aid scheme and, therefore, its implementation will only take place after approval of the Project by the Government of Japan and exchanging of the E/N (Exchange of Notes) between the Government of Japan and the Government of Ethiopia. The basic issues and points to note in the process of implementing the Project are described below.

(1) Project Implementation Body

The organization responsible for the implementation of the Project on the Ethiopian side is the EEPCO. As described earlier in 2-3-1-(5), the EEPCO plans to implement the Project by dividing the necessary work between the Regional Operation Department (Addis Ababa Section) and the Power System Operation Department under the supervision of the Deputy General Manager (Operation). It will, therefore, be necessary for the said Deputy General Manager (Operation) to maintain close contact and to consult with the Japanese consultant and contractor and to nominate a person to be responsible for the Project to ensure the smooth progress of the Project.

The person nominated to be responsible for the Project will be required to fully explain the contents of the Project to the staff members of those substations which are subject to rehabilitation/improvement under the Project as well as to the citizens of Addis Ababa in order to facilitate their understanding of the Project and to encourage their cooperation for the implementation of the Project.

(2) Consultant

A Japanese consultant recommended by JICA will conclude a consulting services agreement with the EEPCO and will conduct the detailed design and work supervision for the Project to materialise the planned procurement and installation of equipment and the construction works under the Project. The consultant will also prepare the tender documents and will conduct the tender on behalf of the EEPCO, the project implementation body.

(3) Contractor

In accordance with the mechanism of Japan's grant aid scheme, a Japanese contractor selected by the Ethiopian side through an open tender will execute the procurement and installation of equipment and the construction work. As it is deemed necessary for the contractor to provide after-services, including the supply of spare parts and an appropriate response to breakdowns, the contractor must pay proper attention to the establishment of an adequate communication channel after the handing over of the equipment and facilities to the Ethiopian side.

(4) Necessity of Dispatch of Engineers

In order to complete the planned substation construction work under the Project in a short period of time, careful coordination will be essential between the different types of work given their complexity, ranging from the construction of equipment foundations, exterior structures and control rooms, etc., substation equipment and facility installation work, etc. As most of the different work will be simultaneously conducted, it is essential that a site manager who is capable of controlling and guiding all the work in an integral manner be dispatched from Japan to ensure work schedule, quality and safety control.

As stated in the clause 2-3-1(3), there are few skilled workers in the private construction comapnies in Ethiopia who are conversant with the installation, testing and adjustment of substation equipment because the EEPCO has directly engaged in the installation work for a long period. Also it is recommended that the EEPCO should incorporate the latest technologies which take the place of conventional ones.

It suggests that the experts in these areas should be dispatched to the Project sites during its installation by the manufactures of substation equipment to supervise or conduct the said work.

(5) Consultant Supervision for the Work Conducted by Ethiopian Side

Among the equipment to be procured and installed under the Project, equipment and materials for the 15 kV distribution lines and some of transformers will be installed by the Ethiopian side. This installation work must be completed together with the completion of the work by the Japanese side in order to duly achieve the improvement and expansion of the distribution network, as the objectives of the Project. The consultant will dispatch an engineer to provide guidance in terms of schedule control, quality control and safety control for the said installation work and will also conduct technology transfer on preventive maintenance, project planning and management to improve the capability of the EEPCO in these areas.

3-1-2 Implementation Conditions

(1) State of Construction Industry in Ethiopia and Technology Transfer

Although major construction work involving hotels, etc., is in progress in Addis Ababa as described in 2-3-1-(3), this work is contracted to foreign construction companies with local companies working as subcontractors.

In the electric power sector, such large-scale projects as the construction of power stations have also been commissioned to foreign construction companies while such relatively small-scale work as the construction of substations and distribution lines is often directly conducted by the EEPCO. This suggests that the employment of workers and construction machinery of local companies is possible and that it will be difficult to employ engineers capable of installing the substation and distribution equipment under the Project.

Accordingly, as far as the substation construction work under the Project is concerned, local construction companies will mainly be used to provide machinery and workers and engineers will be dispatched from Japan to supervise the quality control, schedule control, safety control and testing/adjustment. Using the presence of Japanese engineers on site during the construction period, technology transfer to Ethiopian engineers will be attempted by means of OJT.

(2) Use of Local Equipment and Materials

In planning the construction work, emphasis will be placed on the maximum use of locally available equipment and materials. As it is possible to procure aggregate, cement, reinforcing bars, etc., for civil and building works in Ethiopia, these will be procured for the equipment foundation and control building construction under the Project. In comparison, in regard to substation and distribution equipment, not only such main equipment as circuit breakers and transformers but also such auxiliary equipment as structural steel, conductors, cables and insulators are not manufactured domestically, making their import from Japan and/or a third country necessary.

3-1-3 Scope of Work

There is a division of the work to be conducted by the Japanese side and the Ethiopian side. In regard to the Addis Center Substation and Akaki Substation, both of which will be completely rehabilitated under the Project, the Japanese side will be responsible for the procurement and installation of equipment and associated civil and buildingf work while the Ethiopian side will be

responsible for land preparation, removal of existing facilities, outward laying of cables from the 15 kV outgoing feeder panels and extension of the overhead lines upto the primary receiving point.

In the case of the Addis North Substation and Addis West Substation of which only the transformers will be replaced under the Project, the Ethiopian side will be responsible for the installation of the transformers while the Japanese side will procure the transformers and will dispatch an expert to supervise their installation, testing and adjustment.

In regard to the reinforcement of the 15 kV distribution lines, the Japanese side will only procure the required conductors, cables and 15 kV surge arresters while the Ethiopian side will procure the poles, insulators, distribution transformers and necessary accessories and will conduct the entire installation work. The more detailed work demarcation between the two sides is shown in Table 3-1-1.

Table 3-1-1 Work Demarcation Between Japanese and Ethiopian Sides

Work Item	Work Division		Remarks
	Japan	Ethiopia	
1. Substation Rehabilitation (Addis Center and Akaki Substations)			
(1) Procurement and installation of transformers	×		
(2) Procurement and installation of switchgears for transformers	×		
(3) Procurement and installation of switchgears for a incoming line	×		
(4) Procurement and installation of 15 kV outgoing feeder panels	×		
(5) Procurement and installation of monitoring, control and protection panels	×		including DC power unit
(6) Civil engineering work, cabling work, bus-bar (including poles and insulators, etc.) installation and fire extinguisher necessary for above (1) through (5)	×		
(7) Site cleaning, including removal of existing facilities		×	
(8) Procurement of 15 kV outgoing feeder cables	×		upto connection point with overhead lines
(9) Installation of 15 kV outgoing feeder cables (underground)	× (Akaki)	× (ADC)	Same as above
(10) Dismantling of existing equipment and its re-use at other substations		×	Addis Center No. 3 transformer shall be re-used.
(11) Procurement of spare parts, testing tools and installation and maintenance manuals	×		
(12) Site testing before handing over to Ethiopian side	×		
(13) Construction of perimeter fencing and gates		×	
(14) Installation of lighting system for existing control and battery rooms		×	only Addis Center
(15) Construction of new entrance to existing control room building		×	as above
2. Transformer Renewal (Addis North, Addis West and Kaliti-1 Substations)			
(1) Procurement of transformers (OLTC included)	×		
(2) Re-use of existing earthing transformers		×	including earthing work
(3) Installation of transformers		×	
(4) Re-use of existing OLTC remote control panel and control cable		×	
(5) Re-use of existing transformer protection device and control cable		×	

(6) Re-use of existing power source and cable for transformer cooling fan		×	
(7) Re-use of existing transformer foundations and reinforcement work (if necessary)		×	
(8) Improvement of existing 15 kV outgoing feeder panels (if necessary)		×	
(9) Re-use of existing fire extinguishing facilities		×	
(10) Procurement of installation, testing and maintenance manuals	×		
(11) Site testing and preparating of testing tools		×	supervised by Japanese engineer
3. Improvement of 15 kV Distribution Network			
(1) Procurement of conductors (AAC 95 mm^2; 231 km)	×		
(2) Procurement of lightning arresters (15 kV-10 kA, 2,000 units)	×		
(3) Procurement of electric poles, pole transformers, insulators and accessories (if necessary)		×	
(4) Replacement of conductors and installation of lightning arresters (including poles, Pole mounted transformers, insulators and accessories)		×	
(5) Procurement of one street lightning vehicle	×		
(6) Procurement of one truck with five ton crane	×		
4. Were Genu Substation Improvement			
(1) Procurement of 15 kV distribution cable (250 m)	×		upto connection point with overhead line
(2) Installation of the above		×	including civil engineering work
(3) Procurement of equipment and materials for 15 kV distribution lines (total length: 40 km)	×		conductors insulators, surge arresters and switchgear only
(4) Procurement of equipment and materials for 15 kV distribution lines (total length: 40 km)		×	poles, pole mounted transformers and accessories
(5) Construction of 15 kV distribution lines (total length: 40 km)		×	
(6) Procurement of 15 kV outgoing feeder panels (4)	×		
(7) Installation of 15 kV outgoing feeder panels (4)		×	
(8) Connection between existing 15 kV outgoing feeder panels and new panels		×	materials will be supplied by Japanese side
(9) Procurement of installation and maintenance manuals for 15 kV outgoing feeder panels	×		
(10) Supply of DC power to new 15 kV outgoing feeder panels		×	
(11) Site testing of new 15 kV outgoing feeder panels and preparation of testing tools		×	supervised by Japanese engineer

Note: X indicates the responsible party for the work/procurement concerned.

3-1-4 Consultant Supervision

The consultant will organize a consistent project team to conduct the detailed design and work supervision to ensure the smooth implementation of the Project, taking the objectives of the basic design into consideration, based on Japan's grant aid scheme. The consultant will appoint at least one full-time on-site supervisor during the work supervision stage to conduct schedule control, quality control and safety control. In addition, the consultant will dispatch engineers in line with the progress of the equipment installation, test operation and adjustment and delivery testing, etc., to supervise the relevant work conducted by the contractor.

Furthermore, the consultant will assign Japanese experts to witness the factory test and pre-shipment test of equipment to be manufactured in Japan or a third country when necessary so that any equipment problems after the arrival in Ethiopia can be prevented in advance.

(1) Basic Principles for Work Supervision

The basic principles for the consultant to execute its assigned work are supervision of the work progress to ensure completion within the set schedule, to ensure the quality specified in the contract and to supervise the contractor so that the site work is safely conducted. Important points to note for the work supervision are described below.

1) Schedule Control

The implementation schedule planned at the time of concluding the construction contract and the actual state of progress will be compared every month or every week to ensure that the contractor complies with the date of handing over specified in the contract. If any delay of the work is anticipated, the consultant will issue a warning to the contractor and will request that the contractor implement measures to catch up the delayed situation so that the work is completed within the contracted period. The above comparison will mainly be conducted for the following items.

① Quantity of work completed (quantity of equipment manufacture completed at the factory and quantity of completed civil and building work on site)

② Quantity of equipment and materials delivered (for substation and distribution lines and civil and building work.)

③ State of temporary work and preparation of construction machinery

④ Actual number of engineers, skilled workers and labourers and their ratios compared to the original plan

2) Quality Control

The consultant will supervise the items listed below to ensure that the equipment and materials manufactured, delivered and installed and that the facilities constructed meet the quality demanded by the contract. If there is any doubt in regard to their satisfactory quality, the consultant will immediately request the contractor to rectify, alter or improve the situation.

① Checking of shop drawings and specifications of equipment and materials

② Witnessing of factory inspection of equipment or checking of factory inspection results

③ Checking of equipment installation drawings, instructions and/or manuals

④ Checking of instructions and/or manuals on test operation, adjustment, testing and inspection of equipment

⑤ Supervision of equipment installation work and witnessing of test operation, adjustment, testing and inspection

⑥ Checking of and facilities execution drawings and product fabrication drawings

⑦ Checking of completed buildings facilities and products against the original drawings

3) Safety Control

The consultant will conduct work supervision to prevent site accidents during the construction period in consultation and cooperation with the site representative(s) of the contractor. The following points should be carefully noted regarding safety control on site.

① Enforcement of safety control rules and appointment of a safety control manager

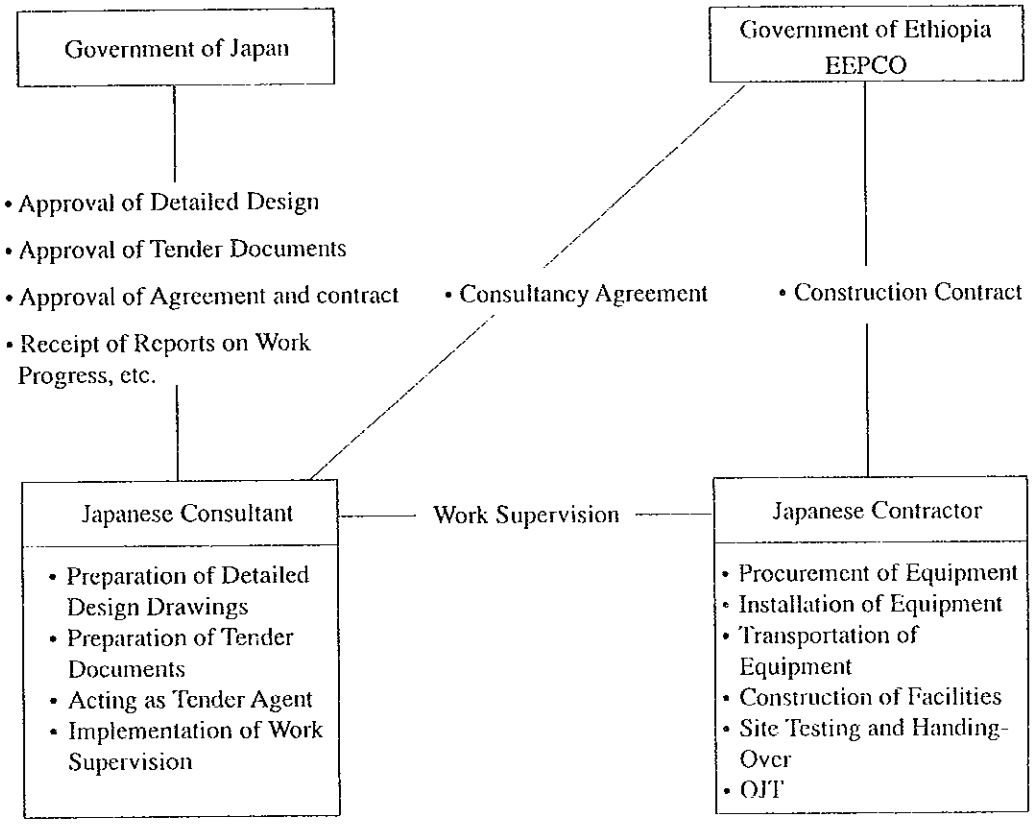
② Prevention of accidents by means of regular inspection of construction machinery

③ Clear instruction of travelling routes for work-related vehicles and construction machinery and strict enforcement of slow driving on site

④ Enforcement of welfare measures and day-offs for workers

(2) Project Implementation System

The relationship between those involved in the implementation of the Project, including the work supervision stage, is shown in Fig. 3-1-1.



