資料－１　調査団員氏名・所属

添付資料

1. 調査団員氏名、所属

(1) 第 1 次現地調査

氏 名	担当業務	現 職
山内 邦裕	総括	独立行政法人 国際協力機構 ガーナ事務所長
村山 博司	計画管理	独立行政法人 国際協力機構 資金協力支援部 実施監理第一課
山口 実	調達監理計画	クラウンエイジェンツ 日本事務所
不二輩 教治	業務主任／系統運用 ／運営維持管理	八千代エンジニヤリング(株)
西川 光久	副業務主任／ 系統連携太陽光発電システム	八千代エンジニヤリング(株)
浦野 勝雄	太陽光発電システム全般	八千代エンジニヤリング(株)
宮本 隆幸	調達計画／積算1	八千代エンジニヤリング(株)
野上 一成	制度・基準／ 環境社会配慮	八千代エンジニヤリング(株)
谷津 哲夫	建築設計1	八千代エンジニヤリング(株)

(2) 第 2 次現地調査

氏 名	担当業務	現 職
不二葦 教治	業務主任／系統運用 ／運営維持管理	八千代エンジニヤリング(株)
西川 光久	副業務主任／ 系統連携太陽光発電システム	八千代エンジニヤリング(株)
浦野 勝雄	太陽光発電システム全般	八千代エンジニヤリング(株)
玉井 昌幸	機材・設備計画	八千代エンジニヤリング(株)
宮本 隆幸	調達計画／積算1	八千代エンジニヤリング(株)
野上 一成	制度・基準／ 環境社会配慮	八千代エンジニヤリング(株)
鶴岡 葉介	建築設計2	八千代エンジニヤリング(株)
赤塚 大輔	業務調整	八千代エンジニヤリング(株)

(3) 概略設計概要説明

氏 名	担当業務	現 職
小川 忠之	総括	独立行政法人 国際協力機構 国際協力専門員（資源・エネルギー）
山口 俊太	計画管理	独立行政法人 国際協力機構 産業開発部 資源・省エネルギー課
不二葦 教治	業務主任／系統運用 ／運営維持管理	八千代エンジニヤリング（株）
西川 光久	副業務主任／ 系統連携太陽光発電システム	八千代エンジニヤリング（株）
浦野 勝雄	太陽光発電システム全般	八千代エンジニヤリング（株）
玉井 昌幸	機材・設備計画	八千代エンジニヤリング（株）

資料－２　調査行程

2. 調査日程

(1) 第１次現地調査

No.	月日	曜日	調査内容		宿泊地
			官ベース	コンサルタント団員（八千代エンジニヤリング㈱）	
			ＪＩＣA/CA (団長/山内、村山、山口)	業務主任/不二輦、西川、浦野、宮本、野上、谷津	
1	12月5日	土	● 東京発（村山、山口）	● 移動{東京 12:00 → ロンドン 15:45 by JL401}	ロンドン
2	12月6日	日	● アクラ着 19:50 by KL589（村山） 21:30 by BA081（山口）	● 移動｛ロンドン 14:50 →アクラ 21:30 by BA081｝	アクラ
3	12月7日	月	● 表敬訪問及びInception Reportの提出・説明： （野口記念医学研究所 (Dr. Nyarko), JICA(事）, University of Ghana, 日本大使館)		アクラ
4	12月8日	火	● 表敬訪問 (MOFEP Mr. Nyarko, ECG (Electricity company of Ghana), MOE(Ministry of Energy))	● 現地調査及び技術協議(野口記念医学研究所)	アクラ
5	12月9日	水	● ミニッツ協議	● 現地調査及び技術協議(野口記念医学研究所)	アクラ
6	12月10日	木	● 表敬訪問（MOEd） ● ミニッツ協議	● 現地調査及び技術協議(野口記念医学研究所)	アクラ
7	12月11日	金	● ミニッツ署名 ● 帰国報告（日本大使館、JICA（事）） ● アクラ発 22:00 by KL590（村山）		アクラ
8	12月12日	土	● アクラ発 8:10 by VK810（山口、コンサルタント団員）		

(2) 第 2 次現地調査

No.	月日	曜日	調　査　内　容 コンサルタント団員（八千代エンジニヤリング㈱） 不二輩、西川、浦野、玉井、宮本、野上、鶴岡、赤塚	宿泊地
1	3月12日	金	• 移動｛Abuja 19:45 →Accra 20:35 by W3061｝	アクラ
2	3月13日	土	• ①資料整理及び団内協議	アクラ
3	3月14日	日	• ①資料整理及び団内協議	アクラ
4	3月15日	月	• ①表敬訪問：JICA(事）、日本大使館、野口記念医学研究所、ガーナ大学、②現地調査	アクラ
5	3月16日	火	• ①現地調査及び技術協議(野口記念医学研究所、環境省、エネルギー委員会)、②現地調達・施工事情調査	アクラ
6	3月17日	水	• ①現地調査及び技術協議(野口記念医学研究所、エネルギー省、気象局)、②現地調達・施工事情調査	アクラ
7	3月18日	木	• ①現地調査及び技術協議(野口記念医学研究所、エネルギー省、エネルギー委員会) • ②現地調達・施工事情調査、	アクラ
8	3月19日	金	• ①現地調査及び技術協議(野口記念医学研究所、ECG)、②現地調達・施工事情調査	アクラ
9	3月20日	土	• ①Technical Memorandum（案）作成、②現地調査結果概要（案）作成	アクラ
10	3月21日	日	• ①Technical Memorandum（案）作成、②現地調査結果概要（案）作成	アクラ
11	3月22日	月	• ①現地調査及び技術協議(野口記念医学研究所) • ②Technical Memorandum（案）作成、③現地調査結果概要（案）作成	アクラ
12	3月23日	火	• ①現地調査及び技術協議(野口記念医学研究所、エネルギー省、環境省) • ②Technical Memorandum（案）作成、③現地調査結果概要（案）作成	アクラ
13	3月24日	水	• ①現地調査及び技術協議(野口記念医学研究所) • ②Technical Memorandum（案）作成、③現地調査結果概要（案）作成	アクラ
14	3月25日	木	• ①Technical Memorandum（案）提出・協議(野口記念医学研究所)、 • ②Technical Memorandumの修正、③現地調査結果概要（案）作成	アクラ
15	3月26日	金	• ①Technical Memorandum 協議・署名(野口記念医学研究所)、②現地調査（ガーナ大学内・電気系統） • ③現地調査結果概要（案）作成	アクラ
16	3月27日	土	• ①現地調査結果概要（案）作成	アクラ
17	3月28日	日	• ①現地調査結果概要（案）作成	アクラ
18	3月29日	月	• ①現地調査結果概要（案）作成 • ②現地再委託先（測量）との契約交渉、③表敬及び報告(野口記念医学研究所、JICA(事）)	アクラ
19	3月30日	火	• ①補足調査、②現地再委託先（測量）との契約締結 • ③移動｛Accra 21:10 → Amsterdam 05:45+1 by KL 590｝	機中泊
20	3月31日	水	• 移動｛Amsterdam 21:00 → Tokyo 15:25+1 by JL 412｝	機中泊
21	4月1日	木	• 成田着　15:25	

(3) 概略設計概要説明

No.	月日	曜日	調査内容		宿泊地
			官ベース団員（小川、山口）	コンサルタント団員（不二輦、西川、浦野、玉井）	
1	7月31日	土	• 他調査より継続	• ①移動{Tokyo 12:15 → Frankfurt 17:20 by JL 407}	フランクフルト
2	8月1日	日	• 他調査より継続	• ①移動｛Frankfurt 10:25 →Accra 14:55 by LH 566｝	アクラ
3	8月2日	月	• ①野口記念医学研究所への表敬訪問及びDraft Reportの提出 • ②ガーナ大学への表敬訪問及びDraft Reportの提出 • ③野口研及び測量会社と計画敷地の再確認 • ④JICAガーナ事務所訪問		アクラ
4	8月3日	火	• ①日本大使館、野口記念医学研究所及びガーナ大学へのDraft Reportの説明と技術協議 • ②測量作業の監理 • ③エネルギー委員会（EC)への本計画の概要説明		アクラ
5	8月4日	水	• ①野口記念医学研究所及びガーナ大学へのDraft Reportの説明と技術協議 • ②野口記念医学研究所及びガーナ大学へ協議議事録の提出と説明 • ③エネルギー省（MOE)への本計画の概要説明		アクラ
6	8月5日	木	• ①野口記念医学研究所及びガーナ大学へのDraft Reportの説明と技術協議 • ②野口記念医学研究所及びガーナ大学と協議議事録内容の協議 • ③協議議事録の修正・変更		アクラ
7	8月6日	金	• ①野口記念医学研究所及びガーナ大学と協議議事録の締結 • ②JICAガーナ事務所へ報告		アクラ
			• ①移動{Accra 17:30 → Dubai 05:50+1 by EK 788｝	• 測量調査の管理	
8	8月7日	土	• ①移動{→ Dubai 05:50+1 by EK 788｝	• ①移動{Accra 21:10 → Amsterdam 05:45+1 by KL 590｝	機中泊
9	8月8日	日	• ①移動{ Dubai 03:15→ Tokyo 18:00 by EK 318｝	• ①移動{Amsterdam 21:00 → Tokyo 15:25+1 by JL 412}	機中泊
10	8月9日	月		• ①移動{→ Tokyo 15:25 by JL 412}	

資料－３　関係者（面会者）リスト

3. 面談者リスト

所属及び氏名	職位
財務経済企画省 **Ministry of Finance and Economic Planning (MOFEP)**	
Mr. Yaw Okyere-Nyako	Director, External Resources Management - Bilateral
野口記念医学研究所 **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
ガーナ大学 **University of Ghana**	
Mr. Philip Azundow	Director, Physical Development and Municipal Service
エネルギー省 **Ministry of Energy (MOE)**	
Mr. Solomon	Deputy Director, Division of Power
Mr. Wisdom Ahiataku-Togobo	Renewable Energy Expert
エネルギー委員会 **Energy Commission**	
Mr. Kwabena A. Otu-Danquah	Chief (Renewable Energy)
Mr. Oscar Amonoo-Neizer	Acting Chief, Power
ガーナ電力公社 **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

在ガーナ日本国大使館
Embassy of Japan in Ghana

茂田　剛	一等書記官
本田　真一	一等書記官、経済協力班長

JICA ガーナ事務所
JICA Ghana Office

木藤　耕一	次長
大草　真紀	企画調査員

資料－４　討議議事録（M/D）

4. 討議議事録(M/D)

(1) 第 1 次現地調査

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 pay 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

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

- 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 1,000m^2 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.

