Ministry of Resources and Development
Marshalls Energy Company
Republic of Marshall Islands

PREPARATORY SURVEY REPORT

ON

THE PROJECT FOR

INTRODUCTION OF CLEAN ENERGY

BY SOLAR ELECTRICITY GENERATION SYSTEM

IN

THE REPUBLIC OF MARSHALL ISLANDS

MARCH 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.

ICONS INTERNATIONAL COOPERATION INC.

SHIKOKU ELECTRIC POWER CO., INC.

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PREFACE

Japan International Cooperation Agency (JICA) conducted the preparatory survey on the Project for Introduction of Clean Energy by Solar Electricity Generation System in the Republic of the Marshall Islands. JICA sent to Marshall Islands a survey team from 29th June to 11th July, 2009.

The team held discussions with the officials concerned of the Government of Marshall Islands, 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 Marshall Islands in order to discuss a draft outline design, and as this result, the present report was finalized.

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

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

March 2010

Kazuhiro YONEDA
Director General
Industrial Development Department
Japan International Cooperation Agency

March 2010

LETTER OF TRANSMITTAL

We are pleased to submit to you the preparatory survey report on the Project for Introduction of Clean Energy by Solar Electricity Generation System in the Marshall Islands.

This survey was conducted by the Consortium of Yachiyo Engineering Co., Ltd., ICONS International Cooperation Inc., and Shikoku Electric Power Co., Inc., under a contract to JICA, during the period from June, 2009 to March, 2010. In conducting the survey, we have examined the feasibility and rationale of the project with due consideration to the present situation of the Marshall Islands and formulated the most appropriate outline design for the project under Japan's Grant Aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Tadayuki Ogawa
Project manager,
Preparatory Survey team on
The Project for Introduction of Clean Energy by
Solar Electricity Generation System

The Consortium of Yachiyo Engineering Co., Ltd.,
ICONS International Cooperation Inc., and
Shikoku Electric Power Co., Inc.

SUMMARY

SUMMARY

① Outline of the Recipient Country

The Republic of the Marshall Islands (hereinafter referred to as the Marshall Islands) is an island nation composed of atolls situated between latitude 4~14° N. and longitude 160~173° E. to the east of Micronesia in the mid-western part of the Pacific Ocean. The national land is made up of 29 atolls and five independent islands in 2 million square kilometers of expansive waters centered around Majuro Atoll which includes the capital city, and the atoll islands consist of some 1,225 coral islands. The combined land area is 181km^2. The national population is approximately 52,000 (estimate from 2006), of which half or approximately 26,000 live on Majuro Atoll where the capital Majuro is located. Almost all citizens are Christian Protestants. The official languages are Marshall and English. The climate is marine tropical and the mean temperature is 28.1℃ with just a small annual fluctuation of ±0.5℃. Average rainfall is 221mm, and the period of low rainfall is generally between January and March.

Like the other states of Micronesia (Palau and the Federated States of Micronesia), the Marshall Islands has depended heavily on financial aid from the United States based on the Compact; indeed American fiscal aid accounts for 45% of GNP and 70% of all government revenue. Normally in developing countries, primary industries account for the main industrial activity, however, since the Marshall Islands is not blessed with any natural resources, government-related expenditure activities are the main sector accounting for between 60~70% of GDP. Other important industries apart from the government sector are agriculture based around production of copra and coconut oil, and fisheries. The economic growth rate was approximately 3% per year on average between 2001~2003 and just 3.6% per year on average between 2004~2007. The Marshall Islands is aiming to reform the economic structure and thereby realize economic growth and economic independence through developing the private sector based around fisheries processing and tourism.

② Background, Concept of the Project

Policy relating to electricity and energy in the Republic of the Marshall Islands (hereinafter referred to as the Marshall Islands) is managed by the Ministry of Resource Development (MRD). The MRD comprises departments in charge of dairy farming, agriculture, trade and investment, national energy, financial affairs and so on, but the National Energy Department is in charge of introducing, utilizing and promoting renewable energy and promoting energy saving. As for the electric power utility, the Marshalls Energy Company (MEC), which is an independent organization separate from the government, conducts work and undertakes all aspects of energy operations from generation to distribution, fuel importing and retailing, etc.

In energy sector in Marshall Islands, 60 % of power generation in Marshall Islands is dependent on diesel generation, and the energy supply setup is extremely vulnerable to global sudden fuel price rise these days. Thus, Following the 2nd Economic & Social Summit staged in 2001, Vision 2018 was presented as the economic development plan targeting the next 15 years up to 2018, and within this the National Energy Policy was established in 2003 in tandem with the sector-separate policies pertaining to

national economy, social development, education promotion and so on.

The vision for the energy sector in the next 15 years was defined as the attainment of "Available, affordable, reliable and sustainable energy for social and economic development for all the people of the Marshall Islands," and the following goals were set. ① Electrify 100% of households in urban areas and 95% of households on remote islands by 2015. ②**Supply 20% of all energy as renewable energy by 2020.** ③Improve energy utilization efficiency in 50% of general households and business facilities and 75% of government-related facilities by 2020. ④Reduce MEC energy supply losses by 20% by 2015.

These goals aim for the supply of electric power including that derived from renewable energies to all citizens, and photovoltaic power is regarded as a central factor in that.

Moreover, since the national land of the Marshall Islands is extremely flat and only reaches a maximum altitude of 3m above sea level, there is concern over the risk of submergence caused by increased sea level resulting from global warming. Accordingly, the deployment of strategic measures to address this has become a matter of urgent concern in the Marshall Islands.

Against such a background, the Ministry of Resource Development compiled a plan for the introduction of clean energy utilizing solar power geared to the promotion of photovoltaic and other renewable energies, and it requested the Government of Japan to provide grant aid for its implementation.

③ Outline of the Study Results and Project Contents

In response to the said request, the Government of Japan decided to implement the necessary study and consigned JICA to dispatch the Project Formulation Study Team on February 2009 to carry out the Project Formulation Study. Based on the result of the Study, following Study Teams were dispatched to carry out the Preparatory Study to implement the necessary study to procure Photovoltaic (PV) generating equipment at Majuro Hospital which build under the Japanese Grant Aid in 2005.

Preparatory Study:	29th June to 12 July, 2009
Discussion of Draft Outline Design:	29th November to 5 December, 2009

The Preparatory Study Team conducted site surveys and proceeded to implement domestic analysis. In doing so, it surveyed and examined the background and contents of the Project, natural conditions, environmental and social consideration, the maintenance setup and the building situation, etc. in the Marshall Islands. It then planned the appropriate scale and contents of the Project as a grant aid undertaking, explained the study findings and contents of the Basic Design to the related agencies on the Marshalls side and reached a basic agreement following discussion,

As a result, the team confirmed that the implementation agency for the Project is Ministry of Resources and Development (MRD) and Execution agency was Marshals Energy Company (MEC) and appropriate scope of Japan's cooperation in the Project was judged to be the installation of grid-connected PV system at Majuro Hospital. The basic plan shown in Table 1 below was carried out (right hand column of the table).

Outline of the Basic Plan

Equipment procurement and installation plan	Procurement and installation of the following PV equipment	Quantity
	PV modules	1 set
	PV module installation frame	1
	Power conditioner	2
	Grid connection transformer	1
	Display unit	1 set
Equipment procurement plan	PV system exchange parts, maintenance tools and test apparatus	1 set

④ Project Work Schedule and Cost Estimation

In the event where the Project is implemented under the scheme of Environment and Climate Change Program Grant Aid of the Government of Japan, the rough Project cost will be approximately 526.6 million yen (approximately 526 million yen borne by Japan and 0.6 million yen by the Marshall Islands). The main cost item borne by the Marshall Islands side will be the final connection works to the grid on the high voltage side. The Project works schedule will be around 26 months including preparation of tender documents.

⑤ Verification of Project Validity

Implementation of the Project will make it possible to supply electric power generated from photovoltaic energy to approximately 26,000 citizens of Majuro City via the Majuro Atoll power grid. In doing so, it will be possible to break away from the energy supply setup that is currently almost 100% dependent on diesel generation and to promote the dissemination of clean energy as a measure to support climate change countermeasures. Accordingly, validity of Project implementation under the Environment and Climate Change Program Grant Aid scheme is deemed to be extremely valid.

Engineers of MEC, which will be responsible for operating and maintaining the Project equipment after handover, possess basic operation and maintenance capacity concerning existing diesel generating and distribution systems and stand-alone PV systems. Concerning grid connection of the PV system, since the appropriate system operation and maintenance technology will be transferred via the soft component for supporting the grid-connected PV system installed in the Project, it should be possible to secure the required operation and maintenance capability providing that the appropriate human resources and budget

are allocated by the MEC in future.

In order for the Project effects to be realized and sustained, the main issues that need to be tackled by the Marshall Islands side are as follows.

(1) To ensure the stable operation of the grid-connected PV system, it will be necessary to strictly observe preventive maintenance measures such as implementing daily and periodic site patrols and inspections and securing the onsite setup for guarding the photovoltaic modules.

(2) To promptly appoint the engineers who will take part in the Project soft component and OJT, to facilitate their attendance at the said training, and to ensure that technology is horizontally conveyed to other engineers who could not participate in the training.

(3) Concerning the grid-connected PV system that will be procured and installed by the Japanese side in the Project, it will be necessary to establish a power tariff scheme that enables future investment costs to be recovered, particularly in anticipation of renewals of the photovoltaic modules and power conditioner at the end of their expected service life.

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3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Soft Component Plan
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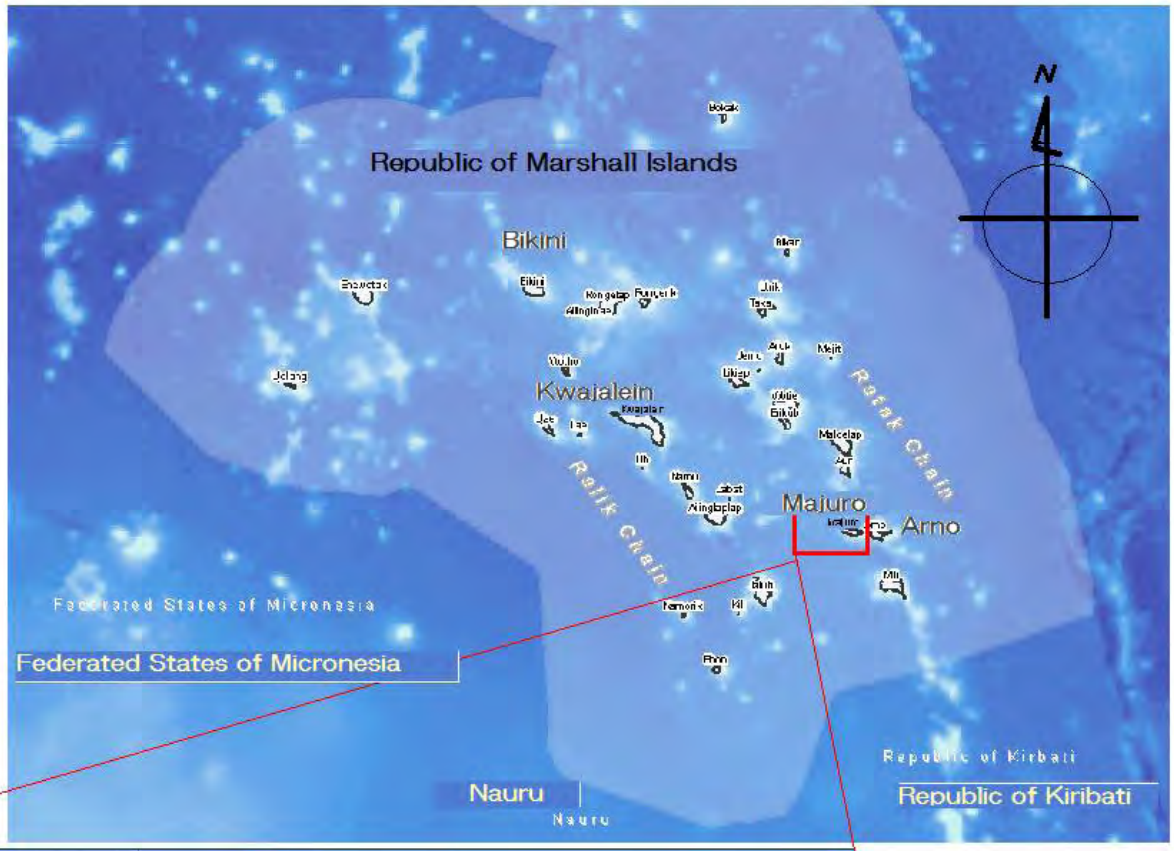
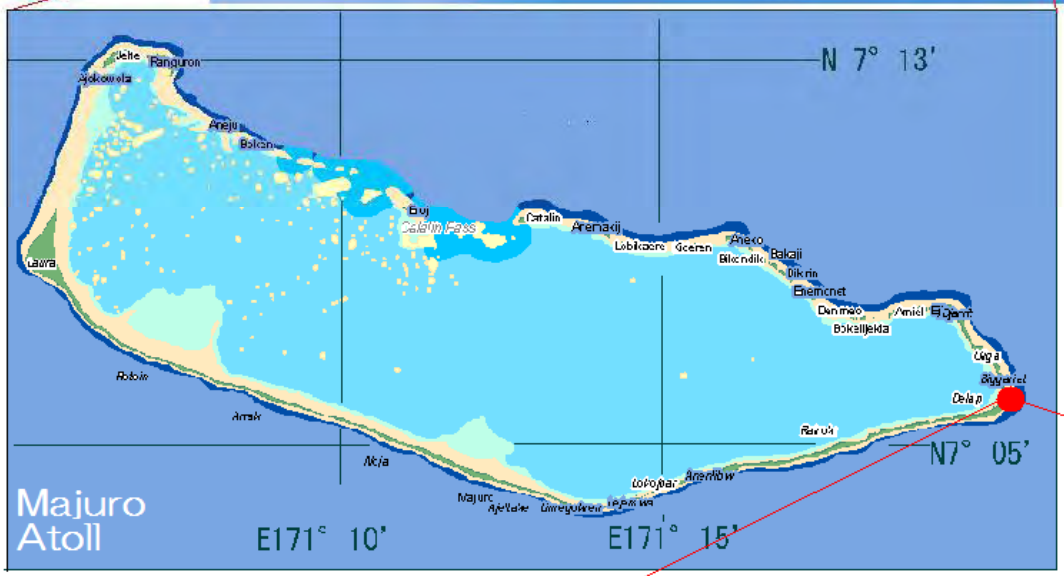
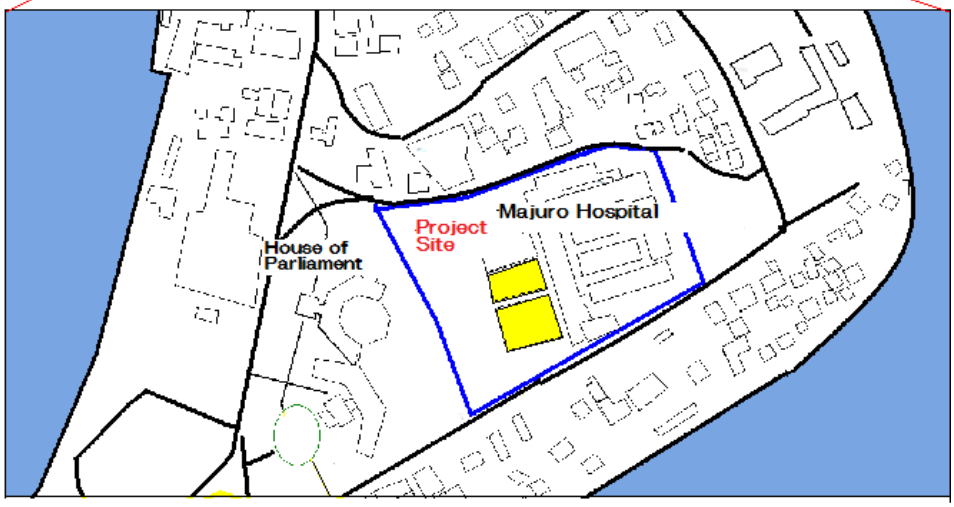
Location Map







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Abbreviations

CMI	College of Marshall Islands
EDF	European Development Fund
EIA	Environment Impact Assessment
EPA	Environment Protection Authority
EU	European Union
GDP	Gross Domestic Products
GNP	Gross National Products
IEC	International Electro technical Commission
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standard
MEC	Marshalls Energy Company
MIMRA	Marshall Island Marine Resources Authority
MOH	Ministry of Health
MRD	Ministry of Resources and Development
SHS	Solar Home System

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Background of the Project

Having very limited land area and low altitude, the Pacific island nations are extremely prone to the effects of climate change and are in urgent need of strategic countermeasures. Support for measures to adapt to climate change in the Pacific island nations and the like started with the announcement of the Cool Earth Partnership – a new fund mechanism for climate change worth US$10 billion (1.25 trillion yen) in total – by the then Japanese Prime Minister Fukuda at the Davos summit held in Switzerland in January 2008. Application of the Mechanism entails twofold support to developing countries that have undergone policy discussions: either support centering on assistance for access to adaptation measures and access to clean energies based on grant aid and technical aid, etc. worth 250 billion yen over five years, or yen loans for climate change countermeasures based on mitigation measures worth 500 billion yen over five years. In the Pacific region, Palau, Micronesia, the Marshall Islands, Nauru, Kiribati, Papua New Guinea, Vanuatu, Tuvalu, Samoa, Tonga, Niue, and the Cook Islands have already joined the Cool Earth Partnership.

In view of this policy by the Government of Japan, JICA has established its basic support policy for climate change countermeasures in developing countries under the heading of "Direction of Climate Change Initiatives," and within this it emphasizes the need to strengthen efforts for cooperation geared to raising the capacity of Pacific island nations to respond to climate change. Upon surveying support needs with a view to bolstering Japanese support for climate change countermeasures in the Pacific region, it was found that urgent needs exist for photovoltaic power generation projects in Micronesia, Palau, the Marshall Islands and Tonga. Based on this information, the Project Formation Study for promoting Environment and Climate Change Program Grant Aid Projects (Photovoltaic Power) in the Pacific Region" was implemented from February to March 2009 assuming the scenario of an Environment and Climate Change Program Grant Aid project utilizing PV. As a result, the needs and feasibility of project implementation in the Marshall Islands have been confirmed, and it is scheduled for official written requests for projects under the Environment and Climate Change Program Grant Aid scheme to be submitted by the Marshall Islands' government. The Government of Japan reviewed the requests with a view to arriving at decisions on early implementation.

The Study here has the following objectives: 1) to collect information relating to PV introduction and to reconfirm the detailed need and validity of cooperation, 2) to compile specific cooperation plans as Environment and Climate Change Program Grant Aid in each country and to perform rough design corresponding to the available amount of grants, and 3) to estimate the rough project costs and prepare reference materials for tender documents.

As a result of the survey and the discussion with Marshall Islands side, for the implementation of the Project, the Project site is Majuro Hospital, of which the competent authority is Ministry of Health. Majuro Hospital serves as both a tertiary medical care facility and as an emergency care hospital. It has between 150~200 visitors including people accompanying patients every day, and the targeted facilities contain a CT room, operating theaters, emergency outpatients room, biopsy inspection room

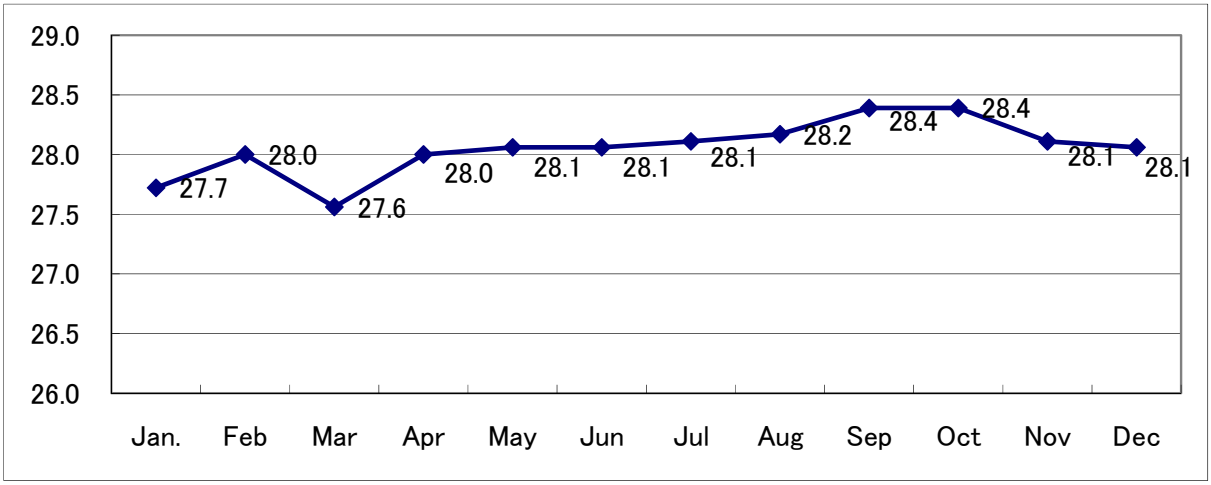
and outpatients consultation room.MEC becomes the owner of the facilities, and takes charge of the O&M in the same manner as ordinary power equipment.

1-2 Natural Conditions

Natural conditions in the Project target area of Majuro are indicated below. Incidentally, since government statistics from 2006 are the latest available data for the Marshall Islands, these shall be used here.

The Marshall Islands are located slightly north of the Equator and comprise 29 atoll groups and five islands dotted over ocean stretching 1,200 km from north to south and 1,300 km from east to west. The climate is marine tropical. The Marshalls are composed of flat coral shelves and the highest altitude is a mere 3m.

Average temperature in the capital Majuro is 28.1℃ and the temperature displays no major fluctuation throughout the year as is shown in Figure 1.2-1.

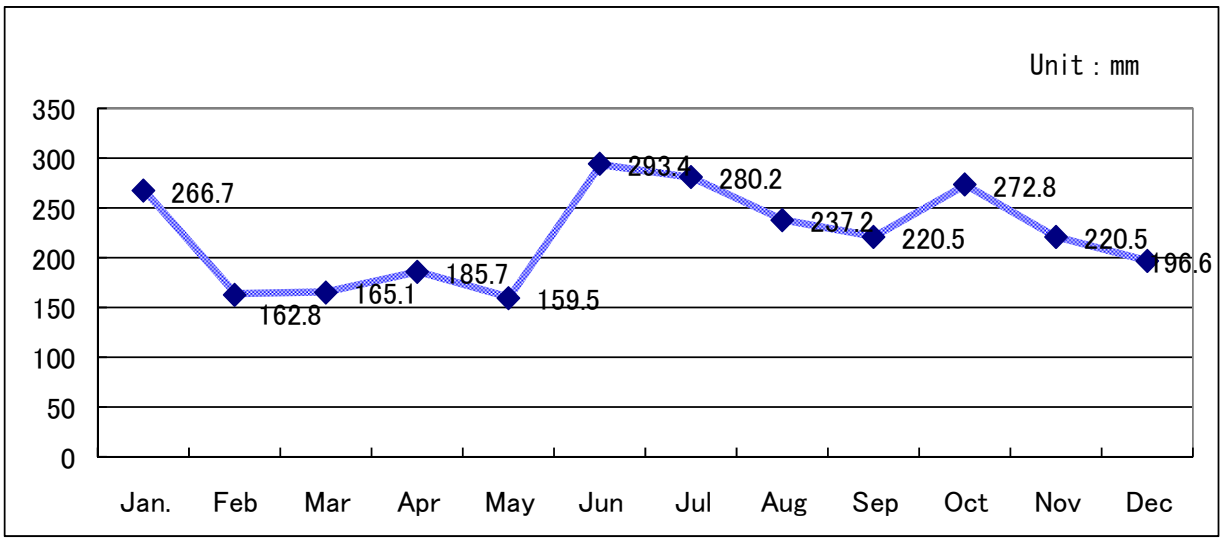


(Source ： Weather Service Office / 2006 data)

Figure 1.2-1 Temperature in Majuro City

Annual average rainfall is 2,660.9mm, and it is 1.8 times compared with rainfall in Tokyo in Japan (Annual average rainfall in Tokyo in Japan: 1,467mm). Monthly average rainfall is 221mm, and from February to May rainfall is decreasing, on the other hands from June rainfall is increasing.

Regarding rainy day, 12 rainy days in February is minimum number, and 22 days in July is maximum number in a year



※Monthly average : 221mm

Annual Avarage2,660.9mm (Source: Weather Service Office / 2006 data)

Figure 1.2-2 Rainfall in Majuro City

Moreover, it was recorded that damage caused by a storm surge and low pressure storm occurred in 1958, and some buildings had damage by gale of typhoon in Majuro, however as Majuro is run off the course of typhoon development, damages caused by typhoon are very few. In addition, there is no record that earthquake had happened in Majuro.

1-3 Environmental and Social Consideration

(1) Environmental and Social Consideration

The agency in charge of matters pertaining to environmental and social consideration is the Environment Protection Authority (EPA), which belongs to Ministry of Health and Environment. When conducting development projects in the Marshall Islands, it is necessary to apply to the EPA according to the required procedure.

(2) Necessary Procedures for Environmental Impact Assessment

The flow for obtaining environmental authorization is indicated below.

① Submit the outline of the development project to the EPA as a Preliminary Proposal

The proposal should contain the following contents.

The following format shall be followed by the proponent in the preparation of the EIA unless otherwise directed by the Authority:

(i) Cover sheet;
(ii) Summary;
(iii) Table of contents;
(iv) Purpose and need for proposed action;
(v) Alternatives, including proposed action;
(vi) Affected environment;
(vii) Environmental consequences;
(viii) List of preparers;
(ix) Distribution list;
(x) Index;
(xi) Appendices (if any).

② Following receipt of the Preliminary Proposal, examination is conducted by the EPA to determine in no more than 10 days whether or not an EIA is required

Where necessary the EPA holds discussions with related government ministries and agencies.

Also, it may request detailed information such as specifications and so on in some cases.

③ If the development project contents impart no major impact to the environment

→The written authorization is presented to the applicant and the development project is implemented.

④ If EIA is deemed to be necessary

→The project applicant submits the necessary documents to the EPA.

The documents should contain the following contents.

Item	Contents
(i) Coversheet	Title of proposed Action. Name, address and telephone number of proponent.
(ii) Summary	Issue to be resolved and the solution
(iii)Table of Contents	The EIA's table of Contents
(iv)Purpose and need for proposed action	Purpose、necessity and explanation regarding contents of proposed action
(v) Alternatives, including proposed action;	Target of location. Alternatives include alternative sites, designs and scales.

(vi)Affected environment	Impacts caused by proposed Action. Related development plan in the region, both public and private sector.
(vii) Environmental consequences	Direct and indirect environmental effects. Cumulative environmental impacts by the proposed project. Discussion about cultural, historical consideration. Mitigate adverse environmental impacts.
(viii) List of preparers	Names of the person who prepared EIA and responsible for analysis..
(ix) Distribution list	Send a copy of drafted EIA and submit comment(s)。

Plus an index and attached documents, etc.

⑤ EIA review

Where necessary, in addition to seeking opinions and expert know-how from related government agencies and stakeholders, public hearings are sometimes held.

⑥ Environmental authorization

（3）Environmental and Social Consideration Procedures for Project Implementation

According to the EPA hearings and investigations, it was necessary to partially renovate the roofs of the target facilities (Ward 2 and Ward 3) when installing equipment in this project. It has been confirmed that the works here do not run counter to the Environmental Impact Assessment Guidelines of the Marshall Islands as the work is implemented on the roof of Majuro Hospital and any waste such as disposal of storage battery are not produced, although marine works and works aboveground sometimes infringe on them. However, in all development projects whether they be performed by the public or private sector, it is compulsory to submit a Preliminary Proposal after the contents and scale have been determined. In the Project, it will be necessary to have the MRD present the Preliminary Proposal once the E/N has been concluded. The MRD, which is the agency in charge of the Project, will need to submit the Preliminary Proposal to the EPA before the start of works. This should include the following contents.

According to the procedures for Project Implementation, MRD submitted Preliminary Proposal to the EPA in January 2010 and got EIA approval for this Project.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Overall goal and Project Objectives

The Project will be implemented with the superior objective of contributing towards the construction of a power supply setup that will benefit the diversification of energy sources and implementation of measures addressing climate change through the utilization of domestic energy in the Marshall Islands.

Responding to the shock of inflation in oil prices in July 2008, the Government of the Marshall Islands issued proclaimed a national state of emergency, and since then increasing expectation has been directed towards the utilization of renewable energies. Moreover, since the Marshall Islands is largely dependent on financial assistance from the United States based on the COMPACT and aid from other countries (including non-project grant aid from Japan) to sustain the lifeline that is electric power supply, this cannot be described as a healthy situation for the state. Diesel fuel drives the majority of power generation in the Marshall Islands, however, because 90% of overall energy is dependent on imported fuel, the energy supply setup is extremely vulnerable to fuel price fluctuations. Thus, one of the issues facing the sector concerns strengthening of the energy supply setup. In order to break away from this condition, Vision 2018 was presented as the economic development plan targeting the next 15 years up to 2018, and following the Vision 2008, National Energy Policy was established in 2003 for energy sector. In the National Energy Policy was defined as the attainment of "Available, affordable, reliable and sustainable energy for social and economic development for all the people of the Marshall Islands," and the following goals were set: ① Electrify 100% of households in urban areas and 95% of households on remote islands by 2015; ② Supply 20% of all energy by renewable energy by 2020; ③ Improve energy utilization efficiency in 50% of general households and business facilities and 75% of government-related facilities by 2020; and ④ Reduce MEC energy supply losses by 20% by 2015.

These goals aim for the supply of electricity to all citizens by the utilization of renewable energies, in which photovoltaic power is regarded as a core theme.

In that sense, there is great significance in making effective use of renewable energies in the Marshall Islands. For that reason, it is important to install grid-connected PV systems such as that proposed in the Project, and promote social action thereby be able to reduce the level of dependence on imported fuel, to decrease CO_2 emission Moreover also the Project enhances independence of the state and mitigate the impacts caused by energy crises such as the one that occurred last year.

The Project will be implemented in Majuro Hospital. Its implementation will be able to contribute to the efforts of the Government of the Marshall Islands to strike a balance between cutting greenhouse gas emissions and realizing economic growth. Moreover, since Majuro Hospital combines primary and secondary medical care facilities and is used by many citizens, by installing PV facilities at the hospital in the Project, this will serve to deepen public awareness of photovoltaic power and utilization of renewable energies.

2-1-2 Outline of the Project

The Project aims to procure and install the PV system equipment required to achieve the above targets, to connect the said system to the existing power grid with a view to achieving stable power supply, and to thereby promote the introduction of renewable energy to the energy sector in the Marshall Islands.

The cooperation basically covers the procurement and installation of the following equipment required for the target PV generating system:

- PV modules
-Module frame for attachment to the hospital roof
- Junction box
- Collecting box
- Power conditioner
- Transformer
- Information control display device
- Cable
- PV system spare parts and maintenance tools

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy

As a result of conducting the detailed site survey and examining the site environment and PV system capacity appropriate to the Project requested from the Marshall Islands side, a grid-connected PV system shall be procured and installed at the Project site of Majuro Hospital. The equipment shall contribute to spread and to promote the grid-connected PV system in Marshall Islands, and be composed of equipment appropriate for Environment and Climate Change Programme Grant Aid of Japan.

2-2-1-2 Natural Conditions

(1) Temperature and Humidity

The annual average temperature in the Marshall Islands is approximately 28℃ and the mean humidity is approximately 80%. Since the Marshall Islands has a marine tropical climate characterized by high temperatures and high humidity throughout the year, the Project equipment shall basically comprise specifications suited to outdoor use in consideration of corrosion caused by rainfall.

(2) Salt Damage

Since the intended PV system site is relatively close to the coastline, in consideration of salt damage countermeasures, anti-corrosive coating shall be applied to the outdoor PV module frame and

the junction box, etc. used for making electrical wiring connections.

(3) The others

There is no record about earthquake in Marshall Islands, therefore seismic factor is not from design. Although, Marshall Islands is located far from an area where hurricane is formed, gust of wind of 50m/second was recorded once every few years. For the installation of PV module, the design concept for structures supporting PV panels should have enough stability against wind power at least 70m/second.

2-2-1-3 Socio-economic Conditions

The grant aid implemented by the Government of Japan and other donors assisted the Marshall Islands to keep relatively well developed infrastructure including roads, public water supply, sewage systems, electricity supply and telecommunications. Moreover, since English is used in Majuro where the Project target site is situated, conditions are convenient for foreign visitors. Most of the citizens of the Marshall Islands are Christians, and there are no religious customs that have a large impact on the construction schedule such as Ramadan in Islamic countries.

2-2-1-4 Construction and Procurement Conditions, Special Situations and Commercial Practice

The Marshall Islands has relied heavily on assistance from Japan, the United States and Taiwan, etc. in order to build its primary infrastructure. When implementing projects for such infrastructure development, it depends a lot on overseas workers primarily from the Philippines. Accordingly, it is difficult to secure skilled engineers than simple laborers possessing only limited technical skill in the Marshall Islands. Since infrastructure conditions are good and roads on Majuro Atoll including the Majuro Atoll Road constructed under Japan's grant aid are kept in good condition, the environment is favorable for transporting equipment and executing works in the Project.

There are no official acts or standards for the Architecture and Civil construction in Marshall Islands. All cooperation projects are adopted donor's country standards or others. Design of equipment and plan and implementation of installation work in the Project shall be in conformity to design and implementation of Japanese standards same as Japanese cooperation projects in the past.

2-2-1-5 Effective Use of Local Companies (Builders, Consultants)

(1) Utilization of Local Contractors

Since the Marshall Islands has general contractors and electrical works companies, it is relatively easy to procure engineers and labors including foreign engineers, transport vehicles, construction works machinery and so on. Accordingly, it will be relatively simple to secure the local labor required for constructing the PV module frame in the Project.

On the other hand, skilled engineers are required in order to install the Project PV system, and since it is difficult to use such local contractors in the Marshall Islands, it will be necessary for Japanese contractor to dispatch engineers who who are able to conduct quality control, offer technical guidance and manage the

works schedule

(2) Utilization of Local Equipment and Materials

The aggregate, cement and reinforcing bars, etc. used in foundation works can be procured in the Marshall Islands. However, there are no facilities capable of implementing heavy corrosion prevention treatment such as galvanizing for steel frames. Accordingly, all steel members for installation in the Project should be carried onto site after undergoing corrosion proofing overseas.

When compiling the execution plan, the items procured locally, such as curing materials and crane trucks, etc. can be procured locally, and such items shall be adopted in the Project. Incidentally, since the Project will coincide with a project for expansion of Majuro Hospital under American aid and a project for construction of facilities based on Japanese fisheries grant aid, it is likely to be difficult to procure scaffolding members.

Moreover, as for the main equipment in the PV system shall be procured from Japan or a third country since local products should not be used in the interests of securing high reliability and compatibility with the existing grid for easy maintenance.

2-2-1-6 Operation and Maintenance

In the Marshall Islands, stand-along PV systems (solar home systems – SHS) are operating on remote islands, and those are maintained by engineers belonging to Marshall Energy Corporation (MEC). However, the first grid-connected PV system with 60kW capacity has only just been introduced to the College of Marshall Islands (CMI) for the first time in 2009 under American assistance based on the Compact, and the local personnel do not possess sufficient maintenance experience. Accordingly, it will be necessary to offer technology transfer on appropriate operation and maintenance to the MEC which will be responsible for operating the system following Project implementation.

