Ministry of the Energy and the Hydraulic Resources
The Gabonese Republic

FINAL REPORT
OF THE PREPARATORY SURVEY
ON THE PROJECT
FOR
INTRODUCTION OF CLEAN ENERGY
BY SOLAR ELECTRICITY GENERATION SYSTEM
IN
THE GABONESE REPUBLIC

August 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

NEWJEC Inc.
JAPAN TECHNO Co., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on THE PROJECT FOR INTRODUCTION OF CLEAN ENERGY BY SOLAR ELECTRICITY GENERATION SYSTEM in Gabonese Republic.

JICA sent to Gabon survey team headed by Mr. Masaru NISHIDA of NEWJEC Inc. and consist of NEWJWC Inc. and JAPAN TECHNO CO., LTD. from September 21st to October 2nd and from December 7th to 25th, 2009.

The team held discussions with the officials concerned of the Government of Gabon, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Gabon in order to discuss a draft outline design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Gabonese Republic for their close cooperation extended to the teams.

August 2010

Kazuhiro YONEDA
Director General,
Industrial Development
Japan International Cooperation Agency

SUMMARY

SUMMARY

I. Outline of the Recipient County

Republic of Gabonese is located in Central Africa, facing Atlantic Ocean with a 800km long coast line, and stretching 2º30"N to 4º S latitude, 9º to 14º E longitude. It is bordered by Equatorial Guinea and Cameroon to the north and Republic of Congo to the east and south. The territory is 268thousand sq-meter, 85% of which is covered by tropical rain forest.

The climate is characterized by high temperature and humidity, with annual temperature varying between 21 degrees and 27 degrees Celsius, and humidity 60 to 98%. The dry season continues for three months and there is rainfall in other months. Regional variation of annual rainfall is rather large; 1,800 to 3,200mm along coastal zone, 1,400 to 2,000mm in inland zone. The capital, Libreville has rainfall of 2,500mm, for over 150 days per year.

The estimated population for 2002 is 1.268million with growth rate at 2.5% per annum. 18% of the population consists of immigrants reflecting large influx of people from surrounding countries.

Gabon is a politically stable country. Even after the Presidential election held in August 2008 for the first time in 40 years, the country stayed mostly undisturbed.

Gross National Income per capita is US$ 6,670 in 2007, way above the level of sub-Sahara Africa, US$ 952 (World Bank, 2009). The economy depends in large part on oil production, which, together with Manganese, accounts for the most of production of the primary industry whose proportion is 60% of total production. Therefore, the economy is inherently susceptible to variation in oil prices. The country is a member state of OPEC.

II. Background of the Project and its Outline

Republic of Gabonese ratified the United Nations Framework Convention on Climate Change in January 1998 and has been acting on the mitigation/adaptation measures, reporting of the progress thereof since. The Government submitted the Initial National Communication in November 2005 prepared with assistance from UNDP, where it stated that it intended to promote the use of new-energy and renewable energy such as hydro, biomass, solar and wind power as mitigation measures to climate change. In fact, the Government has started in 2002 the use of solar energy as power sources for schools and medical facilities in rural areas, with a target to implement as many units as 1,200kW capacity in total by 2020. The Government has

also announced a new environmental initiative, "Gabon Vert (Green Gabon)" in November 2009 where the protection of tropical rain forests and the use of renewable energy including solar energy were pronounced.

The country decided to join "Cool Earth Partnership" and takes up as its policy priority a promotion of the reduction of GHGs emission and the economic development, by the approach of adaptation and mitigation to climate change. In accordance with the initiative, Gabonese Government requested to the Government of Japan for Grant Aid.

Having received this request, JICA conducted the first phase site survey between September 20th and October 3rd in 2009, identified Omar Bongo University and the Ministry of Foreign Affairs, International Cooperation and French Speaking Countries as candidate sites for PV system installation.

III. Outline of Study Result and the Content of the Project

Subsequently JICA sent the Study Team for the second phase site survey between December 6th and 26th to Gabon, to investigate the Site, collect related information and have discussion with the Recipient concerning the contents of the Project.

After coming back to Japan, the Study Team examined the necessity, effectiveness and appropriateness of the Project on the basis of the result of the site survey, and prepared a Basic Design Report. With the Basic Design Report in hand, JICA's Study Team visited Gabon again between May 16th and 26th 2010, explained and discussed the report, and signed the minute of meeting with the Government of Gabonese.

As a result of the study, the Project proposed is to provide Omar Bongo University (UOB) with a photovoltaic system (PV system) of 130kW peak power, and the Ministry of Foreign Affairs (MFAIC) with a PV system of 70kW peak power, to supply electric power to these facilities, as well as training programs covering topics such as methods of operation and maintenance, and planning of solar power projects. The Responsible Organization and the implementing agency are both the Ministry of Energy and Water Resources. The summary of outline design of the PV equipment is shown in the table below.

Category	Content
Site and PV Capacity	UOB: 130kW PV power station MFAIC: 70kW PV power station − PV system shall be grid-interconnected, and surplus power shall be sent back to the utility grid (reverse current) − In the case of blackout, PV system shall be designed to shut down automatically.
Procurement of Generating equipments and Installation Work	130kW and 70kW PV modules Ancillary equipment for PV system - Junction box - Power conditioner cubicle - Meteorological observation device - PV connection panel - Materials for wiring and earth - Electrical facility cubicle - Supporting structures for PV modules - Foundation of supporting structures for the PV system and electrical facility cubicle - Fences, gates, and grave surfacing - Cable connection for Electrical facility cubicle/interconnection point/display equipment
Spare Parts and Tool Kits	Spare parts and tool kits for maintenances of equipment Manuals for O&M and implementation of Operation Guidance

IV. Project Implementation Cost and Period

The cost of Gabonese side of this Project implemented under Japan's Grand Aid scheme is estimated to be CFA 1.7 million, which includes the cost for the clearing of the Site.

The project period is planned to be five months for tendering stage, and fourteen months for the procurement of the Products and their installation.

V. Evaluation of the Project

The generating equipment procured in the Project is designed to be managed by the Sites, Omar Bongo University and the Ministry of Foreign Affairs for its daily operation and maintenance, while the equipment is owned by the Ministry of Energy and Water Resources. The management of the equipment in the long run will be carried out by the Ministry of Higher Education for Omar Bongo University and the Ministry of Foreign Affairs at the respective sites.

At the implementation stage of the Project, a series of the training programs will be provided for operation and maintenance techniques and knowledge of solar generation and its use. The training programs is planned with intentions to make effective and sustainable the operation

and maintenance organization mentioned above, and to contribute to the promotion of solar energy use in Gabon.

The direct effect of this Project is expected to be the introduction of renewable energy source in Gabon, reducing fossil fuel consumption and the emission of the main cause of climate change, CO_2. The study estimates that the expected reduction in CO_2 emission due to the Project is 129 t-CO_2 per year.

As this Project will install large-scale solar generation systems in the midst of the capital for the first time, its demonstration effect can be substantial. In this way the Project will contribute to the Recipient country where private sector involvement is expected in the expanding use of solar energy, particularly in rural areas.

Meanwhile, PV modules and power conditioners made by Japanese manufacturers have technical advantages over other countries in their efficiency, longevity, reliability, etc. in the market. As this Project is limiting the country of origin of this equipment to Japan, the Project will be able to offer advanced technology of Japanese products.

Adding up the discussions above, it is concluded that the Project planned herein is very effective and appropriate as a project implemented as Programme Grant Aid for Environment and Climate Change.

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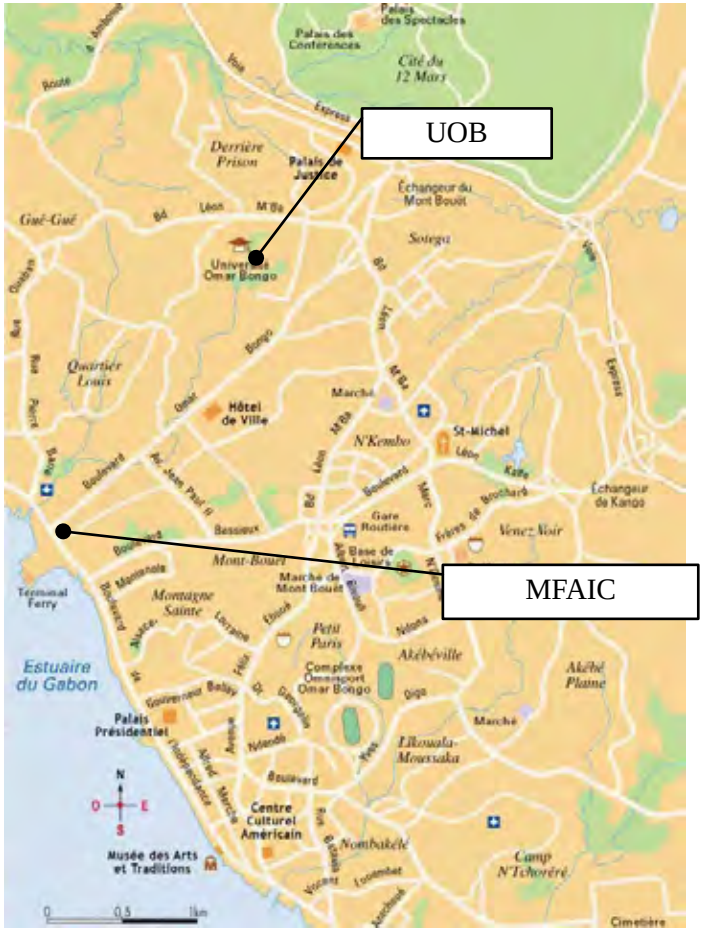
Libreville

Gabon



Libreville City

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Abbreviations

AC	Alternating Current
B/A	Bank Arrangement
CT	Current Transformer
DC	Direct Current
DEG	Diesel Engine Generator
EIA	Environmental Impact Assessment
EU	European Union
E/N	Exchange of Notes
GDP	Gross Domestic Product
GNI	Gross National Income
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
JCS	Japanese Electric Wire & Cable Makers' Association Standard
JEAC	Japan Electric Association Code
JEC	Japanese Electrotechnical Committee
JEM	Standards of Japan Electrical Manufacturer's Association
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
MCCB	Molded Case Circuit Breaker
MEWR	Ministry of Energy and Water Resource
MFAIC	Ministry of Foreign Affairs, International Cooperation and French Speaking Countries
MHE	Ministry of the National education, the Higher education, the Scientific Research and the innovation
MT	Ministry of Transportation
O&M	Operation and Maintenance
UOB	Omar Bongo University
OJT	On the Job Training
PCS	Power Conditioners
PV	Photovoltaic
PVC	Polyvinyl Chloride
SEEG	Société d'Electricité et d'Eaux du Gabon
SI	The International System of Units
VT	Voltage Transformer
XLPE	Cross-linked Polyethylene

CHAPTER 1

BACKGROUND OF PROJECT

Chapter 1 Background of Project

1-1 Background of the Study

Gabonese Government ratified United Nations Framework Convention on Climate Change (UNFCCC) in January, 1998 and has been pushing forward mitigation/adaptation measures as well as reporting their progress. In November 2005, in cooperation with UNDP the country submitted the Initial National Communication to the Convention, where the government proposes to promote the use of new energy/renewable energy such as hydropower, biomass, solar and wind, as mitigation measures. In particular, photovoltaics has been installed at schools and medical facilities in rural areas since 2002. The government has a plan to install 1,200kW of PVs by 2020. Meanwhile, the government announced a new environmental policy "Gabon Vert", which intends to protect tropical rain forests and promote renewable energy including photovoltaics.

Japanese government announced its policy initiative in Davos in January 2008 to assist developing countries which intend to contribute to mitigation of climate change by means of reduction of greenhouse gas emission without compromising their economic development. The initiative is called "cool earth partnership" and aims to support developing countries in their efforts to reduce energy consumption and emissions, and also to adapt to the change in climate. As one of measures, Japanese government set up "Program Grant Aid for Environment and Climate Change", a financial mechanism to support member countries which have difficulties in executing capabilities and funding.

The country decided to join "Cool Earth Partnership" and takes up as its policy priority reduction of GHGs emission and promotion of economic development, by the approach of adaptation and mitigation to climate change. It responded with its candidate projects to the needs surveys conducted by the Ministry of Foreign Affairs of Japan.
Description of the request for this Grant Aid project was as follows.

1) Time of request: November 2009

2) Amount of request: 500 million yen

3) Site candidates: Site A=front garden of the Ministry of Foreign Affairs building, Site B=inside of Omar Bongo University campus

4) Description of request:
   a) Procurement of equipment and materials for grid-interconnected solar power systems
      - Solar power generation facilities: Site A 70kWp, Site B 150kWp
      - Stand

- Power conditioner
- Junction box
- System for data collection and monitoring
- Display equipment
- Cables, etc.

b) Technical support for operation management
- Operation and maintenance manual
- Field training for operation and maintenance staff
- Workshop involving related ministries and agencies

1-2 Project Site and Surroundings

1-2-1 Related Infrastructure

(1) Status of Existing Electric Equipment of the Facility

1) Omar Bongo University (UOB)

The university premise is separated, in terms of electricity provision, into four areas, each of which has its electrical room with a transformer. These areas are; Area 1 is located in the northern part of the university near the main entrance accommodating administration-related buildings and lecturing buildings, Area 2 is in the middle of the premise with mostly lecturing buildings, Area 3 is in the southern part of the premise with student dormitories, and Area 4 accommodates small number of buildings including the library. Electricity consumption at these areas during daytime are 250kW for Area 1, 100kW for Area 2, and 150kW for Area 3 (that for Area 4 was not known but considered very small relative to other areas).

The university has a plan to install a diesel engine generator set. But the details of the plan were not available to the Team in the second phase site study.

2) Ministry of Foreign Affairs, International Cooperation and French Speaking Countries (MFAIC)

Ministry premise has an electric room beside the main entrance separated from the main building. One feeder line of SEEG (Société d'Electricité et d'Eaux du Gabon, a public utility company) comes to the building through a transformer (630kVA) in this room. Main building is an 8-storey building and furnished with 200kW diesel backup generator, which supplies a limited part of the building during blackouts. There are lifts in the building which are furnished with an emergency power unit with batteries.

(2) Status of Electricity Supply in the Region

Electricity distribution system in Gabon is separated in four districts, capital-estuary region, mid-south region, eastern region and coastal region. Installed capacity of generators is 373.89 MW in total, among which 203.85 MW (55%) is made of thermal power plants and 170.04 MW (45%) hydropower plants. Many of these power stations seem to be rather old, and their peak supplying capacity has been derated to 70% of the rated capacity. The rate of losses of transmission/distribution exceeds 10%, which is one of the causes of shortage of power.

Meanwhile, the Ministry of Energy and Water Resources (MEWR or Ministry of Energy) is promoting the use of solar power in rural areas. They take a form of individual installation or a small grid, and 140kW in capacity so far has been realized.

1-2-2 Natural Condition

(1) Location and Topography of the Site

The capital city Libreville is in the north-western part of the country facing Atlantic Ocean. The University is located to the north-east of the city center, lying on the mild slope facing down to the coast.

The Ministry of Foreign Affairs is located at the intersection of the main coastal road and another busy road going eastward. The PV modules are planned to be laid on the front yard of the premise.

(2) Meteorological Conditions

1) Temperature

Libreville is characterized by warm and humid climate all through the year. Temperature variation is relatively small, with the monthly average highest temperature 29.3 degree Celsius, and the lowest 23.1 degree. Table 1-2-2-1 shows the monthly average highest temperature for 1999 to 2008, and Table 1-2-2-2 the lowest.

Table 1-2-2-1 Monthly Average Highest Temperature, Libreville 1999 to 2008

	1	2	3	4	5	6	7	8	9	10	11	12
1999	30.3	30.7	31.0	31.1	30.4	29.2	28.2	28.0	28.8	28.7	29.4	29.8
2000	30.4	31.2	31.4	30.8	30.5	28.6	27.5	27.9	28.4	29.1	29.7	29.9
2001	30.3	31.2	31.3	31.5	30.5	28.7	26.9	27.5	28.9	29.4	29.1	29.2
2002	30.0	30.2	31.0	31.1	30.8	28.9	27.8	28.0	28.6	28.8	29.3	29.8
2003	-	31.3	31.1	31.2	30.6	28.8	28.8	28.4	28.5	29.4	29.4	30.0
2004	30.3	30.7	31.3	30.3	29.4	27.9	27.5	28.6	29.3	29.1	29.4	29.7
2005	31.3	31.5	31.5	31.6	30.0	28.0	27.0	27.5	28.5	29.2	29.4	29.2
2006	29.9	30.3	31.0	30.0	29.4	28.9	27.2	27.4	28.1	28.8	29.0	29.2
2007	30.2	30.6	30.9	30.8	30.4	28.6	27.6	28.0	28.6	28.7	29.2	29.0
2008	29.0	30.7	30.4	30.5	30.0	28.1	27.4	28.1	28.6	29.0	29.1	30.0

Unit: degree Celsius, Source: Climate Department, Ministry of Transport

Table 1-2-2-2 Monthly Average Lowest Temperature, Libreville 1999 to 2008

	1	2	3	4	5	6	7	8	9	10	11	12
1999	23.5	23.6	23.7	23.6	23.6	22.1	23.1	22.8	23.3	23.6	22.3	23.6
2000	23.9	24.2	23.9	23.5	23.5	23.8	22.5	22.9	23.4	23.5	23.3	23.6
2001	23.9	24.5	23.6	23.9	23.9	23.6	22.0	22.2	23.1	23.5	23.9	23.6
2002	24.6	24.5	24.0	24.2	24.2	24.1	23.2	22.7	23.1	22.8	22.6	23.6
2003	-	24.8	24.2	24.1	24.1	24.0	24.0	23.4	23.5	24.2	23.2	24.3
2004	24.4	24.4	25.1	24.6	24.6	23.1	22.7	22.7	23.4	23.5	23.1	23.7
2005	24.9	24.5	23.0	24.6	24.6	23.4	22.6	23.0	23.7	23.5	23.2	23.5
2006	24.1	24.2	24.1	23.8	23.8	24.5	22.9	23.0	23.6	24.3	23.8	24.1
2007	25.0	24.5	23.9	24.2	24.2	23.5	22.9	23.5	23.6	-	23.5	23.8
2008	23.7	24.2	24.2	23.6	23.6	23.5	23.0	22.7	23.7	24.0	24.1	24.2

Unit: degree Celsius, Source: Climate Department, Ministry of Transport

2) Humidity

Average relative humidity in Libreville is 95% at the highest, and 72% at the lowest.

3) Rainfall

Libreville has a heavy rainfall except in dry season between June and August. In the records for 1989 to 2008, the maximum monthly rainfall observed was 804mm, the minimum 0mm, and the annual rainfall is 2,746mm on average. Monthly rainfall records for 1989 to 2008 are shown in the table below.

Table 1-2-2-3 Monthly Rainfall, Libreville 1999 to 2008

	1	2	3	4	5	6	7	8	9	10	11	12
1999	304.5	222.6	306.7	259.1	318.0	13.1	36.6	55.0	161.8	467.9	312.6	138.0
2000	288.5	243.7	353.1	269.4	203.0	163.0	3.5	12.1	140.5	786.8	803.8	378.1
2001	258.6	168.9	345.1	309.6	633.7	53.4	10.2	1.8	9.6	372.1	295.0	161.7
2002	229.2	460.9	407.3	558.8	316.5	10.5	0.1	19.7	288.0	413.9	617.1	350.8
2003	-	224.6	222.2	208.9	125.1	46.7	85.2	18.5	287.6	441.0	707.3	388.5
2004	422.4	409.4	293.2	365.6	39.7	9.1	3.4	28.9	242.7	-	-	-
2005	309.8	252.1	368.2	254.0	2.6	0.0	1.1	2.7	88.5	344.5	516.8	326.3
2006	266.0	140.1	157.3	271.5	101.9	169.4	5.1	4.3	124.8	364.7	539.3	316.0
2007	118.8	185.2	361.0	278.7	745.9	18.8	14.0	10.1	375.9	362.9	481.9	456.1
2008	311.0	199.3	243.9	181.2	306.5	0.5	0.1	29.1	201.5	706.1	288.2	275.9

Unit: mm, Source: Climate Department, Ministry of Transport

4) Wind Speed and Direction

Wind observed in Libreville is mostly westerly. Maximum monthly average wind speed was 20m/sec, and minimum 5m/sec.

5) Earthquake

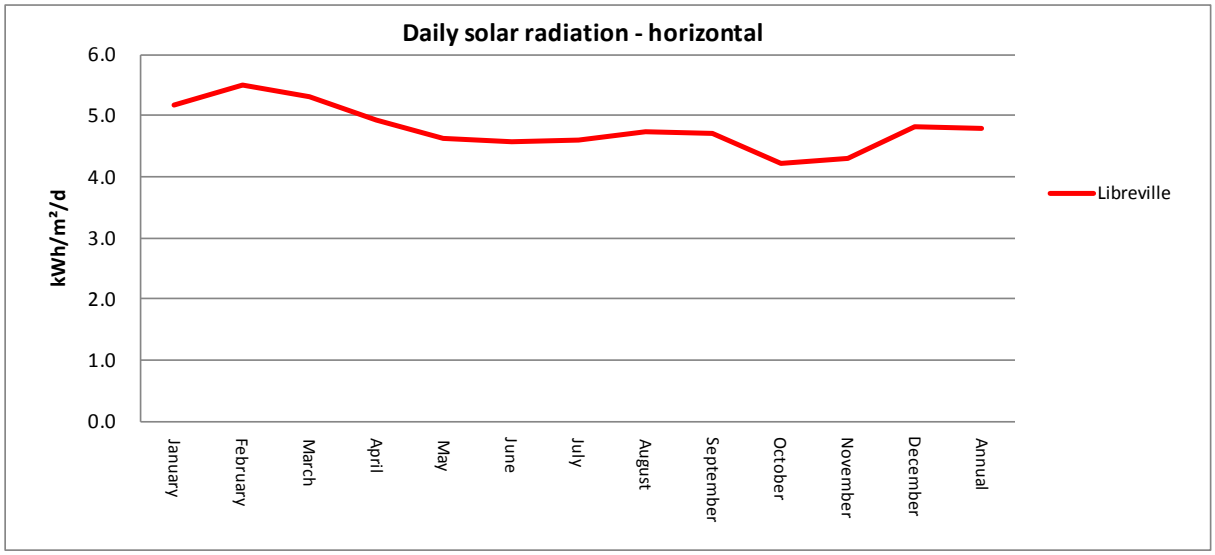
According to the result of interview at the Climate Department of the Ministry of Transport, there has been no significant earthquake observed in Libreville.

6) Salinity

The Ministry of Foreign Affairs premise is facing the coast, and the University is within 2km distance from the coast. Therefore, in the designing of equipment the countermeasures against damages from salinity must be considered.

7) Irradiation

Seasonal variation of irradiation is relatively small in Libreville. Monthly average irradiation on horizontal plane takes highest in February at 5.51kWh/m^2/day, and the lowest in October at 4.23 kWh/m^2/day. The annual average is 4.79 kWh/m^2/day. Figure 1-2-2-1 shows annual variation of average monthly irradiation on horizontal plane.



Source：RETScreen

Figure 1-2-2-1 Average Monthly Irradiation on Horizontal Plane in Libreville

1-2-3 Environmental and Social Considerations

The solar power generation system is understood to be a typical clean energy system due to its characteristics such as no emission of noise, vibration, exhaust and waste fluid in its power generating process. Therefore, the system can be considered to have no adverse impacts from environmental and social aspects.

As described in Chapter 2, the power supply system planned by the project is designed to supply power by Grid-interconnection. The use of batteries as supplement power during periods of insufficient insolation is not planned due to adverse impacts on the environment caused by lead contained in batteries when they are disposed.

During the construction period, several adverse impacts caused by work can be expected. The emission of noise, vibration and exhaust by vehicles and machineries for construction and the risk of accidents caused by the activities of those vehicles and machineries also need to be assumed during the construction period. The volume and hazard of waste emitted by the construction will not be significant but inappropriate management of waste can have risk of negative environmental and social impacts.

The Ministry of Foreign Affairs, one of the two project sites is located in the government office quarters in the city of Libreville and is facing trunk roads with busy traffic. The proposed site for installation of the solar power system is located in front of the main entrance of the building. Therefore, adverse impacts to office work in the building during the

construction period will be considerable. Since visitors will be obliged to pass by part of the work site to enter the building during the construction period, sufficient consideration is needed. In addition, hindrance to surrounding traffic during the peak period for delivery of equipment, material and machinery can be assumed.

The Omar Bongo University, another project site is located slightly away from the center of the city. However, installation work required in the university may have adverse impacts on school activities. The numerous students and school staffs will create busy traffic in the university to cause risks in accidents by construction vehicles and machineries which require consideration.

In order to mitigate the above mentioned adverse impacts during the construction period, appropriate mitigation measures needs to be planned and implemented by the prospective contractor. Informing the work schedule and time table to the parties concerned in order for them to understand clearly the work procedures is also important to avoid the adverse impacts. Especially, sufficient explanation to the students through the authorities of the Omar Bongo University will be needed. As more concrete measures for security, the installation of temporary fencing to guard the site and arrangements for security guards will be required by the contractor. Fencing around the system is planned to prevent electrical shock due to entry of unauthorized persons even after completion of the work.

The screening procedure was carried out during the field survey to confirm the categorization of the project which was set as “C” according to JICA’s guidelines for environmental and social considerations (2004) at the beginning of the study. The following table shows the results of the screening. The items are listed in accordance with the scope of objects in JICA’s guidelines.

Table 1-2-3-1 Screening for Environmental and Social Considerations (UOB)

Item	Influence caused by the Project	Adaptation measure
Air pollution	None	
Water pollution	None	
Soil pollution	None	
Waste	Some waste will be generated during the construction period though there will be no waste after completion.	Necessary arrangements and supervision during the construction period should be provided.
Noise and Vibration	Noise and Vibration will be generated during the construction period.	Necessary arrangements and supervision during the construction period should be provided.
Ground subsidence	None	
Offensive odors	None	
Geographical features	None	
Bottom sediment	None	
Biota and ecosystem	None	
Water usage	None	
Accidents	Danger of traffic accident and electric shock during the construction period	Necessary arrangements and supervision during the construction period should be provided.
Global warming	The project can be a part of efforts to mitigate the warming effect.	
Involuntary resettlement	None	
Local economy such as employment and livelihood etc.	None	
Land use and utilization of local resources	None	
Social institutions such as social infrastructure and local decision-making institutions	Small scale restriction on students' activities might occur because of safety measures during a certain period of the construction stage.	Enough explanations to the students council though university administration should be done.
Existing social infrastructure and services	None	
The poor, indigenous of ethnic people	None	
Misdistribution of benefits and damages	None	
Local conflict of interests	None	
Gender	None	
Children's rights	None	
Cultural heritage	None	
Infectious diseases such as HIV/AIDS	None	

Table 1-2-3-2 Screening for Environmental and Social Considerations (MFAIC)

Item	Influence caused by the Project	Adaptation measure
Air pollution	None	
Water pollution	None	
Soil pollution	None	
Waste	Some waste will be generated during the construction period though there will be no waste after completion.	Necessary arrangements and supervision during the construction period should be provided.
Noise and Vibration	Noise and Vibration will be generated during the construction period.	Necessary arrangements and supervision during the construction period should be provided.
Ground subsidence	None	
Offensive odors	None	
Geographical features	None	
Bottom sediment	None	
Biota and ecosystem	None	
Water usage	None	
Accidents	Danger of traffic accident and electric shock during the construction period	Necessary arrangements and supervision during the construction period should be provided.
Global warming	To contribute for mitigation	
Involuntary resettlement	None	
Local economy such as employment and livelihood etc.	None	
Land use and utilization of local resources	None	
Social institutions such as social infrastructure and local decision-making institutions	None	
Existing social infrastructure and services	None	
The poor, indigenous of ethnic people	None	
Misdistribution of benefits and damages	None	
Local conflict of interests	None	
Gender	None	
Children's rights	None	
Cultural heritage	None	
Infectious diseases such as HIV/AIDS	None	

As shown in the above table, the impacts from the project will occur mostly during the construction period. Therefore, it is considered that long-term serious impacts, if any, can be avoided or mitigated through the execution of appropriate measures at the beginning stage of the project implementation. Based on the above procedure, the project was confirmed to be categorized as "C" again at the stage of field survey.

The General Directorate of Environmental and Natural Protection (GDENP), the Ministry of Environment, Sustainable Development and Natural Protection is in charge of supervision of the environmental Impact Assessment (EIA) in Gabon, complying with relevant provisions in the Ordinance No. 539 (July 15, 2005). In accordance with the law, any project which might have adverse impact on the environment must be assessed by the EIA procedure.

Through meetings with GDENP during the first through the third field surveys, the team explained the outline of the Project along the progress of the study. Since neither site location nor project size were decided at the beginning stage, necessary information for environmental and social considerations was insufficient. Therefore, consultation for environmental and social considerations between GDENP and the team needed to wait for the progress at the second field survey. The team then resumed the consultation with GDENP by explaining the outline of the proposed project and results of the screening in accordance with the project. In response to the explanation, GDENP required the team to describe the following items: measures to prevent electrical shock accidents during the work period; measures to protect the completed facilities; and the size of the proposed project.

During the third field survey, the Team was informed that there had been a committee set up by various related parities for this Project, and GDENP was one of its members. Therefore, the Team prepared an explanatory note concerning the above subjects and handed it over to MEWR counterpart for his presentation at the committee. Having gone through this course of transactions, it was confirmed that the project would not be required to undergo the process of EIA.

1-3 Global Issues

Global warming caused by greenhouse gas (GHG) emission including carbon dioxide is considered to be the main factor of the climate change, regarded as the global issue today. In particular, since the formation of United Nations Framework Convention on Climate Change, it is unanimously agreed that the reduction of CO_2 emission would be unattainable without a contribution from developing countries, as well as developed countries.

Solar generation is very effective in the reduction of CO_2 emission and the cost of energy

production is not affected by fuel. Therefore, solar generation offers additional energy source and the reduction of CO_2 emission at a stable cost, and enables developing countries especially to contribute in the global community and to obtain energy for domestic development, at the same time.

This Project has been initiated by the participation of Gabon to Cool Earth Partnership. It is expected that the Project contribute to both the development of Gabon and alleviation of climate change as the global issue.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

This Project is to provide Omar Bongo University (UOB) and Ministry of Foreign Affairs, International Cooperation and French Speaking Countries (MFAIC) in Libreville, Gabon with a photovoltaic system (PV system) of 130 and 70kW peak power respectively and to supply electric power to the facilities. These installations will supplement power production, particularly during dry seasons when the power system tends to be short in supply from hydro power stations due to insufficient river flow, by meeting part of the electricity demand at these facilities. Thus the projects will help the Recipient in his efforts to reduce GHG emissions and develop its economy at the same time. The PV system works with the power from the utility grid (grid interconnection), and in the case of blackout of grid power the system shuts down automatically.

This Project is conducted under the scheme the Programme Grant Aid for Environment and Climate Change and the tendering for the contract for the procurement of equipments and construction shall be held in Japan. Among the various products to be procured for the Project, PV modules and power conditioners shall be limited to Japanese products. Site works including civil engineering works for foundations, installation of PV modules and electric works, shall be undertaken and managed by the Japanese contractor employing private companies in the recipient country.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Design of the System

This Project is to procure and install a PV system (130 and 70kW) with grid interconnection to UOB and MFAIC in Libreville City. The capacity of the PV system shall be determined taking into account the current electric power consumption and availability of PV module installation areas. The provision of the system shall be confirmed to be free from any interference with other aid agency's activities and the installation areas selected properly in view of the future land use of, and with approval from, the facilities.

As SEEG has agreed to receive reverse power flow (meaning sending power generated by PV system upstream to the utility grid) of the PV systems, the systems are designed to produce

power to be supplied to and consumed in the respective facilities, and to send surplus power to the utility grid when the power production exceeds the consumption in the facilities.

The PV system shall be designed to shut down automatically when there is blackout of utility grid power, and when the grid power has recovered, restart supplying the electric power, automatically after having confirmed some predetermined conditions being met.

2-2-1-2 Design for Physical Conditions of Site

(1) Air Temperature and Humidity

The climate of Libreville is classified as tropical rain forest climate characterized by high temperature and humidity throughout the year and the annual rainfall reaches 3,000 mm.

Power conditioners for the PV system procured in this Project shall be designed to be set in a container cubicle with air conditioning, which relieves the power conditioners of high air temperature outside.

Maximum temperature inside the cubicle shall be set at 27.5 degrees Celsius to protect semiconductors used in power conditioners from the heat. A space heater shall be furnished to the cubicle to prevent the dew condensation due to lowered temperature and high humidity inside the cubicle. Equipment to be installed outside the cubicle shall be designed to work in air temperature as high as 40.0 degrees Celsius.

(2) Lightning Strike

The countermeasures against lightning strikes shall be that against inductive lightning, as the PV arrays are to be lying around two meter high at most, lower than surrounding buildings, and the Site is located within the development of the city, which implies low possibility of direct lightning strikes. Countermeasures for inductive lightning will consist of installation of arresters to junction boxes and power conditioners.

(3) Rainfall

There is intensive rainfall observed in Gabon. A storm water drain should be designed for the PV modules installation area of UOB which is mildly sloped.

(4) Wind and Earthquake

There is no special considerations necessary for wind and earthquake over the standard design.

2-2-1-3 Local Conditions affecting the Works

Local contractors seem to have sufficient capacity for civil works and steelworks which can be used for this Project. Also, there are many capable local companies that have experiences in general electrical works commissioned by SEEG. For PV installation works, some companies have carried out installation of small-scale solar power systems for telephone companies and rural schools. These companies employ experienced electrical engineers on a permanent basis. However, these local contractors have never engaged in construction of large-scale PV plants.

Some local contractors own construction equipment in sufficient numbers and they are kept in good condition. Most of the main roads in the city experience heavy traffic in the daytime, and the installation works should be planned carefully, particularly for transportation routes and times, taking into consideration the traffic conditions.

Planning of installation works also should consider the safety of third parties. The premise of Omar Bongo University is passable by general public and there are many students and faculties as well. It is important to consult the University about the works and their schedule, which should also be communicated to the students and other people. The Works at the Ministry Site, which is facing busy main road, will have to be carried out using relatively small area around the Site. The Works, particularly those involve transportation of materials, etc., should be done paying attention to the safety of the environs.

2-2-1-4 Application of Local Resource

(1) Utilization of Local Companies

It is assumed the Works at the Site will be managed by a Japanese company as a prime contractor who supervises the individual works sub-contracted and carried out by local companies. Local companies also are assumed to carry out, providing equipment and manpower, installation of electric equipment. The Works at the Site include; civil works (earth works, concrete foundation works), steel works (fabrication of support structures for PV modules), equipment installation works (PV modules, electric boards and container cubicle), and electric works (laying cables). Japanese engineer(s) or engineer(s) of other nationalities will have to be sent to the Site for quality control, schedule control, safety control, assembling Supervision, testing and adjustment of equipment.

Rental large crane is available in the country and will be used to install the power conditioner cubicle transported from Japan. Local transporter’s vehicle can carry 40 foot container by inland transportation.

(2) Utilization of Local Materials and Equipments

Most of construction materials such as aggregates, cement and reinforcement bars are available in the country. However, electric equipments and materials including PV modules, power conditioners, and cables are not available and they will be procured in and imported from Japan.

2-2-1-5 Capability of Operation and Maintenance

Operation and routine maintenances of the PV system after the commissioning will be done by UOB and MFAIC under the supervision of MEWR. As these facilities own and have been maintaining power receiving and distributing equipment over a long time to use, these facilities are deemed to have reasonable capacity to maintain electric equipment in general. However, the status of existing equipment in these facilities indicates inadequate practice and lack of knowledge about maintenances with preventive measures including routine inspections. Therefore, this Project should stipulate that the contractor provide guidance for O&M and manuals. Further, the Consultant will be providing training programs in two separate periods; one during the commissioning of the PV system, and the other a few months after the commissioning. In addition, to realize effective and efficient operation and maintenance, a suitable management organization for operations and maintenance should be proposed in the Project.

Some parts in the PV system will need replacement in the long term and this may cost a significant amount. Such expenses may not be possible for the Facilities (UOB and MFAIC) to bear alone within one-fiscal year budget. Therefore, this Project will provide spare parts and maintenance tools to be needed for certain period. It is also important that the executing agency (MEWR) is aware of this and is prepared to make financial arrangement in cooperation with the Facilities and their overseeing authorities (see Section 2-5 for details). As the financial benefit of reduction of power purchase due to power generation is expected to be larger than the said expenses, it is also possible to raise a fund from part of such benefit for future maintenance expenses.

2-2-1-6 Schedule of Procurement and Installation

As this Project is conducted in the scheme of the Programme Grant Aid for Environment and Climate Change, it must be conducted in as efficient manner as possible. To complete the Works and produce expected results by the specified time, the Works should be scheduled considering the sequence of inputs from both Japan and the recipient sides, and also, route, method of transportation, time for various official procedures necessary.

2-2-2 Basic Plan (Construction Plan/Equipment Plan)

2-2-2-1 Design Condition

To design the capacity and specification of the PV system, various conditions described above are considered and consequently, the design conditions shall be set as shown below.

(1) Natural and Local Conditions

1 Outdoor air temperature	40.0 degrees Celsius (Maximum)
2 Electric room's temperature	27.5 degrees Celsius
3 Design relative humidity	Maximum 95%
4 Design wind velocity	40.0m/s
5 Monthly maximum rainfall	803.8mm
6 Seismic force	not to be considered
7 Elevation of the Site	about2m (MFAIC) and 40m (UOB)
8 Allowable Load bearing capacity of the ground	$50kN/m^2$ [1]
9 Salt damage	to be considered

(2) Applicable Standard

1 Japanese Industrial Standards (JIS)	: Industrial product
2 Japanese Electrotechnical Committee (JEC)	: Electric product
3 Standards of Japan Electrical Manufacturer's Association (JEM)	: Electric product
4 Japanese Electric Wire & Cable Makers' Association Standard (JCS)	: Cables
5 International Electrotechnical Commission (IEC)	: Electric product
6 International Organization for Standardization (ISO)	: Electric product
7 Technical Standard for Electrical Facilities	: Electric product

(3) System of Unit

As a general rule, The International System of Units (SI) shall be used

(4) Electric Mode

1 Nominal voltage (Low voltage)	380V (on-load)
2 Wiring system	3 phases-4 wires (connection point of existing equipments)
3 Frequency	50Hz
4 Earthing method	Direct grounding

[1] Assumed by the Team on the basis of observation at the Site with reference to "Guideline of Design of Foundations for Small Buildings(Architectural Institute of Japan)"

2-2-2-2 Layout Plan of the PV System

The PV system procured by this Project is constructed on UOB and MFAIC's premises. Thus, the layout plan of the PV system shall be considered with not only convenience of operations and maintenances but also with following conditions.

- A layout to make the maximum use of solar power in limited space
- Efficiency and convenience of construction works
- Future land use of the Facility

Layout planning at these sites are discussed below.

(1) UOB

The university has its premise on the slope inclined to south-west direction and there are large open areas. However, these unused areas are mostly on valleys and gullies. To use these areas requires civil works of significant scale and cost, including reclamation, drainages and stabilization, which can be obstacles in the implementation of the Project. Therefore, relatively small-scale open areas were sought near the main entrance of the university on mildly sloping open areas. This plan was discussed and consulted with the university and it was agreed to have PV modules of 130kW are to be installed at the said areas

The part of the university consumes about 1,100MWh of electricity per year.

(2) MFAIC

The premise of the Ministry has the main building, a not-completed annex, parking areas and green area with flag poles in front of the main building, among which, the green area enjoys the sunlight without subjected to the shades of surrounding buildings. The plan to use this area to install PV modules of 70kW was proposed by the Team. To increase the capacity of PV system some other possibility was sought: using parking areas to install PV modules in the form of roofs of parking lots, which may allow installation of some 20 to 30 extra kW modules. These proposals were discussed with the Ministry and it was decided to use only green area in the front to have 70kW system for the Ministry.

The Ministry building consumes 1,200MWh of electricity per year.

2-2-2-3 Summary of Outline Design

Considering the design policy, basic standard and layout plan described above, the summary of outline design in this Project is as shown Table 2-2-2-1.

Table 2-2-2-1 Summary of Outline Design

Category	Content
Site and PV Capacity	UOB: 130kW PV equipment MFAIC: 70kW PV power equipment − PV system shall be grid-interconnected, and surplus power shall be sent back to the utility grid (reverse current) − In the case of blackout, PV system shall be designed to shut down automatically.
Procurement of Generating equipments and Installation Work	130kW and 70kW PV modules Ancillary equipment for PV system - Junction box - Power conditioner cubicle - Meteorological observation device - PV connection panel - Materials for wiring and earth - Electrical facility cubicle - Supporting structures for PV modules - Foundation of supporting structures for the PV system and electrical facility cubicle - Fences, gates, and grave surfacing - Cable connection for Electrical facility cubicle/interconnection point/display equipment
Spare Parts and Tool Kits	Spare parts and tool kits for maintenances of equipment Manuals for O&M and implementation of Operation Guidance

2-2-2-4 Outline of Equipment Plan

Elements of the PV system which will be installed at UOB and MFAIC are described below. Outline specification of the each equipment is shown in Table 2-2-2-4 and Table 2-2-2-5.

(1) Outline

1) Type of PV System

Type of the PV system is of grid interconnected without storage battery. Storage battery is not included as it would require large replacement cost and the disposition of used batteries may become environmentally hazardous.

2) Operation during the Power Failure

The PV system shall be shut down automatically when there is blackout of utility grid power. When the utility grid power has been recovered, the PV system shall be manually and/or automatically restarted to supply the electric power after having confirmed some predetermined conditions being met.

(2) Contents of Outline Design

1) Verification of Design Capacity or PV System

There are two Sites in Gabon: the equipment plan of each Site is described below.

a) UOB

The PV system will be connected to the utility grid at the low voltage side of the existing transformer in the electrical room for northern area, which supplies electric power to Administration building. A PV Connection Panel will be furnished by the Project in the northern area electrical room.

Capacity of the PV system was studied as below.

The result of the measurement of power consumption conducted in the second phase study is shown in the figure below.

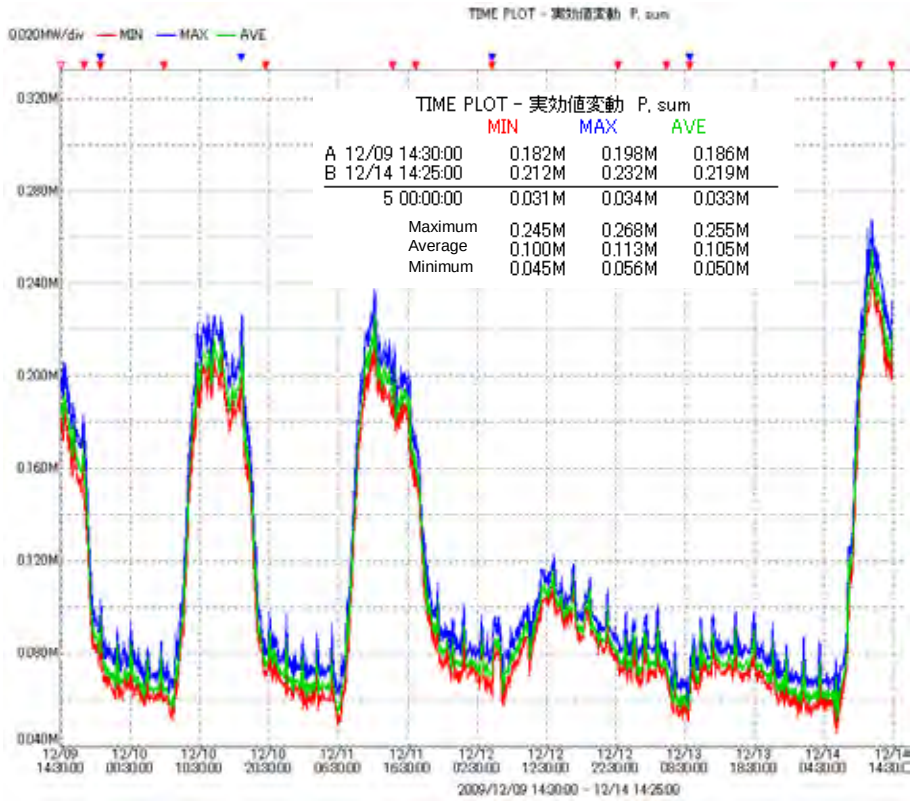


Figure 2-2-2-1 Power Consumption Measurement Result at UOB

This measurement was conducted when the new academic year had just started, and. the Team was informed that the university was not at its full operation. The consumption peaked around noon at a little above 200kW during week days, and day time consumption is well above 130kW. On Saturday (12th December) daily peak is above 130kW but on Sunday (13th December) it is approximately 80kW. The PV system with the capacity of 130kW may have some surplus energy on fine-weather Sundays, but on weekdays all of the energy produced will be consumed within the university.

As there was no actual insolation measurement data available to the Team, the annual

energy production was estimated using software called RETScreen, developed and distributed by Natural Resources Canada. The result shows that 160MWh of energy is expected from the system. This energy is approximately 14.5% of annual power consumption and will mostly contribute to reduce power purchase.

b) MFAIC

The PV system will be connected to the utility grid at the low voltage side of the existing transformer in MFAIC. A PV Connection Panel will be furnished to the existing electrical room.

Capacity of PV system is studied as follows. The result of the measurement of power consumption conducted in the second phase study is shown in the figure below.

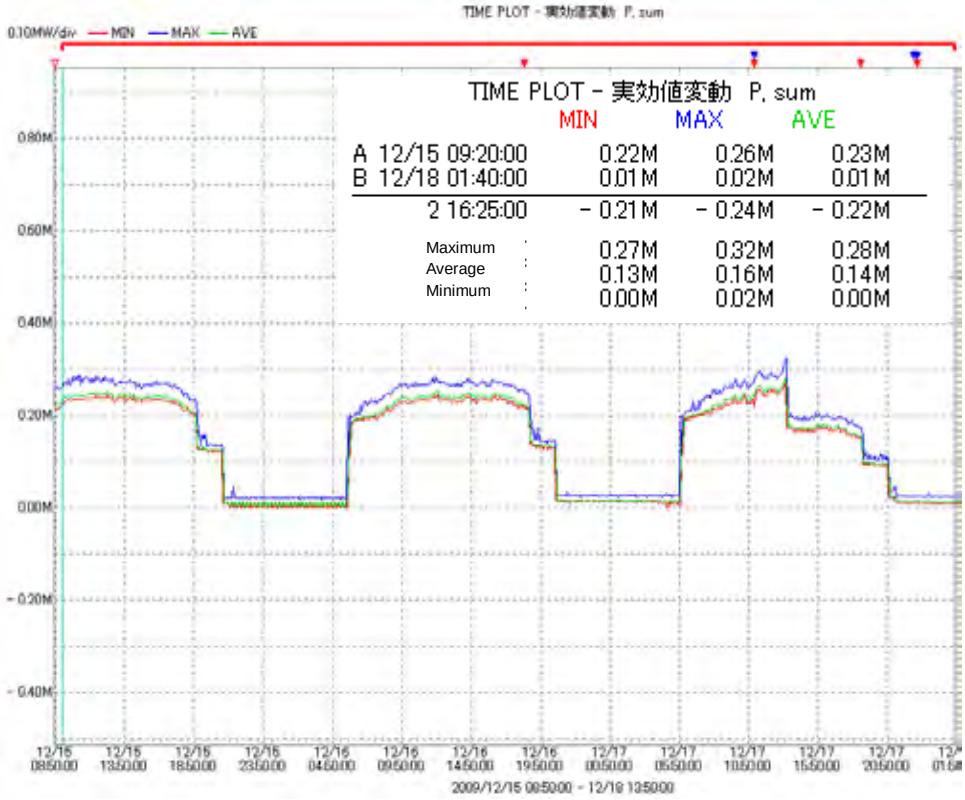


Figure 2-2-2-2 Power Consumption Measurement Result at MFAIC

A technician at MFAIC informed the Team that the peak power consumption of MFAIC was about 280kW, which is well proven by the measurement. Daily load curves are unique in that there are abrupt changes of consumption at 6AM, 6PM and 8PM. This is because of central control of air conditioning: before and after the working hours of the Ministry, the master switch is turned on and off at these hours except on Sundays. Power consumption at outside the working hours is low and stable at around 10kW. The size of PV installation at MFAIC is relatively small to its power consumption. But the energy generated will be mostly consumed within the facility.

As in the case of UOB, the annual energy to be produced by the PV system was estimated using RETScreen software. The estimated 90MWh per year will be approximately 8% of the annual power consumption of the facility, and as discussed above, is expected to be mostly consumed within the facility.

As SEEG may not permit the reverse power flow, 70kW should be appropriate for PV system capacity at MFAIC

System Capacity was determined at the end in consideration of the project budget assumed at the project formulation stage, and the selected land area, layout for PV module installation.

2) Type of PV Module

There are various types of solar cells depending on semiconductors used. Main types of solar cells are silicon and compound. Silicon type has been and is the majority in the market. Silicon type is further classified into crystal and thin film types. Crystalline type is made of once melted and molded matrix sliced into thin wafers. Thin film type is made of extremely thin silicon film developed on a sheet of glass by plasma. Although thin film has the advantage of larger production scale, crystalline type has enjoyed higher conversion efficiency and reliability than thin film so far[2].

With regard to the conversion efficiency, a recent technical report shows that thin film yields higher efficiency measured in annually produced energy, a few percentage points higher, than crystalline type due to the atmosphere temperature and conversion efficiency relationship: the higher the temperature the lower the efficiency. The disadvantage of thin film is that it requires about 1.4 times larger installation area than crystal type.

As the available area for PV module installation is limited at the Site (the MFAIC and UOB), PV module in this Project should be of crystal type.

3) Electric Equipment

a) PV module

Type of PV module should be crystalline type at both UOB and MFAIC sites. Capacity of total PV modules is over 130kW at UOB and 70kW at MFAIC using the 10kW at UOB and 5kW at MFAIC unit (only as a guide) sub-arrays. PV modules are connected to junction boxes by special cables.

Spare parts of PV modules are 3% of installed number (decimal place is cutoff).

PV module specifications, number and unit of sub-arrays must satisfy the following conditions.

- To lay out PV modules without significant change in the design fence and gate

[2] New Energy and Industrial Technology Development Organization of Japan

alignment,

- To match the input voltage of power conditioners with PV output,
- To design sub-array rectangular and use dummy modules if there are sub-arrays with uneven number of modules in order to look coherent,
- To use cables with allowable voltage drop less than 2% to connect the output terminals of PV modules to power conditioners,

Layout of equipment and fence and gate alignment are shown in Outline Design Drawing No.U03 (UOB) and No.M03 (MFAIC).

b) Junction box

Each series circuit of PV modules is connected to both positive and negative terminals of a junction box.

One junction box collects approximately 10kW of PV module output for UOB, and 5kW for MFAIC in nominal term. Junction boxes are equipped with a circuit breaker, anti- reverse flow diode, and arrester for each input.

c) Power Conditioner Cubicle

Outline

Power Conditioner shall consist of four main equipment shown below. These equipment shall be encased in one or a few boards.

- Power Conditioner
- Low Voltage Switchboard
- Branch Switchers for PV Array
- System Controller

All the boards shall be furnished with space heaters inside.

<Power Conditioner>

This equipment converts direct current collected from PV modules, supply the load with alternate current in connection with the utility grid power supply.

Direct current circuit is designed to operate under inflow voltage of 500V or higher.

AC circuit is designed to synchronize the PV generated power to the utility grid power by Maximum Power Point Tracking (MPPT) method.

