10) Monitoring (Action Plan Follow-up) (July. 2015)
Training Course for Technicians of Third Countries
"Maintenance Techniques for Power Equipment"
(Overhead Line)

Post-training Review (Follow up Survey for the Action Plan)
Training Course for Technicians of Third Countries "Maintenance Techniques for Power Equipment" (Overhead Line)

Around six months after the training course, we sent the Questionnaire about the progress of the Action Plan to the trainees.

Based on the answers of this questionnaire, we considered how much the trainees utilized the contents of the training course in their daily jobs.

1. Action Plan

When we see the Action Plan of the trainees, there are many plans to try to utilize the contents of the training course in their daily jobs.

It may be quite natural because the training course is dealing with maintenance technology which would be used in their daily jobs.

Concretely they drew up the following issues as the targets of their Action Plan.

(1) To enhance the quality of their jobs
(2) To transfer the acquired knowledge to their colloquies
(3) To utilize acquired knowledge to their daily and periodical inspection
(4) To improve the technology in daily maintenance and operation works

2. Result and Conclusion of the Post-training Review

We could get answers from all participants for the training course. Points of their answers are shown in the following table.

In this table, the following points were briefly summarized.

(1) Progress of the Action Plan
(2) If not achieved, necessary additional period
(3) Obstacles to achieve the Action plan
(4) Additional issues or request to the training course

Five (5) trainees out of twelve (12) trainees answered they achieved their Action Plan and seven (7) trainees answered they were on the way.

From their answers especially from Liberia, we can recognize that they were in confusion due to Ebola outbreak.

As we mentioned in above 1, the Action Plan has the strong relation to the daily job. Therefore we guess that it would be difficult for the trainees to answer the progress

of the action plan because the image of the achieved situation of the Action Plan would not be so clear.
We considered that this difficulty reflected the result of answers (4 achieved and 7 on going) to judge clearly the progress of the Action Plan.
They commented that the acquired knowledge from the training was very useful and helpful for their daily jobs.

Considering these conditions, we can judge that in spite of the Ebola outbreak the trainees achieved the Action Plan relatively well and the training course is very useful for them.
This kind of intention is very much harmonized with the result of the Questionnaire for trainees` supervisors carried out three (3) months after the training course.

3. Additional issues and/or request to the training course

As for the additional issues and/or request to the training course, we got some following requests from the trainees.

(1) Training period is too short and make it longer. (from Gambia)
(2) To provide more practical contents
(3) To provide training for assembling isolator and knife switch

As for (1), we formulated the syllabus and curriculum as short as possible, considering the opinion of Liberia and Sera Leone. They insisted that they could not dispatch engineers and technicians in a long period because of the shortage of manpower. Therefore it is difficult to correspond to this request.

As for (2), after providing the measuring equipment at the training center, we would like to discuss on the possibility of this training. But if we implement this kind of training, it would be necessary to prepare the expenditure for cables.

As for (3), these issues have already treated in this training curriculum, it would be difficult to spare more time on these issues, considering the balance of the allocation of time in this training course.

Training Course for Technicians of Third Countries "Maintenance Techniques for Power Equipment (July 2014)
Result of the Post Training Review (6 months after the completion of the course)

	Progress of Action Plan	Additional period to achieve A.P.	Obstacles	Additional Items of the Training
G-1	on-going (achieved)	not so long	- lack of materials	- to train the other fellow - practical training for transformer - training period is too short
G-2	achieved		none	- training period is too short - more practical training - transformaer on 33kV/11kV
G-3	on going	4 months	- material constraint - lack of transportation	- Transformer maintenance - switch gear maintenance - construction of MV and LV network - fault finding equipment
G-4	achieved	(achieved in 3 months)	- manual instllation of transformer and sectionalizer	- more personal training - to repair burnt transformer coil and electric meter - longer training period
G-5	on going	3 months	none	- practical training
G-6	on going	2-3 months	- manual instllation of transformer and sectionalizer	- materials used in the training is different in Gambia
S-1	achieved	-	- lack of tools and equipment - lack of materials - vehicles - lack of safety gears	- site visit - facilitate hand-on experrience
S-2	achieved	-	- lack of tools and equipment - lack of materials - vehicles - lack of safety gears	- more practical training - transformer installation and maintenance - assembling isolator/knife switch
S-3	achieved	-	- lack of tools and equipment - lack of materials - vehicles - lack of safety gears	- more practical training - transformer installation and maintenance - assembling isolator/knife switch
L-1	on going	eight months	- limitation of working tools - less manpower - Ebola outbreak	- Hydro operation & maintenance
L-2	on going	1-2 weeks (after Ebola crises)	- less manpower(Ebola outbreak)	- Hydro operation & maintenance - Project management
L-3	on going	7-9 months	- Ebola outbreak - limitation of safety tools	- Hydro operation & maintenance - Project management

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Lamin Darboe (G-1)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- Very effective for us and we are working forward of r other people to benefit the same thing

(2) How long does it take additionally to achieve your Action Plan?

- Not so long because already the experience is in place, but lack of material

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- The difficulties are not much, the only we need is continuous training for staff

(4) If you find some additional issues to the training course, please describe.

- Due to the training we need continuous training for our fellow staff.
- We need some practical training for the transformer.

(5) If you find some contents to improve or revise the training course, please describe.

- The duration for the training is too short. It should be much longer so as to gain more knowledge about the trainings.

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Yaya Dampha (G-2)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- It makes my work easily with my team.

(2) How long does it take additionally to achieve your Action Plan?

- Additionally two some weeks

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- No difficulty after the training

(4) If you find some additional issues to the training course, please describe.

- The time frame is very short if it can be extended to two months.

(5) If you find some contents to improve or revise the training course, please describe.

- The training should be more practical at the field.
- Training of transformers on 33 KV/ 11 KV panels

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Yamadou Camara (G-3)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- A lot of progress has been made since I came from the training in Ghana, which has changed my way of working more easily and the knowledge gain is helping me a lot in making my day to work programme more easily.

(2) How long does it take additionally to achieve your Action Plan?

- Four months

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- The difficulties I normally encounter is sometimes material constraint is our major problem and transportation as I am staying in the provinces. It has to take sometime to get all you need.

(4) If you find some additional issues to the training course, please describe.

- I would like you to train us to be JICA specialist in transformer maintenance, which is our main problem is now switch gear maintenance and construction of both MV and LV networks and fault finding equipment.

(5) If you find some contents to improve or revise the training course, please describe.

- There is a need for JICA to improve or review the training on the various area and to improve the time factor; 1) Transformer maintenance, 2) Switch gear maintenance, 3) Construction on MV/ LV networks, 4) Construction of a substation, 5) Working on line currents

I definitely would like JICA to help us in this various areas and adjust the time factor.

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Omar Touray (G-4)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- It has improved. I have improved in load balance, fault finding, replacement of broken insulator like pin and tension, replacement of broken poles.

(2) How long does it take additionally to achieve your Action Plan?

- The achievement takes me 3 months.

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- Yes, the difficulties are manual installation of transformer and manual installation of sectionalizer.

(4) If you find some additional issues to the training course, please describe.

- My additional issues for the training course are to help us to train more personnel. I want you to introduce how to repair a burnt transformer coil and electric meter or cash power maintenance.

(5) If you find some contents to improve or revise the training course, please describe.

- Yes, we should revise the training course by introducing how to repair a burnt transformer and electric meter fault.
- The training should be longer period.

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Ebrima M. Jallow (G-5)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- It makes my work easier for me and my team mates

(2) How long does it take additionally to achieve your Action Plan?

- Additional three months

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- No difficulties after the training

(4) If you find some additional issues to the training course, please describe.

- The time frame is very short if the time could be extended to four weeks.

(5) If you find some contents to improve or revise the training course, please describe.

- Training should be concentrated on purely practical works, so as to be productive when the trainee returns back home.

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Lamin Ceesay (G-6)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- Lot of the progress has been made since training form Ghana July, 2014.
- Some of the progress are;

a) The training has changed myself on the standard way of work.

b) The knowledge that I gained from the training benefits lot of others.

(2) How long does it take additionally to achieve your Action Plan?

- Approximately two to three months

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- The difficulties was not much since I have only two, ie

a) Manual installation of transformer

b) Manual installation of sectionalizer

(4) If you find some additional issues to the training course, please describe.

- The issues that I think need adjustment are training on installation of sectionalizer and transformer installation by manual.

(5) If you find some contents to improve or revise the training course, please describe.

- Yes, some of them are;

a) The time line of the training was very short

b) The resources we used for the training source are different from the materials uses in Gambia.

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: George Seiya (S-1)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe. *The Action Plan is twofold:*

(a) Compilation of a comprehensive report to the Transmission and Distribution Department of the National Power Authority followed by a power point presentation to the rest of our colleagues (technology transfer).

(b) For the past six months we have been engaged in the injection of new transformer stations in areas identified as Dark Spot zones in an effort to minimize system losses.

(2) How long does it take additionally to achieve your Action Plan?

Since the transformers were not manually mounted, the use of a Tirfor Hoist and rope was inapplicable. In that regard, the achievement of my action plan does not need extra time.

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

Some of the difficulties encountered in the course of achieving the said plan include the following:

(a) Lack of appropriate tools and equipment

(b) Lack of adequate materials to undertake assigned jobs

(c) Vehicle constraints

(d) Lack of adequate safety gears etc.

(4) If you find some additional issues to the training course, please describe.

Some additional issues to the training course include but are not limited to the following:

(a) Enormous emphasis should be laid on regular site visit

(b) Facilitate hands-on experience to better understand and appreciate the required technique.

(c) Stipends and other major allowances should be covered by JICA instead of by individual home institutions.

(5) If you find some contents to improve or revise the training course, please describe.

It is recommended that the following courses be incorporated in the training course:

(a) Transformer installation and maintenance

(b) Protection Coordination Systems

(c) Assembling the gang isolator/knife switch

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Samuel Lewis (S-2)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

1. How about the progress of your Action Plan?

Please describe.

(a) As a field supervisor for the Overhead Construction team, my action plan is implemented nearly every day.

(b) Following the completion of the training a comprehensive report was submitted to the transmission and distribution management of our institution.

(c) During the past six months major construction works on 11kV Overhead Lines were undertaken in which some of the skills acquired were implemented.

2. How long does it take additionally to achieve your Action Plan?

No additional time is required to achieve my action plan as the skills acquired in the course of the training had been fully implemented in the past six months.

3. If you face the difficulty to achieve your Action Plan, please describe the reason.

Some of the difficulties encountered in the course of achieving the said plan include the following:

(a) Lack of appropriate tools and equipment

(b) Lack of adequate materials to undertake assigned jobs

(c) Vehicle constraints

(d) Lack of adequate safety gears etc.

4. If you find some additional issues to the training course, please describe.

-prioritize regular site visit

-More emphasis on practical application

-Stipends and other major allowances should be covered by JICA instead of by individual home institutions.

(5) If you find some contents to improve or revise the training course, please describe.

It is recommended that the following courses be incorporated in the training course:

(a) Transformer installation and maintenance

(b) Assembling the gang isolator/knife switch

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Sheik Ahmed Koroma (S-3)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

(a) Following the completion of the training a comprehensive report was submitted to the transmission and distribution management of our institution.

(b) During the past six months major construction works on 11kV Overhead Lines were undertaken in which some of the skills acquired were implemented.

(2) How long does it take additionally to achieve your Action Plan?

No additional time is required to achieve my action plan as the skills acquired in the course of the training had been fully implemented in the past six months

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

Some of the difficulties encountered in the course of achieving the said plan include the following:

(a) Lack of appropriate tools and equipment

(b) Lack of adequate materials to undertake assigned jobs

(c) Vehicle constraints

(d) Lack of adequate safety gears etc.

(4) If you find some additional issues to the training course, please describe.

-prioritize regular site visit

-More emphasis on practical application

-Stipends and other major allowances should be covered by JICA instead of by individual home institutions.

(5) If you find some contents to improve or revise the training course, please describe.

It is recommended that the following courses be incorporated in the training course:

(a) Transformer installation and maintenance

(b) Assembling the gang isolator/knife switch

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Mayango Koiyan (L-1)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- Replacing rotten 9/11 meter poles
- Injected 4 KVA transformers on two feeders to improve voltage for customers
- Inspecting and measuring the length for each circuit MV + LV lines
- Implementing preventive maintenance on poles and transformers
- Setting up quarterly maintenance schedule
-

(2) How long does it take additionally to achieve your Action Plan?

- Eight (8) months: April 2015 – October 2015

《Short-term》

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- Limitation of working tools
- Less man power
- Delay in shipment or procurement of faulty parts
- Ebola outbreaks in Liberia

(4) If you find some additional issues to the training course, please describe.

- Hydro operation and maintenance

(5) If you find some contents to improve or revise the training course, please describe.

- Repair of distribution transformers
- Practical aspect in measurement/ management of earth resistance

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Andrew M. Santee (L-2)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- How to band a broken/ cut HT/ MV conductor lines
- How to protect a transformer on the pole mannerly, why putting it up on the pole
- How to turn to your customer on time, maintenance to be effective

(2) How long does it take additionally to achieve your Action Plan?

- It takes time to carry on maintenance due to the short of men power, and Ebola crises with in our country.
- After the Ebola crisis have slowed down, we are now taking 1 to 2 weeks to customer connection on the service drop.

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- I face difficulty with my action plan of crises, I was unable to achieve, what I wanted to applied at my job.
- Less man power to do a peace of job

(4) If you find some additional issues to the training course, please describe.

- Hydro training and maintenance or operation
- How to do a stocks on logistics or to put in for material
- How to build tower & project management

(5) If you find some contents to improve or revise the training course, please describe.

- We need to learn more about safety on how to work on a transformer and safety, why working on the hydro.
- How to repair transformer

Thank you very much for your Cooperation.

(Follow-up survey of the Action Plan)

The Questionnaire (Interview) to the Trainee about the Progress of the Action Plan

(Around six months after training course)

Name of the Trainee: Michael G. Zologon (L-3)

Name of the Training Course at ECG:

Training Course for Technicians of the Third countries

"Maintenance Techniques for Power Equipment" (Overhead Lines)

(1) How about the progress of your Action Plan?

Please describe.

- Expansion of a new distribution line to improve
- Relocating transformers to the load centre for balancing of load
- Increasing wire size to reduce current density with thicker conductors

(2) How long does it take additionally to achieve your Action Plan?

- Seven (7) to nine (9) months for the long term action plan

(3) If you face the difficulty to achieve your Action Plan, please describe the reason.

- Ebola outbreak
- Limitation of safety tools
- Lack of logistics

(4) If you find some additional issues to the training course, please describe.

- Project management
- Hydro power plant operation and maintenance procedure

(5) If you find some contents to improve or revise the training course, please describe.

- Protection scheme for power transformer and substation
- Distribution transformer repair (rewinding)
- Current management

Thank you very much for your Cooperation.

11) Monitoring Report on the Training Course for ECG Engineers
"Distribution Planning "(August, 2015)

Monitoring Report on the Training Course for ECG Engineers
"Distribution Planning"

Table of Contents:

Monitoring Report on the Training Course for ECG Engineers
"Distribution Planning"

1. Overview of the Training Course

(1) Objectives

To learn and acquire basic concept and knowledge of distribution planning in the electric power system

(2) Targets of the training course and number of trainees

Total Ten (10) Engineers; 1 trainee who are engaging technical occupations of distribution planning from each ECG regional offices.

(3) Duration of the training course

From Monday, 13rd July, 2015 to Friday, 17th July, 2015 (5days)

2. Implementation of the Training Course

(1) Program of the training course

Program of the training course is shown in Table-

(2) Participants

Participants list of the training course is shown in Table-2.

