APPENDICES

1. MEMBER LIST OF THE STUDY TEAM

Member List of the Study Team

(1) Members for Basic Design Study

Name	Work Assignment	Position
Mr. Yoshiro KURASHINA	Team Leader	Deputy Director, Third Project Management Division, Grant Aid Management Department, JICA
Mr. Masatsugu KOMIYA	Chief Consultant/ Power Supply Planner	Yachiyo Engineering Co., Ltd.
Mr. Kazuhiro NAKAMURA	Power Transmission and Distribution Facilities Planner (I)	Yachiyo Engineering Co., Ltd.
Mr. Tatsuya KOBAYASHI	Power Transmission and Distribution Facilities Planner (Ⅱ)	Yachiyo Engineering Co., Ltd.
Mr. Tadayuki OGAWA	Power Demand Forecast/ Operation & Maintenance Planner (I)	Yachiyo Engineering Co., Ltd.
Mr. Tetsuya SUENOBU	Power Demand Forecast/ Operation & Maintenance Planner (Ⅱ)	Yachiyo Engineering Co., Ltd.
Mr. Tetsuo YATSU	Procurement Planner	Yachiyo Engineering Co., Ltd.

(2) Members for Explanation of Draft Final Report

Name	Work Assignment	Position
Mr. Tsuneo TAKAHATA	Team Leader	Resident Representative, JICA Ghana Office
Mr. Masatsugu KOMIYA	Chief Consultant/ Electrification Planner	Yachiyo Engineering Co., Ltd.
Mr. Kazuhiro NAKAMURA	Distribution Planner (I)	Yachiyo Engineering Co., Ltd.

2. SURVEY SCHEDULE

Survey Schedule –Itinerary of the Basic Design Study–

No	Day		Contents of Field Survey				Stay at
			Official Member (Mr. Kurashina)	Consultant Members			
				Chief Consultant Group (Mr. Komiya and Mr. Yatsu)	Group A (Mr. Nakamura and Mr. Ogawa)	Group B (Mr. Kobayashi and Mr. Suenobu)	
1	2/6	Wed.	• Trip [Tokyo (12:00)-London (15:45) by JL-401]				London
2	2/7	Thu.	• Trip [London (15:05)-Accra (22:05) by BA-081]				Accra
3	2/8	Fri.	• Courtesy call to Embassy of Japan and JICA Ghana office in Accra • Courtesy call to Ministry of Energy (MOE), Ministry of Finance (MOF) and Electricity Company of Ghana (ECG) • Discussion with MOE and ECG regarding the Inception Report, field survey schedule and contents, etc.				Accra
4	2/9	Sat.	• Internal meeting				Accra
5	2/10	Sun.	• Move to Kumasi from Accra	• Same as Official Member (Only for Mr.Komiya)	• Same as Official Member	• Same as Official Member (Only for Mr.Suenobu)	Kumasi
6	2/11	Mon.	• Visit ECG Ashanti Regional Office at Kumasi • Site survey in Nyinahin Area • Move to Accra	• Same as Official Member (Only for Mr.Komiya)	• Same as Official Member	• Same as Official Member (Only for Mr.Suenobu) • Arrival of Mr. Kobayashi at Accra (22:05)	Accra
7	2/12	Tue.	• Discussion on the draft of Minutes of Discussion (M/D) with MOE and ECG • Courtesy call to DANIDA				Accra
8	2/13	Wed.	• Discussion on the draft of Minutes of Discussion (M/D) with MOE and ECG • Courtesy call to Public Utilities Regulatory Commission (PURC)				Accra
9	2/14	Thu.	• Signing of M/D with MOE and ECG • Report to Embassy of Japan and JICA Ghana office in Accra • Further technical discussion with ECG engineers • Trip [Accra (23:50)- London (06:55+1) by BA-078] (Official Member)				Accra
10	2/15	Fri.	• Trip [London (19:00)-Tokyo (15:45+1) by JL-402]	• Attend the conference meeting on Energy Sector Policy framework and investments programme • Courtesy call to the World Bank • Further technical discussion with ECG engineers			Accra
11	2/16	Sat.	(Arrival in Tokyo)	• Internal Meeting • Study and Analysis of Data and information			Accra
12	2/17	Sun.		• Study and Analysis of Data and information • Internal Meeting • Move to Kumasi			Kumasi

No	Day		Contents of Field Survey				Stay at
			Official Member (Mr. Kurashina)	Consultant Members			
				Chief Consultant Group (Mr. Komiya and Mr. Yatsu)	Group A (Mr. Nakamura and Mr. Ogawa)	Group B (Mr. Kobayashi and Mr. Suenobu)	
13	2/18	Mon.		• Same schedule as Group A (Only for Mr.Komiya)	• Field survey at the proposed site for Booster Station • Field survey at Bibiani S/S, Asawinso S/S • Field survey and discussion at Bibiani District Office	• Field survey at the proposed site for Booster Stasion • Field survey at Bibiani S/S • Site survey in Nyinahin Area(①～⑩)	Kumasi
14	2/19	Tue.		• Same schedule as Group A	• Site survey in Amansie West District(⑧～⑩) • Field survey at ECG Kumasi B S/S	• Site survey in Amansie West District(①～⑦) • Field survey at ECG Kumasi B S/S	Kumasi
15	2/20	Wed.		• Same schedule as Group B	• Site survey in Nyinahin Area (⑪and the rest)	• Field survey at ECG Bekwai S/S • Site survey in North Assin District No. I Area	Kumasi/ Cape Coast
16	2/21	Thu.		Ditto	• Field survey at VRA Kumasi S/S • Planning and Discussion regarding 33kV transmission lines, operation and maintenance schedule	• Site survey in North Assin District No. III Area • Field survey and Discussion on the operation and maintenance schedule at ECG Central Regional Office	Kumasi/ Cape Coast
17	2/22	Fri.		Ditto	• Move to Cape Coast	• Site survey in North Assin District No. IV Area	Cape Coast
18	2/23	Sat.		• Internal Meeting • Study and Analysis of Data and information			Cape Coast
19	2/24	Sun.		• Internal Meeting • Study and Analysis of Data and information • Move to Accra			Accra
20	2/25	Mon.		• Explanation of Japan's Grant Aid Scheme, confirmation of data and information such as Organization of Ghanaian government and ECG, Population Census, technical details			Accra
21	2/26	Tue.		• Collection of data and information such as National Development Plan, electricity tariff and trend of other donors/ organizations • Confirmation of operation & maintenance schedule by ECG • Field survey at the local manufacture of wooden poles			Accra
22	2/27	Wed.		• Collection and confirmation of general information such as environmental protection standards, design standards, climate conditions, social life, etc. • Field survey at Energy Commission • Arrival of Mr. Yatsu at Accra			Accra

