

Appendices 1 Member List of the Study Team

1. Member List of the Study Team

(1) First Preparatory Survey

Name	Work Assignment	Position
Mr. Kunihiro Yamauchi	Leader	Resident Representative JICA Ghana Office
Mr. Hiroshi Murayama	Project Coordination	Assistant Director Project Management Division 1 Grant Aid Department, JICA
Mr. Minoru Yamaguchi	Procurement Management	Project Manager Crown Agents Japan
Mr. Kyoji Fujii	Chief Consultant / Distribution System Operation / Operation and Maintenance Planning	Yachiyo Engineering Co., Ltd.
Mr. Mitsuhsa Nishikawa	Deputy Chief Consultant / Grid-connected PV System	Yachiyo Engineering Co., Ltd.
Mr. Katsuo Urano	Solar Power System	Yachiyo Engineering Co., Ltd.
Mr. Takayuki Miyamoto	Procurement Planning 1 / Cost Estimation 1	Yachiyo Engineering Co., Ltd.
Mr. Kazunari Nogami	Related Institutional Framework and Standard / Environmental and Social Considerations	Yachiyo Engineering Co., Ltd.
Mr. Tetsuo Yatsu	Architectural Design 1	Yachiyo Engineering Co., Ltd.

(2) Second Preparatory Survey

Name	Work Assignment	Position
Mr. Kyoji Fujii	Chief Consultant / Distribution System Operation / Operation and Maintenance Planning	Yachiyo Engineering Co., Ltd.
Mr. Mitsuhsa Nishikawa	Deputy Chief Consultant / Grid-connected PV System	Yachiyo Engineering Co., Ltd.
Mr. Katsuo Urano	Solar Power System	Yachiyo Engineering Co., Ltd.
Mr. Masayuki Tamai	Equipment and Facility Planning	Yachiyo Engineering Co., Ltd.
Mr. Takayuki Miyamoto	Procurement Planning 1 / Cost Estimation 1	Yachiyo Engineering Co., Ltd.
Mr. Kazunari Nogami	Related Institutional Framework and Standard / Environmental and Social Considerations	Yachiyo Engineering Co., Ltd.
Mr. Yosuke Tsuruoka	Architectural Design 2	Yachiyo Engineering Co., Ltd.
Mr. Daisuke Akatsuka	Coordinator	Yachiyo Engineering Co., Ltd.

(3) Third Preparatory Survey (Explanation on Draft Final Report)

Name	Work Assignment	Position
Mr. Tadayuki Ogawa	Leader	Senior Advisor, JICA
Mr. Shunta Yamaguchi	Planning Management	Associate Expert Energy and Mining Division, Natural Resources and Energy Group, Industrial Development Department, JICA
Mr. Kyoji Fujii	Chief Consultant / Distribution System Operation / Operation and Maintenance Planning	Yachiyo Engineering Co., Ltd.
Mr. Mitsuhsa Nishikawa	Deputy Chief Consultant / Grid-connected PV System	Yachiyo Engineering Co., Ltd.
Mr. Katsuo Urano	Solar Power System	Yachiyo Engineering Co., Ltd.
Mr. Masayuki Tamai	Equipment and Facility Planning	Yachiyo Engineering Co., Ltd.

Appendices 2 Study Schedule

2. Survey Schedule

(1) First Preparatory Survey

No.	Date	A day of the week	Contents of Survey	Stay at
			Official members (Mr. Yamauchi (JICA), Mr. Murayama (JICA) and Mr. Yamaguchi (Crown Agents)) Consultant members (Mr. Fujii, Mr. Nishikawa, Mr. Urano, Mr. Miyamoto, Mr. Nogami, Mr. Yatsu)	
1	05-Dec. '09	Sat	Trip {Tokyo 12:00 London 15:45 by JL401}	London
2	06-Dec. '09	Sun	Trip {London 14:50 Accra 21:30 by BA081}	Accra
3	07-Dec. '09	Mon	Courtesy call and Explanation of Inception Report to JICA Ghana Office, Embassy of Japan, Noguchi Memorial Institute for Medical Research (NMIMR) and the University of Ghana	Accra
4	08-Dec. '09	Tue	Field Survey and Technical discussion with NMIMR and the University of Ghana Courtesy call and Explanation of Inception Report to Ministry of Finance and Economic Planning (MFEP), Electricity Company of Ghana (ECG) and Ministry of Energy (MOEn)	Accra
5	09-Dec. '09	Wed	Field Survey and Technical discussion with NMIMR and the University of Ghana	Accra
6	10-Dec. '09	Thu	Field Survey and Technical discussion with NMIMR and the University of Ghana Courtesy call and Explanation of Inception Report to Ministry of Education (MOEd)	Accra
7	11-Dec. '09	Fri	Signing of the Minutes of Discussions (MD) with NMIMR and the University of Ghana Report to Embassy of Japan	Accra
8	12-Dec. '09	Sat	Trip {Accra 08:10 Lagos 10:15 by VK810, Lagos 14:20 Abuja 15:35 by W3 157}	Abuja

(2) Second Preparatory Survey

No.	Date	A day of the week	Contents of Survey	Stay at
			Consultant members (Mr. Fujii, Mr. Nishikawa, Mr. Urano, Mr. Tamai, Mr. Miyamoto, Mr. Nogami, Mr. Tsuruoka, Mr. Akatsuka)	
1	12-Mar.'10	Fri	Trip {Abuja 19:45 Accra 20:35 by 061(Arik Air)}	Accra
2	13-Mar.'10	Sat	Sorting of Collected Data and Internal Meeting Survey on Local Procurement and Construction Condition	Accra
3	14-Mar.'10	Sun	Sorting of Collected Data and Internal Meeting	Accra
4	15-Mar.'10	Mon	Courtesy call to JICA Ghana Office (9:00), Embassy of Japan (10:00), NMIMR (11:30), University of Ghana (12:00)	Accra
5	16-Mar.'10	Tue	Field Survey and Technical Discussion with NMIMR Survey for Local Procurement and Construction Condition	Accra
6	17-Mar.'10	Wed	Ditto	Accra
7	18-Mar.'10	Thu	Ditto	Accra
8	19-Mar.'10	Fri	Field Survey and Technical Discussion (NMIMR, Ministry of Energy, VRA, ECG, Ministry of Environment)	Accra
9	20-Mar.'10	Sat	Preparation of Field Report	Accra
10	21-Mar.'10	Sun	Ditto	Accra
11	22-Mar.'10	Mon	Field Survey and Technical Discussion (NMIMR, Ministry of Energy, VRA, ECG, Ministry of Environment), Preparation of Field Report	Accra
12	23-Mar.'10	Tue	Ditto	Accra
13	24-Mar.'10	Wed	Ditto	Accra
14	25-Mar.'10	Thu	Submission, Explanation and Discussion on Field Report (University of Ghana, NMIMR) Modification of Field Report	Accra
15	26-Mar.'10	Fri	Discussion on Field Report (University of Ghana, NMIMR), Modification of Field Report	Accra
16	27-Mar.'10	Sat	Modification of Field Report	Accra
17	28-Mar.'10	Sun	Ditto	Accra
18	29-Mar.'10	Mon	Discussion, Concluding and Signing of Field Report (University of Ghana, NMIMR)	Accra
19	30-Mar.'10	Tue	Report to JICA Ghana Office and Embassy of Japan, Trip {Accra 21:10 Amsterdam 05:45+1 by KL 590}	in Flight
20	31-Mar.'10	Wed	Trip {Amsterdam 21:00 Tokyo 15:25+1 by JL 412}	in Flight
21	1-Apr.'10	Thu	Arrive at Tokyo 15:25	

(3) Third Preparatory Survey (Explanation on Draft Final Report)

No.	Date	A day of the week	Contents of Survey		Stay at
			Official members (JICA) (Mr. Ogawa and Mr. Yamaguchi)	Consultant members Mr. Fujii, Mr. Nishikawa, Mr. Urano, Mr. Tamai)	
1	31-Jul.'10	Sat	In Ghana from previous week	Trip {Tokyo 12:15 → Frankfurt 17:20 by JL 407}	Amsterdam
2	01-Aug.'10	Sun	In Ghana from previous week	Trip {Frankfurt 10:25 → Accra 14:55 by LH 566}	Accra
3	02-Aug.'10	Mon	<ul style="list-style-type: none"> · Courtesy call and submission of Draft report to <u>Noguchi Memorial Institute for Medical Research (NMIMR)</u> · Courtesy call and submission of Draft report to <u>University of Ghana</u> · Confirmation of Project Site with Topographic Survey Company and NMIMR · Courtesy call to JICA Ghana Office 		Accra
4	03-Aug.'10	Tue	<ul style="list-style-type: none"> · Embassy of Japan to Ghana · Explanation of Contents of the Draft Report and Technical discussion with NMIMR · Inspection of Topographic Survey · Visit and Explanation of summary of the Project to <u>Energy Commission (Mr. Kwabena A. Otu-Danquah)</u> 		Accra
5	04-Aug.'10	Wed	<ul style="list-style-type: none"> · Explanation of Contents of the Draft Report and Technical discussion with NMIMR · Submission and Explanation of the Minutes of discussions with NMIMR and University of Ghana · Visit and Explanation of Contents of the Project to <u>the Ministry of Energy (Mr. Wisdom Ahiataku-Togobo)</u> 		Accra
6	05-Aug.'10	Thu	<ul style="list-style-type: none"> · Explanation of Contents of the Draft Report and Technical discussion with NMIMR · Discussion of the Minutes of Discussions with NMIMR and University of Ghana · Correction of the Minutes of Discussions (If necessary) 		Accra
7	06-Aug.'10	Fri	<ul style="list-style-type: none"> · Signing the Minutes of Discussions with NMIMR and University of Ghana · Report to JICA Ghana Office Official Member: Trip {Accra 17:30 → Dubai 05:50+1 by EK 788}		Accra
8	07-Aug.'10	Sat	Trip {Dubai 05:50 by EK 788}	Trip {Accra 21:10→Amsterdam 05:45 by KL 590}	in flight
9	08-Aug.'10	Sun	Trip {Dubai 03:15→Tokyo 18:00 by EK318}	Trip {Amsterdam 21:00→Tokyo 15:25 by JL 412 }	in flight
10	09-Aug.'10	Mon	-	Trip {→ Tokyo 15:25 by JL 412 }	

**Appendices 3 List of Parties Concerned
in the Recipient Country**

3. List of Parties Concerned in the Recipient Country

<u>Name and Organization</u>	<u>Position</u>
Ministry of Finance and Economic Planning (MOFEP)	
Mr. Yaw Okyere-Nyako	Director, External Resources Management - Bilateral
Noguchi Memorial Institute for Medical Research (NMIMR)	
Prof. Alexander K. Nyarko	Director
Mr. Kwadwo Koram	Deputy Director
Mr. E.O. Lamptey	Head of Maintenance
Mr. Issah Shaibu	Electrical Head
Mr. S.K.A. Jones	Planning
Mr. Samuel Neequaye	Planning
Mr. Romulus Ocansey	Electricals
Mr. Emmamuel Nartey	Electricals
University of Ghana	
Mr. Philip Azundow	Director, Physical Development and Municipal Service
Ministry of Energy (MOE)	
Mr. Solomon	Deputy Director, Division of Power
Mr. Wisdom Ahiataku-Togobo	Renewable Energy Expert
Energy Commission	
Mr. Kwabena A. Otu-Danquah	Chief (Renewable Energy)
Mr. Oscar Amonoo-Neizer	Acting Chief, Power
Electricity Company of Ghana (ECG)	
Mr. Tetteh A. Okyne	Director of Operations
Mr. Emmanuel Ankomah	District Manager, Legon District Office
Mr. Kwadwo Ayensu Obeng	Sectional Manager-Design
Mr. George Hommey	Division Manager, Protection and Control
DANIMAR ENGINEERING LTD.	
Mr. Kwasi Addo Nyako	Director
Embassy of Japan in Ghana	
Mr. Tsuyoshi Shigeta	First Secretary
Mr. Shin-ichi Honda	First Secretary, Head of Economic and Economic Cooperation Unit

JICA Ghana Office

Mr, Koichi Kito
Ms. Maki Okusa

Senior Representative
Project Formulation Advisor

Appendices 4 Minutes of Discussions

4. Minutes of Discussions

(1) First Preparatory Survey

**Minutes of Discussions
on the Preparatory Survey
on the Project for Clean Energy Promotion Using Solar Photovoltaic System
in the Republic of Ghana**

The Government of Japan (hereinafter referred to as "GoJ") has established Cool Earth Partnership as a new financial mechanism. Through this, GoJ is cooperating actively with developing countries' efforts to reduce greenhouse gasses emissions, such as efforts to promote clean energy. A new scheme of grant aid, "Program Grant Aid for Environment and Climate Change", was also created by GoJ as a component of this financial mechanism. According to the initiative of Cool Earth Partnership, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with GoJ, decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Clean Energy Promotion Using Solar Photovoltaic System (hereinafter referred to as "the Project").

JICA sent to the Republic of Ghana (hereinafter referred to as "Ghana") the Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Kunihiro Yamauchi, Resident Representative, JICA Ghana Office, and is scheduled to stay in Ghana from December 6th to 12th, 2009.

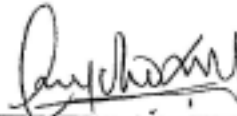
The Team held discussions with the concerned officials of the Government of Ghana and conducted a field survey.

In the course of discussions and field survey, both sides confirmed the main items described in the attached sheets.

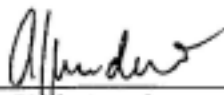
Accra
December 11, 2009



Mr. Kunihiro Yamauchi
Leader
Preparatory Survey Team
Japan International Cooperation Agency



Prof. Alexander Nyarko
Director
Noguchi Memorial Institute for Medical Research
University of Ghana
The Republic of Ghana



Mr. Philip Azundow
Ag. Director
Physical Development and Municipal Service
University of Ghana
The Republic of Ghana



Mr. Yaw Okyere-Nyako
Director
Division of External Resource Mobilization -Bilateral
Ministry of Finance and Economic Planning
The Republic of Ghana

ATTACHMENT

1. Current Situation

The Government of Ghana recognizes the renewable energy could play a more important role in terms of enabling to meet their energy requirement. In the Strategic National Energy Plan (SNEP) established in 2005, it states that the Solar Photovoltaic (PV) is one of the alternative technologies with high potential for promotion of the use of renewable energy, diversification of energy source and saving the utilization of natural resources in Ghana

In this situation, both sides confirm that the Project, which introduces photovoltaic (PV) power generation systems connected with the national power grid, is one of the pilot systems to enhance the possibility of applying renewable energy.

