Master Plan Study for Utilization of Solar Energy

in the Federal Republic of Nigeria

Part-II, (1)
Technical Specification
of
Pilot Project in Jigawa State

October 2005

Japan International Cooperation Agency (JICA)

Preamble

In response to the request of the Government of the Federal Republic of Nigeria (hereinafter referred to as “Nigeria”), the Government of Japan decided to conduct Master Plan Study for Utilization of Solar Energy in the Federal Republic of Nigeria (Hereinafter referred to as “Study”) in accordance with the relevant laws and regulations in force in Japan and entrusted the Study to the Japan International Cooperation Agency (hereinafter referred to as “JICA”), the official agency responsible for the implementation of the technical cooperation programs in the Government of Japan.
JICA sent the Master Plan Study Team (hereinafter referred to as “Team”) to Nigeria and conduct the Study in close cooperation with the authorities concerned in Nigeria. The Study includes a Pilot Project (hereinafter referred to as “Project”) using Photovoltaic (PV) systems, which is implemented in one (1) village each in Jigawa state, Ondo state, and Imo state.

The scope of the Project in Jigawa state includes the procurement, installation, and maintenance of the PV systems consisting of one (1) Battery Charging Station (BCS), one (1) Public Facility, sixty (60) Solar Home Systems (SHS), and ten (10) Street Lightings. The Project will be completed in early March 2006 and will be monitored up to February 2007 to evaluate the sustainability of PV systems.

The specification defines the technical requirement of the PV systems including installation and maintenance. The terms and conditions of the contract are described in the separate volume of “General Conditions of Contract for the Pilot Project.”

Content

1 General Condition

1.1 Project Site

Garkon-Alli, Kiyawa L.G., Jigawa

The village locates in the north of Kiyawa L.G. and about 30 km away from Dutse, the state capital. The village with population of about 5,000 has not been electrified either by grid or by diesel generators.

1.2 Units of Physical Quantities

All the equipment, devices, and materials delivered by the Contractor shall be designed and manufactured in accordance with the international system of units (SI). No British and US measure is allowed to use in this contract. The Contractor shall use SI units and their symbols in all his drawings and documents submitted to the Purchaser.

1.3 Language

All the drawings, documents, and nameplates shall be written in English.

1.4 Design Conditions

All the equipment, devices, and materials delivered by the Contractor shall be designed and manufactured to meet the following ambient conditions:

- Altitude Not more than 1,000 m
- Temperature 5 °C (minimum), 45 °C (maximum)
- Wind Pressure 8.3 kN/m^2
- Average amount of insolation 5.24 kW/m^2-day
- Running no insolation days 3 days

1.5 Requirements for Drawings and Documents

- The Contractor shall submit to the Purchaser all drawings and documents required for the completion of the Project.
- The Contractor shall send all drawings and documents by registered mail or equivalent method, and ensure delivery of them to the Purchaser by due date.
- In order to conform the PV systems to the requirements and intent described in the specification, the Purchaser will have the right to require the Contractor to make changes in the drawings and documents, if necessary.
- The design drawings comprised of arrangement drawings, installation drawings, schematic circuit diagrams shall demonstrate that the PV systems will conform to all requirements and intent described in the specification. These drawings shall indicate necessary data—dimensions, materials, etc.—for the installation, operation and maintenance of the PV systems.

- The Contractor shall keep one (1) complete set of the design drawings in good condition on the site. This set shall be designated “Record Prints.” The Contractor shall record any and all differences between the actual construction and design on the “Record Prints.”
- The size of drawings shall be as follows:

  297 mm × 420 mm (A3)

  210 mm × 297 mm (A4)

  In the lower right-hand corner of each drawing, the Contractor shall indicate the title of the drawing, signature of the Contractor's responsible engineer, date prepared, and drawing number.
- The arrangement and installation drawings shall contain all necessary information—assembling and disassembling instruction, foundation shape, cabling, piping, etc.—for the installation and testing works of the PV systems.
- The schematic circuit diagrams shall show the connection of the components and shall indicate the wire number, terminal number, etc.
- The documents shall be submitted to the Purchaser in accordance with the following list.

Item	Number of copies	Remarks
Drawing lists with target date of submission	5	Within fifteen (15) days after the contract
List of equipment and materials	5	Within fifteen (15) days after the contract
Detailed design calculation sheets	5	Immediately on completion of design
Work schedule	5	Within fifteen (15) days after the contract
List of suppliers and country of origin for each equipment	5	Within fifteen (15) days after the contract
System design drawings	5	Within fifteen (15) days after the contract
List of spare parts	5	Within fifteen (15) days after the contract
Plates and/or Stickers for National Flag of Japan	5	Within thirty (30) days after the contract
Notice and procedures of factory tests	5	Not later than ten (10) days before the tests
Result of factory tests	5	On completion of the tests
Notice and procedures of field tests	5	Not later than ten (10) days before the tests
Result of field tests	5	On completion of the tests
Installation completion report with photographs	5	Within ten (10) days after the completion
As-built drawings	5	At the completion of the installation work
Operation and maintenance manuals	7	Not later than thirty (30) days before the taking-over
Result of maintenance work	7	On completion of the maintenance work
Minutes of meeting	5	Within five (5) days after each meeting

All the above drawings shall be subject to approval of the Purchaser. The work schedule shall show key dates for design, manufacturing, factory tests, shipment, inland transportation, installation and erection, field tests, and completion of the PV systems. The factory and field tests shall be conducted in accordance with the test items described in the specifications, and the results shall clearly show the test procedure, test condition, test circuit, instruction of testing equipment, etc. The completion report shall contain the records, check lists, and photographs, which clearly indicate that the Contractor have installed and erected the PV systems in consistency with the specification. The operation and maintenance manuals shall describe in detail the assembling and disassembling method, operating instruction, and inspection procedure and check list of each component.