Table-1 Curriculum for the Training Course on the Distribution Planning for ECG Engineers

JICA Programme for ECG Engineer Training on Distribution Planning

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

Table-2 Participants List for the Training Course on Distribution Planning for ECG Engineers

No.	Name	Designation	Region	Job category	Work experience	Age
1	James Teye	Electrical Engineer	Accra-West	Project management	17	44
2	Philip A. Antwi	Electrical Engineer	Central	Project implementation	17	32
3	Bridget E. Adoku	Snr Artisan	Tema	Project supervising	5	34
4	Godfred G. Awuku	Electrical Engineer	Eastern	Project manager	13	45
5	Benjamin Odame Thompson	Technician Engineer	Sub-T	Network engineer	16	43
6	Kingsley Edu Opoku	Snr. Artisan	Accra-East	Project manager	8	33
7	Feux Avorpodi	Princ. Technician Eng.	Ash-West	Project supervision	14	38
8	Castro K. Dogbeck	Electrical Engineer	Volta	Operation	8	33
9	Samuel B. Twumasi	Snr. Technician Eng.	Ash-East	Project appraisal	4	31
10	Yabameh Godwin Yao	Snr. Artisan	Western	Project Designer	5	29

3. Monitoring of the Training Course

(1) Pre-training Questionnaires

In order to identify trainees' technical background (knowledge and capacity) including job experience, the Pre-training Questionnaires was done in the course of the orientation in the beginning of the Training Course. A form of the Pre-training Questionnaires is attached in Appendix-A.

As results of the Pre-training questionnaire, overview of trainees who participated this training course is indicated in figures shown below. Age composition of trainees is shown in Fig.-1, years of experience in ECG is shown in Fig.-2 and current job category is shown in Fig.-3.

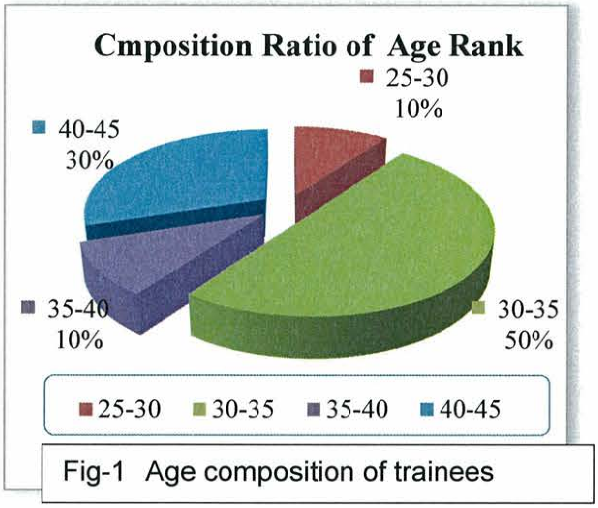


Fig-1 Age composition of trainees

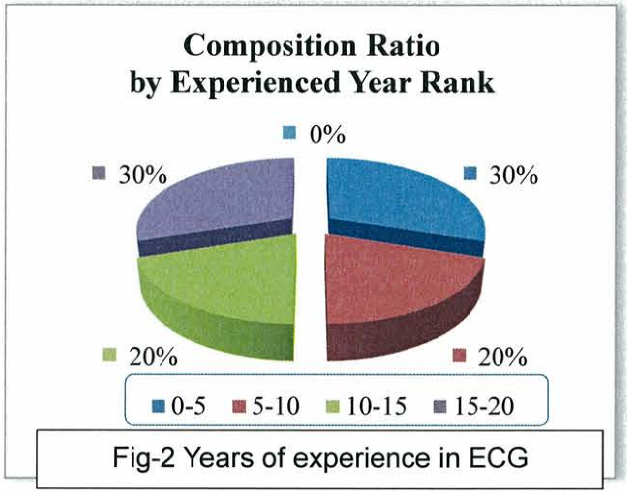


Fig-2 Years of experience in ECG

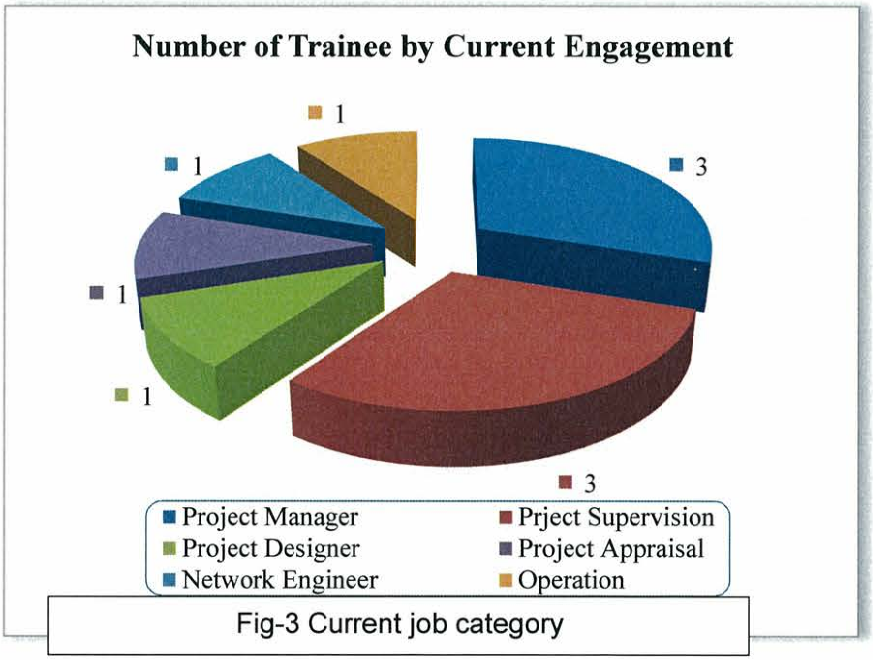


Fig-3 Current job category

According to the composition of the participants age, "31 to 35 years old" is the largest numbers, followed by "41 to 45 years old" is the next largest numbers. "36 to 40 years old" and "26 to 30 years old" are the same number.
According to the composition of the years of experience in ECG of the participants, "0 to 5 years of experience", "6 to 10 years of experience", "11 to 15 years of experience" and "16 to 20 years of experience" are the almost same numbers. More than half of them have more than 10 years of experience and a long career. From the point of view of young participants (inexperienced), on-target participants remain in approximately 50%.

Most of the participants work with Project-related occupations such as "Project Manager" and "Project Supervision", and very few of them works with "Network" and "Operation" related and the number of each participant is one. According to the knowledge of distribution system acquired in this Project-related operation, participants shall be assumed to be appropriate for the content of the training course.
According to the knowledge and technology of general distribution system, at the start of practical training, Results of the question on "sufficient" and "acquired" account for 40%, and including the result of the question on "general" account for 90%. And results of question on "none" and "inexperienced" account for only 10%.
According to the results of question on " demand projection" and " short circuit analysis", depends on training participants. According to the results of question on " load flow / optimization of networks " and " distribution automation", Average is scored below 3.0. Results of question on "none" and "inexperienced" is larger amount of participants than the results of question on "sufficient" and "acquired". (refer to green hatching in Fig.-4) . Result of the Pre-training questionnaire is provided in Appendix-2.

(2) Post-training Questionnaires and Criteria for Evaluation

As results of the Pre-training questionnaire, overview of trainees who participated this training course is indicated in figures below. Age composition of trainees is shown in Fig.-1, years of experience in ECG is shown in Fig.-2 and current jog category is shown in Fig.-3. Result of the Pre-training Questionnaire is provided in Appendix-B. In order to measure the effect of the training course, the Post-training Questionnaire and Action Plan were collected from all trainees in advance of evaluation and closing of the training course. Project Team on the Electrical Engineer Training for African Countries (hereinafter referred to as "PT")

requested trainees that the Post-training Questionnaire should be filled in immediately after subject of the class. A form of the Post-training Questionnaire and Action Plan is attached Appendix-A. In order to measure the effect of the training course and evaluate the appropriateness for the procedure including the material, PT requested trainees that the Post-training Questionnaire and Action Plan should be filled in immediately after subject of the class. These Questionnaires were collected just before the closing ceremony of the training course.

A form of the Post-training Questionnaire and Action Plan is attached Appendix-1, and Result of Post-training Questionnaire is provided in Appendix-2.

Enrolled ten participants in this training course shows 100% of attendance because of full participation of the trainees. Attendance rate is improved compared with the last attendance rate of "system protection and operation" course.

Post–training Questionnaire is provided including A. Comparison of improvement in the technique level, B. Possibility of practical use of acquired knowledge and technology, C. Usefulness in the future, D. Advanced level of technical contents, E. Intelligibility of the lecture and practical work, F. Satisfaction (comprehensive evaluation). These Questionnaire Items aim to evaluate the appropriateness for the procedure including the materials.

According to the results comparison of Pre-training Questionnaire and Analysis A, improvement of the technique level for each trainee is measured, and increase of mean value after training course (improvement in the technique level) is determined. (improvement in the technique level) .

Evaluation item B and C evaluate the possibility of practical use of acquired knowledge and technology after the training course. This monitoring configures the measure for evaluation to assume the effect if the average is scored over 3.0 (intermediate value of evaluation) .

Evaluation item D and E configures the measure for Appropriateness of instructors 評 teaching method. In the case of average scored below 3.0, the improvement of curriculum for the practical training should be considered. According to "D. Advanced level of technique contents", target for average scored 3.5-4.5 is proposed as possibility of acquired technical level for the participants.

Evaluation item F is indicated general satisfaction of training course. While average is scored over 3.0, Satisfaction of comprehensive evaluation should be considered.

(3) Analyses of the Pre and Post-Questionnaires

A) Improvement of the technique level

The result of the question on "Improvement of the technique level" in the Post-Questionnaire is shown in Table-4. And the distinction chart is shown in Fig-1.

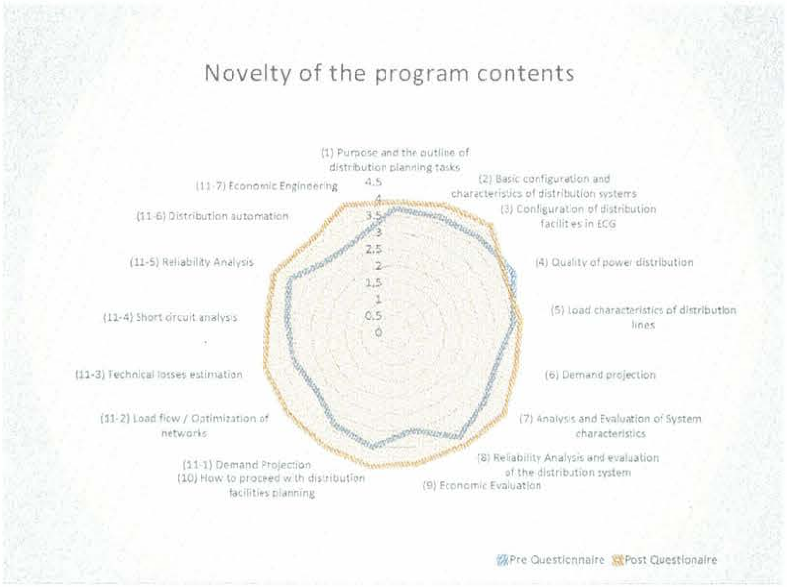
Compared with each item showed improvement of mean value. Especially, (9) "economic evaluation" and (11-1~7) practical training are improved very much.

Table-4 Novelty of the program contents

Questionnaire Item	Pre-Q	Post-Q	Difference	Fluctuation
(1) Purpose and the outline of distribution planning tasks	3.7	3.9	0.2	+
(2) Basic configuration and characteristics of distribution systems	3.7	4.1	0.4	+
(3) Configuration of distribution facilities in ECG	3.8	4.3	0.5	++
(4) Quality of power distribution	4.0	3.7	-0.3	-
(5) Load characteristics of distribution lines	3.6	3.8	0.2	+
(6) Demand projection	3.2	3.8	0.6	++
(7) Analysis and Evaluation of System characteristics	3.4	4.1	0.7	++
(8) Reliability Analysis and evaluation of the distribution system	3.7	4.0	0.3	+
(9) Economic Evaluation	3.0	4.0	1.0	+++
(10) How to proceed with distribution facilities planning	3.5	4.1	0.6	++
(11-1) Demand Projection	3.3	4.0	0.7	++
(11-2) Load flow / Optimization of networks	2.9	4.0	1.1	+++
(11-3) Technical losses estimation	3.1	4.0	0.9	++
(11-4) Short circuit analysis	3.2	3.8	0.6	++
(11-5) Reliability Analysis	3.5	4.0	0.5	++
(11-6) Distribution automation	2.9	3.7	0.8	++
(11-7) Economic Engineering	3.0	4.1	1.1	+++

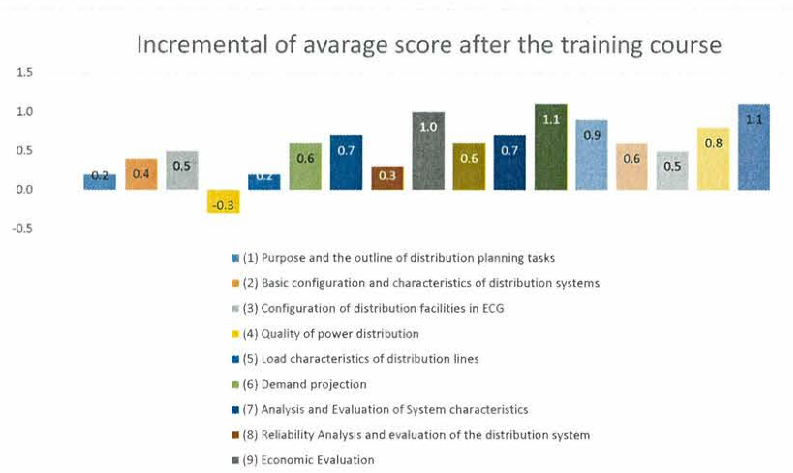
Note: fluctuation

"- " shows negative value, and " +" , "++" and "+++" are positive values. (0<" +" <0.5), (0.5≦ "++" <1.0) , ("+++" >1.0)



According to the left graph,
Left half of the graph is larger, and it obtained that the practical training is improved.

Fig-1 Improvement of the technique level after the training course



According to the left graph, it obtained improvement of the technique level after the training course.
According to the left graph, it obtained

According to the Table-4, especially (9), (11-2), (11-7) incremental average score is over 1.0.

Fig-2 Increase of mean value after the training course

According to improvement of the technical level after the training course (engaged years), for trainees who have 0-10 years experiences (hereinafter referred to as "Group A") and trainees who have over 11 years experiences (hereinafter referred to as "Group B") it is confirmed that the improvement of the technical level for the former is high. Table-5、Table-6、Fig-3～Fig-5).