Note: The consultancy agreement and construction contract must be verified by the Government of Japan.

Fig. 3-1-1 Project Implementation System

(3) Contractor's Supervisory Engineers

In conducting the equipment installation work as well as the necessary civil and building work at the Addis Center Substation and the Akaki Substation, the contractor will use a local construction company as a subcontractor. As it will be necessary for the subcontractor to fully understand the content of the subcontracting agreement regarding the work schedule, work quality and safety measures, the contractor will dispatch Japanese engineers with experience of overseas work similar to that under the Project to guide/educate the subcontractor.

Given the scale and contents of the planned substation construction work under the Project, it is desirable that the contractor dispatch at least those engineers listed in Table 3-1-2 for full-time assignment on site.

Table 3-1-2 Desirable Dispatch of Engineers by the Contractor

Type of Engineer	No.	Assigned Work	Assignment Period
Site Manager	1	Overall work management; consultation and coordination with related organizations and obtaining of necessary permits, etc.; OJT supervision; equipment procurement and control; customs clearance; personnel control; accounting	Entire construction period
Electrical Engineer (A)	1	Installation supervision of transformers, circuit breakers, CT, CVT and bus-bars, etc.	Relevant equipment installation period
Electrical Engineer (B)	1	Installation supervision of outgoing feeder panels, control panels and cabling, etc.	Relevant equipment installation period
Civil Engineer	1	Supervision of civil and building work	Relevant work period
Testing and Adjustment Engineers	2	Testing and adjustment of transforming equipment	Relevant work period

3-1-5 Equipment and Materials Procurement Plan

The substation and distribution equipment and materials to be procured and installed under the Project is not manufactured in Ethiopia and transformers, circuit breakers, current transformers, capacitor voltage transformers, conductors and insulators, etc., are all imported from such European countries as Italy, Germany, Sweden, Spain and France as well as from other countries, including Japan. This variety of import sources is a reflection of the wide base of foreign aid for Ethiopia. Few manufacturers, however, have agents in Ethiopia to provide after services in connection with breakdown repair and spare parts supply. According to the opinion of the Ethiopian side, the most reliable after services are provided by manufacturers in Italy, Germany, Sweden, Japan, or equivalent.

As far as the materials for civil and building work are concerned, locally produced aggregate and cement and imported reinforcing bars, paint, windows and doors and glass are readily available in the domestic market and can, therefore, be procured in Ethiopia. In contrast, it will be necessary to newly import structural steel and finishing materials, etc., as in the case of the substation and distribution equipment.

As 50 ton class cranes and trailers can be leased locally, no problems are anticipated in regard to equipment installation and transportation.

Given the above situation, the required equipment and materials for the Project will be procured in the following manner.

(1) Equipment and Materials for Local Procurement

ready-mixed concrete; cement; sand; concrete aggregate; concrete blocks; bricks; reinforcing bars; paint; timber; glass; petrol; diesel oil; small vehicles; crane; trailer; other equipment and materials for temporary work

(2) Equipment and Materials to be Procured from Japan or Third Country

1) Substation Equipment and materials

transformers; circuit breakers; current transformers; capacitor voltage transformers; outgoing feeder panels; remote control panels; bus-bar materials; bus-bar structures; cables; wires; all other relevant equipment.

2) Distribution Equipment and materials

conductors; cables; insulators; surge arresters; high voltage switchgear; all other relevant equipment.

3) Vehicles

street lightning vehicles; truck with five ton crane

For the transportation of the products procured from Japan or a third country, an adequate packing method will be employed to ensure safe transportation during the long maritime voyage, landing at the port, land transportation to the sites and storage at the sites.

Port Aseb in Eritrea where Ethiopia has the right to free use appears to be the most appropriate port of landing and the distance of some 880 km from Port Aseb to Addis Ababa will be covered by land transport (trucks). Although no customs clearance is required at Port Aseb for entry to Eritrea, it will be necessary for the goods to undergo the import and customs clearance processes after arrival in Addis Ababa at the municipal bonded area. It usually takes one month for imported goods to clear the import and customs clearance processes and the contractor should prepare the necessary documentation in advance to minimise the length of this process as much as possible to comply with the planned Project implementation schedule.

3-1-6 Implementation Schedule

Project implementation will commence with the exchanging of the E/N between the two governments following approval of the Project by the Government of Japan. The implementation stage will largely consist of three stages, i.e. ① detailed design and preparation of tender

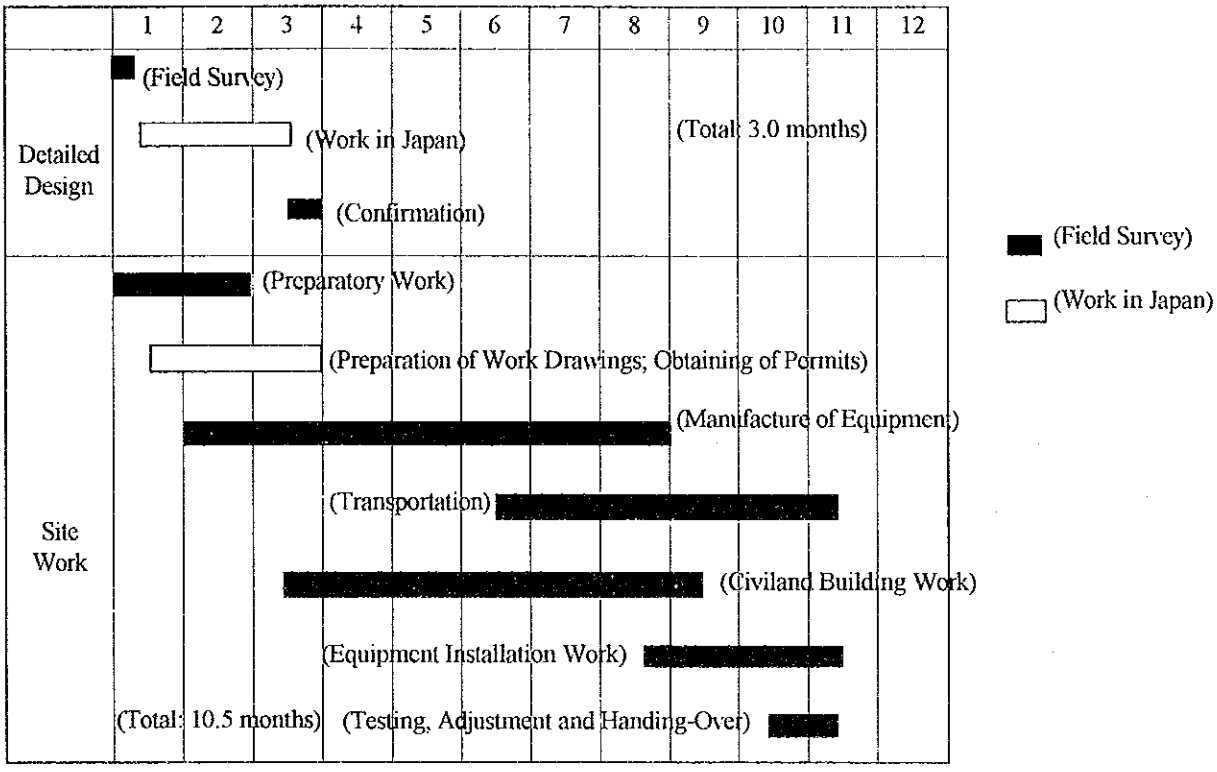
documents, ② tender and signing of equipment procurement contract and ③ equipment procurement and installation.

The project components are the rehabilitation of two existing substations, renewal of the transformers at three existing substations and reinforcement of the 15 kV distribution network, all of which are located in Addis Ababa, and the Project will be implemented in two phases given the scale, contents and urgency of each component.

Phase	Contents
1	(1) Rehabilitation of Akaki Substation
	(2) Procurement of transformers for Addis North Substation
	(3) Procurement of transformer for Addis West Substation
	(4) Procurement of equipment and materials for reinforcement of 15 kV overhead distribution lines
	(5) Procurement of vehicles for reinforcement of 15 kV overhead distribution lines
	(6) Procurement of equipment and materials for improvement of Were Genu Substation
2	(1) Rehabilitation of Addis Center Substation
	(2) Procurement of transformer for Kaliti-1 Substation

Fig. 3-1-2 shows the implementation schedule of the Project.

Phase 1 Work



Phase 2 Work

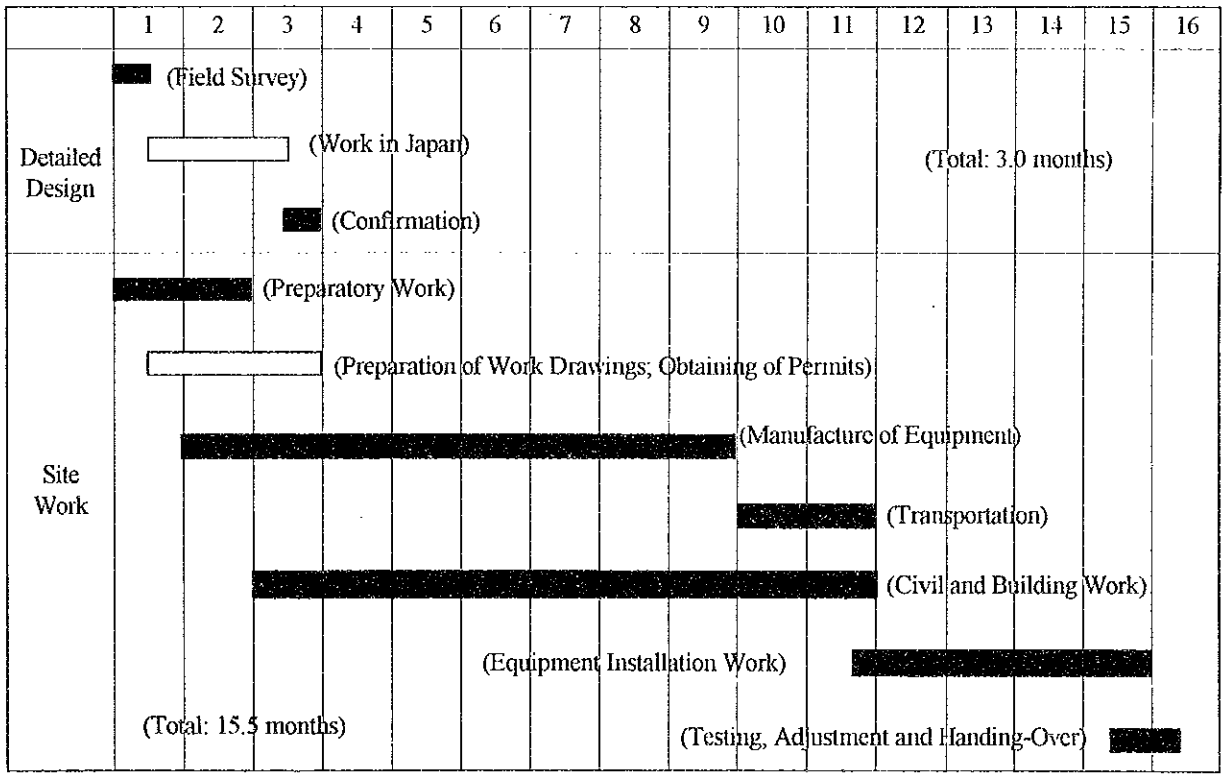


Fig. 3-1-2 Implementation Schedule of the Project

3-1-7 Obligations of Ethiopian Side

In the course of the implementation of the Project, the Government of Ethiopia will be responsible for conducting the following work or providing the following items in addition to the scope of work of the Ethiopian side described in 3-1-3.

(1) To provide necessary data and information for the Project.

(2) To bear all the expenses other than those to be borne by the Grant Aid necessary for the execution of the Project.

(3) To assign exclusive counterpart engineers and technicians to the Project in order to transfer the operation and maintenance technique for the Project and to witness and confirm construction works and qualities of equipment and materials when inspection is carried out.

(4) To install, use and maintain properly and effectively all the equipment and materials purchased under the Japan's Grant Aid.

(5) To secure and provide cleared, embanked, leveled land and access road for substations, prior to the commencement of the works for the Project.

(6) To construct incidental outdoor facilities, boundary fence and entrance gate at each substation by the completion of the Project.

(7) To take necessary measure for the prevention of the environment pollution such as disposal of oil sludge, etc., during installation and construction period.

(8) To ensure speedy unloading and customs clearance of the goods for the Project at port and/or customs in Ethiopia.

(9) To secure and to provide temporary areas for the site office, storage and shops necessary for the construction of Akaki and Addis Center substations for the Japanese contractor(s), during the implementation period.

(10) To provide proper disposal places of excavated soil, waste water and oil discharged during the implementation period.

(11) To secure the stoppage electricity of the existing substation at Akaki and Addis Center substations during the connection works of new power lines under the Project, when necessary.

(12) To arrange necessary traffic control when equipment and materials under the Project are transported to the Project sites.

(13) To relocate the existing No.3 transformer at Addis Center substation to other substation.

3-2 Operation and Maintenance Plan

(1) Basic Concept

The proper operation and maintenance (O & M) of substation and distribution equipment and the preservation of a proper working environment are essential to achieve the improved reliability of the power supply system to provide stable electricity supply services for consumers in Addis Ababa.

The very tight power supply situation in Addis Ababa at present is mainly caused by a functional decline of the existing equipment, etc. due to aging and the insufficient capacity of the existing facilities to meet the increasing electricity demand in recent years as described earlier. In addition, the inadequate preventive maintenance and repair due to the shortage of spare parts forms the background for the insufficient electricity supply. This situation points out a need to replace the obsolate equipment and to increase the supply capacity while reducing the fault/breakdown rate. Furthermore, appropriate preventive maintenance aimed at improving the reliability, safety and efficiency of the substation and distribution equipment is highly desirable. The basic concept of appropriate operation and maintenance is shown in Fig. 3-2-1.

