4. Minutes of Discussions

4-1	Minutes of Discussion	March 8, 1996	11
4-2	Technical Notes	March 25, 1996	27
4-3	Minutes of Discussion	May 29, 1996	37

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON THE PROJECT FOR RURAL ELECTRIFICATION FOR ASESEWA AND YEJI AREAS IN THE REPUBLIC OF GHANA

In response to a request from the Government of the Republic of Ghana, the Government of Japan decided to conduct a Basic Design Study on the Project for Rural Electrification for Asesewa and Yeji Areas (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA has sent to Ghana a Study Team (hereinafter referred to as "the Team") headed by Mr. Hayao Adachi, Development Specialist, JICA, and is scheduled to stay in the country from February 21 to April 2, 1996.

The Team held a series of discussions with the officials concerned of the Government of Ghana and conducted a field survey at Project sites.

As a result of discussions and field survey, both sides have agreed and confirmed the main items described on the attached sheets.

Accra, March 8, 1996

Mr. Hayao Adachi
Leader
Basic Design Study Team
JICA

Dr. William Adote
Director
International Economic Relations
Division
Ministry of Finance

WITNESSES

Dr. Joe Oteng-Adjei
Ag. Director of Power
Ministry of Mines & Energy

Mr. J. S. Okpoti
Deputy Chief Executive
Volta River Authority

Mr. John K. Hagan
Managing Director
Electricity Corporation of Ghana

ATTACHMENT

1. Objective

The objective of the Project is to increase the standard of living of the inhabitants and to promote circulation of agricultural and fishery products through the electrification of the Project area, based on the National Electrification Scheme of the Government of Ghana, hence contributing to socioeconomic development of the nation.

2. Project site

The Project sites are located on the west bank area of Volta Lake, such as in the vicinity of Asesewa, one of market centers in the Eastern Region, and of Yeji, a community fishery center in the Brong-Ahafo Region, as presented in ANNEXES I-(1) and I-(2), respectively.

3. Executing Organization

The Ministry of Energy and Mines is responsible for the coordination of the implementation of the Project. The Electricity Corporation of Ghana (ECG) and the Volta River Authority (VRA) are responsible for the execution of the Project.

4. Major items requested by the Government of Ghana

As a result of a series of discussions with the Team, the Government of Ghana finally requested the items as described in the ANNEX II.

5. Japan's Grant Aid System

The Ghanaian side has understood the system of Japan's Grant Aid as explained in ANNEX III.

6. Necessary Measures to be taken by the Government of Ghana

The Government of Ghana shall take necessary measures as described in ANNEX IV for the smooth implementation of the Project, on condition that the Grant Aid by the Japanese Government is extended to the Project.

7. Schedule of the Basic Design Study

(1) The Team will proceed with further studies in Ghana until April 2, 1996.

(2) JICA will prepare the draft final report of the Basic Design Study in English and dispatch a mission to explain its contents by June 1996.

(3) In case the content of the draft report is accepted in principle by the Government of Ghana, JICA will complete a final report and send it to the Government of Ghana by August 1996.

8. Major Points of Discussions

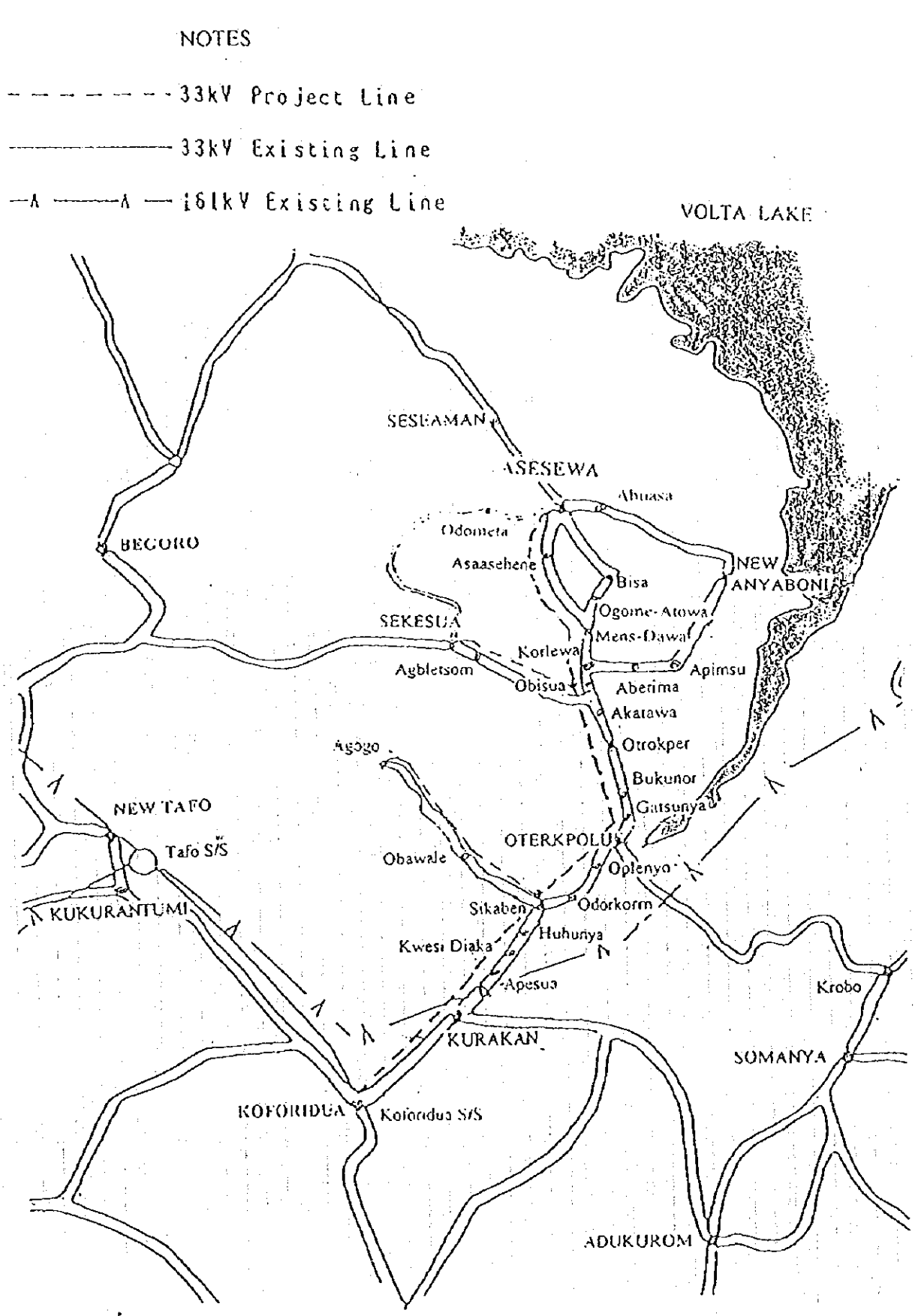
(1) Both sides agreed that the request for the construction of 30km of 33KV line and low voltage distribution network between Worawora and Kwamekrom should be excluded from the final request, since the Government of Ghana has decided to implement the electrification in the area through other funds. In the course of the discussion, the Ghanaian side proposed to replace this request with the electrification of areas between Worawora and Dambai also in the same area of the Volta Region. The Basic Design Team however explained that this substitution would not be possible. Both parties therefore agreed to exclude this proposal from the final request.

(2) The Team observed that the capacity of a 161/11KV transformer in VRA's New Tafo substation was not enough for the electrification of the Asesewa area. The Ghanaian side agreed that a 161/33KV transformer of 33MVA capacity would be newly installed by the Ghanaian side in due course.

(3) The Ghanaian side agreed that the low-voltage distribution network shall be implemented by the Ghanaian side. However, the Ghanaian side requested that the equipment and materials for the basic lines of the low-voltage distribution network and for the initial penetration into customer premises should be provided in the scope of the Japan's Grant Aid. The Team replied that the necessary equipment and materials, to be provided in the scope of Grant Aid, for the low-voltage distribution network and for the initial penetration would be studied in the Basic Design Study.

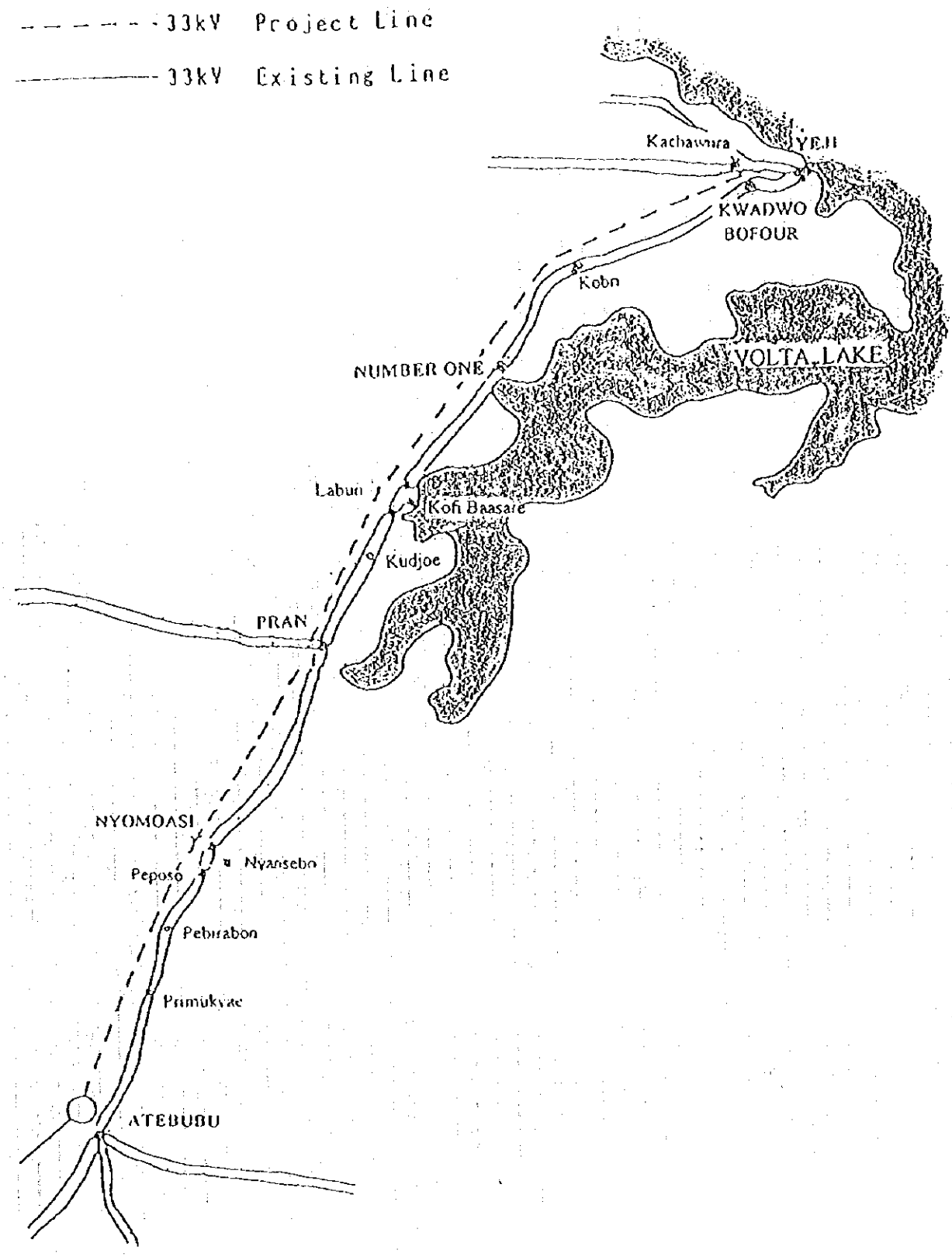
(4) Both sides understood that the Project at this stage emphasizes on enhancement of economic activities. However, it was also recognized that the inhabitants' living standard in remote villages should be incidentally lifted up by extending the network within the economic limitation. The Ghanaian side gave its priorities as in the attachment of ANNEX II. The Team agreed that the priorities given in ANNEX II would be examined in the Scope of the Basic Design Study.