Table-5 Novelty of the program contents

(Engaged years 0～10)

Questionnaire Items	Pre Questionnaire	Post Questionaire	Difference	Fluctuation
(1) Purpose and the outline of distribution planning tasks	3.6	4.0	0.4	+
(2) Basic configuration and characteristics of distribution systems	3.6	3.8	0.2	+
(3) Configuration of distribution facilities in ECG	3.6	4.4	0.8	++
(4) Quality of power distribution	3.8	4.0	0.2	+
(5) Load characteristics of distribution lines	3.6	3.8	0.2	+
(6) Demand projection	3.2	3.8	0.6	++
(7) Analysis and Evaluation of System characteristics	3.6	4.0	0.4	+
(8) Reliability Analysis and evaluation of the distribution system	3.2	4.2	1.0	++
(9) Economic Evaluation	2.6	4.2	1.6	+++
(10) How to proceed with distribution facilities planning	3.2	4.2	1.0	++
(11-1) Demand Projection	3.0	4.0	1.0	++
(11-2) Load flow / Optimization of networks	2.8	3.8	1.0	+++
(11-3) Technical losses estimation	3.0	4.0	1.0	++
(11-4) Short circuit analysis	3.2	3.8	0.6	++
(11-5) Reliability Analysis	3.4	4.2	0.8	++
(11-6) Distribution automation	3.0	3.8	0.8	++
(11-7) Economic Engineering	3.0	4.0	1.0	++

Table-6 Novelty of the program contents

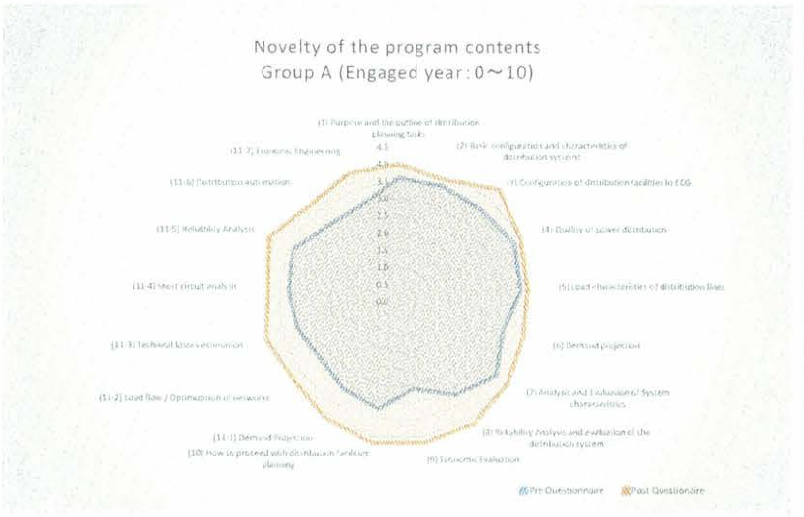
(Engaged years 11～)

Questionnaire Items	Pre Questionnaire	Post Questionaire	Difference	Fluctuation
(1) Purpose and the outline of distribution planning tasks	3.8	3.8	0.0	0
(2) Basic configuration and characteristics of distribution systems	3.8	4.4	0.6	++
(3) Configuration of distribution facilities in ECG	4.0	4.2	0.2	+
(4) Quality of power distribution	4.2	3.4	−0.8	−−
(5) Load characteristics of distribution lines	3.6	3.8	0.2	+
(6) Demand projection	3.2	3.8	0.6	++
(7) Analysis and Evaluation of System characteristics	3.2	4.2	1.0	++
(8) Reliability Analysis and evaluation of the distribution system	4.2	3.8	−0.4	−
(9) Economic Evaluation	3.4	3.8	0.4	+
(10) How to proceed with distribution facilities planning	3.8	4.0	0.2	+
(11-1) Demand Projection	3.6	4.0	0.4	+
(11-2) Load flow / Optimization of networks	3.0	4.2	1.2	+++
(11-3) Technical losses estimation	3.2	4.0	0.8	++
(11-4) Short circuit analysis	3.2	3.8	0.6	++
(11-5) Reliability Analysis	3.6	3.8	0.2	+
(11-6) Distribution automation	2.8	3.6	0.8	++
(11-7) Economic Engineering	3.0	4.2	1.2	+++

It is considered that there is an expectation of large training effect as the

monitoring results showed.

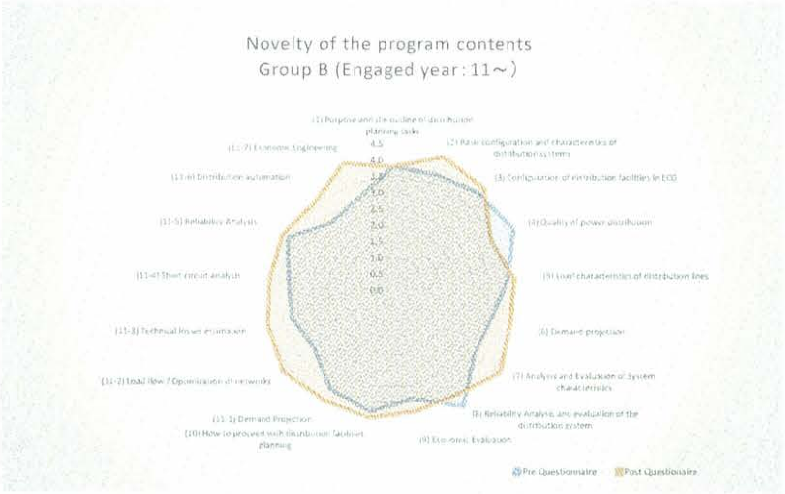
In order to group B, it is considered for the practical training improvement of technical level and the needs from the long time experienced trainees for the practical training course is effective.



According to the left graph, it obtained the improvement of technology level on many of questionnaire item.

Circular by the results of Pre-Questionnaire is completely subsumed in circular by the results of Post-Questionnaire.

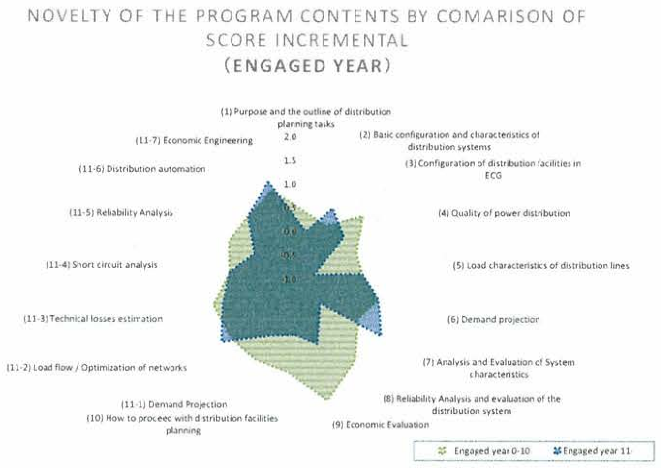
Fig-3 Improvement of the technique level after the training course
(Group A : Engaged year 0～10)



According to the left graph, it obtained the improvement of technology level on many of questionnaire item.

According to the former group A, circular is completely subsumed, on the other hand, protruding part is found in group B.

Fig-4 Improvement of the technique level after the training course
(Group B : Engaged year 11～)



According to the left graph, the improvement degree of group A is larger than that of group B. On the other hand, there is little difference in the part of practical training.

Fig-5 Comparison of improvement in the technique level

B) Possibility of practical use of acquired knowledge and technology

The result of the question on "Possibility of practical use of acquired knowledge and technology" in the Post-Questionnaire is shown in Table-7. Most of average scores are improved in each subject except for the "(8) Relay Setting". Average of the "Relay Setting" is scored below 3.0. From these results, PT can observe as following;

i) Most of trainees felt that the knowledge and technology acquired in this training course could be utilized in their own jobs and quality of their jobs would be improved very much.

It is likely to be caused by following two reasons to be low score on the subject of "(8) Relay Setting"; a) "Relay Setting" is not a work for ECG Regional Offices at this moment and b) class period for the "Relay Setting" in this training course was too short and the lecture was insufficient to explain to trainees in detail.

The result of the question on possibility of practical use of acquired knowledge and technology in the Post- Questionnaire is shown in Table-7. And Potential assessment of years experienced training participants is shown in Fig-6. From these results, there is no questionnaire item which is scored below 3.0. Excellent results are listed in the following table.

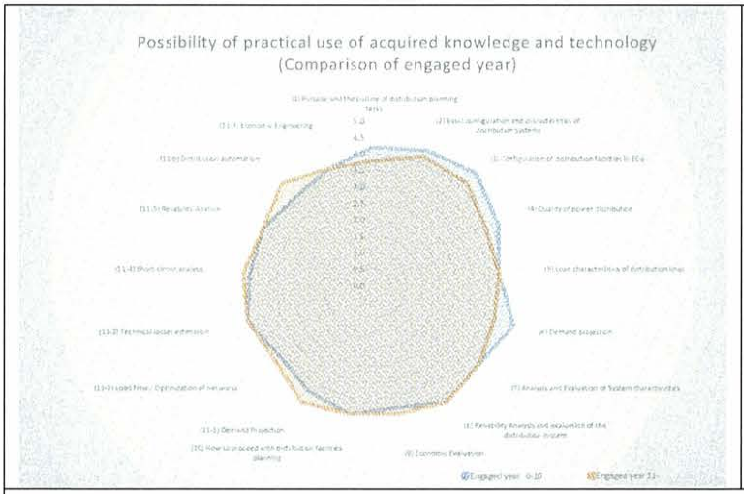
ii) Most of the trainees felt that the knowledge and technology acquired in this training course could be utilized in their own jobs and quality of their jobs would be improved very much.

iii) According to Group A: Engaged year 0-10, evaluation of result for lecture centered item is high. On the other group B : engaged year 11-, evaluation of results for practical training is as same as the evaluation results of group A.

Monitoring results showed for both inexperienced and experienced trainees felt that the knowledge and technology acquired in this training course could be utilized in their own jobs.

Table-7 Possibility of practical use of acquired knowledge and technology (Average)

Questionnaire Items	Mean value
(1) Purpose and the outline of distribution planning tasks	4.0
(2) Basic configuration and characteristics of distribution systems	4.3
(3) Configuration of distribution facilities in ECG	4.4
(4) Quality of power distribution	4.0
(5) Load characteristics of distribution lines	3.8
(6) Demand projection	4.1
(7) Analysis and Evaluation of System characteristics	4.0
(8) Reliability Analysis and evaluation of the distribution system	4.2
(9) Economic Evaluation	3.9
(10) How to proceed with distribution facilities planning	4.0
(11-1) Demand Projection	4.0
(11-2) Load flow / Optimization of networks	3.7
(11-3) Technical losses estimation	4.0
(11-4) Short circuit analysis	3.9
(11-5) Reliability Analysis	3.8
(11-6) Distribution automation	3.9
(11-7) Economic Engineering	3.8



In group A, evaluation for the item for the lecture center is high. Evaluation for practical training is almost the same both group A and group B.

Fig-6 Possibility of practical use of acquired knowledge and technology (Comparison of engaged year)

C) Usefulness in the future

Result of question on usefulness in the future on Post-Questionnaire is shown in Table-8. And Evaluation of usefulness in the future for training participants by engaged year is shown in Fig-7. The Questionnaire is about the possibility of improvement of technical level in future, average of comprehensive questionnaire item is scored over 3.0 and also 15 items (green hatching) among 17 items is scored average 4.0-4.4. (green hatching) . Training participants felt that the knowledge and technology acquired in this training course could be utilized as above results showed.

According to possibility of practical use of acquired knowledge and technology on comparison of engaged year, the results of the question showed same as the result of the question on "B) Possibility of practical use of acquired knowledge and technology".

Above results showed the following.

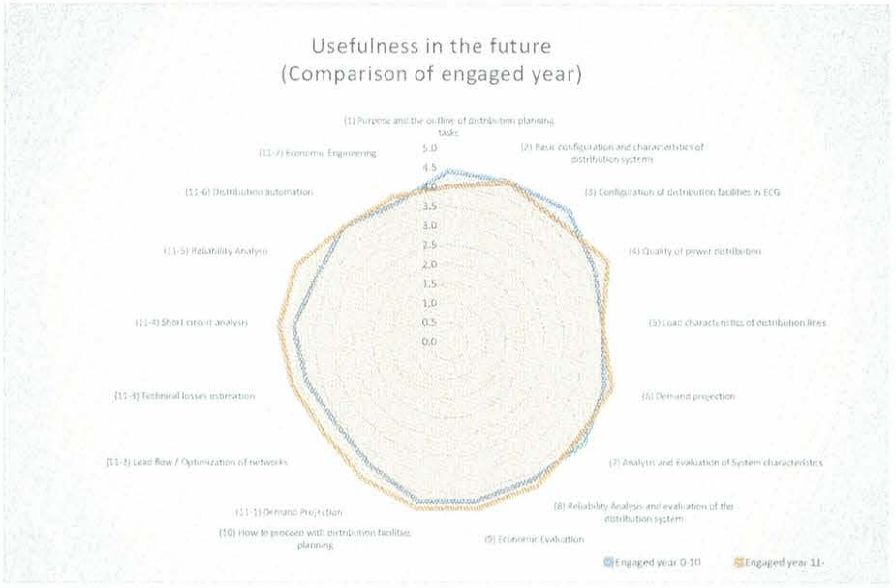
i) Most of trainees felt that the knowledge and technology acquired in this training course could be utilized in their own jobs in future.

ii) In group B: experienced year 11-, evaluation for practical training is as same level as group A or slightly higher than group A. And also, it is desirable that the need from the experienced trainees for operational training was high.

Table-8 Usefulness in the future (Average)

Questionnaire items	Mean value
(1) Purpose and the outline of distribution planning tasks	4.2
(2) Basic configuration and characteristics of distribution systems	4.4
(3) Configuration of distribution facilities in ECG	4.4
(4) Quality of power distribution	4.4
(5) Load characteristics of distribution lines	4.0
(6) Demand projection	4.3
(7) Analysis and Evaluation of System characteristics	4.3
(8) Reliability Analysis and evaluation of the distribution system	4.3
(9) Economic Evaluation	4.3
(10) How to proceed with distribution facilities planning	4.3
(11-1) Demand Projection	4.0
(11-2) Load flow / Optimization of networks	3.8
(11-3) Technical losses estimation	4.0

Questionnaire items	Mean value
(11-4) Short circuit analysis	4.2
(11-5) Reliability Analysis	4.1
(11-6) Distribution automation	4.0
(11-7) Economic Engineering	3.9



Group B is evaluated slightly higher than Group A in the items related to practical training.

Fig-7 Usefulness in the future (Comparison of experienced age)

D) Advanced level of technical contents

Results of the question on Advanced level of technical contents in the Post-Questionnaire is shown in Table-9. Evaluation of the question on Advance level of technical contents on comparison of experienced age is shown in Fig-8.

According to Advanced level of technical contents, comparison of acquired technical level and technical level for training course is asked. Average is scored 3.0, advanced is scored 5.0, and inferior is scored 1.0. Results of the question on Advanced level of technical contents for training course in Post-Questionnaire is shown in Table-7. Evaluation of the question on Advanced level of technical contents for engage year is shown in Fig-8.

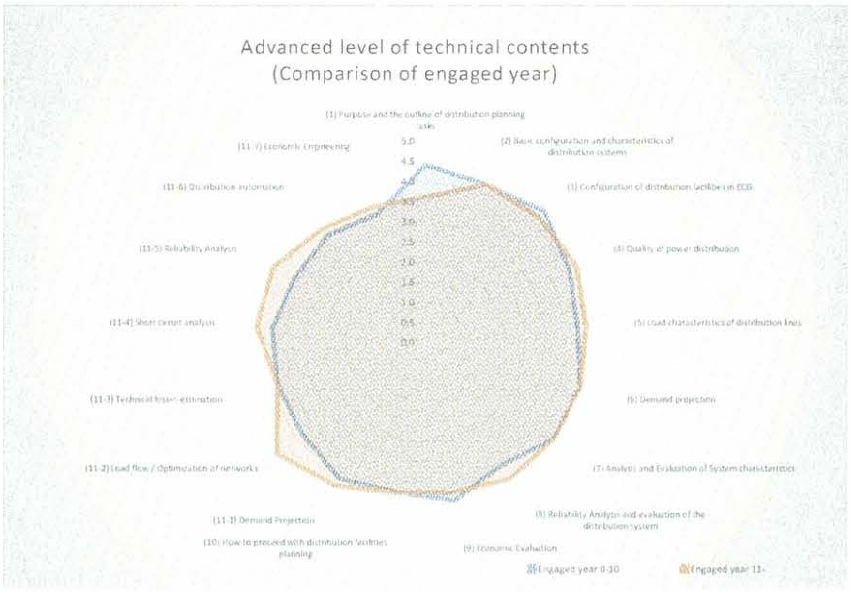
Participants felt that the knowledge and technology acquired in this training course is higher than the existing knowledge and technology. The monitoring results showed following.

i) Average of the evaluation is targeted on approximately 3.5-4.5. Because average of the actual evaluation is within that range, appropriate level for most part of the lecture should be considered.

ii) Evaluation result of the questionnaire in both group A and B was approximately the same, however evaluation for the practical training in group B: experienced age is slightly higher than the group A as the monitoring results showed.