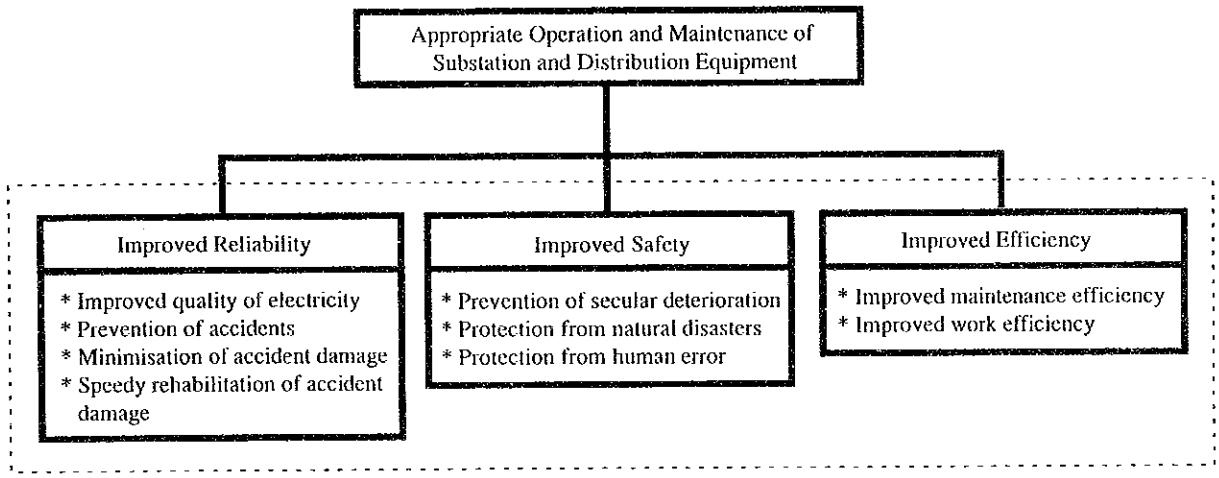


Fig. 3-2-1 Basic Concept of O&M for Substation and Distribution Equipment

Based on the basic operation and maintenance concept described above, the maintenance emphasis for the procured and installed equipment and constructed buildings under the Project should be placed on preventive maintenance which should then be conducted without fail.

The implementation of OJT on the operation and maintenance of the substation equipment is planned by engineers to be dispatched by the Japanese contractor during the installation, testing and adjustment work periods. The EEPCO is, therefore, expected to conduct maintenance work after the commencement of actual operation using the operation and maintenance technique acquired through OJT, bearing the basic issues described above in mind.

(2) Regular Inspection Items

1) Regular Inspection of Substation Equipment

The standard regular inspection items for the substation equipment to be procured and installed under the Project are shown in Table 3-2-1. As the table shows, inspection of the substation equipment is classified as ① "patrolling inspection" which is conducted daily using human senses to check any abnormal heating and sound, etc. of the equipment, ② "standard inspection" to check items beyond the daily patrolling inspection, including the fastening conditions of bolts, etc., of the equipment and the cleanliness or damage to such loaded sections as the surface of insulated items, etc. and ③ "precision inspection" to check the proper functioning of the interlocking mechanism between equipment and other mechanisms.

Standard inspections are conducted every one or two years while precision inspections are conducted approximately every four years.

The periodic replacement of certain parts at the time of either standard inspection or precision inspection based on the characteristics as well as frequency of use of such parts is desirable. These include the fuses, measuring instruments and relays, etc. installed inside the outgoing feeder and other panels which are liable to performance deterioration, including the insulation performance, abrasion of the contact points and changes of the characteristics.

Table 3-2-1 Standard Periodic Inspection Items for Substation Equipment

Subject	Inspection Item	Patrolling Inspection	Standard Inspection	Detailed Inspection
Equipment Outlook	Switchgear indicator and indication lamp	○	○	
	Abnormal sound or odour	○	○	
	Thermal discolouration of terminals	○	○	
	Cracks, damage or staining of bushing and insulator	○	○	
	Rust on casings and frames	○	○	
	Abnormal temperature (thermometer)	○	○	
	Fastening of bushing terminals (mechanical check)	○	○	
Operating Apparatus and Control Panel	Pressure gauge indication	○	○	○
	Counter Indication		○	○
	Condensation and damage inside panels and control boxes		○	○
	State of oil supply and cleaning		○	○
	Fastening of cable terminals	○	○	○
	State of switchgear indication		○	○
	Air leakage and oil leakage		○	○
	Pressure before and after operation (air pressure, etc.)		○	○
	Working of instruments		○	○
	Rust, deformation and/or damage to springs	○	○	○
	Abnormality of fastening pins		○	○
	Auxiliary switchgear and relays		○	○
Measurement/ Testing	Measurement of insulation resistance		○	○
	Measurement of contact resistance			○
	Breaking of heater wire		○	○
	Testing of relay function		○	○

2) Periodic Inspection of Distribution Lines

One of the most important consumer services is the maintenance of distribution lines by means of detecting defects and damage through regular patrolling and immediate repair. In addition, if short circuiting or any other fault is envisaged due to the contact of a tree, etc. with distribution lines, it is essential to take preventive measures, including the felling of the tree. The major check items for patrolling inspection are listed below.

① Breakage of conductors

② Damage to insulators

③ Contact between conductors and trees

④ Damage to poles

⑤ Straightness of poles

⑥ Installed condition of distribution transformers (Pole mounted transformers)

⑦ Abnormal temperature rise of distribution transformers

⑧ Operational status of circuit switches

(3) Maintenance Cost

All of the substations to be re-constructed and transformers to be replaced under the Project are existing substations while the distribution network to be reinforced or improved is mainly in existence. Accordingly, the operation and maintenance of the new facilities following completion of the Project will be conducted by the operation and maintenance staff of the existing substations and distribution department. Therefore, as it will be unnecessary to recruit new operation and maintenance staff, no new operation and maintenance staff cost will result from the implementation of the Project.

Similarly, while budgetary appropriation to cover the spare parts described in (4) below and such consumables as fuses, etc., will be unnecessary as in the case of the operation and maintenance cost, the Ethiopian side will be required to ensure the necessary budgetary appropriation every year so that operation and maintenance can be smoothly conducted.

(4) Spare Parts Procurement Plan

The spare parts for the substation and distribution equipment are classified as standard accessories requiring regular replacement, renewal parts required for such emergencies as fault and breakdowns and consumables, such as fuses and indication lamps, etc. It will be necessary for the Ethiopian side to purchase these spare parts in line with the regular inspection cycle described in (2) above.

The procurement plan of spare parts for two years is considered under the Project and its major items are listed in the table 3-2-2. Accordingly, the Government of Ethiopia should appropriate the budget to purchase the standard accessories, urgent replacing spare parts and consumables by two years later after completion of the Project at the latest.

Table 3-2-2 Spare Parts and Maintenance Tools

1) Spare parts for substations

No.	Item	Quantity		Application
		Phase-I Construction	Phase-II Construction	
1.	Spare parts for main transformer			
1)	132 kV bushing	1 pc	2 pcs	For emergency (1 piece per each substation)
2)	132 kV neutral bushing	1 pc	2 pcs	"
3)	45 kV bushing	2 pcs	1 pc	"
4)	45 kV neutral bushing	2 pcs	1 pc	"
5)	15 kV bushing	3 pcs	2 pcs	"
6)	Silicagel for breather	15 kg	10 kg	For replacement at periodical inspection (5 kg per each substation)
7)	Buchholz relay	3 pcs	2 pcs	For emergency (1 piece per each substation)
8)	Dial type thermometer	3 pcs	2 pcs	"
9)	Dial type oil level indicator (for main tank)	3 pcs	2 pcs	"
10)	Dial type oil level indicator (for OLTC)	3 pcs	2 pcs	"
11)	Packing for above item 8), 9) and 10)	3 sets	2 sets	For replacement at periodical inspection (1 set per each substation)
2.	Spare parts for 132 kV circuit breaker			(For Addis Center Substation)
1)	Closing coil	—	1 pc	For emergency
2)	Tripping coil	—	1 pc	"
3.	Spare parts for 132 kV disconnecting switch			(For Addis Center Substation)
1)	Fixed and moving contacts (3 phases)	—	1 set	For emergency
2)	Auxiliary switch	—	1 pc	"
3)	Contacts for earthing switch (3 phases)	—	1 set	"
4.	132 kV, 10 kA lightning arrester			(For Addis Center Substation)
1)	Single phase	—	1 pc	For emergency
5.	Spare parts for 45 kV circuit breaker			(For Akaki Substation)
1)	Closing coil	1 pc	—	For emergency
2)	Tripping coil	1 pc	—	"
6.	Spare parts for 45 kV disconnecting switch			(For Akaki Substation)
1)	Fixed and moving contacts (3 phases)	1 set	—	For emergency
2)	Auxiliary switch	1 pc	—	"
3)	Contacts for earthing switch (3 phases)	1 set	—	"
7.	45 kV, 10 kA lightning arrester			(For Akaki Substation)
1)	Single phase	1 pc	—	For emergency

No.	Item	Quantity		Application
		Phase-I Construction	Phase-II Construction	
8.	Spare parts for 15 kV metal enclosed switchgear			
1)	15 kV, 2,000 A vacuum circuit breaker	—	1 pc	For emergency (Addis Center Substation)
2)	15 kV, 630 A vacuum circuit breaker	2 pcs	1 pc	For emergency (1 piece for each Addis Center, Akaki and Were Genu Substations)
3)	Closing coil for above 1)	—	1 pc	For emergency (Addis Center Substation)
4)	Tripping coil for above 1)	—	1 pc	"
5)	Closing coil for above 2)	2 pcs	1 pc	For emergency (1 piece for each Addis Center, Akaki and Were Genu Substations)
6)	Tripping coil for above 2)	2 pcs	1 pc	"
7)	Bulb for indication lamp	200%	100%	For emergency (100% for each Addis Center, Akaki and Were Genu Substations)
8)	Fuse link for power and protection	200%	100%	"
9)	15 kV lightning arrester	2 pcs	1 pc	For emergency (1 piece for each Addis Center, Akaki and Were Genu Substations)
10)	Meter (all kinds)	2 pcs	1 pc	"
11)	Protection relay (all kinds)	2 pcs	1 pc	"
12)	Auxiliary relay (all kinds)	2 pcs	1 pc	"
13)	Change over switch (all kinds)	2 pcs	1 pc	"
14)	Control switch (all kinds)	2 pcs	1 pc	"
9.	Spare parts for control and protection panel			
1)	Bulb for indication lamp	100%	100%	For emergency (100% for each Addis Center and Akaki Substations)
2)	Fuse link for protection	100%	100%	"
3)	Meter (all kinds)	1 pc	1 pc	For emergency (1 piece for each Addis Center and Akaki Substations)
4)	Protection relay (all kinds)	1 pc	1 pc	"
5)	Auxiliary relay (all kinds)	1 pc	1 pc	"
6)	Change over switch (all kinds)	1 pc	1 pc	"
7)	Control switch (all kinds)	1 pc	1 pc	"
10.	Spare parts for insulators in the substations			
1)	132 kV post insulator (1 phase)	—	1 pc	For emergency (Addis Center Substation)
2)	45 kV post insulator (1 phase)	1 pc	—	For emergency (Akaki Substation)
11.	Spare parts for outdoor lighting in the substations			(100% for each Addis Center and Akaki Substations)
1)	Lamp	100%	100%	For emergency
2)	Ballast	100%	100%	"

2) Maintenance tools

No.	Item	Quantity		Application
		Phase-I Construction	Phase-II Construction	
1.	Oil purifier (4,000 liter/hour)	1 set	—	Purificrring of transformer insulation oil
2.	Vacuum pump (80 liter/min.)	1 set	—	"
3.	Oil storage tank (1,500 liter)	1 set	—	"
4.	Portable oil tester	1 set	—	Before and completion of purifierring
5.	Testing Transformer (for 45 kV and 15 kV)	1 set	—	Withstand voltage test for 45 kV and 15 kV equipment
6.	Induction voltage regulator	1 set	—	"
7.	Control board	1 set	—	"
8	Portable type noise tester	1 set	—	Measurement of noise for transformer
9.	Universal circuit tester	1 set	—	Voltage, ammeter and resistance
10.	Rotation meter	1 set	—	Measurement of phase rotation
11.	Voltage detector	1 set	—	Voltage detection
12.	Slide transformer	1 set	—	Regulator for low voltage circuit
13.	Portable single phase relay test set	1 set	—	Testing for single phase relay
14.	Portable three phase relay test set	1 set	—	Testing for three phases relay
15.	Portable phase angle indicator	1 set	—	Measurement of phase angle
16.	Portable AC VA meter	1 set	—	Measurement of AC volt and ampere
17.	Portable DC VA meter	1 set	—	Measurement of DC volt and ampere
18.	Insulation tester (500V)	1 set	—	Measurement of resistance
19.	Insulation tester (1,000V)	1 set	—	"
20.	Portable earth resistance tester	1 set	—	Measurement of earth resistance
21.	Digital multi-meter	1 set	—	Measurement of multi purpose
22.	Clip-on meter	1 set	—	Measurement of ampere
23.	Jack-up tool	1 set	—	Installation of transformer
24.	Compressor	1 set	—	Cable termination
25.	Compression tool with dices	1 set	—	"
26.	Cable cutter	1 set	—	"
27.	Winch	1 set	—	Moving of heavy equipment
28.	Generator (5 kVA)	1 set	—	For power source of tools
29.	Wire rope	1 set	—	Lifting up heavy equipment
30.	Maintenance tool	5 sets	—	Electrical tools (spanner, driver, etc.)
31.	Safety protective device	1 set	—	Safety for operators

Note: No maintenance tools will be procured for Phase II because those procured during Phase I will be re-used during Phase II.

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATIONS

4-1 Project Effects

Addis Ababa consumes some 50% (196 MW as of June, 1997) of Ethiopia's total power supply capacity (approximately 380 MW) and enjoys a high electrification rate of some 97%. The aging distribution network and insufficient distribution capacity to meet the demand, however, have resulted in an unstable power supply marked by daily planned power cuts and load restrictions, preventing the full performance of the urban functions of the capital which is the center of national politics and the economy. Moreover, the transition from a socialist regime to a liberal regime is expected to stimulate a rapid population inflow from local areas to the capital because of the development of commercial and industrial facilities and housing. While the latest official figure for the Addis Ababa population in 1994 is some 2.1 million, the present figure (August, 1997) is estimated to be more than three million, including those arriving from local areas. Such a rapid development of commercial and industrial facilities and population increase makes the urgent improvement of the distribution network all the more important to meet the growing demand.

The implementation of the Project will rehabilitate those substations of which the deterioration is particularly noticeable, renew the distribution transformers and conductors which suffer from overloading as well as frequent breakdowns and extend the distribution lines to new residential areas to accommodate the increasing population. As a result, the distribution network in Addis Ababa will be able to permit load distribution between the city's substations to meet the expected electricity demand in the year 2005, establishing a stable power supply system which will eradicate the need for systematic power cuts and load restrictions. This will mean that the current voltage drop of more than 20% will improve to less than 10% so that equipment can function normally and that power cuts due to lightning will be drastically reduced, achieving improvement of the distribution network in Addis Ababa to materialise "the urgent growth of the urban economy and improvement of the living conditions" as called for by the five year national development plan.

