

**BRIEF REPORT ON E.C.G's
INSTRUCTORS AND PRINCIPAL'S
TRAINING IN JAPAN
FROM 23RD MAY, 2014 – 7TH JUNE, 2014**

Presented by :
KINGSFORD AMOAKO
(Technical Instructor)

INTRODUCTION

As part of JICA and E.C.G,s technical cooperation to extend technology transfer to the three SOUTH COUNTRIES in west Africa, the instructors and the principal of the training centre were sent to JAPAN to learn and observe new technologies and the modern way of doing things. The participants had the benefit of visiting some of the electric power companies in Kansai ie KEPCO, KINDEN etc. And also Shikoku Island where Shikoku electric company was located.

It became manifest that each and every electric power company in Japan, generates the power, transmit and distribute the energy in the locality that its find itself. Again, there were electric power companies in the various localities that does the construction work for the power companies.

**TOPIC :
HUMAN RESOURCE DEVELOPMENT IN
ELECTRIC POWER INDUSTRY IN JAPAN**

METHODOLOGY OF THE TRAINING PROGRAMME

The training included

- Lectures
- Audio visual presentation
- Practical demonstrations (when necessary)
- Field/site observations by each and every company visited

OBSERVATION

- Each electric power company has its own training centre/academy
- The recruitment age into each of the training centres
- Each electric power company has a prototype of the network and the associated equipment at the training centre.

OUTLINE OF THE TRAINING PROGRAMME

Date	Day	AM	PM	Place
25th	Mon	Orientation	New Technology of Electric Power (Energy and Gas Combined cycle Power Generation)	Kansai Electric Power Co Ltd (Sakai Power Station)
26th	Tue	Capacity Development for Engineers (Kansai Electric Power Development Center)	Capacity Development for Engineers (Kansai Electric Power Company) (Sakai v&D)	Kansai Electric Power Development Center
28th	Wed	Operation Technology of Distribution System (Lecture & Site Visit)	Operation Technology of Distribution System in the field of Generation and Maintenance of the Power Distribution Facilities. (Site visit)	Kansai Electric Power Development Center
29th	Thu	Human Resource Development in the Electric Construction Company (Site visit)	Capacity Development in the Electric Construction Company (Production & Power)	Kansai Electric Power Development Center
30th	Fri	Electric Power Distribution Technology in the Environmental Protection Area (Site visit)	Capacity Development in the Electric Construction Company (Kansai)	Kansai Electric Power Development Center
1st	Sat			
2nd	Mon	Capacity Development for Engineers (Kansai Electric Power Development Center)	Capacity Development for Engineers (Kansai Electric Power Development Center)	Kansai Electric Power Development Center
3rd	Tue	Capacity Development for Engineers (Kansai Electric Power Company) (Site visit)	Capacity Development for Engineers (Kansai Electric Power Development Center)	Kansai Electric Power Development Center
4th	Wed	Capacity Development for Engineers (Kansai Electric Power Company) (Site visit)	Capacity Development for Engineers (Kansai Electric Power Development Center)	Kansai Electric Power Development Center
5th	Thu	To draft the Action Plan		
6th	Fri	Capacity Development for Engineers (Kansai Electric Power Company) (Site visit)	Capacity Development for Engineers (Kansai Electric Power Development Center)	Kansai Electric Power Development Center
7th	Sat	Home Check-out		

- Each of the electric construction companies also have their own training centres
- Proper training programme/schedule during and even after leaving the training centre had been put in place to monitor and assess the performance of each worker ie.
 - Training by the skill level : to acquire the common skill (management skill etc)
 - Professional training : to acquire the techniques and knowledge required for each position and understand the other types of job in step-by-step manner.

- Training for qualification : to conduct an in gathering training in other to obtain qualifications
- To conduct an employee training at the place of work while he/she is doing the actual job and an experienced employee serves as the course the course instructor using hands-on training
- Personal development : to support and encourage employees to improve oneself.

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- v) Lack of proper monitoring system for trainees progress and training needs for staff
- vi) Lack of systematic human capacity development system or policy for staff.
- vii) Lack of collaboration between E.C.G and manufacturers as well as contractors

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ACTION PLAN

1. PROBLEMS OF CAPACITY DEVELOPMENT FOR ENGINEERS AND TECHNICIANS IN E.C.G

- i) Recruitment age is high for E.C.G trainees (about 30 years).
- ii) Not all staff recruited goes through the training centre for orientation and training
- iii) Insufficient tools and equipment for trainees
- iv) Lack of prototypes of major equipment for the training centre

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2. IMPLEMENTATION

SHORT-TERM

- i) Sending proposal to management to consider and reduce the recruitment age of trainees to a maximum of 23 years.
- ii) We shall advocate and ensure that staff goes through a basic training programme at the training centre.
- iii) We shall solicit for assistance from donor agencies to develop systematic capacity development policy and procedures for E.C.G eg. USAID, CIDA and JICA etc

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iv) We shall modify the monitoring system acquired from the Shikoku Electric Company Ltd. to suit the E.C.G training centres needs and use it alongside the general performance management system.

v) We shall train supervisors in the regions to be able facilitate basic training programmes and support the administration of the new performance system for trainees.

vi) We shall recommend to Management to have a program to send Instructors who have spent more than four years back to the field

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LONG TERM

i) We shall advocate and ensure that management avail samples of any new equipment acquired to the training school.

ii) We shall propose that all third party contractors be train and certify by the training centre before any contract is awarded to the company.

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CONCLUSION

In conclusion, the programme has been of immense benefit to us, as it has broaden our knowledge in human resource development and has equipped us to draw a comprehensive programme for the training centre in the short, medium and long term. Our sincere thanks goes to JICA, NEWJEC and E.C.G for this collaboration and also to all our the companies visited. They were more than prepared to answer all the questions and even went the extra mile.

We say " Arigator Gozaimas" to you all.

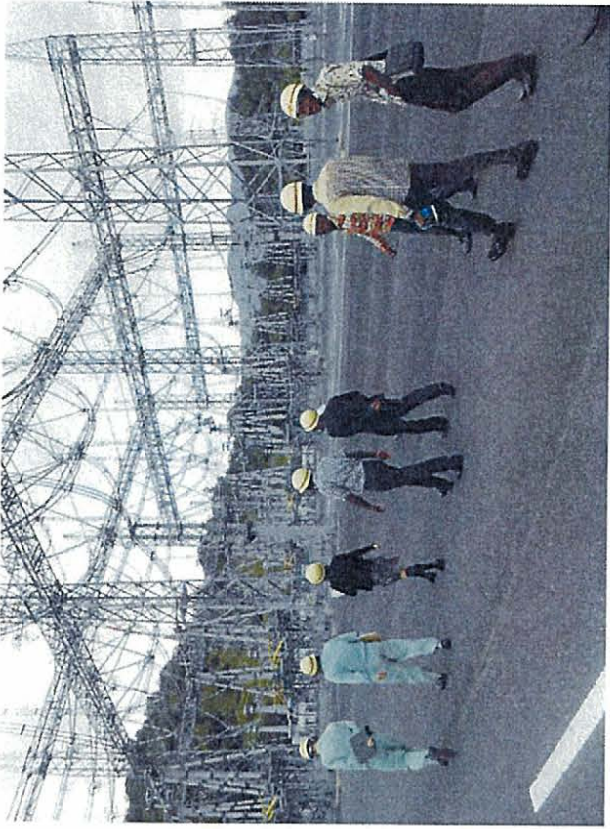
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MEDIUM TERM

i) Staff already recruited without training should made to come to the centre for training or dispatch technical Instructors to the regions and districts to train them.

ii) We shall develop a reward system through technical skills competition at the training centre for all the regions to participate

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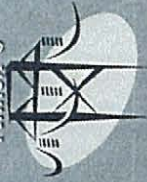


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Activity of First Year (2014)

1. Construction of 33/11 kV Substation for the Training
2. Procurement of the Measurement Instruments for the Training

1

The Purpose of the Construction of Substation and Procurement of Measurement of Instruments

1. The trainee shall easily be able to be trained with real and live Electrical Power Facility in the series of the training.
2. The training of Operation and Maintenance shall be executed with real live facility, consequently the performance of the training will soon be reflected in their work site.
3. How to use the Measurement Instruments shall be studied also with real facility, then trainee will easily understand their usage.

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Background why JICA think to donate the Installation of the Substation and Procurement of Measurement Instruments

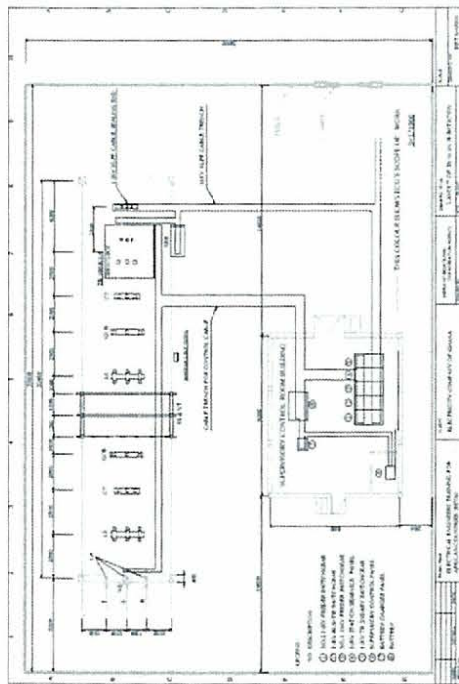
1. ECG already has Operation Simulator for the Power Facility, but the Quality and the Amount might not be enough.
2. There is no Real (Live) Facility for the Training in the ECG Training Center.
3. Even though if ECG only have some live facility, ECG may not be able to execute effective and good training without precious and accurate Measurement (Maintenance) Instruments.
4. ECG Training Center is going to be the stronghold to implement the raising the capacity of Electrical Power Engineer including neighbor countries.

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Implemented Work until Today

1. Produce of tender document for construction of substation.
2. Produce of tender document for procurement of measurement instruments.
3. Procurement of quotation for construction of substation from three (3) Companies.
4. Procurement of quotation for measurement instruments from ECG's accustomed maker "Megger Limited".

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OUTLINE OF THE SUBSTATION PLANNED

Execution of Bidding for the Construction of Substation and the Result

JICA delivered the tender document to seven (7) companies. The Bidding is executed on 18th July, 2014.

Five (5) companies attended the bidding, but one company was late for the bidding time, then disqualified and one more company did not prepare the documents fully, and also disqualified.

Therefore bidding were executed in 3 companies.

As the result, awarded company's is "FIMACO".

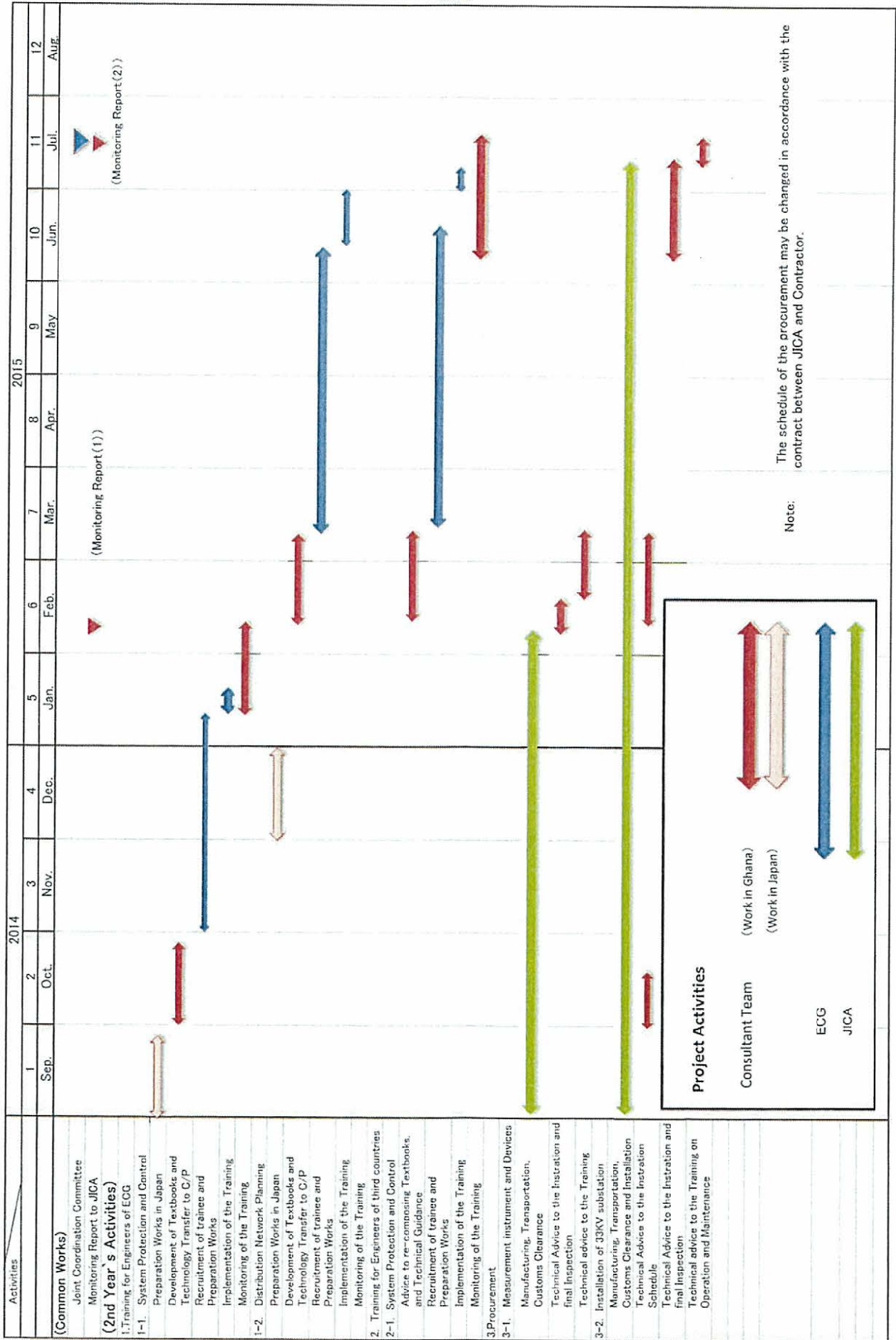
The bidding of Measurement Instruments is now planned to execute in August or September.