Since the Project system will be operated in connection with the existing distribution network, the effective and efficient operation should be ensured through the soft component, which includes the provision of an appropriate operation and maintenance manual and the proposal of operated effectively and efficiently.

2-2-1-7 Grade Setting for Facilities and Equipment

Considering the above conditions, the scope, scale and technical level of equipment procurement and installation shall be compiled according to the following principles.

(1) Concept regarding the scope of facilities and equipment, etc.

To ensure a design that is both technically and economically appropriate, standard products corresponding to IEC and other international standards shall be procured as far as possible. Equipment model types shall be kept to a minimum for the sake of ensuring compatibility and the minimum necessary

equipment composition, specifications and quantities shall be selected.

(2) Concept regarding technical level

Specifications of the component equipment in the PV system shall be selected in conformance with the technical level of the MEC which will be responsible for operation and maintenance following completion of the Project.

(3) Scope regarding the scope of facilities and equipment

PV system equipment in the Project is to be installed on the roof of the Ward 2, Ward3 and external facility of Majuro Hospital which the government of Japan granted in fiscal year of 2005.

The hospital building had been handed over to the Marshall Islands, warranty inspection had completed after one year of completion of the work. PV modules plan to be installed on the top roof of the Ward 2 and 3 and external facilities. The power conditioners (1) plans to be installed electric distribution panel room in Ward 3, and the power conditioners (2) will be in the newly installed container house in the west side of the Ward 3. According to the discussion between the Survey team and MEC, the planned PV system output will connect directly to the high voltage side of 13.8kV Grid. New Step-up transformer for the Grid connection will be located at the east end of the present generator room in the hospital area. Moreover grid-connected point was set at the high voltage side of the present transformer of the hospital.

Both side agreed that Japanese will procure the material for Grid connection and Marshall Islands side will have responsibility for connecting work of the high voltage line to the Grid.

Warranty inspection after the installation of the equipment will cover the equipment and installation works according to the “work share point where the both sides have responsibility for.

2-2-1-8 Procurement and Construction Period

Equipment procured in Japan and other third countries will primarily be transported to the Marshall Islands by sea. The main port in the Marshall Islands is Majuro Port, and the transportation lead-time from Japan to here will be 30 days at the latest. Moreover, the distance from Majuro Port to the Project site at Majuro Hospital is roughly 2.2 km. Since Majuro Hospital is situated some 200m from the main road and this area and the scheduled land for the stockyard located in east side of the Project site are unpaved, cure such as tie in the stockyard will be needed in spite that there is any problems for large vehicles to enter the site. Since the Project target site of Majuro Hospital serves as a secondary medical care facility and also has primary medical care functions, it is used by a lot of citizens. In particular, since Ward 3, where it is planned to install the Project equipment, receives emergency patients, it adopts a 24 hour setup for receiving patients. Moreover, since Ward 3 contains inspection rooms, X-ray rooms and rooms fitted with precision instruments such as CT scanner, etc. that also require a sanitary environment, it will be necessary to take the utmost care explaining the works methods and implementation period to the hospital side and confirming

the works schedule in detail.

Furthermore, there are plans to expand Majuro Hospital under American financial assistance. These works are scheduled to begin at the start of 2010 although the plan still contains numerous undecided items, so it will be necessary to carefully coordinate the securing of the stockyard and timing of the works.

2-2-2 Basic Plan

2-2-2-1 Prerequisite of the plan

(1) Irradiance estimated

In Marshall Islands, there was no irradiance data originally collected. When a PV system is designed in such countries, irradiance data indirectly measured with the satellite of NASA is used usually. However, the irradiance data on the earth's surface which Japan Agency for Marine-Earth Science and Technology (JAMSTEC) has been measuring in Palau shows smaller by 17% than the data of NASA(The details refer to Outline of Field Investigation Result of Palau). Because it is conservative to use JAMSTEC data for a design evaluation, we assumed the 83% value of NASA data is horizontal global irradiation and determined to use the irradiance data as design parameters for estimation of the energy generated by a grid-connected PV system.

Table 2.2.2-1 Horizontal global irradiation as design parameter

Unit: kWh/m^2/day

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Horizontal global irradiation	4.37	4.86	5.07	4.89	4.70	4.41	4.44	4.67	4.50	4.27	4.05	4.02

Source: created by the Survey Team from NASA database

(2) Influence of shadow by obstacles nearby

If buildings, poles and trees, etc. cast a shade over the solar cell array, the amount of generated power will be reduced. The ratio of decline in generated power is not simply proportional to the area of shade but changes according to the shape and intensity (amount of light) of shade and the ratio of direct light to scattered light.

The Project intends to assemble a frame on the roof of Wards 2 and 3 at Majuro Hospital and to install the solar cell panels on this.

Wards 2 and Ward 3 comprise a single story building almost exactly on the north-south axis. There are no buildings or trees in the surrounding area that could cast a cloud on the PV panels, however, a penthouse measuring approximately 4 meters across by 5 meters long by 1.5 meters high exists on the roof of Ward 3 (see Photos 2.2.2-1 and 2.2.2-2). The layout of panels has been designed sufficiently apart from this structure to ensure that no shade is cast on the panels installed on the north and east sides of this structure between the hours of 08:00 in the morning and 16:00 in the afternoon. Figure 2.2.2-1 shows the results of

this examination.

Photographed by : The Survey Team

Photo 2.2.2-1 Exterior of Ward 2 and Ward 3

Photographed by : The Survey Team

Photo 2.2.2-2 Top roof of Ward 2 and Ward 3 and exhaust duct

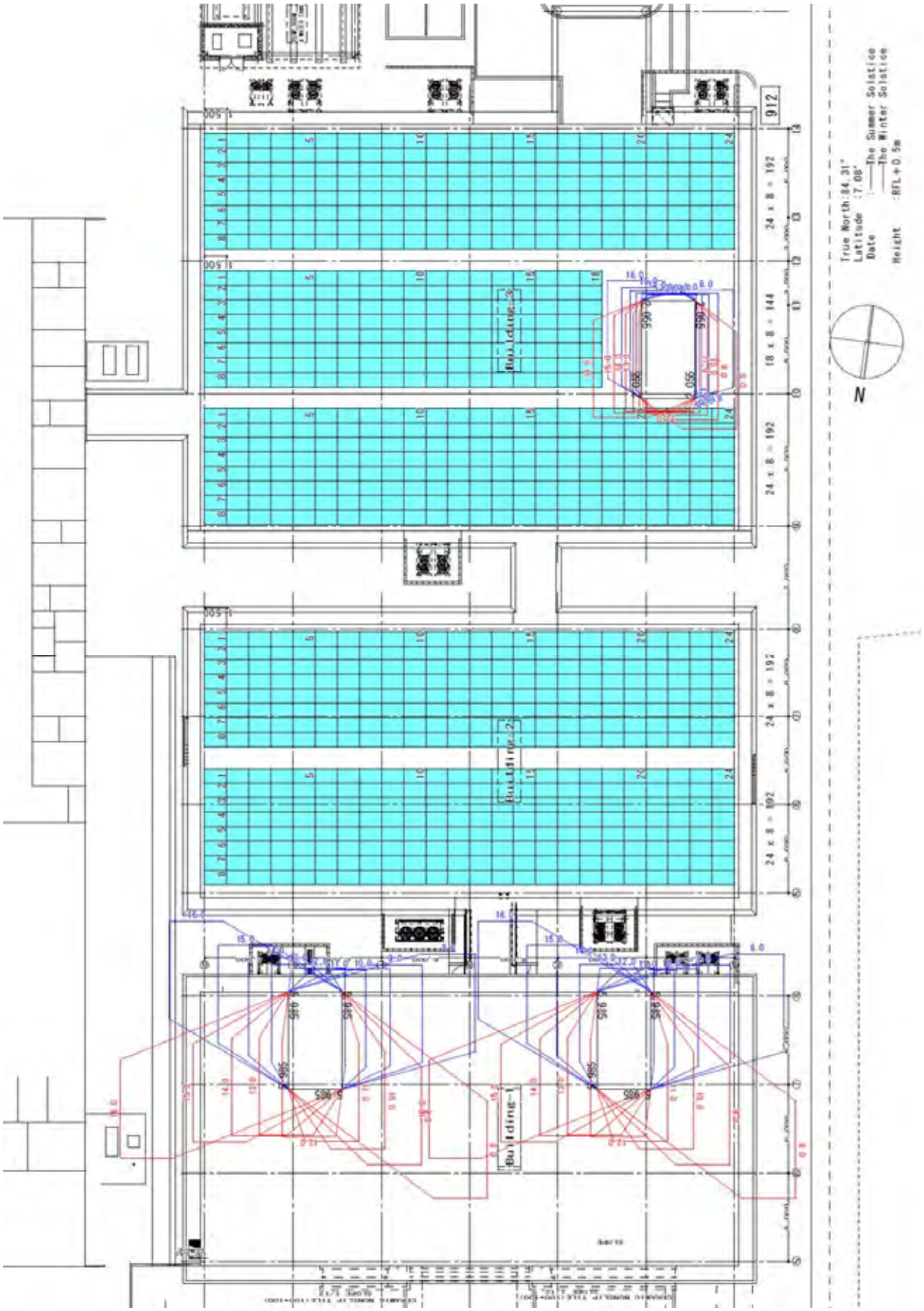


Figure 2.2.2-1 PV Panel layout Plan and influence of shadow

(3) Estimated generated-energy

As described in "(2) Influence of shadow by obstacles nearby," it is judged that there is no influence of shadow of the penthouse in the candidate site roof by considering PV layout placement. Thus, the reduction of the generated-energy by shadow is not considered in the following discussion.

For the calculation of the estimated generated-energy, the equation below is used. In addition, we suppose the setting face angle is 10 degrees from the PV layout in the candidate site to assume by this investigation, and use the inclined surface global irradiation calculated from the horizontal global irradiation that spoke (1) Irradiance estimated as monthly average irradiance. The capacity of the introduced grid-connected PV system is 205kW.

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

(Σ denotes the integrated value of the estimated generated-energies calculated month by month.)

where ・Ep = estimated annual generated-energy (kWh/year)

・H_A = monthly average inclined surface global irradiation ($kWh/m^2/day$)

・Gs = irradiance in standard condition (kW/m^2) = 1 (kW/m^2)

・K = loss factor = Kd * Kt * η_{INV}

* DC correction factor Kd: including loss corrections for soil on the solar cell surface and the fluctuation of solar irradiance, and correction for difference in characteristics of solar cells. Kd is set to 0.8 this time.

* Temperature correction factor Kt: correction factor for the variation of conversion efficiency caused by the temperature rise of solar cells by solar radiation.

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

where α: max. output temperature factor ($\% \cdot °C^{-1}$) = - 0.5 ($\%・°C^{-1}$) [crystals]

Tm: module temperature (°C) = Tav + ΔT

Tav: monthly average temperature (°C)

ΔT: module temperature rise (°C)

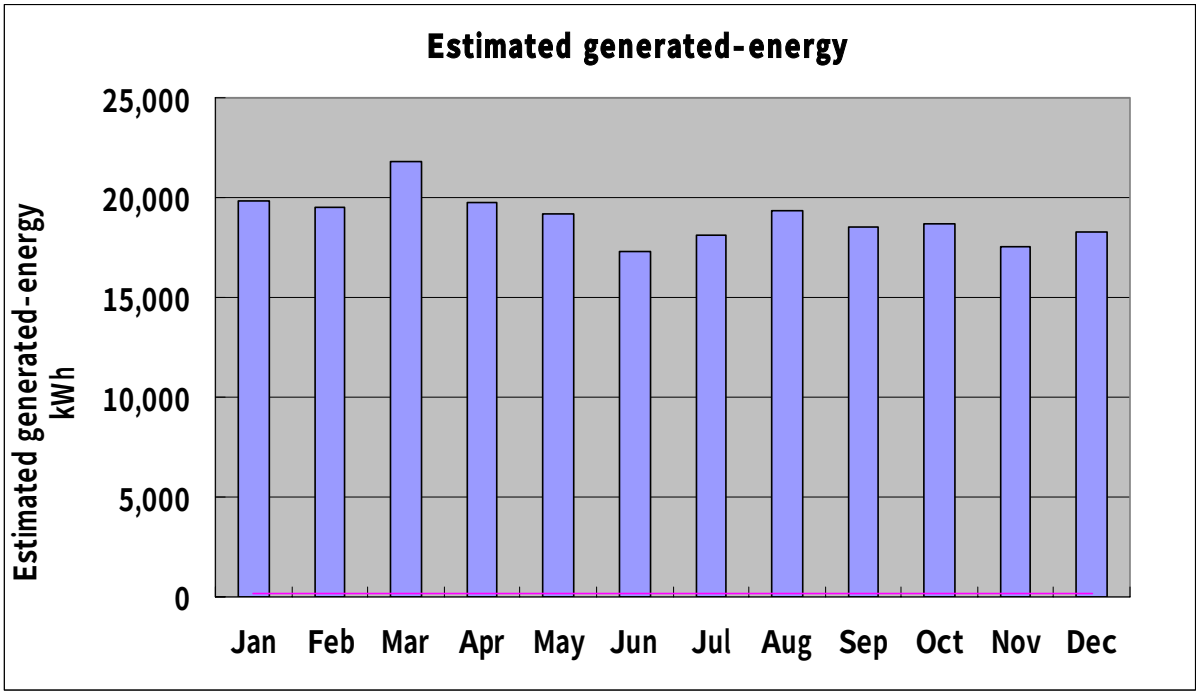
Backside open type	18.4
Roof installation type	21.5

* Inverter efficiency η_{INV}: AC/DC conversion efficiency of inverter. η_{INV} is set to 0.95 this time.

Table 2.2.2-2 Estimated annual generated-energy in Majuro Hospital

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual total
H_A:Inclined surface global irradiation [kWh/㎡/day]	4.59	4.99	5.04	4.72	4.43	4.12	4.17	4.46	4.41	4.31	4.19	4.23	-
Monthly days	31	28	31	30	31	30	31	31	30	31	30	31	365
Hm:Monthly intergrated irradiation [kWh/㎡]	142.3	139.7	156.2	141.6	137.3	123.6	129.3	138.3	132.3	133.6	125.7	131.1	1631.1
Average of daily maximum temperature [℃]	27.3	27.2	27.2	27.4	27.4	27.3	27.1	27.1	27.0	27.0	27.2	27.5	-
Kt:Temperature correction factor	0.8965	0.897	0.897	0.896	0.896	0.897	0.8975	0.898	0.898	0.898	0.897	0.896	-
Ep:Estimated generated-energy [kWh]	19,874	19,526	21,835	19,767	19,171	17,264	18,076	19,333	18,510	18,693	17,567	18,295	**227,911**

Source: created by the Survey Team



Source: created by the Survey Team

Figure 2.2.2-2 Estimated monthly generated-energy in Majuro Hospital

(4) Introduction model of grid-connected PV systems

The introduction models of a grid-connected PV system assumed under grant aid are shown in Table 2.2.2-3 ①and ② are the cases of introduction as the Marshall Islands' facilities, while ③ and ④ are the cases of introduction by private companies (other than public utilities corporations) or citizens as their own facilities. By this investigation and the discussion with the Marshall Islands side, the followings were decided. The target site of this program is Majuro Hospital, of which the competent authority is Ministry of Health (hereinafter called "MOH"). The Marshall Islands becomes the owner of the facilities through MRD, and MEC which has contracted a franchise agreement about O&M of renewable energy facilities with MRD, takes charge of the O&M in the same manner as ordinary power equipment. This introduction model is equivalent to ①, but, from a point of view to propel a climate change adaptation plan by the PV system introduction for the whole country of Marshall Islands, it was confirmed that the rental

expense to the hospital side don't occur in discussion with MOH. In this introduction model, as MEC carries out O&M of the grid-connected PV system introduced under grant aid, it can acquire design / operation knowhow of the grid-connected PV system, and build up sufficient experience to discuss and evaluate its economic efficiency. Therefore, this is considered to be an ideal style, also from the viewpoint of introduction and dissemination of grid-connected PV systems after this grant aid.

Table 2.2.2-3 Expected models of the introduced grid-connected PV system in Marshall Islands

No.	Introduction model	Installation site	PV facility owner	Characteristics, issue, requirement, etc.
①	Marshall Islands installs PV facilities in its building as its facilities.	Building, etc. of Marshall Islands	Marshall Islands	• Because both PV facilities and surrounding ones are Marshall Islands', PV installation design is easy. • Flexibility in PV installation location.
②	Marshall Islands installs its PV facilities on the roof, etc. of the building of other entity, renting the place.	Building, etc. of other entity	Marshall Islands	• Constraint in PV installation place may exist. Rent will be needed. • Consultation on O&M and security is needed. • Negotiation on electricity tariff considering rent, etc. is needed.
③	A building owner installs PV facilities as its power source, and sells surplus energy to MEC.	Building, etc. of other entity	Owner of building, etc.	• Because the facilities are used for private purpose regularly, reverse power flow of surplus energy is small, and thus influence on distribution lines is small. •Technical requirements on equipment to be added for grid connection, such as protective equipment, should be decided based on impartial standards such as guidelines. • Surplus energy purchase system should be prepared.
④	A building owner etc. installs PV facilities for wholesale power supply to MEC.	Building, etc. of other entity	Owner of building, etc.	• In the case large-scale PV facilities are connected to an existing distribution line, addition of overvoltage prevention equipment, etc. should be considered in advance. • System for wholesale power transaction should be prepared.

Source: created by the Survey Team

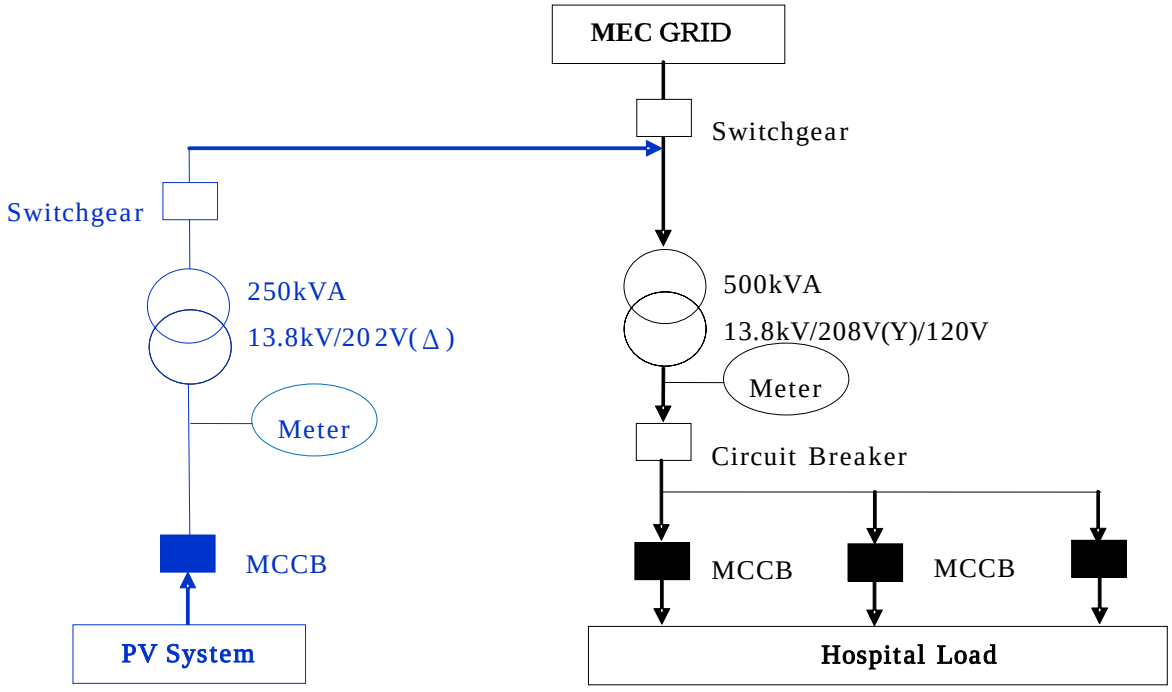
Moreover, in the case where the PV system is connected to the grid, the following models can be considered:

① Connection with low voltage distribution lines	Low voltage distribution lines for supplying power to low voltage consumers: For example, single phase 3 wire: connect to 100V; 3 phase 3 wire: connect to 100V/200V; 3 phase 3 wire: connect to 200V; and 3 phase 4 wire: connect to 100V/200V
② Connection with high voltage distribution lines	Connect to high voltage distribution lines which serve to supply power from distribution substations for supplying to high voltage consumers, via a transformer to low voltage consumers. Generally, connect to 3 phase 3 wire 6.6kV lines or dedicated lines installed with the aim of supplying power to specific consumers.
③ Connection with special high voltage lines	・・・ Connect to special high voltage distribution lines (greater than 7kV) for supplying power to special high voltage consumers.

Majuro Hospital, which is the target facility for installing PV system in the Project, is regarded as an important consumer by the MEC and uses electric power that is brought down to 208V via a transformer (500kVA) after being transmitted along a 13.8kV distribution line (Feeder No. 3).

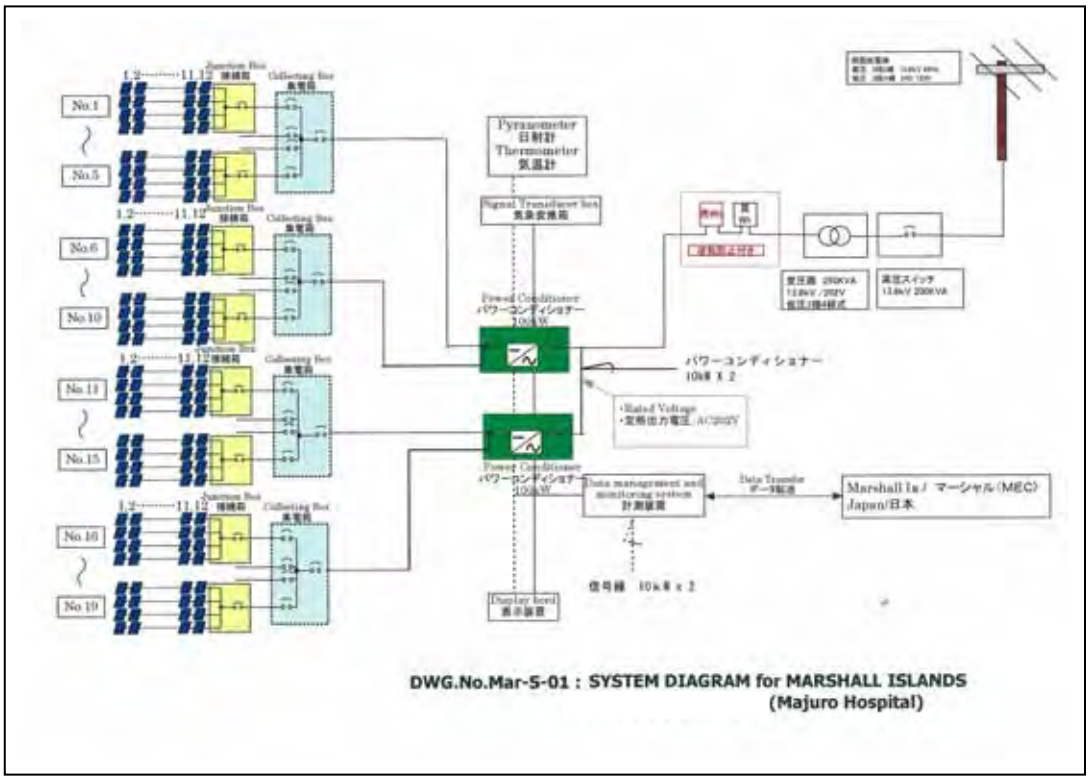
In the Study, examination was conducted on two cases for connecting the PV system to the grid: 1) the case in which the system is connected to the electric panel (low voltage 208V) that supplies electricity to Wards 2 and 3, and 2) the case where the system is directly connected to the 13.8kV distribution line. Taking the impact on the hospital's power load, the ease of connection works and maintenance into account, it was decided to adopt the method of connection to the 13.8kV distribution line. Figure 2.2.2-3 shows the grid connection point of the PV system.

The transformer (250kVA), switchgear and distribution high voltage cable leading to the existing switchgear (hospital receiving side) will be procured on the Japanese side, while the Marshall Islands side (MEC) will procure the connections and components (double bushing, etc.) necessary for connecting to existing switchgear.



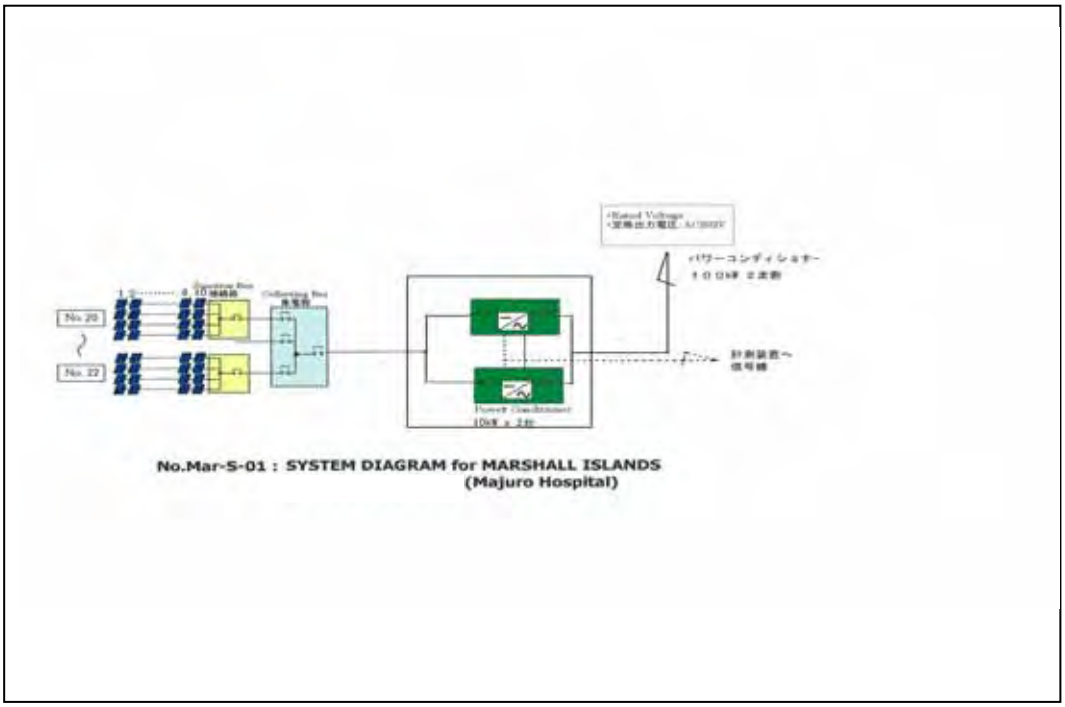
Source: created by the Survey Team

Figure 2.2.2-3 System interconnection point of the PV system



Source: created by the Survey Team

Figure 2.2.2-4 System Diagram for PV system(1)



Source: created by the Survey Team

Figure 2.2.2-5 System Diagram for PV system(2)

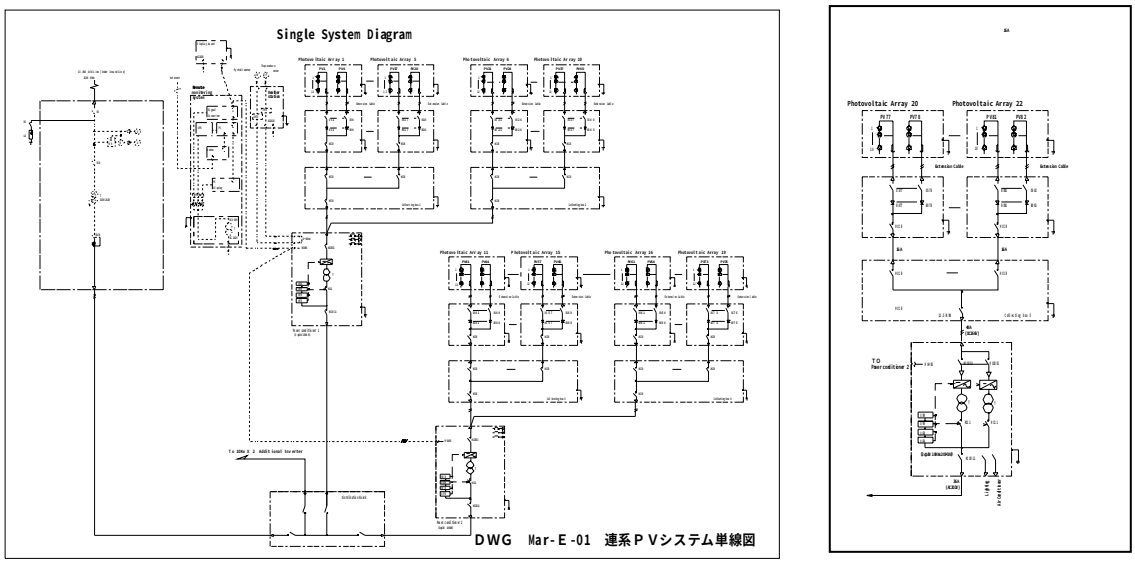


Figure 2.2.2-6 Single line Wiring Plan for PV system

(5) Laws and regulations required for introduction of a grid-connected PV system

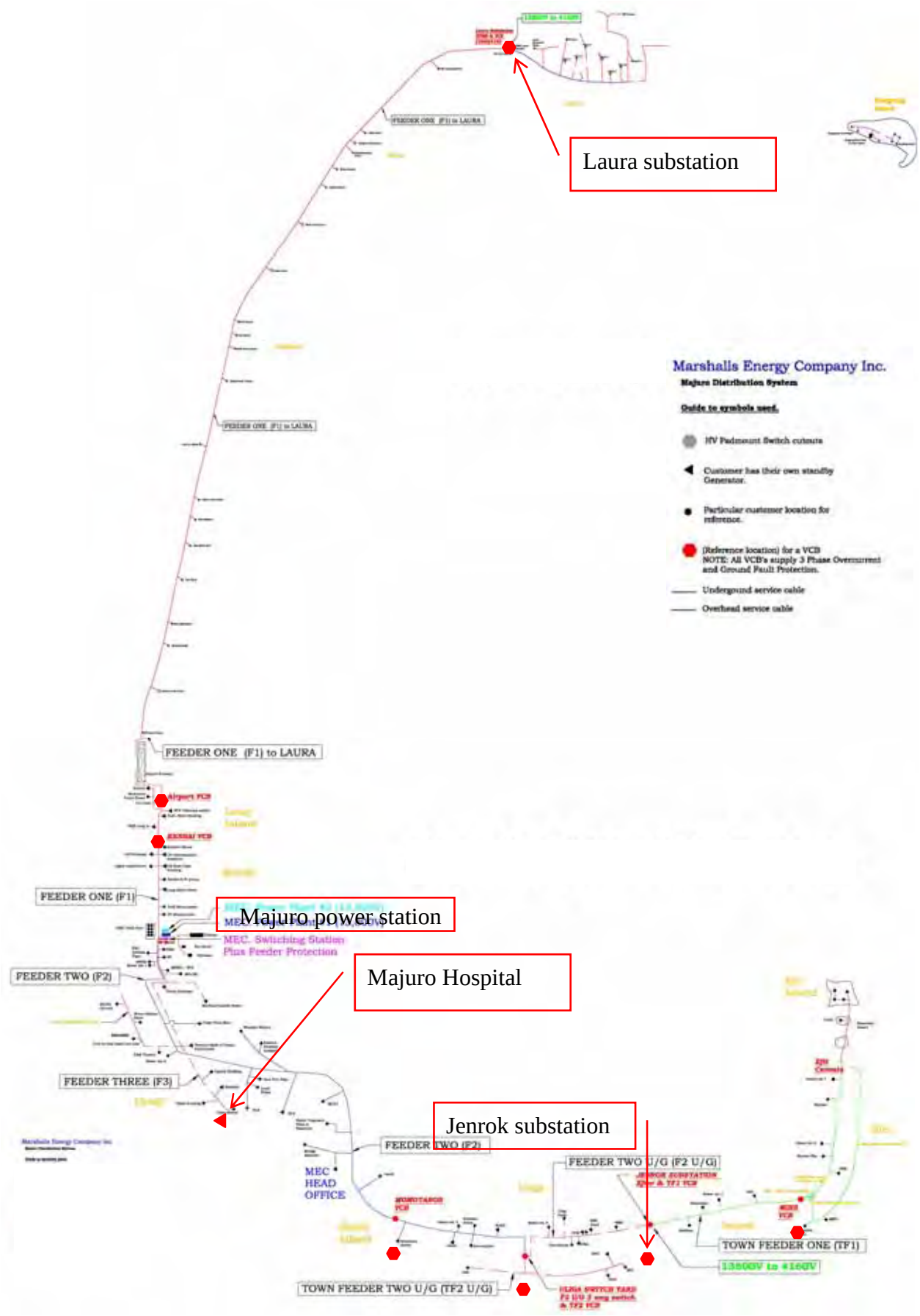
Laws and regulations required for introduction of a grid-connected PV system, which is the target facility of this program, were ascertained. Consequently, as shown in Table 2.2.2-4, securing the power quality of the existing grid, public safety, etc. is extracted as check items in "technical aspects," while how to treat the amount of generated-energy of the introduced PV system, and agreements on the O&M system of it are extracted as check items in "institutional aspects."

Table 2.2.2-4 Check items in laws and regulations when the grid-connected PV system of this project is introduced

Requisites to be checked	
Technical aspects	Power quality: whether or not there are regulations on the influence of the introduced PV system on the electricity of the existing grid (voltage, frequency, flicker and harmonics).
	Safety protection: requisites to be especially considered to secure safety, such as a protective relay to be added for the grid-connection
	Grid connection point: requisites on classification regarding the grid-connection voltage class (high-voltage or low-voltage connection), and on the facilities for connection
Institutional aspects	Approvals and licenses on installation of generation facilities, and regulations on installation contractors and reverse power flow
	Measuring method for energy generated by a grid-connected PV system, and how to treat the amount of generated-energy and electricity tariff.
	O&M organization and system for the introduced PV system.

Source: created by the Survey Team

For power quality (voltage, frequency, flicker and harmonics), it was confirmed that there were definite standards for voltage shown below in Marshall Islands, but there were no standards for frequency, flicker and harmonics at present.



Source：created by the survey team based on materials from MEC

Figure.2.2.2-7 Distribution System single-diagram of Majuro city

<Voltage standards>

- LV : 120V±5%, 208V±5%
- HV : 13.8kV±5%

For safety protection, it was confirmed that there was no particular equipment (protective relay, etc.) that must be added specially for the grid-connection. However, considering prevention of facility damage by the ripple effect of an accident, and securing of public safety, it was determined to adopt an islanding prevention function.

For the grid connection point, it was confirmed that there was no power-receiving voltage class based on demand scale. Due to restriction on the existing facilities on this project site, etc., high-voltage connection was chosen.

For the approvals and licenses on the installation of generating facilities, it is not required here because the facilities introduced this time will be owned by the Marshall Islands through MRD. For reverse power flow, the power flow will all enter the distribution line directly in this case, not passing through the facilities of consumers. However, it was confirmed that there was no institutional problem because the facilities will be owned by the Marshall Islands.

For the O&M organization and system, we will establish the system in collaboration with the Marshall Islands side, carrying out technology transfer on elements concerning O&M in the soft-component.

As mentioned above, it is judged that no preparation for the law and regulations is required for the grid-connected PV system introduced in this project. If a law or institution against which we must take measures is laid down in Marshall Islands in the future, we need to do it. However, it was agreed that the Marshall Islands side had the responsibility to do it in such a case.

