Ministry of Energy and Natural Resources
The Repiblic of Djibouti

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

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 Republic of Djibouti.

JICA sent to Djibouti survey team headed by Mr. Masaru NISHIDA of NEWJEC Inc. and consist of NEWJWC Inc. and JAPAN TECHNO CO., LTD. from July 25th to August 5th and from October 22nd to November 11th, 2009.

The team held discussions with the officials concerned of the Government of Djibouti, 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 Djibouti from April 16th to 22nd 2010 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.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Republic of Djibouti 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

The Republic of Djibouti is located at the stump of "Horn of Africa", facing Yemen across the strait connecting Red Sea and the Gulf of Aden. It borders with Eritrea in the north, Ethiopia in the west and Somalia in the south. The only deep-water port in the region makes the country a focal point of transportation and trade.

The territory is 23,200 sq kilometer, characterized by hot and dry climate with the annual average temperature of 26-35 degree centigrade, and rainfall 100-300mm in depth.

Gross domestic product is US 830 million dollar, and gross national income per capita US 1,090 dollar in 2007 (World Bank). Under the harsh climate the proportion of the primary industry is small at 4.8%, with agricultural output 6,000 to 7,000 tonnes, fishery 1,200 tonnes. Secondary industry is small as well, mostly occupied by water and electricity utilities. Goods traded in the domestic markets are mostly imported. Tertiary industry is active with the country's geographical advantage: port, freight, distribution businesses account for 81% of the economy. Its trading partners are mostly Ethiopia and Somalia.

Population is not well documented with the last census conducted in 1983. The estimation of the Ministry of Economy and Finance shows 632 thousand for 2004. Population growth rate is reported to be around 2% per annum. Concentration in urban areas is high at 76% and Djibouti City is inhabited with 63% of the national population. Remaining 24% includes nomadic people.

II. Background of the Project and its Outline

Djibouti is not endowed with primary resources for conventional electricity generation, such as petroleum, nor with rivers or water resources large enough to be used in hydropower. The country depends 100% of energy on import. Djibouti Government's research into the use of renewable energy began as early as in 1980s. For solar energy use, it has formulated "National Strategy and Action Plans (2008 to 2012)" with assistance from UNDP, in which it clearly stated the intention to promote the use of solar energy as one of the pillars in the energy policy. The statement also mentions the necessity of both soft and hard measures, including formulation of particular development projects, economic measures to nurture related markets, setting up of new agency in charge and institutional provisions. However, in order to put these measures in place, it will have to rely on technical and financial assistance from various donors

outside.

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. In accordance with the initiative, Djibouti Government requested to the Government of Japan for Grant Aid in June 2009.

Having received this request, JICA conducted the first phase site survey between July 26th to August 5th in 2009, identified Centre d'Etudes et de Recherche de Djibouti (CERD) as a candidate site for PV system installation, and made into an agreement with the Recipient.

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

Subsequently JICA sent the Study Team for the second phase site survey between October 23rd and November 11th to Djibouti, 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 Djibouti again between April 17th and 22nd 2010, explained and discussed the report, and signed the minute of meeting with the Government of Djibouti.

As a result of the study, the Project proposed is to provide CERD with a photovoltaic system (PV system) of 300kW peak power and to supply electric power to the facility, 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 Natural Resources. The summary of outline design of the PV equipment is shown in the table below.

Category	Content
Site and PV Capacity	CERD: 300kW PV 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 restart in Stand-alone Mode to supply power to part of CERD
Procurement of Generating equipments and Installation Work	300kWPV modules Ancillary equipment for PV system - Junction box - Power conditioner cubicle - Meteorological observation device - Branch Switchers for Load (for Stand-alone mode) - Materials for wiring and earthing - Electrical facility cubicle - Supporting structures for PV modules - Foundation of supporting structures for PV modules and electrical facility cubicle - Fences, gates, and grave surfacing - Cable connection for Electrical facility cubicle/interconnection point/display equipment/connection to existing loads
Spare Parts and Tool Kits	Spare parts and tool kits for maintenances of equipment Manuals for O&M and implementation of O&M Guidance

IV. Project Implementation Cost and Period

The cost of Djibouti side of this Project implemented under Japan's Grand Aid scheme is estimated to be DJF 1.4 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 operated and maintained by the Site, CERD, for its daily operation and maintenance, with the ownership and the management of the Ministry of Energy and Natural Resources. The maintenance of the equipment in the long run will also require technical assistance and input from the Ministry.

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 Djibouti.

The direct effect of this Project is expected to be the introduction of renewable energy source in Djibouti which is dependent on fossil fuel for the primary energy of electricity, 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 330 t-CO_2 per year.

As this Project will install a large scale solar generation system along the road connecting the center of the capital city and the main airport of the country, its high demonstration effect will contribute to the Recipient's policy to promote the use of solar energy.

The policy also has identified CERD to be a center of the promotion of solar energy technology and use. This Project will support CERD to acquire and accumulate knowledge and techniques in solar energy use.

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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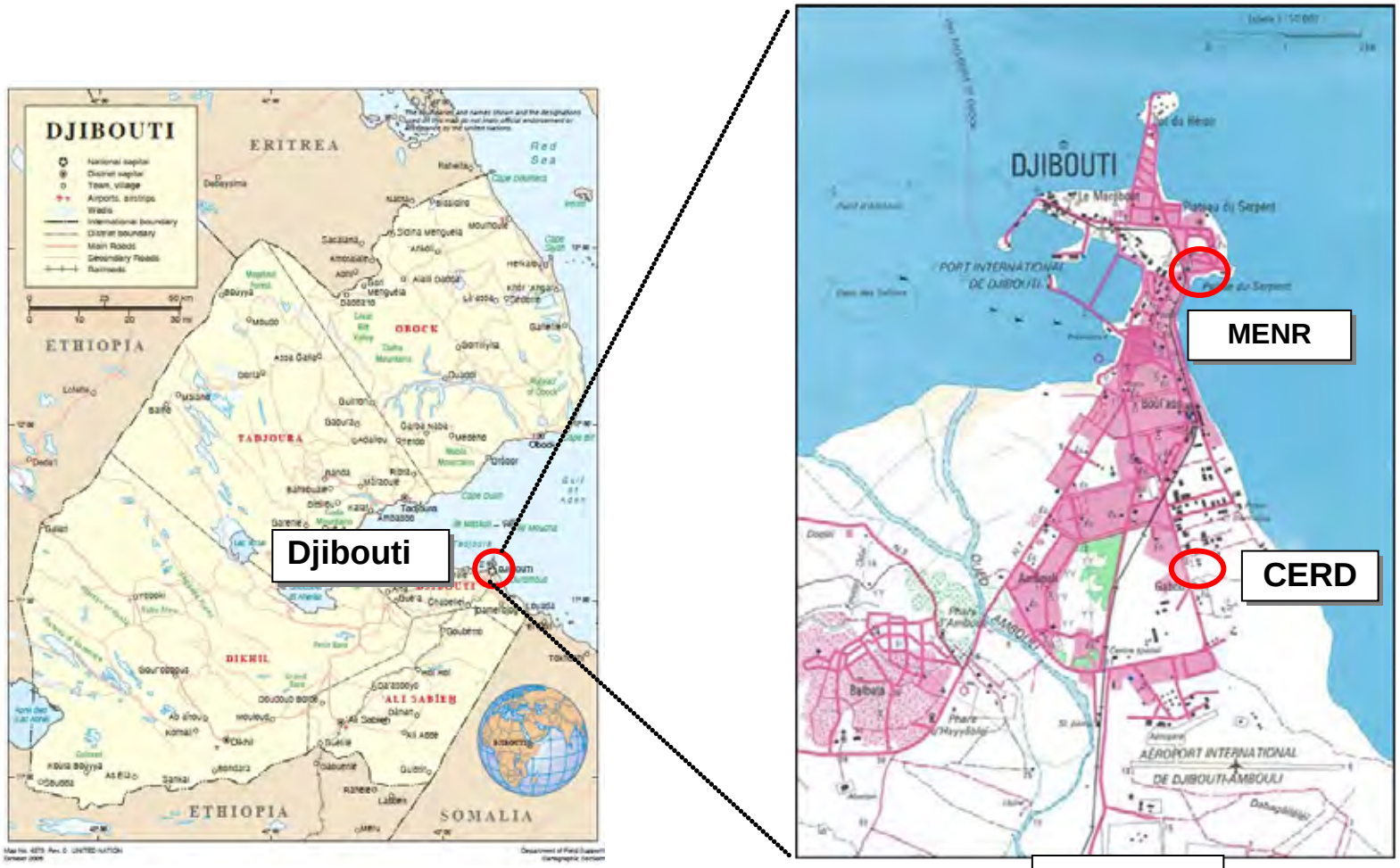

Location of Project Site

Location Map

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Abbreviations

AC	Alternating Current
B/A	Banking Arrangement
CERD	Centre d'Etudes et de Recherche de Djibouti
CT	Current Transformer
DC	Direct Current
DEG	Diesel Engine Generator
EDD	Electricité De Djibouti
EIA	Environmental Impact Assessement
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
ME	Ministry of Housing, Urbanization and Environment
MENR	Ministry of Energy and Natural Resource
MFA	Ministry of Foreign Affairs
MF	Ministry of Finance
O&M	Operation and Maintenance
OJT	On the Job Training
PCS	Power Conditioners
PV	Photovoltaic
PVC	Polyvinyl Chloride
SI	The International System of Units
UNICEF	United Nations International Children's Fund
UNDP	United Nations Development Programme
VT	Voltage Transformer
XLPE	Cross-linked Polyethylene

CHAPTER 1

BACKGROUND OF PROJECT

Chapter 1 Background of the Project

1-1 Background of the Study

Djibouti is not endowed with conventional energy resources such as fossil fuels or hydro potentials. It has to depend on imported fuels for primary energy. The government of Djibouti started as early as in 1980's to harness its renewable resources. Recently the government drew up a national strategy and action plan for the development of renewable resources for the period 2008 to 2012, highlighting its intention to use solar energy as a key resource for Djibouti's energy policy. In the document, specific development plans of solar utilization are discussed, as well as financial incentives such as tax break to promote the market for PV related products, setting up of new public body that handles renewable projects, and establishment of relevant laws and regulations. With these measures, the government is trying to improve the environment of the sector on both hard and soft sides. Meanwhile, for the technical and financial resources, the government has been requesting various donors for assistance.

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. Djibouti Government requested to the Government of Japan for Grant Aid in June 2009 is as follows.

Amount of request: US$6,000,000
Description of request:

1) Solar panel (100kVA)
   Amount: US$300,000×5 = US$1,500,000
   Location: Public facilities in Djibouti City
   (Office of the prime minister, Ministry of finance, Court, Ministry of interior, Ministry of energy and natural resources)

2) Solar panel (50kVA)
   Amount: US$150,000×30 = US$4,500,000
   Location: Laboratory, Ministry, Education and research center, Faculty office building

Having received this request, JICA conducted the first phase site survey and visited the above facilities as in 1) in the first site survey between July 26th and August 5th 2009, in order to determine the potential of installation of solar systems and the aptitude as this Grant Aid project. The survey identified the Centre d'Etudes et de Recherche de Djibouti (CERD) as

most suitable site candidate because it was located in the suburb of Djibouti City and possesses a large open space facing the airport road.

In this Grant Aid project, photovoltaic power generation systems (PV systems) will be provided as part of assistance for countermeasure of climate change in Djibouti, and a part of power supplied in this country will be replaced by renewable energy, supporting the country to cope with both greenhouse gas emission and economic growth, by decreasing dependency on fossil fuel and relieving the burden of electricity charge for this public facility.

1-2 Project Site and Surroundings

1-2-1 Related Infrastructure

(1) Status of Existing Electric Equipment of the Facility

As the main existing electric equipment in the facility, there is a transformer (20kV/380V, 800kVA) inside the EDD owned electrical room. Incoming line is divided into four separate lines each of which is attached with a fuse. One of these lines goes to bio-laboratory of CERD and the communication equipment owned by outside entity. Other three lines pass through a low voltage panel placed in CERD electrical room adjacent to the EDD electrical room, end up in the administration building, the energy laboratory building and the Pedology building. Although there are no existing diagrams or drawings available to show the arrangement of these power cables laid underground, electrical technicians of the facility are roughly aware of the locations of these lines. Also, JICA Team conducted a brief survey to confirm the information given by the technicians.

There are two diesel generator sets in the facility, each of which has 100kW capacity. One of them is used exclusively by the bio-laboratory as it requires 24hr continuous air conditioning for research purpose, and is automatically started or stopped when the power from the utility grid has failed (blackout) or recovered. The other generator set is located in the CERD electrical room. Although it can provide power to three other buildings mentioned above, it did not seem to be used very often even under blackouts, while JICA Team was visiting CERD in the site surveys. Electric equipment used in CERD laboratories, measurement and analysis equipment, are found mostly furnished with UPSs.

The energy consumption of the facility for the period of July 2007 to June 2008 was 174,083kWh, according to EDD invoices.

Layout of main buildings of CERD is shown below.

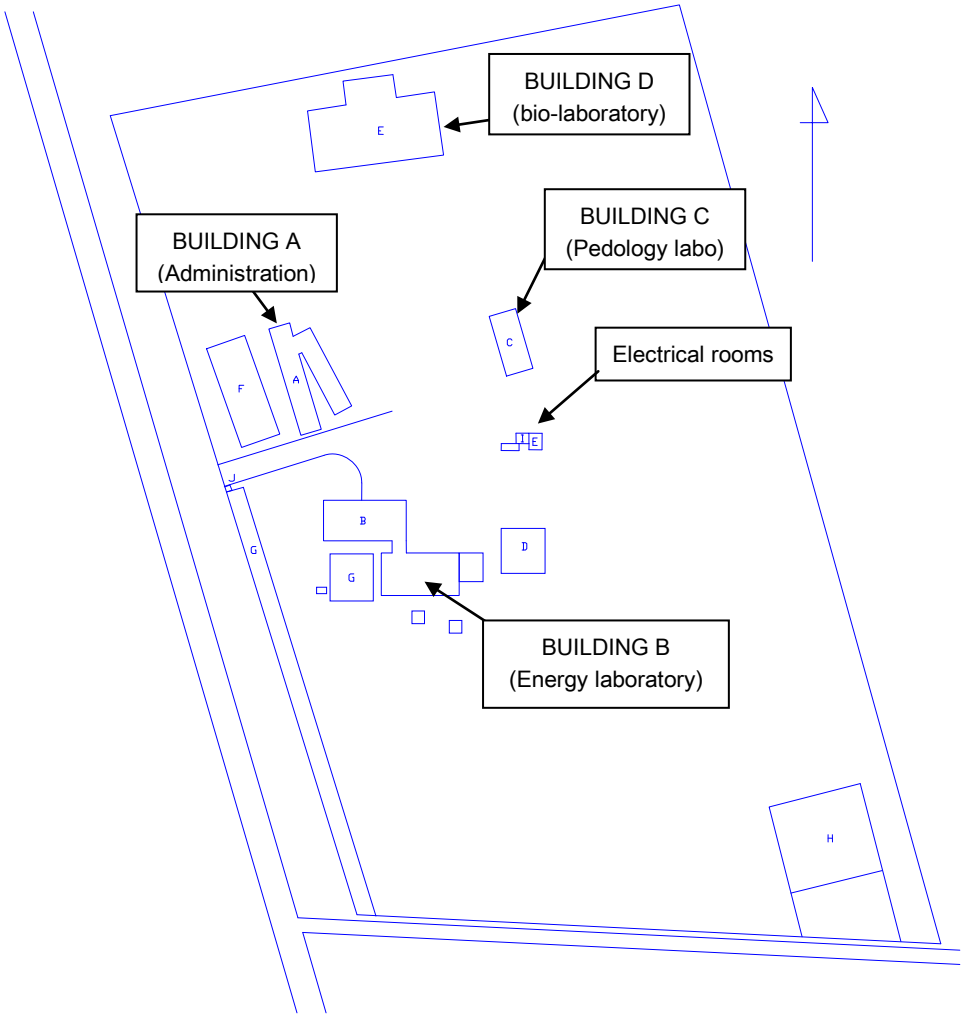


Figure 1-2-1-1 Layout of Buildings in CERD

(2) Status of Electricity Supply in the Region

In Djibouti, supply capacity of electricity seems to be in shortage. Most of electric equipment, such as transmission lines and switch gears, of the public utility EDD, are old and deteriorated which also become causes of frequent blackout. The gap between demanded and supplied energy is large, hence the duration of blackout is long. However, the records of blackout or power failure events are not available and there is no quantitative assessment made. A limited information is available on EDD's annual reports, which are shown in Table 1-2-1-1 for energy demand, energy supply and their balance. The shortage is estimated to be 2% of the demand, suggesting that there is 30 minutes blackout every day on average.

As mentioned above, there are two emergency generator sets in CERD; one is exclusively for bio-laboratory and the other for three other buildings. The capacity of the latter generator seems to be smaller than desirable. The power supply during blackout is restricted, which causes some problems in the operation of research works in the institute.

With the abovementioned situations in the background, the institute expressed to the JICA Team his strong willingness to have equipment capable of sending power even during blackouts. In response to this request, the Team decided to design, with stand-alone function, the PV system to be procured in this Project.

Table 1-2-1-1 Status of Electricity Supply in Djibouti 2007

Description	Status	Remarks
Energy demanded	323GWh	
Energy supplied	330GWh	
Energy shortage	7GWh (2% of the demand)	Shortage due to scheduled blackout and accidents, etc.
No of Connections	37,766	
Energy shortage per connection	Average daily energy consumption per connection is 23.4kWh, and 2% (0.5kWh) of which is in short supply.	Assuming the size of the average consumer being 1kW, there can be blackout for 30 minutes every day.

Source: EDD annual report data edited by JICA Team

As the power utility, EDD, depends completely on fossil fuel for primary energy of the electricity generated and supplied, the power generated by the PV system all will contribute to the reduction of fossil fuel consumption.

1-2-2 Natural Conditions

(1) Location and Topography of the Site

The Project Site, CERD, is located in the capital of Djibouti, approximately three kilometers away from Djibouti International Airport lying to the south of the capital. Its premise is on a flat land a few meters above sea level, stretches approximately 200 meters east-west, 300 meters north-south, lined with fence along its perimeter. The area for PV equipment installation is on the southern end of the premise, used to be covered with bushes and plants which has been removed and cleared as of the Site Survey in April 2010. The area is broadly flat and of fine sand.

(2) Climate Conditions

1) Temperature

Annual variation of temperature in Djibouti takes its peak in July, and bottom in January according to 10-year average between 1999 and 2008. Monthly average highest temperature was recorded in July 2003 at 43.6 degrees Celsius and the lowest March 2008 at 17.8 degrees Celsius. There is no large variation observed between years. 10-year record of monthly average highest temperature is shown in Table 1-2-2-1 and the lowest in Table 1-2-2-2, respectively.

Table 1-2-2-1 Monthly Average Highest Temperature (1999 - 2008)

	JAN	FEV	MAR	AVR	MAI	JUI	JUL	AOU	SEP	OCT	NOV	DEC
1999	29.7	30.1	30.9	33.1	36.7	38.0	42.5	42.7	38.6	34.7	31.7	30.5
2000	29.5	30.2	31.1	34.2	36.5	39.0	43.1	41.7	38.1	34.7	32.2	30.7
2001	29.4	29.5	30.8	32.8	36.6	43.4	42.7	41.1	38.6	34.8	32.0	30.6
2002	29.5	29.9	31.0	33.5	36.7	41.2	42.9	41.4	38.8	34.4	31.9	30.4
2003	29.8	30.8	30.7	32.5	34.2	40.0	43.6	40.4	38.7	34.3	31.0	30.5
2004	29.6	30.1	30.8	32.9	35.9	41.5	43.1	41.1	33.9	33.7	31.2	29.7
2005	29.2	30.0	31.9	32.9	35.6	39.9	42.8	40.7	36.6	34.2	31.8	30.0
2006	29.3	29.7	30.8	32.4	37.2	39.4	42.5	40.9	39.0	33.9	31.6	30.1
2007	29.7	30.4	31.8	33.4	36.2	42.0	42.6	43.3	40.0	33.9	32.2	30.5
2008	29.7	29.5	30.6	32.8	35.2	39.8	42.1	41.4	37.1	34.7	31.0	29.8

Unit: Celsius

Table 1-2-2-2 Monthly Average Lowest Temperature (1999 - 2008)

	JAN	FEV	MAR	AVR	MAI	JUI	JUL	AOU	SEP	OCT	NOV	DEC
1999	22.1	22.5	24.6	25.2	27.7	29.6	31.8	30.9	29.4	26.7	23.1	21.3
2000	20.9	20.6	22.9	25.5	27.1	29.9	31.1	30.5	29.4	26.7	24.1	22.5
2001	20.6	21.7	24.7	25.0	28.3	30.3	31.4	29.9	29.8	26.9	23.5	21.7
2002	20.8	21.2	23.8	25.3	27.7	30.1	31.3	30.2	29.1	26.4	23.8	22.2
2003	22.3	23.8	25.1	26.7	27.8	30.4	33.2	29.2	29.8	26.3	23.7	22.5
2004	23.7	21.6	26.4	27.2	27.9	30.3	32.0	31.2	26.4	26.0	24.3	23.0
2005	22.4	22.9	25.6	25.8	28.4	30.7	32.4	30.5	30.3	26.2	23.8	21.4
2006	22.3	23.7	24.0	25.6	28.4	30.4	32.2	31.1	29.6	27.0	23.7	22.9
2007	18.3	20.4	22.0	24.3	24.6	28.9	25.2	27.1	28.1	22.5	22.2	20.5
2008	20.0	19.0	17.8	22.8	26.0	30.9	32.4	31.6	29.7	26.0	23.9	21.4

Unit: Celsius

2) Humidity

Annual variation of humidity is large; highest in April at 95%, and lowest in July at 44%.

3) Rainfall

Rainfall observed for the last 10 years (1999 to 2008) shows it is wettest in March and driest in February. The largest monthly rainfall is 189mm in March 1999. Average annual rainfall is 152mm. Table 1-2-2-3 shows 10-year record of monthly rainfall.

Table 1-2-2-3 Monthly Rainfall (1999 to 2008)

	JAN	FEV	MAR	AVR	MAI	JUI	JUL	AOU	SEP	OCT	NOV	DEC
1999	3.7	3.5	189.1	0.0	0.0	0.0	0.5	15.0	9.2	127.6	52.0	0.0
2000	0.3	0.0	0.0	0.0	46.0	0.0	0.0	21.1	32.6	23.7	16.7	1.4
2001	6.0	1.7	10.4	0.1	15.7	1.5	1.7	65.0	0.1	1.9	0.0	0.0
2002	84.8	0.3	2.4	24.2	0.0	13.4	0.0	1.5	62.8	1.1	0.0	37.5
2003	8.3	0.3	0.1	17.3	0.0	0.0	0.0	27.0	8.3	0.0	0.0	29.4
2004	17.3	0.0	1.2	108.1	0.0	0.0	0.0	0.0	20.3	1.4	0.0	22.2
2005	18.0	0.0	0.9	31.8	22.2	0.0	5.1	17.1	0.0	1.1	0.0	0.0
2006	32.2	0.2	0.0	5.5	0.0	0.0	0.0	58.5	0.2	29.7	46.8	15.7
2007	3.4	0.8	0.0	0.1	0.0	0.0	15.6	12.6	0.0	1.0	0.2	0.1
2008	4.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	6.8	55.5	0.0

Unit: mm

4) Wind Speed and Direction

Monthly maximum wind speed was recorded in July 2007 at 27m/s. Wind direction is westerly in January and easterly in July.

Table 1-2-2-4 Monthly Maximum Wind Speed and Direction (2000 to 2008)

		JAN	FEV	MAR	AVR	MAI	JUI	JUL	AOU	SEP	OCT	NOV	DEC
2000	dir	100	120	100	80	80	80	300	160	260	60	80	120
	m/s	7	7	9	9	8	9	15	18	10	10	12	12
2001	dir	50	100	80	160	90	290	260	290	40	110	120	100
	m/s	11	11	10	12	12	15	16	18	9	11	9	12
2002	dir	80	80	90	90	80	200	270	300	330	40	80	80
	m/s	7	7	9	9	8	11	15	20	9	10	12	12
2003	dir	110	110	110	80	M	M	M	320	40	80	100	110
	m/s	12	11	13	11	M	M	M	12	15	11	11	11
2004	dir	100	110	80	350	M	320	260	180	M	M	110	110
	m/s	10	12	12	20	M	15	17	18	M	M	8	9
2005	dir	100	80	100	80	20	80	260	260	300	90	110	90
	m/s	8	11	12	11	11	10	17	15	12	11	10	10
2006	dir	60	100	110	80	140	270	280	260	160	80	110	110
	m/s	14	17	15	12	12	16	15	18	16	15	11	13
2007	dir	80	100	80	100	160	220	270	240	160	110	80	120
	m/s	16	10	12	11	13	17	27	17	16	11	13	9
2008	dir	100	60	80	120	140	200	280	310	150	120	80	100
	m/s	8	9	8	7	10	11	12	12	15	14	7	13

Unit: speed in m/s, direction in degree

5) Earthquake

Earthquake records between 1996 and 2006 for the region show that there have been earthquakes of magnitude 4 to 5 class several times. Figure 1-2-2-1 shows the

distribution of epicenters of earthquakes observed.

Therefore, quakeproof design should be adopted. Specifically, paraseismic design code for architectures in Djibouti (Quakeproof Regulation, Directive of Housing and Urbanization, Ministry of Housing, Urbanization, Environment and Territory Management) should be adopted in designing of structures.

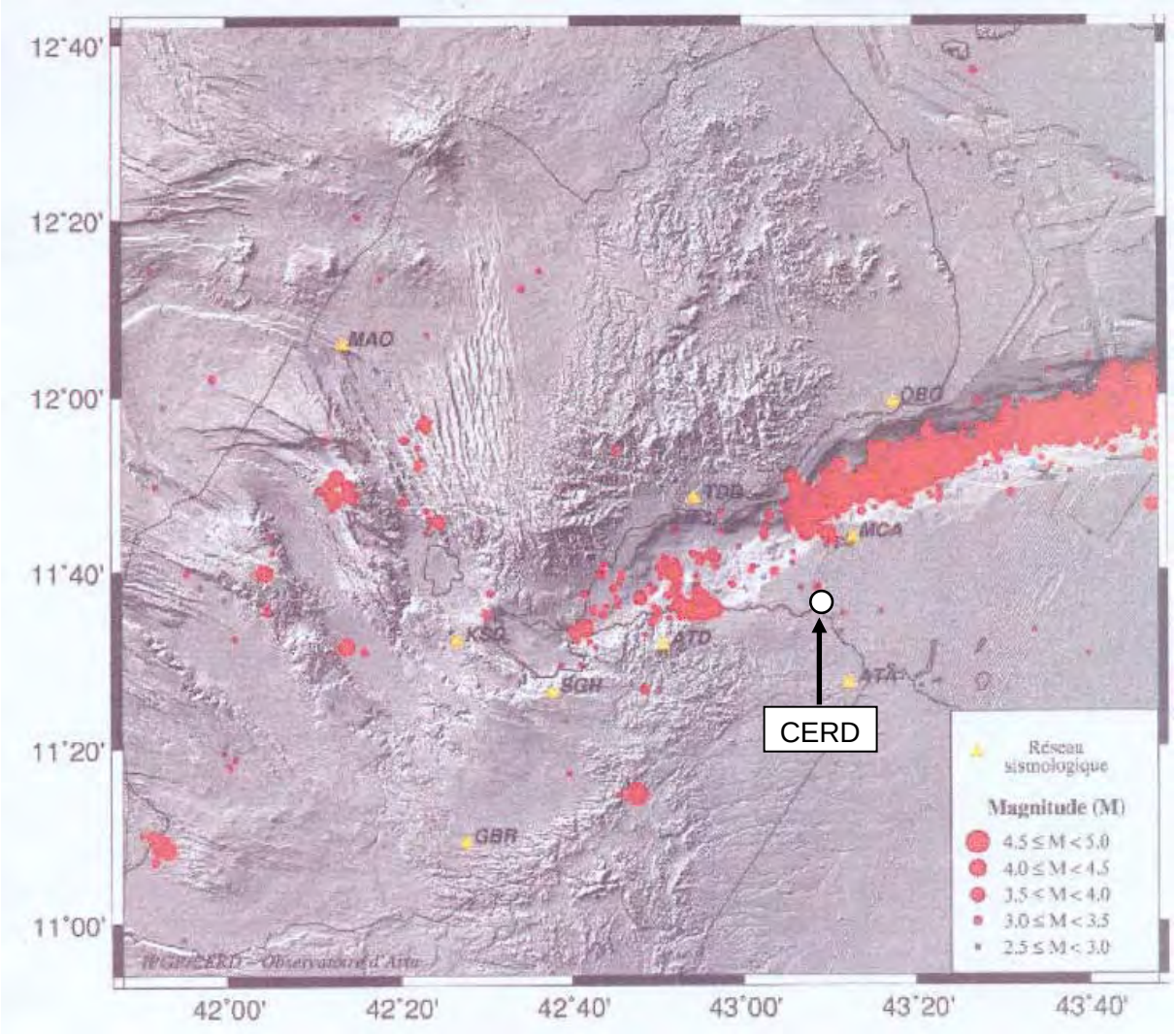


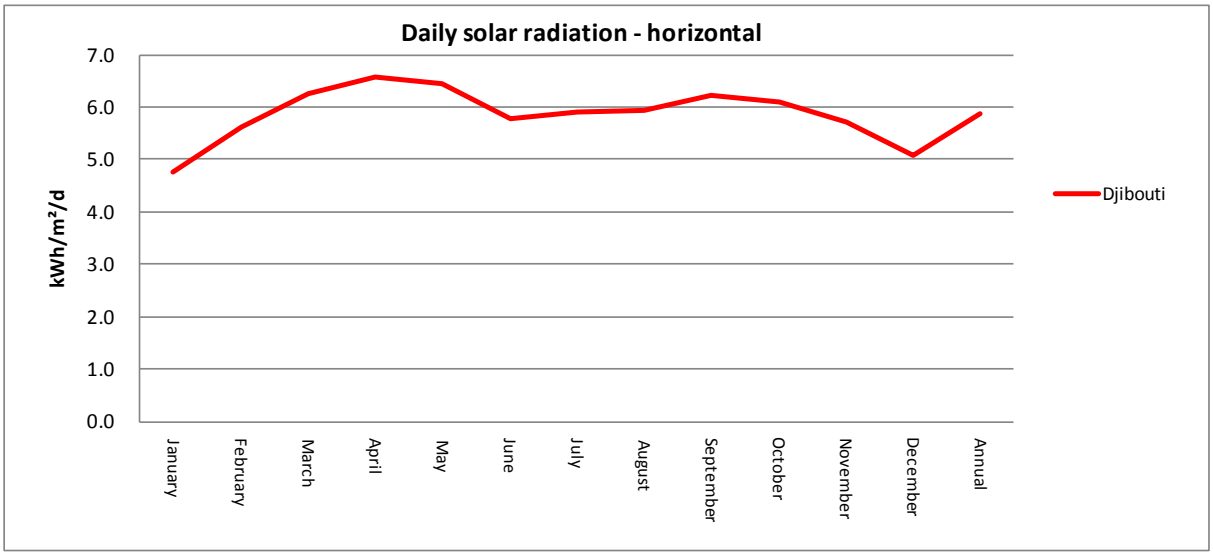
Figure 1-2-2-1 Distribution of Epicenter of Earthquakes Observed (1996-2006)

6) Salinity

CERD is located approximately one kilometer away from the coast. The design of PV equipment should consider the countermeasures against damages from salinity.

7) Irradiation

Seasonal variation of irradiation is relatively small, and Djibouti City enjoys abundant irradiation through the year. Monthly average daily solar radiation on a horizontal plane takes highest in April at 6.58kWh/m^2/day, lowest in January at 4.75 kWh/m^2/day, and its annual average is 5.86 kWh/m^2/day. Figure 1-2-2-2 shows monthly average daily solar radiation in horizontal plane in Djibouti.



Source：RETScreen

Figure 1-2-2-2 Monthly Average Daily Solar Radiation in Djibouti

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” and “Stand-alone operation” is also adopted to supply power to a limited demand during power failure. However, the use of batteries 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.

CERD, the project site is located in the city of Djibouti. The proposed site for installation of the solar power system is a vacant area in the premises of CERD and is facing two roads. Since there are neither closely neighboring inhabitants nor commercial and industrial activities, potential adverse impacts during the construction may affect not on the neighbors but rather the people working in CERD. In addition, hindrance to surrounding traffic during the peak period for delivery of equipment, material and machinery can be assumed.

In order to mitigate the above mentioned adverse impacts during the construction period, appropriate mitigation measures which needs to be planned and implemented by the prospective contractor is required. Informing the work schedule and time table to the staff of CERD and neighbors in order for them to understand clearly the work procedures is also important to avoid the adverse impacts. 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.

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

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	Risk of traffic accidents 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, land for the Project is entirely owned by the CERD	
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 Directorate of Environment (DE), the Ministry of Housing, Urbanization and Environment is in charge of supervision of the environmental Impact Assessment (EIA) in Djibouti, complying with relevant provisions of the law for Environment Impact Assessment (2001). In accordance with the law, any project which might have adverse impact on the environment must be assessed by the EIA procedure. During the meetings with DE, the team explained about the outline of the Project and DE suggested to the team the negative impacts likely to be caused by the project would be quite limited and that the EIA procedure might not be required for the implementation of the project due to the following reasons:

- The photovoltaic solar power system planned by the project is regarded as a clean energy.
- Size of the project will be considered as a small scale.
- Site of the project will be located in the land owned by the beneficiary.

The team then resumed the consultation with DE by explaining the results of the screening which indicated that the project would not be required to undergo the process of EIA in accordance with JICA's guideline for environmental and social considerations.

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 Djibouti to Cool Earth Partnership. It is expected that the Project contribute to both the development of Djibouti 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 Centre d'Etudes et de Recherche de Djibouti (CERD) with a photovoltaic system (PV system) of 300kW peak power and to supply electric power to the facility. The PV system works with the power from the utility grid (grid interconnection), and in the case of blackout of grid power the system can be re-started in "stand alone mode" by manual operation to send power to limited part of the facility.

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 (300kW) with grid interconnection to CERD. The capacity of the PV system shall be determined taking into account the current electric power consumption and capacity of existing transformer. The provision of the system shall be confirmed to be free from any interference with other aid agency's activities and the installation area selected properly in view of the future land use of, and with approval from, the facility.

As Electricité de Djibouti (EDD) agrees to reverse power flow (meaning sending power generated by PV system upstream to the utility grid) of the PV system, the system is designed to produce power to be supplied to and consumed in the facility, and to send surplus power to the utility grid when the power production exceeds the consumption in the facility.

The PV system shall be designed to shut down automatically when there is blackout of utility grid power. After having confirmed some predetermined conditions being met, the System

shall be able to be restarted, disconnected from the utility grid, in "stand-alone mode" by manual operation to supply power to limited part of the facility.

The part of the facility to be supplied with power under stand-alone mode must be strictly without important loads that require stable power supply, in particular those electric equipment that affect human lives, as power production of PV system alone is inherently unstable due to weather conditions and may stop anytime. The loads to be supplied with power under stand-alone mode should be limited to those dispensable, such as air conditioning and lighting, etc.

2-2-1-2 Natural Condition

(1) Air Temperature and Humidity

The climate of Djibouti City is classified as desert climate located in north east Africa. Especially during June to September, there is severe heat wave called “Hamushin” and sometimes the temperature rises to over 40 degrees Celsius.

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 43.6degrees Celsius. Electric Facility Cubicle and outdoor electrical boards shall be designed with Protection Class IP 54.

Supporting structures for PV modules and junction boxes shall be designed to be salinity resistant as the site is located near the sea (main members of supporting structure shall comply with HDZ 55, of JIS H 8641 or equivalent, and junction boxes made of stainless steel).

(2) Lightning Strike

According to the interview to related parties of the Site, the Site is not considered prone to lightning strikes.

The countermeasures 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. Specifically, Junction Boxes and Power Conditioner Cubicle shall be equipped with arrestors.

(3) Storm and Wind

There is no special measures necessary for storm and wind.

(4) Earthquakes

For earthquakes, a horizontal acceleration 0.24G shall be considered in structural design, according to the paraseismic design code for architectures in Djibouti.

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

It has been confirmed that local contractors have sufficient abilities for civil works and steel works which can be used for the Works in this Project. However, their capacity in plant installation works seems to be limited. Therefore, foremans and workers to engage in installation work will have to be given guidance, at the initial stage of the work, regarding the Work. In addition, it should be understood that the efficiency of civil, steel and electric works is compromised by the climatic conditions of the country, high temperatures and humidity.

Djibouti is a Muslim country and it is important to appreciate Muslim customs such as Ramadan in planning implementation schedules.

In the planning of the Project construction management should be given attentions to the above-factors. As a research institute CERD receives many guests from outside, national or foreign, who may be accessible to the Site, and it is important to consider safety measures for people from outside as well as inside. Persons in charge at CERD should be very well informed about the contents and schedule of the Works.

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). As the local companies do not have sufficient experiences in the similar projects, experienced engineer(s) will have to be sent from Japan or other countries 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 will be difficult to be found in local markets.

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

Operation and routine maintenances of the PV system after the commissioning will be done by CERD under the supervision of MENR. As the facility owns and has been maintaining power receiving and distributing equipment over a long time to use, the facility is deemed to have reasonable capacity to maintain electric equipment in general. However, the status of existing equipment in the facility indicates inadequate practice and lack of knowledge about maintenances with preventive measures including routine inspections. Therefore, this Project should provide training program on O&M including important daily and periodic inspections, taught by Japanese specialist in two separate periods; one during the commissioning of the PV system, and the other a few months after the commissioning. Spare parts, tool kits, and Operation and Maintenance manuals for maintaining the PV system should be supplied by the Project as well. 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 need replacement in the long term and this may cost a significant amount. Such expenses may not be possible for the Facility (CERD) to bear alone within one-fiscal year budget. It is important that the executing agency (MENR) is aware of this and is prepared to make arrangement with the Facility. As the financial benefit of reduction of power purchase due to power generation is expected to be larger than the above cost, 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	43.6 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. Mean annual rainfall	152mm
6. Seismic force	to be considered (0.24G horizontal)
7. Elevation of the Site	several meters
8. Load bearing capacity of the ground	assumed to be 50kN/m^2
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 of Electric Equipment	: Electric products

(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

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

The PV system procured by this Project is constructed on CERD'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

CERD has unused space in its premise as large as one ha. However the institute needs a space for future expansion and it intends to reserve as much this unused space as possible. Therefore, the area for PV module installation is not physically constrained but cannot take up unnecessarily large space.

Layout of PV module was studied on the southern end of the open space of CERD, leaving as large area as possible to future expansion of the institute. Most efficient way was found to use the area between the south-west corner of the premise and the communication tower owned by outside entity. This area is as large as to accommodate PV modules of approximately 300kW in size.

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	CERD: 300kW 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 restart in Stand-alone Mode to supply power to part of CERD
Procurement of Generating equipments and Installation Work	300kW PV modules Ancillary equipment for PV system - Junction box - Power conditioner cubicle - Meteorological observation device - Branch Switchers for Load (for Stand-alone mode) - Materials for wiring and earth - Electrical facility cubicle - Supporting structures for PV modules - Foundation of supporting structures for PV modules and electrical facility cubicle - Fences, gates, and grave surfacing - Cable connection for Electrical facility cubicle/interconnection point/display equipment/connection to existing loads
Spare Parts and Tool Kits	Spare parts and tool kits for maintenances of equipment Manuals for O&M and implementation of O&M Guidance

2-2-2-4 Outline of Equipment Plan

Elements of the PV system which will be installed at CERD are described below. Outline specification of the each equipment is shown in Table 2-2-2-6 and Table 2-2-2-7.

