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## 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
中園 雅巳	総括	独立行政法人 国際協力機構 産業開発・公共政策部
宮田智代子	計画管理	独立行政法人 国際協力機構 産業開発・公共政策部
野上 一成	業務主任／太陽光発電システム ／系統連系太陽光発電	八千代エンジニアリング株式会社
矢野 敏雄	副業務主任／土木設計	八千代エンジニアリング株式会社
近藤 和晃	機材・設備計画／環境社会配慮	八千代エンジニアリング株式会社
菊池 洋太	調達計画／積算	八千代エンジニアリング株式会社
熊倉 宏治	建設設計／積算	八千代エンジニアリング株式会社

### (2) 第2次現地調査

氏名	担当業務	現職
中園 雅巳	総括	独立行政法人 国際協力機構 産業開発・公共政策部
宮田智代子	計画管理	独立行政法人 国際協力機構 産業開発・公共政策部
野上 一成	業務主任／太陽光発電システム ／系統連系太陽光発電	八千代エンジニアリング株式会社
矢野 敏雄	副業務主任／土木設計	八千代エンジニアリング株式会社
近藤 和晃	機材・設備計画／環境社会配慮	八千代エンジニアリング株式会社

## 2. 調査日程表

### (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				
			中園、宮田	Aグループ	Bグループ		Cグループ	
			野上、矢野	菊池・近藤	熊倉			
1	9月14日	土		<ul style="list-style-type: none"> <li>移動{東京 00:40 → パリ、シャルルドゴール(フランス) 6:20 by JL-041}</li> <li>移動{パリ、シャルルドゴール(フランス) 11:10 → アブジャ(ナイジェリア) 16:05 by AF-514}</li> </ul>			アブジャ	
2	9月15日	日	<ul style="list-style-type: none"> <li>移動{東京 → パリ}</li> <li>移動{パリ → アブジャ}</li> </ul>	<ul style="list-style-type: none"> <li>団内協議(調査計画及び必要なアウトプットの再確認)</li> </ul>			アブジャ	
3	9月16日	月	<ul style="list-style-type: none"> <li>表敬訪問、インセプションレポート説明、協議(JICA ナイジェリア事務所)</li> <li>インセプションレポート説明、プロジェクトコンポーネントの概要説明・協議(連邦電力省)</li> <li>インセプションレポート説明(連邦首都区・連邦首都区水公社)</li> </ul>			コンポーネントに係る協議・合意	アブジャ	
4	9月17日	火	<ul style="list-style-type: none"> <li>インセプションレポート説明、プロジェクトコンポーネントの概要説明・協議(連邦首都区水公社)</li> <li>サイト状況踏査(ウスマダム浄水場)</li> </ul>				アブジャ	
5	9月18日	水	コンポーネント確認、協議議事録協議	<ul style="list-style-type: none"> <li>サイト状況踏査(既存機材施設の現況)</li> </ul>	<ul style="list-style-type: none"> <li>市場調査</li> <li>データ分析、構造計算</li> </ul>		アブジャ	
6	9月19日	木	<ul style="list-style-type: none"> <li>協議議事録署名、協議(JICA ナイジェリア事務所)、報告(日本大使館)</li> <li>移動{アブジャ→パリ} [中園、宮田]</li> </ul>	<ul style="list-style-type: none"> <li>サイト状況踏査(既存の機材施設の現況)</li> </ul>	<ul style="list-style-type: none"> <li>データ分析、構造計算</li> </ul>		アブジャ	
7	9月20日	金	<ul style="list-style-type: none"> <li>移動{パリ→東京}</li> </ul>	<ul style="list-style-type: none"> <li>サイト状況踏査(アレイ配置・電気室位置・実施時の機材置き場の確認)</li> </ul>			アブジャ	
8	9月21日	土	<ul style="list-style-type: none"> <li>移動{→東京}</li> </ul>	<ul style="list-style-type: none"> <li>サイト状況踏査(既存設備の使用状況確認) (野上、近藤)</li> <li>資料整理、分析 (矢野、菊池、熊倉)</li> </ul>			アブジャ	
9	9月22日	日	<ul style="list-style-type: none"> <li>収集資料整理及び団内協議(概略設計に係る調査項目整理)</li> </ul>				アブジャ	

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	月日	曜日	調査内容		宿泊地	
			Aグループ	Bグループ		
			野上、近藤、菊池	矢野、熊倉		
10	9月23日	月	<ul style="list-style-type: none"> <li>連系方法の検討</li> <li>フィールドレポートの作成</li> </ul>	<ul style="list-style-type: none"> <li>サイト状況踏査(アレイ架台基礎、第3・第4タンク間の基礎建設の検討)</li> </ul>	アブジャ	
11	9月24日	火	<ul style="list-style-type: none"> <li>概略設計(案)(連系方法、アレイ配置)の連邦首都区水公社と協議</li> </ul>		概略設計	アブジャ
12	9月25日	水	<ul style="list-style-type: none"> <li>サイト状況踏査(連結方法の確認)</li> <li>フィールドレポートの作成</li> </ul>	<ul style="list-style-type: none"> <li>構造評価</li> <li>フィールドレポートの作成</li> </ul>		アブジャ
13	9月26日	木	<ul style="list-style-type: none"> <li>フィールドレポートの作成</li> </ul>			アブジャ
14	9月27日	金	<ul style="list-style-type: none"> <li>連邦電力省、連邦首都区水公社とフィールドレポートについての協議、署名</li> </ul>			アブジャ
15	9月28日	土	<ul style="list-style-type: none"> <li>団内協議及び現地調査結果概要の作成</li> </ul>			アブジャ
16	9月29日	日	<ul style="list-style-type: none"> <li>団内協議及び現地調査結果概要の作成</li> </ul>			アブジャ

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	月日	曜日	調査内容					宿泊地	
			野上	菊池	近藤	矢野	熊倉		
17	9月30日	月	<ul style="list-style-type: none"> <li>現地調査結果概要の作成</li> <li>協議(日本大使館)</li> </ul>		<ul style="list-style-type: none"> <li>連邦電力省との環境影響評価に係る協議</li> </ul>	<ul style="list-style-type: none"> <li>土質調査準備</li> <li>現地調査結果概要の作成</li> <li>協議(日本大使館)</li> </ul>	アブジャ		
18	10月1日	火	<ul style="list-style-type: none"> <li>現地調査結果概要の作成</li> </ul>					概略設計に係る協議・合意形成	アブジャ
19	10月2日	水	<ul style="list-style-type: none"> <li>サイト状況調査(既存の設備との取合いの確認)</li> <li>技術協議メモ案作成</li> </ul>	<ul style="list-style-type: none"> <li>連邦電力省との環境影響評価に係る協議</li> </ul>	<ul style="list-style-type: none"> <li>協議(ナイジェリアエネルギー委員会)</li> </ul>	<ul style="list-style-type: none"> <li>土質調査実施調整</li> </ul>	アブジャ		
20	10月3日	木	<ul style="list-style-type: none"> <li>サイト状況調査(機材・土建間の調整)</li> </ul>						アブジャ
21	10月4日	金	<ul style="list-style-type: none"> <li>技術協議メモの協議・署名(連邦首都区水公社)</li> </ul>		<ul style="list-style-type: none"> <li>協議(連邦電力省)</li> </ul>	<ul style="list-style-type: none"> <li>土質調査実施</li> </ul>	アブジャ		

								準備	
22	10月5日	土		• 現地調査結果概要の作成					アブジャ
23	10月6日	日		• 現地調査結果概要の作成					アブジャ
24	10月7日	月		• 現地調査結果概要の作成	• 協議(連邦電力省)	• サイト状況調査(SCADAシステム概要確認)	• 協議(国家計画委員会)	• サイト状況調査(土質調査作業確認)	報告書作成・報告 アブジャ
25	10月8日	火		• 帰国報告(連邦電力省、連邦首都区水公社) • 帰国報告(日本大使館) [野上・矢野]					アブジャ
26	10月9日	水		• 現地調査結果概要の作成 • 協議(連邦電力省) [菊池・近藤] • 移動{アブジャ(ナイジェリア)23:15→パリ(フランス) 6:10+1 by AF-513}					アブジャ
27	10月10日	木		• 移動{→パリ、シャルルドゴール(フランス) 6:10 by AF-513} • 移動{パリ、シャルルドゴール(フランス) 11:30→東京 6:30+1 by JL-042}					機中泊
28	10月11日	金		• 移動{→東京 6:30 by JL-042}					帰国

## (2) 第2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	
			中園、宮田	野上、矢野、近藤	
1	3月1日	土		• 移動{東京 01:30→パリ、シャルルドゴール(フランス)06:20} • 移動{パリ、シャルルドゴール(フランス)11:00→アブジャ(ナイジェリア)16:55}	アブジャ
2	3月2日	日	• 移動{東京 01:30→パリ、シャルルドゴール(フランス)06:20} • 移動{パリ、シャルルドゴール(フランス)11:00→アブジャ(ナイジェリア)16:55}	• 団内協議	アブジャ
3	3月3日	月	8:30 表敬訪問及び調査スケジュールの確認(JICA ナイジェリア事務所) 10:00 準備調査報告書(案)の説明(連邦電力省) 13:00 準備調査報告書(案)の説明(連邦首都区水公社) 15:00 準備調査報告書(案)の説明(連邦首都区)		アブジャ
4	3月4日	火	10:00 サイト状況視察(ウスマダム浄水場) 12:00 団内打ち合わせ(ミニッツドラフト修正) 15:00 系統連系にかかわる協議(Abuja DISCO)		アブジャ
5	3月5日	水	10:00 ミニッツ協議 12:30 技術協議(連邦電力省) 14:30 団内打ち合わせ(ミニッツ原稿最終化等) 17:00 技術協議(連邦首都区水公社)		アブジャ
6	3月6日	木	11:00 ミニッツ署名式 14:00 現地活動報告(JICA ナイジェリア事務所) • 移動{アブジャ(ナイジェリア)23:55 →パリ、シャルルドゴール(フランス)05:50+1}(中園、宮田)		アブジャ/ 機中泊
7	3月7日	金	• 移動{→パリ、シャルルドゴール(フランス)11:00→東京 06:55+1}	• 帰国報告(連邦電力省、連邦首都区水公社)(今後の工程について) • 移動{アブジャ(ナイジェリア)23:55 →パリ、シャルルドゴール(フランス)05:50+1}	機中泊
8	3月8日	土	• 移動{→東京 06:55}	• 移動{→パリ、シャルルドゴール(フランス)11:00→東京 06:55+1}(野上・矢野)	機中泊
9	3月9日	日	• 移動{→東京 06:55}(野上・矢野)		



### 3. 相手国関係者(面談者)リスト

<u>所属及び氏名</u>	<u>職位</u>
国家計画委員会 <b>National Planning Commission</b> Mr. R. O. Ibraheem	Acting Director, Economic Growth Department
ナイジェリアエネルギー委員会 <b>Energy Commission of Nigeria</b> Prof. Eli Jidere Bala Engr. Okon N. Ekpenyong	Director General / CEO Deputy Director
連邦財務省 <b>Federal Ministry of Finance</b> Mrs. Apeji Mr. Omata	Deputy Director of Revenue (oil & gas) Assistant Director of Revenue (non-oil)
連邦電力省 <b>Federal Ministry of Power</b> Engr. A. Adebisi Engr. P. O. Ewesor Engr. Faruk Yusuf Yabo Engr. A. D. Abubakar Engr. Anthony E. Umuenyen Engr. E. E. Ezeeputo Engr. Babalola Olurin Engr. T. O. Dina	Director Deputy Director Assistant Director Assistant Director Assistant Director Assistant Director Electrical Engineer Senior Electrical Engineer
連邦環境省 <b>Federal Ministry of Environment</b> Mr. K. B. Odusanya Mr. J. A. Alonge Mr. F. F. Odika	Acting Director Deputy Director Chief Environment Scientist

## 連邦首都区

**Federal Capital Territory Administration**

Mr. Ari Isa Mohammad	Director, Economic Planning Research & Statistics Department
Mr. Muhammad Lawal Abubakar	FCT Co-ordinator
Mr. Haruna S. Koku	Economic Planning Research & Statistics Department
Mr. Amina Usman	Economic Planning Research & Statistics Department
Engr. B. O. Solomm	Engineer
Engr. M. E. Mohammed	Engineer (FCDA)
Mr. Lawal Astafa	Assistant Director (Economic Planning)
Mr. Asmau Ashata	Account Officer

## 連邦首都区水公社

**Federal Capital Territory Water Board**

Engr. J. B. Anto	Director
Mr. M. O. Adebayo	Head, Quality Control
Mr. Hudu Bello	Head, Commerce
Mr. S. T. Bello	Head, Administration & Supplies
Engr. Ahmed A. Nahuche	Head, Distribution
Dr. M. A. Dan-Hassan	Head, Rural Water Supply and Sanitation
Mrs. Hafsat Ahmed	Head, Finance and Account
Engr. U. A. Aliyu	Head, Reservoir & Production
Mrs. Hamzat R. T.	Head, Internal Audit
Mrs. Janet A. Peni	Head, Public Relations
Engr. M. O. Adebato	Head, Quality Control
Engr. Olufemi Oyekenu	Plant Manager
Engr. Oyekenu O.	Plant Manager (No.1 & No.2)
Engr. R. A. Bello	Plant Manager (No.3 & No.4)
Engr. Julius Afolabi	Head, Mechanical & Electrical
Mr. Billy Oboigbe	Asst Head, Finance & Accounts
Engr. K. M. Kabiu	Water Engineer
Engr. A. R. Lawal	Head, Projects
Engr. Amos Babus	Head (Booster Station)
Engr. Victor Wenegiene	Senior Engineer (Electrical)

## 連邦首都区アブジャ環境保護公社

**Federal Capital Territory Abuja Environmental Protection Board**

Ms. Jokotola Akwni	Assistant Director Environmental Monitoring Planning Research & Statistic Department
Mr. Abdullahi Yahaya	HOU (Environmental Assessment)
Engr. Alaya T. N.	Assistant Director (PRS)
Engr. Zainab Umar	Assistant Director (Environmental Conservation)

## アブジャ配電会社

**Abuja Electricity Distribution Company**

Mr. Neil F Croucher	Chief Executive Officer
Mr. Joe Chiyassa	Executive Director Technical Services
Mr. Joshua E. Michael	Planning & Construction, KANN Abuja
Mr. Emmanuel Sampa Katepa	Business Development (CEC Africa)
Ms. Clara Musama	Business Development (CEC Africa)

## ナイジェリア電力持株会社

**Power Holding Company of Nigeria**

Engr. A. M. Bala	Staff assigned to Lower Usuma Dam Water Treatment Plant
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## JICA ナイジェリア事務所

**JICA Nigeria Office**

関 徹男	所長
美甘 政門	所員
Mr. Agidani Gabriel O.	Consultant

## 在ナイジェリア日本大使館

**Embassy of Japan in Nigeria**

萩野 剛	一等書記官
木花 和仁	一等書記官
青木 啓志	一等書記官
千葉 真梨子	専門調査員

**Minutes of Discussions  
on the Preparatory Survey  
on the Project for Introduction of Clean Energy by Solar Electricity Generation System  
in the Federal Republic of Nigeria**

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 Introduction of Clean Energy by Solar Electricity Generation System (hereinafter referred to as "the Project").

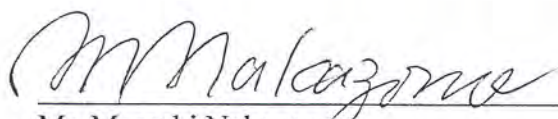
JICA sent to the Federal Republic of Nigeria (hereinafter referred to as "Nigeria") the Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Masashi Nakazono, Executive Technical Advisor to Director General, Industrial Development and Public Policy Department, JICA Headquarter, and is scheduled to stay in Nigeria from September 15<sup>th</sup> to October 9<sup>th</sup>, 2013.

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

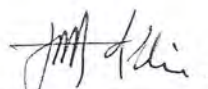
In the course of discussions and field survey, both sides confirmed the main items described in the attached sheets.

Abuja

September 19, 2013



Mr. Masashi Nakazono  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency



Engr. A. Adebisi  
Acting Director  
Electrical Inspectorate and Services Department  
Federal Ministry of Power



Engr. J. B. Anto  
Director  
Federal Capital Territory Water Board



## ATTACHMENT

### 1. Current Situation

The Government of Nigeria recognizes the renewable energy could play a more important role in terms of enabling to meet their energy requirement. In the National Energy Policy, established in 2003, 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 Nigeria

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 reduction of greenhouse effect gas emissions by installing the photovoltaic system to be connected to the national grid.

### 3. Project Implementation Structure

The responsible and implementing organization of the Project is the Federal Ministry of Power, Electrical Inspectorate Services Department (FMOP). The organization which is responsible for operation and maintenance of PV system (including relevant facilities and equipment) installed by the Project is the Federal Capital Territory Water Board (FCTWB), which is the direct beneficiary of the Project as well. (The organization charts of FMOP and FCTWB are shown in Annex-1.)

FMOP agreed to support operation and maintenance activities of FCTWB for the PV system of the Project by arranging technical assistance from the power distribution company managing the area where the Lower Usuma Dam Water Treatment Plant is located in accordance with necessity.

FMOP also agreed to arrange and attend the meeting for interconnection of the PV system of the Project to the commercial grid between FMOP, FCTWB, the Team and the power distribution company managing the area where Lower Usuma Dam Water Treatment Plant is located.

### 4. Items Requested by Nigerian Side

4-1. The Exchange of Note (E/N) and Grant Agreement (G/A) for the Project were already concluded in 2012 between the Nigerian side and Japanese side. According to the E/N and G/A, the grant amount is nine hundred and eighty million Japanese Yen (¥980,000,000). After discussions with the Team considering this, the installation of the on-grid power generating system using PV without power storage system including following equipment was requested by the Nigerian side. However, the Nigerian side and the Team confirmed that the capacity of PV arrays of the Project might be changed as the result of detail analysis in Japan including system design and cost estimation based on the data and information collected in the first field survey in Nigeria.




Table 1 Projects requested by Nigerian Government

	Description
Location	Lower Usuma Dam Water Treatment Plant
Outline	The power produced is used for the Lower Usuma Dam Water Treatment Plant
Requested component	(1) Solar photovoltaic arrays (Crystalline Silicon Type: total capacity might be 800 to 900 kWp) (2) Mounting structures and foundations for photovoltaic arrays of 800 to 900 kWp (3) Junction box and collecting box (4) Power Conditioner (5) Display system (6) Data management system (7) Other relevant component for photovoltaic array such as switchgears cables and fitting materials (8) Spare parts (9) Test equipment (10) Training for operation and maintenance of PV system (11) One building for the electrical equipment (Approx. 50 to 75 m <sup>2</sup> )

4-2. The project site is as shown in Annex-2.

4-3. The Nigerian side explained that there is no duplication between requested contents of the Project and any other plans implemented by the other donors or the Nigerian side.

4-4. The Team will report the findings and items requested by the Nigerian side to JICA Headquarters and the Government of Japan.

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

The Nigerian side understood the Japan's Program Grant Aid for Environment and Climate Change scheme explained by the Team, (as described in Annex-3, 4, 5, 6 and 7).

#### 6. Schedule of the Study

6-1. The Team will proceed to further survey in Nigeria until October 9<sup>th</sup> 2013 as the Preparatory Survey.

6-2. After the completion of the Preparatory Survey, the Team will report the results to Nigerian side, JICA Headquarters and GoJ.



6-3. JICA will prepare the draft report and reference document in English and dispatch a mission to Nigeria in order to explain their contents in the middle of February 2014.

6-4. When the contents of the report and reference document are accepted in principle by the Government of Nigeria, JICA will complete the final report and reference document, and submit them to the Government of Nigeria and to the Procurement Agent by the end of March, 2014.

## 7. Other Relevant Issues

### 7-1 Permission of Land Acquisition / Usage

FMOP, FCTWB and the Team agreed that the PV arrays of the Project will be located on the top surface of No.3 and No.4 Reservoirs at the Lower Usuma Dam Water Treatment Plant (approximately 8,250m<sup>2</sup>) as per attached in Annex-8. FMOP, FCTWB and the Team also agreed that the building for the electrical equipment of the Project will be located near the PV arrays of the Project as per attached in Annex-8.

In addition, the Team explained that an area for temporary use such as temporary office, stockyard, workshop, etc., is also necessary to be secured during installation work of the equipment and materials (approximately 2,500m<sup>2</sup>).

Also, FCTWB agreed to permit the usage of above mentioned land and facilities for installation of the equipment.

### 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 Nigerian side agreed with the policy of Government of Japan and requested that major equipment and materials shall be made in Japan.

### 7-3 Basic concept of PV system design

The Team explained and FMOP and FCTWB agreed that the proposed system has the function of the detection of islanding operation during the power outage of national grid and during the operation of private generators. Through this function, the system will suspend its operation during the above-mentioned durations.

The system is composed of the followings.

- Photovoltaic System of 800 to 900 kWp composed of crystalline silicon cells
- Mounting structures and foundations for photovoltaic arrays installed on the top surface of No.3 and No.4 Water Reservoirs
- Electrical equipment for interconnection

- One-story building for the electrical equipment of the Project (Approx. 50~75 m<sup>2</sup>)

#### 7-4 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.

The Nigerian side agreed to establish a consultative committee in order to coordinate with the Japanese side which consists of the JICA office and the procurement agency. Terms of Reference of the Consultative Committee is referred to Annex-9.

#### 7-5 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 Nigerian side. The Nigerian side agreed to take the JICA Guideline into consideration, and shall complete the necessary procedures.

#### 7-6 Operation and Maintenance

The operation and maintenance organization, FCTWB agreed to secure and allocate the necessary budget and personnel for the operation and maintenance of the PV system of the Project including cleaning of the PV arrays. FMOP, FCTWB and the Team agreed that the benefit obtained from reduced expenditure for electricity charge shall be reverted to FCTWB and FCTWB shall allocate it to the budget for the operation and maintenance of the PV system of the Project.

#### 7-7 Customs and Tax exemption

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

The responsible organization, FMOP agreed to manage procedures for custom clearance and tax exemption for smooth progress of the Project without delay with making a positive approach to related organizations such as the Federal Ministry of Finance.