Power Conditioners shall be installed in multiple units, added by an extra stand-by unit. The stand-by unit shall be placed inside Electrical Facility Cubicle. The system shall be designed in a way that when some units are broken down, remaining unit(s) shall work within the capacity then available. This design is to ensure the maximum lifetime of the system.

<Low Voltage Switchboard>

Low Voltage Switchboard connects AC output of power conditioners to the utility grid at the low voltage side of the existing transformer via a rotable phase-adjusting transformer. It also has the distribution function to supply electric power to selected loads where individual loads can be switched by breakers.

An AC 3 phase arrester is installed at the grid-connection point. This equipment is also furnished with transformers and distributors for the System's own use.

The breaker for the interconnection can be tripped by a cut-off signal transmitted from outside.

< Branch switchers for PV arrays>

Branch Switchers for PV Array equipment is equipment that collects output of PV modules. Output from sub-arrays through collection boxes all converges at this board.

MCCB (Molded Case Circuit Breaker) is equipped inside the board for each junction box input.

An arrester is equipped inside the board for each junction box input. Main DC circuits are designed for applied voltage of DC500V or over.

<System Controller>

This equipment embodies various functions such as sequences and inter-locks, to operate the photovoltaic system properly and safely. The functions included are shown below.

- Start and stop of the PV system
- Interlock
- Protection
- Monitoring function
- Display function
- Recording function

Display function is to be realized by a set of displays set up to show the users and visitors of the facilities the working and its effect of PV systems. For UOB, a location for the display was identified by the road from main gate going inside of university. For MFAIC, it is beside the national flag stand in front of the entrance of main building. The numbers of unit and locations of installation were confirmed with UOB and MFAIC during the Second Phase Site Survey.

Components of this equipment are shown in the table below.

Table 2-2-2-2 List of Components (System Controller)

No.	Device	Specification	Quantity
1	System Control Panel		Complete set
2	Display Equipment (outside)	Display of generating power (current and cumulative output, CO_2 reduction, etc.)	1 complete set

d) Meteorological observation device

Meteorological Observation Device includes such instruments as a solar irradiation meter and thermometer to observe and record the climate conditions of the photovoltaic module installation area.

Components list

Components of this device are shown in Table 2-2-2-3.

Table 2-2-2-3 List of Components (Meteorological observation device)

No.	Component	Specification	Quantity
1	Pyrheliometer (Outside installation)		1
2	Thermometer (Outside installation)		1
3	Transducer (Outside storage box)	For each of 1 and 2 above	2 sets

e) PV connection panel

This equipment connects the output of the System to the distribution of the power from the transformer.

f) Electrical Facility Cubicle

Electrical Facility Cubicle of the PV System encloses the equipment below. The cubicle shall be furnished with air conditioning system to keep the equipment inside from overheating.

- Power Conditioner
- Low Voltage Switchboard
- Branch Switchers for PV Array
- System Controller

g) Support Structure for PV modules

A Support Structure for PV module sets up a sub-array of PV modules arranged in series and in parallel to attain required voltage of sending power. The Support Structure is furnished with fittings for environment monitoring instruments and Junction Boxes to be attached to the Support Structure.

The material is finished with hot dip zinc galvanizing. For the fastening used in the

cradle, a countermeasure shall be taken against larceny.

- Type of installation: ground installation
- Direction and Slope: south, 10 degrees
- Materials: steel
- Coating: Hot dip zinc galvanized and salinity resistance

h) Concrete Foundation of equipment

The foundations of supporting structures, electric facility cubicle, fences and gates are constructed.

♦ Excavation for placing foundations

There is some water pipes buried underground of the PV installation area of MFAIC site. Unfortunately there is no definite information available, although the location of pipes is roughly known. The pipes are in use and must be preserved. Therefore, the excavation work at the area must be done with utmost care, employing hand excavation method as required.

♦ Foundation type

As mentioned elsewhere, there is some water pipes buried underground of the PV installation area of MFAIC site which calls for the use of shallow U-shaped foundations for the supporting structure for PV modules.

Meanwhile, the PV installation area of UOB site is on a mild slope. In this Site, the foundation should be those with shallow shape to minimize the excavation on the slope, and have a larger footprint for the stability against turnover, both of which can be met by U-shaped foundation.

i) Materials of wiring and earthing

♦ Wiring

Exterior cables are of armored type and directly buried underground. Materials of cables are copper, which has large allowable power and flexibility in installation. For insulation general-purpose cross-linked polyethylene is used.

Exterior cable route was designed and decided, considering the information on the existing cables obtained from the Facility, confirmed in-situ with technicians and the director in charge of maintenances, so as not to interfere with the existing cables and future expansion plans of buildings, etc. Cable layout is shown in Outline Design Drawing No.U04 (UOB) and No.M04 (MFAIC).

♦ Earthing

Following earthing fixtures are installed in this Project.

- Earthing of metal objects and electrical equipment to prevent the electric shock
- Earthing of fences and gates
- Independent earthing of control panels and meteorological observation devices, as required

Earthing resistance should be 10 ohms or lower.

j) Fence, gate and gravel surfacing

- Fence and Gates

The Site of UOB seems to be exposed to higher risks of burglary with free entrance of outsiders to the University premise, despite the 24 hour station of security guards. It is observed that exterior units of air conditioners of the buildings are all encased in grids, which calls for tighter measures against burglaries. However, as the PV installation area is located in the center of the University where there are many students and faculties passing and resting, consideration should be given to the aesthetic design of the fence. The fence of 2m high should be installed by the Project, which should be of sturdy vertical gratings with overpassing bafflers.

Meanwhile, the Site of MFAIC is surrounded by the fence and is not very accessible a place for people outside. Therefore, it does not require heavy fencing to segregate the area. However, it is necessary and important to have some measures to prevent people from going inside unwittingly and avoid unnecessary accidents like electric shocks. A fence as high as one meter should be installed by the Project. The design of the fence should be given some consideration on the landscape of the Ministry premise.

The alignment of the fence should be designed considering the shade it makes on PV modules, a space for maintenance works, and tamperproof from outside. Also, it should not enclose unnecessarily large plot of land to make it out of use for the facility.

There should be two sets of gates, smaller one is for everyday use of operators, the larger one for periodical maintenance allowing the entrance of motor vehicles.

The Site of MFAIC does not require the larger gates for the Power Conditioner Cubicle is away from PV installation area.

Layout of fence and gates is shown in Outline Design Drawing No.U03 (UOB) and M03 (MFAIC).

- Gravel surfacing of PV module area

PV module area should be gravel-surfaced in order to stabilize the surface, control the growth of weeds and facilitate the maintenance works. Before the placement of gravel, surface soil should be removed for approximately 10cm in depth and replaced by gravel layer. The area will be enveloped with curbstones or similar concrete blocks to keep gravels within the area. Gravels should be of the size of 20 to 40mm, strong enough to withstand the use of long years.

k) Storm water drainage system

The Sites (Libreville) has an annual precipitation of around 3,000mm deep and in wet season it experiences frequent torrential rains. The PV installation area at UOB is located on the inclined ground which calls for particular attention to the treatment of rain water run-off.

As explained elsewhere, PV module area will be gravel surfaced. Therefore, the area should be furnished with rain water drainage system consisting of a gutter along the lower rim of the area, connected to a pit at the downstream end, and buried pipe which drains the rain water collected at the pit down to the road side drainage ditch.

Meanwhile, the Site at MFAIC is on the flat ground and the placement of PV modules does not significantly change the drainage condition of the area. Therefore, natural drainage should be maintained.

(3) Outline Specification of Main Equipment

Table 2-2-2-4 Specification of Main Equipments (1)

Equipment	Outline Specification	Quantity
PV Module	Capacity of module: UOB Mono/poly-crystal 130kW MFAIC Mono/poly-crystal 70kW Type: mono/poly-crystal silicon, on-ground type (public/industrial use presumed) Conversion efficiency: around 14% presumed Unit capacity of a module: around 210W presumed	1 complete set for each site
Junction Box	Circuit breaker, anti-reverse flow diode, arrester for each input.	1 complete set for each site
Branch switchers for PV arrays	MCCBs for each junction box input Arrester for each junction box input Main DC circuits with applied voltage DC500V.or higher	1 complete set for each site
Power conditioner for grid interconnection	AC rated voltage: Three-phase three-wire system 400V (line-to-line voltage) or 200V ±10% AC rated frequency: 50Hz ±3% AC rated output : Over 130kW (UOB) Over 70kW (MFAIC) DC voltage range : DC0V ~ 500V or higher DC control voltage range DC320V (or lower) to 400V (or higher) Conversion efficiency 93% or higher (at Rated operation) Harmonic current Distortion Factor total 5% or less At each order 3% or less (at Rated operation) External communication equipped Operation mode: Normal operation (Maximum power point tracking for grid connection)	1 complete set
Low voltage switchboard	MCCB (for interconnection, PCS, board's own use) Uninterrupted power supply (UPS) Grid-interconnection Protection Relays Over Current Relay(OC) Over Voltage Relay(OV) Under Voltage Relay (UV) Over Frequency Relay (OF) Under Frequency Relay (UF) Island Operation Detection Function; both active and passive detections adopted Rotable phase-adjusting transformer (3 phase-3 line to 3 phase-4 line)	1 complete set for each site

Table 2-2-2-5 Specification of Main Equipments (2)

Equipment	Outline Specification	Quantity
System controller	Main functions - Start and stop of PV system - Interlock - Protection - Monitoring function - Display function - Recording function	1 complete set for each site
Meteorological observation device	Irradiation meter (exterior) 1 unit Thermometer (exterior) 1 unit Transducers(exterior storage box) one for each of above meters	1 complete set for each site
PV connection panel	MCCB for interconnection point Energy Meters: for receive power and reverse power (1 set each) - Type of device : Active power meter (No need for test and certificate) - Wiring system : 3 phases-4 wires - With Reverse-Rotation Lock Function,	1 complete set for each site
Electrical facility cubicle	With Air conditioning(power supplied from Low Voltage Switchboard) Protection Class: IP54 or equivalent	1 complete set for each site
Support structure for PV modules	Hot dip zinc galvanized and salinity resistance fittings for meteorological devices fittings for junction boxes	1 complete set for each site
Materials of wiring and earthing	Wiring Form: low voltage 2-4core copper cable, XLPE insulation, PVC sheath Applicable standard: IEC Accessory: material for terminal dressing	1 complete set for each site
Fence, gate and gravel surfacing	Fence UOB Height: 2m MFAIC Height: 1m Gate UOB Height: 2m MFAIC Height: 1m Gravel surfacing Grain size: about 2-4cm Gravel layer thickness: 10cm or more	1 complete set for each site

XLPE:cross-linked polyethylene , PVC: polyvinyl chloride

2-2-3 Outline Design Drawing

Number	Title
NO.U01	SINGLE LINE DIAGRAM (Omar Bongo University)
NO.U02	SINGLE LINE DIAGRAM (PV SYSTEM)
NO.U03	GENERAL LAYOUT PLAN
NO.U04	CABLE LAYOUT PLAN
NO.U05	EQUIPMENTS LAYOUT&MODIFICATION (ELECTRIC ROOM)
NO.M01	SINGLE LINE DIAGRAM (MFAIC)
NO.M02	SINGLE LINE DIAGRAM (PV SYSTEM)
NO.M03	GENERAL LAYOUT PLAN
NO.M04	CABLE LAYOUT PLAN
NO.M05	EQUIPMENTS LAYOUT&MODIFICATION (ELECTRIC ROOM)

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Procurement

This Project is implemented by Japan's Programme Grant Aid for Environment and Climate Change with a procurement agent. The Government of Gabonese shall employ the agent for the procurement of products and services, following the exchange of notes between the two governments concerning the Programme Grant Aid. The Consultant and the Contractor shall provide their services and products on contract with the Agent.

The organization chart of the Project is shown in the figure below.

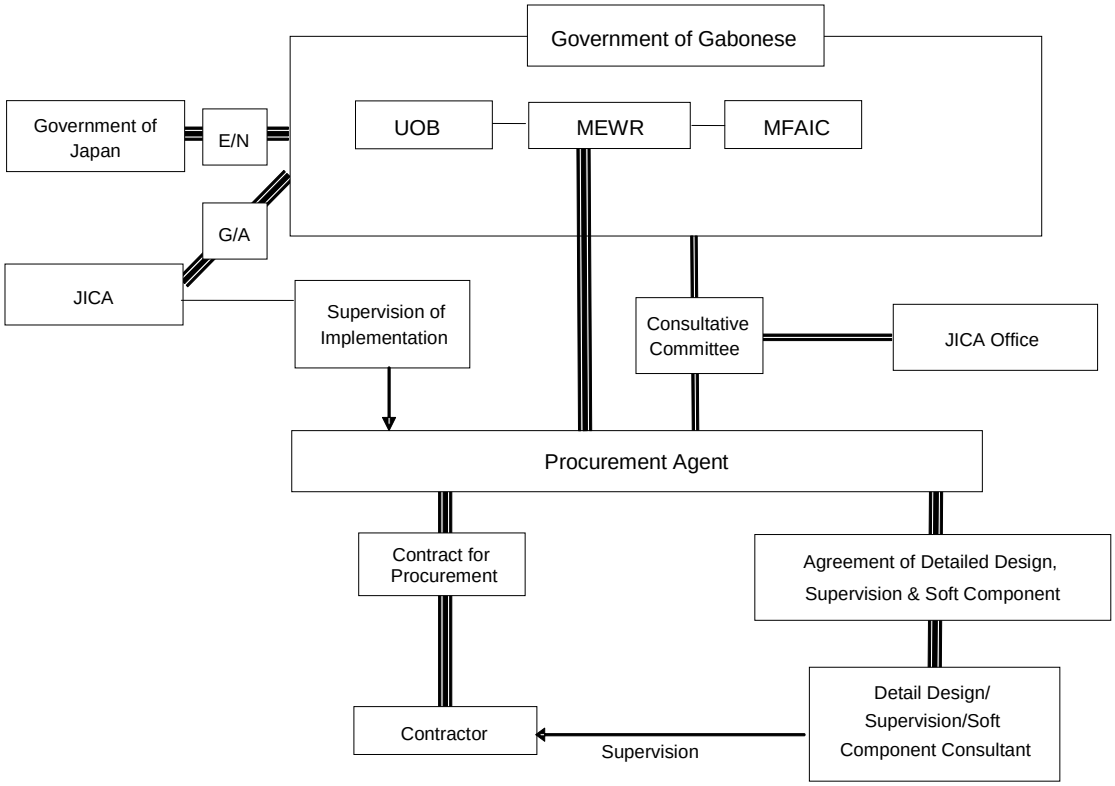


Figure 2-2-4-1 Organization Chart of Implementation

1) The Organization of Recipient Side

The organization of recipient side is; Ministry of Energy and Water Resources as a responsible organization and an executing agency, and UOB and MFAIC as the Sites.

2) The Procurement Agent

On Japan's side, it is the procurement agent who will make into the agent agreement with the recipient, undertake tendering, contracting and manage the whole procurement business. In addition the agent will implement the settlement for consultants and the contractor and fund administration instead of Recipient side.

3) Consultants

The Consultant will assist the procurement agent in his undertaking of tendering, supervise the works of the Contractor, issue certificates for taking over after the completion of procurement/installation works and for the end of defect liability scheduled one year after the taking over. He also will provide training to people concerned so that the equipment will be properly operated and managed.

4) The Contractor

The Contractor, according to the contract made into with the Agent, designs, manufactures and transports the products, installs and commissions the products, and gives guidance to operators for the operation and maintenance of the products. From a perspective of quality and reasonable implementing policy, the Contractor will implement the procurement of equipment and installation on the package.

(2) Implementation Policy

For installation works, local contractors will be utilized in the works under Japanese prime contractor’s supervision. The main works for the Project are civil works (earthworks and concrete foundation works), steel works (assembling of support structure for PV modules) and electrical works (electrical wirings and installation of PV modules).

In principle, Japanese standards are applicable in this Project since the PV system is one of the first of its kind to be built in Gabon. However, adequate methods normally used in the country may be utilized for the installation works.

In principle, the construction methods normally practiced in Gabon shall be utilized for the installation works. Local contractors will be utilized as much as possible in the works under Japanese prime contractor’s supervision. It is difficult to reduce the number of Japanese engineers, if the Contractor is to keep both the quality of equipment that meets the required standards for Japanese grant aid projects, and with a proper management. However, the number of engineers can be as small as possible, without compromising with the quality of the work, by adopting the local standards for the design and specification where possible.

2-2-4-2 Implementation Conditions

(1) Construction Works in the Recipient Country

Although some local companies have carried out small solar power projects such as electrification for hospitals and telephone facilities commissioned by international organization such as GTZ (German Technical Cooperation) in the past, no company has experience in installation of a large-scale solar power system as mush as 100kW. On the other hands, there are many capable local electrical companies in Libreville that have experiences in general electrical works commissioned by SEEG. Although these companies have never engaged in a large-scale PV projects, constructions that meet the required standards for Japanese grant aid projects is expected to be achieved through management and quality control by Japanese engineers and through proper technical guidance to the local contractor. In addition, some capable civil contractors that have been involved in Japanese grant aid projects are identified in the city.

(2) Installation Work Conditions

- Gabon has relatively large rainfall all around the year. The installation work planning should take the seasonal characteristics into consideration, such as avoiding concrete placement in wet season.
- These Sites at the university and the Ministry are located where a large number of the general public can access. Therefore, utmost attention should be paid to prevent any accidents involving third parties.
- Since the spaces of both Sites are limited, measures such as providing security and traffic guards should be considered to secure safe environment for the installation works.

2-2-4-3 Scope of Works

The work demarcation between the Japanese and the Gabon sides is as follows.

Table 2-2-4-1 Allocation of Chief Responsibility

	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 off 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.		●

2-2-4-4 Consultant Supervision

This Project will be started according to the rules of Japan's Programme Grant Aid, after the exchange of notes (E/N) between the two countries which follows the design carefully considered on the basis of the outline design, and its assessment for the appropriateness by the Government of Japan. During the installation works, synchronized with the progress of civil and electric works, the Consultant will send at least one resident engineer for the management of schedule, quality and safety of the Works. The Consultant also witnesses shop and pre-shipment inspections of equipments and materials procured in Japan to avoid any problems from happening, which may appear after the equipment from Japan have arrived at the Site.

(1) Basic Policy on Supervision of the Installation Works

The Consultant shall look after the progress of the works and ensure that the works be finished within a given time-frame. He shall also supervise and guide the Contractor to ensure both the quality of the Works as the Contract Documents stipulate, and the safety of the Works. To attain this objective, the Consultant sends two construction supervisors, one an electric equipment specialist and the other a civil engineer, to the Site coordinated with the progress of the Works.

The main important points in installation work supervision are shown below.

1) Schedule Control

The consultant will compare the implementation schedule originally prepared by the prime Contractor with the progress of the work in terms of the following items every month and every week. If the progress of the work is considered behind the original schedule, the consultant will issue warning and request remedy plans to the Contractor to complete the installation works within a given time-frame.

- confirmation of quantity of work done,
- confirmation of arrivals of equipment and materials,
- comparison between planned and actual turn-out of engineers, technicians and laborers.

2) Safety Control

The consultant will supervise the Contractor through frequent meetings and cooperation to prevent accidents and hazards at the Site from happening.

As PV modules produce electricity while they receive sunlight, countermeasures to avoid incidents of electrical shocks are particularly important.

The following safety aspects are to be focused on in this project.

- setting up safety rules and appointment of safety managers,
- conducting regular inspections of construction machines to prevent accidents,
- pre-planning routes for heavy vehicles and construction equipment and transportation, enforcing maximum speed role
- promoting welfare measures for workers and observe working schedule with holidays.
- practice countermeasures to avoid incidents of electrical shocks

(2) Project Implementation System

Organization and relationships between parties related to the Project including the installation supervision are shown in the figure below.

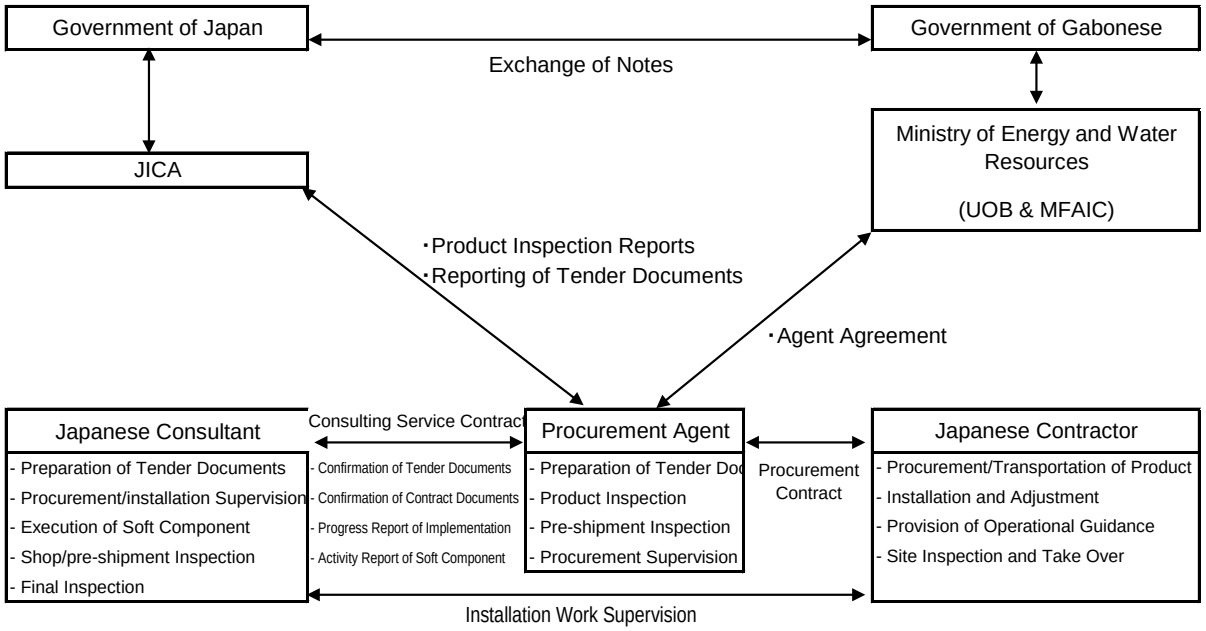


Figure 2-2-4-2 Project Implementation System Chart

2-2-4-5 Quality Control Plan

The Installation work supervisor of the Consultant conducts the supervision by the items shown below to confirm whether the quality of equipment and installation satisfies the relevant stipulations in the Contract Documents (Technical Specifications and Drawings, etc.). If the qualities of the works are questionable, the Consultant will request the Contractor remedies, changes and/or adjustments.

- checking shop drawings and specifications of the equipment and materials,
- witnessing shop inspection or verifying the test reports,
- checking installation procedure statement, site test, adjustment and site inspection procedure statement, and shop drawings,

- supervising the installation work and witnessing test run, adjustment and inspection,
- verifying the shop drawings,
- checking the finished work against the shop drawings.

2-2-4-6 Procurement Plan

(1) Procurement in Japan

Among various items of the Products to be procured in the Project, PV modules and power conditioners shall be of made in Japan.

(2) Transportation Plan

The PV related electrical items procured in Japan will arrive at Owendo Port situated in Owendo, 15km to the south of Libreville. The berth of Owendo Port measures about 500m with the depth of 10m. The port used for Japanese grant aid projects in the past has no mobile crane. Therefore, it is necessary to consider shipping the containers to the port by cargo ships equipped with crane or hiring crane from the rental companies in the city to unload. Many experienced transport companies have their office in Owendo and the access roads from the port to the sites are well maintained. Therefore, there is no concern related to the land transport of the electrical items from the port to the Sites.

2-2-4-7 Operational Guidance Plan

(1) Objectives

Operational Guidance shall be given to those engineers and technicians who will be in charge of operation and maintenance of the PV system so that the system, which is the first case of this size, will be operated and maintained properly, even under emergency situations.

There has been no experience and knowledge of grid-connection of renewable resources such as PV systems in Gabon, and technical information and data concerning the quality of electricity of the grid to which the PV system will be connected are not available. Under these circumstances, adjustment of PV equipment for the commissioning should be finalized with careful observation of the actual connection for a certain time. Meanwhile, the state of maintenance of the existing electrical equipment in UOB and MFAIC is not quite up to the standard required for the PV system. Other local conditions are also negative factors in long-term maintenance of PV equipment which uses sensitive components such as semiconductors. Considering these, it is proposed that the Contractor conduct inspection of the PV equipment three month after the commissioning.

(2) Planning of Operational Guidance

When designing specifications and the grade of PV system, the current technical level of practices in the Recipient country and the knowledge and experiences of people in charge of generating equipment in the Facility are assessed and taken into consideration. There are some differences between PV system equipments and the existing generating equipments, like a diesel engine generator. In addition, as this is first opportunity to introduce the grid connected PV system in Gabon, related parties should not be considered to have capacities for operation and maintenance of PV systems of this scale. Therefore, the Contractor is obliged by the Contract to provide operational guidance to related people concerning the operation and maintenance of the PV system during installation works.

1) Plan for guidance of operations and maintenances during installation works

The program is outlined below

a) Time[3] and location of guidance

Lectures and exercises : approximately one week (at the Site)

b) Instructors

The engineer(s) in charge of supervising installation works, pre-commissioning and adjustment, dispatched by the manufacturer of the PV system are assumed to be the instructor(s) of the guidance.

c) Trainees

The trainees who receive the guidance are mainly technicians in charge of operations and maintenances at the Site after the commissioning. The implementing organization appoints trainees specifically before the installation works start.

Table 2-2-4-2 Organization control of operations and maintenances

Person in charge		number	Main role
Control technician		1	Responsible official and decision making
Operation	Electric technician	1	Management of PV system based on technical knowledge of electric equipment and PV system
	Electric technician	About 2	Normal operation
Maintenance	Electric technician	1	Handling of PV system in troubles based on technical knowledge of electric equipment and PV system
	Electric technician	2	Daily inspection
	Sanitation worker	Few persons	Cleaning of PV modules

[3] Time includes traveling time of the lecturer between Japan and Gabon.

d) Contents of guidance

i) Lectures

Using Operation and Maintenance Manuals, lectures on basic knowledge of the PV system will be given.

- Explanation of Operation and Maintenance Manuals
- Basic Knowledge of Operation and Maintenance (operation scheduling, control, basic knowledge of preventive maintenance, functions of the system, basic knowledge of malfunctions and their handling, spare parts and tools, management of drawing and documents)

ii) Exercises at the Site

During the period of installation works and pre-commissioning, following items will be taught at the Site.

- Methods of start up and shut down of the system
- Explanations on meters on the boards and parts
- Methods of emergency shut down of the system
- Methods and subjects of observations and inspections
- Methods of cleaning of cables, etc.
- Methods of maintenance of electric equipment (including cleaning of PV modules)

2-2-4-8 Soft Component (Technical Assistance) Plan

(1) Background

For Gabon, this Project will be the first-ever experience to have a PV system with grid interconnection, although Gabon has a number of cases of independent off-grid solar systems, those for medical facilities and schools, etc. Therefore, it is important to train those UOB and MFAIC technicians who will be actually operating and maintaining the equipment. At the same time, it is also important to inform officers in the Ministry of Energy and SEEG, and other people who will be involved in the Project, regarding the technical features and institutional issues relevant to PV systems and their interconnection to the utility grid, to prepare them to handle renewable projects in the future.

This training program will be carried out in two separate periods, the first one during the commissioning of the equipment and the other three months after the commissioning. The PV system to be provided by the Project will be interconnected to the utility grid. The quality of electricity from the grid is not quite stable or reliable in the recipient country, which makes the adjustment work of the PV equipment in pre-commissioning to be very important. To improve the stability and reliability of the PV system under such circumstances, the Project proposes to require the Contractor to carry out three-month inspection. Although the

Contactor shall conduct an operational guidance during the commissioning period, this three-month inspection is a good occasion for expert(s) of the manufacturer to come back to the Site and give the reviewing guidance to the operators, who then will find more relevance in the guidance after three months of experience in actual operation and maintenance, which will help ensure the transfer of knowledge to, and its establishment in, the operators and other related people. The training program, in the mean time, shall be planned and carried out in coordination with the operational guidance, dealing with wider topics in the related technical fields to transfer, aiming at more sustainable and propagating effects on the operation.

(2) Objectives in Training Program

The aims are to enable the receipt country stakeholders to do things as shown below.

For operations and maintenances technicians at project site;

- To operate and maintain PV system under normal and emergency conditions, with sufficient knowledge of the function of PV system in connection with the existing electric equipment in the facility,
- To deal with the daily and periodical inspection and maintenance, fully understanding their meaning and importance, and also to change and procure the spare parts and consumables,
- To consider routine activities of operation and maintenance and prepare an operation and maintenance management plan,
- To have basic knowledge that empowers them to give trainings to novice operators within and outside the facility,
- To explain the system to the visitors using publicity leaflets prepared in the program.

For officials in governments and electric company

- To understand the PV system theories, technical characteristics, and institutional issues,
- To have technical knowledge relevant in preparing agreements between private owners of power generators and the electric utility company,
- To acquire the knowledge for the development and guidance of new operations and maintenances staff,
- To promote the use of PV using the publicity leaflets prepared in the program.

(3) Outcome of training programs

- the operation and maintenance management plan has been established, and the PV system procured is operated and maintained autonomously and sustainably,
- O&M activities are followed up by using check sheets,
- Technical officers at the Ministry of Energy, etc. are equipped with knowledge on the method of planning and on the institutional provisions for interconnection of renewable power generation systems,

- Use of PV is being promoted using the publicity leaflets prepared in the program.

(4) Outcome Confirmation and Evaluation

Most tangible outcome will be the operation and maintenance management plan. The operation and maintenance management plan is a plan to be made on the basis of manuals and guidance provided by the Contractor, listing activities of O&M in short-term (daily activities), mid-term (a few months to a few years) and long-term (seven years, an interval of long term maintenance), specifically scheduling the activities, with check sheets for these activities, to make sure the activities are carried out as planned and desired. As discussed below, the training programs are divided into two periods, the first during the commissioning of the equipment and the other three months after the commissioning. The operation and maintenance management plan will be drafted in the first-period program and revised in the second, taking into account the actual experiences in three months.

Also, a trouble shooting manual is to be prepared in the training programs by participants. It is a summary of operators' experiences, and responses sought in discussions in consultation with trainers. The material prepared can be useful in evaluating the degree of understanding of basic knowledge, and the process of preparation itself is helping the deepening of understanding. It also can be used in similar projects elsewhere.

The exercises above are to be started by the discussion among the participants. After evaluating the results, the lecturer joins the discussion, giving additional explanations and instructions as required. Then the participants proceed with the tasks given. These three steps enable the lecturer to evaluate the degree of understanding of the participants before and after the exercise sessions.

Publicity Leaflet will be designed and prepared in the programs, with due consideration to the current status of renewable energy use in the recipient country, to be used and distributed to public in order to introduce the PV system procured in the Project and to promote the use of renewable energy.

- Other outcomes in the first-period program will be evaluated in the following manners at the beginning of the second-period program. The whole program will also be evaluated with the materials presented at the Work Shop to be held at the end of the programs, further supplemented by questionnaires. Evaluation of operation records and daily check sheets for three months,
- Evaluation of problem-response records for three months,
- Evaluation of communication and discussions in Trouble Shooting sessions in the second-period program,
- Evaluation of knowledge acquisition concerning the system-wide management, through Exercises, Workshop and its handouts prepared,

- A questionnaire conducted at end of the training programs

(5) Planning of training program

1) Content

Training program is planned to consist of a series of lectures, exercises, and OJTs led by Japanese consultants. The program is to be carried out in two separate periods; one during the commissioning of the equipment, and the other three months after the commissioning.

There will also be O&M training provided by the Contractor of the Project. Therefore, the consultant will coordinate with the Contractor and plan the details of his training program so that the necessary techniques and knowledge are effectively transferred to the participants of the program. Those training items with a symbol (*) below are the ones presumably provided by the Contractor. The consultants will provide additional information for such items, if necessary, to make them more relevant, not just "how to operate", in the context of understanding of PV systems.

Before commissioning (approximately starting 5 weeks before commissioning)

Lectures on basic knowledge
- Basic theory of photovoltaic generation
- Utilization of photovoltaic generation
- Grid-interconnection and its planning
- Understanding surplus and reverse current
- Supply of power to the facilities from the grid
- Power demand and loads in the facilities
- Workings of PV equipment during blackout
- Planning PV systems
- Arrangement between PV owner and power utility

Lectures on construction planning
- Installation of PV system
- Power distribution in the facility (with exercises)
- Electric equipment in the facility and connection of PV system
- Scheduling works
- Work supervision and inspection, take-over

OJT program
- Witnessing connection works
- Witnessing pre-commissioning/commissioning tests

After commissioning of PV system (continued from "before commissioning" program)

Training provided by the Contractor

- Starting, stopping, restarting the system (*)
- Daily inspection and maintenance (*)
- Periodical inspection and maintenance (*)
- Consumables and replacement work (*)
- Occurrence of faults and actions (*)

Planning O&M works on the basis of Operation Manuals (exercises)

- Making daily check sheet/log sheet form
- Making failure/accident record form
- Maintaining PV equipment in a good condition

For promotion of renewable energy use

- Design and preparation of publicity leaflet

There will be also a training program provided three months after the commissioning, coordinated with Contractor's "three month inspection". After three month of operation and maintenance experience, there will be more relevant, in-depth questions to be asked. There may also be operation issues unique in UOB and MFAIC circumstances. These questions and issues will be discussed and reflected to operation practice and check sheets, as another exercise.

Three months after the commissioning

Evaluation of Establishment of Techniques

- Evaluation of knowledge of basic operation methods
- Evaluation of knowledge of basic maintenance works

Revision of Operation and Maintenance Activities

- Evaluation of 3 month experience of operation and maintenance (as input)
- Trouble shooting sessions (by questionnaire, Q&A session, discussion)
- Revising daily operation and check sheets (exercise)

Improvement of Operation and Maintenance Methodology for Long-run

- Planning operation with considerations on seasonal changes (to consider changes in output of PV system by seasons and resulting operation methods)
- Witnessing three month inspection (there will be demonstration of replacement of parts, such as fuses by manufacturer's engineer)
- Recording the three month inspection (video-taped and recorded on DVD media)

Preparation of Trouble Shooting Manual

- Discussion on the problems experienced and responded in three months, finding better responses and solutions, compiling information into " Trouble Shooting Manual ",

Support for establishing advanced organization for operation and maintenance

- Brief financial assessment of the generation equipment (comparison of income and expenses)
- Improvement of management of equipment for better financial performance of the equipment,
- Planning better use of PV system responding to the increase in power demand,

Round up Exercises

- Revising the operation and maintenance management plan
- Questionnaire

Workshop

- Presenting revised operation and maintenance management plan and Trouble Shooting Manual,
- Reporting results of brief financial assessment and operation records.

The implementation of the second guidance by the Contractor should be included in the Works in the Tender Documents together with the three month inspection. This training program three months after the commissioning should be planned and executed in cooperation with the Contractor's guidance.

2) Participants

Candidate participants to the training sessions are as follows.

UOB and MFAIC technicians:	Those who will be actually operating the PV system
SEEG officers:	in distribution, power purchasing or power plant management related departments, with engineering background (preferably having a degree in electric engineering)
MEWR officials:	in regulatory planning, facility management or facility planning related departments, preferably with engineering background
Other	If there are requests from other ministries or organizations, they may appoint persons in charge of public facility planning and/or its maintenance to join the program.

Preliminary assignment for these participants is shown in the table below.

Table 2-2-4-3 Program Contents and Participants

Activities	Technicians (3-4person)	SEEG (2-3person)	MEWR (2-3person)	others (2-3person)
Before commissioning				
Lectures on basic knowledge	○	○	○	○
Lectures on construction planning	○	○	○	
OJT program	○	○	○	
After commissioning				
Reinforcement of Contractor Guidance	○	○		
Planning O&M works	○			
For promotion of renewable energy use	○	○	○	
Three month after commissioning				
Establishment of Techniques	○	○		
Revision of O&M Activities	○			
Improvement of O&M for Long-run	○			
Preparation of Trouble Shooting Manual	○	○		
Advanced Organization for O&M	○		○	
Round up Exercises	○	○	○	○
Workshop	○	○	○	○

3) Schedules

The schedule for the abovementioned program is shown below.

Table 2-2-4-4 Training Program before/after Commissioning

		-4w	-3w	-2w	-1w	0w	1w	2w	3week
Activities	Preparation								
	Basic knowledge lectures								
	Construction exercise								
	OJT								
	Reinforce Contractor Guidance								
	O&M Management Planning								
	Promotion Material								
Participant	UOB and MFAIC technicians								
	SEEG officers								
	MEWR officers								
Lecturers	Consultant (leader)								
	Consultant (assistant)								
	Interpreter								

Table 2-2-4-5 Training Program Three Months after Commissioning

		1w	2w	3w	4w
Activities	Establishment of Techniques	―			
	Revision of O&M Activities		―		
	Improvement of O&M for Long-run			―	
	Preparation of Trouble Shooting Manual		―		
	Advanced Organization for O&M			―	
	Round up Exercises				―
	Workshop				▼
Participant	UOB and MFAIC technicians	―	―	―	―
	SEEG officers		―		―
	MEWR officers			―	―
Lecturer	Consultant (leader)	―	―	―	―
	Consultant (assistant)		―	―	―
	Interpreter	―	―	―	―

(6) Resources for the Training Program

As already mentioned, this PV system with grid interconnection is first-ever experience in Gabon. Therefore, Japanese consultants are assumed to undertake the implementation of training programs. Consultants to be assigned should have adequate experiences in planning of PV system with grid interconnection.

There will be two Japanese consultants, one leader and one assistant, to be lecturers to the programs of both periods. National consultants are not considered as the recipient country does not have an experience in similar projects.

As the official foreign language of the country is French, and the participants may not be good at speaking English, translation/interpretation service is necessary. But French-English interpretation service available in the country will have problems in technical terms and expressions. If consultants give a lecture in English and an interpreter translates to French, it is most likely to cause confusion and misunderstanding. Therefore, the translation between Japanese and French is more desirable, and the interpreter should be sought in Japan. Hiring Japanese-French interpreter has some other advantages; such as translating additional materials obtained from the Contractor to use in the lectures, which are very likely written in Japanese.

(7) Schedule of Training Programs

Work schedule of training programs is as shown below, assuming that the agreement between

procurement agent and the contractor will be concluded in December 2010.

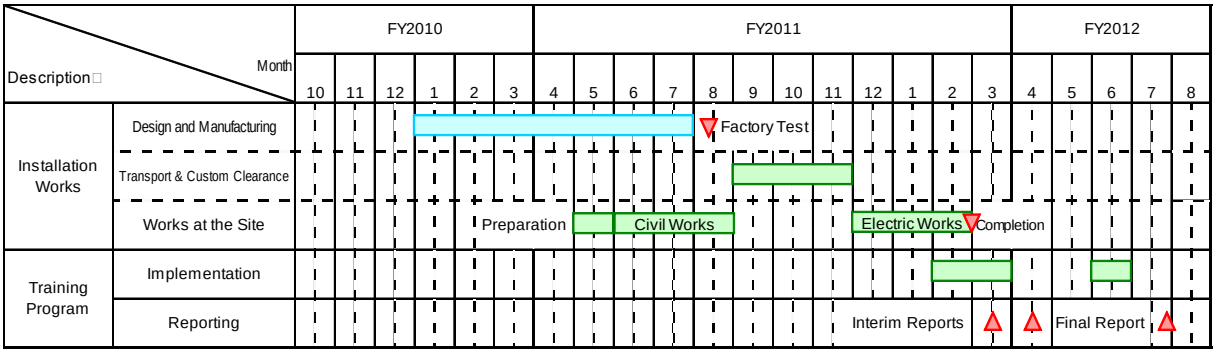


Figure 2-2-4-3 Training Program Implementation Schedule

(8) Products of Training Programs

Products of training programs are outlined below.

- A training program textbook prepared by the Consultant
- Output of Exercises (A single line diagram of the facility, etc.)
- Publicity Leaflet
- Progress reports
- Visual record (DVD) of Periodical Inspection (three month inspection)
- Operation and Maintenance Management Plan (with revision)
- Trouble Shooting Manual
- Workshop materials
- Results of questionnaires
- Final report (including evaluations of operation records and trouble shootings)

(9) The Responsibility of Receipt Country

It is important that participants take part in the training programs in full for the achievement of program objectives, which, however, requires the participants of being away from their work places for weeks. Therefore, there must be an official designation as a participant given by the section/department management who appreciates the usefulness of the programs. It is also important that government agencies appoint persons who will be in charge of PV and renewable energies in the future.

2-2-4-9 Implementation Schedule

In making up the implementation schedule, it is necessary to take the grant aid cooperation into full consideration and set up a proper project implementation system with the work schedule.

The execution schedule is as follows:

(1) Exchange of Notes (E/N)
(2) Consultant Agreement
(3) Tender document preparation
(4) Tendering and signing of contract with the selected contractor
(5) Manufacture and procurement of materials and equipments
(6) Installation of PV equipment
(7) Implementation of soft component
(8) Completion and hand-over

The project will be implemented in about 27 months upon conclusion of the E/N (23 months until the completion of the installation works). The law specifies a maximum 8-hour workday. Sunday is the weekly day of the rest and the total numbers of official public holidays in Gabon is 15 days a year. The whole period of implementation of the Project consists of design and manufacturing, transportation, foundation work, installation work, pre-commissioning and adjustment. The foundation work can be implemented while the electrical items are manufactured in Japan. As rainfall in wet season n Gabon can be very intense, part of civil works including pouring concrete, etc. should be scheduled considering the effects of such weather on the works.

Based on the grant aide scheme of Japan, preliminary implementation schedule is drawn up as shown below.

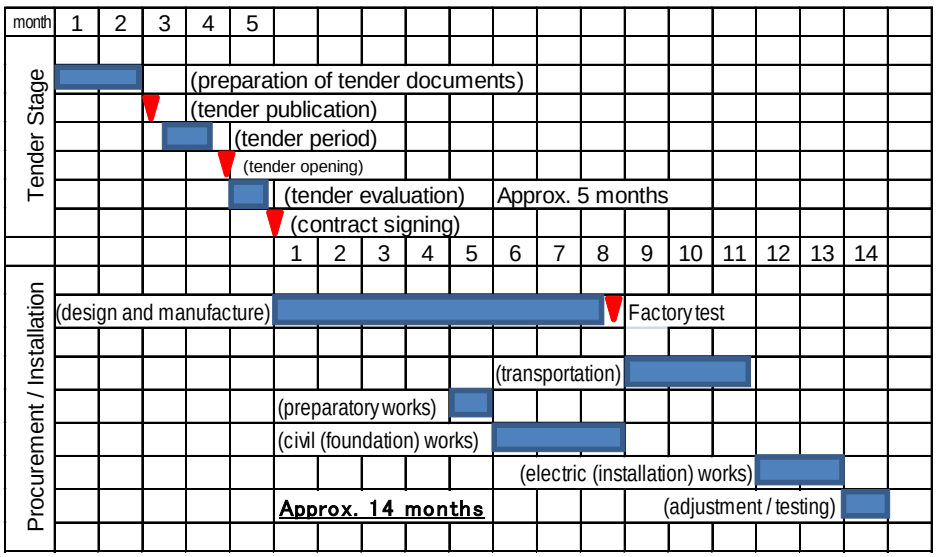


Figure 2-2-4-4 Implementation Schedule of the Project

2-3 Obligations of Recipient Country

Undertakings required of the Recipient Country had been confirmed by the minuets of discussion concluded in First Phase Study of the Project. The specific items required for implementation are listed below.

- To secure the land (done)
- To clear and level the area for PV module installation
- To install fence and gate to PV system installation space
- To conclude a bank arrangement with Japanese bank and pay commission
- 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
- To accept the personnel of our country in charge of this project
- To do required procedure for construction of the electric generating equipment
- To ensure the personnel and financial resource for the operation and maintenances of PV system in the future
- To select and send adequate persons for training program, from the Ministry of Energy, SEEG, other relevant government organizations

2-4 Project Operation Plan

2-4-1 Basic Concept of Operation and Maintenance of Generating Equipment

The generating equipment to be procured in this Project is designed to be operated and maintained by UOB and MFAIC on daily basis. In the long-run, the executing agency Ministry of Energy and Water Resources and SEEG may have to cooperate in the maintenance works. SEEG should also be involved in the agreement necessary for the grid-interconnection and reverse current.

The recipient is expected to implement the preventive measures and proper maintenances of the generating equipments to keep the performance, function, and continuous supply of power, on the basis of improvement of reliability, safety, and efficiency.
Basic concept of maintenance is shown in the figure below

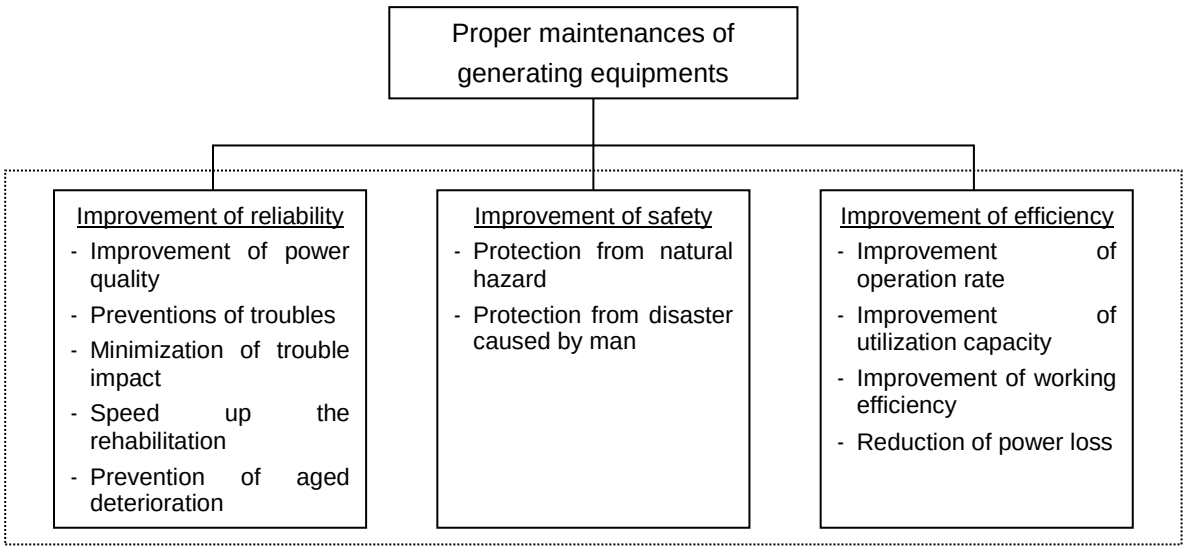


Figure 2-4-1-1 Basic Concept of Generating Equipments Maintenances

Keeping the basic concept in mind, the recipient country should operate and maintain the PV system, utilizing the O&M techniques transferred during the Contract through OJT by Contractor's experts and through training programs by the Consultant, and according to Operation and Maintenance Manuals.

2-4-2 Periodical Inspection

Relevant parties in the Recipient country should draw up an O&M Plan for the PV system on the basis of the standard daily and periodic inspection lists shown in tables below and O&M Manuals presented by the Manufacturer, and execute the O&M works efficiently meeting the power demand.

2-4-2-1 Daily Inspections

Daily inspections are mainly visual inspections conducted daily. Recommended inspection items are shown in Table 2-4-2-1. In the case of any anomalies detected, consult with a responsible engineer of the Facility.

Table 2-4-2-1 Standard Daily Inspection Items and Findings

Category	Items		Findings
PV array	Visual	a) Surface of arrays	Stain and damage
		b) Support stands	Corrosion and rust
		c) Connecting cable	Damage
Junction box	Visual	a) Boxes	Corrosion and rust
		b) Connecting cables	Damage
Power Conditioner Cubicle	Visual	a) Outside boxes	Corrosion and rust, energized part being covered
		b) Connection cables	Damage
		c) Vent hole (air shaft, filters etc)	Aeration, Filter clogging
		d) Condition	Abnormal sound, vibration, odor, and overheating
		e) Control panel	Signal of errors
		f) Power generating	Errors of power generating condition on control panel

2-4-2-2 Bi-monthly inspections

Bi-monthly inspections are advisable to be conducted once every two months. Recommended inspection items are shown in Table 2-4-2-2.

Table 2-4-2-2 Standard Bi-monthly Inspection Items and Findings

Category	Items		Findings
PV Sub-array[4]	Visual and touch	Earthing wires and grounding terminals	Junction with Earthing wires Loose screws
Junction box	Visual and touch	a) Boxes	Corrosion and damage
		b) Connecting cables and terminals	Anomaly in wiring Loose screws
		c) Earthing wires and connecting terminals	Anomaly in wiring Loose screws
	Measurement and test	a) Insulating resistance	<PV – Earthing wires> 0.2MΩ[5] or over, measured voltage DC500V (Measure all circuits) <Output Terminals – Earthing wires> 1MΩ or over Measured voltage DC500V
		b) Open circuit voltage	Specified voltage, Polarity (Measure all circuits)
Power conditioner Cubicle	Visual and touch	a) Outside boxes	Corrosion and damage
		b) Connecting cables and terminals	Anomaly in wiring Loose screws
		c) Earthling wires and connecting terminals	Anomaly in wiring Loose screws
		d) Vent hole (air shaft, filters etc)	Aeration, Filter clogging
		e) Condition	Abnormal sound, vibration, odor, and overheating
		f) Control panel	Signal of errors
	Measurement and test	a) Insulating resistance (Power conditioner - Earthing)	1MΩ or over Measured voltage DC500V
		b) Control panel	Operation checks (Display and power generating)
		c) Re-starting Timer	Confirmation of automatic start-up
Switch for PV	Visual and touch	a) Connecting terminals of switch	Loose screws
	Test	a) Insulating resistance	1MΩor over Measured voltage DC500V

2-4-3 Long Term Operation and Maintenance

Although the expected operation life of PV modules and power conditioners, the main components of PV system, varies by manufacturers, PV modules would last for 20 years[6] and power conditioners 15 years[7], under the proper O&M and favorable environment. Actual operation life, however, depends on the execution of inspections and daily operation/maintenance conditions. There are some parts inside the equipment that have to be

[4] PV modules should be checked for the following points
- Smudges on the surface, cracks and discolorations on the surface, etc,
- Deformation of support structure, rust, loosened bolts, etc.

[5] Allowable Insulating resistance
0.4MΩ or over for Insulating resistance of 300V or over.

[6] Japan Photovoltaic Energy Association.

[7] According to the interviews to several manufacturers.

replaced before operation life of the equipment.

Those maintenances including the replacement of major worn-out parts are generally called "full-scale maintenance", "detailed maintenance" or overhaul, in this Project defined as "long term maintenance". Frequency of long term maintenance is once every five to seven years.

Long term maintenance can be the most expensive maintenance work related to PV system, because major parts may have to be purchased and replaced, and in some unfortunate cases a dispatch of manufacturer's engineers have to be requested. Therefore, unlike regular maintenances and periodic inspections, some special provision for long term maintenance is needed. Regular maintenances and periodic inspections are assumed to be implemented by the technicians and on the current operation budget at the Facility. Long term maintenance, therefore, requires, among others, financial support from the implementing/responsible ministries/agencies of the government. Also, there are some cases which requires the involvement of electricity utility company as the PV system is interconnected to the utility grid.

Table 2-4-3-1 Organization Control of Long Term Maintenance

	Responsible organization	Periodical and Daily Inspection	Long Term Maintenance
Site	MFAIC and OB University	Operation of PV system Planning and implementation	Planning and implementation
Implementing Agency	MEWR	Monitoring of operation and effect on PV system	Financial support
Electric Power Company	SEEG	Monitoring of grid interconnection condition	Technical support

It is desirable for sustainable supply of electric power by the PV system to have a proper supporting program especially targeting long term maintenance. Within this Project, the following measures are proposed.