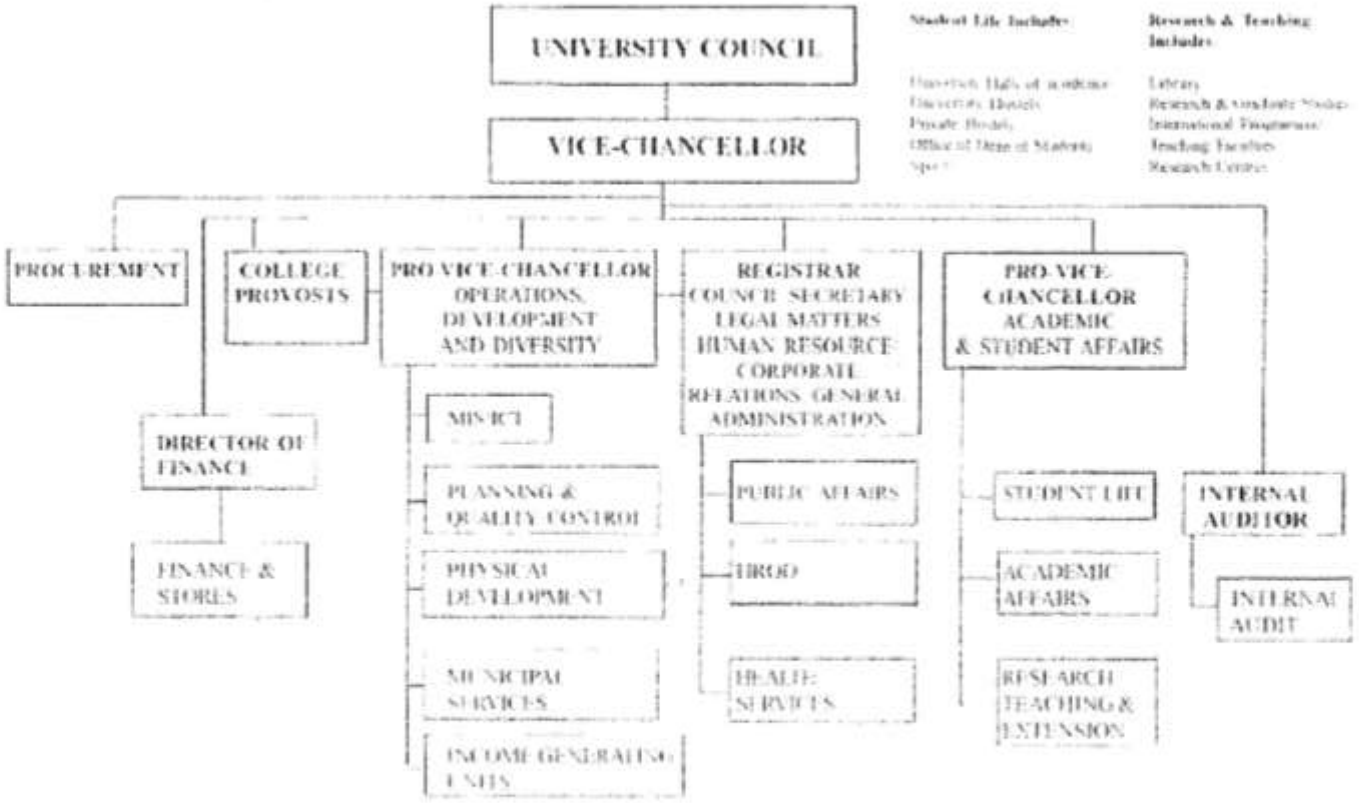
7-8. The Ghanaian side shall provide necessary numbers of counterpart personnel to the Team during the period of their studies in Ghana

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>

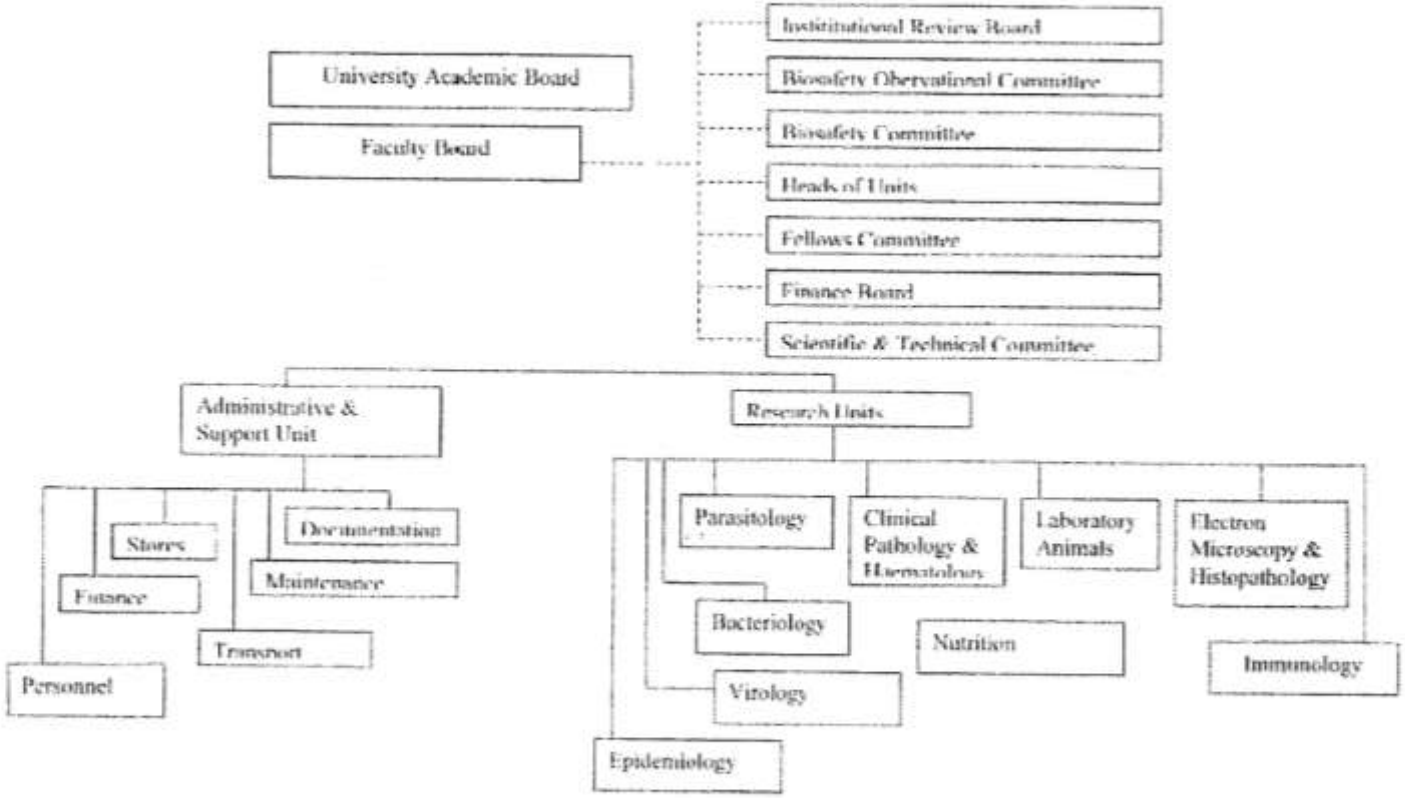
Annex-1 Organization Chart of Responsible Organization
Annex-2 Organization Chart of Implementing Organization
Annex-3 Candidate site of the Project
Annex-4 Program Grant Aid for Environment and Climate Change
Annex-5 General Flow of Program Grant Aid for Environment and Climate Change
Annex-6 Flow of 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 Responsible Organization (University of Ghana)