(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 in future and the disposition of used batteries may become environmentally hazardous.

2) Operation during the Power Failure

The PV system will be designed to shut down and the interconnection cut off automatically when there is blackout of utility grid power. After having confirmed some predetermined conditions being met, the System will be able to be restarted, disconnected from the utility grid in "stand-alone mode" by manual operation to supply power to limited part of the facility.

Conditions that have to be met to start, and that lead to the shutdown of, the stand-alone operation are as follows.

To start up

Necessary conditions: all the following conditions have to be met to start stand-alone mode;

1. Voltage of the grid has been nil for more than a pre-specified time,
2. Voltage of direct current generated by PV modules is above a pre-specified level,
3. The system control has been given permission to use the stand-alone mode,
4. "start button" has been pushed, or "automatic start" has been selected,
5. Other conditions specified by the manufacturer have been met.

Negative conditions: stand-alone mode does not run when any of the following conditions exist

1. Total load at the destination of stand-alone mode power exceeds the current output of the PV system,
2. Other conditions specified by the manufacturer exist.

Shutdown

Stand-alone mode is shut down when any of the following conditions exist

1. Voltage of the grid has been back to proper level for more than a pre-specified time,
2. Voltage of direct current generated by PV modules has fallen below a pre-specified level,
3. Operation hours of the day has been over,
4. "shutdown" button has been pushed at the control panel,
5. Other conditions or orders issued by the system controller (e.g., emergency shutdown).

The system will be designed to start and stop the stand-alone operation either manually or automatically. For some period after the commissioning of the system, it is highly recommended that this be done by manual operation, in order to facilitate the operators' understanding of the operation. Automatic operation should be wanted nevertheless, and can be activated on the condition that the operators and staff of the facility understand the pros and cons of the stand-alone operation. It is because the occurrence of blackout is frequent and unexpected, and manual operation of stand-alone mode can be too troublesome to the operators, which may eventually lead to the situation where the power is not properly supplied to the facility.

The choice of methods of starting/shutting down stand-alone mode does not affect occurrence of malfunctions or lifetime of the PV system. Also, the quality of power of stand-alone operation should not be an issue with respect to the damages to the electric equipment to be supplied thereby, as the protection relays shut down the PV system safely when the quality of power falls below the range of operation,

It should be noted that the PV system cannot be operated in interconnection with the diesel generator (100kW) existing at the facility during blackout.

Concerning "Stand-Alone" function of the PV system, there are important points that must be understood by the users and related parties of the Recipient side, which are shown below.

A. Instability of PV system under stand-alone mode

The use of the stand-alone function of the PV system must be made with a good understanding that its output is unstable.

Specifically, the output of PV system varies due to irradiation. There is no power production during the night, and in rainy or cloudy weather, the output is lower than in sunny weather. Even on a fine day, the output may suddenly fall when a cloud casts a shadow on PV modules. The instant the output of the PV system falls below the power being demanded, the PV system automatically shuts down.

Although the specific operation of the shutting down depends on the design of the manufacturer, it will be generally as follows.

In stand-alone operation, inverters (power conditioners) run under "constant voltage" control. The power generated by PV modules is dependent on the radiation and may fall below the level demanded by the load. If this happens, inverters cannot maintain the voltage within the allowable range of the constant voltage control due to the lack of power. This drop of voltage triggers shutdown of the system, which is immediately followed by automatic opening of conductors, and the system is cut off from the connection.

B. Inappropriate connection of important loads

The destination of power generated by the PV system under the stand-alone mode must not include important loads, such as medical equipment which support human lives (e.g., respirator) and those that affect assets and properties of people or enterprises (e.g., IT equipment of financial institutes) .

Such important loads are usually supported by multiple power sources, not by single source such as grid power only or diesel generator only, even in developed countries where utility grid power is much stable and reliable. Important loads should be furnished with UPS (Uninterruptible Power Supply) and/or other auxiliary power unit.

C. Limitation on the size of electricity consumption of connected equipment

Capacity of PV system under stand-alone mode is quite limited, maximum 20 to 30% of peak capacity. At the destinations of power generated by the PV system under the stand-alone mode, electricity consumption of equipment should be checked to make

sure the total of such consumption does not exceed the limit.

<Case Study>

As an example, the actual recorded output of a 300kW grid-connected PV power plant is shown below. In the figure, vertical axis is for the output of PV system and the horizontal for the time. Output of PV in theory is like a sine curve taken for only positive side, and each peak in the chart corresponds to midday peak.

The output shown in the figure reveals that, in the stand-alone mode where weather-dependent PV is the only source of power, the capacity of the power source significantly fluctuates. Therefore, it becomes much more reliable to use the power for smaller load.

This gives the limitation to the total of the load that is supplied with power under stand-alone mode. The load must be examined and deliberately arranged.

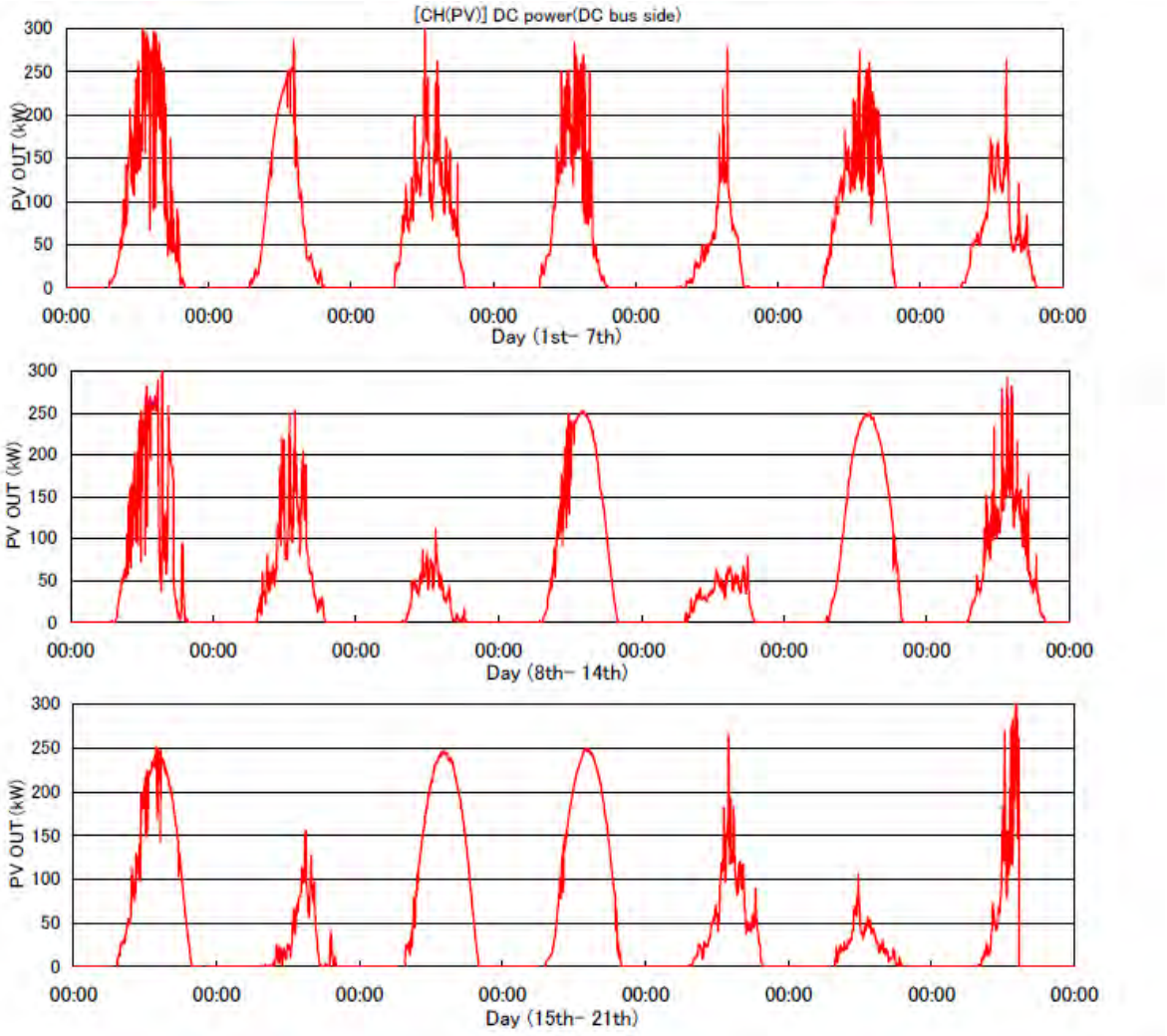


Figure 2-2-2-1 Example of PV output from actual measurement

D. Switches for destination of PV generated power under stand-alone mode

At the destinations of power generated by the PV system under the stand-alone mode, one can choose the power source for a particular load from "Conventional (Diesel)" and "PV", using "Branch Switchers" equipment provided in this Project.

This equipment allows adjustment of the destinations, which may become necessary after changes in types and/or arrangement of electric equipment in the facility. Also, it is possible to set the circuits back to their original conditions (as there is no stand-alone function). The circuits and connections of the Branch Switchers are schematically shown in Figure 2-2-2-2 and

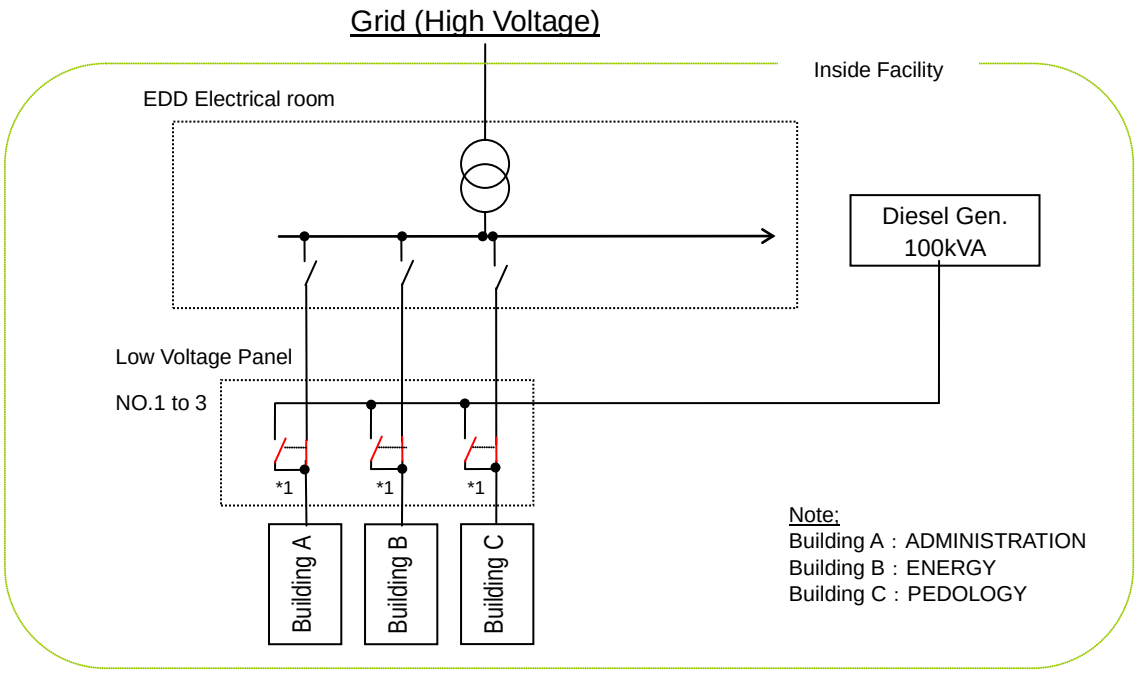
Figure 2-2-2-3. Branch Switchers for Load is operable by hand switching inter-locked breakers inside.

The examples of electric equipment that are appropriate as stand-alone mode destinations are shown in Table 2-2-2-2.

Table 2-2-2-2 Examples of Electric Equipment Appropriate For Stand-alone Mode

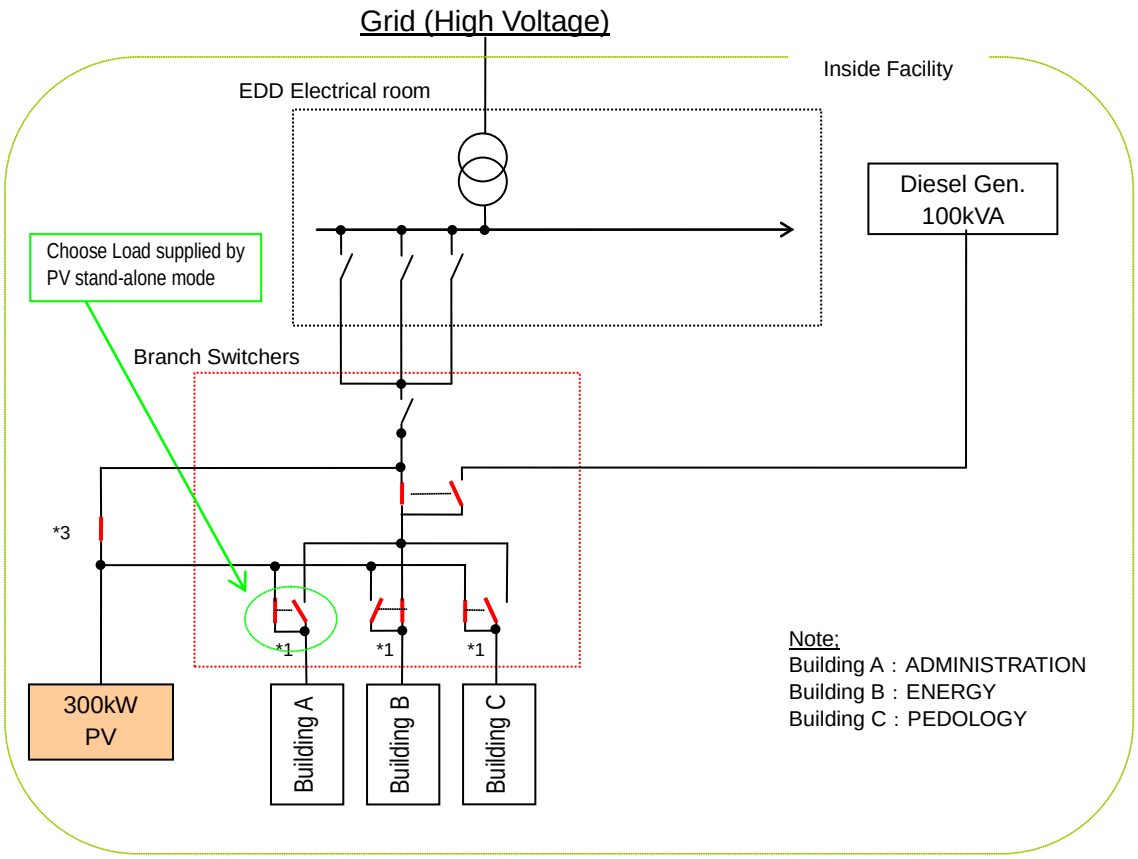
No.	Type of Equipment	Remarks
1	Lighting	
2	Air Conditioner	Excluding centrally controlled
3	Television, Radio	
4	Refrigerator	
5	Electric Cooker	
6	Mobile Phone Charger	
7	Portable Computers	With battery inside
8	Ventilator	
9	Water Pumps	5kWh or smaller recommendable

As is without PV



*1 : Interlocking using Magnetic Conductor

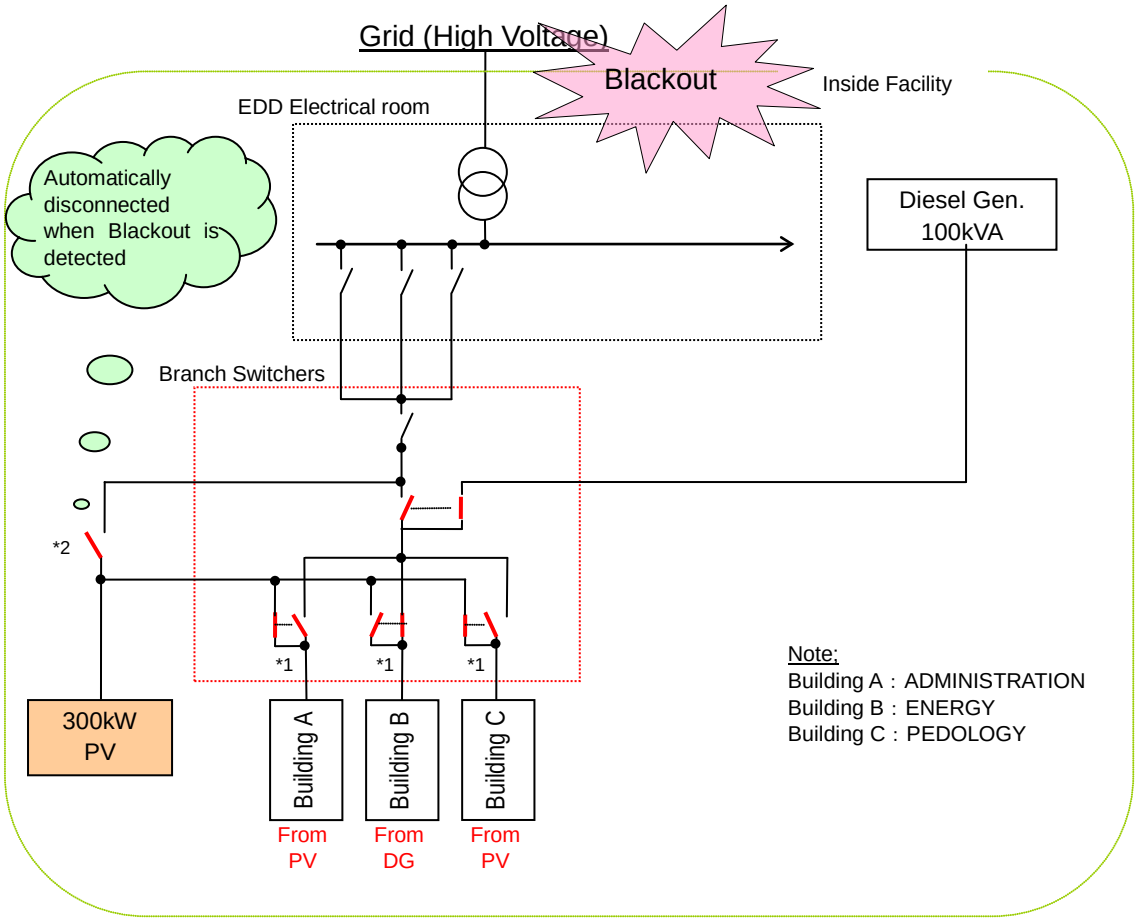
with PV



*3 : Magnetic Conductor (automatic)

Figure 2-2-2-2 Diagram of Power Circuit including Branch Switchers (1)

In Stand Alone Mode (Building A & C supplied by PV, and Building B by DG)



*1 : Mechanical Interlocking, *2 : Magnetic Conductor (automatic), *3 : Interlocking

Advantage of Use of Branch Switchers

1 Destinations of power from PV under stand-alone mode can be selected load by load. The selection can be changed according to future changes in loads (types and power demand of electric equipment to be connected),

2. Restricting further the loads supplied by stand-alone PV at the destinations, operation of stand-alone PV can be adjusted to be more continuous even under changing solar irradiation (countermeasure to output fluctuation),

3. If the use of stand-alone function becomes unnecessary or undesirable (due to changes in loads, etc.) in the long run, the circuits and wirings can be switched back to the original (before PV installation) conditions.

Figure 2-2-2-3 Diagram of Power Circuit including Branch Switchers (2)

(2) Contents of Outline Design

1) Verification of Design Capacity or PV System

The PV system will be connected to the utility grid at the low voltage side (secondary side) of the existing transformer and the load side of the existing EDD watt-hour meter.

The capacity of the PV system is studied. The main loads supplied by the existing transformer are as below.

- Building A (Administration)
- Building B (Energy laboratory)
- Building C (Pedology laboratory)
- Building D (Biology laboratory)

The loads of CERD are mostly electric lights and air conditioners. There is also a biology laboratory with 24-hour temperature control. The main loads of CERD are listed in Table 2-2-2-3. Total load of CERD is about 200kW at the moment. Actual electric power consumption measured at the low voltage side of the transformer was 104kW at maximum.

As EDD allows the reverse power flow, the surplus of generated power will be sent back to the utility grid and serve the general consumers. There will be a surplus power on weekends regardless of the capacity of the system. Therefore, it is appropriate to design the system with the reverse flow considered.

The size and shape of the PV module installation area mentioned in section 2-2-2-2 were re-examined and it was found that the area could conveniently accommodate the layout of sub-arrays of 300kW in capacity.

Output of the 300kW system was estimated using software RETScreen published by Natural Resources Canada as actual measurement of insolation available was not adequate. The estimated annual energy to be produced is approximately 460MWh at most, which is about 260% of the annual energy consumption of CERD (174MWh, from July 2007 to June 2008).

This system capacity was finally determined in consideration with the project budget assumed at the project formulation stage, and the request from CERD side that the PV modules should not take up unnecessarily large area.

Table 2-2-2-3 CERD Loads List

End use	Lighting	Air-conditioner	Ventilation	Cold chamber	Ovens
Total load for this end use	10 kW	150kKW	5kW	10kW	20kW
Number of loads	95	71	55	1	4
Operating hours day/hours		Week except Friday 6 am to 1 pm	Week except Friday 6 am to 1 pm	Running every time	
Rankings of importance (A-E)		A (very important)		A (very important)	
Remarks	Most of the offices don't use lighting in the day, we must conduct a survey to tackle the issue of operating hours,		Usually when air conditioning is running, occupants of the offices don't use fans	The cold chamber is used by the biotechnology group for date trees nursery.	Ovens are used occasionally when some analysis or process is running (e.g. drying of materials)

Source :CERD

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. Silicon 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.

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, PV module in this Project should be of crystal type.

3) Destination of Electric Power in Stand-Alone Mode

The PV system is designed to shut down automatically when there is blackout of utility grid power. After having confirmed some predetermined conditions being met, the System will be able to be restarted, disconnected from the utility grid in "stand-alone mode" by manual operation to supply power to limited part of the facility.

The part of the facility to be supplied with power under stand-alone mode should be strictly without important loads that require stable power supply, in particular those electric

equipment that affect human lives, as power production of PV system alone is inherently unstable due to weather conditions and may fall below the demanded level anytime. The loads to be supplied with power under stand-alone mode should be limited to those dispensable, such as air conditioning and lighting, etc.

Those buildings connected to the transformer are considered as candidates to be supplied with under stand-alone mode.

- Building A (Administration)
- Building B (Energy laboratory)
- Building C (Pedology laboratory)
- Building D (Biology laboratory)

As there is a laboratory where the temperature should be kept constant, an emergency diesel engine generator is installed in Building D with automatic switching. Therefore the PV system which does not supply power during the night cannot replace the existing backup power supply of Building D.

Meanwhile, the requirement of power supply is a little different for Building A, B, and C, where PCs and other electric appliances are furnished with UPSs. There is another diesel generator in CERD but its capacity is not large enough to meet all loads and buildings are operated partially during blackout.

Therefore, if the PV system is connected to any one of Building A, B, or C under stand-alone mode, it will contribute to the power supply during blackout in the day time.

Consequently, Building A, B, and C should be selected as the destinations of electric power supply under stand-alone mode.

4) Electric Equipment

a) PV module

Type of PV module is crystalline type. Capacity of total PV modules is over 300kW using the 10kW 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 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.03.

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 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 are equipped with a stand-alone function which enables providing power to limited part of the Facility, up to the power being produced by PV modules under other constraints, during the period of the power from the utility grid being suspended (blackout).

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.

This equipment should also be designed to have a couple of mechanical magnetic circuit breakers at grid-connection side, so as to enable both manual and automatic operations of starting stand alone mode when the main power from the utility grid is out (blackout).

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. A DC ground relay is equipped for DC bus-line which detects earthing faults of PV modules. 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 facility the working and its effect of PV system. In CERD, one display should be set up at a place where it is most visible, that is beside the entrance gate of CERD, facing outside. Another display should be set up near the entrance of the Energy Laboratory (Building B) which can be frequently observed by researchers at the

Laboratory. Locations of these displays are shown in Drawing No.03.

Components of this equipment are shown in the table below.

Table 2-2-2-4 List of Components (System Controller)

No.	Device	Specification	Quantity
1	System Control Panel		Complete set
2	Display Equipment (outside)	Display of generating power (current output, cumulative energy generated and CO_2 reduction, etc.)	2 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 2-2-2-5.

Table 2-2-2-5 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) Branch Switchers for Load

This equipment shall function as a distributor of the loads and a switcher of two power source; utility grid power and photovoltaic power.

This board shall have a couple of breakers with mechanical inter-locking for each distribution line to load to select either the transformer or PV system for power source.

The single line diagram of Branch Switcher Board is shown in Drawing No.04.

f) Electrical Facility Cubicle

Electrical Facility Cubicle of the PV System encloses the equipment below. The cubicle is 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, 11 degrees
Materials: steel
Coating: Hot dip zinc galvanized and salinity resistant

h) Concrete Foundation of equipment

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

♦ Foundation type

Geology of PV installation area contains large proportion of volcanic ash clay. The soil of this type is easily blown away by wind when dry, turns to colloidal and unpassable when wet. To make the foundations for PV modules stable, the foundation should be of U-shaped type, a horizontal member connecting two vertical members, to have a larger footprint. Also, the soil under the foundation should be excavated for 200mm deep, leveled and compacted, filled with gravels and leveling concrete, before the foundation concrete is placed.

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.05.

♦ 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 premise of CERD is surrounded by fence which at the moment is in poor condition in some segments. PV installation area is located, away from existing buildings, at the far end of the premise, which calls for tighter security measures against burglary even under 24 hour station of guards at the main gate. It has been confirmed that CERD will refurbish the fence near the PV installation area. The Project shall provide the second fence around the PV installation area for improvement of security measures. The fence constructed in the Project shall be part of the PV system with measures against electric shocks.

The height of the fence shall be 2m to fend off intruders.

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.

♦ 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) LED Lamp posts

The PV installation area is located, away from existing buildings, at the far end of the premise, which calls for tighter security measures against burglary even with the 24

hour guard station. There should be lighting for the area.

As the PV system does not produce any electric power during the night, the lighting equipment, which consumes electricity during the nights, should be those using low-electricity-consumption LED lamps. LED lamps, although at the moment should be very likely to be imported from Japan, have advantages of lower energy consumption, longer life, and low CO2 emission resulting from these, which is suitable in view of the objective of the Project. The Project should also provide a set of replacement lamps. If these replacement lamps have run out, the lamp-holding top parts of a lamp post should be able to be replaced with locally available products, leaving no concerns about the sustainability of the installation.

2-2-2-5 Outline Specification of Main Equipment

Table 2-2-2-6 Specification of Main Equipments (1)

Equipment	Outline Specification	Quantity
PV Module	Capacity of PV modules: 300kW peak output or higher 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
Junction Box	Circuit breaker, anti-reverse flow diode, arrester for each input.	1 complete set
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
Power conditioner	AC rated voltage: Three-phase three-wire system 400V (line-to-line voltage) or 200V ±10% AC rated voltage in Stand-Alone Mode: 380 Vrms (line-to-line voltage, with load) AC rated frequency: 50Hz ±3% AC rated output : over 300kW DC voltage range: DC0V ~ 500V or higher DC control voltage range: DC320V(or lower) to 400V (or higher) Conversion efficiency : 93% or higher (Rated operation) Harmonic current: Distortion Factor total 5% or less, at each order 3% or less (Rated operation) External communication: equipped Operation mode 1. Normal operation (Maximum power point tracking for grid connection) 2. Blackout operation (Constant AC voltage control for stand-alone mode)	1 complete set
Low voltage switchboard	MCCB (for interconnection point, load, PCS, board's own use) Magnetic conductor (for interconnection point) 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

Table 2-2-2-7 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
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
Branch switchers for load (For stand-alone mode)	MCCB Mechanical interlock: 1 complete set Energy Meters: each for incoming/outgoing power - Type: precision energy meter - Wiring system: 3 phase-4 wires - Reverse-Rotation Lock Function - Tested by authorized independent testing institute in Japan (no testing necessary in Djibouti)	1 complete set
Electrical facility cubicle	With air conditioning (AC units shall be supplied with power from Low Voltage Switchboard either in grid-interconnection or stand-alone modes.) Protection Class: IP 54 or equivalent	1 complete set
Support structure for PV modules	Hot dip zinc galvanized and salinity resistant fittings for meteorological devices fittings for junction boxes	1 complete set
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
Fence, gate and gravel surfacing	Fence Height: 2m Gate Height: 2m Gravel surfacing, grain size: about 2-4cm Gravel layer thickness: 10cm or more	1 complete set

XLPE:cross-linked polyethylene , PVC: polyvinyl chloride

2-2-3 Outline Design Drawing

Number	Title
NO. 01	SINGLE LINE DIAGRAM (CERD)
NO. 02	SINGLE LINE DIAGRAM (PV SYSTEM)
NO. 03	GENERAL LAYOUT PLAN
NO. 04	BRANCH SWITCHERS FOR LOAD
NO. 05	CABLE LAYOUT PLAN
NO. 06	ELECTRIC ROOM EQUIPMENT LAYOUT (EXISTING)
NO. 07	ELECTRIC ROOM EQUIPMENT LAYOUT (MODIFICATION)
NO. 08	LED OUTDOOR LIGHTNING SYSTEM

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Procurement Policy

This Project is implemented by Japan's Programme Grant Aid for Environment and Climate Change with a procurement agent. The Government of Djibouti 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.

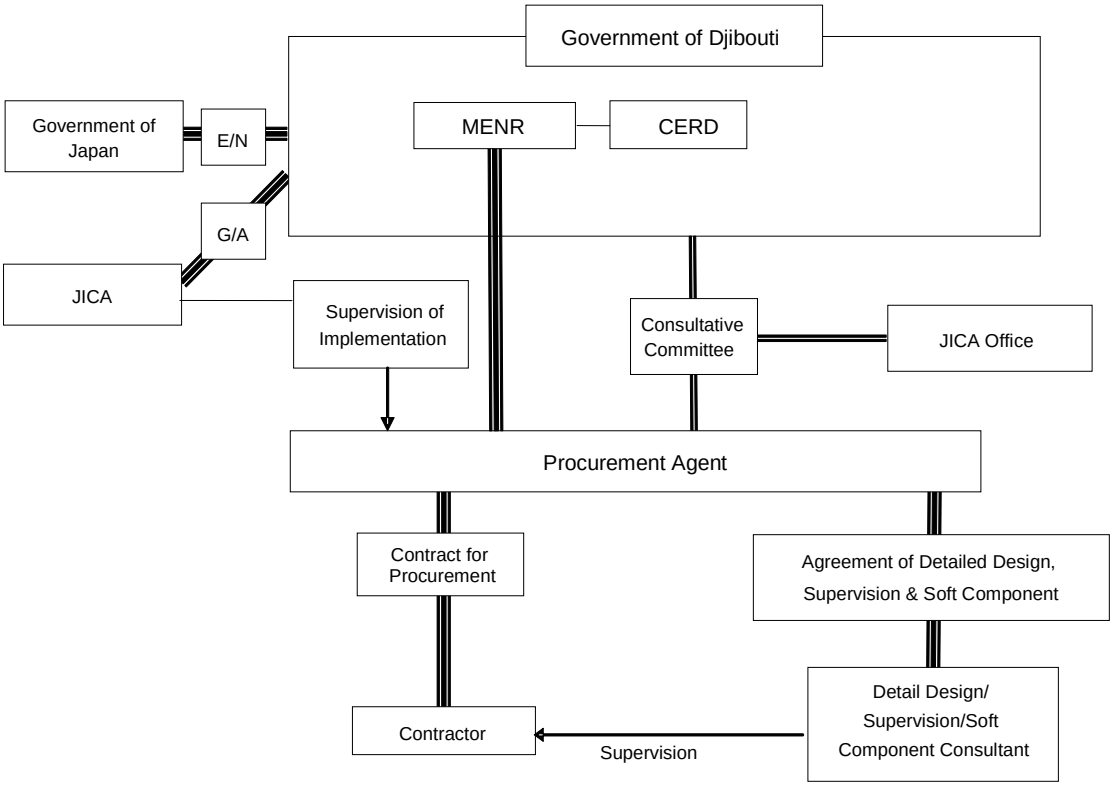


Figure 2-2-4-1 Organization chart of Implementation

1) The Organization of Recipient Side

The organization of recipient side is; Ministry of Energy and Natural Resources as a responsible organization and an executing agency, and CERD as the Site.

2) The Procurement Agent

On Japan's side, it is the procurement agent who will make into the agent agreement with the recipient to 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 the installation works, local contractors will be utilized in the works under Japanese prime contractor’s supervision. The main construction 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 and equipment).

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

2-2-4-2 Implementation Conditions

(1) Construction Business in the Recipient Country

Although there are some local companies dealing with solar home systems in Djibouti, no company has experience in installation of large-scale solar power system as large as 200kW. On the other hands, there are many capable local electrical companies that have experiences in general electrical work. For example, one of the contractors affiliating with BP solar, have

carried out installation of small-scale solar pump systems and general electrical works for French army stationed in Djibouti. Although these companies have never engaged in a large-scale solar power project, the works that meets 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 such as French contractors are identified in the city.

There are some companies dealing with rental of construction machines in the city. However, the conditions of the machines are confirmed to be unfavorable and the available numbers are limited. Therefore, construction methods that do not need machines may have to be applied as much as possible.

(2) Installation Work Conditions

- The temperature is known to be very high. Therefore, the installation plan should be made with due consideration to temperature affected process, such as placing concrete.
- As large proportion of the population is Muslim in Djibouti, the installation works should be planned with Ramadan season in mind.
- The water provided by public utility in Djibouti is unfit for the use in the installation works because of its high conductivity, which is more than 3500μS/cm. Therefore, it is necessary to buy desalinated water from local venders in the city.
- Careful safety measures should be taken to avoid any accidents to employees and visitors of CERD.

2-2-4-3 Scope of Works

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

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

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	None	None
	b. The gas supply system within the site	None	None
	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 prompt 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 exempt or bear tax 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.

The main important points in safety control at the Site are shown below.

- 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.

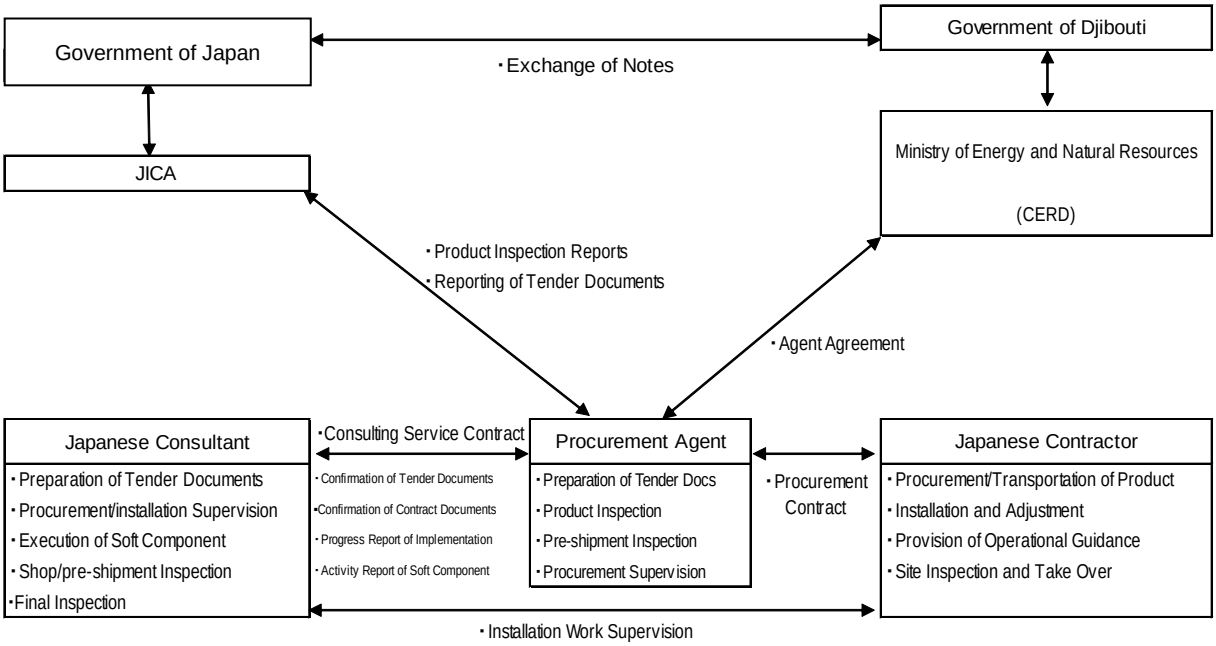


Figure 2-2-4-2 Project Implementation System Chart

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 Djibouti Port. The port is an international port which has 18 berths with the depth of between 7m and 18m. The maximum capacity of the mobile crane is 50ton, which are well beyond the needed capacity of 20ton for this Project. The destination, a research institute called CERD, is located relatively near to the port, within 10km distance. There are many experienced transport companies in Djibouti and the access roads from the port to the research institute are well maintained. Therefore, there is no concern related to the local transport of the imported items.

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 Djibouti, 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 the institute is not quite up to the standard required for the PV system. Other local conditions such as high temperature, dusty site etc., 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 Djibouti, 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 and a certain period after the commissioning.

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

The program is outlined below

a) Time 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

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 shutdown 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 Djibouti, this Project will be the first-ever experience to have a PV system with grid interconnection, although Djibouti 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 CERD 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 EDD, 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.

Operational guidance provided by the Contractor, as explained in the previous section, aims to furnish operators at the Site with practical methods of operation and maintenance of the PV system. On the other hand, the training program discussed here is planned with the objectives to transfer technical knowledge behind the operation methods, building a foundation among the operators and other people concerned for better judgment and application of basic knowledge in the various situations of the management of the PV system, with expectations of

development in future projects of a similar kind.

In particular, as the PV system is designed to be equipped with "stand-alone function" to supply power to part of the facility during blackouts, the program should put some emphasis on the importance of understanding of the limitations and issues of the function for proper use of the function.

Further, as pointed out in 2-2-4-7, due to lack of experience of grid connection of renewable power in the country and that of technical data concerning quality of grid power, it is proposed that the Contractor conduct an inspection three month after the commissioning. The second series of training program will be carried out at the same time, in order to reinforce the training and ensure consolidation and sustainability of the knowledge transferred.

Meanwhile, CERD has a renewable energy institute which from time to time sends its crew of technicians to diagnose and repair independent solar equipment scattered in the country. The institute is hoping to be able to provide a training/education function for those who are/will be engaged in maintenance of such solar equipment in the country side. It is also beneficial for CERD to obtain theoretical and practical knowledge of the use of solar energy so that it will be able to be one of leading institutes in the promotion of solar energy in the country.