(6) Necessity of enhancing the distribution system

When the necessity of enhancing the distribution system is examined, the following two points should be considered after the grid-connected PV system is introduced.

① Distribution facilities (transformers and distribution lines) on the upstream of the grid connection point do not become overloaded.

② Distribution line voltage at the grid connection point does not go out of the control standard range.

The target site of this project is “Majuro Hospital,” and the capacity of the introduced grid-connected PV system is 205kW. As shown in Fig. 2.2.2-7, Majuro Hospital is supplied with power from the Majuro power station by 13.8kV distribution line (#3 feeder). In addition, the grid-connection point assumes it the 13.8kV high-voltage distribution line (the load side of the existing switchgear of the site)

①Distribution facilities (transformers and distribution lines) on the upstream of the grid connection point do not become overloaded.

The installed capacity of the grid-connected PV system installed in Majuro Hospital is 205kW. Considering the output decrease by the temperature rise of the PV module, the efficiency of the inverter, etc, it is assumed that the maximum PV generation output is about 164kW and the maximum current from the

introduced grid-connected PV system to 13.8kV distribution line is about 6.9A. Under the most severe assumption that the magnitude of the reverse power flow into the existing grid is the maximum generation output of the grid-connected PV system, it was confirmed that the distribution facilities (transformers and distribution lines) on the upstream of the grid connection point did not become overloaded.

Majuro Hospital is supplied with power from Majuro Power Station by the 13.8kV underground distribution line, and 2/0 AWG copper wire (67mm^2) is used for the distribution line and its allowable current is 225A, as shown in Table 2.2.2-5.

Therefore, "the reverse power flow current at the maximum PV generation output" 6.9A ≦ "the minimum allowable current in the distribution feeder for grid connection" 225A. Since the condition is satisfied, it is judged that there is no problem in the capacity of the existing distribution lines.

Table 2.2.2-5 Distribution line from Majuro Power Station to Majuro Hospital

Power station	Underground Distribution line	Type of wire	Allowable current
Majuro power station	13.8kV	2/0 AWG copper wire (67mm^2)	225A

Source: created by the Survey Team based on a hearing survey in MEC and American Wire Gauge (AWG)

②Distribution line voltage at the grid-connection point does not go out of the control standard range.

In this examination, it suffices to confirm that the power-receiving voltage at the closest general low-voltage customer does not go out of the control standard range, considering the distribution line from Majuro power station to the grid-connection. In the examination, it should be confirmed that when reverse power flow occurs from the grid-connected PV system to the existing grid under an ordinary light load condition, the power-receiving voltage at the closest general low-voltage customer does not exceed the upper limit of the control standard range. For that purpose, data of the type, size and allowable current of the wires, and that of the load of the target distribution line under a light load, etc., are necessary. The load management conditions of MEC were surveyed in this investigation. Consequently, it was found that these necessary data had not been acquired in Marshall Islands and the examination at a light load was difficult. In this examination, therefore, under a severer condition where all loads are disconnected from the distribution line, in other word, under a condition where reverse power flow occurs from the grid-connected PV system to the no-load distribution line, it is confirmed that the power-receiving voltage at the closest general low-voltage customer does not exceed the upper limit of the control standard range. Here, the examination is done based on the sending end voltage at Majuro power station, which is the start point of the distribution line.

Majuro Hospital is supplied with power from Majuro power station with 13.8kV underground distribution line, and the distance between them is about 2km. 2/0 AWG copper wire (67mm^2) is used for the 13.8kV distribution line, its resistance is used for AWG (American Wire Gauge) in Marshall Islands. The PV generation output is the rated output with a power factor of 1.0. As for the standard voltage, the

standard of Marshall Islands (208V±5%) is used. Under these conditions, it is confirmed that the power-receiving voltage at the closest general low-voltage customer does not go out of the control standard range.

Table 2.2.2-6 Examination result on the distribution line voltage at the grid-connection point and the closest general low-voltage customer

Distance between Majuro power station to Majuro Hospital	Sending end voltage	Type of line	Resistance [Ω/km]	Reverse power flow current from PV	Voltage rise at high voltage	Power-receiving voltage at the closest low-voltage customer
1.98km	13.8kV	2/0 AWG ($76mm^2$)	0.255	6.9A	3.5V	208.2V

Source: created by the Survey Team based on a hearing survey in MEC

The result of this examination shows that the power-receiving voltage at the closest general low-voltage customer is 208.2V when reverse power flow occurs from the grid-connected PV system to the no-load distribution line. Since the value is lower than the upper limit of the control standard range (218V), it is judged that there is no problem.

Based on the above examination results, it is judged that enhancement of the distribution system is not needed.

(7) Examination on power quality

When a grid-connected PV system is introduced, power quality should be examined in parallel with examination on the necessity of distribution system enhancement. “Flicker” and “harmonics” are considered to be the examination items concerning power quality. However, as a result of a hearing investigation in MEC, it was found that there were no definite power quality standards currently. In addition, it is judged that there would be no generation sources of these two items because there are no big factories in the grid of Marshall Islands. Thus, the examination on power quality was omitted in this study. As for harmonics, however, measures against it have been already taken in general purpose grid-connection inverters in Japan. Thus, it was determined that the specifications pursuant to the Japanese guidelines on harmonics suppression measures should be demanded as the specifications for the target facilities of this project.

(8) Allowable capacity of the introduced grid-connected PV system

The output of a PV system fluctuates according to the fluctuation of solar radiation. In the case a PV system is connected to a grid, it is required to verify that the fluctuation component can be absorbed by controlling the existing generating system, and the power quality can be maintained within the standard range. Here, it is examined whether or not a capacity of 205kW, which is the total capacity of the grid-connected PV systems that are planned to be introduced in this project, can be introduced into the existing grid. The examination method is as follows: The allowable capacity of the introduced

grid-connected PV system, against the existing grid, is calculated, and whether or not the allowable capacity is larger than the actual system capacity is checked.

In view of securing power quality, the following two methods are considered as the examination methods on the allowable capacity of the introduced grid-connected PV system against the existing grid:

Step 1: Examination on restrictions in view of grid operation

Step 2: Examination on restrictions in view of distribution line operation

With regard to Step 2, as examined in "6) Necessity of enhancing the distribution system," it is judged that there is no restriction in view of distribution line operation. Hence, the examination result on Step 1 is explained below.

Step 1: Examination on restrictions in view of grid operation

Majuro Hospital is supplied with power from Majuro power station. The operation method of the diesel generator in the plant was checked. Consequently, because switch-on/off of the generator, the adjustment of output (frequency) and voltage are manually conducted by the operator according to an empirical rule, it is considered to be difficult to quickly respond to the output fluctuation of the introduced PV system caused by weather change. In this examination, therefore, evaluation is done based on the governor-free control of the diesel generators operating regularly at a light load, which is the severest condition. (see Table 2.2.2-7. Usually Rated6.4MW *2 units in #2 power station operate. As for two of the five units in #1 power station, they are stopped for repairing plan, the others are going to operate at a heavy load or when either two units in #2 power station. The examination condition adopted here is the severest operation condition observed during the investigation.)

For frequency, there is no definite standard value in Marshall Islands, although, according to the data of the operation records of Majuro power station (see figure 2.2.2-8) which we obtained from MEC, the fluctuation is at least around ± 4%, the examination on allowable capacity of the introduced grid-connected PV system is done using the frequency deviation target value in Japan, 60±0.2Hz (±0.3%), which is a severe value as power quality.

As for the maximum load fluctuation, according to the power station load data (see figure 2.2.2-9), the value can be assumed to be about 400kW

As a result of a hearing survey at the power station, it was known that the drooping rates of diesel governors were all set to 3.5% in diesel generators operating regularly at a light load (Available output:5.0MW*2units), as shown in Table 2.2.2-7. Therefore, considering that the frequency deviation target value is 60±0.2Hz (±0.3%) the allowable output fluctuation range during the governor-free operation is:

10,000kW ＊ (0.3% / 3.5%)　857kW.

The following relationship should be satisfied.

Fluctuation of PV generation output (kW) + Fluctuation of demand (kW) ≦ Allowable output fluctuation of diesel generators operating regularly at a light load (kW)

Thus, the allowable fluctuation of the PV generation output is calculated as follows:

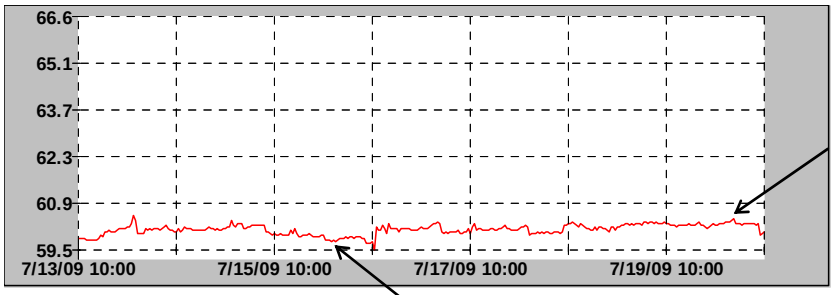
Allowable fluctuation of the PV generation output ≦ 857kW －400kW ＝ 457kW

Assuming that the fluctuation range of the PV generation output is 10 to 90% of the rated capacity based on the past verified examples, the allowable capacity of the introduced grid-connected PV system into the existing grid is calculated to be about 570kW. From this result, and considering the system of 60kW which have been introduced at CMI (it is going to complete in 2010 with about 200kW), it was confirmed that there was no problem in the grid-connected PV system of 205kW that would be introduced by this project.

Table 2.2.2-7 Operation situation of the diesel generator of Majuro power station

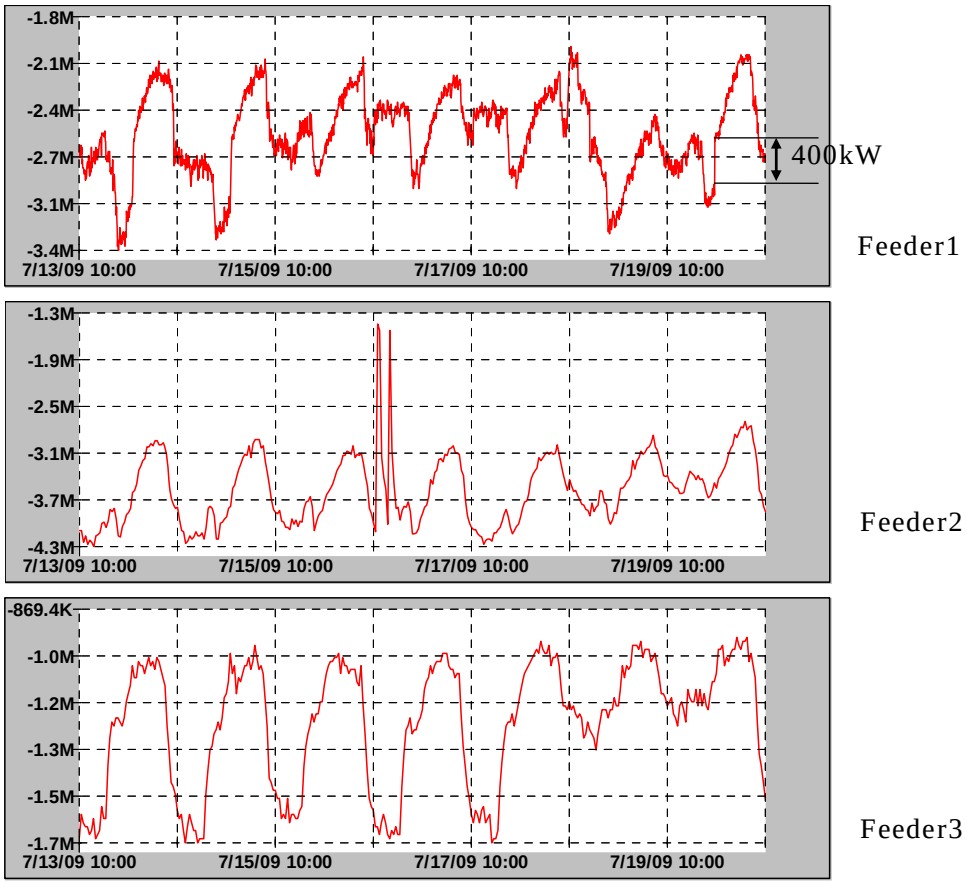
Power Station	Generators (Operational status)	Manufacturer	Operation(July 2nd, 2009)		Rated Output [kW]	Available Output [kW]
			Off peak	Peak		
Majuro Power Station #1	#1(Governor Free)	Peilstick	-	Operation	2,500	1,800
	#2(Governor Free)		-	Operation	2,500	2,400
	#3(Inavailable at present)		-	-	2,500	0
	#4(Inavailable at present)		-	-	2,500	0
	#5(Governor Free)	Catapillar	-	Operation	3,300	1,800
Majuro Power Station #2	#6(Governor Free)	Deutz	Operation	Operation	6,400	5,000
	#7(Governor Free)		Operation	Operation	6,400	5,000
Total Capacity [kW]		-	-	-	**26,100**	**16,000**

Source: created by the Survey Team based on a hearing survey in MEC



Source: MEC

Figure.2.2.2-8 Frequency at Majuro power station



Source: MEC documents

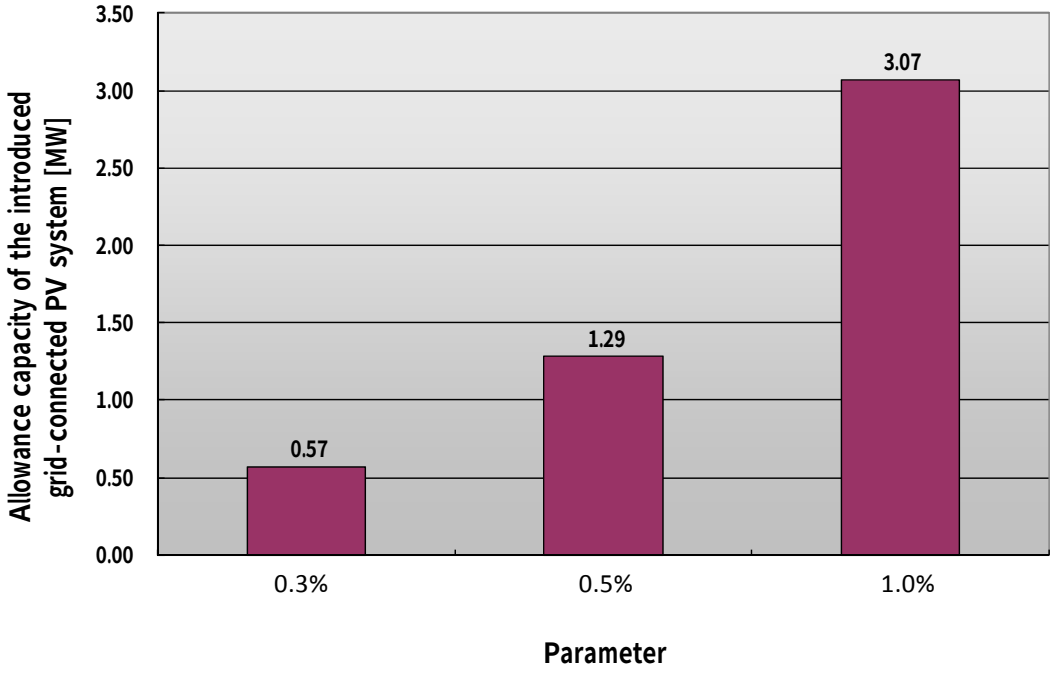
Figure.2.2.2-9 Load of Feeders at Majuro power station

This examination was done based on the frequency deviation target value in Japan, which was a severe value as power quality. The allowable capacity of the introduced grid-connected PV system changes by the change of the target value. Thus, a sensibility analysis was conducted using the allowable frequency fluctuation rate as the parameter. The values below were used for the parameter. (see figure 2.2.2-10)

①60±0.2Hz (±0.3%): frequency deviation target value in Japan

②60±0.3Hz (±0.5%): medium value

③60±0.6Hz (±1.0%): frequency deviation target value in Thailand and Malaysia, where relatively sophisticated electricity infrastructures have been constructed in Southeast Asia



Source: created by the Survey Team

Figure 2.2.2-10 Relationship between the allowable frequency fluctuation rate and the allowable capacity of the introduced PV generating system

2-2-2-2 Overall Plan

The scale and specifications of the Project facilities and equipment shall be planned according to the following conditions.

(1) Climate and Site Conditions

Table 2.2.2-8 Climate and Site Conditions

(a) Altitude	3m
(b) Ambient temperature (maximum)	33.0˚C
(c) Ambient temperature (minimum)	23.0 ˚C
(d) Relative humidity (maximum)	80 %
(e) Monthly maximum rainfall	300mm
(h) Maximum wind velocity	37 m/s

Source: SAWARS

(2) Electrical System Conditions

① Distribution voltage: (Intermediate voltage) 3 phase 3 wire 13.8 kV (maximum 14.52 kV)
(Low voltage) 3 phase 4 wire 208-120 V

② Frequency: 60 Hz

③ Maximum shorting capacity: 13.8 kV system, 12.5 kA A

④ Ground line: 13.8 kV, neutral point multiple grounding

⑤ Ground resistance: 10 Ω or less

⑥ Color: IEC standard (red, white, blue, black)

(3) Facilities Plan Conditions

The PV module frame in the Project will be installed on the roof of Majuro Hospital. Accordingly, the minimum required support frame will be designed upon considering the roof bearing capacity and panel layout that enables the maximum possible electric energy to be obtained from the natural conditions. Moreover, in view of the voltage drop and underground cable laying work between the PV module and power conditioner, the layout plan shall be designed so that the shortest possible distance to the existing electric room is obtained.

2-2-2-3 Outline of the Basic Plan

(1) Basic Plan

Table 2.2.2-9 shows the basic plan of the Project based on the basic design concept described above (see 2-2-1).

Table 2.2.2-9 Outline of the Basic Plan

	Procurement and installation of the following PV equipment	Quantity
Equipment procurement and installation Plan	PV modules	1 set
	PV module installation frame	1 set
	Power conditioner	1 set
	Grid connection transformer	1unit
	Display unit	1 set
Equipment procurement plan	PV system exchange parts, maintenance tools and test apparatus	1 set

(2) Equipment Procurement Quantities

The quantities of the main equipment to be procured in the Project are as shown in Table 2.2.2-10.

Table 2.2.2-10 Quantities of Major Equipment

	Procurement and installation of the following PV equipment	Quantity
Equipment procurement and installation plan	PV modules	972units
	PV module installation frame	1 set
	Junction box	22
	Current collection box	5
	Power conditioner	2(100KW)+ 2(10KW)
	Grid connection transformer	1 set
	Display unit	1 set
	Instrumentation	1 set
	Wiring materials, grounding work materials	1 set
Equipment procurement plan	PV system exchange parts, maintenance tools and test apparatus	1 set

Concerning the works replenishment quantity, the design quantity shall be multiplied by the replenishment factor upon considering breakages, etc. during ocean and inland transportation and installation. The replenishment factor will be decided in consideration of experiences in similar overseas works. In the case of PV power generation, since an unexpected failure in just one panel can prevent power generation in a whole string of connected panels, it is difficult to guarantee performance. Since the project will be implemented under the Government of Japan's Program Grant Aid for Environment and Climate Change scheme, the design quantity multiplied by 3% (replenishment amount) shall be procured to ensure that the installation work is finished in a short time and that performance following installation is guaranteed.

(3) Outline Specifications of Equipment

Existing standards in the Marshall Islands will as far as possible be applied to the PV and distribution equipment procured and installed by the Japanese side. In addition to paying attention to the ease of equipment operation and maintenance following completion of the Project, the number of specification items will be limited and standard design models will be adopted with a view to reducing the installation time.

It is planned to construct steel frame and to install PV module of major equipment on the top roof of the hospital, however taking into consideration that construction limitation such as weight and installation space, maintenance in the future, reduction of replacement work for PV module body as possible, Crystalline silicon type PV module, which is long-term durable, high effective and longlife expected high reliability shall be procured and installed.

Table 2.2.2-11 PV Module Specifications

Equipment	Specifications	Required Specifications
1. PV modules	(1) Applicable standard	IEC and equivalent standards
	(2) Environment of use	Salt damage area
	(3) Ambient temperature	+40℃ or less
	(4) Installation method	Car park roof installation
	(5) Type	Crystalline silicon
	(6) Module efficiency	12% or higher
	(7) Module capacity	100W/sheet or more

Table 2.2.2-12 PV Module Installation Frame Specifications

Equipment	Specifications	Required Specifications
2. PV module installation frame	(1) Support method	Steel frame
	(2) Environment of use	Salt damage area
	(3) Material	SS400 hot dip zinc finish or equivalent quality

Table 2.2.2-13 Junction Box Specifications

Equipment	Specifications	Required Specifications
3. Junction box	(1) Structure	Outdoor, vertical standing type
	(2) Environment of use	Salt damage area
	(3) Ambient temperature and humidity	+40℃ or less, 80% or more
	(4)Maximum input voltage	String unit nominal open voltage (Voc) or more
	(5) Input circuits	Number of sub-array unit parallel lines or more
	(6) Input current	Module nominal shorting current (ISC) per circuit or higher
	(7) Output circuits	1 circuit
	(8) Output current	Module nominal shorting current (ISC) or higher
	(9) Internal devices	- Wiring circuit breaker: Number of circuits - Reverse flow prevention diode: Each string - Induced lightning protector: All input and output circuits, between wires, between earth

Table 2.2.2-14 Collecting Box Specifications

Equipment	Specifications	Required Specifications
4. Current collection box ※1 junction box; or this can be omitted if the number of power conditioner input circuits exceeds the number of junction boxes.	(1) Structure	Outdoor, vertical standing type
	(2) Environment of use	Salt damage area
	(3) Ambient temperature and humidity	+40℃ or less, 80% or more
	(4)Maximum input voltage	String unit nominal open voltage (Voc) or more
	(5) Input circuits	Condensed number of junction boxes or more
	(6) Input current	Junction box output current or more
	(7) Output circuits	1 circuit
	(8) Output current	Sub-array nominal short circuit current x Number of input circuits or more
	(9) Internal devices	- Wiring circuit breaker: Number of circuits - Induced lightning protector: All input and output circuits, between wires, between earth

Table 2.2.2-15 Power Conditioner Specifications

Equipment	Specifications	Required Specifications
5-1. Power conditioner(1)	(1) Structure	Indoor, vertical standing type
	(2) Ambient temperature and humidity	+40℃ or less,80% or less
	(3) Main circuit system	Self exciting voltage
	(4) Switching system	High frequency PWM
	(5) Insulation system	Commercial frequency insulation transformation Non-insulation (no-transformation) permitted only in cases of small capacity
	(6)Cooling system	Forced air cooling
	(7) Rated input voltage	String maximum output voltage (Vpmax) or thereabouts
	(8) Input operation voltage range	The string maximum output voltage (Vpmax) and nominal open voltage (Voc) shall be within range.
	(9) Input circuits	The number of current collection boxes or more
	(10) Output electricity system	3 ϕ 3W
	(11) Rated output voltage	AC202V
	(12) Rated frequency	60Hz
	(13) AC output current distortion factor	General current 5% or less, each sub-wave 3% or less
	(14) Power control system	Maximum output follow-up control
	(15) Rated power conversion efficiency	90% or more
	(16) Control functions	- Automatic start/stop, soft start - Automatic voltage adjustment - Leading reactive power control or output control function (with backflow, only when there is risk of voltage deviation)

Equipment	Specifications	Required Specifications
	(17)Grid-connected protective functions	- Over voltage (OVR) - Under voltage (UVR) - Over frequency (OFR) - Under frequency (UFR) All permanent values, with timed variation
	(18) Islanding operation detection function	- Active type (at least 1 mode out of the following): ① Frequency shift system ② Active power fluctuation system ③ Reactive power fluctuation system ④ Load fluctuation system - Passive type (at least 1 mode out of the following): ① Detection method for power phase jump ②Detection method for sudden increase in third harmonic voltage ③Detection method for frequency change rate

Equipment	Specifications	Required Specifications
5-2.Power conditioner(2)	(1)Basic Standard	JIS、JEM、The Guideline of Quality Control for Grid Connected Electrical Equipment Engineering Standard, Standard Specification for Public Building Works
	(2)General Specification	
	1) Enclosure type	-Indoor use (Ground mount type)
	2)Main circuit system	-Self-excited voltage inverter
	3)Switching method	-High-frequency PWM (Pulse width modulation control)
	4)Insulation method	-Commercial frequency insulation transformer type
	5)Cooling method	-Forced air cooling
	(3)Electrical Specification	
	1)Rated Capacity	-10kW or more
	2)Nominal input voltage	-DC 300V
	3)Maximum allowable input voltage	-DC 500V
	4)Operation input voltage Range	-DC 240～450V
	5)Maximum power point tracking range	-DC 240～420V
	6)Nominal output voltage	-AC 202V (3 phase 3 wires)
	7)Nominal output voltage	-AC 202V
	8)Harmonics for AC output current	-Overall current: 5% or less, each order: 3% or less
	9)Power control method	-Maximum Power Point Tracking (MPPT)
	10) Efficiency	More than 90%
	11)Control Function	-Automatic start / stop with soft-start

Table 2.2.2-16 Transformer Specifications

Equipment	Specifications	Required Specifications
6. Grid-connected transformer	(1) Structure	Outdoor, Cubicle
	(2) Ambient temperature and humidity	+40℃ or less, 80% or more
	(3) Primary voltage	3 ϕ 3W 13.8KV
	(4) Secondary voltage	3 ϕ 3W AC202V
	(5) Frequency	60Hz
	(6) Capacity	250KVA
	(7) Wire connection method	△-△

Table 2.2.2-17 Instrumentation Specifications

Equipment	Specifications	Required Specifications
7. Instrumentation	(1) Actinometer	
	1) Applicable standard	ISO9060 Second class or equivalent
	2) Sensitivity	6～8 mV/(W･m^2)
	(2) Thermometer	
	1) Type	Measurement resistor Pt100Ω 4wire
	2) Shape	With basic shelter
	3) Temperature range of use	-40℃～＋60℃
	(3) Weather converter	Outdoor wall hanging type
	1)Structure	SS400 hot dip zinc finish or equivalent quality
	2) Material	Actinometer (0-10mV), thermometer (Pt100Ω)
	3) Input signals	4-20mA×2
	4) Output signals	AC120V
	5)Power source	Actinometer signal converter, thermometer signal converter, wiring circuit breaker, induced lightning protector
	6) Housed equipment	
	(4) Instrumentation monitoring device (site side)	6 seconds
	1)Data measuring method	Inclined plane solar intensity, temperature, generated electric energy
	- Measurement cycle	Instrumentation monitoring device
	- Data collection items	Serial signal converter (RS485 → RS232C conversion)
	2) Used devices	Uninterrupted power supply (to counter instantaneous stoppage)
		Instrumentation monitoring device box
		Instantaneous value display, graph and form display
	3) Soft specifications (server side)	Power conditioner operating state, interference information display
		Saving of power conditioner protective device configuration information

Equipment	Specifications	Required Specifications
	(5) Remote monitoring system 1) Specifications - Site side data control - Data viewing - Data download 2) Data viewing privilege	 Site side data is transmitted to the server and data is saved on a dedicated server. Web browser display via the internet Form data download and display and printing of forms and graphs Registered user and password control

Table 2.2.2-18 Electric Wire Specifications

Equipment	Specifications	Required Specifications
8. Wiring materials Module ~ Junction box	 (1) Applicable standard (2) Model (3) Size	 IEC, JIS or an equivalent standard ① HEM－CE cable single end (+) with connector ② HEM－CE cable single end (- with connector ③HEM－CE cable single end (+)(-) with connector ① 3.5sq-1C ② 3.5sq-1C ③ 3.5sq-1C
Junction box ~ Current collection box	(1) Applicable standard (2) Model (3) Size	IEC, JIS or an equivalent standard 600V CVD 22mm^2
Collecting box ~ Power conditioner	(1) Applicable standard (2) Model (3) Size	IEC, JIS or an equivalent standard 600V CV-1C×2 60mm^2
Power conditioner ~ Distribution panel	(1) Applicable standard (2) Model (3) Size	IEC, JIS or an equivalent standard 600V CV-1C×3 100mm^2
Transformer ~ Distribution panel	(1) Applicable standard (2) Model (3) Size (4) Other	IEC, JIS or an equivalent standard 600V CV-1C ×3 325mm^2 Terminal lug x 3, bolts, nuts, end terminal materials
Transformer ~ Switchgear ~ Existing switchgear	(1) Applicable standard (2) Model (3) Size	IEC, JIS or an equivalent standard 15kV, CV-1C×3 60 mm^2
Electric room ~ Climate change box Communication cable	(1) Applicable standard (2) Model (3) Size	IEC, JIS or an equivalent standard KPEV 4C 2 mm^2

Equipment	Specifications	Required Specifications
Ground works materials	(1)Applicable standard (2) Model (3) Size (4) Other	IEC, JIS or an equivalent standard 600V IV 38mm^2, 22mm^2, 3.5mm^2 Ground rod 10mm x 1m

Table 2.2.2-19 Outline of Buried Protective Pipe

Equipment	Specifications	Required Specifications
9. Buried protective pipe	(1) Standard	IEC, JIS or an equivalent standard
	(2) Material	Cable protective steel pipe or cable flexible tube

(4) PV System Frame Installation Method

The PV module will be installed on the roofs of Majuro Hospital Wards 2 and 3, and on the roofs of attached buildings. The existing roofs comprise steel deck plate covered with heat insulating board and waterproofing sheets . Therefore, the existing roof structure is not strong enough to allow the frame to be directly attached.

PV module frame bases (C shape channel steel) are held with screw rods from the under roof.
The screw rods are fixed with the bracket, which clip upper and lower side of the concrete beam structure at under roofing.

Triangle trusses which galvanized in factories are installed on top of the frame bases. PV modules are set up on galvanized channel steels set over on the triangle truss.

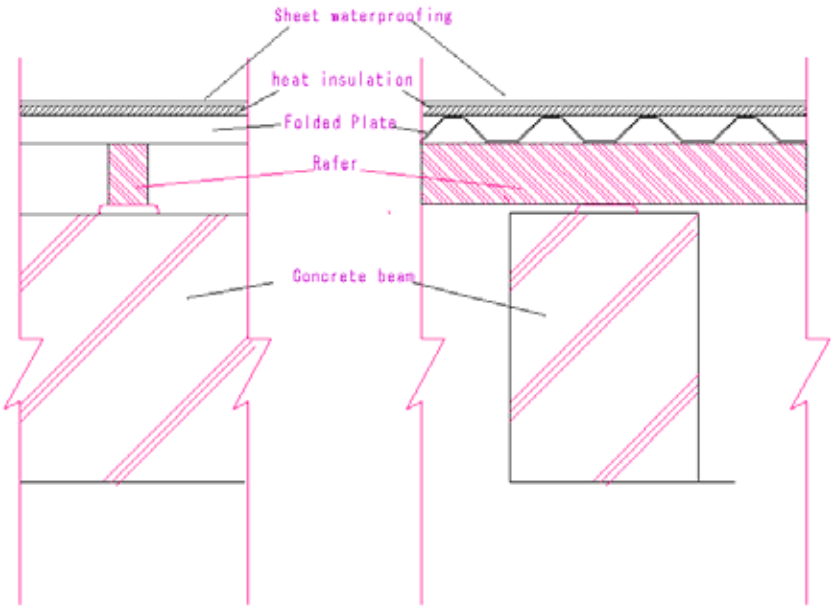


Figure 2.2.2-11 Existing Roof Structure at Majuro Hospital

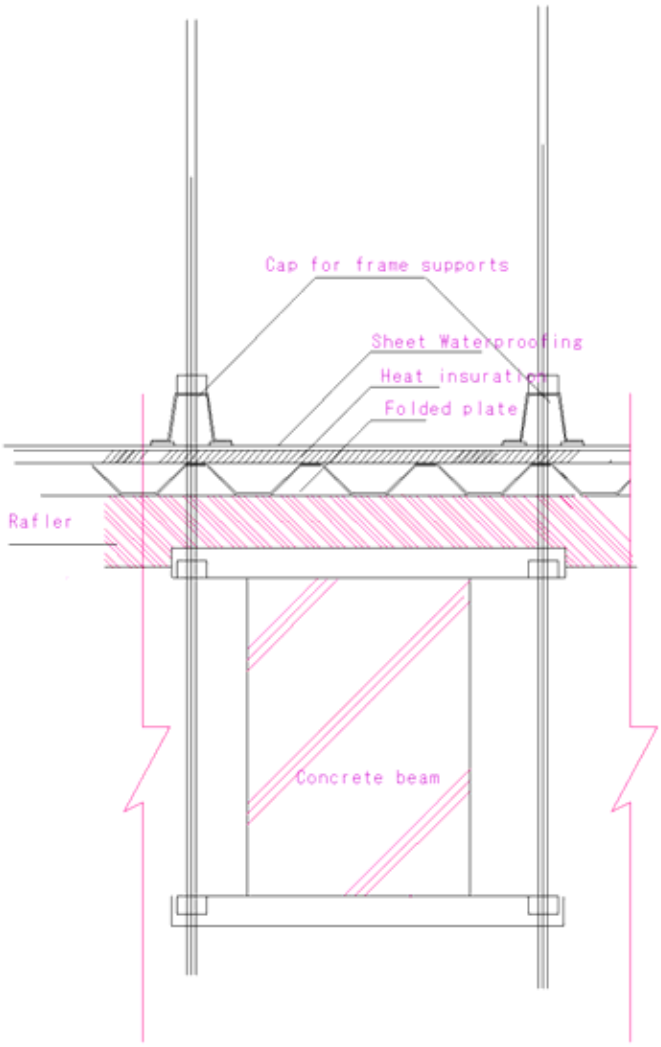


Figure 2.2.2-12 Frame Supports

(5) Support Frame Plan

The works will be implemented on the facilities of Majuro Hospital in the capital city of the Marshall

Since the frame attachment work will entail attaching from the underside of the roof, work will arise inside the hospital rooms, however, since it is not possible to completely shut down the hospital activities for the Project, the work will implemented in phases over six works sections.

The Project site is situated almost halfway between a lagoon and the ocean about 0.5 km to the sea on either side. In consideration of salt damage, all frame members will be given galvanized finish.

(6) Other Installation Works

1) Power conditioner (1) and (2)

2 units of 100kW power conditioner (1) will be installed in the panel room of the existing hospital. In line with this, 4.5kW air-conditioning will be installed to address the heat generated by the power conditioner.

2 units of 100kW power conditioner (2) for PV module installed on the roof of a pump, canopy and power house will be installed in a container which is installed in the east outdoor of Wad 3.It is planned to install an air conditioner in the container.