FMOP also agreed to arrange and attend the meeting for custom clearance and tax exemption of the Project between FMOP, the Team and related organizations.

7-8 The Nigerian side shall ensure the security of all concerned Japanese nationals working for the Project, if deemed necessary.

7-9 The Nigerian side shall provide necessary numbers of counterpart personnel to the Team during the period of their studies in Nigeria

7-10 The Nigerian side shall submit all the answers to the Questionnaire, which the Team handed to the Nigerian side, by September 30<sup>th</sup> 2013.



7-11 The Nigerian side shall submit the technical documents and drawing required for the Outline Design to the Team, especially such as related technical documents and drawings of No.3 and No.4 Reservoir.

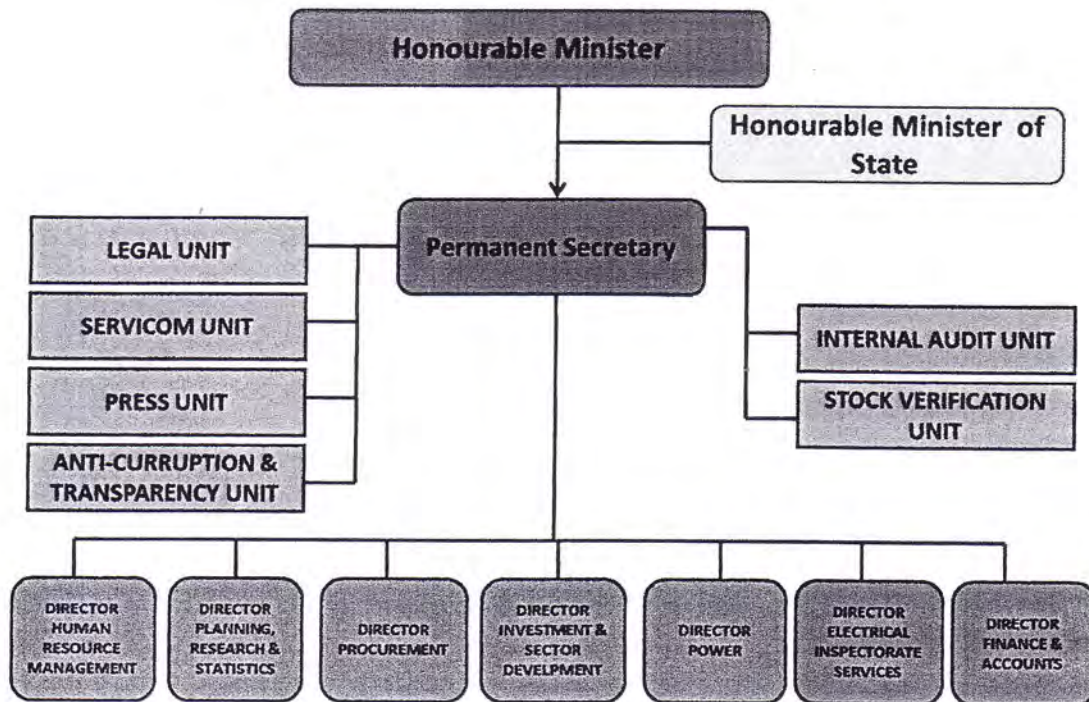
The responsible organization, FMOP agreed to obtain such technical documents and drawing from the Lower Usuma Dam Water Treatment Plant, FCTWB immediately in accordance with the requests from the Team. The responsible organization, FMOP also agreed to obtain approval on the Outline Design planned by FMOP and the Team, including the field report of the first field survey, from the Lower Usuma Dam Water Treatment Plant, FCTWB immediately in accordance with the requests from the Team.

<List of Annex>

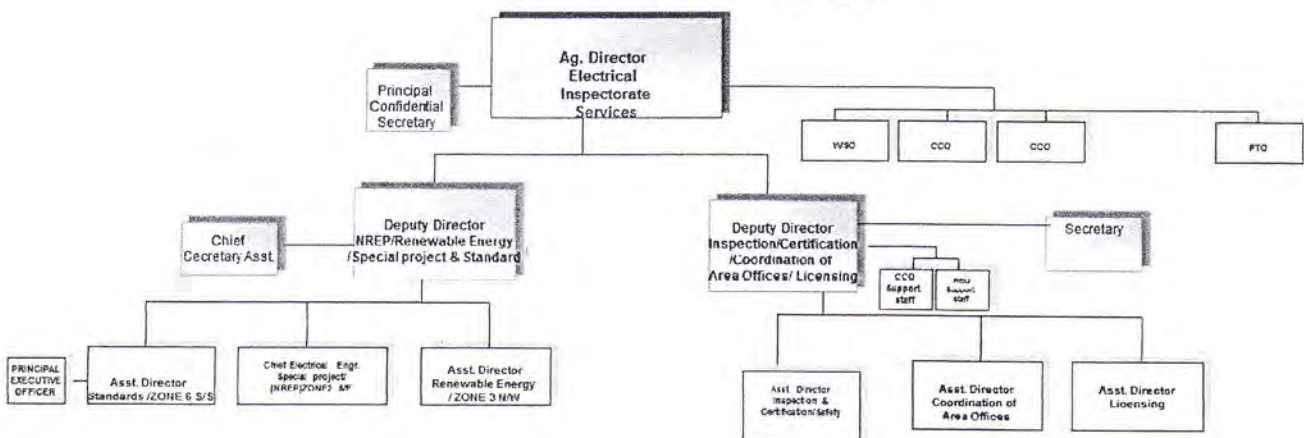
- Annex-1 Organization Chart of Responsible and Implementing Organization of the Project  
Organization Chart of Operation and Maintenance Organization of PV system
- Annex-2 Location of Project Site
- Annex-3 Program Grant Aid for Environment and Climate Change
- Annex-4 General Flow of Program Grant Aid for Environment and Climate Change
- Annex-5 Flow of Funds for Project Implementation
- Annex-6 Project Implementation System
- Annex-7 Major Undertakings to be taken by Each Government
- Annex-8 Layout of Photovoltaic System at the Lower Usuma Dam Water Treatment Plant
- Annex-9 Terms of References of the Consultative Committee

**Organization Chart of Responsible and Implementing Organization  
Federal Ministry of Power**

CURRENT ORGANIZATIONAL STRUCTURE OF THE MINISTRY

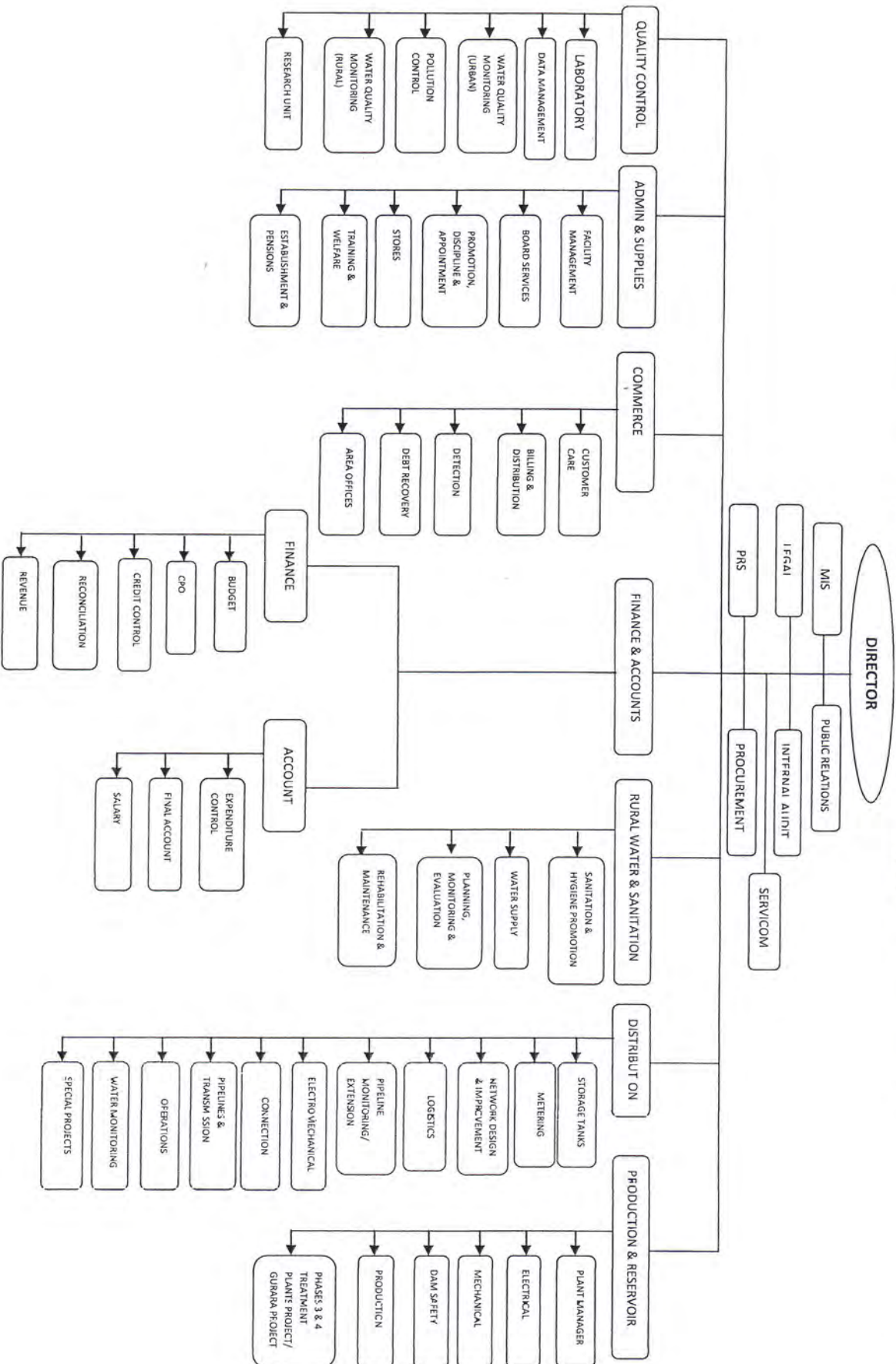


**ELECTRICAL INSPECTORATE SERVICES DEPARTMENT  
FEDERAL MINISTRY OF POWER  
Current Department Organogram**



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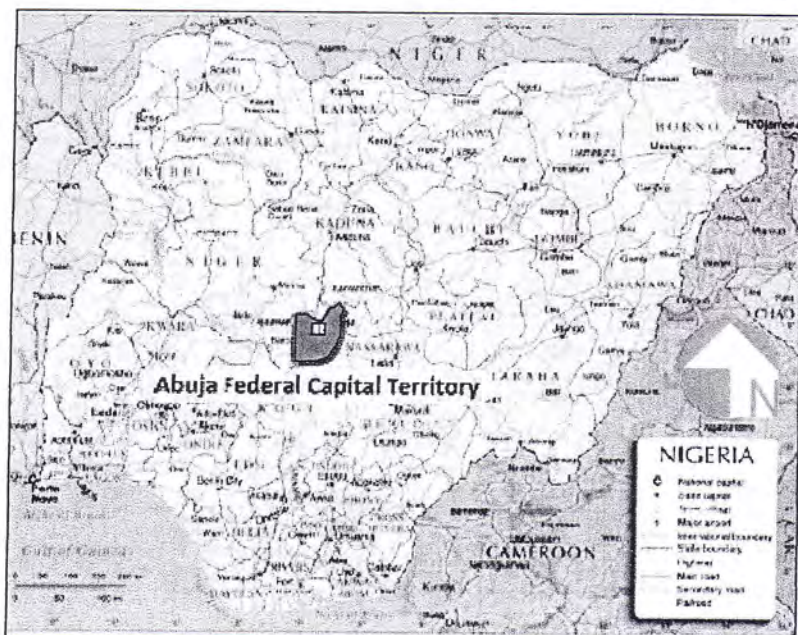
# Organization Chart of Operation and Maintenance Organization of PV system Federal Capital Territory Water Board



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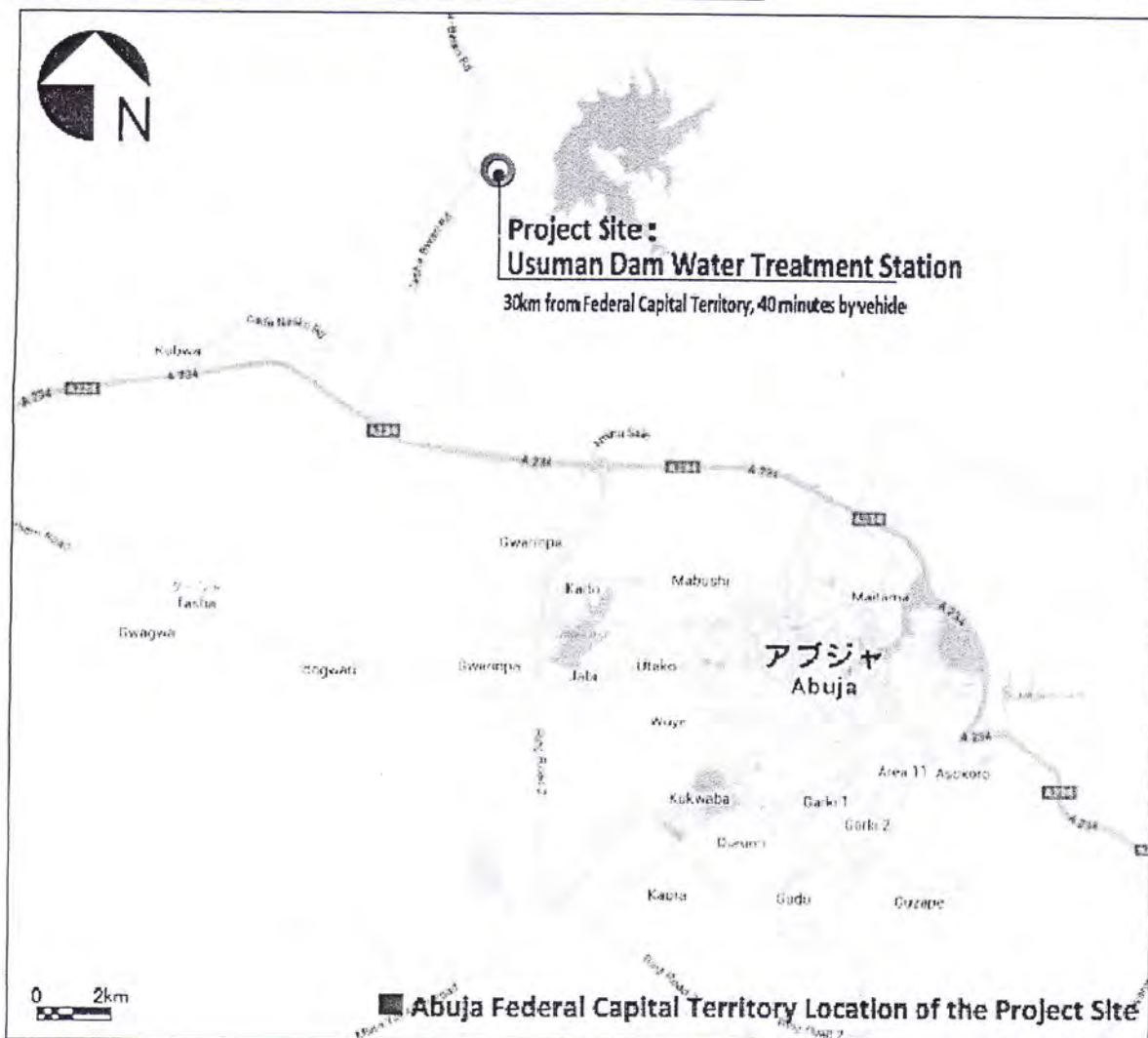


### Location of the Project Site



■ Map of Africa

■ Map of Federal Republic of Nigeria



■ Abuja Federal Capital Territory Location of the Project Site

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

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 Employment Contract 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 (Type I-E)."
- 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 (Type I-E)"

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) Employment Contract

The Recipient shall conclude an Employment Contract with independent and competent agent, in principle, within two months after the date of entry into force of the G/A, in accordance with the A/M. The scope of the Agent's services will be clearly specified in the Employment Contract.

c) Approval of the Employment Contract

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 Employment Contract concluded between the Recipient and the Agent shall become effective upon the approval by JICA in a written form to be eligible for the Grant and accrued interest.

d) Payment Methods

The Employment Contract 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 Employment Contract 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.

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## 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"

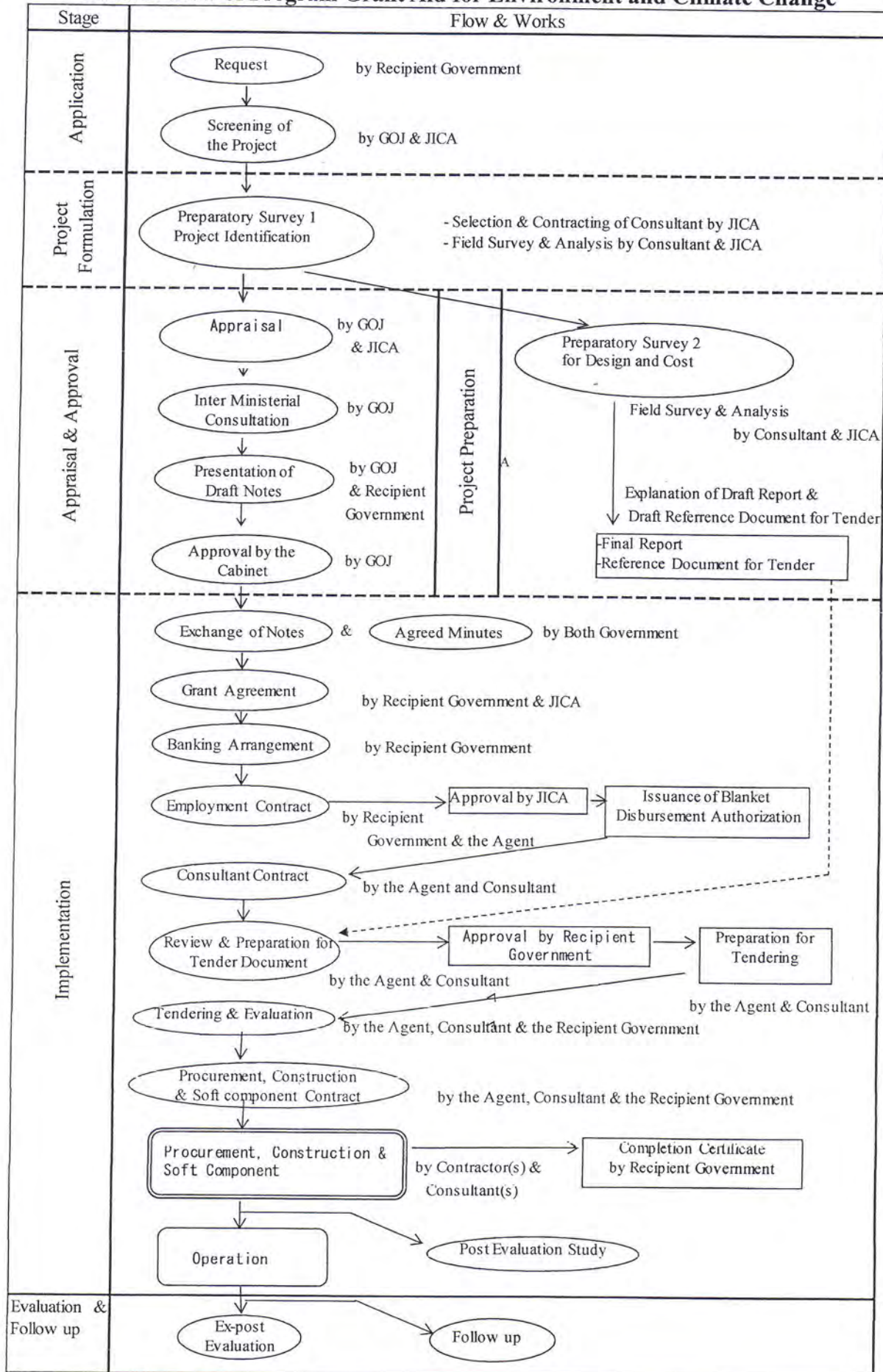
The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

6) "Export and Re-export" of products

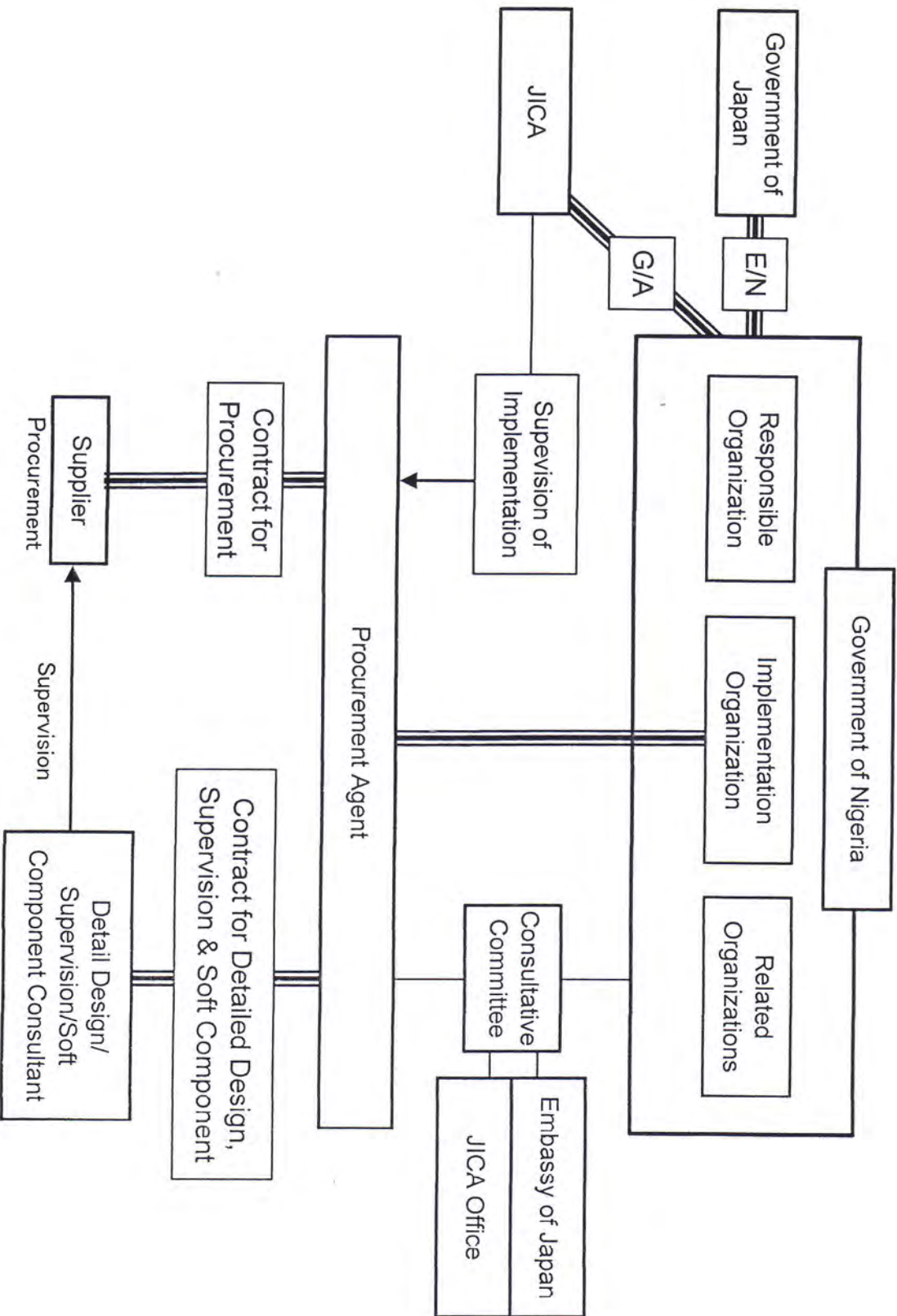
The products purchased under the Grant and its accrued interest will not be exported or re-exported from the Recipient.