The operation and maintenance of the equipment and facilities after completion of the Project will be conducted by the EEPCO which is the sole public corporation in Ethiopia's electricity sector and which was established in July, 1997 following reorganization of the EELPA established in 1956 as a public corporation responsible for the entire electricity sector, ranging from generation and transmission to distribution to consumers throughout Ethiopia. The EEPCO currently receives a government subsidy for its operation but aims at establishing self-financing status in five years time through adequate revisions of the electricity tariff, including that introduced in March, 1997, and cost reduction through reorganization. As all of the new substation and distribution facilities to be introduced under the Project will replace existing facilities, additional operation funding and

manpower after their commissioning will be unnecessary. The transformer installation work and distribution network improvement work to be conducted by the Ethiopian side are similar to that conducted by the EEPCO so far and, therefore, it is believed that the EEPCO has sufficient technical ability to conduct the work and to maintain the new facilities. Consequently, no specific problems are anticipated in regard to the operation and maintenance of the new equipment and facilities and the scope of work to be conducted by the Ethiopian side in connection with the implementation of the Project.

Among the planned equipment, transformers require the most environmental care. The measures to deal with waste oil and noise, etc. to be adopted under the Project should be capable of minimizing the adverse impacts on people living near the substations.

The implementation of the Project will consolidate a key component of the social infrastructure of Addis Ababa which is the capital of Ethiopia and the center for the country's socioeconomic activities (benefitting population: approximately three million, including the recent inflow), facilitate and promote development projects, achieve the vitalisation and stable operation of commercial and industrial activities and improvement of the living conditions of the citizens and establish the foundations for the economic independence of Ethiopia.

Given the above evaluation results, the Project can be implemented without difficulty with Japanese grant aid and is judged to be highly appropriate in view of its envisaged significantly positive effects.

Current State and Problems	Remedial Measures Under the Project	Degree of Positive Effects/Improvement
1. Addis Center Substation Rehabilitation 1) The output of two of the three existing 22 MVA transformers has declined to 60% due to aging, failing to meet the demand, Healthy transformers cannot exchange electricity with other substations because of the different connection systems 2) The receiving side switchgear (132 kV) has broken down due to aging, failing to protect the substation 3) The breakdown of the switchgear for two aged transformers makes their protection impossible 4) The 15 kV outgoing feeder panels frequently break down due to aging and the procurement of spare parts is difficult because their manufacturer no longer exists 5) The size of the existing underground cable (70 mm^2) between the 15 kV outgoing feeder panels to the first contact points of the distribution lines cannot meet the demand	1) Renewal by two 31.5 MVA transformers to meet the forecast demand in the year 2005; use of a connection system to link with other substations 2) Renewal by new switchgear 3) Renewal by new switchgear as well as new transformers 4) Renewal by new 15 kV outgoing feeder panels 5) Renewal by new cable (120 mm^2)	1) Rehabilitation of the substation to make it capable of supplying electricity to government buildings and commercial facilities; linking with other substations to meet the city's power demand in the year 2005 and to establish a reliable power supply system 2) Proper response to breakdowns/faults and safe maintenance work 3) As above 4) Drastic reduction of power cuts due to equipment failure to ensure a reliable power supply system 5) Eradication of power cuts due to over-loading and load restrictions to ensure a reliable power supply system
2. Akaki Substation 1) The output of all three existing transformers has declined to 66% due to aging, failing to meet the demand 2) The switchgear for the receiving side and for two branch lines (45 kV) has broken down, failing to protect the substation and branch transmission lines 3) The breakdown of the switchgear for two aged transformers makes protection of the transformers impossible 4) The 15 kV outgoing feeder panels frequently break down due to aging and the procurement of spare parts is difficult because their manufacturer no longer exists 5) The size of the existing underground cable (70 mm^2) between the 15 kV outgoing feeder panels to the first contact points of the distribution lines cannot meet the demand	1) Renewal by one 12 MVA transformer to meet the forecast demand in the year 2005 2) Renewal by new switchgear 3) Renewal by new switchgear as well as new transformers 4) Renewal by new 15 kV outgoing feeder panels 5) Renewal by new cable (120 mm^2)	1) Rehabilitation of the substation to make it capable to supplying electricity to surrounding industrial and residential areas; linking with other substations to meet the city's power demand in the year 2005 and to establish a reliable v supply system 2) Proper response to breakdowns/faults and safe maintenance work 3) As above 4) Drastic reduction of power cuts due to equipment failure to ensure a reliable power supply system 5) Eradication of power cuts due to over-loading and load restrictions to ensure a reliable power supply system

Current State and Problems	Remedial Measures Under the Project	Degree of Positive Effects/Improvement
3. Addis North Substation Transformers 1) The output of the existing two 12 MVA transformers has declined to some 70% due to aging 2) As the existing transformers cannot meet the increasing demand due to housing development in neighbouring areas, one 16 MVA mobile substation is used to boost the supply	1) Renewal by two 25 MVA transformers to meet the forecast demand in the year 2005	1) Rehabilitation of the substation to make it capable to supplying electricity to surrounding residential areas; linking with other substations to meet the city's power demand in the year 2005 and to establish a reliable power supply system 2) Transfer and re-use of the mobile substation to another substation where the transformer capacity is insufficient
4. Addis North Substation Transformer 1) One of the two existing 12 MVA transformers suffers from abnormal temperature rise when its output exceeds approximately the 55% level due to partial breakdown and the circuit breaker trips with a further increase of the load. It is twelve years old and repair is impossible, failing to meet the current demand	1) Renewal by one 12 MVA transformer	1) Rehabilitation of the substation to make it capable to supplying electricity to surrounding residential areas; linking with other substations to meet the city's power demand in the year 2005 and to establish a reliable power supply system
5. 15 kV Distribution Network Improvement 1) The existing overhead distribution lines in the city were built some 15 - 35 years ago using the then standard 65 mm^2 (allowable current: 150 A). The subsequent demand increase has caused a continual state of over-loading, making it necessary to enforce systematic power cuts and load restrictions, thus making it practically impossible to use electrical equipment because of over 20% valtage drop 2) Of the some 2,000 Pole mounted transformers installed for the existing distribution network, 650 lack a surge arrester or have broken down, resulting in many power cuts due to lightning	1) Renewal of 77 km of lines in need of urgent improvement by stranded aluminium conductors (95 mm^2 with an allowable current of 300 A) 2) Procurement of 2,000 surge arresters for 650 Pole mounted transformers to avoid power cuts due to lightning	1) Eradication of power cuts and load restrictions due to over-loading to establish a reliable power supply system; reduction of a voltage fall to less than 10% to allow the improved use of home appliances, etc. 2) Significant reduction of power cuts due to lightning to establish a reliable power supply system

Current State and Problems	Remedial Measures Under the Project	Degree of Positive Effects/Improvement
6. Maintenance Vehicles 1) The existing maintenance vehicles owned by the EEPCO responsible for the installation and maintenance of the procured equipment and constructed facilities under the Project suffer from frequent breakdowns due to aging, insufficient spare parts and heavy use, in turn caused by the vehicle shortage, making it impossible to conduct proper installation and maintenance 2) The shortage of maintenance vehicles makes it difficult to immediately respond to accidents involving distribution lines, causing difficulties in the prevention of the spread of adverse effects	1) Procurement of the minimum number of vehicles required for the safe and proper construction and maintenance of distribution lines * Street lighting vehicle * Truck with five ton crane	1) Improved mobility and efficiency of distribution line construction work, enabling the Ethiopian side to conduct the work to meet the requirements of Japan's grant aid scheme 2) Improved mobility in the distribution network maintenance regime to ensure proper maintenance 3) Improved efficient in the prevention of the spread of damage due to a distribution line fault to ensure a reliable power supply system
7. Were Genu Substation Improvement 1) The small allowable current (65 mm^2; 150A) of the existing underground distribution cable (from the outgoing feeder panel to the overhead conductor) causes systematic load restrictions and power cuts due to over-loading of the existing distribution lines 2) The capacity and number of existing distribution lines are insufficient to meet the increasing demand of new consumers, such as housing complexes and small factory around the substation	1) Renewal of the existing cables (5 x 50 m) by new cables (120 mm^2; 300 A) 2) Procurement of equipment and materials for new lines of 40 km in total length (conductors, insulators, surge arresters and high voltage switchgear only) 3) Procurement of four 15 kV outgoing feeder panels and connection cables for existing panels	1) Renewal of underground cables to make it capable to supplying electricity to surrounding industrial and residential areas; linking with other substations to meet the city's power demand in the year 2005 and to establish a reliable power supply system 2) Power supply for new users with the newly procured equipment and materials
8. Kaliti-1 Substation Transformer 1) The existing No. 1 transformer for transmission and distribution (132/45/15 kV, 22/22/7.3 MVA) has oil leakage and the efforts of the EEPCO in the last five years to repair it have not been successful, continuing a dangerous situation	1) Renewal by a new transformer	1) Renewal of the leaking transformer to establish a reliable power supply system

4-2 Recommendations

As the Project is expected to achieve the significant effects described in 4-1 above as well as positively contributing to the BHN (basic human need) of the citizens of Addis Ababa, the appropriateness of implementing the Project with Japanese grant aid is positively confirmed. Moreover, the Ethiopian side is deemed to have sufficient manpower and funding capability to operate and maintain the equipment and facilities provided under the Project. However, it is recommended that the Project can be more smoothly and effectively implemented with the improvement of the following points.

(1) While the maintenance staff of the existing substations and distribution network in Ethiopia have sufficient technical expertise to deal with the existing facilities, further training will be required in regard to the latest technological developments. Accordingly, the Ethiopian side should appoint maintenance staff for those substations to be rehabilitated under the Project as soon as possible to allow their participation in the OJT to be provided under the Project.

(2) If the Ethiopian work to install the transformers and distribution equipment to be procured under the Project is delayed, the envisaged functions as a result of project implementation will not be achieved within the project period. In view of such a prospect, the Ethiopian side should form or appoint installation work teams and prepare a work schedule plan, personnel plan and procurement plan, etc. to ensure the prompt completion of the installation work together with the necessary budgetary appropriation.

(3) The Ethiopian side should conduct regular patrolling inspections as well as preventive maintenance, including the felling of trees along the distribution routes, to reduce faults involving distribution lines in order to fully establish a reliable power supply system.

(4) At present, the EEPCO receives a government subsidy for its operation. It will be necessary for the EEPCO to constantly review the need to maintain the electricity tariff at a reasonable level to achieve financial independence, taking the generation cost, operation and maintenance cost and equipment replacement cost, etc. into consideration. In preparing a new tariff, the introduction of a gradually increasing tariff in proportion to the level of consumption as an incentive to reduce the electricity consumption of large consumers while offering a lower bill for low income people should be considered.

(5) The EEPCO will be required to install integrating watt-hour meters for all individual consumers and to conduct strict meter readings and collection of the electricity charge with a view to establishing a fair electricity charge collection system.

APPENDICES

APPENDIX 1

MEMBER LIST OF SURVEY TEAM

1. Members of the Basic Design Study Team

Name	Assignment	Current Position / Company
Mr. Hayao ADACHI	Team Leader	Development Specialist , Institute for International Cooperation, JICA
Mr. Akihito SANJO	Coordinator	First Project Study division, Grant Aid Project Study Department, JICA
Mr. Mitsuhisa NISHIKAWA	Chief Consultant / Power Supply Planner	Yachiyo Engineering Co., LTD.
Mr. Masatsugu KOMIYA	Power Transmission and Distribution Planner	Ditto
Mr. Masayuki TAMAI	Facility Planner / Maintenance and Operation Planner	Ditto
Mr. Kazuhiro NAKAMURA	Procurement Planner / Cost Estimator	Ditto

2. Members of the Explanation Team for the Draft Basic Design

Name	Assignment	Current Position / Company
Mr. Hayao ADACHI	Team Leader	Development Specialist , Institute for International Cooperation, JICA
Mr. Mitsuhisa NISHIKAWA	Chief Consultant / Power Supply Planner	Yachiyo Engineering Co., LTD.
Mr. Masatsugu KOMIYA	Power Transmission and Distribution Planner	Ditto

APPENDIX 2

SURVEY SCHEDULE

1. Basic Design Study

Date	Main activity	Detailed activities	Stay in
July 27 (Sun)	Arrive in Frankfurt	- Trip from Tokyo to Frankfurt by LH711(10:00-14:50)	Frankfurt
July 28 (Man)	Arrive at Addis Ababa	- Trip from Frankfurt to Addis Ababa (ADD) by LH590 (10:45-20:20)	ADD
Jul, 29 (Tue)	Courtesy Call Submission of IC/R	- Courtesy call to JICA Ethiopia Office, the Embassy of Japan, and the Ethiopian Electric Power Company (EEPCO). - Submission and Explanation of the Inception Report including the Field survey schedule and Undertakings by the Ethiopian side.	〃
July 30 (Wed)	Field Survey	- Field survey on the existing substations Akaki, Kaliti-1, Were Genu, Addis North and Addis West.	〃
July 31 (Thu)	Field Survey	- Field survey on the project substations (Addis Center, Gefersa and Sabatta)	〃
Aug. 01 (Fri)	Discussion with EEPCO	- Discussion with EEPCO regarding back ground, necessity, priority of the project.	〃
Aug. 02 (Sat)	Field Survey	- Field survey on the existing hydraulic power station (Koka).	〃
Aug. 03 (Sun)	Data Sorting	- Sorting of data collected	〃
	Preparation of M/D	- Preparation of the Draft Minutes of Discussions (the M/D)	
Aug. 04 (Mon)	Discussion with EEPCO	- Discussion with EEPCO and MEDC regarding the draft M/D	〃
Aug. 05 (Tue)	Discussion with EEPCO	- Discussion with EEPCO regarding the draft M/D	〃
	Field Survey	- Field survey on the existing substation (Addis Center)	
Aug. 06 (Wed)	Discussion with EEPCO	- Discussion of the draft M/D - Modification of the M/D	〃
Aug. 07 (Thu)	Signing of M/D Courtesy Call	- Signing of the M/D - Courtesy call and report to JICA Offices and the Embassy of Japan	〃
	Leaving ADD	- Official members leave ADD for Frankfurt by LH591(22:35)	
Aug. 08 (Fri)	Field Survey	- Field survey on the existing substations (Akaki, Addis South and Nefas Silk)	〃
Aug. 09 (Sat)	Data Sorting	- Sorting of data collected	〃
Aug. 10 (Sun)	Field Survey	- Field survey on the existing substations (Kaliti-1 and Addis North)	〃
Aug. 11 (Mon)	Field Survey	- Field survey on the existing substations (Addis Center, Addis North, Addis West and Were Genu)	〃
Aug. 12 (Tue)	Data Collection	- Technical data at Addis Center substation - Financial data at EEPCO.	〃
Aug. 13 (Wed)	Data Collection	- Labour cost - Financial data at EEPCO	〃