1.6 Approval Procedure of Drawing and Documents

Prior to the fabrication of the components at a factory, the Contractor shall submit the drawings and technical documents for approval to the Purchaser. The Contractor shall conform to the following procedures for the approval from the Purchaser.

- The Purchaser will review the drawings for approval within 15 days after receipt.
- After the review of the drawings, the Purchaser will mark “Approved,” “Approved on Condition,” or “Not Acceptable” as appropriate in the drawings and return one (1) copy of the drawings to the Contractor.
- The Contractor shall make all revisions or new drawings if the returned copy is marked with “Approved on Condition” or “Not Acceptable,” and shall submit the revised or new drawings to the Purchaser for approval. The revised or new drawings shall be subjected to the same procedure as described above.
- The Contractor shall prepare and submit final drawings only after each drawing previously submitted has been returned and marked “Approved.”
- The approval procedure shall be carried out in accordance with the following schedule unless otherwise noted.

Item	Number of copies	Remarks
Drawing for approval	5	Immediately on completion of design, not more than thirty (30) days after the contract
Revised or new drawings for approval	5	Within fifteen (15) days after received copy marked “Approved on Condition” or “Not Acceptable”
Final drawings	5	Within fifteen (15) days after receiving copy marked “Approved”

- The Contractor may proceed with the work covered by the drawings marked “Approved.” He may also proceed with the work covered by the drawing marked “Approved on Condition” as far as he

performs the work in accordance with the Purchaser's notes or comments. The Contractor shall not proceed with any work covered by the drawings marked "Not Acceptable" until he received the revised or new drawings marked "Approved" or "Approved on Condition." If the Contractor proceeds with the work without the approval from the Purchaser, he shall make the necessary changes at his own expense in accordance with the drawings marked "Approved."

- The approval of the drawings from the Purchaser shall not relieve the Contractor of his obligation to satisfy the requirements of the specification or to carry out the responsibility of making corrections on his drawings.

1.7 Normative References

The PV systems shall be installed in accordance with Electrical Installation Regulations of Nigeria. All the equipment, devices, and materials delivered by the Contractor shall be designed, manufactured, and tested in accordance with IEC standards and/or other major international standards. Especially, PV module shall comply with the latest edition of the following references.

- IEC 61215 Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval
- IEC 60904-1 Photovoltaic devices. Part 1: Measurement of photovoltaic (PV) current-voltage characteristics
- IEC 60904-3 Photovoltaic devices. Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data

2 General Specification

2.1 Materials

All materials delivered by the Contractor shall be new and of first-class quality regarding strength, durability and other performances. Any defect and imperfection will not be acceptable.

2.2 Design Stress

The normally allowable unit compressive and tensile stress under any operating conditions shall not exceed 50% of the yield point or 33% of the ultimate tensile strength of the material.

2.3 Welding

The welding shall be done by arc welding and be tested and inspected in accordance with appropriate standards to ensure that the work is free from pinholes, cracks and all other defects.

2.4 Painting

A quality and method of painting shall conform to appropriate standards, and the painting shall last long period of commercial operation without deterioration.

2.5 Galvanizing

Galvanizing shall be done by means of hot dip process after the fabrication of members is completed, and the minimum quantity of zinc coating shall be 350 grams/m^2 for bolts and nuts, 550 grams/m^2 for other parts. Zinc coating shall be uniform, clean, and smooth.

2.6 Wiring

- The wiring shall be 600 V grade polyvinyl chloride (PVC) insulated cables with copper strands. The conductor size shall not be less than the followings:
  25 mm^2 for Main circuit in Battery Charging Station
  6 mm^2 for PV – Controller – Battery
  2.5 mm^2 for Controller – Lighting
  Unless otherwise noted, all equipment and devices for PV systems shall conform to the above size of cables.
- The cables comprise two (2) cores, which have color identification—red for positive electrode and black for negative electrode.
- The cable shall be connected and branched at terminal blocks, which clearly indicate the mark of the terminals. No connection of cables is allowed along the route.

2.7 Packing

- All the Equipment shall be carefully packed so as to withstand long time transport. The electrical equipment shall be completely protected against rust and moisture for transport and storage.
- The spare parts shall be packed and crated firmly to withstand storage for a long time. Packages of spare parts shall have notation on them which clearly indicates that the contents are spare parts and shall be accompanied by a list of contents which describes directions about storing.

2.8 Inland Transportation

- The Contractor shall arrange, carry out, and supervise the inland transportation to the site on his own responsibility.
- The Contractor shall, for his own convenience, arrange for all necessary provision to obtain accurate information about unloading at port and inland transport facilities as well as all local conditions—particularly the safe load bearing capacity of roads and bridges. The Contractor shall bear all expenses relating to the transportation.
- The Contractor shall use every reasonable means and be careful to prevent any of the roads or bridges on the route to the site from being damaged or injured by any traffic of the Contractor. If any problem occurs, the Contractor shall be responsible for all the claims, costs, and charges hereof.

2.9 Installation

- The Contractor shall assign a site manager, who is duly empowered by the Contractor. The manager shall supervise the installation of the PV systems at the site and make decision on all matters arising during the construction.
- The Contractor shall organize skilful workers—crews who perform work under the supervision of the site manager—to install and erect the PV systems.
- The Contractor shall prepare all equipment, devices, tools, and materials needed for the installation, and shall keep them at the site on his own responsibility.
- Discussing with the User, the Purchaser and/or Engineer will direct the Contractor to install the system at the designated place.
- The Contractor shall be responsible to prevent any damage or burglary of equipment during installation of PV system.

2.10 Tests

- The factory tests shall be executed by the Contractor in accordance with the specification and normative references, and all the test results shall be submitted to the Purchaser.
- On completion of individual adjustment and tests of each PV system after installation, the Contractor shall carry out the field tests and Inspections of Goods required in the specifications in the presence of the Purchaser and/or Engineer.