(2) Objectives of Training Program

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

For operations and maintenances technicians at 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, 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 manage selection and arrangement of electric equipment at the destination of "stand-alone mode" power.
- 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 utility 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,
- The stand-alone function is used properly with the adequate arrangement of electric equipment at the destination,
- O&M activities are followed up by using check sheets,
- Technical officers at the Ministry of Electricity and PEC 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) Confirmation and Evaluation of Outcomes

Most tangible outcome will be the operation and maintenance management plan. 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. 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 an operational guidance provided by the Contractor. During this period, 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 CERD from the grid
- Power demand and loads in CERD
- Workings of PV equipment during blackout
- Stand-alone operation and protection functions
- Load management at the destination of Stand-alone mode power
- 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)

Reinforcement of Guidance of 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
- Remedying problems occurred in stand-alone operation
- 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. This revisory training program is proposed to consider three month experience of actual operation and maintenance of PV equipment, operation issues unique in the implementation and in CERD circumstances, to discuss problems and questions arose, 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 and reverse flow 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. The three month inspection carried out by the Contractor engineer will be video-recorded and be used later or 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)
- Confirmation of records of Stand-alone operation and consideration on necessary change in rules,
- 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.

CERD technicians:	Those who will be actually operating the PV system
CERD researchers:	They are expected not just to participate in the program but also to be involved in the process of preparation, execution, evaluation of the program by the consultants

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

MENR 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)	EDD (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 2-2-4-4 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	CERD technicians								
	CERD researchers								
	EDD officers								
	Ministry Officials								
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	CERD technicians				
	CERD researchers				
	EDD officers				
	Ministry Officials				
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 Djibouti. 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 10/2010.

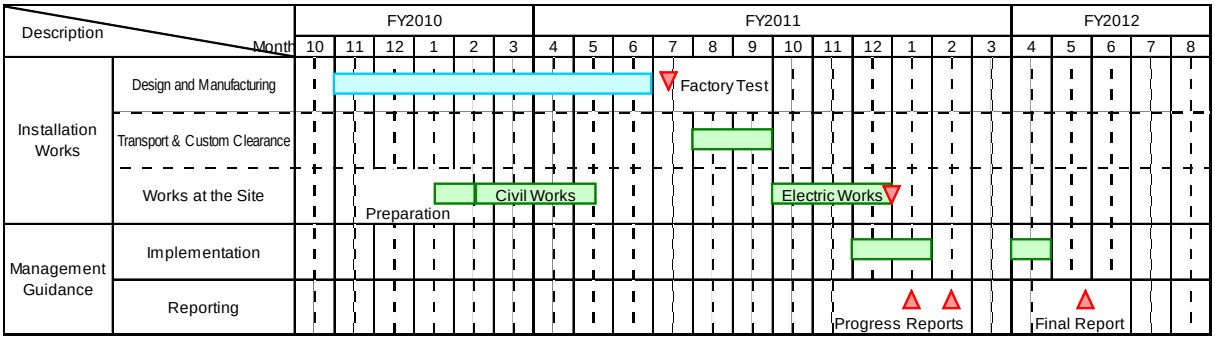


Figure 2-2-4-3 Training Program Implementation Schedule

(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 around 27 months upon conclusion of the E/N. The law specifies a maximum 48-hour workweek with a maximum 8-hour workday. Friday is the weekly day of the rest and the total numbers of official public holidays in Djibouti is 15 days a year. In making up the implementation schedule, it is necessary to consider Ramadan, during which efficiency of works is expected to decline, in order to make a workable and manageable

schedule. 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 conducted while the electric equipment is being manufactured in Japan. It is reported the temperature during summer months, July and August, in Djibouti exceeds 40 degrees centigrade. Therefore, the concrete works are scheduled to be implemented in relatively low temperature seasons.

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

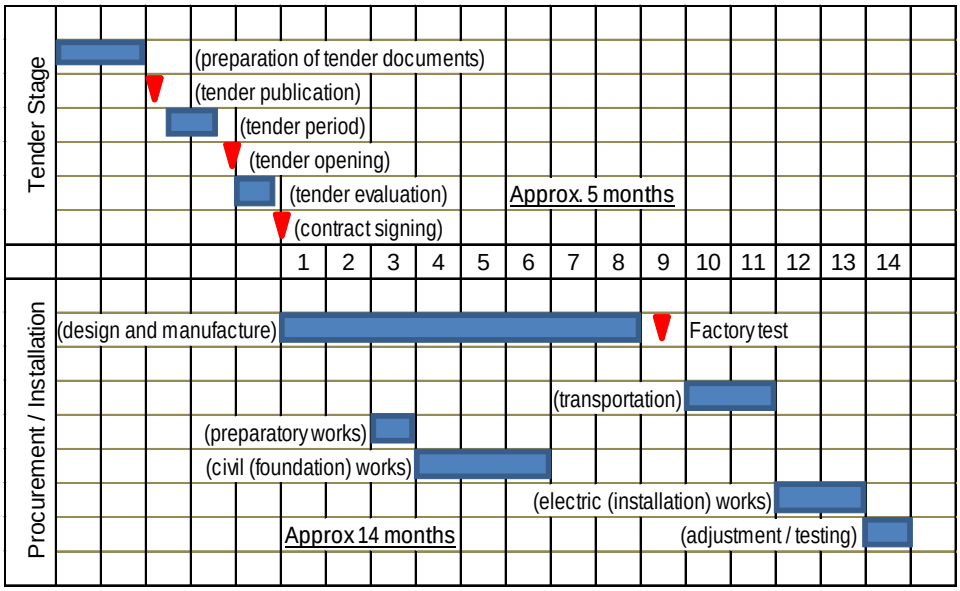


Figure 2-2-4-4 Implementation Schedule of the Project

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 Electricity, PEC, other relevant government organizations

2-4 Project Operation Plan

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

The generating equipment procured in the Project is designed to be managed by the Site, CERD, for its daily operation and maintenance. In the long term, the management of the equipment will require technical assistance and input from the executing agency of the Project, the Ministry of Energy and Natural Resources and EDD.EDD 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.

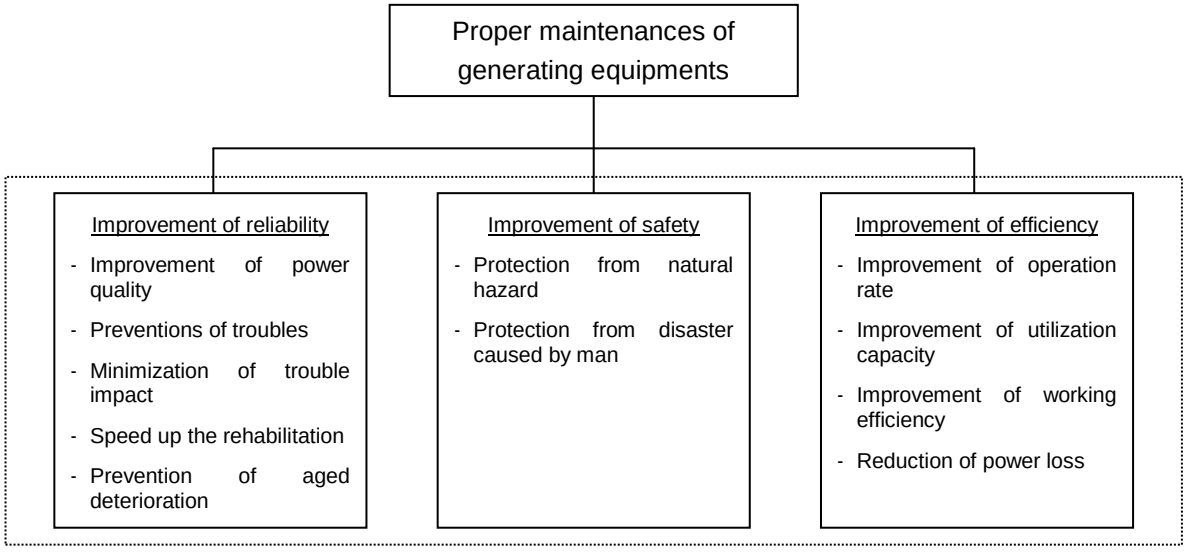


Figure 2-4-1-1 Basic concept of generating equipments maintenances

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.

(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) 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[1]	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[2] 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, generally PV modules[3] are considered to work for 20 years and power conditioners[4] are considered to work for 15 years 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

[1] 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.

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

[3] "Photovoltaic Power Generation System, 3rd edition", September 2006, Japan Photovoltaic Energy Association.

[4] Based on the interviews to manufacturers.

inside the equipment that have to be 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 require 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	CERD	Operation of PV system Planning and implementation	Planning and implementation
Implementing Agency	MENR	Monitoring of operation and effect on PV system	Financial support
Electric Power Company	EDD	Monitoring of grid interconnection and reverse power flow 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
	7) Lamps for LED	100%
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 multi-meter	2 units
(2)	Tools	
	1) Flathead screwdrivers	2 pcs
	2) Philips 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

The cost for the Project born by the Recipient is estimated to be DJF 1.4 million as explained below

(1) The Cost of Djibouti Side

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

- Clearing and leveling of the Site
- Sending trainees of Ministries and EDD to the Training Programs to be held in CERD

As for the clearing and leveling, the Site at the moment has a dumping hole and incinerator that have to be removed before the Work starts. Although there are no trees in the area, there are bushes and thickets to be removed as well. These are all minor works and their costs are estimated as below.

Backfilling dumping site	37,690	DJF
Removal of incinerator	84,584	DJF
Removal of bushes	1,273,700	DJF
total	1,395,974	DJF

Meanwhile, the Training Program is planned to be held at CERD and there is no travel expenses involved in the participation

(2) Condition of calculation

1.	Time of calculation	November, 2009
2.	Exchange rates of foreign currencies	US$ 1 = JPN 95.04 DJF 1 = JPN 0.538
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 facility. Therefore, operating and maintaining the PV system does not require additional persons to be employed by the facility.

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 DJF 6,000.)

- Daily inspection (modules and cubicle) 0.5 hours per day
  0.5hr/8hr [daily working hrs] times DJF 6,000 = DJF 360 per day

- Cleaning of modules (1hr per month per 10kW of modules) 30hours per month
  30hrs/30days/8hr [daily working hrs] times DJF 6,000 = DJF 600 per day

Adding these two, we get daily cost at DJF 960. To convert this to annual cost,
960 times 365 = DJF 350,400 per year

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 ten 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 are estimated as in the table below.

Table 2-5-2-1 Expenses for Spare Parts

	Aggregate for a period of Long-term Maintenance	Average Annual cost
Power Conditioner related (applicable only after the First Long-term Maintenance)	Approx. 3,150,000	Approx 450,000
Air Conditioner related	Approx. 1,050,000	Approx 150,000
Total (after the First Long-term Maintenance)	Approx. 4,200,000	Approx 600,000

(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 DJF, we have the expected purchase cost of spare parts as below.

Before the First Long-term Maintenance

JPN150,000/0.538[JNP/DJF] = DJF 278,000 per year

After the First Long-term Maintenance

JPN 600,000/0. 538 [JNP/ DJF] = DJF 1,115,000 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. As the tariff of electricity is relatively high in Djibouti, the benefit will be way larger than the maintenance cost mentioned above, even when the additional benefit possibly generated by reverse flow is omitted. Therefore, the source of the fund for future maintenance cost will be covered by the value of the energy generated by the PV system.

2-6 Other Relevant Issues

For this Project to be carried out without problems the following matters should be observed.

(1) Preparation of the Site

The plot of land to be used for the installation of PV equipment has been confirmed to fall within the land that CERD is officially entitled to use. This installation area requires no major earth works as it has been an open land. However, there are some minor obstacles to be removed and cleared, such as dumping holes on the ground and a small incinerator.

The premise of CERD is surrounded by fencing along the border, part of which is not in a desirable condition particularly near the installation area. This part of the fence should be removed and re-installed with sturdy fence.

(2) Handling of Reverse Current

In Djibouti, EDD is the sole power producer and there are no other entities allowed to generate and distribute power. Therefore, the PV system procured and installed in the Project will be recognized as an exception under the current regulations. Consequently how to deal the energy to be sent into the EDD network as in reverse current is yet to be determined by the

Djibouti side. Meanwhile there is a need for EDD to consider purchasing power produced by third parties, as the development of geothermal is expected to be done under private initiatives.

Under these circumstances, with a consideration to a financial burden of CERD and/or the Presidential Office in their long term operation and maintenance, the handling of reserve current must be considered and made appropriate for the purpose.

(3) Organization of Operation and Maintenance

The PV equipment to be procured and installed in the Project will be owned by the Ministry of Energy and Natural Resources, and CERD will be operating and maintaining the equipment under the technical supervision of EDD. EDD should be well aware of his task and build a capacity within to supervise the maintenance of the equipment. He should send appropriate personnel to the training programs to be provided by the Program, and sustain the capacity in the organization.

(4) Tax Exemption

Exemption of taxes and duties demanded by the Project to Djibouti side will be handled by the Ministry of Energy and Natural Resources by issuing a new law. 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

In the installation area of PV modules, there are some minor obstacles to be removed and cleared, such as dumping holes on the ground and a small incinerator.

The premise of CERD is surrounded by fencing along the border, part of which is not in a desirable condition particularly near the installation area. This part of the fence should be removed and re-installed with sturdy fence.

(2) Handling of Reverse Current

How to deal the energy to be sent into the EDD network as in reverse current is yet to be determined by the Djibouti side.

With a consideration to a financial burden of CERD and/or the Presidential Office in their long term operation and maintenance, the handling of reserse current must be considered and made appropriate for the purpose.

(3) Organization of Operation and Maintenance

The PV equipment to be procured and installed in the Project will be owned by the Ministry of Energy and Natural Resources, and CERD will be operating and maintaining the equipment under the technical supervision of EDD. EDD should be well aware of his task and send appropriate personnel to the training programs to be provided by the Program, and sustain the capacity in the organization.

(4) Tax Exemption

Exemption of taxes and duties demanded by the Project to Djibouti side will be handled by the Ministry of Energy and Natural Resources by issuing a new law. 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

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

(1) Use of Stand-alone Function

This Project is designed, on the basis of the request from CERD, to furnish the PV system with the stand-alone function. In order to utilize this function safely and effectively, the mechanism of photovoltaics and the working of PV equipment, characteristics of electric instruments on the demand side (destination of stand-alone power) and their arrangement, must be fully understood and managed.

Therefore, it is not only those technicians who will be directly in charge of operation and maintenance of the PV system, but also engineers and researchers who are using electric equipment in CERD, that have to acquire accurate and sufficient understanding of the stand-alone function, through an attendance to the training program or any other means.

(2) Expectations on CERD

CERD was chosen to be the Site of the Project, not only because it has a research department specialized in renewable energy including solar power, but also because it has a crew of technicians who are occasionally sent to take care of the maintenance works of PV installations scattered in the Country. There are expectations that the technical knowledge to be acquired and accumulated in CERD through the actual operation and maintenance of PV system will be spread across the Country in terms of better management and planning of PV equipment. CERD should be encouraged to disseminate the knowledge of related techniques to be acquired and accumulated.

(3) Technical Assistance, Cooperation with Other Donors

There have been many application cases of PV utilization separately and independently by donors and their counterpart agencies. Ministry of Energy and Natural Resources has received support from UNDP in setting up PV utilization policies, and so have other departments of the government, in provision of solar equipment in schools and medical facilities. Also, the Team has been informed that UNICEF has been supporting the Ministry of Agriculture and providing training courses for those people who are maintaining PV installations in the Country. Meanwhile ADDS (Agency of Djibouti for Social Development) is promoting the use of solar home systems (SHSs) in rural areas by provision of subsidies and financing mechanisms.

These efforts of many parties have been made without coordination. This situation is

considered to be an impediment of accumulation and diffusion of knowledge as the Country lacks the occasions and means of sharing information.

Ministry of Energy and Natural Resources is very much positive about the participation of other parties to the training programs provided by this Project, including ADDS. If this kind of inclusiveness is realized, it can be an impetus of cooperation among many parties. Also, as pointed out above, if CERD will have become a leading institute of solar power use in the Country, it will also be able to advise and coordinate with local institutions engaged in solar use.

To realize the effects mentioned above, Ministry of Energy is expected to make effort to coordinate with other donors and agencies, taking opportunities of other projects in various stages of development.

3-2 Project Evaluation

3-2-1 Validity of the Project

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

(1) Reduction of Fossil Fuel Consumption and Carbon Dioxide Emission

Djibouti depends completely on imported fossil fuel for primary energy source of electric generation. Therefore, electric power generated by PV generation equipment as an additional power source leads to reduction of the consumption of fossil fuel, contributing the cut down on CO_2 emission. This should support the policy of Djibouti Government to promote mitigation measures of climate change and improve the welfare of Djibouti people.

- Reduction of fossil fuel consumption
- Reduction of carbon dioxide emission
- Reduction of the Country's dependence on imported fossil fuel

(2) Consistency with Higher Policy

The dependence of Djibouti on imported fossil fuel had made the Government aware of the development of photovoltaic technologies much earlier. However, its actual use has not spread wide, limited to the cases of international assistance in variety of fields scattered across the country. Today, the Government is seeking to promote it, both for the energy policy and the mitigation measures against climate change, in particular for public facilities and households in rural areas in the form of separate, independent source of power (Solar Home Systems).

According to the analysis, as the reasons behind the slow diffusion of its use, it is pointed out that the market environment is not adequate to deal with PV products, and also that the perception of population on its effectiveness has not been developed. As this Project has chosen the Site which is highly visible, it will have demonstration effect of PV equipment to wider public. In addition to this, publicity leaflet is planned to be made during training program sessions. If these efforts produce the results intended, the effects may be more beneficial to the policies than the project directly produce as mentioned above (in 1)), in a form of promotion of private investment with rather high electricity tariff in the country in the background. In this manner, this Project can be said in line with the energy policies of the Government.

(3) Accumulation and Dissemination of Capacity for Operation and Maintenance and PV utilization

CERD, which has been chosen to be the Site for the Project, has been in the focal point of solar energy use in Djibouti. The institute, after the commencement of this preparatory study, has sent one of its staff to EDF, a French utility company, to receive training on the large scale PV facility. To furnish this institute with grid-interconnected PV system, and have the institute operate and maintain the equipment for itself, will lead to the accumulation of technical knowledge in the use of PV systems. As CERD researchers have their renewable energy courses in Djibouti University, and its staff is helping operation and maintenance of solar systems, the accumulated knowledge will be diffused over the Country. CERD also has an intention to hold programs to train people involved in PV utilization on the basis of knowledge to be accumulated therein.

(4) Financial Weight of Operation and Maintenance

The energy expected to be produced by the PV system of the Project can be valued on the basis of electricity tariff charged to CERD to be approximately DJF 33 million, which is much larger than the long-term cost of operation and maintenance. Therefore, the Project will not put a burden, but contribute to, the finance of the Country.

(5) Socio-Environmental Considerations

The photovoltaic generation system to be installed by the Program will work to reduce the consumption of fossil fuel, leading to reduction of emission from thermal power plants locally, and that of CO_2 emission globally.

Meanwhile, it is pointed out that the Contractor should plan the installation works carefully so that there would be no significant impact on environment nor accidents during the works.

(6) 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

By the introduction of the photovoltaic generation system, the Recipient country can reduce the consumption of fuel oil and diesel oil, or do without additional consumption of such fossil fuel, resulting in the reduction of CO_2 emissions. This will contribute to the climate change mitigation policy of the Recipient country. On top of this, to install a photovoltaic generation system of the largest scale in the Capital of the Recipient country, we could expect demonstration and educational effects of clean energy use including solar power on the population within the country and outside. In particular, this Project chose the Site along the road connecting the center of the capital city and the main airport of the country, the demonstration effect can be very high.

CERD, to which the PV system will be provided, will have less consumption of power, hence less payment to the utility company, which will enable the institute more effective use of financial resources. There are secondary effects such as economic effect of less importation of fossil fuel, and diversification of sources of power, as the country has been completely dependent on the imported fossil fuel. Meanwhile, the research on renewable energy is one of CERD's main agenda. It will utilize the generation equipment to be provided by the Project to acquire knowledge of PV technologies, and is expected to play a central part in promotion of its use and in training for operation and maintenance.

(2) Quantitative Effects

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

1) Generated Energy

As the measurement data of irradiation obtained for the Site was not sufficient, the software called RETScreen published by Natural Resources Canada was used to estimate the output of the PV system. The annual energy generated is estimated to be approximately 460MWh. This is about 260% of power consumption at CERD (174MWh in 2007). This energy is approximately 0.14% of EDD's sold energy in 2007.

However, the actual output of the system will be lower than this as there are frequent blackouts of power in the country, during which the output of the PV system will be limited under Stand-alone mode.

2) Financial Benefit

As shown above, the energy generated by the PV system to be provided by the Project will be at maximum 260% of CERD's own consumption of electricity, and the larger part of the energy produced will be sent back to EDD's grid. Therefore, the estimation of the valud of the energy depends on the price of the reverse current power which is yet to be decided. For the simplicity, this price of reverse power is assumed to be the same as the tariff CERD is charged, the energy is estimated to worth DJF 33million a year.

3) Reduction of CO_2 Emission

Unit emission of CO2[5]

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.

Djibouti is 100% dependent on the imported fossil fuel for the primary energy of electricity. Therefore, it is a diesel generator that should be considered the alternative to this Project.

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

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

[5]UNFCCC Web Page (http://cdm.unfccc.int/index.html)

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

Therefore, unit CO_2 emission by the diesel generator is,

0.716 kg-CO_2/kWh.

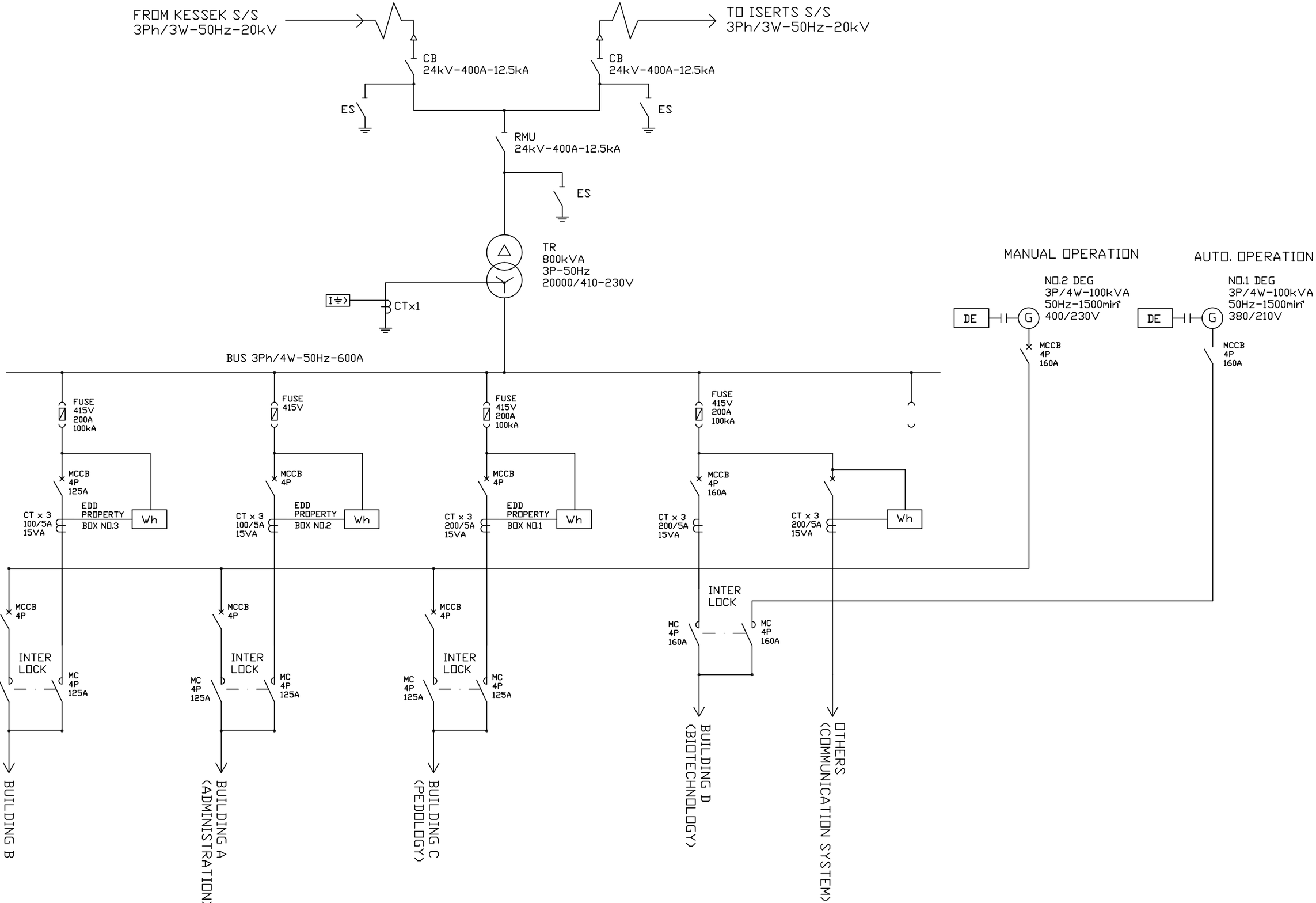
Multiplying this unit onto the annual generated energy of the PV system, 460MWh, we obtain the reduction of CO_2 emission

Annual CO_2 emission reduction by the Project ＝330 t-CO_2

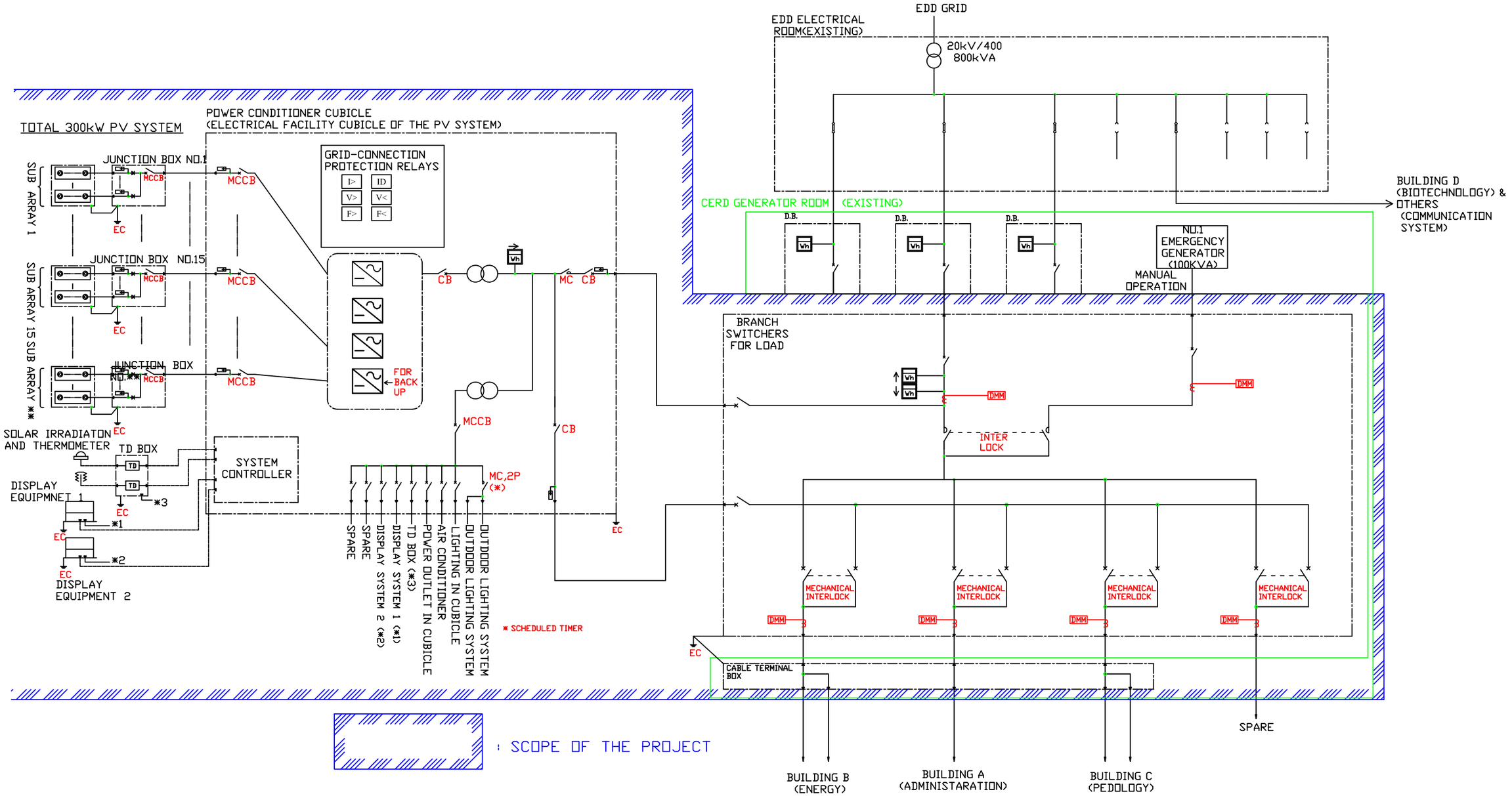
DRAWINGS

DRAWINGS

Number	Title
NO. 01	SINGLE LINE DIAGRAM (CERD)
NO. 02	SINGLE LINE DIAGRAM (PV SYSTEM)
NO. 03	GENERAL LAYOUT PLAN
NO. 04	BRANCH SWITCHERS FOR LOAD
NO. 05	CABLE LAYOUT PLAN
NO. 06	ELECTRIC ROOM EQUIPMENT LAYOUT (EXISTING)
NO. 07	ELECTRIC ROOM EQUIPMENT LAYOUT (MODIFICATION)
NO. 08	LED OUTDOOR LIGHTNING SYSTEM

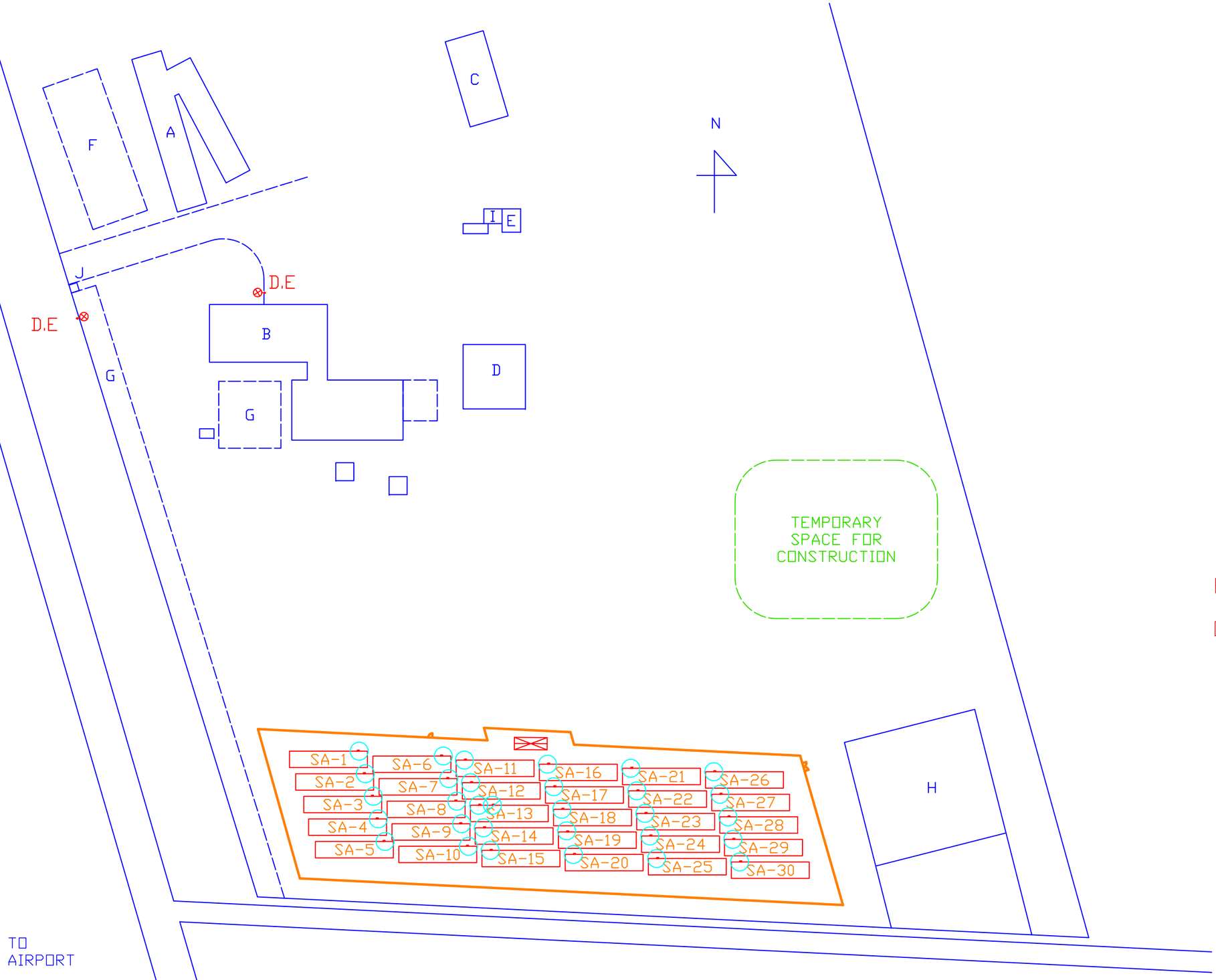


DRAWING NO. 01 SINGLE LINE DIAGRAM (CERD)



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

DRAWING NO. 02 SINGLE LINE DIAGRAM (PV SYSTEM)



LEGEND

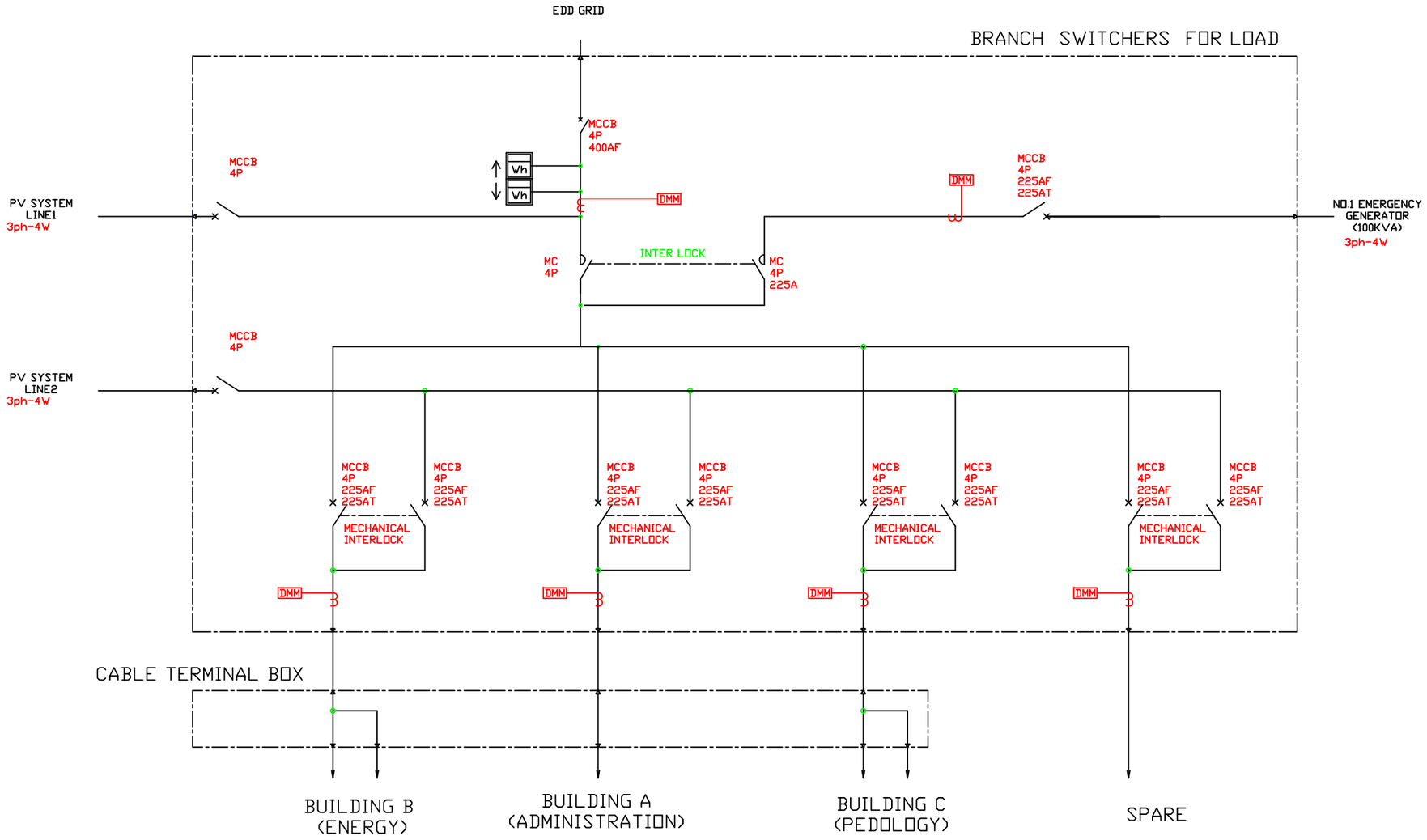
- : ELECTRICAL FACILITY CUBICLE OF THE PV SYSTEM [E.C.FOR PV]
- : PV SUB ARRAY (APPROPRIATE 10kW) [SA]
- : DISPLAY EQUIPMENT[D.E]
- : JUNCTION BOX [J.B]
- : TRANSDUCER BOX FOR METEOROLOGICAL OBSERVATION [T.D. BOX]
- : FENCE
- : GATE

BUILDING NAME LIST

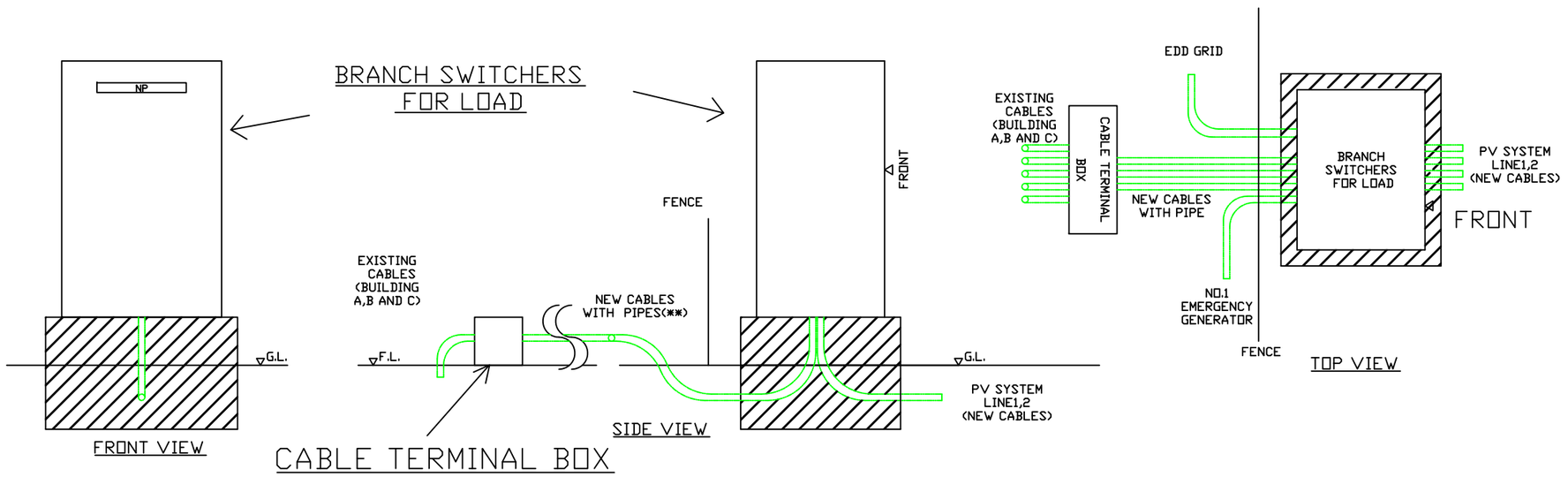
A: ADMINISTRATION BUILDING
B: ENERGY LABORATORY
C: PEDOLOGY LABORATORY
D: MAINTENANCE
E: EDD ELECTRIC ROOM
F: PARKING LOT
G: TREE PLANTING AREA
H: COMMUNICATION TOWER
I: CERD DIESEL GENERATOR ROOM
J: GUARD HOUSE