**General Flow of Program Grant Aid for Environment and Climate Change**

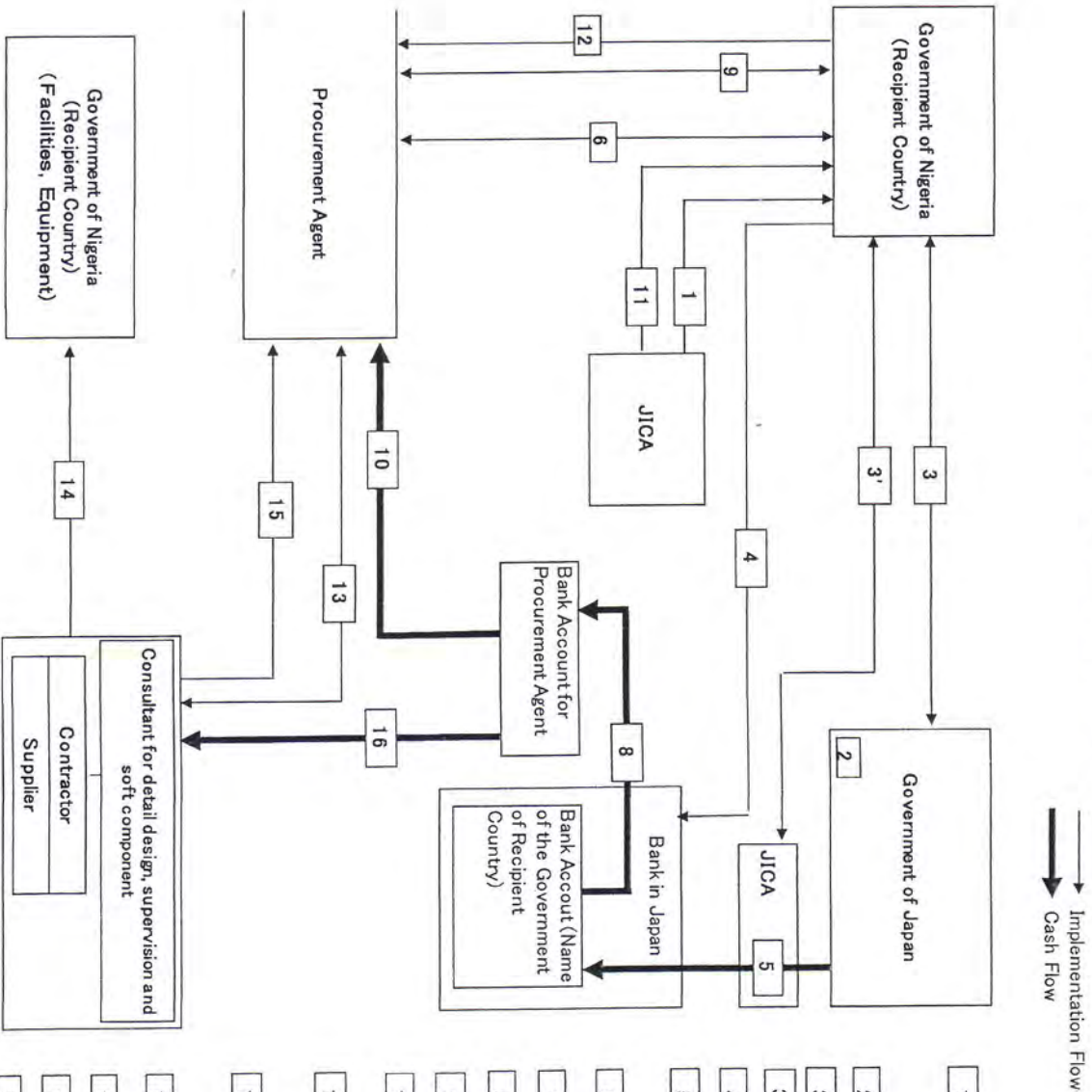


# Project Implementation System



Annex-5  
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Flow of Funds for Project Implementation



- 1 Preparatory Survey / Reference Document for Tender
- 2 Approval of Cabinet
- 3 Signing of Exchange of Notes (E/N)
- 3' Signing of Grant Agreement (G/A)
- 4 Banking Arrangement (B/A)
- 5 Disbursement of Funds from the Government of Japan
- 6 Signing of Employment Contract + Blanket Disbursement Authorization N/A
- 7 Transfer of Funds
- 8 Decision of Project Components
- 9 Payment of Remuneration for Agent
- 10 Recommendation of Consultant for Detail Design / Supervision (JICA → Government of Nigeria)
- 11 Recommendation of Consultant for Detail Design / Supervision (Government of Nigeria → Procurement Agent)
- 12 Conclusion of Contract
- 13 Construction and Procurement
- 14 Application for Payment
- 15 Payment

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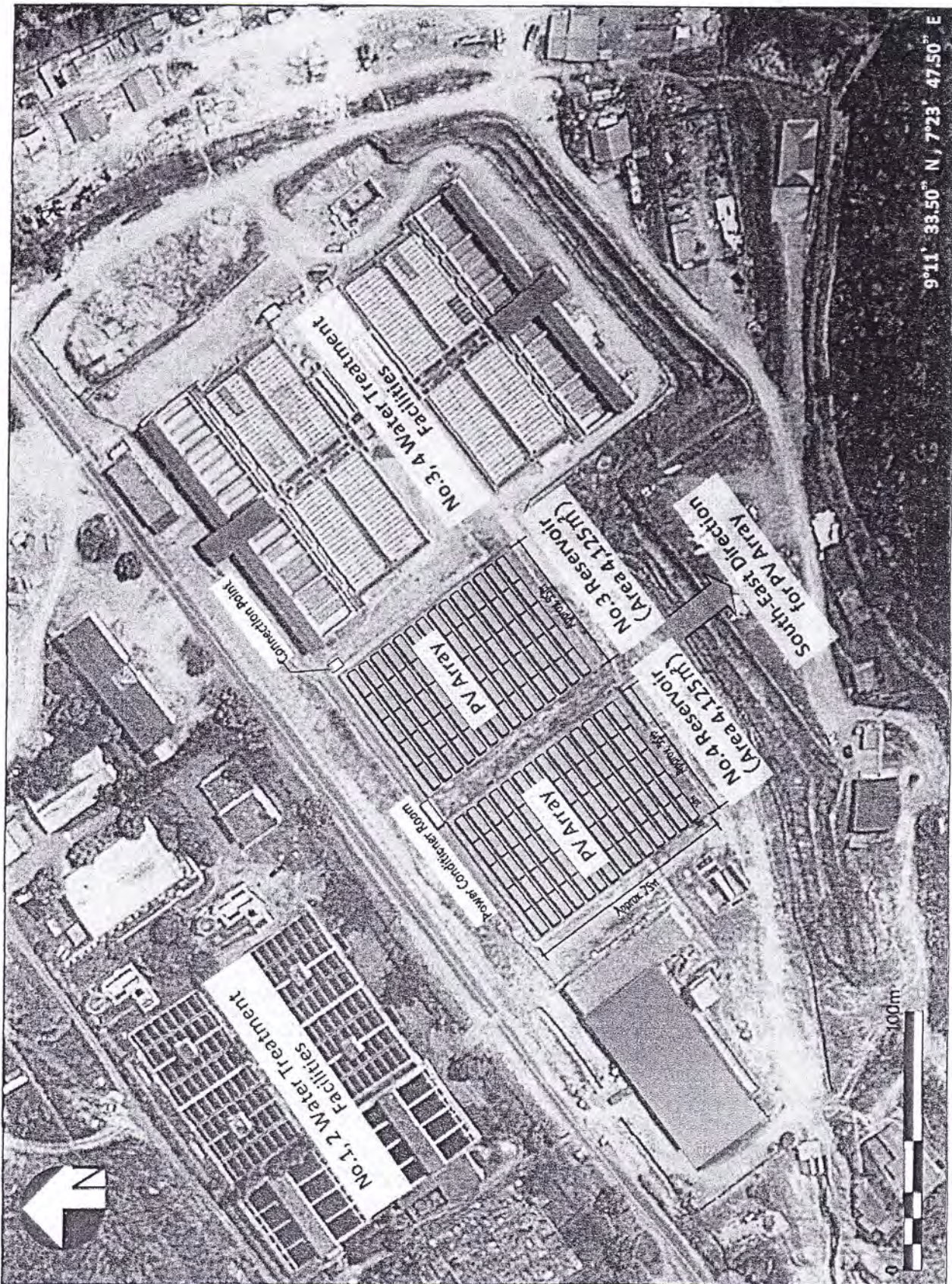


### Major undertakings to be taken by each Government

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.		●



### Layout of Photovoltaic System at the Lower Usama Dam Water Treatment Plant



\*The strength of No.3 and No.4 Reservoirs will be evaluated in the Outline Design. Based on the analysis, usage of the area for installation of PV arrays will be decided.

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## 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.



**Minutes of Discussions  
on the Preparatory Survey  
on the Project for Introduction of Clean Energy by Solar Electricity Generation System  
in the Federal Republic of Nigeria**

In September 2013, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched to the Federal Republic of Nigeria (hereinafter referred to as "Nigeria") 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 Federal Government of Nigeria and the Federal Capital Territory (hereinafter referred to as "Nigerian side") 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 make consult with the concerned officials of the Nigerian side on the components of the Draft Final Report, JICA dispatched a Preparatory Survey Team for Draft Final Report Explanation (hereinafter referred to as "the Team"), which is headed by Mr. Masashi Nakazono, Executive Technical Advisor to Director General, Industrial Development and Public Policy Department, JICA Headquarter, from March 1<sup>st</sup> to 9<sup>th</sup>, 2014.

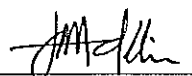
As a result of discussions between JICA and concerned officials of Nigerian side, both sides confirmed the main items described on the attached sheets.

Abuja

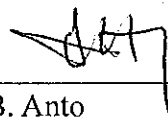
March 6<sup>th</sup>, 2014

中園 雅也

Mr. Masashi Nakazono  
Leader  
Preparatory Survey Team  
Japan International Cooperation Agency

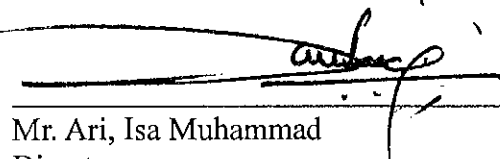


Engr. A. Adebisi  
Director  
Electrical Inspectorate Services Department  
Federal Ministry of Power



Engr. J. B. Anto  
Director  
Federal Capital Territory Water Board

Witnessed by:



Mr. Ari, Isa Muhammad  
Director  
Economic Planning, Research and Statistics  
Department  
Federal Capital Territory Administration



## ATTACHMENT

### 1. Contents of the Draft Final Report

The Federal Ministry of Power (hereinafter referred to as "FMOP"), Federal Capital Territory Administration (hereinafter referred to as "FCTA") and Federal Capital Territory Water Board (hereinafter referred to as "FCTWB") agreed and accepted in principle the contents of the Draft Final Report explained by the Team.

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

The Nigerian side understood contents of the Minutes of Discussions signed by JICA and the Nigerian side (hereinafter referred to as "both sides") on September 19<sup>th</sup>, 2013 (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 described in Annex-1,2,3,4 and 5.

### 3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to FMOP, FCTA and FCTWB by the end of April 2014.

### 4. Confirmation of progress made from the previous M/D

#### 4.1. Project site and capacity of Solar Photovoltaic system

Both sides confirmed that project site is the top surfaces of No3 and No.4 water tanks of the Lower Usuma Dam Water Treatment Plant as shown in Annex-6. The Team explained that the design capacity of Solar Photovoltaic (PV) system (hereinafter referred to as "PV system") to be procured and installed in the Project would be 975kW based on the result of outline design and cost estimation (See Annex 7). However, the actual capacity of PV system in the Project depends on the result of tender opening.

#### 4.2. Project Implementation Structure

Both sides confirmed the responsible and implementing organization of the Project is FMOP. The organization which is responsible for operation and maintenance of PV system (including relevant facilities and equipment) installed by the Project is the FCTWB, which is the direct beneficiary of the Project as well. FCTA is responsible for securing and providing necessary budget to FCTWB for proper implementation of O&M.

FMOP agreed to support operation and maintenance activities of FCTWB for the PV system in the Project by arranging technical assistance from Abuja electricity distribution company (Abuja DISCO) managing the area where the Lower Usuma Dam Water Treatment Plant is located in accordance with necessity. FCTA agreed to manage budgetary allocation for proper operation and maintenance activities of FCTWB.




## 5. Items of Equipment to be procured

The Team explained the items of equipment to be procured as below based on the results of the Preparatory Survey conducted from September to October 2013. After discussion, both sides confirmed that the major equipment such as PV modules consisting of PV cells and Power Conditioners should be produced and purchased in Japan, while products of third country could be acceptable for other type of equipment as a part of components.

**Table 1. List of Major Equipment**

	Components	Quantity or Capacity
Procurement and Installation	1. Photovoltaic system	
	1.1 Solar photovoltaic arrays	975 kWp
	1.2 Junction box	1 lot
	1.3 Collecting box	1 lot
	1.4 Power conditioners	Total capacity of the connected photovoltaic modules or more
	1.5 AC Distribution Panel	1 unit
	1.6 Interconnection Transformer	Total capacity of the connected photovoltaic modules or more
	1.7 Interconnection equipment	1 unit
	2. Data management system	
	2.1 Data logger including UPS system	1 set
2.2 Display system	1 set	
2.3 Weather monitoring instruments (Pyranometer, Temperature meter)	1 set	
3. Cables and fitting materials	1 lot	
Procurement	1. Spare parts	1 lot
	2. Maintenance tools (including high pressure washing machines)	1 lot
Construction	a. Mounting Structures for the photovoltaic arrays b. Foundations for the photovoltaic arrays c. Power Conditioner Building	for the photovoltaic arrays of 975 kWp for the photovoltaic arrays of 975 kWp Gross floor area: Approx. 77.5 m <sup>2</sup>

## 6. Soft Component

The Team explained that the following technical guidance is included in the soft component of the Project:

- (1) Operation and maintenance of the PV system;
- (2) Protection system of the grid connected PV system; and
- (3) Operation and maintenance of the data management system.

## 7. Ownership and Responsibilities for Operation and Maintenance

The Nigerian side explained to the Team that the PV system of the Project will be operated and maintained by FCTWB, the Operation and Maintenance organization of the Project. FCTA agreed

to allocate the budget for FCTWB to operate and maintain the PV system in the Project with applying the expenses saved through their operation and maintenance which reduce consumption of purchased electricity. Operation and maintenance cost for the PV system in the Project is estimated as shown in the table below. The annual cost of the PV system in the Project is approximately 3,341,580 N (20,460 US\$)

**Table 2. Operation and Maintenance Cost**

	Annual cost (N/year)	Remarks
Employment cost	2,691,500	Panel cleaners: 2 people (1 year)
Equipment cost	70,000	Cooler (1 year)
Electricity charge (*1)	276,300	Power conditioner building High-pressure washing machine
Others (contingencies)	303,780	10%
<b>Total</b>	<b>3,341,580</b>	

Note: Electricity charge calculation

- Power conditioner room, High-pressure washing machine, etc. is estimated as 8.0 kW/hour (assuming room temperature of 27-35°C).
- Electricity usage:  $365 \times 9 \times 0.5 \times 8.0 = 13,140\text{kWh}$  / year (assuming 50% conduction rate), 9 hours per day, conduction rate 50%
- Electricity tariff: 21.03 N/kWh

The Nigerian side also explained to the Team that their ownership will be transferred to FCTWB from FMOP immediately after commissioning officially.

### 8. Procurement Process of the Project

Both sides reconfirmed that procurement process would be supervised by the Procurement Agent (hereinafter referred to as "the Agent") who is recommended by the government of Japan Both sides also reconfirmed the roles of the Agent as follows:

- (1) The Agent will render the services stipulated in the provisions of the Grand Agreement (G/A) as well as the Exchange of Notes (E/N) for the Project;
- (2) The Agent will undertake the procurement procedure necessary for the Project according to the provisions of the G/A and E/N and any other concerned guidelines;
- (3) JICA will provide the Draft Final Report and Final Report to the Agent; and
- (4) The Agent will undertake the procurement according to the contents of the Final Report of the Preparatory Survey.

### 9. Project Cost

The Nigerian side agreed that the Project cost should not exceed the upper limit of amount agreed in E/N and G/A. Both sides confirmed that the Project cost contains procurement cost of equipment, the cost for transportation up to the Project Site, installation cost, the Procurement Agent fee, and the consultant fee that includes the cost for soft component for the technical assistance of operation and maintenance of the equipment and PV system as a whole.

The Nigerian side understood that the Project Cost Estimation attached as Annex-8 is not final and

is subject to change by discussion results among related parties of the Government of Japan.

## 10. Confidentiality of the Project

### (1) Detailed specifications of the Facilities and Equipment

Both sides confirmed that all the information related to the Project should not be released to any outside parties before conclusion of all the contract(s) for the Project because they are confidential document that contains information related to the tender.

Such information includes the followings:

- a) detailed drawings, specifications of the facilities and equipment, and other technical information of the facilities and equipment;
- b) the Draft Final Report; and
- c) the Final Report.

### (2) Confidentiality of the Cost estimation

The Team explained the estimated cost of the Project as described in Annex-8. The Nigerian side agreed that the estimated cost of the Project should never duplicated or disclosed to any outside parties (i.e. outside of JICA, the Nigerian side and the Agent) before tender for the project.

## 11. The Consultative Committee

The Nigerian side agreed that the FMOP would chair the Committee in order to facilitate consultation and procurement process. The Terms of Reference of the Committee was settled in Annex-9.

The members of the Committee are as follows:

- (1) Representative of FMOP (Chair)
- (2) Representative of National Planning Commission (NPC);
- (3) Representative of FCTA ;
- (4) Representative of FCTWB ;
- (5) Representative of the Embassy of Japan; and
- (6) Representative of JICA Nigeria Office.

The meeting of the Committee shall be held immediately after the signing of the consulting service contract between the Agent and the Consultant.

Further meetings shall be held upon request of either the Nigerian side or the Japanese side. The Agent may advise JICA and the Nigerian side on the necessity to call a meeting of the Committee.

## 12. Undertakings required by the Recipient Country

The Team requested the Nigerian side to abide by the following undertakings by the Nigerian side in addition to major undertakings described in the previous M/D. The Nigerian side agreed to do so.

### (1) Allocation of land/space for installation of PV system

The owner of the land where the following equipment and materials for PV system will be

installed is FCTWB. FCTWB had already agreed to offer their land and space for the installation of the system. It does not require any procedure concerning the agreement to use necessary land and space for the following facilities within the Lower Usama Dam Water Treatment Plant for the implementation of the Project:

- 1) PV Modules;
- 2) Cables between Equipment;
- 3) Power Conditioners;
- 4) Electric Substation;
- 5) Data Management System and Meteorological Devices; and
- 6) Temporary Stockyard.

#### (2) Preparation for the Site

FCTWB shall clear and level the space for Temporary Stockyard as the preparation of the site by July 2014.

#### (3) Assignment of Counterpart Personnel

##### 1) Overall project management

The Nigerian side agreed to assign the focal point for overall project management and coordination in each of FMOP, FCTA and FCTWB.

##### 2) Soft Component

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

The Nigerian side shall inform to JICA of the name of the focal Counterpart Personnel for the soft component from the following organizations at the first Consultative Committee meeting:

- FMOP;
- FCTWB; and
- Abuja DISCO.

Other personnel will be assigned from each organization as required at the time of installation.

#### (4) Customs and Tax Exemption

As stipulated in the Exchange of Note (E/N) and Grant Agreement (G/A), the necessary measures shall be taken by the Nigerian side to ensure that customs duties are exempted. FMOP shall deal with these measures as the Implementing Agency of the Project with obtaining support from the Federal Ministry of Finance and/or other related parties of the Nigerian side in timely manners.

As also stipulated in E/N and G/A, the Nigerian side shall bear all expenses including demurrage costs due to delay of custom clearance, other than those covered by the Grant and its accrued interest, necessary for the implementation of the Project.

#### (5) Environmental and Social Considerations

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

The Nigerian side shall obtain an official statement from the Federal Ministry of Environment that EIA and IEE are not required for the project.

**(6) Guarantee of design and construction of the existing No.3 and No.4 water tanks**

Japanese side shall be responsible for design and construction of the PV system in accordance with the provisions in the Draft Final Report.