- If the tests do not satisfy the requirements of the specifications or any defects attributed to the Contractor are found during the tests, the Contractor shall promptly repair, replace, adjust, and retest the PV system at his own expenses by the date designated by the Purchaser.

2.11 Plates and/or Stickers for National Flag of Japan

- The Contractor shall provide the plates and/or stickers of Japan's national flag as shown on Fig. 2-1.

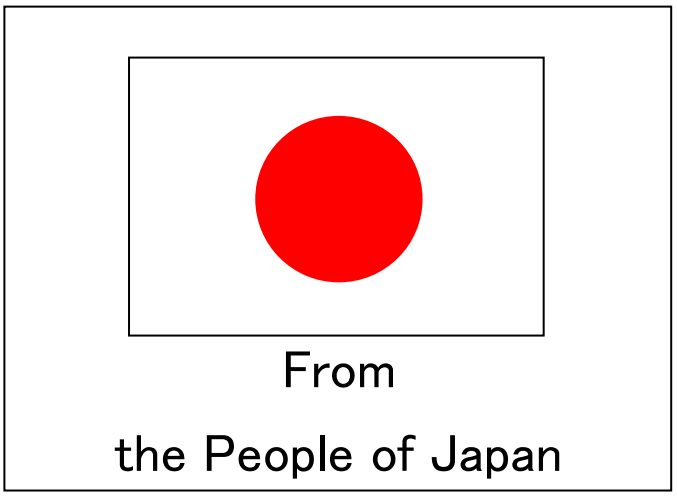


Fig. 2-1 Plates and/or Stickers for National Flag of Japan

- The plates and/or stickers shall be put on all major equipment to be provided for the project, except small equipment or parts on which it is too difficult to apply. The scope of application shall be instructed by the Purchaser. The details of the plates and/or stickers such as layout, description, materials, etc. shall be subject to the approval of the Purchaser.

3 Technical Requirement of Components

3.1 BCS

A BCS consists of station components—PV module, battery charger, charge controller, storage battery, breaker, switch, outlet, lighting, and wiring—and household components—charge controller, storage battery, breaker, switch, outlet, lighting, and wiring. Since the BCS is operated at the system voltage of DC 12 V, all the equipment, devices, and materials for the system shall be suited for the above voltage.

3.1.1 Station Components

3.1.1.1 PV Module

3.1.1.1.1 Requirements

The module shall meet the following technical specification, and the electrical characteristics shall be measured under the standard test conditions—irradiance of 1,000 W/m^2, AM 1.5 spectrum, and cell temperature of 25°C—in accordance with IEC 60904-1 and 3.

- The module shall be either mono-crystalline or poly-crystalline type.
- The maximum power of the module shall be 55 W or more and shall not deteriorate by 10% in ten-year operation.
- The open circuit voltage shall be 20.5 V or more.
- The short circuit current shall be 3.4 A or more.
- The maximum power voltage shall be 16.5 V or more.
- The maximum power current shall be 3.15 A or more.
- The module shall be equipped with a bypass diode in the waterproof terminal box.

3.1.1.1.2 Markings

The module shall have a name plate on it at least the following information and specification:

- Name or trademark of manufacture
- Model and serial number
- Country of origin
- Maximum power, open circuit voltage, short circuit current, maximum power voltage, and maximum power current

3.1.1.2 Battery Charger

3.1.1.2.1 Requirements

The charger shall meet the following technical specification:

- The rated voltage of the charger shall be DC 12 V.
- The rated current of the charger shall be more than DC 20 A.
- The disconnection and reconnection voltages shall be adjustable at least in the following range:

  Low voltage of disconnection 11.1 V – 11.8 V

  Low voltage of reconnection 12.4 V – 12.8 V

High voltage of disconnection 13.7 V – 14.5 V

High voltage of reconnection 13.0 V – 13.8 V

- The charger clearly indicates the mode of operation by means of display or LED.
- The charger shall have protection against short circuit, overvoltage, deep discharge for the battery, and inverse connection of the polarity.
- The charger shall be equipped with terminal blocks to connect cables.

3.1.1.2.2 Markings

The charger shall have a name plate on it at least the following information and specification:

- Name or trademark of manufacture
- Model and serial number
- Country of origin
- Rated voltage and rated current

3.1.1.3 Charge Controller

3.1.1.3.1 Requirements

The controller shall meet the following technical specification:

- The rated voltage of the controller shall be DC 12 V.
- The rated PV input current of the controller shall be more than DC 4.5 A.
- The rated load current of the controller shall be more than DC 4.5 A.
- The disconnection and reconnection voltages shall be adjustable at least in the following range:

  Low voltage of disconnection 11.1 V – 11.8 V

  Low voltage of reconnection 12.4 V – 12.8 V

  High voltage of disconnection 13.7 V – 14.5 V

  High voltage of reconnection 13.0 V – 13.8 V
- The controller clearly indicates the mode of operation by means of display or LED.
- The controller shall have protection against short circuit, overvoltage, deep discharge for the battery, and inverse connection of the polarity.
- The controller shall be equipped with terminal blocks to connect cables.

3.1.1.3.2 Markings

The controller shall have a name plate on it at least the following information and specification:

- Name or trademark of manufacture
- Model and serial number
- Country of origin
- Rated voltage, rated PV input current, and rated load current

3.1.1.4 Storage Battery

3.1.1.4.1 Requirements

The battery shall meet the following technical specification:

- The battery shall be a valve regulated lead-acid battery, sealed type, and deep cycle use.
- The nominal voltage of the battery shall be DC 12 V.
- The rated capacity of the battery shall be more than 100 Ah/10 hr.
- The allowable depth of discharge shall be more than 50%.
- The battery clearly indicates the polarity—red for positive electrode and black for negative electrode.
- The battery shall be equipped with terminal covers to prevent the User from electric shock.
- The battery shall be shipped after it is fully charged.