Annex – 2

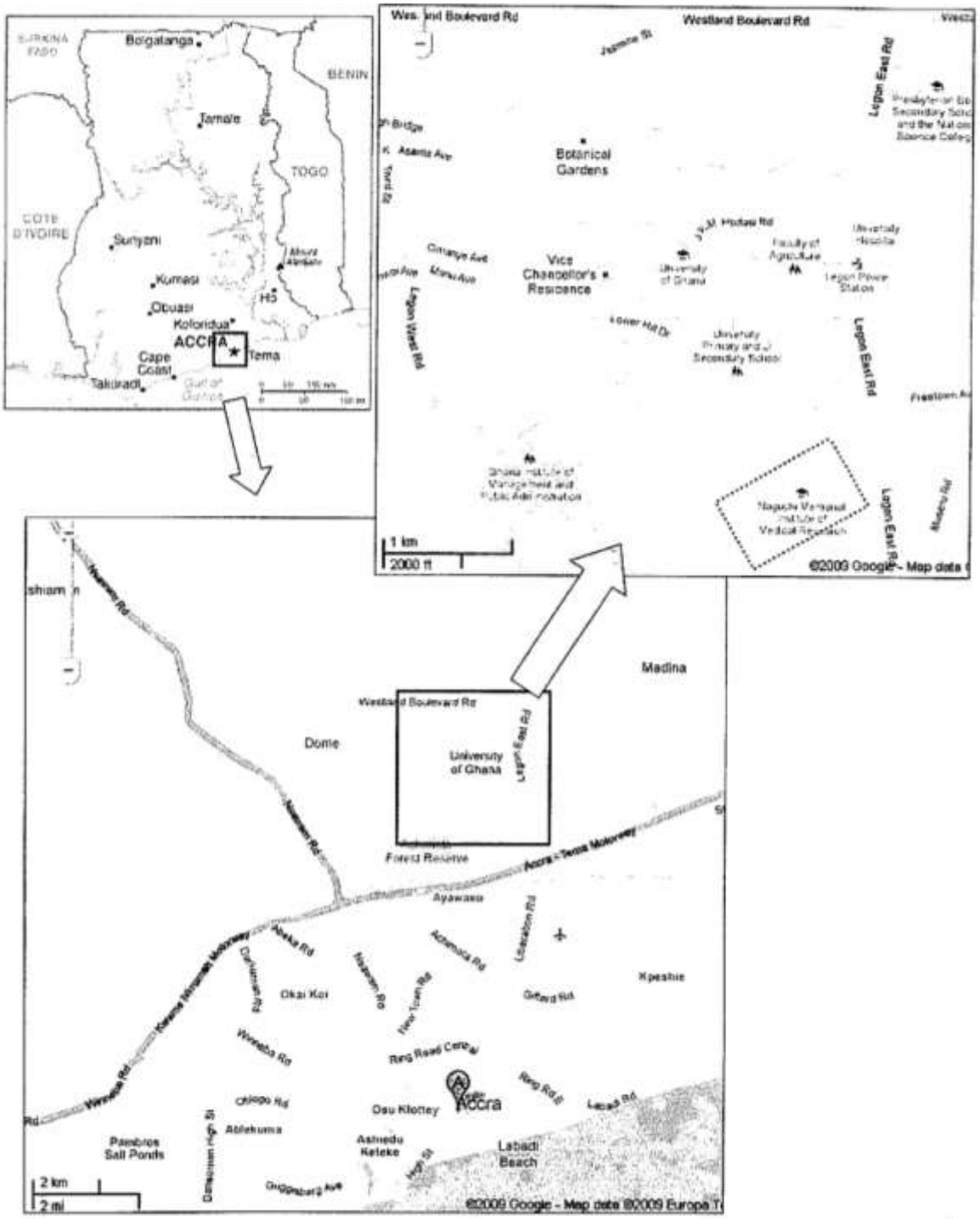
Organization Chart of Implementing Organization
(Noguchi Memorial Institute for Medical Research)



Annex – 3

Candidate Site of the Project

(Location: University of Ghana, Legon, Ghana)



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:

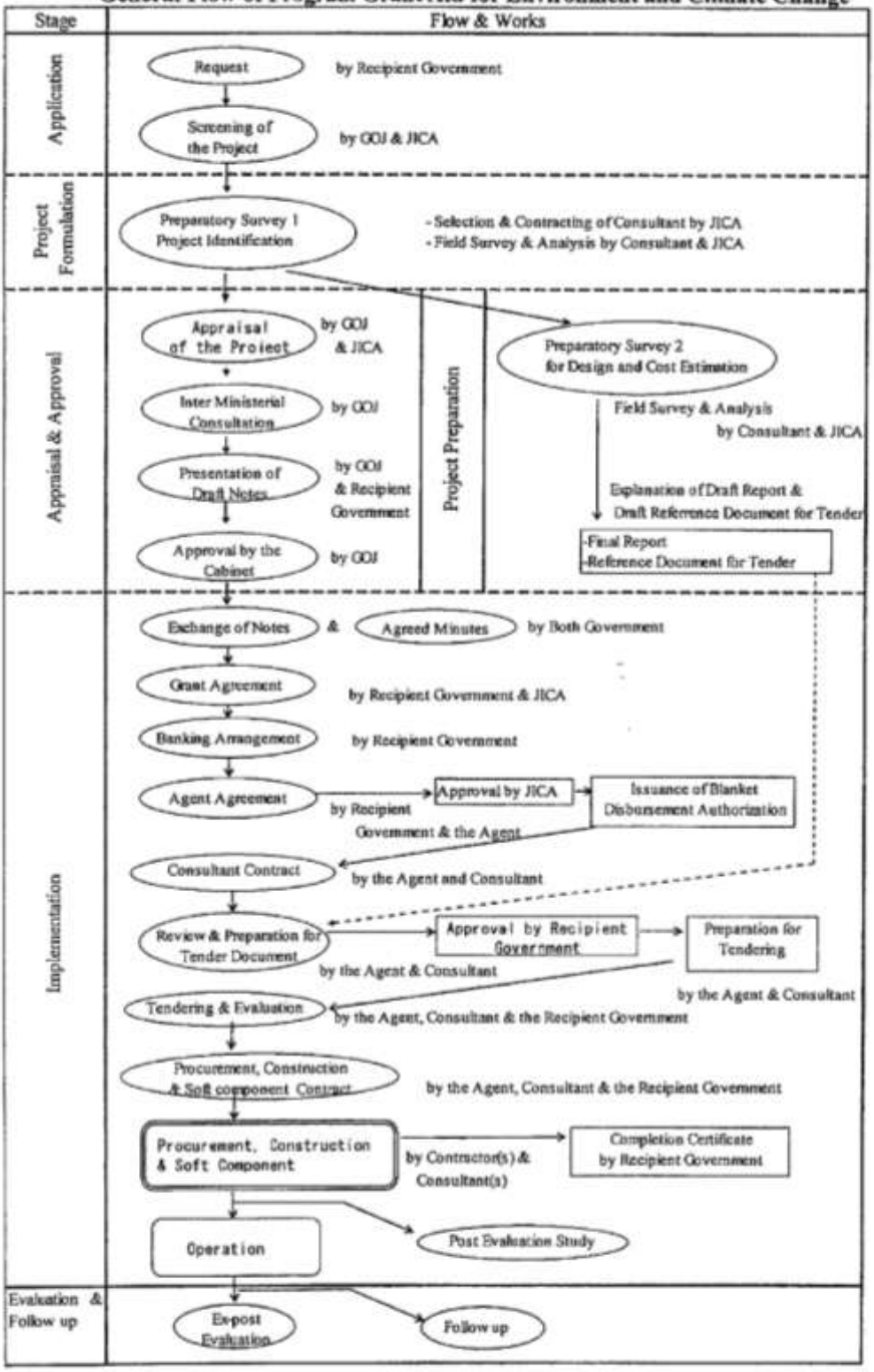
a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.
b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites.
c) To ensure all the expense 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.