FCTWB shall be responsible for design and construction of the existing No.3 and No.4 water tanks before installation of the PV system by Japanese side.

FCTWB shall also be responsible for rearrangement of the contract if required with the contractor for construction work of the existing No.3 and No.4 water tanks, in terms of guarantee of their original design and construction of these facilities.

**(7) Countermeasure against vandalism**

As the public can come close to the PV arrays of the Project, which are installed on the top surface of No.3 and No.4 water tanks, countermeasures against vandalism such as stone throwing shall be considered carefully. FCTWB explained to the Team that FCTWB will procure and install a fence with sufficient height on the north-western side of the PV arrays of the Project alongside of the existing internal road as the countermeasures against vandalism. FCTWB explained to the Team that they will secure enough budget for the procurement and installation and complete it before commencement of installation of the PV arrays of the Project by the Japanese side.

**(8) Regulatory requirements in Nigeria for operation and maintenance of the grid-connected PV system of the Project**

FMOP agreed properly to deal with the Regulatory requirements in Nigeria required for operation and maintenance of the grid-connected PV system of the Project such as acquisition of a license in timely manner.

<List of Annex>

Annex-1 Program Grant Aid for Environment and Climate Change

Annex-2 General Flow of Program Grant Aid for Environment and Climate Change

Annex-3 Flow of Funds for Project Implementation

Annex-4 Project Implementation System

Annex-5 Major Undertakings to be taken by Each Government

Annex-6 Location of Project Site

Annex-7 Layout of Photovoltaic System at the Lower Usuma Dam Water Treatment Plant

Annex-8 Project Cost Estimation

Annex-9 Terms of References of the Consultative Committee

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

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 Employment Contract 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 (Type I-E)."
- 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 (Type I-E)"

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) Employment Contract

The Recipient shall conclude an Employment Contract with independent and competent agent, in principle, within two months after the date of entry into force of the G/A, in accordance with the A/M. The scope of the Agent's services will be clearly specified in the Employment Contract.

c) Approval of the Employment Contract

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 Employment Contract concluded between the Recipient and the Agent shall become effective upon the approval by JICA in a written form to be eligible for the Grant and accrued interest.

d) Payment Methods

The Employment Contract 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 Employment Contract 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.

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## 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"

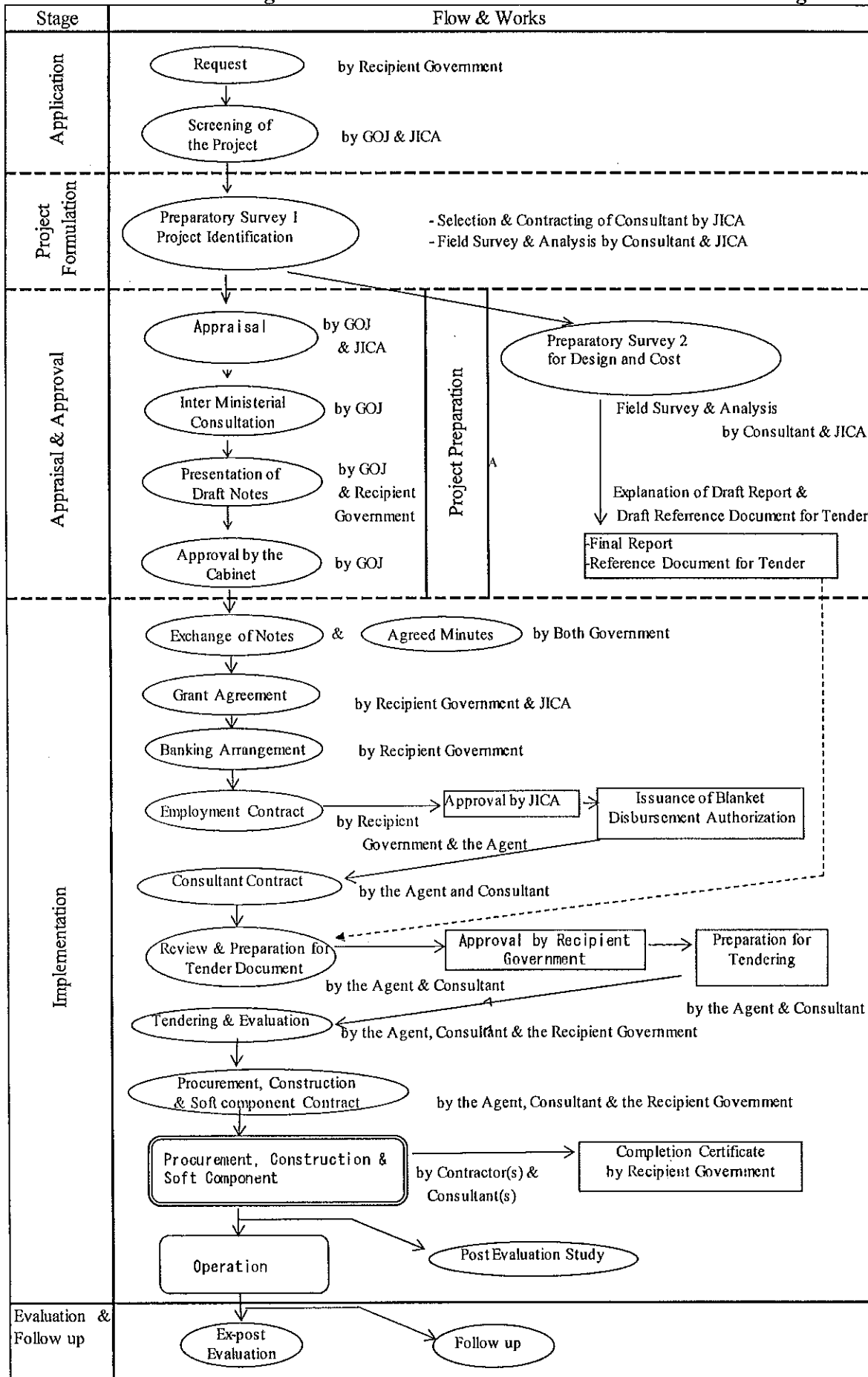
The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

6) "Export and Re-export" of products

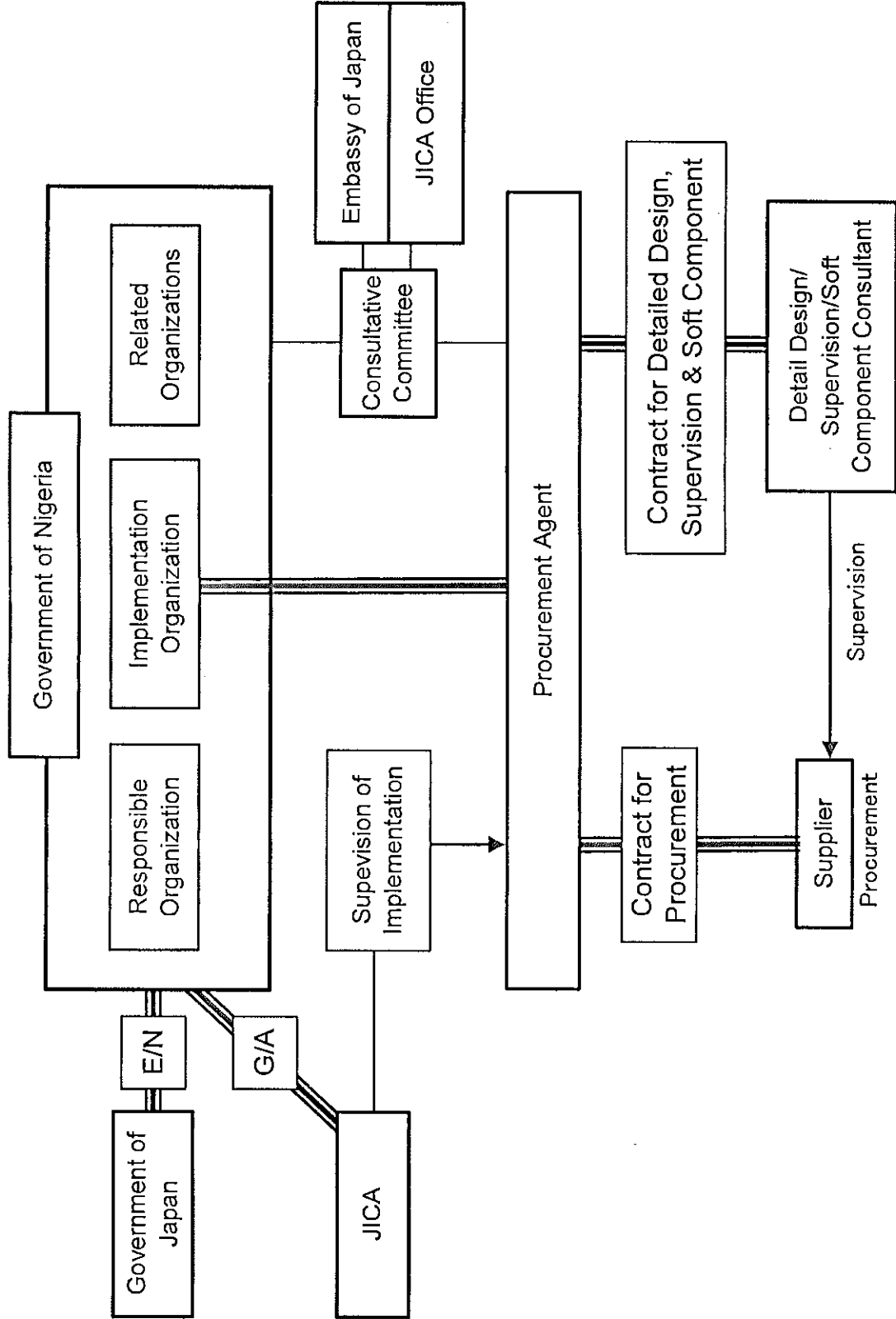
The products purchased under the Grant and its accrued interest will not be exported or re-exported from the Recipient.

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**General Flow of Program Grant Aid for Environment and Climate Change**

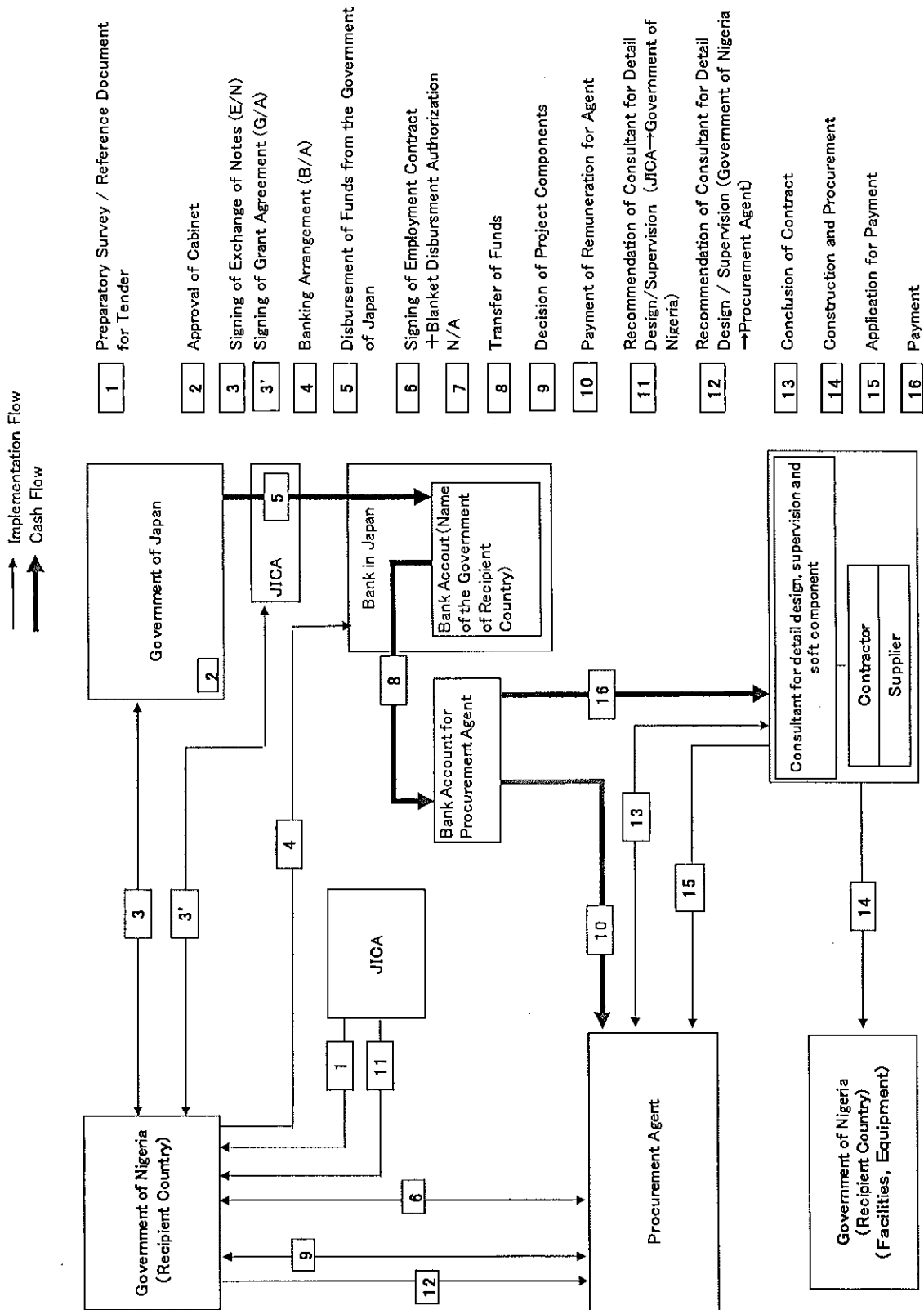


# Project Implementation System



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Flow of Funds for Project Implementation



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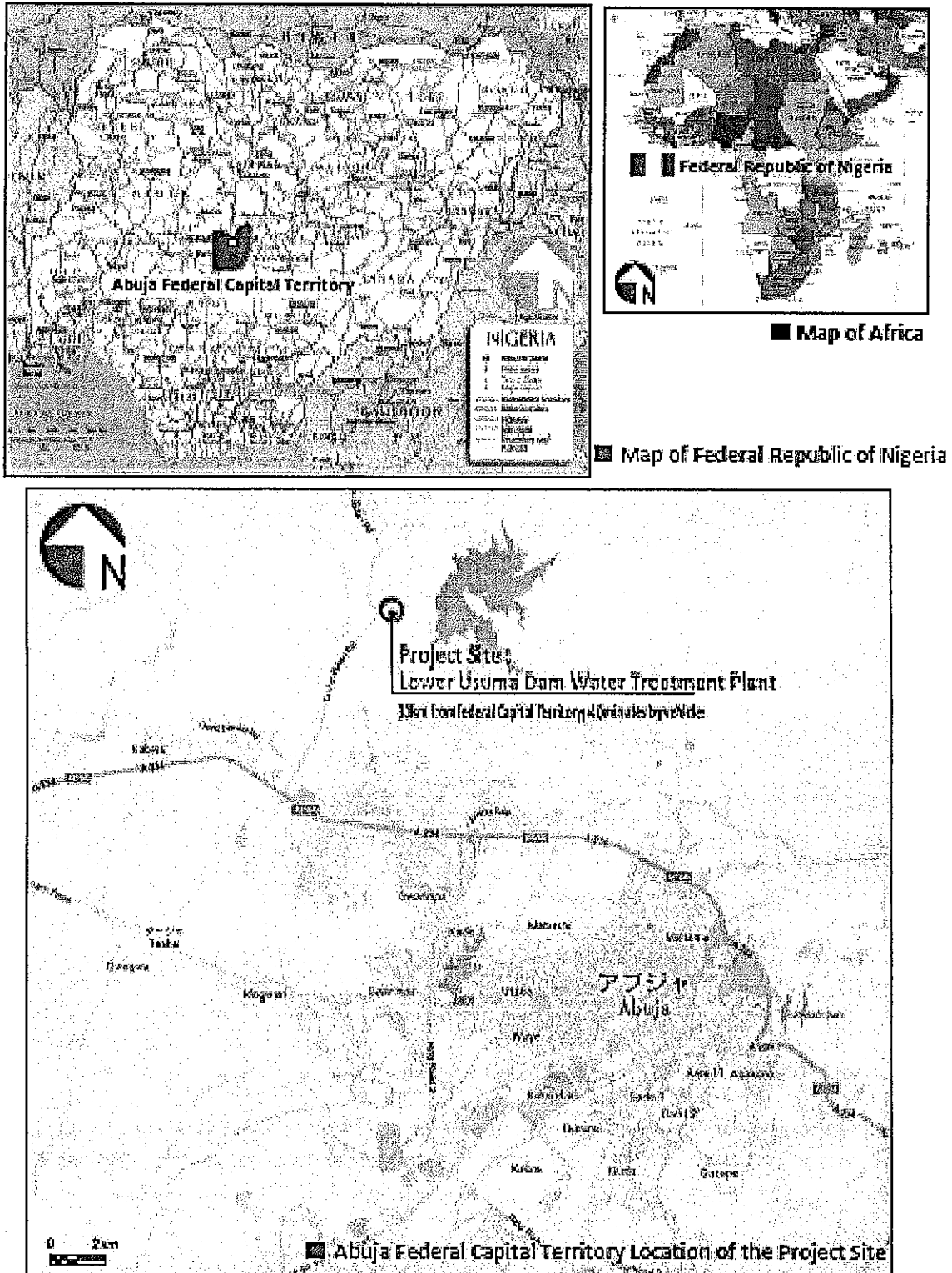


## Major undertakings to be taken by each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side	
			FMOP	FCTWB
1	to secure [a lot] /[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		● Arrangement	● Securement
2	To construct the following facilities			
	1) The Power Conditioner Building	●		
	2) The gates and fences in and around the site		●	
	3) The parking lot (if necessary)		●	●
	4) The road within the site	N/A		
	5) The road outside the site (if necessary)		●	●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site]/[sites]			
	1) Electricity			
	a. The distributing power line to the site (Securement of interconnection point of the PV system)		● Arrangement	● Securement
	b. The drop wiring and internal wiring within the site (Wiring of the equipment of the Project after the interconnection point)	●		
	c. The main circuit breaker and transformer (The main circuit breaker and transformer for the interconnection)	●		
	d. The connection point of electricity for the installation and construction works beside the Project site		● Arrangement	● Securement
	2) Water Supply			
	a. The city water distribution main to the site (Securement of connection point of the water system of the Project)		● Arrangement	● Securement
	b. The supply system within the site (Water line and taps for maintenance of the PV arrays)	●		
	c. The connection point of water for the installation and construction work beside the Project site		● Arrangement	● Securement
	3) Drainage			
	a. The city drainage main (for storm sewer and others to the site)		● Arrangement	● Securement
	b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site	N/A		
	4) Gas Supply			
	a. The city gas main to the site		N/A	N/A
	b. The gas supply system within the site	N/A		
	5) Telephone System			
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		N/A	N/A
	b. The MDF and the extension after the frame/panel	N/A		
	6) Furniture and Equipment			
	a. General furniture		●	
	b. Project equipment (Procurement and installation of the equipment of the Project)	●		
	c. Procurement of materials for final connection of the equipment of the Project to the 11kV system at the interconnection point	●		
	d. Implementation of scheduled outage of the 11kV system, and final connection work of the equipment of the Project to the 11kV system		● Arrangement	● Implementation
4	To bear the following commissions applied by the Japanese bank for banking services based upon the B/A:			
	1) Payment of bank commission		●	

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side	
			FMOP	FCTWB
5	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products			
	1) Marine (Air) transportation of the Products from Japan to the recipient country	●		
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		●	
	3) Internal transportation from the port of disembarkation to the project site	●		
6	Securement of area for temporary storage and offices		● Arrangement	● Securement
7	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 products and the services be exempted		●	
8	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		● Arrangement	● Support
9	To maintain and use properly and effectively for the facilities that are constructed and the equipment that is provided under the Grant		● Monitoring	● Implementation
10	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		●	●
11	To give due environmental and social consideration in the implementation of the Project.		●	
12	Countermeasures against vandalism		●	●

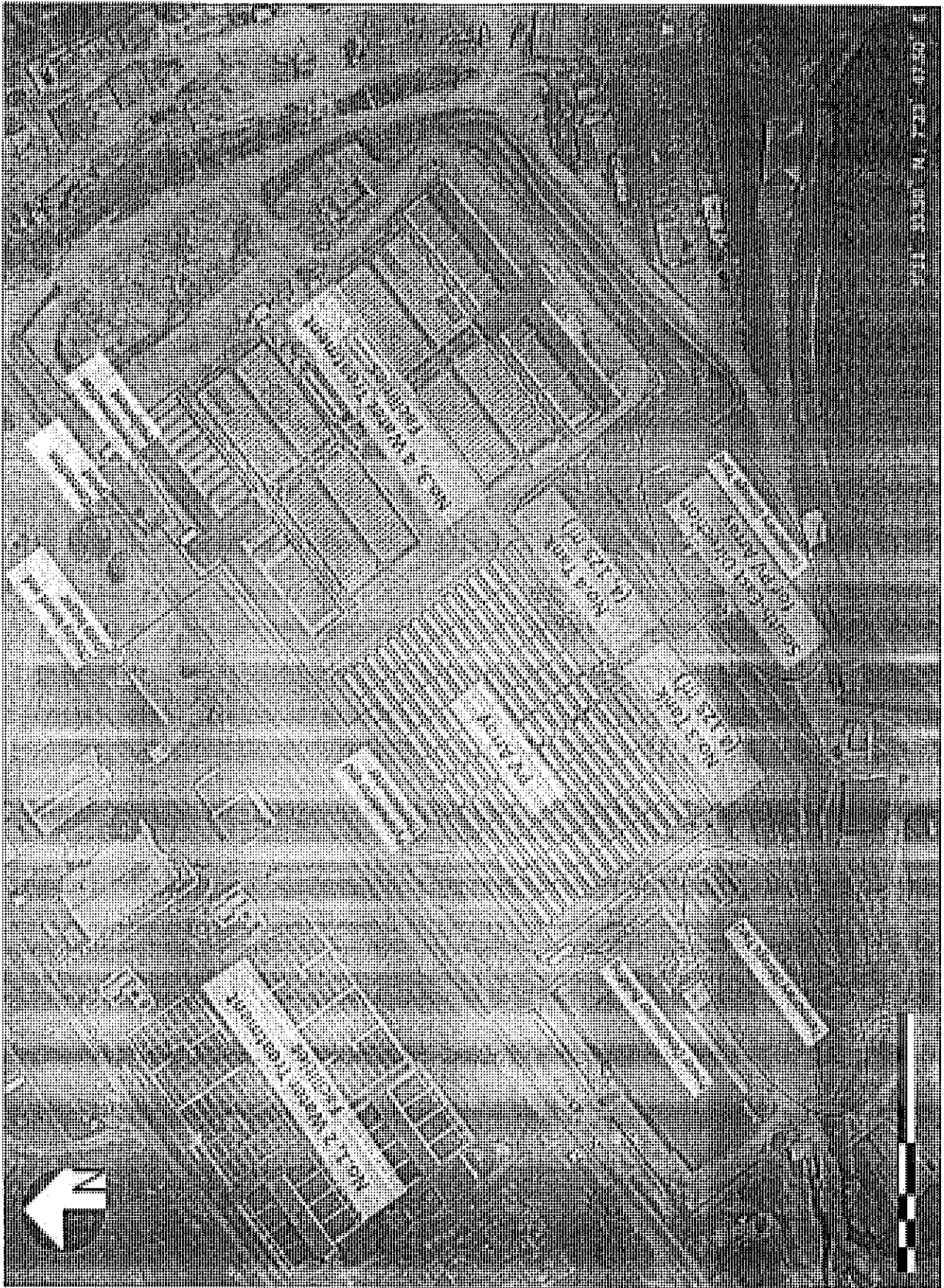
### Location of Project Site



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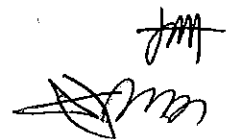


### Layout of Photovoltaic System at the Lower Usuma Dam Water Treatment Plant



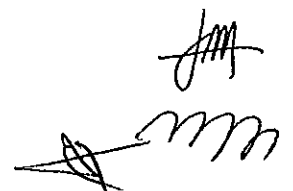
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Terms of Reference of the Consultative Committee (Provisional)

1. To confirm an implementation schedule of the Project for the speedy and effective utilization of the Grant and its accrued interest.
2. To discuss the modifications of the Project, 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 monitor the progress of implementation of the undertakings required by the Recipient Country and to take proactive and effective actions to complete the undertakings in accordance with the targeted schedule in case any delay would be expected or observed.
5. To identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems.
6. To exchange views on publicity related to the utilization of the Grant and its accrued interest.
7. To discuss any other matters that may arise from or in connection with the G/A.