1. Provision of spare parts needed up to the first long term maintenance
2. Provision of a dedicated section in O&M Manuals that explains how to use spare parts

As specification of spare parts and maintenances varies by manufacturers, detailed lists are proposed by bidders and finally will be fixed after tendering.

2-4-4 Spare Parts

Spare parts for the PV system are classified into two categories; standard components for periodic replacements and components for unscheduled replacements. Owners of the PV system have to purchase these parts for periodic inspections and maintenances.

It is planned that the spare parts necessary up to the first long term maintenance are procured by this Project. The Recipient country himself has to meet subsequent needs for spare parts. The lists of spare parts and tools proposed to be procured in the Project are shown in the table below.

Table 2-4-4-1 Spare Parts and Tool List for PV System

NO.	Item	Quantity
Spare parts		
(1)	Periodic replacement	
	1) Low-tension circuit fuses	200%
	2) Lamps	200%
	3) Indication Lamps	200%
	4) Flour lamps, Glow lamps	200%
	5) Lightning arrester	200%
(2)	Unscheduled replacement	
	1) MCCBs	1 complete set
	2) Relays	1 complete set
	3) Capacitors	200%
	4) Funs	200%
	5) PV modules	3%
	6) Power Conditioner (stand-by unit)	1 set
Tool kits		
(1)	Measuring equipments	
	1) AC clamp meter	1 unit
	2) Insulating resistance tester 500V	1 unit
	3) Simple resistance meter	1 unit
	4) Phase indicator	1 unit
	5) Voltmeter for low voltage	1 unit
	6) Digital multimeter	1 unit
(2)	Tools	
	1) Flathead screwdrivers	2 pcs
	2) Phillps screwdrivers	2 pcs
	3) Nippers	2 pcs
	4) Pinchers	2 pcs
	5) Crimp contact pinchers	2 pcs
	6) Card Circuit tester	1 pc
	7) Wire Stripper	2 pcs
	8) Cable cutters	2 pcs
	9) Torque Wrench	1 pc

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) The Cost of Gabonese Side

The obligations of the Recipient side were discussed in section 2-3 of this report, among which the following items may require expenditures.

- Clearing and leveling of the Site

As for the clearing and leveling, UOB site requires a removal of flag poles and their base, and MFAIC site removal of some vegetation. Both are relatively small scale works and their costs are estimated as below.

Removal of Flagpoles and Base	1,570,450	CFA
Removal of vegetation	89,547	CFA
total	1,659,997	CFA

(2) Condition of Calculation

1.	Time of calculation	December, 2009
2.	Exchange rates of foreign currencies	US$ 1 = JPN 93.97 CFA 1 = JPN 0.2065
3.	Time of the Event	as shown in Figure 2-2-4-4
4.	Remarks	Calculation is done according to the rules for Japan's Grand Aid Programmes

2-5-2 Operation and Maintenance Cost

(1) Estimation of Cost of Operation and Maintenance

The following cost factors are considered here.

1. Cost for daily operation
2. Cost for personnel in operation and maintenance
3. Cost for spare parts to be required
4. Cost for renovation

Cost estimation in this section does not consider unlikely, but still possible, breakdown of equipment and resulting repair cost. Also, repair cost after vandalism or sabotage is not considered. Further, the cost of requesting Japanese manufacturer's engineers to be present at the Site for repair and/or diagnosis works is not considered.

1) Cost for Daily Operation

As a PV system does not consume any fuels, there would be very few expenses under this category. To be very precise, there are expenses for water used in cleaning of PV modules, electricity for system monitoring and air conditioning during not-generating hours of the day, which are small enough to be negligible.

2) Cost for Personnel in Operation and Maintenance

The PV system to be procured in the Project can be, and will be operated and maintained by the existing maintenance staff of the facilities. Therefore, operating and maintaining the PV system does not require additional persons to be employed by the facilities.

Meanwhile, part of working hours of the maintenance staff will be taken up by operation and maintenance activities, it is converted to monetary terms for reference purpose. (Daily cost of a person is assumed to be CFA18,000.)

At UOB

- Daily inspection (modules and cubicle) 0.5 hours per day
  0.5hr/8hr [daily working hrs] times CFA18,000 = CFA1,080 per day

- Cleaning of modules (1hr per month per 10 kW of modules) 12hours per month
  12hrs/30days/8hr [daily working hrs] times CFA18,000 = CFA900 per day

Adding these two, we get daily cost at CFA1,980. To convert this to annual cost,
1,980 times 365 = CFA722,700 per year

At MFAIC

- Daily inspection (modules and cubicle) 0.5 hours per day
  0.5hr/8hr [daily working hrs] times CFA18,000 = CFA1,080 per day

- Cleaning of modules (1hr per month per 10 kW of modules) 7hours per month
  7hrs/30days/8hr [daily working hrs] times CFA18,000 = CFA540 per day

Adding these two, we get daily cost at CFA1,620. To convert this to annual cost,
1,620 times 365 = CFA591,300 per year

Adding values for two sites, we have
CFA722,700 + CFA591,300 = CFA1,314,000

3) Cost for Spare Parts to be required

A PV system to be procured in this Project is in general considered to have an expected operation life of fifteen to twenty years. PV modules require little maintenance cost as they have no moving parts, hence less possibility of break down. In particular, Japanese made

PV modules have reputation of lower rate of deterioration of conversion efficiency compared to products of other countries. On top of this, there will be a few per cent extra modules to be procured in the contract as spare parts. There will be no spare parts of PV modules to be purchased by the Recipient in the future, leaving necessity of purchasing only those parts related to power conditioners.

As discussed in Section 2-4-3, the procurement contract for the Project is planned to include provision of spare parts to be necessary up to the first long-term maintenance work. This will relieve the recipient from the expenses of purchasing spare parts until the first long-term maintenance work. The first long-term maintenance work will take place, with some variation among manufacturers, about seven years after the commissioning of the equipment.

There is an exception to the above, the parts related to air conditioners is not included in the list of spare parts provided by the Contractor.

In summary, the cost of spare parts will be for those for air conditioners until the first long-term maintenance, which will be added with those for power conditioners thereafter. Roughly speaking, and on average, these costs for UOB project are estimated as in the table below.

Table 2-5-2-1 Expenses for Spare Parts (UOB)

	Aggregate for a period of Long-term Maintenance	Average Annual cost
Power Conditioner related (applicable only after the First Long-term Maintenance)	Approx. 2,150,000	Approx 300,000
Air Conditioner related	Approx. 1,050,000	Approx 150,000
Total (after the First Long-term Maintenance)	Approx. 3,200,000	Approx 450,000

(Unit: Japanese Yen)

Remarks : As mentioned before, these costs do not include that for dispatch of engineers from abroad. These costs are subject to large variation due to the environment and conditions of operation and main tenance.

Converting these figures into CFA, we have the expected purchase cost of spare parts as below.

Before the First Long-term Maintenance

JPN150,000/0.2065[JNP/CFA] = CFA 726,000 per year

After the First Long-term Maintenance

JPN 600,000/0. 2065 [JNP/CFA] = CFA 2,179,000 per year

For MFAIC project, we have the estimation in a similar way.

Table 2-5-2-2 Expenses for Spare Parts (MFAIC)

	Aggregate for a period of Long-term Maintenance	Average Annual cost
Power Conditioner related (applicable only after the First Long-term Maintenance)	Approx. 1,150,000	Approx 180,000
Air Conditioner related	Approx. 500,000	Approx 70,000
Total (after the First Long-term Maintenance)	Approx. 1,750,000	Approx 250,000

(Unit: Japanese Yen)

Remarks : As mentioned before, these costs do not include that for dispatch of engineers from abroad. These costs are subject to large variation due to the environment and conditions of operation and maintenance.

Converting these figures into CFA, we have the expected purchase cost of spare parts for MFAIC as below.

Before the First Long-term Maintenance

JPN70,000/0.2065[JNP/CFA] = CFA 339,000 per year

After the First Long-term Maintenance

JPN 250,000/0. 2065 [JNP/CFA] = CFA 1,210,000 per year

4) Cost for Renovation

As mentioned in the previous section, PV modules have long expected life with slow deterioration rate. Therefore, PV modules do not require replacement during the lifetime of the whole PV system.

The power conditioners on the other hand are just like ordinary equipment in the power utility industry and some of their parts have statutory service lives. Those parts that have been deteriorated should be, on occasions of periodical and/or long-term maintenance, replaced with the spare parts considered in the previous section. Beyond this, overall replacement of the equipment or renovation is considered out of scope of this Project.

(2) Financial Resources for Operation and Maintenance

A financial benefit of having PV equipment accrues to a party who pays electricity bills, which is not UOB or MFAIC in this Project. Meanwhile, there will be expenses for maintenances of the equipment which must be borne by some party.

As discussed in Section 2-2-4, the energy generated by two PV installations are estimated at; 160MWh for UOB and 90MWh for MFAIC, and most of the energy will be consumed with these facilities. Electricity tariff in Gabon is characterized by large disparity between that for peak hours (18:00 to 22:00) and that for off-peak. UOB is charged at CFA 23.49/kWh, and

MFAIC CFA16.8/kWh, both for off-peak. Using these rates, we could roughly estimate the financial benefit generated by the PV system which are shown to be larger than the spare parts cost mentioned above.

For UOB 160MWh × CFA 23.49 = CFA 3,760,000 per year
For MFAIC 90MWh × CFA 16.8 = CFA 1,510,000 per year

2-6 Other Relevant Issues

(1) Preparation of the Site

The plots of land to be used for the installation of PV equipment have been confirmed to fall within the lands that Omar Bongo University and Ministry of Foreign Affairs are officially entitled to use. These installation areas require no major earth works as they have been open lands. However, there are some minor obstacles to be removed and cleared, that are the flag poles in Omer Bongo University and some trees in the Ministry of Foreign Affairs.

(2) Handling of Reverse Current

As Gabon has not had a similar generation facility to this Project, how to handle the energy sent back to the power grid should be considered and made in an agreement among related parties in Gabon.

(3) Operation and Maintenance Organization

The PV equipment to be procured and installed in the Project will be owned by the Ministry of Energy and Hydraulic Resources, and Omar Bongo University and the Ministry of Foreign Affairs will be operating and maintaining the equipment in their Sites, respectively. However, considering the possibility that similar generation equipment with grid-interconnection like the PV system of this Project may materialize in the future, the Ministry of Energy and SEEG should consider having personnel equipped with technical understanding of such systems. These organizations are advised to select appropriate persons to participate in the training program held by this Project, and maintain such knowledge in their organizations.

(4) Tax Exemption

Exemption of taxes and duties demanded by the Project to Gabon side will be handled by the Ministry of Energy. This process must be done properly and timely for the Project to proceed without delay.

CHAPTER 3

PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Recommendations

3-1-1 Prerequisite to Project Implementation

There are prerequisites for the Project to be implemented without impediments, which are shown below.

(1) Preparation of the Site

The installation areas at the Sites require no major earth works as they have been open lands. However, there are some minor obstacles to be removed and cleared, that are the flag poles in Omer Bongo University and some trees in the Ministry of Foreign Affairs.

(2) Handling of Reverse Current

As Gabon has not had a similar generation facility to this Project, how to handle the energy sent back to the power grid should be considered and made in an agreement among related parties in Gabon.

(3) Operation and Maintenance Organization

The PV equipment to be procured and installed in the Project will be owned by the Ministry of Energy and Hydraulic Resources, and Omar Bongo University and the Ministry of Foreign Affairs will be operating and maintaining the equipment in their Sites, respectively. The Ministry of Energy and SEEG should consider having personnel equipped with technical understanding of such systems and select appropriate persons to participate in the training program held by this Project.

(4) Tax Exemption

Exemption of taxes and duties demanded by the Project to Gabon side will be handled by the Ministry of Energy. This process must be done properly and timely for the Project to proceed without delay.

3-1-2 External Conditions to Achievement of Project Objectives

Gabon side should work on the following matters for the Project's to take effects in sustainable manner.

(1) Promotion of Renewable Energy Use

Utilization of solar power in Gabon is currently underway with the Ministry of Energy being an implementing organization, as a mean to provide power in rural areas that have not been electrified. This Project provides Gabon with grid-interconnected PV system but its direct effect is limited the size of the Project. For this Project to contribute to Gabon both in reduction of greenhouse gas emission and in economic development in larger scale, the Project's impacts have to propagate, as in the activation of renewable projects in the Ministry of Energy, and in dissemination of recognitions among private sector and wider public, resulting in the spread of renewable energy use.

This is one of the reasons the Project has chosen Omar Bongo University and the Ministry of Foreign Affairs, which are both highly visible from wider public, for the Sites. In addition to this, the training programs provided by the Project will prepare a publicity leaflet, along with giving lectures and trainings concerning theories and planning methods of solar power use. It is expected that the Ministry of Energy makes the best use of materials provided by the Project to promote renewable energy use.

In particular, to promote private investment in the fields of renewable energy, it is important to provide information with which investors can value and manage the risks involved in such investments. The Ministry of Energy can utilize the information made available by the Project.

3-2 Project Evaluation

3-2-1 Validity of the Project

The Project is considered valid on the basis of following points.

(1) Consistency with Higher Policy

Gabonese Government has formulated the energy policy and climate change mitigation measures in which it intends to promote the use of new-energy and renewable energy, and to utilize hydro, biomass, solar and wind power to meet the energy demand in rural areas. Among them rural electrification using solar energy has been started by the Ministry of Energy in 2000, where quantitative targets are set. So far, the total capacity implemented amounts to 140kW, in 60 villages and at 700 facilities. Meanwhile, for the Gabonese Government who proclaimed the protection of rain forests and effective use of renewable energy in "Gabon Vert", installation of solar equipment at the Ministry of Foreign Affairs and Omar Bongo University, where many VIPs arrive and potential young people study, can be a symbolic project of its environmental policy.

To promote the use of solar energy in wider front, there should be active participation of private sector and people in general. This Project has chosen the Sites very visible to wider public which may have enlightenment effect, and also publicity leaflet is planned to be made during training program sessions. From these effects expected, the Project is considered to support the government's policy directly and indirectly.

(2) Financial Weight of Operation and Maintenance

The energy expected to be produced by the PV systems of the Project can be valued on the basis of electricity tariff charged to these facilities, which is larger than the long-term cost of operation and maintenance estimated for the facilities. Therefore, the Project will not put a burden, but contribute to the finance of the Country.

(3) Socio-Environmental Considerations

The Study Team explained the outline of the Project and the screening results of expected impacts to the Ministry of Environment, Sustainable Development and Natural Protection, which the Ministry has confirmed.

(4) Benefit from Advanced Technology of Japanese Products

PV equipment consists mostly of PV modules, power conditioners and their peripherals. Especially, PV modules and power conditioners made by Japanese manufacturers have technical advantages over other countries in their efficiency, longevity, reliability, etc. in the market. As this Project is limiting the country of origin of this equipment to Japan, the Project will be able to offer advanced technology of Japanese products.

3-2-2 Effectiveness of the Project

(1) Overall Effect

The Project will introduce a new power source in Gabon's power grid. In SEEG, there has been little investment in hydropower, but in thermal power to meet increasing demand. Recent increase in prices of petroleum products has been putting upward pressure on generation cost and electricity tariff.

Under the circumstances like this, a provision of new power source and energy will check the use of thermal power plants and consumption of fossil fuel. It is a clean energy that contributes to the supply of power, which is the very objective of Cool Earth Partnership.

Installation of solar generation equipment of the largest kind in the capital will have demonstration effects on the country and around, and enlightenment and educational effects

that will work positively on active involvement of private sector in the use of renewable energy.

There is a secondary effect at Omar Bongo University and the Ministry of Foreign Affairs where the purchase of electricity will be reduced. The Government who is paying the electricity bills of these facilities will have more efficient use of financial resources.

(2) Quantitative Effects

Among the effects mentioned above, those that can be quantified are described below.

1) Generated Energy

As mentioned in 2-2-2-4, there will be 160MWh and 90MWh of electric energy at most expected to be generated at Omar Bongo University and the Ministry of Foreign Affairs, respectively. These figures amount to approximately 14.5% and 8% of annual electricity consumption of these facilities.

2) Financial Benefit

The generated energy mentioned above will be mostly consumed in these facilities. Therefore, we could estimate the values of financial benefit accrued from the use of the generation equipment at these Sites by multiplying the tariffs these facilities are charged at.

Such values are CFA3.76 million and CFA1.51million respectively, exceeding the long term cost of maintenance of the equipment.

3) Reduction of CO_2 Emission

Unit emission of CO_2[8]、

The effect of CO_2 emission reduction is calculated here in the following manner,

- To apply the method of CDM, which in the first place assumes the Baseline, and considers the change from the baseline of CO_2 emission with the PV system to be the reduction in CO_2 emission,
- The baseline is defined by the alternative generation method without the PV system.
- The alternative generation method should be of approximately the same scale, and practically possible power plant or generator in the country.
- CO_2 emission of the alternative power plant or generator above for the estimated energy generation of the Project is considered as the reduction of CO_2 emission by the Project.

[8]Refer to UNFCCC HP (http://cdm.unfccc.int/index.html)

For a small scale generation unit below 15MW, UNFCCC/CDM has its rule to use a diesel engine generator for the baseline. However, Gabon has oil and gas resources endowed for power generation. Therefore, we can assume either diesel generator or gas generator (gas engine) to be the baseline for the analysis.

Unit CO_2 emission of a diesel generator and a gas generator can be calculated using "Guideline for Calculation of Greenhouse Gas Emission (March/2007)" published by the Ministry of Environment, Japan as below;

For diesel generator

Specific gravity of diesel fuel	0.86
Mass of diesel fuel for 1L	860g
Fuel consumption of diesel generator	0.235g/kWh
Generation for diesel fuel 1 L	3.66kWh/L（0.860g/L / 0.235g/kWh）
Unit CO_2 emission by combustion of diesel fuel	2.62kg-CO_2/L
Unit CO_2 emission per kWh	0.716kg-CO_2 (=2.62kg-CO_2/L / 3.66kWh/L)

For gas generator, we compare the thermal values of diesel fuel and natural gas,

Thermal value of natural gas:	54.5 Mj/kg
Thermal value of diesel fuel:	44.4Mj/kg
Unit consumption of natural gas	0.235kg/kWh x (44.4/54.5)=0.191 kg/kWh
Unit CO_2 emission of combustion of natural gas:	2.7kg-CO_2/kg
Unit CO_2 emission per kWh	0.516kg-CO_2/kWh (=2.7kg-CO_2/kg x 0.191 kg/kWh)

Among two sources of energy, we use natural gas to estimate the CO_2 emission reduction for the conservativeness of the analysis. Using unit CO_2 emission of natural gas, and multiplying with the annual generated energy expected, 250MWh (total of two Sites), we obtain the estimation of annual CO_2 reduction of the Project,

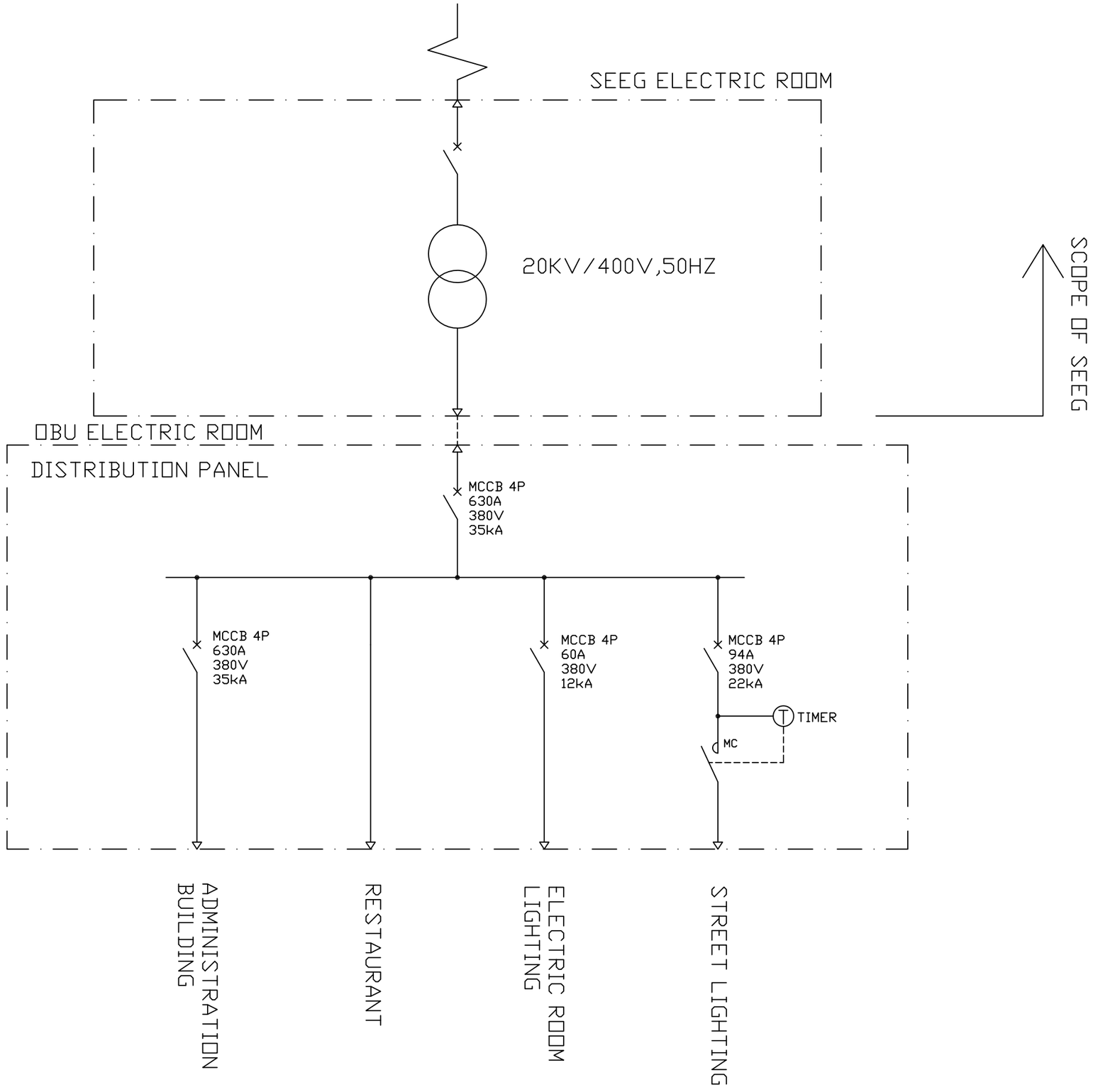
Annual CO_2 emission reduction by the Project

= 250MWh x 0.516kg-CO_2/kWh=129 t-CO_2

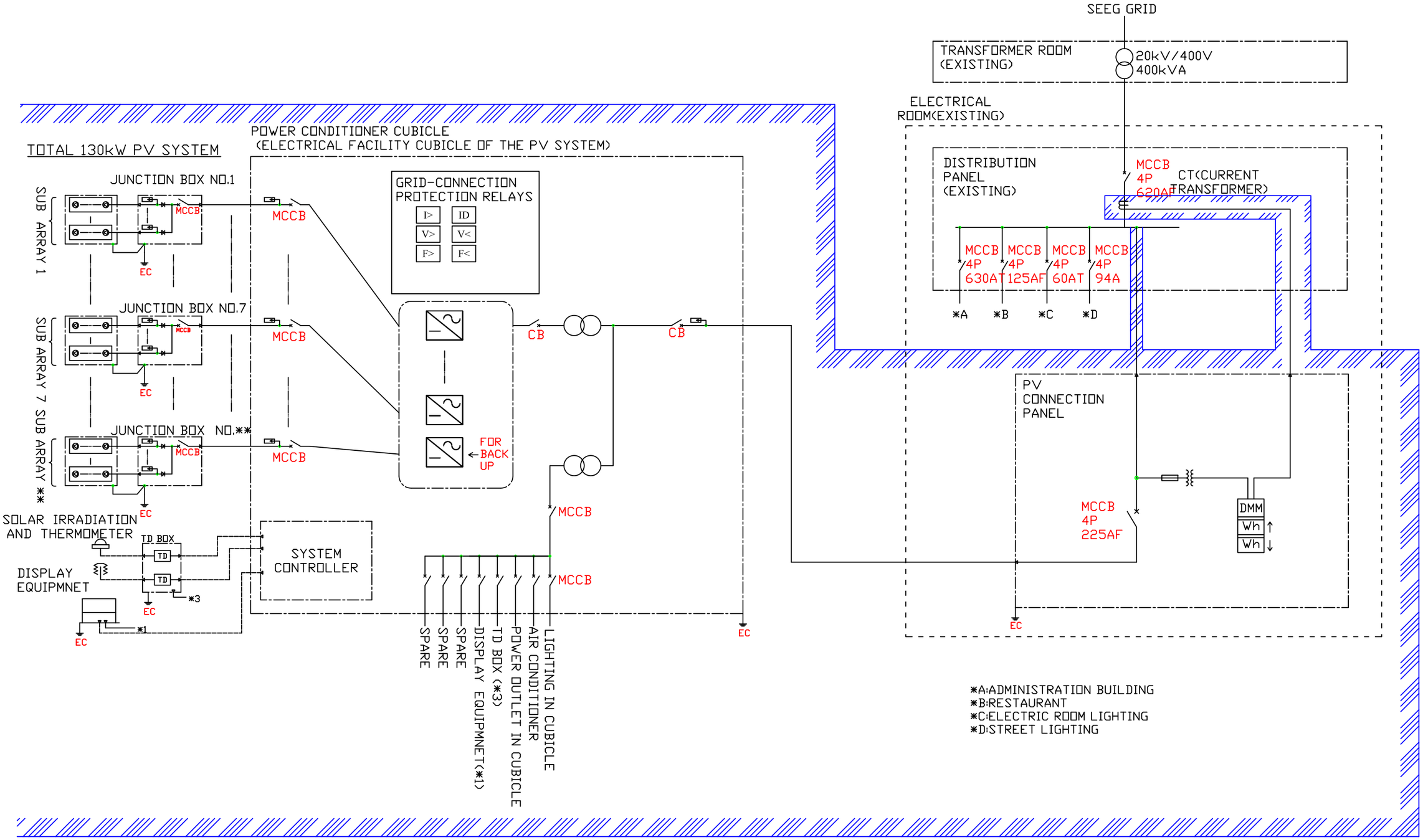
DRAWINGS

DRAWINGS

Number	Title
NO.U01	SINGLE LINE DIAGRAM (Omar Bongo University)
NO.U02	SINGLE LINE DIAGRAM (PV SYSTEM)
NO.U03	GENERAL LAYOUT PLAN
NO.U04	CABLE LAYOUT PLAN
NO.U05	EQUIPMENT LAYOUT (ELECTRIC ROOM)
NO.M01	SINGLE LINE DIAGRAM (MFAIC)
NO.M02	SINGLE LINE DIAGRAM (PV SYSTEM)
NO.M03	GENERAL LAYOUT PLAN
NO.M04	CABLE LAYOUT PLAN
NO.M05	EQUIPMENT LAYOUT (ELECTRIC ROOM)



DRAWING NO. U01 SINGLE LINE DIAGRAM (OMAR BONGO UNIVERSITY)

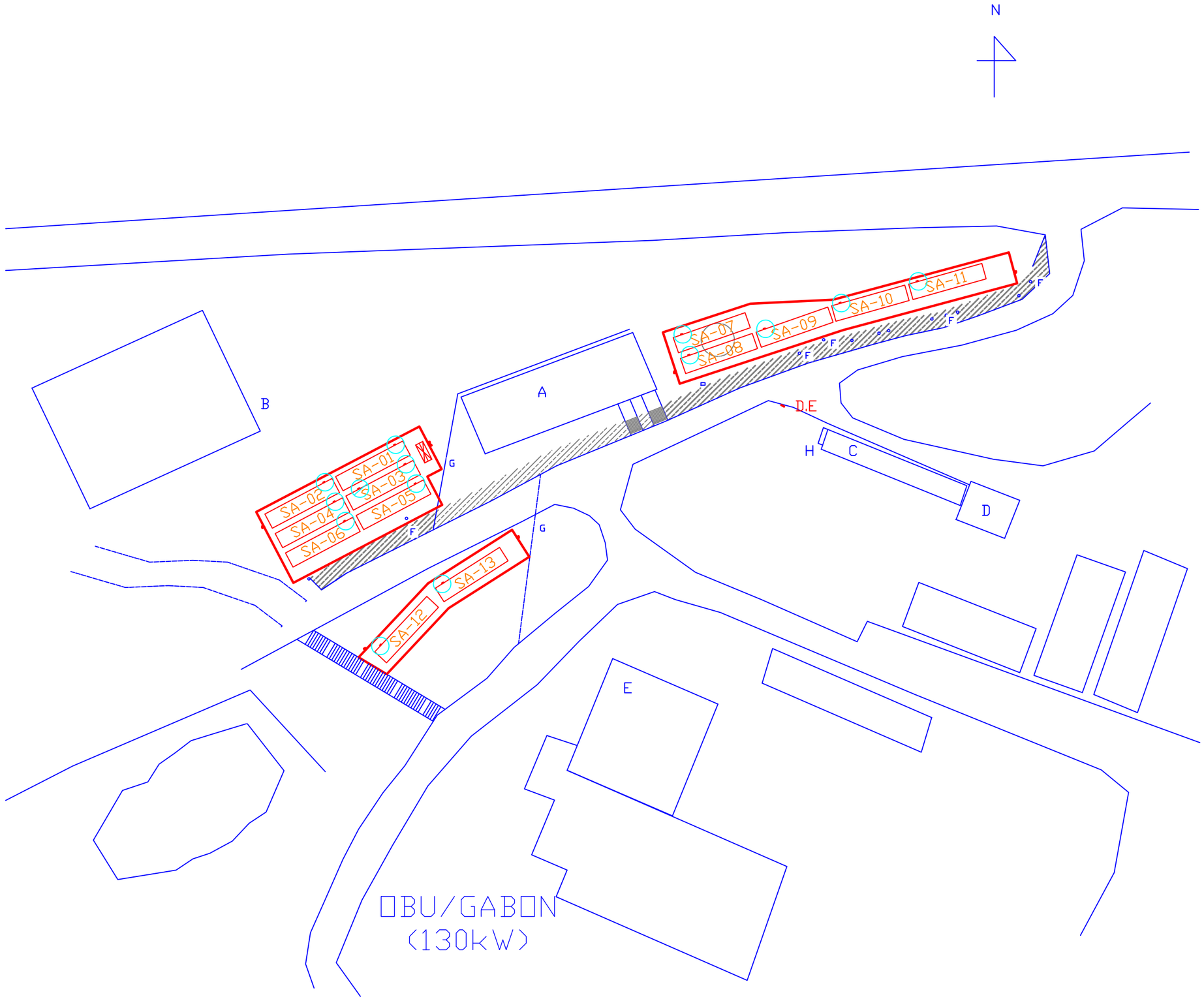


: SCOPE OF THE PROJECT

DMM:DIGITAL MULTI-METER

THE CONTRACTOR SHALL CARRY OUT NECESSARY SURVEY ABOUT THE EXISTING ELECTRICAL FACILITIES.

DRAWING NO. U02 SINGLE LINE DIAGRAM (PV SYSTEM)



LEGEND

: ELECTRICAL FACILITY CUBICLE OF THE PV SYSTEM [E.C.FOR PV]

: PV SUB ARRAY (APPROPRIATE 10kW) [SA]

: DISPLAY EQUIPMENT[D.E]

: JUNCTION BOX [J.B]

: TRANSDUCER BOX FOR METEOROLOGICAL OBSERVATION [T.D. BOX]

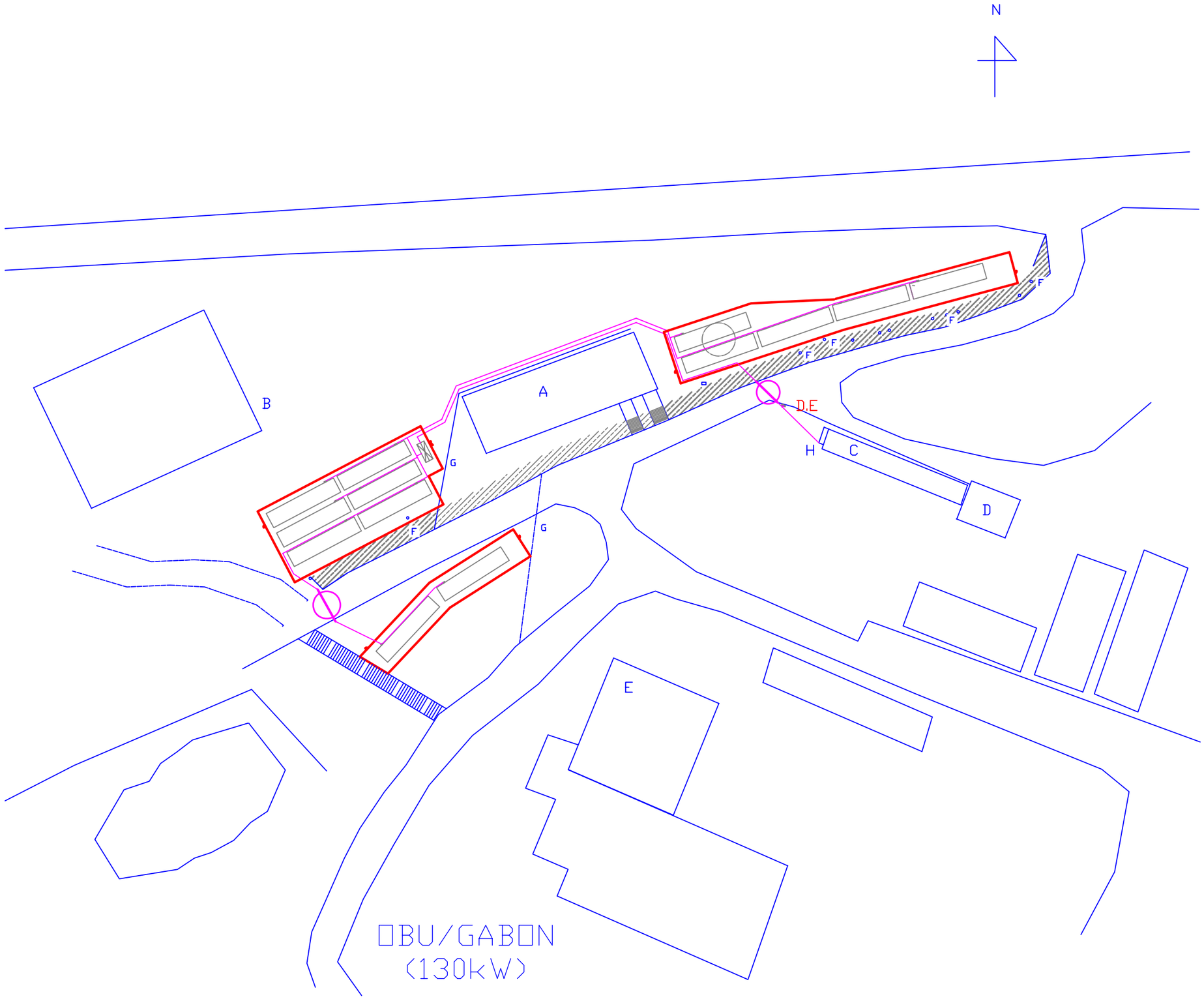
: FENCE

: GATE

BUILDING NAME LIST

A:AMPHITHEATRE
B:LIBRARY
C:SECRETARY-GENERAL BUILDING
D:POST OFFICE
E:RESTAURANT
F:ELECTRIC POLE
G:DRAINAGE DITCH
H:ELECTRICAL ROOM

DRAWING NO. U03 GENERAL LAYOUT PLAN



LEGEND

: ELECTRICAL FACILITY CUBICLE OF THE PV SYSTEM [E.C.FOR PV]

: PV SUB ARRAY (APPROPRIATE 10kW) [SA]

: DISPLAY EQUIPMENT[D.E]

: JUNCTION BOX [J.B.]

: TRANSDUCER BOX FOR METEOROLOGICAL OBSERVATION [T.D. BOX]

: FENCE

: GATE

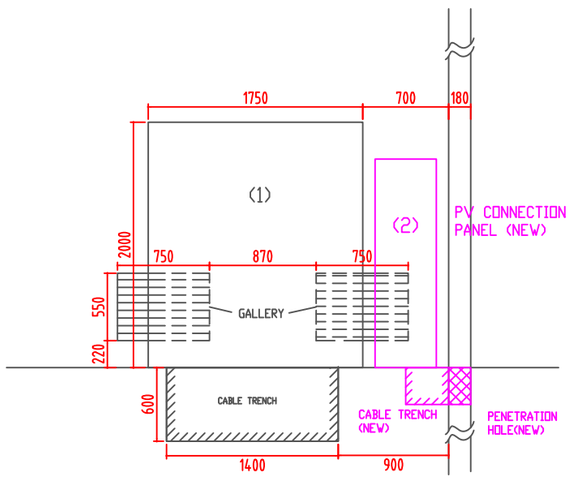
BUILDING NAME LIST

A:AMPHITHEATRE
B:LIBRARY
C:SECRETARY-GENERAL BUILDING
D:POST OFFICE
E:RESTAURANT
F:ELECTRIC POLE
G:DRAINAGE DITCH
H:ELECTRICAL ROOM

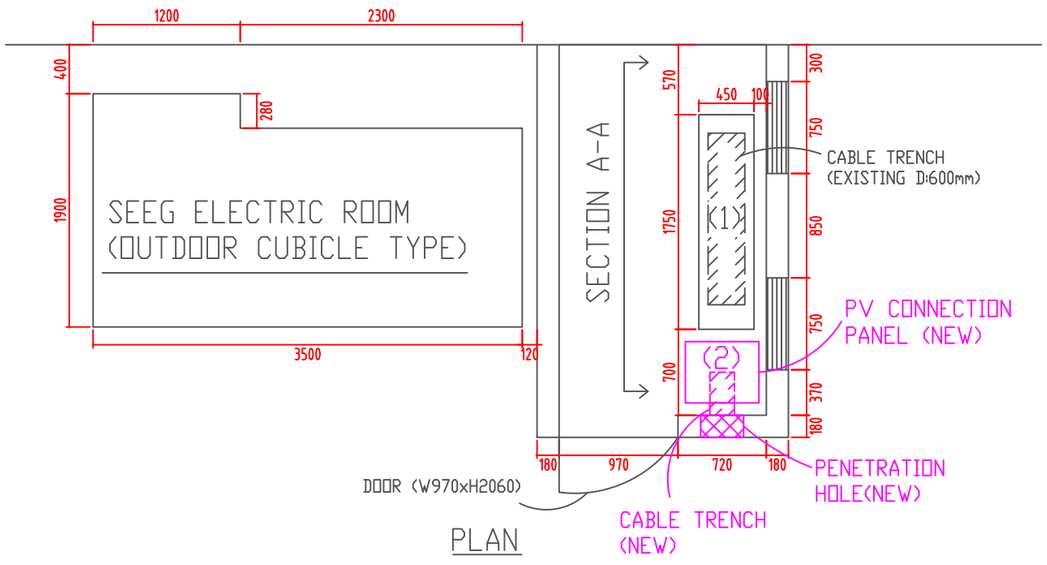
NOTE:
DEPTH FROM THE GROUND SURFACE TO THE CABLE WHICH IS UNDER THE ROAD OF OBU SHALL BE
> MORE THAN 1200MM (WITH FEP PIPE):
SHOWN IN BOLD LINE(ASPHALT AREA):O

DEPTH FROM THE GROUND SURFACE TO THE CABLE SHALL BE
> MORE THAN 600MM SHOWN IN FINE LINE

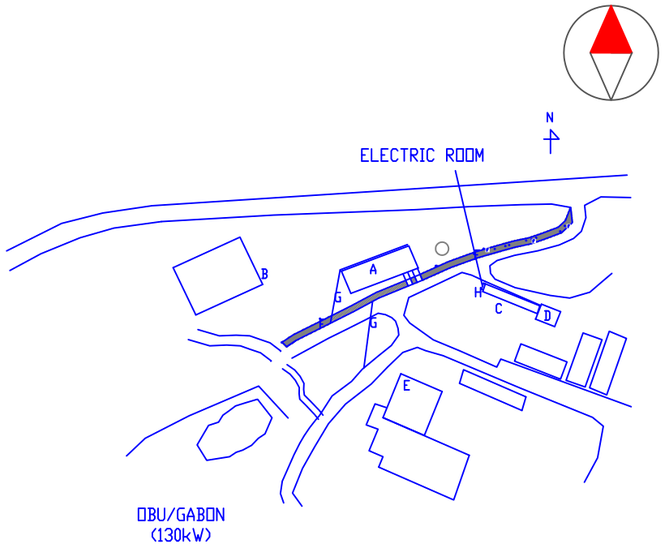
DRAWING NO. U04 CABLE LAYOUT PLAN



SECTION A-A



PLAN



NOTE

: GALLERY

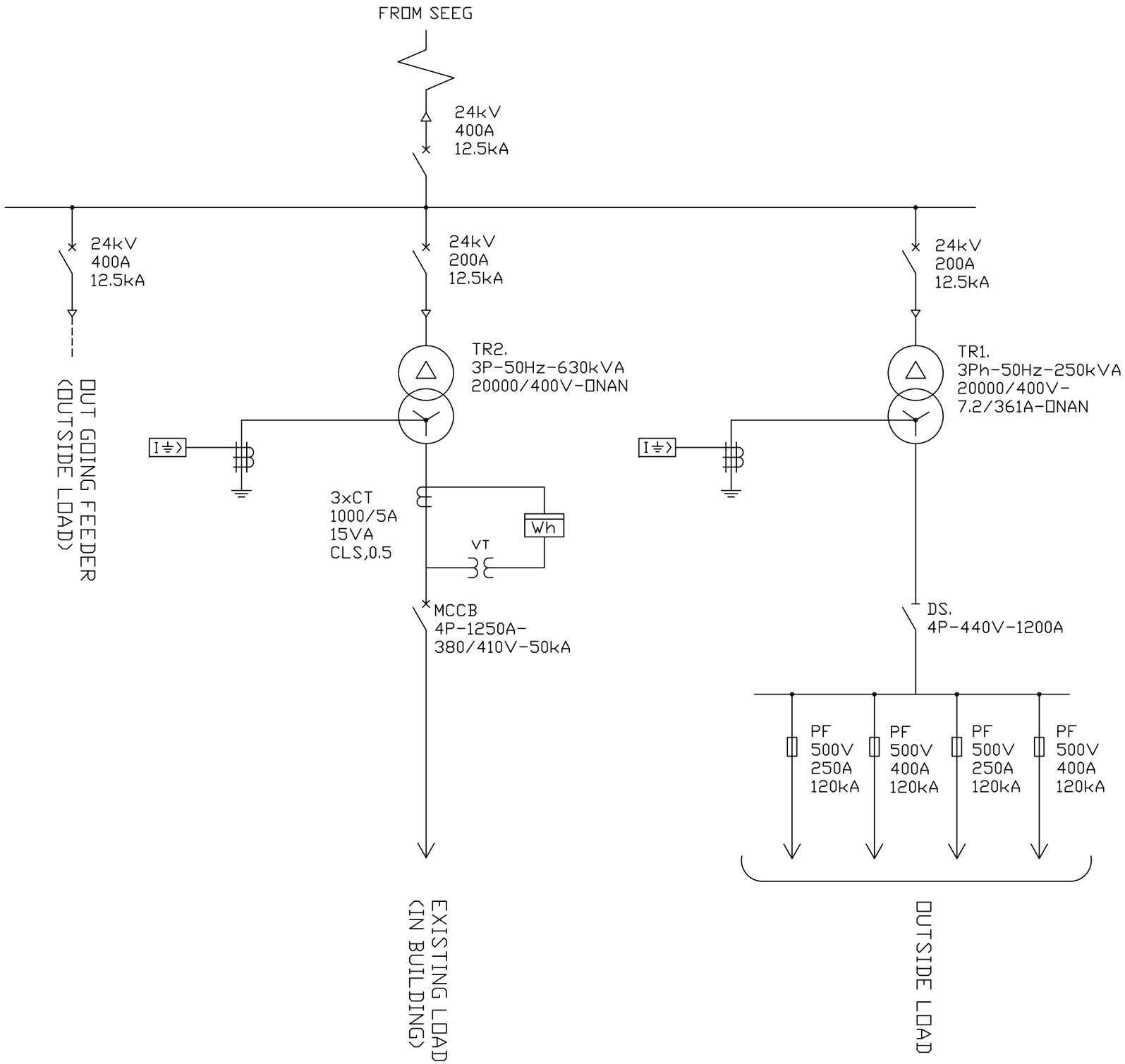
: CABLE TRENCH

: PENETRATION HOLE

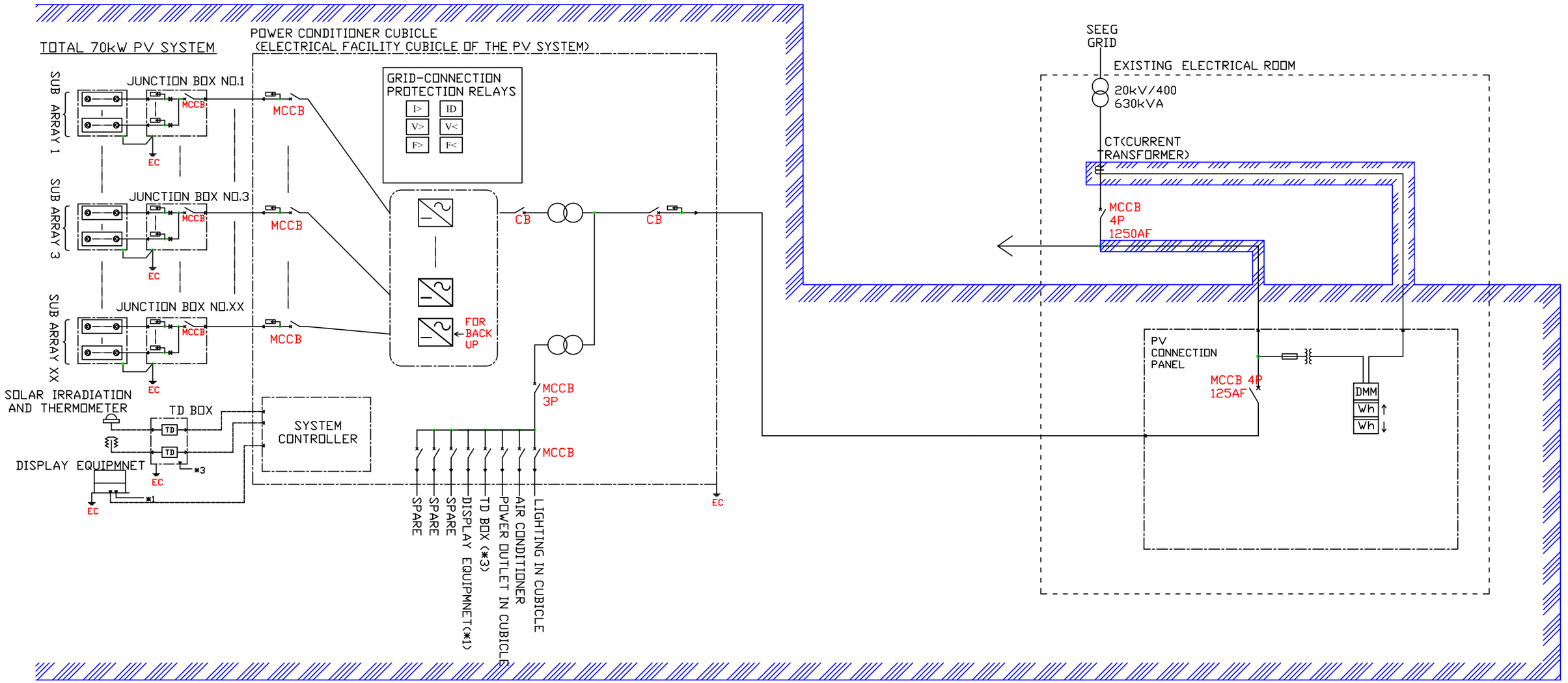
ELECTRICAL EQUIPMENT LIST

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION & WEIGHT				REMARKS
				WIDTH [mm]	DEPTH [mm]	HEIGHT [mm]	WEIGHT [kg]	
(1)	LOW VOLTAGE DISTRIBUTION PANEL	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MOLDED CASE CIRCUIT BREAKER & CONTROL DEVICES	1	1,750	450	2,000	-	EXISTING
(2)	PV CONNECTION PANEL (PVCP)	-	1	-	-	-	-	NEW

DRAWING NO. U05 EQUIPMENT LAYOUT (ELECTRIC ROOM)

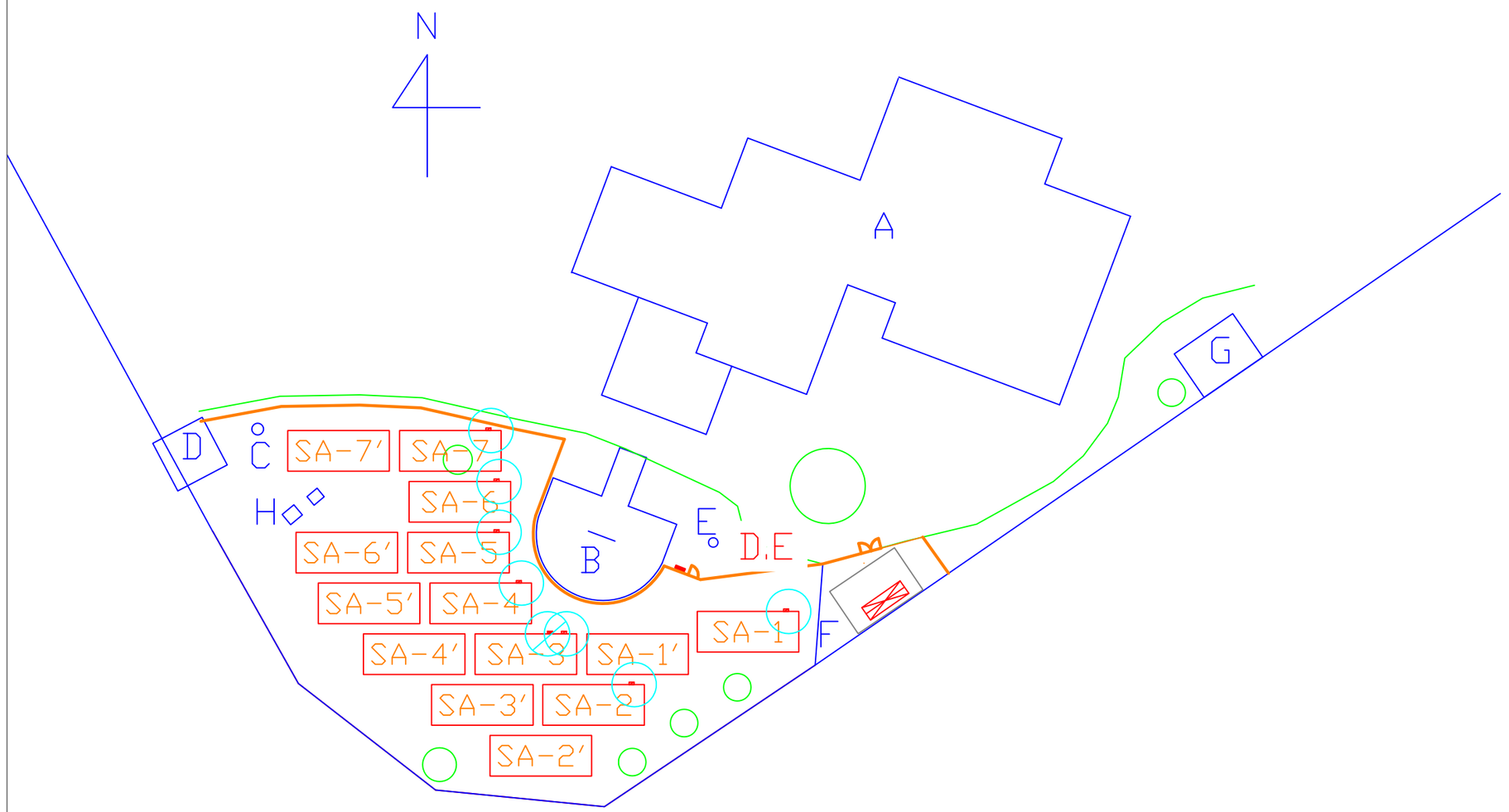


DRAWING NO. M01 SINGLE LINE DIAGRAM (MFAIC)



DMM:DIGITAL MULTI-METER
THE CONTRACTOR SHALL CARRY OUT NECESSARY SURVEY ABOUT THE
EXISTING ELECTRICAL FACILITIES.