2. Objective of the Project

The objective of the Project is to promote clean energy utilization and achieve emissions reductions by installing the photovoltaic system. The power produced is used for the NMIMR.

3. Responsible Organization and Implementing Organization

The responsible organization is the University of Ghana (UG). (The organization chart of the University is shown in Annex-1.)

The implementing agency is the Noguchi Memorial Institute for Medical Research (NMIMR), UG. (The organization chart of the implementing organization is shown in Annex-2.)

4. Items Requested by Ghanaian Side

4-1. After discussions with the Team, the installation of the on-grid power generating system using photovoltaic including following equipment was requested by the Ghanaian side.

Table 1 Projects requested by Ghanaian Government

	Description
Location	Noguchi Memorial Institute of Medical Research, UG
Outline	The power produced is used for the NMIMR
Requested equipment	(1) Solar module (total capacity might be 200kWp) (2) Junction box (3) Power Conditioner (4) Distribution board (5) Cables for electric distribution (6) Data collecting and display device (7) Other relevant component to complete PV installation (8) Training for operation and maintenance of PV system

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- 4-2. The Project site is the as shown in Annex-3.
- 4-3. The Ghanaian side explained that there is no request to any other donors for installation of PV system at the NMIMR.
- 4-4. The Ghanaian side has understood that the detailed component and the design of the Project shall be confirmed at the timing of 2nd phase of the Preparatory Survey.
- 4-5. The Team will report on the findings and items requested by the Ghanaian side to JICA Headquarters and the Government of Japan.

5. Japan's Program Grant Aid for Environment and Climate Change

The Ghanaian side understood the Japan's Program Grant Aid for Environment and Climate Change scheme explained by the Team, (as described in Annex-4, 5, 6, 7 and 8).

6. Schedule of the Study

- 6-1. The Team will proceed to further survey in Ghana until December 19th 2009 as the 1st phase of the Preparatory Survey.
- 6-2. After the completion of the 1st phase of the Preparatory Survey, the Team will report the results to Ghanaian side, JICA Headquarters and GoJ.
- 6-3. Based on the results of the 1st phase of the Preparatory Survey, JICA will conduct the 2nd phase of Preparatory Survey for the discussion of detailed component and design as well as collection of further data necessary for design from the middle of February to March 2010.
- 6-4. JICA will prepare the draft report and reference document in English after the 2nd phase of Preparatory Survey and dispatch a mission to Ghana in order to explain their contents at the end of July 2010.
- 6-5. When the contents of the report are accepted in principle by the Government of Ghana, JICA will complete the final report and reference document, and submit them to the Government of Ghana and to the Procurement Agent by the end of August, 2010.

7. Other Relevant Issues

7-1. Permission of Land Acquisition / Usage

The University of Ghana owns the land mentioned below. Also, NMIMR agreed to obtain permission of the usage of necessary land or facilities from the University for installation of the equipment.

- (a) Securing necessary land or facilities


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- for PV Modules
 - for installation of cables between PV Modules and Power Conditioners
 - for Power Conditioners
- (b) Temporary Stockyard during installation of the equipment and materials
- Approximately 1,000m² areas within the site.

7-2. Procurement of Equipment

The Team explained that, in accordance with the policy of Government of Japan, products of Japan shall be procured for major equipment in the Project. The Ghanaian side also requested products of Japan for major equipment.

7-3. Coordination with Relevant Organizations

The responsible organization for the Project shall be the focal point for the Team, and responsible for the coordination with relevant organizations. Also, the Ghanaian side agreed to establish a consultative committee in order to coordinate with the Japanese side which consists of the Embassy of Japan, the JICA office and the procurement agent. Terms of Reference of the Consultative Committee is referred to Annex-9.

7-4. Environmental and Social Considerations

The Team explained the outline of JICA Environmental and Social Considerations Guideline (hereinafter referred to as "the JICA Guideline") to the Ghanaian side. The Ghanaian side took the JICA Guideline into consideration, and shall complete the necessary procedures

7-5. Operation and Maintenance

The Responsible Organization agreed to secure and allocate the necessary budget and personnel for the operation and maintenance of grid-connected PV system procured and installed under the Project.

7-6. Customs and Tax exemption

The Ghanaian side agreed that the Ghanaian side shall be responsible for the exemption and/or reimbursement (payment/assumption) of all customs, tax, levies and duties incurred in Ghana for implementation of the Project.

7-7. The Ghanaian side shall ensure the security of all concerned Japanese nationals working on the Project site, if deemed necessary.

7-8. The Ghanaian side shall provide necessary numbers of counterpart personnel to the Team during the period of their studies in Ghana

7-9. The Ghanaian side shall submit all the answers to the Questionnaire, which the Team handed to the Ghanaian side, by December 12th.



<List of Annex>

Annex-1 Organization Chart of Responsible Organization

Annex-2 Organization Chart of Implementing Organization

Annex-3 Candidate site of the Project

Annex-4 Program Grant Aid for Environment and Climate Change

Annex-5 General Flow of Program Grant Aid for Environment and Climate Change

Annex-6 Flow of Funds for Project Implementation

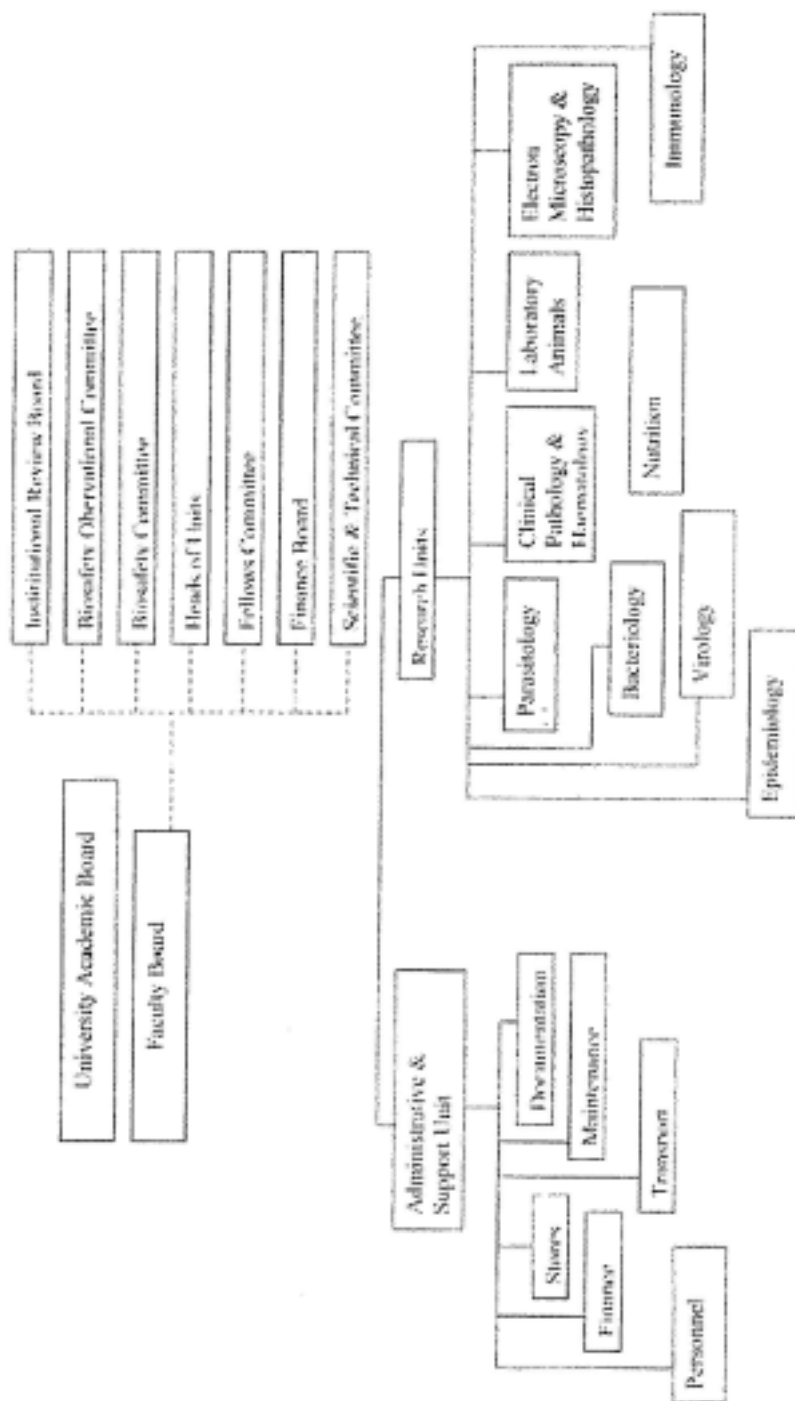
Annex-7 Project Implementation System

Annex-8 Major Undertakings to be taken by Each Government

Annex-9 Terms of References of the Consultative Committee



**Organization Chart of Implementing Organization
(Noguchi Memorial Institute for Medical Research)**

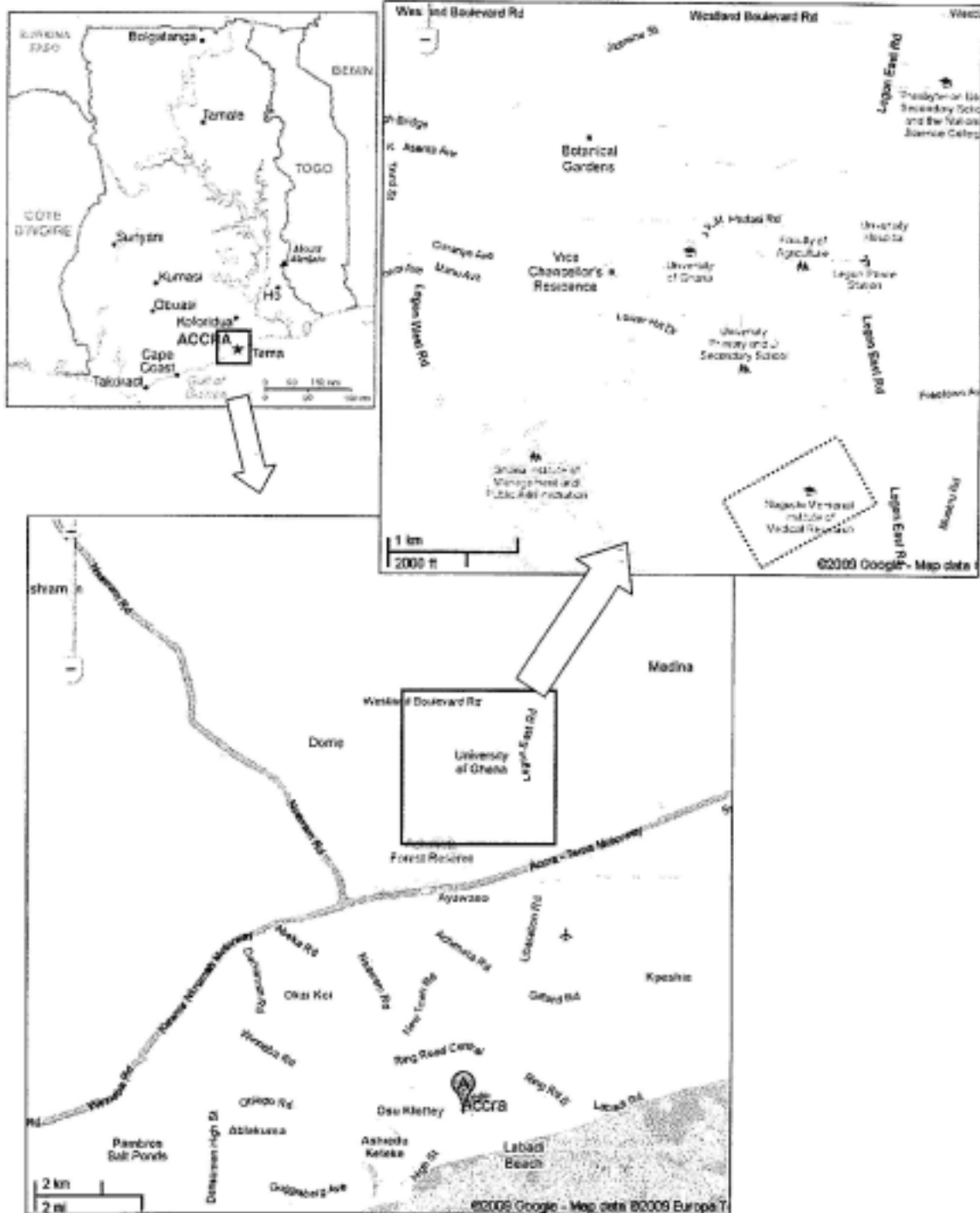


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Candidate Site of the Project

(Location: University of Ghana, Legon, Ghana)



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Program Grant Aid for Environment and Climate Change
of the Government of Japan
 (Provisional)

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

Based on "Cool Earth Partnership" initiative of the Government of Japan, the Program Grant Aid for Environment and Climate Change (hereafter referred to as "GAEC") aims to mitigate effects of global warming by reducing GHGs emission (mitigation; e.g. improvement of energy efficiency) and to take adaptive measures (adaptation; e.g. measures against disasters related to climate change, including disaster prevention such as enhancing disaster risk management). GAEC may contain multiple components that can be combined to effectively meet these needs.

1. Procedures for GAEC

GAEC is executed through the following procedures.