CERD/DJIBOUTI
(300kW)

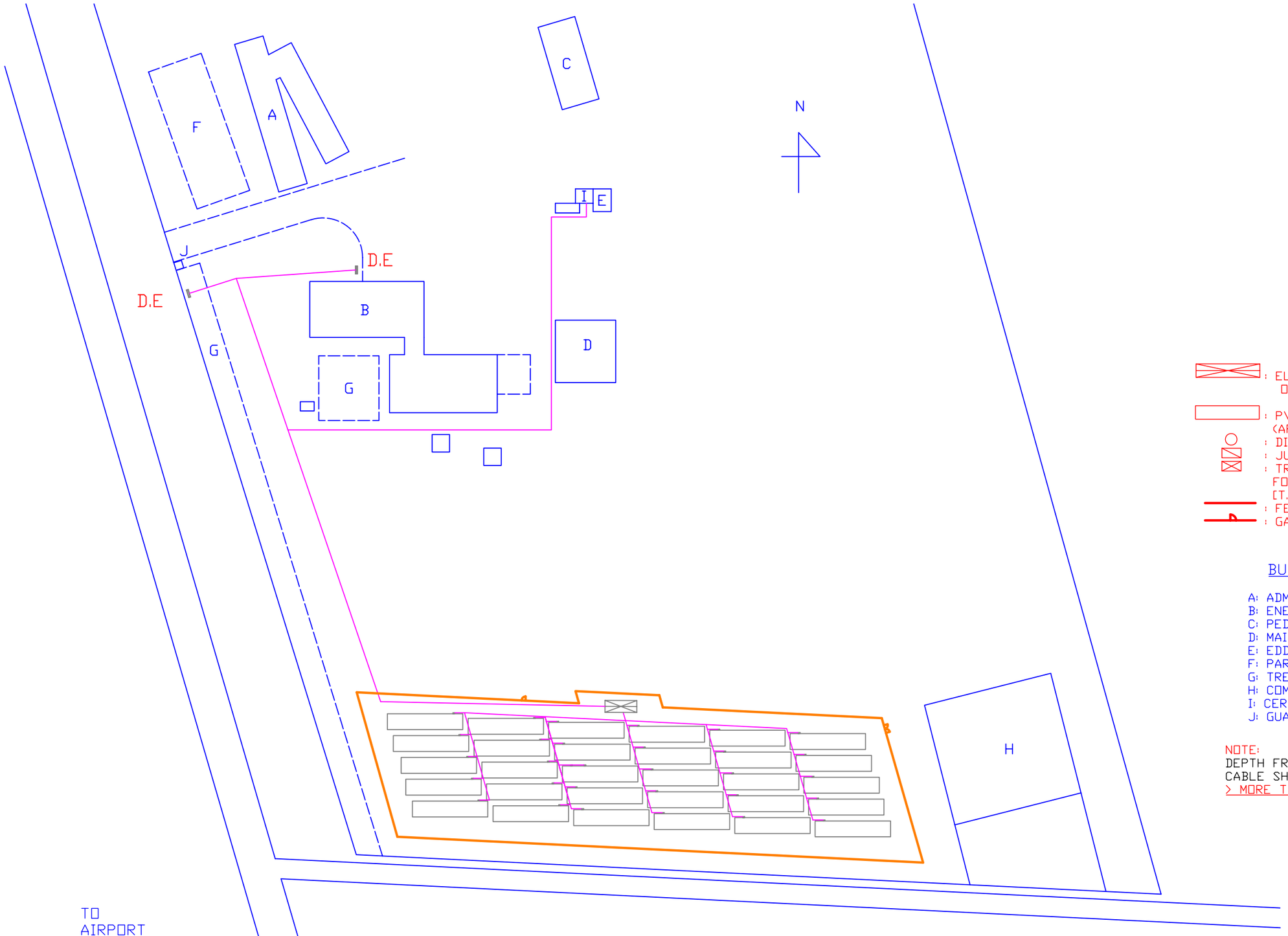
DRAWING NO. 03 GENERAL LAYOUT PLAN



D.B: DISTRIBUTION BOARD
DMM: DIGITAL MULTI-METER



DRAWING NO. 04 BRANCH SWITCHERS FOR LOAD



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

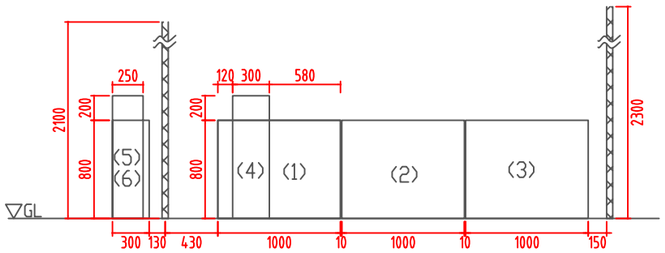
BUILDING NAME LIST

A: ADMINISTRATION BUILDING
B: ENERGY LABORATORY
C: PEDOLOGY LABORATORY
D: MAINTENANCE
E: EDD ELECTRIC ROOM
F: PARKING LOT
G: TREE PLANTING AREA
H: COMMUNICATION TOWER
I: CERD DIESEL GENERATOR ROOM
J: GUARD HOUSE

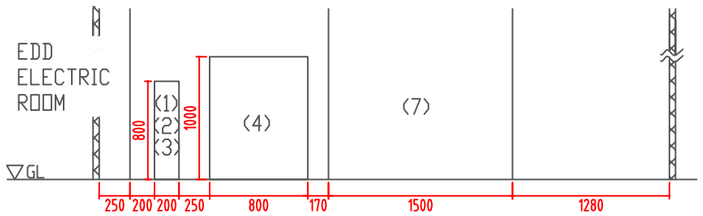
NOTE:
DEPTH FROM THE GROUND SURFACE TO THE CABLE SHALL BE
> MORE THAN 600MM SHOWN IN FINE LINE

CERD/DJIBOUTI
(300kW)

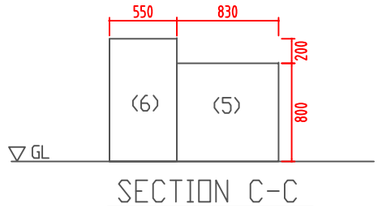
DRAWING NO. 05 CABLE LAYOUT PLAN



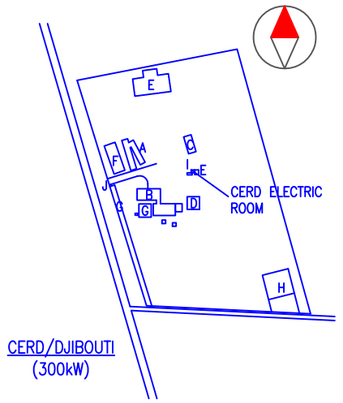
SECTION A-A

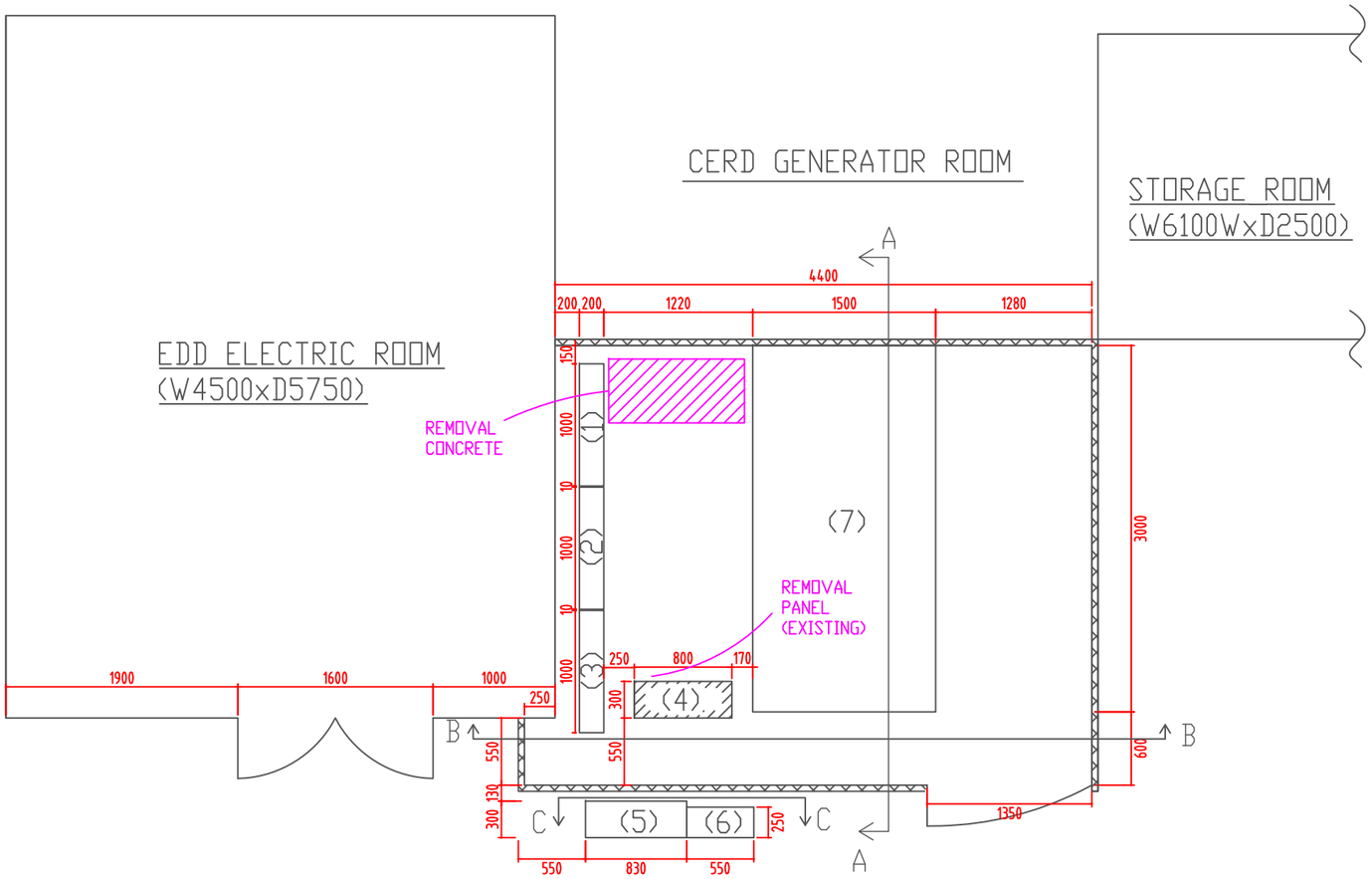


SECTION B-B



SECTION C-C





PLAN

NOTE

: CONCRETE

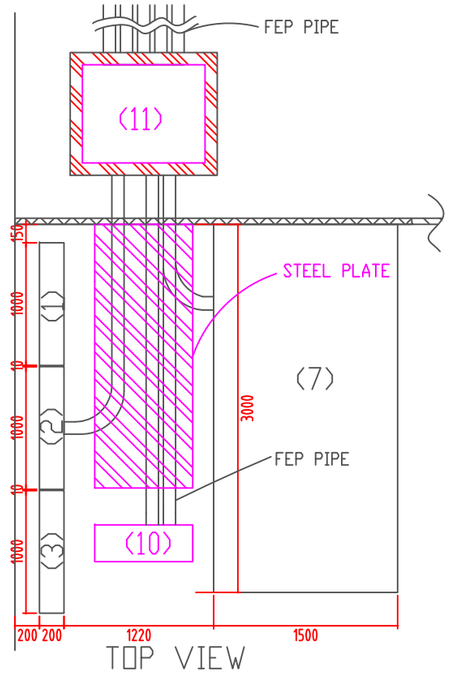
: CABLE TRENCH

: WIRE MESH

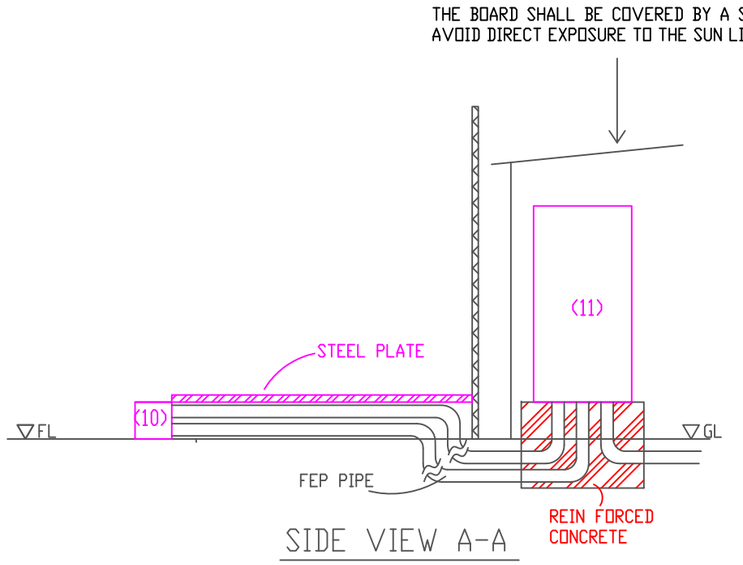
ELECTRICAL EQUIPMENT LIST

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION & WEIGHT				REMARKS
				WIDTH [mm]	DEPTH [mm]	HEIGHT [mm]	WEIGHT [kg]	
(1)	CERD METERING BOX - 1 [BUILDING - C : PEDOLOGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT & WHR METER	1	1,000	200	800	10	EXISTING PANEL
(2)	CERD METERING BOX - 2 [BUILDING-A : ADMINISTRATION]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT & WHR METER	1	1,000	200	800	10	EXISTING PANEL
(3)	CERD METERING BOX - 3 [BUILDING-B : ENERGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT & WHR METER	1	1,000	200	800	10	EXISTING PANEL
(4)	LOW VOLTAGE SWITCHING PANEL	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MAGNET-CONTACTOR, MCCB	1	800	300	1,000	10	EXISTING PANEL
(5)	CERD CONTACTOR BOX [BUILDING-D : BIOTECHNOLOGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT & WHR METER	1	830	300	800	10	EXISTING PANEL
(6)	OTHERS METERING BOX -4 [COMMUNICATION SYSTEM]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MAGNET-CONTACTOR, MCCB	1	550	250	1,000	10	EXISTING PANEL
(7)	No.1 EMERGENCY GENERATOR	SELF-VENTILATION WITH RADIATOR TYPE,3Ph-50Hz-100kVA-400/230V-H Class-IP21	1	-	-	-	382	EXISTING SYSTEM

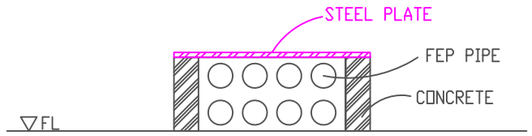
DRAWING NO. 06 ELETRIC ROOM EQUIPMENT LAYOUT (EXISTING)



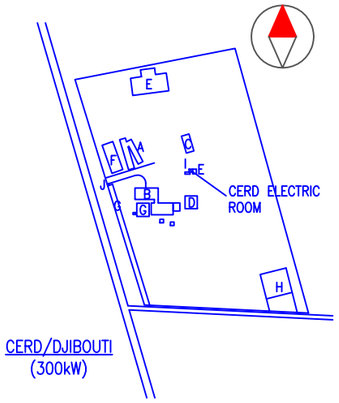
TOP VIEW

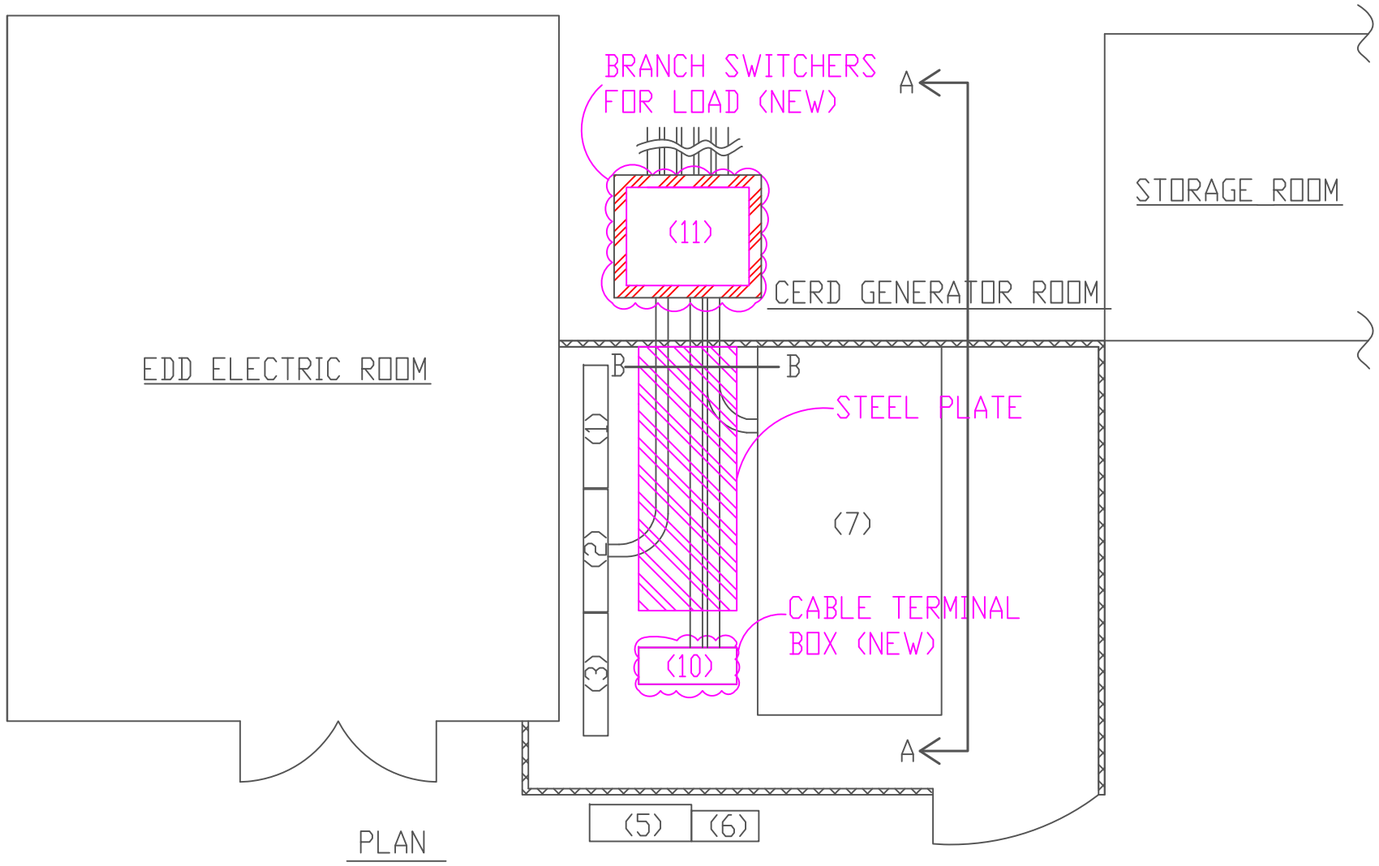


SIDE VIEW A-A



CABLE PIT
SECTION B-B





PLAN

NOTE

: CONCRETE

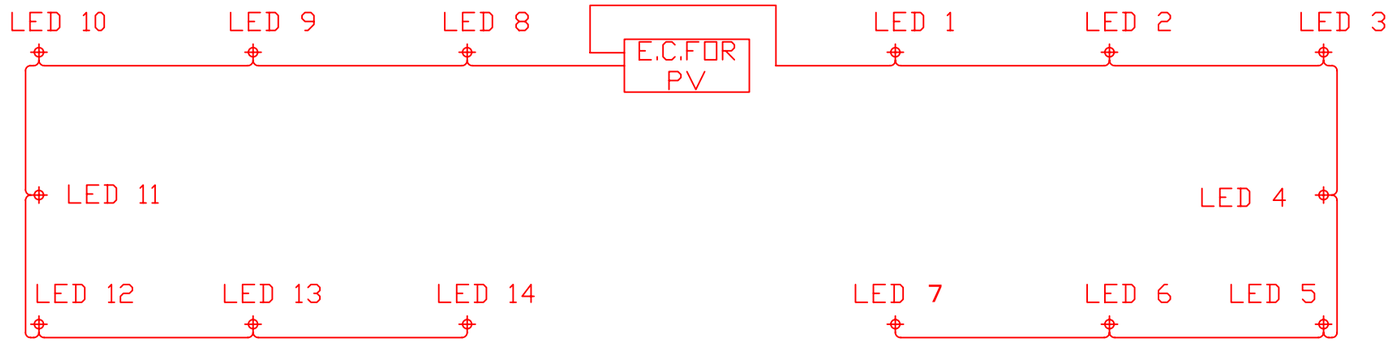
: STEEL PLATE

: WIRE MESH

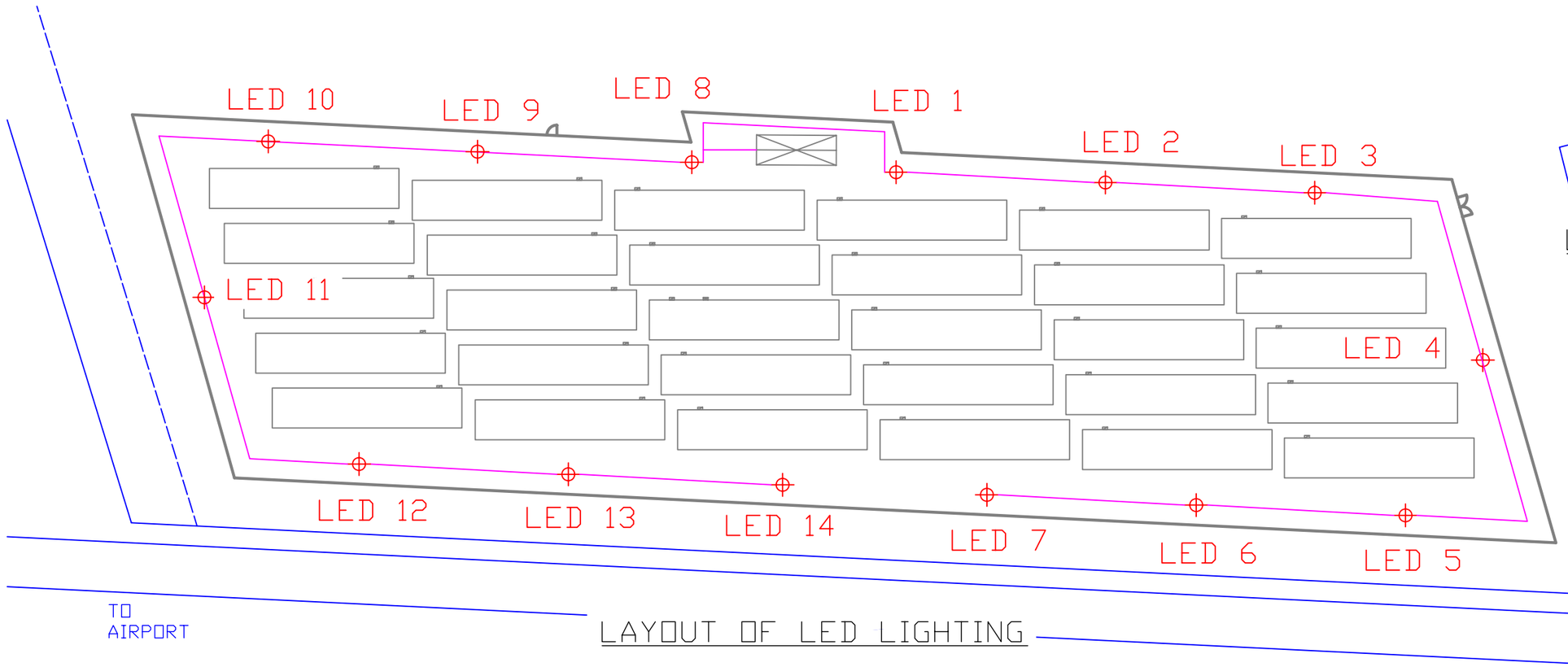
ELECTRICAL EQUIPMENT LIST

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION & WEIGHT				REMARKS
				WIDTH [mm]	DEPTH [mm]	HEIGHT [mm]	WEIGHT [kg]	
(1)	CERD METERING BOX - 1 [BUILDING - C : PEDOLOGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT & WHR METER	1	1,000	200	800	10	EXISTING
(2)	CERD METERING BOX - 2 [BUILDING-A : ADMINISTRATION]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT & WHR METER	1	1,000	200	800	10	EXISTING
(3)	CERD METERING BOX - 3 [BUILDING-B : ENERGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT & WHR METER	1	1,000	200	800	10	EXISTING
(5)	CERD CONTACTOR BOX [BUILDING-D : BIOTECHNOLOGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT & WHR METER	1	830	300	800	10	EXISTING
(6)	OTHERS METERING BOX - 4 [COMMUNICATION SYSTEM]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MAGNET-CONTACTOR, MCCB	1	550	250	1,000	10	EXISTING
(7)	No.1 EMERGENCY GENERATOR	SELF-VENTILATION WITH RADIATOR TYPE,3Ph-50Hz-100kVA-400/230V-H Class-IP21	1	-	-	-	382	EXISTING
(10)	CABLE TERMINAL BOX	-	1	-	-	-	-	NEW
(11)	BRANCH SWITCHERS FOR LOAD	-	1	-	-	-	-	NEW

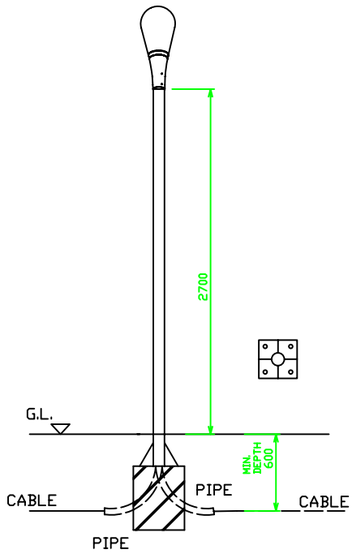
DRAWING NO. 07 ELETRIC ROOM EQUIPMENT LAYOUT (MODIFICATION)



BLOCK DIAGRAM FOR LED LIGHTING SYSTEM



LAYOUT OF LED LIGHTING



LED LIGHTING(DETAIL)
(S=1/50)

CERD/DJIBOUTI
(300kW)

DRAWING NO. 08 LED OUTDOOR LIGHTNING SYSTEM

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. Shumon YOSHIARA	Team Leader	Financing Facilitation and Procurement Supervision Department, JICA
2	Mr. Hajime USUKURA	Planning Management	Financing Facilitation and Procurement Supervision Department, JICA
3	Mr. Fujio HIROTA	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. Tetsuo TSURUSHIMA	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.
11	Ms. Naoko HIRAMATSU	Interpreter	JICE

2st 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. Kazuhiro ARITA	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.

3rd Survey

No.	Name	Position	Affiliation
1	Mr. Hiroyuki KOBAYASHI	Team Leader	Industrial Development Department, JICA
2	Mr. Masaru NISHIDA	Chief Consultant / PV Planning	NEWJEC Inc.
3	Mr. Kenichiro YAGI	Grid Connection PV System	NEWJEC Inc.
4	Mr. Takao SHIRAISHI	Grid Connection and Operation	NEWJEC Inc.
5	Mr. Sho SHIBATA	Coordinator	NEWJEC Inc.
6	Ms. Kumiko YODA	Interpreter	JICE

2. STUDY SCHEDULE

1st Survey

	Date	Day	JICA			Consultant							
			Team Leader	Planning Management	Procurement Planning & Management	Chief Consultant/ PV Planning	Grid Connection PV System	Electric Equipment	Procurement/Cost Estimate	Institutional/Socioeconomic Expert	Grid Connection and Operation	Coordinator	Interpreter
			Mr.Yoshiara JICA	Mr.Usukura JICA	Mr.Hirota JICS	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	23-Jul-09	Thu	Move to Ethiopia										
2	24-Jul-09	Fri	Move to Ethiopia Courtesy Call to EoJ and JICA Ethiopia Office			Courtesy Call to EoJ and JICA Ethiopia Office							Move to Djibouti
3	25-Jul-09	Sat	Move to Djibouti										
4	26-Jul-09	Sun	Courtesy Call to JICA Djibouti Office, EoJ, MoFA and MoF Site Survey at CERD										
5	27-Jul-09	Mon	Discussion on Minutes (MoENR) Site Survey at Candidate Sites					Discussion on Minutes Site Survey (CERD)	Discussion on Minutes Discussion on Project (EDD) Site Survey	Discussion on Minutes Site Survey	Discussion on Minutes Discussion on Project (EDD) Site Survey		Discussion on Minutes Site Survey
6	28-Jul-09	Tue	Discussion on Minutes (MoENR) Courtesy Call to EoJ				Discussion on Project (EDD)	Discussion on Minutes Planning the Project	Discussion on Project (EDD)	Discussion on Project (MoE) Courtesy Call to EoJ	Discussion on Minutes Courtesy Call to EoJ	Discussion on Project (EDD)	Discussion on Minutes
7	29-Jul-09	Wed	Discussion on Minutes (MoENR)				Planning the Project			Discussion on Minutes		Planning the Project	Discussion on Minutes
8	30-Jul-09	Thu	Signing of Minutes (MoENR) Reporting the Result of 1st Survey (JICA Djibouti Office)					Signing of Minutes Planning the Project					
9	31-Jul-09	Fri	Move to Japan			Planning the Project							
10	1-Aug-09	Sat	Move to Japan			Discussion on Project (CERD)		Planning the Project	Discussion on Project (CERD)	Planning the Project	Discussion on Project (CERD)	Planning the Project	Discussion on Project (CERD)
11	2-Aug-09	Sun				Discussion on Project (CERD, MoF, UNICEF)	Site Survey (CERD)		Discussion on Project (CERD, MoENR, Constructor)		Discussion on Project (CERD, MoF, UNICEF)	Site Survey (CERD)	
12	3-Aug-09	Mon				Discussion on Project (CERD, ADD, UNDP)	Planning the Project		Discussion on Project (Constructor)		Discussion on Project (CERD, ADD, UNDP)	Discussion on Project (CERD)	Discussion on Project (Constructor)
13	4-Aug-09	Tue				Discussion on Project (CERD, MoENR, MoF)	Discussion on Project (CERD) Planning the Project	Planning the Project	Discussion on Project (Constructor)	Discussion on Project (CERD, MoENR, MoF)	Planning the Project		Discussion on Project (Constructor)
14	5-Aug-09	Wed				Reporting the Result of 1st Survey (JICA Djibouti Office, EoJ) Move to Ethiopia							
15	6-Aug-09	Thu				Reporting the Result of 1st Survey (JICA Ethiopia Office, EoJ)							

2nd Survey

	Date	Day	Consultant						
			Chief Consultant/ PV Planning	Grid Connection PV System	Electric Equipment	Procurement/Cost Estimate	Grid Connection and Operation	Coordinator	Institutional/Socioeconomic Expert
			Mr.Nishida NEWJEC	Mr. Yagi NEWJEC	Mr. Komiya NEWJEC	Mr. Arita Japan Techno	Mr. Shiraishi NEWJEC	Mr. Shibata NEWJEC	Mr. Takamatsu Japan Techno
1	22-Oct-09	Thu	Move to Djibouti						
2	23-Oct-09	Fri	Discussion on Project (JICA Djibouti Office) / Planning the Project						
3	24-Oct-09	Sat	Courtesy Call (MoENR, CERD)	Courtesy Call (CERD) Planning the Project			Courtesy Call (MoENR, CERD)	Courtesy Call (CERD) Planning the Project	
4	25-Oct-09	Sun	Site Survey (CERD) Courtesy Call (MoFA, EoJ)	Site Survey (CERD)		Discussion with Constructors	Site Survey (CERD) Courtesy Call (MoFA, EoJ)	Site Survey (CERD)	
5	26-Oct-09	Mon	Site Survey (CERD)			Discussion with Constructors	Site Survey (CERD)		
6	27-Oct-09	Tue	Site Survey (CERD)			Discussion with Constructors	Site Survey (CERD)		
7	28-Oct-09	Wed	Site Survey (CERD)			Discussion with Constructors	Site Survey (CERD)		
8	29-Oct-09	Thu	Site Survey (CERD) / Planning the Project			Discussion with Constructors	Site Survey (CERD) / Planning the Project		
9	30-Oct-09	Fri	Planning the Project						Move to Djibouti
10	31-Oct-09	Sat	Site Survey (CERD) / Planning the Project			Discussion with Constructors	Site Survey (CERD) / Planning the Project		Move to Djibouti
11	1-Nov-09	Sun	Site Survey (CERD)			Discussion with Constructors	Site Survey (CERD)		
12	2-Nov-09	Mon	Site Survey (CERD)			Discussion with Constructors	Site Survey (CERD)		
13	3-Nov-09	Tue	Site Survey (CERD)			Discussion with Constructors	Site Survey (CERD)		
14	4-Nov-09	Wed	Site Survey (CERD)			Discussion with Constructors	Site Survey (CERD)		Discussion on Project (CERD)
15	5-Nov-09	Thu	Site Survey (CERD) / Planning the Project			Discussion with Constructors Planning the Project	Site Survey (CERD) / Planning the Project		Planning the Project
16	6-Nov-09	Fri	Planning the Project						Move to Yemen
17	7-Nov-09	Sat	Site Survey (CERD) Discussion on Project (MoE)	Site Survey (CERD)		Discussion with Constructor Site Survey (CERD)	Site Survey (CERD)		
18	8-Nov-09	Sun	Discussion on Basic Design (CERD)						
19	9-Nov-09	Mon	Site Survey (CERD) Discussion on Basic Design (CERD) Discussion on Project (EDD)	Site Survey (CERD) Discussion on Basic Design (CERD)			Site Survey (CERD) Discussion on Basic Design (CERD) Discussion on Project (EDD)	Site Survey (CERD) Discussion on Basic Design (CERD)	
20	10-Nov-09	Tue	Signing of Minutes (CERD) Reporting the Result of 2nd Survey (JICA)	Signing of Minutes (CERD) Planning the Project			Signing of Minutes (CERD) Reporting the Result of 2nd Survey (JICA)	Signing of Minutes (CERD) Planning the Project	
21	11-Nov-09	Wed	Courtesy Call to Presidence of Republic Reporting the Result of 2nd Survey (MoENR, EoJ)	Reporting the Result of 2nd Survey (MoENR, EoJ)			Courtesy Call to Presidence of Republic Reporting the Result of 2nd Survey (MoENR, EoJ)	Reporting the Result of 2nd Survey (MoENR, EoJ)	
22	12-Nov-09	Thu	Move to Ethiopia						
23	13-Nov-09	Fri	Reporting the Result of 2nd Survey (JICA Ethiopia Office, EoJ)						
24	14-Nov-09	Sat	Move to Burundi						

3rd Survey

	Date	Day	JICA	Consultant				
			Team Leader	Chief Consultant/ PV Planning	Grid Connection PV System	Grid Connection and Operation	Coordinator	Interpreter
			Mr.Kobayashi JICA	Mr.Nishida NEWJEC	Mr. Yagi NEWJEC	Mr. Shiraishi NEWJEC	Mr. Shibata NEWJEC	Ms. Yoda JICE
1	16-Apr-10	Fri	Move to Dubai	Move to Djibouti				Move to Dubai
2	17-Apr-10	Sat	Move to Djibouti	Discussion on Project (MoENR, CERD)				Move to Djibouti
3	18-Apr-10	Sun	Courtesy Call (MoFA, EoJ) Discussion on Project (JICA Djibouti Office, MoENR, CERD, EDD)					
4	19-Apr-10	Mon	Discussion on Minutes (MoENR, CERD, EDD)					
5	20-Apr-10	Tue	Discussion on Minutes (MoENR, CERD, EDD)					
6	21-Apr-10	Wed	Signing of Minutes Reporting the Result of 3rd Survey (JICA Djibouti Office, EoJ)					
7	22-Apr-10	Thu	Move to Ethiopia Reporting the Result of 3rd Survey (JICA Ethiopia Office)					
8	23-Apr-10	Fri	Move to Japan					

3. LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

APPENDIX 3 List of Parties Concerned in the Recipient Country

Name and Organization	Position
Ministry of Energy and Natural Resources	
Mr. Moussa Bouh Odowa	Minister
Mr. Fara Ali Ainan	Secretary General
Ms. Hawa Houssein	
Presidence of Republic	
Mr. Mohamed Hassan Abdillahi	Secretary General of the Government
CERD (Centre d'Etudes et de Recherche de Djibouti)	
Dr. Jalludin Mohamed	Director General
Mr. Said Ismail Awaleh	Director of Institute of Earth Science
Mr. Idriss Hared	Head of Renewable Energy Laboratory
EDD (Electricité De Djibouti)	
Mr. Jean-Paul Siry	Vice President
Mr. Wadi Salem	Director of Distribution
Mr. Mohamed Aynan	Chief of Electric Department
Ministry of Economy and Finance	
Mr. Abouraman Aouad IZZI	Secretary General
Mr. Moussa Roleh	Deputy Director General
Mr. Kabir Hamza	Chief of Port and Harbor Section
Mr. Saleban Ahmed	Department of Economy
Ministry of Foreign Affairs and International Cooperation	
Mr. Mohamed Ali Hassan	Director of Bilateral Relations
Mr. Moussa Mohamed	Assistant to Director
Ministry of Housing, Urbanization and Environment	
Mr. Aboubaker Doualé Waiss	Secretary General
Mr. Dani Abdullah Omar	Director of Environment
Agence Djiboutienne de Développement Social	
Mr. Kadar Ismaël Guelleh	Director General

UNICEF (United Nations International Children's Emergency Fund)

Mr. Ahoua Bertin Ehouan	Director of Operation Group
Mr. Ahmedou Ould Sidi Ould Bahah	Expert of Water Resource and Sanitation

UNDP (United Nations Development Programme)

Mr. Harbi Omar Chirdon	Programme Officer

Embassy of Japan in Djibouti

Mr. Masaki Noke	Ambassador
Mr. Toru Sugio	Vice Director/First Secretary

JICA Djibouti Office

Mr. Hidekazu Tanaka	Resident Representative
Mr. Motonobu Ichijo	Advisor of Project Formulation

4. MINUTES OF DISCUSSIONS

Procès-verbal des discussions

sur l'Étude Préparatoire

pour le Projet de Promotion de l'Énergie Propre

en utilisant le Système Solaire Photovoltaïque

Le gouvernement du Japon (ci-après dénommé « le GdJ ») a établi le "Partenariat Cool Earth" comme un mécanisme financier nouveau. A 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. Une nouvelle modalité d'aide financière non remboursable, "Programme d'aide financière non remboursable pour l'environnement et le changement climatique", a aussi 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 Solaire Photovoltaïque en République de Djibouti (ci-après dénommé « le Projet »).

La JICA a envoyé une équipe d'étude (ci-après dénommée « l'Équipe ») en République de Djibouti, dirigée par Monsieur Shumon YOSHIARA, Directeur général adjoint du Département d'aide au financement et de supervision des passations de marché de la JICA. L'Équipe y séjournera du 25 juillet 2009 au 5 août 2009.