3.1.1.4.2 Markings

The battery shall have a name plate on it at least the following information and specification:

- Name or trademark of manufacture
- Model and serial number
- Country of origin
- Rated voltage and rated capacity

3.1.1.5 Others

3.1.1.5.1 Requirements

The other components shall meet the following technical specification:

- The rated current of the breaker for PV input circuit shall be more than 30 A.
- The rated current of the breaker for battery charging circuit shall be more than 20 A.
- The rated current of the breaker for lighting circuit shall be more than 10 A.
- The breaker shall be Molded Case Circuit Breaker (MCCB) and bipolar type.
- The switch shall be bipolar type.
- The outlet shall be special type for DC circuit use.
- The rated voltage of the lighting shall be DC 12 V.
- The rated input of the lighting shall be more than 13 W.
- The lighting shall be fluorescent lamp specially developed for DC circuit use.
- The cable between an outdoor and indoor junction box shall be double circuit with a conductor diameter of 25 mm^2.
- The digital multimeter shall have the function of measuring ohmic resistance and voltage.
- The radio shall be DC 12 V use with a DC plug, and the output shall be approximately 5 W.

3.1.1.5.2 Markings

The other components shall indicate the following information and specification on it, if any.

- Name or trademark of manufacture
- Model and serial number
- Country of origin
- Rated voltage and rated input

3.1.2 Household Components

3.1.2.1 Charge Controller

The requirement and marking is the same as described in 3.1.1.3.

3.1.2.2 Storage Battery

The requirement and marking is the same as described in 3.1.1.4 except the following points:

- The battery shall be a lead-acid battery, vented type, and trickle use.
- The rated capacity of the battery shall be more than 80 Ah/10 hr.
- The battery shall be dry-charged and be shipped with necessary electrolyte.

3.1.2.3 Others

The requirement and marking is the same as described in 3.1.1.5 except the following point:

- The rated input of the lighting shall be more than 9 W.
- The rated current of the breaker shall be more than 10 A.

3.2 Public Facility

A Public Facility consists of PV module, charge controller, storage battery, breaker, switch, outlet, lighting, and wiring. Since the facility is operated at the system voltage of DC 12 V, all the equipment, devices, and materials for the system shall be suited for the above voltage.

3.2.1 PV Module

The requirement and marking is the same as described in 3.1.1.1.

3.2.2 Charge Controller

The requirement and marking is the same as described in 3.1.1.3 except the following points:

- The rated PV input current of the controller shall be more than DC 20 A.
- The rated load current of the controller shall be more than DC 20 A.

3.2.3 Storage Battery

The requirement and marking is the same as described in 3.1.1.4 except the following point:

- The rated capacity of the battery shall be more than 350 Ah/10 hr.

3.2.4 Others

The requirement and marking is the same as described in 3.1.1.5 except the following points:

- The rated current of the breaker shall be more than 20 A.
- The rated input of the lighting shall be more than 11 W.
- The cable from an outdoor junction box to the battery shall be single circuit with a conductor diameter of 25 mm^2.

3.3 SHS

A SHS consists of PV module, charge controller, storage battery, breaker, switch, outlet, lighting, and wiring. Since the SHS is operated at the system voltage of DC 12 V, all the equipment, devices, and materials for the system shall be suited for the above voltage.

3.3.1 PV Module

The requirement and marking is the same as described in 3.1.1.1.

3.3.2 Charge Controller

The requirement and marking is the same as described in 3.1.1.3.

3.3.3 Storage Battery

The requirement and marking is the same as described in 3.1.1.4 except the following point:

- The rated capacity of the battery shall be more than 50 Ah/10 hr.

3.3.4 Others

The requirement and marking is the same as described in 3.1.1.5 except the following points:

- The rated current of the breaker shall be more than 10 A.
- The rated input of the lighting shall be more than 9 W.

3.4 Street Lighting

A Street Lighting consists of PV module, charge controller, storage battery, breaker, switch, outlet, lighting, and wiring. Since the lighting is operated at the system voltage of DC 12 V, all the equipment, devices, and materials for the system shall be suited for the above voltage.

3.4.1 PV Module

The requirement and marking is the same as described in 3.1.1.1.

3.4.2 Charge Controller

The requirement and marking is the same as described in 3.1.1.3 except the following point:

- The controller shall have the function of timer-control to switch on and off the load on a set time.

3.4.3 Storage Battery

The requirement and marking is the same as described in 3.1.1.4 except the following point:

- The rated capacity of the battery shall be more than 60 Ah/10 hr.

3.4.4 Others

The requirement and marking is the same as described in 3.1.1.5 except the following points:

- The rated current of the breaker shall be more than 10 A.
- The lighting shall be a fluorescent lamp and outdoor use, and its rated input shall be more than 25 W.
- All the cable shall be of a conductor diameter of 6 mm^2.

4 Installation

4.1 BCS

4.1.1 Station Components

4.1.1.1 PV Module

The PV array—a set of PV modules—shall be installed and erected as follows:

- The tilt angle of the array shall be fixed on 15 degrees, and the array shall face due south.
- The PV array shall be set up on the ground beside BCS and are installed on galvanized steel frames bolted on a reinforced concrete foundation. The Contractor shall propose the design of the frames and foundation to the Purchaser for approval considering the design wind pressure.
- The steel frames shall be earthed using an earth rod, and the color of the earthling cable shall be green-and-yellow.
- The cables of the PV modules shall be led to an outdoor junction box and be connected to a bus bar in the box. And then, the cables shall be laid underground using flexible conduit and be led to an indoor junction box inside BCS.
- To keep the PV array from being robbed and damaged, the Contractor shall erect a fence around the array. The fence comprised of wire netting and barbed wire shall have a gate with a lock. The Contractor shall propose the design of the fence to the Purchaser for approval in consideration of preventing the array from being shaded by the fence in mid winter.