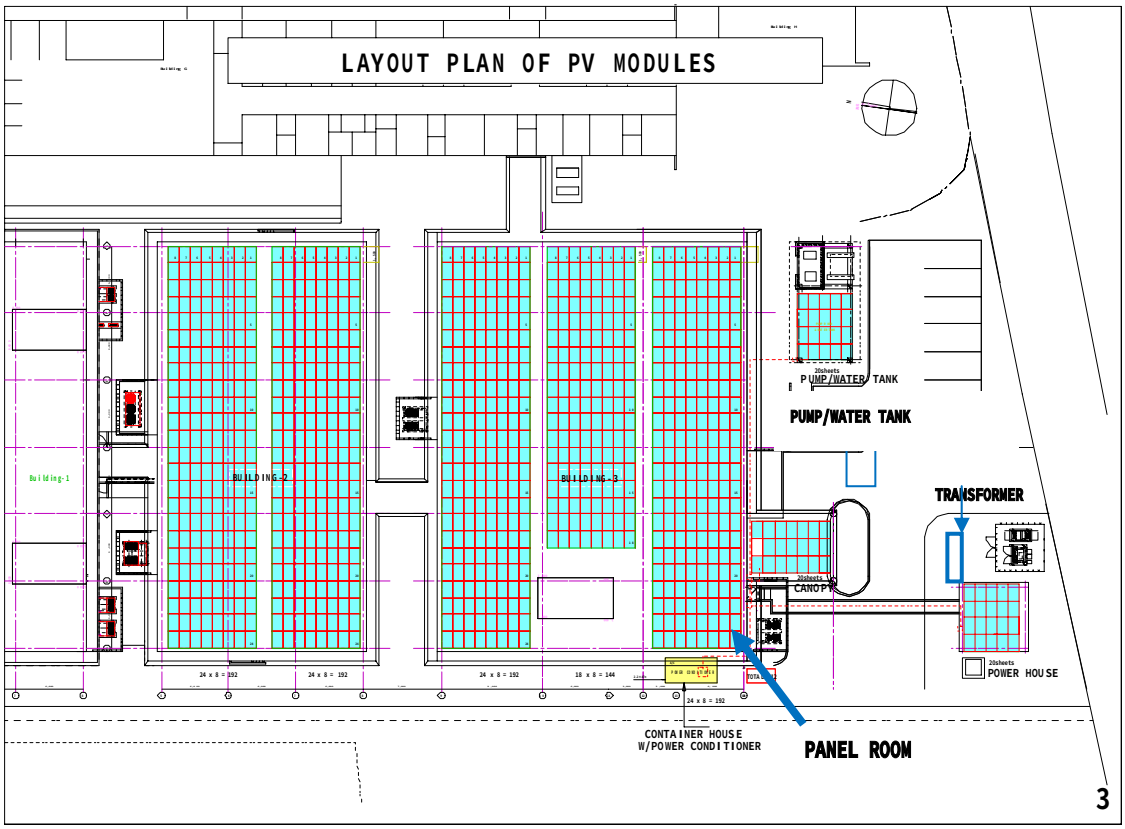


Figure.2.2.2-13 Layout Plan of PV Module

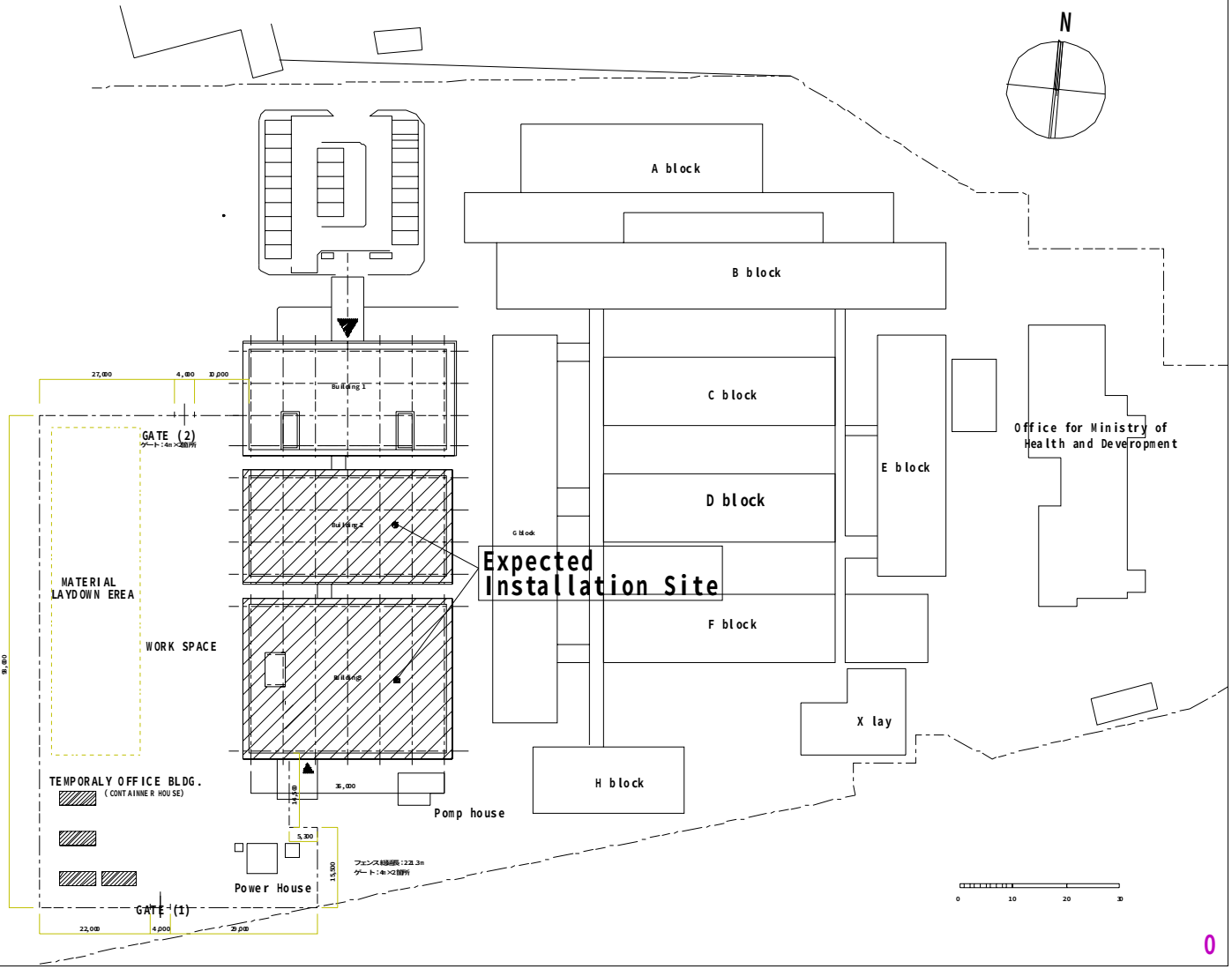
2) Connection transformer

It is planned to execute foundation works for the outdoor transformer and emergency breaking switch and to install approximately 5m of underground pipe.

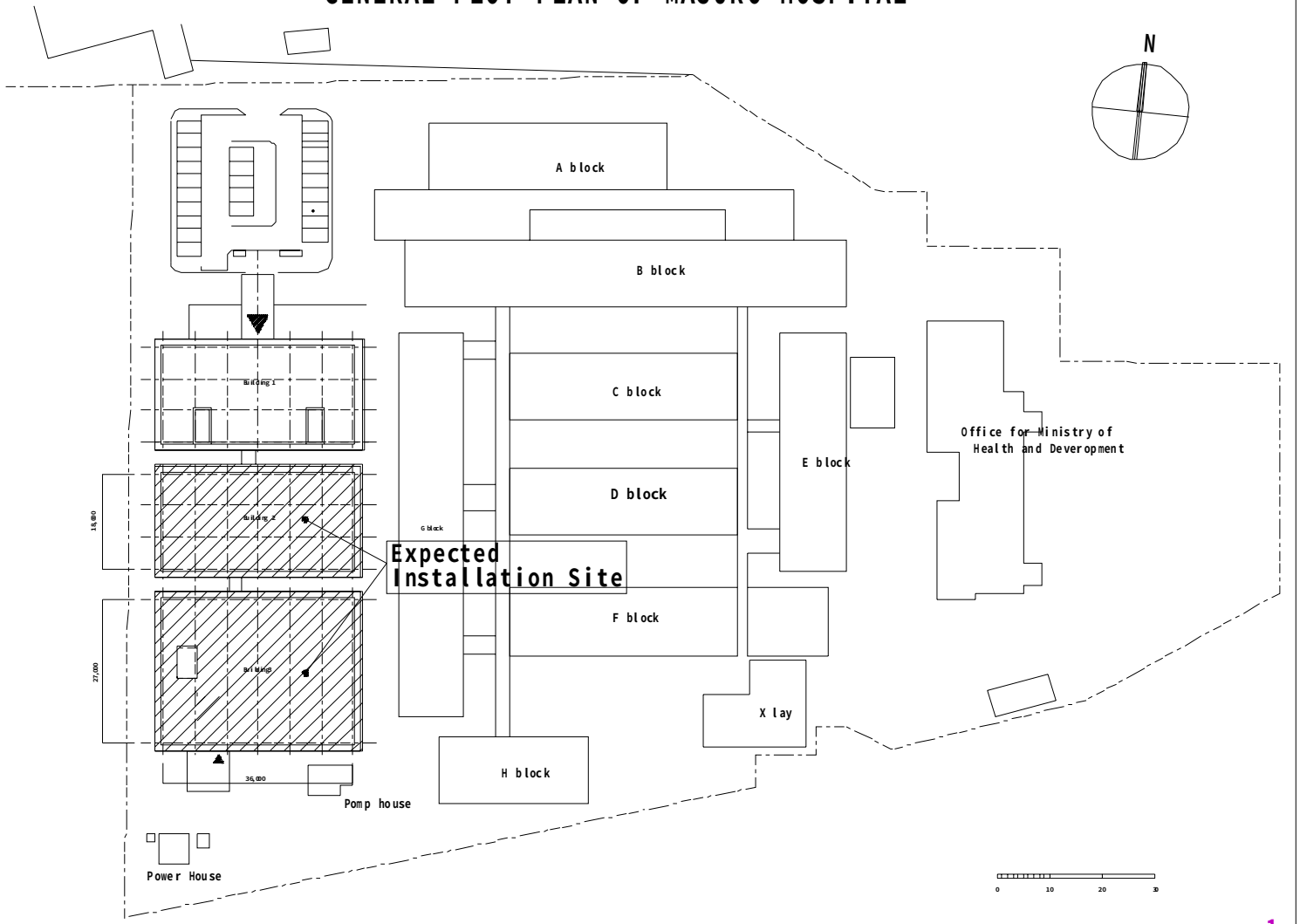
2-2-3 Basic Design Drawings

The basic design drawings for the Project are given below.

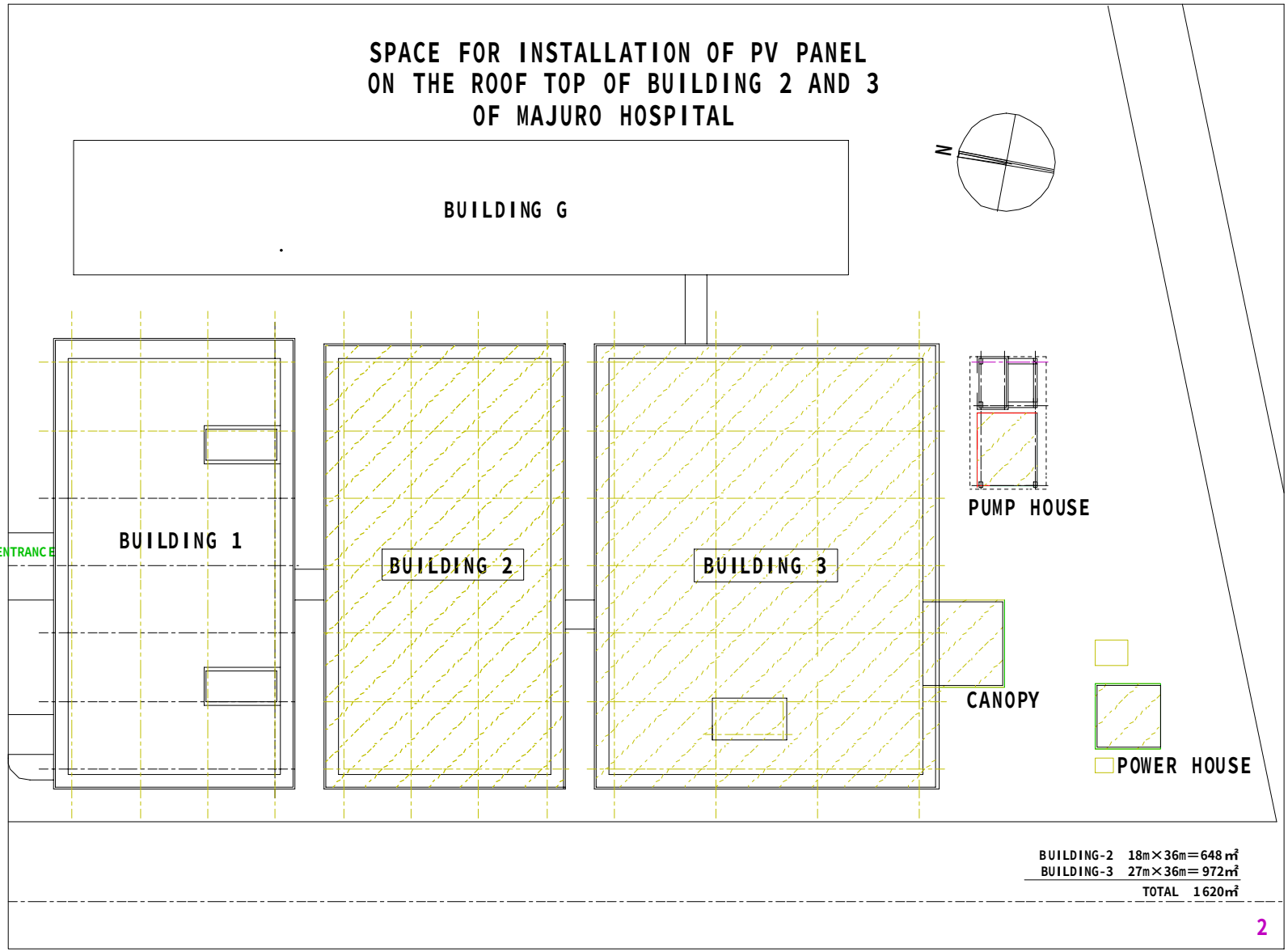
TEMPORALY FACILITIES PLAN

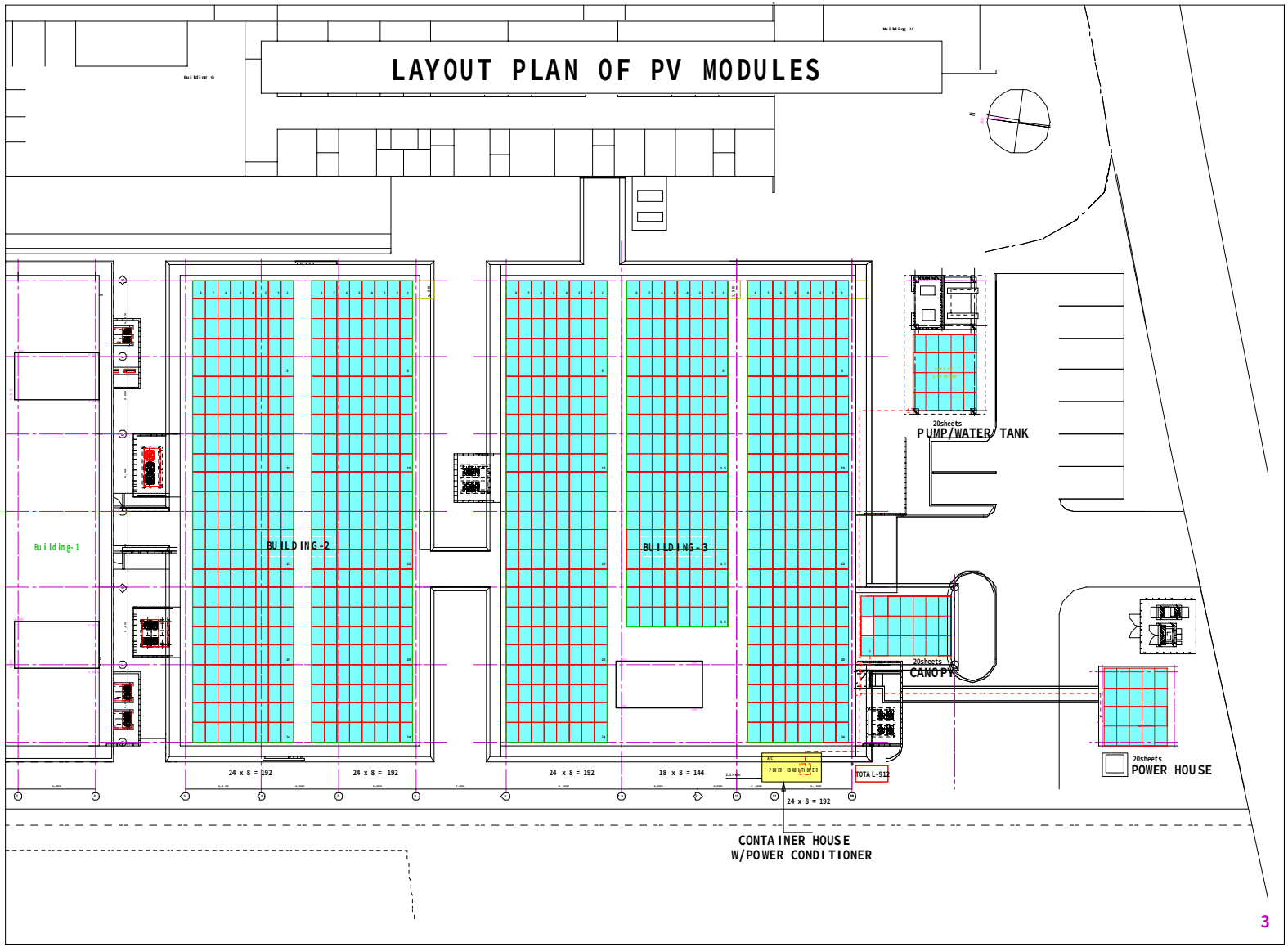


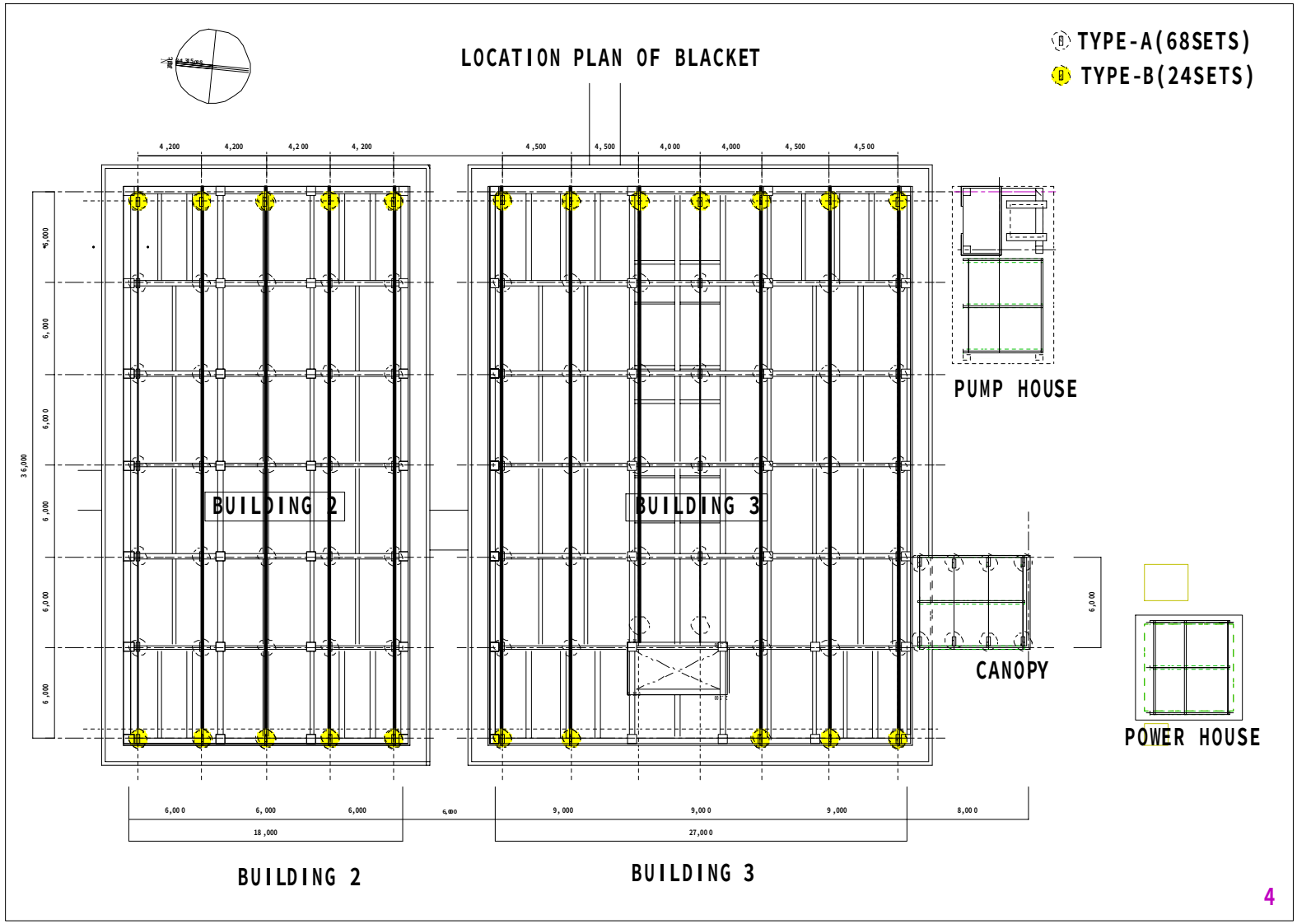
GENERAL PLOT PLAN OF MAJURO HOSPITAL



1


SPACE FOR INSTALLATION OF PV PANEL
ON THE ROOF TOP OF BUILDING 2 AND 3
OF MAJURO HOSPITAL
BUILDING G
N
BUILDING 1
ENTRANCE
BUILDING 2
BUILDING 3
PUMP HOUSE
CANOPY
POWER HOUSE
BUILDING-2 18m×36m=648㎡
BUILDING-3 27m×36m=972㎡
TOTAL 1620㎡
2

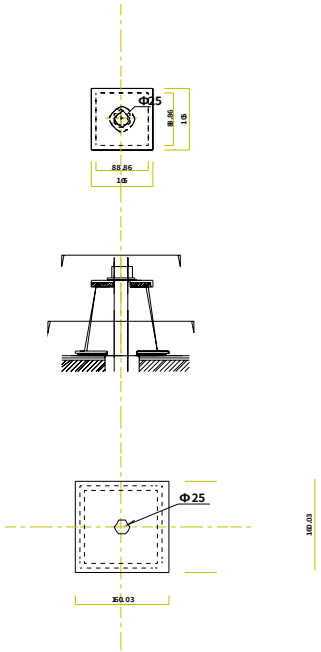

LAYOUT PLAN OF PV MODULES
Building-1
BUILDING-2
BUILDING-3
24 x 8 = 192
24 x 8 = 192
24 x 8 = 192
18 x 8 = 144
TOTAL-912
24 x 8 = 192
20sheets
PUMP/WATER TANK
20sheets
CANOPY
20sheets
POWER HOUSE
CONTAINER HOUSE
W/POWER CONDITIONER
3


LOCATION PLAN OF BLACKET
TYPE-A(68SETS)
TYPE-B(24SETS)
BUILDING 2
BUILDING 3
PUMP HOUSE
CANOPY
POWER HOUSE
BUILDING 2
BUILDING 3
4

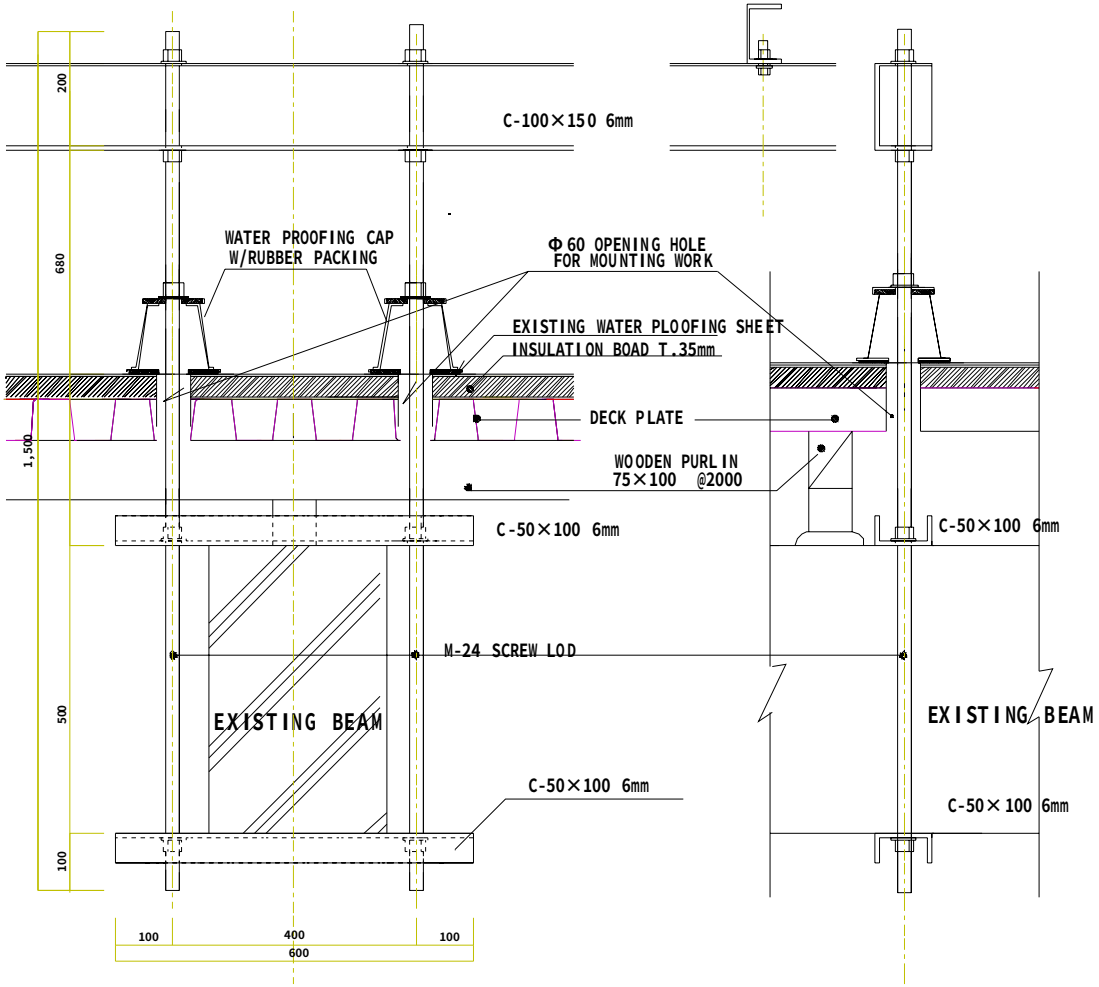
MOUNTING DETAIL OF P/V MODULE

TYPE-A

68 SETS



WATER PROOFING CAP
W/RUBBER PACKING
136 PIECES

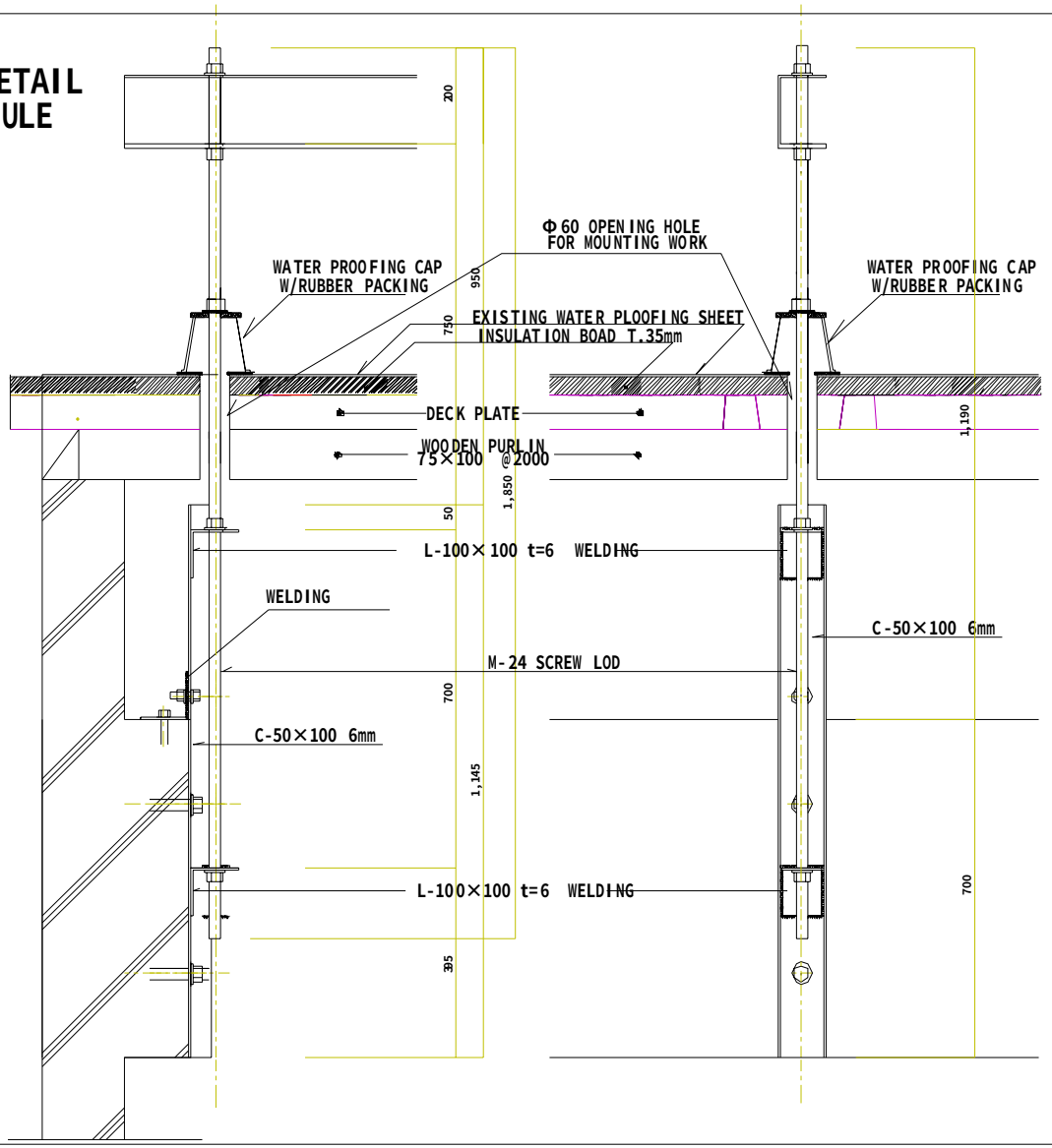


5

MOUNTING DETAIL OF P/V MODULE

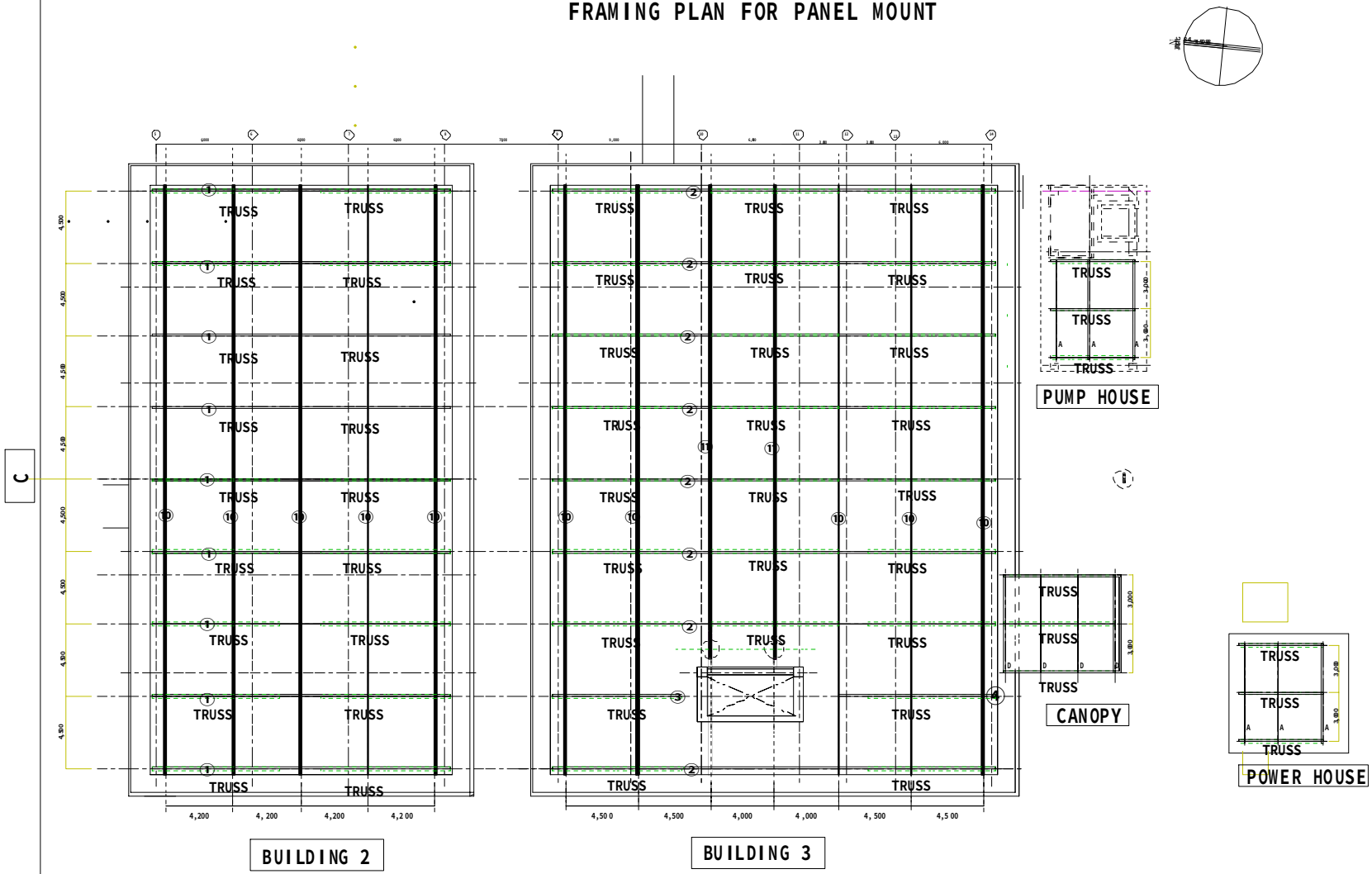
TYPE-B

24 SETS

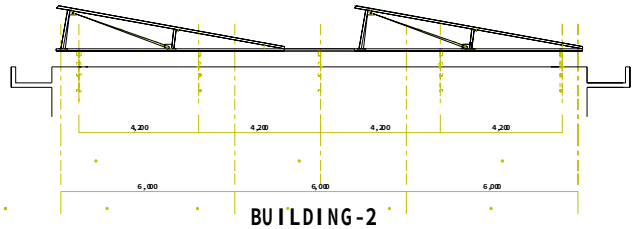


6

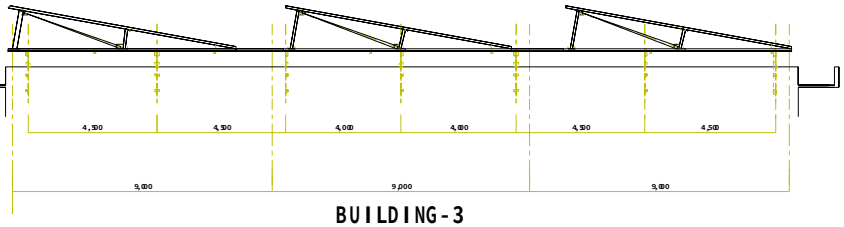
FRAMING PLAN FOR PANEL MOUNT



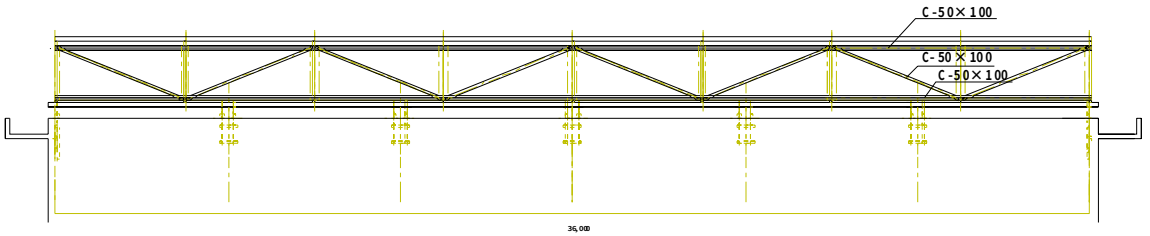
DETAIL OF FRAMING STRUCTURE

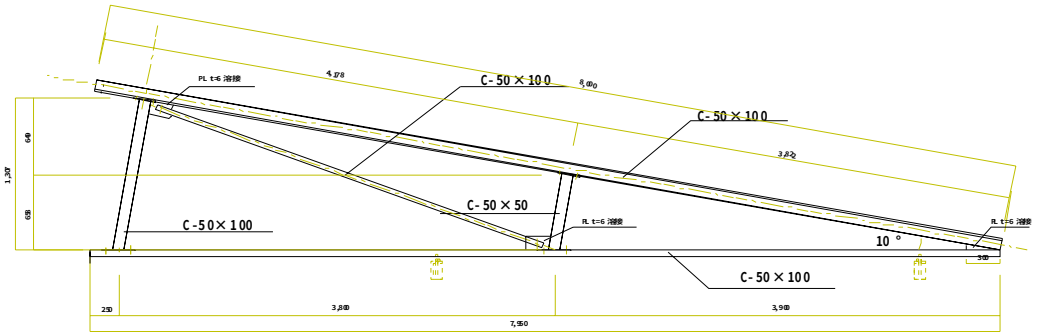


BUILDING-2



BUILDING-3

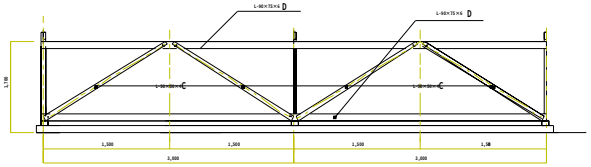




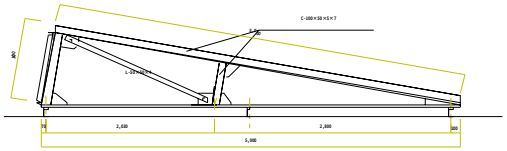
TRUSS

8

DETAIL OF FRAMING STRUCTURE-2

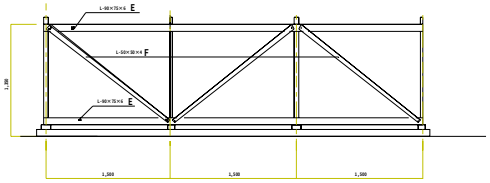


POWER HOUSE
PUMP/WATER TANK

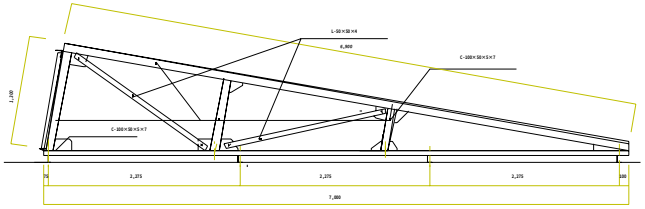


TYPE-A(TRASS)×6 SETS

POWER HOUSE
PUMP/WATER TANK



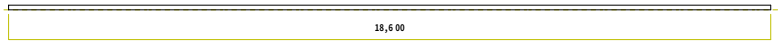
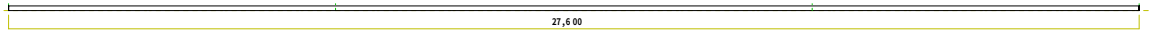
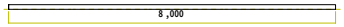
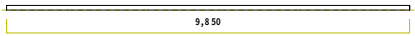
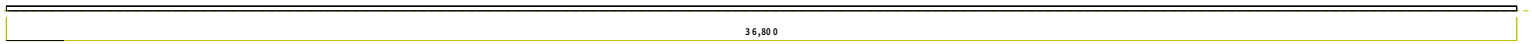
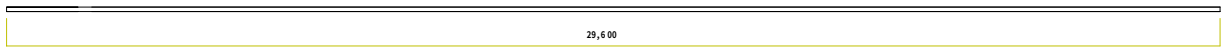
CANOPY