Measurement Instruments to be Procured by JICA

- | | |
|--|------|
| 1. Portable Cable Fault Locator | 1set |
| 2. Oil Tester | 1set |
| 3. Primary Current Injection Test Set | 1set |
| 4. Secondary Injection Test Set (Relay Tester) | 1set |
| 5. Portable Power Quality Analyzer | 1set |

Schedule of the Project Activities in the Second Year

Annex-9(1)



Allocation Plan of the Consultant Team

Field in charge	Name	2nd Year of the Project											
		1	2	3	4	5	6	7	8	9	10	11	12
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.
(Work in Ghana)													
Chief Advisor /Training Planning	Hiroshi Kurakata												
Power Distribution Planning /Design	Takamu Genji												
Power Distribution System Operation	Tatsuhiko Tamura												
Substation Maintenance	Tsuguhiro Yamada												
Training Monitoring /Assistant for Power Distribution Substation Equipment /Procurement	Seiji Ito												
(Work in Japan)													
Chief Advisor /Training Planning	Hiroshi Kurakata												
Power Distribution Planning /Design	Takamu Genji												
Power Distribution System Operation	Tatsuhiko Tamura												
Substation Maintenance	Tsuguhiro Yamada												

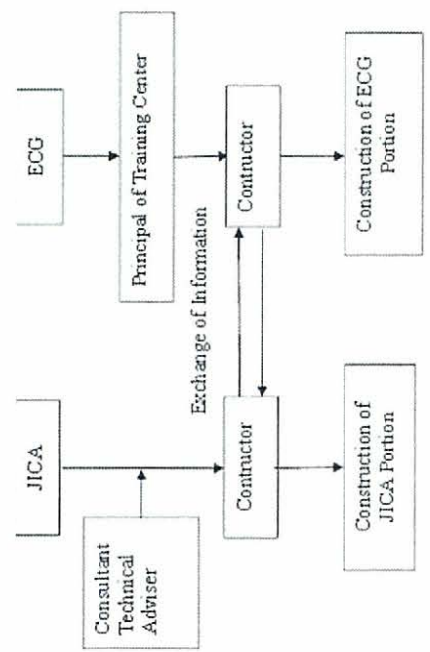
Note: The Schedule of the Substation Equipment/ Procurement may be changed in accordance with the contract between JICA and Contractor.



Activity of the Second Year (2015)

1. Construction of 33/11 kV Substation for the Training
2. Procurement of the Measurement Instruments for the Training

Organization Figure under Consideration



Favorable Condition for Construction of Substation

1. JICA portion and ECG portion shall be combined in the construction schedule.
2. Therefore cooperation and exchange of information between JICA and ECG shall be invaluable.
3. Construction of Supervisory Control Room by ECG shall be pivotal point and then expected to be finished on time. Because control panels from JICA are supposed to be timely installed in it's Room.

The necessity of the training how to use Measurement Instruments for all these 5 items

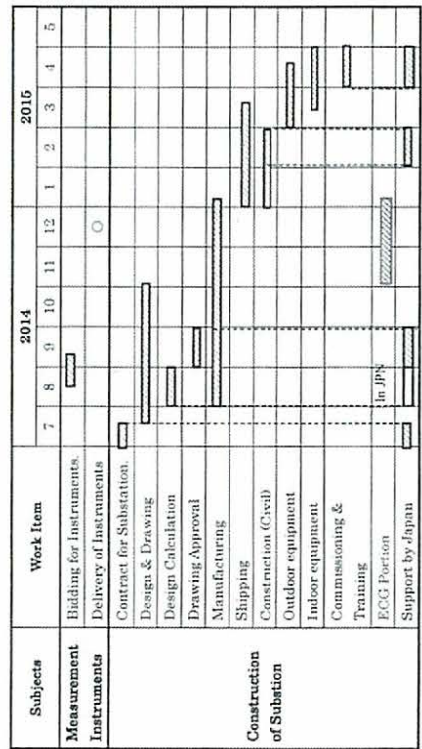
- | | |
|--|-----------|
| 1. Portable Cable Fault Locator | Necessary |
| 2. Oil Tester | Manual |
| 3. Primary Current Injection Test Set | Manual |
| 4. Secondary Injection Test Set (Relay Tester) | Manual |
| 5. Portable Power Quality Analyzer | Manual |

Bidding of Measurement Instruments

- JICA now is planning to execute the Bidding of Measurement Instruments in August or September.
- JICA expect two (2) or three (3) companies will attend the Bidding.
- The delivery of these instruments will be scheduled in December.

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Schedule of Procurement of Measurement Instruments and Construction of Substation



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Annex - II

List of Participants

Name	Title	Organisation
George Yaw Marfo	Principal	ECG Training Centre
Bless Agbi	Technical Instructor (Overhead Lines & Underground Cables)	ECG Training Centre
Samuel Andoh	Technical Instructor (Overhead Lines)	ECG Training Centre
Kingsford Amoako	Technical Instructor (Substation Maintenance)	ECG Training Centre
Issac N. Nukpezah	Technical Instructor (Substation Maintenance)	ECG Training Centre
Peter King Asare	Technical Instructor (Underground Cables)	ECG Training Centre
Hiroshi Sumiyoshi	Senior Representative	JICA Ghana Office
Tomonari Takeuchi	Representative	JICA Ghana Office
Hiroshi Kurakata	Chief Advisor	EETA Project
Takamu Genji	JICA Expert (Power Distribution Planning/ Design)	EETA Project
Tatsuhiko Tamura	JICA Expert (Power Distribution System Operation)	EETA Project
Tsuguhiro Yamada	JICA Expert (Substation Maintenance)	EETA Project
Seiji Ito	JICA Expert (Training Monitoring)	EETA Project
Shinichi Tojihoh	JICA Expert (Substation Equipment/ Procurement)	EETA Project
Ritsuko Kawabe	Project coordinator	EETA Project

**Minutes of the Third Joint Coordinating Committee for
the Project on Electrical Training for African Countries (EETA)**

1. **Date:** 23rd July, 2015
2. **Time:** 10.00 am ~ 12.00 pm
3. **Venue:** Conference room at the ECG Training Centre
4. **Participants:** As attached in Annex-1

5. **Major Objectives of the Committee**
 - To review the overall progress of the project and its activities carried out under the Annual Plan of Operation; and
 - To review and exchange views on major issues arising from or concerning the Project.

6. **Report of Project Activities in the second year**
 - (1) Implementation of the training courses
 - Mr. Andoh, a technical instructor for overhead lines made a presentation on the project activities related to the training courses implemented in the second year.

 - 1) Training course for technicians of ECG
 - The training course for technicians of the ECG entitled “Maintenance Techniques for Power Equipment and Implementation Procedure” was conducted from 22nd to 26th June, 2015. The Human resource department of the ECG nominated ten trainees (10) from all ten regions. The curriculum of the course is herewith attached as Annex – 2.

 - 2) Training course for engineers of ECG
 - The training course for engineers of the ECG entitled “System Protection & Control” was implemented from 23rd to 27th February, 2015. Twenty (20) from all ten regions were invited for the training course. The curriculum of the course is herewith shown in Annex – 3.

 - 3) The training course for engineers of the ECG
 - The training course for engineers of the ECG entitled “Distribution Planning” was conducted from 13th to 17th July, 2015. Ten (10) trainees were nominated from all ten regions. The curriculum of the course is herewith attached as Annex 4.

Training courses for technicians of the third countries entitled “Maintenance Techniques for Power Equipment (Underground Cable Maintenance) and engineers entitled “System Protection & Control” for the second year have been postponed due to the Ebola fever in West African countries.

 - (2) Monitoring of training courses
 - The results of the monitoring in connection with the three training courses conducted for technicians and engineers of ECG were monitored as follows.

 - 1) Training course for technicians of ECG
 - MR. Amoako, a technical instructor for substation maintenance and network reported the outcome from the training course of “Maintenance Techniques for Power Equipment and Implementation Procedure” for technicians of ECG by the

pre-training and post-training questionnaire during the course as given below;

- This training course was implemented very successfully and effectively in order to improve the ability of technicians of ECG
- It is expected that the knowledge and technology acquired in this training course would be utilized awesomely and contribute to enhance the quality of their work.
- The degree of satisfaction to this training is remarkably high, especially in the part of “Significance of preventive maintenance of distribution equipment and “Points of patrol & inspection technique and implementation procedure”, most of trainees evaluated the impact of the training.
- It is presumed that training will achieve the expected outcomes and objectives.

2) Training course for engineers of ECG

Mr. Fujita explained the feedback of the training course on “System Protection & Control” for engineers of the ECG was implemented by the pre-training and post-training questionnaires as in the following.

- This training course could provide a substantial technical improvement for ECG engineers.
- The degree of satisfaction of the course was acclaimed very highly.
- It is presumed that the training will achieve the expected outcome and has been implemented successfully.

3) Training course for engineers of ECG

Mr. Mikumo made a presentation on the results of the training course on “Distribution Planning” for engineers of the ECG was implemented by the pre-training and post-training questionnaires as follows;

- The ECG engineers have been boosted by considerable technical improvement in this training course.
- Regarding the ECG operations, this training course could provide the possibility of practical use of the acquired knowledge.
- The degree of satisfaction was high.
- It is presumed that this training course had been conducted successfully and achieved the expected outcome.

Mr. Genji and Mr. Tamura made the comments concerning the course of “Distribution Planning”.

- The training course has been led to fine achievement by the devoted cooperation of two facilitators, Mr. George Eduful and Mr. Issah B. Majeed. JICA consultant team is deeply grateful to them for their dedication.
- JICA consultant team recommended that both facilitators would be responsible for this training course in next year and subsequent training. This opinion was agreed by the ECG.
- During the second half of the training period, a practical training of technical analysis using the software, Cymdist was conducted. JICA consultant team informed the facilitators’ comments that the period of this practice is too short. Moreover, some trainees had an opinion in the result of course monitoring that the period of lectures on the textbook is too short.

(3) Report of procurement of equipment

1) Procurement of measurement instrument and devices

Mr. Tohjoh reported the progress for the procurement of equipment for the training

courses by JICA Ghana office.

- Five kinds of measurement instrument, which are a portable cable fault locator, oil tester, primary current injection test set, secondary injection test set, and portable power quality analyzer, have been procured including the accessories. In addition, the training was organised on the use of the portable cable fault locator for the ECG instructors from 16th to 18th March, 2015 at the ECG training centre.

2) Construction of substation for training

The approval work of drawings and calculations for the foundation and structures have been almost completed due to much effort by the concerned parties, JICA, ECG, and a contractor FIMACO. Therefore, manufacturing of the equipment has been ongoing. The shipment from India to Ghana has also been started and some equipment had already arrived at the site. Although the initial schedule of the construction was for one year till the end of July, 2015, the contractor has proposed to change the duration to extend until the end of November, 2015.

(4) Achievement of output and modification of the implementation plan

Mr. Kurakata elucidated the achievement of the output of the project activities and modification of the implementation plan of the project. Both sides confirmed the result of the modification of the implementation plan of the project (PDM ver. 3.0 and PO ver. 3.0) attached as Annex – 5.

7. Plan of Project Activities in the third year (Sep. 2015 – Aug. 2016)

(1) Plan of technology transfer


Mr. Kurakata explained the tentative schedule of the project activities in the third year. The schedule of project activities is attached as Annex – 6 and allocation plan of the consultant team is shown in Annex – 7. Mr. Kurakata also stated that the final evaluation would be implemented in February, 2016 with cooperation of JICA headquarters as the final year of the project.

(2) Plan of construction of substation for training

Mr. Tohjoh stated the tentative schedule for the completion of the construction of substation and its subsequent use for the training of substation maintenance for technicians would be implemented in the third year. The document is herewith shown as Annex – 8. ECG was required to complete the connection of 33kv and 11kv cables to the substation by the middle of October, 2015. ECG agreed with this schedule.

As a result of the meeting, the Project Team clarified the activities and schedule of the project and agreed to the matters referred to in the documents attached hereto.