L'Équipe a tenu une série de discussions avec les agents du gouvernement de la République de Djibouti (ci-après dénommé « la partie djiboutienne ») et a effectué des visites sur le terrain.

À la suite de ces discussions et visites sur le terrain, les deux parties ont convenu des points mentionnés dans le document joint au présent procès-verbal.

Fait à Djibouti, le 30 juillet 2009

Shumon YOSHIARA
Chef d'Équipe de l'Étude Préparatoire
Agence Japonaise de Coopération
Internationale
JAPON

Farah Ali Ainan
Secrétaire Général
Ministère de l'Énergie et
des Ressources Naturelles
République de Djibouti

Mohamed Ali Hassan
Directeur de la Relation Bilatérale
Ministère des Affaires Étrangères
République de Djibouti

Saïd Ismael Awaleh
Directeur Général du Centre d'Étude
et de Recherche de Djibouti
République de Djibouti

DOCUMENT JOINT

1. Situation actuelle

La République de Djibouti manque d'électricité chroniquement à cause de l'insuffisance de la capacité de production. Comme elle dépend complètement de l'importation des combustibles fossiles, en vue de promouvoir l'autonomie énergétique, elle s'engage dans l'exploitation d'énergies renouvelables parmi lesquelles la géothermie est prioritaire.

D'autre part, elle est riche en ressources solaires et éoliennes. Elle souhaiterait améliorer le niveau de vie de la population surtout dans les zones rurales par l'utilisation de ces énergies naturelles.

Cependant en réalité, l'exploitation des énergies renouvelables s'y développe difficilement. Il lui est donc demandé d'acquérir et accumuler des connaissances techniques nécessaires pour planifier et mettre en oeuvre l'utilisation desdites énergies.

2. Objectif du Projet

Le Projet a pour but de promouvoir l'utilisation d'énergies propres et d'arriver à réduire les émissions de gaz en mettant en place un système photovoltaïque connecté au réseau national.

3. Organisme responsable et organe d'exécution

L'organisme responsable est le Ministère de l'Energie et des Ressources Naturelles (ci-après dénommé « le MERN ») (dont l'organigramme est joint en Annexe-1).

L'organe d'exécution est aussi le MERN.

L'organisme collaborateur de ce dernier est le Centre d'Étude et de Recherche de Djibouti (ci-après dénommé « le CERD »), sous tutelle du Secrétaire Général du gouvernement (dont l'organigramme est joint en Annexe-2).

4. Éléments requis par le gouvernement du Djibouti

4-1. Pour ce Projet, les deux parties ont examiné au point de vue technique les bâtiments publics y compris des écoles, des centre hospitaliers et des réverbères. À la suite de visites sur le terrain desdits sites, elles ont confirmé le CERD (B.P. 486, Route de l'aéroport, Djibouti) comme site/installations cible pour la mise en place du système.

4-2. Après discussions avec l'Équipe de l'Étude Préparatoire 1, la partie djiboutienne a demandé la fourniture des éléments suivants:

(1) Module solaire (panneau) capacité totale devrait être approximativement de 250 kw

(2) Tableau de distribution

(3) Dispositif électronique de conditionnement de la charge

(4) Dispositif de collecte de données et d'affichage

4-3. La partie djiboutienne a expliqué qu'il n'y a pas de duplications entre le contenu du Projet et celui des plans mis en œuvre par d'autres bailleurs de fond ou par elle-même.

4-4. La partie djiboutienne a compris que les composantes finales et la conception du Projet devront être décidées (confirmées) au moment de l'Étude Préparatoire 2.

4-5. L' Équipe évaluera la pertinence de la demande et fera un compte rendu des résultats de l' Étude au siège de la JICA et au GdJ. La partie djiboutienne a compris que les composantes finales et la conception du Projet seraient définies (confirmées) à la suite d'une étude plus détaillée.

5. Programme japonais d'aide financière non remboursable pour l'environnement et le changement climatique

La partie djiboutienne a compris le Programme japonais d'aide financière non remboursable pour l'environnement et le changement climatique expliqué par l'Équipe (décrit en Annexe-5, 6 et 7).

6. Calendrier de l'Étude

6-1. L'Équipe effectuera une étude approfondie en République de Djibouti jusqu'au 5 août 2009 comme 1ère phase de l'étude préparatoire.

6-2. Si le Cabinet approuve le Projet basé sur les résultats de l'Étude Préparatoire 1, la JICA mènera l'Étude Préparatoire 2 pour la conception du Projet.

7. Autres points importants discutés/abordés

7-1 Le CERD offre un terrain pour l'installation du système PV et peut se servir d'énergies produites par ledit système pour la recherche scientifique et sa consommation. D'autre part, il fournit au MERN ses connaissances et techniques en matière de production d'énergies par le système PV et accorde un appui technique en matière de gestion et de maintenance assurées par le MERN des équipements fournis dans le cadre du Projet.

7-2 Pièce justicative concernant le droit de propriété du site du Projet

Les deux parties ont confirmé que le terrain pour le Projet montré en Annexe-3 est assuré par le CERD. L'emplacement de ce terrain est officiellement montré par la copie du registre cadastre en Annexe-4.

7-3 Préparation du terrain

La partie djouboutienne s'est mise d'accord pour aménager et niveler en cas de nécessité le terrain où le système PV sera installé.

7-4 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 djiboutienne a donné son accord / approbation.

7-5 Coordination avec les organismes concernés

En vue de la mise en oeuvre du Projet, le MERN sera le point focal et il sera responsable pour la coordination avec des organismes concernés. La partie djiboutienne a donné son accord afin d'établir un comité consultatif pour coordonner avec la partie japonaise. Les termes de référence dudit comité se réfère à l'Annexe-10.

7-6 Application des lois et des règlements concernés

Bien qu'il n'existe ni lois ni réglements en matière de connexion au réseau national d'énergies renouvelables à présent, la partie djiboutienne n'a pas contesté que le CERD exploite et procède le système PV et qu'il fasse la connexion au réseau national ainsi que l'injection d'énergies produites par ledit système.

7-7 Considérations environnementales et sociales

.L'Équipe a expliqué à la partie djiboutiennes l'aperçu des directives des considérations environnementales et sociales (dénnomé ci-après "les Directives de la JICA"). La partie djiboutienne en a pris en considération et elle suivra des procédures nécessaires.

Au cours de cette étude préparatoire 1, les deux parties ont confirmé avec le Ministère de l'Habitat, de l'Urbanisme, l'Environnement et de l'Aménagement du Territoire que la mise en oeuvre du Projet ne nécessitera aucune procédure en matière d'évaluation de l'impact sur l'environnement.

7-8 Exploitation et Maintenance

La partie djiboutienne a convenu d'acquérir et d'accorder le budget ainsi que le personnel nécessaires pour l'exploitation et la maintenance des installations fournies et mises en place dans le cadre du Projet.

7-9 Exonération des droits de douane et des taxes

La partie djiboutienne a convenu d'assumer responsabilité de l'exonération et/ou du remboursement (paiement / prise en charge) de tous les droits de douane, taxes intérieures, levées fiscales et devoirs dans le pays pour la mise en œuvre du Projet.

7-10. La partie djiboutienne doit assurer la sécurité de tous les ressortissants japonais concernés qui travaillent pour le Projet, si nécessaire.

7-11. La partie djiboutienne doit fournir un nombre nécessaire d'homologues au personnel de l'Équipe pendant la durée de son étude dans le pays.

< Liste des Annexes >

Annexe-1 Organigramme du MERN

Annexe-2 Organigramme du CERD

Annexe-3 Site du Projet / Site cible du Projet

Annexe-4 Copie du registre cadastre du site

Annexe-5 Programme d'aide financière non remboursable pour l'environnement et le changement climatique

Annexe-6 Circulation générale du Programme d'aide financière non remboursable pour l'environnement et le changement climatique

Annexe-7 Circulation de fonds pour la mise en œuvre du Projet

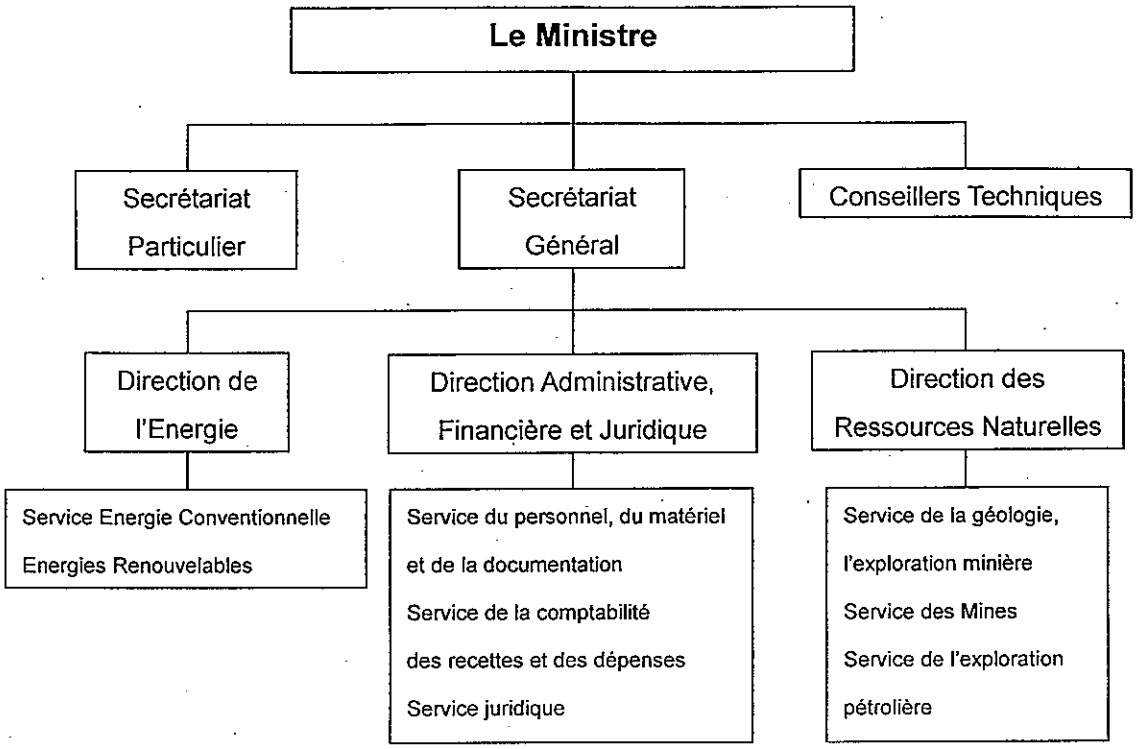
Annexe-8 Système de mise en œuvre du Projet

Annexe-9 Mesures principales à prendre par chaque gouvernement

Annexe-10 Les attributions du Comité

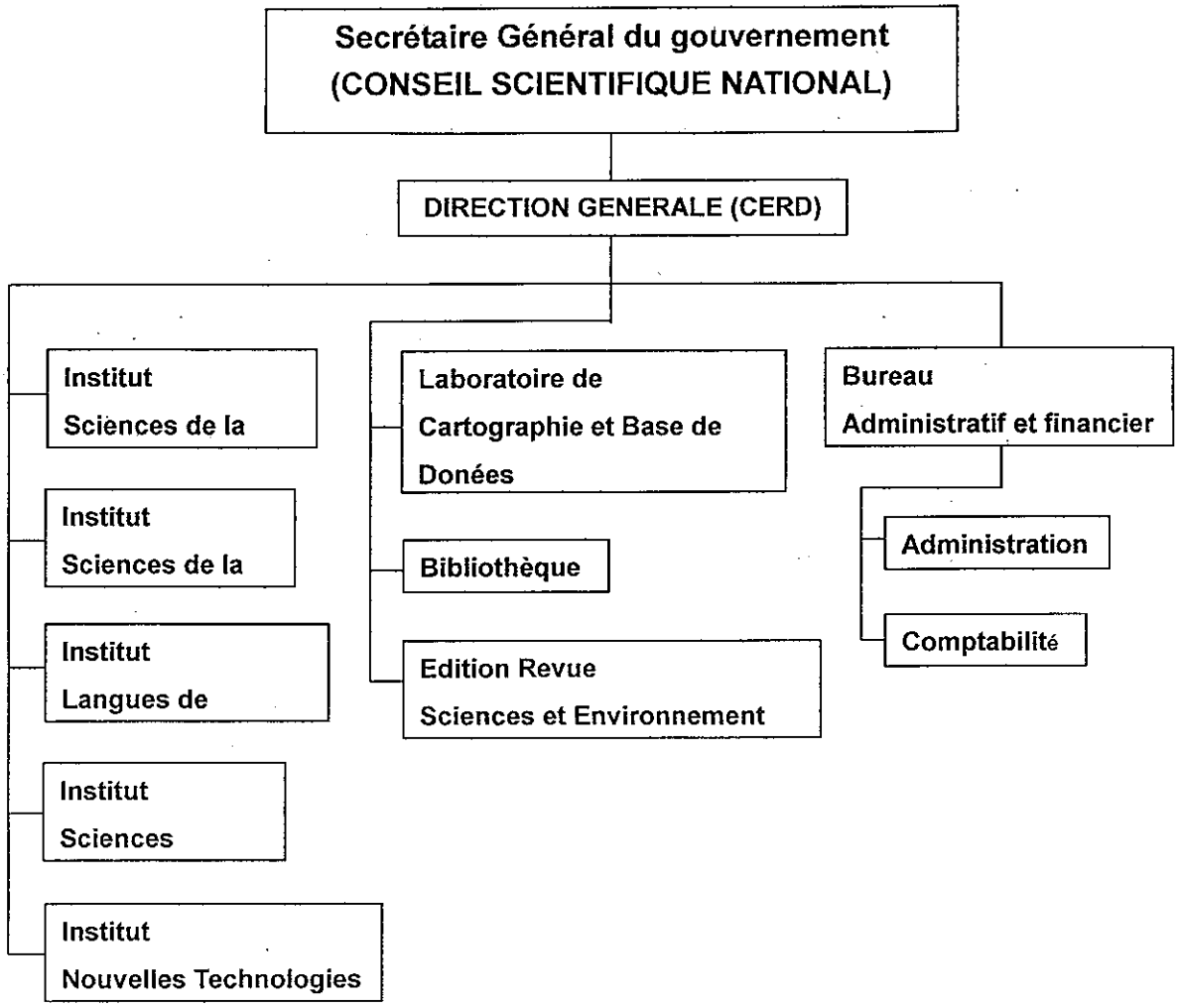
Annexe-1

Organigramme du MERN

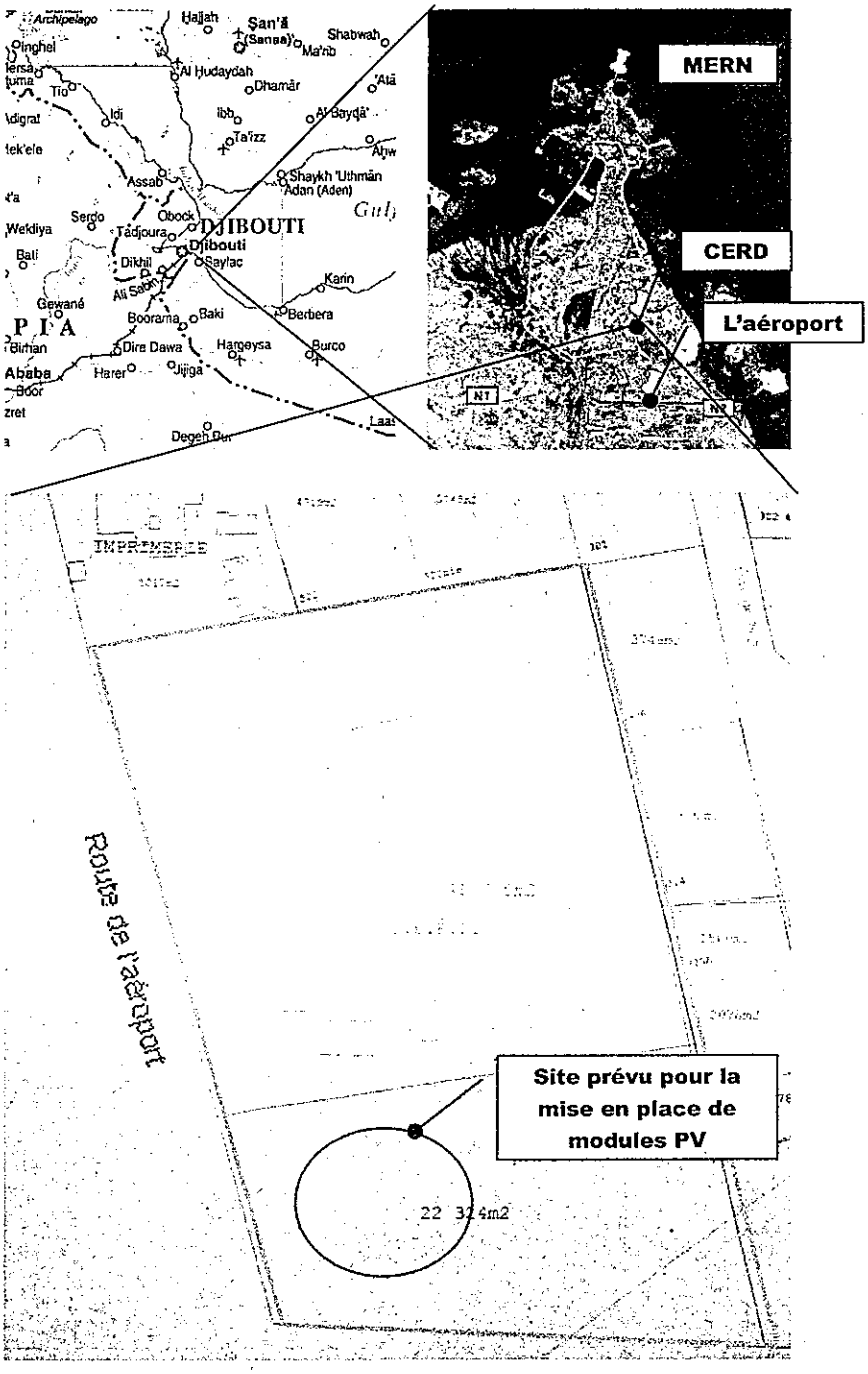


Annexe-2

Organigramme du CERD



Site du Projet / Site cible du Projet



Copie du registre cadastre du site

MINISTERE DES FINANCES ET DE L'ECONOMIE NATIONALE

SERVICE DE L'ENREGISTREMENT DES DOMAINES ET DU TIMBRE

- REPUBLIQUE DE DJIBOUTI -

VISA : PREMIER MINISTRE:

A R R E T E N° 81- 1300/PR/FIN

Affectant à la Présidence de la République une parcelle de terrain sise à Gabode pour mise à la disposition de L'I S E R S T .

LE PRESIDENT DE LA REPUBLIQUE
CHEF DU GOUVERNEMENT,

VU Les lois constitutionnelles n° 77-001 et 77-002 du 27 Juin 1977;

VU Le décret n° 81-076/PR en date du 7 Juillet 1981 portant nomination des membres du Gouvernement;

VU La demande de l'Institut Supérieur d'Etudes et de Recherches Scientifiques et Techniques (I S E R S T)

VU L'avis de la Commission de la Propriété Foncière;

SUR Le rapport du Ministres des Finances et de l'Economie Nationale;

Le Conseil des Ministres entendu dans sa séance du 22 SEPTEMBRE 1981.

A R R E T E

ARTICLE 1er - Il est affecté à la Présidence de la République une parcelle de terrain d'une superficie de 5 hectares environ, sise à Gabode.

ARTICLE 2 - Cette parcelle de terrain est destinée à l'implantation de L'I S E R S T et de la construction de logements de fonction.

.../...

ARTICLE 3 Dans les vingt jours de la date du présent arrêté, le Chef du Service des Domaines fera remise de la parcelle de terrain sus-visée à la Présidence de la République.

Il sera dressé procès-verbal de cette opération lequel comportera évaluation du terrain affecté et détermination de ses limites.

ARTICLE 4 - Le présent arrêté sera enrégistré, publié et exécuté partout où besoin sera.

FAIT A DJIBOUTI, le 30 SEPTEMBRE 1981

HASSAN GOULED APTIDON

Annexe-5

L'Aide Non-Remboursable pour l'Environnement et le Changement Climatique

(Provisoire)

Le Gouvernement du Japon (ci-après dénommé "le GDJ") est la mise 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 1 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 Programmatique Coopération financière non remboursable (ci-après dénommé « le Don ») pour l'Environnement et les Changements climatiques (ci-après dénommé «la CFEC»).

La Don fournit un pays bénéficiaire (ci-après dénommé «le Bénéficiaire») avec des fonds non remboursables pour se 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.

La CFEC vise à réduire des émissions vers tels que la réalisation d'économies d'énergie et la le d 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 CFEC

La CEFC est exécuté par les procédures suivantes.

L'Application (Requête faite par le Bénéficiaire)
L'Étude (étude de conception sommaire réalisée par la JICA)
L'Évaluation et d'approbation (Evaluation par le GDJ et l'approbation par le Conseil des ministres)
La Détermination de la mise en oeuvre (les Notes échangées entre le GDJ et le Bénéficiaire)
L'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 CFEC programme soumise par un pays Bénéficier est examinée par le GDJ (le Ministère des Affaires Etrangères) pour porter un jugement sur son éligibilité pour CFEC.

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

Troisièmement, le GDJ évalue le programme pour voir s'il est adéquate au système de la CFEC, sur la base du rapport de l'Étude préparée par la JICA et les résultats sont par la suite soumis au Conseil des ministres pour approbation.

Quarantièmement, le programme, une fois approuvé par le Conseil des ministres, dévient officiel par l'Échange de Notes signé par le GDJ et le gouvernement du pays bénéficiaire.

Simultanément, le Don sera rendu disponible après la conclusion du 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 des offres, des contrats et ainsi de suite) pour la CFEC 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 par convenue entre les deux gouvernements dans le procès-verbal convenus (« P / V »).

2. L' Étude de Concept de Sommaire

1) Contenu de l'Etude

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'Etude est le suivant :

(1) Confirmer l'arrière-plan, les objectifs et les effets du Programme ainsi que les capacités de maintenance du pays bénéficiaire de l'exécution du Programme.
(2) Evaluer la pertinence du Programme à être exécutée sous le système de coopération 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 juridiction de l'organisme du pays bénéficiaire en charge de l'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'Etude, 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 du CFEC après de l'E/N

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

La CEFC est mise 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 la 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 sous la CFEC seront convenues entre le Bénéficiaire et la JICA au moment de la signature de l'E/N et 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'Aide Non-Remboursable pour l'Environnement et le Changement Climatique 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 du «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 d'un 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 que deux documents identiques, sera soumis à la JICA par le Bénéficiaire par le biais de l'Agent. La JICA confirme ou non l'Accord d'Agent est conclu en conformité avec l'A/D et les Directrices d'Approvisionnement, et approuve l'accord.

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

d) Les 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 et de l'avance que le paiement final à l'agent doit être effectuée lorsque le montant restant est inférieur à trois (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) Les firmes

En principe, un firme de toute nationalité peuvent être contracté si le firme satisfait aux conditions énoncées dans le dossier d'appel d'offre.

Le 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) Les experts d'assistance technique

Les expert(s) pouvant être envoyés pour mettre en œuvre l'assistance technique. L'expert (s) pouvant être recommandé par la JICA lorsque la cohérence conceptuelle de l'Etude est exigé. En principe, les expert (s) est / sont préférables à des nationaux japonais, si approprié.

h) Méthode d'approvisionnement

Dans l'exécution d'approvisionnement, il doit faire 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) Les dossiers d'appel d'offres

Les dossiers d'appel d'offres doivent contenir toutes les informations nécessaires pour permettre aux soumissionnaires de préparer des offres valables pour les produits et services dans la CFEC.

Les droits et obligations du Bénéficiaire, l'Agent et les fournisseurs des produits et services doit être stipulé 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) L'examen de préqualification des soumissionnaires

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

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

k) L'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 des dossier d'appel d'offres, doivent être jugés, en principe, sur la base de ces prix soumis, 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, de clarifier les raisons de la réussite de l'offre et la récusation et soumet au Bénéficiaire pour obtenir la confirmation avant de conclure le contrat avec l'adjudicataire.

L'Agent doit fournir la JICA à un rapport d'évaluation détaillé de l'offre, 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 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 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 ci-dessus (1) doivent être obtenus, les fournissement devra 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, conformément à l'A/D.

m) Conclusion des contrats

Dans le but de fournir des produits et des services en conformité avec les Directives d'approvisionnement, 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 soumission des documents nécessaires du firme sur la base des conditions stipulées dans le contrat, après que les obligations du 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 pour les firmes sur les conditions que ces firmes de présenter au paiement à l'avance une valeur de garantie du montant de l'avance à l'Agent.

4) Les obligations pour le gouvernement du pays bénéficiaire

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

a) acquérir [un parcel] / [des parcels] 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 et en électricité, et d'écoulement des eaux ainsi que d'autres installation auxiliaires nécessaires pour la mise en œuvre du Programme;
c) assurer les établissements avant le fournissement dans le cas de l'installation de l'équipement
d) assurer le déchargement et le dédouanement rapides aux ports de débarquement du Bénéficiaire et faciliter leur transport intérieur / le dédouanement rapide et faciliter leur transport intérieur dans le pays bénéficiaire 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 de l'emploi de l'Agent seront exonérés / seront 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 dans le cas des nationaux japonais, et les personnes physiques ou morales des pays-tiers dans le cas des nationaux des pays-tiers.);
g) assurer que [les Etablissements]/[les Etablissements et les Composants] seront entretenus et utilisés d'une manière convenable et efficace pour la mise en oeuvre du Programme;
h) supporter tous les frais nécessaires pour la mise en œuvre du Programme, 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 Programme.

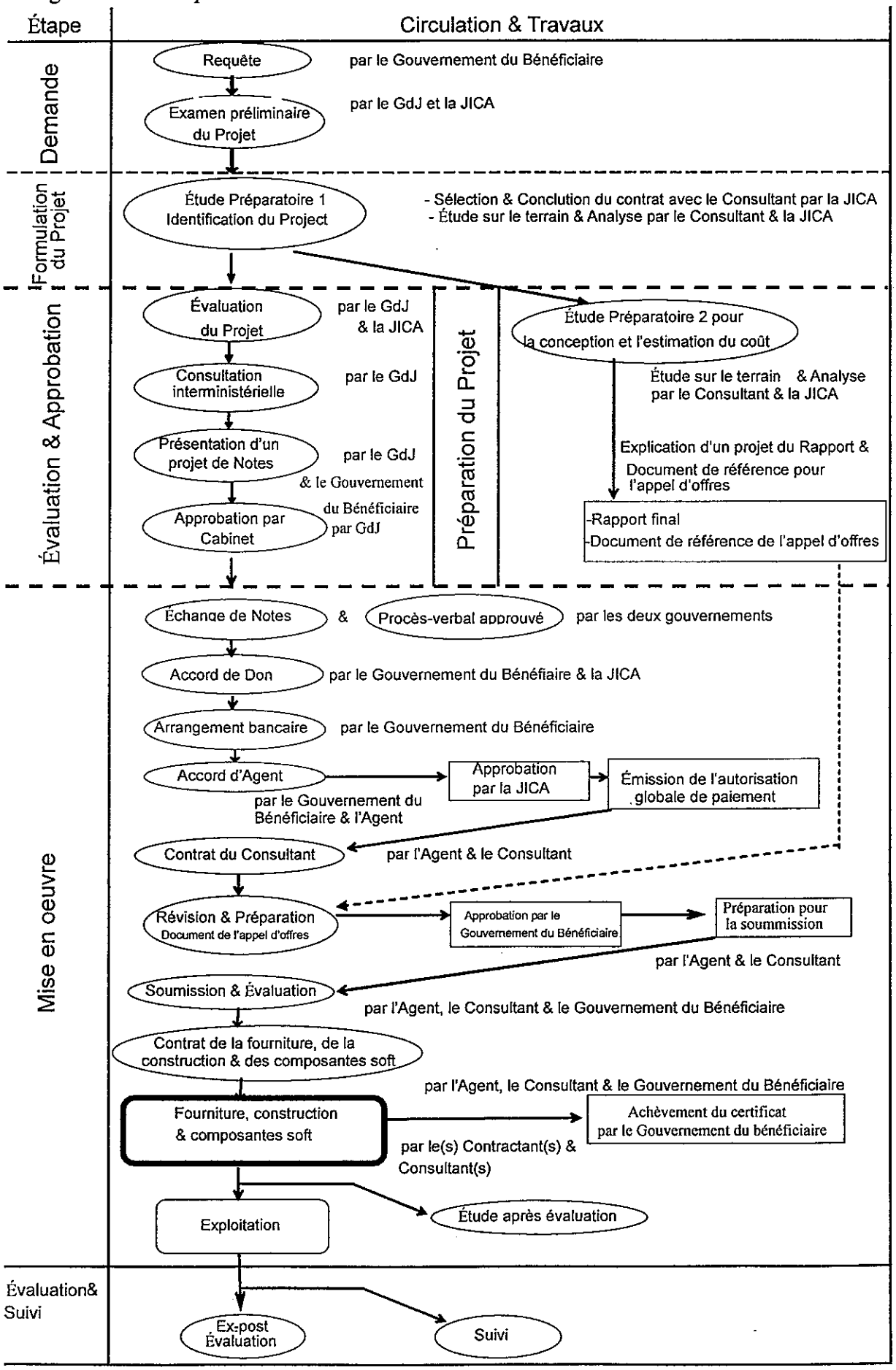
5) Utilisation approprié

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

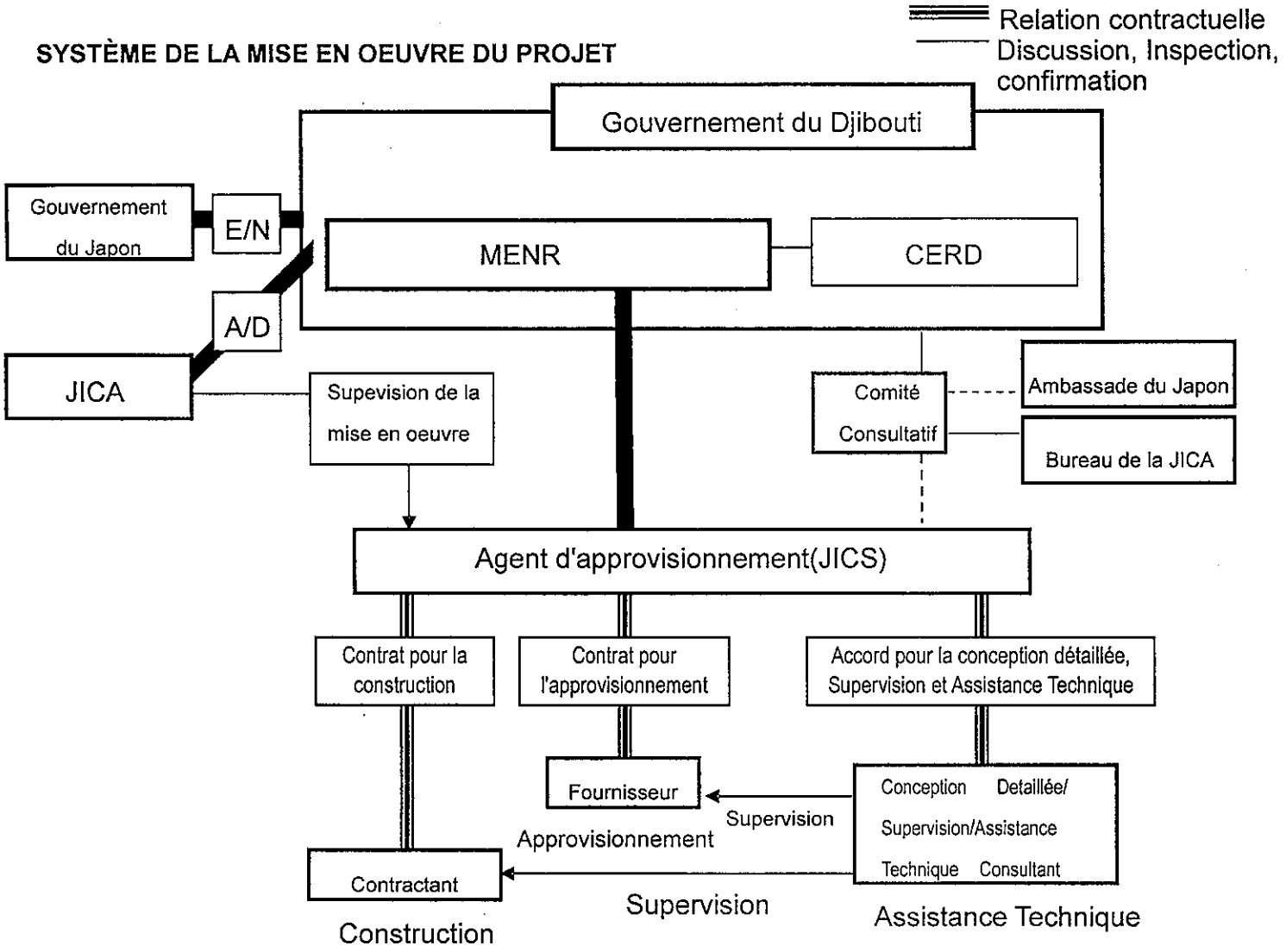
6) Réexportation

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

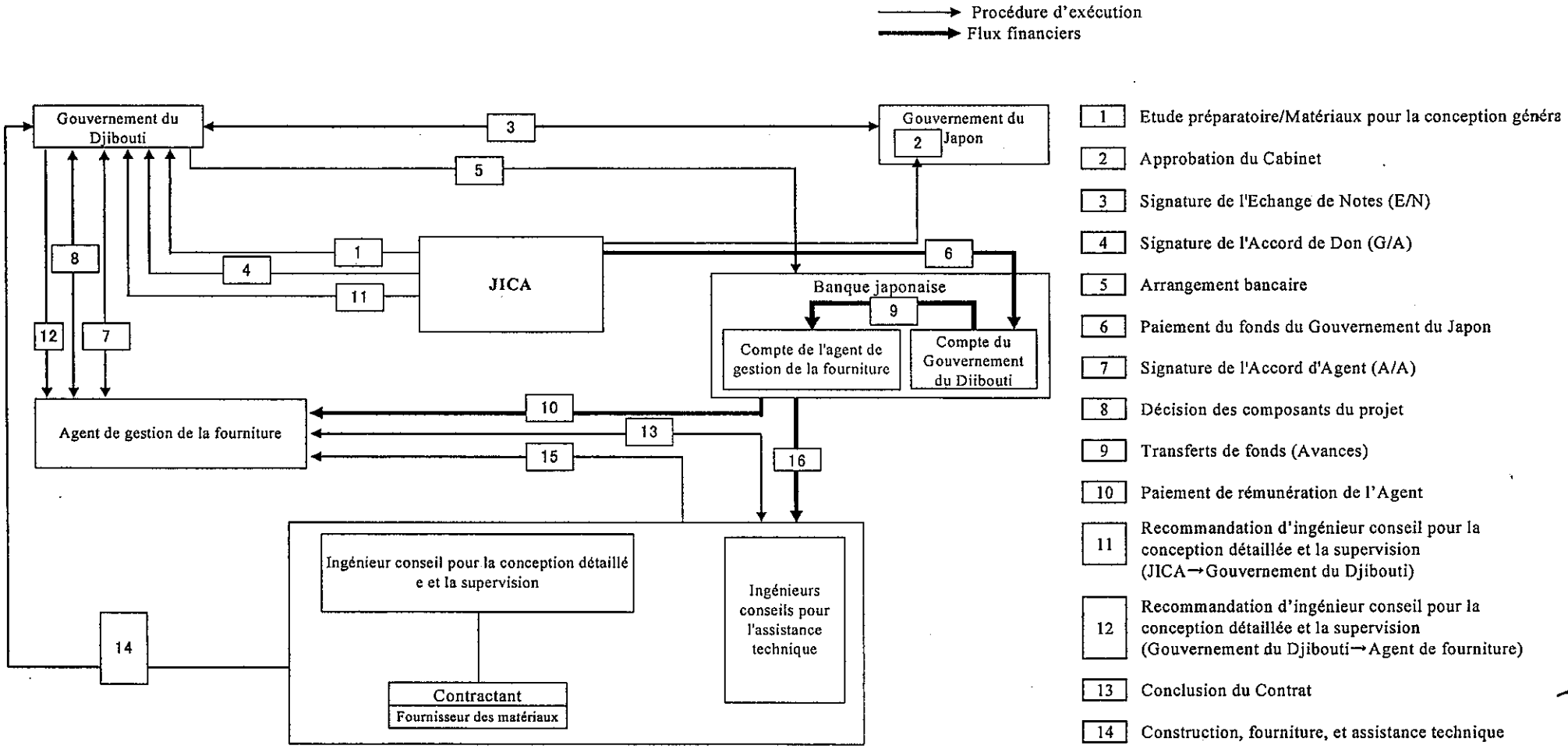
Circulation générale du Programme d'aide financière non remboursable pour l'environnement et le changement climatique



Circulation de fonds pour la mise en œuvre du Projet



Système de mise en œuvre du Projet



Annexe-9

Mesures à prendre par chaque gouvernement (Version CFEC)

	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 (MDF) du bâtiment		•
	b. MDF 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 (B/A):		

	1) Paiement des commissions bancaires		•
	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.		•
14	Tenir dûment compte des questions environnementales et sociales dans la mise en œuvre du Programme.		•

Annexe-10

Les 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 Solar Photovoltaic System

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

JICA sent to the Republic of Djibouti the Preparatory Survey Team (hereinafter referred to as "the Team”), headed by Mr. Yoshiara, Deputy Director General of Financing Facilitation and Procurement Supervision Department, JICA, and is scheduled to stay in the country from 25th July to5th August 2009.

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

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

Djibouti, 30 July 2009

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ATTACHMENT

1. Current Situation

Djibouti has a chronic shortage of electricity due to the lack of supply capacity. The country, in order to reduce the dependency on the imported fossil fuels and to raise the degree of energy autonomy, has been planning the exploitation of renewable sources of energy among which geothermal is given a priority.

Meanwhile, the country is endowed with rich solar and wind resources which it is hoping to use in rural areas to improve the standard of living thereof.

However, the exploitation of renewable sources of energy has been very slow to materialize. There is also a need to acquire and accumulate the technical knowledge necessary in planning and implementation of renewable energy uses.

2. Objective of the Project

The objective of the Project is to promote clean energy utilization and achieve emissions reductions by installing a photovoltaic system to be connected to the national grid.

3. Responsible Organisation and Implementing Agency

The responsible organisation is the Ministry of Energy and Natural Resources. (hereinafter referred to as the "MENR," whose organisation chart of the responsible ministry is shown in Annex-1.)

The implementing agency is the MENR.（The organisation chart of the implementing organisation is shown in Annex-2.）

The collaborating agency of the MERN is the Centre for Study and Research of Djibouti (hereinafter referred to as the "CERD"), which is under the Secretary General of the government. (Organisation chart is shown in Annex-3.)

4. Items Requested by the Government of Djibouti

4-1. For the Project, the both parties examined public buildings including schools, hospitals and public lights from a technical perspective. After the survey of the above-mentioned sites, the both confirmed that the CERD (B.P. 486, Route de l'aéroport, Djibouti) be the installation site for the implementation of the Project.

4-2. After discussions with the Team, the installation of the on-grid power generating system using photovoltaic including following equipment was requested by the Djibouti side.