4.1.1.2 Battery Charger

The charger shall be installed as follows:

- The charger shall be installed in a junction box, which is firmly fixed on the interior wall of BCS.
- At the end of the cables for charging batteries, plugs shall be equipped to clip battery terminals. The plugs shall have color identification—red for positive electrode and black for negative electrode—to prevent the User from misunderstanding the polarity of the circuit.
- All cables are dragged into the junction box from the bottom.

4.1.1.3 Charge Controller

The controller shall be installed as follows:

- The controller shall be installed in the same junction box for the battery chargers.
- All cables are dragged into the junction box from the bottom.

4.1.1.4 Storage Battery

The battery shall be installed as follows:

- The battery shall be horizontally installed on the flat floor at a drafty place.
- The battery shall be stored in a battery box, which has a lid fitted with a lock and a hole backside for the purpose of air ventilation and wiring. The box shall be nonmetal and made from materials enduring acid solution.

- The cable shall be firmly bolted to the terminal at the specified torque.

4.1.1.5 Others

The other components shall be installed as follows:

- The breaker shall be installed in the same junction box for the battery chargers.
- The lighting will be fixed on the beam or ceiling of BCS.
- The cable of interior wiring shall be laid passing through the shortest distance, and shall be fixed on the wall and ceiling using cable clips.

4.1.2 Household Components

4.1.2.1 Charge Controller

The controller shall be installed as described in 4.1.1.3 except the following point:

- The controller shall be installed in a junction box, which is firmly fixed on the interior wall of the house.

4.1.2.2 Storage Battery

The battery shall be installed as described in 4.1.1.4. The Contractor shall be responsible for the initial charge of vented type batteries and follow the manufacturer's instructions to charge them. All batteries shall be put on seals and/or stickers indicating numbers or names to identify owners of batteries.

4.1.2.3 Others

The other components shall be installed as described in 4.1.1.5 except the following points:

- The switch shall be installed in each circuit for the lighting and be fixed on the interior wall.
- The lighting will be fixed on the beam or ceiling of the house.

4.2 Public Facility

4.2.1 PV Module

The PV array—a set of PV modules—shall be installed and erected as described in 4.1.1.1 except the following point:

- The cables of the PV modules shall be led to an outdoor junction box and be connected to a bus bar in the box. And then, the cables shall be laid underground using flexible conduit and be led to an indoor junction box inside the facility.

4.2.2 Charge Controller

The controller shall be installed as described in 4.1.2.1.

4.2.3 Storage Battery

The battery shall be installed as described in 4.1.1.4.

4.2.4 Others

The other components shall be as described in 4.1.2.3.

4.3 SHS

4.3.1 PV Module

The module shall be installed and erected as follows:

- The tilt angle of the module shall be fixed on 15 degrees, and the module shall face due south.
- The module shall be installed on the top of a galvanized steel pole, which is not less than 4 m in length. The Contractor will dig a hole approximately 1,000 mm in depth to erect the steel pole. The pole will be firmly fixed in the ground using gravel and concrete. The Contractor shall propose the way of installation to the Purchaser for approval considering the design wind pressure.
- The frame of the module shall be earthed using an earth rod, and the color of the earthling cable shall be green-and-yellow.
- The cable from the module will be led overhead and fixed on the exterior wall using a messenger wire. The Contractor will drill a hole on the wall with the User consent and lead the cable inside through the hole.
- The module shall be installed in the proper space to minimize the period of shade on it. Installation technicians would benefit using site control devices such as solar pathfinder.

4.3.2 Charge Controller

The controller shall be installed as described in 4.1.2.1.

4.3.3 Storage Battery

The battery shall be installed as described in 4.1.1.4.

4.3.4 Others

The other components shall be as described in 4.1.2.3.

4.4 Street Lighting

4.4.1 PV Module

The module shall be installed and erected as described in 4.3.1 except the following point:

- The cable from the module will be laid along the pole and be connected to the junction box for the charge controller.

4.4.2 Charge Controller

The controller shall be installed as described in 4.1.1.3 except the following point:

- The controller shall be installed in a junction box, which firmly fixed on the pole.

4.4.3 Storage Battery

The battery shall be installed as described in 4.1.1.4 except the following point:

- The battery shall be stored in a battery box, which is firmly fixed on the bottom of the pole and has a lid fitted with a lock. The box shall be metal and be earthed using the same earth rod for the module, and the color of the earthling cable shall be green-and-yellow.

4.4.4 Others

The other components shall be installed as described in 4.1.2.3 except the following point:

- The lighting shall be installed on the top of the pole, but it shall not prevent the PV module from being shaded.

5 Tests

For each component of the PV systems, the Contractor shall submit the result of factory tests to the Purchaser and carry out the field tests as follows:

5.1 PV Module

5.1.1 Factory Tests

- The PV module shall be free from any harmful flaw in its appearance.
- The dimension of the module shall be as designed.
- The maximum output of the module shall meet the technical requirement.

5.1.2 Field Tests

- The PV module shall be free from any harmful flaw in its appearance.
- The module shall be connected correctly in accordance with the approved drawings.
- The open circuit voltage of the module shall conform to the characteristic curve.
- The positive and negative electrode shall be absolutely insulated so as not to short-circuit.

5.2 Battery Charger

5.2.1 Factory Tests

- The charger shall be free from any harmful flaw in its appearance.
- The dimension of the charger shall be as designed.
- The function of the charger shall meet the technical requirement.

5.2.2 Field Tests

- The charger shall be free from any harmful flaw in its appearance.
- The charger shall be connected correctly in accordance with the approved drawings.
- The charger shall work correctly in accordance with the manual.
- The positive and negative electrode shall be absolutely insulated so as not to short-circuit.

5.3 Charge Controller

5.3.1 Factory Tests

- The controller shall be free from any harmful flaw in its appearance.
- The dimension of the controller shall be as designed.
- The function of the controller shall meet the technical requirement.

5.3.2 Field Tests

- The controller shall be free from any harmful flaw in its appearance.
- The controller shall be connected correctly in accordance with the approved drawings.