Date	Main activity	Detailed activities	Stay in
Aug. 14 (Thu)	Data Collection	- Technical data at Addis Center substation - Financial data at EEPCO.	ADD
Aug. 15 (Fri)	Data Collection	- Technical data at Addis Center substation - Labour cost	〃
Aug. 16 (Sat)	Field survey	- Field survey on the 15kV cable connection points around Addis Center substation	〃
Aug. 17 (Sun)	Preparation of F/R	- Preparation of the draft Field Report (F/R)	〃
Aug. 18 (Mon)	Data collection	- Addis Center substation	〃
	Preparation of F/R	- Preparation of the draft F/R	
Aug. 19 (Tue)	Preparation of F/R	- Preparation of the draft F/R	〃
	Data Collection	- Financial data at EEPCO	
Aug. 20 (Wed)	Leave from ADD	- Mr. Tamai and Mr. Nakamura leave ADD for Frankfurt (ET730,22:15-07:20) - Mr. Nishikawa and Mr. Komiya continue to prepare the Field Report	〃
Aug. 21 (Thu)	Preparation of Report	- Preparation of the site survey report	〃
Aug. 22 (Fri)	Discussion of F/R	- Discussion on F/R (draft)	〃
Aug. 23 (Sat)	Modification of F/R	- Modification of the F/R (draft)	〃
Aug. 24 (Sun)	Ditto	- ditto	〃
Aug. 25 (Mon)	Confirmation of F/R	- Obtaining of approval of the F/R	〃
Aug. 26 (Tue)	Data Collection	- Labour cost	〃
	Courtesy Call	- Courtesy call to JICA Ethiopia Office and the Embassy of Japan.	
Aug. 27 (Wed)	Data Collection	- Survey maps (EEPCO)	Frankfurt
	Leaving ADD	- Mr. Nishikawa and Mr. Komiya left ADD for Frankfurt (ET730,22:15-07:20+1)	
Aug. 28 (Thu)	Arrival at Frankfurt	Arrival at Frankfurt	Frankfurt
Aug. 29 (Fri)	Leaving Frankfurt	- Leave Frankfurt to Tokyo (LH710,13:50)	On board
Aug. 30 (Sat)	Arrival in Tokyo	- Arrival in Tokyo (07:50)	Tokyo

2. Consultation on the Draft Final Report

Date	Main activity	Detailed activities	Stay in
Oct. 13 (Mon.)	Trip	- Mr. Adachi : Tokyo to Rome by JL 419 (12:20--20:00) - Mr. Nishikawa & Mr. Komiya : Tokyo to Frankfurt by LH 711 (10:00—14:50)	Rome (Frankfurt)
Oct. 14 (Tue.)	Trip	- Mr. Nishikawa & Mr. Komiya : Frankfurt to Rome by LH 3522 (09:45—11:30) - All members : Rome to Addis Ababa by AZ 852 (15:00--22:10)	ADD
Oct.15 (Wed)	Courtesy call Submission of D/F/R	- Courtesy call to the Embassy of Japan, JICA Ethiopia Office, EEPCO and MEDC. - Submission of and Explanation on the draft final report to EEPCO	//
Oct.16 (Thu.)	Discussion of D/F/R	- Explanation of and discussion on the draft final report with EEPCO - Visiting of ADC substation	//
Oct.17 (Fri.)	Discussion of D/F/R	- Explanation of and discussion on the draft final report with EEPCO	//
Oct.18 (Sat.)	Data Sorting	- Sorting of data collected	//
Oct.19 (Sun.)	Data Sorting Preparation of M/D	- Sorting of data collected - Preparation of the draft minutes of discussions	//
Oct. 20 (Mon.)	Discussion of M/D	- Submission of discussion of the draft minutes of discussions with EEPCO	//
Oct. 21 (Tue.)	Discussion of M/D	- Discussion of the draft minutes of discussions with EEPCO - Finalizing of the minutes of discussions	//
Oct. 22 (Wed)	Signing of M/D	- Signing of the minutes of discussions with EEPCO and MEDC	//
Oct. 23 (Thu.)	Courtesy call Trip	- Courtesy call to the Embassy of Japan, JICA Ethiopia Office, EEPCO and MEDC. - Trip from Addis Ababa to Frankfurt by LH 591 (22:35--06:35+1)	On board
Oct. 24 (Fri.)	Trip	- Arrive at Frankfurt at 06:35 a.m. - Trip from Frankfurt to Tokyo by LH 710 (13:50--07:50+1)	On board
Oct. 25 (Sat.)		- Arrive at Tokyo (07:50)	Tokyo

APPENDIX 3

LIST OF PARTY CONCERNED IN THE RECIPIENT COUNTRY

The Ministry of Economic Development and Cooperation (MEDC)

Head, Bilateral Cooperation Department	Mr. Admassu Abebe
Advisor	Mr. Kinjiro Wada

The Ethiopian Electric Power Cooperation (EEPCO)

Central Organization:

General Manager	Mr. Tesfaalem G.Iyesus
Advisor of G.M	Mr. Yusef Haji Ali
Director, Cooperate Planning Dept.	Mr. Mengesha Shiferaw
Engineer, Cooperate Planning Dept.	Mr. Mekebib Lemma

Engineering Department:

Deputy General Manager, Engineering	Mr. Solomon Abate

Operation Department:

Deputy General Manager, Operations	Mr. Miheret Debebe
Power System Operations Dept.	
Director, Power System Operations Dept.	Mr. Solomon Abebe
Manager, Hydroplant Operation	Mr. Asfaw Seghid
Manager, Koka Power Station	Mr. Assefa Cherinet
Regional Operation Dept.	
Director, ADD Regional Operation Dept.	Mr. Tesfaye Aragaw
Manager, Transmission & Substation Operation Div.	Mr. Tesfaye Delessa
Head, Transmission & Substation Operation Sec.	Mr. Golla Endalew Mera
Engineer, Operation	Mr. Alemayenu Tekleargai
Engineer, Operation	Mr. Beyene Bent
Engineer, Distribution	Mr. Gashaw Hassen
Operator, Akaki substation	Mr. Mebaa Worku
Operator, Akaki substation	Mr. Gedeta Tuffa
Operator, Addis South substation	Mr. Mekuria Lemma
Operator, Addis West substation	Mr. Aliyou Balerer

Finance Department:

Controller Dept.	
Director, Controller Dept.	Mr. Deyu Werdofa
Manager, Corporate Accountants Div.	Mr. Tibebu Sime
Treasury Dept.	
Director, Treasury Dept.	Mr. G. Michael Tamrat

Embassy of Japan in Ethiopia

Counselor	Mr. Kenji Miyata
First Secretary	Mr. Yoichi Sakai
Second Secretary	Mr. Haruhiko Yoshida

Japan International Cooperation Agency, Ethiopia Office

Resident Representative	Mr. Hiroshi Matsutani
Deputy Resident Representative	Mr. Yasuyuki Uehara
Assistant Resident Representative	Mr. Kyosuke Kawazumi
Assistant Resident Representative	Mr. Eita Narita
Director, Technical Cooperation Division	Mr. Yeshitila Amare

APPENDIX 4

MINUTES OF DISCUSSIONS

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY
ON
THE PROJECT FOR URGENT REINFORCEMENT
OF
POWER DISTRIBUTION NETWORK IN ADDIS ABABA
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

In response to a request from the Government of the Federal Democratic Republic of Ethiopia, the Government of Japan decided to conduct a basic design study on the Project for Urgent Reinforcement of Power Distribution Network in Addis Ababa (hereinafter referred to as "the Project") and entrusted the study to Japan International Cooperation Agency (JICA).

JICA has sent to Ethiopia a study team (the Team), which is headed by Mr. Hayao ADACHI, Development Specialist, Institute for International Cooperation, JICA, and is scheduled to stay in the country from July 28 to August 27, 1997.

The Team held discussions with the concerned officials of the Government of Ethiopia and conducted a field survey at the project sites.

In the course of the discussions and field survey, both parties, the Team and the Ethiopian Electric Power Corporation (EEPCO), have confirmed the main items of the Project as described on the attached sheets. The Team will proceed with further works and prepare the Basic Design Study report.

Addis Ababa, August 7, 1997

Mr. HAYAO ADACHI
Leader
Basic Design Study Team
Japan International Cooperation Agency

Mr. TESFAALEM G.IYESUS
General Manager
Ethiopian Electric Power Corporation (EEPCO)
The Federal Democratic Republic of Ethiopia

Witness:

Mr. ADMASSU ABEBE
Head of Bilateral Cooperation Department
Ministry of Economic Development and Cooperation
The Federal Democratic Republic of Ethiopia

ATTACHMENT

1. Objective

The objective of the Project is to establish the reliable power distribution networks to the urgently necessary area in the city of Addis Ababa by mitigating the frequent power outages and reducing of energy losses in order to stabilize the life of people and to activate economic activities .

2. Project Site

The project sites for the Study are existing substations in Addis Ababa city, mainly Addis Center, Akaki, Addis North Addis West, Were Genu, and Kaliti-1 substations and the related area of Addis Ababa city to 15kV distribution lines. The location of the project sites for the Study are shown in Annex-I.

3 Responsible and Implementing Agencies

The Ethiopian Electric Power Corporation (EEPCO) is responsible for the administration and the execution of the Project. The organization of EEPCO is shown in Annex-II.

4. Items requested by the Ethiopia side

After discussion with the Team, the following items were finally requested by the Ethiopian side. The order shown below is in accordance with the Ethiopian side's priority.

(1) Rehabilitation of Addis Center substation
- a) Procurement and installation of two (2) main transformers (132/15 kV, 25/31.5MVA each).
- b) Procurement and installation of switchgears necessary for item a) above.
- c) Procurement and installation of a switchgear for 132 kV incoming line.
- d) Procurement and installation of thirteen (13) panels of 15 kV outgoing feeder.
- e) Procurement and installation of control and protection panels for item b)~d) above.
- f) Construction of civil works, wiring and cabling works, extention of 132 kV bus-bar including insulators, supporting structures and fire extinguisher necessary for equipment of item a)~e) above.

(2) Rehabilitation of Akaki substation
- a) Procurement and installation of a main transformer (45/15 kV, 9/12MVA).
- b) Procurement and installation of a switchgear necessary for item a) above.
- c) Procurement and installation of a switchgear for 45 kV incoming line.
- d) Procurement and installation of four (4) 15 kV outgoing feeder panels.
- e) Procurement and installation of control and protection panels for item b)~d) above.
- f) Construction of civil & building works, wiring and cabling works, extention of 45 kV bus-bar including insulators, supporting structures and fire extinguisher necessary for equipment of item a)~e) above.

(3) Procurement of two (2) main transformers (132/15kV, 20/25MVA each) for Addis North substation.

(4) Procurement of one (1) main transformer (45/15kV, 9/12MVA) for Addis West substation.

(5) Rehabilitation of existing 15kV overhead power distribution line.
   a) Procurement of conductors (maximum 77 km) for rehabilitation of 15 kV power distribution lines.
   b) Procurement of 10kA 15kV surge arrestors (maximum 2,000pcs).
   c) Procurement of 15 kV outgoing underground cables (approximately 4 lines x 50 m) for Were Genu substation.

(6) Procurement of one (1) street lighting vehicle and one (1) 5 tons mobile crane with spare parts which shall be used for construction and maintenance of 15 kV overhead power distribution lines.

(7) Improvement of Were Genu substation
   a) Procurement of 15 kV overhead distribution line materials (total line length 40 km), consisting of conductors, insulators, lightning arrestors and 15 kV outdoor disconnectors .
   b) Procurement of four (4) 15 kV outgoing feeder panels.

(8) Procurement of one (1) main transformer (132/45/15 kV, 22 MVA,ONAF) for Kaliti-I substation.

However, final items to be procured, installed and constructed under Japan's Grant Aid will be decided after further studies in Japan, taking account of :
- existing conditions of power transmission and distribution networks
- power demand forecast
- operation and maintenance capability of the executing authority
- economic and administrative viability of the Project
- priority order requested by the Ethiopian side

5. Japan's Grant Aid System

(1) The Government of Ethiopia has understood the system of Japan's Grant Aid explained by the Team, as described in Annex-III.

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

6. Schedule of the Study

(1) The consultants team will proceed to further studies in Ethiopia until August 28, 1997

(2) Based on the Minutes of Discussions and technical examination of the study results, JICA will prepare a draft basic design study report and dispatch a mission to Ethiopia in

order to explain its contents to the Ethiopian side around the end of October, 1997.

(3) In case that the contents of the draft report are accepted in principal by the Government of Ethiopia, JICA will complete the final report and send it to the Government of Ethiopia by the end of January, 1998.

7. Other relevant issues

(1) Installation of the equipment and materials for the Project.
Both parties agreed that the installation works should be conducted and be completed by the Ethiopian side within 12 months after delivery of equipment and materials procured under the Project, except relevant works at Addis Center and Akaki substations.

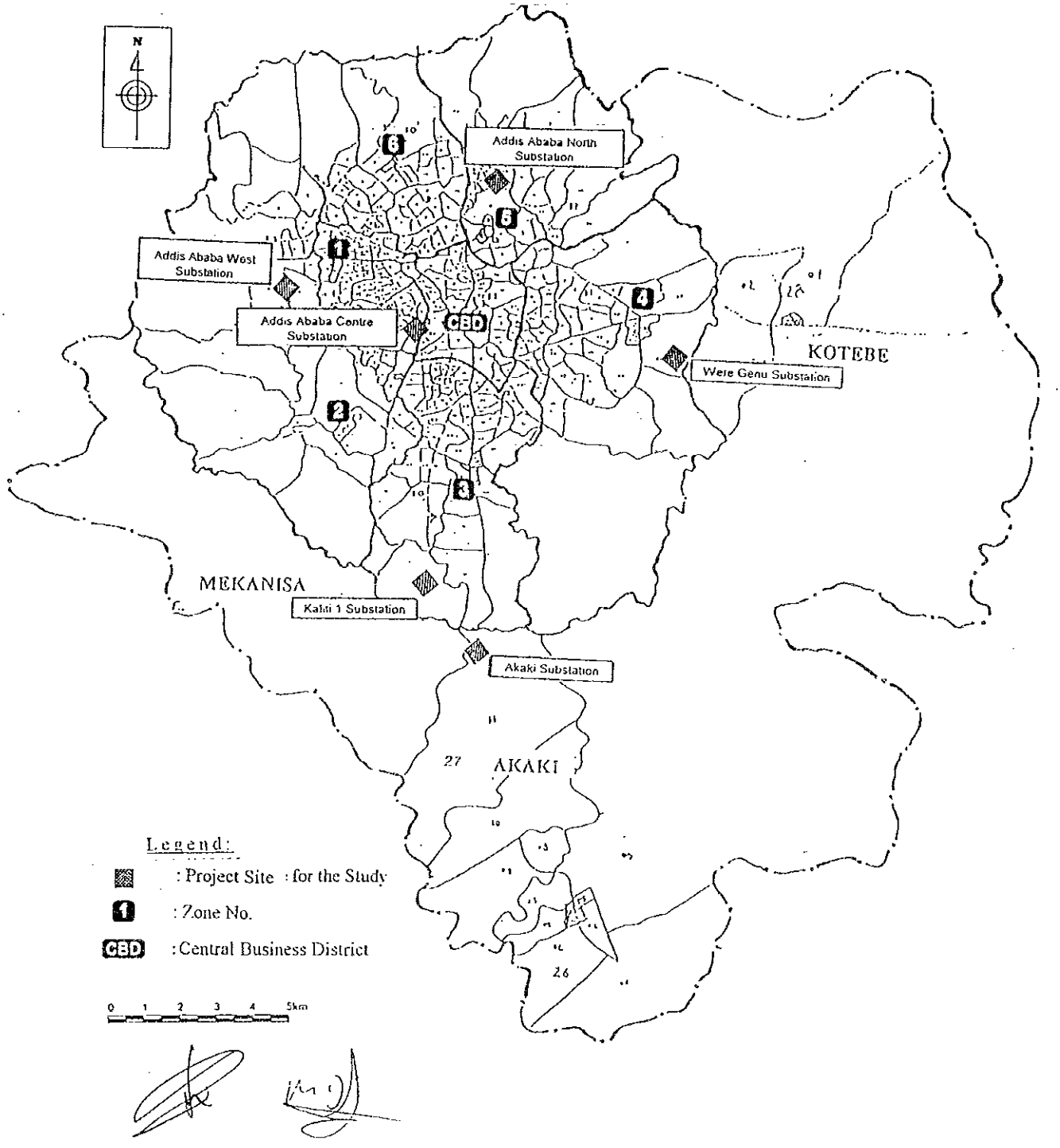
(2) Rehabilitation of the existing substations
Both parties confirmed that the damaged and malfunctioned equipment and materials in the existing substations which will be continuously utilized for the Project should be rehabilitated and be renovated by the Ethiopian side, before completion of installation works by the Japanese side.