(1) Solar module (panel) total capacity might be around 250 kw
(2) Junction Box
(3) Power Conditioner
(4) Data collecting and display device

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

4-4. The Djibouti side has understood that the final component and the design of the Project shall be

determined (confirmed) at the timing of 2nd phase of the Preparatory Survey.

4-5. The Team will assess the appropriateness of the request and will report the findings to the JICA Headquarters and the GoJ. The Djibouti side understood the final components and the design of the Project shall be decided (confirmed) after further survey.

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

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

6. Schedule of the Study

6-1. The Team will proceed to further survey in the Republic of Djibouti until 5th of August 2009 as the 1st phase of the Preparatory Survey.

6-2. If the Cabinet will approve the Project based on the results of the Preparatory Survey, JICA will conduct the Preparatory Survey 2 for the designing of the Project.

7. Other Relevant Issues

7-1 The CERD offer its land for the installation of the PV system and can use the energy of the system for its scientific research and consumption. On the other hand, it provides its knowledge and technique on the energy production by the PV system and agrees technical assistance in terms of the management and maintenance assured by the equipment of the MERN given by the Project.

7-2 Land Title Deed of the Project Site

Both the Djibouti and Japan sides confirmed that the land for the Project shown in Annex-3 secured by the CERD. The location is officially shown as the copy of the estate register in Annex-4.

7-3 Preparation of the land

The Djibouti side agreed to clear and level the space for the implementation of the PV system.

7-4 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 Djibouti side understood/agreed.

7-5 Coordination with Related Organisations

For the implementation of the Project, the MENR shall be the focal point and responsible for the coordination with the related organisations. The Djibouti side agreed to establish a consultative committee in order to coordinate with the Japanese side which consists of the Embassy of Japan, the JICA office and the procurement agency. Terms of References of the Consultative Committee is referred to Annex-9.

7-6 Application of the Related Laws and Regulations

As there is no laws and regulations concerning the grid connection of renewable energy power sources at present, the Djibouti side has no objections for the CERD to own and operate the PV system, and to have it connected to the national grid and to send the surplus of the power generated by the system back to the grid.

7-7 Environmental and Social Considerations

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

As a result of the Preparatory Survey 1, the both sides confirmed, with the Ministry of Habitation, Urbanisation, Environment, and Land Maintenance, that the implementation of the Project does not require any procedure concerning the evaluation of impact on environment.

7-8 Operation and Maintenance

The Djibouti side agreed to secure and allocate the necessary budget and personnel for the operation and maintenance of the facilities procured and installed under the Project.

7-9 Customs and Tax exemption

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

7-10. The Djibouti side shall ensure the security of all concerned Japanese nationals working for the Project, if deemed necessary.

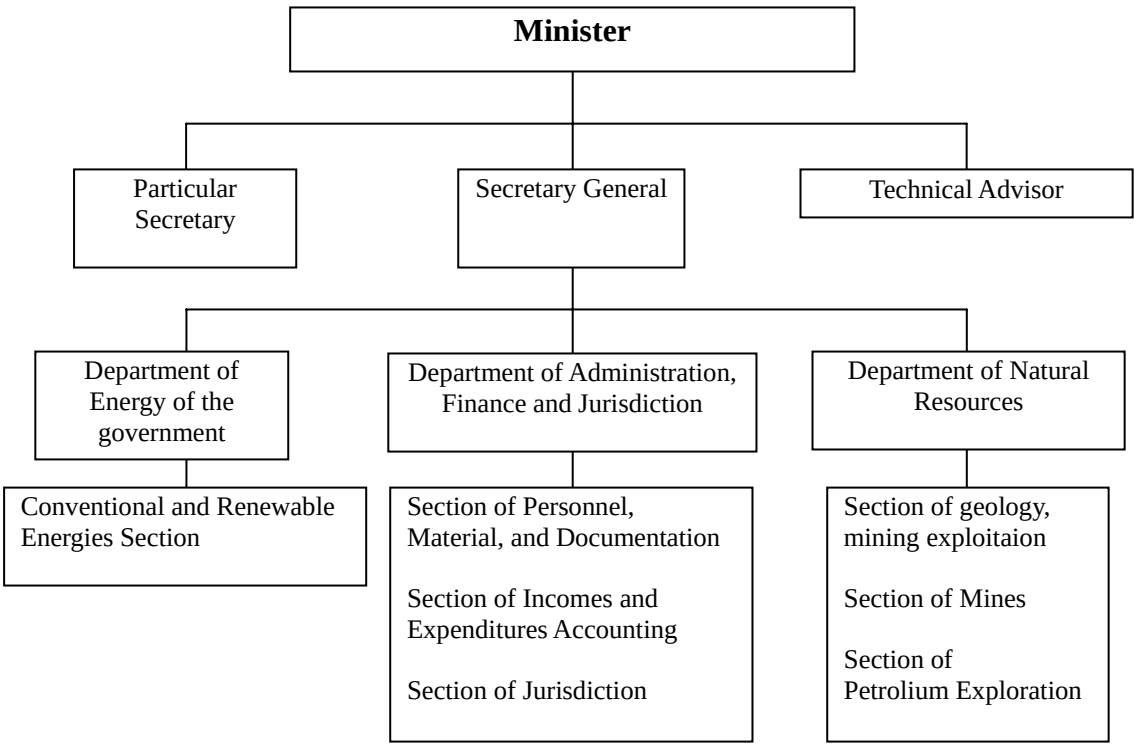
7-11. The Djibouti side shall provide necessary numbers of counterpart personnel to the Team during the period of their studies in Djibouti.

<List of Annex>

Annex-1 Organisation Chart of the MERN
Annex-2 Organisation Chart of the CERD
Annex-3 Project site / Candidate site of the Project
Annex-4 Copy of the Land Title Deed of the Project Site
Annex-5 Program Grant Aid for Environment and Climate Change
Annex-6 General Flow of Program Grant Aid for Environment and Climate Change
Annex-7 Flow of Funds for Project Implementation
Annex-8 Project Implementation System
Annex-9 Major Undertakings to be taken by Each Government
Annex-10 Terms of References of the Consultative Committee

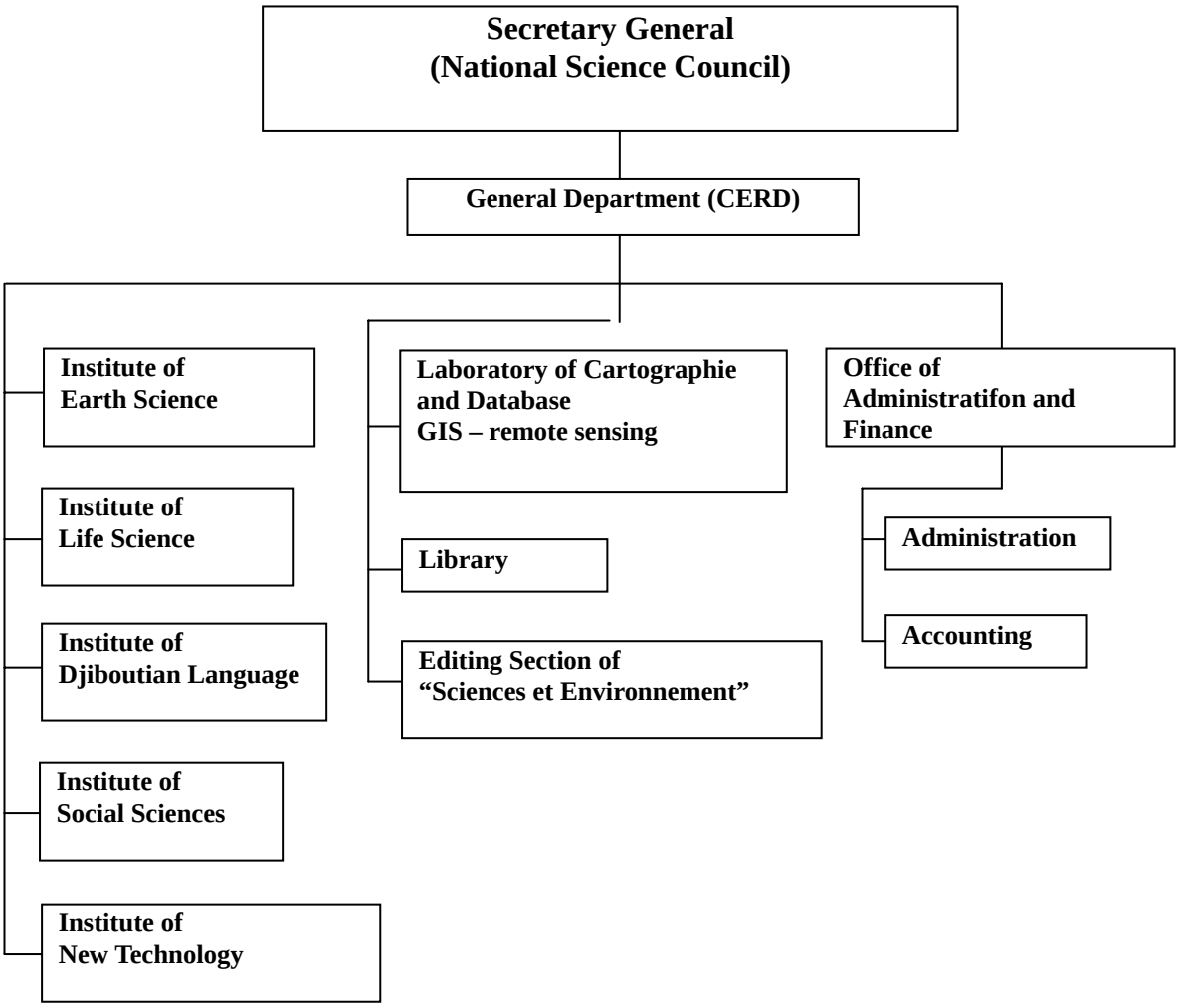
Annexe-1

Organisation Chart of the MERN

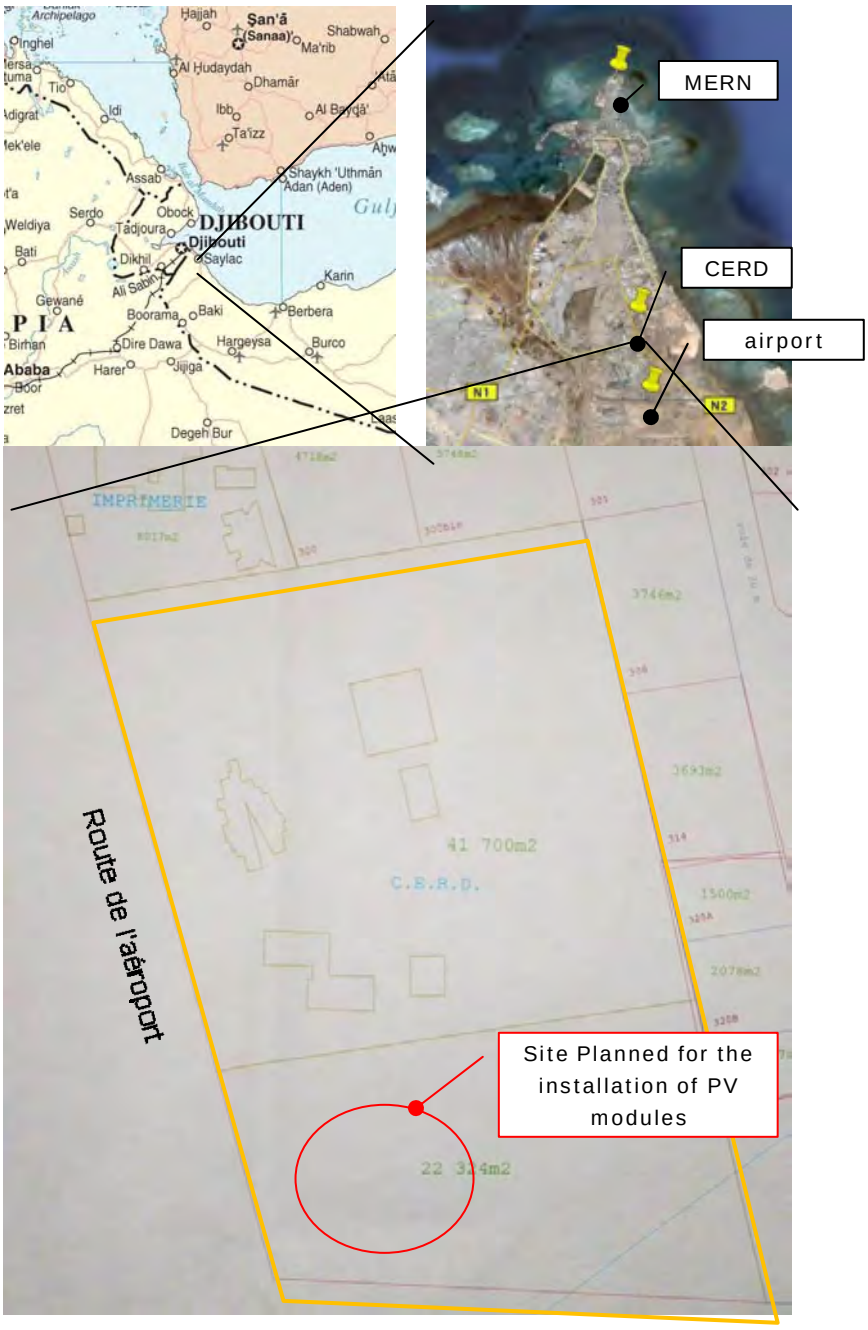


Annexe-2

Organisation Chart of the CERD



Project site / Candidate site of the Project



Copy of the Land Title Deed of the Project Site

MINISTERE DES FINANCES ET DE L'ECONOMIE NATIONALE

SERVICE DE L'ENREGISTREMENT DES DOMAINES ET DU TIMBRE

- REPUBLIQUE DE DJIBOUTI -

VISA : PREMIER MINISTRE:

ARRETE N° 81- 1300/PR/FIN

Affectant à la Présidence de la République une parcelle de terrain sise à Gabode pour mise à la disposition de L'I S E R S T .

LE PRESIDENT DE LA REPUBLIQUE
CHEF DU GOUVERNEMENT,

VU Les lois constitutionnelles n° 77-001 et 77-002 du 27 Juin 1977;

VU Le décret n° 81-076/PR en date du 7 Juillet 1981 portant nonination des membres du Gouvernement;

VU La demande de l'Institut Supérieur d'Etudes et de Recherches Scientifiques et Techniques (I S E R S T)

VU L'avis de la Commission de la Propriété Foncière;

SUR Le rapport du Ministres des Finances et de l'Economie Nationale;

Le Conseil des Ministres entendu dans sa séance du 22 SEPTEMBRE 1981.

A R R E T E

ARTICLE 1er - Il est affecté à la Présidence de la République une parcelle de terrain d'une superficie de 5 hectares environ, sise à Gabode.

ARTICLE 2 - Cette parcelle de terrain est destinée à l'implantation de L'I S E R S T et de la construction de logements de fonction.

.../...

ARTICLE 3 Dans les vingt jours de la date du présent arrêté, le Chef du Service des Domaines fera remise de la parcelle de terrain sus-visée à la Présidence de la République.

Il sera dressé procès-verbal de cette opération lequel comportera évaluation du terrain affecté et détermination de ses limites.

ARTICLE 4 - Le présent arrêté sera enrégistré, publié et exécuté partout où besoin sera.

FAIT A DJIBOUTI, le 30 SEPTEMBRE 1981

HASSAN GOULED APTIDON

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

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

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

1. Procedures for GAEC

GAEC is executed through the following procedures.

Preparatory Survey 1	Preparatory Survey for projectz identification conducted by Japan International Cooperation Agency (JICA)
Application	Request made by a recipient country
Appraisal & Approval	Appraisal by the Government of Japan and Approval by the Cabinet
Determination of Implementation	The Notes exchanged between the Government of Japan and the Recipient Country
Grant Agreement (hereinafter 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 organisation that will render services according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the Agreed Minutes ("A/M").

2 Preparatory Survey

1) Contents of the Survey

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

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

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

The Government of Japan requests the Government of the Recipient to take whatever measures necessary to ensure its responsibility in implementing the Project. Such measures must be guaranteed even if they may fall outside the jurisdiction of the implementing organisation of the Recipient. This has been confirmed by all relevant organisations 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 organisation, 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 prompt unloading and customs clearance of products purchased under the Grant Aid at the port of disembarkation,
d) To ensure that customs duty, internal taxes and other fiscal levies that may be imposed in the Recipient with respect to the purchase of the Components and the Agent’s services will be exempted by the Government of the Recipient.
e) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into the Recipient and stay therein for the performance of their work.

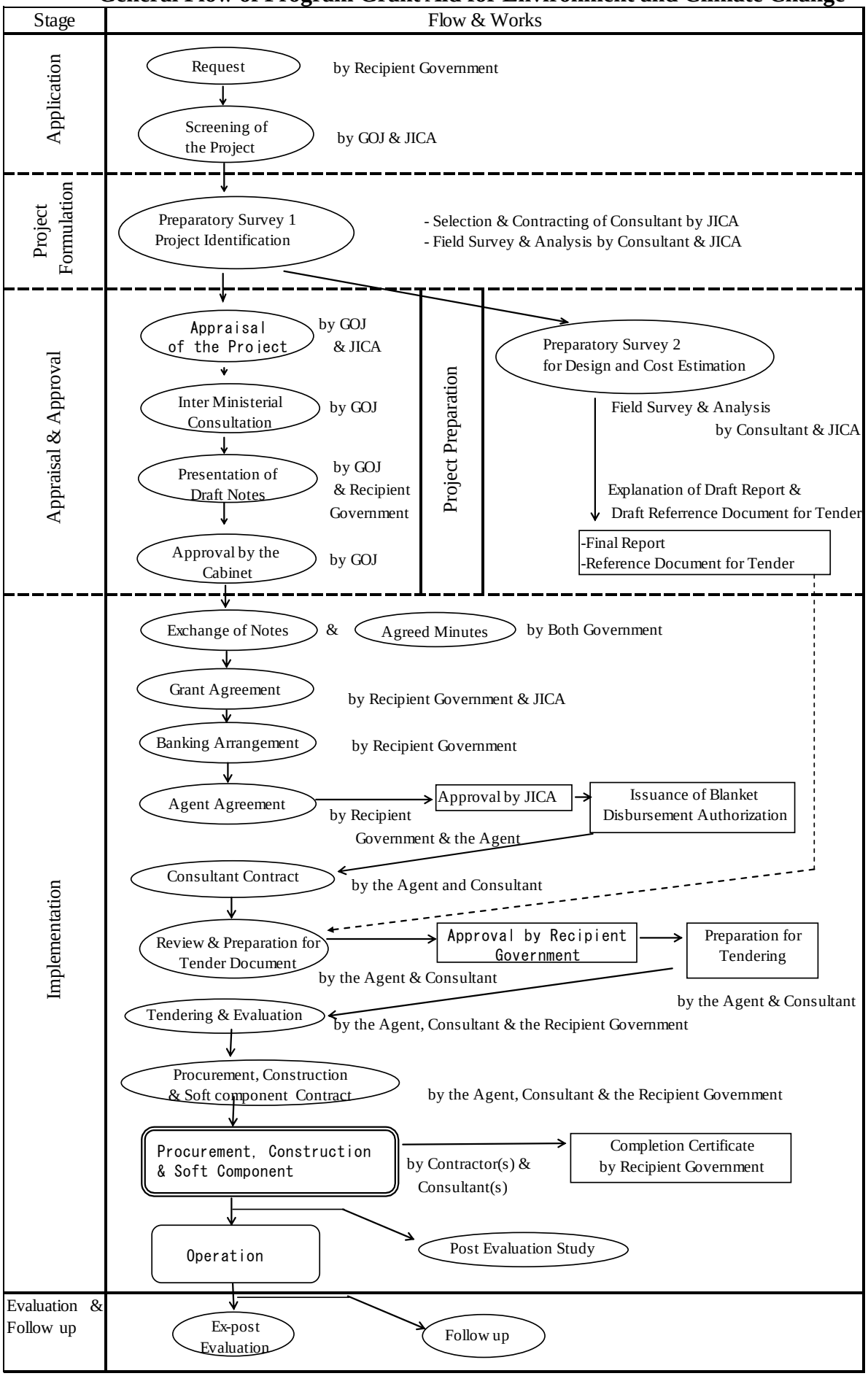
5) "Proper use of funds"

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

6) "Export and Re-export" of products

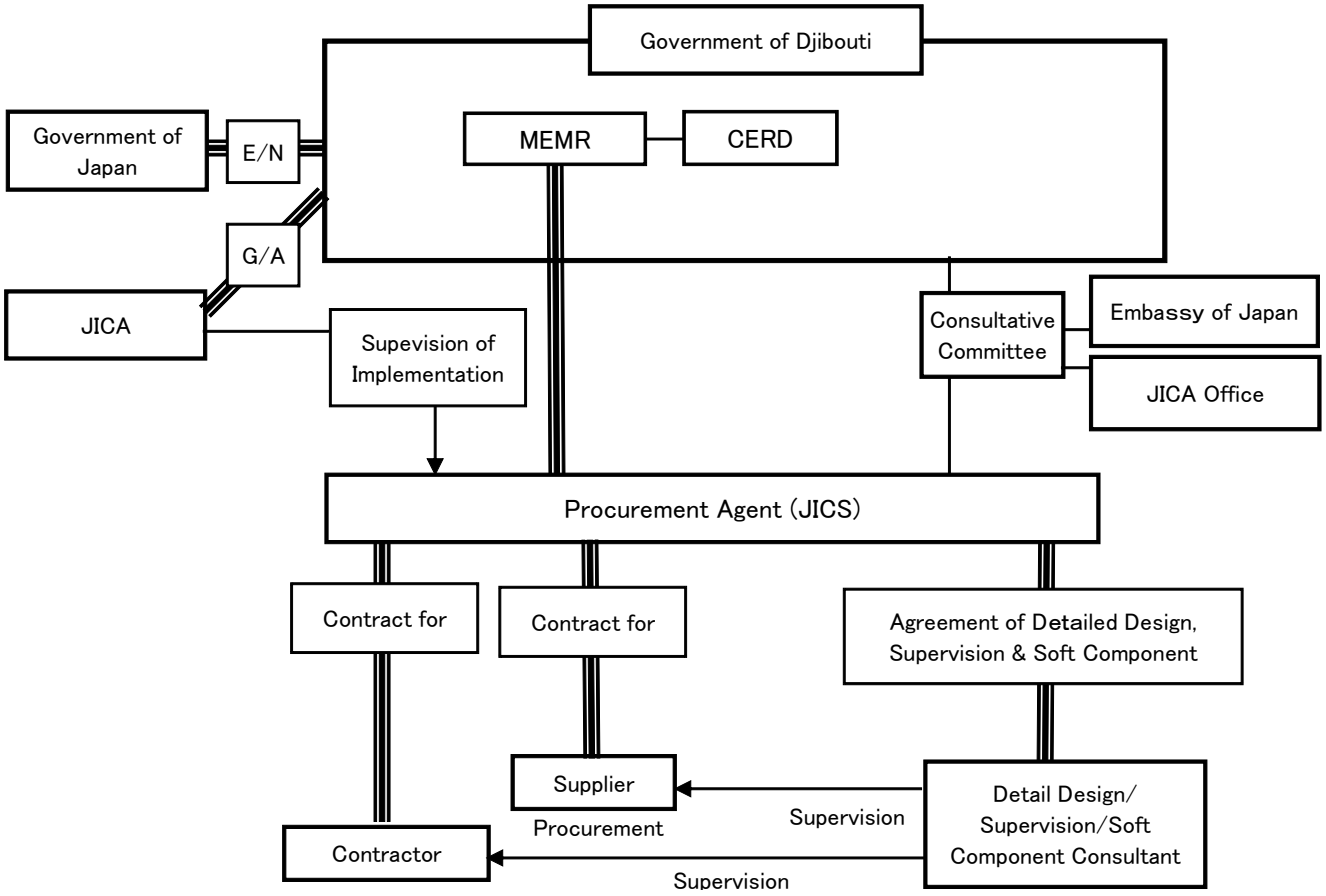
The products purchased under the Grant and its accrued interest will not be exported or re-exported from the Recipient.

General Flow of Program Grant Aid for Environment and Climate Change

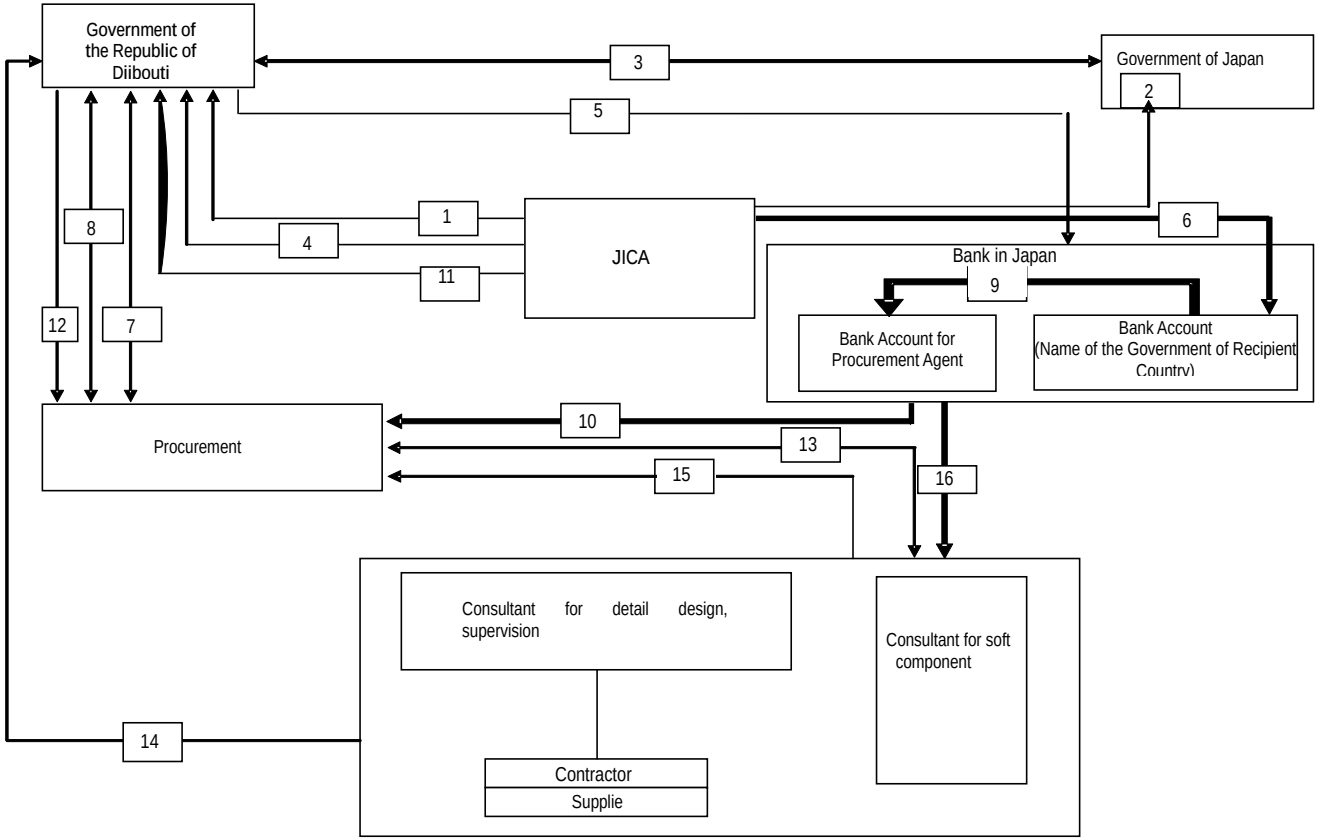


Annex-7

Project Implementation System



Annex-8



1	Preparatory Survey/ Reference Document for Tender
2	Approval of Cabinet
3	Signing of Exchange of Notes (E/N)
4	Signing of Grant Agreement (G/A)
5	Banking arrangement
6	Payment of fund of Government of Japan
7	Signing of Agent Agreement (A/A)
8	Decision on Components of the Project
9	Transfer of Fund (Advance)
10	Payment of remuneration of the Agent
11	Recommendation of Consultant for Detailed Design and Supervision (JICA → Government of Djibouti)
12	Recommendation of Consultant for Detailed Design and Supervision (Government of Djibouti → Procurement Agent)
13	Conclusion of Contract
14	Construction, Procurement, and technical assistance
15	Request of Payment
16	Payment

Annex-9

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 prompt 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 exempt or bear tax 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- 10

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 Solaire Photovoltaïque
en République de Djibouti
(Expication sur le projet final de rapport)

De Juillet à Août et d'Octobre à Novembre 2009, l'Agence Japonaise de Coopération Internationale (désignée ci-dessous « JICA ») a envoyé une mission d'étude préparatoire pour le Projet de Promotion de l'Energie Propre en utilisant le Système Solaire Photovoltaïque (désigné ci-dessous « le Projet ») en République de Djibouti, et à la suite de discussions, d'étude sur le terrain et d'analyse technique de résultats des études au Japon, la JICA a préparé un projet final de rapport de concept de base.

En vue d'expliquer les composantes du projet final de rapport aux autorités officielles du Gouvernement de Djibouti et de s'entretenir avec eux, la JICA a envoyé une Mission d'Etude Préparatoire pour l'explication sur le projet final de rapport (désignée ci-dessous « la Mission »), dirigée par M. Hiroyuki Kobayashi, Directeur du Service de l'Energie et des Mines, Groupe de Ressources Naturelles et d'Energie, Département du Développement Industriel, JICA, du 17 au 22 Avril 2010.

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

Fait à Djibouti, le 21 Avril 2010

Hiroyuki Kobayashi
Chef de Mission
Etude Préparatoire
Agence Japonaise de Coopération Internationale
Japon

Farah Ali Ainan
Secrétaire Général
Ministère de l'Energie et des Ressources Naturelles
République de Djibouti

Badri Ali Bogoreh
Secrétaire Général
Ministère des Affaires Etrangères et de la Coopération Internationale
République de Djibouti

Said Ismail Awaleh
Directeur de l'Institut des Sciences de la Terre
Centre d'Etudes et de Recherche de Djibouti
République de Djibouti

DOCUMENT ATTACHE

1. Composantes du projet final de rapport

La partie djiboutienne a convenu et a accepté en principe les composantes du projet final de rapport expliquées par la Mission.

2. Programme d'aide financière non-remboursable pour l'environnement et le changement climatique du Gouvernement du Japon

La partie djiboutienne a compris les composantes du Procès-verbal des discussions signé par les deux parties le 30 Juillet 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, suite au processus du programme d'aide financière non-remboursable pour l'environnement et le changement climatique du Gouvernement du Japon comme décrit en Annexe-5, 6, 7, 8 et 9 du P/V précédent.

3. Calendrier de l'Etude

La JICA terminera la rédaction du rapport final conformément aux éléments confirmés et l'enverra au Ministère de l'Energie et des Ressources Naturelles (désigné ci-dessous « MERN ») avant 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 le site du Projet est le Centre d'Etudes et de Recherche de Djibouti (désigné ci-dessous « CERD »). La Mission a expliqué que la capacité de conception de modules photovoltaïques était de 300kWc sur la base de la conception sommaire et du coût estimatif.

4-2. Application des lois et régulations concernées

En se basant sur le P/V précédent, la Mission a confirmé que la partie djiboutienne n'avait pas fait d'objection à ce que le CERD fait fonctionner le systéme photovoltaïque, et que ce système soit raccordé au réseau national de distribution pour y injecter le surplus d'électricité produite par ce système. La confirmation a été porté que le MERN avait déjà convenu d'installer le système et l'EDD avait accepté d'injecter l'électricité produite sur le réseau.

5. Equipements à fournir

La Mission a expliqué que les équipements à fournir comme montrés en Annexe-1, étaient

basés sur les résultats de l'étude préparatoire exécutée en Octobre et Novembre 2009. Au terme des discussions, les deux parties ont confirmé que les principaux équipements tels que modules photovoltaïques constituées de cellules photovoltaïques et onduleurs devaient être de produits japonais, et les produits de pays tiers pourraient être acceptés pour les autres équipements qui font partie de composantes.

6. Assistance technique (Composante Soft)

La Mission a expliqué que les points suivants étaient inclus dans le cadre de l'assistance technique du Projet.

- Cours sur les connaissances de base
- Exercices de planification de construction
- Exercices de méthodes d'exploitation et de maintenance
- Formation sur le tas (assistance aux essais et inspections)
- Planification du management sur l'exploitation et la maintenance
- Organisation pour le meilleur management
- Préparation des matériels pour la sensibilisation à l'énergie renouvelable auprès du public
- Atelier de travail

7. Conception du système photovoltaïque (fonction du fonctionnement autonome)

Les deux parties ont convenu de la nécessité de la fonction du fonctionnement autonome lors des coupures d'électricité.

La Mission a expliqué à la partie djiboutienne que le contrôle des charges des bâtiments à alimenter par le fonctionnement autonome était requis, comme mentionné dans le chapitre 2-2-4 du projet final de rapport.

La Mission a également expliqué que l'assistance vis-à-vis du processus de contrôle des charges devait être fournie dans le cadre de l'assistance technique pour l'établissement, et le personnel chargé devrait être formé.

La partie djiboutienne a convenu de prendre la responsabilité par rapport au contrôle des charges au sein du CERD en affectant le personnel approprié et le surveillant.

8. Coûts du Projet

La partie djiboutienne a convenu que les coûts du Projet ne devaient pas dépasser le montant limite convenu dans l'Echange de Notes (désigné ci-dessous « E/N »). Les deux parties ont également confirmé que les coûts du Projet contenaient celui d'approvisionnement en équipements, de transport jusqu'au site du Projet, de pose d'installation, d'agence pour l'approvisionnement et de consultant, ainsi que celui de composante soft pour l'assistance

technique au niveau de l'exploitation et de la maintenance des équipements et de l'ensemble du système photovoltaïque.

La partie djiboutienne a compris que les coûts estimatifs du Projet indiqués en Annexe-2 n'étaient pas la version finale, et qu'ils pourraient être modifiés selon les résultats d'examen à travers la révision de l'étude de concept de base.

9. Calendrier du Projet

Les deux parties ont confirmé le calendrier provisoire de la mise en œuvre du projet comme montré dans le projet final de rapport.

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

La partie djiboutienne a confirmé que le MERN était le propriétaire des équipements pour le système photovoltaïque à fournir par le Projet, et l'opération et la maintenance seraient effectués par le CERD mais sous la supervision de l'EDD.

La partie djiboutienne a confirmé le coût estimatif pour l'exploitation et la maintenance décrit dans le projet final de rapport, et a convenu que le budget et le personnel nécessaires à l'exploitation et à la maintenance du système photovoltaïque raccordé au réseau à fournir et à mettre en place par le Projet étaient assurés.

11. Processus de l'approvisionnement du Projet

Les deux parties ont confirmé que le processus de l'approvisionnement serait sous la supervision de l'Agence pour l'approvisionnement (désigné ci-dessous « l'Agence ») avec la consultation nécessaire par le Comité consultatif (désigné ci-dessous « le Comité »). Les deux parties ont également confirmé les rôles à jouer par l'Agence comme les suivants :

(1) L'Agence fournit les services stipulés dans les clauses de l'Accord de Don (désigné ci-dessous « A/D ») ainsi que de l'E/N du Projet ;

(2) L'Agence sera chargée de processus de l'approvisionnement nécessaire au Projet suivant les clauses de l'A/D, de l'E/N et d'autres lignes directrices concernées ;

(3) La JICA fournira le projet final de rapport et le rapport final à l'Agence ; et

(4) L'Agence entamera l'approvisionnement sur la base du contenu du rapport final de concept de base.

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

La partie djiboutienne a convenu que s'il y avait le montant qui reste pour le Projet après l'appel d'offres, l'élément d'équipements pourrait être ajouté pour le Projet sur la base des listes

inclues dans le rapport final.

La partie djiboutienne a également compris que la décision d'addition ou de réduction des équipements à fournir serait faite à travers la consultation nécessaire parmi les membres du Comité.

12. Le Comité consultatif

La partie djiboutienne a compris que le MERN allait présider le Comité en vue de faciliter la consultation et le processus de l'approvisionnement. Le terme de références du Comité est fixé dans l'Annexe 10 du P/V précédent.

Les membres du Comité sont les suivants :

(1) Représentant du Ministère de l'Energie et des Ressources Naturelles (président)
(2) Représentant du Ministère des Affaires Etrangères et de la Coopération Internationale
(3) Représentant du Centre d'Etudes et de Recherche de Djibouti
(4) Représentant du bureau de JICA Djibouti

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

Les réunions ultérieurs seront organisées selon la demande soit de la partie djiboutienne, soit de la partie japonaise. L'Agence pourrait donner des conseils aux deux parties sur la nécessité de la convocation du Comité.

13. Rôles à jouer par le pays bénéficiaire

La Mission a demandé à la partie djiboutienne de respecter les tâches à assumer par la partie djiboutienne mentionnées ci-dessous en plus des principaux éléments indiqués dans le P/V précédent. La partie djiboutienne s'est mise d'accord de l'assumer.

(1) Acquisition du terrain/espace pour installer le système photovoltaïque

Le propriétaire du terrain où seront installés les équipements et matériels mentionnés ci-dessous du système photovoltaïque est le CERD. Le CERD a déjà convenu d'offrir son terrain pour l'installation de ce système. Une lettre d'autorisation d'utilisation du terrain sera soumise au bureau de JICA Djibouti de la part de Secrétaire Générale du Gouvernement à la fin Avril 2010.

1) Modules photovoltaïques
2) Câbles enfouis entres les équipements
3) Armoire d'onduleur du courant photovoltaïque
4) Parc de stockage provisoire

(2) Préparation du Site

Le MERN doit déblayer et niveler l'espace où le système photovoltaïque sera mis en place, et remplacer une partie de clôture qui entoure l'ensemble du CERD, comme préparation du Site jusqu'à Octobre 2010.

(3) Approvisionnement en pièces et accessoires nécessaires pour les transformateur et équipements existants.

La partie djiboutienne a convenu d'acquérir et de remplacer les pièces et accessoires nécessaires pour les transformateur et équipements existants avant Octobre 2010.

(4) Affaire de l'énergie produite par le système photovoltaïque

L'affaire du courant électrique depuis le CERD à l'EDD devra être discutée et convenue entre ces deux acteurs en consultation avec le MERN avant la mise en service du système photovoltaïque. La partie japonaise pourrait assister la partie djiboutienne pour établir un règlement concerné à travers l'assisatance technique au cours de la mise en œuvre du Projet.

(5) Considérations environnementales et sociales

Il a été confirmé que dans le P/V précédent, le Projet ne demanderait aucune procédure concernant l'évaluation des impacts environnementaux. La partie djiboutienne confirmera cette procédure mentionnée ci-dessus avec le Ministère de l'Habitat, de l'Urbanisation et de l'Environnement avec une lettre officielle qui sera soumise au bureau de JICA Djibouti avant la fin Mai 2010.

(6) Autorisation de construction

Les deux parties ont confirmé que le CERD devrait obtenir les autorisations nécessaires pour la construction avant Octobre 2010, le cas échéant.

(7) Affectation du chef de Projet

Le MERN va affecter une personne qui gère l'ensemble du Projet.

(8) Affectation de l'homologue

1) Gestion de l'ensemble du Projet

La partie djiboutienne doit affecter les personnels suivants comme homologue pour la gestion de l'ensemble du Projet et la coordination de chaque organisme.