Preparatory Survey 1	Preparatory Survey for project identification conducted by Japan International Cooperation Agency (JICA)
Application	Request made by a recipient country
Appraisal & Approval	Appraisal by the Government of Japan and Approval by the Cabinet
Determination of Implementation	The Notes exchanged between the Government of Japan and the Recipient Country
Grant Agreement (hereinafter referred to as the "G/A")	Agreement concluded between JICA and the Recipient
Preparatory Survey 2	Preparatory Survey for design conducted by JICA
Implementation	Procurement through the Procurement Agency by the Recipient

Firstly, if the candidate project for a GAEC is identified by the Recipient and the Government of Japan, the Government of Japan (the Ministry of Foreign Affairs) examines it whether it is eligible for GAEC. When the request is deemed appropriate, JICA, in consultation with the Government of Japan, conducts the Preparatory Survey (hereafter referred to as "the Survey") on the candidate project as Phase 1 of the Survey with Japanese consulting firms.

Secondly, the Recipient submits the official request to the Government of Japan, while the appropriateness, necessity and the basic components of the project are examined in the course of Phase 1 of the Survey,

Thirdly, the Government of Japan appraises the project to see whether it is suitable for Japan's GAEC, based on the Survey report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the Recipient.

Fifthly, JICA engages Grant Agreement (G/A) with the Recipient and executes the Grant by making payments of the amount agreed in the E/N and strictly monitors that the funds of the Grant are properly and effectively used.

Procurement Management Agent is designated to conduct the procurement services of products and services (including fund management, preparing tenders, contracts) for GAEC on behalf of the Recipient. The Agent is an impartial and specialized organization that will render services according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the Agreed Minutes ("A/M").

2 Preparatory Survey

1) Contents of the Survey

The purpose of the Preparatory Survey (hereafter referred to as "the Survey"), conducted by JICA on a requested project (hereafter referred to as "the Project"), is to provide the basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Survey are as follows:

- Confirmation of background, objectives, and benefits of the Project and institutional capacity of agencies and communities concerned of the Recipient necessary for project implementation.
- Evaluation of relevance of the Project to be implemented under the Grant Aid Scheme for Environment and Climate Change from a technical, social, and economic point of view.
- Confirmation of items agreed upon by both parties concerning the basic concept of the Project.
- Preparation of the design of the Project and reference document for tender.
- Estimation of cost for the Project.

The contents of the original request will be modified, as found necessary, in the design of the Project according to the guidelines of Japan's Grant Aid scheme.

The Government of Japan requests the Government of the Recipient to take whatever measures necessary to ensure its responsibility in implementing the Project. Such measures must be guaranteed even if they may fall outside the jurisdiction of the implementing organization of the Recipient. This has been confirmed by all relevant organizations of the Recipient through the Minutes of Discussions.

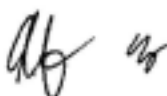
2) Selection of consulting firms

For the smooth implementation of the Survey, JICA will conduct the Survey with registered consulting firms. JICA selects the firms based on proposals submitted by firms with interest in implementing the Survey. The firms selected will carry out the Preparatory Survey and prepare a report, based on the terms of reference set by JICA.

3. Implementation of GAEC after the E/N

1) Exchange of Notes (E/N)

The content of GAEC will be determined in accordance with the Notes exchanged by the two



Governments concerned, in which items including, objectives of the project, period of execution, conditions and amount of the Grant Aid are confirmed.

2) Details of Procedures

Details of procedures on procurement and services under GAEC will be agreed between the authorities of the two governments concerned at the time of the signing of the G/A.

Essential points to be agreed are outlined as follows:

- a) JICA will supervise the implementation of the Project.
 - b) Products and services will be procured and provided in accordance with JICA's "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change."
 - c) The Recipient will conclude a contract with the Agent.
 - d) The Agent is the representative acting in the name of the Recipient concerning all transfers of funds to the Agent.
- 3) Focal points of "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change"
- a) The Agent
The Agent is the organization, which provides procurement of products and services on behalf of the Recipient according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the A/M.
 - b) Agent Agreement
The Recipient will conclude the Agent Agreement, in principle, within two months after the signing of the G/A, in accordance with the A/M. The scope of the Agent's services will be clearly specified in the Agent Agreement.
 - c) Approval of the Agent Agreement
The Agent Agreement is prepared as two identical documents and the copy of the Agent Agreement will be submitted to JICA by the Recipient through the Agent. JICA confirms whether the Agent Agreement is concluded in conformity with the E/N, A/M, and G/A and the Procurement Guidelines for the Program Grant Aid for Environment and Climate Change then approves the Agent Agreement.

The Agent Agreement concluded between the Recipient and the Agent will become effective after the approval by JICA in a written form.

d) Payment Methods

The Agent Agreement will stipulate that "Regarding all transfers of the fund to the Agent, the Recipient will designate the Agent to act on behalf of the Recipient and issue a Blanket Disbursement Authorization ("the BDA") to conduct the transfer of the fund (hereinafter referred to as "the Advances") to the Procurement Account from the Recipient Account.

The Agent Agreement will clearly state that the payment to the Agent will be made in Japanese yen from the Advances and that the final payment to the Agent will be made when the total remaining amount become less than three percent (3%) of the Grant and its accrued interests excluding the Agent's fees.

e) Products and Services Eligible for Procurement

Products and services to be procured will be selected from those defined in the G/A.

f) Firm and Consultant

The firm and consultant who would contract with the Agent shall be Japanese Nationals.

The consultants that will be employed to do detail design and supervise the work for the Project, however will be in principle, Japanese nationals recommended by JICA for the purpose of maintaining technical consistency with the Study.

g) Method of Procurement

When conducting the procurement, sufficient attention will be paid to transparency in selecting the firms and for this purpose, competitive tendering will be employed in principle.

h) Tender Documents

The tender documents should contain all information necessary to enable tenderers to prepare valid offers for the products and services to be procured by GAEC.

The rights and obligations of the Recipient, the Agent and the firms supplying products and services should be stipulated in the tender documents to be prepared by the Agent. Aside from this, the tender documents will be prepared in consultation with the Recipient.

i) Pre-qualification Examination of Tenderers

The Agent may conduct a pre-qualification examination of tenderers in advance of the tender so that the invitation to the tender can be extended only to eligible firms. The pre-qualification examination should be performed only with respect to whether the prospective tenderers have the capability of concluding the contracts.

For this, the following points should be taken into consideration:

- (1) Experience and past performance in contracts of similar kind
- (2) Financial credibility (including assets such as real estate)
- (3) Existence of offices and other items to be specified in the tender documents.
- (4) Their potentialities to use necessary personnel and facilities.

j) Tender Evaluation

The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

Those tenderers which substantially conform to the technical specifications and other stipulations of the tender documents, will be judged in principle on the basis of the submitted price, and the tenderer who offers the lowest price will be designated as the successful tenderer.

The Agent will submit a detailed evaluation report of tenders to JICA for its information, while the notification of the results to the tenderers will not be premised on the confirmation by JICA.

k) Additional procurement

If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the Recipient would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:

(1) Procurement of same products and services

When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged not efficient, additional procurement can be conducted by a negotiated contract with the successful tenderer of the initial tender.

(2) Other procurements

When products and services other than those mentioned above in (1) are to be procured, the procurement should be conducted through competitive tendering. In this case, the products and services for additional procurement will be selected from among those in accordance with the G/A.

l) Conclusion of the Contracts

In order to procure products and services in accordance with the guideline, the Agent will conclude contracts with firms selected by tendering or other methods.

m) Terms of Payment

The contract will clearly state the terms of payment. The Agent will make payment from the "advances," against the submission of the necessary documents from the firm on the basis of the conditions specified in the contract. When the services are the object of procurement, the Agent may pay certain portion of the contract amount in advance to the firms on the conditions that such firms submit the advance payment guarantee worth the amount of the advance payment to the Agent.

4) Undertakings required by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the Recipient is required to undertake necessary measures as the following:

- a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.
- b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites.
- c) To ensure all the expense and prompt execution for unloading, customs clearing at the port of disembarkation and domestic transportation of products purchased under the Grant Aid,
- d) To ensure that customs duty, internal taxes and other fiscal levies that may be imposed in the Recipient with respect to the purchase of the Components and the Agent's services will be exempted by the Government of the Recipient.
- e) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into the Recipient and stay therein for the performance of their work.

5) "Proper use of funds"

The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

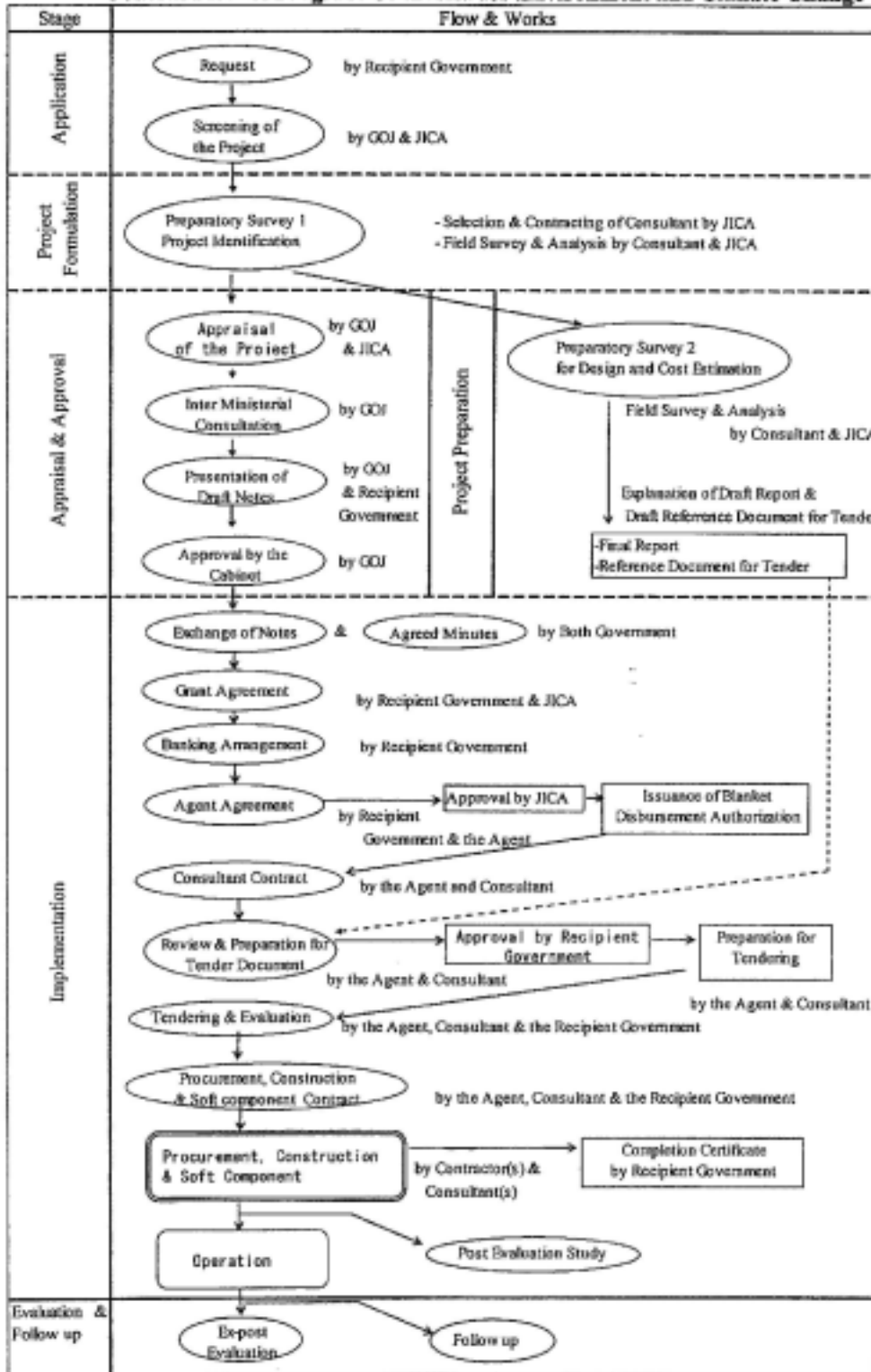
6) "Export and Re-export" of products

The products purchased under the Grant and its accrued interest will not be exported or re-exported from the Recipient.

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Jen

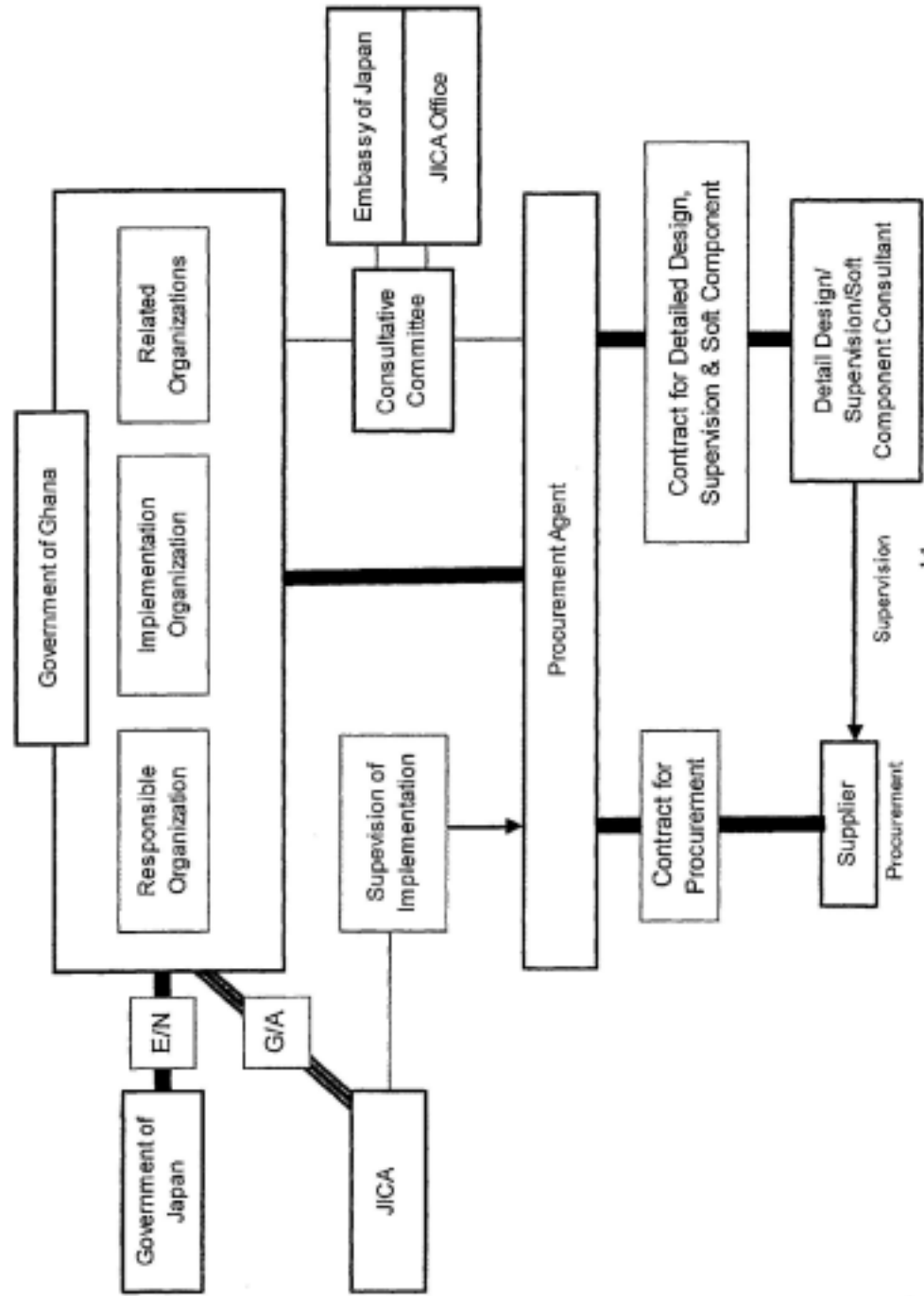
General Flow of Program Grant Aid for Environment and Climate Change