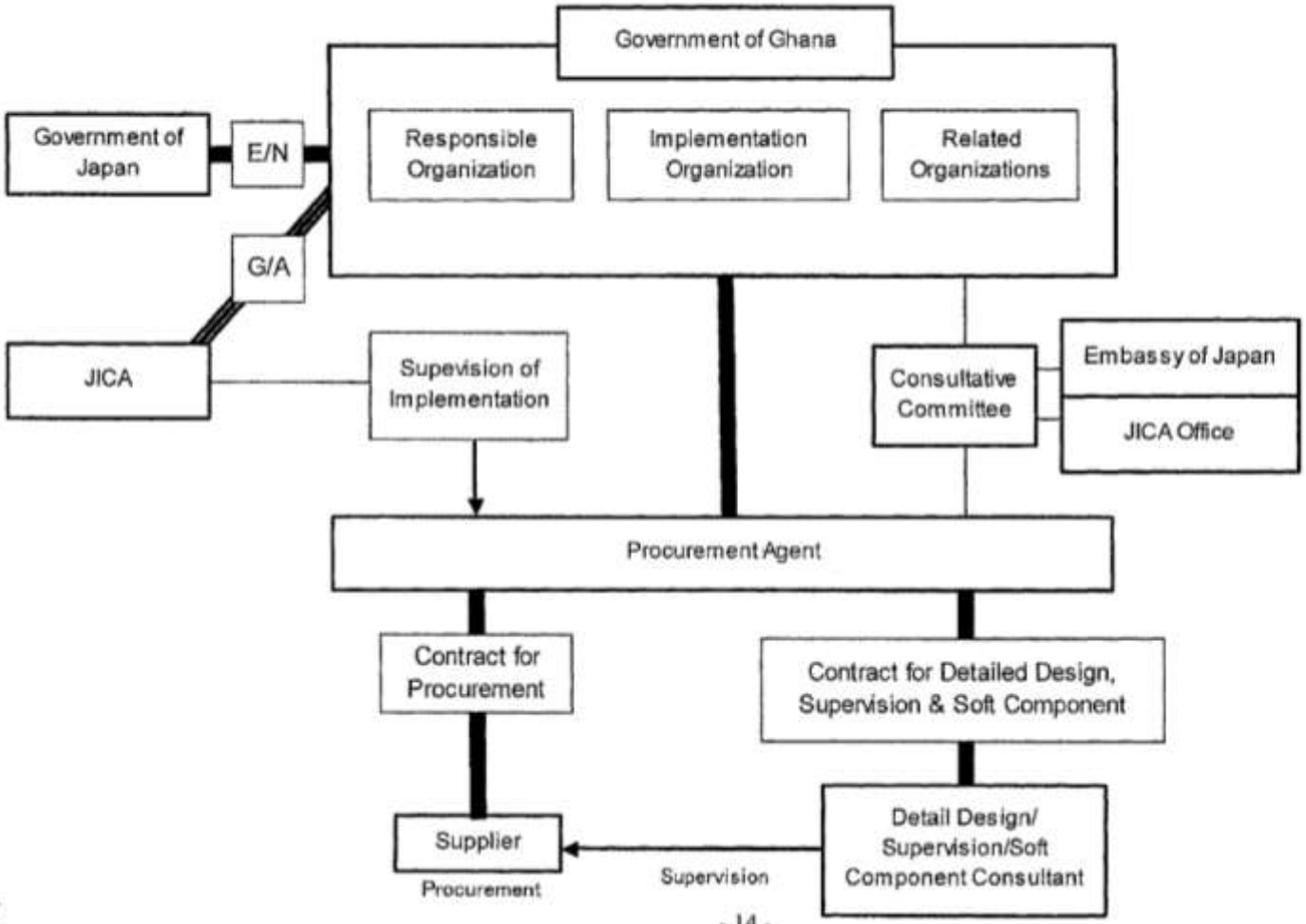
Annex-5

General Flow of Program Grant Aid for Environment and Climate Change

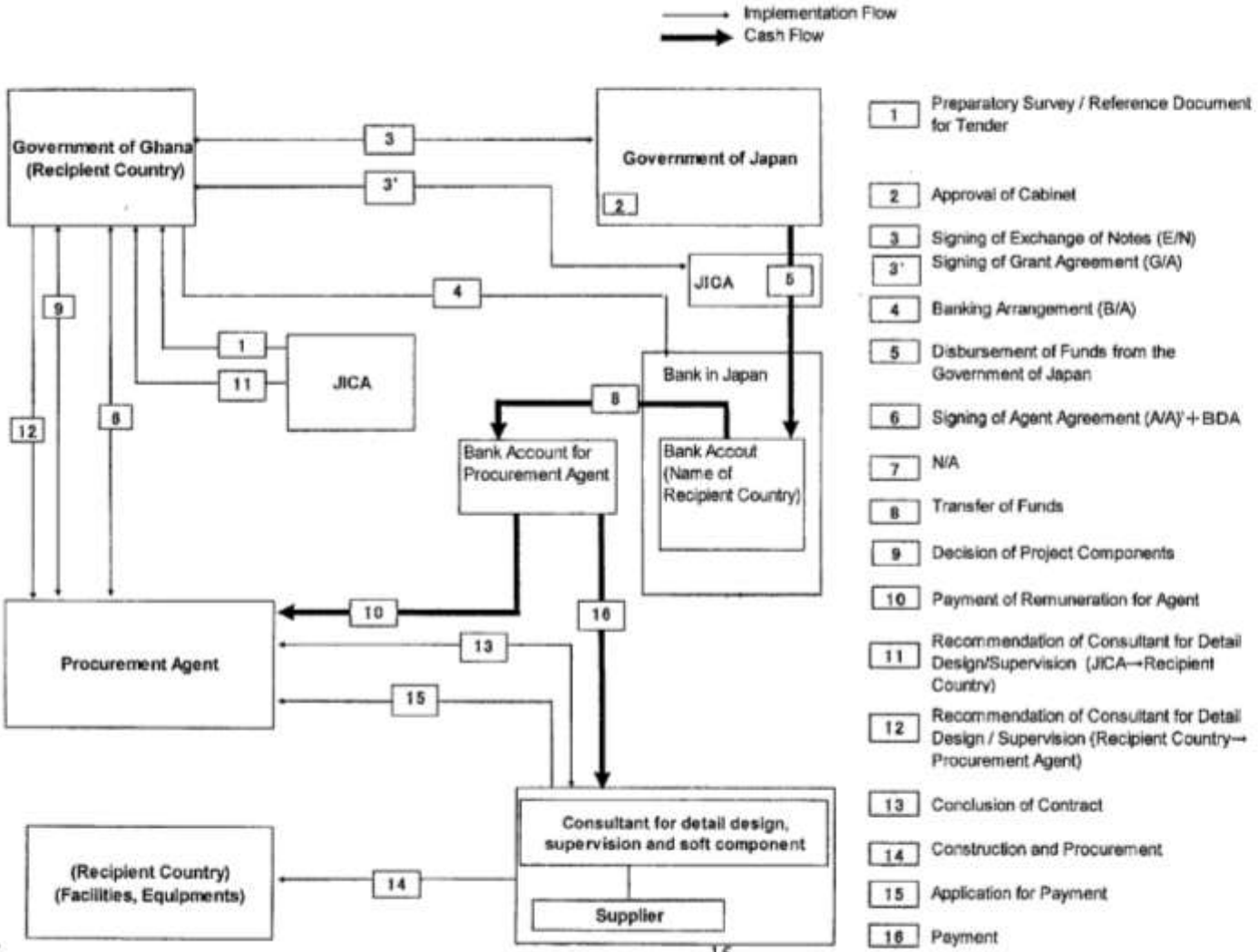


Project Implementation System

Annex-6



Flow of Funds for Project Implementation



Annex-8

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.		●

Annex- 9

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) 概略設計概要説明

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

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,

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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.

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:

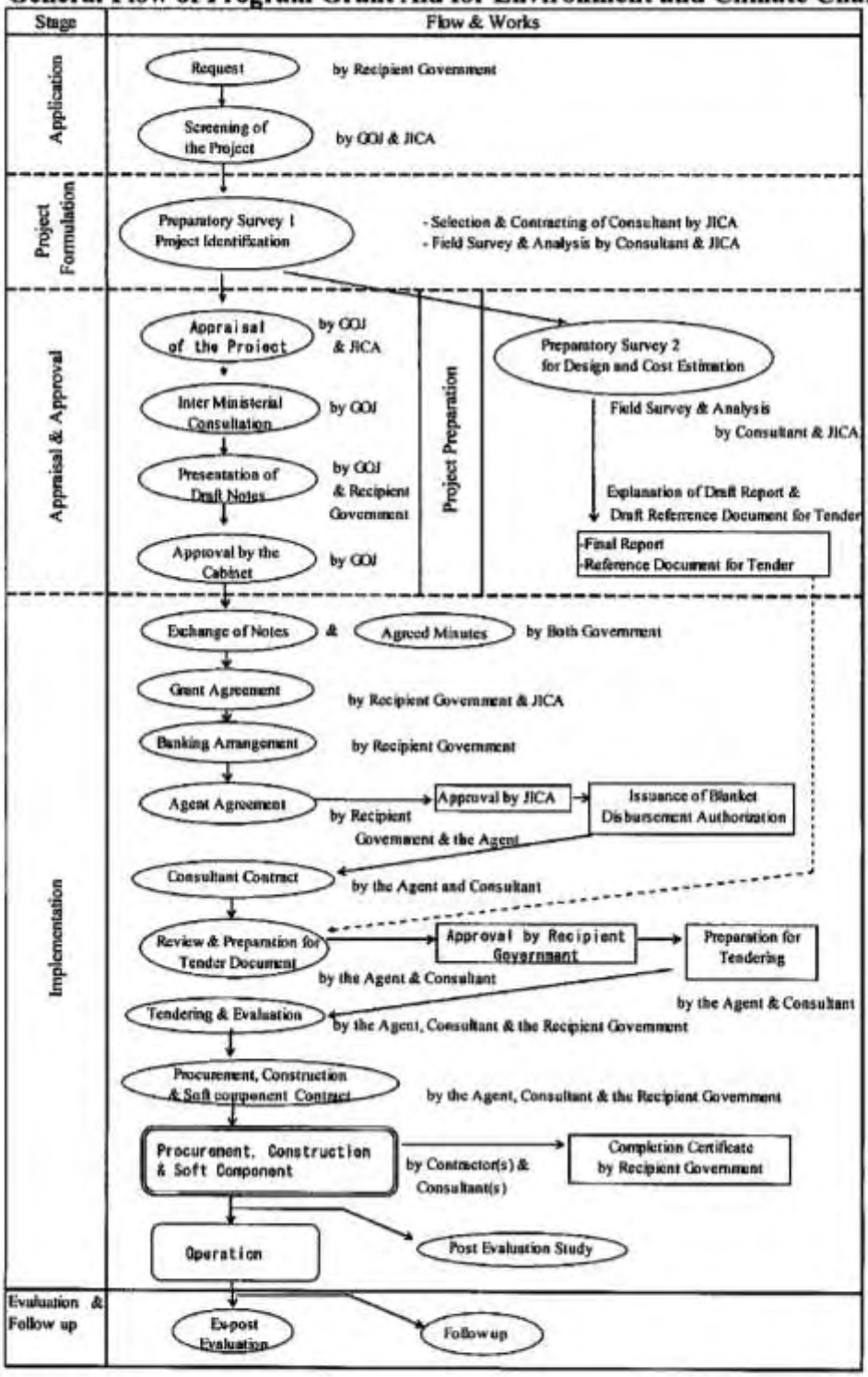
a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.
b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites.
c) To ensure all the expense 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.

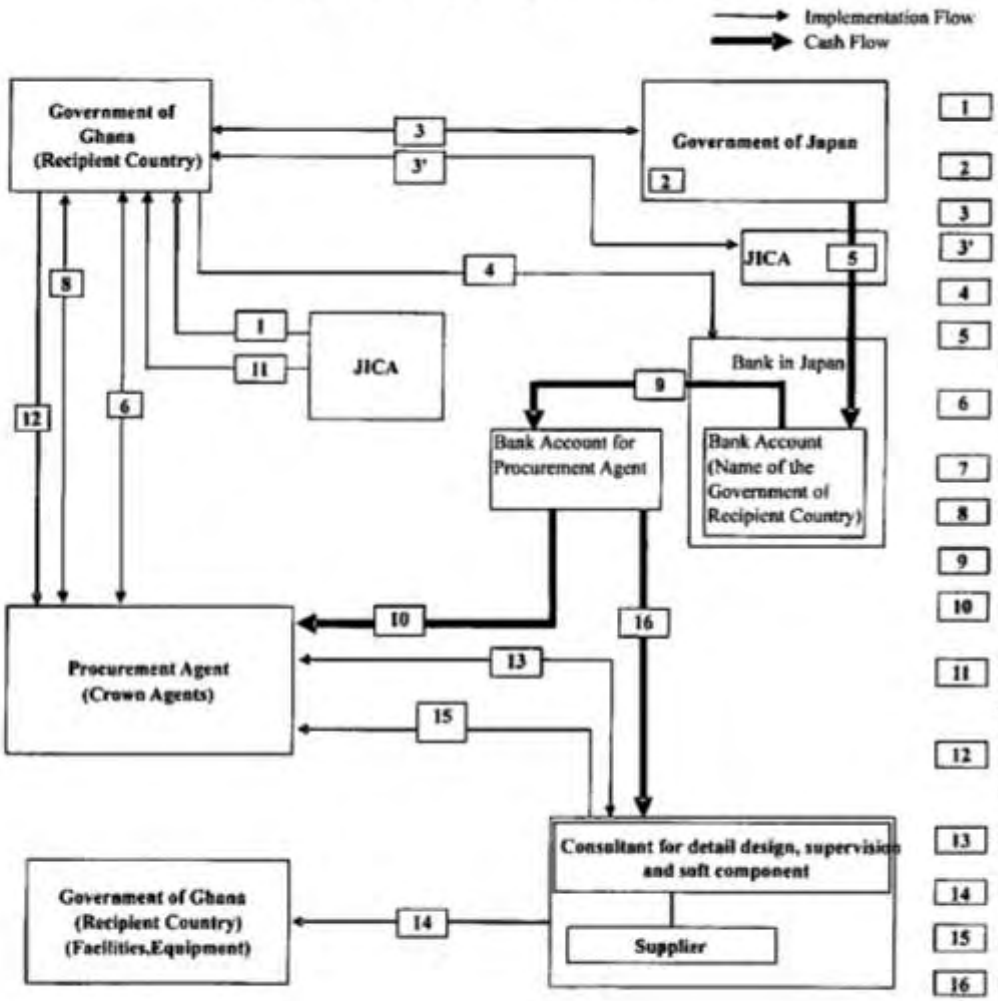
6) "Export and Re-export" of products
The products purchased under the Grant and its accrued interest will not be exported or re-exported from the Recipient.