DRAWING NO. M02 SINGLE LINE DIAGRAM (PV SYSTEM)



LEGEND

: ELECTRICAL FACILITY CUBICLE OF THE PV SYSTEM [E.C.FOR PV]

: PV SUB ARRAY (APPROPRIATE 5kW) [SA]

: DISPLAY EQUIPMENT[D.E]

: JUNCTION BOX [J.B]

: TRANSDUCER BOX FOR METEOROLOGICAL OBSERVATION [T.D. BOX]

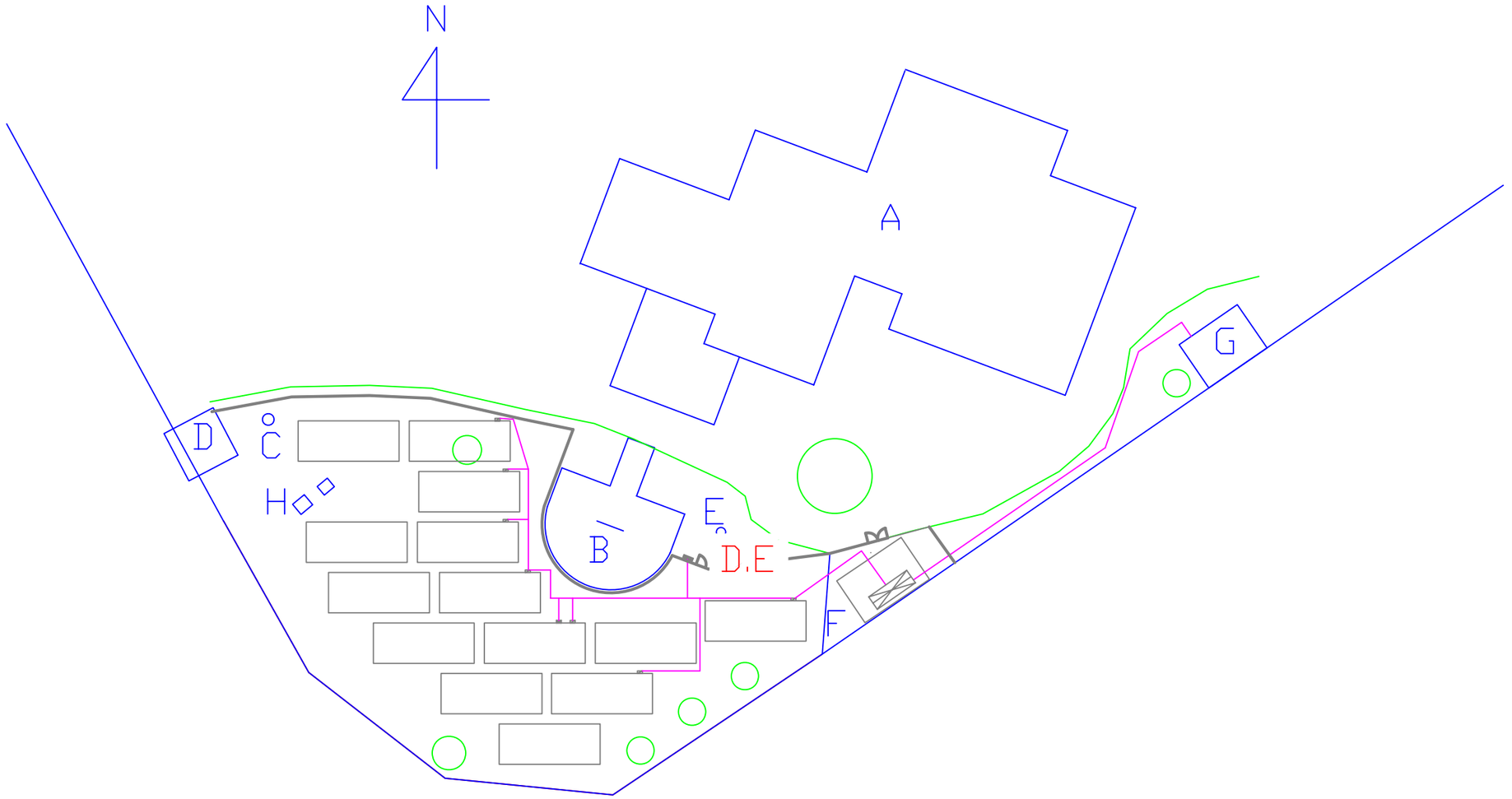
: FENCE

: GATE

BUILDING NAME LIST

A:MAIN BUILDING
B:POLE FOR NATIONAL FLAGS
C:LIGHTING POLE
D:WATER TANK HOUSE
E:FIRE HYDRANT
F:DRAINAGE DITCH
G:ELECTRICAL ROOM
H:MANHOLE

DRAWING NO. M03 GENERAL LAYOUT PLAN



LEGEND

: ELECTRICAL FACILITY CUBICLE OF THE PV SYSTEM [E.C.FOR PV]

: PV SUB ARRAY (APPROPRIATE 5kW) [SA]

: DISPLAY EQUIPMENT[D.E]

: JUNCTION BOX [J.B.]

: TRANSDUCER BOX FOR METEOROLOGICAL OBSERVATION [T.D. BOX]

: FENCE

: GATE

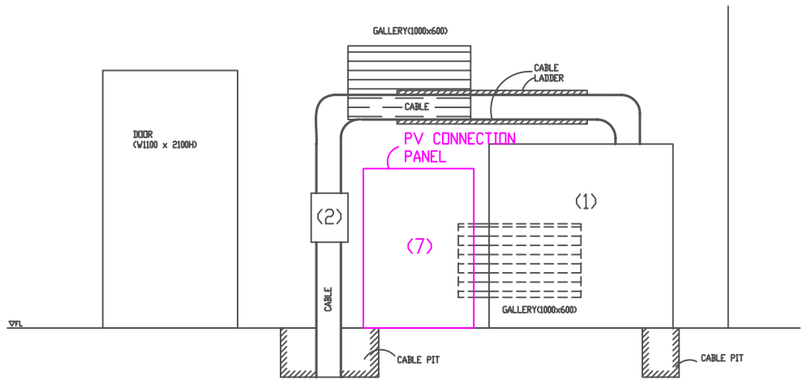
: HAND HOLE

BUILDING NAME LIST

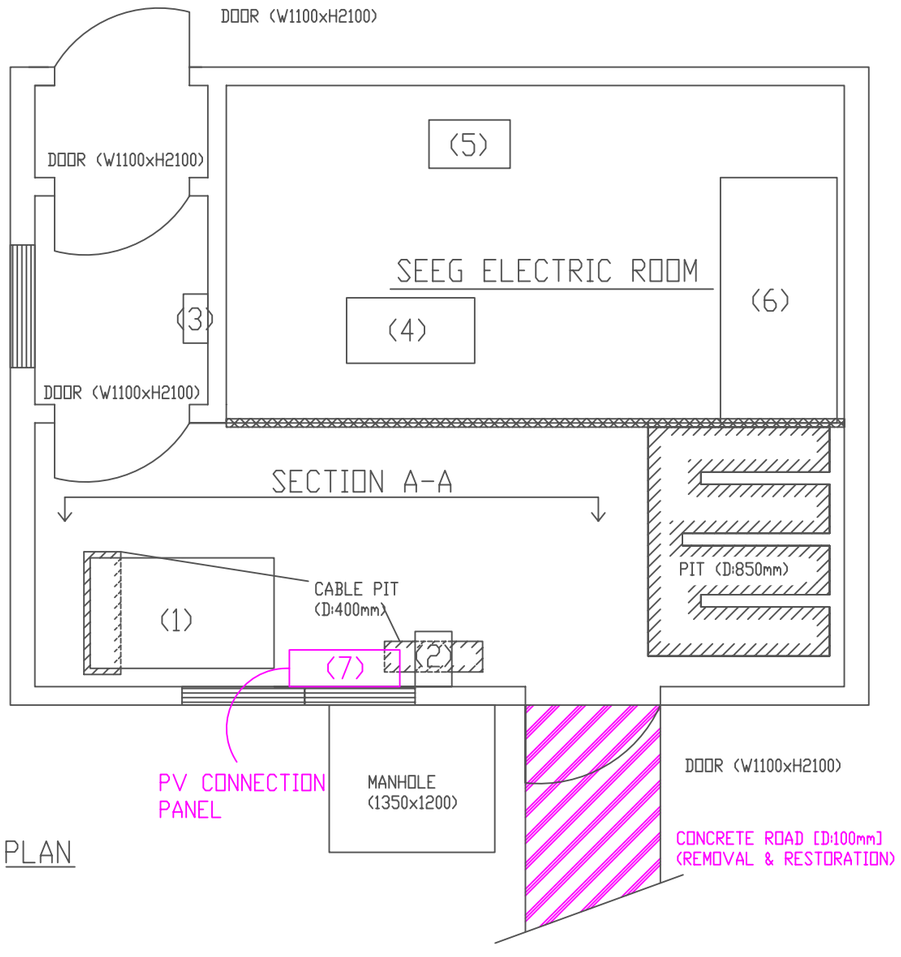
A:MAIN BUILDING
B:POLE FOR NATIONAL FLAGS
C:LIGHTING POLE
D:WATER TANK HOUSE
E:FIRE HYDRANT
F:DRAINAGE DITCH
G:ELECTRICAL ROOM
H:MANHOLE

DEPTH FROM THE GROUND SURFACE TO THE CABLE SHALL BE
> MORE THAN 600MM SHOWN IN FINE LINE

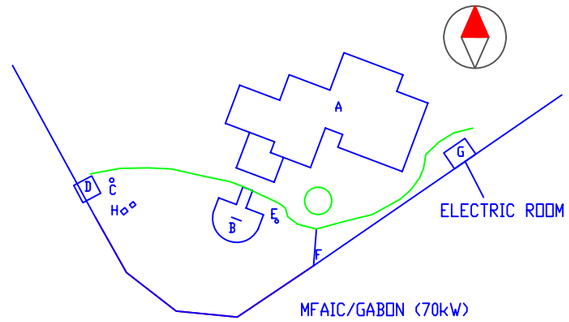
DRAWING NO. M04 CABLE LAYOUT PLAN



SECTION A-A



PLAN



NOTE

: GALLERY

: CABLE PIT

: CONCRETE PAVE

: WIRE MESH

ELECTRICAL EQUIPMENT LIST

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION & WEIGHT				REMARKS
				WIDTH [mm]	DEPTH [mm]	HEIGHT [mm]	WEIGHT [kg]	
(1)	No.TR2 TRANSFORMER	ONAN TYPE, 3PHASE-50Hz-630kVA-20000/400V-18.2/909.4A-Dyn11	1	1,500	900	1,500	-	EXISTING
(2)	LOW VOLTAGE MAIN FEEDER RACK	WALL MOUNTED TYPE FEEDER RACK CONSISTING OF AIR CIRCUIT BREAKER.	1	300	450	400	-	EXISTING
(3)	METERING BOX	OPEN TYPE, WALL MOUNTING, CONSISTING OF WHR METER	1	400	200	500	-	EXISTING
(4)	No.TR1 TRANSFORMER	ONAN TYPE, 3PHASE-50Hz-250kVA-20000/400V-7.2/361A-Dyn11	1	-	-	-	-	SEEG MANAGED
(5)	LOW VOLTAGE FUSE RACK	WALL MOUNTED TYPE FUSE RACK CONSISTING OF DISCONNECTING SWITCH & POWER FUSES.	1	-	-	-	-	SEEG MANAGED
(6)	24kV SWITCHGEAR	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CIRCUIT BREAKER & PROTECTION DEVICES	4	-	-	-	-	SEEG MANAGED
(7)	PV CONNECTION PANEL	-	-	-	-	-	-	NEW

DRAWING NO. M05 EQUIPMENT LAYOUT (ELETRIC ROOM)

APPENDICES

1. MEMBER LIST OF THE STUDY TEAM
2. STUDY SCHEDULE
3. LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY
4. MINUTES OF DISCUSSIONS
5. SOFT COMPONENT (TECHNICAL ASSISTANCE) PLAN
6. REFERENCES

1. MEMBER LIST OF THE STUDY TEAM

Appendix 1 Member of the Study Team

1st Survey

No.	Name	Position	Affiliation
1	Mr. Masaru NISHIDA	Chief Consultant / PV Planning	NEWJEC Inc.
2	Mr. Kenichiro YAGI	Grid Connection PV System	NEWJEC Inc.
3	Mr. Nobuo KOMIYA	Electric Equipment	NEWJEC Inc.
4	Mr. Tetsuo TSURUSHIMA	Procurement/Cost Estimate	Japan Techno Co., Ltd.
5	Mr. Shoji TAKAMATSU	Institutional/Socioeconomic Expert	Japan Techno Co., Ltd.
6	Mr. Takao SHIRAISHI	Grid Connection and Operation	NEWJEC Inc.
7	Mr. Sho SHIBATA	Coordinator	NEWJEC Inc.
8	Ms. Naoko HIRAMATSU	Interpreter	JICE

2st Survey

No.	Name	Position	Affiliation
1	Mr. Yasumichi ARAKI	Team Leader	Financing Facilitation and Procurement Supervision Department, JICA
2	Mr. Yamato KAWAMATA	Planning Management	Financing Facilitation and Procurement Supervision Department, JICA
3	Mr. Hitoshi KANAZAWA	Procurement Planning & Management	JICS
4	Mr. Masaru NISHIDA	Chief Consultant / PV Planning	NEWJEC Inc.
5	Mr. Kenichiro YAGI	Grid Connection PV System	NEWJEC Inc.
6	Mr. Nobuo KOMIYA	Electric Equipment	NEWJEC Inc.
7	Mr. Kazuhiro ARITA	Procurement/Cost Estimate	Japan Techno Co., Ltd.
8	Mr. Shoji TAKAMATSU	Institutional/Socioeconomic Expert	Japan Techno Co., Ltd.
9	Mr. Takao SHIRAISHI	Grid Connection and Operation	NEWJEC Inc.
10	Mr. Sho SHIBATA	Coordinator	NEWJEC Inc.

3rd Survey

No.	Name	Position	Affiliation
1	Mr. Toshinobu KATO	Team Leader	Industrial Development Department, JICA
2	Mr. Yamato KAWAMATA	Planning Management	Financing Facilitation and Procurement Supervision Department, JICA
3	Mr. Masaru NISHIDA	Chief Consultant / PV Planning	NEWJEC Inc.
4	Mr. Kenichiro YAGI	Grid Connection PV System	NEWJEC Inc.
5	Mr. Takao SHIRAISHI	Grid Connection and Operation	NEWJEC Inc.
6	Mr. Sho SHIBATA	Coordinator	NEWJEC Inc.
7	Ms. Kumiko YODA	Interpreter	JICE

2. STUDY SCHEDULE

1st Survey

	Date	Day	Consultant							
			Chief Consultant/ PV Planning	Grid Connection PV System	Electric Equipment	Procurement/ Cost Estimate	Institutional/ Socioeconomic Expert	Grid Connection and Operation	Coordinator	Interpreter
			Mr. Nishida NEWJEC	Mr. Yagi NEWJEC	Mr. Komiya NEWJEC	Mr. Tsurushima Japan Techno	Mr. Takamatsu Japan Techno	Mr. Shiraishi NEWJEC	Mr. Shibata NEWJEC	Ms. Hiramatsu JICE
1	19-Sep-09	Sat	Move to Gabon							
2	20-Sep-09	Sun	Move to Gabon							
3	21-Sep-09	Mon	Courtesy Call (EoJ, MoEHR)							
4	22-Sep-09	Tue	Site Survey (Candidates of Project Site)							
5	23-Sep-09	Wed	Site Survey (Candidates of Project Site)							
6	24-Sep-09	Thu	Discussion on the Project (EoJ, JICA, MoEHR)		Planning the Project		Discussion on the Project (EoJ, JICA, MoEHR)		Planning the Project	Discussion on the Project (MoEHR)
7	25-Sep-09	Fri	Discussion on the Project (MoFAIC, MoHE)	Planning the Project		Collecting the Data	Discussion on the Project (MoE)	Discussion on the Project (MoFAIC, MoHE)	Collecting the Data	Collecting the Data Discussion on the Project (MoE)
8	26-Sep-09	Sat	Planning the Project							
9	27-Sep-09	Sun	Planning the Project							
10	28-Sep-09	Mon	Discussion on the Project (MoFAIC)			Collecting the Data	Planning the Project		Collecting the Data	
11	29-Sep-09	Tue	Discussion on the Project (MoFAIC) Site Survey (MoFAIC)			Collecting the Data Discussion with Constructors	Discussion on the Project	Discussion on the Project (MoFAIC) Site Survey (MoFAIC)	Planning the Project	Collecting the Data Discussion with Constructors
12	30-Sep-09	Wed	Discussion on the Project (MoFAIC, OBU) Site Survey (MoFAIC, OBU)			Discussion with Constructors	Discussion on the Project (MoE)	Discussion on the Project (MoFAIC, OBU) Site Survey (MoFAIC, OBU)	Planning the Project	Discussion with Constructors
13	1-Oct-09	Thu	Site Survey (MoFAIC, OBU)			Discussion with Constructors Move to Japan	Discussion on the Project (MoE) Discussion with Constructors Move to Japan	Site Survey (MoFAIC, OBU)	Planning the Project	Discussion on the Project (MoE) Move to Japan
14	2-Oct-09	Fri	Discussion on the Project (MoFAIC, OBU, SEEG, MoEHR) Reporting the Result of 1st Survey (EoJ)			Move to Japan		Discussion on the Project (MoFAIC, MoHE, SEEG, MoEHR) Reporting the Result of 1st Survey (EoJ)		Move to Japan
15	3-Oct-09	Sat	Move to Ethiopia			Move to Japan		Move to Ethiopia		Move to Japan
16	4-Oct-09	Sun	Move to Yemen					Move to Yemen		

2nd Survey

	Date	Day	JICA				Consultant					
			Team Leader	Planning Management	Procurement Planning & Management	Procurement/ Cost Estimate	Institutional/ Socioeconomic Expert	Grid Connection PV System	Electric Equipment	Procurement/Cost Estimate	Grid Connection and Operation	Coordinator
			Mr. Nishida NEWJEC	Mr. Yagi NEWJEC	Mr. Komiya NEWJEC	Mr. Tsurushima Japan Techno	Mr. Takamatsu Japan Techno	Mr. Shiraishi NEWJEC	Mr. Shibata NEWJEC	Ms. Hiramatsu JICE	Mr. Shiraishi NEWJEC	Mr. Shibata NEWJEC
1	30-Nov-09	Mon	Move to Gabon									
2	1-Dec-09	Tue	Move to Gabon									
3	2-Dec-09	Wed	Courtesy Call (JICA Gabon Office, EoJ, MoFAIC, MoHE, MoEHR)									
4	3-Dec-09	Thu	Discussion on Minutes (MoFAIC, MoEHR, MoHE)									
5	4-Dec-09	Fri	Discussion on Minutes (MoFAIC, MoEHR, MoHE)									
6	5-Dec-09	Sat	Discussion on Minutes (MoFAIC, MoEHR)									
7	6-Dec-09	Sun	Planning the Project				Move to Gabon					
8	7-Dec-09	Mon	Discussion on the Project (JICA, UOB) / Site Survey (UOB) / Discussion on Minutes					Discussion on the Project (JICA, UOB) / Site Survey (UOB)				
9	8-Dec-09	Tue	Signing of Minutes Reporting the Result of 2nd Survey (JICA Gabon Office, EoJ)				Discussion on the Project (UOB) Signing of Minutes	Discussion on the Project (UOB) Site Survey (UOB)		Discussion with Constructors	Discussion on the Project (UOB) Site Survey (UOB)	
10	9-Dec-09	Wed	Move to Japan				Site Survey (UOB)			Discussion with Constructors	Site Survey (UOB)	
11	10-Dec-09	Thu				Collecting the Data Discussion with Constructors	Discussion on the Project (UOB, MoFAIC) Site Survey (UOB, MoFAIC)	Discussion on the Project (UOB, MoFAIC) Site Survey (MoFAIC)	Discussion on the Project (UOB, MoFAIC) Site Survey (UOB, MoFAIC)	Discussion with Constructors	Discussion on the Project (UOB, MoFAIC) Site Survey (UOB, MoFAIC)	Discussion on the Project (UOB, MoFAIC) Site Survey (MoFAIC)
12	11-Dec-09	Fri					Discussion on the Project (UOB, MoFAIC) Site Survey (UOB, MoFAIC)	Site Survey (UOB, MoFAIC)		Discussion with Constructors	Discussion on the Project (UOB, MoFAIC, SEEG) Site Survey (UOB, MoFAIC)	Site Survey (UOB, MoFAIC)
13	12-Dec-09	Sat					Site Survey (UOB) Planning the Project			Discussion with Constructors Site Survey (UOB) Planning the Project	Site Survey (UOB) Planning the Project	
14	13-Dec-09	Sun					Planning the Project					
15	14-Dec-09	Mon					Discussion on the Project (MoEHR) Site Survey (UOB)	Site Survey (UOB)		Discussion with Constructors	Discussion on the Project (MoEHR) Site Survey (UOB)	Site Survey (UOB)
16	15-Dec-09	Tue					Discussion on the Project (MoFAIC, SEEG) Site Survey (UOB)	Site Survey (UOB, MoFAIC)		Discussion with Constructors	Discussion on the Project (MoFAIC, SEEG) Site Survey (UOB)	Site Survey (UOB, MoFAIC)
17	16-Dec-09	Wed					Discussion on the Project (MoEHR) Site Survey (UOB)	Site Survey (UOB)		Discussion with Constructors	Discussion on the Project (MoEHR) Site Survey (UOB)	Site Survey (UOB)
18	17-Dec-09	Thu					Site Survey (UOB)			Discussion with Constructors	Site Survey (UOB)	
19	18-Dec-09	Fri					Discussion on Basic Design (UOB, MoFAIC)			Discussion with Constructors	Discussion on Basic Design (UOB, MoFAIC)	
20	19-Dec-09	Sat					Site Survey (UOB) Planning the Project			Discussion with Constructors Planning the Project	Site Survey (UOB) Planning the Project	
21	20-Dec-09	Sun					Planning the Project					
22	21-Dec-09	Mon					Discussion on the Project (MoFAIC, MoEHR)	Site Survey (UOB, MoFAIC)			Discussion on the Project (MoFAIC, MoEHR)	Site Survey (UOB, MoFAIC)
23	22-Dec-09	Tue					Reporting the Result of 2nd Survey (UOB)					
24	23-Dec-09	Wed					Site Survey (UOB) / Discussion on the Project (JICA Gabon Office, MoEHR, UOB) / Reporting the Result of 2nd Survey (MoFAIC, MoEHR)					
25	24-Dec-09	Thu					Reporting the Result of 2nd Survey (JICA Gabon Office, EoJ)					
26	25-Dec-09	Fri					Planning the Project					
27	26-Dec-09	Sat					Move to Japan					

2nd Survey

	Date	Day	Consultant
			Institutional/Socioeconomic Expert
			Mr. Takamatsu Japan Techno
1	17-Jan-10	Sun	Move to Gabon
2	18-Jan-10	Mon	Courtesy Call (MoEHR, EoJ, JICA Gabon Office)
3	19-Jan-10	Tue	Discussion on the Project (MoE)
4	20-Jan-10	Wed	Discussion on the Project (MoE)
sa	21-Jan-10	Thu	Discussion on the Project (MoE)
6	22-Jan-10	Fri	Discussion on the Project (MoE)
7	23-Jan-10	Sat	Move to Gabon

3rd Survey

	Date	Day	JICA		Consultant				
			Team Leader	Planning Management	Chief Consultant/ PV Planning	Grid Connection PV System	Grid Connection and Operation	Coordinator	Interpreter
			Mr.Kato JICA	Mr.Kawamata JICA	Mr.Nishida NEWJEC	Mr. Yagi NEWJEC	Mr. Shiraishi NEWJEC	Mr. Shibata NEWJEC	Ms. Yoda JICE
1	16-May-10	Sun			Move to Gabon				
2	17-May-10	Mon			Courtesy Call (MoFAIC, UOB, MoEHR, EoJ)				
3	18-May-10	Tue		Move to Gabon	Discussion on the Project (UOB, MoFAIC, MoEHR)				
4	19-May-10	Wed		Move to Gabon	Discussion on the Project (MoEHR, SEEG)				
5	20-May-10	Thu		Discussion on Minutes (MoEHR, MoFAIC, MoHE)					
6	21-May-10	Fri		Discussion on the Project (UOB, MoHE)					
7	22-May-10	Sat	Move to Gabon	Planning the Project					
8	23-May-10	Sun	Move to Gabon	Planning the Project					
9	24-May-10	Mon	Site Survey (UOB, MoFAIC)						
10	25-May-10	Tue	Discussion on Minutes (MoEHR, MoFAIC, MoHE) Signing of Minutes Reporting the Result of 2nd Survey (JICA Gabon Office, EoJ)						
11	26-May-10	Wed	Move to Japan		Move to Japan	Collecting the Data Discussion with Constructors			
12	27-May-10	Thu	Move to Japan		Move to Japan				

3. LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

APPENDICES 3 List of Parties Concerned in the Recipient Country

Name and Organization	Position
Ministry of Energy and Hydraulic Resource	
Mr. Régis Immongault	Minister
Mr. Kalima Jeannot	Deputy Secretary General
Mr. Yvon Tchicot	Director for Cabinet Secretariat
Mr. Etienne Dieudonné Ngoubou	Director General for Energy and Hydraulic Resource
Ms. M'benga Lydie	Technical Adviser
Mr. Minto'o Alex	Technical Adviser
Mr. Ossoucah Philippe	Technical Adviser
Mr. Jean-Julien Ango	Technical Adviser
Mr. Ango Essia	Technical Adviser
SEEG (Société d'Electricité et d'Eaux du Gabon)	
Mr. Daniel ADANG EVOUNA	Vice Director of Technical Division
Mr. Hélène Balley	Director for Institutional Customer
Mr. Pierre Marie Boundiandja	Engineer
Ministry of Foreign Affairs and International Cooperation	
Mr. Emmanuel Mendoume Nze	Secretary General
Mr. Paul Bie Eyene	Deputy Secretary General
Mr. Alfred Moungara Moussotsi	Director General for International Corporation
Mr. Mounguengui Nzigou Faushin	Director for Asia and Oceania
Mr. Allegra Pamela Romance Bongo	Cabinet Secretariat for International Corporation
Mr. Axel Oura-Obouoyi	Adviser
Mr. Engone Rosine	Chief for States of Asia
Ms. Mbazoo Ondo Isabelle	Chief for States of Asia
Mr. Betoe Geneviève	Staff of States of Asia
Mr. Mbadinga Hugues	Adviser of Finance and Economic
Mr. Pierre Oniane Nguema	Cabinet Secretariat
Mr. Steve Malili	Chief for Property Division
Mr. MBA Rodingue F	Officer of Property Division
Mr. Matisiegui Moussavou Blaise	Officer of Property Division

Ministry of the National Education, the Higher Education, the Scientific Research and the Innovation

Mr. Jean-Michel Ella Essone	Deputy Secretary General
Mr. Joséph Mamboungou	Deputy Assistant Secretary
Ms. Christine ESSONGUE KOULA	Adviser

Omar Bongo University

Mr. Pierre Nzinzi	President
Mr. Alain Xavier Madoungou	Cabinet Secretariat
Mr. Erôme Ndzoungou	Vice President
Mr. Jean-Jacques Ekomie	Vice President
Mr. Charles MBA-Ondo	Deputy Secretary
Mr. Obanga Dieudonné	Deputy Assistant Secretary
Mr. Vincent Emane	Director for Maintenance

Ministry of Environment

Mr. Louis Léandre Ebobola Tsibah	Vice Director General for Environment
Mr. Bernard L. Panzou	Technical Adviser

Ministry of Transportation

Mr. Martin Ondo Ella	Director for Climate Department

Embassy of Japan in Gabon

Motoi Kato	Ambassador
Shinichi Hirose	First Counselor
Wahito Yamada	First Secretary

JICA Gabon Office

Katunari Harada	Resident Representative
M. Naoto Nakagawa	First Programmes Advisor
Kazuyoshi Kotake	Programme Officer

4. MINUTES OF DISCUSSIONS

Procès-verbal des discussions
sur l'Étude Préparatoire
du Projet de Promotion de l'Énergie Propre
en utilisant le Système Photovoltaïque
en République Gabonaise

Le Gouvernement du Japon (ci-après dénommé « le GDJ ») a établi le "Partenariat Cool Earth" comme un mécanisme financier nouveau. À travers ce dernier, le GDJ coopère activement avec les pays en voie de développement faisant des efforts en vue de réduire les émissions de gaz à effet de serre (GES), tels que la promotion de l'énergie propre. Aussi, une nouvelle modalité d'aide financière non remboursable, "Programme d'aide financière non remboursable pour l'environnement et le changement climatique", a été créée par le GDJ comme une composante de ce mécanisme financier. Suivant l'initiative du Partenariat Cool Earth, l'Agence Japonaise de Coopération Internationale (ci-après dénommée « la JICA »), en concertation avec le GDJ, a décidé de mener une étude préparatoire (ci-après dénommée « l'Étude ») pour le Projet de Promotion de l'Énergie Propre en utilisant le Système Photovoltaïque en République Gabonaise (ci-après dénommé « le Projet »).

La JICA a envoyé une équipe d'étude (ci-après dénommée « l'Équipe ») en République Gabonaise, dirigée par Monsieur Yasumichi ARAKI, Conseiller de la 1ère Division de gestion des projets de l'aide financière non remboursable au Département d'aide au financement et de supervision des passations de marché de la JICA.

L'Équipe a tenu une série de discussions avec une équipe de cadres concernés du Gouvernement de la République Gabonaise (ci-après dénommé « la Partie gabonaise ») et a effectué une étude sur le terrain.

À l'issue de ces discussions et étude sur le terrain, les deux Parties ont convenu des points mentionnés dans le document joint au présent procès-verbal.

Fait à Libreville, le 8 décembre 2009

Yasumichi ARAKI
Chef de l'Équipe d'étude préparatoire
Agence Japonaise de Coopération
Internationale
JAPON

Jeannot KALIMA
Secrétaire Général adjoint
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RÉPUBLIQUE GABONAISE

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RÉPUBLIQUE GABONAISE

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RÉPUBLIQUE GABONAISE

DOCUMENT JOINT

1. Situation actuelle

La puissance électrique installée en République Gabonaise est de quelque 374 mégawatts (MW). Le taux de couverture atteint 80%, ce qui est l'un des premiers en Afrique. Environ la moitié de l'électricité est produite par les centrales hydroélectriques. Cependant, des carences en électricité sont constatées durant la saison sèche. Aussi, le Ministère de l'Énergie et des Ressources Hydrauliques (ci-après dénommé « le MERH ») souhaite t-il poursuivre le développement des systèmes d'énergie renouvelable afin de réaliser le plan « Gabon Vert », conformément a la politique de promotion de l'énergie propre et de protection des forêts au Gabon prôné par le Gouvernement.

Dans cette optique, les deux Parties ont confirmé la nécessité du Projet introduisant le système photovoltaïque (PV) de production électrique connecté au réseau national, et ont convenu de poursuivre une étude sur le Projet.

2. Objectif du Projet

Le Projet a pour but de promouvoir l'utilisation de l'énergie propre et de réduire les émissions de gaz à effet de serre en mettant en place le système photovoltaïque connecté au réseau national.

3. Organisme responsable et organismes d'exécution

3-1. L'organisme responsable et d'exécution est le MERH. Son organigramme est en cours d'élaboration. Il sera déposé au bureau de la JICA au Gabon dès qu'il sera finalisé.

3-2. Le Projet sera réalisé dans deux sites, à savoir Ministère des Affaires Étrangères, de la Coopération Internationale et de la Francophonie (ci-après dénommé « le MAECIF ») et le Ministère de l'Éducation Nationale, de l'Enseignement Supérieur, de la Recherche Scientifique et de l'Innovation (Université Omar Bongo (ci-après dénommé « l'UOB »)). Leurs organigrammes sont joints en **Annexe-1 et 2.**

4. Éléments requis par le gouvernement gabonais

4-1. En se basant sur le résultat de la 1ère phase de l'Étude, la partie gabonaise a désigné deux institutions comme site cible pour la mise en place du système PV, à savoir le MAECIF et l'UOB, indiqués en **Annexe-3**. L'Équipe a recommandé à la Partie gabonaise de lui indiquer un ordre de priorité. Mais, la Partie gabonaise a expliqué que les sites requis se situaient tous les deux au même niveau élevé de priorité.

Nom du site	Capacité PV
MAECIF	70 kW
UOB	120kW

Les deux Parties ont confirmé que la 2nde phase de l'Étude auxdits sites se poursuivra. La Partie gabonaise a toutefois pris note que l'un des sites pourrait être éliminé du Projet en cas de limitation du budget et de difficultés techniques.

4-2. La Partie gabonaise a expliqué que l'UOB avait un projet d'extension de la bibliothèque existante dû à l'augmentation du nombre d'étudiants, ce qui pourrait réduire l'espace requis pour l'installation des panneaux. Les deux Parties ont convenu que la localisation finale pour la mise en place du système PV a été déterminée comme indiqué en Annexe-3 au cours de l' étude sur le terrain.

4-3. L'Équipe évaluera la pertinence de la requête et rapportera la conclusion de l'Étude au siège de la JICA ainsi qu'au GDJ.

4-4. La partie gabonaise a noté que les composantes finales et la conception du Projet seront déterminées lors de cette Étude Préparatoire à la conception.

4-5. La Partie gabonaise a expliqué qu'il existe aucun projet similaire mis en œuvre par d'autres bailleurs de fonds ou par elle-même.

5. Programme d'Aide Financière Non Remboursable pour l'Environnement et le Changement Climatique du Japon

La Partie gabonaise a acte des modalités du Programme d'Aide Financière Non Remboursable pour l'Environnement et le Changement Climatique du Japon expliquées par l'Équipe et décrites en **Annexe-4, 5, 6, 7 et 8.**

6. Calendrier de l'Étude

6-1. L'Équipe effectuera une étude approfondie en République Gabonaise jusqu'au 26 décembre 2009 comme 2nde phase de l'Étude Préparatoire.

6-2. Au terme de cette 2nde dernière, l'Équipe rapportera ses résultats au siège de la JICA ainsi qu'au GDJ.

7. Autres points importants discutés/abordés

7-1. Terrain pour l'installation du système PV

Les deux Parties ont confirmé la disponibilité des terrains requis pour le Projet, au MAECIF ainsi qu'à l'UOB. Cependant, elles ont convenu de la nécessité de l'aménagement du site de l'Université à cause du relief. La Partie gabonaise a confirmé que le MERH assumera l'aménagement dudit site.

7-2. Fourniture d'équipements

L'Équipe a expliqué que conformément à la politique du GDJ, des produits japonais seront fournis pour les équipements principaux dans le cadre du Projet. La Partie gabonaise a donné son accord.

7-3. Coordination avec les institutions concernées

En vue de la mise en oeuvre du Projet, le MERH sera le point focal du Projet et il sera responsable pour la coordination avec des institutions concernées, à savoir le MAECIF, le Ministère de l'Éducation Nationale, de l'Enseignement Supérieur, de la Recherche Scientifique et de l'Innovation et l'UOB. La Partie gabonaise a donné son accord pour la mise en place d'un

comité consultatif pour coordonner l'exécution du Projet avec la Partie japonaise, notamment l'Ambassade du Japon, le bureau de la JICA et l'Agent d'approvisionnement. Les attributions dudit comité sont détaillées en **Annexe-9**.

7-4. Application des lois et des règlements concernés

Les deux Parties ont confirmé que le MERH assumera la responsabilité pour l'interconnexion du système PV au réseau national.

7-5. Considérations environnementales et sociales

Concernant les considérations environnementales et sociales, la Partie gabonaise a expliqué que les travaux d'aménagement du site pour la mise en place des installations du système PV seront réalisés conformément aux directives environnementales du Gabon, en consultation avec le Ministère en charge de l'Environnement. L'Équipe a remis à la Partie gabonaise l'aperçu des directives des considérations environnementales et sociales de la JICA (ci-après dénommé "les Directives de la JICA"). La partie gabonaise en a pris acte et s'est engagée a suivre les procédures nécessaires.

7-6. Exonération des droits de douane et des taxes

La Partie gabonaise a convenu d'assumer la responsabilité de l'exonération de tous les droits de douane, taxes intérieures, levées fiscales et devoirs dans le pays pour la mise en oeuvre du Projet.

7-7. Formation

Les deux Parties ont confirmé la nécessité de la formation de techniciens chargés de la maintenance des équipements, afin d'assurer un fonctionnement pérenne des installations.

7-8. La Partie gabonaise s'est engagée à assurer la sécurité de tous les ressortissants japonais concernés par le Projet, si c'est nécessaire.

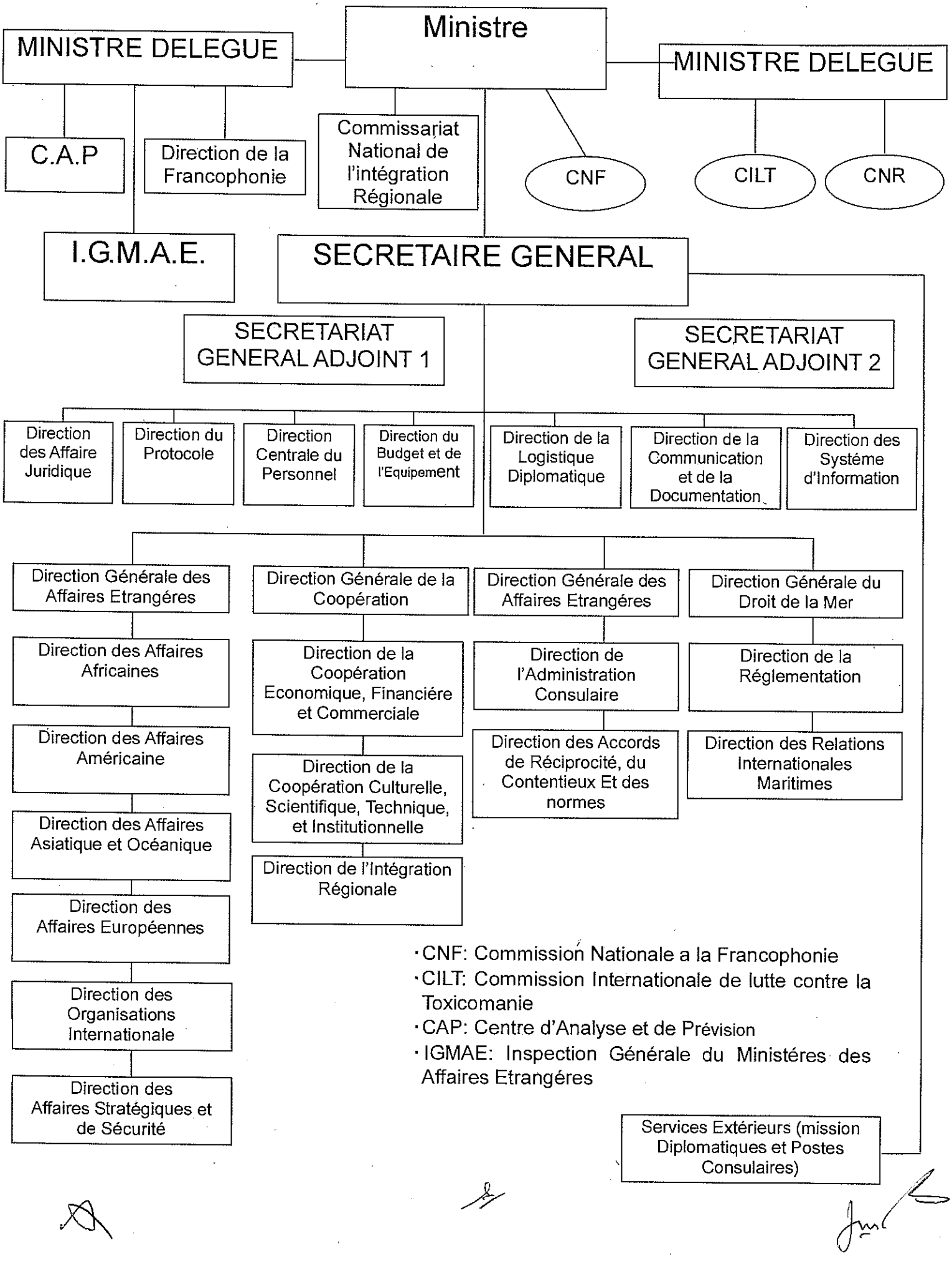
7-9. La Partie gabonaise s'est engagée, par ailleurs, à fournir un nombre suffisant de techniciens à l'Équipe pendant la durée de son étude en République Gabonaise.

< Liste des Annexes >

Annexe-1 Organigramme du MAECIF
Annexe-2 Organigramme de l'UOB
Annexe-3 Site cible du Projet
Annexe-4 Programme d'Aide Financière Non Remboursable pour l'Environnement et le Changement Climatique
Annexe-5 Circulation générale du Programme d'Aide Financière Non Remboursable pour l'Environnement et le Changement Climatique
Annexe-6 Circulation de fonds pour la mise en œuvre du Projet
Annexe-7 Système de mise en œuvre du Projet
Annexe-8 Mesures principales à prendre par chaque gouvernement
Annexe-9 Attributions du Comité

MINISTERE DES AFFAIRES ETRANGERS,
DE LA COOPERATION INTERNATIONALE
ET DE LA FRANCOPHONIE

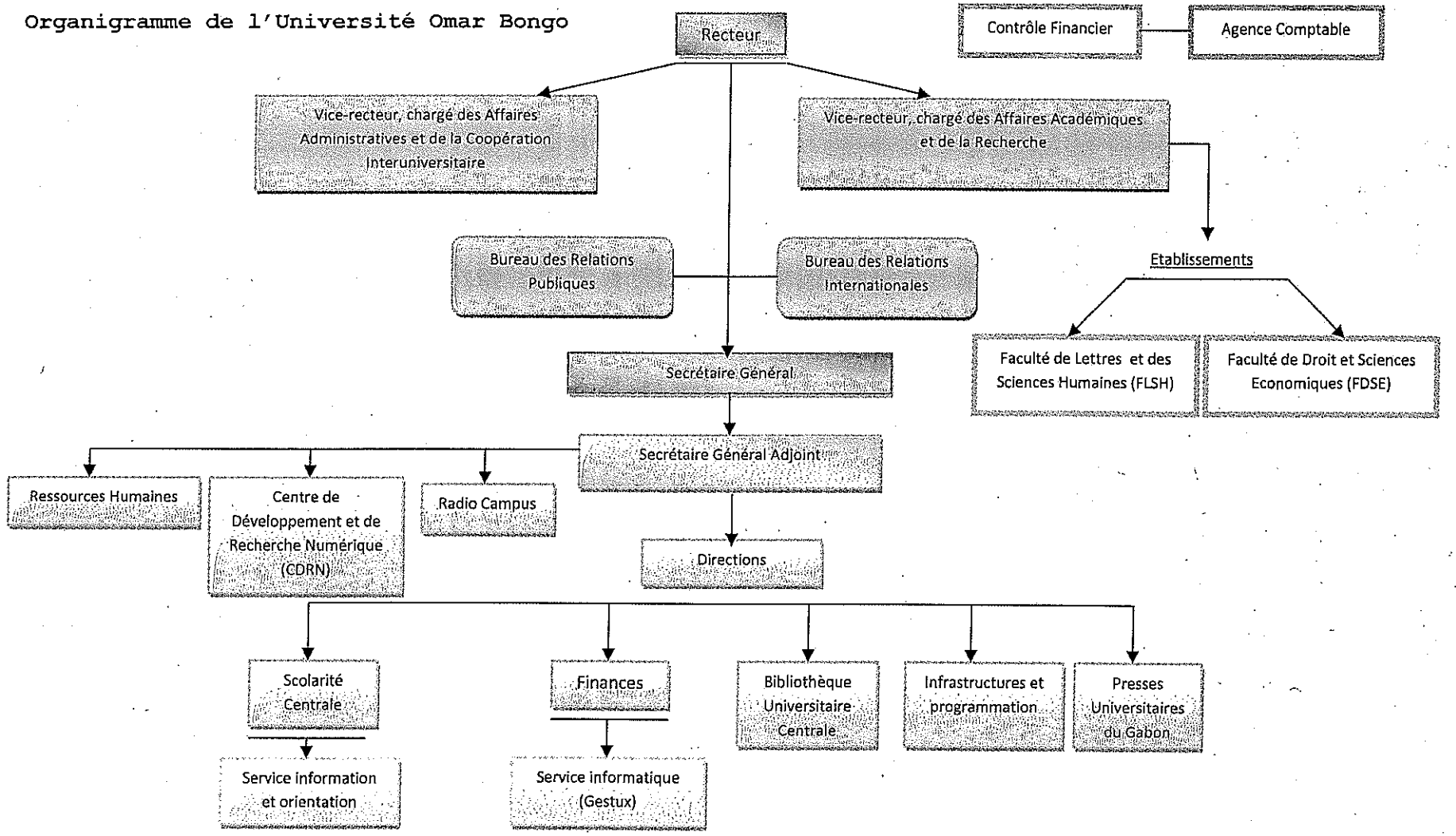
Annexe-1



- CNF: Commission Nationale a la Francophonie
- CILT: Commission Internationale de lutte contre la Toxicomanie
- CAP: Centre d'Analyse et de Prévision
- IGMAE: Inspection Générale du Ministéres des Affaires Etrangéres

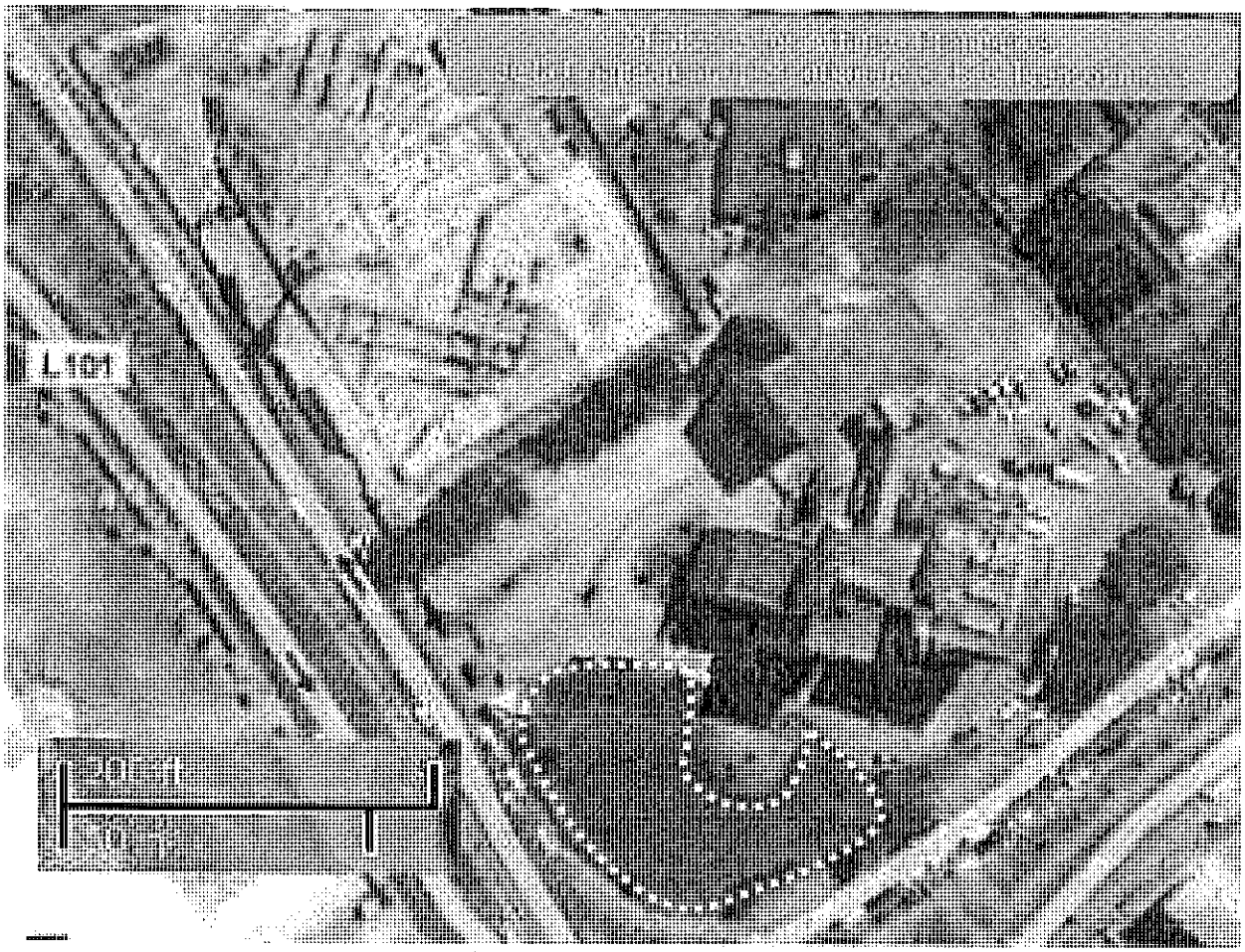
Annexe-2

Organigramme de l'Université Omar Bongo



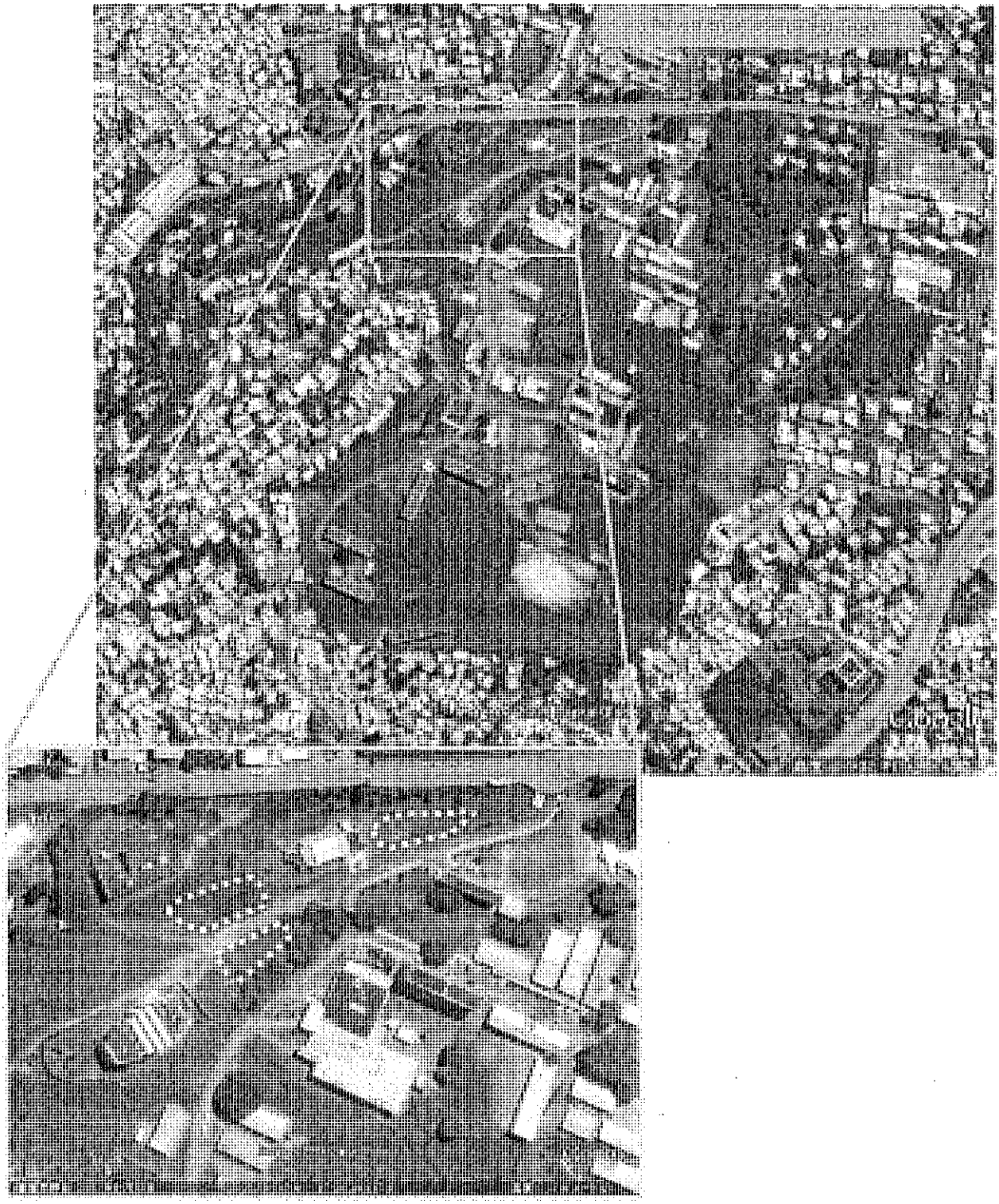
Site cible du Projet

1. MAECIF
Emplacement: Libreville



La capacité de modules PV est de 70kWp

2. UOB
Emplacement: Libreville



La capacité de modules PV est de 120kWp

Aide Financière Non Remboursable pour l'Environnement et le Changement Climatique

(Provisoire)

Le Gouvernement du Japon (ci-après dénommé "le GDJ") a mis en œuvre des réformes structurelles pour améliorer la qualité des opérations de l'Assistance Publique pour le Développement (APD), et dans le cadre de ce réalignement, la nouvelle loi de la JICA est entré en vigueur le 1er Octobre, 2008. Sur la base de la loi et la décision du GDJ, l'Agence japonaise de coopération internationale (ci-après dénommé «la JICA») est devenue l'agence d'exécution du Programme d'Aide Financière Non Remboursable (ci-après dénommé « le Don ») pour l'Environnement et le Changement climatique (ci-après dénommé «l'AFEC»).