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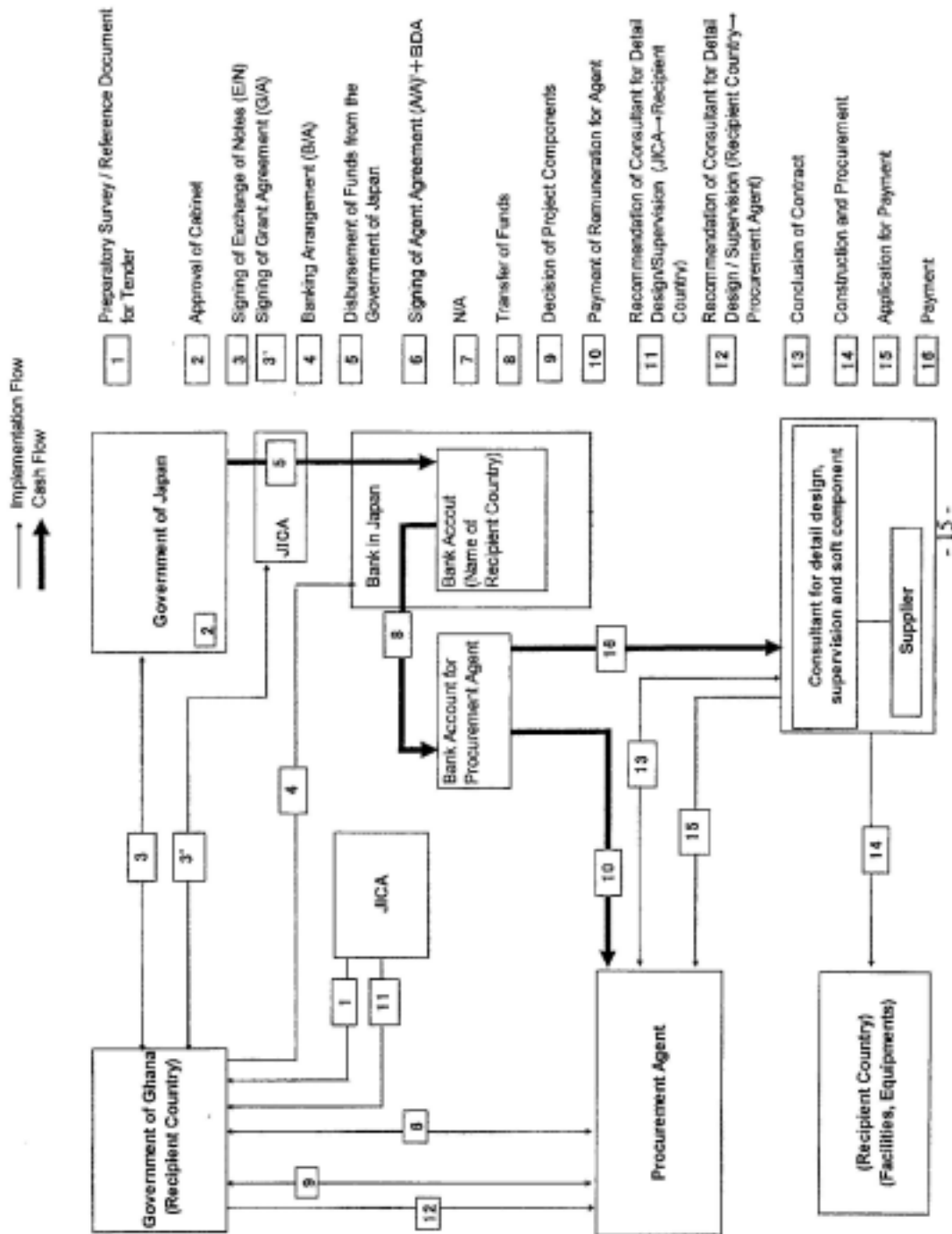
Project Implementation System



Ab

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Flow of Funds for Project Implementation



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Major undertakings to be taken by each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		•
2	To clear, level and reclaim the site when needed urgently		•
3	To construct gates and fences in and around the site		•
4	To construct a parking lot if necessary		•
5	To construct roads		
	1) Within the site	•	
	2) Outside the site and Access road		•
6	To construct the facility and install the equipment	•	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities if necessary:		
	1) Electricity		
	a. The power distribution line to the site		•
	b. The drop wiring and internal wiring within the site	•	
	c. The main circuit breaker and transformer for the site	•	
	2) Water Supply		
	a. The city water distribution main to the site		•
	b. The supply system within the site (receiving and elevated tanks)	•	
	3) Drainage		
	a. The city drainage main (for conveying storm water, sewage, etc. from the site)		•
	b. The drainage system within the site (for sewage, ordinary waste, storm water, etc.)	•	
	4) Gas Supply		
	a. The city gas main to the site		•
	b. The gas supply system within the site	•	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		•
	b. The MDF and the extension after the frame/panel	•	
	6) Furniture and Equipment		
	a. General furniture		•
	b. Project equipment	•	
8	To bear the following commissions applied by the bank in Japan for banking services based upon the Bank Arrangement (B/A):		
	1) Payment of bank commission		•
9	To ensure all the expense and prompt execution of unloading and customs clearance at the port of disembarkation in the recipient country		
	1) Marine or air transportation of the products from Japan or third countries to the recipient	•	
	2) To ensure all the expense and prompt execution of unloading, tax exemption and customs clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	•	
10	To accord Japanese nationals and / or nationals of third countries, including persons employed by the agent whose services may be required in connection with the Components such facilities as may be necessary for their entry into recipient country and stay therein for the performance of their work.		•
11	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the Components and to the employment of the Agent will be exempted by the Government of recipient country		•
12	To maintain and use properly and effectively the facilities that are constructed and the equipment that is provided under the Grant.		•
13	To bear all the expenses, other than those covered by the Grant and its accrued interest, necessary for the purchase of the Components as well as for the agent's fees.		•
14	To ensure environmental and social consideration for the Programme.		•

Terms of Reference of the Consultative Committee (Provisional)

1. To confirm an implementation schedule of the Program for the speedy and effective utilization of the Grant and its accrued interest.
2. To discuss the modifications of the Program, including modification of the design of the facility.
3. To exchange views on allocations of the Grant and its accrued interest as well as on potential end-users.
4. To identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems.
5. To exchange views on publicity related to the utilization of the Grant and its accrued interest.
6. To discuss any other matters that may arise from or in connection with the G/A.



(2) Third Preparatory Survey (Explanation on Draft Final Report)

Minutes of Discussions
on
the Preparatory Survey (Outline Design)
on
The Project for Introduction of Clean Energy by Solar Electricity Generation System
in
the Republic of Ghana

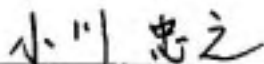
(Explanation on Draft Final Report)

In December 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched to Ghana a Preparatory Survey Team on the Project for Introduction of Clean Energy by Solar Electricity Generation System (hereinafter referred to as "the Project"), to hold discussions with relevant officials of the Government of the Republic of Ghana to conduct field surveys and to make technical evaluations. After discussing results of the Preparatory Survey in Japan, JICA prepared a Draft Final Report of the Outline Design.

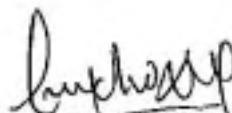
In order to explain and to consult with the concerned officials of the Ghanaian side on the components of the Draft Final Report, JICA dispatched to Ghana a Preparatory Survey Team for Draft Final Report Explanation (hereinafter referred to as "the Team"), which is headed by Mr. Tadayuki OGAWA, Senior Adviser of JICA, from August 2nd to 6th, 2010.

As a result of the discussions held between JICA and concerned officials of the Government of Ghana, the main items described on the attached sheets are confirmed.

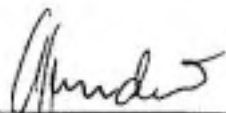
Accra, August 6, 2010



Mr. Tadayuki OGAWA
Leader
Preparatory Survey Team
Japan International Cooperation Agency



Prof. Alexander Nyarko
Director
Noguchi Memorial Institute for Medical Research
University of Ghana
The Republic of Ghana



Mr. Philip Azundow
Director
Physical Development and Municipal Service
University of Ghana
The Republic of Ghana



Mr. Yaw Okyere-Nyako
Director
Division of External Resource Mobilization -Bilateral
Ministry of Finance and Economic Planning
The Republic of Ghana

ATTACHMENT

1. Components of the Draft Final Report

The Noguchi Memorial Institute for Medical Research (hereinafter referred to as "NMIMR") and the University of Ghana (hereinafter referred to as "UG") accepted in principle the components of the Draft Final Report explained by the Team.

2. Program Grant Aid for Environment and Climate Change of the Government of Japan

The Ghanaian side understood the contents of the Minutes of Discussions signed by JICA and the Ghanaian side on 11th December, 2009 (hereinafter referred to as "the previous M/D"), and agreed to take the necessary measures confirmed on the previous M/D for smooth implementation of the Project following procedures of the Program Grant Aid for Environment and Climate Change of the Government of Japan as shown in **Annex-1**.

3. Confirmation of progress made from the previous M/D

3.1. Project site and capacity of PV system

JICA and the Ghanaian side confirmed that project site is UG and NMIMR. The Team explained that the capacity of solar photovoltaic system (hereinafter referred to as "PV system") can be increased up to 315 kWp from 200kWp in the previous M/D based on the result of outline design and cost estimation. The Ghanaian side accepted the change of PV capacity.

3.2. Responsible Organization and Implementing Agency

JICA and the Ghanaian side confirmed that the UG is the responsible organization, and NMIMR is the implementing agency for the Project.

4. Equipment to be procured

The Team explained that the list of equipment to be procured is as shown in **Annex-2** based on the result of the 2nd Preparatory Survey conducted in March 2010. After discussions, JICA and the Ghanaian side agreed to procure the major equipment such as PV module, Power Conditioner and Transformer from Japan.

5. Procurement Process for the Project

JICA and the Ghanaian side reconfirmed that procurement process will be supervised by the Procurement Agent (hereinafter referred to as "the Agent") who is recommended by the government of Japan through necessary consultations with the Consultative Committee (hereinafter referred to as "the Committee"). JICA and the Ghanaian side also reconfirmed the roles of the Agent as follows;

- (1) The Agent will render the services stipulated in the provisions of the G/A (Grant Agreement) as well as the E/N (Exchange of Notes) for the Project;
- (2) The Agent will implement the procurement procedures necessary for the Project according to the provisions of the G/A and E/N and any other relevant guidelines
- (3) JICA will provide a Final Report to the Agent; and
- (4) The Agent will undertake the procurement according to the contents of the Final Report of the Outline Design.

The Team explained that if tender price exceeds the amount agreed on G/A and E/N, quantity or/and items of the equipment would be reduced until the cost for the Project comes down to the amount agreed on G/A and E/N.

The Ghanaian side agreed that if there is a remaining amount of the cost for the Project after tenders, additional items of equipment would be procured based on priorities which will be set by the Committee.

The Ghanaian side also understood that decision on addition or reduction of the equipment to be procured would be made through necessary consultations with members of the Committee.

6. Project Cost

The Ghanaian side agreed that the cost for the Project should not exceed the upper limit of amount agreed on in E/N. JICA and the Ghanaian side also agreed that the cost for the Project contains procurement cost of equipment, the cost for transportation up to the site for the Project, installation cost, the Consultant fee, the Agent fee, and the cost for soft component for the technical support of operation and maintenance of equipment.

7. Confidentiality of the Project

(1) Detailed specifications of the Facilities and Equipment

JICA and the Ghanaian side agreed that all the information related to the Project including detailed drawings and specifications of the facilities and equipment and other technical information shall not be disclosed to any outside parties (i.e. outside of JICA, the Ghanaian side and the Agent) before the conclusion of all the contract(s) for the Project.

(2) Confidentiality of the Cost Estimation

The Team explained the estimated cost of the Project as described in Annex-3. JICA and The Ghanaian side agreed that the estimated cost for the Project should never be duplicated or disclosed to any outside parties (i.e. outside of JICA, the Ghanaian side and the Agent) before tender for the Project. The Ghanaian side understood that the estimated cost for the Project attached as Annex-3 is not final and is subject to change as a result of examination through revision of the Outline Design Study.

8. The Consultative Committee

The Ghanaian side agreed that NMIMR will chair the Committee in order to facilitate

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consultation and procurement process. The Terms of Reference of the Committee are outlined in Annex-8 of the previous M/D.