Tema, 23rd July, 2015



Mr. Koji Makino
Chief Representative
Japan International Cooperation Agency (JICA)
Ghana Office



Mr. Robert Dwanena
Ag. Managing Director
Electricity Company of Ghana



Mr. Hiroshi Kurakata
Chief Advisor
JICA Expert Team



Mr. George Yaw Marfo
Principal
ECG Training Centre

List of Participants

Annex - 1

Name	Title	Organisation
Flora Colerangle	Divisional Manager - Manpower Planning	ECC Headquarters
George Yaw Marfo	Principal	ECC Training Centre
Bless Agbi	Technical Instructor	ECC Training Centre
Samuel Andoh	Technical Instructor	ECC Training Centre
Kingsford Amoako	Technical Instructor	ECC Training Centre
Issac N. Nukpezah	Technical Instructor	ECC Training Centre
Peter King Asare	Technical Instructor	ECC Training Centre
Maxwell Essel	Technical Instructor	ECC Training Centre
Madina Adam	Technical Instructor	ECC Training Centre
Koji Makino	Chief Representative	JICA Ghana Office
Tomonari Takeuchi	Representative	JICA Ghana Office
Prince Bio	Local Consultant	JICA Ghana Office
Hiroshi Kurakata	Chief Advisor	EETA Project
Takamu Genji	JICA Expert	EETA Project
Tatsuhiko Tamura	JICA Expert	EETA Project
Tomohisa Fujita	JICA Expert	EETA Project
Yukihiko Mikumo	JICA Expert	EETA Project
Shinichi Tohjoh	JICA Expert	EETA Project
Ritsuko Kawabe	Project coordinator	EETA Project

**JICA PROGRAMME FOR ECG TECHNICIAN ON
MAINTENANCE OF POWER DISTRIBUTION FACILITIES**

22ND – 26TH JUNE, 2015

DAYS	8:30am – 9:00am	9:00am – 10:00am	10:00am-10:15am	10:15am –12noon	12noon – 1pm	1pm – 3:30pm	
Day 1	Registration and Opening Ceremony	1. Orientation 2. Outline of power distribution facilities <i>Samuel Andoh</i>	S n a c k B r e a k			L u n c h B r e a k	
Day 2	Overhead line and underground cable <i>Bless Agbi</i>			Deterioration mechanism of power distribution <i>Samuel Andoh</i> 1. Management and application of maintenance date 2. Distribution line fault and investigation <i>Peter Asare</i>		1. Inspection and preventive maintenance of distribution line (type and method) 2. Inspection on transformer <i>Bless Agbi</i> 1. Procedure of cable fault location <i>Peter Asare</i> 2. Operation and management of power distribution system a. management of voltage and current b. measurement of earth resistance <i>Samuel Andoh</i>	
Day 3	Outline of substation equipment <i>Kingsford Amoako</i>		S n a c k B r e a k			Outline of distribution equipment <i>Kingsford Amoako</i>	
Day 4	Substation patrol/periodic inspection <i>Isaac Nukpezah</i>			Outline of distribution equipment <i>Kingsford Amoako</i> Substation patrol/periodic inspection <i>Isaac Nukpezah</i>		1. Data management of substation equipment 2. Statistic and analysis of fault <i>Isaac Nukpezah</i>	
Day 5	1. Procedure of fault restoration 2. Overload operation of transformer <i>Kingsford Amoako</i>			Prevention of Human error and safety <i>Isaac Nukpezah</i>		Prevention of Human error and safety <i>Isaac Nukpezah</i> Evaluation	

Annex-3 Curriculum of “System Protection and Control” Training for ECG Engineer

DAYS	8:30am – 9:00am	9:00am – 10:00am	10:00am-10:15am	10:15am –12noon	12noon - 1pm	1pm – 3:30pm	
Day 1	Registration and Opening Ceremony 0. Orientation 1. Overview of Electric Power System <i>Name (lecturer):</i> ING. George Hommey	1. Overview of Electric Power System <i>Name:</i> ING. George Hommey	S h a r k B r e a k L u n c h B r e a k	1. Overview of Electric Power System <i>Name:</i> ING. George Hommey	2. Overview of protection relay system <i>Name:</i> ING. George Hommey	2. Overview of protection relay system <i>Name:</i> ING. George Hommey	
Day 2	3. Neutral Grounding System <i>Name:</i> ING. Rodnell Bilson	4. Protection System for Substation (Transformer Protection System) <i>Name:</i> ING. Rodnell Bilson		4. Protection System for Substation (Transformer Protection System) <i>Name:</i> ING. Rodnell Bilson	4. Protection System for Substation (Transformer Protection System) <i>Name:</i> ING. Rodnell Bilson	4. Protection System for Substation (Transformer Protection System) <i>Name:</i> ING. Rodnell Bilson	4. Protection System for Substation (Transformer Protection System) <i>Name:</i> ING. Rodnell Bilson
Day 3	4. Protection System for Substation (Bus Protection System) 5. Transmission Line Protection System <i>Name:</i> ING. Rodnell Bilson	5. Transmission Line Protection System <i>Name:</i> ING. Rodnell Bilson		5. Transmission Line Protection System <i>Name:</i> ING. Rodnell Bilson	5. Transmission Line Protection System <i>Name:</i> ING. Rodnell Bilson	6. Distribution line Protection System <i>Name:</i> ING. Frank Osei Owusu	6. Distribution line Protection System <i>Name:</i> ING. Frank Osei Owusu
Day 4	6. Distribution line Protection System <i>Name:</i> ING. Frank Osei Owusu	7. Fault Calculation <i>Name:</i> ING. Frank Osei Owusu		7. Fault Calculation <i>Name:</i> ING. Frank Osei Owusu	7. Fault Calculation <i>Name:</i> ING. Frank Osei Owusu	8. Relay Setting <i>Name:</i> ING. Frank Osei Owusu	8. Relay Setting <i>Name:</i> ING. Frank Osei Owusu
Day 5	8. Relay Setting (Practice using Simulator) <i>Name:</i> ING. Frank Osei Owusu ING. Maxwell Graham Engr. Maxwell Essel	8. Relay Setting (Practice using Simulator) <i>Name:</i> ING. Frank Osei Owusu ING. Maxwell Graham Engr. Maxwell Essel		8. Relay Setting (Practice using Simulator) <i>Name:</i> ING. Frank Osei Owusu ING. Maxwell Graham Engr. Maxwell Essel	8. Relay Setting (Practice using Simulator) <i>Name:</i> ING. Frank Osei Owusu ING. Maxwell Graham Engr. Maxwell Essel	8. Relay Setting (Practice using Simulator) <i>Name:</i> ING. Frank Osei Owusu ING. Maxwell Graham Engr. Maxwell Essel	8. Relay Setting (Practice using Simulator) <i>Name:</i> ING. Frank Osei Owusu ING. Maxwell Graham Engr. Maxwell Essel

Note: Name in bold means a name of instructor

Annex-4 Curriculum of Distribution Planning for ECG Engineer

DAYS	8:30am – 10:00am	10:00am-10:15am	10:15am – 12noon	12noon - 1pm	1:00pm – 3:30pm
13/Jul /2015	1.Registration , Opening Ceremony 2.Questionnaire <i>ECG Training center</i>	K	1.Purpose and the outline of distribution planning tasks 3.Configuration of distribution facilities in ECG <i>Mr.George Eduful</i>	K	2.Basic configuration and characteristics of distribution systems 4.Quality of power distribution <i>Mr.George Eduful</i>
14/Jul /2015	5.Load characteristics of distribution lines 6.Demand projection <i>Mr.Issah B.Majeed</i>	a	7. <i>Analysis and Evaluation of System characteristics</i> <i>Mr.George Eduful</i>	a	7. <i>Analysis and Evaluation of System characteristics</i> <i>Mr.George Eduful</i>
15/Jul /2015	7. <i>Analysis and Evaluation of System characteristics</i> <i>Mr.George Eduful</i>	e	8.Reliability Analysis and evaluation of the distribution system 9. Economic evaluation <i>Mr.Issah B.Majeed</i>	e	10.How to proceed with distribution facilities planning <i>Mr.Issah B.Majeed</i>
16/Jul /2015	11. Practice of planning 11-1 Demand Projection 11-2 Load flow / Optimization of networks <i>Mr.Issah B.Majeed</i>	B	11. Practice of planning 11-3 Technical losses estimation 11-4 Short circuit analysis <i>Mr.Issah B.Majeed</i>	B	11. Practice of planning 11-5 Reliability Analysis 11-6 Distribution automation) <i>Mr.Issah B.Majeed</i>
17/Jul /2015	11. Practice of planning 11-7 Economic Engineering <i>Mr.Issah B.Majeed</i>	K	Evaluation, Making Action plan, and Closing Ceremony <i>ECG Training center</i>	K	

Annex-5 (1) Project Design Matrix (Ver.3.0)

PDM (Project Design Matrix)

1. Project Title: The Project for Electrical Engineers Training for African Countries (EETA)

2. Terms of Cooperation : From Sep. 2013 to Sep.2016

3. Target Group: Trainers of ECG

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Overall Goal</p> <p>Distribution System operation and maintenance in ECG and third countries is improved</p>	<ul style="list-style-type: none"> • Distribution loss and SAIFI (The System Average Interruption Frequency Index) will decrease in Ghana and third countries. 	<ul style="list-style-type: none"> • Annual report of ECG and third countries 	<ul style="list-style-type: none"> • There is no drastic change in Energy Policy in Ghana. • Necessary budget shall be allocated for the training.
<p>Project Purpose</p> <p>Training capacity on distribution system operation and maintenance for ECG and third countries is strengthened</p>	<ul style="list-style-type: none"> • Number of training courses for technicians and engineers will increase. • Syllabus, curriculum and training materials will be revised or newly developed. 	<ul style="list-style-type: none"> • Annual report of ECG and third countries • Quarterly Report of ECG and third countries 	<ul style="list-style-type: none"> • Trained trainers continue to work for ECG. • Stakeholders fulfill their responsibilities in maintaining cooperation framework.
<p>Outputs</p> <p>1. Current situation of distribution system operation and maintenance is analyzed and training needs are identified</p>	<ul style="list-style-type: none"> • Report compiled training needs 	<ul style="list-style-type: none"> • Quarterly Report of ECG and third countries • Project Progress Report 	<ul style="list-style-type: none"> • Trainees from third countries continue to participate in the training courses in ECG. • Equipment will be properly maintained for the training courses.
<p>2. Training for technicians of ECG and the third countries is improved</p>	<ul style="list-style-type: none"> • Number of trainees for technicians courses will increase. • Number of certificated trainees (Ghana: a more than 30, third countries: more than 36) 	<ul style="list-style-type: none"> • Quarterly Report of ECG and third countries • Project Progress Report • Syllabus, curriculums and Training materials for the training courses • Inventory list • Result of the Monitoring 	

Annex-5 (I) Project Design Matrix (Ver.3.0)

PDM (Project Design Matrix)

1. Project Title: The Project for Electrical Engineers Training for African Countries (EETA)
2. Terms of Cooperation : From Sep. 2013 to Sep.2016
3. Target Group: Trainers of ECG

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>3. Training for engineers of ECG and third countries is implemented</p>	<ul style="list-style-type: none"> • Number of training courses for engineers will increase programs • Number of trainees (Ghana: a more than 50, third countries: more than 12.) 	<ul style="list-style-type: none"> • Quarterly Report of ECG and third countries • Project Progress Report • Syllabus, curriculums and Training materials for the training courses • Result of the Monitoring 	
<p>4. Monitoring and management capacity of ECG is improved.</p>	<ul style="list-style-type: none"> • Quality of revised texts • Quality of revised tools • Number of JCC meetings 	<ul style="list-style-type: none"> • Quarterly Report of ECG and third countries • Project Progress Report • Manuals and tools 	

Activities	Inputs (Means and Cost) (Japanese Side)	Important Assumptions (Pre-conditions)
<p>1. Current situation of distribution system operation and maintenance is analyzed and training needs are identified</p> <p>1-1 Review the electricity policy and plan of Ghana and regional cooperation framework</p> <p>1-2 Review the current situation challenges of distribution system O&M in ECG and the third countries</p> <p>1-3 Review the current situation of human resources development of ECG engineers and technicians</p> <p>1-4 Identify the training needs of ECG engineers and technicians and the third countries</p>	<p>A. Assignment of Experts</p> <ul style="list-style-type: none"> -Chief Advisor/ Training Planning -Power Distribution Planning/ Design -Power Distribution System Operation -Substation Maintenance -Training Monitoring/ Assistant for Power Distribution -Substation Equipment/ Procurement -Coordinator <p>B. Training in Japan</p> <p>Seven(7) counterpart personnel are planning to be accepted to the training program in Japan in the first years of the Project.</p> <p>C. Provision of Equipment</p> <p>Equipment will be provided based on the R/D.</p> <p>D. Allocation of the necessary budget of trainings for third countries.</p> <ul style="list-style-type: none"> - Allowance for third countries' trainees are provided by JICA. - Transportation fee of trainees is arranged by own organization. <p>(Ghanaian Side)</p> <ul style="list-style-type: none"> A. Assignment of Counterpart personnel - Project Director - Project Manager - Project Coordinator - Technical Manager - Technical Counterpart <p>B. Joint Coordinating Committee</p> <p>C. Office Space and others</p> <p>ECG will provide necessary office facilities including electricity, air-conditioning, water and internet during the duration of the Project.</p> <p>D. Allocation of the necessary budget for the activities described in PDM.</p> <p>E. Training for trainees of third countries</p> <p>ECG assigns necessary lecturers in order to implement trainings for third countries.</p>	<ul style="list-style-type: none"> - Counterparts are assigned. - Necessary budget, office space and facilities for the Project are allocated.
<p>2. Training for technicians of ECG and the third countries is improved</p> <p>2-1 Review the existing training course of ECG for technicians</p> <p>2-2 Replace training equipments and facilities of ECG</p> <p>2-3 Update necessary training materials</p> <p>2-4 Deliver training programs for ECG technicians</p> <p>2-5 Deliver training programs for the third countries</p> <p>2-6 Observe the training performance and feed-back to training courses</p>		
<p>3. Training for engineers of ECG and third countries is implemented</p> <p>3-1 Develop syllabuses, culliculum and material for three training programs</p> <p>3-2 Install new equipments and facilities for training</p> <p>3-3 Strengthen skills and technology of ECG training</p> <p>3-4 Deliver training programs for ECG engineers</p> <p>3-5 Deliver training programs for the third countries</p> <p>3-6 Observe the training performance and feed-back to training courses</p>		
<p>4. Monitoring and management capacity of ECG is improved.</p> <p>4-1 Observe and analyze the current capacity of ECG for monitoring and management of training</p> <p>4-2 Prepare plan for methodologies and procedures for improvement</p> <p>4-3 Improve ECG capacity for training monitoring and management</p>		

Annex-5 (2) Plan of Operation (Ver.3.0)

Project Title: The Project for Electrical Engineers Training for African Countries (EETA)

Terms of Cooperation: From Sep. 2013 for three years

Target Group: Trainers of ECG

		JFY2013		JFY2014				JFY2015				JFY2016		
		2013		2014				2015				2016		
		3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q
Project Period 3 years														
1	Current situation of distribution system operation and maintenance is analyzed and training needs are identified													
1- 1	Review the electricity policy and plan of Ghana and regional cooperation framework	••												
1- 2	Review the current situation challenges of distribution system O&M in ECG and the third countries	••												
1- 3	Review the current situation of human resources development of ECG engineers and technicians	••												
1- 4	Identify the training needs of ECG engineers and technicians and the third countries	••												
2	Training for technicians of ECG and the third countries													
2- 1	Review the existing training course of ECG for technicians	••												
2- 2	Replace training equipments and facilities of ECG	→												
3	Update necessary training materials	→												
2- 4	Deliver training programs for ECG technicians			••	→	→	→	→	→	→	→	→	→	→
2- 5	Deliver training programs for the third countries			••	→	→	→	→	→	→	→	→	→	→
2- 6	Observe the training performance and feed-back to training courses			••	→	→	→	→	→	→	→	→	→	→
3	Training for engineers of ECG and third countries is implemented													
3- 1	Develop syllabuses, curriculums and material for three training programs			→	→	→	→							
3- 2	Install new equipments and facilities for training			→	→	→	→							
3- 3	Strengthen skills and technology of ECG training			••	••									
3- 4	Deliver training programs for ECG engineers					••								
3- 5	Deliver training programs for the third countries					••	→	→	→	→	→	→	→	→
3- 6	Observe the training performance and feed-back to training courses					••	→	→	→	→	→	→	→	→
4	Monitoring and management capacity of ECG is improved.													
4- 1	Observe and analyze the current capacity of ECG for monitoring and management of training	→												
4- 2	Prepare plan for methodologies and procedures for improvement	••												
4- 3	Improve ECG capacity for training monitoring and management			→	→	→	→	→	→	→	→	→	→	→
Evaluations														
	Monitoring Sheet													
	Final Evaluation of the Project							▲		▲		▲		
	Final Report													▲

Annex-7 Allocation Plan of the Consultant Team in the Third Year

Field in charge	Name	3rd Year of the Project											
		1	2	3	4	5	6	7	8	9	10	11	12
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.
(Work in Ghana)													
Chief Advisor /Training Planning	Hiroshi Kurakata												
PowerDistributionPlanning /Design	Takamu Genji												
PowerDistributionSystem Operation	Tatsuhiro Tamura												
Substation Maintenance	Tomohisa Fujita												
TrainingMonitoring /Assistant for Power Distribution	Yukihiro Mikumo												
Substation Equipment /Procurement	Shinichi Tohjo												
(Work in Japan)													
Chief Advisor /Training Planning	Hiroshi Kurakata												
PowerDistributionPlanning /Design	Takamu Genji												
PowerDistributionSystem Operation	Tatsuhiro Tamura												
Substation Maintenance	Tomohisa Fujita												

Note: The Schedule of the Substation Equipment/ Procurement may be changed in accordance to the construction works.