La Don fournit un pays bénéficiaire (ci-après dénommé «le Bénéficiaire») avec des fonds non remboursables pour s'approvisionner des installations, des équipements et des services (services d'ingénierie et de transport des produits, etc.) pour le développement économique et social du pays en vertu des principes en accord avec les lois et règlements du Japon. Le Don n'est pas fourni par l'intermédiaire du don des matériaux comme tels.

L'AFEC vise à la réduction des émissions telle que la réalisation d'économies d'énergie et le contrôle de dégradation de l'environnement à cause du changement climatique. Plusieurs composantes peuvent être combinées pour répondre efficacement aux besoins. Des contractants, des fournisseurs ou des consultants ne se limitent pas seulement à des entreprises japonaises, et la construction peut se faire sur la base du mode local.

1. Procedures de l'AFEC

L'AFEC est exécutée par les procédures suivantes.
Application (Requête faite par le Bénéficiaire)
Étude (étude de conception sommaire réalisée par la JICA)
Évaluation et l'approbation (Évaluation par le GDJ et l'approbation par le Conseil des ministres)
Détermination de la mise en oeuvre (les Notes échangées entre le GDJ et le Bénéficiaire)
Accord de Don (ci-après dénommé « le A/D ») (l'accord conclu entre la JICA et le Bénéficiaire)

Premièrement, la formule de candidature ou la requête pour un programme de l'AFEC soumise par un pays Bénéficiaire est examinée par le GDJ (le Ministère des Affaires Etrangères) pour porter un jugement sur son éligibilité pour l'AFEC.

Deuxièmement, la JICA exécute l'étude de concept sommaire (ci-après dénommé « l'Étude »), en principe sous contrat avec un ou des bureau(x) japonais.

Troisièmement, le GDJ évalue le programme pour voir s'il est adéquat au système de l'AFEC, sur la base du rapport de l'Étude préparée par la JICA et les résultats sont par la suite présentés au

Conseil des ministres pour approbation.

Quatrièmement, le programme, une fois approuvé par le Conseil des ministres, devient officiel para l'Échange de Notes signé par le GDJ et le gouvernement du pays bénéficiaire. Simultanément, le Don sera rendu disponible après la conclusion de l'A/D entre le gouvernement du Bénéficiaire ou de son autorité désignée et la JICA.

La JICA est désignée par le Gouvernement japonais comme une organisation chargée de l'exécution de Don.

L'agent d'approvisionnement (ci-après dénommé « l'Agent ») est désigné à effectuer des services d'approvisionnement et des services (y compris la gestion de fond, la préparation de l'appel d'offres, des contrats et ainsi de suite) pour l'AFEC au nom du Bénéficiaire. L'Agent est un organisme impartial et spécialisé et doit rendre des services en fonction de l'accord d'agent avec le Bénéficiaire. L'Agent est recommandé au Bénéficiaire par le GDJ et convenu entre les deux gouvernements dans le procès-verbal convenus («P/V»).

2. L'Étude de Concept de Sommaire

1) Contenu de l'Étude

Le but de l'Étude effectuée par la JICA sur un programme requis (ci-après dénommé « le Programme » est de fournir un document de base nécessaire à l'évaluation du Programme par le GDJ. Le contenu de l'Étude est le suivant :

(1) Confirmer l'arrière-plan, les objectifs et les effets du Programme ainsi que les capacités de maintenance du pays bénéficiaire ayant besoin de l'exécution du Programme.
(2) Évaluer la pertinence du Programme à être exécuté sous le système d'aide financière non remboursable aux points de vue technologique, social et économique.
(3) Confirmer les éléments convenus par les deux parties, relatifs au concept de sommaire du Programme.
(4) Préparer un plan de concept de sommaire du Programme
(5) Estimer les coûts du Programme.

Le contenu de la requête n'est pas obligatoirement approuvé en tant que contenu du Don. Le Concept de Sommaire du Programme doit être confirmé par rapport au cadre d'aide financière non remboursable du Japon. Le GDJ demande au Bénéficiaire de prendre toutes les mesures qui pourraient s'avérer nécessaires pour assurer son indépendance lors de l'exécution du Programme. Ces mesures doivent être garanties même si elles n'entrent pas dans la juridictions de l'organisme du pays bénéficiaire chargé d'exécution du Programme. Par conséquent, l'exécution du Programme doit être confirmée par toutes les organisations concernées du pays bénéficiaires par la signature du Procès-verbal des discussions.

2) Sélection de consultants

En vue de la bonne exécution de l'Étude, la JICA effectue une sélection parmi les consultants enregistrés auprès de la JICA après avoir procédé à un examen des propositions soumises par ces derniers. Le consultant sélectionné procède à l'étude du concept de sommaire afin d'assurer une cohérence technique entre l'Étude et le plan détaillé.

3. Exécution de l'AFEC après de l'E/N

1) L'E/N et l'A/D

L'AEFC est mis à disposition conformément aux notes échangées par les deux gouvernements concernés, dans lesquelles les objectifs du programme, la période d'exécution, les conditions et le montant du Don, etc., sont confirmés. La conclusion de l'A/D entre la JICA et le Bénéficiaire sera suivie pour définir le procédure nécessaire pour mettre en œuvre le programme tel que les conditions de paiement, les responsabilités du Bénéficiaire et les conditions d'approvisionnement.

2) Procédures détaillées

Les procédures détaillées sur l'approvisionnement de produits et de services dans le cadre de l'AFEC sera convenues entre le Bénéficiaire et la JICA au moment de la signature de l'E/N et l'A/D.

Les points essentiels à convenir sont décrits comme suit:

a) La JICA est en mesure d'accélérer la bonne exécution du Programme.
b) Les produits et services doivent être achetés et fournis conformément aux " Directives de l'Approvisionnement pour l'AFEC de la JICA (Type I–E) (ci-après dénommées «les Directives de l'Approvisionnement»).
c) Le Bénéficiaire doit conclure un contrat de travail avec l'agent.
d) L'agent est le représentant agissant au nom du Bénéficiaire concernant les transferts de fonds à l'Agent.

3) Points focaux des «Directives de l'Approvisionnement »

a) L'Agent

L'Agent est l'organisation qui fournit des services d'approvisionnement de produits et de services pour le compte du Bénéficiaire en fonction de l'agent avec l'accord du Bénéficiaire. L'Agent est recommandé au Bénéficiaire par le GDJ et est convenu entre les deux gouvernements dans les Modalités d'Application (ci-après dénommé « le M/A »).

b) L'Accord d'Agent

Le Bénéficiaire doit conclure un accord de l'agent, dans un délai de deux mois après la date d'entrée en vigueur de l'E/N et l'A/D, conformément au M/A. L'étendue des services de l'Agent doit être clairement spécifiée dans l'accord d'agent.

c) Approbation de l'Accord d'Agent

L'accord d'agent, qui est établi par les deux documents identiques, sera soumis à la JICA par le Bénéficiaire à travers l'Agent. La JICA vérifie si l'Accord d'Agent est conclu en conformité avec l'A/D et les Directives d'Approvisionnement, et l'approuve.

L'accord d'Agent conclu entre le Bénéficiaire et l'Agent prend effet après l'approbation par la JICA sous forme écrite.

d) Méthodes de paiement

L'accord d'agent doit stipuler que «le Bénéficiaire nommera JICS comme représentant agissant au nom du Bénéficiaire concernant tous les transferts des fonds au Compte d'Approvisionnement conformément à l'E/N et à l'A/D ».

L'accord d'agent doit indiquer clairement que le paiement à l'agent doit être faite en yen japonais à partir de l'avance et que le paiement final à l'agent doit être effectuée lorsque le montant restant est inférieur à trois pour cent (3%) du Don et ses intérêts courus.

e) Produits et services éligibles pour l'approvisionnement

Les produits et services qui seront achetés doivent être choisis parmi ceux définis dans l'A/D.

f) Firmes

En principe, une firme de toute nationalité peut être contractée si la firme satisfait aux conditions énoncées dans le dossier d'appel d'offre.

La firme, avec l'approbation de la JICA, peut être des nationaux japonais et les produits qui seront achetés peuvent être des produits fabriqués au Japon ou produites ou fabriquées par le fabricants japonais et / ou son (leur) affilié(s) dans quelque pays.

g) Experts d'assistance technique

L'/les expert(s) pouvant être envoyé(s) pour mettre en œuvre l'assistance technique. L'/les expert(s) peut/peuvent être recommandé(s) par la JICA lorsque la cohérence conceptuelle de l'Étude est exigé. En principe, l'/les expert(s) est/sont préférable(s) à un/des national/nationaux japonais, si approprié.

h) Méthode d'approvisionnement

Dans l'exécution d'approvisionnement, il faut prêter une attention suffisante afin qu'il n'y ait pas d'injustice parmi les soumissionnaires qui sont éligibles pour l'achat de produits et de services.

À cette fin, on applique l'appel d'offres, en principe.

i) Dossier d'appel d'offres

Le dossier d'appel d'offres doit contenir toutes les informations nécessaires pour permettre aux soumissionnaires de préparer des offres valables pour les produits et services dans l'AFEC.

Les droits et obligations du Bénéficiaire, l'Agent et les fournisseurs des produits et services doivent être stipulés dans le dossier d'appel d'offres qui sera établi par l'Agent. En outre, il

faut élaborer le dossier d'appel d'offres en consultation avec le Bénéficiaire.

j) Examen de préqualification des soumissionnaires

L'Agent peut effectuer une préqualification des soumissionnaires avant l'appel l'offres afin que l'invitation ne soit faite qu'aux soumissionnaires éligibles. Il doit effectuer la préqualification seulement en ce qui concerne la question de savoir si les soumissionnaires potentiels ont la capacité de réaliser les contrats concernés sans faute ou non. Dans ce cas, les points suivants devraient être pris en considération:

(1) l'expérience et le rendement passé des contrats de même nature;
(2) la base financière ou la crédibilité financière;
(3) l'existence de bureaux, etc. à préciser dans les dossier d'appel d'offres.

k) Évaluation des offres

L'évaluation des offres devrait être mis en œuvre sur la base des conditions stipulées dans le dossier d'appel d'offres.

Ces offres substantiellement conformant aux spécifications techniques, et sont sensibles à d'autres dispositions du dossier d'appel d'offres, doivent être jugés, en principe, sur la base de ces prix présentés. Et le soumissionnaire qui propose le prix le plus bas doit être désigné comme adjudicataire.

L'Agent rédigera un rapport détaillé d'évaluation des offres, en clarifiant les raisons de la réussite de l'offre et de la récusation. Il le remet au Bénéficiaire pour obtenir la confirmation avant de conclure le contrat avec l'adjudicataire.

L'Agent doit fournir le rapport détaillé d'évaluation des offres aussi à la JICA, en donnant les raisons de l'acceptation ou le rejet des offres.

l) Fournissement additionnel

S'il existe un fond additionnel après l'appel d'offres concurrentiels et/ou sélectifs et/ou la négociation directe d'un contrat, et que le Bénéficiaire désire un fournissement additionnel, il est permis à l'Agent d'effectuer un fournissement additionnel, à la suite des points mentionnés ci-dessous:

(1) Fournissement des mêmes produits et services

Lorsque les produits et services à fournir sont identiques à l'appel d'offres initial et qu'un appel d'offres à la concurrence est jugée défavorable, le fournissement additionnel peut être mis en œuvre par un contrat direct avec l'adjudicataire de l'appel d'offres initial.

(2) Autres fournissements

Lorsque les produits et services autres que ceux mentionnés au (1) ci-dessus doivent être obtenus, les fournissements devront être mis en œuvre par le biais d'un appel d'offre à la concurrence. Dans ce cas, les produits et services pour fournissement

additionnel doit être choisi parmi ceux qui sont conformes à l'A/D.

m) Conclusion des contrats

Dans le but de fournir des produits et des services en conformité avec l'A/D, l'Agent doit conclure des contrats avec des firmes sélectionnées par l'appel d'offres ou d'autres méthodes.

n) Modalités de paiement

Le contrat doit indiquer clairement les modalités de paiement. L'Agent doit effectuer le paiement des "Avances", en échange de la présentation des documents nécessaires de la firme sur la base des conditions stipulées dans le contrat, après que les obligations de la firme ont été remplies. Lorsque les services sont l'objet de fournissement, l'Agent peut payer certaine partie du montant du contrat à l'avance aux firmes à condition que ces firmes lui présentent une valeur de garantie correspondant au montant de l'avance.

4) Obligations pour le gouvernement du pays bénéficiaire

Dans la mise en œuvre du Projet, le gouvernement du pays bénéficiaire prendra les mesures nécessaires pour :

a) acquérir une/des parcelle(s) de terrain nécessaire(s) pour la mise en œuvre du Programme et l'/les aménager;
b) fournir les installations hors du terrain mentionné à (a) ci-dessus telles que les systèmes d'alimentation en eau, en électricité, et d'écoulement des eaux ainsi que d'autres installations auxiliaires et nécessaires pour la mise en œuvre du Projet;
c) assurer les établissements avant le fournissement en cas d'installation de l'équipement;
d) assurer le déchargement et le dédouanement rapides aux ports de débarquement du Bénéficiaire et faciliter leur transport intérieur et le dédouanement rapide des produits;
e) assurer que des droits de douane, des taxes intérieures et d'autres charges fiscales qui pourraient être imposés au pays bénéficiaire à l'égard de l'achat des produits et services, ainsi que l'emploi de l'Agent seront exonérés/supportés par l'autorité désignée par le gouvernement du pays bénéficiaire sans utiliser le Don et son intérêt couru;
f) accorder aux nationaux japonais et/ou nationaux des pays-tiers, y compris les nationaux employés par l'Agent, dont les services pourraient être nécessaires pour la fourniture des Composants, les facilités nécessaires pour leurs entrées et séjours au pays bénéficiaire, afin qu'ils puissent effectuer leur travail (le terme «les nationaux» dans l'Accord signifie les personnes physiques japonaises ou les personnes morales japonaises contrôlées par les personnes physiques japonaises en cas de nationaux japonais, et les personnes physiques ou morales des pays-tiers en cas de nationaux des pays-tiers.);
g) assurer que les établissements/les établissements et les composantes seront entretenus et utilisés d'une manière convenable et efficace pour la mise en oeuvre du Projet;

h) supporter tous les frais nécessaires pour la mise en œuvre du Projet, à part les frais qui sont couverts par le Don et son intérêt couru et;

i) tenir dûment compte des questions environnementales et sociales dans la mise en œuvre du Projet.

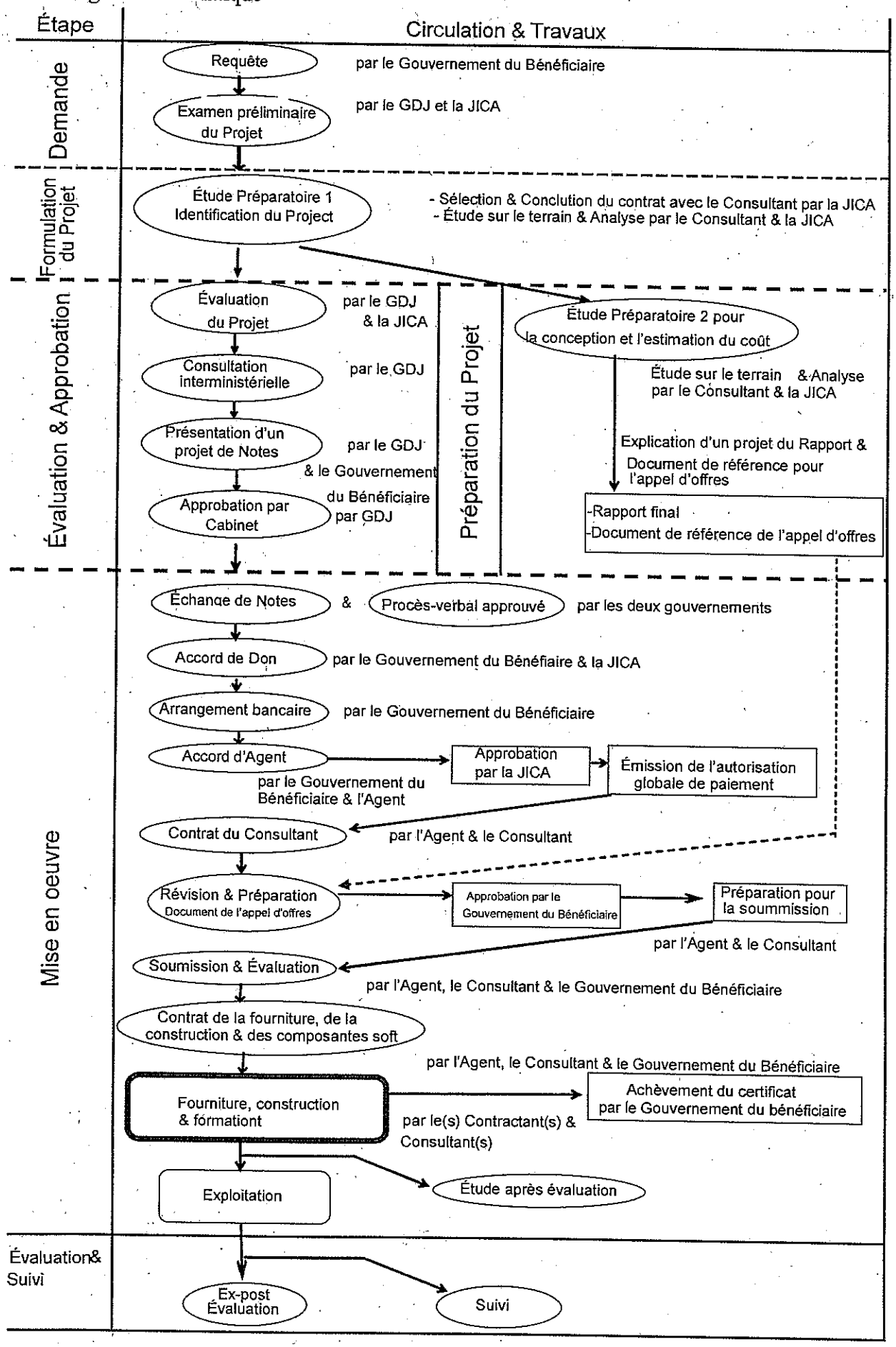
5) Utilisation appropriée

Il exige au Bénéficiaire d'exploiter et maintenir les installations construites et les équipements achetés dans le cadre du Don adéquatement et efficacement, d'assigner le personnel nécessaire pour cette opération et la maintenance et de supporter tous les frais autres que ceux couverts par le Don.

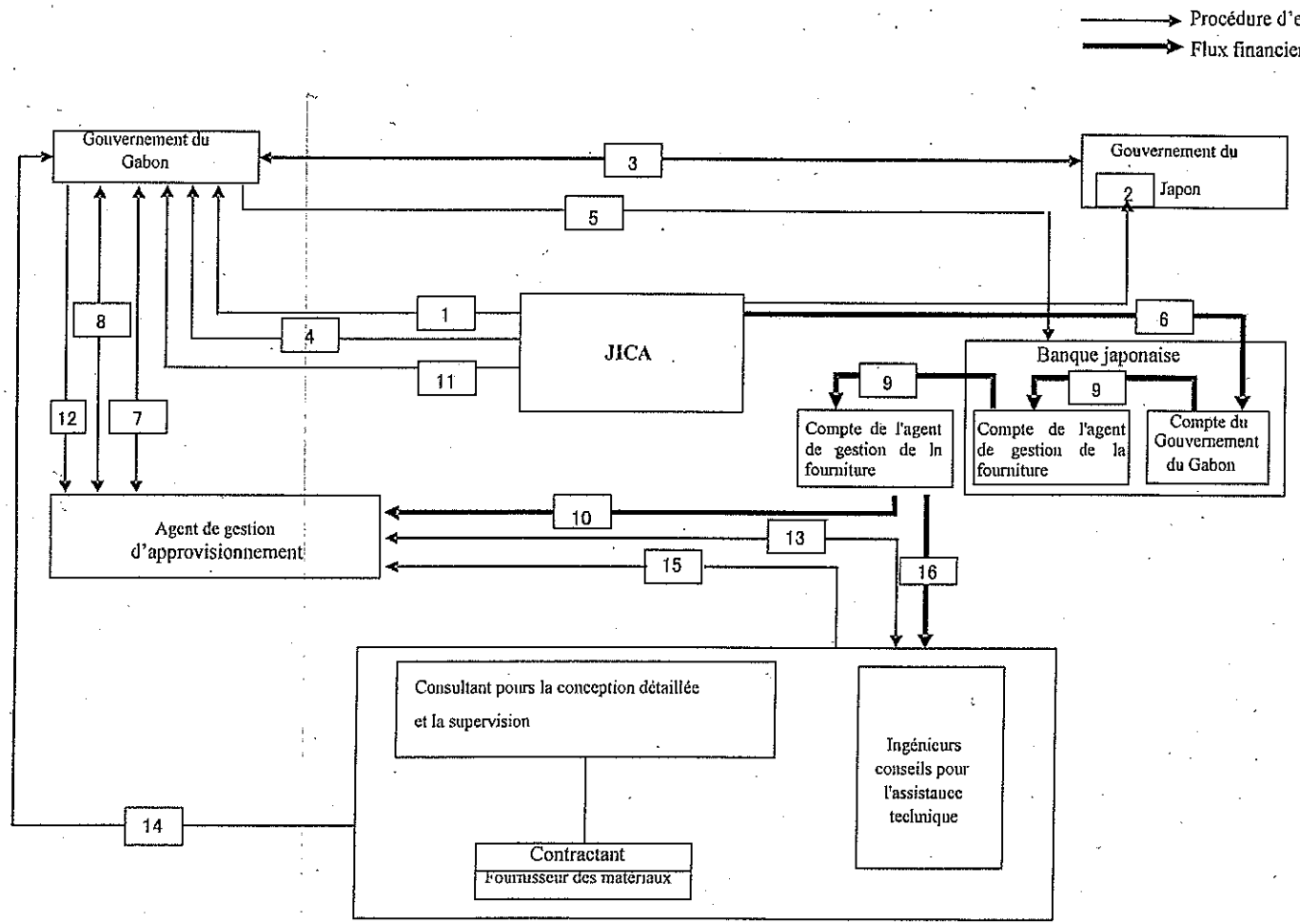
6) Réexportation

Le produits achetés sous le Don ne seront ni exportés ni réexportés du pays bénéficiaire.

Circulation générale du Programme d'Aide Financière Non Remboursable pour l'Environnement et le Changement Climatique



Circulation de fonds pour la mise en œuvre du Projet



1 Etude préparatoire/Matériaux pour la conception générale

2 Approbation du Cabinet

3 Signature de l'Echange de Notes (E/N)

4 Signature de l'Accord de Don (G/A)

5 Arrangement bancaire

6 Paiement du fonds du Gouvernement du Japon

7 Signature de l'Accord d'Agent (A/A)

8 Décision des composants du projet

9 Transferts de fonds (Avances)

10 Paiement de rémunération de l'Agent

11 Recommandation de consultant pours la conception détaillée et la supervision (JICA → Gouvernement du Gabon)

12 Recommandation de consultant pours la conception détaillée et la supervision (Gouvernement du Gabon → Agent d'approvisionnement)

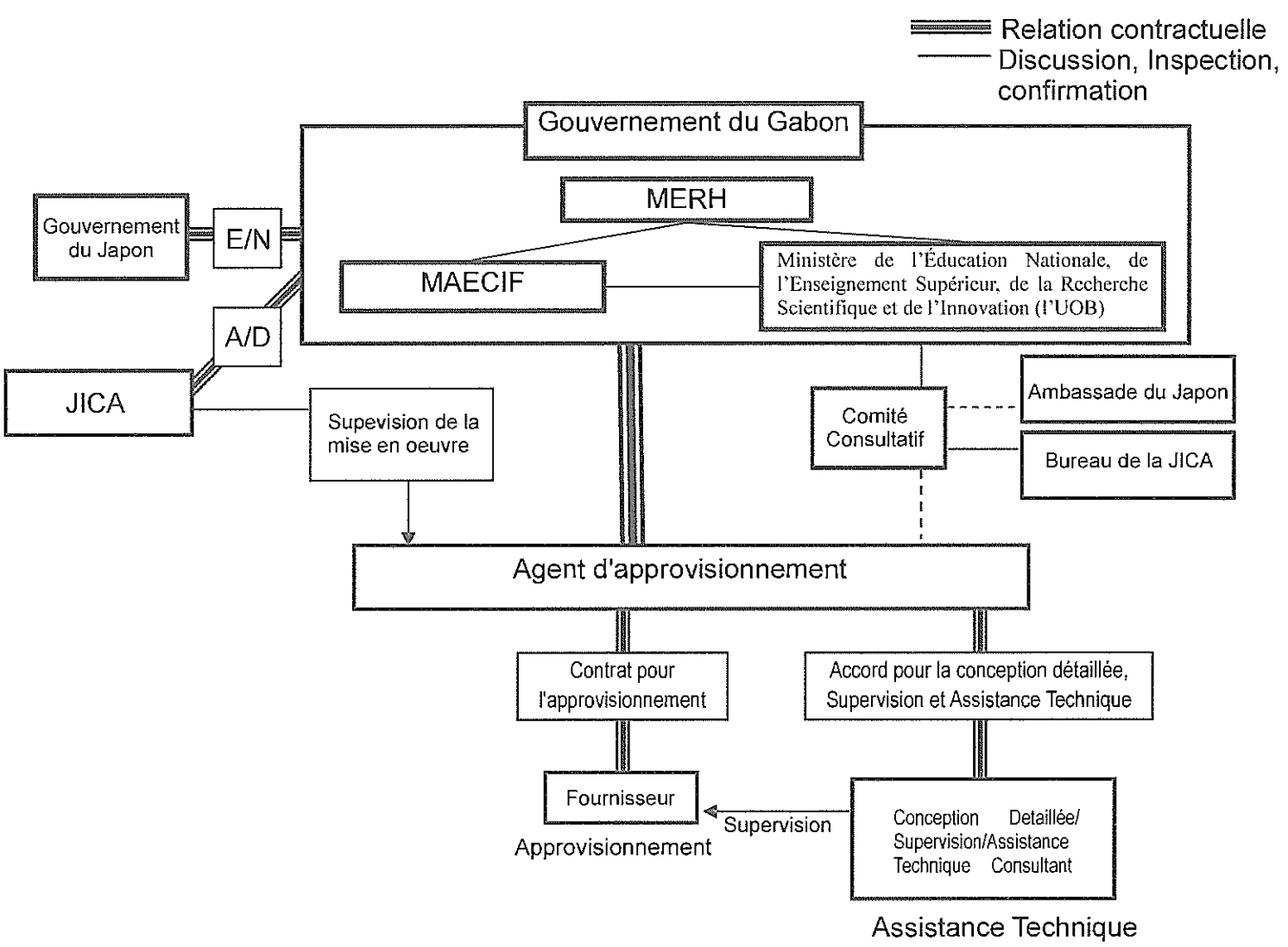
13 Conclusion du Contrat

14 Construction, fourniture, et assistance technique

15 Demande de paiement

16 Paiement

SYSTÈME DE LA MISE EN OEUVRE DU PROJET



Mesures principales à prendre par chaque gouvernement

	Eléments	à couvrir par le Don	à couvrir par la partie bénéficiaire
1	Obtenir une superficie de terrain suffisante		•
2	Défrichage, mise à niveau et récupération du terrain si nécessaire		•
3	Construction de portails et des clôtures autour du terrain		•
4	Construction de parking		•
5	Construction de la route		
	1) A l'intérieur du site	•	
	2) A l'extérieur du site		•
6	Construction de bâtiment	•	
7	Fournir les installations pour la distribution d'électricité, l'eau courante, l'égout et les autres installations accessoires :		
	1) Electricité		
	a. La ligne de distribution jusqu'au site		•
	b. Le câblage de branchement et le câblage interne sur le site	•	
	c. Le disjoncteur du circuit principal et le transformateur	•	
	2) Alimentation en eau		
	a. Conduite principale d'eau courante urbaine jusqu'au site		•
	b. Système d'alimentation sur le site (réservoir de réception et château d'eau)	•	
	3) Drainage		
	a. Conduite principale urbaine d'égout(pour évacuer l'eau de pluie, les eaux d'égout etc. du site)		•
	b. Système d'égout sur le site (pour les eaux d'égout, les déchets ordinaires, l'eau de pluie etc.)	•	
	4) Alimentation en gaz		
	a. Conduite principale urbaine de gaz jusqu'au site	Néant	Néant
	b. Système d'alimentation en gaz sur le site	Néant	Néant
	5) Téléphone		
	a. Ligne téléphonique de jonction jusqu'au répartiteur d'entrée (LTJJRE) du bâtiment		•
	b. LTJJRE et extension après le répartiteur	•	
	6) Mobilier et équipement		
	a. Mobilier ordinaire		•
	b. Equipements du projet	•	
8	Prise en charge des commissions suivantes de la banque japonaise pour les services bancaires basés sur les arrangements bancaires :		
	1) Paiement des commissions bancaires		•

	Eléments	à couvrir par le Don	à couvrir par la partie bénéficiaire
	2) Commission de paiement		•
9	Déchargement et dédouanement au port de débarquement du pays bénéficiaire		
	1) Transport vers le pays bénéficiaire par mer (air) de produits	•	
	2) Exonération d'impôt et dédouanement des produits au port de débarquement		•
	3) Transport à l'intérieur du pays entre le port de débarquement et le site	•	•
10	Accorder à toutes les personnes concernées dont les services pourraient être requis en relation avec la fourniture des produits et les services sous le contrat, toute l'aide nécessaire pour assurer leur arrivée dans le pays bénéficiaire et y permettre leur séjour afin qu'ils puissent exécuter lesdits services.		•
11	Exonération de droits de douane, taxes intérieures et ou autres levées fiscales imposées dans le pays bénéficiaire au nom des parties concernées à l'égard de la fourniture des produits et les services sous le contrat.		•
12	Exploitation et maintenance correcte et efficace des installations construites et des équipements fournis dans le cadre de Don.		•
13	Prise en charge de toutes dépenses, autres que celles couvertes par le Don, nécessaires à la construction des installations, au transport et à la mise en place des équipements.		•

Attributions du Comité

1. confirmer un calendrier de la mise en oeuvre du Projet/ Programme afin d'utiliser le Don et son intérêt couru sans retard et de façon efficace;

2. discuter sur les modifications du Projet / Programme, y compris les modifications de plan des Etablissements;

3. échanger des vues sur la répartition du Don et son intérêt couru ainsi que sur les utilisateurs finaux potentiels;

4. identifier des problèmes qui pourraient retarder l'utilisation du Don et son intérêt couru et chercher les solutions à de tels problèmes;

5. échanger des vues sur la publicité concernant l'utilisation du Don et son intérêt couru et;

6. discuter sur toutes autres questions qui pourraient surgir de ou en relation avec l'Accord.

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

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. Consequently, a new scheme of grant aid, "Program Grant Aid for Environment and Climate Change ", was also created by GoJ as a component of this financial mechanism. According to the initiative of Cool Earth Partnership, the Japan International Cooperation Agency (hereinafter referred to as “JICA”), in consultation with GoJ, decided to conduct a Preparatory Survey (hereinafter referred to as “the Survey”) on the Project for Clean Energy Promotion Using Photovoltaic System in Gabon (hereinafter referred to as "the Project").

JICA sent to Gabon the Preparatory Survey Team (hereinafter referred to as "the Team”), headed by Mr. Yasumichi ARAKI, Advisor, Grant Aid Project Management Division 1, Financing Facilitation and Procurement Supervision Department, JICA.

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

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

Libreville, December 8, 2009

Yasumichi ARAKI
Leader
Preparatory Survey Team
Japan International Cooperation Agency
JAPAN

Jeannot KALIMA
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Ministry of the Energy and the Hydraulic Resources
GABONESE REPUBLIC

Paul BIE EYENE
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Secretary General
Ministry of Foreign Affairs, International Cooperation and French speaking countries
GABONESE REPUBLIC

Jean-Michel ELLA ESSONE
Secretary General
Ministry of the National education, the Higher education, the Scientific Research and the innovation
GABONESE REPUBLIC

ATTACHMENT

1. Current Situation

The installed electric power in Republic Gabonese is about 374 megawatts (MW) and electricity penetration stands at 80%, one of the highest rates in Africa. Around half of electricity is produced by hydroelectric plants. Power shortages, however, are seen during the dry season. Consequently, The Ministry of the Energy and the Hydraulic Resources (hereinafter referred to as "MEHR") has hopes to pursue the development of renewable energy systems in order to realize "Green Gabon" plan, which is the Gabonese policy of promoting clean energy and protecting forests in Gabon advocated by the government.

From this perspective, both sides confirmed that the necessity of the Project, which introduces the photovoltaic (PV) generation system(s) connected to the national power grid, and agreed to proceed with the study of the Project.

2. Objective of the Project

The objective of the Project is to promote clean energy utilization and achieve greenhouse gasses emissions reduction by installing the PV system to be connected to the national grid.

3. Responsible Organization and Implementing Agency

3-1 The responsible organization and the implementing agency is MEHR. The organization chart of MEHR is under elaborated. It will be submitted to the JICA Gabon office as soon as it will be finalized.

3-2 The project will be realized in two sites, the Ministry of Foreign Affairs, International Cooperation and French speaking countries (hereinafter referred to as "MOFA") and the Ministry of the National Education, the Higher Education, the Scientific Research and the Innovation (Omar Bongo University (hereinafter referred to as "OBU")). The organization charts of the implementing organizations are shown in **Annex-1** and **Annex-2**.

4. Items Requested by the Government of Gabon

4-1 The Gabon side designated two sites, MOFA and OBU as shown in **Annex-3**, as candidate sites for installation of the PV system based on the results of the 1st phase of Preparatory Survey. The Team recommended the Gabon side to set up the priority order of the requested sites. However the Gabon side explained that requested sites were put on the high and same level priority.

Name of sites	PV Capacity
MOFA	70kW
OBU	120kW

Both sides confirmed to continue the 2nd phase of Preparatory Survey on the two sites. However, the Gabon side understood that one of the sites would be eliminated from the Project, in case of limitation of the budget and technical difficulty.

4-2 The Gabon side explained OBU had a project to expand existing library building due to

increasing students, which would reduce the space requested for installing panels. Both sides agreed that the final location to install PV system was determined as Annex-3 through field survey.

4-3 The Team will assess the appropriateness of the request and report the findings to JICA Headquarters and the GoJ.

4-4 The Gabon side has understood that the final component and the design of the Project shall be determined at this Preparatory Survey for design.

4-5 The Gabon side explained that there is not any similar project executed by other donors or themselves.

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

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

6. Schedule of the Study

6-1 The Team will proceed to further survey in Gabon until December 26 as the 2nd phase Preparatory Survey.

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

7. Other Relevant Issues

7-1 Land for Installation of the PV system

Both sides confirmed availability of the land spaces requested for the project in MOFA and OBU. However both sides also confirmed the necessity of the site clearance of OBU due to slope landform. The Gabon side confirmed that MEHR should take responsible for clearance of the mentioned sites.

7-2 Procurement of Equipment

The Team explained that, in accordance with the policy of GoJ, products of Japan shall be procured for major equipment in the Project. The Gabon side understood/agreed.

7-3 Coordination with Related Organizations

MEHR shall be the focal point for the Project and responsible for the coordination with related organizations, such as MOFA, OBU and other related organizations. The Gabon side agreed to establish a consultative committee in order to coordinate execution of the project with the Japanese side, in particular the EoJ, the JICA office and the procurement agent. Terms of References of the Consultative Committee is referred to **Annex-9**.

7-4 Application of the Related Laws and Regulations

Both sides confirmed that MEHR should take responsibility for the connection of PV system to the national power grid.

7-5 Environmental and Social Considerations

Concerning the environmental and social considerations, the Gabonese side explained that the work planning of the site for the setting up of facilities of the PV system will be achieved in consultation with the Ministry in charge of the environment. The Team handed the JICA Environmental and Social Considerations Guideline (hereinafter referred to as the "JICA Guideline") to the Gabon side. The Gabon side took the JICA Guideline into consideration, and promised to follow its necessary procedures.

7-6 Customs and Tax exemption

Gabon side shall be responsible for the exemption of all customs, tax, levies and duties incurred in Gabon for implementation of the Project.

7-7 Training

Both sides confirmed the necessity of training for technicians in charge of maintenance of equipments, in order to ensure continuous operation of PV system.

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

7-9 The Gabon side shall promise to provide sufficient numbers of technicians to the Team during the period of their studies in Gabon.

<List of Annex>

Annex-1 Organization Chart of Energy
Annex-2 Organization Chart of Ministry of Foreign Affairs and Omar Bongo University
Annex-3 Candidate site of the Project
Annex-4 Program Grant Aid for Environment and Climate Change
Annex-5 General Flow of Program Grant Aid for Environment and Climate Change
Annex-6 Flow of Funds for Project Implementation
Annex-7 Project Implementation System
Annex-8 Major Undertakings to be taken by Each Government
Annex-9 Terms of References of the Consultative Committee

Annex-3

Candidate site of the Project

1. MOFA
Location: Libreville

Photovoltaic Capacity of PV modules is 70kWp.

2. OBU
Location: Libreville

Photovoltaic capacity of PV modules is 120kW

Annex- 4

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

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

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

1. Procedures for GAEC

GAEC is executed through the following procedures.

Preparatory Survey 1	Preparatory Survey 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 reffered to as the "G/A")	Agreement concluded between JICA and the Recipient
Preparatory Survey 2	Preparatory Survey for design conducted by JICA
Implementation	Procurement through the Procurement Agency by the Recipient

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

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

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

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

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

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

2 Preparatory Survey

1) Contents of the Survey

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

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

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

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

2) Selection of consulting firms

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

3. Implementation of GAEC after the E/N

1) Exchange of Notes (E/N)

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

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

2) Details of Procedures

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

Essential points to be agreed are outlined as follows:

a) JICA will supervise the implementation of the Project.
b) Products and services will be procured and provided in accordance with JICA's "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change."
c) The Recipient will conclude a contract with the Agent.
d) The Agent is the representative acting in the name of the Recipient concerning all transfers of funds to the Agent.

3) Focal points of "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change"

a) The Agent

The Agent is the organization, which provides procurement of products and services on behalf of the Recipient according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the A/M.

b) Agent Agreement

The Recipient will conclude the Agent Agreement, in principle, within two months after the signing of the G/A, in accordance with the A/M. The scope of the Agent's services will be clearly specified in the Agent Agreement.

c) Approval of the Agent Agreement

The Agent Agreement is prepared as two identical documents and the copy of the Agent Agreement will be submitted to JICA by the Recipient through the Agent. JICA confirms whether the Agent Agreement is concluded in conformity with the E/N, A/M, and G/A and the Procurement Guidelines for the Program Grant Aid for Environment and Climate Change then approves the Agent Agreement.

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

d) Payment Methods

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

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

e) Products and Services Eligible for Procurement

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

f) Selection of firms

In principle, firms of any nationality could be contracted as long as the firms satisfy the conditions specified in the tender documents.

The same applies for any individual consultants who will be involved in the Project and provide services necessary for the training and guidance related to the Project.

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

g) Method of Procurement

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

h) Tender Documents

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

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

i) Pre-qualification Examination of Tenderers

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

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

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

j) Tender Evaluation

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

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

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

k) Additional procurement

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

(1) Procurement of same products and services

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

(2) Other procurements

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

l) Conclusion of the Contracts

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

m) Terms of Payment

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

4) Undertakings required by the Government of the Recipient Country

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

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

5) "Proper use of funds"

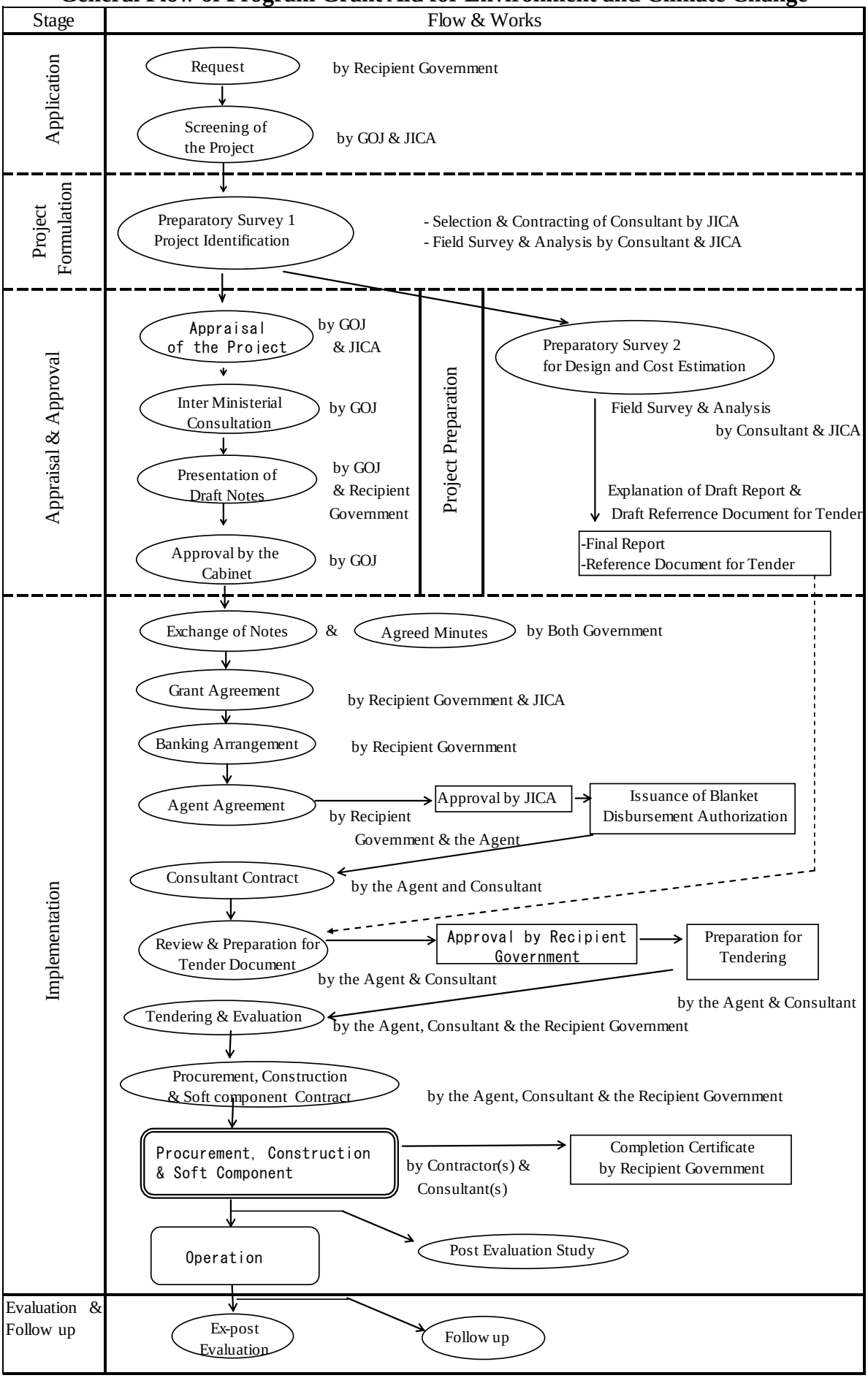
The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

6) "Export and Re-export" of products

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

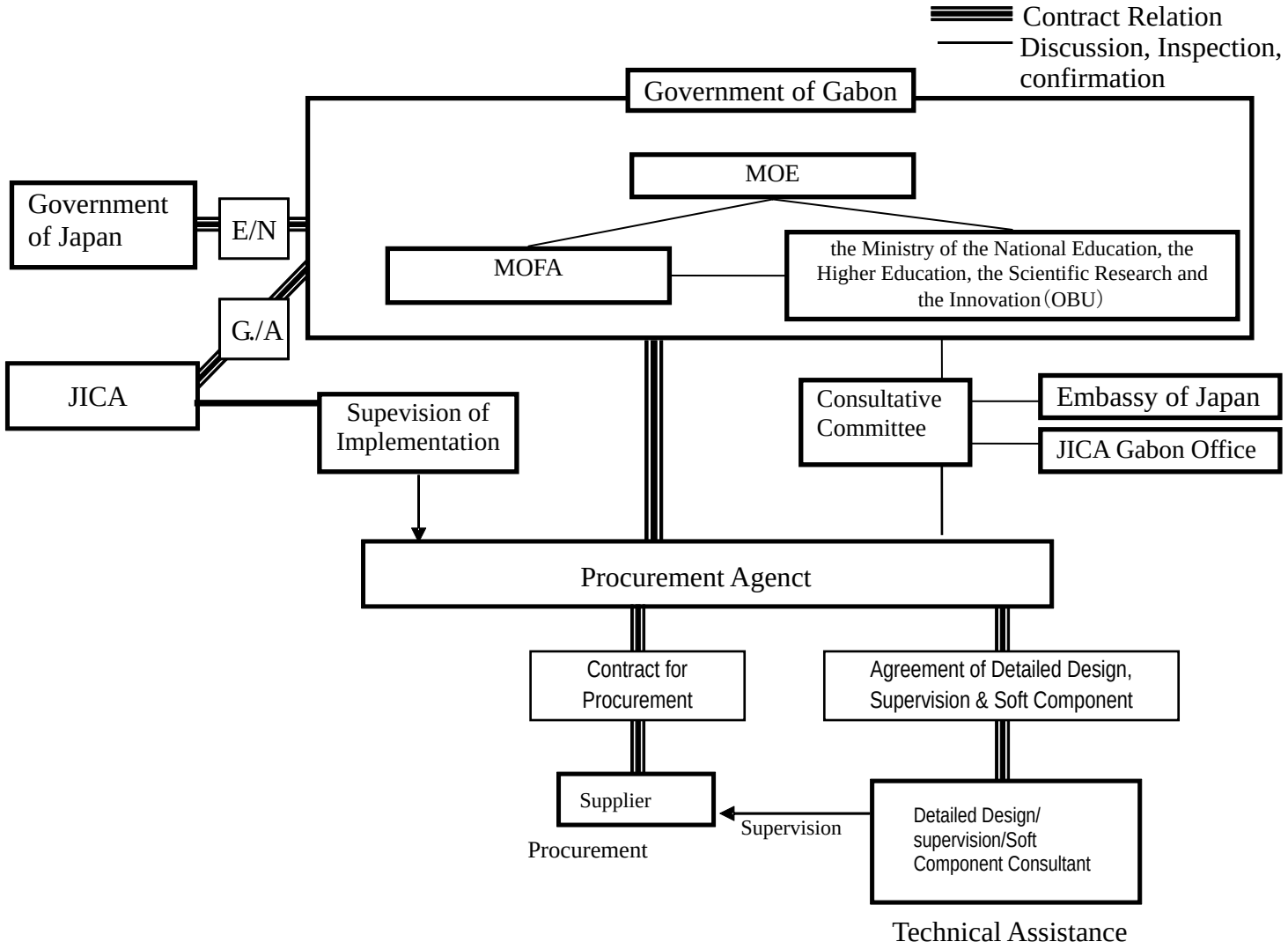
Annex-5

General Flow of Program Grant Aid for Environment and Climate Change



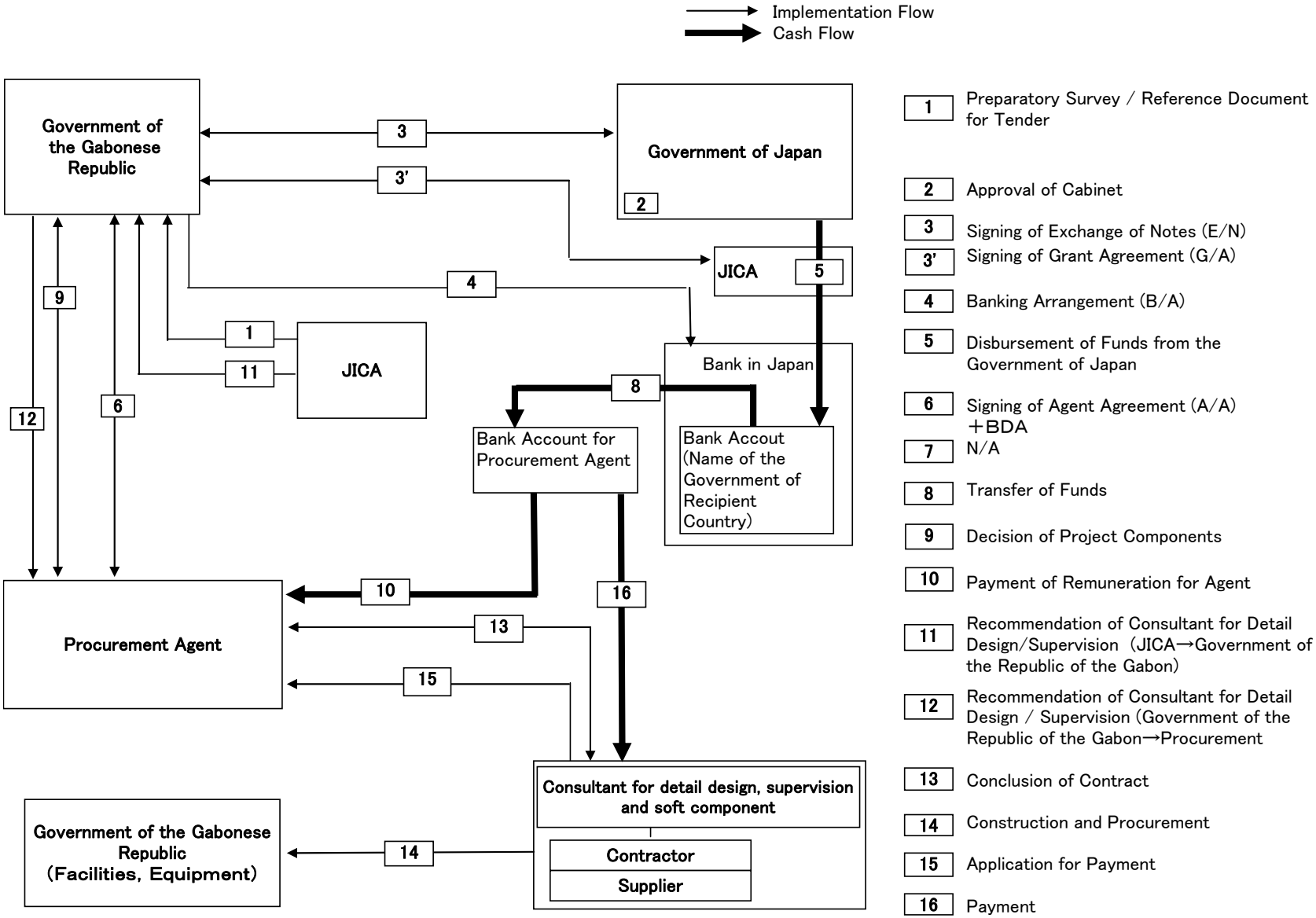
Annex-6

Project Implementation System



Flow of Funds for Project Implementation

Annex-7



Annex-8

Major undertakings to be taken by each Government

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

Annex- 9

Terms of Reference of the Consultative Committee (Provisional)

1. To confirm an implementation schedule of the Programme for the speedy and effective utilization of the Grant and its accrued interest.