Table-9 Advanced level of technical contents (Average)

Questionnaire items	Mean value
(1) Purpose and the outline of distribution planning tasks	4.0
(2) Basic configuration and characteristics of distribution systems	4.2
(3) Configuration of distribution facilities in ECG	4.3
(4) Quality of power distribution	4.1
(5) Load characteristics of distribution lines	3.9
(6) Demand projection	4.0
(7) Analysis and Evaluation of System characteristics	4.0
(8) Reliability Analysis and evaluation of the distribution system	3.8
(9) Economic Evaluation	3.9
(10) How to proceed with distribution facilities planning	3.8
(11-1) Demand Projection	4.1
(11-2) Load flow / Optimization of networks	4.2
(11-3) Technical losses estimation	3.8
(11-4) Short circuit analysis	4.0
(11-5) Reliability Analysis	3.9
(11-6) Distribution automation	3.7
(11-7) Economic Engineering	3.5



The evaluation for the items related to lecture in group A and B are almost same. On the other hand, the evaluation for the item related to practical training in group B is slightly higher than that of group A.

Fig-8 Advanced level of technical contents (Comparison of experienced age)

E) Intelligibility of the lecture and practical work

The result of the question on Intelligibility of the lecture and practical work in the Post-Questionnaire is shown in Table-10. The evaluation of intelligibility of the lecture and practical work on comparison of experienced age is shown in Fig-9.

Implementation of generally intelligible lecture and practical work should be considered, because most of the participants gave high scored in Post-Questionnaire and evaluation of overall mean was scored over 4.2.

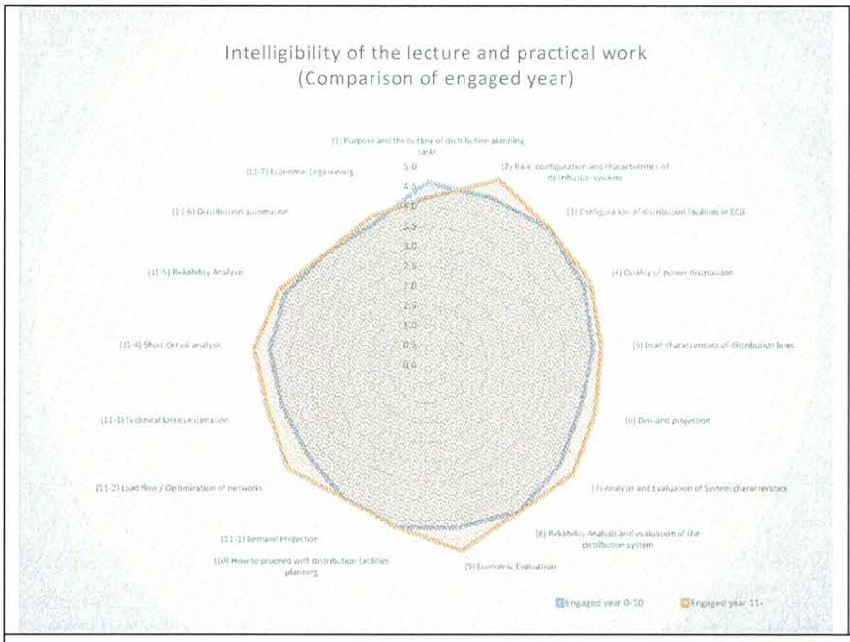
However instructor in ECG who collaborates to produce the text for this practical training was changed due to unforeseen circumstances, substitute instructor read well text from JICA in a short period and gave useful lecture.
It is assumed that ECG has internal facilitator.
Above shows following.

i) Evaluation of intelligibility of the lecture and practical work from the practical training is high as monitoring results showed.

ii) Overall evaluation of group B: experienced age is slightly higher than the group A.

Table-10 Intelligibility of the lecture and practical work (Average)

Questionnaire items	Mean value
(1) Purpose and the outline of distribution planning tasks	4.4
(2) Basic configuration and characteristics of distribution systems	4.8
(3) Configuration of distribution facilities in ECG	4.6
(4) Quality of power distribution	4.5
(5) Load characteristics of distribution lines	4.3
(6) Demand projection	4.2
(7) Analysis and Evaluation of System characteristics	4.4
(8) Reliability Analysis and evaluation of the distribution system	4.4
(9) Economic Evaluation	4.5
(10) How to proceed with distribution facilities planning	4.2
(11-1) Demand Projection	4.0
(11-2) Load flow / Optimization of networks	4.1
(11-3) Technical losses estimation	4.0
(11-4) Short circuit analysis	4.2
(11-5) Reliability Analysis	4.1
(11-6) Distribution automation	3.8
(11-7) Economic Engineering	3.9



The evaluation of intelligibility of the lecture from training participants is generally high. On the other hand, the evaluation for the items related to the lecture in group B is slightly higher than that of group A.
The evaluation for the item (1) "how to proceed with distribution facilities planning", "(9) economic engineering" is especially high.

Fig-9 Intelligibility of the lecture and practical work
(Comparison of experienced age)

F) Satisfaction (comprehensive evaluation)

As results of Post-Questionnaire, comprehensive evaluation of Satisfaction is indicated in Table-11, and comparison of experienced age of Satisfaction is shown in Fig-10. It shows as follows.

i) Average of expectation in advance was targeted on approximately 4.0-4.5. Result of the question on lecture 1-10 without practical training showed satisfaction with expectations.

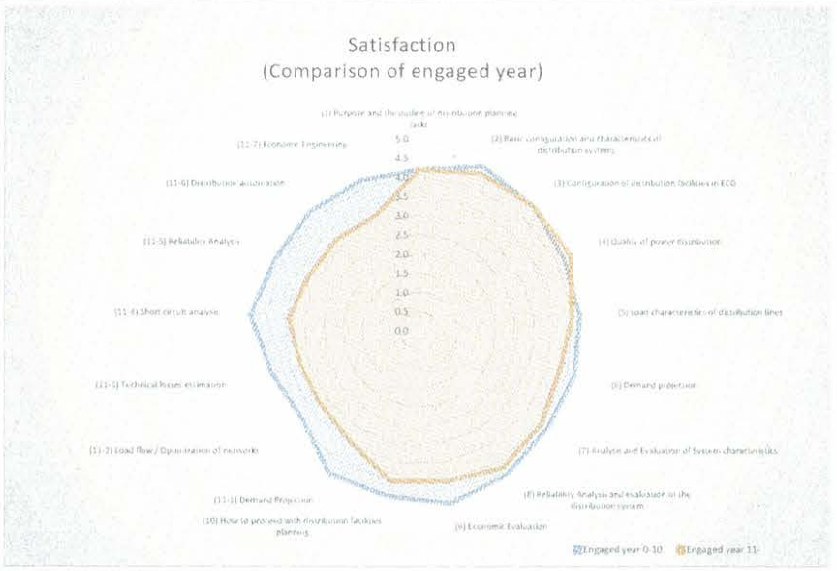
ii) Average of practical training (11-1～7) is scored 3.5-3.9 and it showed that the evaluation for the items related to satisfaction is slightly low. (green hatching)。Because only one set of simulator (system analysis software) was arranged and training participants was not able to operate the simulator, (system analysis software) besides instructor was not be able to be arranged the data of system analysis and training participants felt the lack of the operation without reflecting the purpose and effect of the operation of the simulator to the training participants.

iii) In long time experienced Group B, the evaluation of satisfaction for the practical training is more critical than that of group A. Considering the reason for low average score stated in paragraph ii), it is assumed that the needs for experienced technical engineers are higher than the inexperienced engineers.

Table-11 Satisfaction (comprehensive evaluation)

Questionnaire item	Mean items
(1) Purpose and the outline of distribution planning tasks	4.2
(2) Basic configuration and characteristics of distribution systems	4.5
(3) Configuration of distribution facilities in ECG	4.4
(4) Quality of power distribution	4.3
(5) Load characteristics of distribution lines	4.1
(6) Demand projection	4.0
(7) Analysis and Evaluation of System characteristics	4.1
(8) Reliability Analysis and evaluation of the distribution system	4.3
(9) Economic Evaluation	4.3
(10) How to proceed with distribution facilities planning	4.2

Questionnaire item	Mean items
(11-1) Demand Projection	3.9
(11-2) Load flow / Optimization of networks	3.5
(11-3) Technical losses estimation	3.6
(11-4) Short circuit analysis	3.9
(11-5) Reliability Analysis	3.7
(11-6) Distribution automation	3.7
(11-7) Economic Engineering	3.7



In Group B, the evaluation of "Satisfaction" for the practical training is more critical than that of group A.

Fig-10 Satisfaction (Comparison of experienced age)

(4) Comprehensive summary of the Pre and Post-Training Questionnaires

Analysis result of the Pre and Post-Questionnaires are shown below.

1) There is an expectation of large training effect in this training course for all participants as the monitoring results showed.

2) Most of trainees felt that the knowledge and technology acquired in this training course could be efficiently utilized in their own jobs and quality of their jobs would be highly improved.

3) According to the contents of this training course, there is an expectation of large training effect for trainees who have poor experiences as the monitoring results showed. According to the analysis of mean value, it is desirable to nominate approximately 10 year experienced engineers as participants of training course, it will be better to call trainees who have under 10 years experiences. And therefore, the syllabus and curriculum of this training course are suitable for the engineers little experienced as less than 10 years.

4) On the other hand, the effect of practical training was also very high for over 11 year experienced trainees, and there will be strong expectation for the usefulness in the future.

5) Short hours of instruction are pointed out. Therefore, if the target trainee assumed to be the engineers experienced more than 11 year in the part of practical training, it will be necessary to revise the syllabus and curriculum slightly as an allocation of much time for the practical training.

6) The comprehensive evaluation of satisfaction for this practical training is high.

7) Based on the above result, this training should be considered there is an expectation of large training effect and to have been successfully implemented.

(Note) **Summary of questionnaire**

In this monitoring case, there are other properties such as "Age" and "Job category" in addition to "Experienced age" of the participants.

1. It is observed strong correlation between "Age" and "Experienced age". And the "Experienced age" is closely related with the availability of engineer. Therefore "Experienced age" was selected for the index.

②Summary by job category was not done because of low accuracy.

4. Comments and impressions from lecture Observation

The project team can point out some comments from the observation of lectures besides the questionnaires.

(1) Basic rule for the lecture

1) There are some cases of trainee's delay for classes. These cases will be value punctuality is necessary, otherwise the followings might happen such as delay for classes, lack of explanation by time compression, and delay for the monitoring questionnaire.

(2) Appropriateness of instructors teaching method

1) The way to proceed the lectures clarifies the response of the text structure. And the contents of instruction PPT are prepared for taking appropriate measure of the text, training participants are easy to understand the way to proceed the lectures. This point is improved very much by comparison with the first annual training (Operation and Maintenance of Power Distribution Equipment).

2) The contents of instruction PPT enhance understanding of the lecture. For example, comprehensive and logical part of the text was found many

description such as the following, supplementation of specific value for the operation, introduction of figure made by instructor.

（３） Atmosphere of the lecture

１）Attitude of trainees is very good during the training course.

２）The way to precede the lectures with exchanging views between instructor and trainees is very good. This mood produces a kind of presence because the class is a situation of serious thinking and brain storming. It is very wise arrangement to proceed the lectures with exchanging views between instructor and trainees.

３）The lecture is carried out by a method to increase the usefulness of training including on-the job question and problem of the training participants.

５．Recommendation to next training courses

（１） Nominee Qualifications

It is desirable to nominate young engineers as participants of training course according to the original aim, and it will be better to call trainees who have under 10 years experiences.

More than 10 participants are possible to attend the lecture. However it should be better to keep a policy of approximately 10 participants so that training participants really operate the software in the training.

In addition, as for training participants really operate the software, it will be desirable to arrange the couple of licenses which ECG possesses during training period.

（２） Appropriate accommodation method

There are some cases engineers working in a neighborhood business office of the training center are late for the classes so that it is desirable to introduce the training camp method which provides accommodation for engineers like any other training participant to focus on the training course.

（３） Applicability of this training course to veteran engineers

The curriculum, syllabus and instruction materials of this training course are applicable to the veteran engineer more than 11 years experienced. When we consider the case of application to the veteran engineers, it is necessary to think the way of practical training ought to be in the curriculum of this training course.

There was some pointing out that the training by using the software was liable to lack of time.

This training by using the software follows a strong request which training

participants can learn technical analysis of real operation by ECG. Therefore it will be necessary to improve the curriculum based on the implementation method of ECG how to instruct the technical contents.

12) Amendment of Curriculum and Textbook for Engineers of ECG "Distribution Planning "(November, 2015)

Training Course for Engineers of ECG "Distribution planning" was carried out from 13rd to 17th July 2015. Based on the result of the meeting with the trainers and the Monitoring Report on Training Course for Engineers of ECG "Distribution planning", the Textbook were revised as documents attached hereto.

The textbook used in the next training course will be changed from Version 1.0 to 1.1.

November 2015

Revision on the textbook of "Distribution Planning" from (V - 1.0) to (V - 1.1)

Note: The part with underline in [Before revision] is revised as the way in [after revision]

<table>
<tr><th>No.</th><th>Before revision (V-1.0)</th><th>After revision (V-1.1)</th><th>Note</th></tr>
<tr><td></td><td>Textbook (Main part)</td><td>Textbook (Main part)</td><td></td></tr>
<tr><td>< 1 ></td><td>3-2-1 Supports

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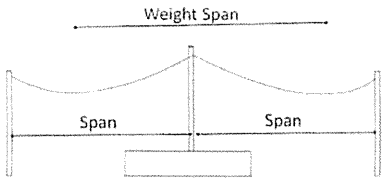
Table 3-2-2 Installation standard of Tower (33kV)<table><tr><td>Basic Span</td><td>170m</td></tr><tr><td>Maximum Span</td><td>200m</td></tr><tr><td>Weight Span</td><td>290m</td></tr></table> 
</td><td>・ Correction(word)

・ A drawing added for better understanding of terms</td></tr>
<tr><td>< 2 ></td><td>3-3-3 Underground cables

Table 3-3-3 Standardized cable data (11kV)<table><tr><th>Type</th><th>structure</th><th>Core material</th><th>Ampacity (Amperes) *1)</th><th>Transmission capacity (MW) *2)</th><th>Maximum feeder length (km) *3)</th></tr><tr><td>630 sq.mm</td><td>Single core</td><td>Aluminum</td><td>570</td><td>27.7</td><td>23</td></tr><tr><td>500 sq.mm</td><td>Single core</td><td>Copper</td><td>625</td><td>30.4</td><td>22</td></tr><tr><td>500 sq.mm</td><td>Single core</td><td>Aluminum</td><td>506</td><td>24.6</td><td>24</td></tr><tr><td>240 sq.mm</td><td>Single core</td><td>Copper</td><td>442</td><td>21.5</td><td>24</td></tr><tr><td>240 sq.mm</td><td>Single core</td><td>Aluminum</td><td>347</td><td>16.5</td><td>23</td></tr></table></td><td>3-3-3 Underground cables

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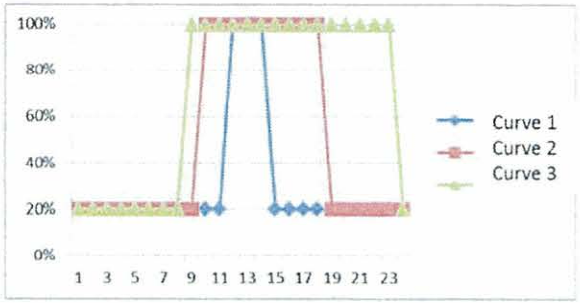
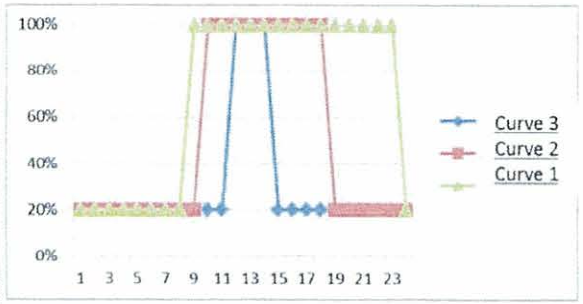
</table>