The members of the Committee are as follows:

- (1) Representative(s) of NMIMR (Chair)
- (2) Representative(s) of UG
- (3) Representative(s) of Ministry of Finance and Economic Planning
- (4) Representative(s) of Ministry of Energy
- (5) Representative(s) of JICA Ghana Office

The first meeting of the Committee shall be held after the signing of the consulting services agreement between the Agent and the Consultant. Further meetings shall be held upon the request of either the Ghanaian side or the Japanese side. The Procurement Agent may advise JICA and the Ghanaian side on the necessity to call for a meeting of the Committee.

9. Other Relevant Issues

9.1. Undertakings required by the Ghanaian side

The Team requested the Ghanaian side to abide by the following undertakings by the Ghanaian side in addition to major undertakings described in the previous M/D and in Annex-4 of this M/D. The Ghanaian side agreed to do so.

(1) Land usage for PV system

The owner of the land to be used for the following purposes of the Project is UG. The Ghanaian side has reconfirmed that there is no objection to use the land for the Project.

- 1) for the installation of PV system
- 2) for the construction of power conditioner house
- 3) for temporary stockyard

NMIMR, on August 2nd, 2010, has applied to UG for the land usage of PV systems including the additional area necessary to accommodate total capacity of 315KW. NMIMR shall obtain the approval letter by the end of August 2010.

(2) Environmental and Social Considerations

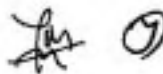
NMIMR, on March 24th, 2010, has applied to the Environmental Protection Agency (EPA) for Environment Assessment Registration. The EPA has inspected the site, and the approval of the application shall be finished by the end of August 2010.

(3) License for Service Providers in the Electricity Supply Industry

The Ghanaian side agreed that the necessary license for service providers in the electricity supply industry will be obtained by UG and/or NMIMR from the Energy Commission (EC) by the commencement of the construction work at the project site, in case the generated power from the PV system is sold to third parties.

(4) Application of the Related Laws and Regulations

- 1) The Ghanaian side agreed that structural design for frames to mount PV panels and power conditioner house shall comply with the Architectural Codes and Standards in



Japan in consideration of relevant laws and regulations as well as natural conditions in Ghana.

- 2) Electrical design for Grid-connected PV system should be conducted in accordance with JIS/IEC and BS.

(5) Customs and Tax Exemption

The Ghanaian side agreed that NMIMR shall be responsible for the exemption of all customs, tax, levies and duties incurred in Ghana for the implementation of the Project.

(6) Assignment of Counterpart Personnel

1) Overall project management

The Ghanaian side assigned following personnel for overall project management and coordination.

NMIMR: Mr. Ebenezer Lamptey, Head of Maintenance

2) Soft Component

The Ghanaian side agreed to assign necessary personnel in accordance with the soft component plan proposed by the Team.

NMIMR will assign the focal Counterpart Personnel for the soft component.

Other personnel will be assigned from other organizations as required at the time of project implementation.

9.2. Ownership and Operation and Maintenance (O&M) Responsibilities of Equipment

The Ghanaian side has reconfirmed that the NMIMR is the final owner of Equipment and responsible for securing necessary budget and personnel for Operation and Maintenance (O&M) of Grid-connected PV system procured and installed under the Project. The Ghanaian side confirmed that the Equipment procured under the Project shall be operated and maintained by NMIMR with the necessary assistance by Electricity Company of Ghana (ECG) and other related organizations.

<List of Annex>

Annex-1 Program Grant Aid for Environment and Climate Change of the Government of Japan

Annex-2 List of Equipment

Annex-3 Estimated Project Cost (Confidential)

Annex-4 Major Undertakings to be taken by the Ghanaian side

Program Grant Aid for Environment and Climate Change
of the Government of Japan
 (Provisional)

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

Based on "Cool Earth Partnership" initiative of the Government of Japan, the Program Grant Aid for Environment and Climate Change (hereafter referred to as "GAEC") aims to mitigate effects of global warming by reducing GHGs emission (mitigation; e.g. improvement of energy efficiency) and to take adaptive measures (adaptation; e.g. measures against disasters related to climate change, including disaster prevention such as enhancing disaster risk management). GAEC may contain multiple components that can be combined to effectively meet these needs.

1. Procedures for GAEC

GAEC is executed through the following procedures.

Preparatory Survey 1	Preparatory Survey for project identification conducted by Japan International Cooperation Agency (JICA)
Application	Request made by a recipient country
Appraisal & Approval	Appraisal by the Government of Japan and Approval by the Cabinet
Determination of Implementation	The Notes exchanged between the Government of Japan and the Recipient Country
Grant Agreement (hereinafter referred to as the "G/A")	Agreement concluded between JICA and the Recipient
Preparatory Survey 2	Preparatory Survey for design conducted by JICA
Implementation	Procurement through the Procurement Agency by the Recipient

Firstly, if the candidate project for a GAEC is identified by the Recipient and the Government of Japan, the Government of Japan (the Ministry of Foreign Affairs) examines it whether it is eligible for GAEC. When the request is deemed appropriate, JICA, in consultation with the Government of Japan, conducts the Preparatory Survey (hereafter referred to as "the Survey") on the candidate project as Phase 1 of the Survey with Japanese consulting firms.

Secondly, the Recipient submits the official request to the Government of Japan, while the appropriateness, necessity and the basic components of the Program are examined in the course of Phase 1 of the Survey,

Thirdly, the Government of Japan appraises the Program to see whether it is suitable for Japan's GAEC, based on the Survey report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the Program, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the Recipient.

Fifthly, JICA engages Grant Agreement (G/A) with the Recipient and executes the Grant by making payments of the amount agreed in the E/N and strictly monitors that the funds of the Grant are properly and effectively used.

Procurement Management Agent is designated to conduct the procurement services of products and services (including fund management, preparing tenders, contracts) for GAEC on behalf of the Recipient. The Agent is an impartial and specialized organization that will render services according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the Agreed Minutes ("A/M").

2. Preparatory Survey

1) Contents of the Survey

The purpose of the Preparatory Survey (hereafter referred to as "the Survey"), conducted by JICA on a requested project (hereafter referred to as "the Project"), is to provide the basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Survey are as follows:

- Confirmation of background, objectives, and benefits of the Project and institutional capacity of agencies and communities concerned of the Recipient necessary for project implementation.
- Evaluation of relevance of the Project to be implemented under the Grant Aid Scheme for Environment and Climate Change from a technical, social, and economic point of view.
- Confirmation of items agreed upon by both parties concerning the basic concept of the Project.
- Preparation of the design of the Project and reference document for tender.
- Estimation of cost for the Project.

The contents of the original request will be modified, as found necessary, in the design of the Project according to the guidelines of Japan's Grant Aid scheme.

The Government of Japan requests the Government of the Recipient to take whatever measures necessary to ensure its responsibility in implementing the Project. Such measures must be guaranteed even if they may fall outside the jurisdiction of the implementing organization of the Recipient. This has been confirmed by all relevant organizations of the Recipient through the Minutes of Discussions.

2) Selection of consulting firms

For the smooth implementation of the Survey, JICA will conduct the Survey with registered consulting firms. JICA selects the firms based on proposals submitted by firms with interest in implementing the Survey. The firms selected will carry out the Preparatory Survey and

prepare a report, based on the terms of reference set by JICA.

3. Implementation of GAEC after the E/N

1) Exchange of Notes (E/N)

The content of GAEC will be determined in accordance with the Notes exchanged by the two Governments concerned, in which items including, objectives of the project, period of execution, conditions and amount of the Grant Aid are confirmed.

2) Details of Procedures

Details of procedures on procurement and services under GAEC will be agreed between the authorities of the two governments concerned at the time of the signing of the G/A.

Essential points to be agreed are outlined as follows:

- a) JICA will supervise the implementation of the Project.
 - b) Products and services will be procured and provided in accordance with JICA's "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change."
 - c) The Recipient will conclude a contract with the Agent.
 - d) The Agent is the representative acting in the name of the Recipient concerning all transfers of funds to the Agent.
- 3) Focal points of "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change"
- a) The Agent
The Agent is the organization, which provides procurement of products and services on behalf of the Recipient according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the A/M.
 - b) Agent Agreement
The Recipient will conclude the Agent Agreement, in principle, within two months after the signing of the G/A, in accordance with the A/M. The scope of the Agent's services will be clearly specified in the Agent Agreement.
 - c) Approval of the Agent Agreement
The Agent Agreement is prepared as two identical documents and the copy of the Agent Agreement will be submitted to JICA by the Recipient through the Agent. JICA confirms whether the Agent Agreement is concluded in conformity with the E/N, A/M, and G/A and the Procurement Guidelines for the Program Grant Aid for Environment and Climate Change then approves the Agent Agreement.

The Agent Agreement concluded between the Recipient and the Agent will become effective after the approval by JICA in a written form.
 - d) Payment Methods
The Agent Agreement will stipulate that "Regarding all transfers of the fund to the Agent, the Recipient will designate the Agent to act on behalf of the Recipient and issue a Blanket Disbursement Authorization ("the BDA") to conduct the transfer of the fund (hereinafter

referred to as "the Advances") to the Procurement Account from the Recipient Account.

The Agent Agreement will clearly state that the payment to the Agent will be made in Japanese yen from the Advances and that the final payment to the Agent will be made when the total remaining amount become less than three percent (3%) of the Grant and its accrued interests excluding the Agent's fees.

e) Products and Services Eligible for Procurement

Products and services to be procured will be selected from those defined in the G/A.

f) Firm and Consultant

The firm and consultant who would contract with the Agent shall be Japanese Nationals.

The consultants that will be employed to do detail design and supervise the work for the Project, will, however, be in principle, Japanese nationals recommended by JICA for the purpose of maintaining technical consistency with the Study.

g) Method of Procurement

When conducting the procurement, sufficient attention will be paid to transparency in selecting the firms and for this purpose, competitive tendering will be employed in principle.

h) Tender Documents

The tender documents should contain all information necessary to enable tenderers to prepare valid offers for the products and services to be procured by GAEC.

The rights and obligations of the Recipient, the Agent and the firms supplying products and services should be stipulated in the tender documents to be prepared by the Agent. Aside from this, the tender documents will be prepared in consultation with the Recipient.

i) Pre-qualification Examination of Tenderers

The Agent may conduct a pre-qualification examination of tenderers in advance of the tender so that the invitation to the tender can be extended only to eligible firms. The pre-qualification examination should be performed only with respect to whether the prospective tenderers have the capability of concluding the contracts.

For this, the following points should be taken into consideration:

- (1) Experience and past performance in contracts of similar kind
- (2) Financial credibility (including assets such as real estate)
- (3) Existence of offices and other items to be specified in the tender documents.
- (4) Their potentialities to use necessary personnel and facilities.

j) Tender Evaluation

The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

Those tenderers which substantially conform to the technical specifications and other stipulations of the tender documents will be judged in principle on the basis of the submitted price, and the tenderer who offers the lowest price will be designated as the successful tenderer.

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The Agent will submit a detailed evaluation report of tenders to JICA for its information, while the notification of the results to the tenderers will not be premised on the confirmation by JICA.

k) Additional procurement

If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the Recipient would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:

(1) Procurement of same products and services

When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged not efficient, additional procurement can be conducted by a negotiated contract with the successful tenderer of the initial tender.

(2) Other procurements

When products and services other than those mentioned above in (1) are to be procured, the procurement should be conducted through competitive tendering. In this case, the products and services for additional procurement will be selected from among those in accordance with the G/A.

l) Conclusion of the Contracts

In order to procure products and services in accordance with the guideline, the Agent will conclude contracts with firms selected by tendering or other methods.

m) Terms of Payment

The contract will clearly state the terms of payment. The Agent will make payment from the "advances," against the submission of the necessary documents from the firm on the basis of the conditions specified in the contract. When the services are the object of procurement, the Agent may pay certain portion of the contract amount in advance to the firms on the conditions that such firms submit the advance payment guarantee worth the amount of the advance payment to the Agent.

4) Undertakings required by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the Recipient is required to undertake necessary measures as the following:

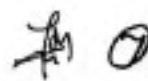
- a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.
- b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites.
- c) To ensure all the expense and prompt execution for unloading, customs clearing at the port of disembarkation and domestic transportation of products purchased under the Grant Aid,
- d) To ensure that customs duty, internal taxes and other fiscal levies that may be imposed in the Recipient with respect to the purchase of the Components and the Agent's services will be exempted by the Government of the Recipient.
- e) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into the Recipient and stay therein for the performance of their work.