(3) Site preparation
The Ethiopian side agreed to clear the lands at Addis Center and Akaki substations before the commencement of construction works to be done by the Japanese side.

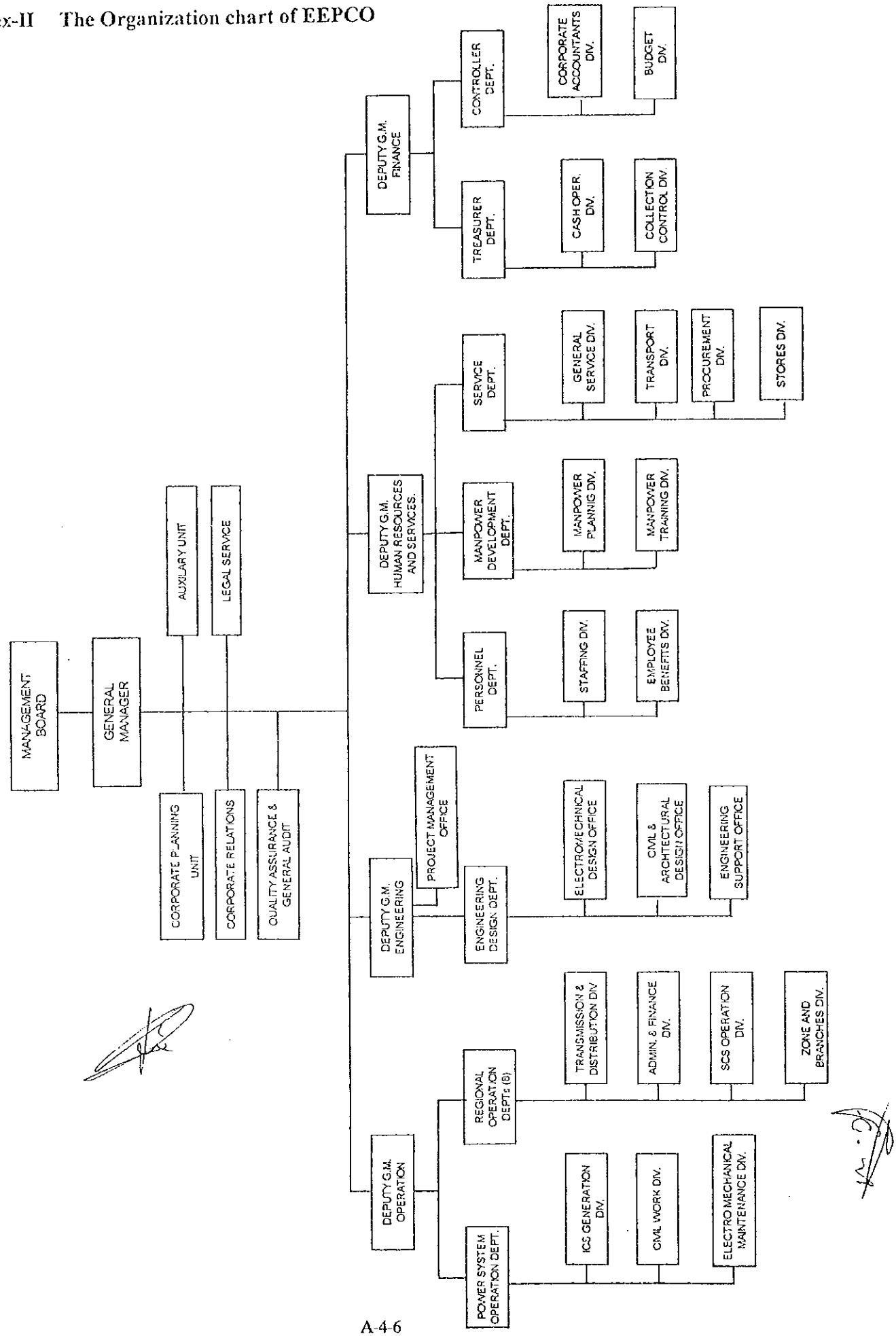
(4) Demand forecast
The Ethiopian side agreed to provide the latest information on the demand forecast in Addis Ababa city area, block by block, to the Team.

(5) Site survey
The Ethiopian side agreed to conduct the topographic and soil survey for Addis Center and Akaki substations and the results shall be submitted to the Team before the Team's departure from Addis Ababa.

Annex-I Project Site for the Study



Annex-II The Organization chart of EEPCO



Annex-III Japan's Grant Aid Scheme

Japan's Grant Aid Scheme

1. Grant Aid Procedures

(1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

(2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.
Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).
Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.
Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.
Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the Study
The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

a) Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.
d) Preparation of a basic design of the Project
e) Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.
The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firms(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

(2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

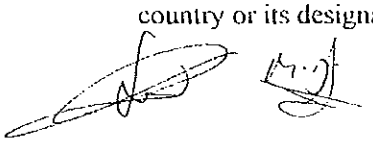
1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
3) To secure buildings prior to the procurement in case the installation of the equipment.

4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) "Proper Use"
The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(8) "Re-export"
The products purchased under the Grant Aid should not be re-exported from the recipient country.

(9) Banking Arrangements (B/A)
1) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
2) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.



Annex-IV Necessary measures to be taken by the Government of the Federal democratic of Ethiopia on condition that Japan's Grant Aid is extended.

1. to provide necessary data and information for the Project.

2. to bear all the expenses other than those to be borne by the Grant Aid necessary for the execution of the Project.

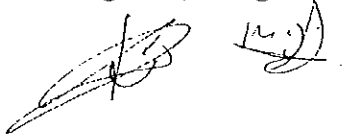
3. to assign exclusive counterpart engineers and technicians to the Project in order to transfer the operation and maintenance technique for the Project and to witness and confirm construction works and qualities of equipment and materials when inspection is carried out.

4. to install, use and maintain properly and effectively all the equipment and materials purchased under the Japan's Grant Aid.

5. to secure and provide cleared, embanked, leveled land and access road for substations, prior to the commencement of the works for the Project.

6. to construct incidental outdoor facilities, boundary fence and entrance gate at each substation by the completion of the Project.

7. to take necessary measure for the prevention of the environment pollution such as disposal of oil sludge, etc., during installation and construction period.



MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY
ON
THE PROJECT FOR REINFORCEMENT
OF
POWER DISTRIBUTION NETWORK IN ADDIS ABABA
IN
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
(CONSULTATION ON DRAFT REPORT)

In July 1997, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Project for Reinforcement of Power Distribution Network in Addis Ababa (hereinafter referred to as "the Project") to the Federal Democratic Republic of Ethiopia, and through discussions with EEPCO staff, field survey, and technical examination of the results in Japan, has prepared the draft report of the Study.

In order to explain and to consult the Ethiopian side on components of the draft report, JICA sent to Ethiopia a study team, which is headed by Mr. Hayao ADACHI, Development Specialist, Institute for International Cooperation, JICA, and is scheduled to stay in the country from October 14 to 23, 1997.

As a result of discussions, both parties (Japanese side and Ethiopian side) confirmed the main items described on the attached sheets.

Addis Ababa, October 22, 1997

Mr. HAYAO ADACHI
Leader
Basic Design Study Team
Japan International Cooperation Agency

Mr. TESFAALEM G.IYESUS
General Manager
Ethiopian Electric Power Corporation (EEPCO)
The Federal Democratic Republic of Ethiopia

Witness: Mr. ADMASSU ABEBE
Head of Bilateral Cooperation Department
Ministry of Economic Development and Cooperation
The Federal Democratic Republic of Ethiopia

ATTACHMENT

1. Components of the Draft Report

The Government of the Federal Democratic Republic of Ethiopia 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 Ethiopia has understood the system of Japan's Grant Aid explained by the Team, as described in Annex-I.

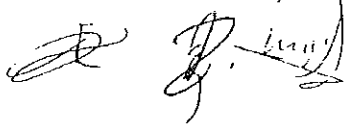
(2) The Government of Ethiopia will take necessary measures, as described in Annex-II, for smooth implementation of the Project, on condition that the Grant Aid assistance by the Government of Japan is extended to the Project.

3. Further schedule

The Team will make the final report in accordance with the confirmed items, and send it to the Government of Ethiopia by the end of January 1998.

4. Other relevant issues

The Ethiopian side agreed that a Japanese Consultant will dispatch an engineer to assist the works to be done by Ethiopian side under the Project, such as re-conductoring work of 15kV distribution lines, installation work of transformers at Addis North, Addis West, and Kaliti-1 substations, and installation work of 15kV switchgears at Were Genu substation.



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(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firms(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

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When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
3) To secure buildings prior to the procurement in case the installation of the equipment.

4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) "Proper Use"
The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(8) "Re-export"
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2) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

Annex-II Necessary measures to be taken by the Government of the Federal Democratic Republic of Ethiopia on condition that Japan's Grant Aid is extended.

1. to provide necessary data and information for the Project.

2. to bear all the expenses other than those to be borne by the Grant Aid necessary for the execution of the Project.

3. to assign exclusive counterpart engineers and technicians to the Project in order to transfer the operation and maintenance technique for the Project and to witness and confirm construction works and qualities of equipment and materials when inspection is carried out.

4. to install, use and maintain properly and effectively all the equipment and materials purchased under the Japan's Grant Aid.

5. to secure and provide cleared, embanked, leveled land and access road for substations, prior to the commencement of the works for the Project.

6. to construct incidental outdoor facilities, boundary fence and entrance gate at each substation by the completion of the Project.

7. to take necessary measure for the prevention of the environment pollution such as disposal of oil sludge, etc., during installation and construction period.

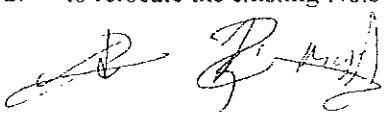
8. to secure and to provide temporary areas for the site office, storage and shops necessary for the construction of Akaki and Addis Center substations by the Japanese contractor(s).

9. to provide proper disposal places of excavated soil, waste water and oil discharged during the implementation period.

10 to secure the stoppage electricity of the existing substation at Akaki and Addis Center substations during the connection works of new power lines under the Project, when necessary.

11. to arrange necessary traffic control when equipment and materials under the Project are transported to the Project sites.

12. to relocate the existing No.3 transformer at Addis Center substation to other substation.



APPENDIX 5

COST ESTIMATION BORNE BY THE RECIPIENT COUNTRY

Cost Estimation Borne by the Recipient Country

Main items of the construction cost to be borne by Ethiopia side are as follows:

1.	Site clearing, demolishing of existing facilities, modification of existing control building and installation of 15kV underground cables in Addis Center Substation	:	Some US$ 324,000
2.	Site clearing and modification of terminal tower in Akaki Substation	:	Some US$ 53,000
3.	Installation of main transformers in Addis North Substation	:	Some US$ 13,000
4.	Installation of main transformers in Addis West Substation	:	Some US$ 8,000
5.	Construction of 15kV distribution lines and installation of 15kV outgoing feeder panels in Were Genu Substation	:	Some US$ 500,000
6.	Installation of main transformer in Kaliti-1 Substation	:	Some US$ 13,000
7.	Construction of 15kV distribution lines (re-conduction of wires and installation of lightning arresters)	:	Some US$ 334,000

(Total : Some US$ 1,245,000)

APPENDIX 6

DEMAND FORECAST

6-1 Power Demand Forecast by EEPCO

The power demand forecast for each substation in Addis Ababa region until the year 2010 is calculated by EEPCO Planning Department for reference to the study. The following table shows the total forecast demand in the Addis Ababa region calculated by EEPCO.

Load Forecast of Addis Ababa Region by EEPCO

(Unit: MW)

Descriptions	1997 (recorded)	1998 (estimated)	1999 (estimated)	2005 (estimated)	2010 (estimated)
Total Demand (MW)	195	283.4	312.7	570.6	937.3
Increasing ratio against last year	2.5%	45%	10.5%	10.5%	10.5%

Source: EEPCO

In the above table, the demand in 1998 shows 1.45 times lager than 1997, because of the connection of the waiting consumers. And the average increasing ratio from 1999 is 1.105 which is same average ratio as the past 5 years records. As a result, estimated demand in 2005 (570.6 MW) is some 3 times lager than 1997 record (195 MW), and some 5 times in 2010.

6-2 Power Demand Forecast by The Team

1. Power demand forecast by the Team

The Team has undertaken the load forecast study under the following conditions:

(1) The Population Census 1994 shall be adopted for the population, No. of household, as well as administrative zoning of the city.

(2) Demand increasing ratio from 1998 to 1999 shall be 1.092 per year, based on the following assumptions. This increasing ratio shall include the demand for waiting consumers and industrial/commercial development.

1) Population increase ratio: 1.0379 per year (according to the Population Census 1994)

2) Power demand increasing ratio per household: 1.053 per year (according to increasing ratio 1991 to 1995, EEPCO)

thus, 1) x 2) = 1.092

(3) Demand increasing ratio from 2000 to 2010 shall be 1.053 per year, according to the "Ethiopia Power Planning Study, Main Report (May 1996, Acres International Limited)

In the demand forecast study by the Team, the demand for each zone is analyzed in accordance with No. of household of each zone showing in the census and the demand per household estimated by the Team. The following table shows the result of the load forecast made by the Team. As a result of the study, estimated demand in 2005 (317 MW) is some 1.6 times lager than 1997 record (195 MW), and some 2 times in 2010. (Detailed demand forecast is attached herewith.)