<3>	3-4-1 Supports Table 3-4-1 Installation standard of Pole (11kV)	3-4-1 Supports Table 3-4-1 Installation standard of Pole (400/230V)	・ Correction(value)
<4>	9-3-2 Conversion formulas of economic evaluation method (EE method) (4) Present worth coefficient for uniform annual repayment at year-end: $\frac{(1+i)^n-1}{i(1+i)^n}$ $P = \$1{,}000 \times \frac{(1+0.1)^{10}-1}{0.1\times(1+0.1)^{10}} = \underline{\$61{,}450{,}000}$. The outcome equals the amount converted to the present worth from $\underline{\$159{,}370{,}000}$ of the above example.	9-3-2 Conversion formulas of economic evaluation method (EE method) (4) Present worth coefficient for uniform annual repayment at year-end: $\frac{(1+i)^n-1}{i(1+i)^n}$ $P = \$1{,}000 \times \frac{(1+0.1)^{10}-1}{0.1\times(1+0.1)^{10}} = \underline{\$6{,}145}$. The outcome equals the amount converted to the present worth from $\underline{\$15{,}937}$ of the above example.	・ Correction(value)
<5>	9-3-2 Conversion formulas of economic evaluation method (EE method) (5) Capital recovery coefficient: $\frac{i(1+i)^n}{(1+i)^n-1}$ $R = \$1{,}000{,}000 \times \frac{0.1\times(1+0.1)^{10}}{(1+0.1)^{10}-1} = \underline{\$1{,}630{,}000}$	9-3-2 Conversion formulas of economic evaluation method (EE method) (5) Capital recovery coefficient: $\frac{i(1+i)^n}{(1+i)^n-1}$ $R = \$1{,}000{,}000 \times \frac{0.1\times(1+0.1)^{10}}{(1+0.1)^{10}-1} = \underline{\$163{,}000}$	・ Correction(value)
	Appendix 1 Exercise of Technical Analysis	**Appendix 1 Exercise of Technical Analysis**	
< 6 >	3.1 Calculation of Load Factor (LF) and Loss Factor (FLS) 	3.1 Calculation of Load Factor (LF) and Loss Factor (FLS) 	・ Correction(word)

	Appendix 2 Exercise of Technical Analysis (Solution)	**Appendix 2 Exercise of Technical Analysis (Solution)**	
< 7 >	**3. Power loss calculation at substation** **3.2 Calculation of annual Power loss** <Example> The case of 15MVA×2Bank with f_{LD}=50% 1) Iron Loss Energy Iron loss for the 15-MVA transformer is 10kW → Energy Loss (per a bank)= 10 kW x 8760h = 87,600 kWh ---(a) 2) Cupper Loss Energy ・Load loss of full load for 15 MVA is 80kW(@Rated Load) ・Loss factor(F_{LS})= 0.4 (@ F_{LD} =50%) (result of 2.<1>(2)(b)) → Energy Loss (per a bank)(kWh/Year) =(Energy Loss at Full Load) ×F_{LS}×8760(hours) = 80 ×0.4×8760(hours)= 280,320 MWh ---(b) 3) Total Energy Loss = ((a)+(b))*2banks = (87,600 + 280,320) *2 = 735,840 MWh/year	**3. Power loss calculation at substation** **3.2 Calculation of annual Power loss** <Example> In 'case 2(15MVA×2Bank)' with 'Load Curve 2' 1) Energy of Iron loss Iron loss for the 15MVA transformer is 10.3kW → Energy of Iron Loss (per a bank)= 10.3 kW × 8760h = 90,228 kWh/year ---(a) 2) Energy of Cupper Loss •Load loss of full load for 15 MVA is 105kW(@Rated Load) •Loss factor(F_{LS})= 0.4 (result of 3.1(2)(b)) → Energy of Cupper Loss (per a bank) = (Energy Loss at Full Load) ×F_{LS}×8760h = 105kw ×0.4×8760h= 367,920 kWh/year ---(b) 3) Total Energy Loss { Iron Loss(a)+Cupper Loss(b) } × 2 banks = (90,228 + 367,920) ×2 = 916,296 kWh/year	・ Example values (cupper loss and iron loss) for the calculation are replaced for more realistic ones. ・ Explanation revised for easier understanding
< 8 >	**4.3(-alternative) Short-circuit current calculation when distributed generator interconnected to the power system** $Is=17.5\times\alpha\times[\delta\times\eta+(\delta+\eta)\times(\beta+\alpha)]/[\alpha\times(\eta+\beta+\alpha)+\{\beta\times\eta+(\delta+\eta)\times(\beta+\alpha)\}]$ (kA)	**4.3(-alternative) Short-circuit current calculation when distributed generator interconnected to the power system** $Is=17.5\times[\alpha\times(\eta+\beta+\alpha)+\{\beta\times\eta+(\delta+\eta)\times(\beta+\alpha)\}]/[\alpha\times\{\delta\times\eta+(\delta+\eta)\times(\beta+\alpha)\}]$ (kA)	・ Correction(equation)

13) Result of the Questionnaire for Trainees` Supervisors "System Protection and Control "(November, 2015)

Result of the Questionnaire for Trainees' Supervisors
Training Course for Engineers of ECG
"System Protection and Control" (February 2015)

The questionnaire asking the training effects were implemented against the supervisors of each trainee. In this period, the project team obtained the answer from all the supervisors of 17 trainees, and reports the result of investigation as follows.

1. Effectiveness of the Training Course from the view of supervisors of the trainees

   It can be considered that "the effectiveness of training course was recognized efficiently" according to the positive answer provided by supervisors at the workplaces.

2. Improvement points in the trainee's job pointed out by the supervisors
   - The appropriate proposals concerning system protection and control can be becoming to do.
   - The analyzing capacity for trouble shooting is improved.
   - The capacity for reporting by providing the necessary information.
   - The reliability of the service was improved by enhancing the collaborations with colleagues or supervisors.
   - Improvement of safety awareness. Smooth operation along established procedure can be done.
   - Awareness of importance of mounting device for equipment and confidence of field operation has been obtained by this training course.
   - Improvement of the knowledge for system control & protection.
   - Improvement of the knowledge by learning the application way of various system protection relay type.
   - New ideas and responsibility as a controller of the region were obtained.
   - The knowledge provided by the training course were utilized to practical works.
   - The ability of interpretation of relay indication was improved.

3. Items to be added to the training pointed out by the supervisors
   1) The lack of training duration for the simulator operation

      Use of the simulator in ECG training course was a first case, and since the

instructors unexperienced in operating the simulator.

The project team will instruct C/P to do advanced preparation for the simulator operation and training on the power system accidents so that the next training will be implemented smoothly.

4. Other requests to the training course

1) Extension of training duration for the operation of simulator.
2) All trainees including the personnel living near the training centre, should be accommodated in order to be concentrated to the training course.
3) This training course should be taken by many engineers by increasing the frequency of implementation.
4) The training course should be related to the "SCADA" to make the system operation automatic.
5) Establishment of design & construction course for engineers.
6) Standardization of system protection course will be necessary for engineers not engaged in system protection.

The project team considers the countermeasures against the requests described above as follows.

Requests	Countermeasures
1)	Consideration for extension by curriculum arrangement.
2)	Informing to C/P and asking the consideration for appropriate countermeasures.
3)	Informing to C/P and asking the consideration for appropriate countermeasures.
4)	Considering an effective use of "SCADA" facilities installed in the training centre.
5)	Informing to C/P and asking the consideration for appropriate countermeasures.
6)	Informing to C/P and asking the consideration for appropriate countermeasures.

5. Conclusion

Judging from the result of the questionnaire for trainees' supervisors, we can conclude that the training course was implemented effectively enough to enhance techniques and knowledge of ECG Engineers.

No.	Improvement of "Trainee" job	Improvement point	If any additional issues of the course	If any request to the course
P-1	Yes	Improvement of the capacity such as implementing the appropriate proposals for system protection & control in the assigned region.	Nothing in particular	Short duration. Necessity of the training as required
P-2	It lead to knowledge improvement	Improvement of the capacity for quick seeking of facility failure and the capacity for safety operation. Improvement of skills for regular reporting.	Training for human resource management.	Should be available to attend the lectures for all personnel to be trainees.
P-3	Yes	Improvement of the trouble shooting and analyzing capacities.	Number of participants and frequency must be increased.	Should be extended the course for simulation practice. Trainees should be accommodated in order to concentrate the training course.
P-4	It lead to improvement of safety matters	Improvement of the reporting and information collecting. Strengthening of collaboration with relevant colleagues or supervisors provided the improvement of the service reliability and safety operations.	Training for human resource management.	Practice on trouble shooting.
P-5	Yes	Improvement of quality and time saving in reporting.	Nothing in particular	The training course should be open to more many personnel.
P-6	Yes	Improvement of design and proposing new plans. Quality and necessary time for reporting.	ditto	ditto
P-7	Yes	Improvement of the capacity for analysis. Time saving for trouble shooting.	Lack of time for simulation practice.	Frequent implementation.
P-8	Yes	Improvement of the capacity for analysis. Time saving for trouble shooting.	Lack of time for simulation practice.	Frequent implementation.
P-9	Yes	Improvement of safety awareness. Smooth operation along established procedure can be done.	Duration of the training course is short.	The training course should be related to the "SCADA" to make the system operation automatic.

P-10	Yes	Awareness of importance of mounting device for equipment and confidence of field operation have been obtained by this training course.	Nothing in particular	Alternative training course of system control & protection for operators. Establishment of design & construction course for engineers
P-11	Yes	Improvement of awareness against the problems in the field of system control & protection based on the monthly and quarter of the year's report.	Nothing in particular	Ditto
P-12	Yes	Improvement of the knowledge for system control & protection. Eventually, various data analysis and timely information transfer to the data center could be done.	Nothing in particular	Nothing in particular
P-13	Yes	ditto	Nothing in particular	Nothing in particular
P-14	It lead to improvement of the knowledge	Improvement of the knowledge by learning the application way of various system protection relay type.	Simulation software for use in the training course in order to fully comprehension will be necessary.	Standardization of system protection course will be especially necessary for engineers not engaged in system protection.
P-15	ditto	ditto	Ditto	ditto
P-16	Yes	New ideas and responsibility as a controller of the region were obtained.	Nothing in particular	Nothing in particular
P-17	Yes	The knowledge provided by the training course were utilized to practical works. The ability of interpretation of relay indication was improved.	Nothing in particular	Nothing in particular
Com ments	Pretty much, "Yes"	Improvement of the capacity for analysis, trouble shooting, reporting, safety awareness, knowledge for system control & protection and ownership.	Lack of course for human resource management and lack of practice in the training course. Delivery of simulation software.	Frequent implementation. Enhancing to do the practice. Standardization of system protection course. Establishment of derived training course.

2016年6月20日

ホンジュラス国電力公社（略称ENEE）向けカニャベラル&リオリンド水力発電増強事業
契約調印（本年6月30日予定）に至る迄の活動経緯

1．全般

JICAの「水力発電増強事業計画作成支援専門家派遣」案件の受注・実施～JICAの「上下水道公社向けマイクロ水力発電設備建設（無償資金協力）」案件の受注・実施に因り、「カニャベラル&リオリンド水力発電増強事業（円借款および米州開発銀行の協調融資）」の契約に漕ぎ着けた。
本増強事業の契約に漕ぎ着けた要素として、前者の有償勘定技術支援業務の実施、および後者の実施中での技術営業活動が挙げられる。

本増強事業の契約に至るまでの主な出来事：
2015年3月下旬：円借款（160億円）の締結
【注】円借款は発電設備を対象、米州開発銀行は変電設備を対象。
2015年9月末：プロポーザル提出
2015年11月下旬：価格プロポーザル開封
2016年4月末：契約交渉会議（5日間）

2．水力発電増強事業計画作成支援専門家派遣（2012年1月下旬～2012年4月初に実施）

ホンジュラス国の電力分野の国家方針である2010年以降2038年にかけての火力発電の縮減化～再生可能エネルギーの拡大化（2010年時の発電設備総容量は1,610MWで、内、火力は1,084MW [67%]で水力は526MW [33%]。これを2025年時には水力を中心に68%に拡大化）に沿って、ENEEは円借款適用を踏まえたカニャベラルおよびリオリンド水力発電設備（計109MW：同国の水力発電設備容量の約20%）の改修（運転開始後40年以上に亘り操業中）と増強（109MW→129.8MW）を行うための専門家派遣にて、円借款への適性を確認した。
当社はJICAから受注し（22百万円）、4名の専門家（水力電機、水力土木、経済財務分析、環境社会配慮）にて、ENEEが計画した事業予算のレビューと事業費を策定した。

3．上下水道公社向けマイクロ水力発電設備の建設（2013年5月～2016年1月に実施）

首都テグシガルパ市内に在る浄水場の放水有効落差を利用した430kWの発電設備の建設を、JICAの無償資金協力（9.52億円、コンサルタント分は103.2百万円）により実施。
2016年3月初めに竣工。

以上

14) Monitoring (Action Plan Follow-up)
"System Protection and Control "(November, 2015)

Follow-up Survey for the training course of "System Protection & Control" for ECG engineers

Follow-up survey based on the action plans was conducted after six months of the training course and analysed the results of the survey.

1. Action Plan

   Most action plans planed to adopt the training contents in a daily routine work. The items are mentioned concretely as follows;

   1) To analyse various data gotten at substation and report the analysed data to the data collation centre by the deadline
   2) To improve the internet connectivity to implement the above mentioned report
   3) To visit the primary substation and check operational aspects of relays periodically
   4) To train substation staff on foundation of power system and analysis of various data

2. Result and conclusion of the follow-up survey

   The follow-up survey was collected from seventeen trainees out of twenty trainees. The rest of three trainees were excluded from the object of survey as their attendant ratio was less than seventy percentages. The points were summarized briefly as below;

   (The following table is attached as a reference)

   1) Progress of the Action Plan
   2) If not achieved, how long does it take to achieve?
   3) Challenges of the achievement
   4) Additional issues or requests to the training course

   Eight trainees answered that they have already achieved their aims and nine trainees have been still making efforts in order to achieve their goals. As aforementioned, most of trainees mentioned about the internet facilities to report regularly and smoothly in their action plans. It is supposed to demonstrate the result that nine trainees have been putting their efforts. The majority of those surveyed also stated that they report to the data collation centre after analysing each data of substations by the deadline. On the other hand, the supervisors' questionnaires were collected after three months of the training. Their supervisors answered that they reported punctually and the contents of the report were improved. It is, therefore, considered that the result of the questionnaire corresponded to their action as the trainees tried to achieve their action plans. It can be said that the

achievement of the action plans is high.

Regarding the degree of achievement of the Action Plan, we can judge that the trainees achieved the Action Plan very well. Some of trainees utilize the knowledge and technology learned in the training course very well and others have been making effort to utilize them as much as possible.

3. Additional requests for the training course

Many requests are as follows;

1) More practical training
2) To provide many opportunities for engineering staff in system protection and control in order to participate in this training course for other engineers

In the former request, it is possible to accept their request that more practical training should be added by using relay equipped at a substation being constructed at the ECG training centre and exercises fault calculation. Although the latter one is related to the plan of human resource training and budgetary issues of ECG, it will be requested to ECG management to give more opportunities to other engineers to participate in the training courses.