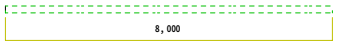
TYPE-B(TRASS)×4 SETS

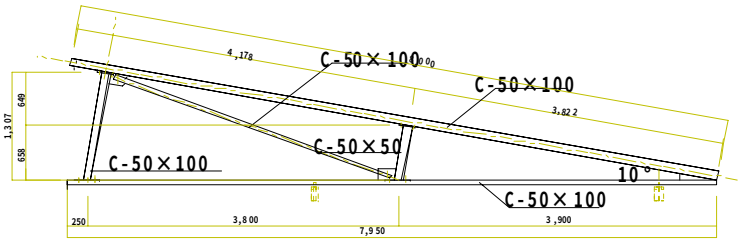
CANOPY

MEMBER LIST OF STEEL STRUCTURE

①		×9	W/2JOINTS	C-50×100(18,600) 9 SETS
②		×8	W/4JOINTS	C-50×100(27,600) 8 SETS
③		×1	W/1JOINT	C-50×100(8,000) 1 SETS
④		×1	W/1JOINT	C-50×100(9,850) 1 SETS
⑩		×2	W/5JOINTS	C-50×100(36,800) 2 SETS
⑪		×10	W/4JOINTS	C-50×100(29,600) 10 SETS

TRUSS





TRUSS×43

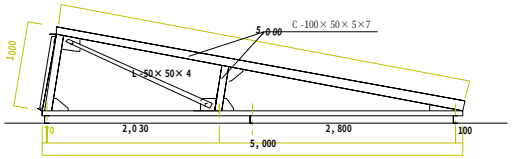
10

MEMBER LIST OF STEEL STRUCTURE-2

FOR PUMP/WATER TANK & POWER HOUSE

A	6,100	×6	C-50×100(6,100) 6 SETS
B	6,100	×4	L-90×75×6(6,100) 4 SETS
C	4,200	×8	C-50×50×4 (4,200) 8 SETS

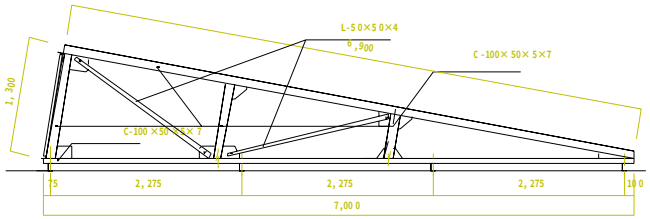
TYPE-A(TRASS)×6 SETS



FOR CANOPY

D	4,600	×4	C-50×100(4,600) 4 SETS
E	4,600	×2	L-90×75×6(4,600) 2 SETS
F	3,700	×3	L-50×50×4(3,700) ×3 SETS

TYPE-B(TRASS)×4 SETS



11

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Project will be implemented based on the Government of Japan's Program Grant Aid for Environment and Climate Change. According to this, the Project will receive approval by the Government of Japan and the two countries' governments will sign the Exchange of Notes (E/N) before the Project progresses to the implementation stage. The Procurement Management Agent will be recommended to the Marshall Islands side by the Government of Japan, while the Ministry of Resource Development (MRD) acting as the mandatory will manage the main works to ensure that the contract (tender and equipment procurement) is appropriately and smoothly executed. The MRD will also administer funds on behalf of the Government of the Marshall Islands.

(1) Implementation Setup

Following the conclusion of the Exchange of Notes (E/N) and Grant Agreement (G/A) concerning the Project, the Government of the Marshall Islands will entrust selection and contracting of the works consultant and suppliers to the Agent. Also, the works supervision consultant and suppliers will implement their respective duties upon binding contracts with the Agent.

(2) Responsible Government Agency

The responsible government agency will be the Ministry of Resource Development (MRD).

(3) Implementing Agency

The implementing agency for the Project is the Marshalls Energy Company (MEC). The Project will be implemented as a Program Grant Aid for Environment and Climate Change undertaking based on the Agent Agreement that is concluded between the MRD – the responsible government agency on the Marshalls side – and the Japanese Agent.

Other related agencies on the Marshalls side are as indicated below, and it will be necessary to fully share information and coordinate with each agency in the implementation stage. When coordinating with each agency, it has been confirmed that the MRD will act as the primary contact.

Members of Energy Task Force are composed of the following agencies.

Ministry of Resource Development
Ministry of Foreign Affairs
Ministry of Internal Affairs
Economic Policy, Planning and Statistics Office
Office of Environment Planning and Policy Coordination
Majuro Atoll Waste Company
Marshalls Energy Company

Japanese government provided numerous general grant aid projects in the road and fishery sectors, etc. in the Marshall Islands, however, it will be necessary to share necessary information with the responsible government agency (MRD) and Energy Task Force agencies to ensure smooth implementation. Since the

Marshall Islands has no experience of tender and contract operations using a procurement agency. Also the main agencies on the Marshall's side and JICA will establish a consultative committee composed of representatives from each to discuss the items during the implementation of the Project.

The Project implementation setup is indicated below.

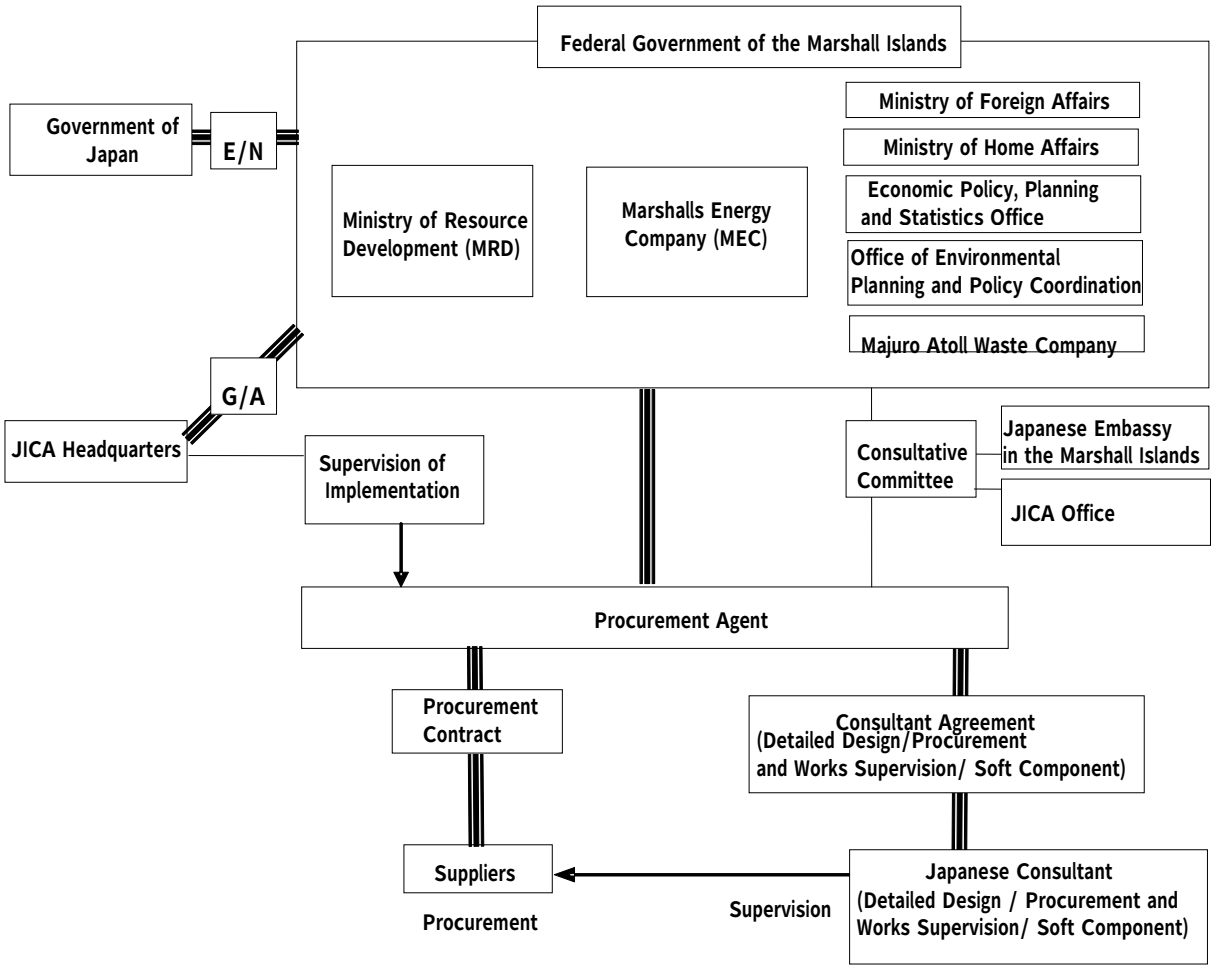


Figure 2.2.4-1 Implementation Setup

(4) Procurement Management Agent

1) Implementation Contents

The Agent, which will be recommended to the Marshall side by the Government of Japan, will implement and execute general supervision to ensure that the Project components are appropriately and smoothly implemented in its capacity as the mandatory of the implementing agency.

The Procurement Management Agent will prepare the tender documents for equipment procurement, thereby initiating the tender management proceedings and procurement operations for the Project.

Concerning tender work supervision, the Agent will prepare documents concerning the Agent Agreement, bank arrangements and contracts pertaining to tender, and it will distribute the tender documents and conduct duties pertaining to the tender, evaluation and contracting of suppliers.

In the area of works management, the supervisor dispatched by the Japanese Agent will conduct fund management including payments, expenditure planning in the event where excess funds arise, confirmation of implemented contents and reporting of progress to both governments, as well as maintain constant discussions, coordinate with and report to the Marshall side.

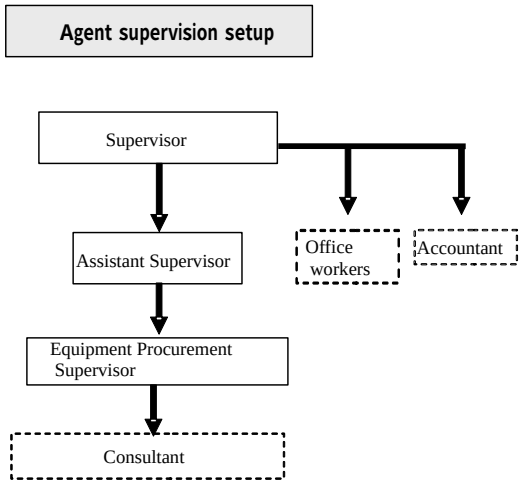
2) Implementation Setup

- Tender work management period

The Agent will compile the tender documents, confirm equipment specifications and evaluate the tendering firms, however, since the international competitive tender for equipment procurement is likely to be complicated, the Agent will procure local auxiliary personnel. Moreover, since it will be necessary to receive and answer technical questions on the tender contents and appropriately evaluate the technical proposals of tenderers, the Japanese consultant will assist in the technical affairs.

- Works supervision period

The Agent will conduct general management during the works execution period, however, this will only comprise checking of key points and will be conducted under the works supervision of the Japanese consultant.



(5) Procurement Supervision Consultant

The technical consultant that is appointed by the Agent will supervise the procurement and construction works in its capacity as the procurement supervision and procurement supervision consultant. The Consultant will supervise the quality of work, schedule and safety, etc. of facilities construction, confirm quality, functions, performance and quantities in the equipment procurement, and check for exterior damage, etc. during the transportation of equipment. If it discovers any problems, it will immediately prepare a report and discuss countermeasures with related officials. Moreover, the Consultant in charge of procurement supervision will assess the performance of works contractors.

(6) Equipment Suppliers

The suppliers selected by the Agent by tender must fully understand and certainly and without delay execute the contents of the contracts they bind with the Agent.

2-2-4-2 Implementation Conditions

(1) Construction Conditions and Technology Transfer in the Marshall Islands

Chinese and other foreign-affiliated general construction contractors and electricity works companies can be found in the Marshall Islands, meaning that it is possible to locally procure transportation vehicles and construction equipment and order the distribution equipment installation works and underground cable works to local contractors. However, since the Project is being implemented as Program Grant Aid for Environment and Climate Change, which requires high quality execution in a short time, and considering the quality of works realized in similar grid-connected PV systems installed by local contractors, it will be essential to dispatch skilled engineers to ensure schedule control, quality control and safety control.

Furthermore, since the only experience of grid-connected PV system installation works in the Marshall Islands so far has been the system installed at the College of Marshall Islands (CMI) and highly skilled engineers are required when installing equipment and conducting adjustments and tests, etc. after installation, it will be hard to find local personnel with these skills. Accordingly, when implementing the installation work, it is desirable that the Japanese contractor procures local laborers and works equipment and dispatches engineers from Japan. Moreover, the engineers will conduct technology transfer in the shape of OJT for Marshall engineers during the installation period.

- Since the hospital operations cannot be completely closed down, the Project work will be conducted while making partial closures. The rough works schedule will be presented to and coordinated with the hospital side six months in advance.
- For the sake of safety, hospital users will be informed of the works and signboards, etc. will be established to warn users in advance. During the works, particular care will be directed to ensuring safety through closing down parts of the hospital and assigning security guards.
- Adequate curing will be carried out in works sections to ensure that dirt and dust do not spread through the hospital during the works. Since the works sections include inspection rooms, X-ray rooms and rooms fitted with precision instruments such as CT scanner, etc., it will be necessary to take the utmost care in installing scaffolding and implementing curing.
- Power outage lasting around two hours is predicted when the PV equipment installation is finished and the PV mainline is connected to the high voltage grid. Since the hospital owns an emergency generator, this will be operated during the power outage. Routine operations are not implemented on Saturday and Sunday, however, the work will be advanced while maintaining close communications with the hospital side to ensure that work does not coincide with emergency operations or other contingencies.

(2) Utilization of Local Equipment and Materials

The aggregate, cement and reinforcing bars, etc. required for building the foundations of power conditioner for the PV modules, and to use foundation work for grid connection transformer can be procured in the Marshall Islands, although it will be necessary to implement management and supervision of quality and deadlines. Accordingly, when compiling the execution plan, locally procurable equipment shall be utilized as far as possible.

(3) Safety Measures

The Project target site has relatively few problems in terms of law and order, however, it will be necessary to display ample care for preventing theft of equipment and securing the safety of works personnel. Accordingly, not only is it essential that the Marshall Islands side take safety measures, but also the Japanese side will need to take steps such as assigning guards and so on.

(4) Tax Exemptions

In order to receive exemptions of customs charges and tariffs on the Project equipment, the contractor will need to give advance notification to the Ministry of Finance via the MRD. It is possible to receive exemptions of 8% on tariffs and 8% on domestic taxes, however, it has been confirmed that this is not a post rebate system but rather a total exemption scheme whereby the implementing agency in the Marshall Islands.

(5) Transportation

Japanese ships operating out of Guangzhou Port in China pass through Kobe, Nagoya and Yokohama, before arriving at Majuro Port as the first port of call in the Marshal Islands. Only one container vessel per month is operated by a single shipping company, and this as a rule carries 20-feet containers. The shipping time from Japan to the Marshall Islands is one week.

Handling at Majuro Port is carried out by the private firm Majuro Stevedore & Terminal Co., Inc., which has the capability to handle around 400 containers per month including 40-feet containers.

Concerning movement of containers in built-up areas, the port has cranes that can load and unload containers, however, heavy machinery that can unload containers from container trucks is limited in the city. Accordingly, in most cases cargoes are transferred to trucks at Majuro Port or containers are carried onto works sites by container truck and their contents are unloaded directly from the containers on the truck. Considering the local unloading conditions, the equipment transported from Japan will be packed in such a way that it can be unloaded from containers manually or using 3-ton forklifts.

2-2-4-3 Scope of Work

According to the Program Grant Aid Scheme for Environment and Climate Change, Table 2.2.4-1 shows the detailed scope of works on the Japanese and Marshall Islands sides.

Table 2.2.4-1 Scope of Works on the Japanese and Marshall Islands Sides

No.	Item	Japan	Marshall	Remarks
1	Securing of the equipment installation site		●	
2	Facilities construction works and equipment installation	●		Including temporary installation works in line with the facilities construction
3	Electrical works			
	(1) Electrical works			
	a) Indoor wiring works (lighting, sockets, etc.)	●		(Secondary side)
	(2) Telephone and IT works			
	a) Indoor wiring and pit works	●		

No.	Item	Japan	Marshall	Remarks
4	Commission for opening of bank account based on the B/A		●	
5	Handling of transport and customs clearance procedures and taxes			
	(1) Responsibility for ocean transport (air transport) of products related to procured equipment to the recipient country (Marshall Islands)	●		
	(2) Tax burden and customs clearance procedures at the port of unloading in Palau		●	
	(3) Transportation of procured equipment, etc. from the port of unloading to the inland site in the Marshall Islands	●	●	
	(4) Exemption or bearing of domestic value added tax on procured construction materials and equipment in the Marshall Islands		●	
6	OJT concerning operation and maintenance of facilities and procured equipment	●		The Marshalls side will select the personnel who will receive OJT
7	Operation and maintenance of facilities and procured equipment		●	
8	Other costs not covered by the grant aid		●	

Note: B/A: Banking Arrangement
●: Indicates the scope of responsibility regarding each item.

2-2-4-4 Consultant Supervision

Based on the scheme of the Government of Japan's Program Grant Aid for Environment and Climate Change, the Consultant will organize a consistent Project Team to smoothly conduct the preparation of tender document and procurement supervision work according to the principles of the rough design. The Consultant will permanently assign at least one engineer to the Project site during the procurement supervision stage in order to conduct schedule control, quality control, performance control and safety control. Furthermore, an expert in Japan will attend plant inspections and pre-shipping inspections of equipment and materials manufactured in Japan with a view to ensuring that no troubles occur following delivery of materials and equipment to the Marshall Islands.

(1) Basic Concept of Procurement

The basic concept of procurement supervision by the Consultant will be as follows: to supervise the works progress to ensure they finish within the designated period, and to supervise and instruct the supplier to ensure that the quality, performance and delivery times specified in the contract are secured and that the site works are executed safely.

The important points to consider in Consultant supervision are described below.

(2) Schedule Control Supervision

The consultant supervise compare progress with the implementation schedule decided in the contract every month or every week in order to adhere to the delivery deadline given in the contract. In cases where delays are predicted, the consultant will warn the suppliers, present and instruct a plan of countermeasures and offer guidance to ensure that the works and equipment delivery are completed within the contract period. The comparison of the planned schedule and actual progress will be carried out according to the

following items.

① Confirmation of works performance (manufacture of equipment and materials in plant and performance of installation works on site)
② Confirmation of equipment and materials delivery
③ Confirmation of temporary installation works and construction machinery preparations
④ Confirmation of yield and actual numbers of engineers, skilled workers and laborers, etc.

(3) Quality and Performance Control

Supervision will be carried out based on the following items to determine whether the manufactured, delivered and installed equipment and materials and constructed facilities satisfy the required quality and performance stated in the contract documents. In cases where doubts arise over quality and performance, the Consultant will immediately demand that the supplier make amendments, revisions or corrections.

(4) Safety Supervision

Consultant will have discussions and cooperation with responsible staff of the supplier and safety control will be exercised during the work period in order to prevent industrial accidents and accidents affecting third parties. Important points to consider in safety control on the site are as follows:

① Establishment of safety control regulations and appointment of manager
② Prevention of accidents through implementation of periodic inspections of construction machinery
③ Planning of the works vehicles and construction machinery operating routes and thorough enforcement of slow driving
④ Encouragement of laborers to utilize welfare measures and vacations

(5) Works Supervisor

The supplier will implement the PV module and frame construction works, the procurement and installation of PV equipment and materials and the installation of distribution and communications cables. In order to implement these works, the supplier will employ a subcontractor in the Marshall Islands. Therefore, since the supplier will need to ensure that the subcontractor complies with the works schedule, quality, performance and safety measures prescribed in the contract, it will dispatch an engineer who has experience of similar projects in overseas countries to provide guidance and advice on the site.

2-2-4-5 Quality Control Plan

The Consultant's supervisor will carry out supervision and checking based on the following items to ensure that the supplier secures the quality of Project equipment and materials and the execution and installation performance stipulated in the contract documents (technical specifications and implementation design drawings, etc.).

① Attendance of plant inspections of equipment and materials and checking of plant inspection results
② Checking of packing, transportation and on-site temporary storage methods

③ Checking of shop drawings and installation guidelines of equipment and materials
④ Checking of trial operation, adjustment, test and inspection guidelines of equipment and materials
⑤ Supervision of site installation works of equipment and materials and attendance of trial operations, adjustments, tests and inspections
⑥ Checking of facilities shop drawings against work performance on site
⑦ Checking of completion drawings

2-2-4-6 Procurement Plan

The PV modules and power conditioner to be procured and installed in the Project are not manufactured in the Marshall Islands. In the grid-connected PV system that was introduced to College of Marshall Islands (CMI) under support from U.S.A Compact fund, PV modules made by Evergreen of Germany and other equipments were procured from New Zealand. CMI has had environment to obtain technical service as the consulting firm of New Zealand has been implementing Construction and procurement supervision until the time that project is completed in 2011. However, since these PV equipment manufacturers have no branch offices or agents in the Marshall Islands, there is no system for conducting post-installation service such as responding to breakdowns and repairs and procuring spare parts, etc. Furthermore, in neibouring areas some equipment manufacturers have branch offices or agents, therefore Marshall Islands side has geological restriction which it is difficulties to obtain technical support. Thus, the Marshalls side is hoping that higher quality equipment will be procured here. Accordingly, when selecting the supplier of PV equipment in the Project, it will be necessary to take local conditions, ease of operation and maintenance by local engineers, and existence of the post-installation setup for procuring spare parts and responding to breakdowns, etc. into account.

Moreover, the MEC, which will be in charge of operating and maintaining the PV equipment following completion of the Project, recognizes that Japanese PV equipment makers are superior to makers in other countries in terms of product quality and reliability, and it hopes that Japanese PV equipment will be employed in this Japanese grant aid project. Moreover when Marshall Islands side procures spare parts and other equipments, in case procuring these equipment from Hawaii, it requires a long time and the prices will be higher because these equipments should be imported from main land of United States. On the other hands, there is a direct shipments from Japan to Marshall Islands, it is possible to obtain these equipments with reasonable prices and requires a short time for procurement.

In consideration of the above conditions, the suppliers of equipment and materials in the Project will be as follows.

(1) Locally procured equipment and materials

Works equipment and materials including cement, sand, concrete aggregate, reinforcing bars, timber, gasoline, diesel oil, works vehicles, cranes, trailers and other temporary installation equipment

(2) Equipment and materials procured in Japan

PV modules, power conditioner, grid-connection transformer, display unit, wiring materials, container house, etc.

2-2-4-7 Operation Guidance Plan

Before the works are finished, guidance will be carried out on the initial equipment controls and operation and maintenance methods. Such guidance will basically be carried out by instructors from the manufacturer or works contractor via site OJT according to the operation and maintenance manual.

In order to advance the plan of guidance smoothly, the MEC (the implementing agency) will need to hold close communications and discussions with the Japanese Consultant and supplier and to appoint a full-time engineer to take part in the OJT. The appointed engineer will need to convey technology to other employees who cannot participate in the Project and cooperate with enhancing the maintenance capability of the MEC.

2-2-4-8 Soft Component Plan

(1) Background

In Marshall, almost all of the power supply in the country depends on diesel power generation at present and there is the influence of increasing the crude oil prices, the Marshall government considers departure from the fossil fuel as an urgent task. In the National Energy Policy which was formulated in 2003 and, New National Energy Policy and Energy Action Plan are described in them by including the utilization of the renewable energy (Ex; the grid-connected PV system). Therefore, the Marshall government is taking the active cooperation to the Plan of the Program Grant Aid for Environment and Climate Change (the Project) which will introduce the grid-connected PV system.

The Project site is the Majuro National Hospital, the responsible organization for the Project is Ministry of Resources and Development (MRD) and the implementation agency is Marshall Energy Company (MEC) which takes the charge of the electricity business. The MEC has the electric power department and the water department, and the electric power department takes the charges of Fuel sale, PV generation, Majuro power station and Island power stations (Ebeye, etc.). The MEC is relative small organization composed of 176 staffs and is 100% owned by the government. And no possibility of buying up by private company was confirmed in the survey.

As for the introduction cases of PV systems, the approximate 1,470 units of the SHS were introduced by the support of EU and Taiwan in order to promote the electrification in the isolated islands. As for the Majuro area, 60kW PV system already has been introduced in the College of Marshall Islands in June, 2009 by the support of US. This concept has the plan to connect the 200kW PV system to the national grid up to 2011, but all generated power at present is consumed only inside the college. Therefore, it is difficult for staffs of the MRD in charge of policy-making or the MEC in charge of management of electric facilities of the Project site to master adequate technology on PV systems through their daily work. In addition, the grid-connected PV system will not meet with the success without the cooperation of the MEC, because the introduced grid-connected PV system shall be connected to the national grid. And in the view of the future

dissemination of the grid-connected PV system in Marshall, it would be desirable to transfer the technology to the MEC.

As for the MEC technicians, it can be judged that they have the basic knowledge of the PV generation, because there are a few technicians who took the charge of O&M of the SHS in the isolated islands and they already have the actual performance of them. Accordingly, the establishment of the concept and the method of the O&M of the grid-connected PV system will be thought to take some time, however, the proper technical transfer on the O&M of the introduced facilities into the implementing agency of the Project, MEC, over the broad-and-shallow range from a basic level on the PV generation to an application level on the O&M of the PV facilities, dividing the process into the several steps and confirming the establishment of the knowledge will be able to promote the continuous and smooth O&M of the grid-connected PV system introduced by the Project.

(2) Goal

The goal is that the implementing agency of the Project, MEC, comes to be able to implement continuous and smooth O&M based on the O&M manual.

(3) Current problems and measures for improvement

Table 2.2.4-2 Current problems and measures for improvement

Current problems	Measures for improvement	Necessary soft-component
▪ The necessary structure for O&M of grid-connected PV system is not established	▪ MEC establishes the O&M system within MEC.	▪ Make a proposal on the segmentalization and specification of O&M system, and discuss it with the persons concerned.
▪ Technical knowledge and skills for grid-connected PV system is not enough	▪ Prepare the O&M manual of the grid-connected PV system.	▪ Support implementation guidance on the manual.
▪ The knowledge of concept and methodology for O&M of grid-connected PV system is not enough	▪ Implement technical training on PV systems including the "independent type" and "grid-connected type." ▪ Implement training on monitoring, such as the monitoring method, periodical inspection method, etc.	▪ Conduct proper technical training on PV systems. ▪ Conduct proper technical training on monitoring.
▪ Trouble-shooting for grid-connected PV system is difficult	▪ Create the O&M manual including troubleshooting ▪ Conduct implementation guidance on the manual and educational activities so that the O&M are properly done.	▪ Support implementation guidance on the manual. ▪ ditto
▪ Electricity tariff structure for grid-connected PV system is not established	▪ Determine most appropriate electricity tariff.	▪ Make a proposal on most appropriate electricity tariff, and discuss it with the person concerned.

Source : created by the Survey Team

(4) Outcome

1) The O&M manual of the grid-connected PV system introduced in the Project, including troubleshooting, is created.
2) Basic knowledge on the grid-connected PV system introduced in the Project is acquired, and the O&M of the facilities is carried out continuously.
3) The most appropriate electricity tariff is determined (if necessary), and a continuous and smooth O&M system is established.

(5) Contents of the training

The following activities will be implemented to achieve the above outcomes.

In Majuro State, the grid-connected PV system has not been disseminated yet even though a new grid-connected PV system is being installed in the College of Marshall Islands. Accordingly, the MEC does not have the technical knowledge on the grid-connected PV systems yet. Therefore, training covering a broad range from a basic level on PV generation to an application level on the O&M of PV facilities is implemented in the Project. Table 2 shows the specific contents which are divided into Category 1 to 4. The implementation process of each category is implemented in certain intervals to promote the steady and efficient settlement and is implemented four times totally.

Concerning the necessary number of days, the implementation contents are covered broadly from the documentation (ex. manuals) with mutual cooperation with Marshall to the technical transfer and the confirmation of the settlement. Therefore, the one week is considered as the minimum unit of the necessary number of days in order to follow the steps of this plan steadily. And concerning the member of the consultant, the necessary members are 2 persons (1 manager and 1 staff), because in the preparation of the manuals, the formation of 2 teams can promote the efficiency of the work and in the lecture, 1 staff as the lecturer and other staff as the assistance can promote the effective lecture.

Table 2.2.4-3 Contents of the training

Category	Specific contents (purpose)	Man Month	
1. Establishment of the O&M system	1.1 Clarification of the responsibility of individuals who carry out the O&M	0.25MMx2persons	Total 1.00MMx2persons
	1.2 Proposal on the most appropriate electricity tariff	0.25MMx2persons	
	1.3 Creation of the O&M manual in collaboration with Marshall side	0.50MMx2persons	
2. Technical training	2.1 Principle and basic knowledge of PV systems	0.25MMx2persons	Total 1.25MMx2persons
	2.2 Characteristics of grid-connected PV systems	0.25MMx2persons	
	2.3 Matters to be examined when a grid-connected PV system is introduced.		
	2.4 Installation	0.25MMx2persons	
	2.5 Inspection		
	2.6 Operation		
	2.7 Maintenance		
	2.8 Troubleshooting	0.50MMx2persons	
3. Institutional Training	3.1 Collection method of electricity tariff	0.25MMx2persons	Total 0.75MMx2persons
	3.2 Optimizing O&M manual	0.25MMx2persons	
	3.3 Evaluation of the O&M system	0.25MMx2persons	
4. Monitoring	4.1 Optimizing monitoring method	0.25MMx2persons	Total 1.00MMx2persons
	4.2 Periodical inspection	0.25MMx2persons	
	4.3 Evaluation items	0.25MMx2persons	
	4.4 Report of monitoring results	0.25MMx2persons	
Total		4.00MMx2persons	

Source： created by the Survey Team

(6) Implementation Schedule for the Soft Component

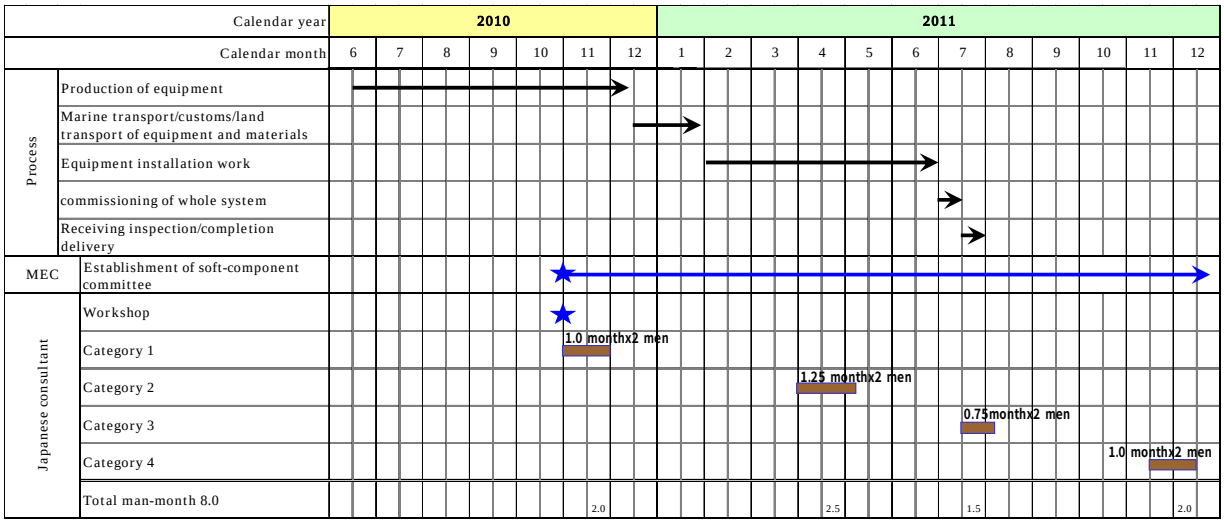
The implementation schedule shall be divided into 4 steps. Category 1-4 in Table 2.2.4-3 shall be conducted in each step. The achievement of each step shall be confirmed and evaluated as follows. Proposed Schedule for the implementation of Soft Component is shown Figure 2.2.4-2.