No	Day		Contents of Field Survey				Stay at
			Official Member (Mr. Kurashina)	Consultant Members			
				Chief Consultant Group (Mr. Komiya and Mr. Yatsu)	Group A (Mr. Nakamura and Mr. Ogawa)	Group B (Mr. Kobayashi and Mr. Suenobu)	
23	2/28	Thu.		• Collection of information regarding transportation of the equipment and materials and the installation of transmission lines for the Project • Market survey in Accra			Accra
24	3/1	Fri.		• Confirmation of obligations, workforce and budget of Ghanaian side for the Project • Market survey in Accra			Accra
25	3/2	Sat.		• Internal Meeting • Study and Analysis of Data and information			Accra
26	3/3	Sun.		Ditto			Accra
27	3/4	Mon.		Ditto			Accra
28	3/5	Tue.		Ditto			Accra
29	3/6	Wed.		Ditto			Accra
30	3/7	Thu.		• Explanation and discussion on the field report with MOE and ECG			Accra
31	3/8	Fri.		Ditto			Accra
32	3/9	Sat.		• Move to Cape Coast • Correction of the field report and internal meeting			Cape Coast
33	3/10	Sun.		Ditto			Cape Coast
34	3/11	Mon.		• Field survey regarding operation and maintenance conditions at ECG Western Regional office • Site survey at local pole manufactures in Takoradi • Move to Accra			Accra
35	3/12	Tue.		• Explanation and discussion on the field report with MOE and ECG • Obtaining approval for the field report from MOE and ECG			Accra
36	3/13	Wed.		• Collection and analysis of data and information, internal meeting			Accra
37	3/14	Thu.		Ditto			Accra
38	3/15	Fri.		• Courtesy call to concerned organizations in Accra • Report to Embassy of Japan and JICA Ghana office in Accra			Accra
39	3/16	Sat.		• Trip [Accra (22:25)-London (05:30+1) by BA-078]			
40	3/17	Sun.		• Trip [London (19:00)-Tokyo (15:45+1) by JL-402]			
41	3/18	Mon.		(Arrival in Tokyo)			

Survey Schedule –Itinerary for Explanation of Draft Final Report–

No	Day		Contents of Field Survey Official Member and Consultant Members	Stay at
1	6/1	Sat.	• Trip [Tokyo (12:00)-London (16:25) by JL-401]	London
2	6/2	Sun.	• Trip [London (14:15)-Accra (22:05) by BA-081]	Accra
3	6/3	Mon.	• Courtesy call to Embassy of Japan and JICA Ghana office in Accra, explanation of draft final report • Courtesy call to Ministry of Energy (MOE), Ministry of Finance (MOF) and Electricity Company of Ghana (ECG) , explanation of draft final report	Accra
4	6/4	Tue.	• Discussion on the draft final report with DANIDA • Internal Meeting	Accra
5	6/5	Wed.	• Discussion with MOE and ECG including confirmation of obligations, workforce and budget of Ghanaian side for the Project	Accra
6	6/6	Thu.	• Move to Kumasi from Accra • Explanation of the draft final report at ECG Ashanti Regional office, confirmation of workforce by Ghanaian side • Field survey at VRA Kumasi A substation and ECG substation A	Kumasi
7	6/7	Fri.	• Field Survey and Confirmation at Bibiani Booster Station and Nyinahin Area • Further discussion at ECG Ashanti Regional office	Kumasi
8	6/8	Sat.	• Internal Meeting • Study and Analysis of Data and information • Move to Cape Coast from Kumasi	Cape Coast
9	6/9	Sun.	• Internal Meeting • Study and Analysis of Data and information	Cape Coast
10	6/10	Mon.	• Move to Takoradi from Cape Coast • Explanation of the draft final report at ECG Western Regional office, confirmation of workforce by Ghanaian side • Move to Accra from Takoradi • Discussion on the draft of Minutes of Discussion (M/D) with MOE and ECG	Accra
11	6/11	Tue.	• Discussion on the draft of Minutes of Discussion (M/D) with MOE and ECG • Signing of M/D	Accra
12	6/12	Wed.	• Report to Embassy of Japan and JICA Ghana office in Accra • Trip [Accra (22:45)-London (06:35+1) by BA-078]	
13	6/13	Thu.	• Trip [London (19:45)-Tokyo (15:15+1) by JL-402]	
14	6/14	Fri.	• (Arrival in Tokyo)	

3.LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

List of Parties Concerned in the Recipient Country

The World Bank (WB)

Mr. Mangesh Hoskote	Sr. Power Sector Specialist
Mr. Kofi Boateng Agyen	Operations Officer (Energy Sector)
Mr. Hoon Sahib Soh	Economist

Danish Development Agency (DANIDA)

Mr. Joseph B. Danquah	Programme Officer, Energy/Environment

Energy Commission (EC)

Mr. Kofi Asante	Executive Secretary
Mr. E. Cato Brown	Director, Petroleum
Mr. Francis Gbeody	Chief Program Officer

Public Utilities Regulatory Commission (PURC)

Mr. Stephen N. Adu	Commissioner, Executive Secretary
Mr. William Kwasi Gboney	Director
Mr. Nii Oicai Kotei	Director, Water Inspectorate
Ms. Mami Dufie Ofori	Director, Consumer Services
Mr. Simons Yao Akorli	Energy Analyst

Ministry of Finance (MOF)

Mr. M.A. Quist-Therson	Director, Bilateral Cooperation
Mr. G.D. Apatu	Head, Bilateral Cooperation
Dr. S.O. Archer	Principal Economic Officer, Japan Desk
Mr. E. Aaron Adjetey	Senior Economic Officer, Japan Desk

Ministry of Energy (MOE)

Hon. Albert Kan-Dapaah (MP)	Minister of Energy
Mr. S.Q.Barnor	Chief Director
Mr. G.D.Boateng	Director of Power (at B/D Mission)
Mr. Emmanuel Antwi-Darkwa	Director of Power (at Draft Report Explanation Mission)
Mr. Gabriel Quain	Deputy Director of Energy
Mr. Chris K. Anaglo-Mawunesbloe	Associate Programme Officer, Rural Electrification
Mr. Solomon Adjetey	Programme Officer, Rural Electrification
Mr. Kennedy Debrah	Programme Officer, Rural Electrification

Electricity Company of Ghana (ECG) Head Office

Mr. Stephen Akuoko	Director of Engineering
Mr. W.K. Kyeremanteng	Director of Operation
Mr. C.S. Tetteh	Director of Finance
Mr. Wilson Kwame Adjiku	Divisional Manager (Corporate Planning)
Mr. Cephas Gakpo	Divisional Manager (Design & Construction)
Mr. Daniel Kwadzo Mensah	Divisional Manager (Management Accounting)
Mr. Francis Lawson	Divisional Manager (Rural Electrification)
Mr. Patrice Afenyo	Project Engineer (Rural Electrification)
Mr. Charles Yakah	Project Engineer (Rural Electrification)
Mr. S.Boakye Appiah	Sectional Manager (Construction)
Mr. Henry Lutterodt	Design & Construction Engineer

Electricity Company of Ghana (ECG) Ashanti Regional Office

Mr. William Hutton-Mensah	Regional Director
Mr. Ing. Peter Opoku	Regional Engineer
Mr. Yakubu Iddrisu	Regional Accountant
Dr. Kwabena Adomah	Project Engineer in Ashanti Region
Mr. George Abadoo	Project Engineer in Ashanti Region
Mr. Nii Okine-Gem	Regional Draughtsman

Electricity Company of Ghana (ECG) Western Regional Office

Mr. D.Boa Essilfie	Regional Director (at B/D Mission)
Mr. Daniel Azu	Regional Director (at Draft Report Explanation Mission)

Electricity Company of Ghana (ECG) Bibiani District Office

Mr. Emmanuel Justice Ofori	District Manager
Mr. Tetteh Daniel Kwao	District Technical Officer
Mr. David Sadcey	Assistant Technician (Asawinso S/S)

Atwima District Assembly

Hon. Charles Yeboah	District Chief Executive
Mr. Alhaji Ziblim Yakubu	District Co-ordinating Director

Environmental Protection Agency (EPA)

Mr. Emmanuel Osae-Quansah	Senior Programme Officer
Ms. Shialey Otiukoraug	Progrmme Officer

Embassy of Japan in Ghana

Mr. Hiromu Nitta	Ambassador Extraodinary and Plenipotentiary of Japan
Mr. Motoyoshi Noro	Deputy Head of Mission (Counsellor)
Mr. Takanobu Kuroda	First Secretary
Ms. Sachiko Nishioka	Special Economic Adviser

JICA Ghana Office

Mr. Tsuneo Takahata	Resident Representative
Mr. Fumio Miyagawa	Deputy Resident Representative
Mr. Kazutomo Hihara	Assistant Resident Representative
Mr. Christopher Nuoyel	Senior Programme Officer

4. MINUTES OF DISCUSSIONS

Minutes of Discussions
On the Basic Design Study
On the Project for Rural Electrification
In the Republic of Ghana

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

JICA sent to Ghana the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Yoshiro KURASHINA, Deputy Director of the Third Project Management Division, the Grant Aid Management Department, JICA, and is scheduled to stay in the country from February 7 to March 16, 2002.