2. To discuss the modifications of the Programme, 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.

Procès-verbal des discussions
sur l'Etude Préparatoire
pour le Projet de Promotion de l'Energie Propre en utilisant le Système Photovoltaïque
en République Gabonaise
(Explication sur le Projet de Rapport Final)

En septembre et décembre 2009, l'Agence Japonaise de Coopération Internationale (désignée ci-dessous « JICA ») a envoyé les missions d'étude préparatoire pour le Projet de Promotion de l'Energie Propre en utilisant le Système Photovoltaïque (désigné ci-dessous « le Projet ») en République Gabonaise, et à la suite de discussions, d'études sur le terrain et d'analyse technique de résultats des études au Japon, la JICA a préparé un Projet de Rapport Final de conception sommaire.

En vue d'expliquer les composantes du Projet de Rapport Final aux officiels concernés du Gouvernement du Gabon et de s'entretenir avec eux, la JICA a envoyé une Mission d'Etude Préparatoire pour l'explication sur le Projet de Rapport Final (désignée ci-dessous « la Mission »), dirigée par M. Toshinobu KATO, Directeur Général Adjoint du Département de Développement Industriel, JICA, du 19 au 26 mai 2010.

Au terme des discussions, les deux parties ont confirmé les principaux éléments mentionnés dans le document joint.

Fait à Libreville, le 25 mai 2010

Toshinobu KATO
Chef de Mission d'Etude Préparatoire
Agence Japonaise de Coopération Internationale
JAPON

Jeannot KALIMA
Secrétaire Général adjoint
du Ministère de l'Energie
et des Ressources Hydrauliques
REPUBLIQUE GABONAISE

Paul BIE EYENE
Ambassadeur du Gabon
Secrétaire Général
du Ministère des Affaires Etrangères,
de la Coopération Internationale
et de la Francophonie
REPUBLIQUE GABONAISE

Jean-Michel ELLA ESSONE
Secrétaire Général
du Ministère de l'Education Nationale,
de l'Enseignement Supérieur,
de la Recherche Scientifique
et de l'Innovation
REPUBLIQUE GABONAISE

DOCUMENT JOINT

1. Composantes du Projet de Rapport Final

La partie gabonaise a convenu et a accepté en principe les composantes du Projet de Rapport Final expliquées par la Mission.

2. Programme d'Aide Financière Non-Remboursable pour l'Environnement et le Changement Climatique du Gouvernement du Japon

La partie gabonaise a compris les composantes du Procès-verbal des discussions signé par les deux parties le 8 décembre 2009 (désigné ci-dessous « le P/V précédent ») et prendra les mesures nécessaires qui ont été confirmées dans le P/V précédent afin que le Projet soit exécuté de manière régulière, suivant le processus du Programme d'Aide Financière Non-Remboursable pour l'Environnement et le Changement Climatique du Gouvernement du Japon comme décrit en **Annexe 4, 5, 6, 7 et 8 du P/V précédent.**

3. Calendrier de l'Etude

La JICA terminera la rédaction du Rapport Final sur la base des éléments confirmés et l'enverra au Ministère de l'Energie et des Ressources Hydrauliques (désigné ci-dessous « MERH ») en août 2010.

4. Confirmation du progrès fait depuis le P/V précédent

4-1. Site du Projet et capacité des modules photovoltaïques

Les deux parties ont confirmé que les sites du Projet sont le Ministère des Affaires Etrangères, de la Coopération Internationale et de la Francophonie (désigné ci-dessous « MAECIF ») et le Ministère de l'Education Nationale, de l'Enseignement Supérieur, de la Recherche Scientifique et de l'Innovation (désigné ci-dessous « MENESRSI »), plus précisément à l'Université Omar Bongo (désignée ci-dessous « UOB »). La Mission a expliqué que les capacités de conception de modules photovoltaïques à fournir et à installer au MAECIF et à l'UOB sont prévues à 70kWc et 130kWc respectivement, sur la base du résultat de la conception sommaire et du coût estimatif.

4-2. Application des lois et régulations concernées

En se basant sur le P/V précédent, les deux parties ont confirmé de nouveau que le MERH assumera la responsabilité pour le raccordement du système photovoltaïque au réseau national de distribution. Il a été également confirmé par les deux parties que le MERH achèvera les arrangements et les procédures nécessaires concernant les

autorisations pour l'installation et l'exploitation du système photovoltaïque à raccorder au réseau national avant octobre 2010.

5. Equipements à fournir

La Mission a expliqué que les équipements à fournir comme listés en Annexe-1, sont basés sur les résultats des études préparatoires exécutées en septembre et décembre 2009. Au terme des discussions, les deux parties ont confirmé que les principaux équipements tels que les modules photovoltaïques composés de cellules photovoltaïques et les onduleurs doivent être des produits japonais. Les produits de pays tiers pourront être acceptés pour les équipements restants faisant partie du Projet.

6. Assistance technique (Programmes de formation)

La Mission a expliqué que les éléments suivants sont inclus dans le cadre de l'assistance technique du Projet :

- Cours sur les connaissances de base de la production d'énergie photovoltaïque ;
- Formation sur la planification de construction/installation ;
- Formation pratique sur l'exploitation et la maintenance ;
- Formation sur le tas (assistance aux essais et inspections) ;
- Formation sur la planification du management de l'exploitation et de la maintenance ;
- Evaluation de l'organisation de l'exploitation et de la maintenance ;
- Préparation des matériels pour la sensibilisation du public à l'énergie propre ; et
- Atelier de travail.

7. Coût du Projet

La partie gabonaise a convenu que le coût du Projet ne doit pas dépasser le montant limite convenu dans l'Echange de Notes (désigné ci-dessous « E/N ») et l'Accord de Don (désigné ci-dessous « A/D »). Les deux parties ont également confirmé que le coût du Projet consiste en l'approvisionnement en équipements, au transport jusqu'aux sites du Projet, à la pose des installations, aux services de l'Agent d'Approvisionnement (désigné ci-dessous « Agent ») et du Consultant y compris l'assistance technique (programmes de formation) au niveau de l'exploitation et de la maintenance des équipements et de l'ensemble du système photovoltaïque.

La partie gabonaise a compris que le coût du Projet indiqué en Annexe-2 est estimatif. Il pourra faire l'objet de modification selon les résultats d'examen à travers la révision de l'étude de conception sommaire.

8. Calendrier du Projet

Les deux parties ont confirmé que le calendrier provisoire de la mise en œuvre du Projet enregistre un retard de deux mois par rapport à celui indiqué dans le Projet de Rapport Final.

9. Propriété et responsabilité vis-à-vis de l'exploitation et de la maintenance

La partie gabonaise a confirmé de nouveau que le MERH est le propriétaire des équipements pour les systèmes photovoltaïques à fournir par le Projet, et que le MAECIF et l'UOB sont les responsables de l'exploitation et de la maintenance desdits systèmes pour chaque site.

La partie gabonaise a confirmé le coût estimatif pour l'exploitation et la maintenance décrit dans le Projet de Rapport Final, et a convenu que le MAECIF et le MENESRSI en assumeront le coût. Le MAECIF et l'UOB désigneront le personnel nécessaire à l'exploitation et à la maintenance des systèmes photovoltaïques.

10. Le Comité Consultatif

La partie gabonaise convient que le MERH préside le Comité Consultatif (désigné ci-dessous « le Comité ») en vue de faciliter la consultation et le processus d'approvisionnement. Les attributions du Comité sont fixées dans l'Annexe 9 du P/V précédent.

Les membres du Comité sont les suivants :

(1) Représentant du MERH (président)
(2) Représentant du MAECIF
(3) Représentant du MENESRSI
(4) Représentant de l'UOB
(5) Représentant du Bureau de JICA

La réunion du Comité doit être organisée immédiatement après la signature du contrat entre l'Agent et le Consultant.

Les réunions ultérieures seront organisées à la demande soit de la partie gabonaise, soit de la partie japonaise. L'Agent pourrait donner des conseils aux deux parties sur la nécessité de la convocation du Comité.

11. Processus d'approvisionnement du Projet

Les deux parties ont confirmé que le processus d'approvisionnement sera sous la supervision de l'Agent. Les deux parties ont réaffirmé les rôles à jouer par l'Agent comme suit:

(1) L'Agent se chargera des processus d'approvisionnement nécessaires à la mise en œuvre du Projet selon l'Accord d'Agent en conformité avec les clauses de l'E/N, de l'A/D et d'autres lignes directrices concernées ;
(2) La JICA fournira le Projet de Rapport Final et le Rapport Final à l'Agent ; et
(3) L'Agent entamera l'approvisionnement sur la base du concept et de la conception

sommaire du Rapport Final.

La Mission a expliqué que si le montant de l'appel d'offres dépasse celui qui avait été convenu dans l'E/N et l'A/D, la quantité ou/et les élements d'équipements pourraient être réduits jusqu'à ce que le montant corresponde à celui convenu dans l'E/N et l'A/D.

La partie gabonaise a convenu qu'un réliquat du fond du Projet, après l'appel d'offres de l'équipement/services conçus dans le Rapport Final, sera disponible pour approvisionner l'équipement additionnel en concordance avec le concept du Rapport Final.

La partie gabonaise admet également que la décision d'addition ou de réduction des équipements à fournir sera faite après consultation des membres du Comité.

12. Tâches à assumer par le pays bénéficiaire

La Mission a demandé à la partie gabonaise, qui l'a accepté, d'assumer ces tâches mentionnées ci-dessous en plus des principaux éléments indiqués dans le P/V précédent.

(1) Acquisition du terrain/espace pour la mise en place du système photovoltaïque

Les propriétaires des terrains où seront installés les équipements et matériels mentionnés ci-dessous des systèmes photovoltaïques sont le MAECIF et l'UOB. Le MAECIF et l'UOB ont déjà convenu d'offrir leurs terrains pour le Projet. Aucune procédure n'est requise au Gabon concernant l'utilisation des terrains nécessaires pour le Projet.

1) Modules photovoltaïques
2) Câbles enfouis entre les équipements
3) Cabines de l'armoire d'onduleur
4) Parcs de stockage provisoire

(2) Préparation du Site

Le MERH est responsable pour le déblaiement des sites (abattage des arbres au MAECIF et enlèvement des mâts de drapeau à l'UOB) effectué par le MAECIF et l'UOB avant octobre 2010.

(3) Considérations environnementales et sociales

Les deux parties ont confirmé que le Ministère des Eaux et Forêts, de l'Environnement et du Développement Durable a convenu que le Projet ne demande aucune procédure concernant l'évaluation des impacts environnementaux.

(4) Injection de l'électricité sur le réseau depuis le système photovoltaïque

La partie japonaise a été informée que le MERH a adressé une lettre à la Société d'Electricité

et d'Eaux du Gabon (désigné ci-dessous « SEEG ») concernant la possibilité d'injecter l'électricité depuis le système photovoltaïque sur le réseau de la SEEG. La partie gabonaise décidera de l'injection ou non de l'électricité produite par le système photovoltaïque sur le réseau de la SEEG et en informer à la partie japonaise avant fin juin 2010. Si elle est acceptée, la partie gabonaise va présenter à la partie japonaise les conditions techniques du raccordement au réseau. Sur cette base, la partie japonaise doit examiner et réviser la conception du système photovoltaïque.

Au cas où l'injection de l'électricité sur le réseau serait acceptée, les modalités devront être discutées et convenues entre le MERH et la SEEG après concertation avec le MAECIF et l'UOB avant la mise en service des systèmes photovoltaïques. La partie japonaise pourrait assister la partie gabonaise dans l'établissement d'un règlement y relatif à travers l'assistance technique (Programmes de formation) au cours de la mise en œuvre du Projet.

(5) Autorisation de construction

Les deux parties ont confirmé que le MAECIF et l'UOB obtiendront les autorisations pour la construction/installation concernée au Projet avant octobre 2010, si nécessaire.

(6) Désignation des points focaux

1) Points focaux pour la gestion du Projet

La partie gabonaise a désigné les personnes suivantes comme points focaux pour la gestion du Projet et la coordination au sein de chaque organisme.

- MERH : M.Alex Minto'o Ebang
- MAECIF : SEM. Aimé Mfoula-Nghanguy
- UOB : Pr. Pierre Nzinzi

2) Points focaux pour l'assistance technique (Programmes de formation)

La partie gabonaise a convenu d'affecter les personnes nécessaires conformément au plan de l'exécution de l'assistance technique proposé par la Mission.

La partie gabonaise va communiquer les noms des responsables de formation des organismes suivants à la JICA lors de la première réunion du Comité.

- MERH
- MAECIF
- UOB
- SEEG
- Autres

D'autre personnel pourrait être affecté par chaque organisme selon la demande lors de

l'installation.

(7) Dédouanement et exonération des impôts

Le Gouvernement de la République Gabonaise prendra les mesures nécessaires pour assurer que des droits de douane, des taxes intérieures et d'autres charges fiscales qui pourraient être imposés en République Gabonaise à l'égard de l'achat des Composants ainsi que l'emploi de l'Agent seront supportés par l'autorité désignée par le Gouvernement de la République Gabonaise sans utiliser le Don et son intérêt couru.

13. Confidentialité du Projet

Les deux parties ont confirmé que toutes les informations liées à ce Projet ne devraient pas être communiquées à l'extérieur avant la conclusion de tous les contrats sur le Projet, car ce sont des documents confidentiels qui contiennent les informations relatives à l'appel d'offres.

Ces informations sont les suivantes :

a) Plans détaillés, spécifications et autres informations techniques des matériels et équipements ;
b) Coût estimatif ;
c) Projet de Rapport Final ; et
d) Rapport Final.

« Annexes »

Annexe-1. Liste des équipements

Annexe-2. Coût estimatif du Projet (Confidentiel)

Annexe-1

Liste des principaux équipements

pour le MAECIF

Equipement		Quantité
Système de production d'électricité photovoltaïque		1 système
1-1.	Modules photovoltaïques (en silicium cristallin)	70 kW
1-2.	Boîte de jonction	1 jeu
1-3.	Armoire d'onduleur	1 jeu
1-4.	Appareil d'observation météorologique	1 unité
1-5.	Armoire de jonction photovoltaïque	1 unité
1-6.	Châssis pour les modules photovoltaïques	1 jeu
1-7.	Divers matériels	1 jeu
1-8.	Pièces de rechange, consommables et outillages	1 jeu
1-9.	Matériels pour le câblage et la mise à la terre	1 jeu
1-10.	Clôture, portes et gravier	1 jeu

pour l'UOB

Equipement		Quantité
Système de production d'électricité photovoltaïque		1 système
1-1.	Modules photovoltaïques (en silicium cristallin)	130 kW
1-2.	Boîte de jonction	1 jeu
1-3.	Armoire d'onduleur	1 jeu
1-4.	Appareil d'observation météorologique	1 unité
1-5.	Armoire de jonction photovoltaïque	1 unité
1-6.	Châssis pour les modules photovoltaïques	1 jeu
1-7.	Divers matériels	1 jeu
1-8.	Pièces de rechange, consommables et outillages	1 jeu
1-9.	Matériels pour le câblage et la mise à la terre	1 jeu
1-10.	Clôture, portes et gravier	1 jeu

Annexe-2

Coût Estimatif du Projet (Confidentiel)

Ce coût est estimatif et sera examiné ultérieurement par le Gouvernement du Japon pour l'approbation du Don.

1. Coût pris en charge par la partie japonaise:

2. Coût pris en charge par la partie gabonaise: XAF 1 660 000

	Rubrique	Montant
1.	Déblaiement des Sites (enlèvement des mâts de drapeau à l'UOB, abattage des arbres au MAECIF)	XAF 1 660 000
2.	Total (1.)	XAF 1 660 000

3. Coût pris en charge par la partie gabonaise pour l'exploitation et la maintenance (chaque année)

(1) Frais de personnel	Environ XAF 1 314 000
(2) Consommables et pièces de rechange à court terme	Environ XAF 1 065 000
(2') Consommables et pièces de rechange à long terme	Environ XAF 3 389 000
(3) Total (à court terme)	Environ XAF 2 379 000
(3') Total (à long terme)	Environ XAF 4 703 000

Les équipements à fournir par le Projet pourront être exploités et entretenus par le personnel existant de l'établissement (MAECIF et UOB). Les services pour l'exploitation et la maintenance vont prendre un peu de temps consacré par le personnel tous les jours, ce qui est évalué en terme de monnaie.

Parfois les équipements demandent le remplacement des pièces et des consommables usés. A court terme, la plupart des pièces et des consommables nécessaires seront couverts par l'approvisionnement du Projet, seuls les articles mineurs et disponibles localement seront acquis par la partie gabonaise. Une fois usé l'approvisionnement du Projet, les articles nécessaires à acquérir par la partie gabonaise seront augmentés.

4. Conditions de l'estimation

(1) Période d'estimation: Novembre 2009

(2) Taux d'échange : USD 1,00 = JPY 93,97

XAF 1,00 = JPY 0,2065

(3) Autres: Cette estimation ci-dessus a été faite conformément aux régulations et aux lignes directrices du Don japonais.

Minutes of Discussions
on the Preparatory Survey
on the Project for Clean Energy Promoting Using Photovoltaic System
in the Gabonese Republic
(Explanation on Draft Final Report)

In September and December 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Teams on the Project for Clean Energy Promoting Using Photovoltaic System (hereinafter referred to as "the Project") in the Gabonese Republic (hereinafter referred to as "Gabon"), and through discussions, field surveys and technical examination of the results of the surveys in Japan, JICA prepared a Draft Final Report of the Outline Design.

In order to explain and to consult with the concerned officials of the Government of Gabon on the component of the Draft Final Report, JICA sent Gabon the Preparatory Survey Team for Draft Final Report Explanation (hereinafter referred to as "the Team"), which was headed by Mr. Toshinobu KATO, Deputy Director General, Industrial Development Department, JICA, from May 19th to 26th, 2010.

And as a result of discussion, both sides confirmed the main items described on the attached sheets.

Libreville, May 25, 2010

Toshinobu KATO
Leader
Preparatory Survey Team
Japan International Cooperation Agency
JAPAN

Jeannot KALIMA
Secretary General assistant
Ministry of the Energy and the Hydraulic Resources
GABONESE REPUBLIC

Paul BIE EYENE
Ambassador of Gabon
Secretary General
Ministry of Foreign Affairs, International Cooperation and French speaking countries
GABONESE REPUBLIC

Jean-Michel ELLA ESSONE
Secretary General
Ministry of the National Education, the Higher Education, the Scientific Research and the Innovation
GABONESE REPUBLIC

ATTACHMENT

1. Components of the Draft Final Report

The Gabon side agreed and accepted in principle the components of the Draft Final Report explained by the Team.

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

The Gabon side understood components of the Minutes of Discussion signed by both sides on 8th December, 2009 (hereinafter referred to as “the previous M/D”), and will take the necessary measures confirmed in 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-4, 5, 6, 7 and 8 of the previous M/D**.

3. Schedule of the Study

JICA will complete the final report based on the confirmed items and send it to the Ministry of the Energy and the Hydraulic Resources (hereinafter referred to as "MEHR”) in August 2010.

4. Confirmation of progress made for the previous M/D

4.1. Project site and capacity of PV module

Both sides confirmed that project sites is the Ministry of Foreign Affairs, International Cooperation and French speaking countries (hereinafter referred to as "MOFA”) and the Ministry of the National Education, the Higher Education, the Scientific Research and the Innovation (hereinafter referred to as “MNEHESRI”), more precisely at Omar Bongo University (hereinafter referred to as "OBU”). The Team explained that the design capacities of Photovoltaic (PV) modules to be procured and installed in MOFA and OBU are expected to be 70kWp and 130kWp respectively, based on the result of outline design and cost estimation.

4.2. Application of the Related Laws and Regulations

Based on the previous M/D, the both sides reconfirmed that that MEHR shall take responsibility for connection of PV system to the national power grid. It was also confirmed by both sides that MEHR shall complete necessary arrangements and procedures concerning the permissions for the installation and operation of the PV system to be connected to the national grid until October 2010.

5. Items of Equipment to be procured

The Team explained that items of equipment to be procured are as listed in Annex-1, based on the results of the Preparatory Survey conducted in September and December 2009. After discussions, both sides confirmed that major equipment such as PV modules consist of PV cells and power conditioners shall be products of Japan. The products of third country can be acceptable for the rest of the equipment in the Project.

6. Soft Component (Training Programs)

The Team explained that the following items are included in the soft component of the Project:

- Lectures on Basic knowledge of PV power generation;
- Training on Construction/Installation Planning;
- Field Training on Operation and Maintenance;
- On the Job Training (witnessing Tests and Inspections);
- Training on Operation and Maintenance Management Planning;
- Evaluation of O&M Organization;
- Preparation of materials for public awareness of clean energy; and
- Workshop.

7. Project Cost

The Gabon side agreed that the Project cost shall not exceed the upper limit of amount agreed on in E/N and G/A. Both sides also confirmed that the Project cost consists of procurement of equipment, transportation of equipment up to the Project sites, installation thereof, services of the Procurement Agent (hereinafter referred to as "the Agent") and the Consultant including soft component (training programs) of operation and maintenance of the equipment and PV system as a whole.

The Gabon side understood that the Project Cost attached as Annex-2 is estimated. It can be modified by the result of examination through revision of the Outline Design Study.

8. Project Schedule

Both sides confirmed that the tentative implementation schedule is two months behind the one shown in the Draft Final Report.

9. Ownership and Responsibilities for Operation and Maintenance

The Gabon side has reconfirmed that MEHR is the owner of the equipments for the PV systems to be procured under the Project, and the MOFA and OBU are responsible for Operation and Maintenance (O&M) of the said equipments in each site.

The Gabon side confirmed the estimated cost for O&M described in the Draft Final Report and agreed that MOFA and the MNEHESRI will secure the cost. MOFA and OBU will assign necessary personnel for the O&M of the PV systems.

10. The Consultative Committee

The Gabon side agreed that the MEHR will chair the Consultative Committee ((hereinafter referred to as "the Committee")) in order to facilitate consultation and procurement process. The Terms of Reference of the Committee was settled in Annex-9 of the previous M/D.

The members of the Committee are as follows:

(1) Representative of MEHR (Chair)

(2) Representative of MOFA

(3) Representative of Ministry of MNEHESRI
(4) Representative of OBU
(5)Representative of JICA Office

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

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

11. Procurement Process of the Project

Both sides reconfirmed that procurement process will be supervised by the Agent. Both sides also reaffirmed roles of the Agent as follows:

(1) The Agent shall undertake the procurement procedures necessary for implementation of the Project, in accordance with the Agent Agreement and provisions/stipulations of the E/N, the G/A and any other relevant guidelines;
(2) JICA will provide the Draft Final Report and Final Report to the Agent; and
(3) The Agent shall carry out procurement according to the concept and Outline Design of the Final Report.

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

The Gabon side agreed that the balance of the Project fund, after tendering of the equipment/services planned in the Final Report, will be available to procure additional equipment that is(are) consist with the concept of the Final Report.

The Gabon side also admits that decision on addition or reduction of the equipment to be procured will be made after consultation of the Committee members.

12. Undertakings required by the Recipient Country

The Team requested the Gabon side, who accepts it, to abide by the following undertakings by the Gabon side in addition to major undertakings described in the previous M/D. The Gabon side agreed to do so.

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

The owners of the lands where the following equipment and materials for PV system will be installed are MOFA and OBU. MOFA and OBU had already agreed to offer their lands for the Project. It does not require any procedure in Gabon concerning the use of necessary land areas for the Project.

1) PV Modules
2) underground cables between equipment
3) Power Conditioner Cubicles

4) Temporary stockyards

(2) Preparation for the Site

MEHR shall be responsible for the clearance (removal of trees at MOFA, removal of flag poles at OBU) of the sites implemented by MOFA and OBU until October 2010.

(3) Environment and Social Considerations

Both sides confirmed that the Ministry of Water and Forest, Environment and Sustainable Development has agreed that the Project does not require any procedure concerning the evaluation of impact on environment.

(4) Reverse power flow from PV system

Japanese side has been informed that MEHR submitted a letter to SEEG, concerning the possibility of sending reverse power flow from the PV system to the SEEG power grid. The Gabon side shall decide whether the reverse power flow is acceptable in the power system of SEEG, and inform Japanese side of its decision by the end of June, 2010. If accepted, the Gabon side will present to the Japanese side the technical conditions of grid-interconnection. Based on that, Japanese side should examine and revise the design of the PV system.

In case that the reverse power flow is accepted, the modality of reverse power flow should be discussed and agreed MEHR and SEEG after consultation with MOFA and OBU by the time of the commencement of the operation of the PV systems. The Japanese side could assist the Gabonese side to set the relevant rule through soft component during the implementation of the Project.

(5) Construction permissions

Both sides confirmed that the MOFA and OBU should obtain permissions for the construction/installation concerning the Project by October 2010, if necessary.

(6) Assignment of Focal Points

1) Focal Points for Project Management

The Gabon side assigned following focal points for overall project management and coordination in each organization.

MEHR	:Mr. Alex Minto’o Ebang,
MOFA	:EXC. Aimé Mfoula-Nghanguy,
OBU	:Prof. M. Pierre Nzinzi.

2) Focal Points for Soft Component (Training Programs)

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

The Gabon side shall inform the names of the responsible of the training from the following organizations to JICA at the first Consultative Committee meeting.

- MEHR
- MOFA
- OBU
- SEEG
- Others

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

(7) Customs and Tax Exemption

The Government of the Republic of Gabonese shall take necessary measures to ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Gabonese with respect to the purchase of the components as well as the employment of the Agent be borne by its designated authority without using the Grant and its accrued interest.

13. Confidentiality of the Project

Both sides confirmed that all the information related to the Project shall 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 are the followings:

a) detailed drawings, specifications, and other technical information of the facilities and equipment;

b) cost estimation;

c) the Draft Final Report;

d) the Final Report

<List of Annex>

Annex-1 List of Equipments

Annex-2 Project Cost Estimation (Confidential)

Annex-1

List of Major Equipments

for Ministry of Foreign Affairs, International Cooperation and French Speaking Countries

Equipment		Quantity
Photovoltaic Generating System		1 System
	1-1. Photovoltaic (PV) Module (Crystalline Silicon)	*70 kW*
	1-2. Junction Box	*1 Lot*
	1-3. Power Conditioner Cubicle	*1 Lot*
	1-4. Meteorological Observation Device	*1 Unit*
	1-5. PV Connection Panel;	*1 Unit*
	1-6. Support Structure for PV module	*1 Lot*
	1-7. Miscellaneous Materials	*1 Lot*
	1-8. Spare Parts, Consumables and Tools	*1 lot*
	1-9.Materials of wiring and earthing	*1 lot*
	1-10.Fence, gate and gravel surfacing	*1 lot*

for Omar Bongo University

Equipment		Quantity
Photovoltaic Generating System		1 System
	1-1. Photovoltaic (PV) Module (Crystalline Silicon)	*130 kW*
	1-2. Junction Box	*1 Lot*
	1-3. Power Conditioner Cubicle	*1 Lot*
	1-4. Meteorological Observation Device	*1 Unit*
	1-5. PV Connection Panel;	*1 Unit*
	1-6. Support Structure for PV module	*1 Lot*
	1-7. Miscellaneous Materials	*1 Lot*
	1-8. Spare Parts, Consumables and Tools	*1 lot*
	1-9.Materials of wiring and earthing	*1 lot*
	1-10.Fence, gate and gravel surfacing	*1 lot*

Project Cost Estimation (Confidential)

This is the cost estimation and would be further examined by the Government of Japan for the approval of the Grant Aid.

1. Cost to be borne by the Japanese side:

2. Cost to be borne by the Gabon side: CFA 1,660,000

Item	Amount
1. Clearing of the Sites (removal of flag poles at UOB, removal of trees at MFAIC)	CFA 1,660,000
2. Total (1.)	CFA 1,660,000

3. Cost to be borne by the Gabon side for Operation and Maintenance (every year)

(1) Personnel expenses Approximately CFA 1,314,000

(2) Expendable and replacement parts cost in the short run
Approximately CFA 1,065,000

(2') Expendable and replacement parts cost in the long run
Approximately CFA 3,389,000

(3) Total (in the short run) Approximately CFA 2,379,000

(3') Total (in the long run) Approximately CFA 4,703,000

The equipment to be procured in the Project can be operated and maintained by the existing maintenance staff of the facilities (MOFA and OBU). The O&M work will take up a little time of the staff on daily basis, which is evaluated in money term.

At intervals the equipment will require replacement of worn out parts and consumables. In the short run, most of parts and consumables to be needed will be covered by those provided in the Project, only minor, locally available items have to be purchased by Gabon side. After the provisions of the Project have run out, necessary items that have to be purchased by Gabon side will increase.

4. Conditions for estimation

(1) Time of estimation: December 2009

(2) Foreign exchange rate: US$ 1.00 = JPY 93.97
CFA 1.00 = JPY 0.2065

(3) Others:

The above estimation was carried out in accordance with relevant rules and the guideline of Japan’s Grant Aid.

5. SOFT COMPONENT (TECHNICAL ASSISTANCE) PLAN

(1) Background

The Project for Introduction of Clean Energy by Solar Electricity Generation System by the Government of Republic of Gabonese will procure Photovoltaic Generation Systems with 130kW and 70kW capacity, furnish them to Omar Bongo University and the Ministry of Foreign Affaires, Cooperation, French Speaking Countries and Regional Integration, respectively, and supply the generated energy to these facilities for their energy demand. For Gabon, this Project will be the first-ever experience to have a PV system with grid interconnection, although Gabon has a number of cases of independent off-grid solar systems. Therefore, it is important to train those technicians at these facilities who will be actually operating and maintaining the equipment. At the same time, it is also important to inform officers in charge of facilities and technical matters of the utility company SEEG (Société d'Electricité et d'Eaux du Gabon), and the Ministry of Energy and Water Resources overseeing it, and other people who will be involved in the Project, regarding the technical features and institutional issues relevant to PV systems and their interconnection to the utility grid, to prepare them to handle renewable projects and to cooperate with private power producers in the future.

The contractor will be conducting an Operation Guidance for the purpose of furnishing the operators with practical methods of operation and maintenance of the equipment. However, the basic knowledge underlying these methods is crucial in nurturing capabilities of judgment and decision making in various occasions of operating and maintaining the equipment, which is also useful in development and application thereto of future similar projects.

The technicians at Omar Bongo University and the Ministry of Foreign Affaires who will be operating the generating equipment have been managing the electric facilities in these public establishments, including a diesel generating unit in the case of the Ministry, but they do not seem to be specialists in electric engineering. They must be trained to be able to operate the equipment properly on the basis of firm knowledge of the mechanism. Meanwhile, the officers of the Ministry of Energy have been planning and implementing solar equipment in rural electrification projects. However, such projects are all of off-grid types, and very different from this Project where they are tasked with formulating new rules for grid-interconnection and reverse current. They are expected to acquire knowledge necessary for future formulation energy policy and designing of institutions, on the basis of the evaluation of effectiveness of renewable energy in the power system of the country, and the firm understanding of technical requirements of grid-interconnection including reverse current. At the same time, the are given a role to technically support the management activities conducted by Omar Bongo University and the Ministry of Foreign Affairs, they should be very well informed of the equipment and workings of PV system, along with SEEG's technical personnel who handle the grid-interconnection business.

The country has not had experience of interconnecting renewable energy generation to the national

power grid. On top of that the quality of electricity thereof is not quite stable or reliable and its information has not been made available. Therefore, the Project proposes to require the Contractor to carry out three-month inspection after the commissioning of the Products to confirm proper settings and resulting workings of the equipment. Considering the plan that the training program will have to proceed with evaluation of, and adoption to the capability of participants, it is very useful to take advantage of this occasion, to carry out the revisory training programs at the same time, to build up the knowledge, to deepen it, and to secure the sustainability of firm operation and maintenance techniques.

(2) Target of Training Program

To achieve the objectives of the training programs, the specific targets are set as below.

[For operators of the equipment the Site]

- To operate and maintain PV system under normal and emergency conditions, with sufficient knowledge of the function of PV system in connection with the existing electric equipment in the facility,
- To deal with the daily and periodical inspection and maintenance, fully understanding their meaning and importance in the long run, and also able to change and procure the spare parts and consumables,
- To consider routine activities of operation and maintenance and prepare an operation and maintenance management plan,
- To have basic knowledge that empowers them to give trainings to novice operators within and outside the facility,
- To explain the system to the visitors using publicity leaflets prepared in the program.

[For officials of the Ministry and public electric company]

- To understand the PV system theories, technical characteristics, and institutional issues of grid-interconnection,
- To have technical knowledge relevant in preparing agreements between private owners of power generators and the electric utility company,
- To acquire the knowledge for the development of future projects and guidance of new operation and maintenance staff,
- To promote the use of PV using the publicity leaflets prepared in the program.

(3) Outcome of training programs

- the operation and maintenance management plan has been established, and the PV system procured is operated and maintained autonomously and sustainably,
- O&M activities are followed up by using check sheets,

- Technical officers at the Ministry and SEEG are equipped with knowledge on the method of planning and on the institutional provisions for interconnection of renewable power generation systems,
- Use of PV is being promoted using the publicity leaflets prepared in the program.

(4) Outcome confirmation and evaluation

Most tangible outcome will be the operation and maintenance management plan. The operation and maintenance management plan is a plan to be made on the basis of manuals and guidance provided by the Contractor, listing activities of O&M in short-term (daily activities), mid-term (a few months to a few years) and long-term (seven years, an interval of long term maintenance), specifically scheduling the activities, with check sheets for these activities, to make sure the activities are carried out as planned and desired. As discussed below, the training programs are divided into two periods, the first during the commissioning of the equipment and the other three months after the commissioning. The operation and maintenance management plan will be drafted in the first-period program and revised in the second, taking into account the actual experiences in three months.

Also, a trouble shooting manual is to be prepared in the training programs by participants. It is a summary of operators' experiences, and responses sought in discussions in consultation with trainers. The material prepared can be useful in evaluating the degree of understanding of basic knowledge, and the process of preparation itself is helping the deepening of understanding. It also can be used in similar projects elsewhere.

The exercises above are to be started by the discussion among the participants. After evaluating the results, the lecturer joins the discussion, giving additional explanations and instructions as required. Then the participants proceed with the tasks given. These three steps enable the lecturer to evaluate the degree of understanding of the participants before and after the exercise sessions.

Publicity Leaflet will be designed and prepared in the programs, with due consideration to the current status of renewable energy use in the recipient country, to be used and distributed to public in order to introduce the PV system procured in the Project and to promote the use of renewable energy.

Other outcomes in the first-period program will be evaluated in the following manners at the beginning of the second-period program. The whole program will also be evaluated with the materials presented at the Work Shop to be held at the end of the programs, further supplemented by questionnaires.

- Evaluation of operation records and daily check sheets for three months,
- Evaluation of problem-response records for three months,
- Evaluation of communication and discussions in Trouble Shooting sessions in the

second-period program,

- Evaluation of knowledge acquisition concerning the system-wide management, through Exercises, Workshop and its handouts prepared,
- A questionnaire conducted at end of the training programs

In preparing these questions, attentions should be paid to set particular questions and/or assignment concerning the key topics of the programs, which enable to assess the effectiveness of the training.

(5) Planning of training programs

1) Contents

Training program is planned to consist of a series of lectures, exercises, and OJTs led by Japanese consultants. The program is to be carried out in two separate periods; one during the commissioning of the equipment, and the other three months after the commissioning.

There will also be O&M training provided by the Contractor of the Project. Therefore, the consultant will coordinate with the Contractor and plan the details of his training program so that the necessary techniques and knowledge are effectively transferred to the participants of the program. Those training items with a symbol (*) below are the ones presumably provided by the Contractor. The consultants will provide additional information for such items, if necessary, to make them more relevant, not just "how to operate", in the context of understanding of PV systems.

Before commissioning (approximately starting 4 weeks before commissioning)

Lectures on basic knowledge

- Basic theory of photovoltaic generation
- Utilization of photovoltaic generation
- Grid-interconnection and its planning
- Understanding surplus and reverse current
- Supply of power to the buildings from the grid
- Power demand and loads in the buildings
- Workings of PV equipment during blackout
- Planning PV systems
- Arrangement between PV owner and power utility

Lectures on construction planning

- Installation of PV equipment
- Power distribution in the facility
- Electric equipment in the facility and connection of PV system
- Scheduling works

- Work supervision and inspection, take-over

OJT program

- Witnessing connection works
- Witnessing pre-commissioning/commissioning tests

After commissioning of PV system (continued from "before commissioning" program)

Training provided by the Contractor

- Starting, stopping, restarting the system (*)
- Daily inspection and maintenance (*)
- Periodical inspection and maintenance (*)
- Consumables and replacement work (*)
- Occurrence of faults and actions (*)

Planning O&M works on the basis of Operation Manuals (exercises)

- Making daily check sheet/log sheet form
- Making failure/accident record form
- Maintaining PV equipment in a good condition
- Making Operation and Maintenance Management Plan

For promotion of renewable energy use

- Design and preparation of publicity leaflet

It is very often experienced, in Japan and in other countries as well, that initial setting of the equipment and/or the lack of familiarity of operation lead to malfunction or unsatisfying performance of the equipment. Therefore, it is necessary to carry out revisory training program a certain period after the commissioning. Initial malfunctions and poor operation practices generally show up soon after the commissioning, but settle down as the countermeasures are taken. It is not wise to leave them for too long without doing anything, while too short an observation may overlook the problems or leave operators insufficient time and experiences. Therefore, the revisory training program is proposed to take place soon after approximately three month period since the commissioning, when certain experiences and operation records have built up. Then, the three month experience of actual operation and maintenance of PV equipment, operation issues unique in the implementation and in Omar Bongo University and the Ministry of Foreign Affairs circumstances are reviewed to address problems and questions, and to revise the operation and maintenance management plan. This process aims for the establishment of more pragmatic and steady method of operation.

On top of these, the records of power generation are to be analyzed to provide exercise materials for more advanced operation planning and brief financial assessment, in order to build a capability for planning and management of PV systems in wider applications. It should be

coordinated with the three month inspection carried out by the Contractor engineer, to make witnessing thereof part of training programs, and video-record the inspections, adjustments and changing of parts along with the conversations take place during the proceeding between Contractor engineer and program participants. The recorded material can be reviewed during later sessions of the program. The material should be brought back to Japan, edited and recorded on DVDs, which will be used later on such occasions as the guidance of new members of operation staff, or that of similar projects outside the facility. This aims at the promulgation of Project's positive effect in time and in space, resulting in the realization of initial objectives of the Project.

The following contents are being considered.

Three months after the commissioning

Evaluation of Establishment of Techniques

- Evaluation of knowledge of basic operation methods
- Evaluation of knowledge of basic maintenance works
- Revision of Operation and Maintenance Activities
- Evaluation of 3 month experience of operation and maintenance (as input)
- Trouble shooting sessions (by questionnaire, Q&A session, discussion)
- Revising daily operation and check sheets (exercise)

Improvement of Operation and Maintenance Methodology for Long-run

- Planning operation with considerations on seasonal changes (to consider changes in output of PV system by seasons and resulting operation methods)
- Witnessing three month inspection (there will be demonstration of replacement of parts, such as fuses by manufacturer's engineer)
- Recording the three month inspection (video-taped and recorded on DVD media)

Preparation of Trouble Shooting Manual

- Discussion on the problems experienced and responded in three months, finding better responses and solutions, compiling information into " Trouble Shooting Manual ",

Support for establishing advanced organization for operation and maintenance

- Brief financial assessment of the generation equipment (comparison of income and expenses)
- Improvement of management of equipment for better financial performance of the equipment,
- Planning better use of PV system responding to the increase in power demand,

Round up Exercises

- Revising the operation and maintenance management plan
- Questionnaire

Workshop

- Presenting revised operation and maintenance management plan and Trouble Shooting Manual,
- Reporting results of brief financial assessment and operation records.

2) Participants

Candidate participants to the training sessions are as follows.

UOB and MFAIC technicians: Those who will be actually operating the PV system

SEEG officers: in distribution, power purchasing or power plant management related departments, with engineering background (preferably having a degree in electric engineering)

MEWR officials: in regulatory planning, facility management or facility planning related departments, preferably with engineering background

Other: If there are requests from other ministries or organizations, they may appoint persons in charge of public facility planning and/or its maintenance to join the program.

Preliminary assignment for these participants is shown in the table below.

Table 1 Program Contents and Participants

Activities	Technicians (3-4person)	SEEG (2-3person)	Ministries (2-3person)	Others (2-3person)
Before commissioning				
Lectures on basic knowledge	○	○	○	○
Lectures on construction planning	○	○	○	
OJT program	○	○	○	
After commissioning				
Reinforcement of Contractor Guidance	○	○		
Planning O&M works	○			
For promotion of renewable energy use	○	○	○	
Three month after commissioning				
Establishment of Techniques	○	○		
Revision of O&M Activities	○			
Improvement of O&M for Long-run	○			
Preparation of Trouble Shooting Manual	○	○		
Advanced Organization for O&M	○		○	
Round up Exercises	○	○	○	○
Workshop	○	○	○	○

3) Schedules

The schedule for the abovementioned program is shown below.

Table 2 Training program before/after commissioning

		-4w	-3w	-2w	-1w	0w	1w	2w	3week
Activities	Preparation								
	Basic knowledge lectures								
	Construction exercise								
	OJT								
	Reinforce Contractor Guidance								
	O&M Management Planning								
	Promotion Material								
Participant	UOB and MFAIC technicians								
	SEEG officers								
	MEWR officers								
Lecturers	Consultant (leader)								
	Consultant (assistant)								
	Interpreter								

Table 3 Training program three months after commissioning

		1w	2w	3w	4w
Activities	Establishment of Techniques				
	Revision of O&M Activities				
	Improvement of O&M for Long-run				
	Preparation of Trouble Shooting Manual				
	Advanced Organization for O&M				
	Round up Exercises				
	Workshop				▼
Participant	UOB and MFAIC technicians				
	SEEG officers				
	MEWR officers				
Lecturer	Consultant (leader)				
	Consultant (assistant)				
	Interpreter				

(6) Resources for the training program

As already mentioned, this PV system with grid interconnection is first-ever experience in Gabon. Therefore, Japanese consultants are assumed to undertake the implementation of training programs. Consultants to be assigned should have adequate experiences in planning of PV system with grid interconnection.

There will be two Japanese consultants, one leader and one assistant, to be lecturers to the programs of both periods. National consultants are not considered as the recipient country does not have an experience in similar projects.

As the official foreign language of the country is French, and the participants may not be good at speaking English, translation/interpretation service is necessary. But French-English interpretation service available in the country will have problems in technical terms and expressions. If consultants give a lecture in English and an interpreter translates to French, it is most likely to cause confusion and misunderstanding. Therefore, the translation between Japanese and French is more desirable, and the interpreter should be sought in Japan. Hiring Japanese-French interpreter has some other advantages; such as translating additional materials obtained from the Contractor to use in the lectures, which are very likely written in Japanese.

The work schedule of consultants is planned as below. The first period program takes forty days, and the second twenty days. After including return travels to and from the Site, the assignment should be two months and one month, respectively.

Table 4　Work Schedule of Consultants

Program	Work Description	Duration
Preparation　5 days	- Discussion on contents and materials with MERW and SEEG - Confirmation of contents with UOB and MFA - Coordination with the Contractor - Preparation of materials	2days 1day 1day 1day
Before commissioning　15 days		
Lectures on basic knowledge	- Basic theory of photovoltaic generation - Utilization of photovoltaic generation - Grid-interconnection and its planning - Understanding surplus and reverse current - Supply of power to the buildings from the grid - Power demand and loads in the buildings - Workings of PV equipment during blackout - Planning PV systems - Arrangement between PV owner and power utility -	10days in total
Lectures on construction planning	- Installation of PV equipment - Power distribution in the buildings - Electric equipment in the buildings and connection of PV system - Scheduling works - Work supervision and inspection, take-over	0.5days ↓ 1day 1.5days 1day
OJT program	・ Witnessing connection work and tests/inspection of the Contractor	（5days）
After commissioning　20 days		
Reinforcement of Contractor Guidance	- Following Operation Guidance of the Contractor; - additional explanations given on workings of PV system in the facility, using Operation and Maintenance Manual and the training materials, - discussions on findings of participants.	5days
Planning O&M works	- Proposing daily activities needs and making daily check sheet/log sheet form - Listing periodical inspection items, activity necessary, to make check sheet, - Listing long-term inspection items, activity necessary, to make inspection schedule -	12days in total
Promotion of renewable energy use	- Planning the materials, editing, laying-out, and prepare the leaflets	5days
Three months after commissioning　20 days		
Establishment of Techniques	- Confirmation and evaluation of operation records by the Consultant, - Confirmation of basic operation knowledge and technique, - Discussions on daily operation and maintenance activities.	1day 1day 1day
Revision of O&M Activities	- Revision and evaluation of three-month experience of operation and maintenance, - Trouble shooting (extracting problems and solutions, through enquiries and discussions), - Revision of daily operation and maintenance check sheets.	1day 1day 1day 1day
Improvement of O&M for Long-run	- Considering seasonal changes of demand and power generation, - Witnessing three-month inspection carried out by the Contractor(including changing of spare parts), - Recording the above on video.	1days 2days （half day） （2days）
Preparation of Trouble Shooting Manual	- Summarizing problems and solutions extracted in the above program to prepare Trouble Shooting Manual.	1day
Advanced Organization for O&M	- Simple financial analysis of PV equipment (cost and income related to PV operation), - Discussion on management of facilities and equipment, - Increase of demand, consumption of PV generated energy, and better use of energy in the facility.	1.5days 1days 1.5days
Round Up Exercises	- Updating Operation and Maintenance Management Plan, - Questionnaires on understanding, - Preparation of Work Shop presentation.	2days 1days 2days
Work Shop	- Presenting Operation and Maintenance Management Plan, Trouble Shooting Manual and reporting records of operation including financial performance.	1day

(7) Schedule of training programs

Work schedule of training programs is as shown below, assuming that the agreement between procurement agents and contractors will be concluded in 10/2010.

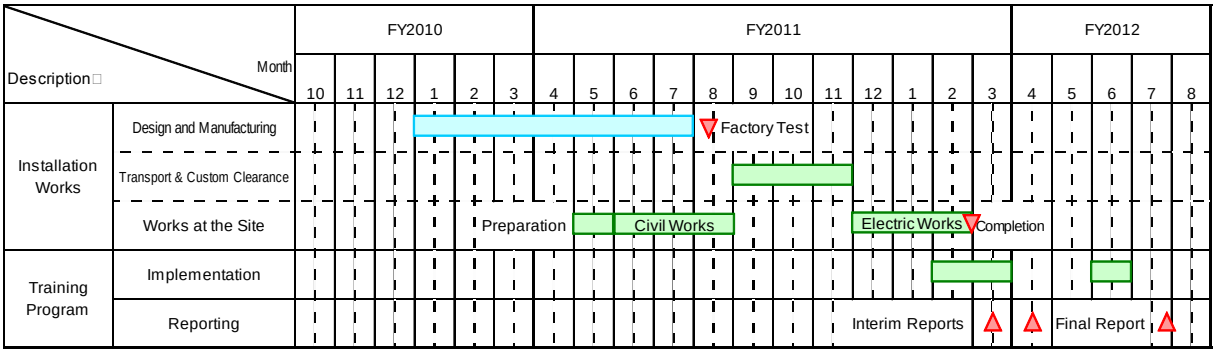


Figure 1 Management Guidance Implementation Schedule

(8) Products of training programs

Products of training programs are outlined below.

- A training program textbook prepared by the Consultant
- Output of Exercises (A single line diagram of the facility, etc.)
- Publicity Leaflet
- Progress reports
- Visual record (DVD) of Periodical Inspection (three month inspection)
- Operation and Maintenance Management Plan (with revision)
- Trouble Shooting Manual
- Workshop materials
- Results of questionnaires
- Final report (including evaluations of operation records and trouble shootings)

(9) The responsibility of receipt country

It is important that participants take part in the training programs in full for the achievement of program objectives, which, however, requires the participants of being away from their work places for weeks. Therefore, there must be an official designation as a participant given by the section/department management who appreciates the usefulness of the programs. It is also important that government agencies appoint persons who will be in charge of PV and renewable energies in the future.

6. REFERENCES

6.1 Technical Notes for Draft Basic Design

Le 22 Décembre 2009

A Monsieur Pierre NZINZI
Recteur de L'Unitersité Omar Bongo
République Gabonaise

Objet: Conception et programme de formation du projet pour l'introduction des énergies renouvelables en utilisant la puissance photovoltaique

Monsieur,

Nous voudrions vous remercier de votre coopération pour la réalisation de ce projet.

Le Groupe d'Etudes de la JICA (Agence de Coopération Internationale Japonaise) a pour la période allant du 7 Décembre au 22 Décembre 2009 mené avec succès au sein de l'université, la deuxième phase de son étude comprenant la conception du projet.
Les schémas et le programme de formation ont été élaborés pendant cette même période et présentés à Monsieur le Secrétaire Général Adjoint et à Monsieur le Directeur du Patrimoine et de la Conciergerie de l'université le 18 Décembre, en attendant que le travail final et l'ébauche du projet soient confirmés à la fois par le siège de la JICA et le gouvernement japonais.
Le Secrétaire Général Adjoint, le Directeur du Patrimoine et de la Conciergerie et le groupe ont discuté des plans et les résultats ont été approuvés et amendés, tels que joints dans le document.

Tout en comptant toujours sur votre collaboration, veuillez agréer, Monsieur le Recteur, l'expression de notre haute considération.

M. Nishida

Masaru NISHIDA
Chef des Consultants,
Du Groupe d'Etudes de la JICA

Discussion on Proposed PV Project at OB University

Date: December 18th, 2009

Place: Omar Bongo University

1. Scope of the Project

The Project proposed will provide **Omar Bongo University** (the University) with the works as shown below.