(5) The Ghanaian side requested some counterpart engineers to be trained in Japan. The Team replied that an official request should be submitted to the Government of Japan.



ANNEX. I - (1)

Electricity grid extension from Koforidua to Asesewa in the Eastern Region



ANNEX. I - (2)

Electricity grid extension from Atebubu to Yeji

in the Brong Ahafo Region

ANNEX II-(1)

Items requested by the Government of Ghana:

1. Asesewa Electrification

(1) Construction of about 96km of 33KV line

(2) Supply and installation of substation equipment

(3) Supply of materials and equipment for low voltage network for the towns and villages proposed as shown in ANNEX II-(2)

2. Yeji Electrification

(1) Construction of about 80km of 33KV line

(2) Supply of materials and equipment for low voltage network for the towns and villages proposed as shown in ANNEX II-(2)

3. Others

Supply of vehicles, tools, measuring and testing instruments for construction and future maintenance work for the facilities under the Project

ANNEX II-(2)

Towns and villages proposed to be electrified are;

1. Asesewa Area

Towns/Villages	Population('84)	Number of Houses('84)	Priority
Asesewa	6,391	569	A
Abuasa	366	39	B
Odometa	1,179	168	A
Asaasehene.	459	44	B
Ogome-Atowa	289	49	B
Bisa	548	91	A
Mensa-Dawa	100	20	B
Korlewa	111	14	B
Abetima	507	57	A
Apimsu	323	50	B
Anyaboni	1,552	637	A
Obisua	75	14	C
Agbletsom	-	-	C
Sekesua	2,338	275	A
Akatawia	370	65	B
Otrokper	668	94	A
Bukunor	422	60	B
Gatsunya	-	-	C
Oterkpolu	1,394	200	B
Oplenyo	567	42	B
Odorkorm	233	24	A
Sikaben	-	-	C
Obawale	-	-	C
Agogo	993	93	A
Huhunya	1,218	137	A
Kwasi Diaka	26	4	C
Apesua	600	67	A

2. Yeji Area

Towns/Villages	Population('84)	Number of Houses('84)	Priority
Yeji	11,144	679	A
Kwadwo Bofour	686	62	A
Kachawura	246	31	B
Kobri	775	96	A
Number One	1,881	227	A
Labun	-	-	C
Kudjoe	-	-	C
Kofi Baasare	-	-	C
Pran	5,654	402	A
Nyomoasi	-	-	C
Nyansebo	73	12	C
Peposo	127	17	B
Pebirabon	218	27	B
Primukyae	62	11	C

ANNEX III

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 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)

a) 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.

b) 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 Ghana on condition that the Japan's Grant Aid is extended:

1. To provide necessary data and information for the conduct of the study,

2. To secure the land necessary for sites of the Project,

3. To provide lands for temporary site offices, warehouses and stockyards during the construction period,

4. To clear, level and reclaim the sites prior to the commencement of the construction,

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

6. To bear advising commission of Authorization to Pay (A/P) and payment commission to Japanese foreign exchange bank for the banking service based on Banking Arrangement (B/A),

7. To ensure prompt execution for unloading, tax exemption and customs clearance at the port of disembarkation,

8. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in Ghana with respect to the supply of the products and services under the verified contracts,

9. To accord Japanese nationals, whose services may be required in connection with the supply of products and the services under the verified contracts, such facilities as may be necessary for their entry into Ghana and stay therein for the execution of the Project,

10. To provide necessary permissions, licenses and other authorization for carrying out the Project,

11. To take necessary actions to expedite the approval for execution of the Project by authorities concerned in the Government of Ghana,

12. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant Aid,

13. To bear all expenses other than those covered by the Grant Aid, necessary for construction of the facilities as well as for the transportation and the installation of the equipment,

14. To construct the low-voltage distribution networks and lead-in lines into each consumer,

15. To replace the transformer and its auxiliaries at New Tafo substation prior to the commencement of actual operation of the Project,

16. To coordinate and solve any issues related to the Project, which may be raised from third parties and inhabitants in the Project area during implementation of the Project, and

17. To take necessary measures against and responsibility for the interruption of electricity transmission during implementation of the Project.

TECHNICAL NOTES
BASIC DESIGN STUDY ON THE PROJECT FOR RURAL ELECTRIFICATION FOR ASESEWA AND YEJI AREAS IN THE REPUBLIC OF GHANA

The Basic Design Study Team dispatched by Japan International Cooperation Agency (JICA) had a series of discussions with the authorities of the Government of the Republic of Ghana and conducted field surveys in the Project sites.

As a result of the discussions and field surveys, both parties have confirmed the main technical items described on the attached sheets.

Confirmed and signed on 29th March, 1996.

Mr. T. Ichikawa
Chief Consultant
Basic Design Study Team

Dr. Joe Oteng-Adjei
Ag. Director of Power
Ministry of Mines & Energy

WITNESSES

Mr. F.R.L. Lawson
Manager
Electricity Corporation of Ghana

Mr. Amoako-Baah
Sr. Electrical Engineer
Volta River Authority

ATTACHMENT

1. General

(1) Organization for the carrying out of the Project is as shown on Fig. 1.

(2) Site stockyards at Asesewa and Yeji should be provided by ECG and VRA.

(3) 33kV line route survey and acquisition of the right of way are under responsibility of ECG and VRA. The result of line route survey will be submitted by the time of signing of Exchange of Notes between both Governments.

(4) Supply of materials for low voltage network from the grant aid would not include wooden poles.

2. Asesewa Electrification

(1) Replacement of the main transformer (161/11kV 10MVA to 161/33kV 33MVA) and expansion of 33kV switchyard in Tafo substation will be carried out by VRA and ECG respectively as shown on Fig. 2.

(2) 33kV line route is selected as per Fig. 3 by considering to minimize future problems such as voltage drop, power loss or voltage fluctuation.

(3) Power supply point for 33kV Asesewa line is to be the new 33kV feeder bay in ECG's switchyard in Tafo substation, however, completion time of the expansion work may possibly be later than the completion of this project. Therefore tentative supply point is to be at the first steel tower of existing Koforidua line and temporary T-off will be made from the tower to the first structure of Asesewa line by overhead line as shown on Fig. 4. This temporary T-off arrangement is to be included in the Japanese project scope. After completion of switchyard expansion, ECG will remove the tentative overhead connection and make new connection between feeder bay and Asesewa line.

(4) Road repairing works are needed to enhance construction and provide access for future

maintenance in some portions of the 33kV line route between Simlesi and Agogo. The necessary road repairs will be done by ECG.

3. **Yeji Electrification**

(1) Yeji area is to be electrified by extension of 33kV line from Atebubu. The new 33kV line route is as shown on Fig. 6. Locations of the pole mounted transformers to be installed are shown on Fig. 7.

(2) Voltage booster station will be constructed at the suitable place between Ejura and Atebubu. Capacity of the voltage regulating transformer and the exact place to install the equipment will be decided after detailed examination and calculation in Japan. Final result will be explained at the next visit scheduled by June 1996.

(3) It is necessary to consider applying the fireproof line support structure e.g. lattice tower, steel pole or concrete pole. This would be funded by the grant aid.

(4) The Ghanaian side made a request that the seven towns along the Yeji line route which were left out should be covered as part of the grant aid project. This is in line with Government Policy that all community along the supply line route should be connected to the national electricity grid.