The Team held discussions with the officials concerned of the Government of Ghana and conducted a field survey at the study area.

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

Accra, February 14, 2002

Yoshiro Kurashina
Leader
Basic Design Study Team
Japan International Cooperation Agency

G. D. Boateng
Director of Power
Ministry of Energy
Republic of Ghana

M. A. Quist-Therson
Director
External Resource Mobilization (Bilateral)
Ministry of Finance
Republic of Ghana

Stephen Akuoko
Director of Engineering
Electricity Company of Ghana
Republic of Ghana

ATTACHMENT

1. Objective of the Project

The objective of the Project is to supply electricity to the Project sites by installation of transmission and distribution networks.

2. Project sites

The study areas are shown in Annex-1.

Both sides agreed to select the sites of the Project from the above study areas after discussions based on the draft report prepared by the Team.

3. Responsible and Implementing Organizations

3-1. The Responsible Ministry is the Ministry of Energy (MOE).

3-2. The Implementing agency is the Electricity Company of Ghana (ECG).

3-3. The organization charts of MOE and ECG are shown in Annexes 2-1 and 2-2.

4. Items requested by the Government of Ghana

After discussions with the Team, the following components were finally requested by the Ghanaian side;

(1) Procurement and installation of the equipment and materials for 33kV transmission lines and/or 11kV Sub-transmission lines in the Nyinahin District, the Amansie West District and the North Assin District.

(2) Procurement of the equipment and materials for 415V/240V distribution lines at the study areas. (24 Sites in the Nyinahin District, 12 Sites in the Amansie West District, 27 Sites in the North Assin District)

(3) Internal transportation of the equipment and materials from the port to the Project sites.

JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5-1. The Ghanaian side understands the Japan's Grant Aid scheme explained by the Team, as described in Annex-3.

5-2. The Ghanaian side will take the necessary measures, as described in Annex-4, for smooth implementation of the Project as a condition for the Japan's Grant Aid to be implemented.

6. Schedule of the Study

6-1. The consultant will proceed to further studies in Ghana until March 16, 2002.

6-2. JICA will prepare the draft report in English and dispatch a mission to Ghana in order to explain its contents around June 2002.

6-3. In case that the contents of the report is accepted in principle by the Government of Ghana, JICA will complete the final report and send it to the Government of Ghana by September 2002.

7. Other Relevant Issues

7-1. The Ghanaian side will provide necessary data and information for the study.

7-2. The Ghanaian side will secure personnel and budget necessary for the Project on condition that the Japan's Grant Aid is extended to the Project.

7-3. The Ghanaian side will take all possible measures to secure safety of the concerned people during the study and implementation of the Project on condition that the Japan's Grant Aid is extended to the Project.

7-4. The Ghanaian side will take necessary procedures for the land acquisition before the commencement of construction work on condition that the Japan's Grant Aid is extended to the Project.

7-5. Both sides agreed the demarcation of the works as follows;

(1) the Japanese side

a) Procurement and installation of the equipment and materials for 33kV transmission lines and/or 11kV sub-transmission lines including electrical poles,

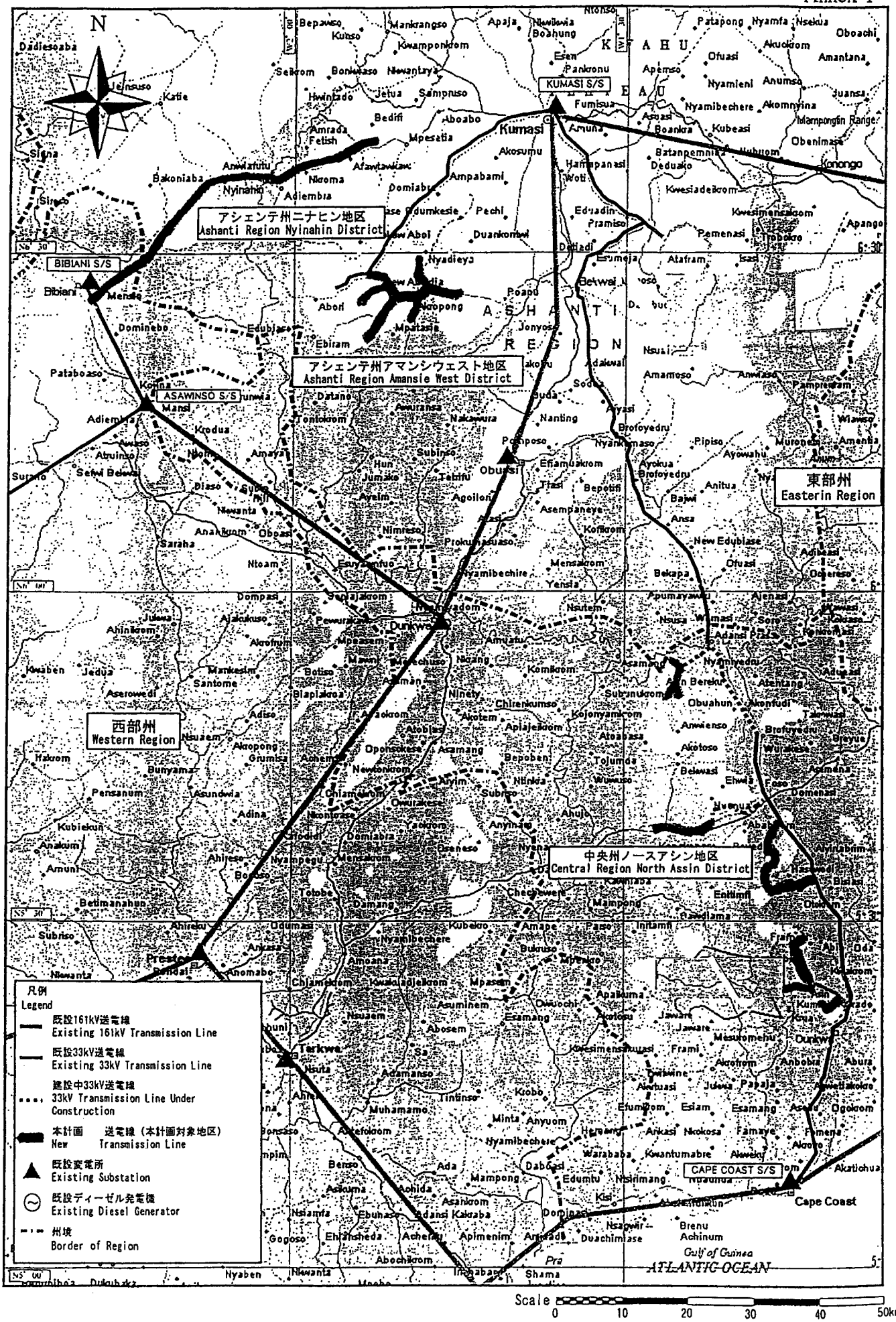
b) Procurement of the equipment and materials for 415V/240V distribution lines including kWh meters.