General Flow of Program Grant Aid for Environment and Climate Change



Project Implementation System

Flow of Funds for Project Implementation



Annex-2

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/㎡, Ambient temperature: 25℃, 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 to210 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

Annex – 3

Project Cost Estimation (Confidential)

This Page is Closed due to the confidenciality

This Page is Closed due to the confidenciality

Annex-4

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		●

17	To allocate necessary budget for operation and maintenance of Equipment procured under the Programme after completion		•

資料－５　事業事前計画表

5. 事業事前計画表

１．案件名（国名）

国名：ガーナ共和国
案件名：太陽光を活用したクリーンエネルギー導入計画
（案件名英文）The Project for Introduction of Clean Energy by Solar Electricity Generation System

２．事業の背景と必要性

(1) 当該国におけるエネルギーセクターの現状と課題

ガーナ共和国（以下「ガ」国と称す）では、1990 年代半ばまではボルタ湖（人造湖）の豊富な水源を利用した水力発電により、国内の電力供給並びにコートジボワール及びトーゴなど近隣国への電力輸出を行っていた。しかしながら、近年は国内電力需要の増加に伴い水力発電のみでは必要な電力供給を賄えず、不足する電力については、火力発電所の建設を推進するほか、コートジボワールからの国際連系線を介した電力融通で補っている。更に、最近では気候変動の影響により渇水が頻繁に発生し、主要電源であるアコソンボ水力発電所の発電量が低下してきている。このため「ガ」国では、エネルギー源の多様化、再生可能エネルギーの導入促進を政策目標として掲げ、エネルギー供給事情の改善と環境負荷の軽減を両立すべく、政策の実現に向けて努力している。このような中、太陽光発電を含む再生可能エネルギーは、温室効果ガス排出量を抑制しながら、電力の安定供給を実現する技術として、その導入に対する支援が期待されている。

(2) 当該国におけるエネルギーセクターの開発政策における本事業の位置づけ

「ガ」国は、気候変動枠組み条約(United Nations Framework Convention on Climate Change) 及び京都議定書を批准し、積極的に気候変動対策に取り組もうとしている。2006 年に策定された戦略的国家エネルギー計画（SNEP：Strategic National Energy Plan 2006-2020）では、2020 年までに発電設備容量に占める再生可能エネルギーの割合を 10%にすることを目標とし、バイオマス、風力、太陽光、小水力等の再生可能エネルギーの導入が進められている。「ガ」国では、従来から地方未電化地域の電化を目的として、配電系統に連系されない小規模な独立型太陽光発電設備の導入が進められてきたが、系統に連系された大規模な太陽光発電システムは未だ導入されていない。本事業は、太陽光発電システムを整備することにより、再生可能エネルギーによる発電量を増加し、エネルギー源の多様化に貢献するとともに、温室効果ガスの削減など気候変動対策にも寄与するものである。

(3) 気候変動対策におけるエネルギーセクターに対する我が国及び JICA の援助方針と実績

我が国は、従前より、排出削減等の気候変動対策に取り組む途上国及び気候変動の悪影響に対して脆弱な途上国への支援を積極的に行ってきており、2008 年には 5 年間で 100 億ドル規模の新たな資金メカニズムを発表している。この新たな資金メカニズムの一環として、2008 年度より途上国の適応策及び緩和策を支援するため、「環境プログラム無償」が新設された。今般、外務省は途上国に対し、太陽光発電等を活用した環境プログラム無償に関する支援ニーズや具体的アイデアにかかる要望調査を実施し、同調査の結果、「ガ」国から本事業にかかる協力要請がなされた。

我が国から「ガ」国への政府開発援助では、基礎的生活分野を中心として「ガ」国の貧困削減努力に対する支援及び地域格差の解決に関するイニシアティブ支援を基本的政策として実施している。電力セクターへの援助も、全国平均で 55%～60%と低い電化率に起因する住環境の悪化や生産性の低下を改善する目的で行われてきた。JICA では、再生可能エネルギーに関して、電化率の低い北部 3 州を対象とした「再生可能エネルギー利用地方電化計画マスタープラン調査」、「太陽光発電普及のための人材育成プロジェクト」(技術協力プロジェクト)を実施している。

(4) 他の援助機関の対応

世界銀行、デンマーク、スペインは、未電化地域を対象として、太陽光発電システムによる電力アクセス向上プロジェクトを実施している。

３．事業概要

(1) 事業の目的（協力プログラムにおける位置づけを含む）

アクラ市において、太陽光発電関連機材を調達し技術者育成支援を行うことにより、発電能力の向上、エネルギー源の多様化、再生可能エネルギー利用に関するガーナ国民の意識啓発を図り、もって気候変動対策において先進国･途上国双方の取組を促す日本のイニシアティブを示すことに寄与する。

(2) プロジェクトサイト/対象地域名

ガーナ大学附属 野口記念医学研究所（利用者数 約 240 名）／アクラ市レゴン地域

(3) 事業概要

1) 土木工事、調達機器等の内容

太陽光発電システム一式（315kW）（太陽電池モジュール、パワーコンディショナー、接続箱、集電箱、遮断器、変圧器、電線類、データ記録装置、発電量表示装置等）

2) コンサルティング・サービス/ソフトコンポーネントの内容

【ソフトコンポーネント】

系統連系型太陽光発電システムに関する基礎知識及び保守点検、緊急時の対応等の維持運営管理に関する研修

(4) 総事業費/概算協力額

(5) 事業実施スケジュール（協力期間）

入札期間を含め約 16 ヶ月（予定）

(6) 事業実施体制（実施機関/カウンターパート）

1) 責任機関：ガーナ大学
2) 実施機関：野口記念医学研究所

(7) 環境社会配慮・貧困削減・社会開発

1) 環境社会配慮

① カテゴリ分類：B

② 影響と緩和・軽減策

本計画の太陽光システムはバッテリーを使用しないシステムを予定しており、廃バッテリー処理に伴う環境への重大な影響はない。敷地造成の際に整地作業や、木々の伐採（または移動）と蟻塚の撤去が必要になるが、いずれも環境影響としては非常に小規模なものである。

2) 貧困削減促進

特に関連する事項は無い

3) ジェンダー

特に関連する事項は無い

(8) 他援助機関等との連携・役割分担

特に無し

(9) その他特記事項

特に無し

４．外部条件・リスクコントロール

(1) 事業実施のための前提条件

実施にあたって、野口記念医学研究所が太陽光パネル据付用地の使用に係る許可をガーナ大学から取得する（2010 年 8 月に取得済み）。

(2) プロジェクト全体計画達成のための外部条件

再生可能エネルギー導入促進のための施策の実施及び財源の確保

５．過去の類似案件の評価結果と本事業への教訓

「太陽光発電プロジェクト利用地方電化の課題と可能性に関する調査（プロジェクト研究）」報告書（2005 年）他において、バッテリーが維持管理の課題となる要素が高いと指摘されている。そのため、廃棄バッテリー処理体制や、将来的にバッテリーを交換する費用を負担可能な実施体制等の確立が必要であるが、体制確立に相当な時間を要する場合もある。本件で調達する太陽光発電システムは電力系統に連系し、バッテリーを極力使用しない維持管理負担の少ないシステムを構築することとする。

６．評価結果

以下の内容により本案件の妥当性は高く、また有効性が見込まれると判断される。

(1) 妥当性

２（２）に記載のとおり、本事業は「ガ」国の戦略的国家エネルギー計画で目指している再生可能エネルギーによる発電設備容量の増加に寄与するものである。また、「ガ」国において最大規模となる系統連系型太陽光発電システムを導入することは、再生可能エネルギー利用に関する啓発の意義が大きく、今後の「ガ」国での再生可能エネルギー導入促進効果が見込めると考えられる。さらに、国際社会全体にとって喫緊の課題である気候変動対策において、先進国・途上国双方の取組を促し、温室効果ガスの排出削減と経済成長の両立を目指す途上国を支援するという日本のイニシアティブを示す意味でも妥当である。

(2) 有効性

1) 定量的効果

指標名	基準値（2010 年）	目標値（2015 年）【事業完成３年後】
送電端電力量（MWh/年）	0	382
CO_2 削減量（t/年）	0	220

2) 定性的効果

再生可能エネルギーの利用促進に関する国民への意識啓発、気候変動対策における日本のイニシアティブの提示

７．今後の評価計画

(1) 今後の評価に用いる主な指標

6.(2) 1)のとおり。

(2) 今後の評価のタイミング

・事後評価　　事業完成３年後

以　上

資料－６　ソフトコンポーネント計画書

6. ソフトコンポーネント計画書

(1) ソフトコンポーネントを計画する背景

ガーナ共和国「太陽光を活用したクリーンエネルギー導入計画」は、ガーナ共和国（以下、「ガ」国）のガーナ大学附属 野口記念医学研究所（NMIMR）を対象サイトとして、系統連系型の太陽光発電設備（出力 315kWp）及び関連する変圧器、所内配電用資機材の調達・据付を行うものである。