Fig. 1 PROJECT IMPLEMENTING ORGANIZATION

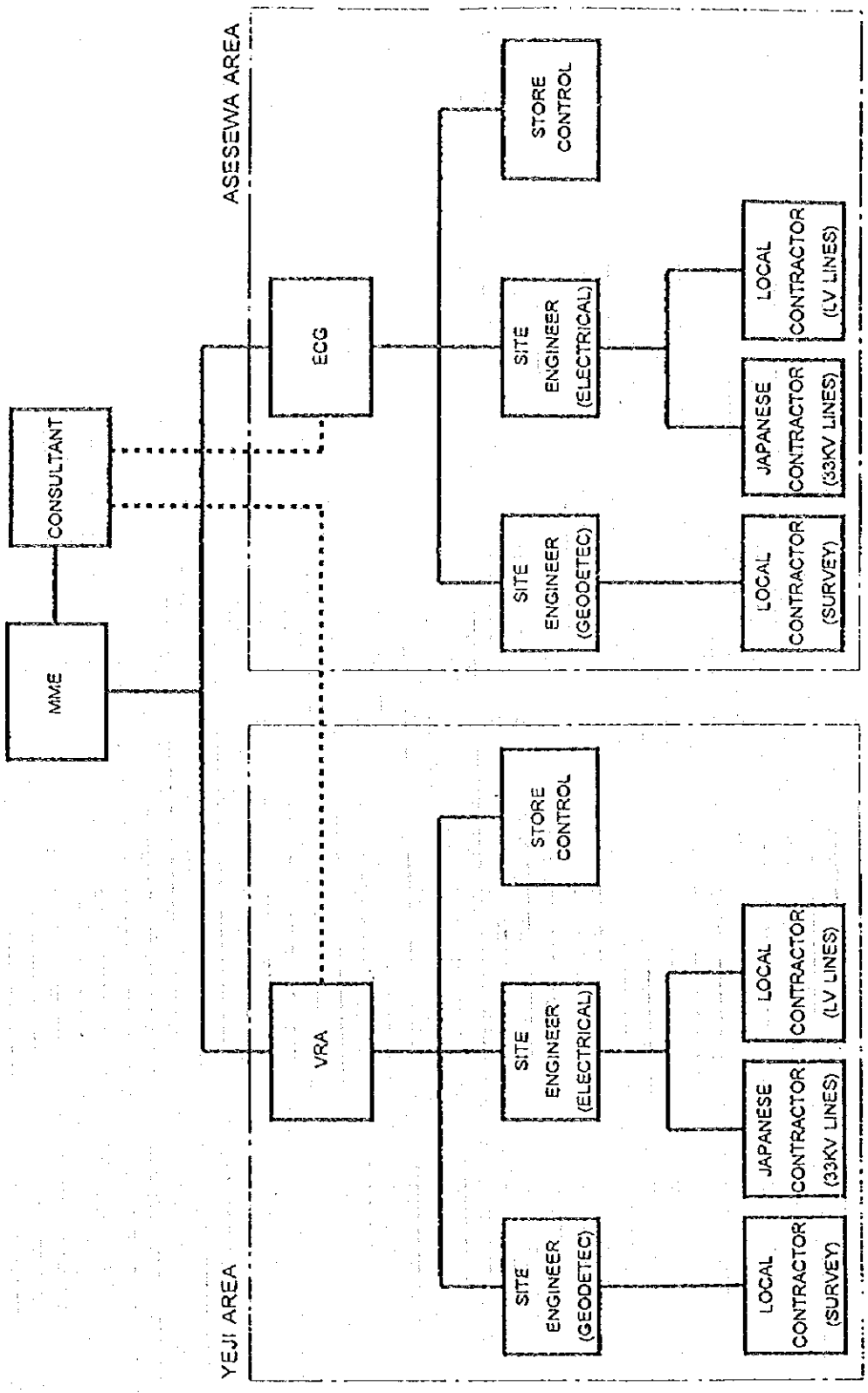
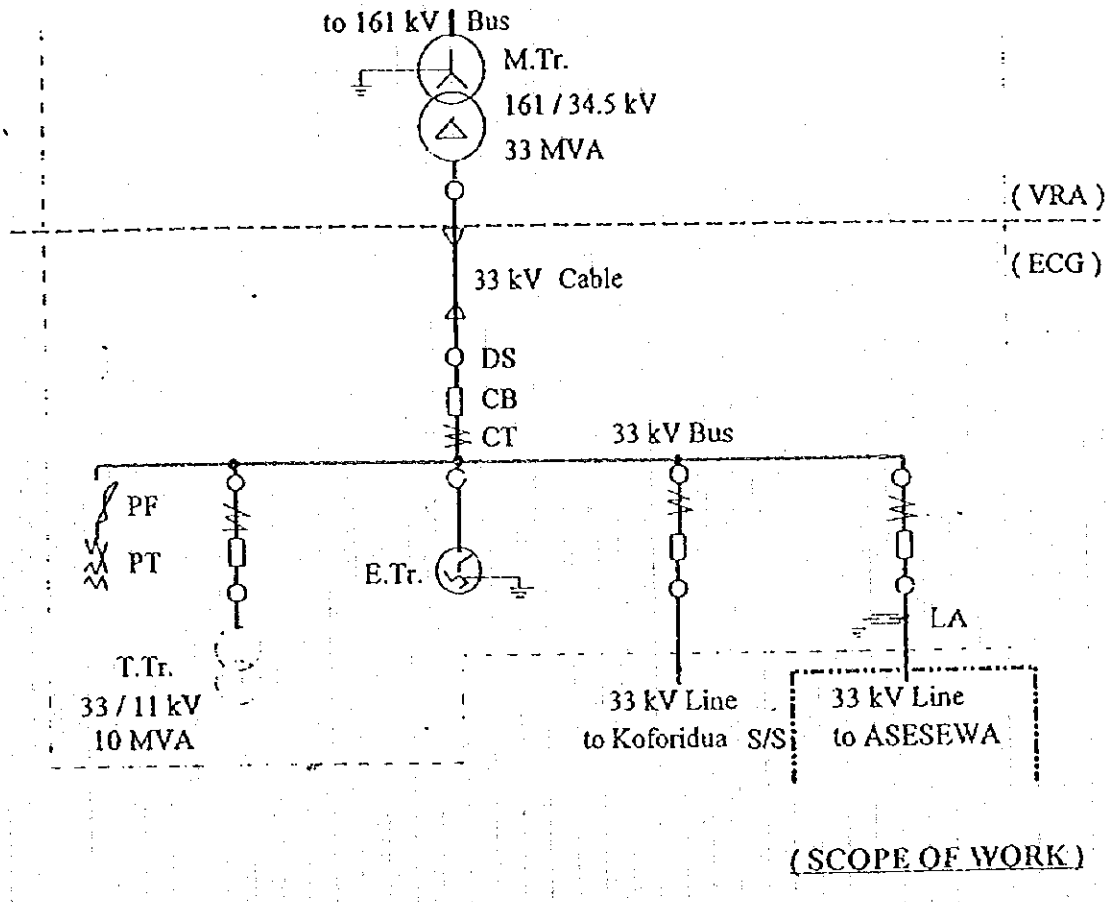


Fig. 2. SINGLE LINE DIAGRAM OF NEW TAFO SUBSTATION



Note : New Tafo substation will be prepared by VRA and ECG.

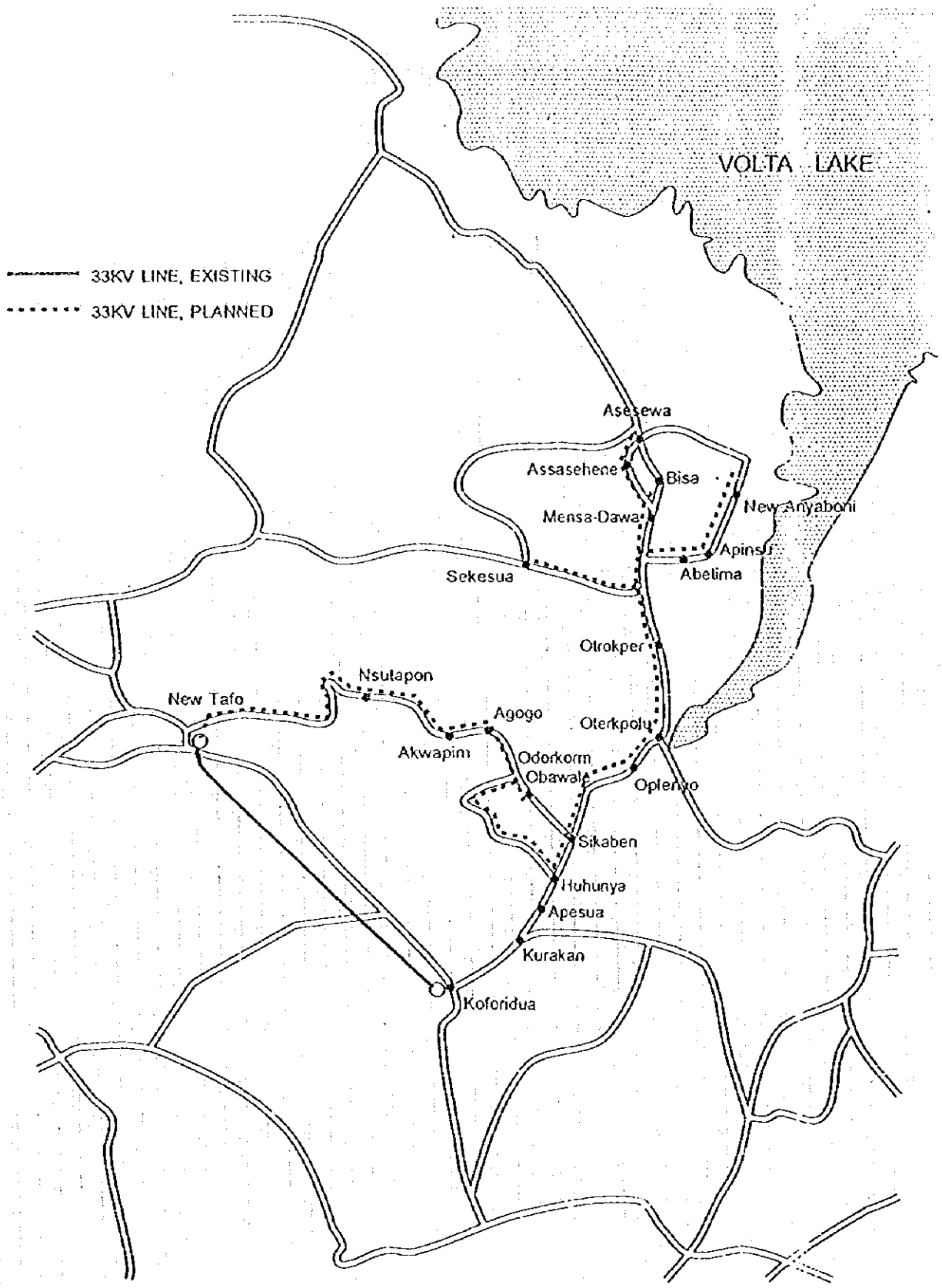


Fig. 3 ELECTRICITY GRID EXTENSION
NEW TAFO - ASESEWA

Fig. 4 SINGLE LINE DIAGRAM OF TAFO SUBSTATION

(in case of connection to the existing line)