ECG TRAINING SCHOOL SUBSTATION CONSTRUCTION SCHEDULE

CLASS	NO	SCHEDULE OF 2015		July	August	September	October	November
		ITEMS						
APPROVAL WORK	1	Foundation & Structure Detail Drawing Approval						
	2	Foundation Plan Submission Approval						
	3	Pending System & Vendor Drawings Approval						
EQUIPMENT SHIPPING SCHEDULE	1	33/11 kV Power Transformer						
	2	11/0.4 kV aux Transformer						
	3	33 kV Circuit Breaker						
	4	33 kV Isolator						
	5	33 kV Current Transformer						
	6	33 kV Voltage Transformer						
	7	33kV Lightning Arrester						
	8	11 kV VCB Panel Board						
	9	11 kV Neutral Earthing Resistor						
	10	Control and Relay Panel						
	11	Bay Marshalling Kiosk						
	12	GI Structure for 33 kV Switchyard						
	13	Tubular Bus Bars						
	14	33 kV Bus Support Insulator						
	15	Clamp and Connector						
	16	AAC Conductor						
	17	11 kV Cable & Kit						
	18	LT Power and Control Cable						
	19	Earthing Material						
	20	110V Battery, Charger and DCDB						
INSTALLATIO	1	Civil Work						
	2	Installation Work						
	3	Control Room Construction (ECG)						
	4	33 kV & 11 kV Cable Connection (ECG)						
	5	Testing & Commissioning						
	6	Operation & Maintenance Training						
	7	Scheduled Completion shall be 27/Nov.						



MINUTES OF MEETING
BETWEEN
THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF
THE REPUBLIC OF GHANA
AND
TERMINAL EVALUATION TEAM OF
THE JAPAN INTERNATIONAL COOPERATION AGENCY
ON
THE PROJECT FOR ELECTRICAL ENGINEERS TRAINING FOR AFRICAN COUNTRIES

The Terminal Evaluation Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Hiroshi SUMIYOSHI visited the Republic of Ghana (hereinafter referred to as "Ghana") from February 5 to 25, 2016 for the purpose of conducting a terminal evaluation on the Project for Electrical Engineers Training for African Countries (hereinafter referred to as "the Project").

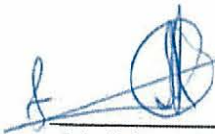
During its stay in Ghana, the Team had a series of discussions, exchanged views, and compiled a terminal evaluation report (hereinafter referred to as "the Report") with the authorities concerned of the Government of the Republic of Ghana (hereinafter referred to as "the Ghanaian side") over the matters for the successful implementation of the Project.

As a result of the discussions, both sides agreed upon the matters referred to in the document attached hereto.

Tema, February 25, 2016

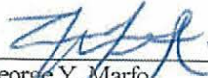
Mr. Hiroshi SUMIYOSHI
Leader
Terminal Evaluation Team
Japan International Cooperation Agency



Mr. Solomon A. Asoalla
Acting Chief Director
Ministry of Power



Mr. Robert Dwamena
Managing Director
Electricity Company of Ghana



Mr. George Y. Marfo
General Manager
ECG Training Centre

ATTACHMENT

1. Recognition of the Terminal Evaluation Report

Both sides recognized that the Report as Appendix 1 was proper and accepted.

2. Termination of the Project

Based on the results of the terminal evaluation, both sides agreed to terminate the Project as planned.

3. Modification of indicator on Project Design Matrix

Based on the results of the terminal evaluation (lessons learned), JICA Expert Team proposed to add indicators to measure the achievement of the output4 “Monitoring and management capacity of ECG is improved” as follows. Both sides agreed on the additional indicators and revised PDM as version 4.

[Before]

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERLIFICATION
Output4. Monitoring and management capacity of ECG is improved	<ul style="list-style-type: none"> • Quality of revised texts • Quality of revised tools • Number of JCC meetings 	<ul style="list-style-type: none"> • Quarterly Report of ECG third countries • Project Progress Report • Manuals and tools

[After]

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERLIFICATION
Output4. Monitoring and management capacity of ECG is improved	<ul style="list-style-type: none"> • Quality of revised texts • Quality of revised tools • Number of JCC meetings • Number of Monitoring Reports • PDCA cycle of Monitoring Activities will be established. 	<ul style="list-style-type: none"> • Quarterly Report of ECG third countries • Project Progress Report • Manuals and tools • Monitoring Reports

4. Copyright Issue of the Textbooks

Both sides recognized that there is a potential risk to utilize the textbooks without proper reference and therefore the current textbooks should be used only by the Project stakeholders internally.

END

Appendix 1: Terminal Evaluation Report

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TERMINAL EVALUATION REPORT
ON THE TECHNICAL COOPERATION PROJECT
ON
THE PROJECT ON ELECTRICAL ENGINEERS TRAINING
FOR
AFRICAN COUNTRIES (EETA)

Ministry of Power
And
Japan International Cooperation Agency

Accra
Republic of Ghana

February, 2016

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List of Terms

CD	Capacity Development
C/P	Counterpart
ECG	Electricity Company of Ghana
ECOWAS	Economic Community of West African States
EPP	Emergency Power Program
GEDAP	Ghana Energy Development and Access Project
GEF	Global Environmental Facility
GRIDCo	Ghana Grid Company
HRD	Human Resource Development
IFC	International Finance Corporation
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
LEC	Liberia Electricity Corporation
MD	Managing Director
M/M	Minutes of Meeting
MOE	Ministry of Energy
MOEWR	Ministry of Energy and Water Resources
MOP	Ministry of Power
MOU	Memorandum of Understanding
NABPTEX	National Board for Professional & Technician Examination
O&M	Operation and Maintenance
OJT	On-the-Job Training
PDCA	Plan-Do-Check-Act
PDM	Project Design Matrix
PO	Plan of Operations
R/D	Record of Discussions
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
T&D	Transmission and Distribution
ToT	Training of Trainers
VRA	Volta River Authority
VRA-NED	Volta River Authority - Northern Electricity Department
WAPP	West Africa Power Pool

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Appendix

1. Project Design Matrix (ver.3)
2. Evaluation Grid of Terminal Evaluation
3. List of Equipment
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5. List of Participants at the Meeting with MOP
6. Flow of Training and Monitoring
7. Flow of Reports

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1. Framework of Terminal Evaluation Study

1-1. Background and Objective of the Terminal Evaluation

Background

Ghana has achieved one of the highest electrification rates in Africa and electrification plans on the national level has already seen the electrification of all district capitals. The Government of Ghana is vigorously working to electrify communities by extending the grid through various Projects including Self-Help Electrification Program (SHEP).

The Electricity Company of Ghana (ECG) is a distribution company that purchases power from the VRA and others and sells it to the final customers. The company is mandated to distribute and supply electric power to eight ECG operational regions of Ghana. ECG has its own Training Centre with seven trainers engaged in electrical technical training. Since ECG is a distribution company, most of the training involves electrical distribution technology. Approximately forty newly hired technicians every year undergo a mandatory two year artisanal training. In addition, programs are organized for existing staff members who have been already assigned to field operations without receiving the initial training and those who have to update their skills in specialized areas of operation. Three main courses are offered for the trainees at the ECG Training Centre; in-house training for new staff members; open course training for external personnel; and a staff facilitation program for the existing personnel. Training services using external consultants are also offered.

The ECG Training Centre has had the experience of receiving technicians from both Liberia and Sierra Leone for training in the past. The Training Centre provided class room sections and on-the-job training to the participants. The system has been well organized and many former trainees from those countries have successfully applied the gained skills to their work in their respective countries.

In August 2009, the Government of Ghana requested for Japan's Technical Cooperation project for capacity development for Electric Engineers in West African Countries. In August/September 2010, Detailed Planning Survey Team organized by JICA visited Ghana and had a series of discussions on the Project with authorities concerned of the Government of Ghana. As a result, the Team and Ghanaian Side clarified the framework and schedule for implementing the project and reached a common understanding.

Objectives of the Terminal Evaluation

The objectives of the Terminal Evaluation are as follows:

- (1) To review and assess the inputs, activities and achievements of the Project,
- (2) To identify problems and issues to be addressed for successful implementation of the Project for the remaining period.
- (3) To propose suggestions for better implementation of the Project in the remaining

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period, and

(4) To consider the necessity of project extension

1-2. Members of the Terminal Evaluation Mission

The Team is composed of the members as below.

No	Name	Designation	Organisation
1	Mr. Hiroshi Sumiyoshi	Mission Leader	Senior Representative, JICA Ghana Office
2	Mr. Tomonari Takeuchi	Coordinator	Representative, JICA Ghana Office
3	Dr. Hiroaki Nagayama	Evaluation Consultant	Individual Consultant (Professor, Kyoto University)

1-3. Schedule of the Terminal Evaluation

The Terminal Evaluation in Ghana was conducted from Feb 5th to Feb 25th 2016. The detailed schedule is as follows.

Table 1: Schedule of Terminal Evaluation

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■ Schedule

Date	Day	Mr. Hiroshi Sumiyoshi	Mr. Tomonari Takeuchi	Dr. Hiroaki Nagayama
5-Feb	Fri			Leave Japan
6-Feb	Sat			Arrives in Ghana
7-Feb	Sun			Interview with JICA Experts
8-Feb	Mon			Meeting and Interview with ECG Principal
9-Feb	Tue			Interview with ECG Staffs
10-Feb	Wed		Meeting with MOP	Meeting with MOP
11-Feb	Thu			Interview with ECG trainers (1)
12-Feb	Fri		Meeting with ECG MD	Interview with Divisional Manager of Project Office Interview with ECG HRD Interview with ECG Trainers (2)
13-Feb	Sat			Drafting the evaluation report
14-Feb	Sun			
15-Feb	Mon		Discuss and modify the draft evaluation report with C/Ps in ECG Trainign Centre and JICA Experts to finalize	Discuss and modify the draft evaluation report with C/Ps in ECG Trainign Centre and JICA Experts to finalize
16-Feb	Tue		Discuss and modify the draft evaluation report with C/Ps in ECG Trainign Centre and JICA Experts to finalize	Discuss and modify the draft evaluation report with C/Ps in ECG Trainign Centre and JICA Experts to finalize
17-Feb	Wed		Discuss and modify the draft evaluation report with C/Ps in ECG Trainign Centre and JICA Experts to finalize	Discuss and modify the draft evaluation report with C/Ps in ECG Trainign Centre and JICA Experts to finalize
18-Feb	Thu	Agreement on the result of evaluation between ECG Training Centre and JICA	Agreement on the result of evaluation between ECG Training Centre and JICA	Agreement on the result of evaluation between ECG Training Centre and JICA
19-Feb	Fri	Sharing the evaluation report with MoP, ECG HQs	Sharing the evaluation report with MoP, ECG HQs	Leave Ghana
20-Feb	Sat			Arrive in Japan
21-Feb	Sun			
22-Feb	Mon			
23-Feb	Tue	Joint Coordinating Committee (JCC) to approve the evaluation result report with MoP, ECG HQs, ECG Training Centre, and JICA (TBD: one day within this week)		
24-Feb	Wed			
25-Feb	Thu			

1-4. List of Interviewees

1. Ministry of Power (MOP)

Mr. William Hutton-Mensah	Director, Distribution, MoP
Mr. William E. Sam-Appiah	Director, Generation & Transmission, MoP
Mr. Sulemana Abubakari	Deputy Director, Power/ Distribution, MoP
Mr. Chris Anaglo	Deputy Director, MoP

2. ECG (Electricity Company of Ghana)

【Head Quarter】

Mr. Robert Dwamena	Managing Director
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Project Purpose
Training capacity on distribution system operation and maintenance for ECG and third countries is strengthened
Outputs
<ol style="list-style-type: none"> 1. Current situation of distribution system operation and maintenance is analyzed and training needs are identified 2. Training for technicians of ECG and the third countries is improved 3. Training for engineers of ECG and third countries is implemented 4. Monitoring and management capacity of ECG is improved.
Activities
<ol style="list-style-type: none"> 1. Current situation of distribution system operation and maintenance is analyzed and training needs are identified <ol style="list-style-type: none"> 1-1 Review the electricity policy and plan of Ghana and regional cooperation framework 1-2 Review the current situation challenges of distribution system O&M in ECG and the third countries 1-3 Review the current situation of human resources development of ECG engineers and technicians 1-4 Identify the training needs of ECG engineers and technicians and the third countries 2. Training for technicians of ECG and the third countries is improved <ol style="list-style-type: none"> 2-1 Review the existing training course of ECG for technicians 2-2 Replace training equipment and facilities of ECG 2-3 Update necessary training materials 2-4 Deliver training programs for ECG technicians 2-5 Deliver training programs for the third countries 2-6 Observe the training performance and feed-back to training courses 3. Training for engineers of ECG and third countries is implemented <ol style="list-style-type: none"> 3-1 Develop syllabuses, curriculum and material for three training programs 3-2 Install new equipment and facilities for training 3-3 Strengthen skills and technology of ECG training 3-4 Deliver training programs for ECG engineers 3-5 Deliver training programs for the third countries 3-6 Observe the training performance and feed-back to training courses 4. Monitoring and management capacity of ECG is improved. <ol style="list-style-type: none"> 4-1 Observe and analyze the current capacity of ECG for monitoring and management of training

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- 4-2 Prepare plan for methodologies and procedures for improvement
- 4-3 Improve ECG capacity for training monitoring and management

Project Design Matrix (hereinafter referred to as “PDM”) approved in the 3rd Joint Coordinating Committee (hereinafter referred to as “JCC”) on July 23 is shown in Appendix 1.