「ガ」国では、エネルギーの安定供給とエネルギー安全保障を達成するため、多様なエネルギー源の開発を推進することをエネルギー政策の目標として掲げており、その方策として再生可能エネルギーの導入が進められている。同方針を受けて、「ガ」国では再生可能エネルギーの導入目標として、2020 年までに電力供給における再生可能エネルギーの割合を 10%とすることが定められている。本無償資金協力事業は、「ガ」国における再生可能エネルギー導入の目標達成に資するとともに、「ガ」国政府による気候変動対策（緩和策）として、太陽光を利用した発電を行うことにより火力発電用燃料の使用量並びに温室効果ガスの排出量を削減するものである。

「ガ」国における太陽光発電設備の導入状況は、援助機関が中心となり主に北部各州へ SHS（Solar Home System）、ワクチン保存用 PV[1]冷蔵庫、ソーラーポンプ、PV 街灯などを設置しているほか、系統連系型太陽光発電システム（以下、「PV 連系システム」と称す）としては、スペインの援助により 50kW が MOE (Ministry of Energy)の駐車場の屋根に設置されている。最近ではドイツの援助で EC (Energy Commission)ビルの前庭に 4.5kW の追尾式 PV 連系システムが導入された。このように「ガ」国では、太陽光発電設備の導入が進められているものの、PV 連系システムが導入された実績は 2 件のみであり、「ガ」国における PV 連系システムの運転・維持管理に対する知見は十分とは言えない。

NMIMR では、研究所の電気設備や非常用発電機の日常的な運転・維持管理を行っており、電気設備の運転・維持管理に関する基本的な知見は持ち合わせている。しかしながら、NMIMR に太陽光発電システムが導入されたことはなく、日常の業務を通じて PV 連系システムの運転・維持管理に必要な知識・技術を習得することは困難である。また、配電系統の運用者である ECG（ガーナ電力公社）においても、系統連系型の自家発電設備が配電系統に接続され、運用された経験は乏しいことから、PV 連系システムに対する留意事項、事故対応について十分な知見を有していない。更に、電力の売買を伴わない発電設備の系統連系については、規制や技術基準等が整備されていない。

本ソフトコンポーネントでは、プロジェクト開始時の円滑な立ち上がりを支援することと、PV 連系システムが持続的に運転・維持管理されることを目的とし、実施機関となる NMIMR のメンテナンス部を主な対象として PV 連系システムの運転・維持管理に関する技術移転を実施する。また、太陽光発電設備が連系される配電系統の運用者・維持管理者においても、PV 連系システムの特性を把握しておく必要があることから、大学構内の配電設備の維持管理主体であるガーナ大学施設部、配電系統の運用者である ECG、電力事業に関する規制機関であるエネルギー省やエネルギー委員会に対しても、PV 連系システムの概要、系統運用上の留

[1] PV：Photovoltaic の略で、太陽電池を意味する。

意事項や連系に係る技術要件について、必要な技術移転を行う。

⑵ ソフトコンポーネントの目標

本ソフトコンポーネントの目標は、以下の通りである。下記の目標が達成されることにより、無償資金協力事業の効果が持続的に発現することが期待される。

1) プロジェクトの竣工後、「ガ」国側による PV 連系システムの運転・維持管理が円滑に開始される。

2) PV 連系システムの運転・維持管理が持続的に行われる。

3) 太陽光発電設備が連系された配電系統が、安定的に運用される。

⑶ ソフトコンポーネントの成果

本ソフトコンポーネントで達成すべき成果は、以下の通りである。

表 1 ソフトコンポーネントの成果

目 標	ソフトコンポーネントの成果	対象者
1. プロジェクトの竣工後、「ガ」国側による PV 連系システムの運転･維持管理が円滑に開始される。	1-1 PV 連系システムの運転・維持管理組織が確立される。 1-2 運転・維持管理要員が、PV 連系システムの運転・維持管理技術を習得する。	NMIMR メンテナンス部
2. PV 連系システムの運転・維持管理が持続的に行われる。	2-1 PV 連系システムの運転・維持管理マニュアルがトラブルシューティングを含んで作成される。	NMIMR メンテナンス部
	2-2 PV 連系システムの概要、特性が理解される。 2-3 PV 連系システムのトラブルシューティング方法が確立される。（大学内の配電系統が対象）	ガーナ大学 施設部
3. 太陽光発電設備が連系された配電系統が､安定的に運用される。	3-1 PV 連系システムの概要、特性（逆潮流を含む）が理解される。	ECG エネルギー省 エネルギー委員会
	3-2 PV 連系システムのトラブルシューティング方法が確立される。（ECG の配電系統が対象）	ECG

⑷ 成果達成度の確認方法

本ソフトコンポーネントの成果は､作成された運転･維持管理マニュアルと参加者のレポートを確認することにより把握する。表 2 に活動内容別の成果確認方法を示す。マニュアルでは、運転・維持管理に係る組織と役割、日常管理、定期点検、トラブルシューティング等、必要な項目が全て網羅され、技術的な内容が誤りなく記載されていることを確認するとともに、必要に応じて助言、指導を行う。レポートでは、技術移転のテーマ毎に受講者が理解した内容を記述させ､講義内容の理解度を評価する。なお､理解が十分でない項目については､補足講義を行う。

表 2 ソフトコンポーネントの成果と確認方法

対象者	ソフトコンポーネントの成果	達成度確認方法
NMIMR メンテナンス部	• PV 連系システムの運転・維持管理組織が確立される。 • 運転・維持管理要員が、PV 連系システムの運転・維持管理技術を習得する。 • PV 連系システムの運転・維持管理マニュアルがトラブルシューティングを含んで作成される。	• マニュアル • レポート • マニュアル
ガーナ大学 施設部	• PV 連系システムの概要、特性が理解される。 • PV 連系システムのトラブルシューティング方法が確立される。（大学内の配電系統が対象）	• レポート • マニュアル
ECG	• PV 連系システムの概要、特性（逆潮流を含む）が理解される。 • PV 連系システムのトラブルシューティング方法が確立される。（ECG の配電系統が対象）	• レポート • マニュアル
エネルギー省	• PV 連系システムの概要、特性（逆潮流を含む）が理解される。	• レポート
エネルギー委員会	• PV 連系システムの概要、特性（逆潮流を含む）が理解される。	• レポート

(5) ソフトコンポーネントの活動（投入計画）

1) ソフトコンポーネントの内容と活動

ソフトコンポーネントの活動内容は表 3 に示したように、太陽電池の基礎から、運転、維持管理、モニタリングまでカバーする。技術移転の手法は、座学、演習（受講者によるマニュアル作成）と機材を使用した実習を用いる。実習にて使用する機材は、NMIMR へ導入予定の太陽電池モジュール、計測器、工具類を活用する。なお、無償資金協力により NMIMR に導入される PV 連系システムでは、配電系統側への逆潮流は発生しないが、「ガ」国で将来的に逆潮流を含む PV 連系システムが導入されることを想定し、逆潮流に関する内容も技術移転の項目に含めることとする。

表 3　ソフトコンポーネントの活動内容と技術移転方法

目　標	ソフトコンポーネントの成果	活動内容	技術移転方法	対象者
1. プロジェクトの竣工後、「ガ」国側による PV 連系システムの運転･維持管理が円滑に開始される。	1-1 PV 連系システムの運転･維持管理組織が確立される。	• 運転維持管理実施者の責任内容の明確化 • 運転維持管理体制の評価	• 座学 • 座学、グループ演習	NMIMR メンテナンス部
	1-2 運転・維持管理要員が、PV 連系システムの運転・維持管理技術を習得する。	• PV システムの原理と基礎知識の移転 • PV 連系システムの特徴及び保護機能（逆潮流を含む）に係る講義 • 運転管理技術の移転 • 維持管理技術の移転 • 定期点検手法の技術移転 • モニタリング	• 座学 • 座学 • 実習（実機による運転操作） • 実習（点検リストの作成、点検、補修） • 実習（絶縁抵抗、開放電圧測定を含む） • 実習（運転データの記録・評価、設備の状態監視）	NMIMR メンテナンス部
2. PV 連系システムの運転・維持管理が持続的に行われる。	2-1 PV 連系システムの運転･維持管理マニュアルがトラブルシューティングを含んで作成される。	• 「ガ」国側との相互協力による運転維持管理マニュアルの作成 • トラブルシューティング、運転維持管理マニュアルの適正化	• 座学、演習(マニュアル作成) • 実習（マニュアルに基づく運転操作、事故想定訓練）	NMIMR メンテナンス部
	2-2 PV 連系システムの概要､特性が理解される。 2-3 PV 連系システムのトラブルシューティング方法が確立される。(大学内の配電系統が対象)	• PV 連系システムの特徴及び保護機能（逆潮流を含む）に係る講義 • トラブルシューティング（逆潮流を含む）、運転維持管理マニュアルの適正化	• 座学 • 実習（マニュアルに基づく運転操作、事故想定訓練）	ガーナ大学 施設部
3. 太陽光発電設備が連系された配電系統が､安定的に運用される。	3-1 PV 連系システムの概要、特性（逆潮流を含む）が理解される。	• PV 連系システムの特徴及び保護機能（逆潮流を含む）に係る講義 • PV 連系システム導入時の検討課題（逆潮流を含む）	• 座学 • 座学	ECG エネルギー省 エネルギー委員会
	3-2 PV 連系システムのトラブルシューティング方法が確立される。（ECG の配電系統が対象）	• トラブルシューティング（逆潮流を含む）、運転維持管理マニュアルの適正化	• 実習（マニュアルに基づく運転操作、事故想定訓練）	ECG