(2) the Ghanaian side

a) Installation of 415V/240V distribution lines including service drop wires and kWh meters,

b) Procurement and Installation of the electrical poles for the distribution lines.

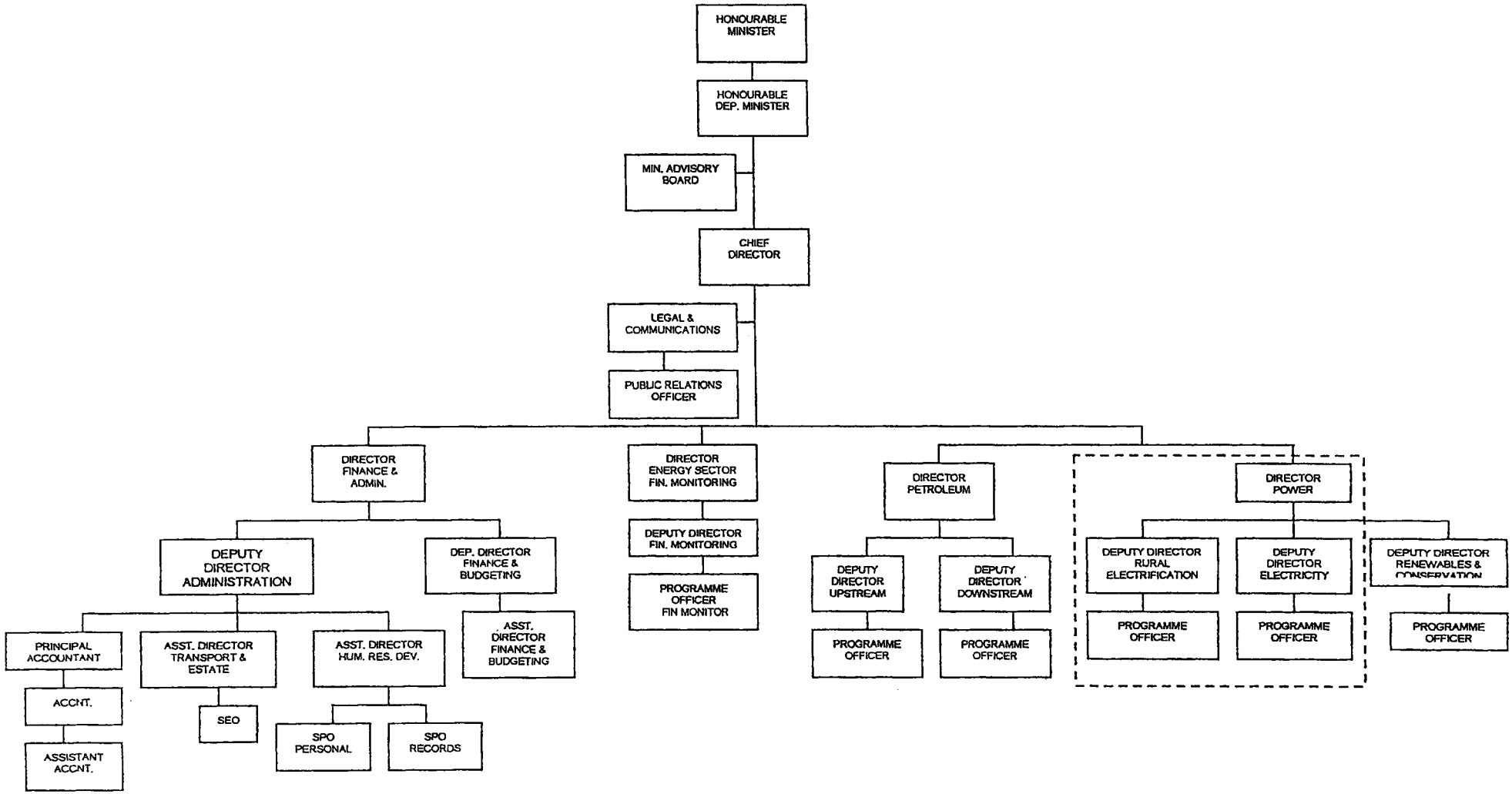
7-6. The Ghanaian side requested for the service drop wires with necessary materials to be included in the scope of Japanese side.



Location Map of the Study Areas

Annex 2-1

ORGANISATIONAL STRUCTURE: MINISTRY OF ENERGY



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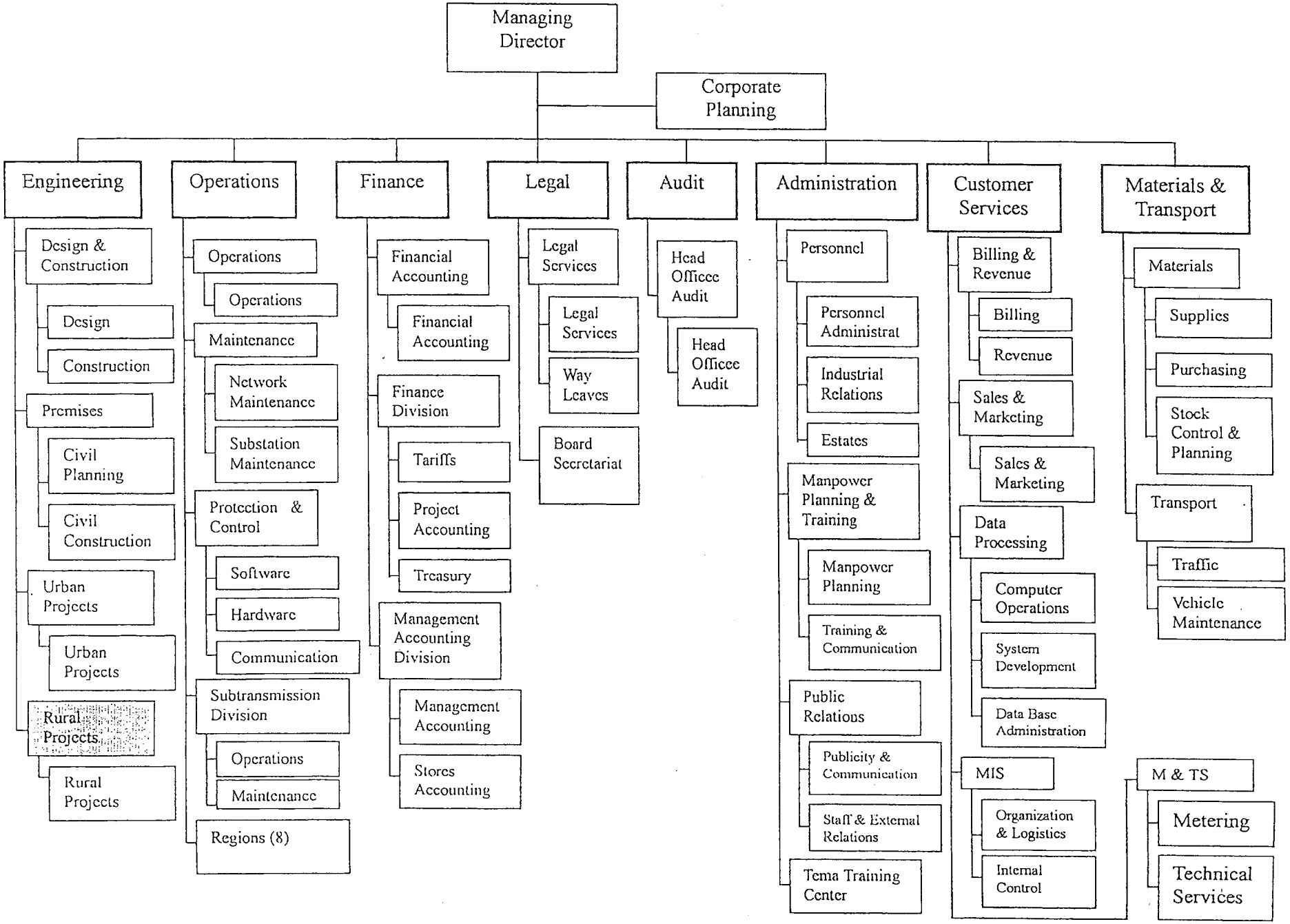

Organization Chart of Electricity Company of Ghana (ECG)

Japan's Grant Aid Scheme

The Grant Aid scheme 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. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

Japan's Grant Aid scheme 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)

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 scheme, 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 (E/N) signed by the Governments of Japan and the recipient country.