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ナイジェリア連邦共和国  
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

ソフトコンポーネント計画書

平成 26 年 3 月

八千代エンジニアリング株式会社



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## 1. ソフトコンポーネントを計画する背景

ナイジェリア連邦共和国（以下、「ナ」国と称す）「太陽光を活用したクリーンエネルギー導入計画」では、「ナ」国連邦首都区に位置するウスマダム浄水場を対象サイトとして、系統連系型の太陽光発電システム及び関連する変圧器、所内配電用資機材の調達及び据付を行うものである。贈与契約に示される限度額（9.8億円）を踏まえ、積算時点（2013年10月）の通貨交換レート等の積算条件をもとに、概略事業費の積算を行うと、設備容量は975kWp程度になる。

ウスマダム浄水場において、配水部門の機械・電気課（機械技術者2名、電気技術者9名、運転技師5名、配管工1名の計17名から構成）は、浄水場構内設備全般の運転維持管理を担当しており、本計画による太陽光発電システムの運転維持管理はこの課が担う。ウスマダム浄水場では電圧階級33kVにて商用系統より受電し、構内の33/11kV変電施設にて11kVに降圧された後、浄水場内に配電されている。そのため、機械・電気課職員は電気設備の運転維持管理に係る基本的な知識及び技能は有しているものの、系統連系太陽光発電システムを対象とする場合、同システムは初めての導入となることから運転維持管理に係る知識及び技術はほぼ無く、日常の業務をとおして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アブジャ配電会社、及び電力事業に係る中央省庁の連邦電力省は、系統連系型の分散型電源が配電系統に接続され運転された経験は乏しいことから、系統連系太陽光発電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上、現状では系統連系に係る法規制も整備されていない。

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、並びに系統連系太陽光発電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、運転維持管理機関となる連邦首都区水公社のウスマダム浄水場の機械・電気課を主な対象として系統連系太陽光発電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、太陽光発電システムが連系される配電系統の運用者・維持管理者においても、系統連系太陽光発電システムの特徴を把握しておく必要があることから、ウスマダム浄水場機械・電気課、配電系統の運用者であるアブジャ配電会社、さらには「ナ」国の電力政策の立案と実施、電力事業の監督を行う連邦電力省に対しても、系統連系太陽光発電システムの概要、系統運用上の留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。

## 2. 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、「ナ」国側による系統連系太陽光発電システムの運転維持管理体制が構築される。
- (2) 系統連系太陽光発電システムの運転維持管理を行うための技術が移転される。
- (3) 太陽光発電システムが連系された配電系統が安定的に運用される。

## 3. 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、表3-1のとおりである。

表 3-1 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、「ナ」国側による系統連系太陽光発電システムの運転維持管理体制が構築される。	1-1 系統連系太陽光発電システムの運転維持管理組織を構築する。	・ ウスマダム浄水場機械・電気課
	1-2 系統連系太陽光発電システムの概要及び特性が理解される。	・ ウスマダム浄水場機械・電気課 ・ アブジャ配電会社 ・ 連邦電力省
2. 系統連系太陽光発電システムの運転維持管理を行うための技術が移転される。	2-1 系統連系太陽光発電システムの運転維持管理方法を習得する。	・ ウスマダム浄水場機械・電気課
	2-2 系統連系太陽光発電システムの運転維持管理システムを確立する。	
	2-3 系統連系太陽光発電システムのトラブルシューティング手法を習得する。	・ ウスマダム浄水場機械・電気課 ・ ウスマダム浄水場管理部
3. 太陽光発電システムが連系された配電系統が安定的に運用される。	3-1 モニタリング実施体制が構築され、モニタリング手法を習得する。	・ ウスマダム浄水場機械・電気課 ・ アブジャ配電会社 ・ 連邦電力省
	3-2 運転維持管理マニュアルを作成する。	・ ウスマダム浄水場機械・電気課

なお、本案件実施中に日本人技術者（据付業者）により実施される初期操作指導・運用指導の内容は次のとおりである。

- 系統連系太陽光発電システム完成時、運転開始前の検査、点検、測定
- 試運転方法
- 運転開始後の日常点検

以上のように、初期操作指導・運用指導内容は、本計画設備の操作及び点検方法等、本計画の設備の仕様を踏まえつつ、コントラクターが応用的な技術を指導するものである。一方、本ソフトコンポーネントによる成果のねらいは、系統連系太陽光発電システムの運転維持管理体制の構築、太陽光発電の原理、系統連系に係る技術等、コンサルタントが本計画設備を運転維持管理する上で必要となる基礎的な技術の移転を行うものである。したがって、初期操作指導・運用指導と本ソフトコンポーネントの内容は互いに補完し合う関係がある。

#### 4. 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 4-1 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 4-1 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
ウスマダム浄水場 機械・電気課	<ul style="list-style-type: none"> <li>● 系統連系太陽光発電システムの運転維持管理組織を構築する。</li> <li>● 系統連系太陽光発電システムの概要及び特性が理解される。</li> <li>● 系統連系太陽光発電システムの運転維持管理方法を習得する。</li> <li>● 系統連系太陽光発電システムの運転維持管理システムを確立する。</li> <li>● 系統連系太陽光発電システムのトラブルシューティング手法を習得する。</li> <li>● モニタリング実施体制が構築され、モニタリング手法を習得する。</li> <li>● 運転維持管理マニュアルを作成する。</li> </ul>	<ul style="list-style-type: none"> <li>● レポート</li> <li>● マニュアル</li> </ul>
ウスマダム浄水場 管理部	<ul style="list-style-type: none"> <li>● 系統連系太陽光発電システムのトラブルシューティング手法を習得する。</li> </ul>	<ul style="list-style-type: none"> <li>● レポート</li> </ul>
アブジャ配電会社	<ul style="list-style-type: none"> <li>● 系統連系太陽光発電システムの概要及び特性が理解される。</li> <li>● モニタリング実施体制が構築され、モニタリング手法を習得する。</li> </ul>	<ul style="list-style-type: none"> <li>● レポート</li> </ul>
連邦電力省	<ul style="list-style-type: none"> <li>● 系統連系太陽光発電システムの概要及び特性が理解される。</li> <li>● モニタリング実施体制が構築され、モニタリング手法を習得する。</li> </ul>	<ul style="list-style-type: none"> <li>● レポート</li> </ul>

## 5. ソフトコンポーネントの活動（投入計画）

### 5-1 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 5-1 に示したように、太陽光発電システムの基礎から、運転維持管理、モニタリングまでの技術移転を図る。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、ウスマダム浄水場へ導入予定の太陽光アレイ、計測器、工具類を活用する。

なお、本計画によりウスマダム浄水場に導入される系統連系太陽光発電システムでは、配電系統側への逆潮流は発生しないと想定されるが、「ナ」国で将来的に逆潮流を含む系統連系太陽光発電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 5-1 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、「ナ」国側による系統連系太陽光発電システムの運転維持管理体制が構築される。	1-1 系統連系太陽光発電システムの運転維持管理体制組織を構築する。	<ul style="list-style-type: none"> <li>系統連系太陽光発電システムの運転維持管理体制が明確化される。</li> </ul>	<ul style="list-style-type: none"> <li>座学</li> <li>座学、グループ演習</li> </ul>	<ul style="list-style-type: none"> <li>ウスマダム浄水場機械・電気課</li> </ul>
	1-2 系統連系太陽光発電システムの概要及び特性が理解される。	<ul style="list-style-type: none"> <li>太陽光発電システムの原理と基礎知識を習得する。</li> <li>系統連系太陽光発電システムの特徴及び保護機能を理解する。</li> <li>系統連系太陽光発電システム導入時の検討課題を把握する。</li> </ul>	<ul style="list-style-type: none"> <li>座学</li> <li>グループ演習</li> </ul>	<ul style="list-style-type: none"> <li>ウスマダム浄水場機械・電気課</li> <li>アブジャ配電会社</li> <li>連邦電力省</li> </ul>
2. 系統連系太陽光発電システムの運転維持管理を行うための技術が移転される。	2-1 系統連系太陽光発電システムの運転維持方法を習得する。	<ul style="list-style-type: none"> <li>系統連系太陽光発電システムの運転管理方法が構築される。</li> <li>系統連系太陽光発電システムの維持管理方法が構築される。</li> </ul>	<ul style="list-style-type: none"> <li>座学</li> <li>実習（実機による運転操作）</li> <li>実習（点検リストの作成、点検、補修）</li> <li>実習（絶縁抵抗、開放電圧測定を含む）</li> </ul>	<ul style="list-style-type: none"> <li>ウスマダム浄水場機械・電気課</li> </ul>
	2-2 系統連系太陽光発電システムの運転維持方法を確立する。	<ul style="list-style-type: none"> <li>構築された運転維持管理システムの評価がなされ、必要に応じて修正及び見直しがなされる。</li> </ul>	<ul style="list-style-type: none"> <li>座学</li> </ul>	<ul style="list-style-type: none"> <li>ウスマダム浄水場機械・電気課</li> </ul>
	2-3 系統連系太陽光発電システムのトラブleshooting手法を習得する。	<ul style="list-style-type: none"> <li>系統連系太陽光発電システムのトラブleshooting方法が確立される。</li> </ul>	<ul style="list-style-type: none"> <li>座学、グループ演習</li> <li>実習（マニュアルに基づく運転操作、事故想定訓練）</li> </ul>	<ul style="list-style-type: none"> <li>ウスマダム浄水場機械・電気課</li> <li>ウスマダム浄水場管理部</li> </ul>
3. プロジェクトの竣工後、「ナ」国側による系統連系太陽光発電システムの運転維持	3-1 モニタリング実施体制が構築され、モニタリング手法を習得する。	<ul style="list-style-type: none"> <li>モニタリング方法が確立する。</li> <li>定期点検項目及び点検方法を習得する</li> <li>モニタリング時の評価項目及び評価手法を習得する。</li> </ul>	<ul style="list-style-type: none"> <li>座学</li> <li>実習（運転データの記録・評価、設備の状態監視）</li> </ul>	<ul style="list-style-type: none"> <li>ウスマダム浄水場機械・電気課</li> <li>アブジャ配電会社</li> <li>連邦電力省</li> </ul>



<p>管理体制が構築される。</p>	<p>3-2 運転維持管理マニュアルを作成する。</p>	<ul style="list-style-type: none"> <li>モリタリング結果報告の記載方法を理解する。</li> <li>「ナ」国側と相互協力にて運転維持管理マニュアルが作成される。</li> </ul>	<ul style="list-style-type: none"> <li>座学、演習（マニュアル作成）</li> </ul>	<ul style="list-style-type: none"> <li>ウスマダム浄水場機械・電気課</li> </ul>
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## 5-2 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 5-1 の活動を実施することにより、運転維持管理機関である連邦首都区水公社のウスマダム浄水場が系統連系太陽光発電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、浄水場構内の配電設備の運用者であるウスマダム浄水場、配電系統の運用者であるアブジャ配電会社や、電力政策の立案と実施、電力事業の監督を行う連邦電力省に対しても、系統連系太陽光発電システムの概要や、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（太陽光発電システム）、指導技術者 2（系統連系）の 2 名を表 5-2 に示す期間「ナ」国に派遣し、技術移転を行う。

表 5-2 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 (日数)	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 (太陽光発電システム)	3号	0.50月 (12日間)	1回	<ul style="list-style-type: none"> <li>運転維持管理機関内の運転維持管理体制の構築</li> <li>構築した運転維持管理体制の各部署の役割分担の整理</li> <li>運転維持管理機関への系統連系太陽光発電システムの概要・特性に関する技術移転</li> </ul>
指導技術者 2 (系統連系)	3号	0.50月 (12日間)	1回	<ul style="list-style-type: none"> <li>電力事業を管轄する省庁、電力事業者との運転維持管理に係る相互協力体制の構築</li> <li>構築した運転維持管理体制の各部署の役割分担の整理</li> <li>電力事業を管轄する省庁、電力事業者への系統連系太陽光発電システムの概要・特性に関する技術移転</li> </ul>
2. 技術トレーニング				
指導技術者 1 (太陽光発電システム)	3号	0.50月 (12日間)	1回	<ul style="list-style-type: none"> <li>太陽光発電の原理に係る技術移転</li> <li>納入機材を活用した実技研修 (解放電圧及び短絡電流の実計測訓練及び I-V 曲線の導出と理解等)</li> <li>運転維持管理実施のための点検リストの作成及び整備</li> </ul>
指導技術者 2 (系統連系)	3号	0.50月 (12日間)	1回	<ul style="list-style-type: none"> <li>系統事故、構内事故に係るトラブルシューティングと対策方法に係る技術移転</li> <li>「ナ」国にて想定される系統連系太陽光発電システム導入時の課題の整理</li> <li>「系統連系規程」に示される基本事項に係る技術移転</li> </ul>
3. モニタリング				
指導技術者 1 (太陽光発電システム)	3号	0.50月 (12日間)	1回	<ul style="list-style-type: none"> <li>運転維持管理機関による運転維持管理状況のモニタリング及びアドバイス</li> <li>トラブルシューティングを含む運転維持管理マニュアルの作成</li> </ul>
指導技術者 2 (系統連系)	3号	0.50月 (12日間)	1回	<ul style="list-style-type: none"> <li>電力事業を管轄する省庁、電力事業者の協力体制に係るモニタリング及びアドバイス</li> <li>トラブルシューティングを含む運転維持管理マニュアルに係る技術移転</li> </ul>

### (2) 「ナ」国側の投入計画

「ナ」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。

## 1) 太陽光発電システム運営委員会（仮称）

本ソフトコンポーネントの開始時までには、連邦電力省は、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「太陽光発電システム運営委員会（仮称）」を設置する。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、ソフトコンポーネント期間中には定期的に委員会を開催する。また、太陽光発電システム運営委員会の設置と同様に、本計画にて据付する太陽光発電システムの維持管理の役割を直接担う、ウスマダム浄水場スタッフから構成される太陽光発電システムワーキンググループを設置し、太陽光発電システム運営委員会は本ソフトコンポーネント計画終了後、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、同太陽光発電システムワーキンググループを指導する。太陽光発電システムワーキンググループは同委員会に太陽光発電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。

太陽光発電システム運営委員会はウスマダム浄水場内に事務局を置き、連邦電力省が運営責任機関となり、アブジャ配電会社、連邦首都区水公社（ウスマダム浄水場）の3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名から2名程度で構成する。太陽光発電システム運営委員会の組織を図5-1に示す。

太陽光発電システム運営委員会は及び太陽光発電システムワーキンググループは、表5-3に示す実施体制に従って運営するとともに、「ナ」国における系統連系太陽光発電システムの普及に備えて下記事項を討議する。

- ① 系統連系太陽光発電システムの運転維持管理に関する課題
- ② 系統連系太陽光発電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
- ③ 系統連系太陽光発電システムを「ナ」国で普及させる上での障害
- ④ 系統連系太陽光発電システムを「ナ」国で普及させるための法的規制
- ⑤ 系統連系太陽光発電システムを「ナ」国で普及させるための技術基準(逆潮流を含む)

## 2) 太陽光発電システムワーキンググループ案

太陽光発電システムワーキンググループは太陽光発電システム運営委員会の下部組織として設立し、太陽光発電システム運営委員会の指導・監督の下、系統連系太陽光発電システムの運転維持管理を実践する。

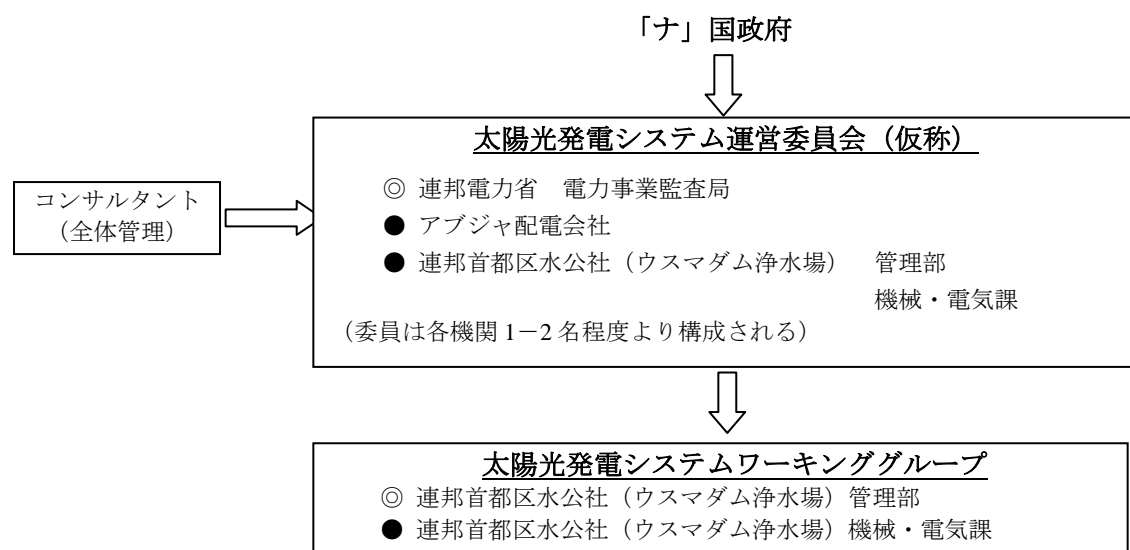


図5-1 太陽光発電システム運営委員会実施体制（案）

表5-3 太陽光発電システム運営委員会実施体制（案）

	日本人 コンサルタント	太陽光発電システム運営 委員会	太陽光発電システム ワーキンググループ
本計画の組織	2名	5-10名	3-5名
本計画の運営方法	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
本計画内容の オリエンテーション	説明	開催	開催、参加
運転維持管理マニュアル	助言	原案チェック	原案作成
維持管理フォローアップ	管理指導	運転維持管理報告	運転維持管理報告
報告先	在「ナ」国日本大使館及び JICA	日本人コンサルタント	太陽光発電システム 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・据付される系統連系太陽光発電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、日本の太陽光発電製品、システムに精通している必要がある。「ナ」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、日本の太陽光発電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 7-1 に示す。

日本より派遣された技術者は、表 7-1 に示す実施工程に従い、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

運転維持管理体制構築の支援を目的に行うことから、また機材据付前に運転維持管理体制を確立させておくことは設備据付時における当事者意識を喚起できることから、アレイ据付工事前に実施する。

### ➤ 技術トレーニング

システムの点検・運転等については実設備を利用し行う。また設備が運開するまでに備えておくべき運転維持管理マニュアル等についてのトレーニングを行うため、アレイ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

「ナ」国側が自主的に運転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、検収・竣工引渡し後を目途に実施する。



表 7-1 ソフトコンポーネントの実施スケジュール

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
準備工事		■														
基礎工事及び架台工事			■	■	■	■	■	■								
モジュール検査							■	■								
PVアレイ据付工事							■	■	■							
試運転・調整														■		
運転指導														■		
検収・竣工引渡し															▼	
ソフト コンポーネント	1. 運転維持管理体制の構築				■											
	2. 技術トレーニング						■									
	3. モニタリング														■	
成果品	運転維持管理マニュアル				■											
	実施状況報告書						■									
	完了報告書															■

## 8. 成果品

本ソフトコンポーネントの成果品は表 7-1 に記載したように、運転維持管理マニュアル、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 11,757 千円であり、内訳は表 9-1 に示す通りである。

表 9-1 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	2,334
直接経費	6,436
間接費	2,987
合計	11,757

## 10. 相手国実施機関の責務

「ナ」国側はソフトコンポーネントを円滑に実施してその効果を最大に発現させるため、以下の責務を全うすることとする。

- 連邦首都区水公社（ウスマダム浄水場）は、本ソフトコンポーネント実施に協力する太陽光発電システム運営委員会を設置する。
- 連邦首都区水公社（ウスマダム浄水場）は、本ソフトコンポーネント実施に必要な作業室等を用意する。
- 連邦首都区水公社（ウスマダム浄水場）は、本ソフトコンポーネントに必要な人員を提供する。
- 太陽光発電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。


- 連邦首都区水公社（ウスマダム浄水場）は、運転維持管理マニュアルに基づき、系統連系太陽光発電システムを適切に運転維持管理していく。
- 連邦首都区水公社（ウスマダム浄水場）は、運転維持管理マニュアルに基づいた一定期間において、実績報告を日本人コンサルタントへ提出する。


**PREPARATORY SURVEY  
ON  
THE PROJECT FOR  
INTRODUCTION OF CLEAN ENERGY  
BY SOLAR ELECTRICITY GENERATION SYSTEM  
IN THE FEDERAL REPUBLIC OF NIGERIA**


**THE FIRST FIELD SURVEY**

**FIELD REPORT**

27<sup>TH</sup> SEPTEMBER, 2013

  
Mr. Kazunari Nogami  
Chief Consultant for the Project  
Yachyo Engineering Co., Ltd.