2) 投入計画

① 日本側の投入計画

本ソフトコンポーネントでは、表 3 の活動を実施することにより、実施機関である NMIMR が PV 連系システムの運転・維持管理方法を具体的に理解し、実践するために必要な技術を移転する。また、大学構内の配電設備の運用者であるガーナ大学施設部、配電系統の運用者である ECG や、電力システムに関する監督、規制機関であるエネルギー省、エネルギー委員会に対しても、PV 連系システムの概要や、運用上の留意事項について、技術移転を行う。受注コンサルタントは、指導技術者 1（PV システム）、指導技術者 2（系統連系）の 2 名を表 4 に示す期間「ガ」国に派遣し、技術移転を行う。

表 4　ソフトコンポーネントに係る投入計画

名称		格付	派遣期間	渡航回数	作業内容
1.	運転維持管理体制の構築				
	指導技術者 1（PV システム）	3 号	0.50 月	1 回	実施機関内の運転維持管理体制の構築
	指導技術者 2（系統連系）	3 号	0.50 月	1 回	電力事業者との相互協力体制の構築
2.	技術トレーニング				
	指導技術者 1（PV システム）	3 号	1.00 月	1 回	PV システムの運転維持管理技術の移転
	指導技術者 2（系統連系）	3 号	1.00 月	1 回	商用系統との連系に関する技術の移転
3.	モニタリング				
	指導技術者 1（PV システム）	3 号	0.50 月	1 回	PV システムに関する技術の習得状況の評価
	指導技術者 2（系統連系）	3 号	0.50 月	1 回	系統連系に関する技術習得状況の評価

② 「ガ」国側の投入計画

「ガ」国側の投入として、ソフトコンポーネントの受け皿となる受講者の任命と講義への参加、運転・維持管理組織の立ち上げ、ソフトコンポーネントを円滑に実施するための運営組織の設立等が必要となる。具体的には、以下の通りである。

a PV システム運営委員会（仮称）

本ソフコンの開始後、NMIMR メンテナンス部は、ソフトコンポーネントの円滑な実施とソフトコンポーネント終了後の持続的運用を目的とした「PV システム運営委員会（仮称）」を速やかに設置する。同委員会は、ソフトコンポーネントの実質的受け皿となり、またソフトコンポーネントの達成状況把握、意見交換、課題討議の場も兼ねることから、ソフコン期間中には定期的に委員会を開催する。PV システム運営委員会は本ソフコン計画終了後、本計画機材の運転・維持管理が持続的かつ円滑に行われるよう、PV ワーキンググループを指導する。PV ワーキンググルーは同委員会に PV システムの運転・維持管理の状況を報告し、必要なときは指導・助言を受ける。

PV システム運営委員会は NMIMR（野口記念医学研究所）内に事務局を置き、MOE、EC、ECG、ガーナ国立大学、NMIMR の 5 機関より構成される。メンバーは各機関の担当部署メンバーで構成され、各機関 1 名～2 名で構成する。PV システム運営委員会の組

織を図 1 に示す。

PV システム運営委員会は、表 5 に示す実施体制に従って運営するとともに、「ガ」国における PV 連系システムの普及に備えて下記事項を討議する。

- PV 連系システムの運転・維持管理に関する課題
- PV 連系システムが電力会社の配電系統運用、電力品質に与える影響
- PV 連系システムを「ガ」国で普及させる上での障害
- PV 連系システムを「ガ」国で普及させるための法的規制
- PV 連系システムを「ガ」国で普及させるための技術基準(逆潮流を含む)

b　PV ワーキンググループ（PVWG）案

PV ワーキンググループ（以後 PVWG と称す）は PV システム運営委員会の下部組織として設立し、PV システム運営委員会の指導・監督の下、PV 連系システムの運転・維持管理を実践する。

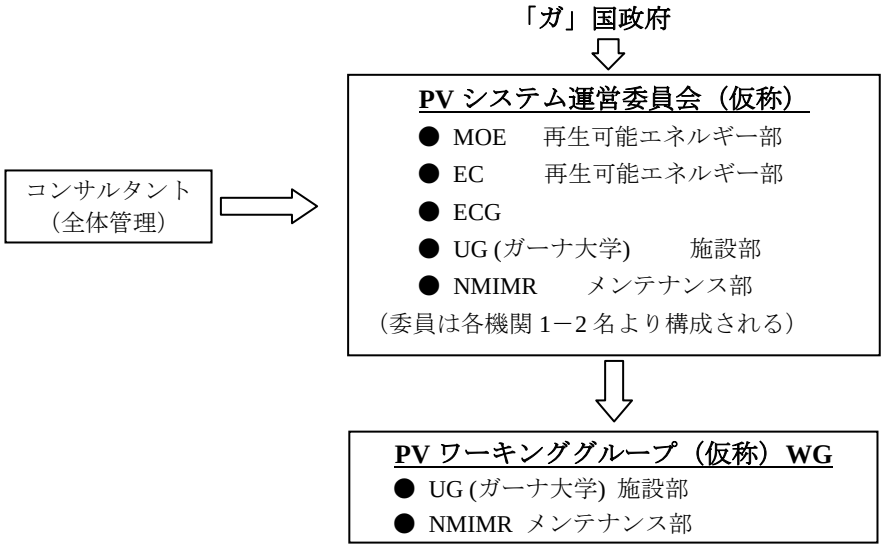


図 1　PV システム運営委員会実施体制（案）

PV システム運営委員会、PV ワーキンググループの実施体制（案）を表 5 に示す。

表 5　PV システム運営委員会実施体制（案）

	日本人コンサルタント	PV システム 運営委員会	PV ワーキング グループ
人数	2 名	5－10 名	3－5 名
役割	全体の進捗状況管理	業務全体の管理	システムの維持管理
ｿﾌﾄｺﾝﾎﾟｰﾈﾝﾄでの役割	説明	開催	開催、参加
維持管理マニュアル	助言	原案チェック	原案作成
運転管理、分析	助言	データ分析、考察	運転操作、データ分析
維持管理フォローアップ	管理指導	維持管理報告	維持管理報告
報告先	日本大使館 JICA ガーナ事務所	JICA ガーナ事務所	PV システム 運営委員会

(6) ソフトコンポーネントの実施リソースの調達方法

無償資金協力で調達・据付される PV 連系システムの主要機器は日本製であることから、ソフトコンポーネントで派遣する技術者は、日本の PV 製品、システムに精通している必要がある。「ガ」国内にも太陽光発電設備の据付を行う技術者はいるものの、欧州や中国の製品しか取り扱ったことがなく、また系統連系についても十分な経験を有していない。このため、ソフトコンポーネントの実施リソースとしては、日本の PV システムや系統連系を熟知した受注コンサルタントが直接支援する方式を採用する。

(7) ソフトコンポーネントの実施工程案

ソフトコンポーネント実施工程を表 6 に示す。

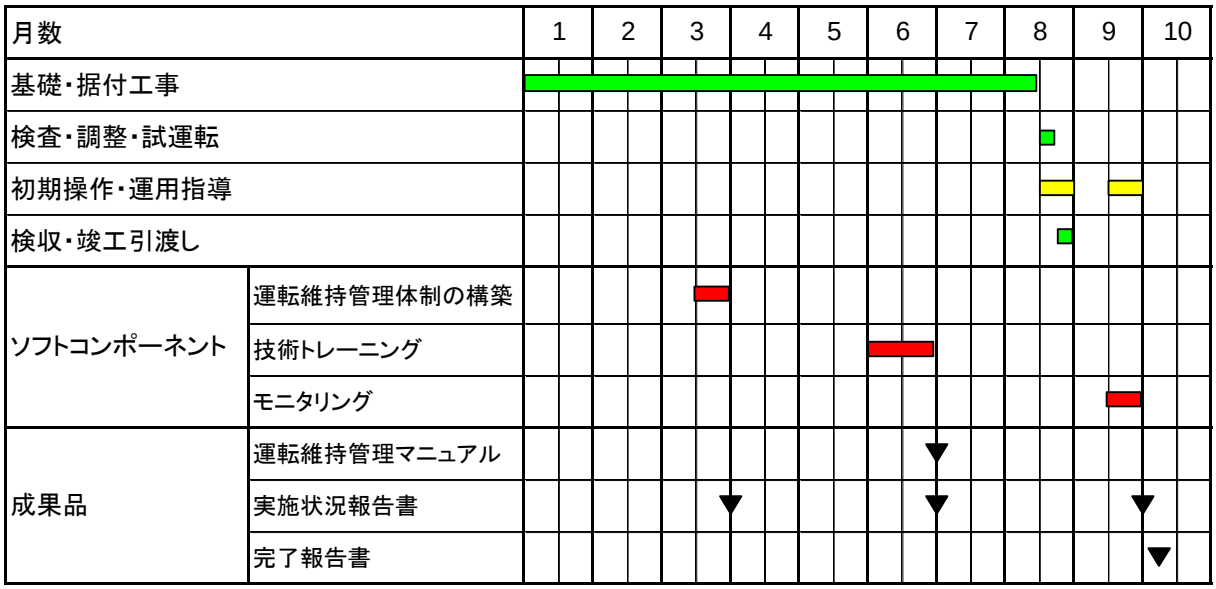
日本より派遣された技術者は、表 6 のとおりそれぞれのカテゴリーごとに、ソフトコンポーネントを実施する。各カテゴリーの実施時期については、以下のとおりである。

運転維持管理体制の構築： 維持管理体制構築の支援を目的に行うこと。機材据付前に維持管理体制を明確化させておくことは、設備据付時に当事者意識を喚起できることから、設備据付以前に実施する。

技術トレーニング： 据付・点検・運転等については実設備を利用し行う。設備が運開するまでに備えておくべき維持管理マニュアル等について整備するため、据付工事の半ばから設備運開前に実施する。