Category1：Evaluation and instruction of O&M Manual

Category2：Making Report for the Item 2.1-2.3 in Table 2.2.4-3, and making report and technical evaluation for the Item 2.4-2.8 in Table 2.2.4-3.

Category3：Interview survey to O&M staff and evaluation of the actual field work

Category4：Interview survey to O&M staff and evaluation of O&M Manual

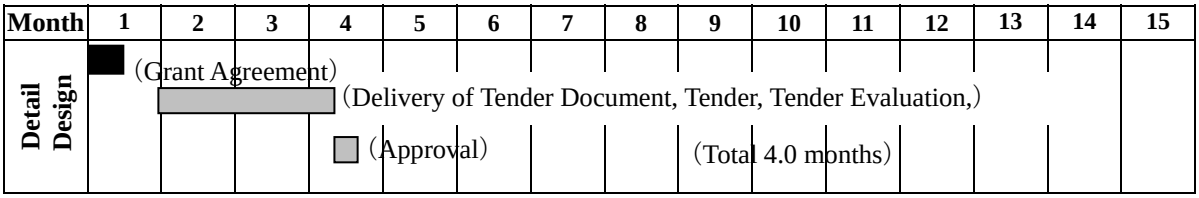


*The progress report will be submitted after each category

Figure 2.2.4-2 Proposed Schedule for the implementation of Soft Component

2-2-4-9 Implementation Schedule

The Team designed the Implementation Schedule of the Project as follows based on scheme of Japanese Environment Program grant aid.



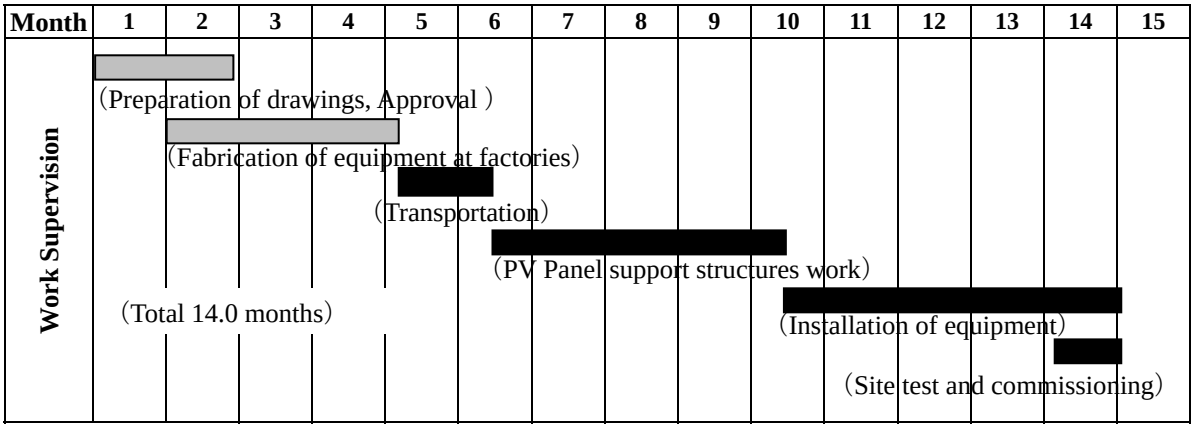


Figure 2.2.4-3 Implementation of the Project

2-3 Obligation of recipient Country

When it comes to implementing the Project, in addition to the scope of works on the Marshall Islands side indicated in 2.4.1-1 Scope of Works, Procurement and Installation, items to be implemented or borne by the Marshall Islands side are as follows.

(1) To provide information and materials necessary for the Project

(2) To secure tax exemption and customs clearance and the speedy unloading of products for the

Project at the port of unloading in the Marshall Islands

(3) To grant permission for Japanese nationals to enter and stay in the Marshall Islands in relation to the products and services provided based on the authorized contract

(4) To exempt Japanese nationals from taxes and tariffs, etc. that is ordinarily levied in the Marshall Islands on products and services supplied based on authorized contracts.

(5) To pay commission fees to the Japanese bank in relation to opening of the bank account for the Project

(6) To bear all items not covered under Japan's Program Grant Aid for Environment and Climate Change when implementing the Project

(7) To attend equipment and materials inspections on site and to appoint an engineer and skilled workers as counterparts for the transfer of operation and maintenance technology

(8) To formulate the power stoppage plan required during the equipment installation works and to implement the necessary procedures for it

(9) To properly and effectively use and maintain the equipment and materials procured under Japan's grant aid

(10) To secure a disposal site for excavated earth, sewage, waste oil and recovered equipment and materials during the works period

(11) To implement final connections of low voltage distribution cables and existing distribution panel for outputting from the PV equipment to be procured and installed on the Japanese side. However, the materials (terminal lugs and bolts, etc.) required for treating the ends of such cables and connecting them will be procured on the Japanese side.

(12) To offer safety guidance and education to local residents

2-4 Project Operation Plan

2-4-1 Routine Inspection and Periodic Inspection Items

Since the PV system to be procured and installed in the Project will play an important part in promoting renewable energy power generation in the Marshall Islands in the future, it will be necessary to establish a setup for appropriate and long-term maintenance by the MEC. Table 2.4.1-1 and Table 2.4.1-2 show the items that need to be covered in routine inspections and periodic inspections of major equipment in standard PV systems. It should be noted, however, that these inspection items will be renewed via maintenance support in the soft component while taking into account the maintenance setup in the Marshall Islands.

Table 2.4.1-1 Routine Inspection Items for Standard Equipment

Inspection Target	Inspection Item	Result
Solar cell array	Surface dirt, damage	
	Frame corrosion, rust	
	External wiring damage	
Junction box	External box corrosion, rust	
	External wiring damage	
Power conditioner	External box corrosion, rust	
	External wiring damage	
	Noise, odor during operation	
	Blockage of the ventilation outlet filter	
	Installed environment (humidity, temperature, etc.)	
Grounding	Wiring damage	
Power generation situation	Confirmation of normal operation via support instrumentation and displays	

Table 2.4.1-2 Periodic Inspection Items for Standard Equipment

Inspection Target	Inspection Item	Result	Measurement Test and Result
Solar cell array	Surface dirt, damage		Insulation resistance MΩ
	Frame corrosion, rust		
	External wiring damage		Open voltage V
	Grounding wire damage, ground wire looseness		
Junction box	External box corrosion, rust		Insulation resistance MΩ
	External wiring damage		
	Grounding wire damage, ground wire looseness		
Power conditioner	External box corrosion, rust		Display section operations
	External wiring damage		
	Noise, odor during operation		Insulation resistance MΩ
	Blockage of the ventilation outlet filter		
	Installed environment (humidity, temperature, etc.)		
	Grounding wire damage, ground wire looseness		
Grounding	Wiring damage		Grounding resistance Ω

2-4-2 Spare Parts Purchase Plan

(1) Spare Parts Categories

The spare parts targeted in the Project are classified into the following uses.

① Replacement parts : Repair parts needed to replace parts that are damaged, etc.

② Emergency spare parts : Instruments that need to be urgently replaced, otherwise the power distribution system could be compromised due to equipment failure, etc.

(2) Selection Criteria for Each Category

1) Replacement parts

These parts experience no periodic wear or degradation in everyday operation, however, assuming them to be repair parts with a high possibility of damage, adopt 100% of the amount projected to be necessary per year.

2) Emergency spare parts

A power conditioner will be procured as an emergency spare part since this could cause major interference to the PV system and would be difficult to quickly repair on site if damaged for some unforeseen and unexpected reason. In the Project, from the viewpoint of procuring the minimum necessary instruments, generated power will diminish if problems arise in solar cells. In the PV system, since the publicity effect of the display unit on ordinary users is great, since any damage would adversely affect the public image and affect the maintenance capacity of the implementing agency, it is necessary to take steps to mitigate the effects.

Moreover, since it is difficult for the Marshall Islands side to implement quick repairs of instruments on site with its existing technology levels, it will need to replace damaged instruments in order to get the system working again. However, since the implementing agency responsible for operation and maintenance in the Project does not possess the necessary equipment for conducting replacement, it will be necessary to procure a power conditioner as an emergency spare part for replacement.

(3) Test Apparatus and Maintenance Tools

The minimum required test apparatus and maintenance tools for conducting appropriate maintenance of the Project PV system will be procured.

Table 2.4.2-1 Spare Parts and Maintenance Tools Procured in the Project

Equipment	Unit	Quantity
1. Replacement parts		
1.1 Distribution circuit breaker 50A	Unit	2
1.2 Distribution circuit breaker 225A	Unit	1
1.3 24-hour timer	Unit	1
1.4 AC/DC converter	Unit	1
1.5 PV module	Unit	27
2. Emergency spare parts		
2.1 Power conditioners (100kW)	Unit	1
3. Test apparatus		
3.1 Multi digital meter	Unit	1
3.2 Insulation resistance meter	Unit	1
3.3 Electroscope (low voltage)	Unit	1
3.4 Clamp meter	Unit	1
3.5 I-V curve tracer	Unit	1
4. Maintenance tools		
4.1 Driver set	Unit	2
4.2 Nipper, 150 type	Unit	2
4.3 Pliers, 150 type	Unit	2
4.4 Terminal pressure fitting pliers	Unit	1
4.5 Hammer	Unit	1
4.6 Card tester	Unit	1
4.7 Socket wrench (9~21)	Set	1
4.8 Conduction tools	Unit	1

2-5 Project Cost Estimation

2-5-1 Estimated Cost of the Requested Japanese Assistance

The total project cost in the event where the Project is implemented under the grant aid scheme of the Government of Japan will be approximately 526.6 million yen, and the breakdown of costs on both sides based on the abovementioned scope of works is estimated as follows according to the following estimation criteria. However, the project cost estimate given here is a provisional value and does not represent the supply limit stated in the exchanged notes. The actual cost will be subjected to more detailed review when the Project implementation contents are examined.

(1) Cost on the Japanese side

Rough total project cost approximately 526 million yen

Item		Rough project Cost (million yen)
Equipment	205kW PV system and grid connection equipment	453
Implementation design and procurement supervision cost		37
Soft component cost		21
Procurement agent costs		15

(2) Cost on the Marshall Islands side 6,800 US$ (approximately 0.6 million yen)

The contents and cost of work on the Marshall Islands side are as follows:

① High voltage side connection work and connection section works: 1,500 US$ (approximately 0.15 million yen)

② Payment of commission to Japanese bank for opening bank account: 5,300 US$ (approximately 0.53 million yen)

(3) Estimation criteria

①Estimation point: : July 2009

②Exchange rate : 1 US$＝96.59 yen (TTS mean value from January to June 2009)

③Works and procurement period: The detailed design and equipment procurement and installation period is as shown in the implementation schedule.

④Other points : The Project will be implemented according to the Grant Aid Scheme of the Government of Japan.

2-5-2 Operation and Maintenance Cost

The equipment to be procured in the Project is basically maintenance-free, however, it will be necessary to always keep replacement parts on hand in case of breakdowns as was mentioned earlier (see 2-4-2). Moreover, in cases of periodic inspections or when abnormal situations or breakdowns occur, it will be necessary to dispatch MEC engineers and thereby incur personnel expenses. Therefore, the Marshall Islands side will need to budget for the following operation and maintenance expenses (annual) to ensure that no problems arise in the operation and maintenance of equipment.

① Personnel expenses Approximately 20,000US$
(approximately 2 million yen)

② Expendable and replacement parts costs Approximately 20,000US$
(approximately 2 million yen)

③ Total (4 areas) Approximately 40,000US$ (approximately 4 million yen)

Since the above cost amounts to no more than approximately 1% of the Marshall Islands distribution system operation and maintenance budget in 2008 (approximately 18,785,000 US$/year), there should be no major problem in securing the operation and maintenance costs for the Project.

2-6 Other Relevant Issues

Important points to consider that will have a direct impact on the Project implementation are thought to be as follows.

(1) In order for the Marshall Islands side to procure and install 415 V low voltage distribution line equipment to coincide with the transformer equipment and 33 kV distribution lines to be procured and installed by the Japan side in the Project, it will need to select the distribution operator in charge of the target area and compile the implementation plan, staffing plan and equipment procurement plan, etc. to ensure the smooth execution of the works.

(2) Although the Project will establish the power supply system for consumers in the target area, the Government of the Marshall Islands will need to review the distribution network in consideration of future growth in the consumer area and expand the network, etc. with a view to improving the quality of life for residents and rectifying differentials, etc.

(3) It will be desirable to survey the socioeconomic indicators for the target area collected in this study after implementation of the Project in order to quantitatively assess the effect that the Project and similar electrification projects impart on socioeconomic conditions in non-electrified areas.

(4) When implementing the Project, the works and operation and maintenance activities shall be implemented in cooperation with the responsible organization and implementing agency while paying attention to the environmental impact mitigation measures compiled by the Survey Team and the recommendations described in approved documents from the responsible government agency in the Marshall Islands.

CHAPTER 3

PROJECT EVALUATION AND RECOMMENDATIONS

Chapter 3 Project Evaluation and Recommendation

3-1 Project Effects

The anticipated effects of the Project implementation are as follows.

(1) Direct Effects

Current Conditions and Problems	Project Countermeasures (target works)	Degree of Project Effects and Improvement
The Government of the Marshall Islands regards breaking away from a supply setup dependent on diesel fuel in the energy and electric power sector to be an urgent issue, and it is also concerned over climate change, unstable crude oil prices and transportation costs. Accordingly, it regards development of renewable clean energies, primarily photovoltaic power, as a priority policy. However, the Marshalls Energy Company (MEC), which is responsible for electricity supply, does not possess sufficient operation and maintenance capability in the renewable energy field.	Procure and install a grid-connected PV system (connected to existing distribution lines) at the Project target site of Majuro Hospital. Moreover, through the soft component, improve the operation and maintenance capability of the MEC which will be responsible for operating and maintaining the grid-connected PV system.	(1) Reduction of diesel fuel consumption The power generated by the grid-connected PV system procured and installed in the Project will enable the operating capacity of existing diesel generating equipment to be reduced, thereby enabling approximately 56 kl of diesel consumption to be saved every year. (2) Reduction of CO_2 emissions In line with reduction in the operating capacity of diesel generating equipment, CO_2 emissions will be cut by approximately 144 tons per year. (3) Improvement of operation and maintenance capability Operation and maintenance capability for connecting the Project system to the existing distribution grid and conducting safe and stable operation will be improved.

(2) Indirect Effects

Current Conditions and Problems	Project Countermeasures (target works)	Degree of Project Effects and Improvement
In the Marshall Islands, a grid-connected PV system has been introduced on a trial basis at the College of Marshall Islands (CMI) in the national capital under financial assistance from the United States (Compact). However, dissemination activities among energy sector officials and ordinary citizens in the Marshall Islands are not well advanced.	Procure and install a grid-connected PV system (connected to existing distribution lines) at the Project target site of Majuro Hospital	Since the Project site of Majuro Hospital is situated in the center of Majuro and is the tertiary medical care institute of the Marshall Islands, it will be possible to publically advertise the use of PV power to citizens who use the hospital. Since Project implementation will spread awareness of the potential of PV power system to all sections of society, this will facilitate further dissemination the future.

3-2 Recommendations

3-2-1 Recommendations to be taken by Recipient Country

In order for the Project effects to be realized and sustained, the main issues that need to be tackled by the Marshall Islands side are as follows.

(1) To ensure the stable operation of the grid-connected PV system, it will be necessary to strictly observe preventive maintenance measures such as implementing daily and periodic site patrols and inspections and securing the onsite setup for guarding the photovoltaic modules.

(2) To promptly appoint the engineers who will take part in the Project soft component and OJT, to facilitate their attendance at the said training, and to ensure that technology is horizontally conveyed to other engineers who could not participate in the training.

(3) Concerning the grid-connected PV system that will be procured and installed by the Japanese side in the Project, it will be necessary to establish a power tariff scheme that enables future investment costs to be recovered, particularly in anticipation of renewals of the photovoltaic modules and power conditioner at the end of their expected service life.

3-2-2 Technical Cooperation and Coordination with Other Donors

As a similar undertaking to the Project, a project to install a PV system on the roof of the College of Marshall Islands (CMI) in the capital Majuro is being advanced under financial support (COMPACT) from the United States. This project is composed of three phases planned for completion in 2011, and so far Phase 1 has been finished. In Phase 1, a grid-connected PV system with 60kW capacity was established and went into operation in June 2008, and the system is eventually scheduled to have capacity of 198kW. The power generated in this system exceeds consumption on the college campus and since it is planned to supply electricity from this system to the city grid in future, technical support concerning operation and maintenance of the grid-connected PV system has been conducted in classroom and practical training, and these contents can be referred to when implementing the soft component in the Project. Otherwise, there has been no technical cooperation that can offer preconditions for Project implementation.

APPENDICES

1. MEMBER LIST OF THE STUDY TEAM

1. Member List of the Study Team

1-1 Preparatory Study

Name	Assignment	Organization
Ryuji MATSUNAGA	Leader	Japan International Cooperation Agency (JICA)
Takafumi YASUMOTO	Planning Management	Japan International Cooperation Agency (JICA)
Yoshihisa SHIRAISHI	Procurement Management	Japan International Cooperation System (JICS)
Kaname MOTOKI	Vice	ICONS International Cooperation Co., Ltd..
Masahiro SAKURAI	Grid-connected PV System 2/ Related Institutional Framework and Standards 2	ICONS International Cooperation Co., Ltd.
Masahiro IZUMIKAWA	Grid-connected PV System 4/ Related Institutional Framework and Standards 4	Shikoku Electric Power Co., Inc.
Takayuki KURITA	Equipment / Installation Planning2	ICONS International Cooperation Co., Ltd.
Masakazu ISHII	Procurement Planning / Cost Estimation 2	ICONS International Cooperation Co., Ltd.
Yousuke TSURUOKA	Architectural Design	Yachiyo Engineering Co., Ltd.

1-2 Discussion of Draft Outline Design

Name	Assignment	Organization
Kazuo SENGA	Leader	Japan International Cooperation Agency (JICA) Resident representative, Marshall Islands Office
Tadayuki Ogawa	Chief Consultant / PV System 1/Environmental and Social Considerations1	Yachiyo Engineering Co., Ltd.
Kaname MOTOKI	Vice Consultant / PV System 1/Environmental and Social Considerations1	ICONS International Cooperation Co., Ltd.
Yoshitetsu FUJISAWA	Grid-connected PV System 1/ Related Institutional Framework and Standards 1	Shikoku Electric Power Co., Inc.
Masahiro IZUMIKAWA	Grid-connected PV System 4/ Related Institutional Framework and Standards 4	Shikoku Electric Power Co., Inc.
Makoto ABE	Procurement Planning / Cost Estimation 1	Yachiyo Engineering Co., Ltd.

2. STUDY SCHEDULE

2. Study Schedule

2.1 Preparatory Study Schedule

No.	Date	Day of the week	Survey Contents		Stay at
			Officials	Consultants	
			Mr. Ryuji MATSUNAGA Mr. Takafumi YASUMOTO Mr. Mr. Yoshihisa SHIRAISHI		
1	Jun.28	Sun	Trip [→Majuro]	• Trip [Narita → Guam] CO962 (1030 - 1500) • Trip [Narita → Guam] NW108 (1030-1505)Mr. Izumikawa）	Guam
2	Jun. 29	Mon	• Courtesy Call to the Ministry of Foreign Affairs • Courtesy Call to the Ministry of Resources & Development • Courtesy Call to the Embassy of Japan • Courtesy Call to the Office of Chief Secretary • Meeting with the Energy Task Force	• Trip [Guam → Majuro] CO956 (0820 - 1908)	Majuro
3	Jun.30	Tue	• Joint meeting with the Ministry of Resources & Development and the MEC • Site observation for the installation of solar system	• Courtesy call and meeting with Ministry of Resources and Development (MRD) • Courtesy call and meeting with Taskforce and Marshall Electric Company Ltd (MEC). • Explanation and Discussion of Inception Report, Questionnaire, etc with MRD and MEC. • Site Survey at Majuro Hospital • Site Survey at Marshall High School	Majuro
4	Jul.1	Wed	• Meeting with Ministry of Resources & Development regarding the Minutes of Meeting • Site observation for the installation of solar system	• Meeting with Ministry of Resources & Development regarding the Minutes of Meeting • Technical Meeting with MRD and MEC • Site Survey at Collage of Marshall Islands • Site Survey at Water catchment in Majuro Airport	Majuro
5	Jul.2	Thu	• Signing of the Minutes of Meeting • Report to the Embassy of Japan • Report to JICA Marshall Islands Office	• Signing of the Minutes of Meeting • Report to the Embassy of Japan • Report to JICA Marshall Islands Office	Majuro
6	Jul.3	Fri		• Site Survey at MEC Power Plant and Distribution Line • Site Survey at Majuro Hospital • Technical Meeting with MRD and MEC	Majuro
7	Jul.4	Sat	• Departure of JICA Survey Team (Mr. Matsunaga, Mr. Shiraishi)	• Sorting of data and information collected • Site Survey at MEC Power Plant and Distribution Line	Majuro
8	Jul.5	Sun	• Departure of JICA Survey Team (Mr. Yasummoto)	• Sorting of data and information collected	Majuro
9	Jul.6	Mon		• Technical Meeting with MRD and MEC • Site survey at Majuro Hospital • Market Survey • Confirmation on the procedures for EIA, and others	Majuro
10	Jul.7	Tue		• Site Survey at MEC Power Plant • Technical Meeting with MRD and MEC • Market Survey	Majuro

No.	Date	Day of the week	Survey Contents		Stay at
			Officials	Consultants	
			Mr. Ryuji MATSUNAGA Mr. Takafumi YASUMOTO Mr. Mr. Yoshihisa SHIRAISHI		
11	Jul.8	Wed		• Market Survey • Technical Meeting with MRD and MEC • Meeting with Ministry of Health and MRD	Majuro
12	Jul.9	Thu		• Technical Meeting with MRD and MEC • Meeting with Ministry of Health and MRD	Majuro
13	Jul.10	Fri		• Singing of the Field Report • Report to the Embassy of Japan • Report to JICA Marshall Islands Office	Majuro
14	Jul.11	Sat		• Trip [Majuro → Guam] CO957 (1055 - 1720)	Guam
				• Trip[Majuro →Pohnpei] CO957 (1055 – 1420)(Mr. Tsuruoka)	Pohnpei
15	Jul.12	Sun		• Trip [Guam → Narita] JO982 (0420 - 0705)	

2.2 Discussion of Draft Outline Design schedule

No.	Date	Day of the week	Survey Contents		Stay at
			Official	Consultant Members	
				Mr. Tadayuki OGAWA, Mr. Kaname MOTOKI Mr. Yoshitetsu FUJISAWA, Mr. Masahiro IZUMIKAWA Mr. Fumikazu DOI, Mr. Makoto ABE	
1	Nov. 29	Sun.		• Trip [Tokyo (11:05) → Guam (15:35) by CO962]	Guam
2	Nov. 30	Mon		• Trip [Guam (08:20) → Majuro (19:08) by CO956]	Majuro
3	Dec. 1	Tue.		• Courtesy call to EOJ and JICA Marshall Office • Courtesy call and meeting with Ministry of Foreign Affairs • Courtesy call and meeting with Ministry of Resource and Development • Courtesy call and meeting with Marshall Energy Company (MEC) • Explanation and Discussion of Draft Final Report, and Minutes of Discussion (M/D)	Majuro
4	Dec. 2	Wed.		• Explanation and Discussion of Draft Tender Documents • Site Survey at the Project Site, Power Stations and Distribution Lines	Majuro
5	Dec. 3	Thu.		• Signing of M/D • Report to EOJ and JICA Marshall Office on the result of second field survey	Majuro
6	Dec. 4	Fri.	National Holiday	• Sorting of data and information collected	Majuro
7	Dec. 5	Sat.		• Trip [Majuro (10:55) → Pohnpei (14:20) by CO957]	Pohnpei

3. LIST OF PARTIES CONCERNED

IN THE RECIPIENT COUNTRY

3. LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

Organization and Name	Job Title
3.1 Preparatory Study	
Ministry of Resources and Development	
Mr. Thomas Kijiner Jr.	Secretary
Ms. Rebecca Lorrenij	Deputy Secretary
Mr. Nick Wardrop	Energy Adviser
Ms. Angeline Haine	Energy Planner
Mr. Walter Myazoe	Energy Officer
Ministry of Foreign Affairs	
Ms. Kino S. Kabua	Secretary
Ministry of Health	
Dr. Mane Paul	Assistant Secretary
Mr. Russell Edwards	Assistant Secretary
Mr. Franei Siu	BT Counselor
Ministry of Finance	
Mr. Bruce Bifimon	Assistant Secretary Customs, Treasury, Revenue & Taxation
Marshalls Energy Company	
Mr. Steve Wakefield	Manager
Mr. Steve Gooden	Director Distribution Technical
Mr. Roger Wirson	Director, Physical Plant
Environmental Protection Authority	
Mr. Michal Honeth	Coastal Advisor
Mr. Terry Keyin	Deputy General Manager
Economic Policy, Planning and Statistics Office	
Mr. Carl Hacker	Director
Collage of Marshall Islands	
Mr. Roger Wilson	Director of Physical Plant

Embassy of Japan in Republic of the Marshall Islands

Prof. Dr. Kazuyuki Ohdaira	Charge'd'Affaires
Mr. Tomoaki Miyamoto	Adviser(Economic and Technical Cooperation)

JICA Marshall Islands Office

Mr. Kazuo Senga	Resident Representative
Mr. Takayuki Murakami	Volunteer Coordinator

-Construction companies
Pacific International, Inc.

Mr. Jerry Kramer	Chief Excective Officer
Mr. Robert "Bobby" Muller	Project manager

MJCC

Mr. Hideo Kikuchi	Managing Director
Mr. Robert "Bobby" Muller	Account Dept

Anil Development, Inc. / DAR sales & services

Mr. Charles T. Dominic	Managing Director

-Rent a car
Japan Recycle Corporation

Mr. Susumu Yoshimura	General Manager

ELM Motor

Mr. Henry Lin	General Manager

3.2 Discussion of Draft Outline Design schedule

Ministry of Resources and Development

Mr. Thomas Kijiner Jr.	Secretary
Ms. Rebecca Lorrenij	Deputy Secretary
Ms. Angeline Haine	Energy Planner
Mr. Walter Myazoe	Energy Officer

Ministry of Foreign Affairs

Ms. Kino S. Kabua	Secretary

Ministry of Health

Dr. Mane Paul	Assistant Secretary
Mr. Russell Edwards	Assistant Secretary
Mr. Franei Siu	BT Counselor

Ministry of Finance

Mr. Bruce Bifimon	Assistant Secretary Customs, Treasury, Revenue & Taxation

Marshalls Energy Company

Mr. Steve Wakefield	Manager
Mr. Roger Wirson	Director, Physical Plant

Environmental Protection Authority

Mr. Michal Honeth	Coastal Advisor
Mr. Terry Keyin	Deputy General Manager

Collage of Marshall Islands

Mr. Roger Wilson	Director of Physical Plant

4. MINUTES OF DISCUSSIONS

Minutes of Discussions
of the Preparatory Survey
of the Project for the introduction of Clean Energy
by Grid-Connected Solar Electricity Generation 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 the introduction of Clean Energy by Grid-Connected solar electricity generation system in the Republic of Marshall Islands (hereinafter referred to as "the Project").

JICA sent to Marshall Islands the Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Ryuji MATSUNAGA, Deputy Director General, Office for Climate Change, JICA , and is scheduled to stay in the country from June 29 to July 11 as the Preparatory Survey for Detailed Design.

The Team held discussions with the concerned officials of the Government of the Republic of Marshall Islands (hereinafter referred to as "RMI") and conducted a field survey.

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

Majuro, July 2, 2009

Mr. Ryuji MATSUNAGA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
JAPAN

Mr. Thomas Kijiner, Jr.
Secretary
Ministry of Resources and Development
Republic of the Marshall Islands

Ms. Kino S. Kabua
Secretary
Ministry of Foreign Affairs
Republic of the Marshall Islands

Mr. Steve Wakefield
Manager
Marshalls Energy Company (MEC)

ATTACHMENT

1. Current Situation

Based on the result of the previous project formulation study and the official request from the Government of RMI, Detailed Design and Draft Tender Documents shall be created under the Survey.

2. Objective of the Project

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

3. Responsible Organization and Implementing Agency

The responsible organization is the Ministry of Resources and Development (MRD). (The organization chart of the responsible ministry is shown in Annex-1.)

The implementing agency is the Marshalls Energy Company (MEC). (The organization chart of the implementing organization is shown in Annex-2.)

4. Project Component

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

(1) Photovoltaic (PV) Module (Panel) (total capacity between 160 – 200 kW)
(2) Junction Box
(3) Power Conditioner
(4) Transformer
(5) Data collecting and display device

4-2. Project site is the Majuro Hospital as shown in Annex-3

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

4-4. The Team will assess the appropriateness of the request and will report the findings to JICA Headquarters and the GoJ. The RMI side has understood that 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 RMI side understood the Japan's Program Grant Aid for Environment and Climate Change scheme explained by the Team as described in Annex-4, 5 and 6.

6. Schedule of the Study

(1) The Team will proceed to further survey in RMI until July 10, 2009.
(2) JICA will prepare the draft report and reference document in English and dispatch a mission to RMI in order to explain their contents in the end of November, 2009.

(3) When the contents of the report are accepted in principle by the Government of RMI, JICA will complete the final report and reference document, and submit them to the Government of RMI and to the Procurement Agent by the end of January, 2010.

7. Other Relevant Issues

7-1 Major Undertakings to be taken by Each Government

The RMI side confirmed that major undertakings as shown in Annex-7 should be taken by RMI side at its own budget. In addition, the RMI side should be responsible for the following issues;

(1) Securing necessary land
- for PV Modules
- for underground cables between PV Modules and Power Conditioners
- for Power Conditioners

(2) Temporary Stockyard during installation of the equipment and materials

(3) Vehicles for Operation and Maintenance

(4) Tables and PCs, if necessary

7-2 Land Acquisition Procedures

The RMI side agreed to complete all necessary procedures for official land acquisition for the above 7-1 (1) by the end of September, 2009.

7-3 Procurement of Equipment and Materials

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

The RMI side agreed with the policy of GoJ.

7-4 Coordination with Related Organizations

The Responsible Organization for the Project (MRD) shall be the focal point for the Team, and responsible for the coordination with related organizations.

7-5 Application of the Related Laws and Regulations

The Responsible Organization for the Project (MRD) shall be responsible for the application of related laws and regulations for the operation of the Grid-Connected PV system before commissioning of the Project.

7-6 Property of Equipment and Materials

The Responsible Organization for the Project (MRD) shall own the equipment and materials provided under the Project during and after implementation of the Project.

7-7 Environmental and Social Considerations

The Team explained the outline of JICA Environmental and Social Considerations Guideline

(hereinafter referred to as "the JICA Guideline") to the RMI side. The RMI side took the JICA Guideline into consideration, and shall complete the necessary procedures.

7-8 Operation and Maintenance

The RMI side agreed to secure the necessary budget and personnel for the Operation and Maintenance of Grid-Connected PV system procured and installed under the Project.

7-9 Customs and Tax exemption

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

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

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

7-12 The RMI side shall submit all the answers to the Questionnaire, which the Team handed to the RMI side on July 10, 2009.