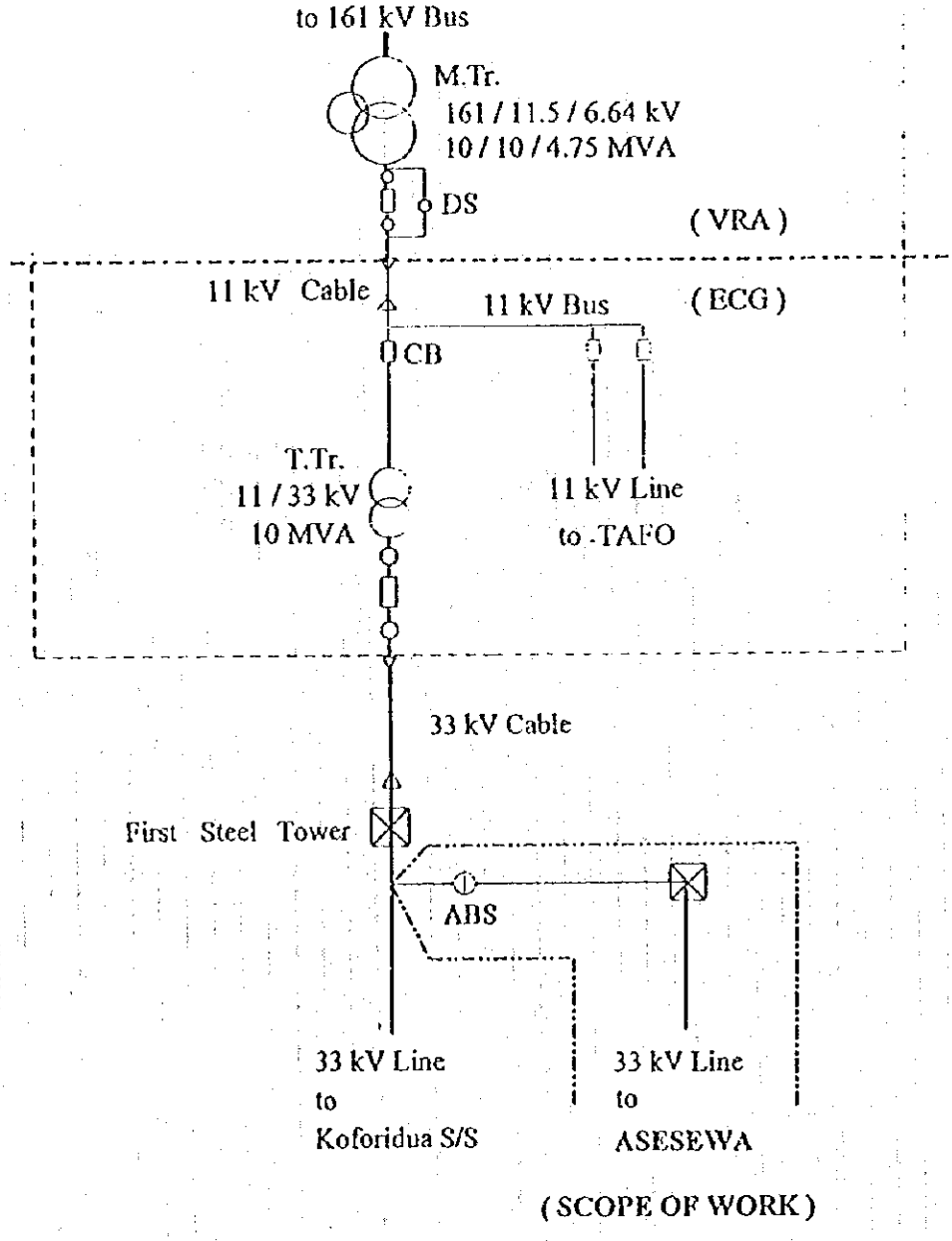
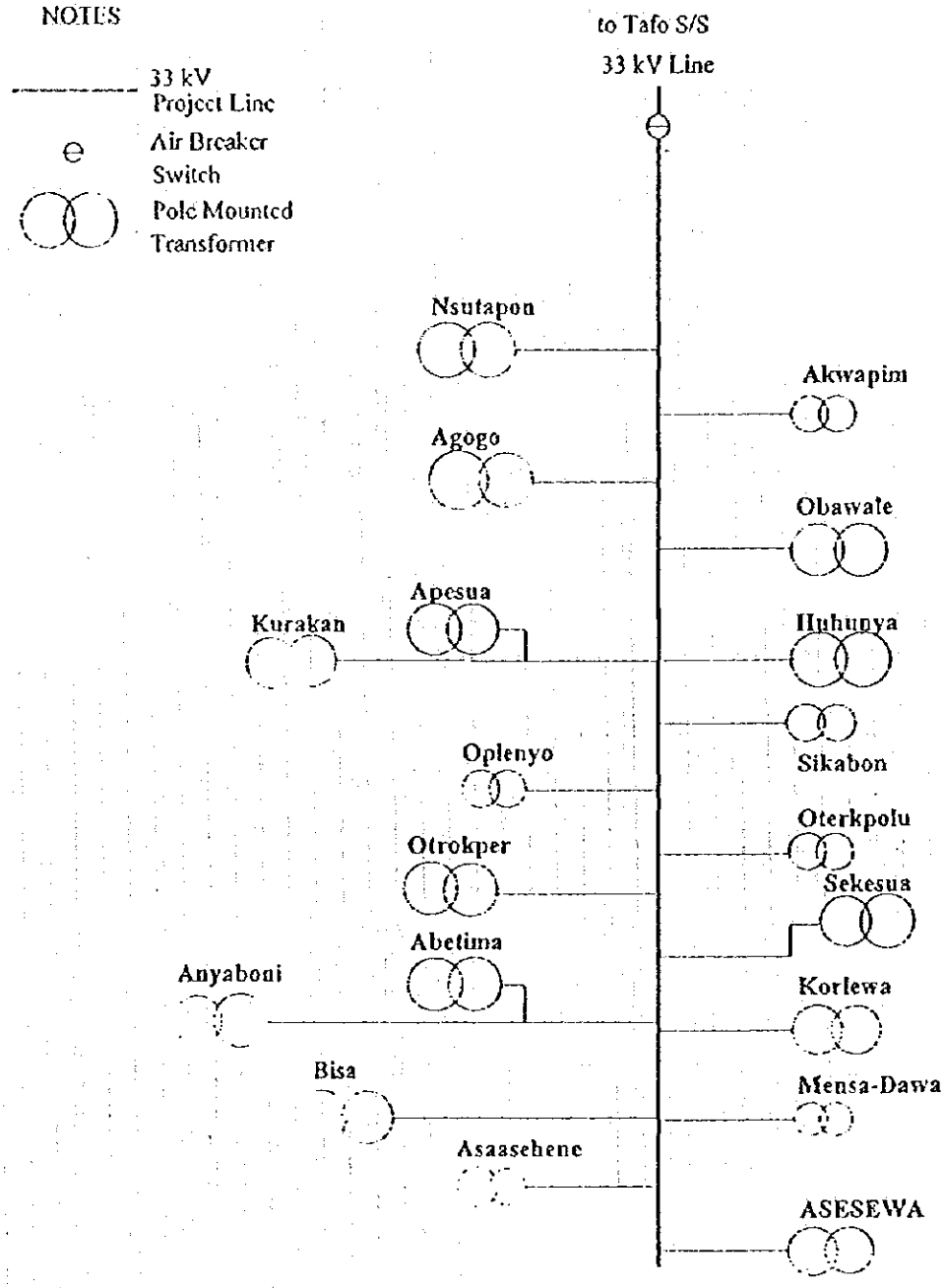


Fig. 5 ASESEWA Area Electrification

Tafo S/S ~ Asesewa

(33 kV Line Length ≒ 96 km)



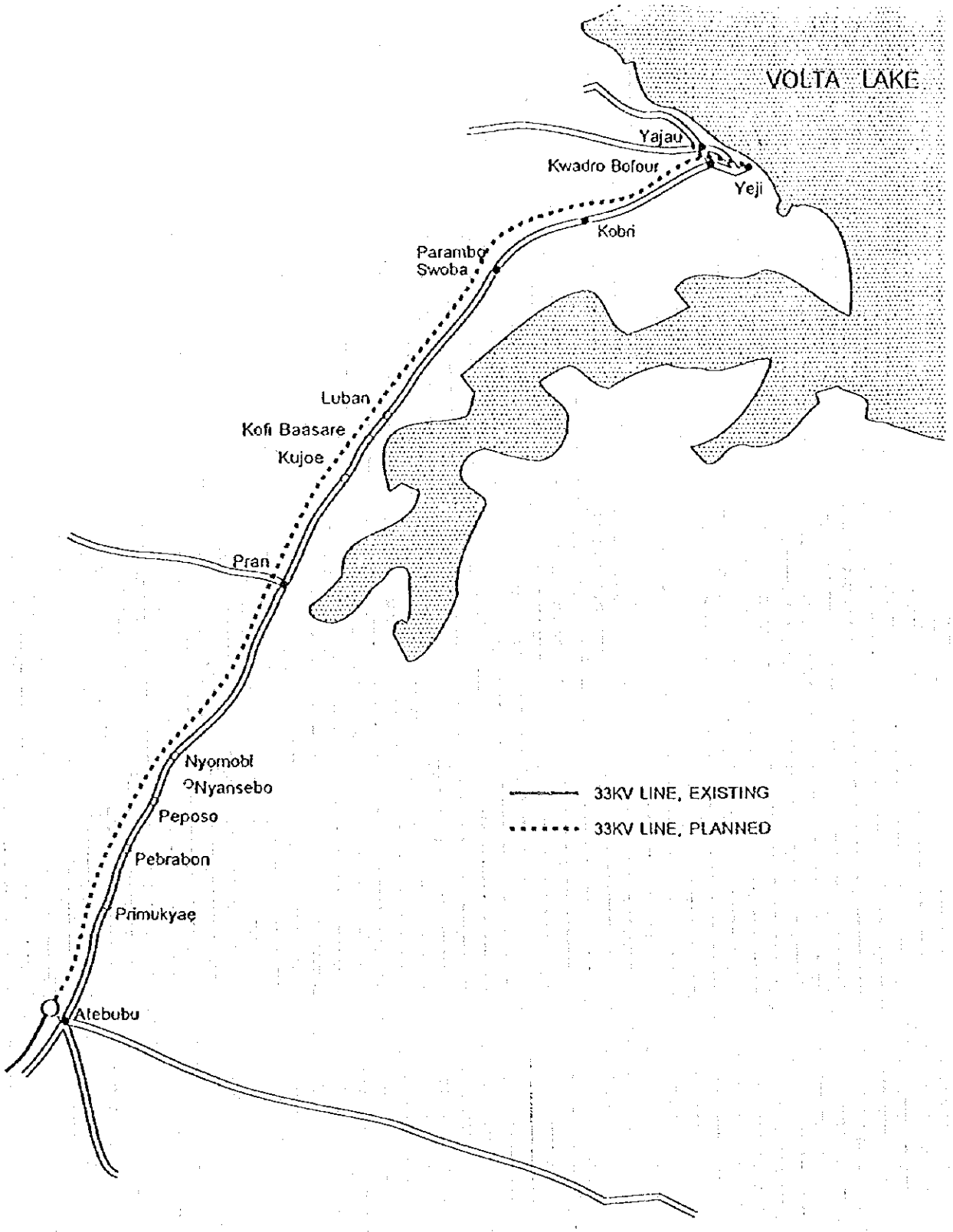
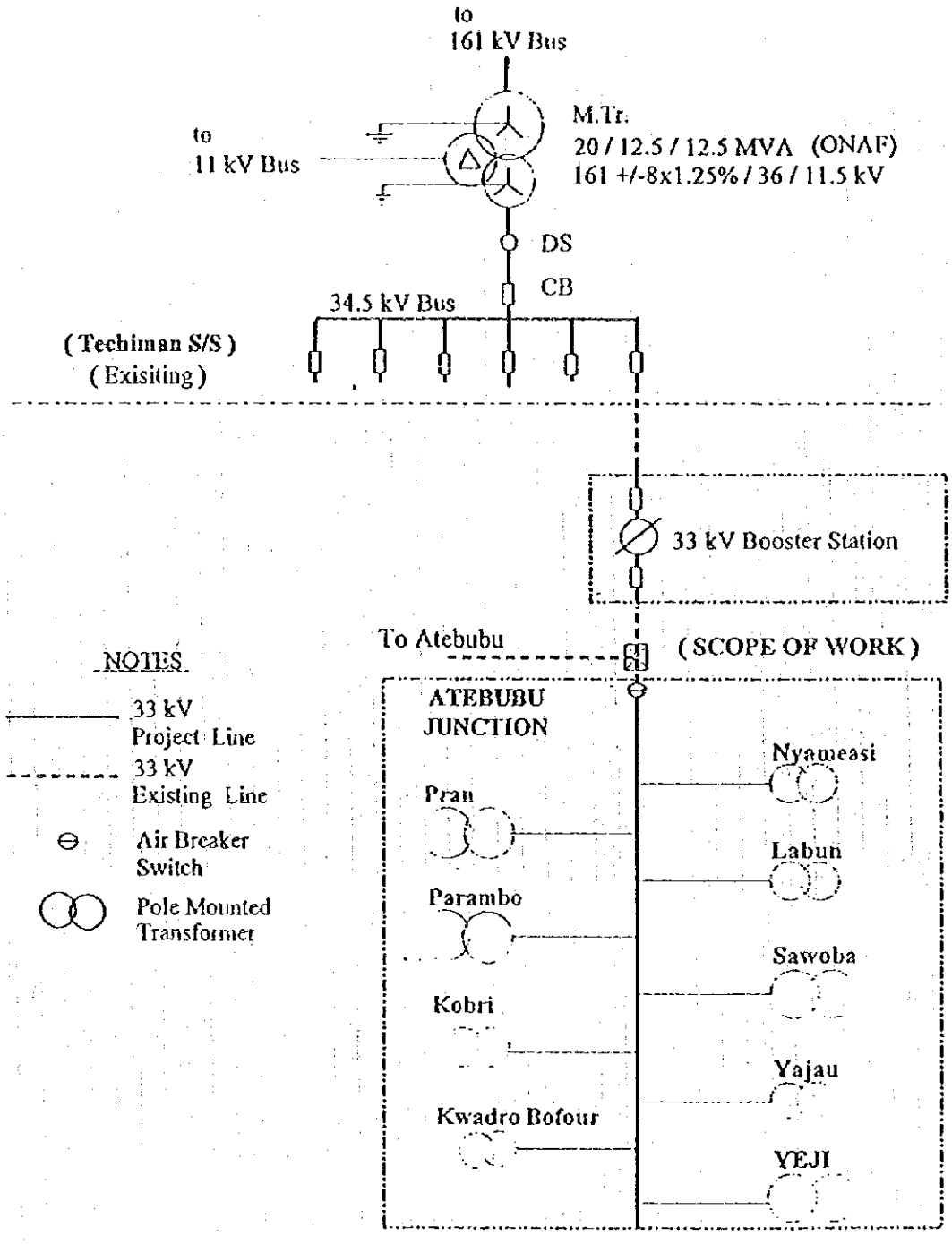