  
Engr. A. Adebisi  
Acting Director  
Electrical Inspectorate and Services Department  
Federal Ministry of Power

  
Engr. J.B. Anto  
Director  
Federal Capital Territory Water Board

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**ANNEX**

ANNEX 1	Members of the Team
ANNEX 2	Minutes of Discussions signed on 19 <sup>th</sup> September, 2013
ANNEX 3	Plan of Internal Traffic Route and Stockyards for Construction Materials /Equipment
ANNEX 4	Specifications of the Equipment



The Project is composed of procurement and installation of Approx. 800 to 900 kWp of PV system.

The layout of the components of the Project at the Plant is shown in Figure 2. FMOP, FCTWB and the Team agreed that the PV arrays of the Project will be located on the top surface of No.3 and No.4 Tanks, and over the part between No.3 and No.4 Tanks at the Plant (Approx. 8,800m<sup>2</sup>) as shown in Figure 2. FMOP, FCTWB and the Team also agreed that the power conditioner building of the Project will be located at the north western corner of No.3 Tanks as shown in Figure 2.

In addition, the Team explained that areas of at least 2,500m<sup>2</sup> for temporary use such as construction of project site offices and workshops, and storage of materials and equipment are also necessary during the period of execution of the Project and shall be provided by the Plant and FCTWB free of charge to Japanese side. The tentative locations of such areas proposed by the Team are shown in Figure 2.

Also, FCTWB agreed to permit the usage of above mentioned land and facilities for installation of the equipment.

However, the area is dependent on capacity of the PV system of the Project. More definite size will be considered by the Team based on the Outline Design and cost estimation in Japan, discussed between the Ministry of Foreign Affairs, JICA and the Team and explained to the Nigerian side in the second field survey.



Figure 2 Layout of the components of the Project at Lower Usama Dam Water Treatment Plant

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1. Introduction

Japan International Cooperation Agency (JICA) dispatched a survey team to the Federal Republic of Nigeria to appraise the Project for Introduction of Clean Energy by Solar Electricity Generation System in the Federal Republic of Nigeria (the Project) which was requested by the Government of Nigeria in a new scheme of Japan's Grant Aid, "Program Grant Aid for Environment and Climate Change". The Project is aimed at introducing large scale of on-grid photovoltaic (PV) system.

The Federal Ministry of Power (FMOP), Federal Capital Territory Water Board (FCTWB) and JICA Preparatory Survey Team for the Project (the Team) had series of technical discussions to form a mutual understanding of the contents and the scope, and preconditions for the Outline Design of the Project at the stage of the first survey and three parties agreed to record the following points as a conclusion of the discussions.

Components of the Project will be further examined and may be modified through the consultation with the Ministry of Foreign Affairs and JICA headquarters. It is important for both sides to understand that the Preparatory Survey is not a commitment for the future implementation of the Project.

2. Project site location

The Project site is located at the Lower Usama Dam Water Treatment Plant (the Plant), Abuja.

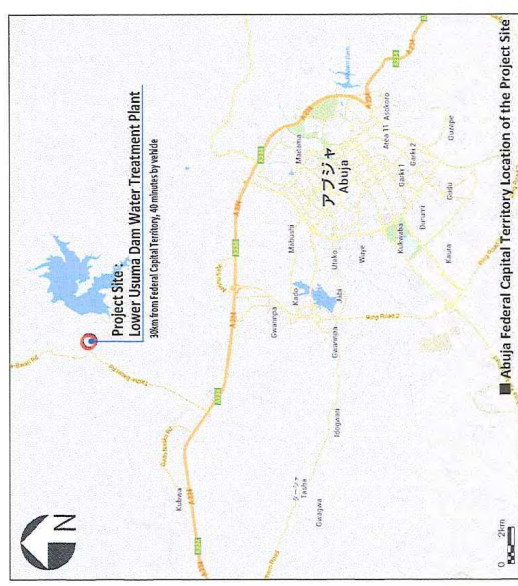


Figure 1 Project Site Location

Source: JICA Study Team using Google Map

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### 3. Components for the Project

#### 3.1 Final Requested Components

The Nigerian and Japanese sides agreed on the final requested components in conformity with the Minutes of Meetings on 19<sup>th</sup> September, 2013 in the first field survey as shown below.

**Table 1 Outline of the Project**

Components	Quantity or Capacity
1. PV system 1.1 Micro-grid control system (1) Solar PV arrays (Crystalline Silicon Type) (2) Junction box (3) Collecting box (4) Power conditioners (5) Low voltage main circuit breakers panel (6) Transformer for interconnection (7) High voltage circuit breaker panel 1.2 Data management system (1) Data logger including UPS system (2) Display system (3) Weather monitor instruments (Pyranometer, Temperature meter) 2. Cables and fitting materials	800 to 900 kWp  1 lot 1 lot  Total capacity of the connected photovoltaic modules or more 1 unit 1 unit  1 set 1 set 1 set  1 lot
1. Spare parts 2. Maintenance tools (including high pressure washing machines)	1 lot 1 lot
a. Mounting Structures for the PV arrays b. Foundations for the PV arrays c. Power Conditioner Building	for the PV arrays of 800 to 900 kWp for the PV arrays of 800 to 900 kWp Gross floor area: Approx. 77.5 m <sup>2</sup>

Source: JICA Study Team

In addition to the components mentioned above, soft component to improve knowledge and techniques for operation and maintenance of the PV system will be included in the Project.

The Exchange of Notes (E/N) and Grant Agreement (G/A) for the Project were already concluded in 2012 between the Nigerian side and Japanese side. According to the E/N and G/A, the grant amount is nine hundred and eighty million Japanese Yen (¥980,000,000).

After discussions with the Team considering this, the installation of the on-grid power generating system using PV without power storage system including following equipment was requested by the Nigerian side in the Minutes of Discussions signed on 19<sup>th</sup> September, 2013. However, the Nigerian side and the Team confirmed that the capacity of PV arrays of the Project might be changed as the result of detail analysis in Japan including system design and cost estimation based on the data and information collected in the first field survey in Nigeria.

### 3.2 Drawings

The following drawings are attached to this field report.

- G-01 General layout of the Project site
- G-02 Layout of the PV arrays
- E-01 Single line diagram of the Lower Usama Dam Water Treatment Plant
- E-02 Single line diagram of the PV system of 800 kWp
- E-03 Connection arrangement with the existing electrical equipment
- A-01 Mounting Structure Foundation (1) Typical Section on Reservoir
- A-02 Mounting Structure Foundation (2) Typical Section at Central Passage
- A-03 Power Conditioner Building (1) Location, Section
- A-04 Power Conditioner Building (2) Plan, Elevation, Section
- A-05 Power Conditioner Building (3) Finishing Schedule, Fitting List
- A-06 Power Conditioner Building (4) Facilities Plan

### 3.3 Technical issues discussed in the first field survey

#### (1) Location of the PV arrays

FMOP, FCTWB and the Team agreed that the PV arrays of the Project will be located on the top surface of No.3 and No.4 Tanks, and over the part between No.3 and No.4 Tanks at the Plant (Approx. 8,800m<sup>2</sup>) as shown in Drawing No. G-02. FMOP, FCTWB and the Team also agreed that the power conditioner building will be located as shown in Drawing No. G-02.

FMOP, FCTWB and the Team also agreed that the detail layout of the PV arrays on the top surface of No.3 and No.4 Tanks, and over the part between No.3 and No.4 Tanks may be changed in accordance with the Outline Design conducted by the Team in the analysis in Japan with paying attention to discussions in the first field survey.

#### (2) Operational conditions of the water treatment plants at the Plant and reverse power to the commercial grid from the PV system

The Team confirmed the demand of each 11 kV trunks (total 3 feeders) from 1<sup>st</sup> of November, 2012 to 17<sup>th</sup> September, 2013 at the Plant. As the result, it is assumed that introduction of PV system of Approx. 900 kWp at the Plant could cause reverse power from the PV system to the commercial grid of the distribution company.

However, it is explained by FCTWB that such reverse power to the commercial grid of the distribution company will not happen at the time of commissioning of the PV system of the Project in consideration of the followings.

- Though No.3 and No.4 Plants have been constructed in respond to remarkable increase of water demand in the Federal Capital Territory, these plants are still in condition of test

operation currently. When the PV system of the Project is commissioned, No.3 and No.4 Plants will have been operated in full load in addition to No.1 and No.2 Plants currently operating in full load.

- Through the plants at the Plant are currently operated in accordance with demand, they will be operated so that energy from the PV system can be consumed in the Plant fully with adjusting tank balance after the PV system of the Project is commissioned.

### (3) Maintenance of the PV arrays

As Nigeria has harmattan season, cleaning of the PV arrays shall be carried out frequently to apply the PV system effectively in the season. However, cleaning of the PV system after harmattan is too heavy labor to carry out only in human power in consideration of such huge scale of the PV system of the Project as 800 to 900 kWp. FMOP, FCTWB and the Team agreed that it is required to procure equipment to clean the PV arrays efficiently in the Project such as high pressure washing machines. The Team agreed to suggest the components as the scope of the Japanese side to the Japanese related organization in the analysis in Japan after the first field survey.

To use such high pressure washing machines on the top surface of No.3 and No.4 Tanks, electric sockets and water taps shall be provided in interval of Approx. 20 m along the catwalks procured and installed in the Project for maintenance of the PV arrays. The Team also agreed to suggest the components as the scope of the Japanese side to the Japanese related organization in the analysis in Japan after the first field survey, in case that high pressure washing machines will include the components.

FCTWB agreed that the electric sockets and water taps will be installed on the top surface of No.3 and No.4 Tanks by the Japanese side, in case that high pressure washing machines will include the components. FCTWB also agreed that the booster pump to supply enough pressure to the water lines to use high pressure washing machines properly will be installed at the branch point from the existing water utility line at the Plant as the scope of the Japanese side, if necessary.

However, the branch point with a valve for the water supply line to the Project site shall be prepared near the PV arrays by FCTWB.

### (4) Countermeasures against vandalism

Based on the scheme of the Program Grant Aid of Japan, the projects for Introduction of Clean Energy by Solar Electricity Generation System have been carried out all over the world by JICA. Through these experiences, it is revealed that countermeasures against vandalism such as stone-throwing to the PV arrays or stealing of the PV modules shall be considered properly before implementation of the Project. Especially, in case of the Project, as the public can come

close to the PV arrays which are located on the top surface of No.3 and No.4 Tanks, countermeasures against vandalism shall be considered carefully. FMOP and FCTWB agreed to consider countermeasures against vandalism before the second field survey and suggest to the Team in the second field survey.

### (5) Mounting structures and foundations for the PV arrays

The PV arrays for the Project will be installed on top of the roof slab of No.3 and No.4 Tanks as shown on Drawing G-02

The Team proposed and Nigerian side agreed that the design concept of the installation of the arrays is as follows:

- 1) Design loads to be considered for installation of the arrays including their mounting structures and foundations shall be less than those considered for the design of the existing tanks, such as precast roof units, beams, columns, walls and base slabs.
- 2) The mounting structures will be made of steel shapes and the foundations will be of reinforced concrete.
- 3) To achieve the above policy, the loads of 5 cm thick of gravel laid on top of the roof slab shall be offset with the loads of the arrays including their mounting structures and foundations by removing the gravel in 5 cm thick from the top of the roof slab. The Team confirmed from FCTWB as well as the Plant that the purpose of installation of gravel is to protect the top surface of roof slab against damages to be caused by direct sunshine and growth of grasses, and is also for ease of rainwater drainage on top of the roof, while such protection can be maintained after installation of the arrays together with remaining 5 cm thick of gravel left on top of the roof slab.
- 4) The Team shall design the layout of arrays, mounting structures and foundations in order to assure the access to the openings for inspection of inside of the tanks and the avoidance of interference with the air vents installed on top of the roof slab. The Team shall also provide corridors 1.3m wide made of expanded metal between the arrays for inspection and cleaning of arrays installed on top of the roof slab.
- 5) The Team shall also provide the different types of supporting structures and foundations for the arrays to be installed between No.3 and No.4 Tanks. The sufficient clearance between the ground surface and lower face of the supporting beams of the arrays between No.3 and No.4 Tanks shall be secured for easy passage and work required for the operation and maintenance of the tanks and the arrays by the staffs of the Plant.
- 6) Nigerian side shall ensure that such modification of the structural design of the tanks can be made by the Team, while the Team shall ensure that the design concept mentioned above



can be assured.

- 7) Nigerian side shall also settle whatever rearrangement of the contract with the Contractor, Bivwater International Limited, in terms of guarantee of their design and construction of the said tanks.

### 3.4 Terminal Points with the existing equipment and facilities

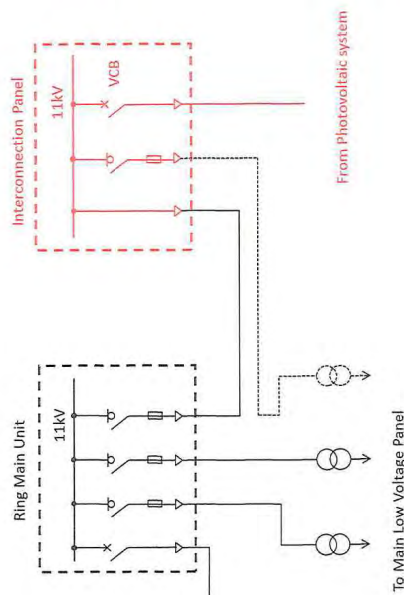
#### (1) Interconnection point with the existing electrical system

FMOP, FCTWB and the Team agreed that the PV system of the Project will be connected to the 11 kV system at No.3 and No.4 Plants in consideration of two points below.

- As the bus composition of the main low voltage panel of No.3 and No.4 Plants is complex, and complex interlock-logic exists. If the PV system of the Project is connected to the low voltage system at No.3 and No.4 Plants, mishandling is concerned.
- As the scale of the PV system of the Project is assumed as 800 to 900 kWp and length from power conditioners to the interconnection point is more than 200 m, voltage drop between the parts is severe in case of application of cables whose size are general in the market.

#### (2) Interconnection method with the existing electrical system

FMOP, FCTWB and the Team agreed that the interconnection method of the PV system will be arranged as shown in Figure.3 in consideration of the followings.



Source: JICA Study Team

Figure.3 Interconnection Method

- An empty feeder exists in the 11 kV system at No.3 and No.4 Plants in addition to two

occupied feeders for the existing transformer banks of 1,000 kVA each. This empty feeder is for the future expansion of a transformer bank to respond to the assumed growth of water demand in the Federal Capital Territory. If the PV system, which does not hold load following function and operates as supplemental power source, is connected to the feeder, it will obstruct the original designing philosophy of No.3 and No.4 Plants. Therefore, the interconnection method as shown in Figure.3 will be applied to secure the feeder for the future expansion of a transformer bank even if the PV system is connected to the feeder.

- The Project site, the Plant is the critical infrastructures operated and maintained as water source of the Federal Capital Territory. The interconnection method shall carefully be designed so that troubles and failures of the PV system will not affect to the other electric system of the Plant and the PV system will be isolated immediately after detection of such troubles and failures. Therefore, a circuit breaker at the interconnection point shall be procured and installed as the scope of the Japanese side to isolate the PV system immediately after detection of a short circuit or ground fault on the line between the interconnection point and the interconnection transformer of the Project.

#### (3) Protection system for interconnection

It is confirmed in the operational records of the Plant that the quality of supplied power around the Plant is not as stable as it is in Japan. Therefore, FMOP, FCTWB and the Team agreed that protection system for interconnection of the power conditioners shall have wider set value and time with paying attention to general specifications of the power conditioners in the market.

#### (4) Connection with the existing drainage system

The Team proposed and Nigerian side agreed that the design policy and concept of the drainage system after installation of the arrays are as follows:

- 1) Since the arrays for the Project will be installed on top of the roof slab of No.3 and No.4 tanks, no additional drainage system will be required.
- 2) The existing drainage pipes installed through the parapets in the south side of the tanks can still be served for rainwater drainage on top of the roof slab after installation of arrays.
- 3) Amount of rainfall on top of roof slab after installation of the arrays is the same as that of the original design.
- 4) The amount of water after cleaning of top surface of arrays is smaller than that of rainfall considered in the original design. It shall also be noted that no cleaning work of top surface of arrays will be required while raining.
- 5) No eaves and gutters shall be provided for drainage of rainwater on top of the roof of the power conditioner building. Amount of such rainwater remains the same as those fallen on

the surface of ground in the proposed area for construction of the building. The ground surface surrounding the building shall also covered with the gravel, thus no special protection of raindrops from the roof of the building against erosion or scouring of the ground surface will be required.

- 6) Therefore, there is no need to use the existing surface rainwater drainage ditch as a result of change in the circumstances caused by the installation of the arrays on top of the tanks.

#### 4. Environmental and Social Considerations

##### 4.1 Procedures for environmental and social considerations in Nigeria

FMOP, FCTWB and the Team agreed that the procedures for environmental and social considerations will be carried out in accordance with the followings.

- (1) FMOP will prepare and submit the Project Proposal, required in the "Environmental Impact Assessment Act No.86" (1992) to the Federal Ministry of Environment (FMOE). The Project Proposal shall contain the items as shown in the Table 2 as stipulated in the "Environmental Impact Assessment Act No.86" (1992).

**Table 2 Items to be included to the Project Proposal**

Project title	The Project for Introduction of Clean Energy by Solar Electricity Generation System
Implementing organization	FMOP
Project site	Lower Usuna Dam Water Treatment Plant
Outline	Procurement and installation of PV system of Approx. 1,000 kWp
Sector	Renewable Energy
Life time of the Project	Assumed as 25 years
Origin of procured materials and equipment	Main equipment procured from Japan
Implementing agency of the EIA	(To be specified)

- (2) FMOP will confirm notice of the classification of the Project for environmental and social assessment from FMOE after his evaluation of the Project Proposal.
- (3) FMOP will prepare and submit the Terms of Reference (TOR) for environmental and social assessment to FMOE in accordance with the classification, if necessary.
- (4) FMOP will obtain the approval of the TOR from FMOE, if necessary.
- (5) FMOP will carry out partial environmental and social assessment, if necessary.

FMOP also agreed to take it into consideration in proceeding the procedures and discussion with FMOE that the FMOE stated that there was no need to implement either a full-scale EIA or partial EIA when FMOP and JICA implemented a pilot project under the Master Plan Survey for Solar Energy Utilization in Nigeria in 2007. Because, it is considered that the PV system creates no

major environmental impacts.

#### 4.2 Land acquisition

As shown in Figure 2, the PV system of the Project will be installed on the property of FCTWB. FCTWB agreed to use the area for the Project in the Minutes of Discussions of the first field survey signed between FMOP, FCTWB and the Team on 19<sup>th</sup> September, 2013.

#### 5. Work Demarcations between the Nigerian and Japanese Side

The Nigerian and Japanese sides agreed on the following work demarcations for the Project.