Revision of PDM versions is shown as below.

Table.2: Transition of PDM

version	Approval	Revised
PDM ver.1	Detailed Planning Study	Nov. 30, 2010
PDM ver.2	1st JCC	Dec. 9, 2013
PDM ver.3	3rd JCC	July 23, 2015

1-6. Methodology of Terminal Evaluation

The Terminal Evaluation is carried out in accordance with the JICA Guideline for Project Evaluation, along with the following process:

- (1) Assessing progress of the Project based on the plan shown in the PDM and other relevant documents,
- (2) Analyzing the Project by the five evaluation criteria,
- (3) Recommending improvements of the Project, and
- (4) Drawing lessons learned for other similar types of projects.

Both quantitative and qualitative data and information were collected for the Study by the following methods:

- > Reviews of the project reports and other relevant documents, and
- > Questionnaire and/or interview to Japanese experts, counterparts, and other stakeholders.

The five evaluation criteria used for the analysis of the Project are as follows.

- (1) Relevance:
Consistency of the Project Purpose and the Overall Goal with development policies and needs of Ghana as well as the ODA policy of Japan towards Ghana.
- (2) Effectiveness:
Likelihood of achievement of the Project Purpose by the end of the project period as a result of attaining outputs at the time of the Terminal Evaluation.

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(3) Efficiency:

Extent of conversion from the inputs to the outputs assessed from the aspects of achievement of the planned outputs as well as quantity, quality and timing of the inputs by the Japanese and Ghana sides.

(4) Impact:

Impacts of the Project are assessed by likelihood of achievement of the Overall Goal, which is the intended impact of the Project and positive and negative, direct and indirect effects having been brought or to be brought by the Project.

(5) Sustainability:

Continuity of positive effects and benefits brought by the Project after the completion of the Project. It is assessed by the institutional, organizational, technical and financial aspects.

Based on the five evaluation criteria, the Project was assessed on a grade evaluation system (Very high, High, Medium, Fair, Low)

2. Project Performance and Implementation Process

2-1. Inputs

The inputs for the Project are shown in the table below.

Table 3: Inputs for the Project (by the end of February 2016)

Japanese Side	Ghana Side
<ul style="list-style-type: none">Experts: experts in 7 areas (121Man Months)	<ul style="list-style-type: none">Counterpart Personnel: 8 people were assigned.
<ul style="list-style-type: none">Equipment: Foreign Currency: 853,870 USD Local Currency: 25,099 GHS	<ul style="list-style-type: none">Land and Facilities: (EX)Project office space and facilities in ECG Control room of ECG
<ul style="list-style-type: none">General Operation Cost for Ghana: Foreign Currency: 8,994 (000JPY) Local Currency: 413,489 (GHS)	
<ul style="list-style-type: none">General Operation Cost for Third Countries: Foreign Currency: 4,143 (000JPY) Local Currency: 65,255 (GHS)	
<ul style="list-style-type: none">Travelling costs for Training in Japan Foreign Currency: 3,879 (000JPY)	

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Japanese side

Inputs by the Japanese side were as planned.

【Dispatch of Japanese experts】

List of experts in the following 7 areas were dispatched.

A. Assignment of Experts

- Chief Advisor/ Training Planning
- Power Distribution Planning/ Design
- Power Distribution System Operation
- Substation Maintenance
- Training Monitoring/ Assistant for Power Distribution
- Substation Equipment/ Procurement
- Training Management/Coordinator

【Training in Japan】

Seven (7) counterpart personnel were accepted to the training program in Japan in the first years of the Project (From 25th May 2014 to 7th June 2014).

Seven 7 C/Ps visited in Japan.

- (1) Mr. George Marfo Principal of the ECG Training Centre
- (2) Mr. Isaac K. Nukpezah Instructor for substation maintenance and network operation and safety
- (3) Mr. Kingsford Amoako Instructor for substation maintenance and network operation and safety
- (4) Mr. Maxwell Essel Instructor metering and protection
- (5) Mr. Samuel Andoh Instructor for overheads lines
- (6) Mr. Peter King Asare Instructor for underground cables
- (7) Mr. Agbi Bless Worlanyo Instructor for overhead lines and underground cables

【Provision of Equipment】

The equipment provided by the Japanese side are substation for training, measurement equipment, software, etc. The list of equipment is attached in Appendix 3.

Ghana side

A. Assignment of Counterpart personnel

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- Project Coordinator
- Technical Manager
- Technical Counterpart (6 people)

【Joint Coordinating Committee (JCC)】

JCC were held as Appendix 4.

- The first Joint Coordinating Committee 9th December, 2013
- The second Joint Coordinating Committee 16th July, 2014
- The third Joint Coordinating Committee 23rd July, 2015

C. Office Space and others

ECG provided necessary office facilities including electricity, air-conditioning, and water during the duration of the Project.

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2-2. Activities

Table 4: Progress of Courses Implemented

Courses Implemented	Courses			Total		Implement responsibility is JICA	
	1 year	2 year	3 year	Implemented	Plan	Implemented	Plan
Technicians of ECG	⊙	○		2	3	1	1
Engineers of ECG		⊙	○	2	2	1	1
		⊙	⊙	1	2	1	1
			⊙	1	1	1	1
Technicians of Third Countries	⊙			1	1	1	1
Engineers of Third Countries				1	0	0	1
				2	2	0	1
Total Number of the implementation	2	3		7	13	5	8

Implementation ratio of the Training Courses = 53.8%(62.5%)

The Number of Participants

	Courses			Total		Implement responsibility is JICA	
	1 year	2 year	3 year	Implemented	Plan	Implemented	Plan
Technicians of ECG	10/10	9/10	0/10	19	30	10	10
Engineers of ECG		17/10	10/10	17	20	17	10
		10/10	0/10	10	20	10	10
Technicians of Third Countries			10/10	0	10	10	10
	L 3/3			3	3	3	3
	S 3/3			3	3	3	3
	G 6/6			6	6	6	6
		0/3		0	3	0	3
		0/6		0	6	0	6
		0/3		0	3	0	3
			0/4	0	4	0	4
			0/4	0	4	0	4
			0/4	0	4	0	4
Engineers of Third Countries		0/2	0/2	0	4	0	2
		0/2	0/2	0	4	0	2
		0/2	0/2	0	4	0	2
Total Number of the implementation	22/22	36/48	20/58	75	128	59	82

Implementation ratio of the Trainees = 60.8%(71.9%)

Note1: ⊙implemented mainly by Japanese expert

○implemented mainly by ECG

Note2: Implementation ratio of the Training Courses = Ratio in courses implemented mainly by Japanese expert (Ratio in courses implemented mainly by ECG)

Implementation ratio of the trainees = Same as in Note 2 for the number of trainees

Source: JICA Expert Team

L: Liberia
S: Sierra Leone
G: Gambia

Performance/Plan

2-3. Achievement of Output

Table 5: Achievement of Output (As of Feb. 2016)

Outputs	Verifiable Indicators	Achievement
Output 1 Current situation of distribution system operation and maintenance is analyzed and training needs are identified		Output 1 is achieved
	Report compiled training needs	Visited EGG and the third countries (Liberia, Sierra Leone, and Gambia) during September and November of 2013 and identified the needs of C/P and stakeholders for technicians and for engineers, respectively. The report describing these needs has been issued. After the survey trip, the JICA team has continued to listen to these needs during the training and subsequent monitoring processes.
Output 2 Training for technicians of ECG and the third countries is improved		Output 2 is partially achieved. For ECG: Output 2 is mostly achieved. For third countries: Output 2 is partially achieved.
	• Number of trainees for technician courses will increase.	Compared with before 2013, the number of training for technicians has not been changed. (Quality of the training has been improved)
	• Number of certified trainees (Ghana: more than 30, third countries: more than 36)	As of February 17, 2016 The number of ECG trainee technicians: 19/30 (Implemented/Planned) The number of trainee technicians from the third countries: 12/36 (Implemented/Planned)
Output 3 Training for engineers of ECG and third countries is implemented		Output 3 is partially achieved. For ECG: Output 3 is mostly achieved. For third countries: Output 3 is partially achieved.
	• Number of training courses for engineers will increase	As of February 17, 2016 The number of courses for ECG engineers: 4/5 (Implemented/Planned) The number of courses for engineers from the third countries: 0/2 (Implemented/Planned)
	• Number of trainees (Ghana: more than 50, third countries: more than 12)	As of February 17, 2016 The number of ECG trainee engineers: 47/50 (Implemented/Planned) The number of trainee engineers from the third countries: 0/12 (Implemented/Planned)

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Outputs	Verifiable Indicators	Achievement
<p>Output 4 Monitoring and management capacity of ECG is improved.</p>		<p>Output 4 is mostly achieved.</p> <p>Technology transfer on course monitoring has been conducted for specific members of C/P. Close monitoring is required to judge achievement of self-sustainability.</p> <p>As of February 2016, three staff members had been assigned to monitoring. (One is the HRD manager and the other two are a technical manager, and a trainer respectively.)</p> <p>Since HRD has institutionalized the monitoring and feedback system even before the Project started, further institutionalization will present no problem.</p>
	<p>• Quality of revised texts</p>	<p>Training staff at the ECG Training Center have wide and deep knowledge in their fields, as well as hands-on experiences and skills. In close collaboration with Japanese experts, comprehensive and structured textbooks have been written. Over the course of follow-up discussions and work, these textbooks have been revised.</p> <p>Major revisions of the textbooks are as follows:</p> <ol style="list-style-type: none"> 1) Textbook for technicians: Two revisions were made. Version 1.0 was revised to 1.1 in June 2015. 2) Textbook for Engineer course 'System protection and Control' : Second training conducted in February 2016, version 1.0 is to be revised to 1.1 3) Textbook for Engineer course 'Distribution planning' and 'Distribution design': Version 1.0 (expected to be revised to Version 1.1 in July 2016) <p>The Consultant team drafted a monitoring plan for the training courses in March 2014 and monitoring activities were carried out based on this monitoring plan.</p> <p>'A survey on the monitoring system of the ECG Training Centre' was conducted in October 2014 to grasp the current situation of the Center.</p>
	<p>• Quality of revised tools</p>	<p>Pre and post questionnaires were reviewed at this technical cooperation project for checking the level of understanding of the courses.</p>
	<p>• Number of JCC meetings</p>	<p>JCC meetings were held as follows.</p> <ul style="list-style-type: none"> • The first Joint Coordinating Committee: 9th December, 2013 • The second Joint Coordinating Committee: 16th July, 2014 • The third Joint Coordinating Committee: 23rd July, 2015 <p>Report on implementation, schedule adjustments for the next year, and revision of PDM were discussed. The outcome of monitoring was shared among all stakeholders and discussed for further improvement. At the third meeting of JCC, one of trainers attached to the Centre presented the monitoring process he was involved in.</p>

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2-4. Prospects for Achievement of the Project Purpose

Achievement of the Project Purpose is as follows.

Table 6: Achievement of Project Purpose

Project Purpose	Verifiable indicators	Achievement
Training capacity on distribution system operation and maintenance for ECG and third countries is strengthened	<ul style="list-style-type: none"> Number of training courses for technicians and engineers will increase. 	Compared with before 2013, the number of training courses for technicians has not changed. However, training courses for engineers have started with JICA Technical Cooperation. Three courses have already been implemented.
	<ul style="list-style-type: none"> Syllabus, curriculum and training materials will be revised or newly developed. 	The syllabus and curriculum have been well prepared. In order to prepare them, Japanese experts had taken initiatives to create textbooks, considering regulations for construction and safety and the current situation of Ghana. The textbooks were also created based on constant and frequent communication between Japanese experts and lecturers in the Training Centre and the Project Office of ECG. The textbooks are highly regarded by the lecturers. However, there is no reference attached in the figures and tables of the textbooks, and it is difficult to distinguish between content written by the JICA experts and quotations from original sources.

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2-5. Prospects for Achieving Overall Goal

Prospects for Achieving Overall Goal

Table 7: Achieving Overall Goal (as of February 2016)

Overall Goal	Verifiable indicators	Achievement
Distribution System operation and maintenance in ECG and third countries is improved	• Distribution loss and SAIFI (The System Average Interruption Frequency Index) will decrease in Ghana	By implementation of the project, capabilities for O&M have improved. However, due to high outages, frequent accidents in transmission and distribution lines, it is difficult to figure out whether or not the distribution loss and SAIFI will be decreased within three to five years after the completion of the project.
	• Distribution loss and SAIFI (The System Average Interruption Frequency Index) will decrease in third countries.	Same as above

2-6. Implementation Process

2-6-1 Organization of Implementation

The Project has been implemented in accordance with the structure shown in the Figure 1.

It is indispensable to enhance the initiative from ECG by the time of project completion in order to ensure the sustainability of the Project. No serious communication problem has been identified between the Japanese and Ghanaian sides.