5) "Proper use of funds"

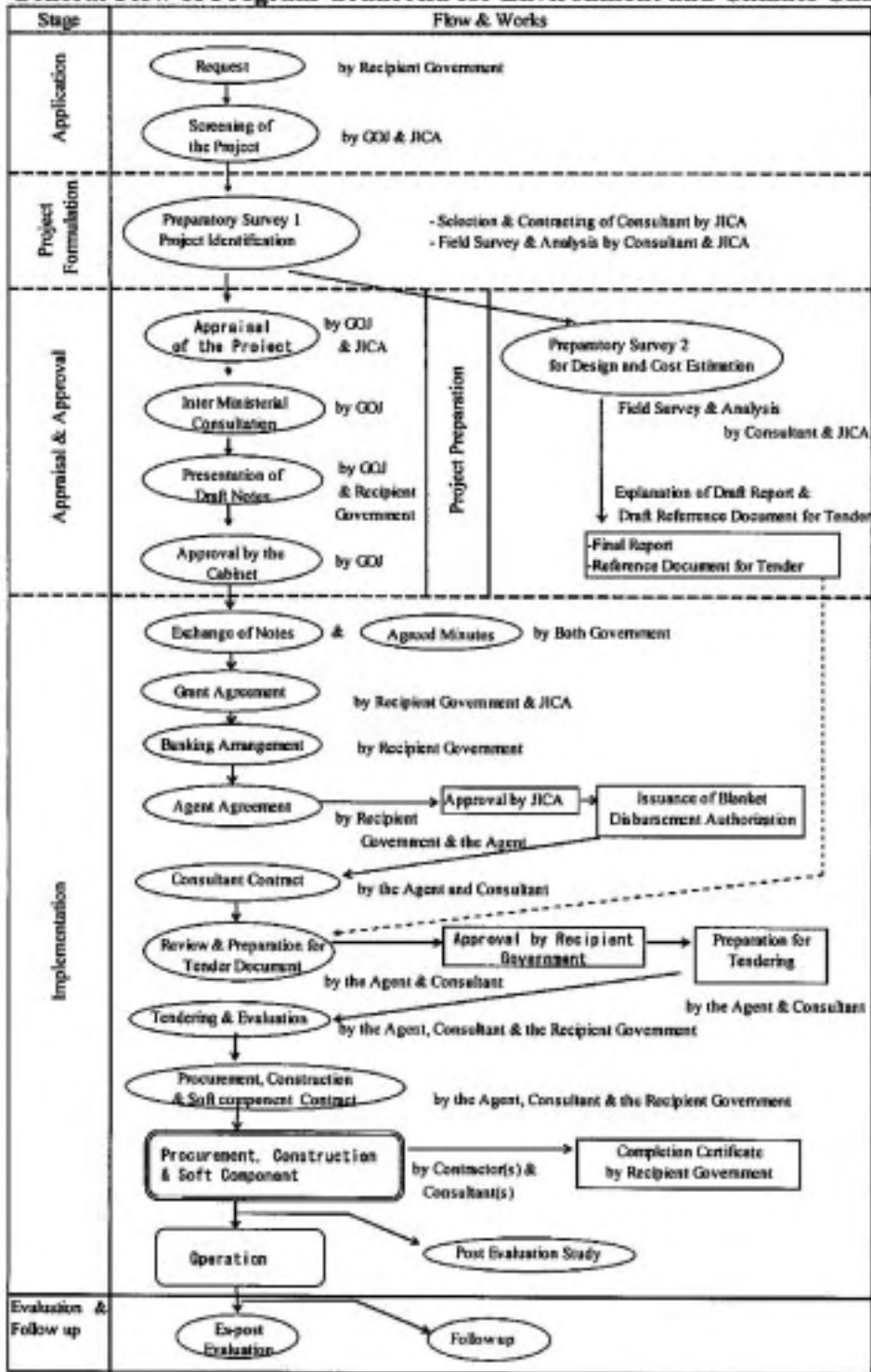
The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

6) "Export and Re-export" of products

The products purchased under the Grant and its accrued interest will not be exported or re-exported from the Recipient.

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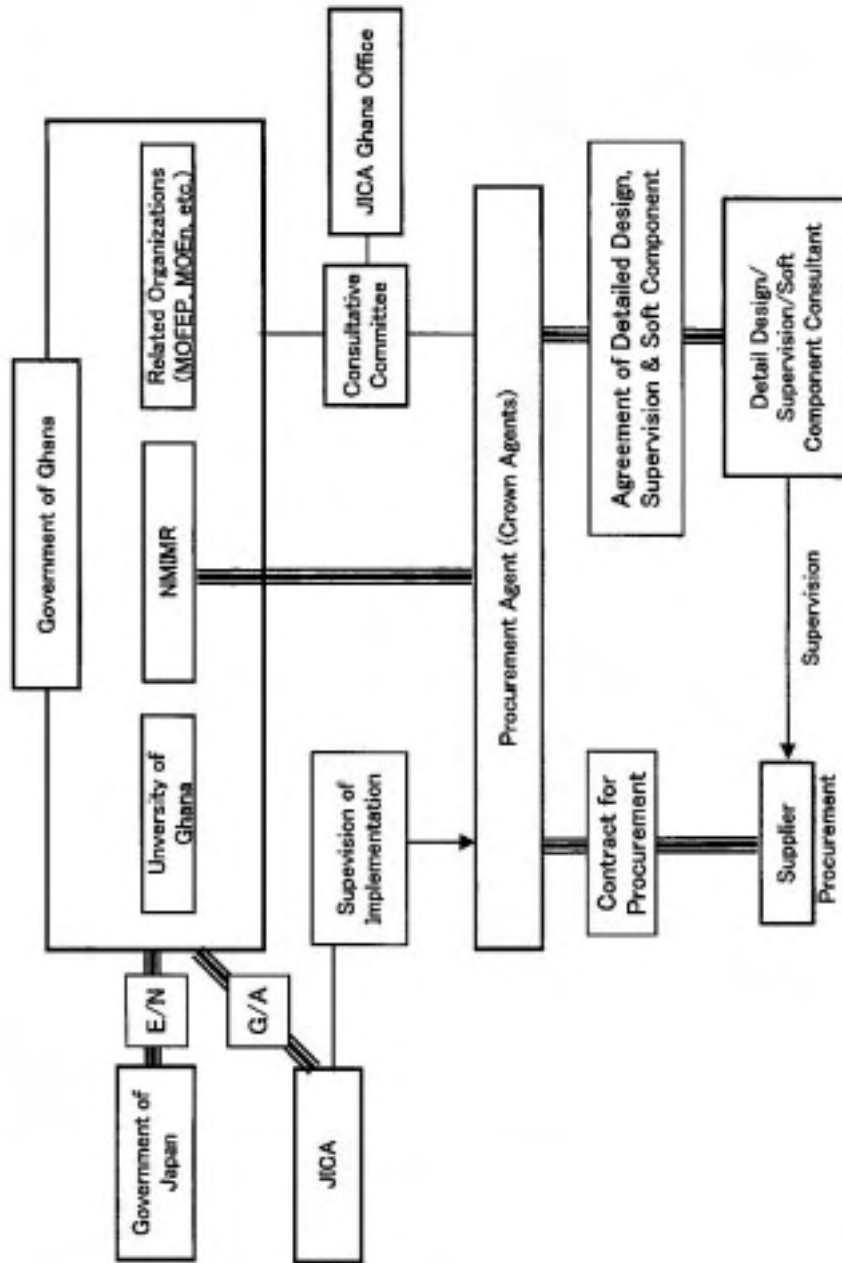
General Flow of Program Grant Aid for Environment and Climate Change



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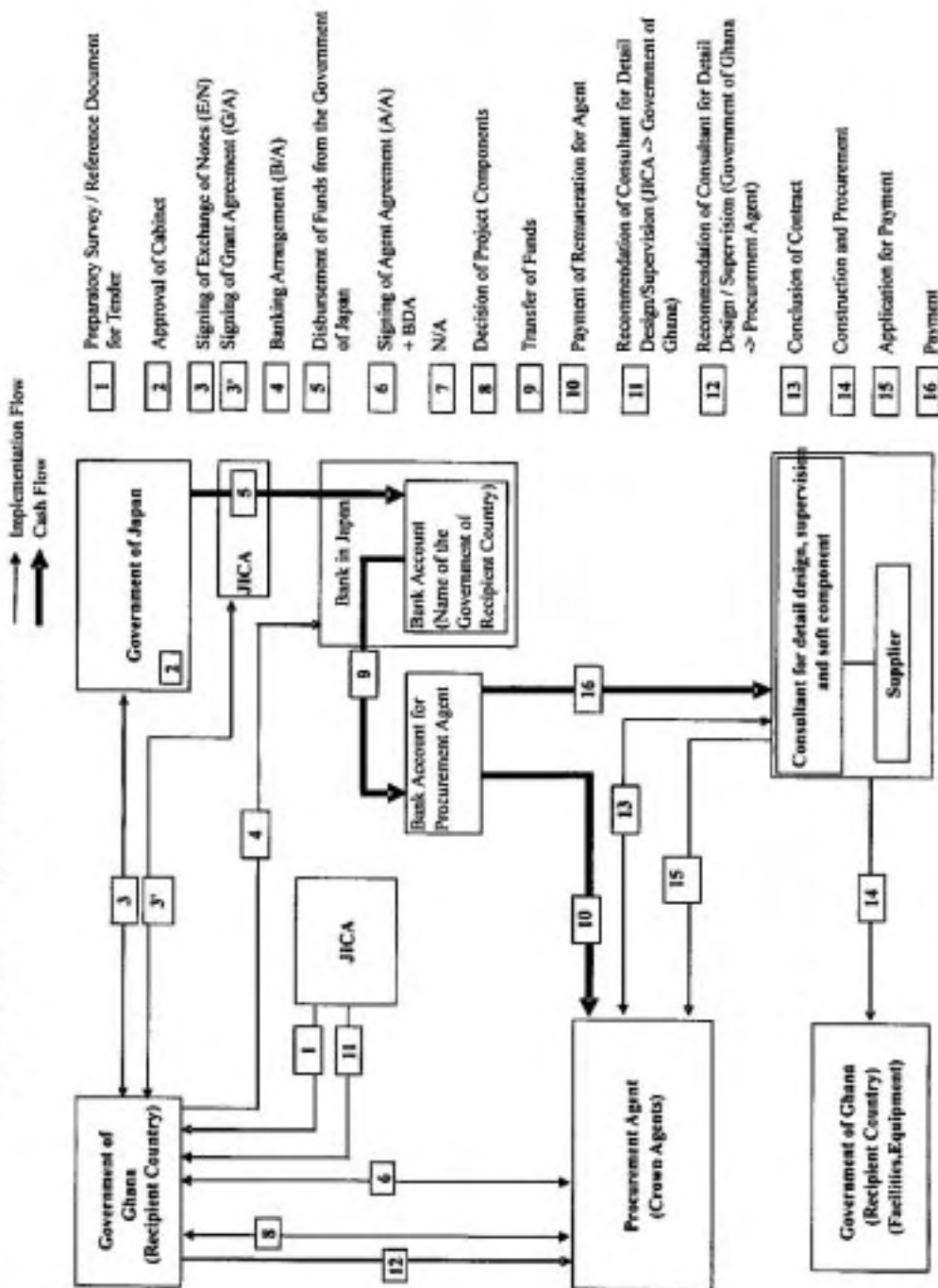
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Project Implementation System



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Flow of Funds for Project Implementation



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- Signature 3 (right)

List of Major Equipments

The following table shows a list of major equipments procured under the Program.

Components	Specification	Qty.	Unit	Purpose
PV module	Total capacity 315 kWp or more at the standard Test condition (Solar irradiation: 1,000 W/m ² , Ambient temperature: 25°C, Air Mass (AM): 1.5) and Mono-crystalline, Multi-crystalline Silicon Type or, Tandem-type of Crystalline Silicon and Amorphous Silicon and IP 65 or more. Applicable standard JIS C 8917 for withstanding voltage and insulation test and IEC 61215 or JIS C 8990 for design qualification. Module efficiency 12 % or more and Module output from 180W to 210 W.	1	Lot	To generate power to grid-connected PV system by receiving solar insolation
Mounting structure for PV modules	Ground mounting type and Base metal applied SS 400 (JIS G 3101), SPHC (JIS H 8641) or stronger with Galvanized finishing	1	Lot	To support PV module at required height and angle
Power Conditioner	Indoor use ground mount type self-excited voltage inverter with rated capacity 100kW or more and system efficiency 90% or more and power factor control 95% or more with grid-connecting facility and safety protection relays (OCR, UVR, OVR, UFR, OFR).	4	Units	To convert the generated power from DC to AC and synchronize with existing electrical system and to match and supply power to load and grid.
Junction box	Outdoor use wall mounted type, tropical area use with reverse power flow protection, circuit breaker and surge absorber. Protection class IP44 or higher	1	Lot	To connect strings of PV modules to collecting boxes
Connection box	Outdoor use wall mount type, tropical area use with reverse power flow protection, circuit breaker and surge absorber. Protection class IP 44 or higher.	1	Lot	To connects the power from Junction box to power conditioners.
Transformer Panel	500kVA dry type indoor use molded type Transformer installed in Metal enclosed indoor use self standing type cubicle and protection class IP 20 or more with necessary MCCBs.	1	Unit	To step up primary side voltage of Power conditioner to 415/240 V 3phase 4 wire and to connect existing grid and supply power to the existing loads.
Display system	This system consist of Floor mount Liquid crystal 60 inch monitor located at entrance hall and Media Converters, Media Extenders and UPS (500VA or more), Hub, etc.	1	Lot	To display information of PV system such as total and daily generated power , total CO2 reduction amount etc.
Protection and Data management system	This system consist of PLC data processing devices, Media converters, Signal converter with transuding device, Measurement instruments (Solar Irradiance and Ambient temperature), Data Logger, UPS, Hub and necessary cables.	1	Lot	To measure and manage PV system output and climatic conditions.
400 V MCCB Panel	Indoor use, air insulated, metal enclosed and self standing type with MCCB 4p 400 AF/400AT x1 and Relay signal transmission standards	1	Unit	To connect 415 v circuit between PV system and existing distribution system.
Cable	IEC, JIS or equivalent standard CV cable or CV with metal armor cable.	1	Lot	To connect between PV modules and Junction boxes, between Junction boxes and Collecting boxes, between Collecting boxes and Power conditioners, between Power conditioner and Transformer, Transformer and Interconnection point etc.