- Ministère de l'Energie et des Ressources Naturelles
- Ministère des Affaires Etrangères et de la Coopération Internationale

- Centre d'Etudes et de Recherche de Djibouti

2) L'assistance technique

La partie djiboutienne a convenu d'affecter le personnel nécessaire conformément au plan de l'exécution de l'assistance technique proposé par la Mission.

La partie djiboutienne va informer les noms des homologues au bureau de JICA Djibouti lors de la première réunion du Comité consultatif.

- Ministère de l'Energie et des Ressources Naturelles
- Centre d'Etudes et de Recherche de Djibouti
- Eléctricité De Djibouti
- Autres

Autres personnels seront affectés de la part de chaque organisme selon la demande lors de l'installation.

(9) Dédouanement et éxonération des impôts

La partie djiboutienne a convenu que le MERN serait responsable de l'éxonération totale du droit de douane, taxe, charges fiscales, TVA et droits imposés à Djibouti pour la mise en œuvre du Projet.

14. Confidentialité du Projet

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

Ces informations contiennes les suivantes :

a) Plans détaillés, spécifications et autres informations techniques des matériels et équipements ;

b) Coût estimatif ;

c) Projet final de rapport ;

d) Rapport final

« Annexes »

Annexe-1. Liste des équipements

Annexe-2. Coûts estimatifs du Projet (Confidentiel)

Annexe-1

Liste des principaux équipements

Equipement		Quantité
Système de production d'électricité photovoltaïque		1 système
1-1.	Modules photovoltaïques	300 kW
1-2.	Boîte de jonction	1 jeu
1-3.	Armoire d'onduleur du courant photovoltaïque	1 jeu
1-4.	Appareil d'observation météorologique	1 unité
1-5.	Armoire de commutation des charges	1 unité
1-6.	Equipement de la cabine électrque pour le système photovoltaïque	1 unité
1-7.	Châssis pour les modules photovoltaïques	1 jeu
1-8.	Divers matériels	1 jeu
1-9.	Pièces de rechange, consommables et outillages	1 jeu
1-10.	Matériels pour le câblage et la mise à la terre	1 jeu
1-11.	Clôture, portes et gravier	1 jeu

Annexe-2

Coût Estimatif du Projet (Confidentiel)

Ce coût estimatif est provisoire 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 djiboutienne: FD 1 396 000

Rubrique	Montant
1. Déblaiement et nivellement du Site	FD 1 396 000
2. Total (1.)	FD 1 396 000

En plus du coût ci-dessus, les coûts relatifs au remplacement de clôture et à l'approvisionnement et au remplacement des pièces et accessoires pour le transformateur existant doivent être pris en charge par la partie djiboutienne.

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

(1) Frais de personnel	environ FD 350 000
(2) Consommables et pièces de rechange à court terme	environ FD 278 000
(2') Consommables et pièces de rechange à long terme	environ FD 1 115 000
(3) Total (à court terme)	environ FD 628 000
(3') Total (à long terme)	environ FD 1 465 000

Les équipements à fournir par le Projet pourront être exploités et entretenus par le personnel existant de l'établissement (CERD). 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 djiboutienne. Une fois usé l'approvisionnement du Projet, les articles nécessaires à acquérir par la partie djiboutienne seront augmentés.

4. Conditions de l'estimation

(1) Période d'estimation: Novembre 2009

(2) Taux d'échange : US$ 1,00 = JP¥ 95,04 FD 1,00 = JP¥ 0,538

(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 Introduction of Clean Energy by Solar Electricity Generation System
(le Projet de Promotion de l'Énergie Propre en utilisant le Système Solaire Photovoltaïque)
in the Republic of Djibouti
(Explanation on Draft Final Report)

From July to August and from October to November 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team on the Project for Clean Energy Promoting Using Solar Photovoltaic System (hereinafter referred to as "the Project") in the Republic of the Djibouti (hereinafter referred to as "Djibouti"), 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 Djibouti on the component of the Draft Final Report, JICA sent Djibouti the Preparatory Survey Team for Draft Final Report Explanation (hereinafter referred to as "the Team"), which is headed by Mr. Hiroyuki Kobayashi, Director, Energy and Mining Division, Natural Resources and Energy Group, Industrial Development Department, JICA, from April 17th to 22nd, 2010.

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

Djibouti, April 21, 2010

Hiroyuki Kobayashi
Leader
Preparatory Survey Team
Japan International Cooperation Agency
JAPAN

Farah Ali Ainan
Secretary General
Ministry of Energy and Natural Resources
The Republic of Djibouti

Badri Ali Bogoreh
Secretary General
Ministry of Foreign Affaires and International Cooperation
The Republic of Djibouti

Said Ismail Awaleh
Director
Institute of Earth Science
Centre for Study and Research of Djibouti
The Republic of Djibouti

ATTACHMENT

1. Components of the Draft Final Report

The Djibouti 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 Djibouti side understood components of the Minutes of Discussion signed by both sides on 30th July, 2009 (hereinafter referred to as "the previous M/D"), and would take the necessary measures confirmed on the previous M/D for smooth implementation of the Project following procedures of the Program Grant Aid for Environment and Climate Change of the Government of Japan as described in **Annex-5, 6, 7, 8 and 9 of the previous M/D**.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Ministry of Energy and Natural Resources (hereinafter referred to as the "MENR,") by 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 site is Centre for Study and Research of Djibouti (hereinafter referred to as the "CERD"). The Team explained that the design capacity of Photovoltaic (PV) module is 300kWp 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 Team reconfirmed that the Djibouti side has no objections for the CERD to operate the PV system, and to have it connected to the national grid and to send the surplus of the power generated by the system back to the grid. It was also confirmed that the MENR has gave permission for the installation of the PV system and EDD has accepted the reverse flow into the national grid.

5. Items of Equipment to be procured

The Team explained that the items of equipment to be procured as shown in Annex-1 based on the result of the Preparatory Survey conducted in October and November 2009. After discussion, both side confirmed that the major equipment such as PV modules consist of PV cells and Power Conditioners should be products of Japan, and products of third country could be acceptable for other equipment as a part of components.

6. Soft Component

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

- Lectures on Basic knowledge

- Exercises on Construction Planning
- Exercise on Method of Operation and Maintenance
- On the Job Training (witnessing Tests and Inspections)
- Operation and Maintenance Management Planning
- Organization for better management
- Preparation of materials for public awareness of clean energy
- Workshop

7. Design of PV System (Function for Stand-Alone Operation)

Both sides shared the understanding on the necessity of stand-alone operation function during the electric blackout.

The Team explained to the Djibouti side that load control is required in the building to which the electricity is supplied by the stand-alone operation function, referring the Chapter 2-2-4 in the Draft Final Report.

The Team also explained that the assistance to establish a procedure for the load control should be provided through the soft component, and the personnel in charge should be trained.

The Djibouti side agreed to take responsibility of load control in the CERD by allocating appropriate personnel and supervising it.

8. Project Cost

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

The Djibouti side understood that the Project Cost Estimation attached as Annex-2 is not final and is subject to change by the result of examination through revision of the Outline Design Study.

9. Project Schedule

Both sides confirmed the tentative implementation schedule as shown in the Draft Final Report.

10. Ownership and Responsibilities for Operation and Maintenance

The Djibouti side has reconfirmed that MENR is the owner of the equipment for the PV system to be procured by the Project, and the Operation and Maintenance (O&M) of the said equipment will be conducted by CERD under the supervision of EDD.

The Djibouti side confirmed that the estimated cost for O&M described in the Draft Final Report and agreed to secure necessary budget and personnel for the O&M of Grid-connected PV system procured and installed under the Project.

11. Procurement Process of the Project

Both sides reconfirmed that procurement process would be supervised by the Procurement Agent (hereinafter referred to as "the Agent") with necessary consultation by the Consultative Committee (hereinafter referred to as "the Committee"). And both sides also reconfirmed roles of the Agent as follows;

(1) The Agent renders the services stipulated in the provisions of the G/A as well as the E/N for the Project;
(2) The Agent will undertake the procurement procedure necessary for the Project according to the provisions of the G/A and E/N and any other concerned guidelines;
(3) JICA will provide the Draft Final Report and Final Report to the Agent; and
(4) The Agent will commence the procurement according to the contents of the Final Report of the Outline Design.

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

The Djibouti side agreed that if there is a remaining amount of the cost for the Project after tenders, additional items of equipment would be procured based on an equipment lists which were set in the Final Report.

The Djibouti side also understood that decision on addition or reduction of the equipment to be procured would be made through necessary consultation among members of the Committee.

12. The Consultative Committee

The Djibouti side understood that the MENR will chair the Committee in order to facilitate consultation and procurement process. The Terms of Reference of the Committee was settled in Annex-10 of the previous M/D.

The members of the Committee are as follows:

(1) Representative of MENR (Chair)
(2) Representative of Ministry of Foreign Affaires and International Cooperation
(3) Representative of CERD
(4) Representative of JICA Djibouti 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 Djibouti side or the Japanese side. The Agent may advise both sides on the necessity to call a meeting of the Committee.

13. Undertakings required by the Recipient Country

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

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

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

installed is CERD. The CERD had already agreed to offer its land for the installation of the system. The letter concerning the permission for the use of necessary land space, from the Secretary General of the Government of Djibouti to JICA Djibouti Office, will be submitted by the end of April 2010.

1) for PV Modules
2) for underground cables between equipments
3) for Power Conditioner Cubicle
4) for Temporary stockyard

(2) Preparation for the Site

CERD should clear and level the space for PV system installation and replace a part of the fence which is surrounding the whole area of CERD as the preparation of the site until October 2010.

(3) Procurement of necessary parts and accessories for existing transformer and relevant equipments

The Djibouti side agreed to procure and replace the necessary parts and accessories for existing transformer and relevant equipments by October 2010.

(4) Dealing of power flow from PV system

Dealing of power flow from CERD to EDD should be discussed and agreed between these parties in consultant with MENR by the time of the commencement of PV system operation. The Japanese side could assist the Djibouti side to set the relevant rule through soft component during the implementation of the Project.

(5) Environment and Social Considerations

It was confirmed in the previous M/D, the Project does not require any procedures concerning the evaluation of impact on environment. The Djibouti side will confirm the mentioned procedure with Ministry of Housing, Urbanization and Environment by receiving an official letter to be submitted to the JICA Djibouti Office until the end of May 2010.

(6) Construction permissions

Both sides confirmed that the CERD should obtain necessary permissions for the construction by October 2010, if necessary.

(7) Assignment of the project manager

MENR will assign a project manager who will manage the project totally.

(8) Assignment of Counterpart Personnel

1) Overall project management

The Djibouti side should assign counterpart personnel from the following organizations for

overall project management and coordination in each organization. The Djibouti side shall inform the name of the counterpart personnel to JICA Djibouti Office at the first Consultative Committee meeting.

Ministry of Energy and Natural Resources

Ministry of Foreign Affaires and International Cooperation

Centre for Study and Research of Djibouti

2) Soft Component

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

The Djibouti side shall inform the name of the participants from the following organizations to JICA Djibouti Office at the first Consultative Committee meeting.

- MENR
- CERD
- EDD
- others

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

(9) Customs and Tax Exemption

The Djibouti side agreed that the MENR shall be responsible for the exemption of all customs, tax, levies, VAT and duties incurred in Djibouti for the implementation of the Project.

14. 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 includes the followings:

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

b) cost estimation;

c) the Draft Final Report;

c) the Final Report

<List of Annex>

Annex-1 List of Equipments

Annex-2 Project Cost Estimation (Confidential)

List of Major Equipments

Equipment		Quantity
Photovoltaic Generating System		1 system
	1-1. Photovoltaic (PV) Module	*300 kW*
	1-2. Junction Box	*1 lot*
	1-3. Power Conditioner Cubicle	*1 lot*
	1-4. Meteorological Observation Device	*1 unit*
	1-5. Branch Switcher Board	*1 unit*
	1-6. Electrical Facility Cubicle of the PV system	*1 unit*
	1-7. Support Structure for PV module	*1 lot*
	1-8. Miscellaneous Materials	*1 lot*
	1-9. Spare Parts, Consumables and Tools	*1 lot*
	1-10.Materials of wiring and earthing	*1 lot*
	1-11.Fence, gate and gravel surfacing	*1 lot*

Project Cost Estimation (Confidential)

This cost estimate is provisional 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 Djibouti side: DJF 1,396,000

Item	Amount
1. Clearing and leveling of the Site	DJF 1,396,000
2. Total (1.)	DJF 1,396,000

Adding to the above cost, the cost of the replacement of the fence and the cost of the procurement and replacement of the parts and accessories for existing transformer should be borne by the Djibouti side.

3. Cost to be borne by the Djibouti side for Operation and Maintenance (every year)
   (1) Personnel expenses Approximately DJF 350,000
   (2) Expendable and replacement parts cost in the short run
   Approximately DJF 278,000
   (2') Expendable and replacement parts cost in the long run
   Approximately DJF 1,115,000
   (3) Total (in the short run) Approximately DJF 628,000
   (3') Total (in the long run) Approximately DJF 1,465,000

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

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 Djibouti side. After the provisions of the Project have run out, necessary items that have to be purchased by Djibouti side will increase.

4. Conditions for estimation
   (1) Time of estimation: November 2009
   (2) Foreign exchange rate: US$ 1.00 = JP¥ 95.04
   DJF 1.00 = JP¥ 0.538
   (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 the Republic of Djibouti will procure a Photovoltaic Generation System with 300kW capacity, furnish it to Centre d'Etudes et de Recherche de Djibouti, CERD and supply the generated energy to the institute for its energy demand. For Djibouti, this Project will be the first-ever experience to have a PV system with grid interconnection, although Djibouti has a number of cases of independent off-grid solar systems. Therefore, it is important to train those CERD technicians 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 public utility company Electricité de Djibouti, EDD, and the Ministry of Energy and Natural 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.

In particular, as the PV system to be installed at CERD is designed to be equipped with "stand-alone function" which enables supplying power to part of the institute during blackout of power from the utility grid, it is important to understand the limitations and characteristics of the function for the proper use thereof.

The technicians at CERD who will be operating the generating equipment have been familiarized with the handling of independent solar home systems (SHS). But it will be the first time for them to handle large scale photovoltaic system with industrial-standard inverters. They must be trained to be able to operate the equipment properly on the basis of firm knowledge of the mechanism. The researchers of CERD are also very much informed about small-scale solar systems as the technicians. Still it is desirable that they know more than just how to operate the equipment: they should be able to plan similar projects and to instruct others to use such systems more efficiently. The officers of the Ministry of Energy and Natural Resources and public power company are, in the Programme, tasked with formulating new rules for grid-interconnection and reverse current. The country has had only one power producer, the public power company EDD, but it now faces new development of geo-thermal plants under IPP scheme. Therefore, officers of these organizations have to acquire knowledge needed to consider future energy policy and to design necessary legislations while evaluating rationally the effectiveness of the use of renewable energy in the

country's power system.

The country has not had experience of interconnecting renewable energy generation to the national power grid and the quality of electricity thereof is not quite stable or reliable. Therefore, the Programme proposes to require the Contractor to carry out three-month inspection after the commissioning of the Products. 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.

Meanwhile, CERD has a renewable energy institute which from time to time sends its crew of technicians to diagnose and repair independent solar equipment scattered in the country. The institute is hoping to be able to provide a training/education function for those who are/will be engaged in maintenance of such solar equipment in the country side. It is also beneficial for CERD to obtain theoretical and practical knowledge of the use of solar energy so that it will be able to be one of leading institutes in the promotion of solar energy in the country.

(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 be able to handle proper selection of loads and their arrangements at the destination of Stand-alone function,
- 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,
- the Stand-alone function is properly and safely used with appropriate arrangement of loads at the destination,
- O&M activities are followed up by using check sheets,
- Technical officers at the Ministry and EDD 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 Programme 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 CERD from the grid

- Power demand and loads in CERD
- Workings of PV equipment during blackout
- Stand-alone operation and protection functions
- Load management at the destination of Stand-alone mode power
- 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
- Remedying problems occurred in stand-alone operation
- 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 CERD 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 and reverse flow 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 Programme's positive effect in time and in space, resulting in the realization of initial objectives of the Programme.

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.

CERD technicians:	Those who will be actually operating the PV system
CERD researchers:	They are expected not just to participate in the program but also to be involved in the process of preparation, execution, evaluation of the program by the consultants
EDD officers:	in distribution, power purchasing or power plant management related departments, with engineering background (preferably having a degree in electric engineering)
MENR 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)	EDD (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	CERD technicians		―	―	―	―	―	―	―
	CERD researchers	―	―	―	―	―	―	―	―
	EDD officers		―	―	―	―	―		
	Ministry Officials		―	―	―				
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	CERD technicians	―	―	―	―
	CERD researchers	―	―	―	―
	EDD officers		―		―
	Ministry Officials			―	―
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 Djibouti. Therefore, Japanese consultants are 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 MENR and EDD - Confirmation of contents with CERD - 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 CERD from the grid - Power demand and loads in CERD - Workings of PV equipment during blackout - Planning PV systems - Arrangement between PV owner and power utility - Stand-alone operation and protection functions - Load management at the destination of Stand-alone mode power	10days in total
Lectures on construction planning	- Installation of PV equipment - Power distribution in CERD - Electric equipment in CERD 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 - Discussion on the use of stand-alone function, - Checking electric equipment inside buildings, listing, and arranging the loads - Discussion and preparation of stand-alone function utilization guideline	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 and evaluation of Stand-alone operation records, - 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.

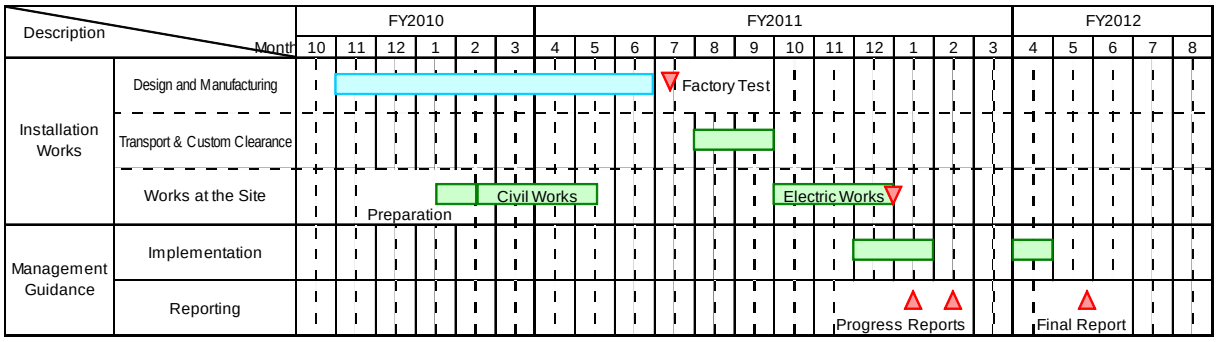


Figure 1 Management Guidance Implementation Schedule

(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

MINUTES OF MEETING

Project for Introduction of Clean Energy using Photovoltaic Power

Subject	Explanation for the scope of PV system and Training Program provided to Centre d'Étude et de Recherche de Djibouti (CERD)
Date	Monday, November 10, 2009.
Place	CERD

Result of Meeting

1. The scope of the PV system

JICA STUDY TEAM explained the scope of the PV system to CERD as per the attachment1 and the following drawing list, and CERD agreed with the proposed scope of PV system.

[List of Drawings]

➢ DJ-01	SINGLE LINE DIAGRAM (EXISTING)
➢ DJ-03a	SINGLE LINE DIAGRAM (PV SYSTEM)
➢ DJ-04	GENERAL LAYOUT PLAN
➢ DJ-12	CABLE LAYOUT PLAN (OUTSIDE)
➢ DJ-15	EQUIPMENTS LAYOUT&MODIFICATON (EXISTING ELECTRIC ROOM)
➢ DJ-18	PAVING STONE PLAN
➢ DJ-19	LAYOUT OF FENCE AND GATE
➢ DJ-20	FENCE, GATE (DETAIL)
➢ DJ-22	EQUIPMENTS LAYOUT IN CERD GENERATOR ROOM

2. Training Program

JICA STUDY TEAM explained to CERD the proposed training program as per the attachment 2, and CERD agreed with the proposition.

3. Request and confirmation by JICA STUDY TEAM

JICA STUDY TEAM requested CERD to clean up and remove unused pieces of equipment in and around the electrical room.

JICA STUDY TEAM reminded CERD that it is the recipient's responsibility to clear all procedures concerning applications, approvals and licenses, if necessary, related to installation, operation and grid-connection of the PV system in CERD.

4. Temporary facilities of construction

CERD will prepare the space for temporary facilities and storage of materials imported from Japan during construction works at free of charge.

5. Others

Both parties understand that the final scope of the PV system and the design of the Project shall be determined (confirmed) by the JICA Headquarters and the Government of Japan..

Masaru NISHIDA
Chief of Consultants,
JICA Solar Study Team
JAPAN

Saïd Ismael Awaleh
Director of the Institute of Earth Science
Centre d'Étude et de Recherche de Djibouti
République de Djibouti

Attachment-1

Discussion on Proposed PV Project at CERD

Date: November 8th, 2009

Place: CERD (Centre d'Etudes et de Recherches Scientifiques de Djibouti)

1. Scope of the Project

The Project proposed will provide CERD with the Works as shown below.

- Installation of PV system with a capacity of 250kW
- Installation of Electrical Facility Cubicle
- Removal of a Low Voltage Switching Panel in CERD generator room, and installation of the Branch Switcher Board for Load next to CERD generator room
- Installation of fences and gates surrounding PV modules

The system under planning is also presented as in Attachment 1 and the following drawing list.

[List of Drawings to be presented]

- DJ-01 SINGLE LINE DIAGRAM (EXISTING)
- DJ-03a SINGLE LINE DIAGRAM (PV SYSTEM)
- DJ-04 GENERAL LAYOUT PLAN
- DJ-12 CABLE LAYOUT PLAN (OUTSIDE)
- DJ-15 EQUIPMENTS LAYOUT&MODIFICATON (EXISTING ELECTRIC ROOM)
- DJ-18 PAVING STONE PLAN
- DJ-19 LAYOUT OF FENCE AND GATE
- DJ-20 FENCE, GATE (DETAIL)
- DJ-22 EQUIPMENTS LAYOUT IN CERD GENERATOR ROOM

2. Operation of the PV System

(1) Operation under normal condition

PV System is designed to start sending power in the morning and stop in the late afternoon every day, by a scheduled timer.

If the power from the power company (EDD) network is cut (black out), the system automatically shuts down. After the power is back, the system must be restarted manually.

(2) Stand-alone operation under power cut from Power Company

Upon a request from the CERD, the PV system is designed to be equipped with "stand-alone operation function", which enables the operation of the system during black out. Stand-alone operation may be activated as follows:

- When the electricity supply from EDD is down, the system will be shut down automatically.
- Then, by manual operation, the system may be restarted to meet the limited demand of CERD.
- The system may not be able to meet the electricity demand in the whole CERD, as a PV system has inherent unreliability due to the weather. Those part of the building in CERD (Building A (Administration Ward) B(Energy) and C(Pedology)) to be supplied with power by PV system during black out can be selected by switches in "Branch Switcher Board for Load ".
- When the power from EDD is back, by manual operation, the system must be once shut down and restarted in normal operation mode.

(3) Maintenance

- Daily inspection will have to be done once a day by maintenance staff of CERD.
- Other periodical inspections will be necessary, which may involve replacement of consumables and worn-out parts.

3. Construction

There are a few important matters that need to be understood about the construction work.

(1) Interruption of Power Supply to CERD at the power system switch

The electric panel (board), Branch Switchers for Load, will have to be replaced by new ones. The replacement work requires interruption of power supply from EDD, to relevant part of CERD, that are Building A (Administaration), B(Energy), and C(Pedology).

There will be mobile diesel generators to be employed by the Contractor as substitute source of power. However, there will be absolute power cuts to CERD, a few times during the Work, to switch the source of power from/to EDD to/from mobile diesel units.

Details of the Work will be planned, and submitted for approval of the Engineer, by the Contractor.

(2) Need to Secure Temporary Storage of Materials and Equipment

CERD is requested to secure, free of charge, the space in CERD for storing materials and equipment transported from Japan. The area suitable for the purpose is shown in a green rectangle in Figure 1.

(3) Temporary Storage of Construction Waste

The construction work will produce large amount of wastes. They will have to be stored temporally somewhere in the premise of CERD before the Contractor dispose of it in a proper and

lawful way.

4. Preparation for the Project

(1) Application for the interconnection of the PV system to EDD network.

As the PV equipment will be interconnected to EDD network, a necessary procedure, which may involve applying for a license, will have to be initiated by CERD.

(2) Preparation of the Site

The following matters should be undertaken by Djibouti side.

- To secure and keep open the space for PV system installation.
- To clear and level the space for PV system installation.
- To clean up the inside and surrounding of electric rooms before the construction work starts.
- To construct fence on the south of CERD before the construction work starts.
- To remove an incinerator and a trash stash in the space for PV system installation before the construction work starts.

5. Project Schedule (tentative only)

- Preparation of contract with the Contractor : mid 2010
- Commencement of the Work at the Site : early 2011
- Completion of the Project and Commissioning : early 2012

6. Matters to be Confirmed

(Non)

Attachment-1

Basic Specification of PV System (Draft)

Name of Site :CERD (Centre d'Etudes et de Recherches Scientifiques de Djibouti)

Item	Specification
Type of the PV system	Grid connection (No Storage Battery)
Capacity of the PV system	250kW
Basic configuration of the system	Refer to Fig.1
Basic layout of the system	Refer to the drawing NO.DJ-04
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
Reverse power flow	Supply surplus power to the grid.
Protection Relay of Grid connection	Over current(OC), Over voltage(OV), Undervoltage(UV), Over frequency(OF),Under frequency (UF),Islanding detector
Electric power supply in the case of power failure (blackout)	Building A(Administration), Building B(Energy) and Building C(Pedology) are to be fed with power from the System during power failure (blackout) of the grid (EDD network)
Display system	2 sets to be installed. Information to be displayed are 1) Current Output of the System (kW) 2) Energy Generated the day (kWh) 3) Estimated reduction of CO2 emission
Fence and Gate for PV system	Refer to the drawing NO.DJ-19,DJ-20
Meteorological observation device	Solar radiation and Thermometer system at the PV panels
Language of operation and maintenance manuals	English

Note) Due to the instability of PV output, PV system cannot supply power to critical load such as life supporting equipment.

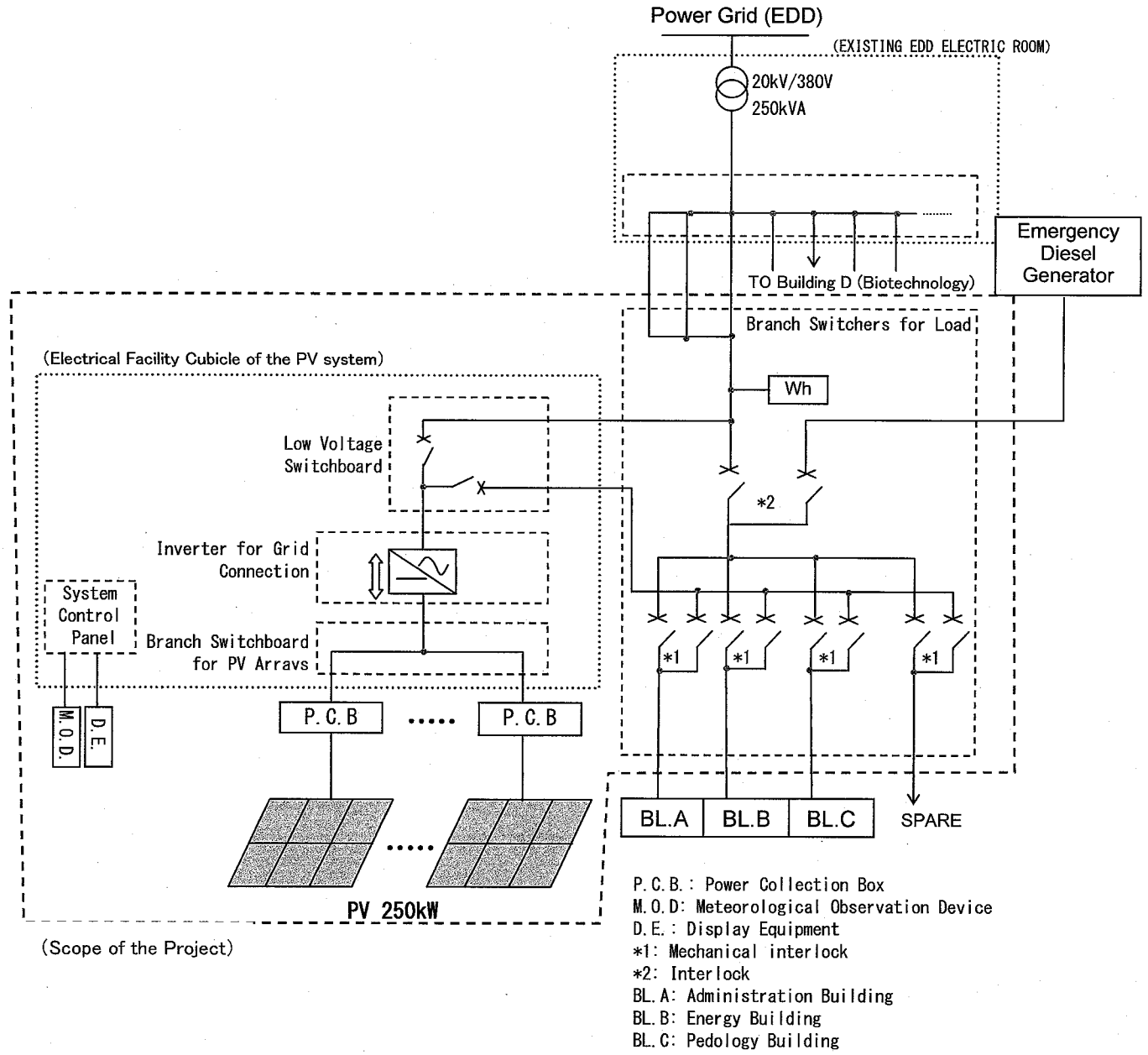
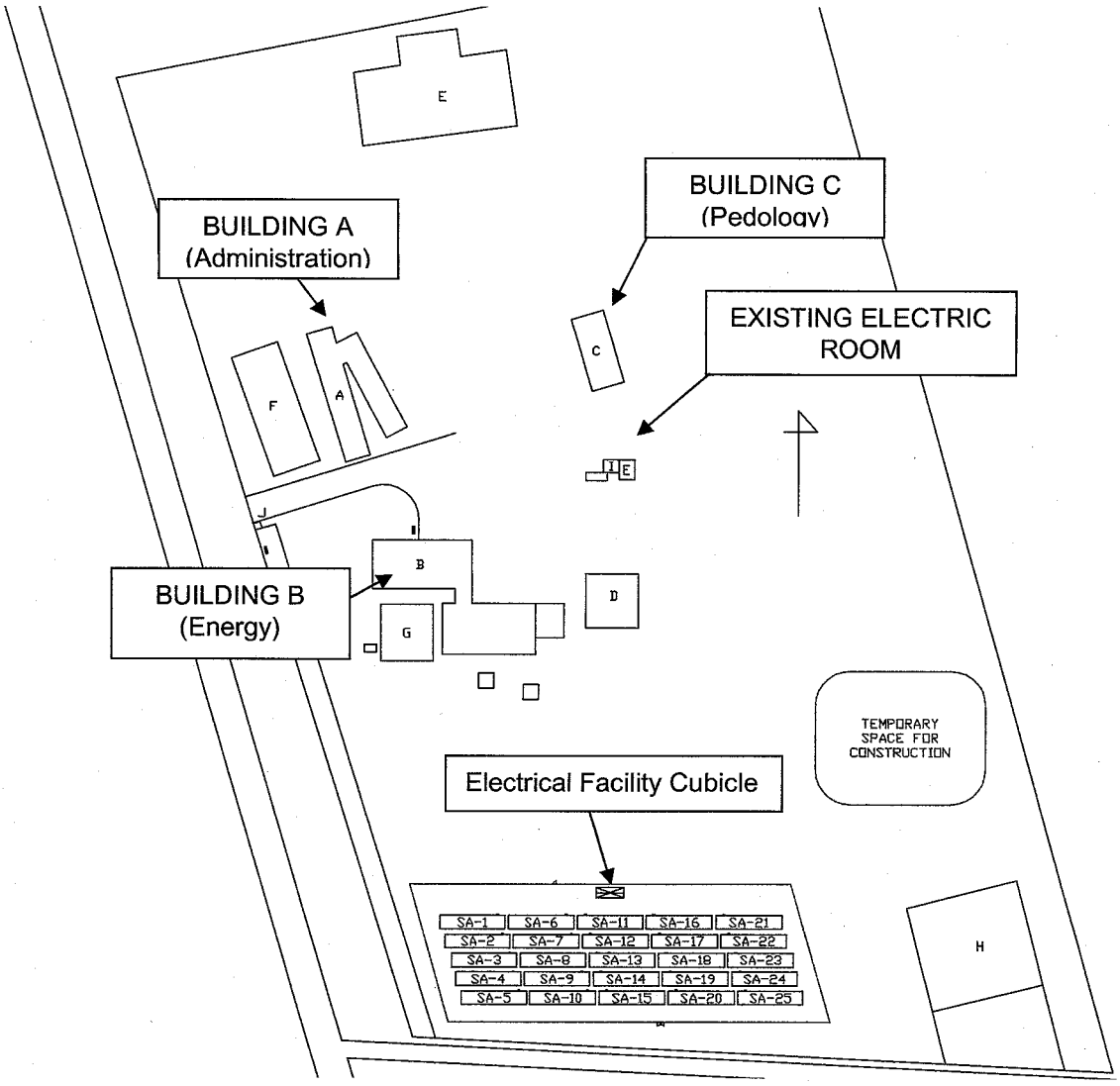


Fig. 1 Planned Configuration of PV system



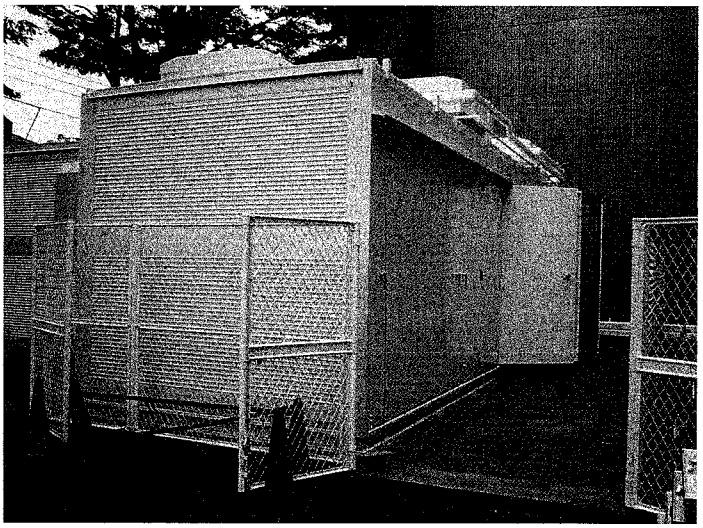
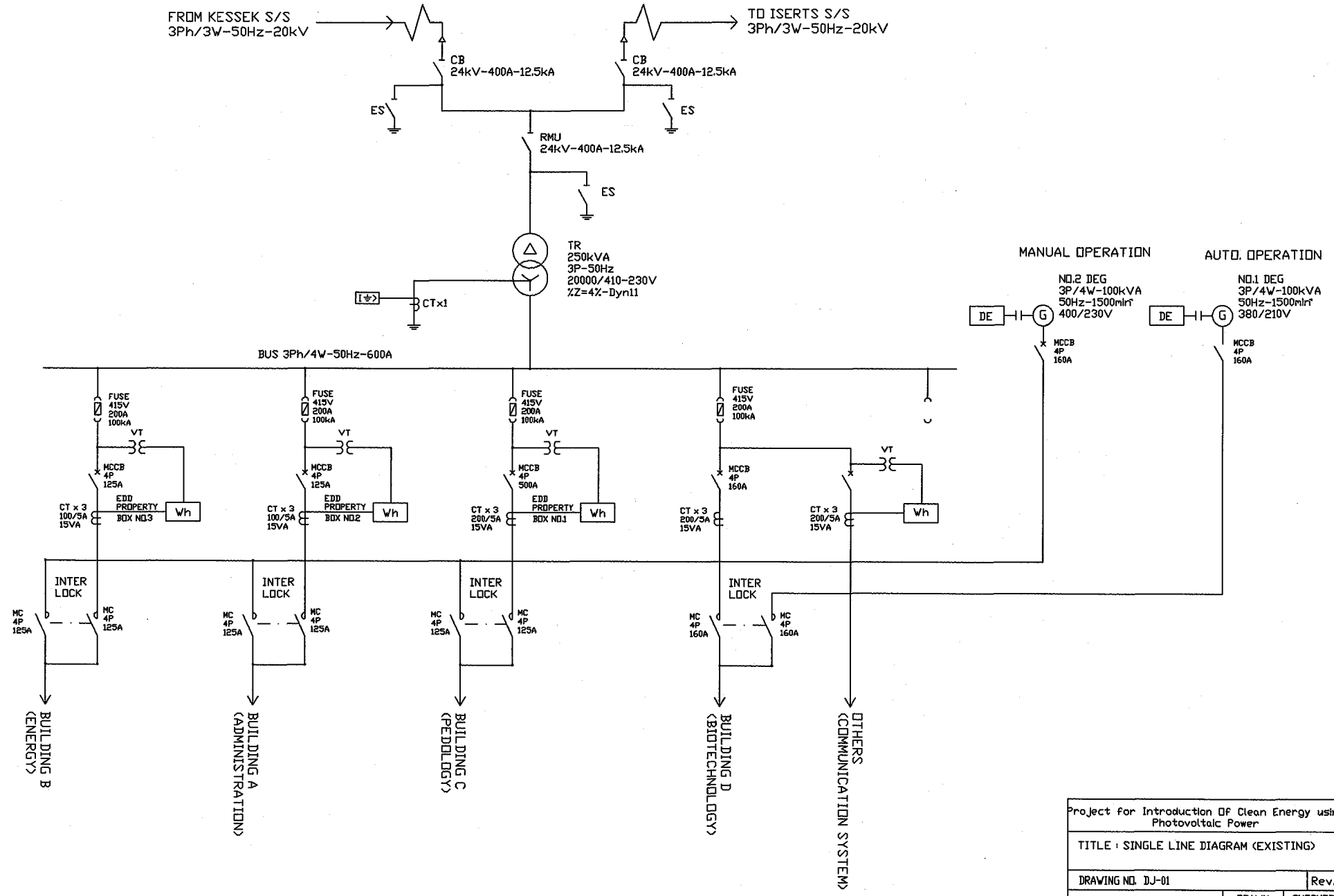
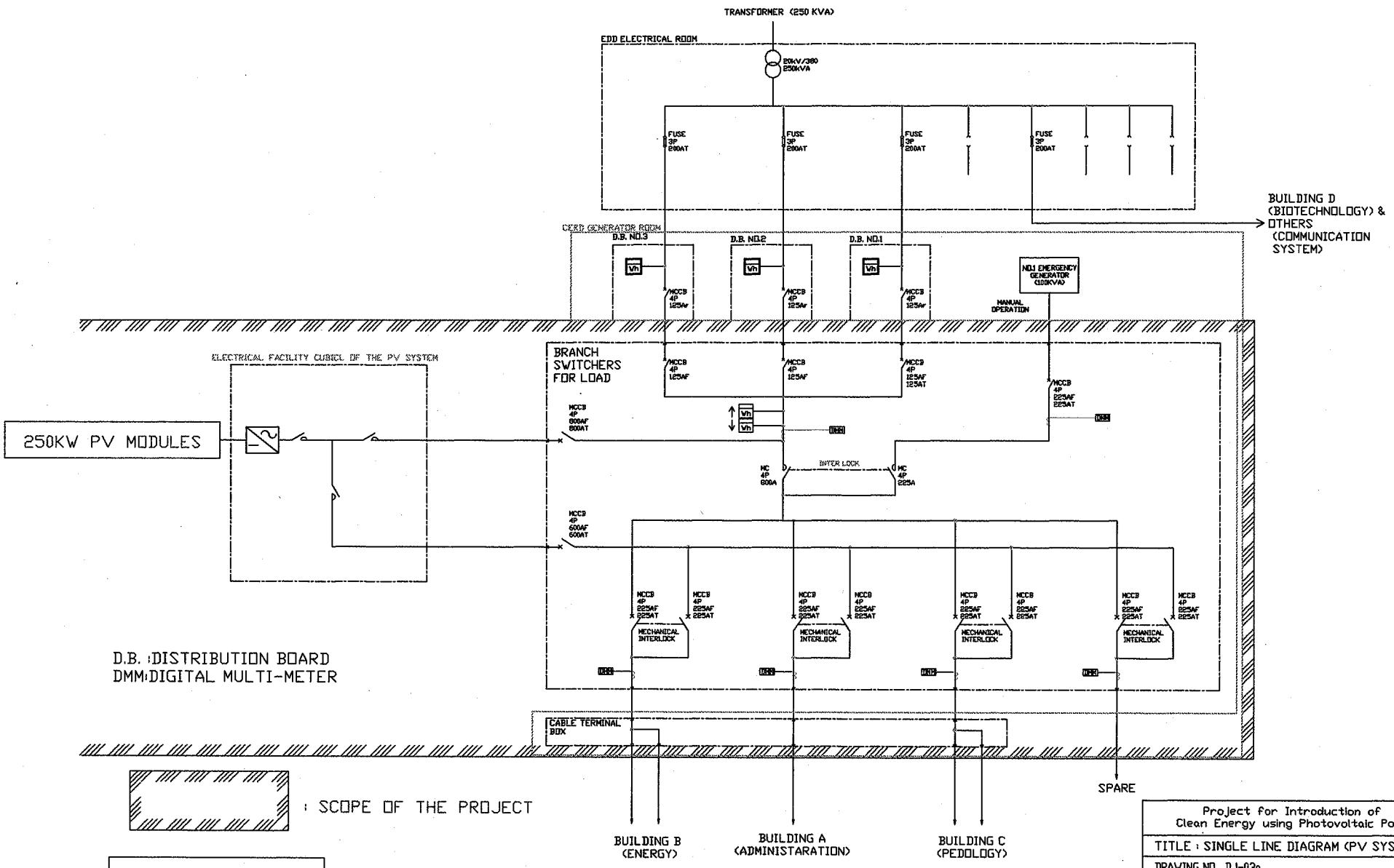