Training Course of "System Protection & Control" for ECG engineers (February 2015)

Result of the Post Training Review (6 months after the course)

	Progress of Action Plan	Additional period to achieve AP	Challenges of the Achievement	Additional Items of the Training and Requests
P-1	On going	1year	-Poor internet connectivity	-More practical training
P-2	On going	Progressing towards the achievement	-Lack of ability to manage his own schedule	None
P-3	Achieved	-	-Construction of communication network	-Programming -Practical work on relay setting
P-4	Achieved	-	-Construction of cooperative framework with personnel at the primary substation	-More practical work -Visiting primary substation
P-5	Achieved	-	None	-Training for all protection and control staffs
P-6	On going	Soon	None	-Practical work using the simulator -Informing training syllabus and curriculum in advance for a better understanding -Extension of time period of training course
P-7	Achieved	-	-Poor internet connectivity	-Function of protection relay set and how to use it
P-8	Achieved	-	None	-Extension of time period of training course
P-9	On going	6 months	None	-Extension of time period of practical work

	Progress of Action Plan	Additional period to achieve AP	Challenges of the Achievement	Additional Items of the Training and Requests
P-10	On going	1 month	-Shortage of human resources with technical capabilities	-Refresher of training course
P-11	On going	2 weeks	None	-Revising training course periodically in line with current protection system
P-12	On going	3 months	-Construction of internet	-Training for other engineers
P-13	On going	3 months	-Construction of internet -More training for operational staff	-Training for other engineers -Extension of time period of training course
P-14	On going	1 year	-More computer for operational work	-Extension of time period of training course
P-15	Achieved	-	None	None
P-16	Achieved	-	-Poor internet connectivity	None
P-17	Achieved	-	-Poor internet connectivity -Shortage of human resources with technical capabilities	-Extension of time period of training course

15) Result of the Questionnaire for Trainees` Supervisors "Distribution Planning "(December, 2015)

Result of the Questionnaire for Trainees' Supervisors
Training Course for Engineers of ECG
"Distribution Planning" (July 2015)

The questionnaire asking the training effects were implemented against the supervisors of each trainee. In this period, the project team obtained the answer from all the supervisors of 10 trainees, and reports the result of investigation as follows.

1. Effectiveness of the Training Course from the view of supervisors of the trainees

   It can be considered that "the effectiveness of training course was recognized efficiently" according to the positive answer provided by supervisors at the workplaces.

2. Improvement points in the trainee's job pointed out by the supervisors
   - Methods of checking on the viability of projects.
   - Projects execution period has reduced.
   - Confidence and proposal skills for system improvement.
   - Ability to choose the conductor and cable sizes in the design.
   - Ability to carry out load assessment with regards to Distribution substations/Customer demand.
   - Communication on the work schedules.
   - Analytical reasons could be seen in the way of work.
   - The economical operation of networks.
   - Organizing skills for the work.
   - Planning of work for every week and project supervision.
   - Skills of setting targets in the meeting.
   - Skills on projects preparation.
   - Data gathering for project planning and data analysis.
   - Skills on forecasting load for appropriate number of transformers and their sizes.
   - Understanding on network optimization and reduction of technical losses.

3. Items to be added to the training pointed out by the supervisors
   1) Configuration of distribution facilities in ECG.
   2) Countermeasure to growing power demand.
   3) Including CVP analysis in the basic Economic Evaluation Concepts.
   4) Load flows in electrical practice of planning.

5) Training for all our engineers.
6) Load forecasting and power quality issues.
7) Short duration for the training course and time allocation.

4. Other requests to the training course
   1) Similar training for other engineers.
   2) Distribution system planning with focus on consumer loads.
   3) Including of the Basic Computer Software for load flows.
   4) Measurement of power quality issues.
   5) Forecast of power quality level.
   6) Another training course for other electrical engineers.
   7) Use of the software during the training.

The project team considers the countermeasures against the requests described above as follows.

Requests	Countermeasures
1)	Consideration in ECG training centre.
2)	Informing to C/P and asking the consideration for appropriate countermeasures.
3)	Informing to C/P and asking the consideration for appropriate countermeasures.
4)	Telling demands to the lecturers in ECG traning centre.
5)	Informing to C/P and asking the consideration for appropriate countermeasures.
6)	Consideration in ECG training centre.
7)	Telling demands to the lecturers in ECG traning centre.

5. Conclusion

Judging from the result of the questionnaire for trainees' supervisors, we can conclude that the training course was implemented effectively enough to enhance techniques and knowledge of ECG Engineers.

No.	Improvement of "Trainee" job	Improvement point	If any additional issues of the course	If any request to the course
P-1	Yes	Methods of checking on the viability of projects.	No	-
P-2	Yes	Projects execution period has reduced.	Not Applicable	Similar training for other engineers
P-3	Yes	Confidence Proposal skills for system improvement	Configuration of distribution facilities in ECG How to improve upon to meet growing power demand	Planning distribution system with focus on consumer loads with high level of harmonics
P-4	Yes	DISTRIBUTION NETWORK DESIGN · Ability to choose the conductor and cable sizes in the design LOAD ASSESSMENT · Ability to carry out load assessment with regards to Distribution substations/Customer demand	Basic Economic Evaluation Concepts should also include CVP analysis so that Engineers would be able to apply some of these concepts to avoid financial waste. (i.e. Recovery period, Return on investment etc.)	Basic Computer Software for load flows should be made.
P-5	Yes	Communication on the work schedules. Analytical reasons could be seen in the way of work.	Load flows in electrical practice of planning are important More training for all our engineers	1. Reliability levels and standards 2. Harmonics and it practically in our network system operation
P-6	Yes	More concerned about the economical operation of networks	Introduction of load forecasting and power quality issues were valuable	The followings should be included. a. Measurement of power quality issues on existing networks b. Forecast of levels of power quality issues and factor them is system expansion planning
P-7	Yes	1. Organizing skills for the work 2. Planning of work for every week 3. Project supervision 4. Skills of setting targets in the meeting	The training program is very good, since it is based on the engineering	The training course should be a fresher course
P-8	Yes	Skills on projects preparation	No	Other Electrical Engineers should be considered for another training

No.	Improvement of "Trainee" job	Improvement point	If any additional issues of the course	If any request to the course
P-9	Yes	Data gathering for project planning Data analysis	The duration for the training course was short. More time should be allocated.	Such training course should be organized for improvement of project management. Subsequent training programs should be tailored towards international exposure and the modern trends in project planning and management.
P-10	Yes	Skills on forecasting load for appropriate number of transformers and their sizes Understanding on network optimization and reduction of technical losses	No	Use of the software during the training was requested. (e.g. The software emphasize the importance of load forecasting, data analysis, etc.)
Comments	All supervisor mentioned as "Yes"	***Knowledge:*** Methods of checking on the viability of projects. The economical operation of networks ***Ability:*** Communication on the work schedules. Ability to choose the conductor and cable sizes in the design ***Skills:*** Proposal skills for system improvement, Organizing skill for the work, Planning of work for every week, Project supervision, Setting targets in the meeting, projects preparation, Data gathering and analysis, forecasting load for appropriate number and size of transformers, Shortening the projects execution period ***Understanding:*** Network optimization and reduction of technical losses ***Etc.:*** Confidence	· Configuration of distribution facilities in ECG. · Countermeasure to growing power demand. · Including CVP analysis in the basic Economic Evaluation Concepts. · Load flows in electrical practice of planning. · Training for all our engineers. · Load forecasting and power quality issues. · Short duration for the training course and time allocation.	· Similar training for other engineers · Planning distribution system with focus on consumer loads · Basic Computer Software for load flows · Measurement of power quality issues. · Another training course for other electrical engineers. · Use of the software during the training.

16) Monitoring (Action Plan Follow-up)
"Distribution Planning "(March, 2016)

Follow-up Survey for the training course of "Distribution Planning" for ECG engineers

Follow-up survey based on the action plans was conducted after six months of the training course and analyzed the results of the survey.

1. Action Plan

   Most action plans planed to adopt the training contents in a daily routine work. The items are mentioned concretely as follows;

   1) To collect the data for load growth etc., reading and evaluation
   2) To make the works efficient by obtaining the relevant software (ex; the evaluation of system characteristics)
   3) To share the knowledges or information to the engineers in the region
   4) To make the data reliability of demand forecasting better and the preparation of new projects

2. Result and conclusion of the follow-up survey

   The follow-up survey was collected from ten trainees all of the trainees. The main points were summarized briefly as below;

   (The following table is attached as a reference)

   1) Progress of the Action Plan
   2) If not achieved, how long does it take to achieve?
   3) Challenges of the achievement
   4) Additional issues or requests to the training course

   According to this, two trainees answered that they have already achieved their aims and eight trainees have been still making efforts in order to achieve their goals. As previous description, most of trainees mentioned about "Procurement of the software and making the works efficient" in their action plans. Since these action plans were difficult to achieve in short term, and then the result like this such as "two trainee achieved, eight trainees have been still making efforts" has been led.

   In addition, many trainees pointed the action plans such as "Data collection, Reliability of collected data, reading and evaluation of data".

   The main difficulties of achievement are pointed out as "The constraints in financial matters of organizations", "Lack of data and reliability" or "Lack of tools or software", and then these also

pointed out as the items should be added to the training course.

3. Additional requests for the training course

The following requests are mainly pointed out as the items should be added to this training course.

1) Contents of the software (e. g.: load indicator, Application software for some drills, etc.)

2) Economic feasibility study

3) CVP analysis

Originally there are strong requests for the matter of description 1), the project team asked ECG to consider the countermeasures under the circumstance of the constraints in the ECG human resource development and financial matters.

The requests for the matters of description 2) and 3), the project team asked ECG to consider and provide many chances of taking the training course for ECG engineers.

Training Course of "Distribution Planning" for ECG engineers (July 2015)

Result of the Post Training Review (6 months after the course)

	Progress of Action Plan	Additional period to achieve AP	Challenges of the Achievement	Additional Issues of the Training and Requests
P-1	On going	1year	- Delays in operating the networks to commission projects - Inadequate vehicle for project supervision - Delays in getting required tools to spike underground cable before job commence	- Software on load flow studies and technical economic feasibility studies
P-2	Achieved	Progressing towards the achievement	-Stopping of upgrading of transformers	None
P-3	Achieved	1 year	- Intermittent shortage of materials from the Regional Stores. - Lack of vehicles that can cover the remote project sites.	- Intermittent shortage of materials from the Regional Stores. - Lack of vehicles that can cover the remote project sites. - Modelling software to analyzed system data
P-4	On going	1 year	- The company's financial constraints	- Including CVP analysis - Basic Computer Software for load flows

	Progress of Action Plan	Additional period to achieve AP	Challenges of the Achievement	Additional Issues of the Training and Requests
P-5	On going	-	- Not much time to contact the planning division.	-Training course for the planning section -The cost benefit study for the operational area
P-6	On going	3 to 5 weeks	- Lack of training for other engineers - Lack of regular training on modern techniques - Lack of tools and software - Lack of reliable data	- The right software-based application during subsequent training courses should be used. - Too short duration of the training program
P-7	On going	Depending on the duration of the execution projects underway	-Team work and required other section	None
P-8	On going	6 months	- Unavailability of software and power analyzer	- Training should come with software
P-9	On going	2 months	- Timely basis to gather data for analysis	- The training course should be given an international touch - Project planning can be added to the content
P-10	On going	6 month	- The vast geographical displacement of the region	-Too short duration for the training course

17) Monitoring Report on the Training Course for ECG Engineers "Distribution Design "(February, 2016)

Monitoring Report on the Training Course for ECG Engineers

"Distribution Design"

Table of Contents

Monitoring Report on the Training Course for ECG Engineers

"Distribution Design"

1. Overview of the Training Course

(1) Objectives

To learn and acquire basic concept and knowledge of distribution design in the electric power system

(2) Targets of the training course and number of trainees

Total Ten (10) Engineers; 1 trainee who is engaging technical occupations of distribution planning from each ECG regional offices.

(3) Duration of the training course

From Monday, 15th February, 2016 to Wednesday, 17th February, 2016 (3days)

2. Implementation of the Training Course

(1) Program of the training course

Program of the training course is shown in Table-1

(2) Participants

Participants list of the training course is shown in Table-2.

Table-1 Curriculum for the Training Course on Distribution Design for ECG Engineers

JICA Programme for ECG Engineer Training on Distribution Design (Feb.2016)

DAYS	8:30am – 10:00am	10:00am-10:15am	10:15am – 12noon	12noon - 1pm	1:00pm – 3:30pm
15th Feb	- Registration - Opening Ceremony - Questionnaire *ECG Training center*	Snack Break	1. Introductory Lessons 2. General conditions and requirements for design 3. Overhead Line designs *3.1 Mechanical designs* *3.2 Electrical designs*	Lunch Break	3. Overhead Line designs *3.3 General guidelines for design of OHL* *3.4 ECG standard of OHL components* *3.5 Standard rules for OHL design* 4. Underground network designs
16th Feb	5. Substation designs *5.1 Types of Substations* *5.2 Equipment for each type of substations* *5.3 Sizing and Installation position of transformers*		6. Protection & Earthing *6.1 Protection & earthing for substations* *6.2 Neutral grounding system* *6.3 Protection & earthing for OHL*		6. Protection & Earthing *6.4 Protection & earthing for UGL* *6.5 Equipment earthing* *6.6 Lightning protection*
17th Feb	6. Earth Grid and Lightning Protection Modelling		7. Power quality issues for a distribution network 8. Improvement of distribution network reliability		- Evaluation, - Making Action plan - Closing Ceremony *ECG Training center*

Table-2 Participants List for the Training Course on Distribution Design for ECG Engineers

No.	Name	Region	Job category	Work experience	Age
1	Emmanuel Antwi Addo	Eastern	Substation Maintenance	3	30
2	Richard Ankomah	Central	Project Engineer	6	33
3	Nelson Sefa Boakye	Ash-East	Project Engineer	12	40
4	Emmanuel Osei Amoako	Ash-West	Project Engineer	10	37
5	Godwin Yabameh	Western	Electrical Engineer	6	30
6	Bismark Kyere Yeboah	Tema	District Engineer	5	34
7	Carl Ankrah	Accra West	Planning Engineer	10	34
8	Benjamin Thompson	Sub-T	Network Engineer	17	44
9	Dickson Nyaku	Accra East	Rechargeable Engineer	15	45
10	Castro K. Dogbeda	Volta	Project Engineer	8.5	33

3. Monitoring of the Training Course

(1) Pre-training Questionnaires

In order to identify trainees' technical background (knowledge and capacity) including job experience, the Pre-training Questionnaires was done during the orientation in the opening of the Training Course. A form of the Pre-training Questionnaires is attached in Appendix-A.

As results of the Pre-training questionnaire, overview of trainees who was participated in this training course is indicated in figures below. "Age of trainee in ECG" is shown in Fig.-1, Years of experience in ECG is shown in Fig.-2, and Number of trainee by current engagement is shown in Fig.-3.

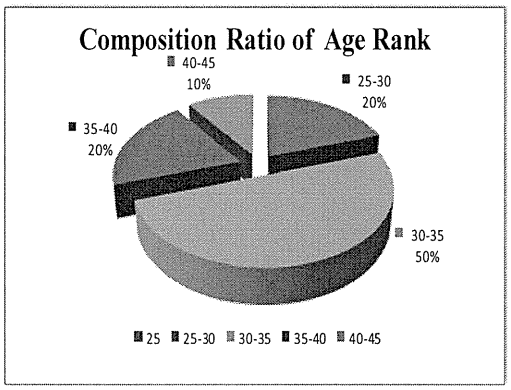


Fig-1 Age of trainee in ECG

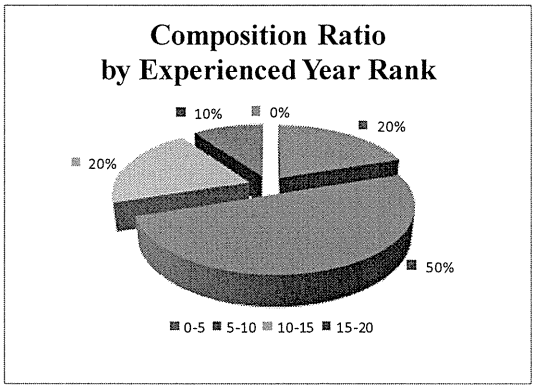


Fig-2 Years of experience in ECG

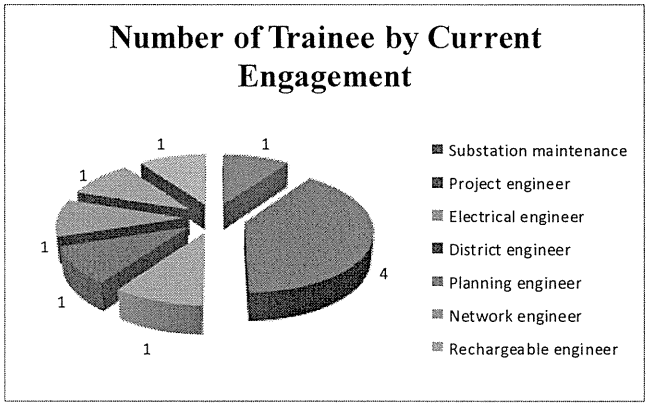


Fig-3 Number of trainee by current engagement

According to Fig-1, the group of "31 - 35" in Age of trainee is most major. And next group is "26 -31" and "36-40".