Source: JICA Study Team

Project Cost Estimation (Confidential)

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Major undertakings to be taken by each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		•
2	To clear bush at the site when needed urgently		•
3	To clear, level and reclaim the site	•	
4	To construct gates and fences in and around the site	•	•
5	To construct a parking lot if necessary		•
6	To construct roads		
	1) Within the site	•	
	2) Outside the site and Access road		•
7	To construct the facility and install the equipment under the Programme	•	
8	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities if necessary:		
	1) Electricity		
	a. The power distribution line to the site from the existing electrical room	•	
	b. The drop wiring and internal wiring within the site	•	
	c. The main circuit breaker and transformer for the site	•	
	2) Water Supply		
	a. The city water distribution main to the site		•
	b. The supply system within the site (receiving and elevated tanks)	•	
	3) Drainage		
	a. The city drainage main (for conveying storm water, sewage, etc. from the site)		•
	b. The drainage system within the site (for sewage, ordinary waste, storm water, etc.)	•	
	4) Gas Supply		
	a. The city gas main to the site		•
	b. The gas supply system within the site	•	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		•
	b. The MDF and the extension after the frame/panel	•	
	6) Furniture and Equipment		
	a. General furniture		•
	b. Project equipment (data management system only)	•	
9	To bear the following commissions applied by the bank in Japan for banking services based upon the Bank Arrangement (B/A):		
	1) Payment of bank commission		•
10	To ensure all the expense and prompt execution of unloading and customs clearance at the port of disembarkation in the recipient country		
	1) Marine or air transportation of the products from Japan or third countries to the recipient	•	
	2) To ensure all the expense and prompt execution of unloading, tax exemption and customs clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	•	
11	To accord Japanese nationals and / or nationals of third countries, including persons employed by the agent whose services may be required in connection with the Components such facilities as may be necessary for their entry into recipient country and stay therein for the performance of their work.		•
12	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the Components and to the employment of the Agent will be exempted by the Government of recipient country		•
13	To maintain and use properly and effectively the facilities that are constructed and the equipment that is provided under the Grant.		•
14	To bear all the expenses, other than those covered by the Grant and its accrued interest, necessary for the purchase of the Components as well as for the agent's fees.		•
15	To ensure environmental and social consideration for the Programme.		•
16	Responsibility of operation and maintenance of Equipment and materials procured, facility constructed, under the Programme after completion		•

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17	To allocate necessary budget for operation and maintenance of Equipment procured under the Programme after completion		•
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**Appendices 5 Soft Component
(Technical Assistance) Plan**

5. Soft Component (Technical Assistance Plan)

1. Background to Planning the Soft Component

The Project for Clean Energy Promotion using Solar Photovoltaic System in the Republic of Ghana (hereafter referred to as Ghana) aims to procure and install a grid-connected photovoltaic system (output 315 kWp) and related transformers and in-station distribution equipment at the Noguchi Memorial Institute for Medical Research (NMIMR) attached to the University of Ghana.

One of the goals of Ghana's energy policy is to promote the development of diverse energy resources in order to achieve stable energy supply and energy security, and introduction of renewable energy is being advanced as one means of realizing this. In line with this policy, as the target for introducing renewable energy, it is aimed to raise the share of renewable energy out of total power supply to 10 percent by 2020. This Grant Aid Project will contribute to realizing this target for renewable energy introduction in Ghana and benefit measures to address climate change by the Government of Ghana through conducting photovoltaic power generation and thereby reducing fuel consumption and greenhouse gas emissions in thermal power generation.

Efforts to introduce photovoltaic systems in Ghana have so far comprised installation of SHS (solar home systems), PV¹ refrigerator for storing vaccines, solar pumps and PV streetlamps, etc. primarily by aid agencies, while large-scale photovoltaic system development has been limited to installation of a 50 kW grid-connected system on the roof of the Ministry of Energy (MOE) car park under assistance by the Government of Spain. More recently, a 4.5 kW follow-up PV grid-connected system was introduced in the front yard of the Energy Commission (EC) under assistance by the Government of Germany. Thus, photovoltaic power systems are being introduced in Ghana, however, there are still only two grid-related PV systems and the local sides lacks experience and knowledge for operating and maintaining PV grid-connected systems.

Since NMIMR staff conduct the routine operation and maintenance of electrical equipment and emergency generator at the research institute, they have basic knowledge on electrical equipment operation and maintenance. However, since NMIMR does not possess photovoltaic generating equipment, it will be difficult for the institute's staff to acquire the know-how and technology required for operating and maintaining the PV grid-connected system through their everyday work. Moreover, due to limited experience in installing and operating grid-connected private generator systems, the ECG (Electricity Corporation of Ghana) also lacks knowledge concerning important points and troubleshooting for PV grid-connected systems. Furthermore, Ghana has no regulations or technical criteria, etc. concerning the grid connection of generating facilities that do not entail power sale or purchase.

This soft component aims to support the smooth launch of activities at the start of the Project and to facilitate the sustainable operation and maintenance of the PV grid-connected system through implementing technology transfer on PV grid-connected system operation and maintenance primarily for NMIMR (implementing agency) Maintenance Department. Moreover, since it is also necessary for

¹ PV: Abbreviation for photovoltaic, meaning of solar cells.

operation and maintenance staff of the distribution grid to which the PV system will be connected to grasp the characteristics of the PV grid-connected system, the necessary technology transfer concerning outline of the PV grid-connected system, important points in system operation and technical conditions for interconnection will be carried out with respect to the Facilities Department of the University of Ghana, which is in charge of maintaining distribution facilities on campus, the ECG, which is the grid operator, and the Ministry of Energy and Energy Committee, which are the regulating agencies for the power sector.

2. Goals of the Soft Component

The goals of the soft component are as indicated below. It is anticipated that through achieving these goals the effects of the Grant Aid project will be realized on a sustained basis.

- (1) Operation and maintenance of the PV grid-connected system will be commenced by the Ghanaian side following completion of the Project.
- (2) Operation and maintenance of the PV grid-connected system will be conducted on a sustained basis.
- (3) The power distribution grid to which the PV system is connected will be operated in a stable manner.

3. Outputs of the Soft Component

The outputs that should be achieved in the soft component are as indicated below.

Table 3-1 Outputs of the Soft Component

Target	Soft Component Outputs	targets
1 . Operation and maintenance of the PV grid-connected system will be commenced by the Ghanaian side following completion of the Project.	1-1 The operation and maintenance organization for the PV grid-connected system is established.	NMIMR Maintenance Department
	1-2 Operation and maintenance personnel acquire the operation and maintenance technology for the PV grid-connected system.	
2 . Operation and maintenance of the PV grid-connected system will be conducted on a sustained basis.	2-1 The PV grid-connected system operation and maintenance manual including contents on troubleshooting is prepared.	NMIMR Maintenance Department
	2-2 The outline and characteristics of the PV grid-connected system are understood.	University of Ghana Facilities Department
	2-3 Troubleshooting methods for the PV grid-connected system are established. (The distribution grid within the university is the target).	
3 . The power distribution grid to which the PV system is connected will be operated in a stable manner.	3-1 The outline and characteristics (including reverse flows) of the PV grid-connected system are understood.	ECG Ministry of Energy Energy Commission
	3-2 Troubleshooting methods for the PV grid-connected system are established. (The ECG distribution grid is the target).	ECG

4. Method for Confirming the Degree of Attainment of Outputs

Outputs of the soft component will be grasped by confirming the prepared operation and maintenance manual and reports of the participants. Table 4-1 shows the methods for confirming outputs according to each component of activity. In the manual, it will be confirmed that all necessary items including operation and maintenance organization, roles, routine maintenance, periodic inspections and troubleshooting, etc. are covered and that technical contents are stated without error, and advice and guidance will be offered where necessary. In the reports, trainees will be asked to describe the contents they have understood under each technology transfer topic in order to evaluate the degree of understanding regarding the lecture contents. Moreover, supplementary lectures will be conducted on items for which understanding is insufficient.

Table 4-1 Soft Component Outputs and Confirmation Method

Target	Soft Component Outputs	Method for Confirming Degree of Attainment
NMIMR Maintenance Department	<ul style="list-style-type: none"> • The operation and maintenance organization for the PV grid-connected system is established. • Operation and maintenance personnel acquire the operation and maintenance technology for the PV grid-connected system. • The PV grid-connected system operation and maintenance manual including contents on troubleshooting is prepared. 	<ul style="list-style-type: none"> • Manual • Reports • Manual
University of Ghana Facilities Department	<ul style="list-style-type: none"> • The outline and characteristics of the PV grid-connected system are understood. • Troubleshooting methods for the PV grid-connected system are established. (The distribution grid within the university is the target). 	<ul style="list-style-type: none"> • Reports • Manual
ECG	<ul style="list-style-type: none"> • The outline and characteristics (including reverse flows) of the PV grid-connected system are understood. • Troubleshooting methods for the PV grid-connected system are established. (The ECG distribution grid is the target). 	<ul style="list-style-type: none"> • Reports • Manual
Ministry of Energy	<ul style="list-style-type: none"> • The outline and characteristics (including reverse flows) of the PV grid-connected system are understood. 	<ul style="list-style-type: none"> • Reports
Energy Commission	<ul style="list-style-type: none"> • The outline and characteristics (including reverse flows) of the PV grid-connected system are understood. 	<ul style="list-style-type: none"> • Reports

5. Soft Component Activities (Input Plan)

5-1 Soft Component Contents and Activities

As is indicated in Table 5-1, the contents of soft component activities extend from the basics of solar cells to operation and maintenance and monitoring. Technology transfer will be conducted by means of classroom lessons, drills (manual preparation by the trainees) and practical exercises using actual equipment and materials. The equipment and materials used in the practical exercises will be the PV modules, measuring instruments and tools that are scheduled for introduction to NMIMR. Moreover, although the Project PV grid-connected system will not generate reverse flows to the distribution grid, assuming that PV grid-connected systems which entail reverse flows will be introduced to Ghana in future, contents pertaining to reverse flow will be included in the technology transfer items.

Table 5-1 Contents of Soft Component Activities and Method of Technology Transfer

Target	Soft Component Outputs	Contents of Activities	Technology Transfer Method	Target
<p>1 . Operation and maintenance of the PV grid-connected system will be commenced by the Ghanaian side following completion of the Project.</p>	<p>1-1 The operation and maintenance organization for the PV grid-connected system is established.</p>	<ul style="list-style-type: none"> • Clarification of the responsibilities of operation and maintenance personnel • Evaluation of the operation and maintenance setup 	<ul style="list-style-type: none"> • Classroom lessons • Classroom lessons, group drills 	<p>NMIMR Maintenance Department</p>
	<p>1-2 Operation and maintenance personnel acquire the operation and maintenance technology for the PV grid-connected system.</p>	<ul style="list-style-type: none"> • Transfer of PV system principles and basic knowledge • Lectures on PV grid-connected system features and protective functions (including reverse flows) • Transfer of operation technology • Transfer of maintenance technology 	<ul style="list-style-type: none"> • Classroom lessons • Classroom lessons • Practical exercises (operations using actual equipment) • Practical exercises (preparation of inspection list, inspections, repairs) • Practical exercises (including measurement of insulation resistance and open-circuit voltage) 	<p>NMIMR Maintenance Department</p>
<p>2 . Operation and maintenance of the PV grid-connected system will be conducted on a</p>	<p>2-1 The PV grid-connected system operation and maintenance manual, including contents on troubleshooting, is prepared.</p>	<ul style="list-style-type: none"> • Technology transfer of periodic inspection techniques • Monitoring • Preparation of an operation and maintenance manual based on mutual cooperation with the Ghanaian side • Optimization of troubleshooting and 	<ul style="list-style-type: none"> • Practical exercises (recording and evaluation of operating data, monitoring of equipment status) • Classroom lessons, drills (manual preparation) • Practical exercises 	<p>NMIMR Maintenance Department</p>

sustained basis.		operation and maintenance manual	(operations manual, breakdown simulation training)	
	2-2	The outline and characteristics of the PV grid-connected system are understood.	<ul style="list-style-type: none"> Lectures on PV grid-connected system features and protective functions (including reverse flows) 	University of Ghana Facilities Department
	2-3	Troubleshooting methods for the PV grid-connected system are established. (The distribution grid within the university is the target).	<ul style="list-style-type: none"> Optimization of troubleshooting (including reverse flows) and operation and maintenance manual 	
	3 . The power distribution grid to which the PV system is connected will be operated in a stable manner.	3-1	The outline and characteristics (including reverse flows) of the PV grid-connected system are understood.	<ul style="list-style-type: none"> Lectures on PV grid-connected system features and protective functions (including reverse flows) Issues for examination (including reverse flows) when introducing the PV grid-connected system
3-2		Troubleshooting methods for the PV grid-connected system are established. (The ECG distribution grid is the target).	<ul style="list-style-type: none"> Optimization of troubleshooting (including reverse flows) and operation and maintenance manual 	<ul style="list-style-type: none"> Classroom lessons Practical exercises based on manual, breakdown simulation training)

5-2 Input Plan

(1) Input Plan on the Japanese Side

In this soft component, through implementing the activities indicated in Table 5-1, the necessary technology transfer will be conducted to enable the implementing agency (NMIMR) to specifically understand and practice operation and maintenance methods for the PV grid-connected system. Moreover, with respect to the University of Ghana Facilities Department, which operates power distribution facilities on the campus, the ECG, which operates the power distribution grid, and the Ministry of Energy and Energy Committee, which supervise and regulate power systems, technology transfer will be conducted concerning the outline of the PV grid-connected system and important points in operation. The Consultant will dispatch Guidance engineer 1 (PV system) and Guidance engineer 2 (grid interconnection) to Ghana in order to conduct technology transfer for the period shown in Table 5-2.

Table 5-2 Input Plan concerning the Soft Component

Name	Rank	Period of Dispatch	Number of Trips	Work Contents
1. Construction of the operation and maintenance setup				
Guidance engineer 1 (PV system)	3	0.50 months	1	Construction of the operation and maintenance setup in the implementing agency
Guidance engineer 2 (grid interconnection)	3	0.50 months	1	Construction of the mutual communication setup with the power utility operator
2. Technical training				
Guidance engineer 1 (PV system)	3	1.00 months	1	Transfer of operation and maintenance technology for the PV system
Guidance engineer 2 (grid interconnection)	3	1.00 months	1	Transfer of technology concerning interconnection with the commercial grid
3. Monitoring				
Guidance engineer 1 (PV system)	3	0.50 months	1	Evaluation of technology learning concerning the PV system
Guidance engineer 2 (grid interconnection)	3	0.50 months	1	Evaluation of technology learning concerning grid interconnection

(2) Input Plan on the Ghanaian Side

As the inputs on the Ghanaian side, it will be necessary to appoint the trainees who will receive the soft component, guarantee their participation in lectures, establish an operation and maintenance organization and establish a steering organization to smoothly implement the soft component. Specific inputs will be as follows.

1) PV System Operating Committee (provisional title)

Following the start of the soft component, the NMIMR Maintenance Department will promptly establish the PV System Operating Committee (provisional title) to ensure the smooth implementation of the soft component and sustainable operation following completion of the soft component. Since the Committee will be the recipient of the soft component while also serving as a forum for grasping the achievements, exchanging opinions and discussing issues in the soft component, it will hold regular meetings during the term of the soft component. Following completion of the soft component

plan, the PV System Operating Committee will offer guidance to the PV Working group to ensure that operation and maintenance of the Project equipment is smoothly and continuously conducted after the soft component is finished. The PV Working Group will report to the Committee on the operation and maintenance conditions of the PV system and will receive guidance and advice when required.