Demand Forecast of Addis Ababa Region by the Team

(Unit: MW)

Descriptions	1997 (recorded)	1998 (estimated)	1999 (estimated)	2005 (estimated)	2010 (estimated)
Zone-1 (Residence area)	20.4	22.2	24.3	33.1	42.9
Zone-2 (Residence area)	28.8	31.5	34.4	46.8	60.6
Zone-3 (Industrial and residence area)	46.9	51.2	56.0	76.3	98.8
Zone-4 (Residence area)	32.6	35.6	38.9	53.0	68.6
Zone-5 (Central Business District and Residence Area)	58.3	63.7	69.6	94.8	122.8
Zone-6 (Rural Residence Area)	7.9	8.7	9.5	12.9	16.7
Total Demand (MW)	195	212.5	232.5	317.0	410.4
Increasing ratio against last year	2.5%	9.2%	9.2%	5.3%	5.3%

Source: The Study Team

2. Power demand forecast for each substation

The Team has studied the load forecast for each substation basis as the load sharing plan (See Attachemnt). For the load sharing plan, the following items are taken into consideration:

(1) Total required load for Addis Ababa region shall be distributed by all the operated substations in the region.

(2) Location of substation to be distribute the load shall be near the target area as much as possible, in order to minimize the distribution loss as well as to make ease maintenance of distribution lines. (See Attachment "Location Map of substations in Addis Ababa Region")

(3) Usable capacity of transformer in the existing substations shall be considered.

(4) New transformer capacity requested for Japan's grant aid project, i.e., Addis Center, Addis North, Addis West, Kaliti-1and Akaki shall be adopted in 1999.

(5) New transformers of planned and under constructed substations, i.e., Mekanisa and Kaliti-North shall be adopted in 1999.

Study results are given in the Attachment "Load Sharing Plan of Substations". The plan envisages that the all the transformer capacities required for the Project will be reasonable for the distribution network in Addis Ababa region and be utilizing with the existing substations appropriately until 2005. However, since the spare capacity of all the transformers will be only 6.96MW in 2005, consideration shall be made for new additional transformer for future demand after 2005 in order to make stable operation of the network.

Demand Forecast of ADD city (1994-2010)

No.	Zone	Calculation Bases (1994)			Peak Demand Forecast of Each Zone															
		Population (recorded in 1994) [person]	No. of Houses (recorded in 1994) [houses]	Demand/house (assumption in 1994) [kW/house]	Recorded				Forecast											
					1994 [MW] [MVA]	1995 [MW] [MVA]	1996 [MW] [MVA]	1997 [MW] [MVA]	1998 [MW] [MVA]	1999 [MW] [MVA]	2000 [MW] [MVA]	2001 [MW] [MVA]	2002 [MW] [MVA]	2003 [MW] [MVA]	2004 [MW] [MVA]	2005 [MW] [MVA]	2006 [MW] [MVA]	2007 [MW] [MVA]	2008 [MW] [MVA]	2009 [MW] [MVA]	2010 [MW] [MVA]
1	Zone-1 Residence Area	314,565	58,168	0.30	17.5 20.6	18.8 22.1	19.9 23.4	20.4 24.0	22.3 26.2	24.3 28.6	25.6 30.2	27.0 31.7	28.4 33.4	29.9 35.2	31.5 37.1	33.2 39.0	34.9 41.1	36.8 43.3	38.7 45.6	40.8 48.0	43.0 50.5
2	Zone-2 Residence Area	427,238	82,538	0.30	24.8 29.1	26.5 31.2	28.2 33.1	28.9 34.0	31.5 37.1	34.4 40.5	36.2 42.6	38.2 44.9	40.2 47.3	42.3 49.8	44.6 52.4	46.9 55.2	49.4 58.1	52.0 61.2	54.8 64.5	57.7 67.9	60.7 71.5
3	Zone-3 Industrial Area & Res.	380,174	75,670	0.53	40.1 47.2	43.0 50.6	45.6 53.7	46.8 55.0	51.1 60.1	55.8 65.6	58.7 69.1	61.8 72.7	65.1 76.6	68.5 80.6	72.2 84.9	76.0 89.4	80.0 94.2	84.3 99.1	88.7 104.4	93.4 109.9	98.4 115.8
4	Zone-4 Residence Area	461,313	93,392	0.30	28.0 33.0	30.0 35.3	31.9 37.5	32.7 38.4	35.7 42.0	38.9 45.8	41.0 48.2	43.2 50.8	45.5 53.5	47.9 56.3	50.4 59.3	53.1 62.5	55.9 65.8	58.9 69.3	62.0 72.9	65.3 76.8	68.7 80.9
5	Zone-5 CBD & Residence Area	434,661	80,879	0.62	50.1 59.0	53.8 63.2	57.0 67.1	58.5 68.8	63.8 75.1	69.7 82.0	73.4 86.4	77.3 90.9	81.4 95.8	85.7 100.8	90.2 106.2	95.0 111.8	100.1 117.7	105.4 124.0	111.0 130.5	116.8 137.4	123.0 144.7
6	Zone-6 Rural Residence Area	94,786	19,812	0.34	6.7 7.9	7.2 8.5	7.7 9.0	7.9 9.2	8.6 10.1	9.4 11.0	9.9 11.6	10.4 12.2	10.9 12.9	11.5 13.5	12.1 14.3	12.8 15.0	13.4 15.8	14.2 16.7	14.9 17.5	15.7 18.5	16.5 19.4
	Total	2,112,737	410,459		167.3 196.8	179.3 211.0	190.3 223.9	195.0 229.4	212.9 250.5	232.5 273.6	244.9 288.1	257.8 303.3	271.5 319.4	285.9 336.3	301.0 354.2	317.0 372.9	333.8 392.7	351.5 413.5	370.1 435.4	389.7 458.5	410.4 482.8

Remarks:

1) Population in 1994 is based on the censuses of Addis Ababa City in 1994.

2) Average power factor (PF) =0.85

3) Demand Increasing Ratio from 1998 to 1999 shall be 1.092 per year, based on the following assumptions:

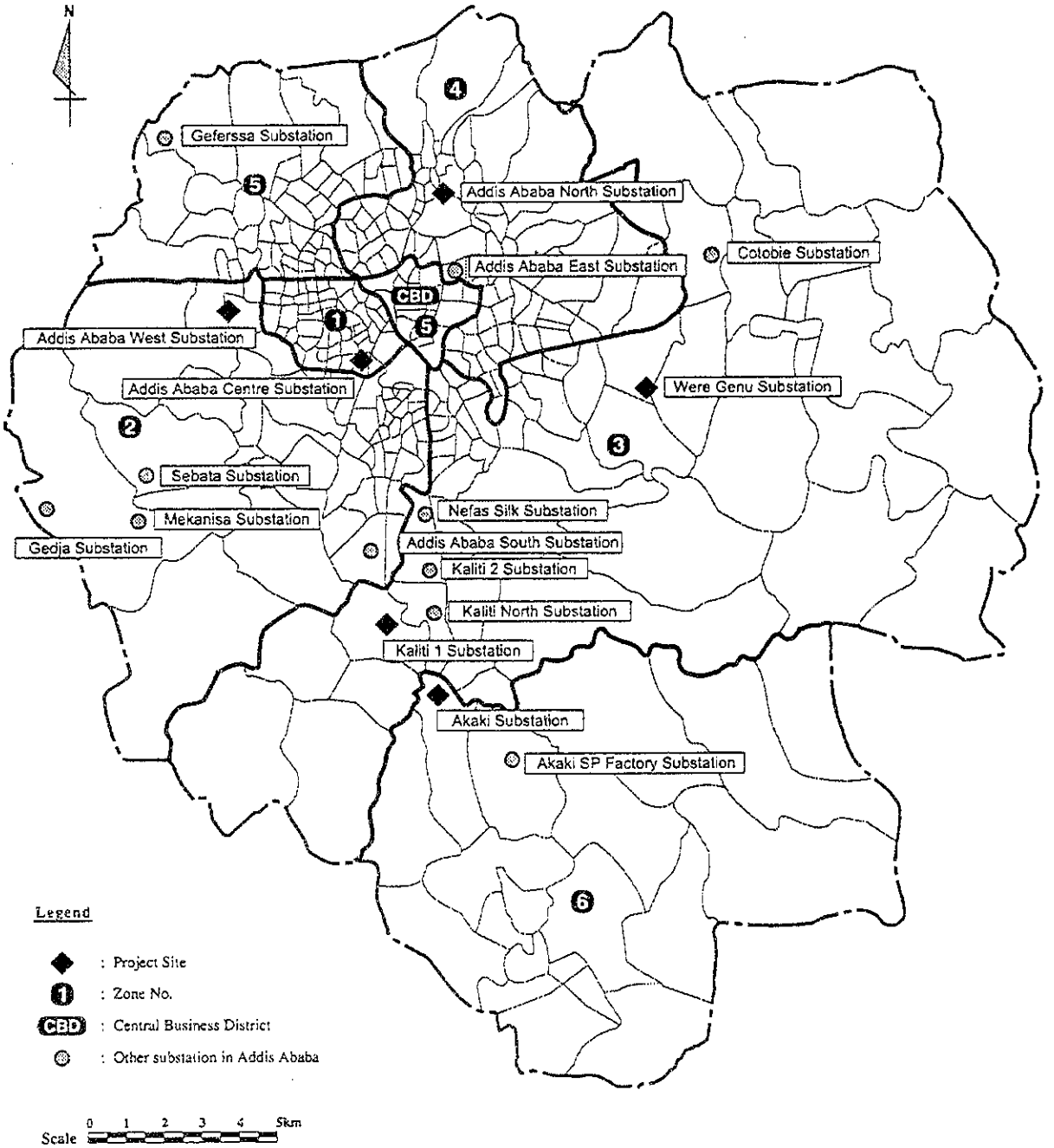
- Population increase ratio: 1.0379 per year (1994 Census)
- Power demand increase ratio per household;: 1.053 per year (average increase ratio from 1991 - 1995, EEPCO)

* 1.092=1.0379 x 1.053

4) Demand Increasing Ratio from 2000 to 2010 shall be 1.053 per year, according to the" Ethiopia Power Planing Study , Main Report" (May 1996, Acres International).

5) Demand for waiting consumers (about 7,000) shall be 2.1MW, and be included in 1998.

6) Demand for Industrial and commercial including hotel constructions shall be included in the above increasing ratio 3).


N
Geferssa Substation
Addis Ababa North Substation
Addis Ababa East Substation
Cotobie Substation
CBD
Addis Ababa West Substation
Addis Ababa Centre Substation
Were Genu Substation
Sebata Substation
Mekanisa Substation
Gedja Substation
Nefas Silk Substation
Addis Ababa South Substation
Kaliti 2 Substation
Kaliti North Substation
Kaliti 1 Substation
Akaki Substation
Akaki SP Factory Substation
1
2
3
4
5
6
Legend
: Project Site
: Zone No.
: Central Business District
: Other substation in Addis Ababa
Scale
0 1 2 3 4 5km

1. LOAD SHARING PLAN of ADD Region Substation (in 1994)

No.	Zone	Population (recorded) [person]	No. of Houses (recorded) [houses]	Demand/hous (assumed) [kW/house]	Peak Demand of each Zone (assumed) [MW] [MVA]	LOAD SHARING PLAN [MW] (Required Transfonner Capacity of 15kV line)																
							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
						Substation Name	ADC	ADE	ADN	GFS	ADW	SBT	GDJ	ADS	KLT-1	KLT-2	KLT-N	NFS	AKK-1	AKK-S	CTB	WGN	MKN	Total
						Installed Capa [MVA]	3x22	2x6	2x12	1x4	2x12	1x10	1x3	2x6	2x7.3 +10	1x22	1x20	1x25	3x3	2x6	1x20	2x20	2x25	(0
						Usable Capa [MW]	37.9	15.3	19.0	2.7	22.4	7.7	0.0	10.7	7.1	9.8	0.0	11.9	0.0	4.2	10.3	8.6	0	167.6
1	Zone-1 Residence Area	314,565	58,168	0.30	17.5	Share Factor (%)	100.0%																	100.0%
					20.6	[MW]	17.5																	17.5
2	Zone-2 Residence Area	427,238	82,538	0.30	24.8	Share Factor (%)	4.4%				64.5%	31.1%												100.0%
					29.1	[MW]	1.1				16.0	7.7												24.8
3	Zone-3 Industrial Area & Res.	380,174	75,670	0.53	40.1	Share Factor (%)								26.5%	11.1%	24.3%		29.5%				8.6%		100.0%
					47.2	[MW]								10.6	4.4	9.7		11.8				3.4		40.1
4	Zone-4 Residence Area	461,313	93,592	0.30	28.0	Share Factor (%)			52.0%												29.6%	18.4%		100.0%
					33.0	[MW]			14.6												8.3	5.2		28.0
5	Zone-5 CBD & Residence Area	434,661	80,879	0.62	50.1	Share Factor (%)	38.5%	30.5%	8.8%	5.4%	12.8%										4.0%			100.0%
					59.0	[MW]	19.3	15.3	4.4	2.7	6.4										2.0			50.1
6	Zone-6 Rural Residence Area	94,786	19,812	0.34	6.7	Share Factor (%)									38.5%					61.5%				100.0%
					7.9	[MW]									2.6					4.1				6.7
					167.3	[MW]	37.9	15.3	19.0	2.7	22.4	7.7	0.0	10.6	7.0	9.7		11.8	0.0	4.1	10.3	8.6		167.2
	Total	2,112,737	410,459		196.8	[MVA]	44.6	18.0	22.3	3.2	26.3	9.1	0.0	12.5	8.3	11.5		13.9	0.0	4.9	12.1	10.1		196.7
						Spare Capacity of TRF (MW)	0.00	0.01	0.02	0.02	0.01	0.00	0.00	0.06	0.07	0.05	0.00	0.07	0.00	0 06	0.00	0.02	0.00	0.37
																(under construction)							(under planning)	

Legend:

1 **ADC:** **ADD Center**
2 ADE: ADD East
3 **ADN:** **ADD North**
4 GFS: Geferssa
5 **ADW:** **ADD West**
6 SBT: Sabata
7 GDJ: Gedja
8 ADS: ADD South
9 **KLT-1:** **Kaliti-1**
10 KLT-2: Kaliti-2
11 KLT-N: Kaliti-Nort (Out of order)
12 NFS: Nefas-Silk
13 **AKK-1:** **Akaki-1**
14 AKK-S: Akaki SP Factory
15 CTB: Cotobie
16 **WGN:** **Were Genu**
17 MKN: Mekanisa (Under planing)

Remarks:
1) Population in 1994 is based on the censuses of Addis Ababa City in 1994.
2) PF=0.85
3) Usable capacity shows the recorded peak demand of each substation in 1994.
4) Usable Capacity of ABB North (ABN) excludes Mobile Transformer (16 MVA).
5) ABB East (ABE)substation was overlouded.