According to Fig-2, the group of "6 - 10" in years of experience is most major. And next group is "0 -5" and "11-15".

According to Fig-3, "Project engineer" is most major, and other each group consists of 1 personnel.

The participants to be suitable for the target account for a percentage of 70% of all, from the view point of junior engineers fewer than 10 years experienced.

Number of trainees by each current engagement is shown below. Number of "Project Engineer" is 4, and number of other occupation such as "Substation Maintenance", "Electrical Engineer", "District Engineer", "Planning Engineer", "Network Engineer" and "Rechargeable Engineer" is 1.

The mean values of score from the questionnaire are 3.3 to 4.4 as shown in the row of "Pre-Questionnaire" in Fig. 3, and then generally level of the knowledge is not so low.

Especially the mean value of score in "(3-3) ECG standards on overhead line designs", "(4) Underground network designs (e.g. ECG standards on cable selection and installation)", "(5-1) Types of Substations & their relevance to the ECG network", "(5-2) Equipment constituting each type of substation" and "(5-3) Sizing of transformers and selection of installation location" are more than 4.0, and then it is thought that the advanced knowledge level is high.

(2) Post-training Questionnaires and Criteria for Evaluation

In order to measure the effect of the training course, the Post-training Questionnaire and Action Plan were collected from all trainees in advance of evaluation and closing of the training course. Members of ECG training centre requested the trainees that the Post-training Questionnaire should be filled in immediately after subject of the class. A form of the Post-training Questionnaire and Action Plan is attached Appendix-A.

Post-training Questionnaires are prepared from the following view points; A) Novelty of the program contents, B) Possibility of practical use of acquired knowledge, C) Usefulness in future, D) Advanced level of technical contents, E) Intelligibility of the lectures, F) Satisfaction (comprehensive evaluation).

From the results of the comparison between Pre-training Questionnaire and A) of Post-Questionnaires, the degree of each individual's technical improvement level is measured and the effect of a training course can be judged from the degree of improvement of the whole average value.

The possibility of the practical use of knowledge and technology acquired in this training course can be known from the average value of B) and C). If the average value is higher than 3.0, it will be regarded as effective.

From the average value of D) and E), the appropriateness of methods of operation for training course can be evaluated. If the average value is less than 3.0, it can be considered that it is necessary to improve the methods of operation, a textbook, etc. of a training course. ECG training centre prepared the syllabus and curriculum of the training course which would be set a little higher than skills and knowledge that trainees have and then the score of evaluation would be targeted the range of 3.5-4.5 regarding to the D) Advanced level of technical contents.

From the average value of F), the synthetic degree of satisfaction to a training course can be judged. If the average value is higher than 3.0, it can be considered that the training course was satisfactory contents.

(3) Analyses of the Pre and Post-Questionnaires

A) Improvement of the technique level

The result of the question on "Novelty of the program contents" in the Post-training Questionnaire is shown in Table-3.

It can be confirmed that the mean values of more than half subjects are improved from those of Pre-training Questionnaires. Particularly the improvement degree of "(6) Protection & Earthing" and "(7) Power quality issues for a distribution network" has increased. On the other hand, the items deteriorated were caused by the simplification or omission of the lecture contents relevant to question items under the influence of the schedule progress on that day. Concretely, it can be considered that the degree of advanced knowledge acquisition was high, because the contents of Chapter1 to Chapter 4 were most essential matters and should be learned for ECG Engineers.

Whereas, it can be confirmed that the mean value are slightly less than 4.0 according to the Post-training questionnaire, and then approximately 50% of lecture were recognized as new knowledge.

In the section (5-1), (5-2) and Chapter (8), a little time has been spent for the lectures because of schedule compression.

Table-3 Novelty of the program contents

Questionnaire Items	Pre-	Post-	Difference
(1) Responsibilities & job function of the design engineer	4.0	3.6	-0.4
(2) General Design Considerations of ECG standard (e.g. design and construction parameters such as clearance	3.7	3.6	-0.1
(3)Overhead line designs (3-1) Theory of Mechanical design (e.g. strength calculation of load on pole,stay,Wire)	3.5	3.6	0.1
(3-2) Theory of Electrical design (e.g. calculation of current capacity, voltage drops, losses)	3.7	3.7	0.0
(3-3) ECG standards on overhead line designs	4.0	3.7	-0.3
(4) Underground network designs(e.g. ECG standards on cable selection and installation)	4.0	3.8	-0.2
(5) Substation design work (5-1) Types of Substations & their relevance to the ECG network	4.4	3.9	-0.5
(5-2) Equipment constituting each type of substation	4.4	3.5	-0.9
(5-3) Sizing of transformers and selection of installation location	4.4	3.9	-0.5
(6) Protection & Earthing (6-1) Significance of various types of earthing	3.8	4.0	0.2
(6-2) Protection for substations	3.9	3.9	0.0
(6-3) Protection for overhead line	3.8	4.1	0.3
(6-4) Lightning protection	3.8	4.2	0.4
(6-5) ECG standards on protection & earthing system for substation, overhead line, underground cable etc.	3.7	3.9	0.2
(7) Power quality issues for a distribution network (7-1) Voltage regulation technology	3.4	3.6	0.2
(7-2) Power quality management method addressing supply voltage,flicker,harmonics	3.3	3.7	0.4
(7-3) ECG standards on Power quality(e.g. Customer supply voltage,flicker,harmonics)	3.5	3.8	0.3
(8) Methods for improving distribution network reliability	3.7	3.6	-0.1

B) Possibility of practical use of acquired knowledge and technology

The result of the question on "Possibility of practical use of acquired knowledge and technology" in the Post-Questionnaire is shown in Table-4. Average of all item are scored over 4.0. From these results, it can be observed that most of trainees felt that the knowledge and technology acquired in this training course could be utilized in their own jobs and quality of their jobs would be improved very much.

Table-4 Possibility of practical use of acquired knowledge and technology (Average)

Questionnaire Items	Mean value
(1) Responsibilities & job function of the design engineer	4.0
(2) General Design Considerations of ECG standard (e.g. design and construction parameters such as clearance	4.3
(3)Overhead line designs (3-1) Theory of Mechanical design (e.g. strength calculation of load on pole,stay,Wire)	3.8
(3-2) Theory of Electrical design (e.g. calculation of current capacity, voltage drops, losses)	4.1
(3-3) ECG standards on overhead line designs	4.4
(4) Underground network designs(e.g. ECG standards on cable selection and installation)	4.3
(5) Substation design work (5-1) Types of Substations & their relevance to the ECG network	4.3
(5-2) Equipment constituting each type of substation	4.2
(5-3) Sizing of transformers and selection of installation location	4.1
(6) Protection & Earthing (6-1) Significance of various types of earthing	4.3
(6-2) Protection for substations	4.2
(6-3) Protection for overhead line	4.4
(6-4) Lightning protection	4.3
(6-5) ECG standards on protection & earthing system for substation, overhead line, underground cable etc.	4.0
(7) Power quality issues for a distribution network (7-1) Voltage regulation technology	4.1
(7-2) Power quality management method addressing supply voltage,flicker,harmonics	4.0
(7-3) ECG standards on Power quality(e.g. Customer supply voltage,flicker,harmonics)	4.4
(8) Methods for improving distribution network reliability	4.3

C) Usefulness in the future

The result of the question on "Usefulness in future" in Post-training Questionnaire is shown in Table-5. The questions are about the knowledge for their jobs. The scores of each subject exceeded 3.0 substantially, and also mean values of 11 items out of 18 items indicated 4.0 to 4.1.

From the above, it can be thought that the participants felt high usefulness related to their current jobs.

Table-5 Usefulness in the future (Average)

Questionnaire Items	Mean value
(1) Responsibilities & job function of the design engineer	4.0
(2) General Design Considerations of ECG standard (e.g. design and construction parameters such as clearance	4.0
(3)Overhead line designs (3-1) Theory of Mechanical design (e.g. strength calculation of load on pole,stay,Wire)	4.0
(3-2) Theory of Electrical design (e.g. calculation of current capacity, voltage drops, losses)	4.0
(3-3) ECG standards on overhead line designs	4.1
(4) Underground network designs(e.g. ECG standards on cable selection and installation)	4.1
(5) Substation design work (5-1) Types of Substations & their relevance to the ECG network	3.9
(5-2) Equipment constituting each type of substation	4.1
(5-3) Sizing of transformers and selection of installation location	3.8
(6) Protection & Earthing (6-1) Significance of various types of earthing	3.9
(6-2) Protection for substations	3.9
(6-3) Protection for overhead line	4.1
(6-4) Lightning protection	4.0
(6-5) ECG standards on protection & earthing system for substation, overhead line, underground cable etc.	3.9
(7) Power quality issues for a distribution network (7-1) Voltage regulation technology	3.6
(7-2) Power quality management method addressing supply voltage,flicker,harmonics	3.8
(7-3) ECG standards on Power quality(e.g. Customer supply voltage,flicker,harmonics)	4.0
(8) Methods for improving distribution network reliability	4.0

D) Advanced level of technical contents

The result of the question on "Advanced level of technical contents" in Post-training Questionnaire is shown in Table-6. Technical level of the training course is asked in this question. If technical level is the same as trainee has, the value is marked to 3.0, if the contents of training are felt to be quite advanced, the value is marked to 5.0 and to the contrary if quite low, the value is marked to 1.0.

According to this, it can be thought that the participants felt the technology level is higher than current technology level in all items. Therefore it will be pointed out the matter as follows.

The lecture level were considered as appropriate in their almost contents, because the average score were 4.0 to 4.3 except for the case of "Protection for substation" indicating 3.9. Even the average score of "Protection for substation" is slightly less than 0.1 point against 4.0.

Table-6 Advanced level of technical contents (Average)

Questionnaire Items	Mean value
(1) Responsibilities & job function of the design engineer	4.1
(2) General Design Considerations of ECG standard (e.g. design and construction parameters such as clearance	4.3
(3)Overhead line designs (3-1) Theory of Mechanical design (e.g. strength calculation of load on pole,stay,Wire)	4.1
(3-2) Theory of Electrical design (e.g. calculation of current capacity, voltage drops, losses)	4.0
(3-3) ECG standards on overhead line designs	4.3
(4) Underground network designs(e.g. ECG standards on cable selection and installation)	4.1
(5) Substation design work (5-1) Types of Substations & their relevance to the ECG network	4.3
(5-2) Equipment constituting each type of substation	4.3
(5-3) Sizing of transformers and selection of installation location	4.1
(6) Protection & Earthing (6-1) Significance of various types of earthing	4.0
(6-2) Protection for substations	3.9
(6-3) Protection for overhead line	4.3
(6-4) Lightning protection	4.3
(6-5) ECG standards on protection & earthing system for substation, overhead line, underground cable etc.	4.1
(7) Power quality issues for a distribution network (7-1) Voltage regulation technology	4.2
(7-2) Power quality management method addressing supply voltage,flicker,harmonics	4.0
(7-3) ECG standards on Power quality(e.g. Customer supply voltage,flicker,harmonics)	4.3
(8) Methods for improving distribution network reliability	4.3

E) Intelligibility of the lecture and practical work

The result of the question on "Intelligibility of the lecture" in Post-training Questionnaire is shown in Table-7. Overall average score are over 4.0 to 4.5 and thus all classes were intelligible and valuable. It was proved that ECG Internal Facilitators had very high teaching

techniques. According to this, it considered that generally the lectures easy to understand have been done. And then, the relevance of explanation method of lecturers, presentation and text book were confirmed. In addition, there were some exclusive lecturers in the beginning plan for this training course. However, they comprehended the text book edited by JICA project team with short term. Then the lecturers could implement useful lectures. According to this, the existence of internal facilitators with advanced skills in ECG could be conjectured.

Table-7 Intelligibility of the lecture and practical work (Average)

Questionnaire Items	Mean value
(1) Responsibilities & job function of the design engineer	4.1
(2) General Design Considerations of ECG standard (e.g. design and construction parameters such as clearance	4.4
(3)Overhead line designs (3-1) Theory of Mechanical design (e.g. strength calculation of load on pole,stay,Wire)	4.1
(3-2) Theory of Electrical design (e.g. calculation of current capacity, voltage drops, losses)	4.2
(3-3) ECG standards on overhead line designs	4.3
(4) Underground network designs(e.g. ECG standards on cable selection and installation)	4.5
(5) Substation design work (5-1) Types of Substations & their relevance to the ECG network	4.0
(5-2) Equipment constituting each type of substation	4.2
(5-3) Sizing of transformers and selection of installation location	4.4
(6) Protection & Earthing (6-1) Significance of various types of earthing	4.1
(6-2) Protection for substations	4.0
(6-3) Protection for overhead line	4.3
(6-4) Lightning protection	4.5
(6-5) ECG standards on protection & earthing system for substation, overhead line, underground cable etc.	4.1
(7) Power quality issues for a distribution network (7-1) Voltage regulation technology	4.3
(7-2) Power quality management method addressing supply voltage,flicker,harmonics	4.1
(7-3) ECG standards on Power quality(e.g. Customer supply voltage,flicker,harmonics)	4.3
(8) Methods for improving distribution network reliability	4.4

F) Satisfaction (comprehensive evaluation)

The result of the question on "Satisfaction (Comprehensive Evaluation)" in Post-training Questionnaire is shown in Table-8. According to this, the following matters are indicated.

Prior to the training, it was assumed that the adequate value would be from 4.0 to 4.5. Judging from the results, we could get the good results as we expected.

Table-8 Satisfaction (comprehensive evaluation) (Average)

Questionnaire Items	Mean value
(1) Responsibilities & job function of the design engineer	4.5
(2) General Design Considerations of ECG standard (e.g. design and construction parameters such as clearance	4.6
(3)Overhead line designs (3-1) Theory of Mechanical design (e.g. strength calculation of load on pole,stay,Wire)	4.4
(3-2) Theory of Electrical design (e.g. calculation of current capacity, voltage drops, losses)	4.2
(3-3) ECG standards on overhead line designs	4.4
(4) Underground network designs(e.g. ECG standards on cable selection and installation)	4.4
(5) Substation design work (5-1) Types of Substations & their relevance to the ECG network	4.4
(5-2) Equipment constituting each type of substation	4.3
(5-3) Sizing of transformers and selection of installation location	4.3
(6) Protection & Earthing (6-1) Significance of various types of earthing	4.4
(6-2) Protection for substations	4.3
(6-3) Protection for overhead line	4.4
(6-4) Lightning protection	4.4
(6-5) ECG standards on protection & earthing system for substation, overhead line, underground cable etc.	4.3
(7) Power quality issues for a distribution network (7-1) Voltage regulation technology	4.2
(7-2) Power quality management method addressing supply voltage,flicker,harmonics	4.2
(7-3) ECG standards on Power quality(e.g. Customer supply voltage,flicker,harmonics)	4.5
(8) Methods for improving distribution network reliability	4.4

(4) Summary of the result from the monitoring questionnaire for the training course

According to the survey by using the Pre-Post questionnaire, this training course is evaluated as follows.

1) It is evaluated that the big technical improvement has been led to all the participants of the training course. Therefore, the expected training effects have been obtained by this training course.