- Installation of the PV System with the capacity of 120kW
- Installation of the Electrical Facility Cubicle
- Installation of the PV Connection Box (PVCB) in the Electric Room
- Installation of the Fence which surrounds the PV Modules and the Electrical Facility Cubicle

The system under planning is also presented as in the Attachment 1 and the following drawing list.

[List of Drawings to be presented]

- GA-U01 SINGLE LINE DIAGRAM (EXISTING)
- GA-U03a SINGLE LINE DIAGRAM (PV SYSTEM)
- GA-U04 GENERAL LAYOUT PLAN
- GA-U12 CABLE LAYOUT PLAN (OUTSIDE)
- GA-U15 EQUIPMENTS LAYOUT (ELECTRICAL ROOM)
- GA-U18 PAVING STONE PLAN
- GA-U19 LAYOUT OF FENCE AND GATE

2. Operation of the PV System

(1) Operation under the normal condition

The PV System is designed to start sending electric power in the morning and stop in the late afternoon every day, by the scheduled timer.

If the electric power from SEEG (the Power Company) network is stopped (blackout, etc.,), the PV System will automatically shut down. After the power is recovered, the system must be restarted manually.

(2) Maintenance

- Daily inspection has to be done once a day by maintenance staff of the University.
- Periodical inspection is necessary, which may involve change of consumables and worn-out

parts.

3. Construction

There are a few important matters that need to be understood about the construction work (the Work).

(1) Interruption of power supply to the University at the power system switch

One electric board (PVCB) has to be installed in the Electric Room. The installation work requires interruption of the electric power supply from the Power Company to a part of the University load. It is necessary to cover the electric power supply to the whole University load by the mobile diesel generator to be prepared by the Contractor as the substitute source of electric power supply. However, there is entire electric power cut of the University a few times during the Work and the switching of the electric power supply from/to the Power Company to/from the mobile diesel generator.

Details of the Work is to be planned, and submitted by the Contractor for approval of the engineer.

(2) Need to secure the Temporary Storage of the Materials and the Equipment

The University is requested to secure, free of charge, the space in the area of University for storing the Materials and the Equipment transported from Japan.

(3) The Temporary Storage of the Construction Waste

The construction work produces large amount of wastes. They have to be stored temporally somewhere in the premise of the University before the Contractor disposes of them in a proper and lawful way.

4. Preparation for the Project

(1) Application for the interconnection of the PV System to the Power Company network.

As the University becomes the owner of the PV System for his own use, and the PV System is interconnected to the Power Company network, a necessary procedure, which may involve applying for a license and so on, is to be initiated by the University.

(2) Preparation of the Site

The following matters should be undertaken by the University.

- To secure and keep open the space for PV System installation
- To clear and level the PV System installation areas
- To clean up the inside of the Electric rooms before the Work starts
- To remove or relocate flag poles and foundation situated in one of PV installation areas.

5. Project Schedule (tentative only)

- Preparation of the contract with the Contractor : mid 2010
- Commencement of the Work at the Site : early 2011
- Completion of the Project and Commissioning : early 2012

Attachment-1

Basic Specification of PV System (Draft)

Name of Site : Omar Bongo University

Item	Specification
Type of the PV system	Grid connection (No Storage Battery)
Capacity of the PV System	120kW
Basic configuration of the PV system	Refer to Fig.1 (Page.5)
Basic layout of the PV System	Refer to the drawing NO.GA-U04, (Page.9)
Electrical Facility Cubicle of the PV System	Refer to Fig.2 (Page.6)
Grid connection point	Low voltage (At secondary side of the transformer)
Support stand of the PV Module	Hot dip zincing coated steel
Reverse power flow	There is no reverse power flow (Not to supply surplus electric power generated by the PV System to the SEEG power Grid)
Protection Relay of Grid connection	Over current(OC), Over voltage(OV), Under voltage(UV), Over frequency(OF), Under frequency (UF), Islanding detector(ID)
Electric power supply in the case of power failure (blackout)	Not to supply electric power generated by the PV System to the load in the case of power failure
Display system	One set to be installed. Information to be displayed are 1) Current Output of the PV System (kW) 2) Electric power generated in one day (kWh) 3) Estimated reduction of CO2 emission
Fence and Gate for PV System	Refer to the drawing NO.GA-U19, (Page.13)
Meteorological observation device	Solar radiation and temperature measuring system at the PV panels
Language of operation and maintenance manuals	French

Note) Due to the instability of the PV System output, the PV System cannot supply the electric power to the critical load such as life supporting equipment.

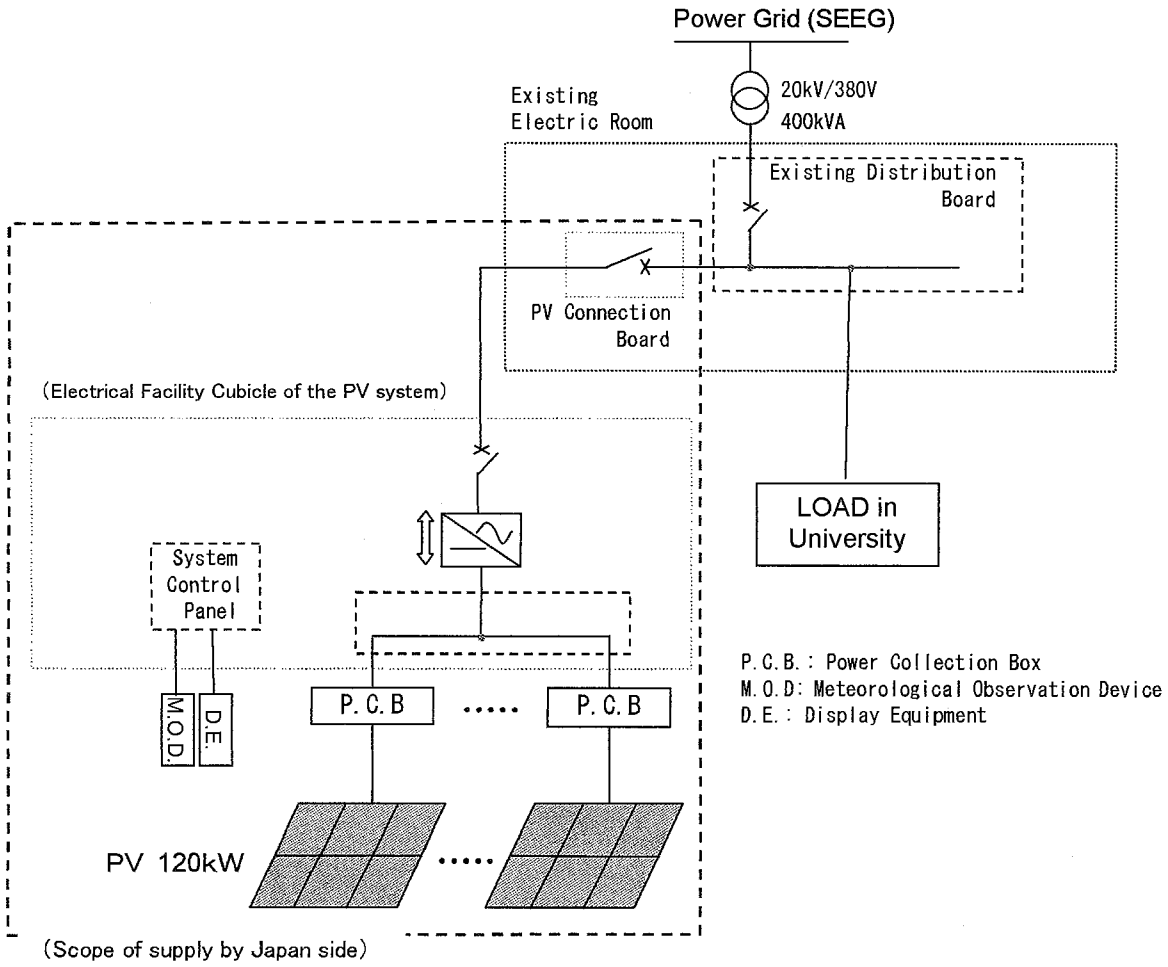
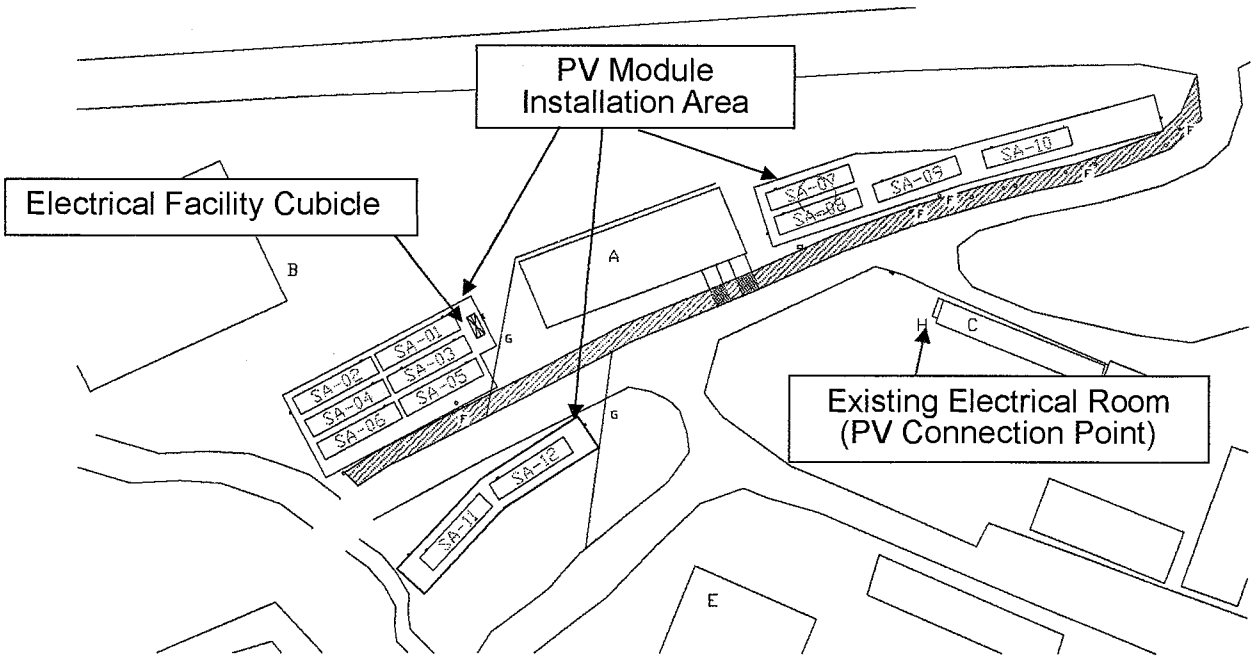


Fig. 1 Planned Configuration of PV system



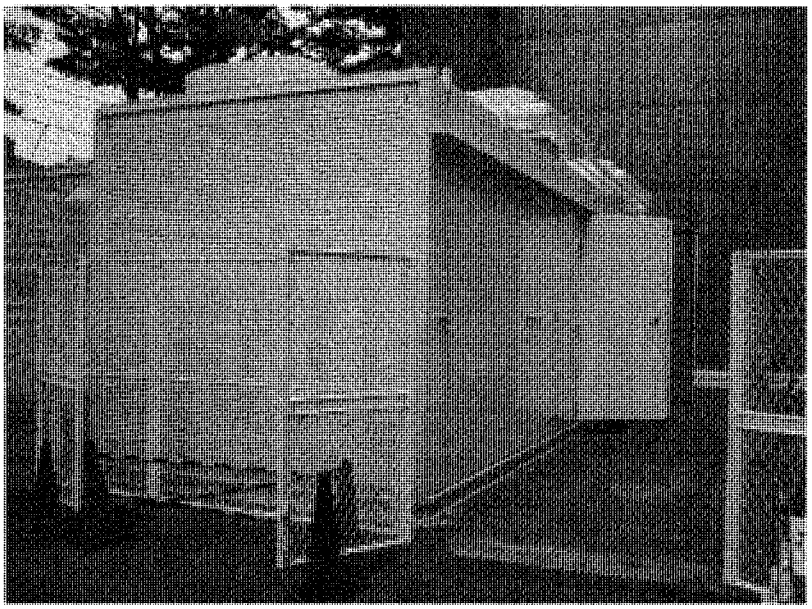
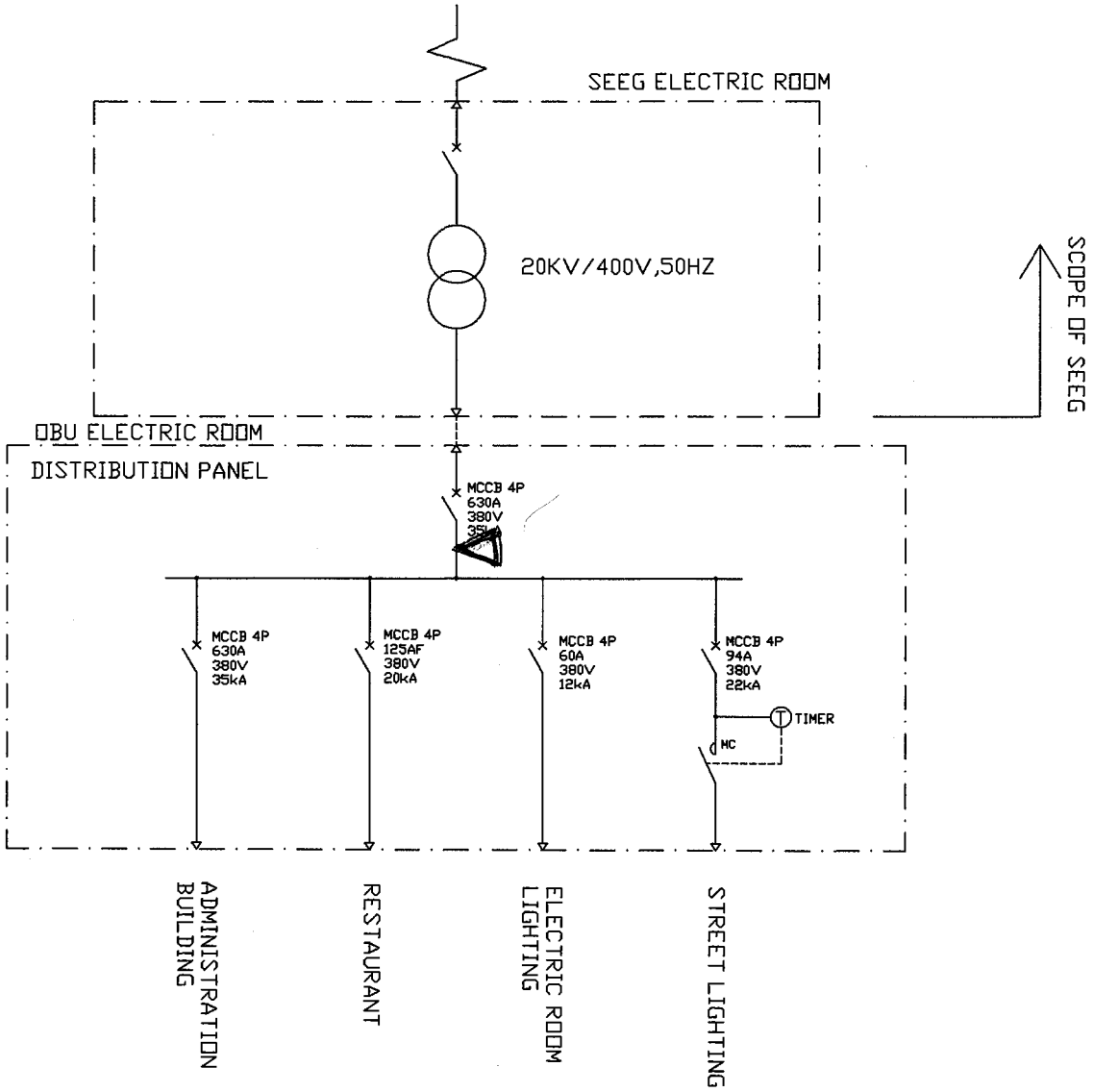


Fig.2 Example of Electrical Facility Cubicle of the PV system



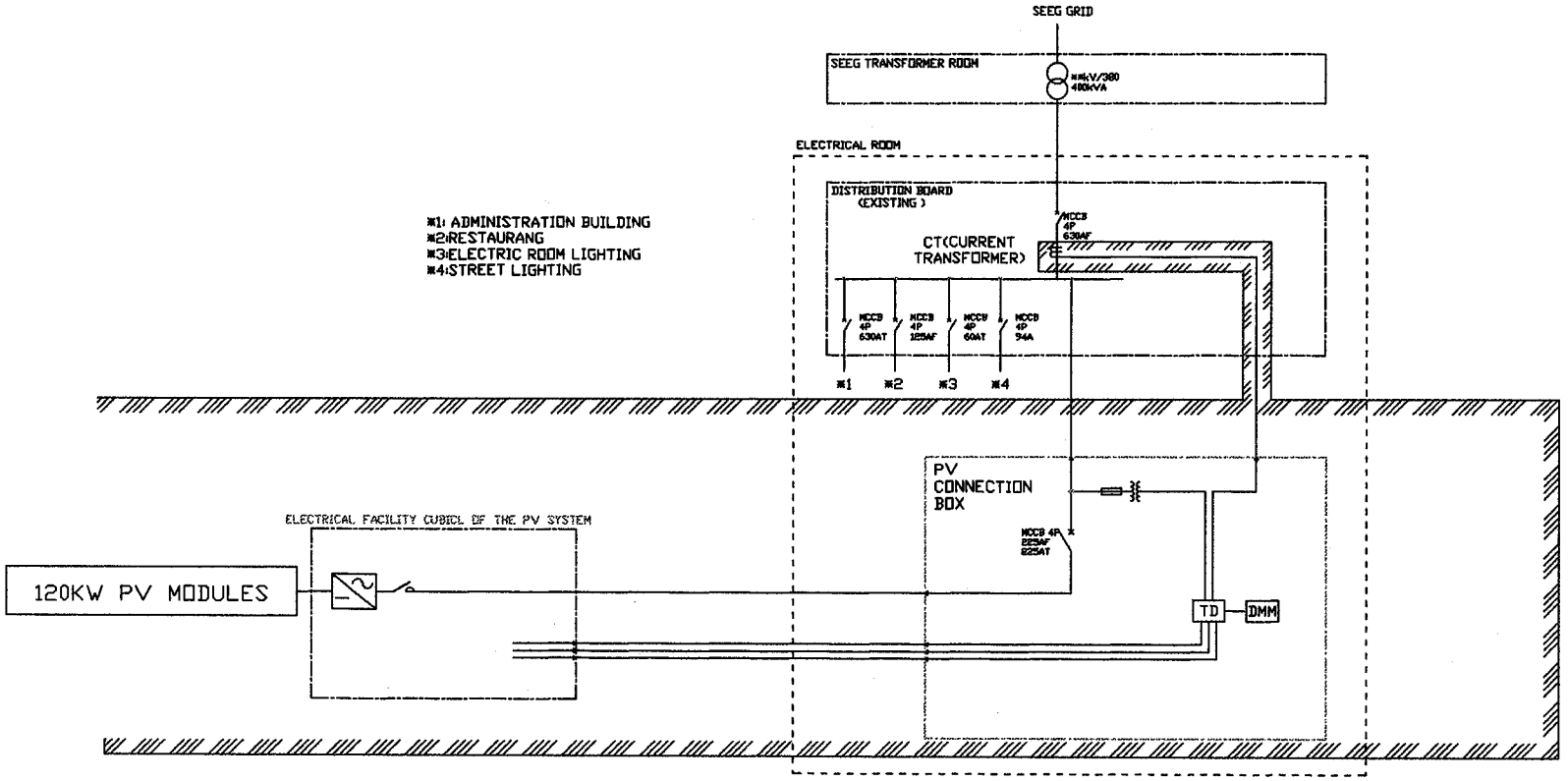
SYMBOL	ABBREVIATION	DESCRIPTION
ISO	ISO	ISOLATOR
ES	ES	EARTHING SWITCH
	LBS	LOAD BREAK SWITCH
RM	RM	RING MAIN SWITCH
	LA	LIGHTNING ARRESTER
VCB	VCB	VACUUM CIRCUIT BREAKER
ACB	ACB	AIR CIRCUIT BREAKER
MCCB	MCCB	MOLDED CASE CIRCUIT BREAKER
VS	VS	VACUUM SWITCH
MC	MC	MAGNETIC SWITCH
PF	PF	POWER FUSE
	F	FUSE
	TR	POWER TRANSFORMER
SR	SR	SERIAL REACTOR
SC	SC	STATIC CAPACITOR
U>	-	OVER VOLTAGE RELAY
U<	-	UNDER VOLTAGE RELAY
I>	-	OVER CURRENT RELAY
I<	-	UNDER CURRENT RELAY
Id/I>	-	DIRECTIONAL OVER CURRENT RELAY
I0>	-	OVER CURRENT GROUNDING RELAY
Id>	-	DIFFERENTIAL RELAY
3E	-	3-E RELAY (MULTI-FUNCTION MOTOR RELAY)
P<	-	REVERSE POWER RELAY
I<	-	REVERSE CURRENT RELAY
	-	OVER LOAD RELAY
	-	THERMAL RELAY
	VT	VOLTAGE TRANSFORMER
	EVT	EARTH VOLTAGE TRANSFORMER
	CT	CURRENT TRANSFORMER
	ZCT	ZERO PHASE CURRENT TRANSFORMER
V	V	VOLT METER
A	A	AMMETER
Hz	Hz	FREQUENCY METER
W	W	WATT METER
Wh	Wh	WATT HOUR METER
cosφ	PF	POWER FACTOR METER
var	Var	VAR METER
VD	VD	VOLTAGE DETECTOR
	VS	VOLT METER CHANGE-OVER SWITCH
	AS	AMMETER CHANGE-OVER SWITCH
	-	CABLE HEAD
	-	BUS DUCT

Project for Introduction OF Clean Energy using Photovoltaic Power

TITLE : SINGLE LINE DIAGRAM (EXSITING)

DRAWING NO. GA-U01		Rev.1
DATE	DRAWN	CHECKED
SCALE: Non.(A3) Unit:mm		

NEWJEC | NEWJEC Inc. Osaka, JAPAN



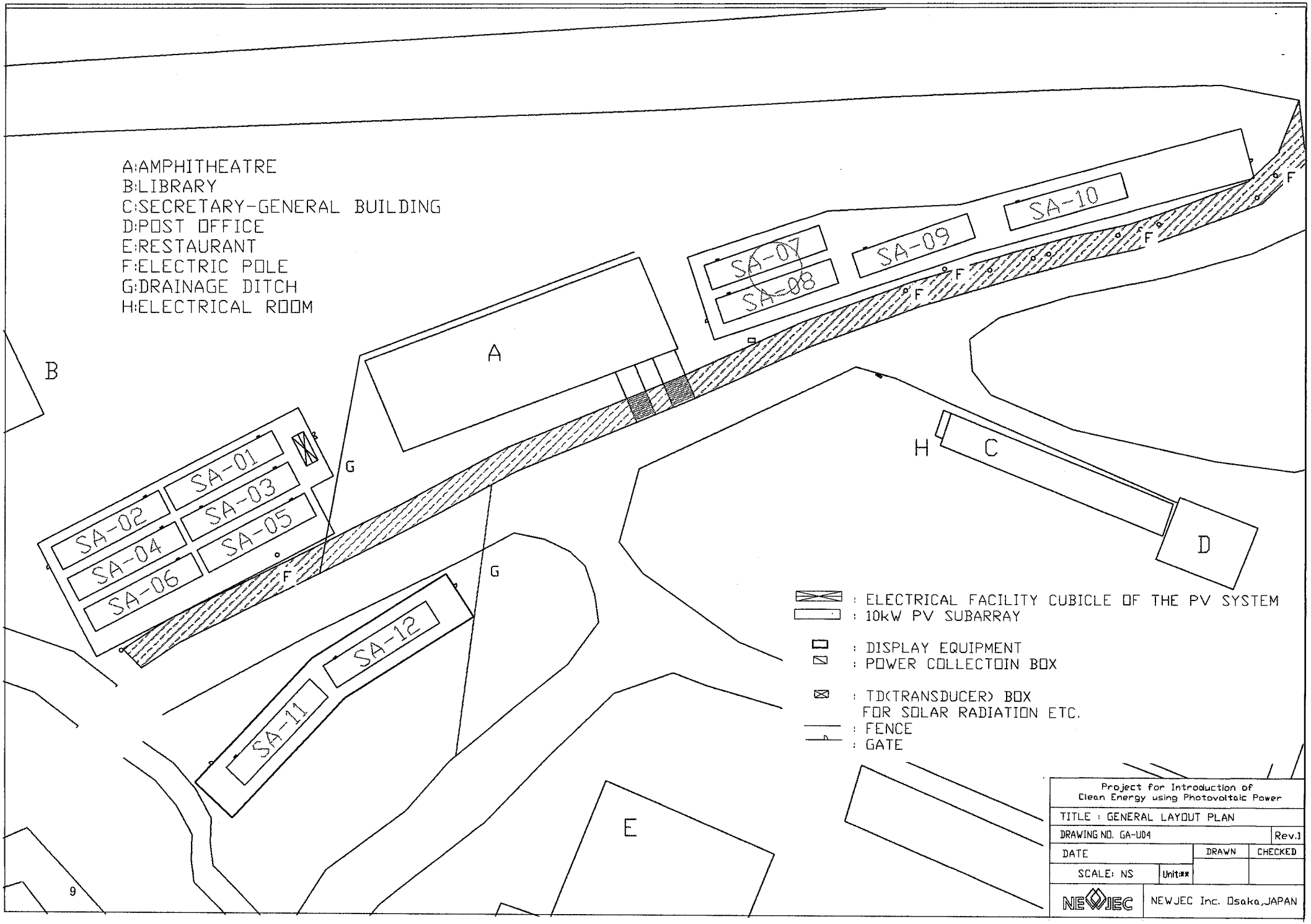
: SCOPE OF THE PROJECT

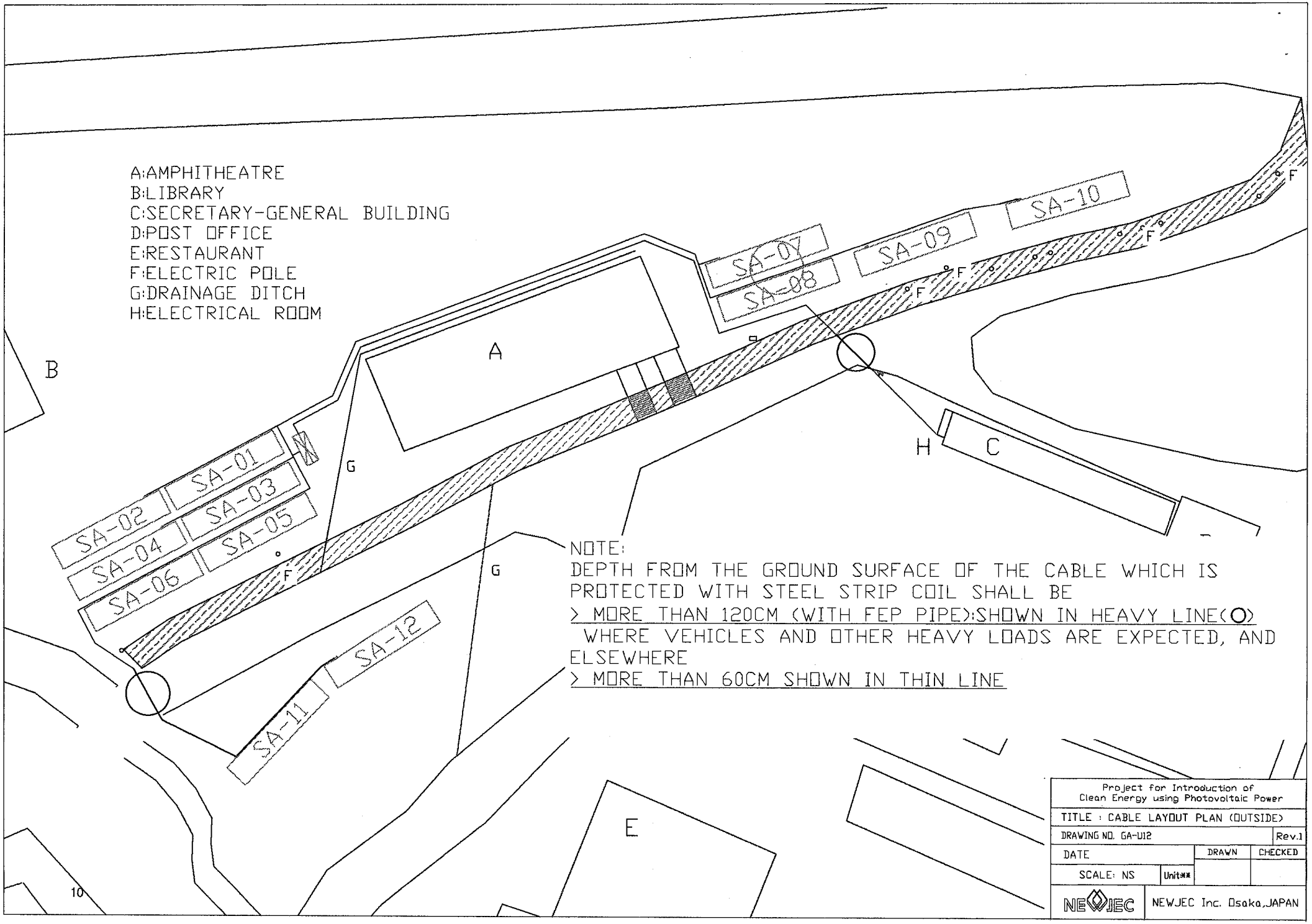
DMM:DIGITAL MULTI-METER
TD:TRANSDUCER

For Reference Only

* The value will be reviewed by the detailed design result, if necessary.

Project for Introduction of Clean Energy using Photovoltaic Power			
TITLE : SINGLE LINE DIAGRAM (PV SYSTEM)			
DRAWING NO. GA-U03a			Rev.1
DATE		DRAWN	CHECKED
SCALE: Non.(A3)	Unit:※※		
NEWJEC	NEWJEC Inc. Osaka,JAPAN		


A:AMPHITHEATRE
B:LIBRARY
C:SECRETARY-GENERAL BUILDING
D:POST OFFICE
E:RESTAURANT
F:ELECTRIC POLE
G:DRAINAGE DITCH
H:ELECTRICAL ROOM
A
B
C
D
E
H
SA-01
SA-02
SA-03
SA-04
SA-05
SA-06
SA-07
SA-08
SA-09
SA-10
SA-11
SA-12
F
G
: ELECTRICAL FACILITY CUBICLE OF THE PV SYSTEM
: 10kW PV SUBARRAY
: DISPLAY EQUIPMENT
: POWER COLLECTOIN BOX
: TD(TRANSDUCER) BOX FOR SOLAR RADIATION ETC.
: FENCE
: GATE
Project for Introduction of Clean Energy using Photovoltaic Power
TITLE : GENERAL LAYOUT PLAN
DRAWING NO. GA-U04
Rev.1
DATE
DRAWN
CHECKED
SCALE: NS
Unit:**
NEWJEC
NEWJEC Inc. Osaka,JAPAN


A:AMPHITHEATRE
B:LIBRARY
C:SECRETARY-GENERAL BUILDING
D:POST OFFICE
E:RESTAURANT
F:ELECTRIC POLE
G:DRAINAGE DITCH
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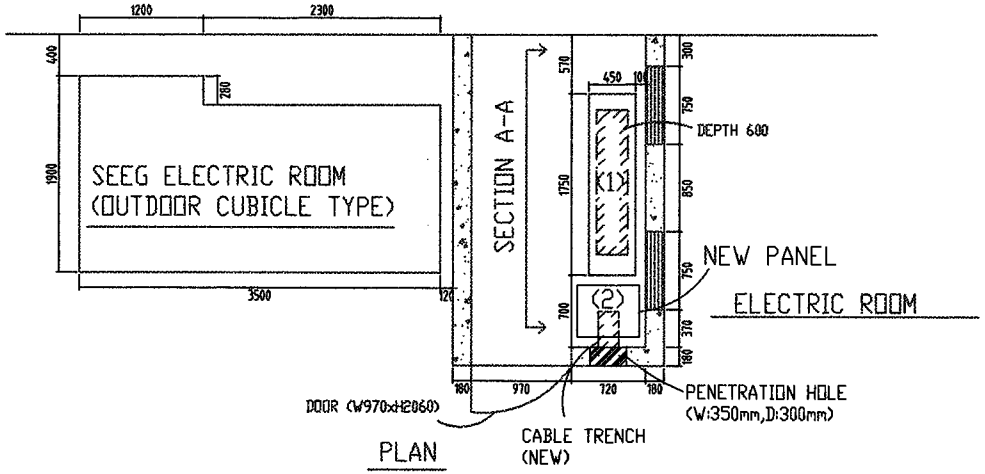
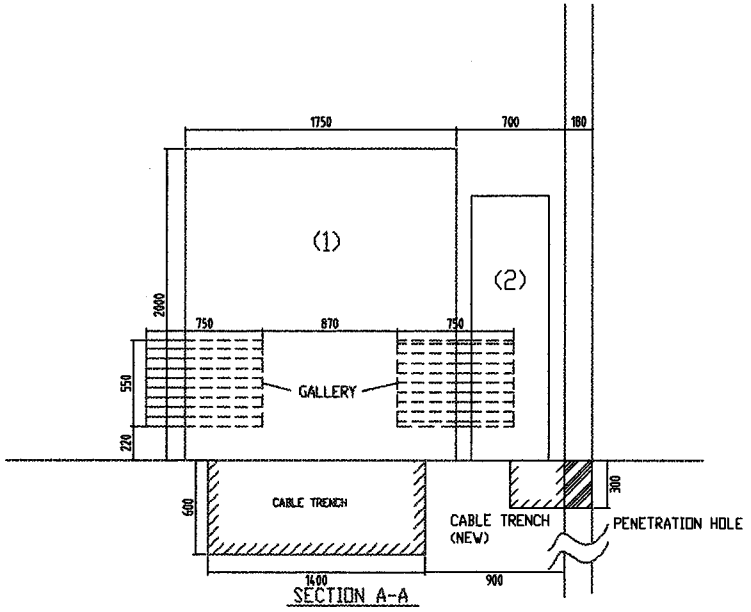
SA-01
SA-02
SA-03
SA-04
SA-05
SA-06
SA-07
SA-08
SA-09
SA-10
SA-11
SA-12
A
B
C
D
E
F
G
H
NOTE:
DEPTH FROM THE GROUND SURFACE OF THE CABLE WHICH IS PROTECTED WITH STEEL STRIP COIL SHALL BE
> MORE THAN 120CM (WITH FEP PIPE):SHOWN IN HEAVY LINE(○)
WHERE VEHICLES AND OTHER HEAVY LOADS ARE EXPECTED, AND ELSEWHERE
> MORE THAN 60CM SHOWN IN THIN LINE
Project for Introduction of Clean Energy using Photovoltaic Power
TITLE : CABLE LAYOUT PLAN (OUTSIDE)
DRAWING NO. GA-U12
Rev.1
DATE
DRAWN
CHECKED
SCALE: NS
Unit:㎜
NEWJEC
NEWJEC Inc. Osaka,JAPAN





NOTE

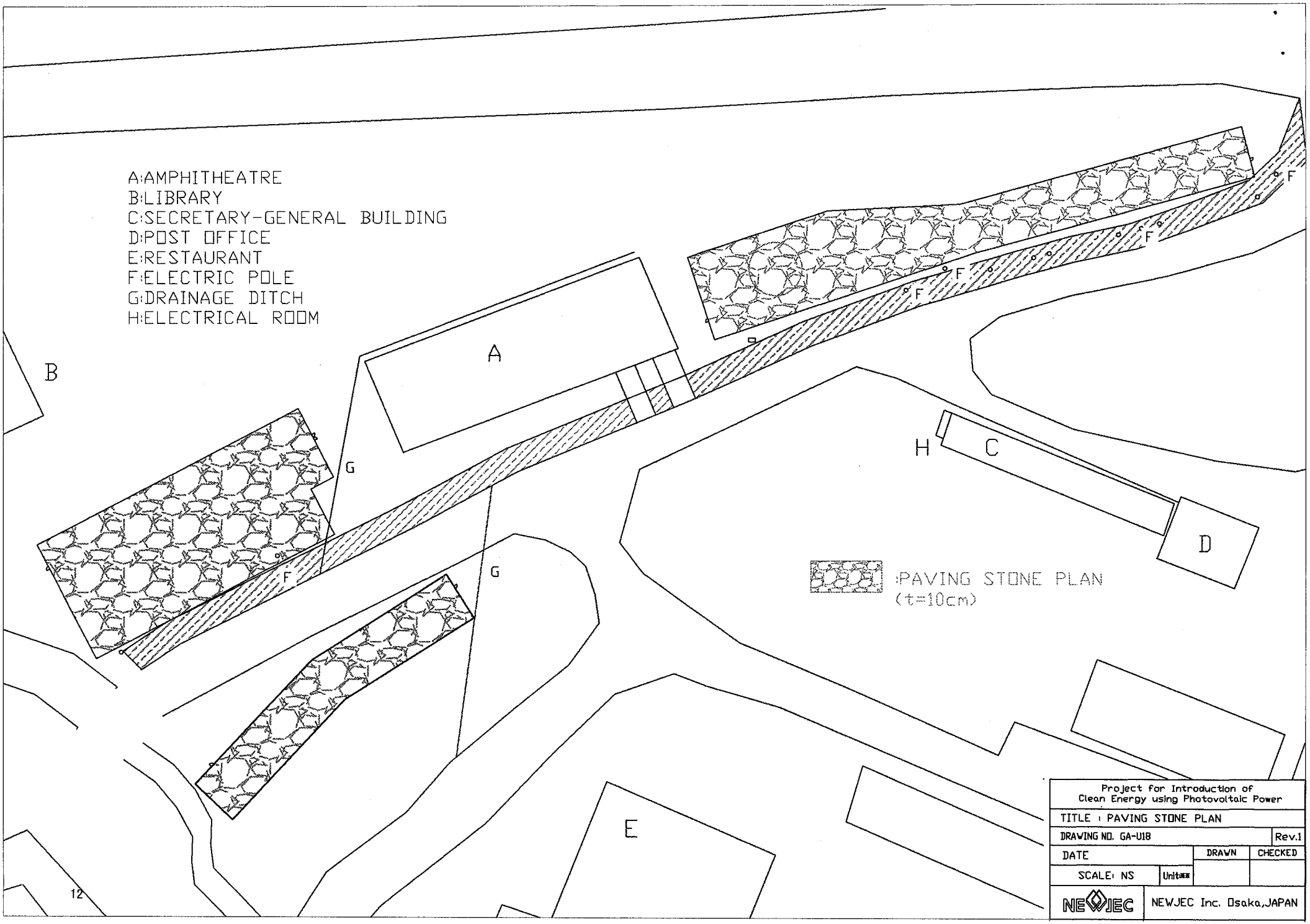
: GALLERY

: CABLE TRENCH

: PENETRATION HOLE

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION & WEIGHT				REMARKS
				WIDTH (mm)	DEPTH (mm)	HEIGHT (mm)	WEIGHT (kg)	
(1)	LOW VOLTAGE DISTRIBUTION PANEL	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MOLDED CASE CIRCUIT BREAKER & CONTROL DEVICES	1	1,750	450	2,000	-	UOB MANAGED
(2)	PV CONNECTION BOARD	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MOLDED CASE CIRCUIT BREAKER & CONTROL DEVICES	1	-	-	-	-	NEW EXPANTION PANEL (NEW)

11	PROJECT TITLE	DRAWING TITLE	Scale : 1 : 100 (A3)	Designed by	Checked by	Approved by	Date :
		EQUIPMENTS LAYOUT (ELECTRIC ROOM)		Draftman	Drawing No.		Edition / Sheet
			Date: 07.JULY.2008		GA - U15		



Project for Introduction of Clean Energy using Photovoltaic Power			
TITLE : PAVING STONE PLAN			
DRAWING NO. GA-U18			Rev.1
DATE		DRAWN	CHECKED
SCALE: NS	Unit:		
NEWJEC	NEWJEC Inc. Osaka,JAPAN		

A:AMPHITHEATRE
B:LIBRARY
C:SECRETARY-GENERAL BUILDING
D:POST OFFICE
E:RESTAURANT
F:ELECTRIC POLE
G:DRAINAGE DITCH
H:ELECTRICAL ROOM

GATE (TYPE1)

GATE (TYPE1)

GATE (TYPE2)

GATE (TYPE1)

GATE (TYPE1)

A

B

C

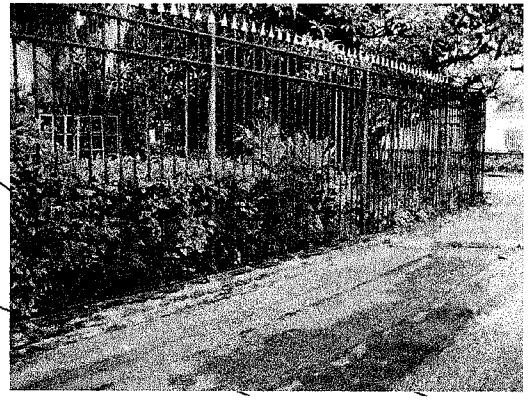
D

E

F

G

H



EXAMPLE OF FENCE (H=2M)

Project for Introduction of Clean Energy using Photovoltaic Power			
TITLE : LAYOUT OF FENCE AND GATE			
DRAWING NO. GA-U19			Rev.1
DATE		DRAWN	CHECKED
SCALE: NS	Unit:mm		
NEWJEC	NEWJEC Inc. Osaka,JAPAN		

Attachment 2

Proposition de Programmes de formation sur les Systèmes PV
Projet d'Introduction des Énergies Propres en Utilisant la Puissance Photovoltaique

Groupe d'Etude de l'Energie Solaire de la JICA

1. Historique

Pour le Gabon, ce sera le tout premier projet jamais expérimenté combinant le système solaire avec le réseau de la SEEG, bien que le Gabon dispose d'un nombre de panneaux solaires fonctionnant de manière autonome, destinés aux facilités médicales et scolaires, etc. Par conséquent, il est impérieux de former ces techniciens de l'Université Omar Bongo (UOB) et du Ministère des Affaires Etrangères (MAE) qui se chargeront de l'entretien des équipements. En même temps, il serait bénéfique d'informer les officiels du Ministère de l'Energie (ME) et peut-être ceux de la SEEG et á d'autres personnes intéressées par le projet, en ce qui concerne les aspects techniques et les problemes institutionnels appropriés aux systèmes PV et leur interconnection au réseau national, ă les amener ă se servir des projets renouvelables dans le futur.

2. Programme de Formation

Tel que prévu, le programme de formation comprend une série de conferences, exercices et trauvaux dirigés par des consultants japonais. Le programme s'exécutera en deux phases séparées; L'une au lancement du projet et l'autre trois mois après.

Il y aura aussi une formation d'installation et de maintenance des équipements dispensée par le contracteur du projet. Ainsi, le consultant et le contracteur travailleront en étroite collaboration sur les details de leur programme de formation afin que les techniques et connaissances nécessaires soient transmises efficacement aux participants á ce programme. Ces éléments de formation ayant un symbole (*), en dessous figurent ceux fournis on peut le présumer, par le Contracteur.

Les consultants apporteront des informations, supplémentaires sur de tels éléments, si nécessaire, pour les rendre plus pertinentes, pas juste "comment fonctionner", dans le contexte de la connaissance du fonctionnement des systèmes PV.

<u>Avant le Lancement du Projet</u> (approximativement 4 semaines avant)

Conférence sur des notions de base

- L'interconnexion de la grille et l'injection du système PV
- Caractéristiques de la production des modules PV
- Planning des systèms PV
- Demande en énergie, capacité des équipements á L'UOB et au Ministère des Affaires Etrangères.

Fonction pour la protection des systèmes PV en cas de délestage

Conférences sur le projet de construction

Distribution d'énergie dans un site et connexion du système PV

Calendrier des travaux

Construction des systèmes PV

Programme des travaux dirigés

Présence aux travaux de connexion

Présence avant le lancement du projet/tests de lancement du projet.

Après Le Lancement du Système PV

Formation assurée par le Contracteur

Lancement, arrêt et relancement du système (*)

Inspection et maintenance journalières (*)

Inspection et maintenance périodiques (*)

Travail consommable et maintenance (*)

Périodes d'interruption et actions (*)

Programmation des Travaux d'installation et de maintenance sur la base des manuels d'opération (exercises)

Elaboration d'une fiche de présence journalière

Formulaire comportant des données sur les échecs ou accidents

Entretien dans de bonnes conditions des facilitiés des PV.

Il y aura également un programme de formation dispensé 3 mois après le lancement des travaux, en rapport avec l'inspection de trois mois du Contracteur. Aprés 3 mois d'exécution des travaux et d'expérience en maintenance, il y aura des questions plus pertinentes et profondes á poser. Il pourrait aussi y avoir des problèmes d'exécution qui soient propres á chacun des sites que sont l'UOB et les Affaires Etrangères, selon les circumstances. Tous ces problèmes seront débattus et pris en compte dans la phase d'exécution et de feuilles de vérification, comme exercice supplémentaire.

Trois mois après le lancement des travaux

Un atelier : (A travers le questionnaire, une session questions & réponses, discussion)(*)

Présence à l'inspection de trois mois

Révision des opérations jounalières et fiches de présence

3. Participants

Techniciens de L'UOB et du Ministère des Affaires Etrangères:

Tous ceux qui utiliseront les systèmes

Les agents du ME: un planning régulatoire, la gestion des facilités ou les départments liés aux facilités de planning, de préférence avec un profit en ingénierie.

Les agents de la SEEG: au niveau de la distribution, l'achat d'énergie ou les departments liés à la gestion de l'usine, avec un profit en ingénierie (de préférence avoir un diplôme en ingénierie électrique)

4. Calendrier / hovaires

Programme Formation avant/après le Lancement des Travaux

		-5 sem	-4 sem	-3 sem	-2 sem	-1 sem	0 sem	1 sem	2 sem
Activités	préparation								
	Conférence sur des notions de base								
	Exercise de Construction								
	OJT								
	Formation de contracteur								
	O&M Planning								
Participants	UOB & MAE techniciens								
	Agents du ME								
	Agents de la SEEG								
Conférenciers	Consultant (chef)								
	Consultant (adjoint)								
	Interprète								

Programme Formation 3 mois après le Lancement des Travaux

		1 sem	2 sem	3 sem	4 sem
Activités	Review of logs (preparation)				
	Atelier				
	Présence à l'inspection de 3 mois				
	Révision de fiches de présence				
Participants	UOB & MFA technicians				
Conférenciers	Consultants (chef)				
	Interprète				

Discussion on Proposed PV Project at Ministry of Foreign Affairs

Date: December 18th, 2009

Place: Ministry of Foreign Affairs

1. Scope of the Project

The Project proposed will provide **Ministry of Foreign Affairs (MOFA)** with the works as shown below.

- Installation of the PV System with the capacity of 70kW
- Installation of the Electrical Facility Cubicle
- Installation of the PV Connection Box (PVCB) in the Electrical Room
- Installation of the Fence which surrounds the PV Modules and the Electrical Facility Cubicle

The system under planning is also presented as in the Attachment 1 and the following drawing list.

[List of Drawings to be presented]

- GA-M01 SINGLE LINE DIAGRAM (EXISTING)
- GA-M03a SINGLE LINE DIAGRAM (PV SYSTEM)
- GA-M04 GENERAL LAYOUT PLAN
- GA-M12 CABLE LAYOUT PLAN (OUTSIDE)
- GA-M15 EQUIPMENTS LAYOUT (ELECTRICAL ROOM)
- GA-M18 PAVING STONE PLAN
- GA-M19 LAYOUT OF FENCE AND GATE
- GA-M20 FENCE,GATE(DETAIL)

2. Operation of the PV System

(1) Operation under the normal condition

The PV System is designed to start sending electric power in the morning and stop in the late afternoon every day, by the scheduled timer.

If the electric power from SEEG (the Power Company) network is stopped (blackout, etc.,), the PV System will automatically shut down. After the power is recovered, the system must be restarted manually.

(2) Maintenance

- Daily inspection has to be done once a day by maintenance staff of MOFA.
- Periodical inspection is necessary, which may involve change of consumables and worn-out

parts.

3. Construction

There are a few important matters that need to be understood about the construction work (the Work).

(1) Interruption of power supply to MOFA at the power system switch which is controlled by the Power Company.

One electric board (PVCB) has to be installed in the Electric Room. The installation work requires interruption of the electric power supply from the Power Company to the whole MOFA building.

It is necessary to cover the electric power supply to the whole MOFA load by the mobile diesel generator to be prepared by the Contractor as the substitute source of electric power supply. However, there is entire electric power cut of MOFA a few times during the Work and the switching of the electric power supply from/to the Power Company to/from the mobile diesel generator.

Details of the Work is to be planned, and submitted by the Contractor. for approval of the engineer.

(2) Need to secure the Temporary Storage of the Materials and the Equipment

MOFA is requested to secure, free of charge, a space in the area of the MOFA for the Contractor to store the Materials and the Equipment transported from Japan.

(3) The Temporary Storage of the Construction Waste

The construction work produces large amount of wastes. They have to be stored temporally somewhere in the premise of MOFA before the Contractor disposes of them in a proper and lawful way.

4. Preparation for the Project

(1) Application for the interconnection of the PV System to the Power Company network.

As the PV System is interconnected to the Power Company network, a necessary procedure, which may involve applying for a license and so on, has to be initiated by MOFA.

(2) Preparation of the Site

The following matters should be undertaken by GABONESE side.

- To secure and keep open the space for PV System installation
- To clear and level the PV System installation area
- To clean up the inside of the Electric rooms before the Work starts
- To cut/remove the trees and plants in the PV Module installation area [Refer to Page.5]
- To trim the branches of the trees, which make shadow over the PV power modules [Refer to

Page.5]

(The trees outside the Ministry of Foreign Affairs near the PV Modules is included.)

5. Project Schedule (tentative only)

- Preparation of the contract with the Contractor : mid 2010
- Commencement of the Work at the Site : early 2011
- Completion of the Project and Commissioning : early 2012

Attachment-1

Basic Specification of PV System (Draft)

Name of Site : Ministry of Foreign Affairs

Item	Specification
Type of the PV system	Grid connection (No Storage Battery)
Capacity of the PV System	70kW
Basic configuration of the PV system	Refer to Fig.1 (Page.5)
Basic layout of the PV System	Refer to the drawing NO.GA-M04, (Page .9)
Electrical Facility Cubicle of the PV System	Refer to Fig.2
Grid connection point	Low voltage (At secondary side of the transformer)
Support stand of the PV Module	Hot dip zincing coated steel
Reverse power flow	There is no reverse power flow (Not to supply surplus electric power generated by the PV System to the SEEG power Grid)
Protection Relay of the SEEG Grid connection	Over current(OC), Over voltage(OV), Under voltage(UV), Over frequency(OF), Under frequency (UF), Islanding detector(ID)
Electric power supply in the case of power failure (blackout)	Not to supply electric power generated by the PV System to the load in the case of power failure
Display system	One set to be installed. Information to be displayed are 1) Current Output of the PV System (kW) 2) Electric power generated in the day (kWh) 3) Estimated reduction of CO2 emission
Fence and Gate for PV System	Refer to the drawing NO.GA-M19, (Page.13)
Meteorological observation device	Solar radiation and temperature measuring system at the PV panels
Language of operation and maintenance manuals	French

Note) Due to the instability of the PV System output, the PV System cannot supply the electric power to the critical load such as life supporting equipment.