- The controller shall work correctly in accordance with the manual.
- The positive and negative electrode shall be absolutely insulated so as not to short-circuit.

5.4 Storage Battery

5.4.1 Factory Test

- The battery shall be free from any harmful flaw in its appearance.
- The dimension of the battery shall be as designed.
- The voltage and capacity of the battery shall meet the technical requirement.

5.4.2 Field Test

- The battery shall be free from any harmful flaw in its appearance.
- The battery shall be connected correctly in accordance with the approved drawings.
- The voltage of the battery shall meet the technical requirement.
- The positive and negative electrode shall be absolutely insulated so as not to short-circuit.

5.5 Others

5.5.1 Factory Test

- The other components shall be free from any harmful flaw in its appearance.
- The dimension of other components shall be as designed.

5.5.2 Field Test

- The other components shall be free from any harmful flaw in its appearance.
- The other components shall be connected correctly in accordance with the approved drawings.
- The positive and negative electrode shall be absolutely insulated so as not to short-circuit.

6 Training and Maintenance

6.1 Training

To facilitate the skills of the operation and maintenance crews assigned by the Purchaser, the Contractor has the following obligations:

- Throughout the installation and field tests of the PV systems, the Contractor shall show his engineering works to the Purchaser, Engineer, and crews.
- Not later than a week before the commencement of commercial operation of the PV systems, the Contractor shall organize the training course—at least for three (3) days—for the Purchaser Engineer, and crews. The course shall be held based on the operation and maintenance manuals for the PV systems.
- The Contractor shall arrange all the materials, tools, and equipment needed for the training at his own expense.

6.2 Maintenance

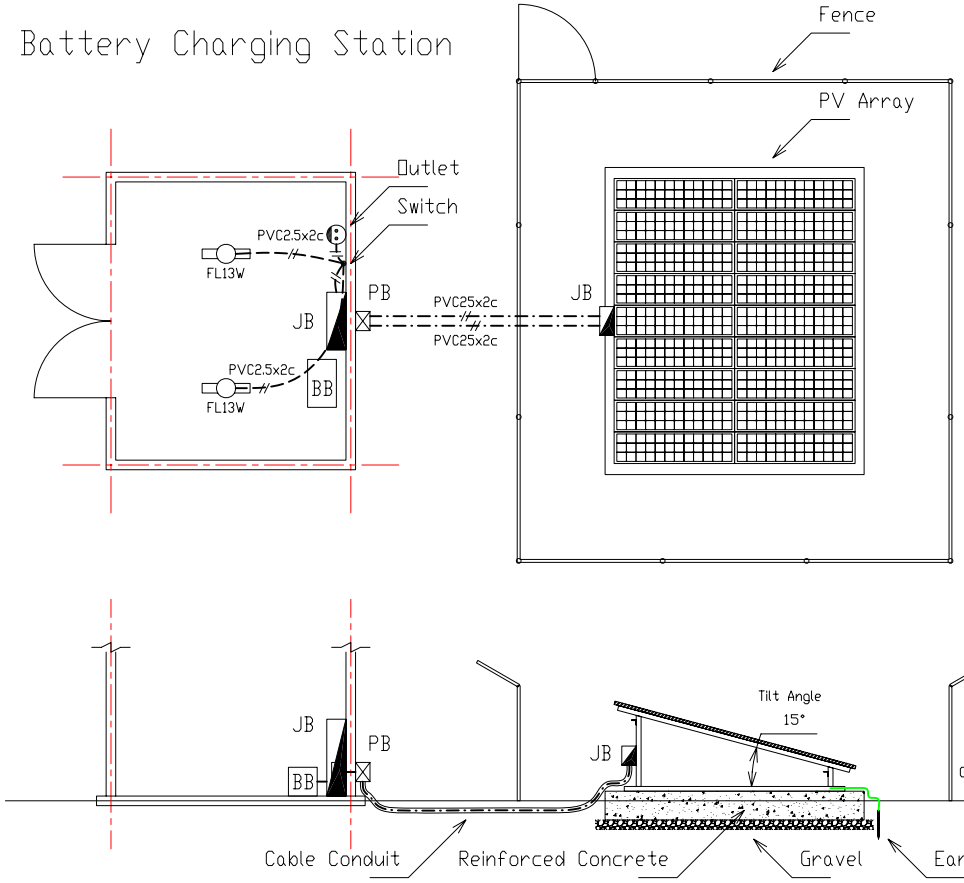
The Contractor shall execute periodical maintenance works of the PV systems twice up to February 2007. The requirements of maintenance work are as follows:

- The maintenance work shall be done for each system and at least cover the following items: weather information, appearance inspection, voltage measurement of terminals, cleaning, adjustment, measurement of battery electrolyte level, refill of distilled water, and replacement of defective components.
- The Purchaser will decide the date of maintenance work, and the Contractor shall execute the maintenance work on the date in the presence of the Purchaser, Engineer, and crews. The Contractor shall immediately prepare the result of maintenance work and report it at the site.
- The Contractor shall arrange all the materials, tools, and equipment needed for the maintenance at his own expense. No additional charge will be paid for the work to the Contractor.
- Throughout the maintenance work of the PV systems, the Contractor shall show his maintenance work to the maintenance crews assigned by the Purchaser.