Fig. 6 ELECTRICITY GRID EXTENSION
ATEBUBU - YEJI

Fig. 7 YEJI Area Electrification

Atebubu ~ Yeji

(33 kV Line Length : 80 km)



MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON THE PROJECT FOR RURAL ELECTRIFICATION FOR ASESEWA AND YEJI AREAS IN THE REPUBLIC OF GHANA

In February 1996, the Japan International Cooperation agency (JICA) dispatched a Basic Design Team on the Project for Rural Electrification for Yeji and Asesewa Areas (hereinafter called to as "the Project") to Ghana, and through discussions, field survey, and technical examination of the results in Japan, JICA has prepared a Draft Basic Design Report of the Study.

In order to explain and to consult Ghana on the components of the Draft Basic Design Report, JICA sent to Ghana a Draft Basic Design Report Explanation Team, headed by Mr. Hayao ADACHI, Development Specialist, JICA, from 22 to 29 of May, 1996.

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

Accra, May 29, 1996

Mr. Hayao Adachi
Leader
Basic Design Study Team
JICA

Dr. William Adote
Director
International Economic Relations Division
Ministry of Finance

WITNESSES

Mr. Leo Derkyi
Director, Administration
Ministry of Mines & Energy

Mr. G.O. Dokyi
Deputy Chief Executive (E&O)
Volta River Authority

Mr. John K. Hagan
Managing Director
Electricity Corporation of Ghana

ATTACHMENT

1. Components of Draft Report

The Government of Ghana has agreed and accepted in principle the components of the Draft Basic Design Report explained by the Team.

2. Japan's Grant Aid System

(1) The Government of Ghana has understood the system of Japan's Grant Aid Scheme described in ANNEX I explained by the Team.

(2) The Government of Ghana will take necessary measures, described in ANNEX II, for smooth implementation of the Project on condition that Japan's Grant Aid 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 Ghana in and around July 1996.

4. Other Relevant Issues

(1) The Government of Ghana shall establish field offices with appropriate staff and budget in Asesewa area and Yeji area for the administration of construction in the Project and the maintenance after the construction

(2) The Government of Ghana shall secure the land for Voltage Compensating Station in the vicinity of Atebubu.

(3) The Government of Ghana shall survey and clear 33 kV line route in due course

(4) Road repairing works are needed to enhance construction and provide access for future maintenance in some portions of the 33kV line route between Sindest and Agogo. The necessary road repairs will be done by the Government of Ghana

(5) Supply of materials for low voltage network from the grant aid would not include low voltage wooden poles.

(6) The Ghanaian side requested to increase the number of pickup trucks due to the wide area of the project site. The Ghanaian side also requested that instead of single cabin pickup trucks double cabin 4WD pickup trucks shall be provided. The Team took note of the request.

(7) The Ghanaian side requested some counterpart engineers to be trained in Japan. The Team replied that an official request should be submitted to the Government of Japan.

ANNEX I

ON JAPAN'S GRANT AID PROGRAM

1. Japan's Grant Aid Procedures after the Study

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

- **Study** (Preliminary Study / Basic Design Study conducted by JICA)
- **Appraisal & Approval** (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
- **Determination of Implementation** (The Notes exchanged between the both Governments)
- **Implementation** (Implementation of the Project)

(2) The Government of Japan appraises to see whether or not the Project is suitable for Japan's Grant Aid Program, based on the Basic Design Study Report prepared by JICA and the results are then submitted for approval by the Cabinet.

The project, approved by the Cabinet becomes official when pledged by the Exchange of Notes signed by the two Governments.

Finally, for the implementation of the project, JICA assists the recipient country in preparing contracts and so on.

2. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds needed to procure facilities, equipment and services for economic and social development of the country under the following principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not in principle [illegible]

(2) Exchange of Notes (E/N)

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

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

(4) Under the Grant, in principle, products and services of origins of Japan or the recipient country are to be purchased

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

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

(5) Necessity of the "Verification"

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

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

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

1) to secure land necessary for the sites of the project and to clear and level the land prior to commencement of the construction work.
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 installation work in case the Project is providing 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 their operation and maintenance as well as to bear all the expenses other than those to be borne by the Grant Aid.

(8) "Re-export"

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

(9) Banking Arrangements (B/A)

1) The Government of the recipient country or its designated authority shall 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 contracts verified.

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 Ghana on condition that Japan's Grant Aid is extended;

1. To secure the sites for the Project,

2. To clear, level and reclaim the sites prior to the commencement of the construction,

3. To provide lands for temporary site offices, warehouses and stockyards during the construction period.

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

5. To exempt taxes and to take necessary measures for customs clearance of the materials and equipment brought for the Project at the port of disembarkation.

6. To bear advising commission of Authorization to Pay (A/P) and payment commission to Japanese foreign exchange bank for the banking service based on Banking Arrangement (B/A).

7. To ensure prompt execution for unloading, tax exemption and customs clearance at the port of disembarkation.

8. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Ghana with respect to the supply of the products and services under the verified contracts.

9. To accord Japanese nationals, whose services may be required in connection with the supply of products and the services under the verified contracts, such facilities as may be necessary throughout duration of their work.

10. To provide necessary permissions, licenses and other authorization for carrying out the

Project,

11. To take necessary actions to expedite the approval for execution of the Project by authorities concerned in the Government of Ghana,

12. To use and maintain properly and effectively all the facilities constructed and equipment purchased under the Grant,

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

14. To construct the low-voltage distribution networks and lead-in lines into each consumer,

15. To replace the transformer and its auxiliaries at New Tafo substation prior to the commencement of actual operation of the Project,

16. To coordinate and solve any issues related to the Project, which may be raised from third parties and inhabitants in the Project area during implementation of the Project,

17. To take necessary measures against and responsibility for the interruption of electricity transmission during implementation of the Project, and

18. To obtain exemption from payment of pre-shipment inspection fee.

5. Cost Estimation Borne by the Government of Ghana

(Unit: Million Cedis)

Item	Asesewa	Yeji	Total
Procurement of LV wooden poles	379.73	294.94	674.67
Survey and bush clearing	128.09	99.49	227.58
Civil works	8.58	6.67	15.25
Service wire and accessories	34.52	26.82	61.34
Construction of LV network	156.75	121.76	278.51
Contingency	70.77	54.97	125.74
Total	778.44	604.65	1,383.09

Appendix 6-1

Load Forecast

For the purpose of developing the load forecast, the same methodology adopted in NEP study was applied in this Project. The following parameters are taken into consideration.

(1) Population

The town population in 1996 was projected based on 1984 census and the growth rates in each district.

(2) Residential load

1) Rural town (less than 2,000 persons): 920kWH/household
2) Small town (2,000 to 5,000 persons): 1,250kWH/household
3) Large town (mare than 5,000 persons): 1,540kWH/household

(3) Commercial load

1) Rural town (less than 2,000 persons): 27% of residential consumption
2) Small town (2,000 to 5,000 persons): 32% of residential consumption
3) Large town (mare than 5,000 persons): 32% of residential consumption

(4) Point load

The following loads, confirmed through site survey, were augmented.

Hospital: 40kW, Clinic: 5kW, School: 0.5kW, Corn Mill: 1kW

(5) Market penetration rate

The market penetration rates were assumed;

Within 1 year after completion of the Project: 35%
Five years after completion of the Project: 50%
Ten years after completion of the Project: 75%
Fifteen years after completion of the Project: 90%

(6) Future demand growth

The base year loads, forecasted based on the population in 1996 and the parameters mentioned above, were projected for the 15 year period, 1998 to 2013. For this future load estimation, the population growth rate shown in (1) above are applied.

TABLE A.1 - LOAD FORECAST (1988 to 2013) - ASESEWA AREA

Towns	Base Year Load ('96) (kW)	1998 (kW)	2003 (kW)	2008 (kW)	2013 (kW)
- District: Yilo Krobo					
Kurakan	180.4	67.5	113.7	201.2	284.8
Oterkpolu	109.4	40.9	68.9	122.0	172.7
Huhunya	54.3	20.3	34.2	60.5	85.7
Agogo	68.2	25.5	43.0	76.0	107.7
Akwapim Yilor	41.9	15.7	26.4	46.7	66.1
Owurahai	36.3	13.6	22.9	40.5	57.3
Nsutapon	58.3	21.8	36.7	65.0	92.0
Sikaben	30.4	11.4	19.2	33.9	48.0
Trawa	29.6	11.1	18.7	33.0	46.7
Etwiso Otrompe	27.7	10.4	17.5	30.9	43.7
Ominase	24.8	9.3	15.6	27.7	39.1
Oplenyo	24.3	9.1	15.3	27.1	38.4
Apesua	24.5	9.2	15.4	27.3	38.7
Ahinkwa	23.5	8.8	14.8	26.2	37.1
Sutri	22.1	8.3	13.9	24.6	34.9
Odortorm Obawale	24.6	9.2	15.5	27.4	38.8
Others	11.2	4.2	7.1	12.5	17.7
Yilo Krobo Total	791.5	296.3	498.8	882.5	1,249.4
- District: Manya Krobo					
Asesewa	595.3	217.7	347.1	581.1	778.2
Sekesua	149.8	54.8	87.3	146.2	195.8
Anyaboni	119.5	43.7	69.7	116.6	156.2
Akantim	70.7	25.9	41.2	69.0	92.4
Aketebuor	60.5	22.1	35.3	59.1	79.1
Bepoase	52.0	19.0	30.3	50.8	68.0
Abesle	47.8	17.5	27.9	46.7	62.5