<List of Annex>

Annex-1 Organization Chart of Ministry of Resources and Development

Annex-2 Organization Chart of Marshalls Energy Company

Annex-3 Project site / Candidate site of the Project

Annex-4 Japan's Environment Program Grant Aid Scheme

Annex-5 Flow of Funds for Project Implementation

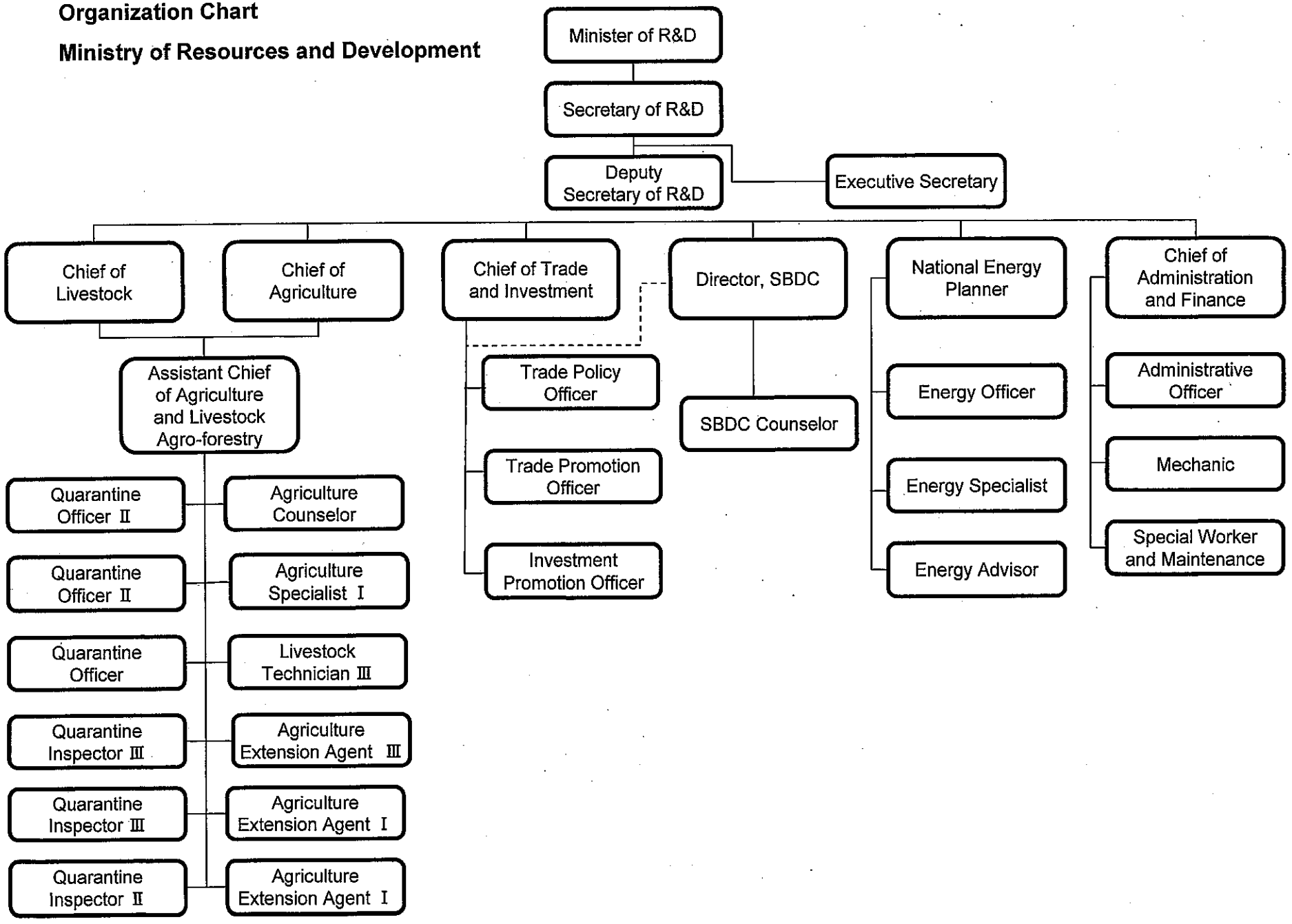
Annex-6 Project Implementation System

Annex-7 Major Undertakings to be taken by Each Government

Annex-8 Terms of Reference of the Consultative Committee (Provisional)

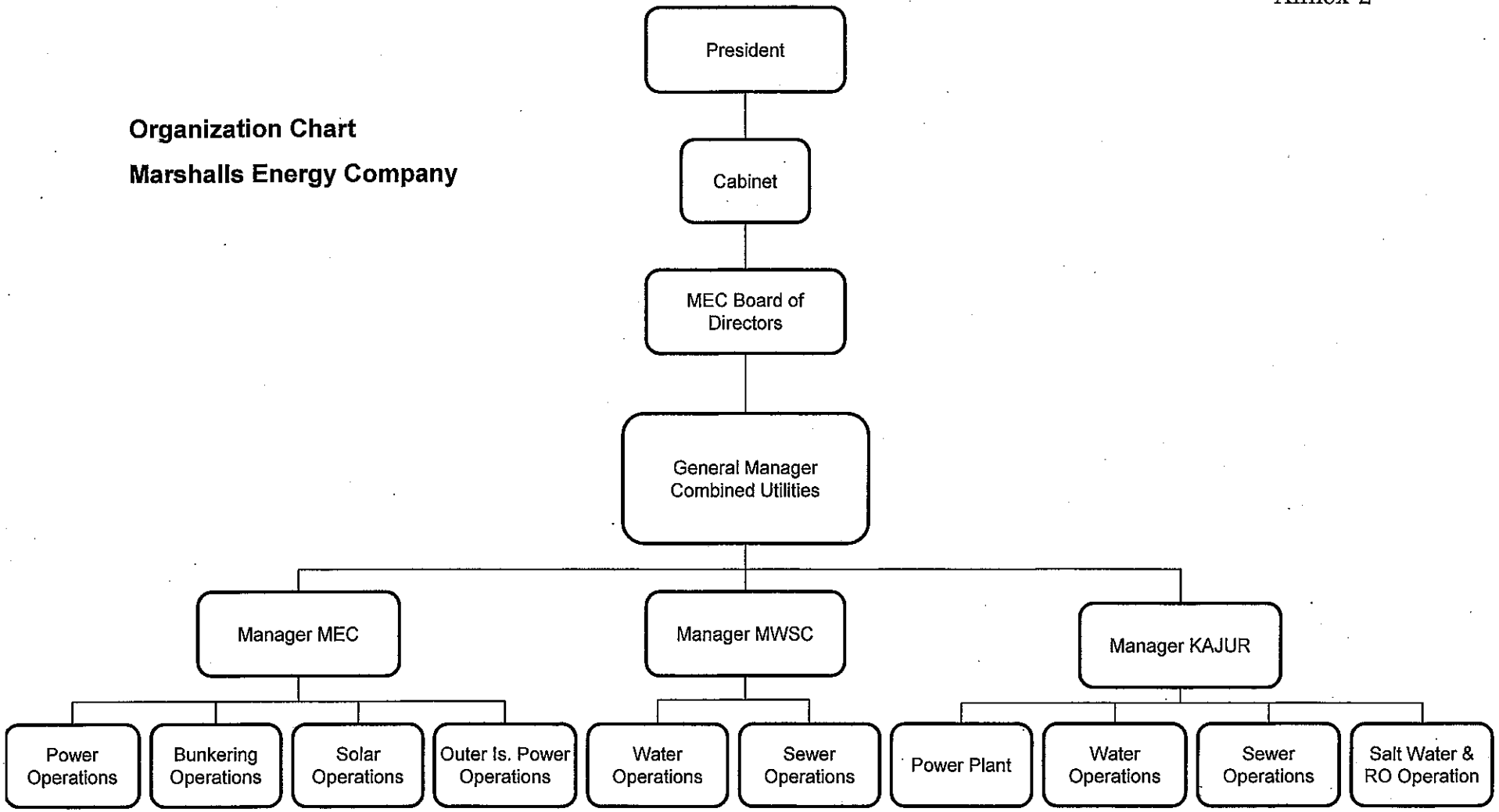
Organization Chart

Ministry of Resources and Development

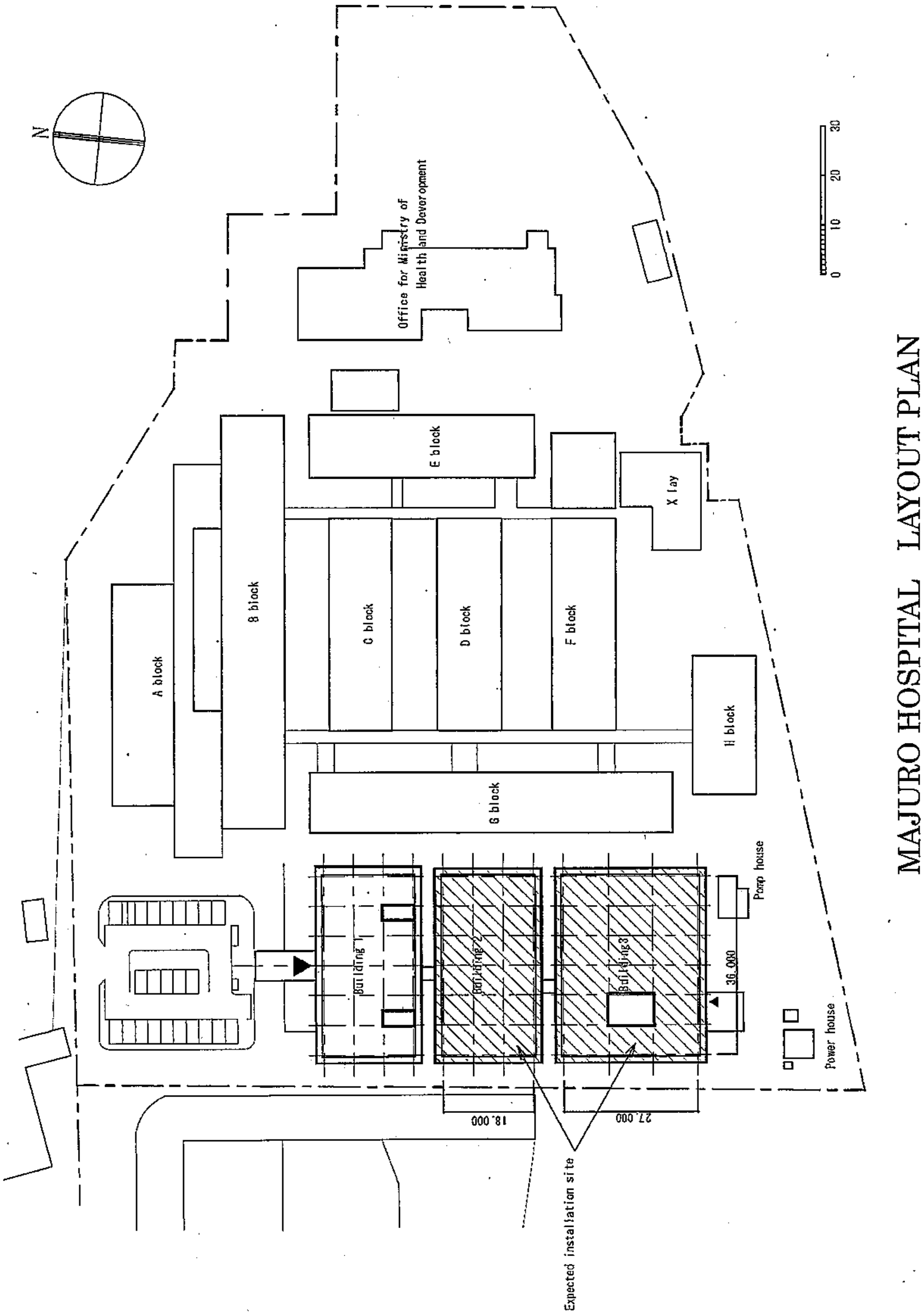


Organization Chart

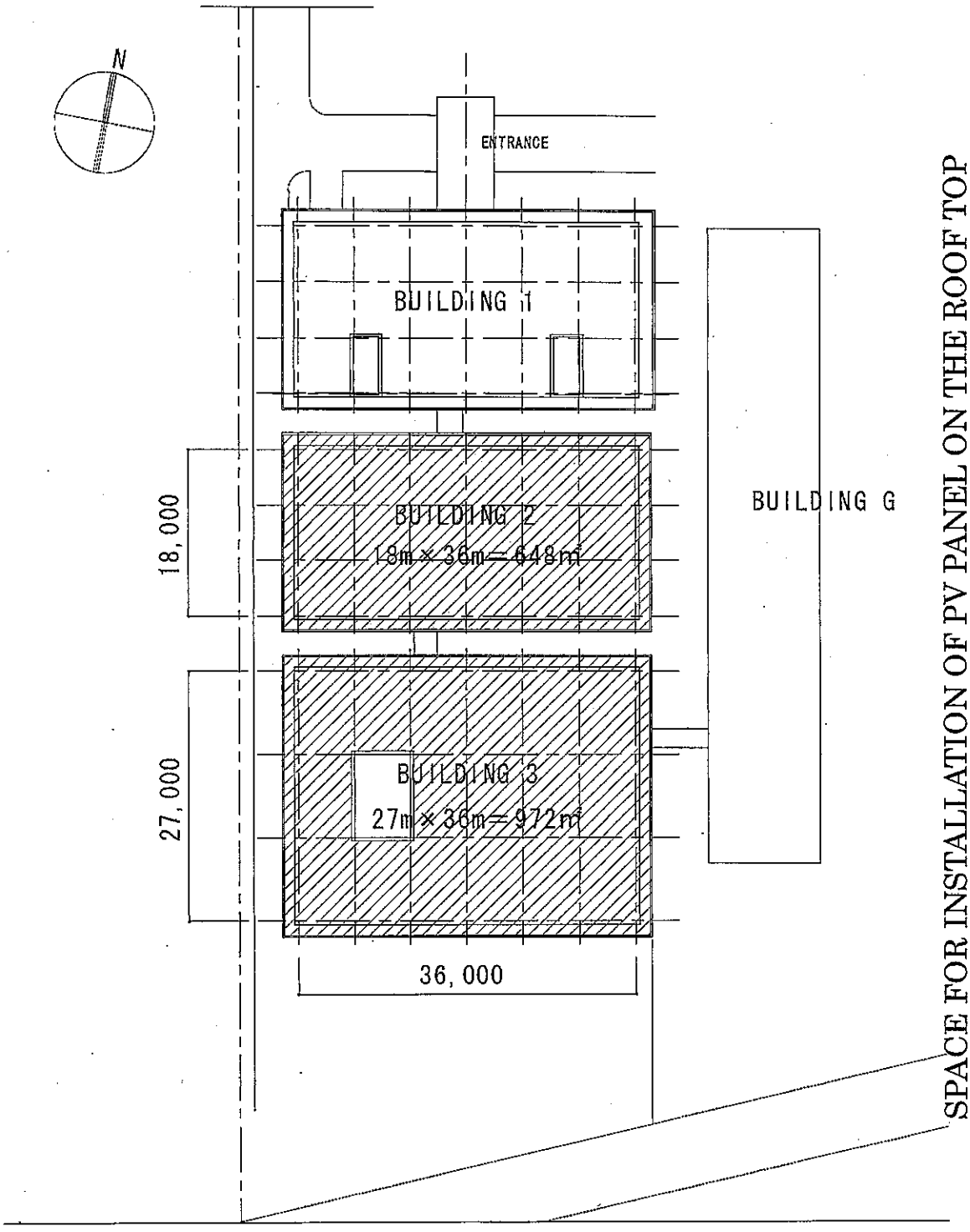
Marshalls Energy Company



Candidate Site of the Project



Candidate Site of the Project



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).

1. Procedures for GAEC

GAEC is executed through the following procedures.

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

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

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

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

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of

Notes (E/N) signed by the Governments of Japan and the Recipient.

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

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

2 Preparatory Survey

1) Contents of the Survey

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

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

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

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

2) Selection of consulting firms

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

3. Implementation of GAEC after the E/N

1) Exchange of Notes (E/N)

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

2) Details of Procedures

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

Essential points to be agreed are outlined as follows:

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

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

a) The Agent

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

b) Agent Agreement

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

c) Approval of the Agent Agreement

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

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

d) Payment Methods

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

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

e) Products and Services Eligible for Procurement

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

f) Selection of firms

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

The same applies for any individual consultants who will be involved in the project and provide services necessary for the training and guidance related to the Project. The consultants that will be employed to do detail design and supervise the work for the Project, however will be, in principle Japanese nationals recommended by JICA for the purpose of maintaining technical consistency with the Survey

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

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

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

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

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

j) Tender Evaluation
The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

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

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

k) Additional procurement
If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the Recipient would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:
(1) Procurement of same products and services
When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged not efficient, additional procurement can be conducted by a negotiated contract with the successful tenderer of the initial tender.
(2) Other procurements

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

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

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

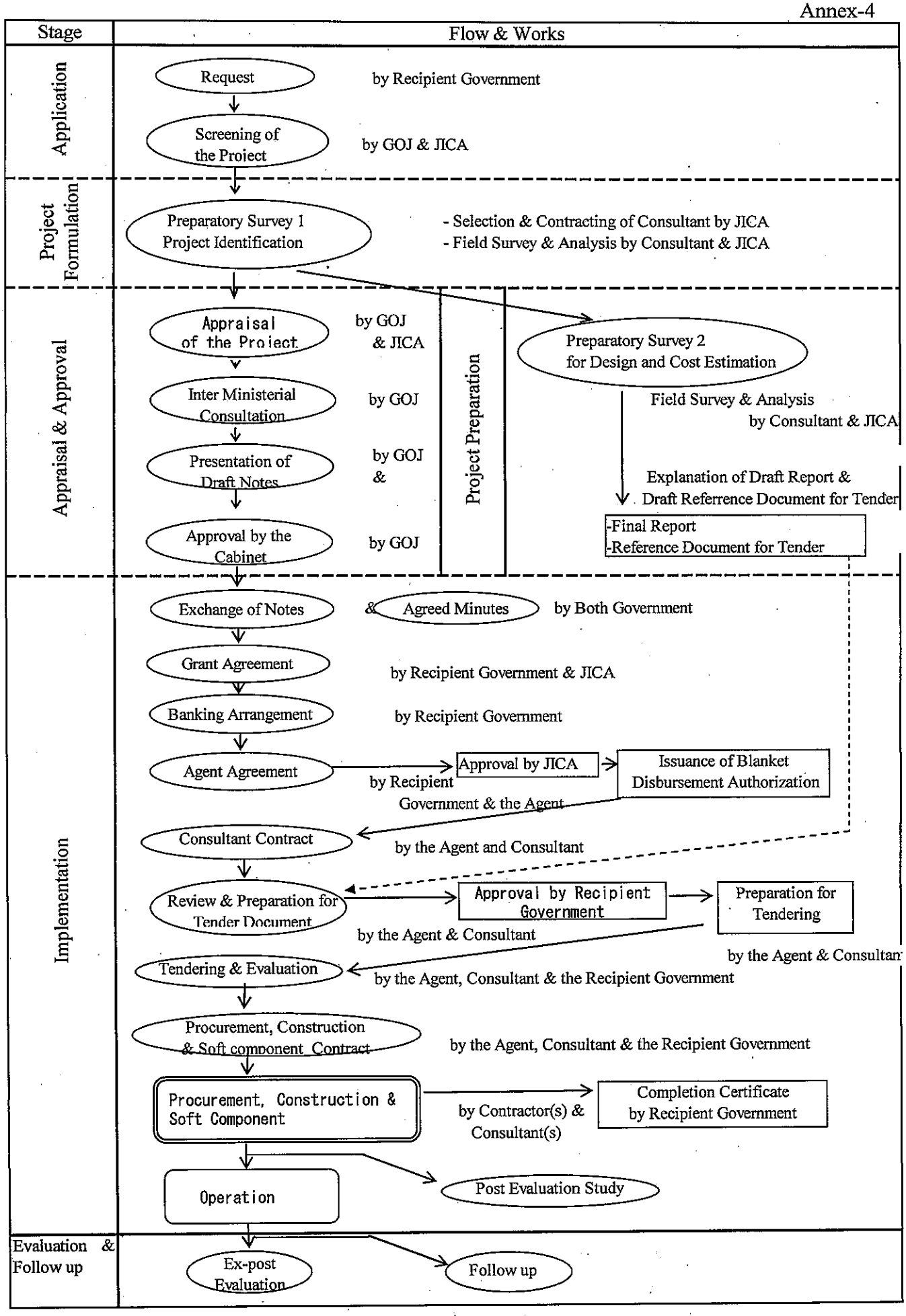
4) Undertakings required by the Government of the Recipient Country
In the implementation of the Grant Aid Project, the Recipient is required to undertake necessary measures as the following:

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

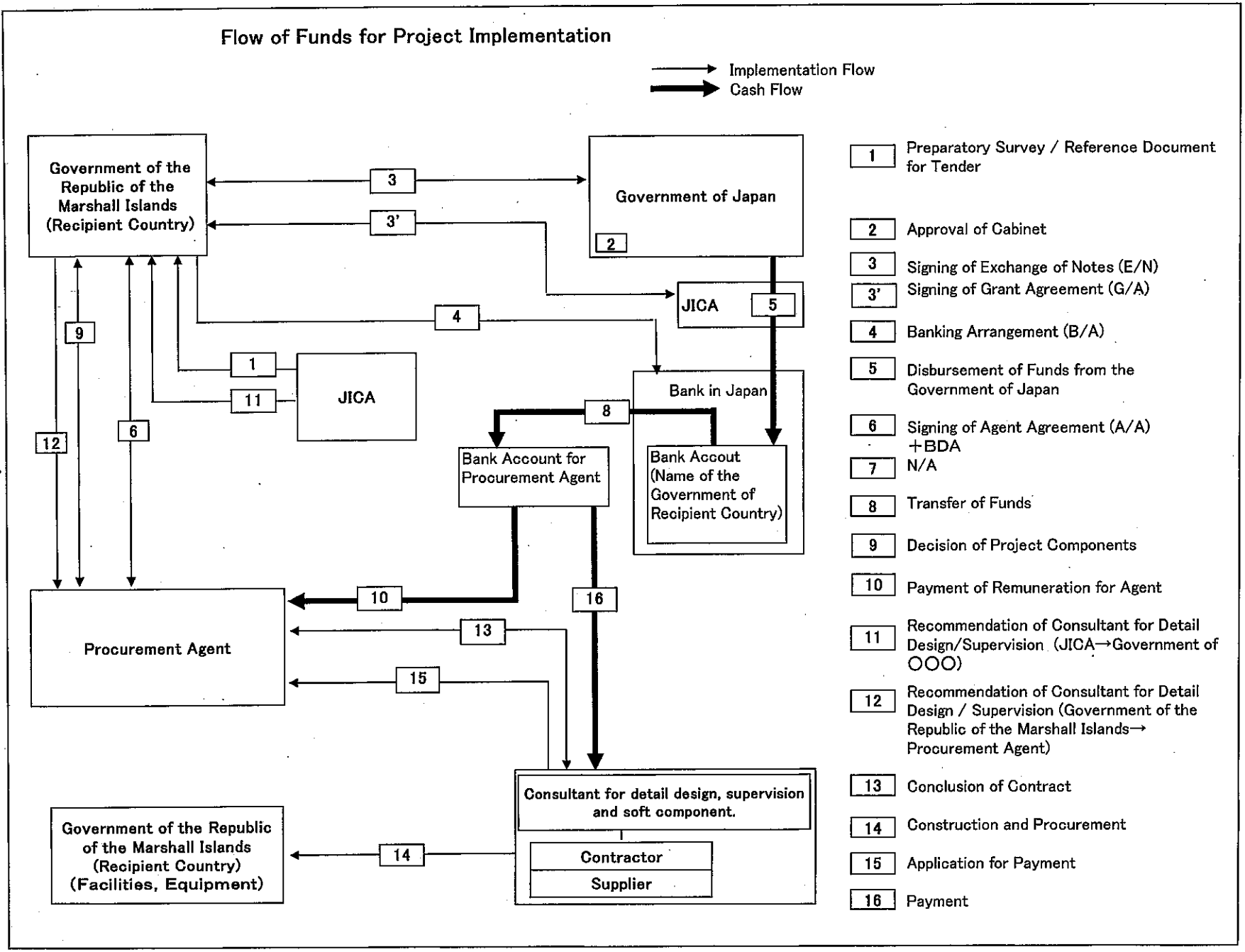
5) "Proper use of funds"
The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered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

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

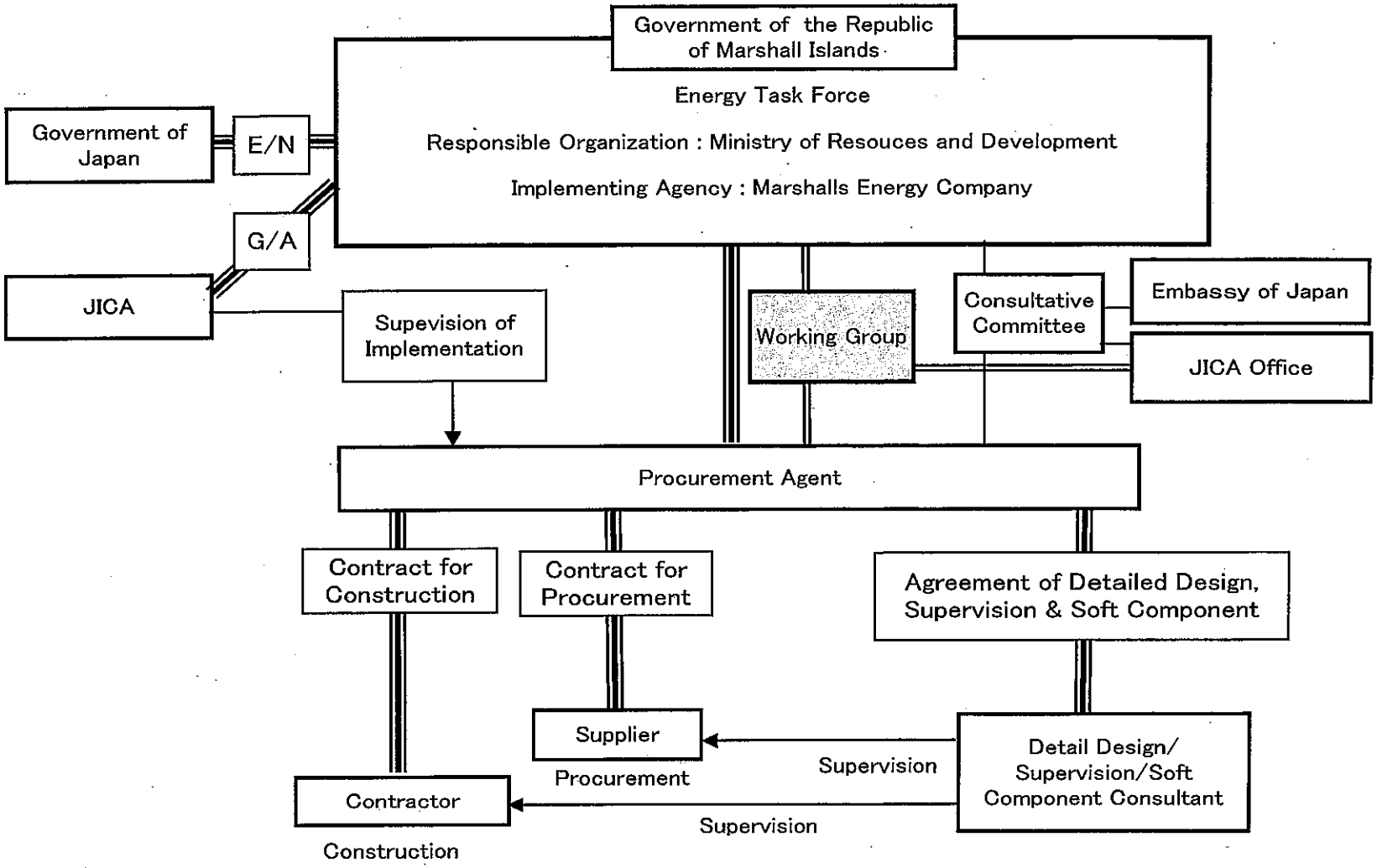
Annex-4


Stage
Flow & Works
Application
Request
by Recipient Government
Screening of the Project
by GOJ & JICA
Project Formulation
Preparatory Survey 1
Project Identification
- Selection & Contracting of Consultant by JICA
- Field Survey & Analysis by Consultant & JICA
Appraisal & Approval
Appraisal of the Project
by GOJ & JICA
Inter Ministerial Consultation
by GOJ
Presentation of Draft Notes
by GOJ &
Approval by the Cabinet
by GOJ
Project Preparation
Preparatory Survey 2
for Design and Cost Estimation
Field Survey & Analysis
by Consultant & JICA
Explanation of Draft Report &
Draft Referrence Document for Tender
-Final Report
-Reference Document for Tender
Implementation
Exchange of Notes
& Agreed Minutes
by Both Government
Grant Agreement
by Recipient Government & JICA
Banking Arrangement
by Recipient Government
Agent Agreement
by Recipient Government & the Agent
Approval by JICA
Issuance of Blanket Disbursement Authorization
Consultant Contract
by the Agent and Consultant
Review & Preparation for Tender Document
by the Agent & Consultant
Approval by Recipient Government
Preparation for Tendering
by the Agent & Consultant
Tendering & Evaluation
by the Agent, Consultant & the Recipient Government
Procurement, Construction & Soft component Contract
by the Agent, Consultant & the Recipient Government
Procurement, Construction & Soft Component
by Contractor(s) & Consultant(s)
Completion Certificate by Recipient Government
Operation
Post Evaluation Study
Evaluation & Follow up
Ex-post Evaluation
Follow up

Flow of Funds for Project Implementation



Project Implementation System



REPUBLIC OF THE MARSHALL ISLANDS
MINISTRY OF RESOURCES & DEVELOPMENT
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Majuro, Marshall Islands 96960
Phone: (692) 625-3206 Fax: (692) 625-7471
Email: rndsec@ntamar.net

ENERGY TASK FORCE

The Energy Task Force was created during the event of the Economic Emergency 2008. The Energy Task Force role is to mitigate issues relating to fuel crises and other energy related issues.

Members: Chief Secretary Casten Nemra (Chairman), Deputy Secretary Jorelik Tibon (Chairman), Secretary Tommy Kijiner, Jr. (RND), Secretary Kino Kabua (MOFA), Yumi Crisistomo (OEPPC), Deborah Manase (OEPPC), Secretary Wilbur Heine (IA), Carl Hacker (EPPSO), Roger Cooper (MAWSC), Ben Graham (Consultant), Steve Wakefield (MEC), and Angeline C. Heine (Energy Division, RND), Energy Adviser (Nick Wardrop Ministry of Finance (Kayo Yamaguchi-Kotton)

Implementation for Outer Island Solar System
In terms of implementing the Solar Units, there is an existing MOU between the Ministry of Resources & Development (RND) and Marshalls Energy Company (MEC). The MOU states that while the RND through its Energy Division is responsible for the development and implementation of the country's renewable energy power projects and other related issue, the MEC is mandated to provide, install, operate, and maintain the renewable energy power projects in the RMI, with necessary technical assistance.

MOFA: Ministry of Foreign Affairs
RND: Ministry of Resources & Development
IA: Ministry of Internal Affairs
EPPSO: Economic Planning Policy Statistics Office
OEPPC: Office of Environment Planning and Policy Coordination
MAWC: Majuro Atoll Waste Company
MEC: Marshall Islands Energy Company
MOU: Minutes of Understanding

Annex-7

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 ports 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 Program.		●

Annex- 8

Terms of Reference of the Consultative Committee (Provisional)

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

2. To discuss the modifications of the Program, including modification of the design of the facility.

3. To exchange views on allocations of the Grant and its accrued interest as well as on potential end-users.

4. To identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems.

5. To exchange views on publicity related to the utilization of the Grant and its accrued interest.

6. To discuss any other matters that may arise from or in connection with the G/A.

Minutes of Discussions
on
the Outline Design Study
on
The Project for Introduction of Clean Energy by Solar Electricity Generation System in the Republic of the Marshall islands

(Explanation on Draft Final Report)

In December 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 Marshall Islands (hereinafter referred to as "RMI"), and through discussions, field survey and technical examination of the results of the survey in Japan, JICA prepared a Draft Final Report of the Outline Design.

In order to explain and to consult with the concerned officials of the Government of RMI on the component of the Draft Final Report, JICA sent RMI the Draft Final Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Kazuo SENGA, Representative of Office of RMI, JICA, from 30th November 2009 to 5th December 2009.

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

Majuro, 3rd December, 2009

Mr. Kazuo SENGA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
JAPAN

Mr. Thomas Kijiner, Jr.
Secretary
Ministry of Resources and Development
Republic of the Marshall Islands

Ms. Kino S. Kabua
Secretary
Ministry of Foreign Affairs
Republic of the Marshall Islands

Ms. Justina R. Langidrik
Secretary
Ministry of Health
Republic of the Marshall Islands

Mr. David Paul
General Manager
Marshalls Energy Company(MEC)
Republic of the Marshall Islands

ATTACHMENT

1. Components of the Draft Final Report

The Ministry of Resources and Development (hereinafter referred to as "MRD"), Ministry of Foreign Affairs, and Marshalls Energy Company (hereinafter referred to as "MEC") agreed and accepted in principal 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 RMI side understood components of the Minutes of Discussion signed by both sides on 2nd 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 shown in **Annex-1**.

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

3-1. Project site and capacity of PV module

Both sides confirmed that project site is Majuro Hospital and the capacity of PV module is 192kW.

3-2. Official permission to set the PV system on the project site

Both sides confirmed completion of necessary procedures for official permission from related organization to set the PV system on the roof of Majuro Hospital.

4. Items of Equipment to be procured

The Team explained that the items of equipment to be procured as shown in **Annex-2** based on the result of the Preparatory Survey conducted in June and July, 2009.

5. Procurement Process of the Project

Both sides reconfirmed that procurement process would be supervised by the Procurement Management 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; and

(3) 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 Project cost comes down to the amount agreed on G/A and E/N.

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

The RMI 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.

6. Project Cost

The RMI 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 Agent fee, and the cost for soft component for the technical support of operation and maintenance of equipment.

7. Confidentiality of the Project

7.1. Detailed specifications of the Facilities

Both sides confirmed that all the information related to the Project including detailed drawings and specifications of the facilities and equipment and other technical information shall not be released to any outside parties before conclusion of all the contract(s) for the Project.

7.2. Confidentiality of the Cost Estimation

The Team explained the cost estimation of the Project as described in **Annex-3**. Both sides agreed that the Project Cost Estimation should never be duplicated or released to any outside parties before tender for the Project. The RMI side understood that the Project Cost Estimation attached as Annex-3 is not final and is subject to change by the result of examination through revision of the Outline Design Study.

8. The Consultative Committee

The RMI side understood that the MRD will chair the Committee in order to facilitate consultation and procurement process. The Terms of Reference of the Committee was settled in Annex-8 of the previous M/D.

The members of the Committee are as follows:

(1) Representative of Ministry of Resources and Development (Chair)
(2) Representative of Ministry of Foreign Affairs
(3) Representative of Ministry of Finance
(4) Representative of Ministry of Health
(5) Representative of Marshalls Energy Company
(6) Representative of JICA Marshall Islands Office

The first meeting of the Committee shall be held immediately after the JICA's approval of the Agent Agreement which shall be concluded between MRD and the Procurement Agent. The employment of the Agent shall be agreed between the two Governments. Further meetings shall be held upon request of either the RMI side or the Japanese side. The Procurement Agent may advise both sides on the necessity to call a meeting of the Committee.

9. Other Relevant Issues

9.1. Undertakings required by the Recipient Country

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

(1) Land Acquisition for PV system

The Responsible Organization for the Project (MRD) issued a Memorandum to Ministry of Health to utilize the New Hospital Wing (Building-2, Building-3) Roof for installation of PV Module on 30th June, 2009.

In response to the above request, Ministry of Health agreed to install the PV system as requested by the MRD on 9th of July, 2009 as shown in Annex-4. Therefore, the RMI side has completed all necessary procedures for official land acquisition for the following equipment and materials for PV system ;

1) for PV Modules

2) for underground cables between equipment
3) for Power Conditioners

(2) Generated Energy by PV system

The necessary tariff structure for power generated by PV system shall be same as the national tariff. The Japanese side shall assist the RMI side through soft component during the implementation of the Project.

(3) Environmental and Social Considerations

The RMI side agreed that the MRD shall be responsible for obtaining necessary permission by Environment Protection Agency (EPA) by 15th of January, 2010. The RMI side shall report the result to JICA Marshall Islands Office. The Team shall provide necessary data and information for the application.

(4) Application of the Related Laws and Regulations

There are no official laws and regulations to be applied on building design and construction work in RMI. Therefore, the RMI side agreed the structural design for the roof top installation of PV system shall comply with the Architectural Regulation in Japan.

Electrical design for Grid-connected PV system should be done in accordance with JIS/IEC.

The RMI side agreed that the MRD shall be responsible for the application of related laws and regulations for the operation of the PV system for interconnection with the distribution lines before commissioning of the Project. The Japanese side shall assist the RMI side to introduce necessary procedures through soft component during the implementation of the Project.

(5) Customs and Tax Exemption

The RMI side agreed that the RMI Government shall be responsible for the exemption and/or reimbursement of all customs, tax, levies and duties incurred in RMI for the implementation of the Project.

(6) Assignment of Counterpart Personnel

1) Overall project management

The RMI side agreed to assign necessary personnel for Overall project management.

The RMI side shall inform the name of the following number of Counterpart Personnel to JICA Marshall Islands office by 15th of January, 2010:

- Two staff from MRD
- Two staff from MEC

2) Soft Component

The RMI side agreed to assign necessary personnel for O&M of the equipment in accordance with the soft component plan proposed by the Team.

The RMI side shall inform the name of the following number of Counterpart Personnel to JICA Marshall Islands office by 15th of January, 2010:

- One staff from MRD
- Five staff from MEC

(7) Banking Arrangement

The RMI side, being convinced that the conclusion of the Banking Arrangement (B/A) and Blanket Disbursement Authorization (BDA) constitutes a very important factor to implement the Program smoothly and without delay, shall take the necessary measures. The flow of funds is shown in the Annex-I.

By signing the BDA, the RMI side designates the Procurement Agent as the representative authorized to act in the name of the RMI side concerning all transfers of the Grant plus any interest earned to the Procurement Account.

(8) The final connection work

The final connection work of medium voltage power cable with the load side of existing switchgear shall be done by RMI side. Japanese side is responsible for the procurement of necessary terminal equipment for the same connection work. However the RMI side is responsible for the procurement of the double bushing.