Finally, for the smooth 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 Government of Japan. The contents of the Study are as follows:

- 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.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid scheme from a technical, social and economic point of view.
- Confirmation of items agreed upon by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project
- 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) firm(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.

3. Japan's Grant Aid Scheme

1) 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.

2) "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) consulting 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 natural disaster, 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.

3) 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.)

4) 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.

5) 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:

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

6) "Proper Use"

The recipient country is required to operate and maintain 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.

7) "Re-export"

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

8) 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 a 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 (A/P) issued by the Government of the recipient country or its designated authority.

9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and Payment commissions to the Bank.

Annex-4

Major Undertakings by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Ghanaian Side
1	To secure land.		●
2	To clear, level and reclaim the site when needed.		●
3	To provide facilities for the distribution of electricity, water supply, drainage and other basic facilities.		●
4	To bear the following commissions to the Japanese bank for banking services based upon the B/A.		
	1) Advising commission of A/P		●
	2) Payment commission		●
5	To ensure unloading and customs clearance at port of disembarkation in recipient country.		
	1) Marine transportation of the products from Japan to the port of the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from port of the port of disembarkation to the project site		●
6	To accord Japanese nationals, whose service may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.		●
7	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imported in the recipient country with respect to the supply of the products and services under the verified contracts.		●
8	To maintain and use properly and effectively the facilities installed and equipment provided under the Grant Aid.		●
9	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the installation of the facilities as well as for the transportation of the equipment.		●

(B/A: Banking Arrangement, A/P: Authorization to Pay)

Minutes of Discussions
on the Basic Design Study
on the Project for Rural Electrification
in the Republic of Ghana
(EXPLANATION ON DRAFT FINAL REPORT)

In February 2002, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the project for Rural Electrification (hereinafter referred to as "the Project") to the Republic of Ghana (hereinafter referred to as "Ghana"), and through discussions, field survey, and technical examination of the results in Japan, JICA prepared a draft final report of the study.

In order to explain and to consult with the officials concerned of the Government of Ghana on the components of the draft final report, JICA sent to Ghana the Basic Design Explanation Team (hereinafter referred to as "the Team"), which was headed by Mr. Tsuneo Takahata, Resident Representative of the JICA Ghana Office, from June 2 to 12, 2002.

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

Accra, June 11, 2002

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ATTACHMENT

1. Components of the Draft Report

The Government of Ghana agreed and accepted in principle the components of the draft final report explained by the Team.

2. Japan's Grant Aid Scheme

The Ghanaian side understands the Japan's Grant Aid scheme and the necessary measures to be taken by the Government of Ghana as explained by the Team and described in ANNEX-3 and ANNEX-4 of the Minutes of Discussions signed by both sides on February 14, 2002.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Ghana by September, 2002.

4. Other Relevant Issues

4-1. The Ghanaian side will secure personnel and budget necessary for the Project on condition that the Japan's Grant Aid is extended.

4-2. The Ghanaian side will take all possible measures to secure safety of the concerned people during the study and implementation of the Project on condition that the Japan's Grant Aid is extended.

4-3. The Ghanaian side will take necessary procedures for the land acquisition before the commencement of construction work on condition that the Japan's Grant Aid is extended.

4-4. Both sides agreed with the demarcation of the works as follows, on condition that the Japan's Grant Aid is extended;

(1) the Japanese side

a) Procurement and installation of the equipment and materials for 33kV transmission lines including electrical poles,

b) Procurement of the equipment and materials for 415V/240V distribution lines,

c) Procurement of service drop wires, kWh meters and MCCBs.

(2) the Ghanaian side

a) Procurement of service drop wires, kWh meters and MCCBs.

b) Installation of 415V/240V distribution lines including service drop wires, kWh meters and MCCBs,

c) Procurement and installation of the electrical poles for the distribution lines.

Concerning the above-mentioned service drop wires, kWh meters and MCCBs, the half of the necessary quantity for the target households will be procured in the Japan's Grant Aid and the rest half will be procured by the Ghanaian side.

5. Request by Ghanaian Side

The Ghanaian side requested that electrification in the Amansie West Dsitrict, which was mentioned in the Draft Report, should be included in the Project, if possible.

5. COST ESTIMATION BORNE BY THE RECIPIENT COUNTRY

COST ESTIMATION BORNE BY THE RECIPIENT COUNTRY

Main items of the construction costs to be borne by the Ghanaian side are as follows:

1. Nyinahin Area in Ashanti Region

① Tree trimming for 33kV Transmission Line Routes:	Some	US$ 54,000
② Tree trimming for LV Distribution Line Routes:	Some	US$ 26,100
③ Civil Works for the Booster Station:	Some	US$ 3,600
④ Procurement and Installation of 415/240V Distribution Lines:	Some	US$ 462,000
⑤ Installation of Service Drop Wires, kWh meters and MCCBs:	Some	US$ 18,700
Sub-total:	Some	US$ 564,400

2. Amansie West District in Ashanti Region

① Tree trimming for 33kV Transmission Line Routes:	Some	US$ 27,900
② Tree trimming for LV Distribution Line Routes:	Some	US$ 8,000
③ Procurement and Installation of 415/240V Distribution Lines:	Some	US$ 142,100
④ Installation of Service Drop Wires, kWh meters and MCCBs:	Some	US$ 7,500
Sub-total:	Some	US$ 185,500
Total:	Some	US$ 749,900
		(¥ 97,740,000)

6. VOLTAGE DROP STUDY

1. Study Conditions

1.1 Transmission System

The transmission routes from existing 33kV transmission lines to the Project sites are shown in the main text: 2-2-3 (1).

1.2 Voltage, Frequency and Load Power Factor

- System Voltage : 33kV, 3-phase 3-line system, overhead line transmission method
- Frequency : 50Hz
- Power factor of load : 0.85

1.3 Load Conditions

The forecasted power demand in 2009 which is 5 years after the commencement of electricity supply service under the Project is applied to loads at the Project sites according to the power demand forecast described in the main text 2.2.2.1-1 and 2.2.2.1-2.

1.4 Line Constant

Type and line constant of existing and new transmission lines are as follows.