2) A big outcome has been expected especially in the application of the obtained techniques or knowledges for the works of each ECG staff. And also These techniques and knowledges have sufficient application availabilities to the development of the participant's career in the future.

3) Although the original schedule was composed of 5days, it has been change to 3days. Since some parts of theme in the actual lectures were simplified. After the end of training course, the principal of the training centre mentioned that training courses would be carried out in the system of 3 lecturers and 5days. Therefore, the simplification like this could not be considered from the next time.

4) The general satisfaction to this training course is very high.

From above, this training course has been done successfully with the originally planned outcome.

4. Comments and impressions from lecture Observation

The project team can point out some comments from the observation of lectures besides the questionnaires.

(1) Basic rule for the lecture

i) Facilitators/ Instructors never be late classes. The lectures got started 30 minutes behind the beginning time planned by the curriculum. Particularly gathering of the trainees was very late, and then it took an additional 30 minutes after the starting of the lecture for gathering of whole members. In order to implement the training course securely, it will be necessary to be punctual.

ii) Some trainees were seen apart from their desks due to respond calling on mobile phone during a class.

(2) Appropriateness of instructors teaching method

i) In the training course of distribution design conducted by Eng. Eduful, the trainees were able to observe the construction site of newly building substation. This construction entirely corresponded with the content of the lecture entitled as "Earthing Grid and Lihgtning Protrction Modeling", and then the trainees could observe the actual earthing grid under construction and lightning arrester. Actual structure of earthing grid hardly could not be frequently observed. According to this situation, timely implementation of the training during the construction of the substation was very meaningful.

ii) The lecturers explained the meaning of relevant works and the role of engaged engineers at the beginning of the lecture. This explanation will be considered as effective in order to understand the training course meaning and to provide incentives of attending the training course.

iii) The lecturers made efforts to enhance the trainee's comprehension by repeating the substances of lectures at the critical junctures.

(3) Atmosphere of the lecture

1) Attitude of trainees was very good during the training course.

2) The way to precede the lectures with exchanging views between instructor and trainees is very good. This mood produces a kind of presence because the class is a situation of serious thinking and brain storming. It is very wise arrangement to proceed with the lectures by exchanging views between instructor and trainees.

3) The lectures were done with Q & A related to the operational uncertainties or problems, and then the method to be able to enhance the usefulness of the training course has been applied.

5. Concluding Remarks

The training course was highly improved as the bullet points shown below compare to previous training course held on July, 2014.

1) When the curriculum or schedule to be improved, it should be considered that the improvement without unreasonable was necessary. The control of lecturer's schedule or the internal adjustment will be desirable so that the training course planned as the curriculum can be implemented. In case of not to dispatch the scheduled lecturers, it is desirable to arrange the alternative lecturers according to the circumstance.

Generally, the duration of the lectures were tending to short. The trial to make the knowledge acquisition level high and to obtain the higher degree of satisfaction should be considered.

As for instruction method, the improvement based on their consideration of ECG's needs should be done.

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18) Amendment of Curriculum and Textbook for Engineers of ECG "Distribution Design "(July, 2016)

Training Course for Engineers of ECG "Distribution Design" was carried out from 15th to 17th February 2016. Based on the result of the meeting with the trainers and the Monitoring Report on Training Course for Engineers of ECG "Distribution Design", the Textbook were revised as documents attached hereto.

The textbook used in the next training course will be changed from Version 1.0 to 1.1.

July 2016

Revision on the textbook of "Distribution Design" from (V - 1.0) to (V - 1.1)

Note: The part with underline in [Before revision] is revised as the way in [after revision]

<table>
<tr><th>No.</th><th>Before revision (V-1.0)</th><th>After revision (V-1.1)</th><th>Note</th></tr>
<tr><td>< 1 ></td><td>Textbook (Main part)

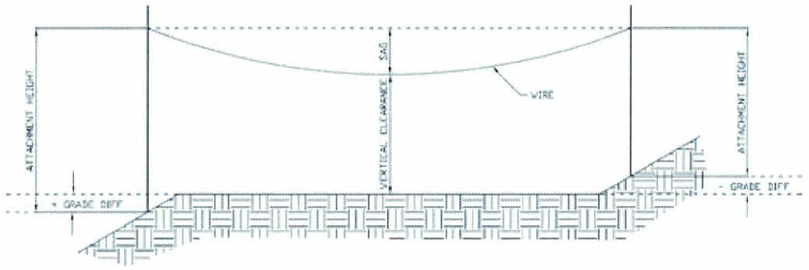
2-2-4-4 Internal system clearances – overhead insulated cable system
 

Figure 2-2-1 overhead insulated cable system</td><td>Textbook (Main part)

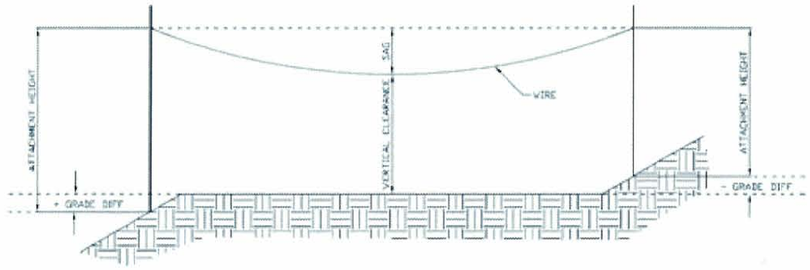
2-2-4-4 Internal system clearances – overhead insulated cable system
 

Figure 2-2-1 overhead insulated cable system
(Reference: section 7-1-3-6-4 of the Distribution Design Manual)</td><td>- Source of the figure added</td></tr>
<tr><td>< 2 ></td><td>3-1-4-5 Conductor "sag and tension" basics and calculation
(2) Loading cases and definitions
Table 3-1-6 Definition of load cases
<table><tr><th>Load Case</th><th>Explanation</th></tr><tr><td>EDT
(everyday tension)</td><td>It is actually the ideal steady state of the conductor for design basic calculations only; unlikely to happen in normal situation; maximum tension 20% of UTS of the conductor is to be read as ceiling not the optimum</td></tr><tr><td>HW
(high wind)</td><td>Usual case of part loaded conductor; used as case for calculation of maximum tension of the conductor and its effects on poles etc.</td></tr><tr><td>ERR
(erection)</td><td>Normal case applicable during the stringing; actually only temporary initial case for conductor before creep will transfer that case into EDT.</td></tr><tr><td>MT
(maximum temperature)</td><td>Steady state of the conductor used for maximum sag calculation and clearance check.</td></tr></table></td><td>3-1-4-5 Conductor "sag and tension" basics and calculation
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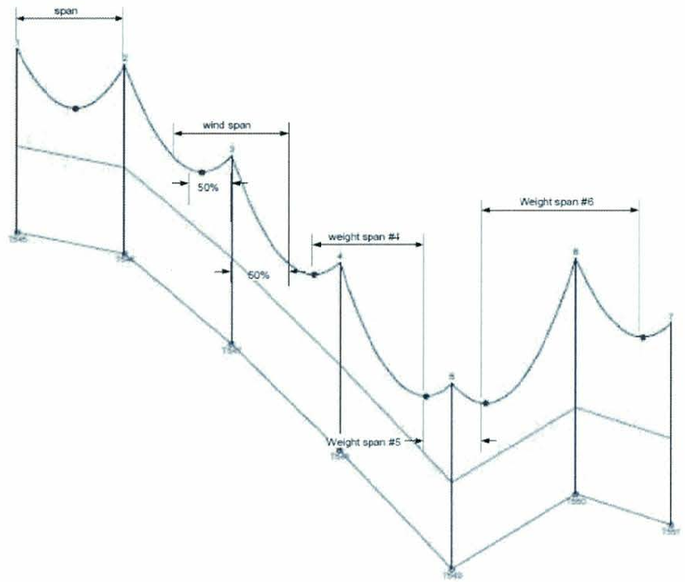
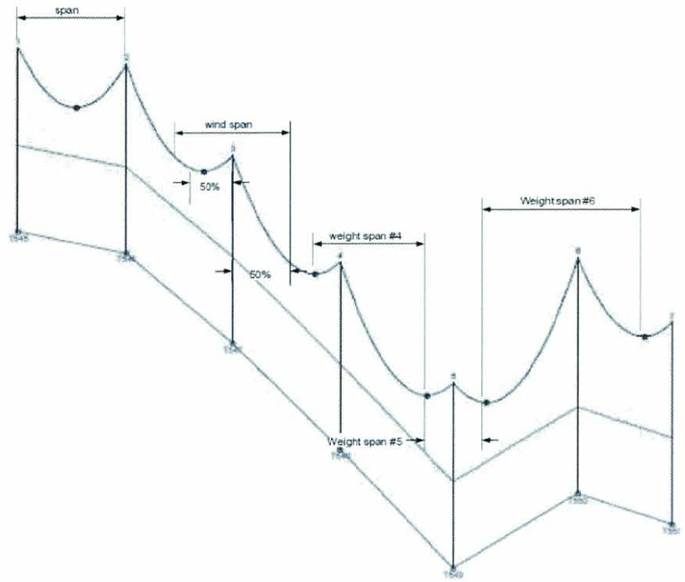
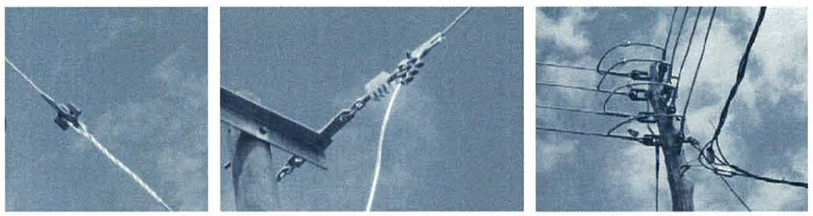
(maximum temperature)</td><td>Steady state of the conductor used for maximum sag calculation and clearance check.</td></tr></table>(Reference: section 5-3-4-5 of the Distribution Design Manual)</td><td>- Correction(Table number)

- Source of the Table added</td></tr>
</table>

<3>	3-1-4-5 Conductor "sag and tension" basics and calculation (3) Other definitions  **Figure 3-1-11** Wind span and weight span	3-1-4-5 Conductor "sag and tension" basics and calculation (3) Other definitions  **Figure 3-1-11** Wind span and weight span *(Reference: section 5-3-4-5-2 of the Distribution Design Manual)*	- Source of the figure added
<4>	3-4-3-6 Low voltage ABC cables fittings  Stay insulator MV tension clamp LV pole fitting **Figure 3-4-1** Example of MV/LV Fitting and materials	3-4-3-6 Low voltage ABC cables fittings  Stay insulator MV tension clamp LV pole fitting **Figure 3-4-2** Example of MV/LV Fitting and materials	- Source of the figure added - Correction(Figure number)

19) Result of the Questionnaire for Trainees` Supervisors "Distribution Design" (July, 2016)

Project on Electrical Engineers Training for African Countries in Republic of Ghana

Result of the Questionnaire for Trainees' Supervisors

Training Course for Engineers of ECG

"Distribution Design"

(February 2016)

July, 2016

Japan International Cooperation Agency

NEWJEC Inc.

Result of the Questionnaire for Trainees' Supervisors
Training Course for Engineers of ECG
"Distribution Design" (February 2016)

The questionnaire asking the training effects were implemented against the supervisors of each trainee. In this period, the project team obtained the answer from all the supervisors of 9 trainees, and reports the result of investigation as follows.

1. Effectiveness of the Training Course from the view of supervisors of the trainees

   It can be considered that "the effectiveness of training course was recognized efficiently" according to the positive answer provided by supervisors at the workplaces.

2. Improvement points in the trainee's job pointed out by the supervisors

   - Improved assessment of completed /on-going network and substation construction to ascertain design flaws and suggest improvements.
   - Increased technical knowledge regarding re-location of secondary distribution substations and feeders.
   - Performance report was changed to be analytical.
   - Efficiency and effectiveness have been obtained on designing of network and substations.
   - Knowledge in Distribution Design.
   - Reduction of correction in his proposed design.
   - Awareness and assertive in the work as a designer.
   - Keen on optimizing cost.
   - Recognition of reliability, quality and safety.
   - Facilitation of smooth project implementation and early completion.
   - The ECG standard is adhered as the design guideline.
   - To be thorough in terms of utilizing all engineering considerations. - Designing new injections to improve the system -
   - Acquisition of more proactive way of doing things.
   - The trained personnel now takes into consideration the load center when proposing location for transformer installation.
   - Becoming accurate in designing distribution network.

3. Items to be added to the training pointed out by the supervisors
    1) More practical demonstration
    2) Information of training contents in advance
    3) Introductory lessons including overview of power and energy sectors
    4) Extension of duration to implement
    5) Appropriate duration against the volume
    6) Software and equipment for analysis

4. Other requests to the training course
    1) Similar / same training for other engineers
    2) Provision of the materials to supervisors
    3) Following-up to see specific applicability of knowledge etc. obtained by the trainees
    4) Target extension in the network and operation types
    5) Increase of participants
    6) Appropriate software and equipment

    The project team considers the countermeasures against the requests described above as follows.

Requests	Countermeasures
1)	Consideration in ECG training centre.
2)	Informing to C/P and asking the consideration for appropriate countermeasures.
3)	Consideration in ECG training centre.
4)	Informing to C/P and asking the consideration for appropriate countermeasures.
5)	Consideration in ECG training centre.
6)	Telling demands to the lecturers in ECG training centre.

5. Conclusion

Judging from the result of the questionnaire for trainees' supervisors, we can conclude that the training course was implemented effectively enough to enhance techniques and knowledge of ECG Engineers.

No.	Improvement of "Trainee" job	Improvement point	If any additional issues of the course	If any request to the course
P-1	Yes	- Improved assessment of completed/on-going network and substation construction to ascertain design flaws and suggest improvements. - Increased technical knowledge regarding re-location of secondary distribution substations and feeders.	No	Other engineers in the region also participate in similar / same training program
P-2	Yes	- Performance report was changed to be analytical - Efficiency and effectiveness have been obtained on designing of network and substations	The subsequent training should be more of practical demonstration	The training is being requested for other colleagues
P-3	Yes	- Knowledge in Distribution Design - Reduction of correction in his proposed design	If the content of what the participants are made known to us, it will help in the selection process.	Copies of the materials also should be given to the supervisors
P-4	Yes	Knowledge in Distribution Design	Ditto	Ditto
P-5	Yes	- Awareness and assertive in the work as a designer - Keen on optimizing cost - Recognition of reliability, quality and safety - Facilitation of smooth project implementation and early completion	Consideration of the introductory lessons including overview of power and energy sectors	- Follow-up to see specific applicability of knowledge etc. obtained by the trainees - The course should be extended to more staff in design process
P-6	Yes	The ECG standard is adhered as the design guideline	No	All types of distribution network and operation should be taught
P-7	Yes	To be thorough in terms of utilizing all engineering considerations – Designing new injections to improve the system -	To make the program more flexible, the number of days needs to be extended.	More engineers must benefit from this program

No.	Improvement of "Trainee" job	Improvement point	If any additional issues of the course	If any request to the course
P-8	Yes	Acquisition of more proactive way of doing things	The time for the course was not enough considering the volume	More opportunity to the training course
P-9	Yes	The trained personnel now takes into consideration the load center when proposing location for transformer installation	Software application	Increase of participants
P-10	Yes	Becoming accurate in designing distribution network	Software and equipment for power quality analysis	Purchase and distribution to all regions of appropriate software and equipment.
Comments	All supervisors mentioned as "Yes"	· Assessment of network and substation construction · Report making · Design skill for network and substation · Distribution design knowledge · Reduction of correction in design · Designing new injections · More proactive work way · Accuracy in designing	· Should be more practical · Information of training contents in advance · Introductory lessons including overview of power and energy sectors · Extension of duration to implement · Appropriate duration against the volume · Software and equipment for analysis	· Similar / same training for other engineers · Provision of the materials to supervisors · To see specific applicability of knowledge obtained by the trainees · Target extension in the network and operation types · Increase of participants · Appropriate software and equipment