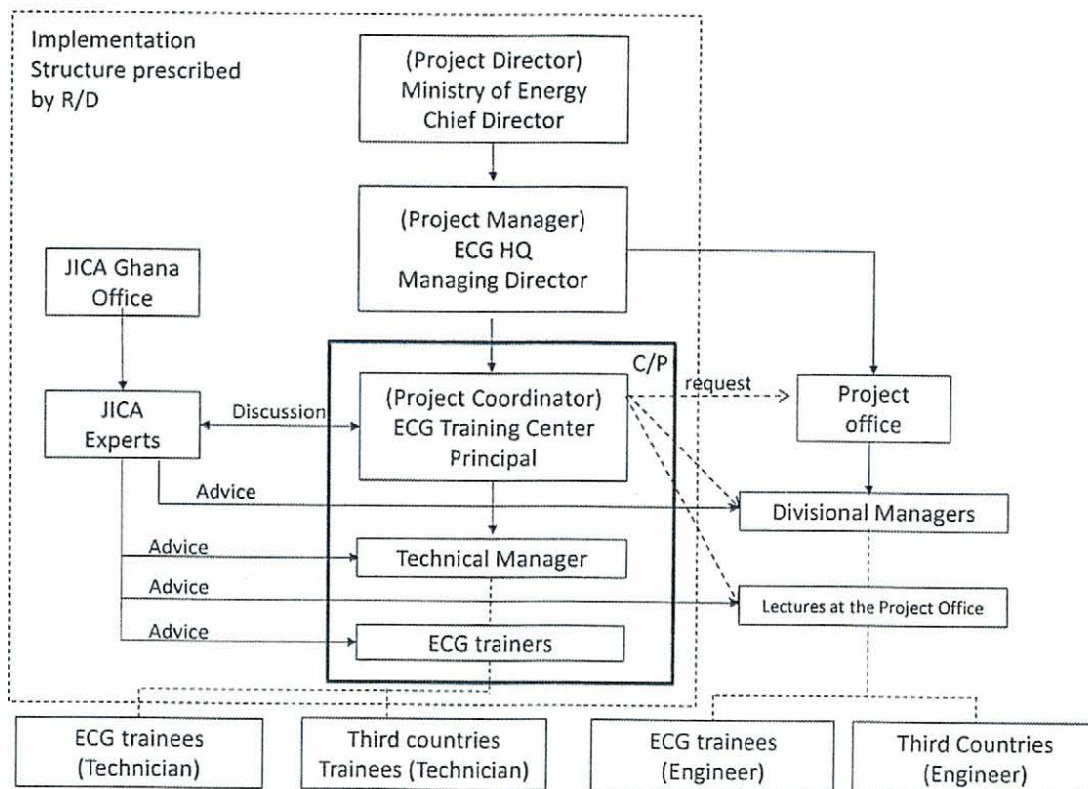
In Figure 1, the area circled with a dotted box is an originally agreed Implementation Structure on R/D signed on Nov. 2010. During the needs survey, the need for the involvement of engineers from the Project Office was raised, and the engineers were involved as lecturers for some training courses.

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Note: [] originally agreed Implementation Structure on R/D signed on Nov. 2010.

Source: Revised from R/D

Figure 1: Implementation structure.

(1) Progress of activities

Activities are carried out as planned based on the PDM.

1) Changes to Plan of Operation (PO)

The initial PO has been changed in accordance with the progress of the project. The schedule for the expert in charge of Sub-station Equipment/Procurement has been slightly changed due to a delay in installing the sub-station for training (M/M of the expert also increased for one month).

2) Progress of PO

The work has been carried out based on the proposed PO except the work related to the expert in charge of Sub-station Equipment/Procurement.

【Contributing factors】

Japanese experts have taken initiative to create textbooks based on local regulation such as in construction and local needs. This has been done in close collaboration of Japanese

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experts and staff of the ECG Training Centre. The textbooks were highly regarded by the C/P.

[Obstructive factor]

1) Delay in installing sub-station for training

The sub-station was planned to be completed in July 2015 in the original plan. Under the current plan, it will be completed by the end of March 2016, amounting to eight months of delay. On August 8, 2014, the contracts were signed by JICA and FIMACO & ASSOCIATES., Ltd (a local company). From April 2015, site preparation was started. In July 2015, the control room was completed. FIMACO & ASSOCIATES., Ltd entrusted PG ASSOCIATES PRIVATE LIMITED (an Indian company) with drawings and corrections and to purchase equipment from Crompton Greaves (an Indian company).

Major reasons for delay are;

- A) Time required for handling additional requests from ECG,
- B) Time required for organizational approval of drawings in ECG,
- C) Delay in progress of the part to be covered by ECG, and
- D) Lack of capability of drawing and design revision as well as management for procurement (e.g. delay in transportation of equipment from India), by FIMACO.

2) Treatment issue for training staff from Project Office

Regarding to the training staff from the Project Office, the honorarium approved by ECG for lecturers from the Project Office is 100 GHS/day. The lecturers from the Project Office will appreciate the upgrade of the amount of honorarium to motivate themselves for further involvement for the Centre activities.

Selection of members for counterpart training in Japan was made based on R/D signed at the initial stage of the project. However during the Project, the need for involvement of engineers from the Project Office was risen, and the engineers were involved as lecturers for some training courses. However, the engineers could not participate in the training in Japan since they were not authorized as C/P in the Implementation Structure prescribed on R/D. This also discourages them from further cooperation in the Training Centre activities.

(2) Project Management (participation in the decision making process)

Japanese experts and C/P have been actively involved in the regular meetings and the JCC meetings. During these meetings, all parties were involved in the creation of the textbook, as well as lecturing and monitoring methods.

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2-6-2. Implementation on Monitoring

(1) How the monitoring has been implemented.

Japanese experts and C/P have implemented the monitoring process and presented it at the three JCC meetings. At the meetings, they have discussed the progress of the Project and future plans.

(2) Appropriate monitoring system

JCC meetings were carried out among the ECG Training Centre, Japanese experts, and JICA. Important stakeholders such as the Ministry of Power and ECG top management should be involved in some way.

(3) Clear division of roles to be played by respective stakeholders

Since the ECG Training Centre belongs to ECG, the Centre needs to get authorization from the ECG Headquarters (HQ) to start new activities. When the Centre provided training for customers outside of ECG, contracts with the outside customers were made with the HQ. Training fee is paid to the HQ.

In case of hiring lectures outside of ECG Training Centre, the contract is made with the HQ. The HQ is to pay honorarium.

2-6-3 Relationship between JICA experts and counterparts (C/P)

(1) Current situation of communication

1) Ghana side

The Director of Distribution of the Ministry of Power is the former Managing Director of ECG. Consequently, communication between ECG HQ, the ECG Training Centre, and the Ministry of Power has been very good.

2) Japanese experts and C/P

Japanese experts and C/P closely collaborated in creating the textbook and its revision.

(2) Countermeasures in the event of problems and changes made to plan

Problems or changes were solved by close communication among Japanese experts and C/P, e.g. Ebola virus outbreak and delays in the installation of sub-stations.

2-6-4 Commitment of top management to the Project

The Director of Distribution of the Ministry of Power has a deep understanding of the activities of the Training Centre and has strongly supported the Project.

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2-6-5 Ownership of Ghana

(1) Allocation of budget

A necessary budget was allocated to the ECG Training Centre from the ECG HQ. However, the above-mentioned issues on the honorarium have been identified.

(2) Commitment by the ECG members

Commitment by the ECG members has been very high.

3. Evaluation by Five Criteria

3-1. Relevance

The relevance of the project is very high. This is to be maintained until project completion and thereafter.

(1) Necessity

It is imperative that Distribution System operation and maintenance in ECG and third countries are improved. Support for addressing this issue has been requested by ECG.

Before starting the Project, holistic textbooks were not published in Ghana for technicians and engineers. Therefore, the needs for the Project are very high. The training of engineers has started from the outset of the Project.

The project is highly relevant to the third countries in following aspects:

- 1) There is much in common between Ghana and the third countries in O&M of distribution equipment and HRD,
- 2) Compared to the third countries, the ECG Training Centre is better equipped with training facilities, and
- 3) There are professional lecturers attached to the Training Centre and the engineers at the Project Office working at the forefront.

(2) Consistency with the Development Plan of Ghana

According to Ghana Shared Growth Development Agenda II (2014-2017), priority policy interventions focus on the following key areas: 1) electricity and thermal energy; 2) renewable energy (hydro, biomass, wind, and solar); 3) waste-to-energy; 4) Other energy sources including nuclear energy; 5) access to petroleum products; 6) energy efficiency and conservation; 7) transportation of energy products; 8) energy and the environment; 9) Gender and Energy; 10) the regulatory environment; 11) mobilization of investment for energy sector development; and 12) building human resource capacity and research and development. The Project is relevant to the above-mentioned key areas of 1), 6), and 12).

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(3) **Consistency with the Japanese ODA Policy**

Japan's Basic Policy of Assistance to Ghana sets up the ODA policy "Promoting Dynamic Economic Growth that Benefits the People Widely". The infrastructure sector is positioned as one of the strategic areas which contribute to achievement of this policy through utilizing Japanese technological capabilities to their maximum extent.

(4) **Relevance of the targeting group**

Direct beneficiaries are 20 training staff (8 trainers attached to the Centre, 12 lecturers from ECG) at the ECG Training Centre and associated administrative staff and lecturers sent from the Project Office. Indirect beneficiaries are 6,200 ECG staff utilizing the Training Centre in general, especially 690 engineers and 270 technicians of ECG, and 120 trainees from the third countries in the field of distribution maintenance. There are three criteria for selecting trainees.

- 1) Trainees are selected one each from ten regional centres of ECG.
- 2) Staff specialty is the same field as the provided courses.
- 3) Trainees have at least three years' experience.

Course participants have been chosen upon discussion among the regional Centre of ECG and the Training Centre.

The Project team has recommended staff with less than ten years of work experience. However, the Training Centre intends to enhance the quality of the courses by accommodating participants from diverse backgrounds.

(5) **Superiority in technical know-how and experience from Japan**

Distribution planning, maintenance, protection and control, and associated monitoring techniques of Newjec, Kansai Electric Power Co., Inc. and Shikoku Electric Power Co., Inc. have been transferred. The created textbook reflects local regulations and needs.

(6) **Change in Business Environment**

Privatization (Concession) has progressed throughout the electric sector. The Project is expected to be affected in some way as a consequence. However, according to the interview with the ECG MD on Feb 12, 2016, the status of the Training Centre will not be changed even if the ECG is privatized.

3-2. Effectiveness

Effectiveness of the project is Medium.

(1) **Prospects for achieving Project Purpose**

1) **Appropriateness of the Project Purpose**

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1-1) Possibility of achieving the Project Purpose

The Project Purpose "Training capacity on distribution system operation and maintenance for ECG and third countries is strengthened" is appropriately set and partially achieved. Though the training capacity of ECG Training Centre has been improved, the situation of the third countries has not been improved by the Project.

1-2) Appropriateness of indicators of Project Purpose

Indicators are;

- Number of training courses for technicians and engineers will increase.
- Syllabus, curriculum and training materials will be revised or newly developed.

However, these indicators alone are insufficient. Objective indicators such as test scores for checking the absolute level of understanding should be included.

(2) Causal relationship between Outputs and Project Purpose

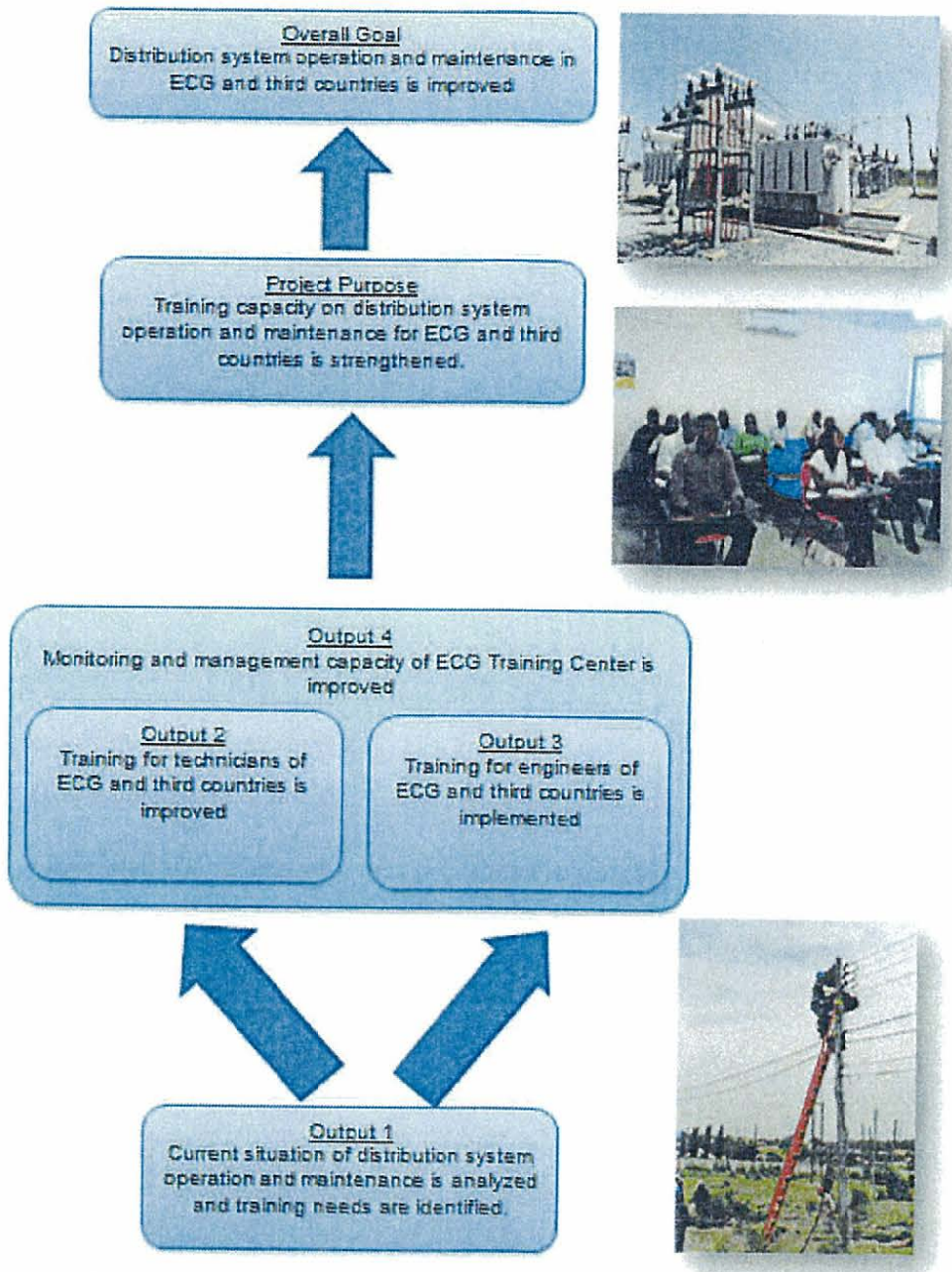
1) Contributing factors of Outputs to the Project Purpose

This project has been carried out in accordance with the following scheme.