**Table 3 Major undertakings to be taken by each party**

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side	
			FMOP	FCTWB
1	to secure [a lot] / [lots] of land necessary for the implementation of the Project and to clear the [site] / [sites];		●	●
2	To construct the following facilities: 1) The power conditioner building 2) The gates and fences in and around the site 3) The parking lot (if necessary) 4) The road within the site 5) The road outside the site (if necessary)	●	●	●
3	To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the [site] / [sites] 1) Electricity a. The distributing power line to the site (Securement of interconnection point of the PV system) b. The drop wiring and internal wiring within the site (Wiring of the equipment of the Project after the interconnection point) c. The main circuit breaker and transformer (The main circuit breaker and transformer for the interconnection) d. The connection point of electricity for the installation and construction work beside the Project site 2) Water Supply a. The city water distribution main to the site (Securement of connection point of the water system of the Project) b. The supply system within the site (Water line and taps for maintenance of the PV arrays) c. The connection point of electricity for the installation and construction work beside the Project site 3) Drainage a. The city drainage main (for storm sewer and others to the site) b. The drainage system (for toilet sewer, common waste, storm drainage and others) within the site 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	N/A	●	●



No.	Items	To be covered by Grant Aid	To be covered by Recipient Side	
			FMOP	FCTWB
	b. Project equipment (Procurement and installation of the equipment of the Project)	•		
	c. Procurement of materials for final connection of the equipment of the Project to the 11kV system at the interconnection point	•		
	d. Implementation of scheduled outage of the 11kV system, and final connection work of the equipment of the Project to the 11kV system		•	Implementation
4	To bear the following commissions applied by the Japanese bank for banking services based upon the B/A: 1) Payment of bank commission		•	
5	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products 1) Marine (Air) transportation of the Products from Japan to the recipient country 2) Tax exemption and custom clearance of the Products at the port of disembarkation 3) Internal transportation from the port of disembarkation to the project site	•	•	Securement
6	Securement of area for temporary storage and offices		•	Arrangement
7	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 products and the services [ be exempted] / [be borne by the Authority without using the Grant]		•	Securement
8	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country, and stay therein for the performance of their work		•	Arrangement
9	To maintain and use properly and effectively for the facilities that are constructed and the equipment that is provided under the Grant		•	Monitoring
10	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		•	Implementation
11	To give due environmental and social consideration in the implementation of the Project.		•	

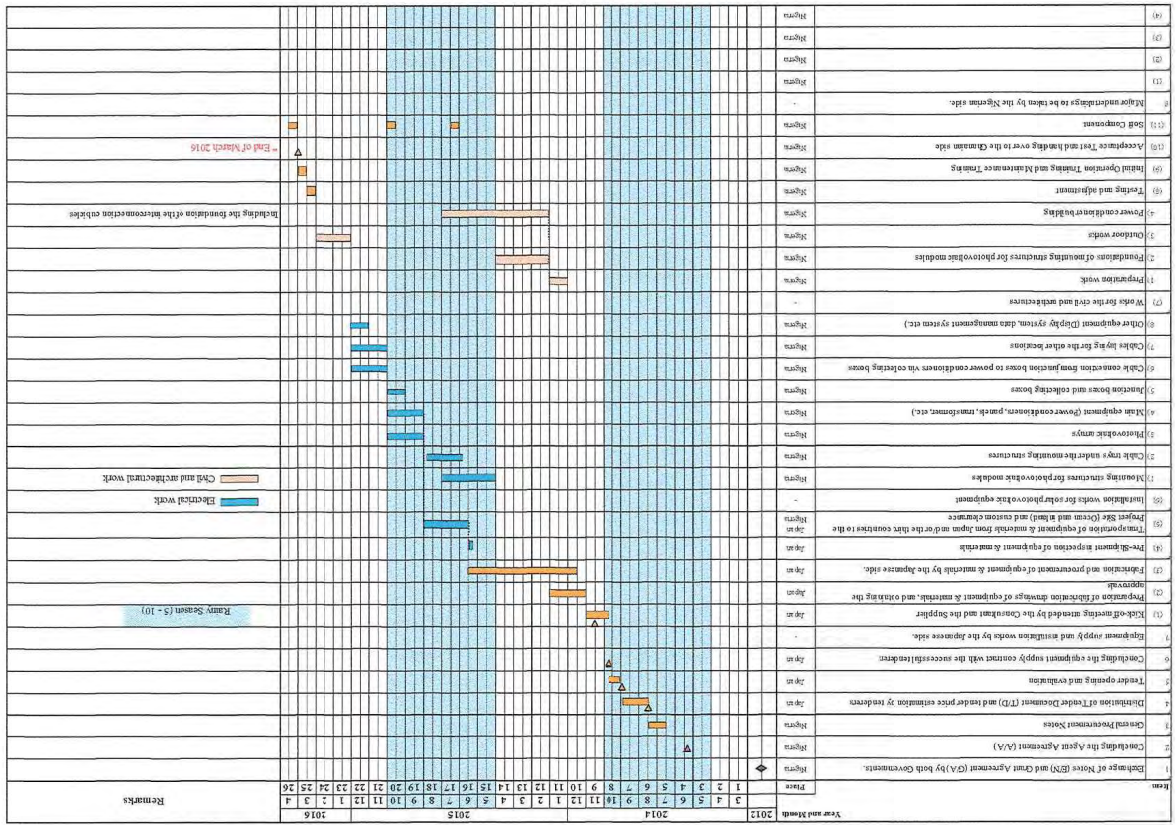
[Notes] B/A: Banking Arrangement, N/A: Not Applicable

Though each work to be covered by the Nigerian side shall be carried out by each authority mentioned above with independence, other related parties in Nigeria support the authority for smooth implementation of the Project.

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6. Project Implementation Schedule

The tentative Project Implementation Schedule is shown as the following table.



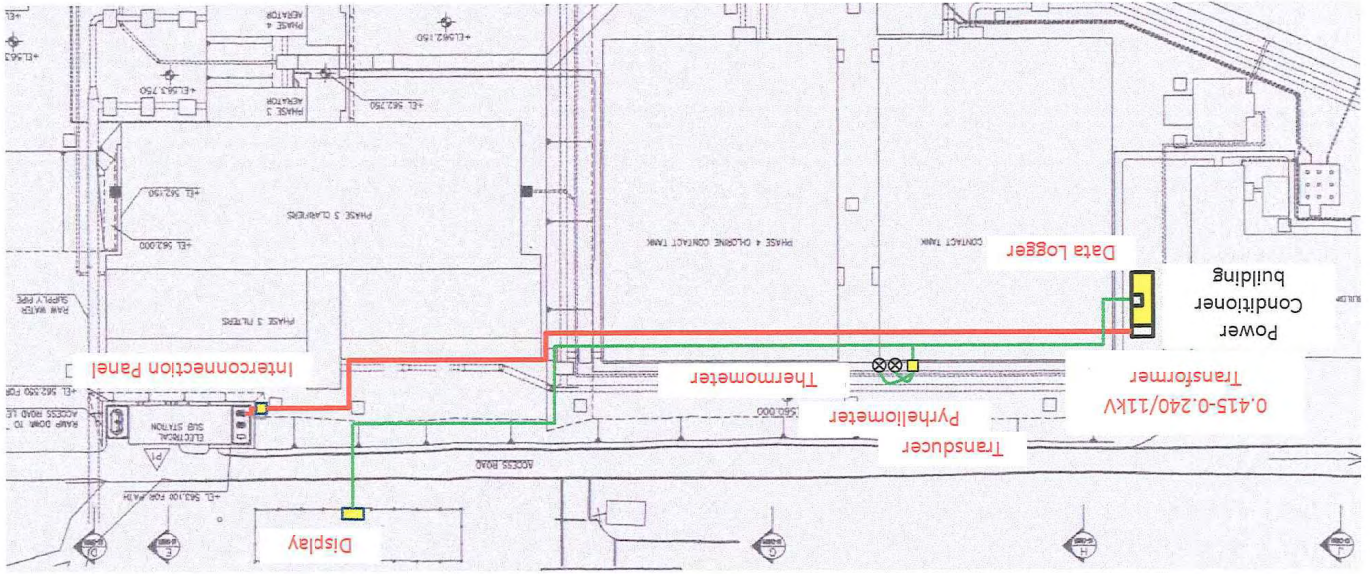
Tentative Project Implementation Schedule for the Project for Introduction of Clean Energy by Solar Electricity Generation System in the Federal Republic of Nigeria

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## Drawings

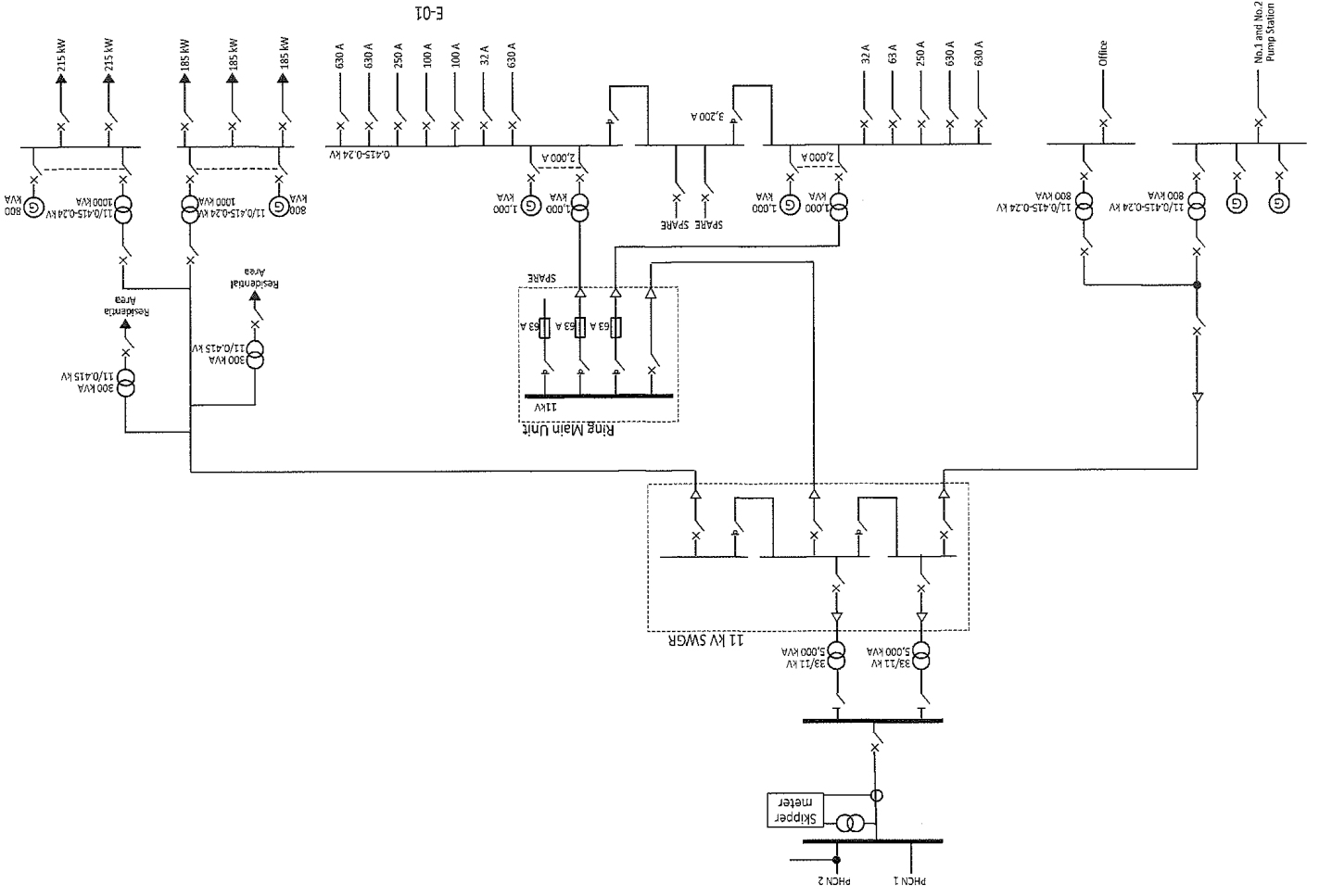
- G-01 General layout of the Project site
- G-02 Layout of the photovoltaic arrays
- E-01 Single line diagram of the Lower Usuma Dam Water Treatment Plant
- E-02 Single line diagram of the photovoltaic system of 800 kWp
- E-03 Connection arrangement with the existing electrical equipment
- A-01 Mounting Structure Foundation (1) Typical Section at Reservoir
- A-02 Mounting Structure Foundation (2) Typical Section at Central Passage
- A-03 Power Conditioner Building (1) Location, Section
- A-04 Power Conditioner Building (2) Plan, Elevation, Section
- A-05 Power Conditioner Building (3) Finishing Schedule, Fitting List
- A-06 Power Conditioner Building (4) Facilities Plan

G-01  
General layout of the Project site

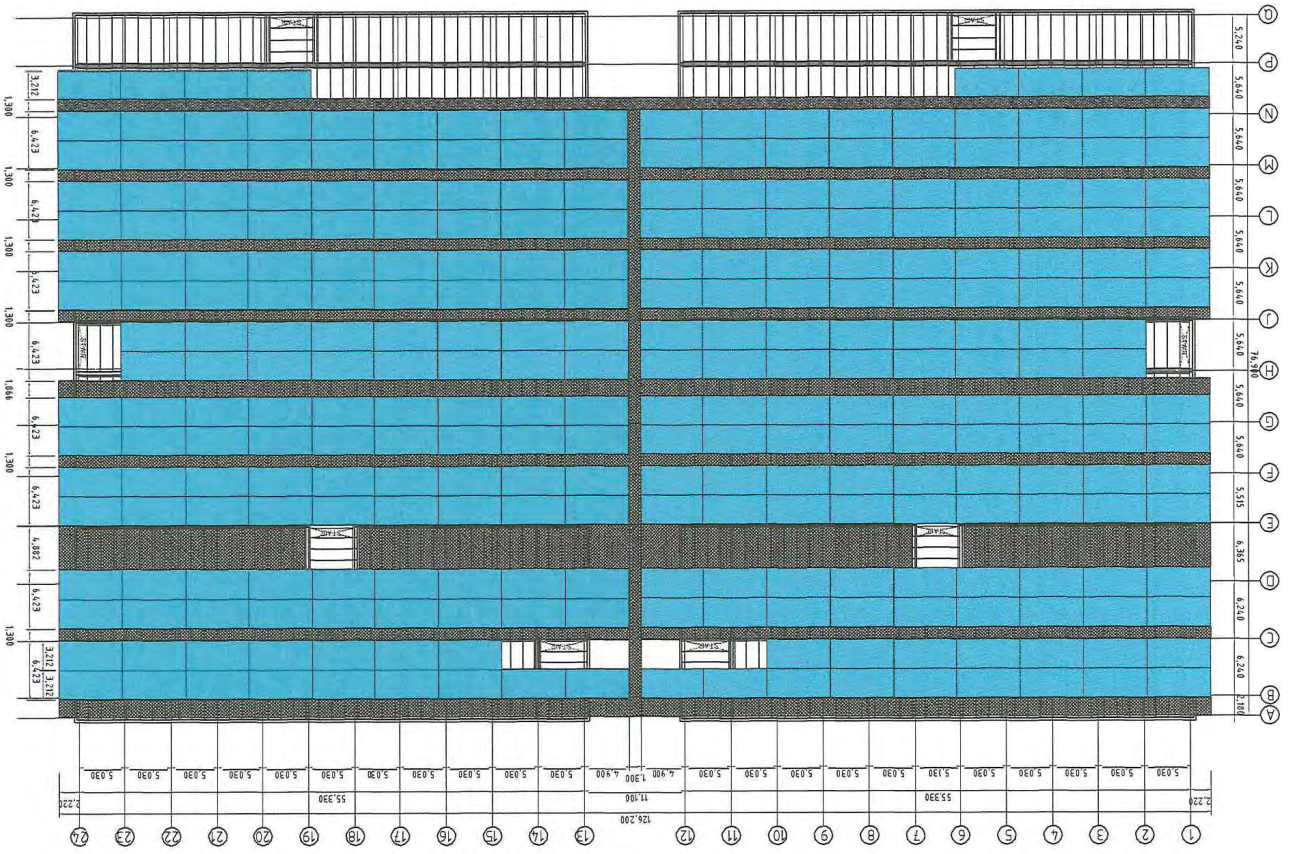




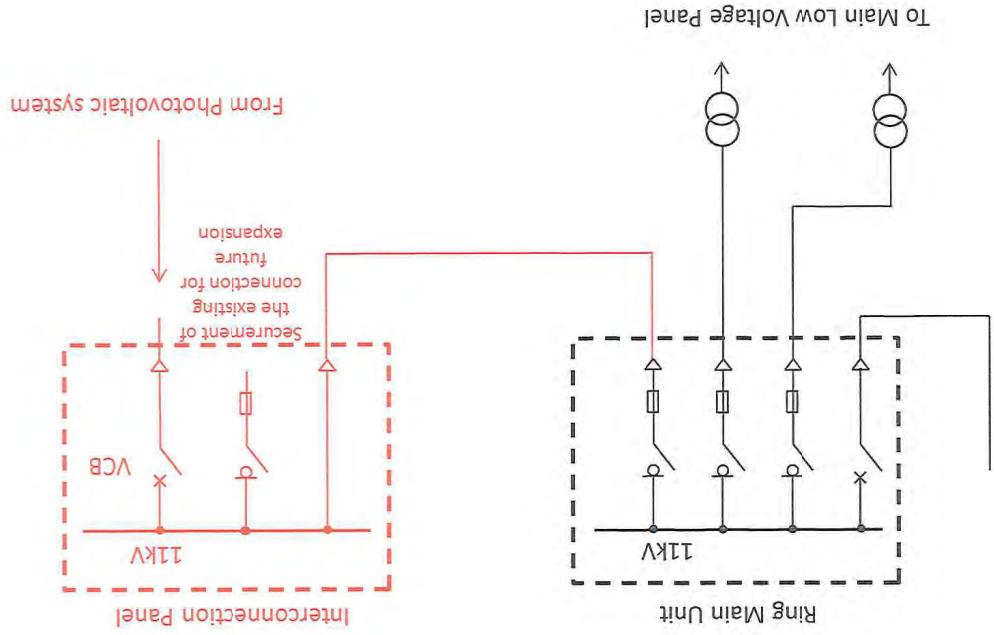
Single line diagram of the Lower Usama Dam Water Treatment Plant



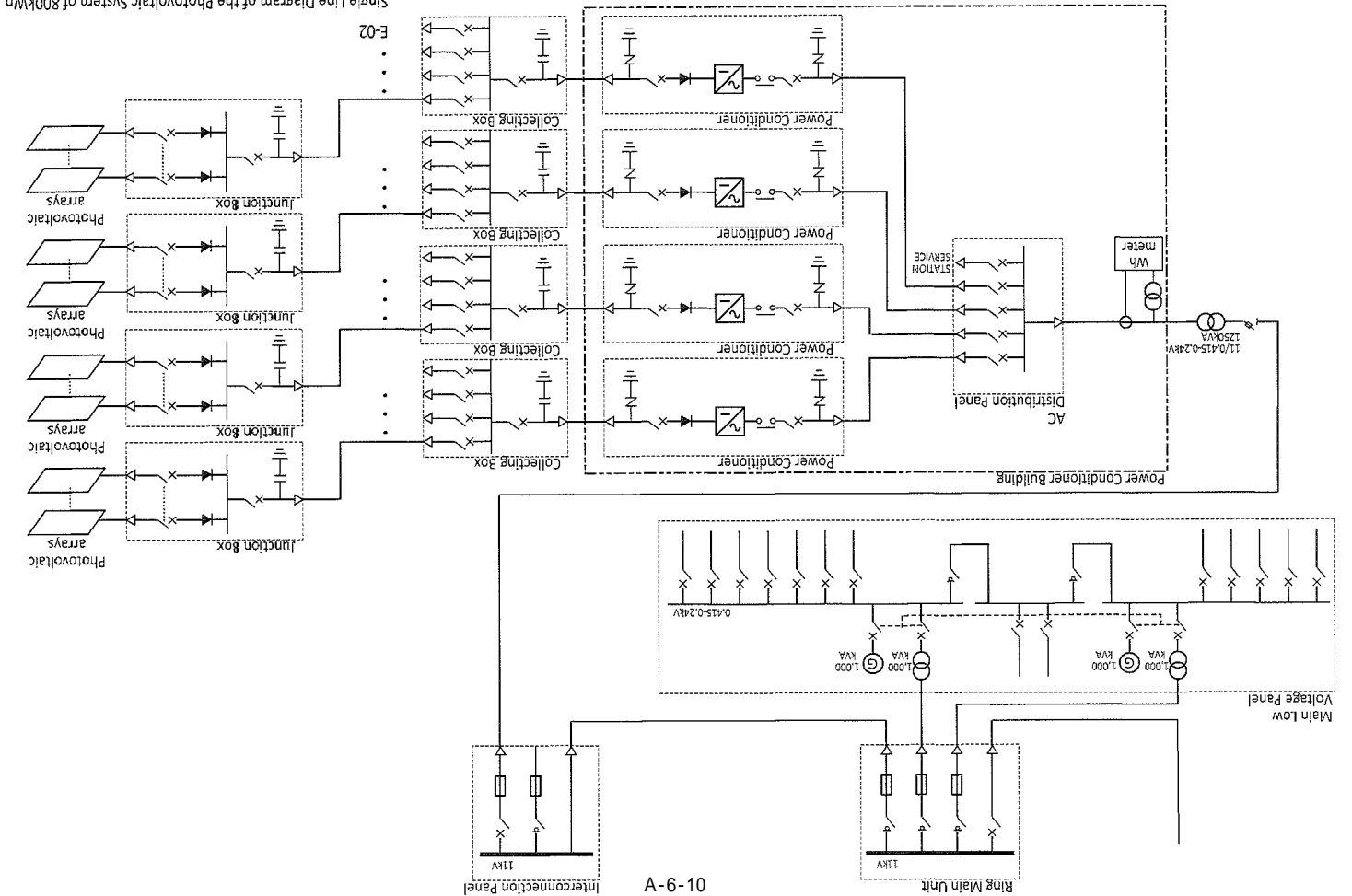
G-02  
Layout of the photovoltaic arrays