TABLE A.1 - LOAD FORECAST (1988 to 2013) - ASESEWA AREA

Towns	Base Year Load ('96) (kW)	1998 (kW)	2003 (kW)	2008 (kW)	2013 (kW)
Akurusu Sisi	42.4	15.5	24.7	41.4	55.4
Bkulom	40.8	14.9	23.8	39.8	53.3
Akokoma	40.3	14.7	23.5	39.3	52.7
Asedza	37.6	13.8	21.9	36.7	49.2
Aiyesu	37.4	13.7	21.8	36.5	48.9
Osonson	36.0	13.2	21.0	35.1	47.1
Kokone	35.2	12.9	20.5	34.4	46.0
Asitidorm	34.9	12.8	20.3	34.1	45.6
Wulapon	34.4	12.6	20.1	33.6	45.0
Seseamon	34.2	12.5	19.9	33.4	44.7
Abetima Apimsu	42.7	15.6	24.9	41.7	55.8
Kwaopeniase	33.6	12.3	19.6	32.8	43.9
Akontaa	33.4	12.2	19.5	32.6	43.7
Bleponsu	32.5	11.9	18.9	31.7	42.5
Takorase West	32.0	11.7	18.7	31.2	41.8
Otrokper	49.7	18.2	29.0	48.5	65.0
Akumesu Sisi	29.9	10.9	17.4	29.2	39.1
Fefe	29.6	10.8	17.3	28.9	38.7
Plekumaso Agbom	28.0	10.2	16.3	27.3	36.6
Nyankumase	28.0	10.2	16.3	27.3	36.6
Dawa Mensah	32	11.7	18.7	31.2	41.8
Sesemang	26.9	9.8	15.7	26.3	35.2
Santowa	26.4	9.7	15.4	25.8	34.5
Nsutapon	26.2	9.6	15.3	25.6	34.2
Dawa Tlim	26.2	9.6	15.3	25.6	34.2
Bisa	28.6	10.5	16.7	27.9	37.4
Dzaman	24.3	8.9	14.2	23.7	31.8
Asaasehene	21.6	7.9	12.6	21.1	28.2
Others	81.1	29.7	47.3	79.2	106.0
Manya Krobo Total	2,101.5	768.7	1,225.4	2,051.4	2,747.1

TABLE A.1 - LOAD FORECAST (1988 to 2013) - ASESEWA AREA

Towns	Base Year Load ('96) (kW)	1998 (kW)	2003 (kW)	2008 (kW)	2013 (kW)
Asesewa Area Total	2,893.0	1,065.0	1,724.2	2,933.9	3,996.5
- Indirect					
Koforidua Load	8,002.0	8,616.9	10,368.7	12,476.8	15,013.5
Akateng	250.0		93.5	157.5	278.8
Indirect Total	8,252.0	8,616.9	10,462.2	12,634.3	15,292.3
Asesewa Line Total	11,145.0	9,681.9	12,186.4	15,568.2	19,288.8

TABLE A.2 - LOAD FORECAST (1988 to 2013) - YEJI AREA

Towns	Base Year Load ('96) (kW)	1998 (kW)	2003 (kW)	2008 (kW)	2013 (kW)
- District: Atebubu					
Yeji	791.5	297.6	508.3	911.7	1,308.2
Pran	359.0	135.0	230.5	413.5	593.3
Parambo	207.0	77.8	132.9	238.4	342.1
Sawoba	126.8	47.7	81.4	146.1	209.6
Kobri	27.5	10.3	17.7	31.7	45.5
Kwadro Bofour	25.6	9.6	16.4	29.5	42.3
Yajau	24.0	9.0	15.4	27.6	39.7
Nyameasi	19.7	7.4	12.7	22.7	32.6
Peposo	21.1	7.9	13.6	24.3	34.9
Labun/Kudjoe	15.2	5.7	9.8	17.5	25.1
Others	25.6	9.6	16.4	29.5	42.3
Total	1,643.0	617.6	1,055.1	1,892.5	2,715.6
- Indirect					
Atebubu*	602.4	647.1	773.7	925.2	1,106.2
Amanten	324.4	122.0	208.3	373.7	536.2
Garadina	27.2	10.2	17.5	31.3	45.0
Baantama	71.2	26.8	45.7	82.0	117.7
Waise	25.3	9.5	16.2	29.1	41.8
Kwame Danso	309.6	116.4	198.8	356.6	511.7
Ejura*	1,026.1	1,102.2	1,317.9	1,575.9	1,884.3
Hiawoanwu*	100.6	108.1	129.2	154.5	184.7
Indirect Total	2,486.8	2,142.3	2,707.3	3,528.3	4,427.6

TABLE A.3 - BASE YEAR LOAD FORECAST - ASESEWA AREA

Towns	Popn	Houses	Domest Energy (MWh)	Comm Energy (MWh)	Peak Power (kW)	Point Load (kW)	Total Power (kW)
- District: Yilo Krobo							
Kurakan	4,238	459	573.8	183.6	172.9	7.5	180.4
Oterkpolu	2,072	224	280.0	89.6	84.4	25.0	109.4
Huhunya	1,809	196	180.3	48.7	52.3	2.0	54.3
Agogo	1,475	160	147.2	39.7	42.7	25.5	68.2
Akwapim Yilor	1,449	157	144.4	39.0	41.9		41.9
Owurahai	1,258	136	125.1	33.8	36.3		36.3
Nsutapon	1,140	123	113.2	30.6	32.8	25.5	58.3
Sikaben	1,053	114	104.9	28.3	30.4		30.4
Trawa	1,029	111	102.1	27.6	29.6		29.6
Etwiso Otrompe	960	104	95.7	25.8	27.7		27.7
Ominase	858	93	85.6	23.1	24.8		24.8
Oplenyo	845	91	83.7	22.6	24.3		24.3
Apesua	834	90	82.8	22.4	24.0	0.5	24.5
Ahinkwa	811	88	81.0	21.9	23.5		23.5
Sutri	768	83	76.4	20.6	22.1		22.1
Odortorm Obawale	744	81	74.5	20.1	21.6	3.0	24.6
Others	385	42	38.6	10.4	11.2		11.2
Yilo Krobo Total	21,728	2,352	2,389.3	687.8	702.5	89.0	791.5
- District: Manya Krobo							
Asesewa	8,318	1,121	1,726.3	552.4	520.3	75.0	595.3
Sekesua	2,268	306	382.5	122.4	115.3	34.5	149.8
Anyaboni	2,018	272	340.0	108.8	102.5	17.0	119.5
Akantim	1,963	265	243.8	65.8	70.7		70.7
Aketebuor	1,682	227	208.8	56.4	60.5		60.5
Bepoase	1,448	195	179.4	48.4	52.0		52.0
Abesle	1,330	179	164.7	44.5	47.8		47.8

TABLE A.3 - BASE YEAR LOAD FORECAST - ASESEWA AREA

Towns	Popn	Houses	Domest Energy (MWh)	Comm Energy (MWh)	Peak Power (kW)	Point Load (kW)	Total Power (kW)
Akurusu Sisi	1,178	159	146.3	39.5	42.4		42.4
Bkulom	1,134	153	140.8	38.0	40.8		40.8
Akokoma	1,121	151	138.9	37.5	40.3		40.3
Asedza	1,045	141	129.7	35.0	37.6		37.6
Aiyesu	1,036	140	128.8	34.8	37.4		37.4
Osonson	1,004	135	124.2	33.5	36.0		36.0
Kokone	981	132	121.4	32.8	35.2		35.2
Asitidorm	970	131	120.5	32.5	34.9		34.9
Wulapon	955	129	118.7	32.0	34.4		34.4
Seseamon	953	128	117.8	31.8	34.2		34.2
Abetima Apimsu	947	128	117.8	31.8	34.2	8.5	42.7
Kwaopeniase	935	126	115.9	31.3	33.6		33.6
Akontaa	931	125	115.0	31.1	33.4		33.4
Bleponsu	902	122	112.2	30.3	32.5		32.5
Takorase West	890	120	110.4	29.8	32.0		32.0
Otrokper	869	117	107.6	29.1	31.2	18.5	49.7
Akumesu Sisi	829	112	103.0	27.8	29.9		29.9
Fefe	825	111	102.1	27.6	29.6		29.6
Plekumaso Agbom	781	105	96.6	26.1	28.0		28.0
Nyankumase	778	105	96.6	26.1	28.0		28.0
Dawa Mensah	761	103	94.8	25.6	27.5	4.5	32.0
Sesemang	746	101	92.9	25.1	26.9		26.9
Santowa	731	99	91.1	24.6	26.4		26.4
Nsutapon	727	98	90.2	24.4	26.2		26.2
Dawa Tlim	726	98	90.2	24.4	26.2		26.2
Bisa	713	96	88.3	23.8	25.6	3.0	28.6
Dzaman	672	91	83.7	22.6	24.3		24.3
Asaasehene	598	81	74.5	20.1	21.6		21.6
Others	2,255	304	279.7	75.5	81.1		81.1
Manya Krobo Total	46,020	6,206	6,595.2	1,903.2	1,940.5	161.0	2,101.5

TABLE A.3 - BASE YEAR LOAD FORECAST - ASESEWA AREA

Towns	Popn	Houses	Domest Energy (MWh)	Comm Energy (MWh)	Peak Power (kW)	Point Load (kW)	Total Power (kW)
AREA TOTAL	67,748	8,558	8,984.5	2,591.0	2,643.0	250.0	2,893.0

TABLE A.4 - BASE YEAR LOAD FORECAST -YEJI AREA

Towns	Popn	Houses	Domest Energy (MWh)	Comm Energy (MWh)	Peak Power (kW)	Point Load (kW)	Total Power (kW)
- District: Atebubu							
Yeji	17,118	1,472	2,266.9	725.4	683.2	108.3	791.5
Pran	8,685	747	1,150.4	368.1	346.7	12.3	359.0
Parambo	5,183	446	686.8	219.8	207.0		207.0
Sawoba	3,563	306	382.5	122.4	115.3	11.5	126.8
Kobri	1,191	102	93.8	25.3	27.2	0.3	27.5
Kwadro Bofour	1,053	91	83.7	22.6	24.3	1.3	25.6
Yajau	1,043	90	82.8	22.4	24.0		24.0
Nyameasi	786	68	62.6	16.9	18.2	1.5	19.7
Peposo	756	65	59.8	16.1	17.3	3.8	21.1
Labun/Kudjoe	600	52	47.8	12.9	13.9	1.3	15.2
Others	1,115	96	88.3	23.8	25.6		25.6
Total	41,093	3,535	5,005.4	1,575.7	1,502.7	140.3	1,643.0
- Indirect							
Atebubu	15,091	1,298	1,998.9	639.6	602.4		602.4
Amanten	8,125	699	1,076.5	344.5	324.4		324.4
Garadina	1,190	102	93.8	25.3	27.2		27.2
Baantama	2,255	189	236.3	75.6	71.2		71.2
Waise	1130	95	87.4	23.6	25.3		25.3
Kwame Danso	7956	667	1027.2	328.7	309.6		309.6
Ejura	28,969	2,211	3,404.9	1,089.6	1,026.1		1,026.1
Hiawoanwu	3,499	267	333.8	106.8	100.6		100.6
Indirect Total	68,215	5,528	8,258.8	2,633.7	2,486.8		2,486.8