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Source: JICA Expert Team

Fig. 2: Overview of the Project

This framework has been carried out in the following procedures

The development procedure of each training course has the following common steps:

- Needs Survey for the training course (in Ghana and third countries)
- Development of the training course (syllabus, curriculum and training materials)
- Technology transfer to the lecturers
- Implementation of the training course

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- Monitoring
- Improvement of the training course (syllabus, curriculum and training materials)
- Re-introduction to the lecturers

Mr. Geroge Yaw Marfo, Training Centre principal, is highly esteemed within ECG. He has assisted choosing appropriate participants and invited engineers from the Project Office.

(3) **Disturbing factors of Outputs in achieving Project Purpose.**

1) **Suspension for the trainees (both technicians and engineers) from the third countries.**

The courses for technicians 'Underground Cable' and 'Substation Maintenance', and the course for engineers 'System Protection and Control' were suspended from October 2014 due to the Ebola outbreak. On January 14, 2016, the epidemic of the Ebola virus in West Africa was announced to be over. However, soon after this announcement, a new case of the disease was reported. The situation is being closely observed. Nevertheless, restarting the courses is expected to be difficult.

2) **The sub-station for training could not be utilized due to the delay in construction.**

3-3. **Efficiency**

Efficiency of the Project is medium.

(1) **Appropriateness of input in terms of quality, quantity, timing and costs**

It is appropriate for input from the Japanese side in terms of quality, quantity and timing except for the installation of the sub-station for training.

For training of engineers, the three courses 'System Protection and Control', 'Distribution Design' and 'Distribution Planning' have been selected among the requested seven training fields based on their needs, the past results of JICA cooperation, and the advanced distribution system in Japan.

Input is designed to be minimized to encourage existing resources of C/P with efficient support from Japanese side.

The dispatch period of Japanese experts is adjusted based on the progress of the Project. The delay of eight months in installation of the sub-station for training decreased the efficiency of the Project.

(2) **Appropriateness of input from quality, quantity, timing, and costs from the Ghanaian side**

It is appropriate for input from the Ghanaian side in terms of quality, quantity and

timing.

Since the ECG Training Centre has experience implementing training programs for WAPP members, the training for the third countries was efficiently implemented.

(3) External Factors

A disturbing factor for achieving outputs is the outbreak of the Ebola virus, which interfered with training for participants from the third countries.

3-4. Impact

Impact of the Project is Medium.

(1) Achievement of Overall Goal

1) It is not clear whether or not the Overall Goal will be achieved as a result of completion of the project

The Overall Goal is to decrease Distribution loss and SAIFI in Ghana and third countries by strengthening the training capacity on distribution system operation and maintenance for ECG and third countries.

However, it is unrealistic that the Distribution loss and SAIFI will decrease in Ghana within three to five years upon completion of the Project. The reasons for this are as follows:

- a) In Ghana, there are frequent outages (At present, an outage occurred frequently due to shortage of power supply)
- b) Transmission and distribution lines frequently break down

This phenomenon is even apparent in the third countries.

The most recently available data of the ECG annual report is from its 2012 version. Forecasting achievement of the Overall Goal in terms of this data is difficult.

Concerning the indicator SAIFI (not SAIDI) a Japanese expert provides the following explanation.

- a) The Project was effective in reducing SAIFI, but not SAIDI
- b) SAIFI is highly correlated with SAIDI

2) Important assumptions from the Project Purpose to the Overall Goal

2)-1 There is no drastic change in energy policy in Ghana.

The Director of Distribution in the Ministry of Power is seen to be highly interested in the activities of the Training Centre and the Project (from a meeting on 12 February, 2016), and so there would be no drastic change to the activities at the Training Centre.

However, privatization (concession) will have a significant impact on electricity

policy in Ghana.

2)-2 A necessary budget shall be allocated for training

Since ECG is highly conscious about the training for staff, the budget will be allocated as planned in the future. However, there are a few issues about honorarium for the lecturers from the Project Office.

3) Important assumptions of achieving the Project Purpose

Important assumptions of achieving the Project Purpose is 'Trained trainers continue to work for ECG.'

Trainers attached to the Training Centre are highly motivated to teach. There is a low turnover rate at the Training Centre and the cycle of transfer of assignments is rather long. Risk associated with HRD seems to be low.

(2) Impact on others except for the Overall Goal

1) Positive Impact

The following are positive impacts:

- a) Securing the quality of the contents of the training course has been realised.
- b) Contact with Japanese experts has left a favorable impression towards Japan and Japanese.

2) Negative impact

There is no negative impact toward any of the following:

- a) Governmental policy and regulation
- b) Gender, human rights, and poverty issues
- c) Communities in Ghana
- d) The environment
- e) Technology
- f) Society in Ghana

3-5. Sustainability

The sustainability of the Project is medium.

(1) Organizational aspects-Capability for continuation of the project

The ECG Training Centre has provided training in the area of distribution for utility companies inside and outside of Ghana.

Self-sustainable service provision is expected to continue.

At the ECG Training Centre, three staff members are assigned to monitoring.

Transfer of monitoring techniques will be made to other staff members. Even before

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the Project, monitoring has been institutionalized in the ECG, so no significant problems of transference are expected.

However, monitoring brings the additional workload of analyzing the questionnaire outcomes and collection of supervisors' evaluations.

(2) Institutional Aspects

If the ECG continues to provide training in the WAPP, the position of the ECG in West Africa will be enhanced and will become indispensable. The Training Centre has been adopted as one of the Centres of Excellence for distribution training in the WAPP. Continuing to provide training to trainees from WAPP member countries will increase sustainability of the Project.

(3) Sustainability in allocation of budget

The ECG Training Centre is positioned under the ECG HQ, so the ECG Training Centre lacks its own accounting system. However, a necessary budget has been allocated in the past and can be expected to be allocated hereafter.

Privatization (Concession) may have some impact on budget execution.

However, according to the interview with the ECG MD on Feb 14, 2016, the status of the Training Centre will not be changed even if the ECG is privatized.

(4) Technical aspects

1) Were technology development and transfer made in considering technology level of ECG?

Textbooks are tailored to the current situation of ECG (construction standard, regulation, and local needs). Frequent communication among Japanese experts and lecturers took place over the course of making the textbooks, thus leading to technology transfer between the two parties.

2) Has C/P acquired the transferred technology and knowledge?

- Initial courses are carried out under the full responsibility of the Japanese experts. Successive training courses are carried out mainly by the C/P and lecturers from the Project Office. Judging from the fact that course management has been smoothly progressing, sufficient knowledge and technology can be said to have been acquired.

3) Was transferred technology widely used?

- Improvement of the training course, such as its syllabus, curriculum, and training materials, will be made and updated through repetition of monitoring and feedback to be done by C/P and engineers from the Project Office. It is expected that these materials will be used at the ECG even after the Project through improvement of the management capability of the C/P.

4. Conclusion, Recommendations and Lessons Learned

4-1. Conclusion

In this Project, Training capacity on distribution system operation and maintenance for ECG and third countries is strengthened through constant and frequent communication between Japanese experts and lecturers in the Training Centre and the Project Office of ECG. Japanese experts had taken initiatives to create textbooks, considering regulations, and the current situation of Ghana. The textbooks are highly regarded by the C/P, lecturers and trainees.

The Project mostly achieved the activities as planned, while for the third countries, the courses for technicians ('Underground Cable' and 'Substation Maintenance'), and the course for engineers ('System Protection and Control') were suspended from October 2014 due to the Ebola outbreak.

Delay in installation of sub-station lowered efficiency of the Project.

Privatization (Concession) has progressed throughout the electric sector. The Project is expected to be affected in some way as a consequence. However, according to the interview with the ECG MD on Feb12, 2016, the status of the Training Centre will not be changed even if the ECG is privatized.

Table 8 shows the difference in evaluation made at the detailed survey and at the terminal evaluation. Only the sustainability score has dropped from "High" to "Medium"

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Table 8 : Comparison of the Project Evaluation at the Detailed Survey and the Terminal Evaluation

	Detailed Survey (2010 Nov.)	Terminal Evaluation (2016 Feb.)
Relevance	High	High
Effectiveness	Medium	Medium
Efficiency	Medium	Medium
Impact	Medium	Medium
Sustainability	High	Medium

Note: 1. Very High (非常に高い)
 2. High (高い) / おおむね高い
 3. Medium (中程度) / 見込める
 4. Fair (やや低い)
 5. Low (低い)

4-2. Recommendations

(1) **Sourced trainers and lecturers from more diversified staff pools**

ECG has been getting accreditation from the NABPTEX, and will be able to issue some kinds of certificates for trainees in near future. Similarly, in order to mobilize trainers and lecturers with updated hands-on experience, the provision of certificates for them according to the acquired skills will be effective in incentivizing potential entrants to the trainers and lectures positions at the Centre.

(2) **Needs for follow-up training for the trainees from the third countries.**

In regions including the third countries, ECG is the only institution equipped with training facilities. As soon as the Ebola virus is eradicated, training which has hitherto been suspended should be restarted and follow-up training commenced.

(3) **Implementation of Hands-on training using the sub-station.**

In regions including the third countries, ECG is the only institution equipped with sub-stations. The use of these sub-stations for hands-on training is recommended.

4-3. Lessons

(1) **Need for verification of PDM during the project period**

1) **Drawback in selecting indicator for overall goal**

Regarding the indicator of Overall Goal 'Reduction of distribution loss', distribution loss can be caused by frequent outages, and the breakdown of transmission and distribution lines. These should have been included in the 'Important assumptions' of the Overall

Goal. Such careful consideration should be taken in similar types of projects.

2) Indicator for measuring outputs

Output 4 'Monitoring and management capacity of ECG is improved' is difficult to be measured by such indicators as revised text books and tools and the number of JCC meeting that were held. Indicators, such as publication of monitoring reports in collaborations with HRD, increase the ratio of retrieved questionnaires to the trainees' supervisors.

After the launch of the project, JICA, Japanese experts, and Ghana C/P have identified these drawbacks and inconsistencies, and no revisions have been made before the time of terminal evaluation.

Regarding JCC, these problems should be pointed out and corrected.

(2) **Implementation of tests for checking understanding of the trainees.**

At the ECG Training Centre, there have been no tests issued to the trainees for checking course comprehension. Implementing such tests will be proposed. The level of understanding of the trainees is diversified. In order to grasp the absolute level of understanding of the trainees, and to implement the courses in a more effective way, imposing tests can be one of the effective methods.

Tests should be implemented before and after the workshops. Pre-tests are intended to check the initial level of understanding of the participants. Post-tests are intended to check the amount of knowledge accrued over the course of the lectures. Since interviewed training staff is all in favor of the introduction of these tests, and since the tests have already been implemented for artisans, implementation by the ECG will be straightforward.

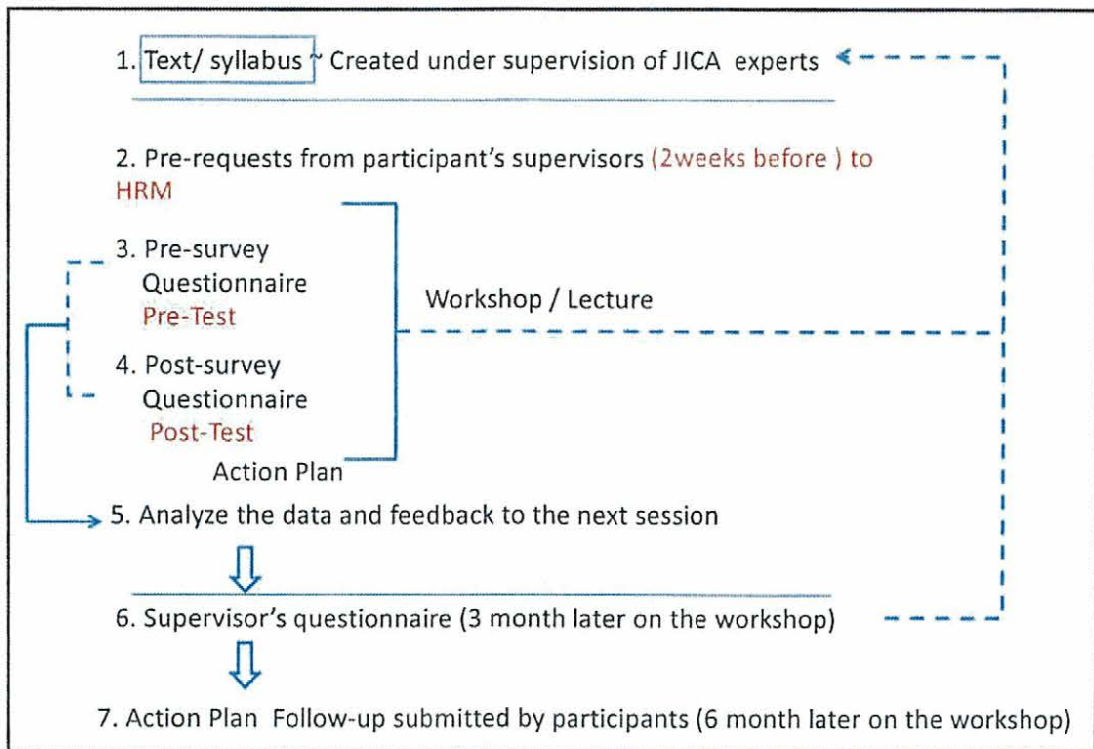
With the full scale introduction of the tests, the positioning of the tests in the overall PDCA system of the training, and the interpretation in the career development system of ECG, the costs associated with its introduction should be analyzed and considered.