2. LOAD SHARING PLAN of ADD Region Substation (in 1997)

No.	Zone	Peak Demand of each Zone (assumed) [MW] [MVA]	LOAD SHARING PLAN [MW] [Required Transformer Capacity of 15kV line]																	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
			Substation Name	**ADC**	ADE	**ADN**	GFS	**ADW**	SBT	GDJ	ADS	**KLT-1**	KLT-2	KLT-N	NFS	**AKK-1**	AKK-S	CTB	**WGN**	MKN	Total
			Installed Capa [MVA]	3x22	2x6	2x12 +16	1x4	2x12	1x10	1x3	2x6	2x7.3 +10	1x22	1x20	1x25	3x3	2x6	1x20	2x20	2x25	0
			Usable Capa [MW]	37.9	13.0	34.1	3.5	21.1	8.2	1.4	13.3	8.3	14.9	0.0	9.8	2.7	11.8	13.7	13.2	0	206.9
1	Zone-1	20.4	Share Factor (%)	100.0%																	100.0%
	Residence Area	24.0	[MW]	20.4																	20.4
2	Zone-2	28.9	Share Factor (%)	6.0%				62.0%	28.0%	4.0%											100.0%
	Residence Area	34.0	[MW]	1.7				17.9	8.1	1.2											28.9
3	Zone-3	46.8	Share Factor (%)								28.0%	5.0%	31.0%		20.0%	4.0%			12.0%		100.0%
	Industrial Area & Res.	55.0	[MW]								13.1	2.3	14.5		9.4	1.9			5.6		46.8
4	Zone-4	32.7	Share Factor (%)			52.0%												28.0%	20.0%		100.0%
	Residence Area	38.4	[MW]			17.0												9.1	6.5		32.7
5	Zone-5	58.5	Share Factor (%)	26.8%	22.0%	29.2%	6.0%	5.0%				4.0%						7.0%			100.0%
	CBD & Residence Area	68.8	[MW]	15.7	12.9	17.1	3.5	2.9				2.3						4.1			58.5
6	Zone-6	7.9	Share Factor (%)									38.0%					62.0%				100.0%
	Rural Residence Area	9.2	[MW]									3.0					4.9				7.9
		195.0	[MW]	37.8	12.9	34.1	3.5	20.8	8.1	1.2	13.1	7.7	14.5		9.4	1.9	4.9	13.2	12.1		195.0
	Total	229.4	[MVA]	44.5	15.1	40.1	4.1	24.5	9.5	1.4	15.4	9.0	17.1		11.0	2.2	5.7	15.6	14.3		229.4
			Spare Capacity of TRF (MW)	0.09	0.14	-0.07	0.00	0.24	0.16	0.23	0.23	0.63	0.36	0.00	0.46	0.83	6.89	0.49	1.08	0.00	11.89
													(under construction)						(under planning)		

Legend:

	ADC:	**ADD Center**
2	ADE:	ADD East
3	**ADN:**	**ADD North**
4	GFS:	Geferssa
5	**ADW:**	**ADD West**
6	SBT:	Sabata
7	GDJ:	Gedja
8	ADS:	ADD South
9	**KLT-1:**	**Kaliti-1**
10	KLT-2:	Kaliti-2
11	KLT-N:	Kaliti-North
12	NFS:	Nefas-Silk
13	**AKK-1:**	**Akaki-1**
14	AKK-S:	Akaki SP Factory
15	CTB:	Cotobie
16	**WGN:**	**Were Genu**
17	MKN:	Mekanisa

Remarks:

1) Demand in 1997 is based on the demand forecast of ABB city.
2) PF=0.85
3) Usable capacity shows the recorded peak demand of each substation in 1996.
4) Usable Capacity of AKK-1 is the recorded peak demand in 1995.
4) ABE and ABS substations were overloaded.

3. LOAD SHARING PLAN of ADD Region Substation (in 1999)

No.	Zone	Peak Demand of each Zone (assumed) [MW] [MVA]	LOAD SHARING PLAN [MW] [Required Transformer Capacity of 15kV line]																	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
			Substation Name	**ADC**	ADE	**ADN**	GFS	**ADW**	SBT	GDJ	ADS	**KLT-1**	KLT-2	KLT-N	NFS	**AKK-1**	AKK-S	CTB	**WGN**	MKN	Total
			Installed Capa [MVA]	**2x31.5**	2x6	**2x25**	1x4	**1x12 1x12**	1x10	1x3	2x6	**1x7.3 +10 1x7.3**	1x22	1x20	1x25	**1x12**	2x6	1x20	2x20	2x25	0
			Usable Capa [MW]	**53.6**	13.0	**42.5**	3.5	**20.0**	8.2	1.4	13.3	**20.0**	14.9	20.0	9.8	**10.2**	11.8	13.7	13.2	42.5	311.6
1	Zone-1	24.3	Share Factor (%)	100.0%																	100.0%
	Residence Area	28.6	[MW]	24.3																	24.3
2	Zone-2	34.4	Share Factor (%)	1.0%				10.0%	20.0%	4.0%										65.0%	100.0%
	Residence Area	40.5	[MW]	0.3				3.4	6.9	1.4										22.4	34.4
3	Zone-3	55.8	Share Factor (%)								20.0%	13.0%	25.0%	25.0%	17.0%						100.0%
	Industrial Area & Res.	65.6	[MW]								11.2	7.2	13.9	13.9	9.5						55.8
4	Zone-4	38.9	Share Factor (%)			50.0%												22.0%	28.0%		100.0%
	Residence Area	45.8	[MW]			19.5												8.6	10.9		38.9
5	Zone-5	69.7	Share Factor (%)	40.0%	15.0%	21.0%	5.0%	12.0%										7.0%			100.0%
	CBD & Residence Are	82.0	[MW]	27.9	10.5	14.6	3.5	8.4										4.9			69.7
6	Zone-6	9.4	Share Factor (%)													60.0%	40.0%				100.0%
	Rural Residence Area	11.0	[MW]													5.6	3.7				9.4
		232.5	[MW]	52.6	10.5	34.1	3.5	11.8	6.9	1.4	11.2	7.2	13.9	13.9	9.5	5.6	3.7	13.4	10.9	22.4	232.5
	Total	273.6	[MVA]	61.8	12.3	40.1	4.1	13.9	8.1	1.6	13.1	8.5	16.4	16.4	11.2	6.6	4.4	15.8	12.8	26.3	273.6
			Spare capaity of TRF (MW)	0.98	2.54	8.39	0.02	8.19	1.36	0.00	2.17	12.75	0.91	6.06	0.33	4.58	8.01	0.28	2.31	20.13	79.04

Legend:

	ADC:	**ADD Center**
2	ADE:	ADD East
3	**ADN:**	**ADD North**
4	GFS:	Geferssa
5	**ADW:**	**ADD West**
6	SBT:	Sabata
7	GDJ:	Gedja
8	ADS:	ADD South
9	**KLT-1:**	**Kaliti-1**
10	KLT-2:	Kaliti-2
11	KLT-N:	Kaliti-North
12	NFS:	Nefas-Silk
13	**AKK-1:**	**Akaki-1**
14	AKK-S:	Akaki SP Factory
15	CTB:	Cotobie
16	**WGN:**	**Were Genu**
17	MKN:	Mekanisa

Remarks:

1) Demand in 1999 is based on the demand forecast of ABB city.
2) PF=0.85
3) Usable capacity shows the planned maximum peak demand of each substation.
4) Japan's grant aid project will be completed in 1999.
5) KLT-N and MKN substations shall be completed by 1999.

4. LOAD SHARING PLAN of ADD Region Substation (in 2005)

No.	Zone	Peak Demand of each Zone (assumed) [MW] [MVA]	LOAD SHARING PLAN [MW] [Required Transformer Capacity of 15kV line]																	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
			Substation Name	ADC	ADE	ADN	GFS	ADW	SBT	GDJ	ADS	KLT-1	KLT-2	KLT-N	NFS	AKK-1	AKK-S	CTB	WGN	MKN	Total
			Installed Capa [MVA]	2x31.5	2x6	2x25	1x4	1x12 1x12	1x10	1x3	2x6	1x7.3 +10 1x7.3	1x22	1x20	1x25	1x12	2x6	1x20	2x20	2x25	0
			Usable Capa [MW]	53.6	10.2	42.5	3.5	20.0	8.2	2.0	10.0	20.0	14.9	13.6	17.0	10.2	8.2	13.6	34.0	42.5	324.0
1	Zone-1	33.2	Share Factor (%)	100.0%																	100.0%
	Residence Area	39.0	[MW]	33.2																	33.2
2	Zone-2	46.9	Share Factor (%)						16.0%	4.0%					15.0%					65.0%	100.0%
	Residence Area	55.2	[MW]						7.5	1.9					7.0					30.5	46.9
3	Zone-3	76.0	Share Factor (%)								13.0%	26.0%	19.0%	17.0%		6.0%			5.0%	14.0%	100.0%
	Industrial Area & Res.	89.4	[MW]								9.9	19.8	14.4	12.9		4.6			3.8	10.6	76.0
4	Zone-4	53.1	Share Factor (%)			45.0%													55.0%		100.0%
	Residence Area	62.5	[MW]			23.9													29.2		53.1
5	Zone-5	95.0	Share Factor (%)	21.3%	10.5%	19.5%	3.5%	21.0%							10.2%			14.0%			100.0%
	CBD & Residence Are	111.8	[MW]	20.2	10.0	18.5	3.3	20.0							9.7			13.3			95.0
6	Zone-6	12.8	Share Factor (%)													40.0%	60.0%				100.0%
	Rural Residence Area	15.0	[MW]													5.1	7.7				12.8
		317.0	[MW]	53.4	10.0	42.4	3.3	20.0	7.5	1.9	9.9	19.8	14.4	12.9	16.7	9.7	7.7	13.3	33.0	41.1	317.0
	Total	372.9	[MVA]	62.8	11.7	49.9	3.9	23.5	8.8	2.2	11.6	23.2	17.0	15.2	19.7	11.4	9.0	15.7	38.8	48.4	372.9
			Spare Capacity of TRF (MW	0.13	0.22	0.08	0.18	0.04	0.73	0.12	0.12	0.24	0.41	0.68	0.27	0.53	0.54	0.30	1.00	1.36	6.96

Legend:

	ADC:	**ADD Center**
2	ADE:	ADD East
3	**ADN:**	**ADD North**
4	GFS:	Geferssa
5	**ADW:**	**ADD West**
6	SBT:	Sabata
7	GDJ:	Gedja
8	ADS:	ADD South
9	**KLT-1:**	**Kaliti-1**
10	KLT-2:	Kaliti-2
11	KLT-N:	Kaliti-North
12	NFS:	Nefas-Silk
13	**AKK-1:**	**Akaki-1**
14	AKK-S:	Akaki SP Factory
15	CTB:	Cotobie
16	**WGN:**	**Were Genu**
17	MKN:	Mekanisa

Remarks:

1) Demand in 1999 is based on the demand forecast of ABB city.
2) PF=0.85
3) Usable capacity shows the planned maximum peak demand of each substation.
4) Japan's grant aid project will be completed in 1999.
5) KLT-N and MKN substations shall be completed by 1999.
6) No.2 Transformer of WGN substation shall be taken into operation in 2005.

5. LOAD SHARING PLAN of ADD Region Substation (in 2010)

No.	Zone	Peak Demand of each Zone (assumed) [MW] [MVA]	LOAD SHARING PLAN [MW] [Required Transformer Capacity of 15kV line]																	
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
			Substation Name	**ADC**	ADE	**ADN**	GFS	**ADW**	SBT	GDJ	ADS	**KLT-1**	KLT-2	KLT-N	NFS	**AKK-1**	AKK-S	CTB	**WGN**	MKN	Total
			Installed Capa [MVA]	**2x31.5**	2x6	**2x25**	1x4	**1x12 1x12**	1x10	1x3	2x6	**1x7.3 +10 1x7.3**	1x22	1x20	1x25	**1x12**	2x6	1x20	2x20	2x25	0
			Usable Capa [MW]	**53.6**	10.2	**42.5**	3.5	**20.0**	8.2	2.0	10.0	**20.0**	14.9	13.6	17.0	**10.2**	8.2	13.6	34.0	42.5	324.0
1	Zone-1	43.0	Share Factor (%)	100.0%																	100.0%
	Residence Area	50.5	[MW]	43.0																	43.0
2	Zone-2	60.7	Share Factor (%)						16.0%	4.0%					15.0%					65.0%	100.0%
	Residence Area	71.5	[MW]						9.7	2.4					9.1					39.5	60.7
3	Zone-3	98.4	Share Factor (%)								13.0%	26.0%	19.0%	17.0%		6.0%			5.0%	14.0%	100.0%
	Industrial Area & Res.	115.8	[MW]								12.8	25.6	18.7	16.7		5.9			4.9	13.8	98.4
4	Zone-4	68.7	Share Factor (%)			45.0%													55.0%		100.0%
	Residence Area	80.9	[MW]			30.9													37.8		68.7
5	Zone-5	123.0	Share Factor (%)	21.5%	10.5%	19.5%	3.5%	21.0%							10.0%			14.0%			100.0%
	CBD & Residence Are	144.7	[MW]	26.5	12.9	24.0	4.3	25.8							12.3			17.2			123.0
6	Zone-6	16.5	Share Factor (%)													40.0%	60.0%				100.0%
	Rural Residence Area	19.4	[MW]													6.6	9.9				16.5
		410.4	[MW]	69.4	12.9	54.9	4.3	25.8	9.7	2.4	12.8	25.6	18.7	16.7	21.4	12.5	9.9	17.2	42.7	53.3	410.4
	Total	482.8	[MVA]	81.7	15.2	64.6	5.1	30.4	11.4	2.9	15.0	30.1	22.0	19.7	25.2	14.7	11.7	20.3	50.3	62.7	482.8
			Spare Capacity of TRF (MW	-15.86	-2.72	-12.42	-0.80	-5.84	-1.48	-0.43	-2.79	-5.58	-3.84	-3.13	-4.41	-2.31	-1.72	-3.62	-8.73	-10.76	-86.44

Legend:

	ADC:	**ADD Center**
2	ADE:	ADD East
3	**ADN:**	**ADD North**
4	GFS:	Geferssa
5	**ADW:**	**ADD West**
6	SBT:	Sabata
7	GDJ:	Gedja
8	ADS:	ADD South
9	**KLT-1:**	**Kaliti-1**
10	KLT-2:	Kaliti-2
11	KLT-N:	Kaliti-North
12	NFS:	Nefas-Silk
13	**AKK-1:**	**Akaki-1**
14	AKK-S:	Akaki SP Factory
15	CTB:	Cotobie
16	**WGN:**	**Were Genu**
17	MKN:	Mekanisa

Remarks:

1) Demand in 1999 is based on the demand forecast of ABB city.
2) PF=0.85
3) Usable capacity shows the planned maximum peak demand of each substation.
4) Japan's grant aid project will be completed in 1999.
5) KLT-N and MKN substations shall be completed by 1999.
6) No.2 Transformer of WGN substation shall be taken into operation in 2005.