(9) Arrangement for the remote monitoring system

All necessary work for the Internet connection(LAN) for the proposed electrical room in Majuro Hospital and MEC's power plant shall be arranged by the RMI side.

The necessary payment for the Internet connection shall be borne by the RMI side.

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

The RMI side has reconfirmed that the RMI Government, through MRD, is the owner of equipment and the Marshalls Energy Company (MEC) is responsible for Operation and Maintenance (O&M) of equipment. The RMI side confirmed that the Equipment procured under the Project shall be operated and maintained in accordance with the existing Franchise Agreement dated on 15th April 2003 between MRD and MEC. The Team explained that the RMI side was requested to secure necessary budget and personnel for the O&M of Grid-connected PV system procured and installed under the Project.

9.3. Final Report

The RMI side agreed that the Final Report should never be duplicated in any form nor released to any other party(s), because the Final Report is confidential document as it contains information related to the tender.

<List of Annex>

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

Annex-2 List of Equipments

Annex-3 Project Cost Estimation (Confidential)

Annex-4 Utilization of New Hospital Wing Roof for Grid-connected Solar PV

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

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

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

1. Procedures for GAEC

GAEC is executed through the following procedures.

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

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

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

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

submitted to the Cabinet for approval.

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

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

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

2. Preparatory Survey

1) Contents of the Survey

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

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

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

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

2) Selection of consulting firms

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

3. Implementation of GAEC after the E/N

1) Exchange of Notes (E/N)

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

2) Details of Procedures

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

Essential points to be agreed are outlined as follows:

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

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

a) The Agent

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

b) Agent Agreement

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

c) Approval of the Agent Agreement

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

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

d) Payment Methods

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

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

e) Products and Services Eligible for Procurement

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

f) Firm and Consultant
The firm and consultant who would contract with the Agent shall be Japanese Nationals.

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

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

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

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

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

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

j) Tender Evaluation
The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

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

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

k) Additional procurement
If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the Recipient would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:
(1) Procurement of same products and services

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

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

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

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

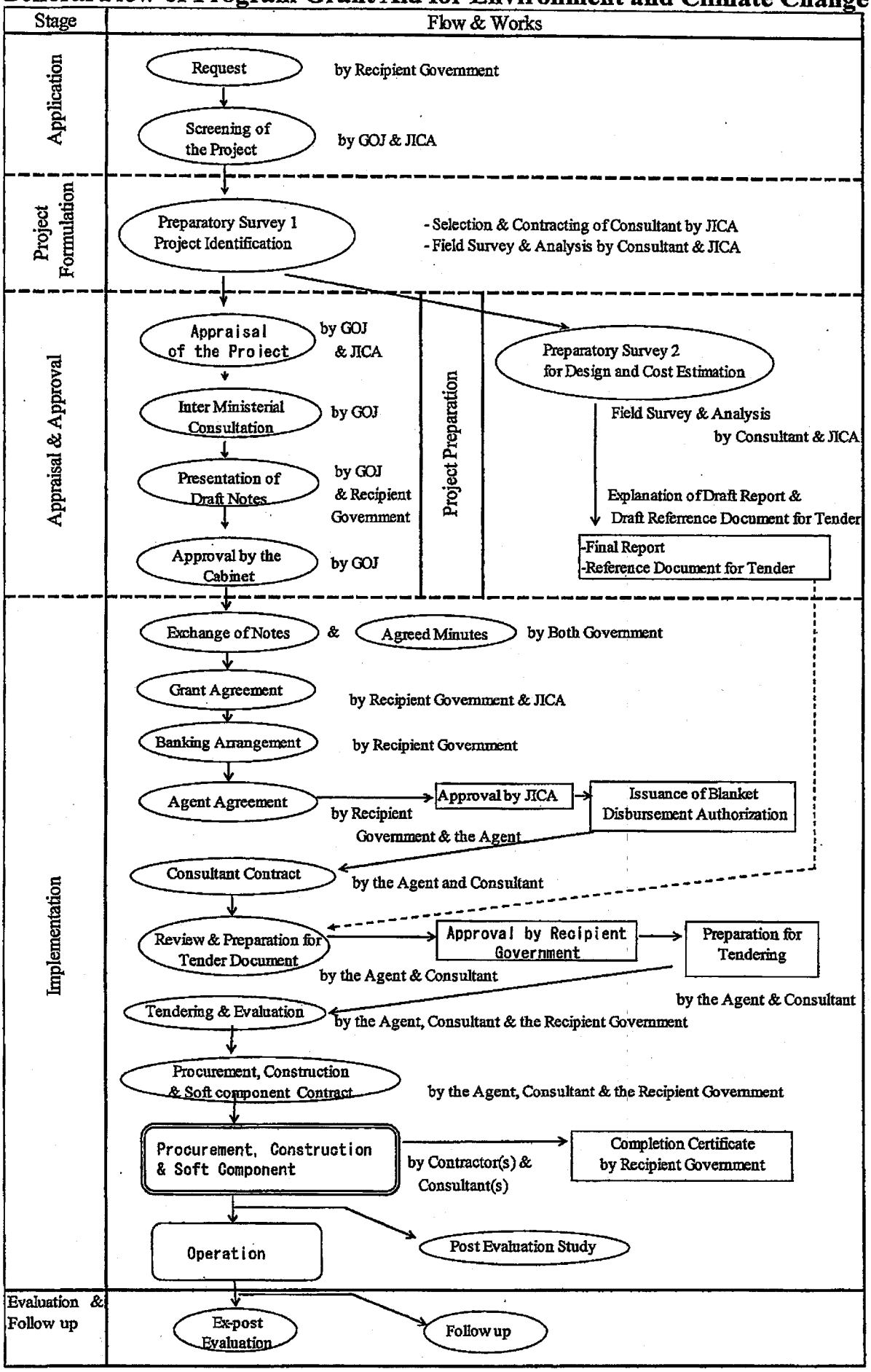
4) Undertakings required by the Government of the Recipient Country
In the implementation of the Grant Aid Project, the Recipient is required to undertake necessary measures as the following:

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

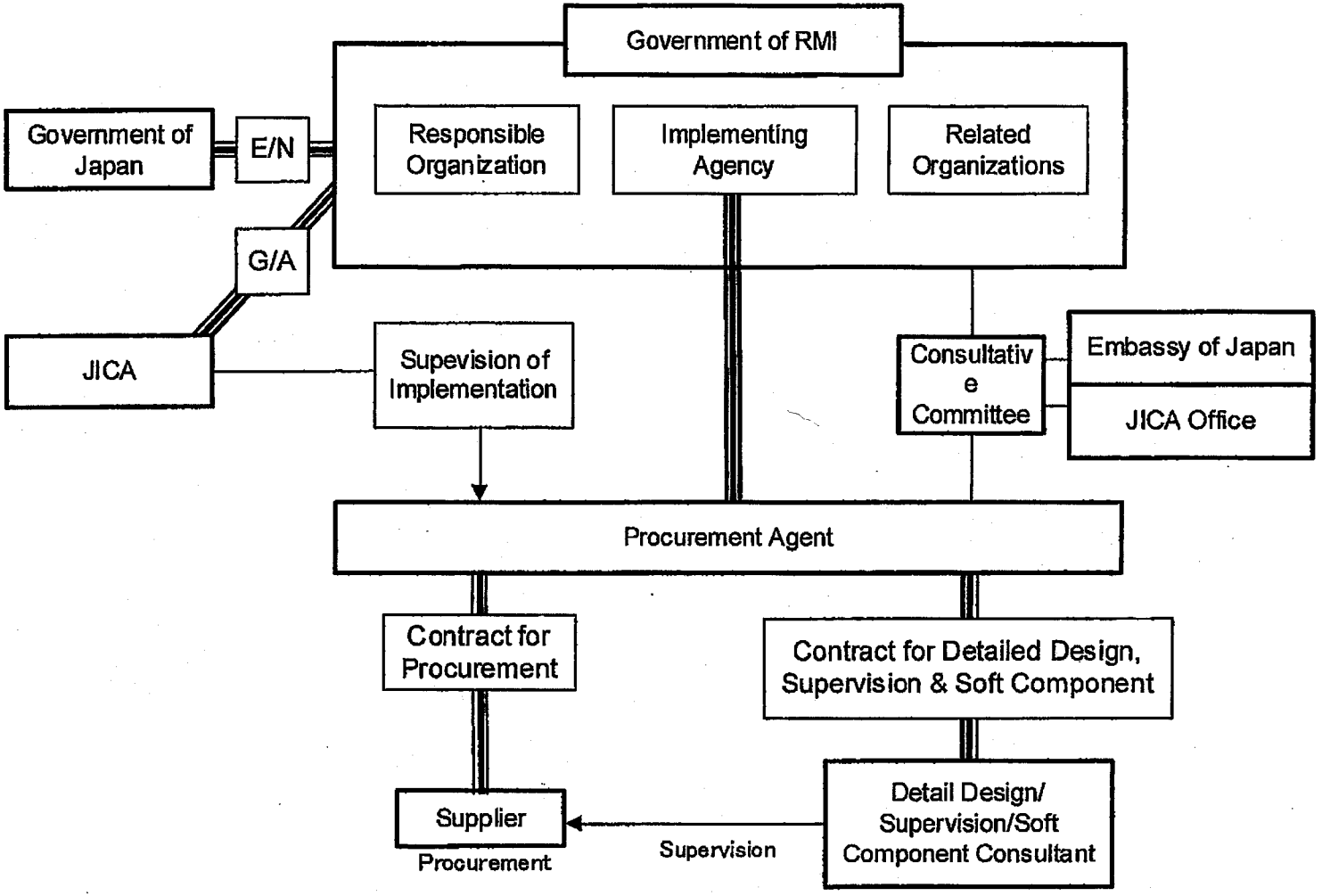
5) "Proper use of funds"
The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered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

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

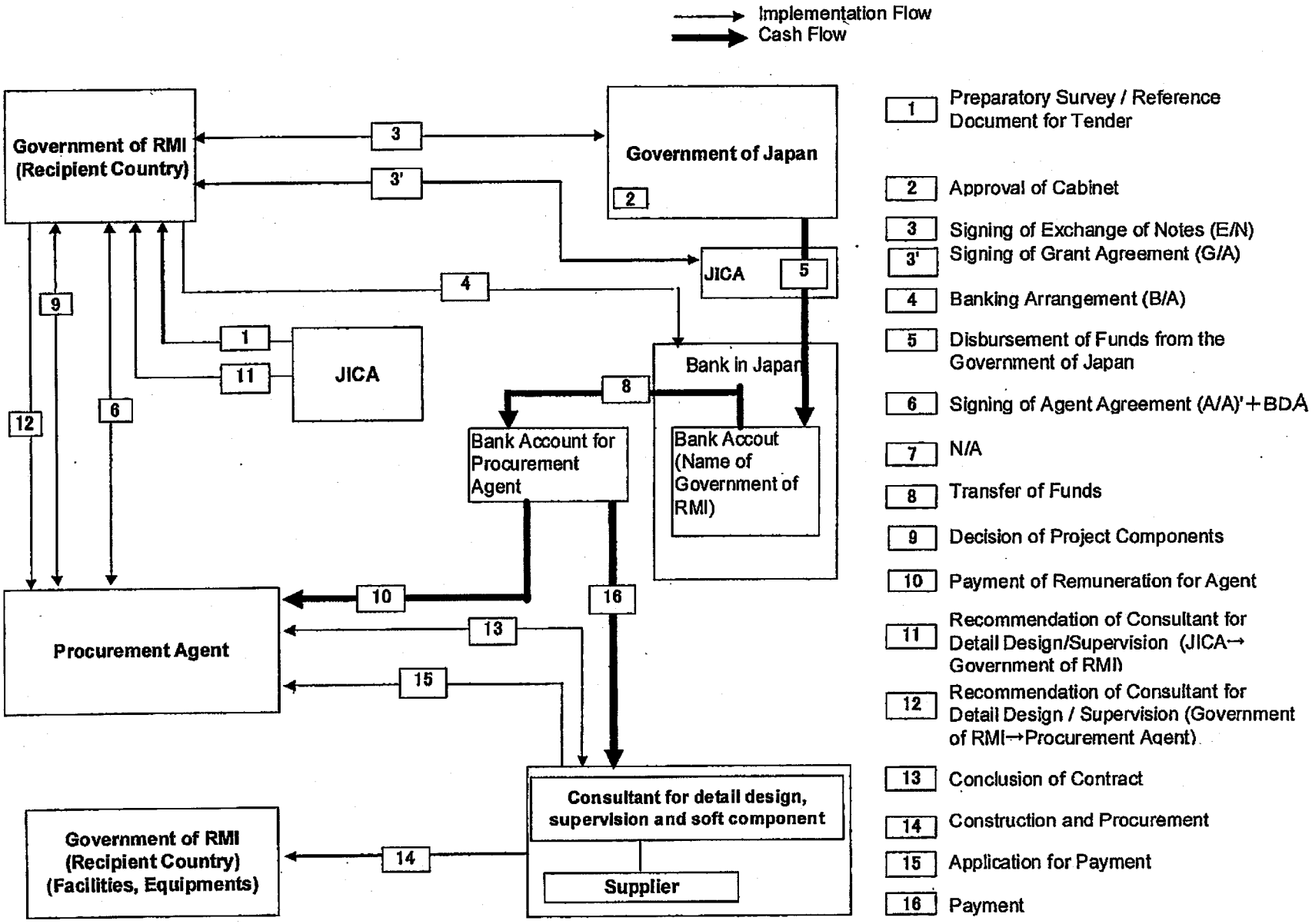
General Flow of Program Grant Aid for Environment and Climate Change



Project Implementation System



Flow of Funds for Project Implementation



Annex –2

List of Equipments

1-1 List of Equipments
The following table shows a list of equipments procured under the Project.

Item No.	Name of Equipment	Quantity	Final Delivery Point (Site)
1	Photovoltaic Module	939 pcs.	Majuro Hospital
2	Mounting structure for Photovoltaic Module	1 lot	Majuro Hospital
3	Junction Box	19 unit	Majuro Hospital
4	Collecting Box	4 unit	Majuro Hospital
5	Power conditioner	2 unit	Majuro Hospital
6	Transformer	1 unit	Majuro Hospital
7	Display board	1 lot	Majuro Hospital
8	Data management and monitoring system	1 lot	Majuro Hospital
9	Cables and Conduits	1 lot	Majuro Hospital
10	Test Equipment	1 lot	Majuro Hospital
11	Maintenance Tools	1 lot	Majuro Hospital
12	Spare Parts	1 lot	Majuro Hospital
13	Power conditioner (for replenishment)	1 unit	Majuro Hospital

1-2 List of optional equipments

The following table shows the list of optional equipments.

Item No.	Name of Equipment	Final Delivery Point (Site)
1	Photovoltaic Module	Majuro Hospital
2	Power conditioner	Majuro Hospital

Annex – 3

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: approximately ¥ 503.6 million

Item	Amount (Million Japanese Yen)
1. Procurement cost of equipment and materials	430.3
2. Procurement Agent & Consulting Services Fee	73.3
3. Total (1+2)	503.6

2. Cost to be borne by the RMI side: US$ 6,000 (approximately ¥ 0.6million)

The contents and cost of work on the Marshall Islands side are as follows:

Item	Amount
1. High voltage side connection work and connection section works	1,500 US$ (Approximately ¥0.15 million)
2. Payment of commission to Japanese bank	5,300 US$ (Approximately ¥0.53 million)
3. Total (1+2)	6,800 US$ (Approximately ¥0.68 million)

Operation and Maintenance Cost on the Marshall Islands side are as follows:

The equipment to be procured in the Project is basically maintenance-free, however, it will be necessary to always keep replacement parts on hand. Moreover, in cases of periodic inspections or when abnormal situations or breakdowns occur, it will be necessary to dispatch MEC engineers and thereby incur personnel expenses. Therefore, the Marshall Islands side will need to budget for the following operation and maintenance expenses (annual) to ensure that no problems arise in the operation and maintenance of equipment.

(1) Personnel expenses	Approximately 20,000US$ (Approximately 2 million yen)
(2) Expendable and replacement parts costs	Approximately 20,000US$ (Approximately 2 million yen)
(3)Total	Approximately 40,000US$ (Approximately 4 million yen)

Since the above cost amounts to no more than approximately 1% of the Marshall Islands

distribution system operation and maintenance budget in 2008 (approximately 18,785,000 US$/year), there should be no major problem in securing the operation and maintenance costs for the Project.

3. Conditions for estimation
   (1) Time of estimation: July 2009
   (2) Foreign exchange rate: 1 US$ = ¥ 96.59
   (3) Others:

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

Republic of the Marshall Islands
MINISTRY OF HEALTH
P.O. Box 16
Majuro, Marshall Islands 96960
Phone: (692) 625-5660/5661 * Fax: (692) 625 3432 *Email: rmfmohe@ntamar.net ; jrmmohe@ntamar.net

July 9, 2009

TO : Thomas Kijiner, Jr.
Secretary of Resources and Development

FROM : Secretary of Health

SUBJECT : Utilization of New Hospital Wing Roof for Grid-connected Solar PV

I am pleased to inform you that you have my concurrence as per the request, in reference to the installation of the Grid-connected Solar PV system at the new hospital wing roof, as specified in the memorandum. In furtherance, I believe the project will benefit the Ministry of Health as well as reduce the electrical loads carried by the Majuro Energy Company.

Thank you.

Justina R. Langidrik, MPH

Cc: Rebecca Lorennij, Assistant Secretary
Mr. Nick Wardrop, Adviser

REPUBLIC OF THE MARSHALL ISLANDS
Ministry of Resources and Development
P.O. Box 1727
Majuro, Marshall Islands MH 96960

MEMORANDUM

Date: June 30, 2009

To: Mrs. Justina Langidrik
Secretary of Health

For Info: Minister of Resources & Development
Minister of Health
Acting Chief Secretary
Hospital Administrator
MEC Manager
National Energy Planner

From: Secretary of Resources & Development

Subject: Utilization of New Hospital Wing Roof for Grid-connected Solar PV

I am pleased to reference our telephone discussion this morning regarding the utilization of the roof of the New Wing at the Majuro Hospital as the site for the installation of a grid-connected solar PV project.

As background, the grid-connected solar PV project will be funded under the Japanese Government's Cool Earth Initiative. The project is worth approximately $4,000,000 (USD Four Million). It is anticipated that a system between 160 to 200 kW power rating will be installed.

As you are aware, the existing rooftop space in Majuro does not always provide the ideal space necessary to install larger grid-connected solar PV systems. The new wing of the Majuro Hospital is being considered because:

1. There is sufficient roof space on the new hospital wing to house a system of this size;
2. The blue-print for the building, which is required in determining its' structural integrity, is readily accessible; and

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5. SOFT COMPONENT

(TECHNICAL ASSISTANCE) PLAN

Soft Component Plan

(1) Background

In Marshall, almost all of the power supply in the country depends on diesel power generation at present and there is the influence of increasing the crude oil prices, the Marshall government considers departure from the fossil fuel as an urgent task. In the National Energy Policy which was formulated in 2003 shows the compassable, highly reliable and sustainable energy supply to all public for the development of society as the foresight in 15 years in the energy field. In addition, New National Energy Policy and Energy Action Plan were formulated in July 2009 and the specific plans are described in them by including the utilization of the renewable energy (Ex; the grid-connected PV system). Therefore, the Marshall government is taking the active cooperation to the Plan of the Program Grant Aid for Environment and Climate Change (the Project) which will introduce the grid-connected PV system.

The Project site is the Majuro National Hospital, the responsible organization for the Project is Ministry of Resources and Development (MRD) and the implementation agency is Marshall Energy Company (MEC) which takes the charge of the electricity business. The MEC has the electric power department and the water department, and the electric power department takes the charges of Fuel sale, PV generation, Majuro power station and Island power stations (Ebeye, etc.). The MEC is relative small organization composed of 176 staffs and is 100% owned by the government. And no possibility of buying up by private company was confirmed in the survey.

As for the introduction cases of PV systems, the approximate 1,470 units of the SHS were introduced by the support of EU and Taiwan in order to promote the electrification in the isolated islands. As for the Majuro area, 60kW PV system already has been introduced in the College of Marshall Islands in June, 2009 by the support of US. This concept has the plan to connect the 200kW PV system to the national grid up to 2011, but all generated power at present is consumed only inside the college. Therefore, it is difficult for staffs of the MRD in charge of policy-making or the MEC in charge of management of electric facilities of the Project site to master adequate technology on PV systems through their daily work. In addition, the grid-connected PV system will not meet with the success without the cooperation of the MEC, because the introduced grid-connected PV system shall be connected to the national grid. And in the view of the future dissemination of the grid-connected PV system in Marshall, it would be desirable to transfer the technology to the MEC.

As for the MEC technicians, it can be judged that they have the basic knowledge of the PV generation, because there are a few technicians who took the charge of O&M of the SHS in the isolated islands and they already have the actual performance of them. Accordingly, the establishment of the concept and the method of the O&M of the grid-connected PV system will be thought to take some time, however, the proper technical transfer on the O&M of the introduced facilities into the implementing agency of the Project, MEC, over the broad-and-shallow range from a basic level on the PV generation to an application level on the O&M of the PV facilities, dividing the process into the several steps and confirming the establishment of the knowledge will be able to promote the continuous and smooth O&M of the grid-connected PV system introduced by the Project,.

The current issues concerning the O&M of the PV system are as follows.

- ✓ The necessary structure for O&M of grid-connected PV system is not established.
- ✓ Technical knowledge and skills for grid-connected PV system is not enough.
- ✓ The knowledge of concept and methodology for O&M of grid-connected PV system is not enough.
- ✓ Trouble-shooting for grid-connected PV system is difficult.
- ✓ Electricity tariff structure for grid-connected PV system is not established.

Table - 1 Current problems and measures for improvement

Current problems	Measures for improvement	Necessary soft-component
▪ The necessary structure for O&M of grid-connected PV system is not established	▪ MEC establishes the O&M system within MEC.	▪ Make a proposal on the segmentalization and specification of O&M system, and discuss it with the persons concerned.
▪ Technical knowledge and skills for grid-connected PV system is not enough	▪ Prepare the O&M manual of the grid-connected PV system.	▪ Support implementation guidance on the manual.
▪ The knowledge of concept and methodology for O&M of grid-connected PV system is not enough	▪ Implement technical training on PV systems including the "independent type" and "grid-connected type." ▪ Implement training on monitoring, such as the monitoring method, periodical inspection method, etc.	▪ Conduct proper technical training on PV systems. ▪ Conduct proper technical training on monitoring.
▪ Trouble-shooting for grid-connected PV system is difficult	▪ Create the O&M manual including troubleshooting ▪ Conduct implementation guidance on the manual and educational activities so that the O&M are properly done.	▪ Support implementation guidance on the manual. ▪ ditto
▪ Electricity tariff structure for grid-connected PV system is not established	▪ Determine most appropriate electricity tariff.	▪ Make a proposal on most appropriate electricity tariff, and discuss it with the person concerned.

Source： created by JICA study team

(2) Goal

The goal is that the implementing agency of the Project, MEC, comes to be able to implement continuous and smooth O&M based on the O&M manual.

(3) Outcome

1) The O&M manual of the grid-connected PV system introduced in the Project, including troubleshooting, is created.
2) Basic knowledge on the grid-connected PV system introduced in the Project is acquired, and the O&M of the facilities is carried out continuously.
3) The most appropriate electricity tariff is determined (if necessary), and a continuous and smooth O&M system is established.

The following activities will be implemented to achieve the above outcomes.

In Majuro State, the grid-connected PV system has not been disseminated yet even though a new grid-connected PV system is being installed in the College of Marshall Islands. Accordingly, the MEC does not have the technical knowledge on the grid-connected PV systems yet. Therefore, training covering a broad range from a basic level on PV generation to an application level on the O&M of PV facilities is implemented in the Project. Table 2 shows the specific contents which are divided into Category 1 to 4. The implementation process of each category is implemented in certain intervals to promote the steady and efficient settlement and is implemented four times totally.

Concerning the necessary number of days, the implementation contents are covered broadly from the documentation (ex. manuals) with mutual cooperation with Marshall to the technical transfer and the confirmation of the settlement. Therefore, the one week is considered as the minimum unit of the necessary number of days in order to follow the steps of this plan steadily. And concerning the member of the consultant, the necessary members are 2 persons (1 manager and 1 staff), because in the preparation of the manuals, the formation of 2 teams can promote the efficiency of the work and in the lecture, 1 staff as the lecturer and other staff as the assistance can promote the effective lecture.

Table 2 Contents of training

Category	Specific contents (purpose)	Man Month	
1. Establishment of the O&M system	1.1 Clarification of the responsibility of individuals who carry out the O&M	0.25MMx2persons	Total 1.00MMx2persons
	1.2 Proposal on the most appropriate electricity tariff	0.25MMx2persons	
	1.3 Creation of the O&M manual in collaboration with Marshall side	0.50MMx2persons	
2. Technical training	2.1 Principle and basic knowledge of PV systems	0.25MMx2persons	Total 1.25MMx2persons
	2.2 Characteristics of grid-connected PV systems	0.25MMx2persons	
	2.3 Matters to be examined when a grid-connected PV system is introduced.		
	2.4 Installation	0.25MMx2persons	
	2.5 Inspection		
	2.6 Operation		
	2.7 Maintenance		
	2.8 Troubleshooting	0.50MMx2persons	
3. Institutional Training	3.1 Collection method of electricity tariff	0.25MMx2persons	Total 0.75MMx2persons
	3.2 Optimizing O&M manual	0.25MMx2persons	
	3.3 Evaluation of the O&M system	0.25MMx2persons	
4. Monitoring	4.1 Optimizing monitoring method	0.25MMx2persons	Total 1.00MMx2persons
	4.2 Periodical inspection	0.25MMx2persons	
	4.3 Evaluation items	0.25MMx2persons	
	4.4 Report of monitoring results	0.25MMx2persons	
Total		4.00MMx2persons	

Source： created by JICA study team

(4) Method to confirm the achievement of outcome

The implementation schedule shall be divided into 4 steps. Category 1-4 in Table 2 shall be conducted in each step. The achievement of each step shall be confirmed and evaluated as follows;

Category１：Evaluation and instruction of O&M Manual

Category２：Making Report for the Item 2.1-2.3 in Table 2, and making report and technical evaluation for the Item 2.4-2.8 in Table 2.

Category３：Interview survey to O&M staff and evaluation of the actual field work

Category４：Interview survey to O&M staff and evaluation of O&M Manual

(5) Activity for Soft Component

1) Content

The implementation contents of the soft component in order to understand and implement the specific methods of the O&M for the introduced grid-connected PV system are shown in Table 2.

2) Implementation of Orientation

Collaboration work with MEC is indispensable for the implementation of soft component. The consultant will hold the orientation to explain and obtain consents on the objectives, contents, activity schedule of the soft component to the Marshall side.

The participants for the orientation shall include the responsible organization of the Project, the Energy Planning Division in MRD, and the concerned persons (O&M staffs for the electric facilities) in the Majuro hospital with MEC in addition to the MEC, and the necessary information shall be informed to the concerned persons which are not included in the soft component committee. For example, the concerned persons in the site shall understand the basic points for the O&M of the system as the site owner for introducing the PV system and shall provide the cooperation to construct the communication routes to PUC in case fault occurs.

3) Establishment of Soft Component Committee

Soft component committee shall be established by MEC in order to implement the soft component and promote the sustainable operation of the system. The committee shall act as the liaison function of the soft component, and shall be periodically held in order to ensure sustainable operation and maintenance of the PV system during the implementation of the Project. The committee shall be considered as the opportunity to check the progress of the soft component, exchange opinion and discuss among concerned parties.

And the consultant shall support Marshall to carry on the elements of the soft component committee in this plan, if Marshall will judge the carrying on the elements of the soft component committee is necessary.

4) O&M Manual

During the implementation of the Project, MEC is requested to work out the O&M Manual in collaboration with the consultant. In order to draw the initiative from Marshall side, MEC shall be the main body to make the draft of the Manual while the consultant will evaluate, provide necessary comments and feedback on it. The Manual shall also contain the method for trouble-shooting.

(6) Procurement of necessary resources for Soft Component

In order to implement the soft component effectively and efficiently, the soft component committee shall be established. The soft component committee, together with close collaboration with the consultant, shall be the main body for the operation and maintenance of PV system after installation of the Project. The committee shall be composed of approximately five members from MEC (the staff in charge of O&M, his or her manager) and approximately one member from MRD. Proposed framework for the implementation of soft component is shown as follows.

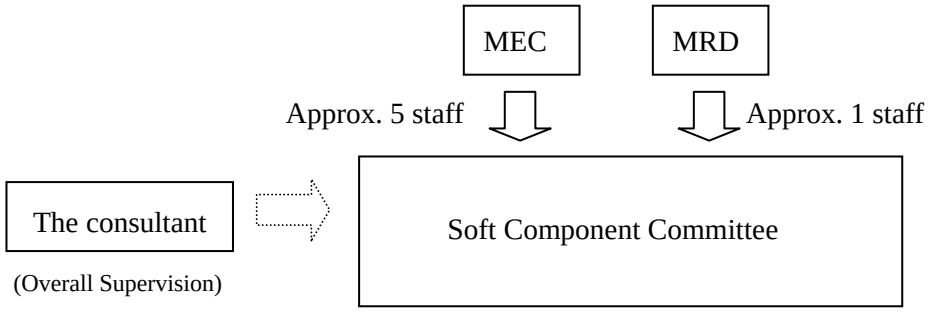


Figure - 1 Proposed Framework for the implementation of Soft Component

Table - 3 The Role and Responsibility of each Party

Responsible Party	Japanese Consultant	MEC	MRD
Member for Soft Component Committee	2 staff	Approx. 5 staff (O&M staff & Manager)	Approx. 1 staff
Operation Method for Soft Component Committee	Management of the overall progress	➢ Management of the overall work ➢ Actual O&M	—
Electricity Tariff	Propose	Examination and final decision	Advice
Workshop	Explanation	Main body	Assistance
O&M Manual	Advice	Making Draft	Advice
Follow-up for O&M	Management and guidance	Submission of the result	Advice
Reporting to	Embassy of Japan in Marshall and JICA Office	Japanese Consultant	-

The introduced grid-connected PV system in the Project is going to be the Japanese products and is going to conform to the guidelines for technical requirements of the interconnection concerning power quality in Japan. Therefore, it is desirable that the implementer in this plan is Japanese consultant who knows the guideline totally.

(7) Implementation Schedule for the Soft Component

The implementation process is shown in Figure 2. The training is implemented according to the category shown in Table 2. The implementation time of each category is as follows:

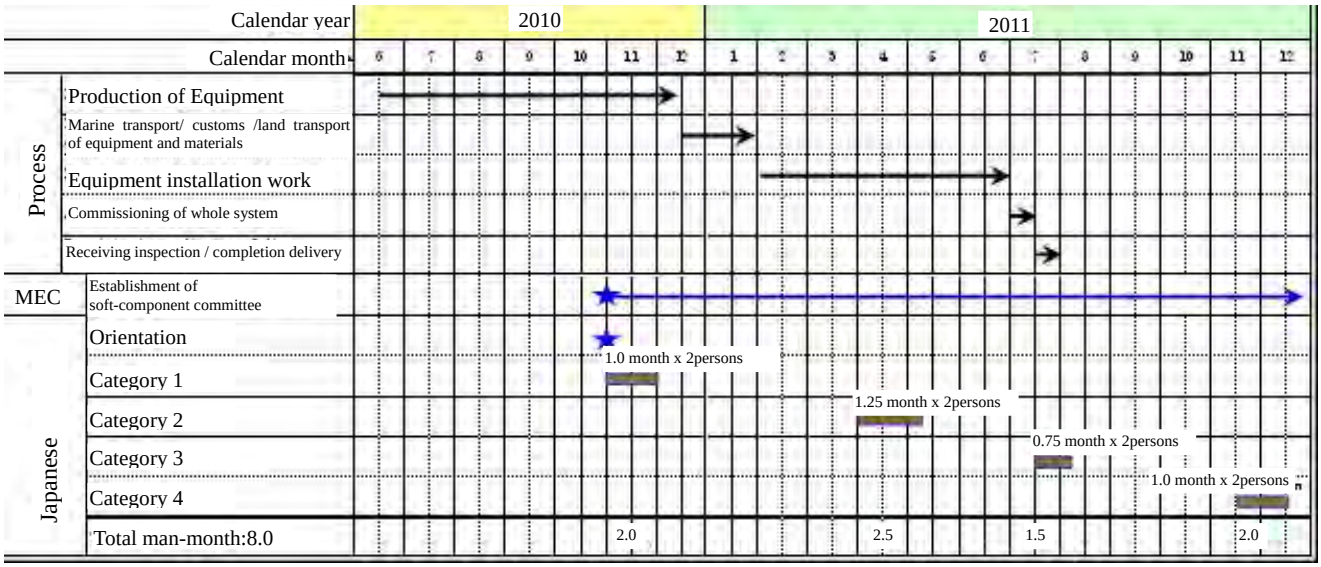
Category 1 : Implemented before the installation of facilities because this training is done to facilitate the establishment of the O&M system, and because, by clarifying the O&M system before the facility installation, awareness as the person in charge can be raised at the time of installation.

Category 2 : Implemented in the middle of the installation work because this training, concerning the installation, inspection, operation, etc., is done using actual facilities.

Category 3 : Implemented before the operation of the facilities starts because this training is related to the O&M manual, etc., that should be prepared before the start of the operation.

Category 4 : Implemented approximate four months after the completion of the installation because the focus of this training is to confirm that the RMI side can carry out the O&M by themselves.

The equipment and materials are newly procured and installed under the Project. Therefore, O&M structure shall be established from the beginning. Therefore, the soft component shall be commenced before the installation works start.



*The progress report will be submitted after each category

Figure - 2 Proposed Schedule for the implementation of Soft Component

(8) Output of the Soft Component

Following output shall be obtained through implementation of the soft component.

1) Record for holding the Orientation
2) Minutes of Discussion for the Soft Component Committee
3) Progress Report
4) Report to confirm the actual understanding
5) Result of the interview survey to O&M staff and actual work progress by the O&M staff
6) O&M Manual

(9) Required Responsibility to the Marshall side

1) MEC shall establish the Soft Component Committee.
2) MEC shall prepare necessary work space and rooms.
3) MEC and MRD shall provide necessary staff for the implementation of the soft component.
4) Soft Component Committee shall work out the O&M Manual in coordination with the Consultant.
5) MEC shall examine and determine the most appropriate electricity tariff for the introduced Grid-connected PV system based on the proposal by the Consultant.
6) MEC shall appropriately operate and maintain the Grid-connected PV system based on the O&M Manual.
7) MEC shall submit the report of the result and the progress of the operation and maintenance to Japanese Consultant during the period specified under the O&M Manual.

6. OTHER RELEVANT DATA

LIST OF ACQUIRED REFERENCE MATERIALS AND DATA

No.	Name	Form Book/Video/Map/ Photograph etc.	Original/Copy	Issue Organization	Issue Year
1	Majuro New Hospital files	Plan	Copy	Marshalls Energy Company	2006
2	Majuro Reservoir Info	Plan	Copy	Marshalls Energy Company	2006
3	Collage of Marshall Islands files	Plan	Copy	Ministry of Resources and Development	2009
4	Environmental Impact Assessment Regulations	Book	Copy	Environment Protection Authority	1994
5	Yearbook 2005-2006	Book	Copy	Economic Policy, Planning and Statistic office	2006
6	MRI National Energy Policy and Energy Action Plan	Book	Copy	Ministry of Resources and Development	2009
7					
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