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Note: Before the JICA project, STEP 2, 4, 6 were already done by ECG Training Centre

Source: Created by Terminal Evaluation Team

Fig. 3: Proposed Procedure for Monitoring Training Centre

(3) Clarification of sources and quoted sentences in the textbook.

Although the textbook is highly regarded by the C/P and trainers, the textbook's sources have not been clarified. Sentences should be quoted in original Japanese and their translated forms. JICA and its consultants should have rigorously abided by this requirement.

This commission has the potential risk of leading to copyright issues in the future.

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Appendix 1. Project Design Matrix (ver. 3)

1. Project Title: The Project for Electrical Engineers Training for African Countries (EETA)

2. Terms of Cooperation : From Sep. 2013 to Sep.2016

3. Target Group: Trainers of ECG

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Overall Goal</p> <ul style="list-style-type: none"> Distribution System operation and maintenance in ECG and third countries is improved 	<ul style="list-style-type: none"> Distribution loss and SAIFI (The System Average Interruption Frequency Index) will decrease in Ghana and third countries. 	<ul style="list-style-type: none"> Annual report of ECG and third countries 	<ul style="list-style-type: none"> There is no drastic change in Energy Policy in Ghana. Necessary budget shall be allocated for the training.
<p>Project Purpose</p> <p>Training capacity on distribution system operation and maintenance for ECG and third countries is strengthened</p>	<ul style="list-style-type: none"> Number of training courses for technicians and engineers will increase. Syllabus, curriculum and training materials will be revised or newly developed. 	<ul style="list-style-type: none"> Annual report of ECG and third countries Quarterly Report of ECG and third countries 	<ul style="list-style-type: none"> Trained trainers continue to work for ECG. Stakeholders fulfill their responsibilities in maintaining cooperation framework.
<p>Outputs</p> <p>1. Current situation of distribution system operation and maintenance is analyzed and training needs are identified</p>	<ul style="list-style-type: none"> Report compiled training needs 	<ul style="list-style-type: none"> Quarterly Report of ECG and third countries Project Progress Report 	<ul style="list-style-type: none"> Trainees from third countries continue to participate in the training courses in ECG. Equipment will be properly maintained for the training courses.
<p>2. Training for technicians of ECG and the third countries is improved</p>	<ul style="list-style-type: none"> Number of trainees for technicians courses will increase. Number of certificated trainees (Ghana: a more than 30, third countries: more than 36) 	<ul style="list-style-type: none"> Quarterly Report of ECG and third countries Project Progress Report Syllabus, curriculums and Training materials for the training courses Inventory list Result of the Monitoring 	
<p>3. Training for engineers of ECG and third countries is implemented</p>	<ul style="list-style-type: none"> Number of training courses for engineers will increase Number of trainees (Ghana: a more than 50, third countries: more than 12) 	<ul style="list-style-type: none"> Quarterly Report of ECG and third countries Project Progress Report Syllabus, curriculums and Training materials for the training courses Result of the Monitoring 	
<p>4. Monitoring and management capacity of ECG is improved.</p>	<ul style="list-style-type: none"> Quality of revised texts Quality of revised tools Number of JCC meetings 	<ul style="list-style-type: none"> Quarterly Report of ECG and third countries Project Progress Report Manuals and tools 	

Appendix 2. Evaluation Grid of Terminal Evaluation

Five Evaluation Criteria	Evaluation Questions		Basis for Judgment	Data required	Source of Information (collection method)	Basis for Judgment
	Main Items	Sub Items				
Verification of Accomplishments	Accomplishment of Overall Goal Distribution System operation and maintenance in ECG and third countries is improved	Distribution loss and SAIFI (System Average Interruption Frequency Index) will decrease in Ghana.	Comparison of data between program start and completion Comparison of data between the project completion and three years post completion	Distribution loss SAIFI (System Average Interruption Frequency Index) SAIDI (System Average Interruption Duration Index)	Annual report of ECG Quarterly report of ECG	Annual report of ECG and third countries
		1. Distribution loss and SAIFI will decrease in the third countries.	<ul style="list-style-type: none"> Comparison of data between the program start and completion Comparison of data between the project completion and three years post completion 	<ul style="list-style-type: none"> Distribution loss SAIFI (The System Average Interruption Frequency Index) SAIDI (System Average Interruption Duration Index) 	Annual report of ECG Quarterly report of the third countries	Annual report of ECG and third countries
	Accomplishment of Project purpose Training capacity on the distribution system operation and maintenance for ECG and third countries is strengthened	1. Number of training courses for technicians and engineers will increase. 2. Syllabus, curriculum and training materials will be revised or newly developed.	<ul style="list-style-type: none"> Accomplishment of output 1 to 4 Accomplishment of output 1 to 4 	<ul style="list-style-type: none"> Number of training courses carried out Prepared texts and tools 	Project Monitoring Sheet Project Monitoring Sheet Syllabus, curriculums and Training materials for the training courses	Project Monitoring Sheet Project Monitoring Sheet Syllabus, curriculums and Training materials for the training courses
Accomplishment of outputs 1. Current situation of the distribution system operation and maintenance is analyzed and training needs are identified	1.1 Report compiled training needs	<ul style="list-style-type: none"> Quantity and quality of reports needs 	<ul style="list-style-type: none"> Training needs survey 	Training needs survey report	Training needs survey report	Literature review

Five Evaluation Criteria	Evaluation Questions		Basis for Judgment	Data required	Source of Information (collection method)	Basis for Judgment				
	Main Items	Sub Items								
2. Training for technicians of ECG and the third countries is improved	2.1 Number of trainees for technician courses will increase. 2.2 Number of trainees (Ghana: more than 30, the third countries: more than 36)	Increase in number of trained trainees	Number of trained trainees	Project Monitoring Sheet	Literature review	Literature review				
							Number of training courses for engineers	Number of trained trainees	Project Monitoring Sheet	Literature review
3. Training for engineers of ECG and third countries is implemented	3.1 Number of training courses for engineers will increase 3.2 Number of trainees will increase 3.3 Number of trainees (Ghana: more than 50, third countries: more than 12)	Number of trainees completed	Number of trainees completed	Project Monitoring Sheet	Literature review	Literature review				
							Text book for training	Quality of revised texts	Project Monitoring Sheet	Literature review
4. Monitoring and management capacity of ECG is improved.	4.1 Quality of revised texts 4.2 Number of JCC meetings 5.2.1 Activities are done as planned 5.2.2 Project management (Participating in decision making process)	Number of JCC meetings held	Records of JCC	Minutes of JCC (1st ~ 3rd)	Literature review	Literature review				
							Comparison of planned and actual activities	Reasons for change and modification	Project Monitoring Sheet	Literature review
Implementation of monitoring	5.2.1 Monitoring is carried out	Monitoring is carried out	Monitoring records	Project Monitoring Sheet Pre and post	Literature review	Literature review				
							Progress of activities	Progress of activities	Project Monitoring Sheet	Literature review

Five Evaluation Criteria	Evaluation Questions		Basis for Judgment	Data required	Source of Information (collection method)	Basis for Judgment
	Main Items	Sub Items				
A	H				questionnaires Results of the questionnaire for Trainees' supervisors monitoring (Action Plan follow up)	
					Project Monitoring Sheet Pre and post questionnaires Action Plan follow-up (Technicians) Results of the questionnaire for Trainees' supervisors monitoring (Action Plan follow up)	Literature review
		5.2.2 Monitoring mechanism is appropriate	Monitoring mechanism is appropriate	Monitoring records	Interview	Literature review Interview
		5.2.3 Roles to be played by the respective institutions are appropriate	Division of roles to play responsibilities are clearly defined			Literature Review
		5.3.1 Status of communications between C/P and experts	Degree (frequency) of communication			Interview
		5.3.2 Measures to be taken when problems occur or plan changes	Measures to be taken when problems occur or plan changes			Interview
		5.4 Commitment by top management	Commitment of top management of ECG and Ministry of Electricity			Interview
		5.5 Ownership of institutions concerned (ECG)	5.5.1 Budget allocation	Budget allocation	Interview ECG Annual report	Interview ECG Annual report
			5.5.2 Commitment of ECG members	Commitment of ECG members		Interview

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Evaluation Results

Evaluation Criteria	Evaluation Questions		Data required	Source of Information (collection method)	Basis for Judgment
	Main Items	Sub Items			
6.1.1 Necessity		Consistency between project purpose and needs of Ghana side			Training needs survey reports Interview
		Are the project purpose and Overall goal still consistent with the development needs of Ghana?	<ul style="list-style-type: none"> National Development plan for Ghana National Energy Strategy of Ghana 	Mid-term state development policy framework Prior evaluation report / Country support policy / Energy resources support policy Country support plan to Ghana (September 2016) JICA country project development plan (April 2009)	Literature review
6.1.2 Importance		Is the project relevant to the Japanese ODA policy?	<ul style="list-style-type: none"> Japanese/JICA ODA and Energy policy 		
6.1.3 Relevance on approach		Relevance of target group	<ul style="list-style-type: none"> Selection process of trainees 		
		Advantage of engineering knowledges and experiences			

Evaluation Criteria	Evaluation Questions		Data required	Source of Information (collection method)	Basis for Judgment
	Main Items	Sub Items			
6.1 Relevance	6.1.1 Necessity	Consistency between project purpose and needs of Ghana side			Training needs survey reports
	6.1.4 Other issues	Changes in environment surrounding projects	<ul style="list-style-type: none"> Privatization 		Interview

Evaluation Criteria	Evaluation Questions		Data required	Source of Information (collection method)	Basis for Judgment
	Main Items	Sub Items			
6.2 Effectiveness	6.2.1 Prospects for accomplishment of the project purpose	Appropriateness of accomplishment of the project purpose	<ul style="list-style-type: none"> Accomplishments of activities 	Table of accomplishments	Interview Literature review
	6.2.2 Are the outputs of the project expected to contribute to the achievement of the Project Purpose as planned?	Are there any factors promoting achievement of the project purpose?	<ul style="list-style-type: none"> External factors Contributing factors 	Project monitoring sheets	Interview Literature review
		Are there any factors for impeding achievement of the Project Purpose?	<ul style="list-style-type: none"> External factors Contributing factors 	Project monitoring sheets	Interview Literature review
6.3 Efficiency	6.3.1 Are the quality, quantity and timing of the inputs appropriate for	Appropriateness of inputting human resources and equipment	<ul style="list-style-type: none"> Number and area of expertise of Japanese 	Project monitoring sheets	Interview Literature

Evaluation Criteria	Evaluation Questions		Data required	Source of Information (collection method)	Basis for Judgment
	Main Items	Sub Items			
6.4 Impact	<p>producing the planned outputs?</p> <p>6.3.2 Are there any impeding or facilitating factors in terms of efficiency?</p> <p>6.4.1 Prospect of achieving the overall goal at the time of evaluation. Is the overall goal expected to be achieved?</p> <p>6.4.2 Positive influences outside of overall Goals</p>		<ul style="list-style-type: none"> experts Number of areas of expertise of C/P Number of training in Ghana (Number of participants and contents) Number of training in Japan (Number of participants and contents) Number and variety of equipment 		review
		Utilization of inputs (Human resources and equipment)	<ul style="list-style-type: none"> Number of participants Utilization of equipment 	Project monitoring sheets	Interview Literature review
		Appropriateness of timing of inputs	<ul style="list-style-type: none"> Actual input (Comparison with plan) 	Project monitoring sheets	Interview Literature review
6.5 Sustainability	<p>6.5.1 Are the project effects likely to be sustainable after the completion of the project from the policy, institutional and organizational aspect?</p> <p>6.5.2 Are the project effects likely to be sustainable from financial aspects?</p>	Are there any impeding or facilitating factors in terms of efficiency?	<ul style="list-style-type: none"> Effective utilization of local resources Accomplishment of outputs External factors 		Interview Literature review
		Is the overall goal likely to be achieved as a result of the achievement of the project purpose?	<ul style="list-style-type: none"> Distribution loss (Comparison of project start and three years upon project completion.) Decrease in SAIFI, SAIDI(same as above) 	Project monitoring sheets	Interview Literature review
		Cases	<ul style="list-style-type: none"> Cases 	Project monitoring sheets	Interview Literature review
6.5 Sustainability	<p>6.5.1 Are the project effects likely to be sustainable after the completion of the project from the policy, institutional and organizational aspect?</p> <p>6.5.2 Are the project effects likely to be sustainable from financial aspects?</p>	Capacity of continuing projects	<ul style="list-style-type: none"> Characteristics of ECG (# of staff expertise) Privatization 	Project monitoring sheets	Interview Literature review
		Is the financial situation of ECG sound?	Is the financial situation of ECG sound?	ECG annual reports (Current and prospective)	Interview Literature review
		Necessary budget will be allocated for the training (including personnel expenses)	<ul style="list-style-type: none"> Budget Revenue 	ECG annual reports Result of the questionnaire for trainees' supervisors Action Follow-up	Interview Literature review

Evaluation Criteria	Evaluation Questions		Data required	Source of Information (collection method)	Basis for Judgment
	Main Items	Sub Items			
6.5.3 Are the project effects likely to be technically sustainable?	Was appropriate technology transfer implemented?	<ul style="list-style-type: none"> Utilization of knowledge and techniques C/P were transferred Utilization of equipment 	ECG annual reports Result of the questionnaire for trainees' supervisors Action Follow-up	Interview Literature review	
	Was C/P gained enough technology and knowledge?	<ul style="list-style-type: none"> Utilization of knowledge and techniques C/P were transferred 	ECG annual reports Result of the questionnaire for trainees' supervisors Action Follow-up	Interview Literature review	
	Will equipment, techniques be widely used?	Actual on-site utilization case	ECG Annual reports Result of the questionnaire for trainees' supervisors Action Follow-up		

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