The PV System Operating Committee, which will establish a secretariat in NMIMR (Noguchi Memorial Institute of Medical Research), will comprise representatives from five agencies, namely MOE, EC, ECG, University of Ghana and NMIMR. Specifically, one or two members each from the responsible departments in each agency will join the Committee. Figure 5-1 shows the organization of the PV System Operating Committee.

The PV System Operating Committee will be operated according to the implementation setup shown in Table 5-3 and it will discuss the following items geared to disseminating the PV grid-connected system throughout Ghana.

- Issues concerning the operation and maintenance of the PV grid-connected system
- Impacts of the PV grid-connected system on operation of the power company’s grid and quality of power supply
- Impediments to disseminating the PV grid-connected system in Ghana
- Legal regulations for disseminating the PV grid-connected system in Ghana
- Technical criteria (including reverse flow current) for disseminating the PV grid-connected system in Ghana

2) PV Working Group (PVWG) Draft

The PV Working Group (PVWG) will be established as a subordinate organization of the PV System Operating Committee and will conduct operation and maintenance of the PV grid-connected system under the guidance and supervision of the Committee.

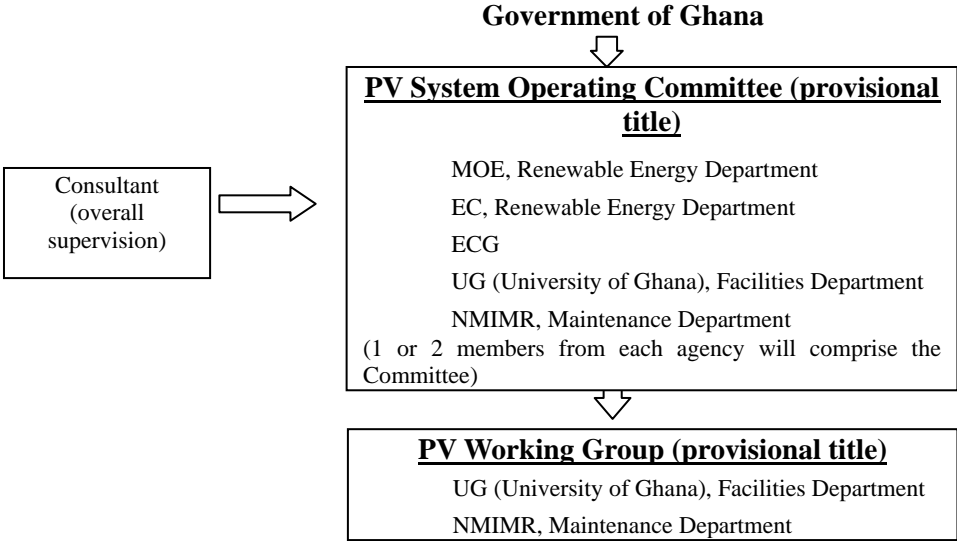


Figure 5-1 PV System Operating Committee Implementation Setup (Proposed)

Table 5-3 shows the implementation setup (proposal) for the PV System Operating Committee and PV Working Group.

Table 5-3 PV System Operating Committee Implementation Setup (Proposed)

	Japanese Consultant	PV System Operating Committee	PV Working Group
Number of members	2	5-10	3-5
Role	Overall progress management	Overall work management	System maintenance
Role in soft component	Explanation	Staging	Staging, participation
Maintenance manual	Advice	Draft proposal checking	Draft proposal preparation
Operation, analysis	Advice	Data analysis, consideration	Operation, data analysis
Maintenance follow-up	Management guidance	Maintenance reporting	Maintenance reporting
Report destinations	Japanese Embassy JICA Ghana Office	JICA Ghana Office	PV System Operating Committee

6. Method for Procuring Resources for Soft Component Implementation

Since the major instruments of the PV grid-connected system to be procured and installed in the Project are made in Japan, the engineers dispatched in the soft component will need to be well versed in Japanese PV products and systems. Although there are engineers who can conduct PV system installation in Ghana, they have only ever handled European or Chinese products and also lack experience in grid interconnection. Accordingly, as the implementation resources for the soft component, a system whereby a consultant with a thorough understanding of Japanese PV systems and grid interconnection gives direct support will be adopted.

7. Soft Component Implementation Schedule (Proposed)

Table 7-1 shows the soft component implementation schedule.

The engineers dispatched from Japan will implement the soft component according to the categories shown in the table. The timing of each category will be as indicated below.

Construction of the operation and maintenance setup: The objective will be to support construction of the operation and maintenance setup. Since clarifying the maintenance setup before installation will stimulate awareness among staff, this will be implemented before the equipment is installed.

Technical training: Actual equipment will be used for conducting training on installation, inspection and operation, etc. In order to prepare the maintenance manual, etc. required before the equipment goes into operation, training will be implemented from around halfway through installation and before equipment goes into operation.

Monitoring: Since monitoring will be geared to confirming that the Ghanaian side can autonomously conduct maintenance, it will be implemented for approximately one month after completion of installation.

Table 7-1 Soft Component Implementation Schedule

Month		1	2	3	4	5	6	7	8	9	10	
Foundation and installation works		█										
Inspection, adjustment, trial operation									█			
Initial operation guidance									█	█		
Acceptance inspection, completion and handover									█			
Soft component	Construction of the operation and maintenance setup			█								
	Technical training						█					
	Monitoring									█		
Outputs	Operation and maintenance manual							▼				
	Progress report				▼			▼				
	Final report										▼	

8. Outputs

As is shown in Table 7-1, outputs of the soft component will be the Operation and Maintenance Manual (including troubleshooting), Progress Reports (English Progress Reports for the client), the Final Report (English Final Report for the client) and the teaching materials used in technology transfer.

9. Responsibilities of Agencies on the Ghanaian Side

- (1) Noguchi Memorial Institute for Medical Research (NMIMR) will establish the PV System Operating Committee for cooperating with the soft component.
- (2) NMIMR will provide the conference rooms, etc. needed for implementing the soft component.
- (3) NMIMR will provide the human resources necessary for implementing the soft component.
- (4) The PV System Operating Committee will prepare the maintenance manual while consulting with the consultant. Also, it will revise and update the manual according to actual conditions following the start of system operation.
- (5) NMIMR will appropriately maintain the grid-connected PV system based on the maintenance manual. In cases where PV system maintenance personnel and so on are transferred, the outputs of the soft component will be utilized in transferring technology to successors.
- (6) The PV System Operating Committee will conduct inspections and present performance reports to the JICA Ghana Office based on the maintenance manual.

Appendices 6 Project Benefits

6. Project Benefits

(1) Estimated generated electrical energy

The rated output of the grid-connected PV system to be installed in the Project is 315 kW_p. The following formula is used for calculating the estimated generated electrical energy, and the solar irradiation amount (on the south-facing incline of 5 degrees) shown in Table 1 is used as the mean monthly solar irradiation.

$$E_p = \Sigma (H_A / G_s) * K * P$$

(Σ indicates the cumulative estimated generated electrical energy for each month).

Where,

- E_p = Estimated annual generated electrical energy (kWh/year)
- H_A = Mean monthly solar irradiation on installed surfaces (kWh/m²/day)
- G_s = Standard solar intensity (1kW/m²)
- P = PV cell capacity
- K = Loss coefficient = $K_d * K_t * \eta_{INV}$
 - * DC correction coefficient K_d : This has been set at 0.8 and includes correction for loss caused by dirt on the surface of PV cells and fluctuations in solar intensity, and correction for disparities in PV cell characteristics.
 - * Temperature correction coefficient K_t : Correction coefficient for fluctuations in conversion efficiency due to rises in the temperature of PV cells caused by sunlight.

$$K_t = 1 + \alpha (T_m - 25) / 100$$

Where, α : Maximum output temperature coefficient (%·°C⁻¹) = - 0.5 (%·°C⁻¹)
[Crystal]

T_m : Module temperature (°C) = $T_{av} + \Delta T$

T_{av} : Mean monthly temperature (°C)

ΔT : Module temperature increase (°C)

Rear open type	18.4
Roof type	21.5

ΔT : 18.4 °C

- * Inverter efficiency η_{INV} : Inverter AC-DC conversion efficiency. This is assumed to be 0.94 here.

In the case where the PV power generating system in the Project operates without any stoppages, generated electrical energy of 382,227 kWh per year can be anticipated.

Table 1 Generated Electrical Energy Estimation

Item	Unit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Solar irradiation	kWh/m ² /day	4.53	5.11	5.41	5.29	5.41	4.29	4.29	4.26	4.83	5.62	5.59	4.75	
Days in month	days	31	28	31	30	31	30	31	31	30	31	30	31	
Monthly solar irradiation	kWh/m ²	140.43	143.08	167.71	158.7	167.71	128.7	132.99	132.06	144.9	174.22	167.7	147.25	
Mean maximum temperature		30.6	30.9	31.1	30.5	30.3	27.7	26.9	26.7	27.4	28.8	30	30.1	
Mean temperature		28.3	29.3	29.3	28.8	28.4	26.8	26.1	26	26.3	27.3	28.1	28.8	
Module temperature Tm		46.7	47.7	47.7	47.2	46.8	45.2	44.5	44.4	44.7	45.7	46.5	47.2	
Temperature correction coefficient Kt		0.8915	0.8865	0.8865	0.8890	0.8910	0.8990	0.9025	0.9030	0.9015	0.8965	0.8925	0.8890	
Loss coefficient K		0.670	0.667	0.667	0.669	0.670	0.676	0.679	0.678	0.674	0.671	0.669		
PV power output	kW	315	315	315	315	315	315	315	315	315	315	315	315	
Power generated	kWh/month	29,656	30,046	35,218	33,420	35,397	27,407	28,431	28,248	30,943	36,998	35,454	31,009	382,227

Note) Mean temperature: Mean values from Accra Meteorological Agency in 2007, 2008 and 2009

Figure 1 shows the pattern of generated electrical energy in each month.

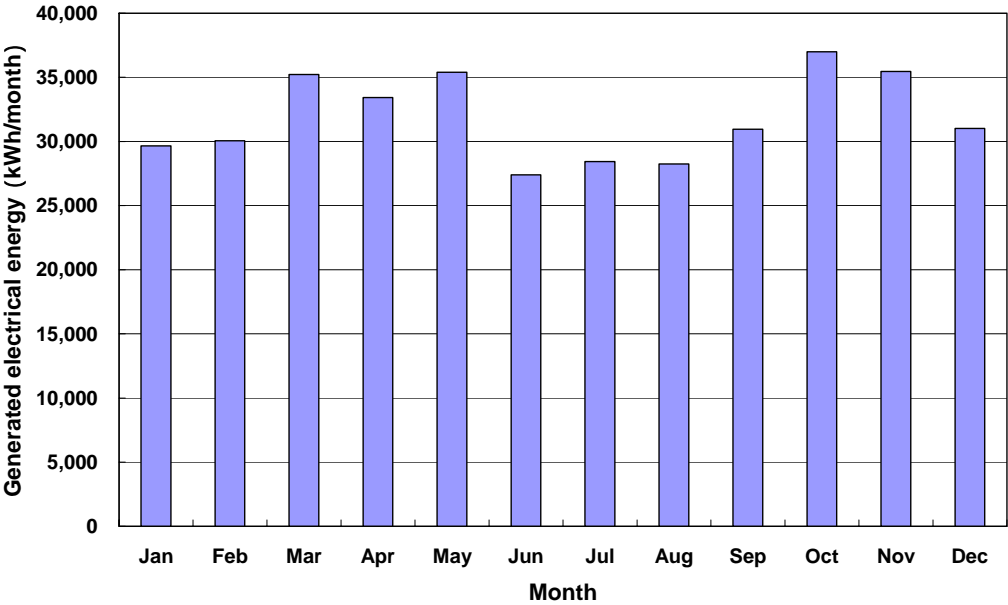


Figure 1 Generated Electrical Energy Estimation

(2) Power consumption reduction effect

The amount of power consumed by NMIMR in 2009 was 1,314,240 kWh/year. According to the above calculation, since the Project PV power generating system can be expected to generate 382,227 kWh/year, NMIMR will be able to reduce its power consumption by 29.1 percent.

[Formula] $382,227 \text{ kWh/year} \div 1,314,240 \text{ kWh/year} = 0.291$ 29.1% reduction

(3) Power tariff saving

NMIMR was supposed to pay 28,080 GHc in electricity tariffs in 2009 (actually, the University of Ghana paid the electricity tariff to ECG representing the institutions of the university). Judging from the above annual power consumption, the unit electricity tariff can be calculated as follows.

$$\text{[Formula]} \quad 28,080 \text{ GHc} \div 1,314,240 \text{ kWh} = 0.021366 \text{ GHc/kWh}$$

Since the Project PV system will enable power consumption to be reduced by 382,227 kWh/year, NMIMR can make a saving of 8,167 GHc per year on electricity tariffs.

$$\text{[Formula]} \quad 0.021366 \text{ GHc/kWh} \times 382,227 \text{ kWh/year} = 8,167 \text{ GHc/year}$$

(4) CO₂ emissions reduction effect

According to statistics from the Ghana Energy Commission, the base unit of CO₂ emissions in power generation in 2007 was 0.575 tCO₂/MWh. As a result of the PV power generation in the Project, it will be possible to reduce CO₂ emissions by 219.8 tons per year.

$$\text{[Formula]} \quad 0.575 \text{ tCO}_2/\text{MWh} \times 382,227 \text{ kWh/year} \div 1,000 = 219.8 \text{ tCO}_2/\text{year}$$

According to statistics by the International Energy Agency (IEA), total CO₂ emissions in Ghana in 2007 were 9,000,000 tons. The amount of CO₂ emission reductions enabled by PV power generation in the Project will be equivalent to $2.44 \times 10^{-3}\%$ of the total CO₂ emissions in 2007.

$$\text{[Formula]} \quad 219.8 \text{ t} \div (9.0 \times 10^6 \text{ t}) = 2.44 \times 10^{-5} \quad 2.44 \times 10^{-3}\%$$