モニタリング： 「ガ」国側が自主的に維持管理できているかを確認することに焦点をおき実施するため、据付完了約 1 ヶ月後を目途に実施する。

表 6　ソフトコンポーネントの実施スケジュール



(8) 成果品

本ソフトコンポーネントの成果品は表 6 に記載したように、運転維持管理マニュアル（トラブルシューティングを含む）、実施状況報告書（施主向けには英文 Progress Report）、完了報告書（施主向けには英文 Final Report）、並びに技術移転に使用した教材類である。

(9) ソフトコンポーネントの概算事業費

本ソフトコンポーネントの概略事業費は 17,119 千円であり、内訳は表 7 に示す通りである。

表 7　ソフトコンポーネントの概略事業費

項　目	金額（千円）
直接人件費	3,112
直接経費	10,024
間接費	3,983
合　計	17,119

(10) 相手国実施機関の責務

1) NMIMR（野口記念医学研究所）は、本ソフトコンポーネント実施に協力する PV システム運営委員会を設置する。
2) NMIMR は、本ソフトコンポーネント実施に必要となる会議室等を用意する。
3) NMIMR は、本ソフトコンポーネントに必要な人員を提供する。
4) PV システム運営委員会は、コンサルタントと協議し、運転維持管理マニュアルの作成を自ら実施する。また、システムの運転開始後、実情に応じてマニュアルの改訂、更新を行う。
5) NMIMR は、運転維持管理マニュアルに基づき、PV 連系システムを維持管理する。PV システム運転管理責任者などが異動する場合は、ソフトコンポーネントの成果品を活用し、後任者へ技術移転を行う。
6) PV システム運営委員会は、維持管理マニュアルに基づいた点検の実績報告書を JICA ガーナ事務所へ提出する。

資料－７　プロジェクトの裨益効果

7.　プロジェクトの裨益効果

1. 推定発電電力量

本計画で設置する系統連系型太陽光発電システムの定格容量は 315 kWp である。推定発電電力量の算出式は次式を用い、月平均日射量は表 1 に示す日射量（南 5 度傾斜面）を用いる。

$Ep = \Sigma (H_A / Gs)* K * P$

（Σ は月別に算出した推定発電量の積算値を示す）

ここで

・Ep = 推定年間発電量 (kWh/年)

・H_A = 設置面の月平均日射量 (kWh/m^2/日)

・Gs = 標準日射強度（$1kW/m^2$）

・P = 太陽電池容量

・K = 損失係数 = Kd * Kt * η_{INV}

* 直流補正係数 Kd :太陽電池の表面の汚れ、太陽の日射強度が変化することによる損失の補正、太陽電池の特性差による補正を含み、0.8 と想定した。

* 温度補正係数 Kt : 日射により太陽電池の温度が上がり、変換効率が変化するための補正係数。

$Kt = 1 + \alpha (Tm - 25) / 100$

ここに、α: 最大出力温度係数 ($\%・℃^{-1}$) = - 0.5 ($\%・℃^{-1}$) [結晶系]

Tm: モジュール温度 (℃) = Tav + ΔT

Tav: 月平均気温 (℃)

ΔT: モジュール温度上昇 (℃)

裏面開放形	18.4
屋根置き形	21.5

ΔT：18.4 ℃

* インバータ効率 ηINV: インバータの交直変換効率。今回は 0.94 とした。

本計画の太陽光発電システムが停止することなく稼動した場合、年間 382,227 kWh の発電量が期待できる。

表 1　推定発電量計算

項目	単位	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月	合計
日射量	kWh/m^2/日	4.53	5.11	5.41	5.29	5.41	4.29	4.29	4.26	4.83	5.62	5.59	4.75	
月日数	日	31	28	31	30	31	30	31	31	30	31	30	31	
月間日射量	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	
平均最高気温	℃	30.6	30.9	31.1	30.5	30.3	27.7	26.9	26.7	27.4	28.8	30	30.1	
平均気温	℃	28.3	29.3	29.3	28.8	28.4	26.8	26.1	26	26.3	27.3	28.1	28.8	
モジュール温度 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	
温度補正係数 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	
損失係数 K		0.670	0.667	0.667	0.669	0.670	0.676	0.679	0.679	0.678	0.674	0.671	0.669	
太陽電池出力	kW	315	315	315	315	315	315	315	315	315	315	315	315	
発電量	kWh/月	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

注）平均気温はアクラ気象庁：2007,2008,2009 年の平均気温の平均値

図 1 は月毎の推定発電量のパターンを示したものである。

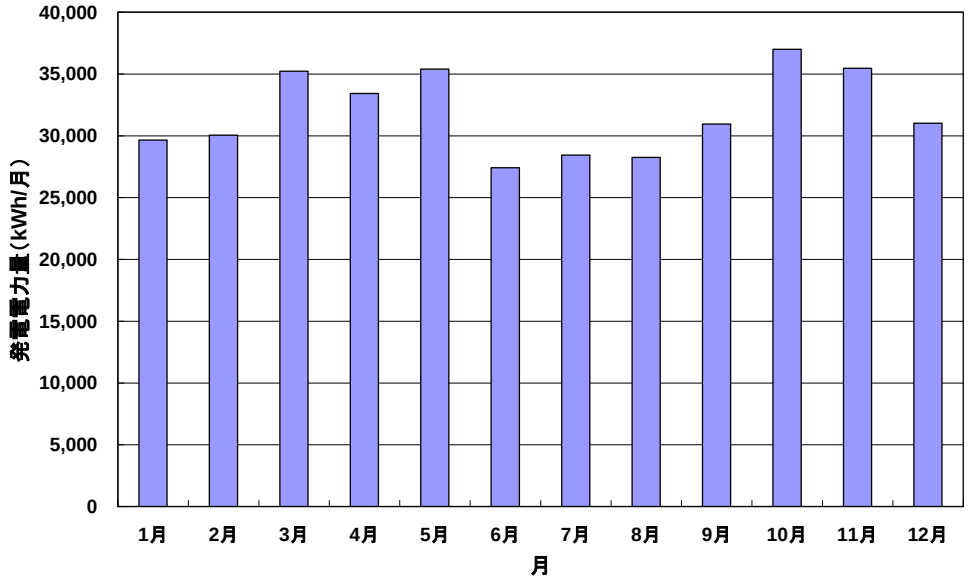


図 1　推定発電量

2. 電力使用量削減効果

2009 年における野口記念医学研究所の使用電力量は、1,314,240 kWh/年であった。上述の試算により、本計画の太陽光発電システムで 382,227 kWh/年の発電量が期待できることから、野口記念医学研究所は年間で 29.1%の電力使用量が削減できる。

［計算式］382,227 kWh/年÷1,314,240 kWh/年＝0.291 → 29.1%削減

3. 電力料金削減効果

2009 年における野口記念医学研究所の電気料金は、28,080 ガーナセディ（実際にはガーナ大学が ECG に支払う）であった。上述の年間電力使用量から、電気料金単価は以下の通り計算できる。

［計算式］28,080 ガーナセディ÷1,314,240 kWh＝0.021366 ガーナセディ/kWh

本計画の太陽光発電により削減できる電力量は 382,227 kWh/年であることから、ガーナ大学は年間で 8,167 ガーナセディの電気料金が削減できる。

［計算式］0.021366 ガーナセディ/kWh×382,227 kWh/年＝8,167 ガーナセディ/年

4. CO_2 排出量削減効果

「ガ」国エネルギー委員会の統計によれば、2007 年における発電の CO_2 原単位は 0.575 tCO_2/MWh である。本計画の太陽光発電により、年間で 219.8 t の CO_2 排出量が削減される。

［計算式］0.575 tCO_2/MWh×382,227 kWh/年÷1,000＝219.8 tCO_2/年

国際エネルギー機関（IEA）の統計によれば、2007 年の「ガ」国における総 CO_2 排出量は 9.0 百万トンである。本計画の太陽光発電による CO_2 排出削減量は、2007 年の総 CO_2 排出量の 2.44×10^{-3}%に相当する。

［計算式］219.8 t÷(9.0×10^{6} t)＝2.44×10^{-5} → 2.44×10^{-3}%

資料－８　参考資料／入手資料リスト

8. 収集資料リスト

調査名： ガーナ共和国 太陽光を活用したクリーンエネルギー導入計画準備調査

番号	名 称	形態 図書・ビデオ・ 地図・写真等	ｵﾘｼﾞﾅﾙ・ ｺﾋﾟｰ	発 行 機 関	発行年
1	National Energy Policy	図書	コピー	Ministry of Energy, Ghana	Nov. 2009
2	University of Ghana-Legon Master Plan	図書	コピー	University of Ghana	Oct. 2009
3	Organization Structure for University of Ghana	図書	コピー	University of Ghana	Dec. 2009
4	Noguchi Memorial Institute for Medical Research Organizational Chart	図書	コピー	Noguchi Memorial Institute for Medical Research	Dec. 2009
5	Annual Budget and Breakdown Including Cost for O&M	図書	コピー	Noguchi Memorial Institute for Medical Research	Dec. 2009
6	Ghana Gazette, 13th November 2007 (Electricity Tariff of ECG)	図書	コピー	Government of Ghana	Nov. 2007
7	Basic Statistics	図書	コピー	University of Ghana	Mar. 2009
8	ガーナ野口研 1 期・2 期 竣工図〈電気〉	図面	コピー	株式会社久米設計	Mar. 1998
9	ガーナ野口研 既存図〈電気〉	図面	コピー	株式会社久米建築事務所	Mar. 1977
10	Power Schematic Diagram of H. T. Distribution Network (Power Station at Legon _ ECG)	図面	コピー	University of Ghana	
11	Technical Drawings for the Project for Supply of Noguchi Memorial Institute for Medical Research	図書	コピー	Noguchi Memorial Institute for Medical Research	Nov. 2009
12	Drawings for the Project for Improvement of Noguchi Memorial Institute for Medical Research (Phase Ⅱ)	図面	コピー	株式会社久米設計	Nov. 1998