Table A 5 - LOCATION OF POLE MOUNTED TRANSFORMER

Towns	Popn	Houses	Total Power (kW)	No. of Pole Mounted Transformer (kVA)			No. of Point Load Considered			
				50	100	200	Hospital	Clinic	School	Corn Mill
- District: Yilo Krobo										
Kurakan	4,238	459	180.4		2				3	6
Oterkpolu	2,072	224	109.4		1			1	12	14
Huhunya	1,809	196	54.3		1				4	
Agogo	1,475	160	68.2	1				2	7	12
Akwapim Yilor	1,449	157	41.9	1						
Nsutapon	1,140	123	58.3	1				1	11	15
Sikaben	1,053	114	30.4	1						
Opienyo	845	91	24.3	1						
Apesua	834	90	24.5	1					1	
Odorform/Obawale	744	81	24.6	1					6	
- District: Manya Krobo										
Asesewa	8,318	1,121	595.3	2	3	1	1	3	46	17
Sekesua	2,268	306	149.8	1	1			1	29	15
Anyaboni	2,018	272	119.5	2				1	8	8
Abetima/Apimsu	947	128	42.7	1					7	5
Otrokper	869	117	49.7	1				1	19	4
Dawa Mensah	761	103	32.0	1					3	3
Bisa	713	96	28.6	1					4	1
Asaasehene	598	81	21.6	1						
Asesewa Area Total	32,151	3,919	1,656	17	8	1	1	10	160	100
- District: Atebubu										
Yeji	17,118	1,472	791.5	2	3	2	1	6	27	83
Pran	8,685	747	359.0	2	3			1	9	15
Parambo	5,183	446	207.0		2					
Sawoba	3,563	306	126.8	1	1			1	4	16
Kobri	1,191	102	27.5	1					1	
Kwadro Bofour	1,053	91	25.6	1					1	2
Yajau	1,043	90	24.0	1						
Nyameasi	786	68	19.7	1					2	2
Peposo	756	65	21.1	1					1	7
Labun/Kudjoe/ Kofi Baasare	600	52	15.2	1					1	2
Yeji Area Total	39,978	3,439	1,617	11	9	2	1	8	46	127
TOTAL	72,129	7,358	3,272.9	28	17	3	2	18	206	227

POWER FLOW STUDY (Tafo-Asesewa)

Impeadance adopted (Conductor AAC 120 sqmm, 100%=1000KVA, 33KV)

CASE-1 Tafo-Agogo-Asesewa Route

Node	(0)	Line 1	(2)	Line 3	(4)	Line 5	(6)
km		26		50		14	
%R		0.787		1.514		0.424	
%X		0.851		1.637		0.458	
%Y		9.101		17.50		4.900	

Node	(0)	Line 7	(8)
km		21	
%R		0.636	
%X		0.686	
%Y		7.350	

Note 1) Node:
(0) Tafo
(2) Agogo
(4) Asesewa
(6) Akateng
(8) Koforidua

CASE-II Tafo Koforidua-Asesewa Route

(A) Tafo - Koforidua 1 cct

Node	(0)	Line 1	(2)	Line 3	(4)	Line 5	(6)	Line 7	(8)
km		21		14		34		14	
%R		0.636		0.424		1.030		0.424	
%X		0.686		0.458		1.113		0.458	
%Y		7.350		4.900		11.90		4.900	

(B) Tafo - Koforidua 2 ccts

Node	(0)	Line 1	(2)	Line 3	(4)	Line 5	(6)	Line 7	(8)
km		21		14		34		14	
%R		0.318		0.424		1.030		0.424	
%X		0.344		0.458		1.113		0.458	
%Y		14.70		4.900		11.90		4.900	

Note 2) Node:
(0) Tafo
(2) Koforidua
(4) Huhunya
(6) Asesewa
(8) Akateng

POWER FLOW STUDY (Tafo-Koforidua-Asesewa)

Location	Load (KW)	PF=90% Bus Voltage (%)	PF=90% Outgoing P(KW)	PF=90% Outgoing Q(KVar)	PF=95% Bus Voltage (%)	PF=95% Outgoing P(KW)	PF=95% Outgoing Q(KVar)	Remarks		
I Asesewa-Koforidua 1 cct										
(As of 1998)								PF	0.9	0.95
Tafo	-	102.2	10,559	5,428	100.9	10,476	3,834	δV(%)	11.9	10.8
Koforidua	8,617	92.0	1,081	393	91.8	1,079	227			
Huhunya	296	91.3	778	284	91.1	777	164	Total loss(KW)	877.0	794.0
Asesewa	769	90.0	-	-	90.0	-	-	ditto (%)	8.3	7.6
(As of 2003)										
Tafo	-	106.1	13,562	7,136	104.5	13,435	5,103	δV(%)	15.2	13.9
Koforidua	10,369	93.5	1,864	750	93.1	1,860	463			
Huhunya	499	92.3	1,345	528	92.0	1,343	321	Total loss(KW)	1,375.0	1,248.0
Asesewa	1,225	90.1	94	6	90.0	94	-9	ditto (%)	10.1	9.3
Akateng	94	90.0	-	-	90.0	-	-			
II Asesewa-Koforidua 2 ccts										
(As of 2003)										
Tafo	-	99.8	12,896	6,352	98.7	12,831	4,387	δV(%)	9.8	8.8
Koforidua	10,369	93.5	1,864	750	93.1	1,860	463			
Huhunya	499	92.3	1,345	528	92.0	1,343	321	Total loss(KW)	709.0	644.0
Asesewa	1,225	90.1	94	6	90.0	94	-9	ditto (%)	5.5	5.0
Akateng	94	90.0	-	-	90.0	-	-			
(As of 2008)										
Tafo	-	103.9	16,743	8,479	102.4	16,638	5,945	δV(%)	13.4	12.1
Koforidua	12,477	96.0	3,224	1,456	95.3	3,212	962			
Huhunya	883	93.9	2,283	1,010	93.4	2,276	659	Total loss(KW)	1,174.0	1,069.0
Asesewa	2,051	90.1	158	37	90.1	158	12	ditto (%)	7.0	6.4
Akateng	158	90.0	-	-	90.0	-	-			
(As of 2013)										
Tafo	-	108.0	21,084	10,938	106.1	20,926	7,773	δV(%)	16.7	15.2
Koforidua	15,014	98.3	4,525	2,133	97.4	4,503	1,465			
Huhunya	1,249	95.4	3,166	1,475	94.8	3,153	991	Total loss(KW)	1,795.0	1,637.0
Asesewa	2,747	90.2	279	96	90.2	279	63	ditto (%)	8.5	7.8
Akateng	279	90.0	-	-	90.0	-	-			

POWER FLOW STUDY (Tafo-Agogo-Asesewa)

Location	Load (KW)	PF=90% Bus Voltage (%)	PF=90% Outgoing P(KW)	PF=90% Outgoing Q(KVar)	PF=95% Bus Voltage (%)	PF=95% Outgoing P(KW)	PF=95% Outgoing Q(KVar)	Remarks		
								PF	0.9	0.95
(As of 1998)										
Tafo	-	99.3	1,086	283	98.3	1,085	121	δV(%)	2.8	2.5
Agogo	296	98.2	780	218	97.3	779	101			
Asesewa	769	96.5	-	-	95.8	-	-	Total loss (KW)	739.0	665.0
								ditto (%)	7.1	6.4
Tafo	-	99.3	9,335	4,881	98.3	9,262	3,462			
Koforidua	8,617	90.0	-	-	90.0	-	-			
(As of 2003)										
Tafo	-	101.2	1,882	646	100.0	1,878	364	δV(%)	4.9	4.5
Agogo	499	99.2	1,352	462	98.2	1,349	258			
Asesewa	1,225	96.3	94	1	95.5	94	-14	Total loss (KW)	1,104.0	994.0
Akateng	94	96.2	-	-	95.5	-	-	ditto (%)	8.3	7.5
Tafo	-	101.2	11,409	6,076	100.0	11,303	4,349			
Koforidua	10,369	90.0	-	-	90.0	-	-			
(As of 2008)										
Tafo	-	103.5	3,285	1,403	102.1	3,269	909	δV(%)	8.7	7.8
Agogo	883	99.8	2,307	966	98.8	2,299	616			
Asesewa	2,051	94.6	158	33	94.2	158	9	Total loss (KW)	1,699.0	1,529.0
Akateng	158	94.6	-	-	94.1	-	-	ditto (%)	9.8	8.9
Tafo	-	103.5	13,983	7,599	102.1	13,829	5,492			
Koforidua	12,477	90.0	-	-	90.0	-	-			
(As of 2013)										
Tafo	-	106.3	4,648	2,166	104.7	4,517	1,474	δV(%)	11.9	10.9
Agogo	1,249	101.2	3,215	1,459	99.9	3,198	975			
Asesewa	2,747	93.9	279	92	93.5	279	50	Total loss (KW)	2,555.0	2,301.0
Akateng	279	93.7	-	-	93.3	-	-	ditto (%)	11.7	10.7
Tafo	-	106.3	17,195	9,554	104.7	15,973	6,978			
Koforidua	15,014	90.0	-	-	90.0	-	-			

POWER FLOW STUDY (Techiman-Atebubu-Yeji)

Impeadance adopted (Conductor ACSR 100 sqmm, 100%=1000KVA, 34.5KV)

Node	Distance (Km)	%R	%X	%Y	Remarks
Techiman					
		2.029	2.352	30.450	1 cct
	79	1.015	1.176	60.900	2 ccts
		0.676	0.784	91.350	3 ccts
Ejura					
		1.670	1.935	25.054	1 cct
	65	0.835	0.968	50.108	2 ccts
		0.557	0.645	75.162	3 ccts
Atebubu					
	17.1	0.439	0.509	6.592	
Peposo					
	1.8	0.046	0.054	0.694	
Nyameasi					
	12.8	0.329	0.381	4.934	
Pran					
	5.5	0.141	0.164	2.120	
Kujoe					
	4.5	0.116	0.134	1.734	
Others					
	10.8	0.277	0.322	4.162	
Param/Saw					
	7.6	0.195	0.226	2.930	
Kobri					
	11.3	0.290	0.336	4.356	
Kwad/Bof					
	2.6	0.067	0.077	1.002	
Yeji					

Booster:

A Booster is installed at Atebubu. The ratings is as follows;