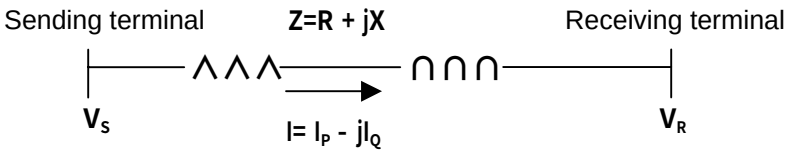
- Electric wire size: All aluminum conductor (ACC) 120mm^2

- Line constant : R; 0.274Ω/km
  X; 0.357Ω/km
  C; 0.011 μF/km
  (Source: Subtransmission & Distribution Master Plan Acres, December 1996, Acres)

1.5 Calculation Method of Voltage Drop

(1) Calculation Techniques

- Both line constant (R+jX) and load current (I_P-jI_Q) are regarded to be complex numbers.
- Voltage drop: $\triangle V=(I_P \cdot R + I_Q \cdot X) + j(I_P \cdot X - I_Q \cdot R)$



(Lag is dealt with by —)

V_R = V_S – I×Z △V = I×x Z (Voltage drop)

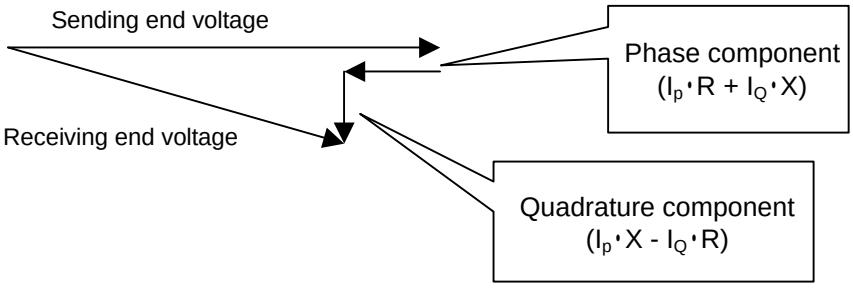
△V = $(I_P - jI_Q) \times (R + jX)$

$= I_P \cdot R + I_P \cdot jX - jI_Q \cdot R - jI_Q \cdot jX$ $\quad j^2 = -1$

$= (I_P \cdot R + I_Q \cdot X) + j(I_P \cdot X - I_Q \cdot R)$

Phase component Quadrature component

- However, the second item in the above equation is a quadrature component to power voltage with little impact, so it is ignored.



- Consequently, voltage drop of 3-phase 3-line transmission lines is obtained by △V = $\sqrt{3}\,(I_P \cdot R + I_Q \cdot X)$.

(2) Equational distribution load

Voltage drop when loads are distributed through the same type of distribution lines in an equational manner is regarded to be a voltage where all loads are concentrated at a central point in distribution lines.

2. Calculation Results

The results of the above- calculation method are as follow.

District	Line End Voltage (kV)	Voltage Drop (kV) (Voltage drop rate for rated voltage)
Nyinahin	24.7	-8.3 (-25.0%)
Amansie West	31.0	-2.0 (-6.1%)

Remark: Allowable limit of voltage drop of 33kV system based on ECG standards is 7.5%.

The detailed results are shown in the following charts.

- Fig. A6-1 : Voltage Drop Calculation Results (Nyinahin Area)
- Table A6-1 (1/3 to 3/3) : Voltage Drop Calculation Results Output (Nyinahin Area)
- Fig. A6-2 : Voltage Drop Calculation Results (Amansie West District)
- Table A6-2 (1/3 to 3/3) : Voltage Drop Calculation Output (Amansie West District)

Fig. A6-1 Voltage Drop Calculation Results (Nyinahin Area)

Table A6-1 (1/3) Voltage Drop Calculation Results Output (Nyinahin Area)

1* NODE DATA *

CODE		B-KV	EKS	PG	QG	PL	QL
TRN-22		33	0.0000	0.0000	0.0000	7.1000	4.4000
TRN-23		33	0.0000	0.0000	0.0000	9.0000	5.6000
TRN-11		33	0.0000	0.0000	0.0000	187.5000	116.2000
TRN-12		33	0.0000	0.0000	0.0000	1.8000	1.1000
AGBL		33	0.0000	0.0000	0.0000	800.0000	495.8000
CONNECT		33	0.0000	0.0000	0.0000	0.0000	0.0000
TRN-01		33	0.0000	0.0000	0.0000	2.0000	1.2000
TRN-24		33	0.0000	0.0000	0.0000	5.8000	3.6000
TRN-13		33	0.0000	0.0000	0.0000	3.4000	2.1000
BIBIANI		33	0.0000	0.0000	0.0000	160.0000	99.2000
TRN-02		33	0.0000	0.0000	0.0000	1.7000	1.1000
TRN-14		33	0.0000	0.0000	0.0000	7.4000	4.6000
TRN-03		33	0.0000	0.0000	0.0000	7.2000	4.5000
TRN-15		33	0.0000	0.0000	0.0000	19.6000	12.1000
TRN-04		33	0.0000	0.0000	0.0000	4.8000	3.0000
TRN-16		33	0.0000	0.0000	0.0000	4.4000	2.7000
TRN-05		33	0.0000	0.0000	0.0000	5.1000	3.2000
TRN-17		33	0.0000	0.0000	0.0000	2.2000	1.4000
TRN-06		33	0.0000	0.0000	0.0000	7.7000	4.8000
TRN-18		33	0.0000	0.0000	0.0000	8.0000	5.0000
TRN-07		33	0.0000	0.0000	0.0000	8.6000	5.3000
TRN-19		33	0.0000	0.0000	0.0000	8.6000	5.4000
TRN-08		33	0.0000	0.0000	0.0000	4.3000	2.7000
TRN-09		33	0.0000	0.0000	0.0000	15.7000	9.7000
TRN-20		33	0.0000	0.0000	0.0000	7.3000	4.5000
TRN-21		33	0.0000	0.0000	0.0000	2.0000	1.3000
ASAWINSO		33	100.0000	0.0000	0.0000	0.0000	0.0000
EXIST		33	0.0000	0.0000	0.0000	92.5000	57.3000
TRN-10		33	0.0000	0.0000	0.0000	5.9000	3.7000
0	TOTAL			0.0000	0.0000	1389.6000	861.5000

1* BRANCH DATA (POSITIVE-SEQUENCE) *

CODE	FROM	TO	R	X	Y/2
BN-23	TRN-22	TRN-23	0.0604	0.0787	0.0045
BN-12	TRN-11	TRN-12	0.1006	0.1311	0.0075
BN-002	AGBL	CONNECT	0.0028	0.0048	0.0003
BN-01	CONNECT	TRN-01	0.0352	0.0459	0.0026
BN-24	TRN-23	TRN-24	0.0201	0.0262	0.0015
BN-13	TRN-12	TRN-13	0.0151	0.0197	0.0011
BN-003	CONNECT	BIBIANI	0.0094	0.0160	0.0009
BN-02	TRN-01	TRN-02	0.1208	0.1574	0.0090
BN-14	TRN-13	TRN-14	0.0277	0.0361	0.0021
BN-03	TRN-02	TRN-03	0.0377	0.0492	0.0028
BN-15	TRN-14	TRN-15	0.0805	0.1049	0.0060
BN-04	TRN-03	TRN-04	0.0302	0.0393	0.0023
BN-16	TRN-15	TRN-16	0.0704	0.0918	0.0053
BN-05	TRN-04	TRN-05	0.0428	0.0557	0.0032
BN-17	TRN-16	TRN-17	0.0629	0.0820	0.0047
BN-06	TRN-05	TRN-06	0.1157	0.1508	0.0087
BN-18	TRN-17	TRN-18	0.0327	0.0426	0.0024
BN-07	TRN-06	TRN-07	0.0528	0.0689	0.0039
BN-19	TRN-18	TRN-19	0.0679	0.0885	0.0051
BN-08	TRN-07	TRN-08	0.0252	0.0328	0.0019
BN-09	TRN-08	TRN-09	0.0252	0.0328	0.0019
BN-20	TRN-19	TRN-20	0.0604	0.0787	0.0045
BN-21	TRN-20	TRN-21	0.0226	0.0295	0.0017
BN-000	ASAWINSO	EXIST	0.2447	0.4166	0.0244
BN-10	TRN-09	TRN-10	0.0704	0.0918	0.0053
BN-22	TRN-21	TRN-22	0.0327	0.0426	0.0024
BN-001	EXIST	AGBL	0.2918	0.4967	0.0292
BN-11	TRN-10	TRN-11	0.1484	0.1934	0.0111