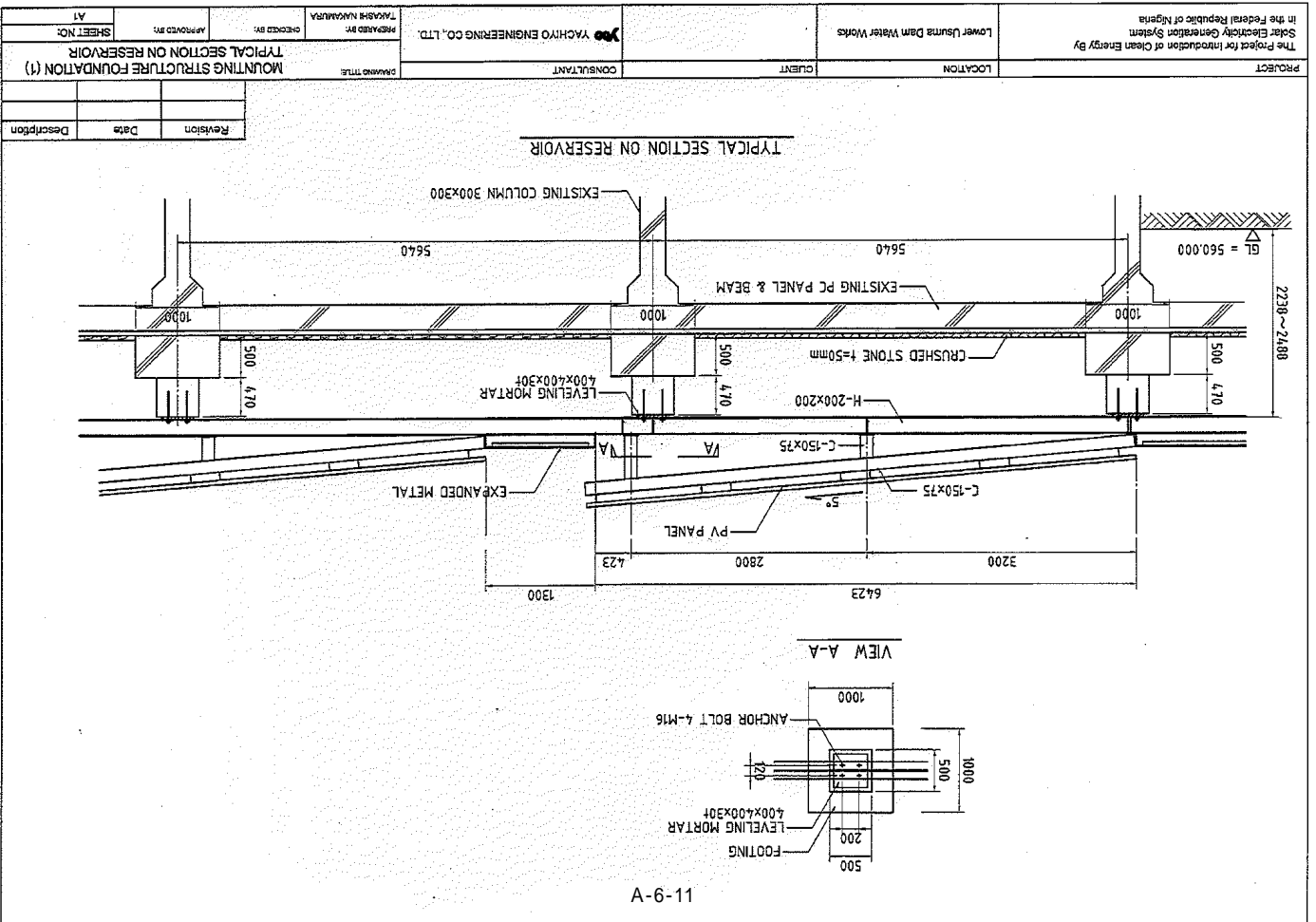
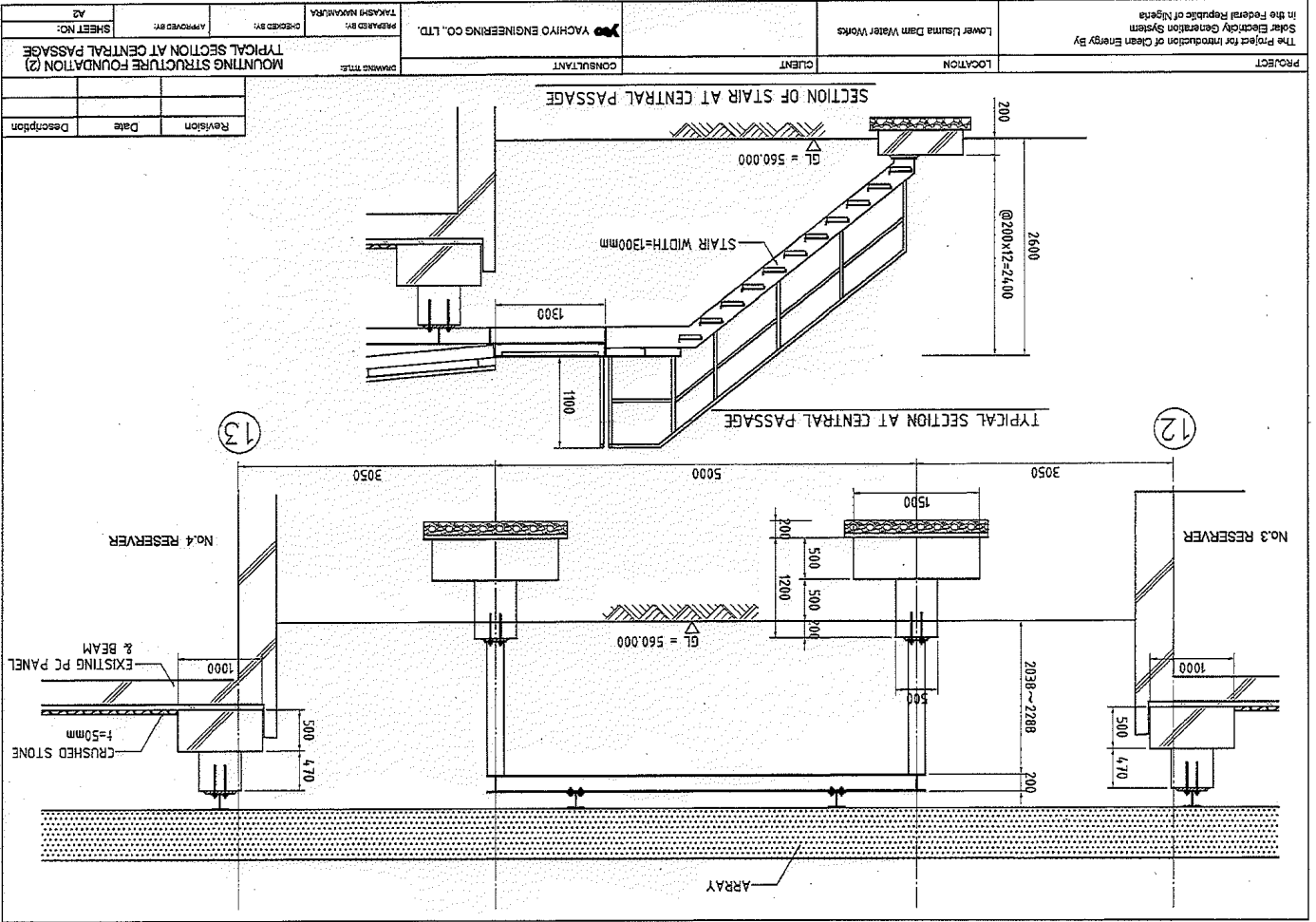
E-03 Connection arrangement with the existing electrical equipment



Single Line Diagram of the Photovoltaic System of 800kWp









PROJECT	The Project for Introduction of Clean Energy By Solar Electricity Generation System in the Federal Republic of Nigeria		
LOCATION	Lower Usama Dam Water Works		
CLIENT	YACHYO ENGINEERING CO. LTD.		
CONSULTANT	YACHYO ENGINEERING CO. LTD.		
DRAWING TITLE	POWER CONDITIONER BUILDING (4) FACILITIES PLAN		
SHEET NO.	AS		

SYMBOL	DESCRIPTION	QTY	SPECIFICATION	LOCATION
ACF-1	WALL MOUNTED TYPE HEAT-PUMP SYSTEM AIR CONDITIONER	1	COOLING CAPACITY : 10.0 KW COMPRESSOR POWER : 4.1 KW INDOOR FAN POWER : 250 W OUTDOOR FAN POWER : 100 W POWER : 1 PHASE - 240 V - 50 HZ	CONTROL ROOM
FE-1	WALL MOUNTED TYPE PROPELLER SUPPLY FAN	2	CAPACITY : 2000L X 510 m <sup>3</sup> /H X 40Pa X 25W POWER : 1 PHASE - 240 V - 50 HZ ASSEMBLY : MOTORIZED TYPE SHUTTER	ELECTRICAL ROOM
FS-1	WALL MOUNTED TYPE PROPELLER SUPPLY FAN	2	CAPACITY : 2000L X 510 m <sup>3</sup> /H X 40Pa X 25W POWER : 1 PHASE - 240 V - 50 HZ ASSEMBLY : MOTORIZED TYPE SHUTTER	ELECTRICAL ROOM

**FLOOR PLAN**

**LEGEND**

- RATED VOLTAGE : 16 240V-50HZ
- STARTER (FLUORESCENT LAMP) : GLOW STARTER
- POWER FACTOR : HIGH POWER FACTOR
- SOCKET OUTLET 2P+E 250V / 2-GANG
- SWITCH 1P10A2(W/PLATE)

REVISION	Date	Description

PROJECT	The Project for Introduction of Clean Energy By Solar Electricity Generation System in the Federal Republic of Nigeria		
LOCATION	Lower Usama Dam Water Works		
CLIENT	YACHYO ENGINEERING CO. LTD.		
CONSULTANT	YACHYO ENGINEERING CO. LTD.		
DRAWING TITLE	POWER CONDITIONER BUILDING (3) FINISHING SCHEDULE, FITTING LIST		
SHEET NO.	AS		

MARK NO.	ELEVATION	TYPE	MATERIAL - FINISH	GLASS	HARDWARE	REMARK
2		DOUBLE SWING DOOR	STEEL - OIL PAINT	---	HINGE LEVER HANDLE DOOR CLOSER, KEYS LOCK	---
3		SINGLE SWING DOOR	STEEL - OIL PAINT	---	HINGE LEVER HANDLE DOOR CLOSER, KEYS LOCK	---
1		SLIDING WINDOW	ALUMINUM - ELECTRO COLOR	FLAOT GLASS t=5mm	---	ALUMI GRILL, MOSQUITO NET WINDOW
2		FIXED WINDOW	STEEL - OIL PAINT	FLAOT GLASS t=5mm	---	READY-MADE HARDWARE

ROOM NAME	FLOOR	BASEBOARD	WALL	CEILING	REMARKS
ELECTRICAL ROOM	FLOOR	MORTAR STEEL TROWEL DUSTPROOF PAINT FINISH	MORTAR STEEL TROWEL MORTAR STEEL TROWEL EP PAINT FINISH	DECORATED PLASTERBOARD LIGHT IRON SUSPENDED FRAME CEILING SYSTEM CH=3000	VENTILATION FAN 100THK GLASSWOL INSULATION ON CEILING
CONTROL ROOM	FLOOR	MORTAR STEEL TROWEL DUSTPROOF PAINT FINISH	MORTAR STEEL TROWEL MORTAR STEEL TROWEL EP PAINT FINISH	DECORATED PLASTERBOARD LIGHT IRON SUSPENDED FRAME CEILING SYSTEM CH=3000	AIR-CONDITION VENTILATION FAN 100THK GLASSWOL INSULATION ON CEILING

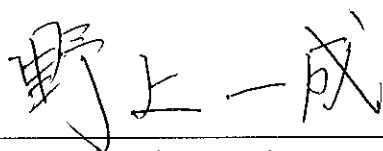
GENERAL	EXTERIOR FINISHING SCHEDULE
BUILDING AREA	77.5 m <sup>2</sup>
TOTAL FLOOR AREA	77.5 m <sup>2</sup>
UNDER GROUND STRUCTURE	REINFORCED CONCRETE CONSTRUCTION
UPPER GROUND STRUCTURE	REINFORCED CONCRETE CONSTRUCTION
ROOF	PROTECTION CONCRETE t=80mm WITH WIRE MESH #6X150X150 WATER-PROOF COATING
WALL	150THK CONCRETE BLOCK WITH MORTAR EP PAINT FINISH
BASEBOARD	EXPOSED CONCRETE EP PAINT FINISH
CANOPY	TOP : MORTAR STEEL TROWEL EP PAINT FINISH UNDER : EXPOSED CONCRETE EP PAINT FINISH
LOCATION	SPECIFICATION

**PREPARATORY SURVEY  
ON  
THE PROJECT FOR  
INTRODUCTION OF CLEAN ENERGY  
BY SOLAR ELECTRICITY GENERATION SYSTEM  
IN THE FEDERAL REPUBLIC OF NIGERIA**

**THE FIRST FIELD SURVEY**

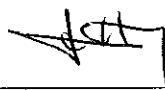
**TECHNICAL MEMORANDUM**

4<sup>TH</sup> OCTOBER, 2013



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Mr. Kazunari Nogami  
Chief Consultant for the Project  
Yachiyo Engineering Co., Ltd.



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Engr. J.B. Anto  
Director  
Federal Capital Territory Water Board



## 1. Introduction

The Federal Ministry of Power (FMOP), Federal Capital Territory Water Board (FCTWB) and the Preparatory Survey Team, Japan International Cooperation Agency (the Team) agreed and concluded the Minutes of Discussions on the Project for Introduction of Clean Energy by Solar Electricity Generation System in the Federal Republic of Nigeria (the Project) on 19th September, 2013.

FMOP, FCTWB and the Team also agreed and signed on the field report, prepared by the Consultant headed by Mr. Kazunari Nogami and describing the basic policy on the Outline Design of the Project, on 27th September, 2013.

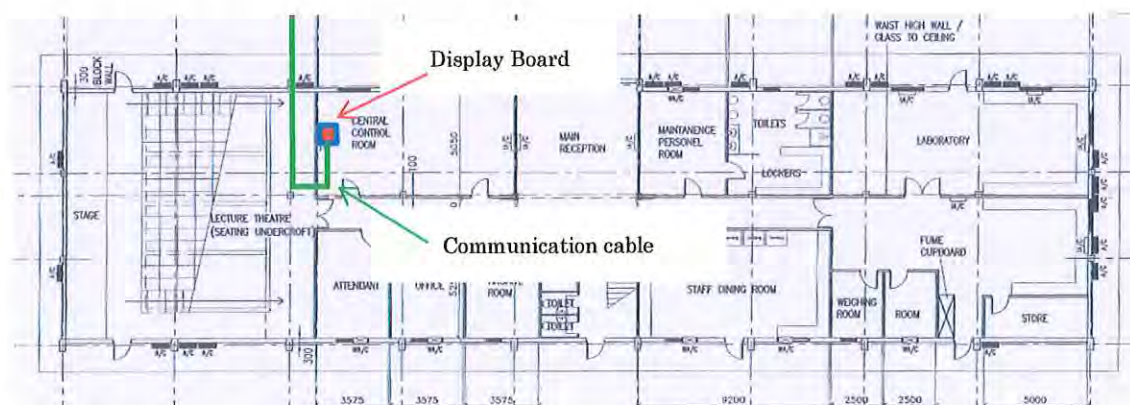
This technical memorandum is prepared to agree more detail technical items so that the Consultant can conduct the cost estimation of the Project in the analysis in Japan after the first field survey.

## 2. Location of the display board and the communication cable

FCTWB and the Team agreed that a display board to indicate energy and power of the photovoltaic (PV) system of the Project and a data logger will be located at the existing SCADA room of the administration building for No.3 and No.4 Plants as shown in Figure 1.

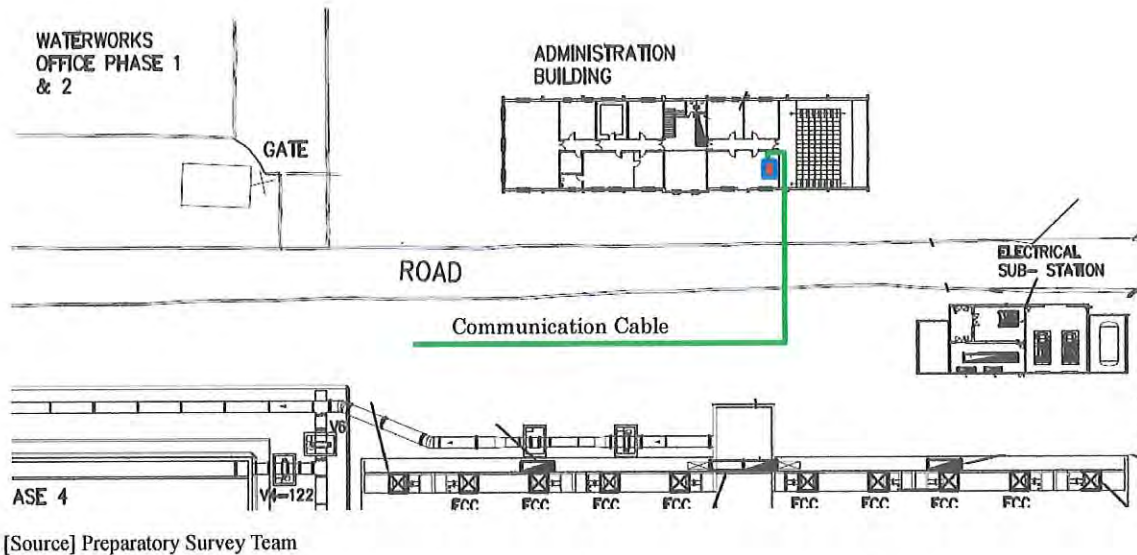
FCTWB explained to the Team that conduits have been provided from the room to the other side of the in-plant road of the Lower Usama Dam Water Treatment Plant as shown in Figure 2.

Therefore, the conduits will be used for the Project and it is not necessary to damage the wall of the building or the in-plant road.



[Source] Preparatory Survey Team

**Figure 1 Location of the display board in the administration building**

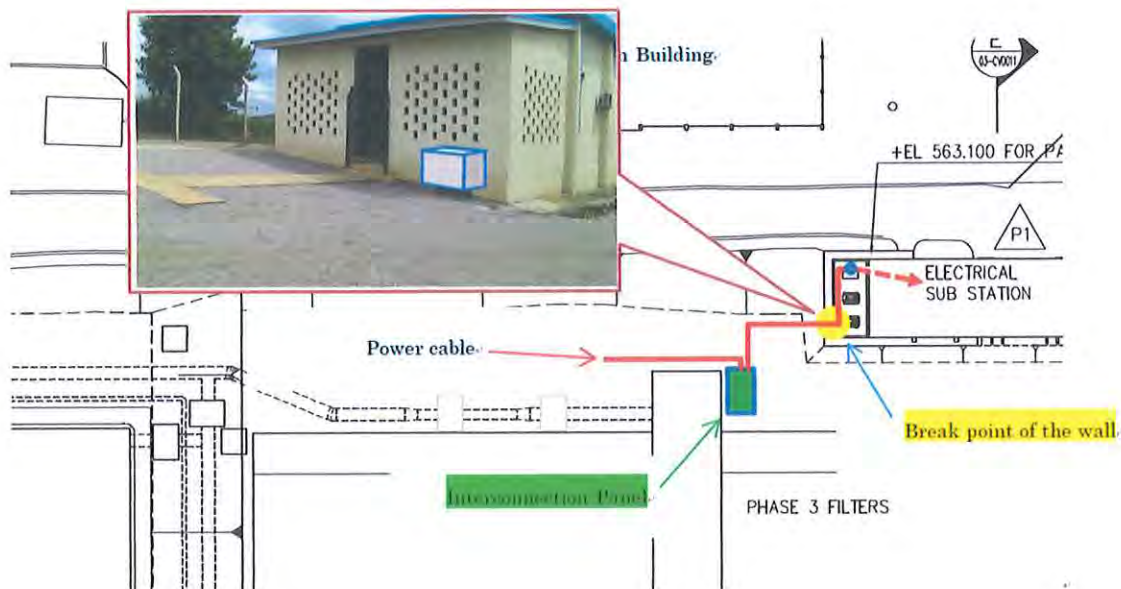


[Source] Preparatory Survey Team

**Figure 2 Location of the communication cable**

**3. Layout of the Interconnection Panel and the Power Cable**

FCTWB and the Team agreed that interconnection panels of the Project will be located at the part shown in Figure 3. The condition around the part is shown in Picture 1. FCTWB and the Team agreed that a cable duct shall be provided at the part where cables rise over the ground level and go into the existing electrical substation as the scope of the Japanese side to avoid exposure of the cables as shown in Figure 3. FCTWB allowed that the Contractor will make conduits on the existing wall after making holes.



[Source] Preparatory Survey Team

**Figure 3 Location of the interconnection panel and power cables**



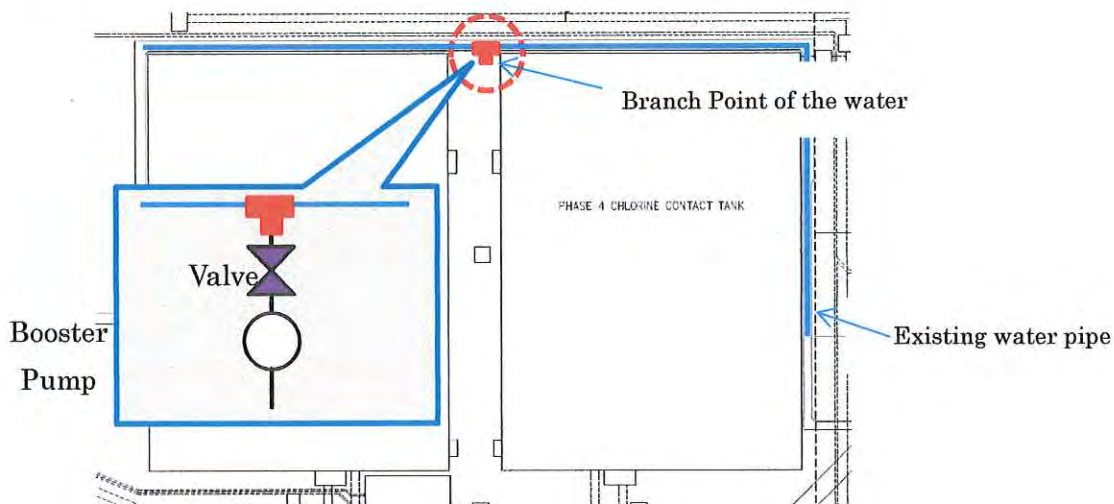


[Source] Preparatory Survey Team

**Picture 1 Location of the interconnection panel**

#### 4. Layout of the water source for cleaning of the PV Arrays

FCTWB explained to the Team that a branch point with a valve for the water supply will be provided by FCTWB before the Project at the location shown in Figure 4. FCTWB and the Team agreed that a booster pump for the water lines for cleaning of the PV arrays will be installed near the branch point as the scope of the Japanese side, if necessary.



[Source] Preparatory Survey Team

**Figure 4 Layout of the water source for cleaning of the PV Arrays**

## **5. Supervisors of the Consultant and the Contractor during implementation of the Project**

FCTWB requested the Team to arrange the Project as Japanese supervisors of the Consultant and the Contractor will be dispatched to Nigeria not for parts of the period of the Project implementation but for all the period in consideration that The Project site, the Lower Usuma Dam Water Treatment Plant is such critical infrastructures as water source of the Federal Capital Territory and the Project implementation shall carefully be managed not to interfere operation of the plant.

## **6. Countermeasures against vandalism**

Based on the scheme of the Program Grant Aid of Japan, the projects for Introduction of Clean Energy by Solar Electricity Generation System have been carried out all over the world by JICA. Through these experiences, it is revealed that countermeasures against vandalism such as stone-throwing to the PV arrays or stealing of the PV modules shall be considered properly before implementation of the Project. Especially, in case of the Project, as the public can come close to the PV arrays which are located on the top surface of No.3 and No.4 Tanks, countermeasures against vandalism shall be considered carefully. FMOP and FCTWB agreed to consider countermeasures against vandalism before the second field survey and suggest to the Team in the second field survey.