Capacity : 5000 KVA
Voltage range: 34.5 KV, -15~+5%
Impedance : 0.75%

POWER FLOW STUDY (Techiman-Yeji) -1

Location	Load (KW)	PF=90% Bus Voltage (%)	PF=90% Outgoing P(KW)	PF=90% Outgoing Q(KVar)	PF=95% Bus Voltage (%)	PF=95% Outgoing P(KW)	PF=95% Outgoing Q(KVar)	Remarks		
								PF	0.9	0.95
(As of 1998)										
Techman	-	103.5	3,009.1	869.8	101.8	2,996.9	435.6	δV(%)	12.8	11.3
Ejura	1,210.3	95.4	1,607.3	362.7	94.7	1,604.4	120.6			
Booster-in	-	91.6	1555.7	521.9	91.4	1555.4	280.8	Total loss(KW)	249.2	237.0
Atebubu	932.0	91.6	623.7	70.5	91.4	623.4	-25.5	ditto (%)	8.3	7.9
Pepeso	7.8	91.3	613.7	119.4	91.1	613.5	24.5			
Nyameasi	7.4	91.2	606.1	121.3	91.1	605.9	27.6			
Pran	135.0	90.9	469.6	95.1	90.9	469.4	22.3	Booster E2/E1	1	1
Kujoe	5.7	90.8	463.5	109.3	90.8	463.3	37.5	Power passing	1642	1581
Others	9.6	90.8	453.5	118.7	90.7	453.4	48.2	thru. booster		
Param/Saw	125.5	90.6	327.3	91.2	90.5	327.2	40.4	(KVA)		
Kobri	10.3	90.5	316.7	109.9	90.5	316.7	60.6			
Kwad/Bof	18.6	90.3	297.7	136.0	90.3	297.7	89.7			
Yeji	297.6	90.3	-	-	90.3	-	-			
(As of 2003)										
Techman	-	105.3	4,330.7	1,763.9	104.8	4,263.0	1,073.0	δV(%)	14.5	11.3
Ejura	1,447.1	92.8	2,471.7	885.5	94.0	2,451.7	477.0			
Booster-in	-	86.3	2,334.0	927.2	88.5	2,331.6	546.8	Total loss(KW)	568.3	500.6
Atebubu	1,260.2	92.5	1,073.8	295.7	95.0	1,071.4	114.3	ditto (%)	13.1	11.7
Pepeso	13.6	91.8	1,053.8	337.6	94.5	1,052.1	162.4			
Nyameasi	12.7	91.8	1,040.4	336.5	94.4	1,038.8	163.7			
Pran	230.5	91.2	805.2	260.7	94.0	804.2	126.9	Booster E2/E1	1.075	1.075
Kujoe	9.8	91.1	794.2	272.2	93.8	793.4	141.2	Power passing	2511	2396
Others	16.4	90.9	776.8	277.5	93.7	776.1	150.0	thru. booster		
Param/Saw	214.3	90.6	560.2	205.3	93.4	559.8	113.7	(KVA)		
Kobri	17.7	90.4	541.6	219.7	93.3	541.4	132.6			
Kwad/Bof	31.8	90.1	508.6	238.4	93.0	508.5	158.7			
Yeji	508.3	90.0	-	-	93.0	-	-			

POWER FLOW STUDY (Techiman-Yeji) -2

Location	Load (KW)	PF=90% Bus Voltage (%)	PF=90% Outgoing P(KW)	PF=90% Outgoing Q(KVar)	PF=95% Bus Voltage (%)	PF=95% Outgoing P(KW)	PF=95% Outgoing Q(KVar)	Remarks		
								PF	0.9	0.95
(As of 2008)										
Techman	-	104.9	6,026.6	2,056.1	103.6	5,976.9	1,155.7	δV(%)	10.9	8.7
Ejura	1,730.4	96.5	3,908.7	1,387.5	96.2	3,887.8	779.3			
Booste-in	-	91.5	3,748.2	1,644.7	91.8	3,742.1	1,053.5	Total loss(KW)	605.8	556.1
Atebubu	1,797.9	97.9	1,950.3	723.9	98.4	1,944.2	417.8	ditto (%)	10.1	9.3
Pepeso	24.3	96.7	1,906.0	751.3	97.3	1,901.0	452.0			
Nyameasi	22.7	96.5	1,861.1	744.4	97.2	1,877.3	448.9			
Pran	413.5	95.6	1,453.1	572.7	96.4	1,450.8	344.1	Booster E2/E1	1.075	1.075
Kujoe	17.6	96.3	1,431.8	579.1	96.1	1,429.9	354.0	Power passing	4094	3888
Others	29.5	95.0	1,399.3	577.0	95.9	1,397.6	357.2	thru. booster		
Param/Saw	384.5	94.4	1,007.7	419.8	95.4	1,006.8	261.5	(KVA)		
Kobri	31.7	94.1	973.3	427.4	95.1	972.8	274.9			
Kwad/Bof	57.1	93.6	912.5	433.7	94.7	912.4	291.5			
Yeji	911.7	93.5	-	-	94.6	-	-			
(As of 2013)										
Techman	-	102.4	7,264.3	2,234.0	102.7	7,182.1	1,049.0	δV(%)	8.7	5.7
Ejura	2,069.0	95.6	4,807.3	1,677.7	96.7	4,767.1	877.7			
Booster-in	-	91.4	4,641.4	2,143.0	93.3	4,623.2	1,391.0	Total loss(KW)	674.6	592.4
Atebubu	1,805.1	99.9	2,836.3	1,190.6	102.3	2,818.1	730.8	ditto (%)	9.3	8.2
Pepeso	34.9	98.1	2,759.4	1,189.7	100.7	2,747.4	745.7			
Nyameasi	32.6	97.9	2,722.5	1,175.4	100.5	2,711.1	737.7			
Pran	593.3	96.5	2,098.8	899.5	99.3	2,092.0	562.1	Booster E2/E1	1.1	1.1
Kujoe	25.1	96.0	2,065.8	897.8	98.9	2,060.2	566.9	Power passing	5113	4829
Others	42.3	95.7	2,017.1	885.8	98.6	2,012.4	563.6	thru. booster		
Param/Saw	551.7	94.8	1,450.6	639.1	97.9	1,448.2	408.0	(KVA)		
Kobri	45.5	94.3	1,398.6	636.9	97.6	1,398.1	415.6			
Kwad/Bof	82.0	93.6	1,309.8	626.7	96.9	1,309.6	422.2			
Yeji	1,308.2	93.5	-	-	96.8	-	-			

ANNUAL LOSS ENERGY IN ASESEWA & YEJI

1 ASESEWA

The relationship between load factor and loss factor at the distribution transformer can be expressed by the empirical formula:

*1

Loss factor = 0.15 load factor + 0.85 (load factor)^2

Then,

Annual loss energy (KWh)= 8760 x Loss factor x Peak loss(KW)

Estimation of Annual loss energy in Asesewa & Koforidua 33 KV System is shown in the Table below;

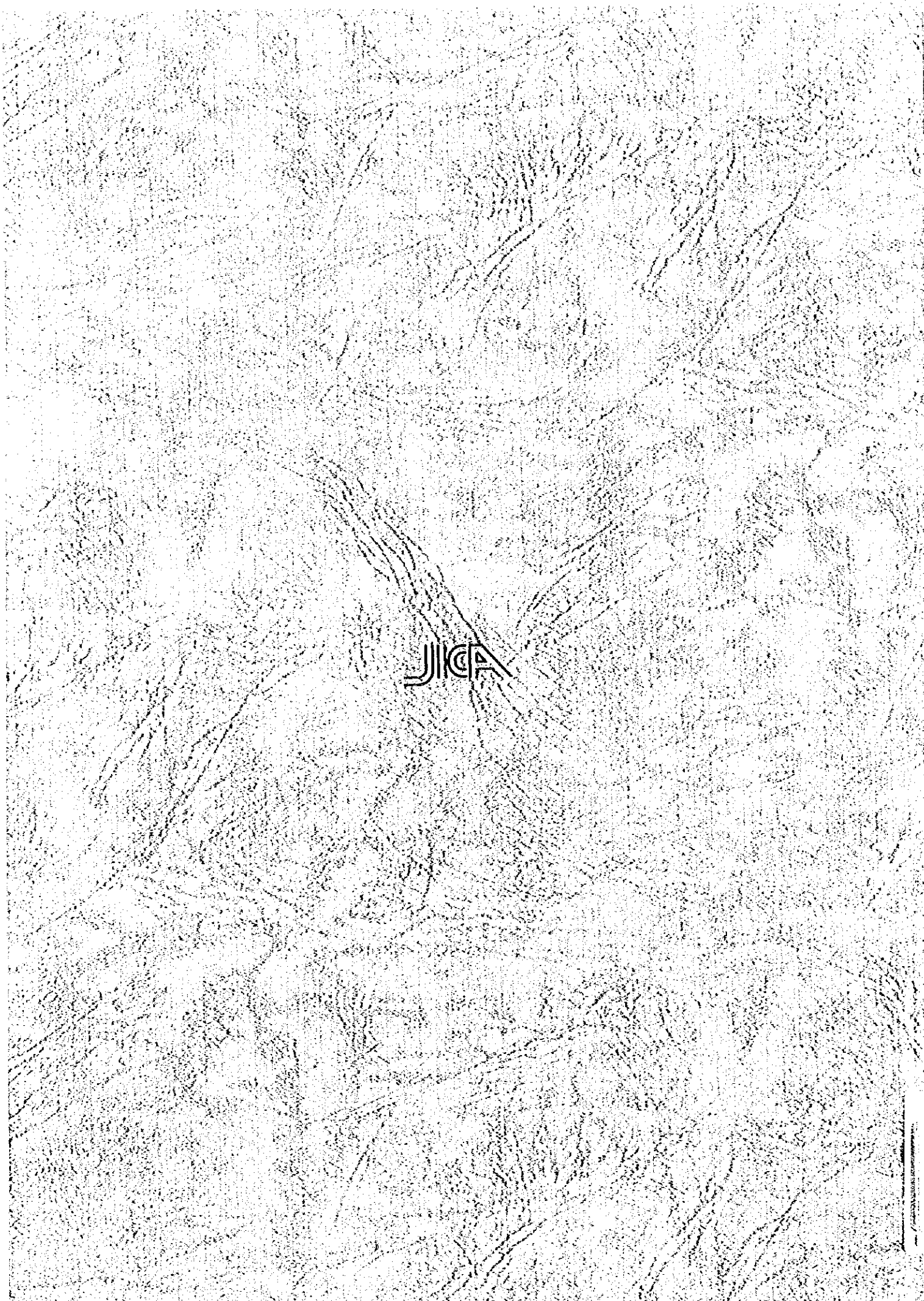
Year	Original request (Tafo-Koforidua-Asesewa)				Alternative (Tafo-Agogo-Asesewa)	
	No of lines between Tafo-Kofo.					
	----1 cct----------		----2 ccts --------			
	Peak loss(KW)	Annual loss energy(MWh)	Peak loss(KW)	Annual loss energy(MWh)	Peak loss(KW)	Annual loss energy(MWh)
(Power factor = 0.9)						
1998	877	4007			739	3376
2003	1375	6282	709	3239	1104	5044
2008			1174	5364	1699	7762
2013			1795	8201	2555	11673
(Power factor = 0.95)						
1998	794	3628			665	3038
2003	1248	5665	644	2942	994	4541
2008			1069	4884	1529	6985
2013			1637	7479	2301	10512

*1 Page 18-109,13th Edition,Standard Hand Book for Electrical Engineers, Mc GRAW-HILL International Edition

2 YEJI

Estimation of Annual loss energy in Yeji 33 KV System is shown in the Table below;

Year	Peak loss(KW)	Annual loss energy(MWh)	Peak loss(KW)	Annual loss energy(MWh)
	(Power factor=0.9)		(Power factor=0.95)	
1998	250	1142	237	1083
2003	569	2600	501	2289
2008	606	2769	557	2545
2013	675	3084	593	2709


JICA