Table A6-1 (2/3) Voltage Drop Calculation Results Output (Nyinahin Area)

0 NODE = 29 BRANCH = 28 SLACK NODE = ASAWINSO ITMAX = 10 SIGMA = 0.1000
0 *** POWER FLOW ***

NODE	CODE	VOLTAGE E(KV)	VOLTAGE |E|(%)	VOLTAGE ANGLE	GENERATOR P(%)	GENERATOR Q(%)	LOAD P(%)	LOAD Q(%)
	TRN-22	24.754	75.011	-7.150	0.000	0.000	7.094	4.393
	TRN-23	24.746	74.989	-7.156	0.000	0.000	9.001	5.602
	TRN-11	25.013	75.796	-6.926	0.000	0.000	187.503	116.202
	TRN-12	24.944	75.587	-6.986	0.000	0.000	1.783	1.080
	AGBL	26.739	81.027	-5.531	0.000	0.000	800.005	495.807
	CONNECT	26.727	80.990	-5.544	0.000	0.000	-0.012	-0.018
	TRN-01	26.633	80.705	-5.615	0.000	0.000	2.004	1.204
	TRN-24	24.745	74.986	-7.157	0.000	0.000	5.799	3.599
	TRN-13	24.933	75.556	-6.995	0.000	0.000	3.422	2.124
	BIBIANI	26.714	80.952	-5.558	0.000	0.000	160.004	99.206
	TRN-02	26.313	79.735	-5.861	0.000	0.000	1.704	1.105
	TRN-14	24.915	75.501	-7.010	0.000	0.000	7.391	4.591
	TRN-03	26.213	79.434	-5.939	0.000	0.000	7.196	4.494
	TRN-15	24.868	75.358	-7.051	0.000	0.000	19.601	12.100
	TRN-04	26.135	79.198	-6.000	0.000	0.000	4.801	3.002
	TRN-16	24.838	75.265	-7.077	0.000	0.000	4.403	2.703
	TRN-05	26.027	78.869	-6.086	0.000	0.000	5.098	3.198
	TRN-17	24.813	75.189	-7.099	0.000	0.000	2.194	1.394
	TRN-06	25.738	77.993	-6.319	0.000	0.000	7.701	4.802
	TRN-18	24.800	75.152	-7.110	0.000	0.000	8.005	5.006
	TRN-07	25.609	77.602	-6.425	0.000	0.000	8.600	5.300
	TRN-19	24.779	75.086	-7.128	0.000	0.000	8.596	5.395
	TRN-08	25.549	77.421	-6.474	0.000	0.000	4.299	2.698
	TRN-09	25.490	77.243	-6.522	0.000	0.000	15.701	9.701
	TRN-20	24.764	75.041	-7.142	0.000	0.000	7.298	4.500
	TRN-21	24.759	75.028	-7.145	0.000	0.000	2.009	1.308
	ASAWINSO	33.000	100.000	0.000	1614.845	1238.168	0.000	0.000
	EXIST	30.019	90.965	-2.330	0.000	0.000	92.500	57.299
	TRN-10	25.334	76.770	-6.653	0.000	0.000	5.900	3.699
TOTAL					1614.845	1238.168	1389.601	861.496

Table A6-1 (3/3) Voltage Drop Calculation Results Output (Nyinahin Area)

*** LINE FLOW ***

BRANCH	FROM	TO	P ==>	Q ==>	I ==>	LOSS-P	LOSS-Q	CHARGE	<== P	<== Q	<== I
BN-23	TRN-22	TRN-23	14.806	9.202	0.2324	0.003	-0.001	-0.005	-14.803	-9.203	0.2324
BN-24	TRN-23	TRN-24	5.799	3.598	0.0910	0.000	-0.001	-0.002	-5.799	-3.600	0.0910
BN-12	TRN-11	TRN-12	87.132	54.430	1.3554	0.185	0.232	-0.009	-86.947	-54.198	1.3555
BN-13	TRN-12	TRN-13	85.165	53.110	1.3279	0.027	0.033	-0.001	-85.139	-53.077	1.3279
BN-002	AGBL	CONNECT	513.969	330.399	7.5408	0.159	0.273	0.000	-513.810	-330.127	7.5408
BN-01	CONNECT	TRN-01	353.792	230.851	5.2161	0.958	1.245	-0.003	-352.834	-229.606	5.2161
BN-003	CONNECT	BIBIANI	160.054	99.292	2.3256	0.051	0.085	-0.001	-160.004	-99.206	2.3256
BN-02	TRN-01	TRN-02	350.829	228.394	5.1871	3.250	4.223	-0.012	-347.578	-224.170	5.1871
BN-14	TRN-13	TRN-14	81.712	50.961	1.2746	0.045	0.056	-0.002	-81.667	-50.905	1.2746
BN-03	TRN-02	TRN-03	345.873	223.064	5.1616	1.004	1.307	-0.004	-344.868	-221.756	5.1617
BN-15	TRN-14	TRN-15	74.278	46.312	1.1594	0.108	0.134	-0.007	-74.170	-46.178	1.1594
BN-04	TRN-03	TRN-04	337.678	217.265	5.0549	0.772	1.001	-0.003	-336.907	-216.264	5.0550
BN-16	TRN-15	TRN-16	54.566	34.079	0.8537	0.051	0.061	-0.006	-54.515	-34.018	0.8538
BN-05	TRN-04	TRN-05	332.099	213.258	4.9834	1.063	1.379	-0.004	-331.036	-211.879	4.9834
BN-17	TRN-16	TRN-17	50.112	31.312	0.7851	0.039	0.045	-0.005	-50.073	-31.267	0.7851
BN-06	TRN-05	TRN-06	325.937	208.680	4.9071	2.786	3.621	-0.011	-323.151	-205.059	4.9072
BN-18	TRN-17	TRN-18	47.884	29.871	0.7506	0.018	0.021	-0.003	-47.865	-29.850	0.7506
BN-07	TRN-06	TRN-07	315.452	200.256	4.7908	1.212	1.577	-0.005	-314.240	-198.679	4.7908
BN-19	TRN-18	TRN-19	39.858	24.846	0.6250	0.027	0.029	-0.006	-39.831	-24.817	0.6250
BN-08	TRN-07	TRN-08	305.643	193.376	4.6607	0.547	0.710	-0.002	-305.095	-192.665	4.6607
BN-20	TRN-19	TRN-20	31.235	19.422	0.4898	0.014	0.014	-0.005	-31.220	-19.408	0.4899
BN-09	TRN-08	TRN-09	300.797	189.965	4.5951	0.532	0.690	-0.002	-300.265	-189.275	4.5951
BN-10	TRN-09	TRN-10	284.569	179.569	4.3562	1.336	1.736	-0.006	-283.233	-177.834	4.3563
BN-21	TRN-20	TRN-21	23.919	14.904	0.3756	0.003	0.002	-0.002	-23.916	-14.902	0.3756
BN-22	TRN-21	TRN-22	21.907	13.596	0.3436	0.004	0.002	-0.003	-21.903	-13.594	0.3437
BN-000	ASAWINSO	EXIST	1614.845	1238.167	20.3489	101.327	172.463	-0.045	-1513.519	-1065.704	20.3492
BN-001	EXIST	AGBL	1421.019	1008.405	19.1552	107.070	182.210	-0.043	-1313.949	-826.195	19.1555
BN-11	TRN-10	TRN-11	277.335	174.136	4.2656	2.700	3.506	-0.013	-274.634	-170.630	4.2657
					TOTAL LOSS	225.292	376.656	-0.209			