Fig.2 Example of Electrical Facility Cubicle of the PV system



Project for Introduction Of Clean Energy using Photovoltaic Power		
TITLE : SINGLE LINE DIAGRAM (EXISTING)		
DRAWING NO. DJ-01		Rev.1
DATE	DRAWN	CHECKED
SCALE: Non.(A3) Unit:mm		
NEWJEC	NEWJEC Inc. Osaka, JAPAN	

Proposed PV system for CERD



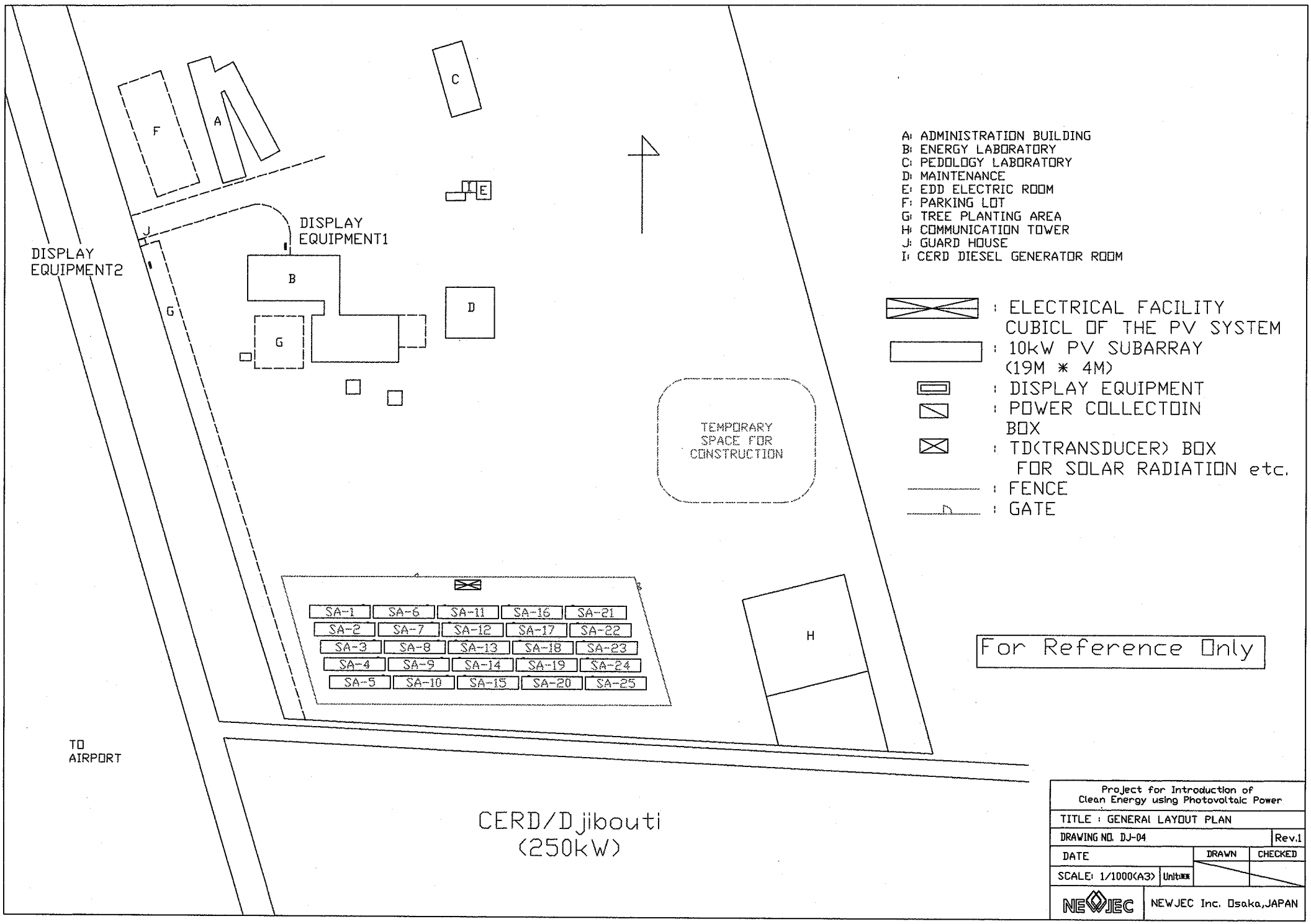
D.B. :DISTRIBUTION BOARD
DMM:DIGITAL MULTI-METER

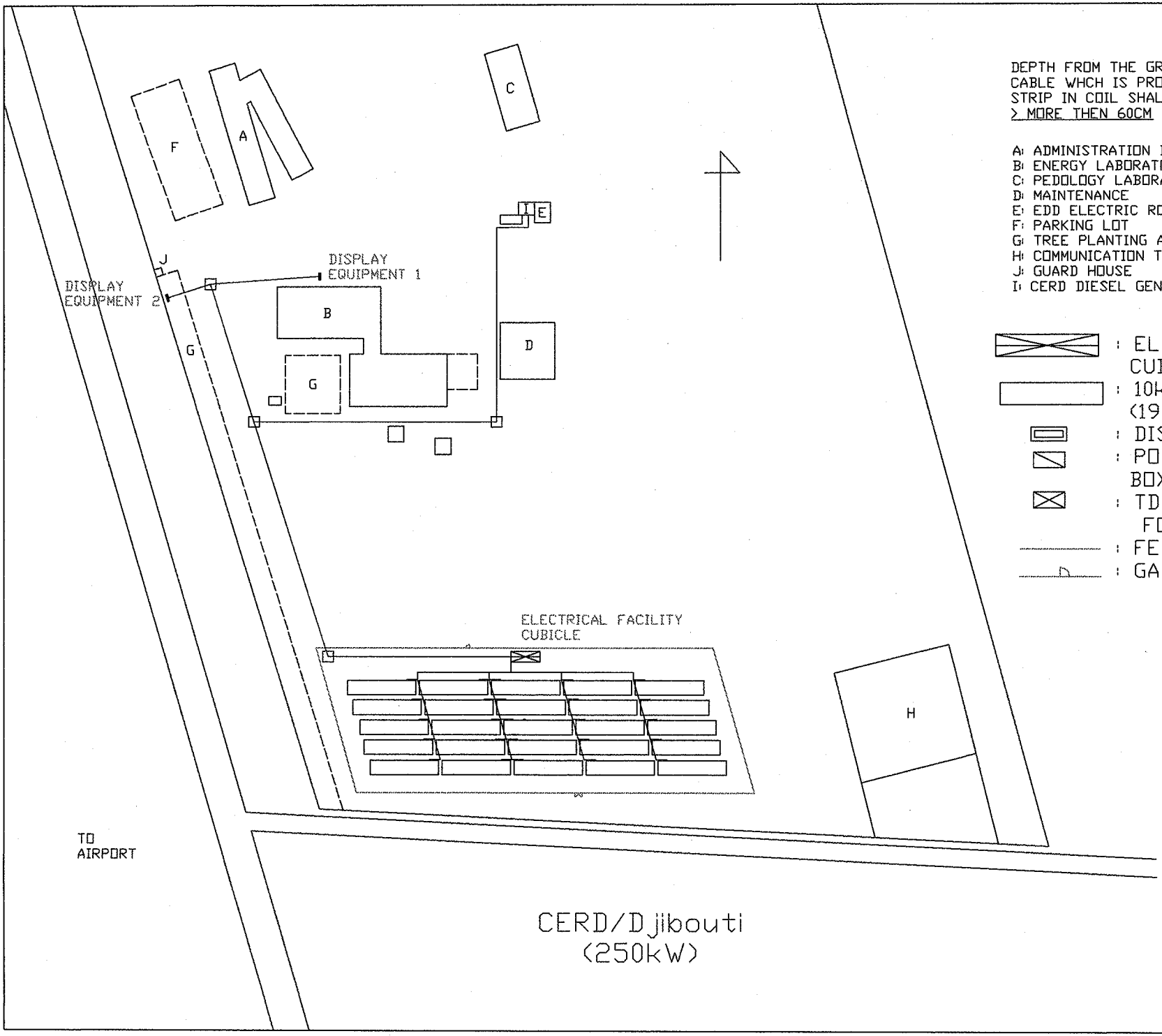
: SCOPE OF THE PROJECT

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. DJ-03a		Rev.1
DATE	DRAWN	CHECKED
SCALE: Non.(A3) Unit:mm		
NEWJEC	NEWJEC Inc. Osaka,JAPAN	


A: ADMINISTRATION BUILDING
B: ENERGY LABORATORY
C: PEDOLOGY LABORATORY
D: MAINTENANCE
E: EDD ELECTRIC ROOM
F: PARKING LOT
G: TREE PLANTING AREA
H: COMMUNICATION TOWER
J: GUARD HOUSE
I: CERD DIESEL GENERATOR ROOM
: ELECTRICAL FACILITY CUBICL OF THE PV SYSTEM
: 10kW PV SUBARRAY (19M * 4M)
: DISPLAY EQUIPMENT
: POWER COLLECTOIN BOX
: TD(TRANSDUCER) BOX FOR SOLAR RADIATION etc.
: FENCE
: GATE
DISPLAY EQUIPMENT1
DISPLAY EQUIPMENT2
TEMPORARY SPACE FOR CONSTRUCTION
SA-1 SA-6 SA-11 SA-16 SA-21
SA-2 SA-7 SA-12 SA-17 SA-22
SA-3 SA-8 SA-13 SA-18 SA-23
SA-4 SA-9 SA-14 SA-19 SA-24
SA-5 SA-10 SA-15 SA-20 SA-25
TO AIRPORT
CERD/Djibouti (250kW)
For Reference Only
Project for Introduction of Clean Energy using Photovoltaic Power
TITLE : GENERAL LAYOUT PLAN
DRAWING NO. DJ-04
Rev.1
DATE
DRAWN
CHECKED
SCALE: 1/1000(A3)
Unit:mm
NEWJEC
NEWJEC Inc. Osaka,JAPAN

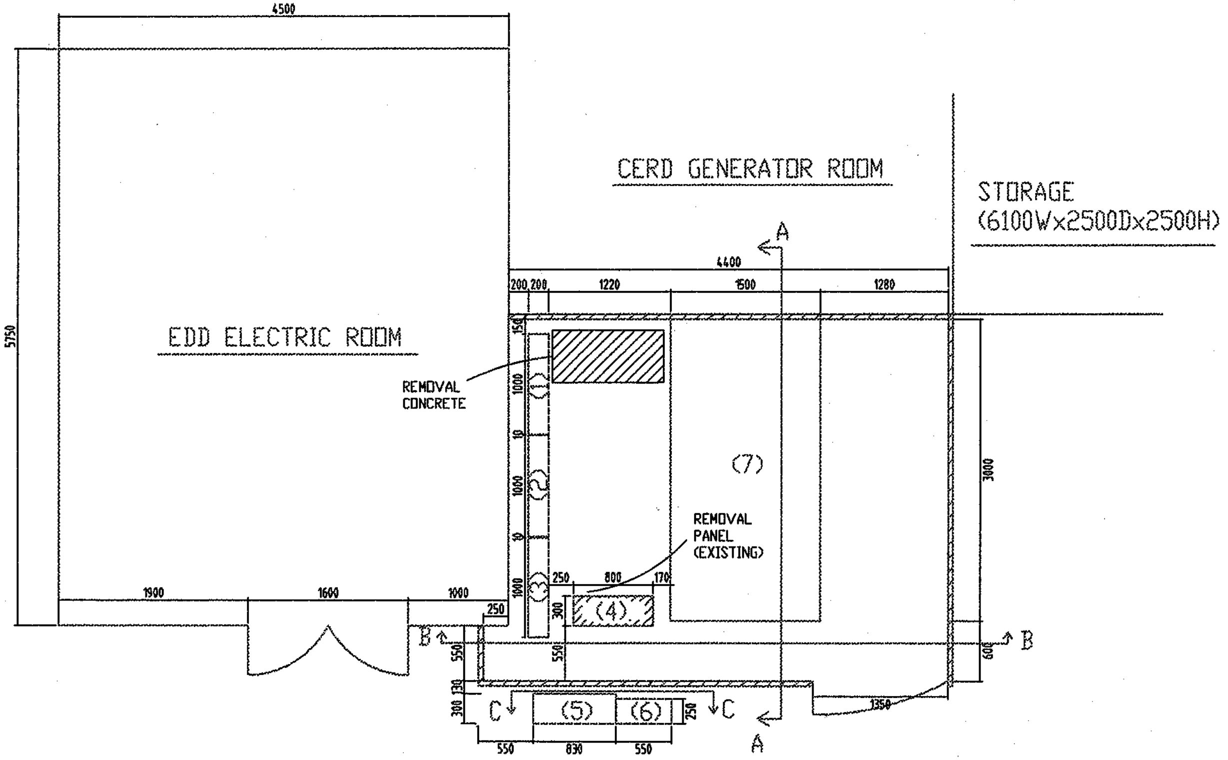


DEPTH FROM THE GROUND LEVEL OF THE CABLE WHCH IS PROTECTED WITH STEEL STRIP IN COIL SHALL BE
> MORE THEN 60CM

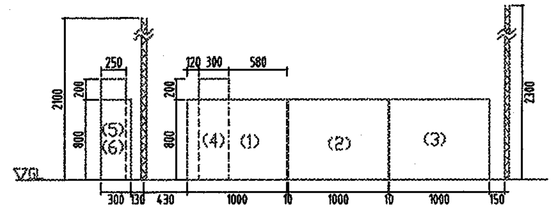
A: ADMINISTRATION BUILDING
B: ENERGY LABORATORY
C: PEDOLOGY LABORATORY
D: MAINTENANCE
E: EDD ELECTRIC ROOM
F: PARKING LOT
G: TREE PLANTING AREA
H: COMMUNICATION TOWER
J: GUARD HOUSE
I: CERD DIESEL GENERATOR ROOM

: ELECTRICAL FACILITY CUBICL OF THE PV SYSTEM
: 10kW PV SUBARRAY (19M * 4M)
: DISPLAY EQUIPMENT
: POWER COLLECTOIN BOX
: TD(TRANSDUCER) BOX FOR SOLAR RADIATION etc.
: FENCE
: GATE

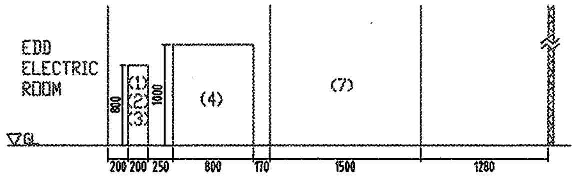
Project for Introduction of Clean Energy using Photovoltaic Power		
TITLE : CABLE LAYOUT PLAN		
DRAWING NO. DJ-12		Rev.1
DATE	DRAWN	CHECKED
SCALE: NOS(A3) Unit:mm		
NEWJEC	NEWJEC Inc. Osaka,JAPAN	



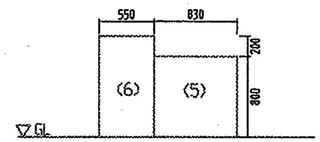
PLAN



SECTION A-A



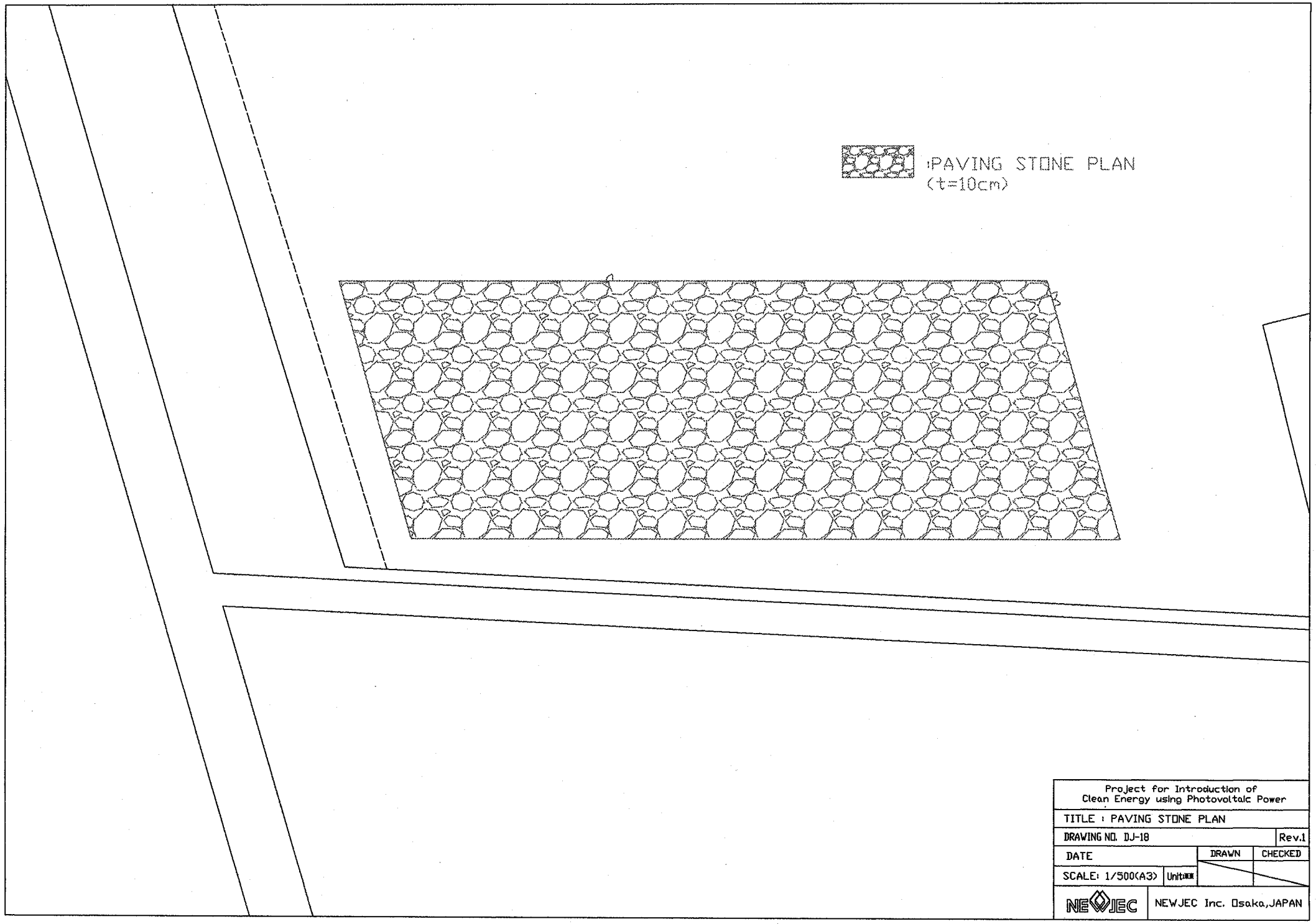
SECTION B-B



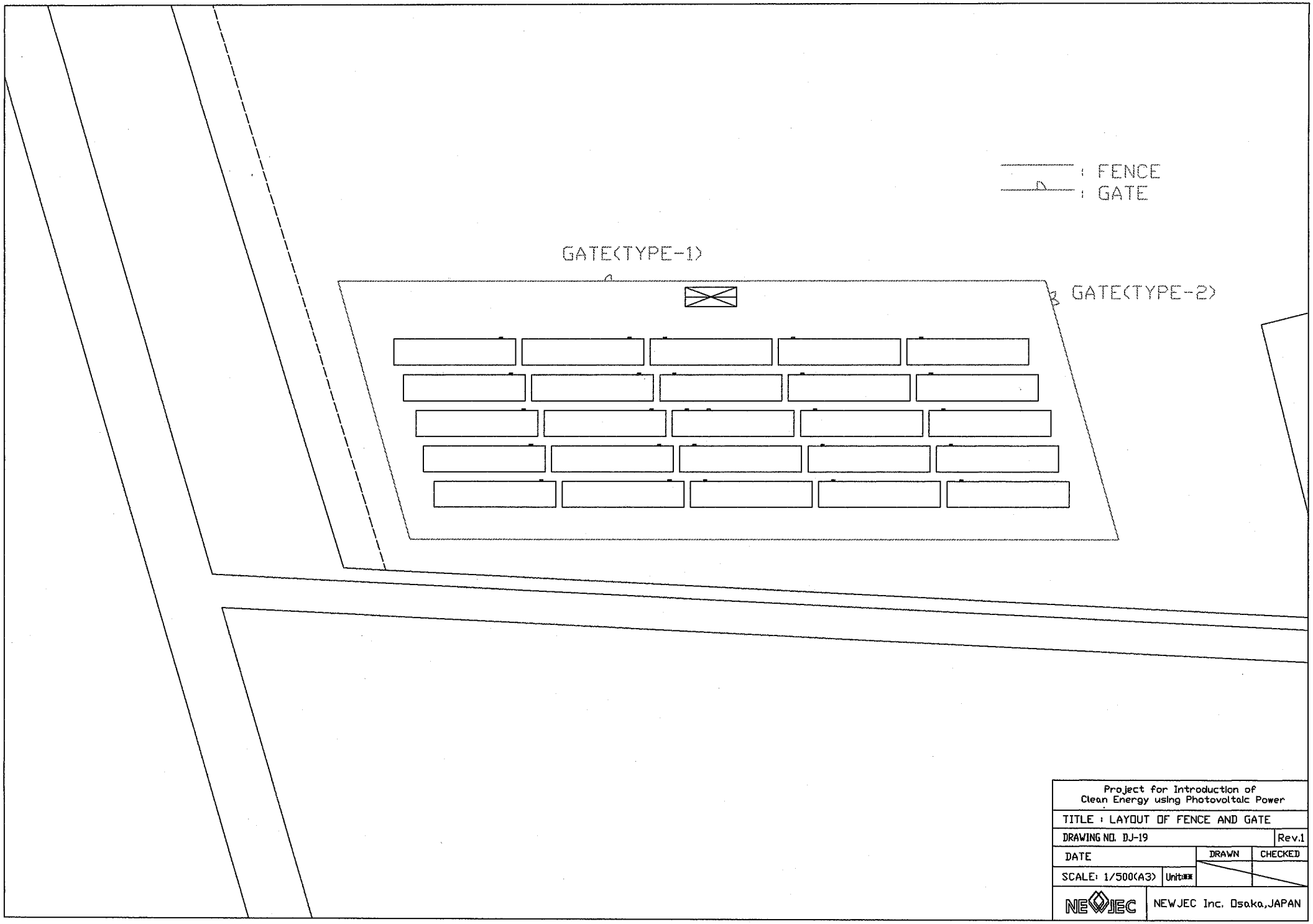
SECTION C-C

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION &WEIGHT				REMARKS
				WIDTH [mm]	DEPTH [mm]	HEIGHT [mm]	WEIGHT [kg]	
(1)	CERD METERING BOX-1 [BUILDING-C : PEDOLOGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT &WHR METER	1	1,000	200	800	10	EXISTING PANEL
(2)	CERD METERING BOX-2 [BUILDING-A : ADMINISTRATION]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT &WHR METER	1	1,000	200	800	10	EXISTING PANEL
(3)	CERD METERING BOX-3 [BUILDING-B : ENERGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT &WHR METER	1	1,000	200	800	10	EXISTING PANEL
(4)	LOW VOLTAGE SWITCHING PANEL	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MAGNET-CONTACTOR, MCCB	1	800	300	1,000	10	EXISTING PANEL
(5)	CERD CONTACTOR BOX [BUILDING-D : BIOTECHNOLOGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/VT &WHR METER	1	830	300	800	10	EXISTING PANEL
(6)	OTHERS METERING BOX-4 [COMMUNICATION SYSTEM]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MAGNET-CONTACTOR, MCCB	1	550	250	1,000	10	EXISTING PANEL
(7)	No.1 EMERGENCY GENERATOR	SELF-VENTILATION WITH RADIATOR TYPE,3Ph-50Hz-100kVA-400/230V-H Class-IP21	1	-	-	-	382	EXISTING SYSTEM

PROJECT TITLE	DRAWING TITLE: EQUIPMENTS LAYOUT&MODIFICATION (EXISTING ELECTRIC ROOM)	Scale : 1 : 100 (A3)	Designed by	Checked by	Approved by	Date :	
		Date: 07.JULY.2008	Draftman	Drawing No. DJ - 15		Edition	Sheet



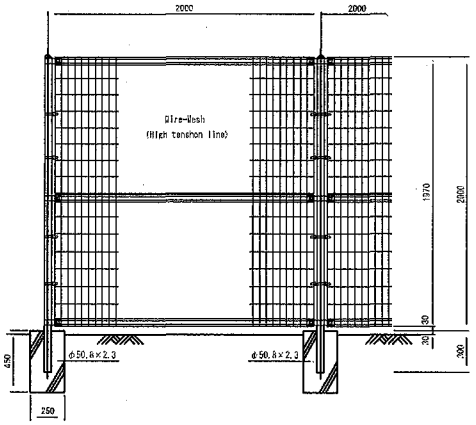
Project for Introduction of Clean Energy using Photovoltaic Power		
TITLE : PAVING STONE PLAN		
DRAWING NO. DJ-18		Rev.1
DATE	DRAWN	CHECKED
SCALE: 1/500(A3) Unit:		
NEWJEC	NEWJEC Inc. Osaka,JAPAN	

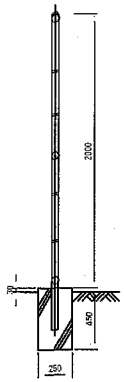


Project for Introduction of Clean Energy using Photovoltaic Power		
TITLE : LAYOUT OF FENCE AND GATE		
DRAWING NO. DJ-19		Rev.1
DATE	DRAWN	CHECKED
SCALE: 1/500(A3) Unit:mm		
NEWJEC	NEWJEC Inc. Osaka,JAPAN	

DJIBOUTI

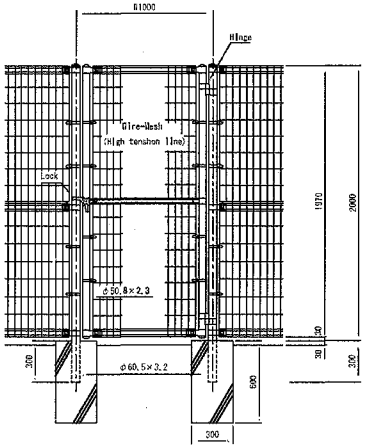
FENCE H = 2,000



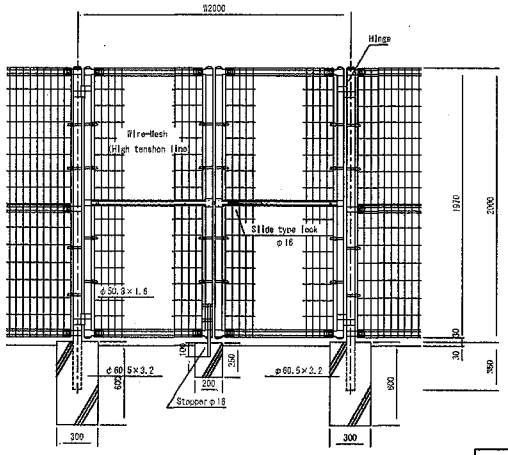


Cross section of Panel

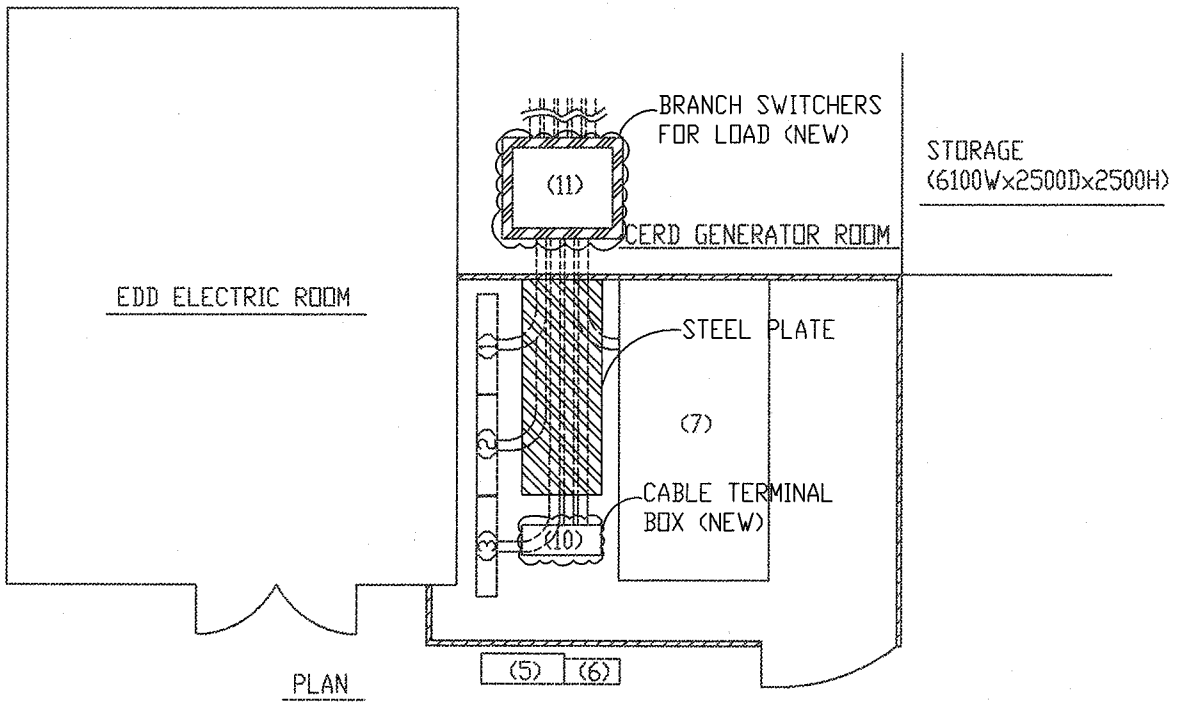
FENCE GATE(TYPE 1) H=2000 W=1000

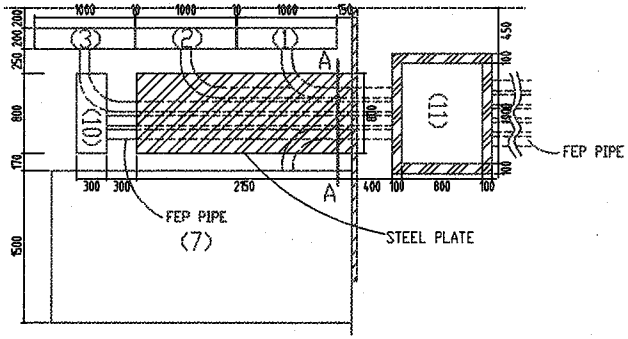


FENCE GATE(TYPE 2) H-2000 W-2000

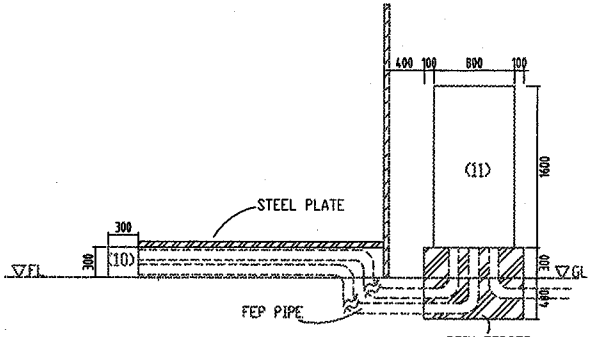


Project for Introduction of Clean Energy using Photovoltaic Power		
TITLE : FENCE, GATE (DETAIL)		
DRAWING NO. YE-20		Rev.1
DATE	DRAWN	CHECKED
SCALE: Non. (A3) Unit:mm		
NEWJEC	NEWJEC Inc. Osaka, JAPAN	





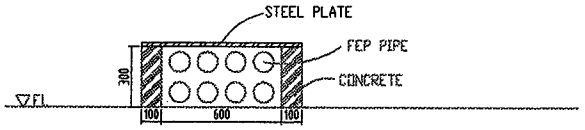
TOP VIEW



SIDE VIEW

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION & WEIGHT				REMARKS
				WIDTH [mm]	DEPTH [mm]	HEIGHT [mm]	WEIGHT [kg]	
(1)	CERD METERING BOX - 1 [BUILDING - C : PEDOLOGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/T &WHR METER	1	1,000	200	600	10	EXISTING PANEL
(2)	CERD METERING BOX - 2 [BUILDING-A : ADMINISTRATION]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/T &WHR METER	1	1,000	200	600	10	EXISTING PANEL
(3)	CERD METERING BOX - 3 [BUILDING-B : ENERGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/T &WHR METER	1	1,000	200	600	10	EXISTING PANEL
(5)	CERD CONTACTOR BOX [BUILDING-D : BIOTECHNOLOGY]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF CT/T &WHR METER	1	830	300	600	10	EXISTING PANEL
(6)	OTHERS METERING BOX - 4 [COMMUNICATION SYSTEM]	METAL-ENCLOSED, SELF-STANDING TYPE CONSISTING OF MAGNET-CONTACTOR, MCCB	1	550	250	1,000	10	EXISTING PANEL
(7)	No.1 EMERGENCY GENERATOR	SELF-VENTILATION WITH RADIATOR TYPE,3Ph-50Hz-100KVA-400/230V-H Class-IP21	1	-	-	-	382	EXISTING SYSTEM

No.	EQUIPMENT	DESCRIPTION	QUANTITY	DIMENSION & WEIGHT				REMARKS
				WIDTH [mm]	DEPTH [mm]	HEIGHT [mm]	WEIGHT [kg]	
(10)	CABLE TERMINAL BOX (NEW)	-	1	800	300	300		NEW
(11)	BRANCH SWITCHERS FOR LOAD (NEW)		1	1,000	800	1,600		NEW



CABLE PIT
SECTION A-A

	PROJECT TITLE	DRAWING TITLE	Scale :	Designed by	Checked by	Approved by	Date :
		EQUIPMENTS LAYOUT&MODIFICATION	1 : 100 (A3)				
			Date: 07.JULY.2008	Draftman	Drawing No. DJ - 22	Edition	Sheet

Attachment-2

Proposal on Training Programs for PV System
Project for Introduction of Clean Energy using Photovoltaic Power

JICA Solar Study Team

1. Background

For Djibouti, this Project will be the first-ever experience to have a PV system with grid interconnection, although Djibouti has a numerous cases of independent off-grid solar systems, those for medical facilities and schools, etc. National electric utility, EDD, has not have an experience of interconnection with IPPs. Therefore, it is important in the first place to train those CERD technicians who will be actually operating and maintaining the facility, at the same time, it is also important to inform officers in the Ministry of Energy and EDD, 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 power grid, in their handling renewable projects in the future.

Meanwhile, CERD has a renewable energy institute which from time to time sends its crew of technicians to diagnose and repair independent solar facilities scattered in the country. The institute is hoping to be able to provide a training/education function for those who are/will be engaged in maintenance of such solar facilities in the country side. It is also beneficial for CERD to obtain theoretical and practical knowledge of the use of solar energy so that it will be able to be one of leading institutes in the promotion of solar energy in the country.

2. Training Program

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 facility, 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.

<u>Before commissioning</u> (approximately starting 4 weeks before commissioning)

Lectures on basic knowledge

Grid interconnection and reverse current of PV system

Characteristics of PV module output

Planning PV systems

Power demand, load in a facility (CERD)

Protection function of PV system in case of power failures

Stand alone operation of PV system

Lectures on construction planning

Power distribution in a facility and connection of PV system

Scheduling works

Construction of PV system

OJT program

Witnessing connection works

Witnessing precommissioning/commissioning tests

<u>After commissioning of PV system</u>

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 facility in a good condition

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 CERD circumstances. These questions and issues will be discussed and reflected to operation practice and check sheets, as another exercise.

<u>Three months after the commissioning</u>

Trouble shooting (by questionnaire, Q&A session, discussion) (!)

Witnessing three month inspection

Revising daily operation and check sheets

3. Participants

CERD technicians: Those who will be actually operating the PV system

CERD researchers: They are expected not just to participate in the program but also to be involved in the process of preparation, execution, evaluation of the program by the consultants

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

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

4. Schedules

Training program before/after commissioning

		-5w	-4w	-3w	-2w	-1w	0w	1w	2w
Activities	preparation								
	Basic knowledge lectures								
	Construction exercise								
	OJT								
	Contractors training								
	O&M Planning								
Participant	CERD technicians								
	CERD researchers								
	EDD, MERN officers								
Lecturers	Consultant (leader)								
	Consultant (assist)								
	Interpreter								

Training program three months after commissioning

		1w	2w	3w	4w
Activities	Review of logs (preparation)				
	Trouble shooting				
	Witnessing 3M inspection				
	Revising check sheets				
Participant	CERD technicians				
	CERD researchers				
Lecturer	Consultants (leader)				
	Interpreter				


JICA