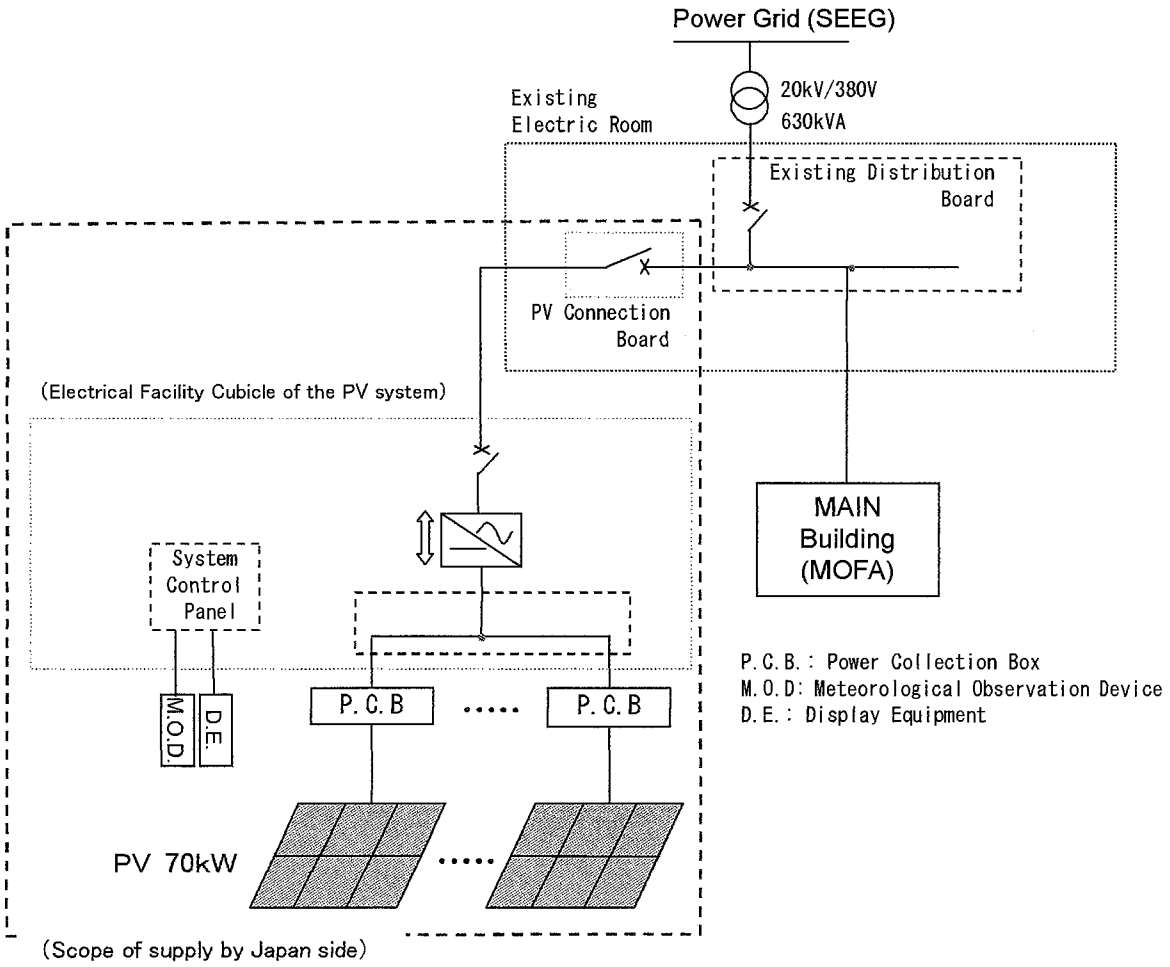
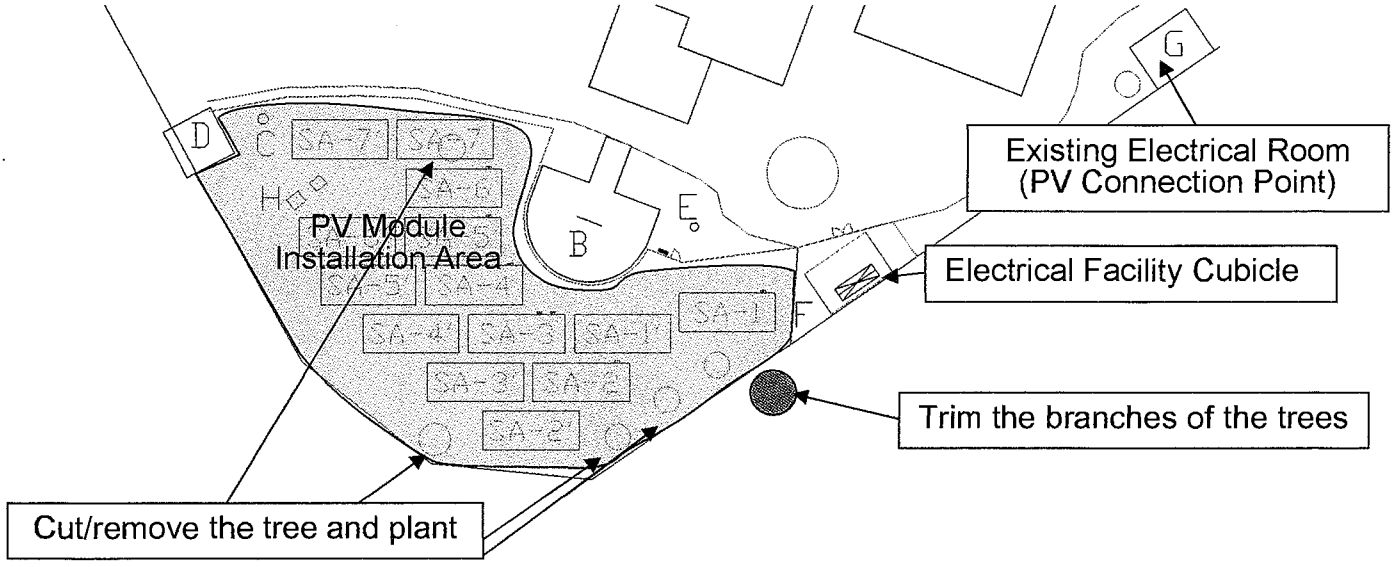


Fig. 1 Planned Configuration of PV system



The layout of Sub array (SA) will be reviewed by the detailed design result, if necessary.

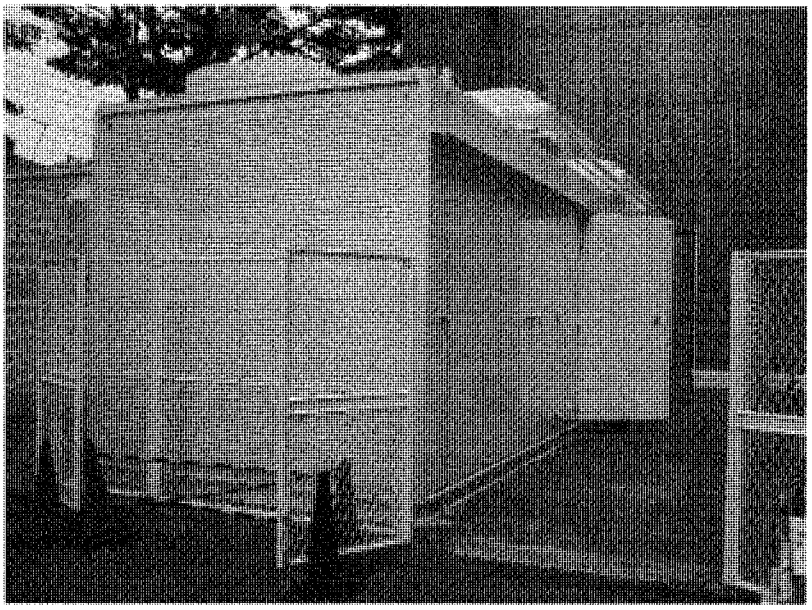
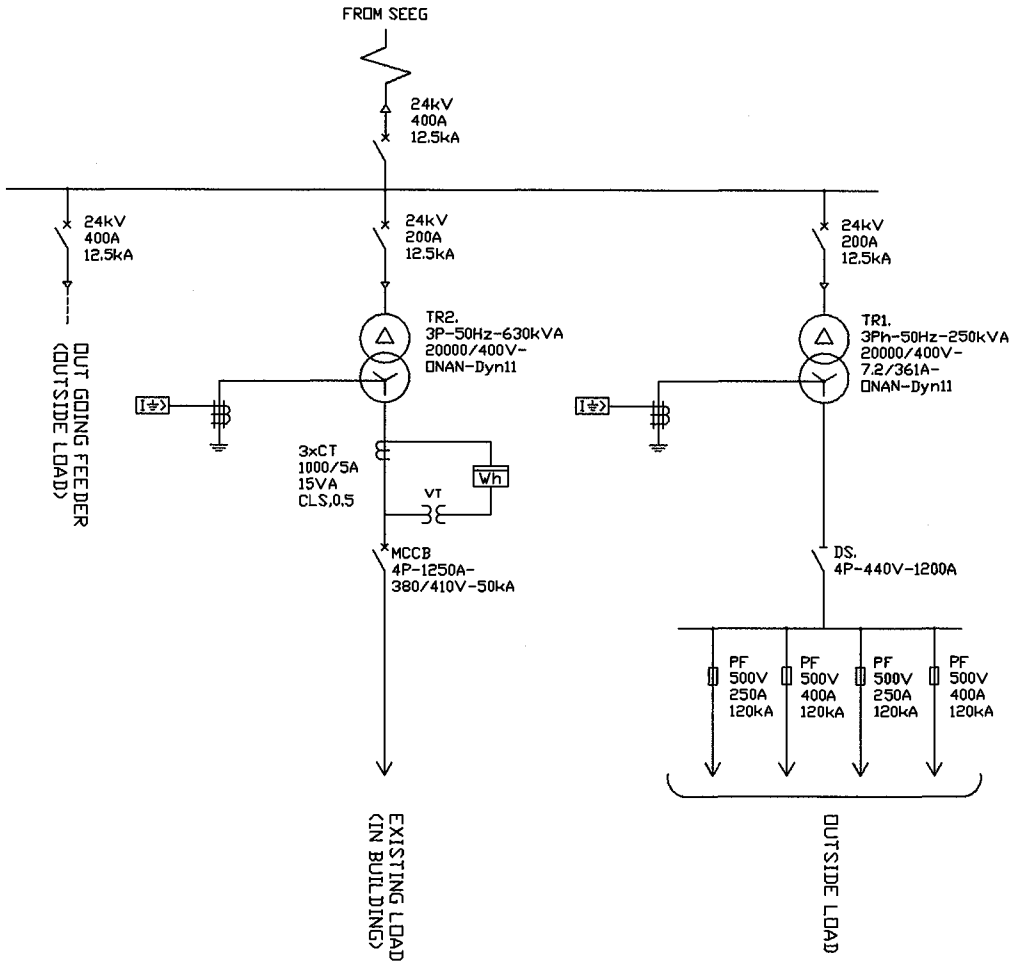


Fig.2 Example of Electrical Facility Cubicle of the PV system



SYMBOL	ABBREVIATION	DESCRIPTION
ISO	ISO	ISOLATOR
ES	ES	EARTHING SWITCH
	LBS	LOAD BREAK SWITCH
RM	RM	RING MAIN SWITCH
	LA	LIGHTNING ARRESTER
VCB	VCB	VACUUM CIRCUIT BREAKER
ACB	ACB	AIR CIRCUIT BREAKER
MCCB	MCCB	MOLDED CASE CIRCUIT BREAKER
VS	VS	VACUUM SWITCH
MC	MC	MAGNETIC SWITCH
PF	PF	POWER FUSE
F	F	FUSE
	TR	POWER TRANSFORMER
SR	SR	SERIAL REACTOR
SC	SC	STATIC CAPACITOR
U>	-	OVER VOLTAGE RELAY
U<	-	UNDER VOLTAGE RELAY
I>	-	OVER CURRENT RELAY
I<	-	UNDER CURRENT RELAY
Id/I>	-	DIRECTIONAL OVER CURRENT RELAY
I⏚>	-	OVER CURRENT GROUNDING RELAY
Id>	-	DIFFERENTIAL RELAY
3E	-	3-E RELAY (MULTI-FUNCTION MOTOR RELAY)
P<	-	REVERSE POWER RELAY
I<	-	REVERSE CURRENT RELAY
	-	OVER LOAD RELAY
	-	THERMAL RELAY
	VT	VOLTAGE TRANSFORMER
3	EVT	EARTH VOLTAGE TRANSFORMER
	CT	CURRENT TRANSFORMER
	ZCT	ZERO PHASE CURRENT TRANSFORMER
V	V	VOLT METER
A	A	AMMETER
Hz	Hz	FREQUENCY METER
W	W	WATT METER
Wh	Wh	WATT HOUR METER
cosφ	PF	POWER FACTOR METER
var	Var	VAR METER
VD	VD	VOLTAGE DETECTOR
	VS	VOLT METER CHANGE-OVER SWITCH
	AS	AMMETER CHANGE-OVER SWITCH
	-	CABLE HEAD
	-	BUS DUCT

Project for Introduction Of Clean Energy using Photovoltaic Power

TITLE : SINGLE LINE DIAGRAM (EXISTING)

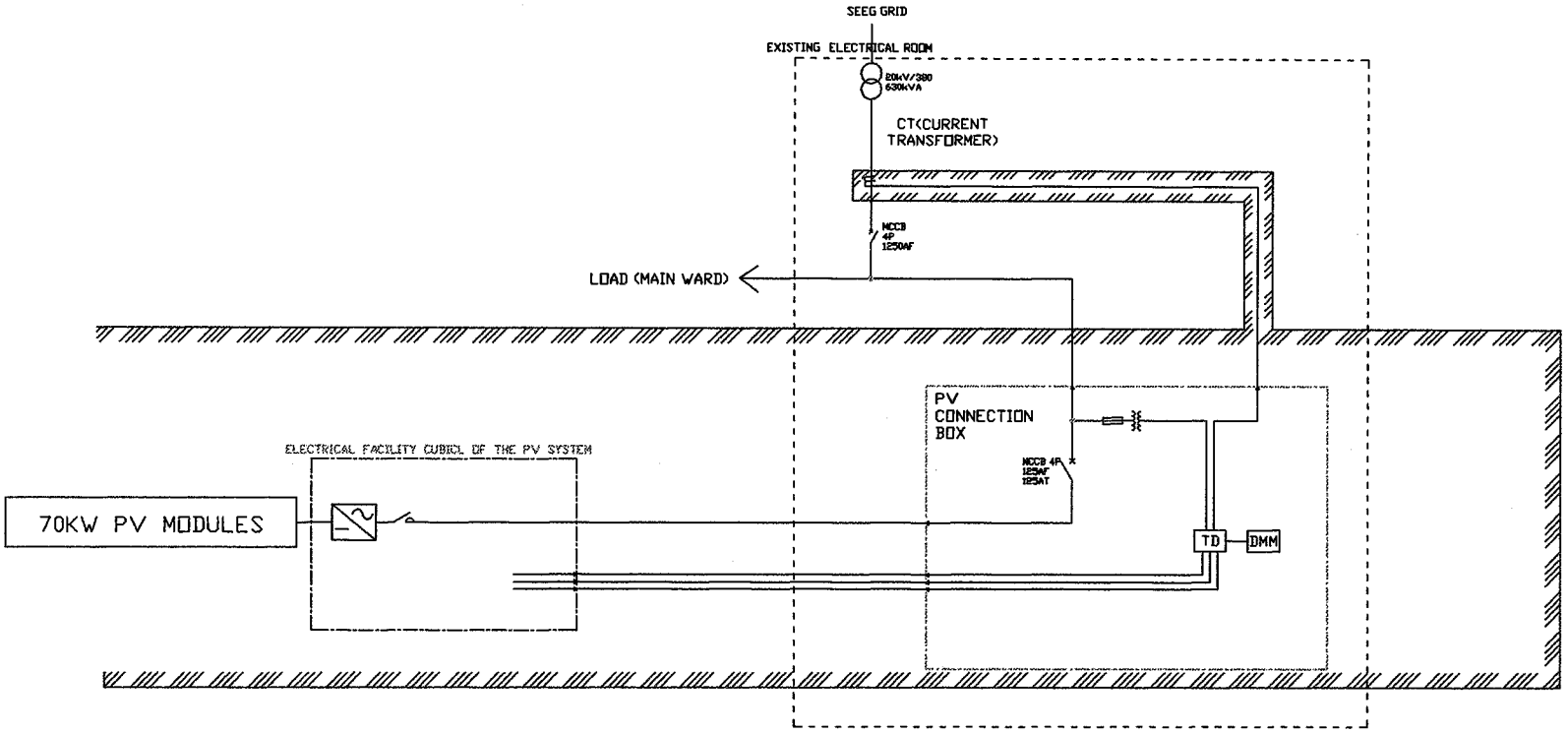
DRAWING NO. GA-M01 | Rev.1

DATE | DRAWN | CHECKED

SCALE: Non.(A3) | Unit:

NEWJEC | NEWJEC Inc. Osaka,JAPAN

Proposed PV system for MOFA



: SCOPE OF THE PROJECT

DMM:DIGITAL MULTI-METER
TD:TRANSDUCER

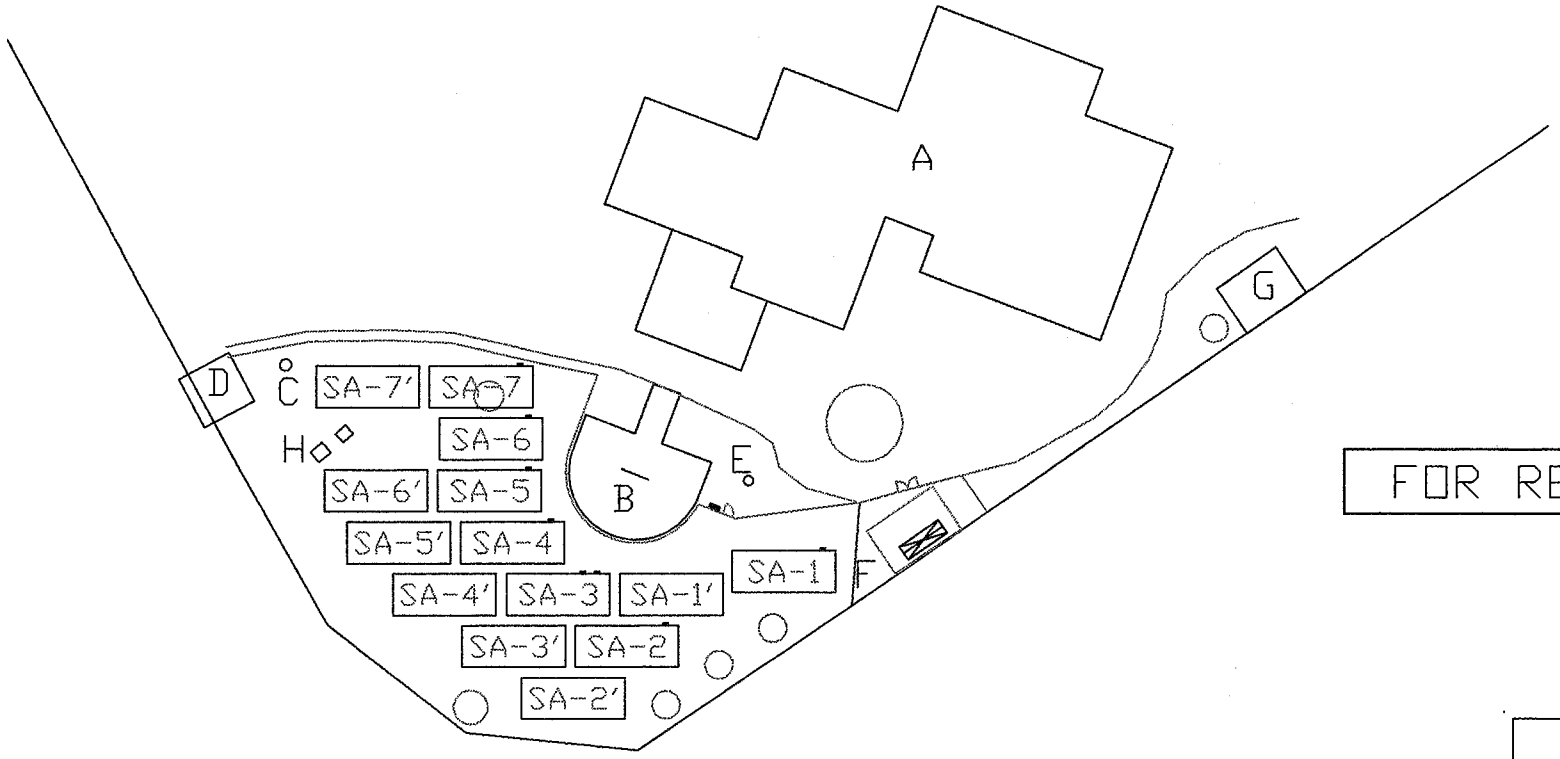
For Reference Only

* The value will be reviewed by the detailed design result, if necessary.

Project for Introduction of Clean Energy using Photovoltaic Power			
TITLE : SINGLE LINE DIAGRAM (PV SYSTEM)			
DRAWING NO. GA-M03a			Rev.1
DATE		DRAWN	CHECKED
SCALE: Non.(A3)	Unit:mm		
NEWJEC	NEWJEC Inc. Osaka,JAPAN		

A:MAIN BUILDING
B:POLE FOR NATIONAL FLAGS
C:LIGHTING POLE
D:WATER TANK HOUSE
E:FIRE HYDRANT
F:DRAINAGE DITCH
G:EXISTING ELECTRICAL ROOM
H:MANHOLE

: ELECTRICAL FACILITY CUBICLE OF THE PV SYSTEM
: PV SUBARRAY
: DISPLAY EQUIPMENT
: POWER COLLECTOIN BOX
: TD(TRANSDUCER) BOX FOR SOLAR RADIATION etc.
: FENCE
: GATE

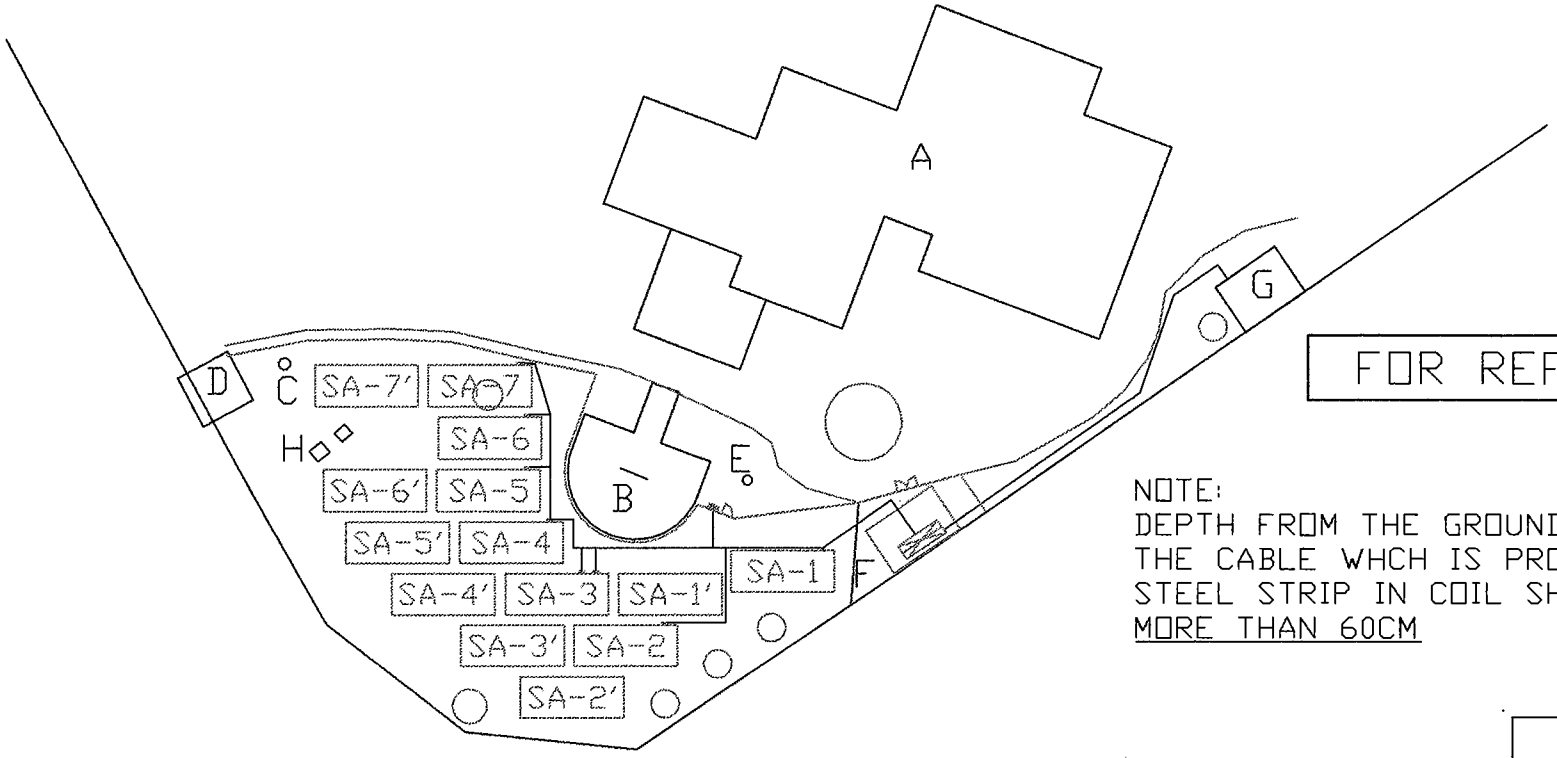


FOR REFERENCE

Project for Introduction of Clean Energy using Photovoltaic Power			
TITLE : GENERAL LAYOUT PLAN			
DRAWING NO. GA-M04			Rev.1
DATE		DRAWN	CHECKED
SCALE: NS	Unit:		
NEWJEC	NEWJEC Inc. Osaka,JAPAN		

A:MAIN BUILDING
B:POLE FOR NATIONAL FLAGS
C:LIGHTING POLE
D:WATER TANK HOUSE
E:FIRE HYDRANT
F:DRAINAGE DITCH
G:EXISTING ELECTRICAL ROOM
H:MANHOLE

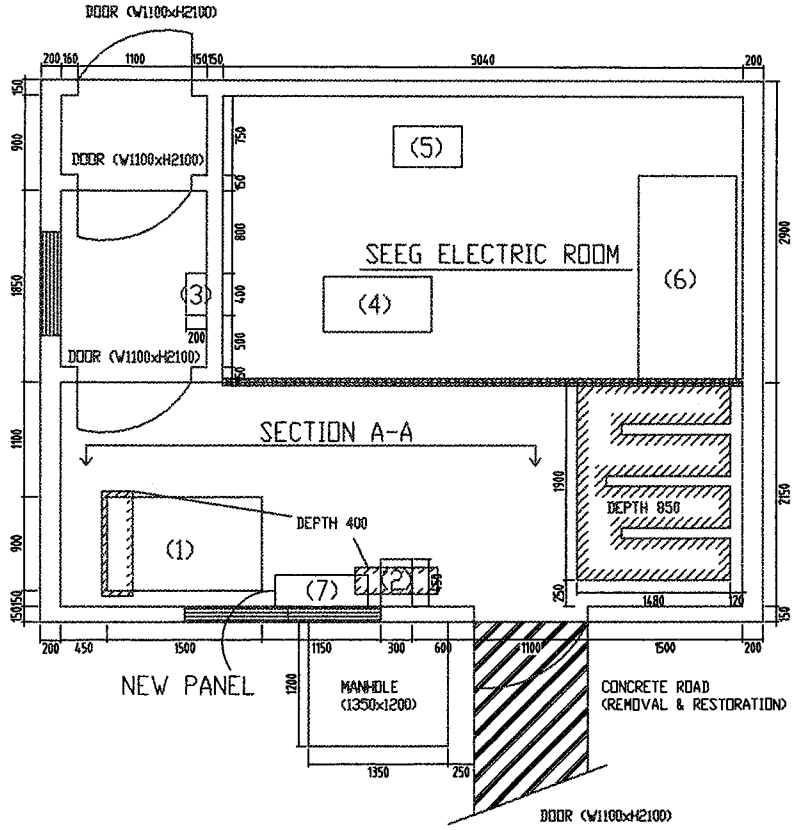
: ELECTRICAL FACILITY CUBICLE OF THE PV SYSTEM
: PV SUBARRAY
: DISPLAY EQUIPMENT
: POWER COLLECTOIN BOX
: TD(TRANSDUCER) BOX
FOR SOLAR RADIATION etc.
: FENCE
: GATE



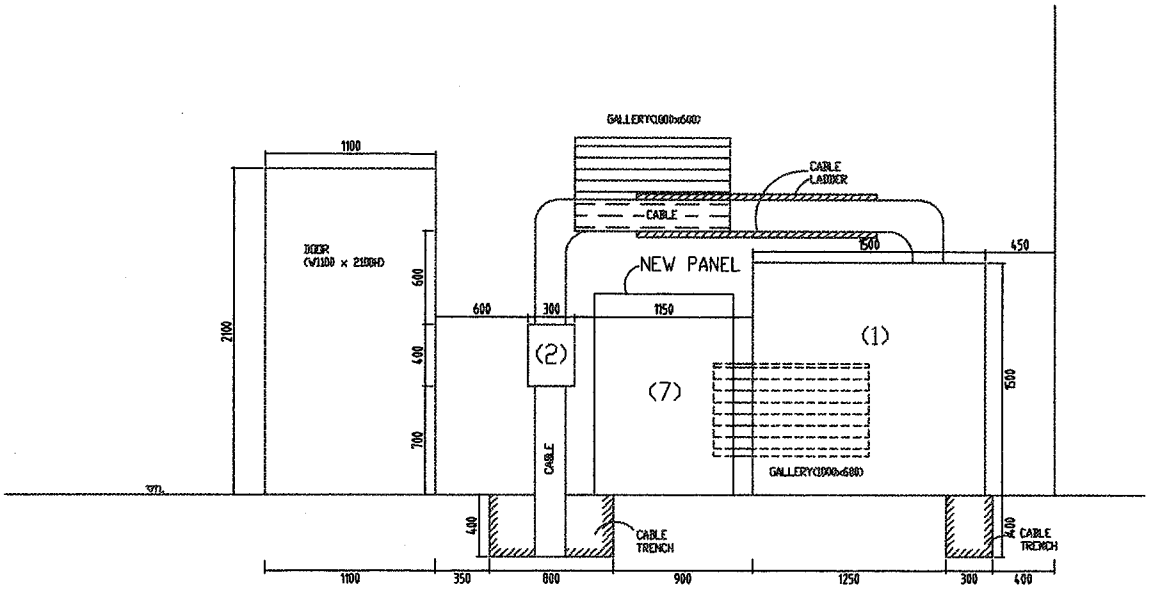
FOR REFERENCE

NOTE:
DEPTH FROM THE GROUND SURFACE OF THE CABLE WHCH IS PROTECTED WITH STEEL STRIP IN COIL SHALL BE MORE THAN 60CM

Project for Introduction of Clean Energy using Photovoltaic Power		
TITLE : CABLE LAYOUT PLAN (OUTSIDE)		
DRAWING NO. GA-M12		Rev.1
DATE	DRAWN	CHECKED
SCALE: NS Unit:		
NEWJEC	NEWJEC Inc. Osaka,JAPAN	



PLAN



SECTION A-A

NOTE

: GALLERY

: CABLE TRENCH

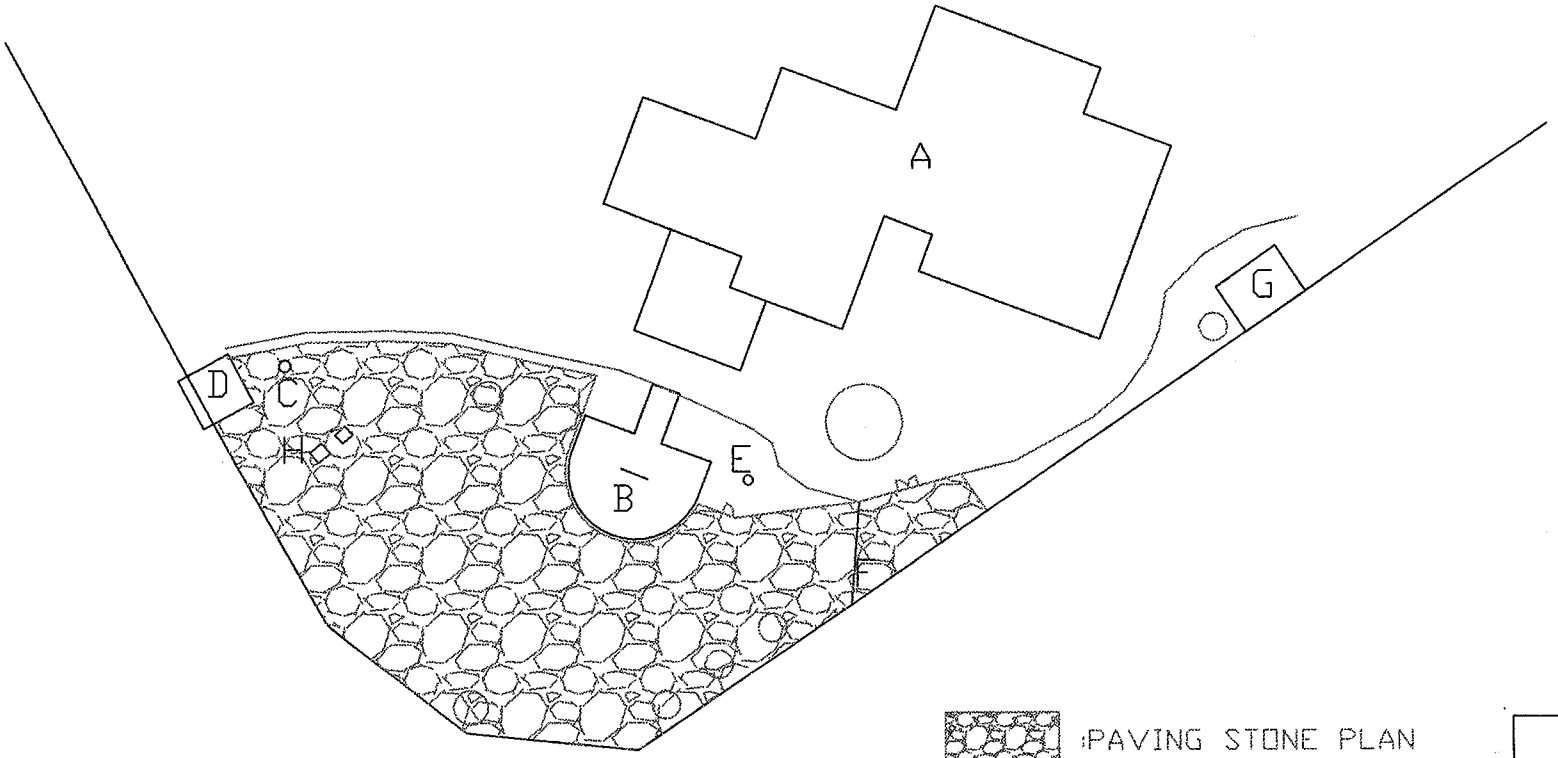
: CONCRETE PAVE

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION & WEIGHT				REMARKS
				WIDTH [mm]	DEPTH [mm]	HEIGHT [mm]	WEIGHT [Kg]	
(1)	No.TR2 TRANSFORMER	ONAN TYPE, 3PHASE-50Hz-630kVA-20000/400V-18.2/909.4A-Dyn11	1	1,500	900	1,500	-	MOF MANAGED
(2)	LOW VOLTAGE MAIN FEEDER RACK	WALL MOUNTED TYPE FEEDER RACK CONSISTING OF AIR CIRCUIT BREAKER.	1	300	450	400	-	MOF MANAGED
(3)	METERING BOX	OPEN TYPE, WALL MOUNTING, CONSISTING OF WHR METER	1	400	200	500	-	EXISTING PANEL
(4)	No.TR1 TRANSFORMER	ONAN TYPE, 3PHASE-50Hz-250kVA-20000/400V-7.2/361A-Dyn11	1	-	-	-	-	SEEG MANAGED
(5)	LOW VOLTAGE FUSE RACK	WALL MOUNTED TYPE FUSE RACK CONSISTING OF DISCONNECTING SWITCH & POWER FUSES.	1	-	-	-	-	SEEG MANAGED
(6)	24kV SWITCHGEAR	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CIRCUIT BREAKER & PROTECTION DEVICES.	4	-	-	-	-	SEEG MANAGED
(7)	PV SYSTEM FEEDER PANEL	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MCCB	1	-	-	-	-	NEW EXPANTION PANEL (NEW)

PROJECT TITLE	DRAWING TITLE	Scale :	Designed by	Checked by	Approved by	Date :
	EQUIPMENTS LAYOUT (ELECTRIC ROOM)	1 : 100 (A3)				
		Date: 07.JULY.2008	Draftman	Drawing No. GA - M15		Edition / Sheet

A:MAIN BUILDING
B:POLE FOR NATIONAL FLAGS
C:LIGHTING POLE
D:WATER TANK HOUSE
E:FIRE HYDRANT
F:DRAINAGE DITCH
G:EXISTING ELECTRICAL ROOM
H:MANHOLE

FOR REFERENCE

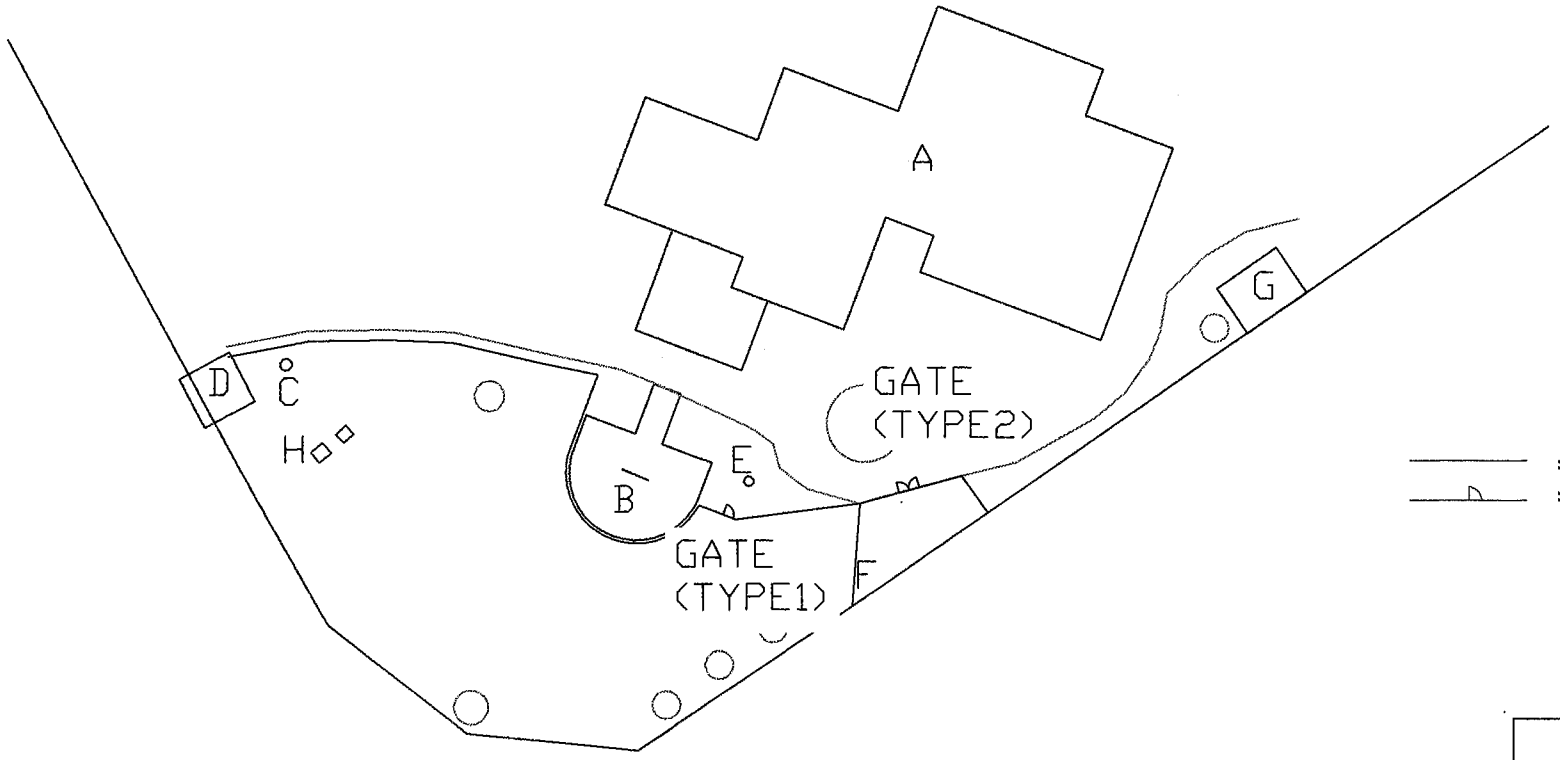


:PAVING STONE PLAN
(t=10cm)

Project for Introduction of Clean Energy using Photovoltaic Power			
TITLE : PAVING STONE PLAN			
DRAWING NO. GA-M18			Rev.1
DATE		DRAWN	CHECKED
SCALE: NS	Unit:		
NEWJEC	NEWJEC Inc. Osaka,JAPAN		

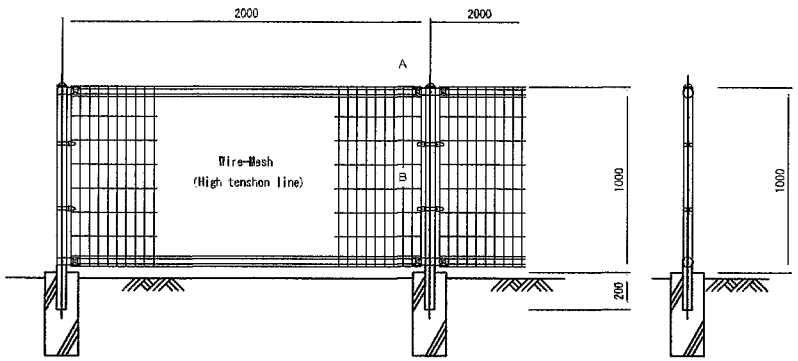
A:MAIN BUILDING
B:POLE FOR NATIONAL FLAGS
C:LIGHTING POLE
D:WATER TANK HOUSE
E:FIRE HYDRANT
F:DRAINAGE DITCH
G:EXISTING ELECTRICAL ROOM
H:MANHOLE

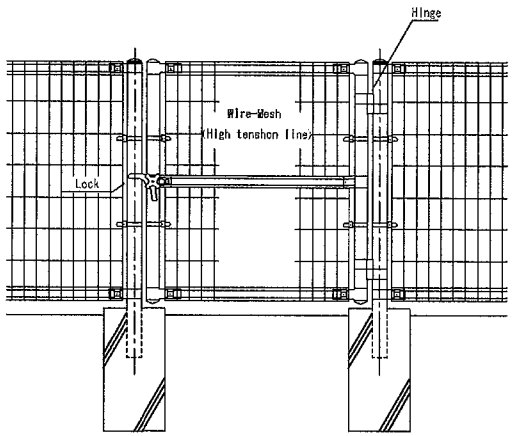
FOR REFERENCE



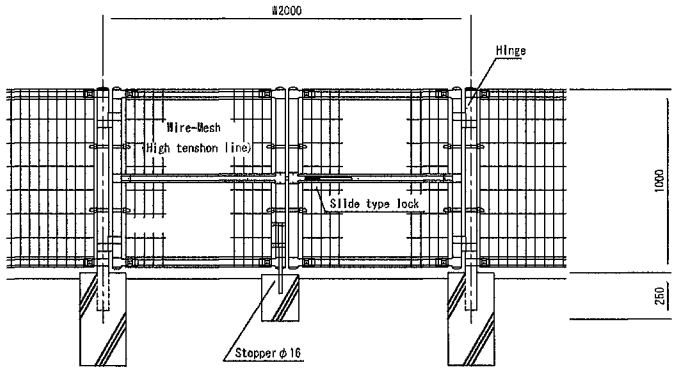
Project for Introduction of Clean Energy using Photovoltaic Power			
TITLE : LAYOUT OF FENCE AND GATE			
DRAWING NO. GA-M19			Rev.1
DATE		DRAWN	CHECKED
SCALE: NS	Unit:		
NEWJEC	NEWJEC Inc. Osaka,JAPAN		

FENCE H=1000





FENCE GATE(TYPE2) H-1000 W-2000



Project for Introduction of Clean Energy using Photovoltaic Power		
TITLE : FENCE, GATE(DETAIL)		
DRAWING NO. GA-M20		Rev.1
DATE	DRAWN	CHECKED
SCALE: Non. (A3) Unit:mm		
NEWJEC	NEWJEC Inc. Osaka, JAPAN	

Attachment 2

Proposition de Programmes de formation sur les Systèmes PV
Projet d'Introduction des Énergies Propres en Utilisant la Puissance Photovoltaique

Groupe d'Etude de l'Energie Solaire de la JICA

1. Historique

Pour le Gabon, ce sera le tout premier projet jamais expérimenté combinant le système solaire avec le réseau de la SEEG, bien que le Gabon dispose d'un nombre de panneaux solaires fonctionnant de manière autonome, destinés aux facilités médicales et scolaires, etc. Par conséquent, il est impérieux de former ces techniciens de l'Université Omar Bongo (UOB) et du Ministère des Affaires Etrangères (MAE) qui se chargeront de l'entretien des équipements. En même temps, il serait bénéfique d'informer les officiels du Ministère de l'Energie (ME) et peut-être ceux de la SEEG et á d'autres personnes intéressées par le projet, en ce qui concerne les aspects techniques et les problemes institutionnels appropriés aux systèmes PV et leur interconnection au réseau national, ă les amener ă se servir des projets renouvelables dans le futur.

2. Programme de Formation

Tel que prévu, le programme de formation comprend une série de conferences, exercices et trauvaux dirigés par des consultants japonais. Le programme s'exécutera en deux phases séparées; L'une au lancement du projet et l'autre trois mois après.

Il y aura aussi une formation d'installation et de maintenance des équipements dispensée par le contracteur du projet. Ainsi, le consultant et le contracteur travailleront en étroite collaboration sur les details de leur programme de formation afin que les techniques et connaissances nécessaires soient transmises efficacement aux participants á ce programme. Ces éléments de formation ayant un symbole (*), en dessous figurent ceux fournis on peut le présumer, par le Contracteur.

Les consultants apporteront des informations, supplémentaires sur de tels éléments, si nécessaire, pour les rendre plus pertinentes, pas juste "comment fonctionner", dans le contexte de la connaissance du fonctionnement des systèmes PV.

<u>Avant le Lancement du Projet</u> (approximativement 4 semaines avant)

Conférence sur des notions de base

- L'interconnexion de la grille et l'injection du système PV
- Caractéristiques de la production des modules PV
- Planning des systèms PV
- Demande en énergie, capacité des équipements á L'UOB et au Ministère des Affaires Etrangères.

Fonction pour la protection des systèmes PV en cas de délestage

Conférences sur le projet de construction

Distribution d'énergie dans un site et connexion du système PV

Calendrier des travaux

Construction des systèmes PV

Programme des travaux dirigés

Présence aux travaux de connexion

Présence avant le lancement du projet/tests de lancement du projet.

Après Le Lancement du Système PV

Formation assurée par le Contracteur

Lancement, arrêt et relancement du système (*)

Inspection et maintenance journalières (*)

Inspection et maintenance périodiques (*)

Travail consommable et maintenance (*)

Périodes d'interruption et actions (*)

Programmation des Travaux d'installation et de maintenance sur la base des manuels d'opération (exercises)

Elaboration d'une fiche de présence journalière

Formulaire comportant des données sur les échecs ou accidents

Entretien dans de bonnes conditions des facilitiés des PV.

Il y aura également un programme de formation dispensé 3 mois après le lancement des travaux, en rapport avec l'inspection de trois mois du Contracteur. Aprés 3 mois d'exécution des travaux et d'expérience en maintenance, il y aura des questions plus pertinentes et profondes á poser. Il pourrait aussi y avoir des problèmes d'exécution qui soient propres á chacun des sites que sont l'UOB et les Affaires Etrangères, selon les circumstances. Tous ces problèmes seront débattus et pris en compte dans la phase d'exécution et de feuilles de vérification, comme exercice supplémentaire.

Trois mois après le lancement des travaux

Un atelier : (A travers le questionnaire, une session questions & réponses, discussion)(*)

Présence à l'inspection de trois mois

Révision des opérations jounalières et fiches de présence

3. Participants

Techniciens de L'UOB et du Ministère des Affaires Etrangères:

Tous ceux qui utiliseront les systèmes

Les agents du ME: un planning régulatoire, la gestion des facilités ou les départments liés aux facilités de planning, de préférence avec un profit en ingénierie.

Les agents de la SEEG: au niveau de la distribution, l'achat d'énergie ou les departments liés à la gestion de l'usine, avec un profit en ingénierie (de préférence avoir un diplôme en ingénierie électrique)

4. Calendrier / hovaires

Programme Formation avant/après le Lancement des Travaux

		-5 sem	-4 sem	-3 sem	-2 sem	-1 sem	0 sem	1 sem	2 sem
Activités	préparation								
	Conférence sur des notions de base								
	Exercise de Construction								
	OJT								
	Formation de contracteur								
	O&M Planning								
Participants	UOB & MAE techniciens								
	Agents du ME								
	Agents de la SEEG								
Conférenciers	Consultant (chef)								
	Consultant (adjoint)								
	Interprète								

Programme Formation 3 mois après le Lancement des Travaux

		1 sem	2 sem	3 sem	4 sem
Activités	Review of logs (preparation)				
	Atelier				
	Présence à l'inspection de 3 mois				
	Révision de fiches de présence				
Participants	UOB & MFA technicians				
Conférenciers	Consultants (chef)				
	Interprète				

6.2 The Letter for Environmental Impact Assessment

MINISTERE DES EAUX ET FORETS, DE L'ENVIRONNEMENT ET DU DEVELOPPEMENT DURABLE

DIRECTION GENERALE DE L'ENVIRONNEMENT ET DE LA PROTECTION DE LA NATURE

DIRECTION DE L'ENVIRONNEMENT ET DE LA NATURE

N° 00093 /MEFEDD/DGEPN/DEN/

REPUBLIQUE GABONAISE
Union – Travail – Justice

Libreville, le 21 JAN. 2010

LE DIRECTEUR GENERAL

Monsieur le Responsable des Considérations Environnementales et Sociales
Equipe d'Etudes de la **JICA**
Libreville

Objet : Recommandations relatives au projet de promotion des Energies Propres en utilisant le système photovoltaïque solaire

Monsieur,

Suite aux échanges que nous avons eus le **lundi 19 janvier 2010** dans la salle réunion de la Direction Générale de l'Environnement et de la Protection de la Nature, j'ai l'honneur de vous informer que les impacts associés à la réalisation de votre projet ont été clairement identifiés.

A cet effet, nous vous demandons de bien vouloir intégrer les recommandations ci-dessous, lesquelles tiennent lieu d'informations complémentaires à fournir à l'administration en charge de l'environnement, à savoir :

- Préciser les moyens de sécurité envisagés pour prévenir les risques d'électrocution des travailleurs sur les deux (02) chantiers durant la phase de construction ;
- Préciser les mesures prévues lors de la phase d'exploitation pour la sécurisation des installations sur les sites retenus ;
- Préciser la superficie des futures installations sur les deux (02) sites retenus (Ministère des Affaires Etrangères et Université Omar Bongo).

Veuillez agréer, Monsieur, l'assurance de ma considération distinguée.

P. Le Directeur Général de l'Environnement
P.I Le Directeur Général Adjoint

Dr. Ange Simplice BOUKINDA


JICA