ITERATION 4 MUMIN= 1.0010e+00 IT= 3

Fig. A6-2 Voltage Drop Calculation Results (Amansie West District)

Table A6-2 (1/3) Voltage Drop Calculation Output (Amansie West District)

1* NODE DATA *

	CODE	B-KV	EKS	PG	QG	PL	QL
	BR-1	33	0.0000	0.0000	0.0000	0.0000	0.0000
	TRA-06	33	0.0000	0.0000	0.0000	10.0000	6.2000
	TRA-05	33	0.0000	0.0000	0.0000	9.6000	5.9000
	TRA-07	33	0.0000	0.0000	0.0000	9.2000	5.7000
	KUMASI-B	33	0.0000	0.0000	0.0000	2471.1001	1531.5000
	EXIST	33	0.0000	0.0000	0.0000	242.9000	150.5000
	TRA-08	33	0.0000	0.0000	0.0000	18.9000	11.7000
	CONNECT	33	0.0000	0.0000	0.0000	0.0000	0.0000
	TRA-09	33	0.0000	0.0000	0.0000	4.5000	2.8000
	KUMASI-A	33	100.0000	0.0000	0.0000	0.0000	0.0000
	TRA-10	33	0.0000	0.0000	0.0000	19.8000	12.3000
	TRA-01	33	0.0000	0.0000	0.0000	15.2000	9.4000
	TRA-02	33	0.0000	0.0000	0.0000	32.9000	20.4000
	TRA-03	33	0.0000	0.0000	0.0000	1.5000	0.9000
	TRA-04	33	0.0000	0.0000	0.0000	3.6000	2.2000
0	TOTAL			0.0000	0.0000	2839.2000	1759.5000

1* BRANCH DATA (POSITIVE-SEQUENCE) *

CODE	FROM	TO	R	X	Y/2
BA-06	BR-1	TRA-06	0.0377	0.0492	0.0028
BA-07	TRA-05	TRA-07	0.0403	0.0525	0.0030
BA-001	KUMASI-B	EXIST	0.3765	0.6410	0.0376
BA-08	TRA-05	TRA-08	0.1661	0.2164	0.0124
BA-002	EXIST	CONNECT	0.3765	0.6410	0.0376
BA-09	TRA-08	TRA-09	0.0226	0.0295	0.0017
BA-000A	KUMASI-A	KUMASI-B	0.0567	0.0636	0.1077
BA-000B	KUMASI-A	KUMASI-B	0.0567	0.0636	0.1077
BA-10	TRA-09	TRA-10	0.0478	0.0623	0.0036
BA-01	CONNECT	TRA-01	0.1308	0.1705	0.0098
BA-02	TRA-01	TRA-02	0.0730	0.0951	0.0055
BA-05A	TRA-02	BR-1	0.0277	0.0361	0.0021
BA-03	TRA-02	TRA-03	0.0755	0.0983	0.0056
BA-05B	BR-1	TRA-05	0.0151	0.0197	0.0011
BA-04	TRA-03	TRA-04	0.0377	0.0492	0.0028

Table A6-2 (2/3) Voltage Drop Calculation Output (Amansie West District)

NODE = 15 BRANCH = 15 SLACK NODE = KUMASI-A ITMAX = 10 SIGMA = 0.1000
*** POWER FLOW ***

NODE	CODE	VOLTAGE E(KV)	VOLTAGE |E|(%)	VOLTAGE ANGLE	GENERATOR P(%)	GENERATOR Q(%)	LOAD P(%)	LOAD Q(%)
	BR-1	31.039	94.059	-1.588	0.000	0.000	0.007	0.008
	TRA-06	31.037	94.052	-1.590	0.000	0.000	9.999	6.199
	TRA-05	31.034	94.041	-1.592	0.000	0.000	9.596	5.896
	TRA-07	31.031	94.034	-1.594	0.000	0.000	9.198	5.697
	KUMASI-B	32.541	98.608	-0.234	0.000	0.000	2471.091	1531.502
	EXIST	31.547	95.597	-1.147	0.000	0.000	242.895	150.494
	TRA-08	30.988	93.903	-1.624	0.000	0.000	18.904	11.705
	CONNECT	31.207	94.566	-1.472	0.000	0.000	-0.002	-0.002
	TRA-09	30.984	93.892	-1.627	0.000	0.000	4.494	2.792
	KUMASI-A	33.000	100.000	0.000	2881.262	1811.229	0.000	0.000
	TRA-10	30.978	93.874	-1.631	0.000	0.000	19.799	12.299
	TRA-01	31.103	94.252	-1.544	0.000	0.000	15.202	9.402
	TRA-02	31.052	94.097	-1.579	0.000	0.000	32.893	20.392
	TRA-03	31.050	94.090	-1.581	0.000	0.000	1.502	0.902
	TRA-04	31.049	94.087	-1.582	0.000	0.000	3.598	2.197
	TOTAL				2881.262	1811.229	2839.177	1759.484

Table A6-2 (3/3) Voltage Drop Calculation Output (Amansie West District)

*** LINE FLOW ***

BRANCH	FROM	TO	P ===>	Q ===>	I ===>	LOSS-P	LOSS-Q	CHARGE	<=== P	<=== Q	<=== I
BA-06	BR-1	TRA-06	10.000	6.197	0.1251	0.001	-0.004	-0.005	-9.999	-6.201	0.1251
BA-05B	BR-1	TRA-05	62.042	38.416	0.7758	0.009	0.010	-0.002	-62.033	-38.406	0.7758
BA-07	TRA-05	TRA-07	9.198	5.695	0.1150	0.001	-0.005	-0.005	-9.198	-5.699	0.1151
BA-08	TRA-05	TRA-08	43.243	26.832	0.5412	0.049	0.041	-0.022	-43.194	-26.791	0.5413
BA-001	KUMASI-B	EXIST	377.341	243.314	4.5532	7.806	13.219	-0.071	-369.535	-230.094	4.5536
BA-002	EXIST	CONNECT	126.639	79.601	1.5647	0.922	1.502	-0.068	-125.717	-78.100	1.5651
BA-09	TRA-08	TRA-09	24.294	15.088	0.3045	0.002	0.000	-0.003	-24.292	-15.088	0.3046
BA-01	CONNECT	TRA-01	125.719	78.103	1.5651	0.320	0.400	-0.017	-125.399	-77.703	1.5652
BA-10	TRA-09	TRA-10	19.802	12.300	0.2483	0.003	-0.003	-0.006	-19.799	-12.303	0.2483
BA-000A	KUMASI-A	KUMASI-B	1440.631	905.612	17.0163	16.419	18.205	-0.212	-1424.212	-887.407	17.0175
BA-000B	KUMASI-A	KUMASI-B	1440.631	905.612	17.0163	16.419	18.205	-0.212	-1424.212	-887.407	17.0175
BA-02	TRA-01	TRA-02	110.198	68.299	1.3755	0.138	0.170	-0.010	-110.060	-68.129	1.3756
BA-05A	TRA-02	BR-1	72.063	44.644	0.9009	0.022	0.026	-0.004	-72.040	-44.618	0.9009
BA-03	TRA-02	TRA-03	5.104	3.086	0.0634	0.000	-0.010	-0.010	-5.104	-3.096	0.0634
BA-04	TRA-03	TRA-04	3.598	2.194	0.0448	0.000	-0.005	-0.005	-3.598	-2.199	0.0448
		TOTAL LOSS				42.111	51.752	-0.653			

ITERATION 3 MUMIN= 1.0008e+00 IT= 2