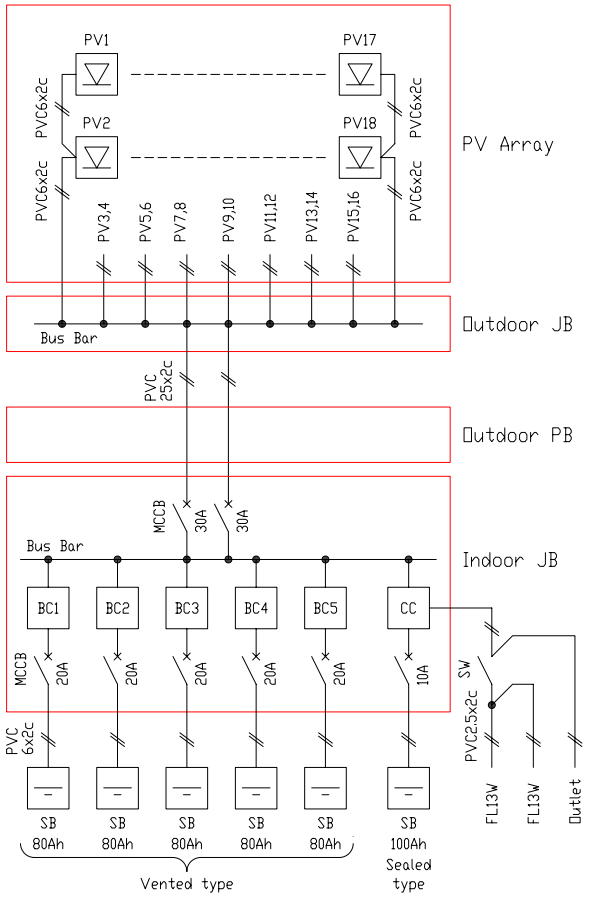
Annex 1 Drawings of PV Systems

RevNo	Revision note	Date	Signature	Checked

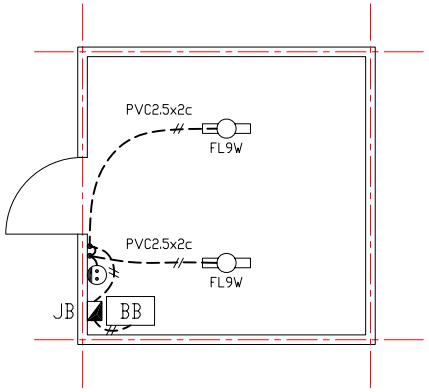
Battery Charging Station



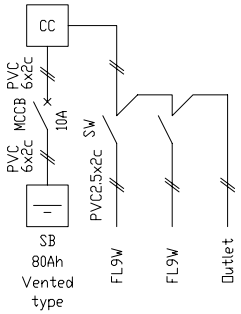
BCS Circuit



Household



Household Circuit



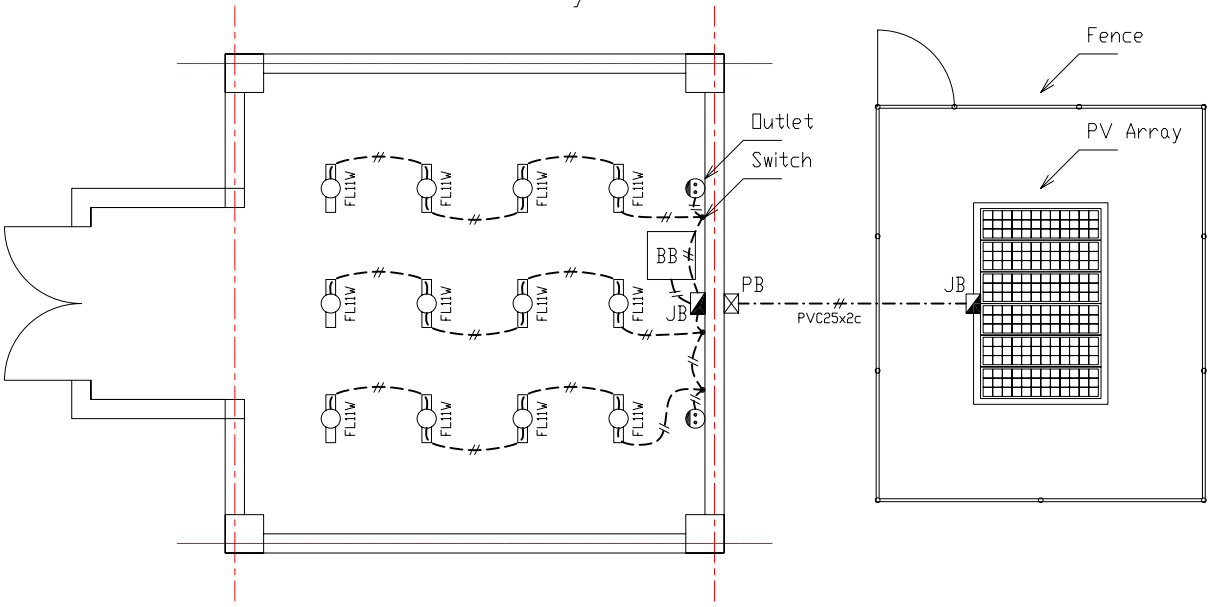
Abbreviations

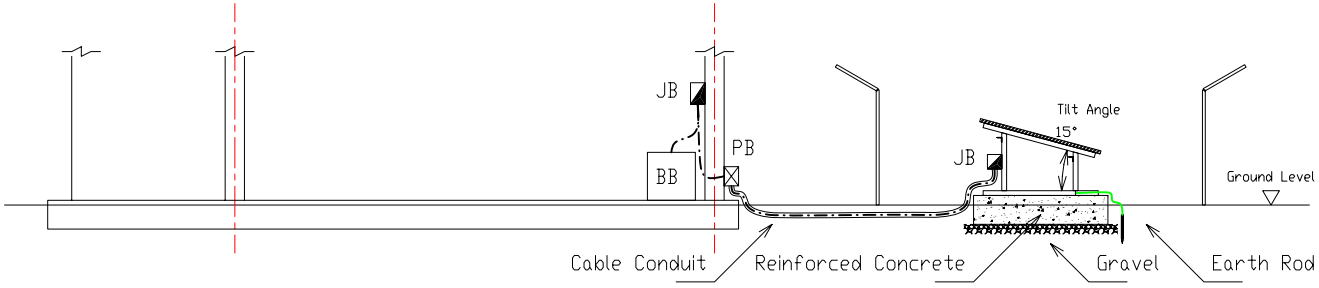
BB	Battery Box	JB	Joint Box	PVC	Polyvinyl Chloride Cable
BC	Battery Charger	MCCB	Molded Case Circuit Breaker	SB	Storage Battery
CC	Charge Controller	PB	Pull Box	SW	Switch
FL	Fluorescent Light	PV	Photovoltaic		

Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference	
Designed by K.SAITO		Checked by T.OGAWA	Approved by - date M.NISHIKAWA -	File name TSJ annex1	Date 09/15/2005	Scale
Japan International Cooperation Agency MASTER PLAN STUDY FOR UTILIZATION OF SOLAR ENERGY IN THE FEDERAL REPUBLIC OF NIGERIA				BATTERY CHARGING STATION		
				TSJ-001	Edition 001	Sheet 001

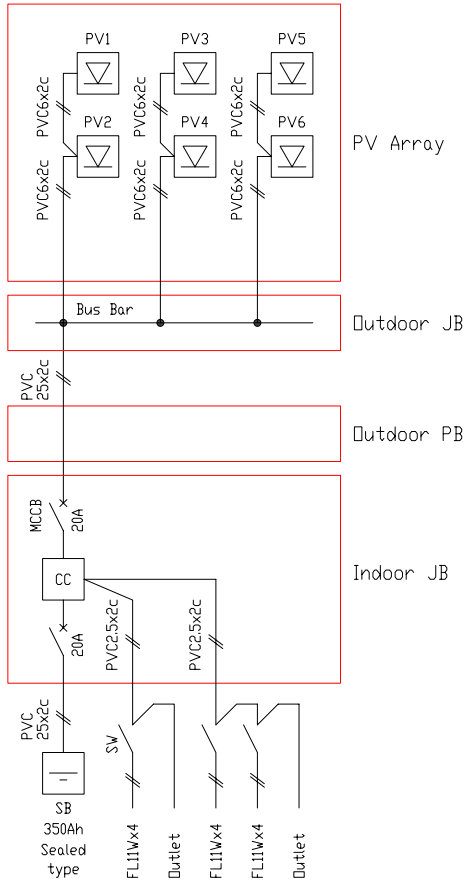
RevNo	Revision note	Date	Signature	Checked

Public Facility





Public Facility Circuit



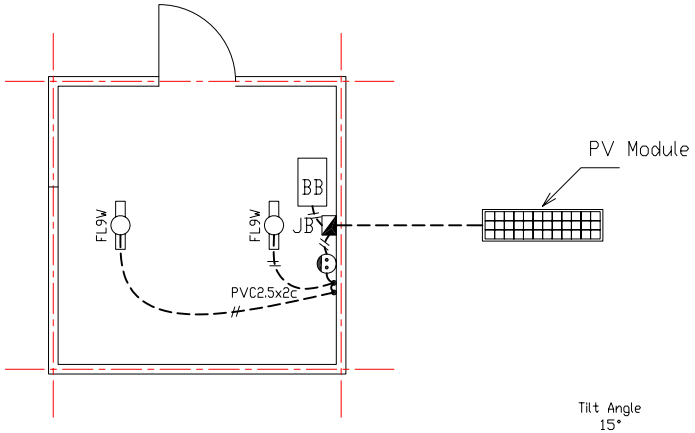
Abbreviations

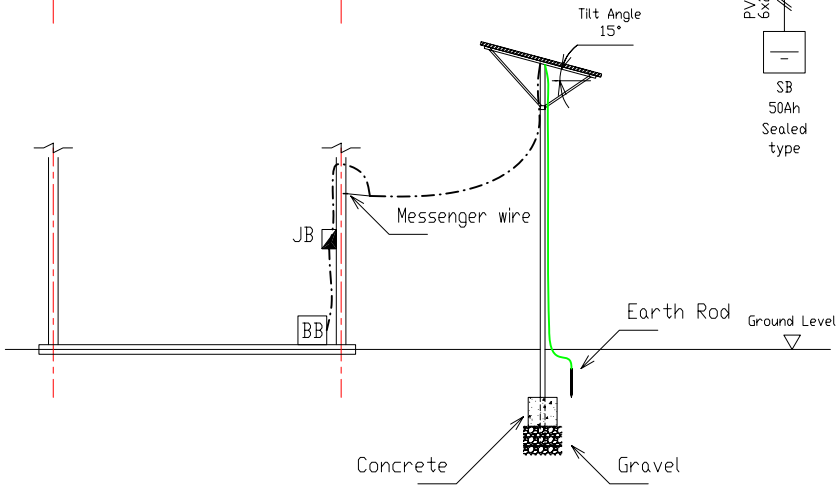
BB	Battery Box	MCCB	Molded Case Circuit Breaker	SB	Storage Battery
CC	Charge Controller	PB	Pull Box	SW	Switch
FL	Fluorescent Light	PV	Photovoltaic		
JB	Joint Box	PVC	Polyvinyl Chloride Cable		

Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference
Designed by K.SAITO		Checked by T.OGAWA	Approved by - date M.NISHIKAWA -	File name TSJ annex1	Date 09/15/2005	Scale
Japan International Cooperation Agency MASTER PLAN STUDY FOR UTILIZATION OF SOLAR ENERGY IN THE FEDERAL REPUBLIC OF NIGERIA			PUBLIC FACILITY		
			TSJ-002	Edition 001	Sheet 002

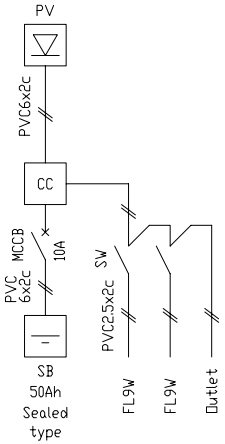
RevNo	Revision note	Date	Signature	Checked

Solar Home System

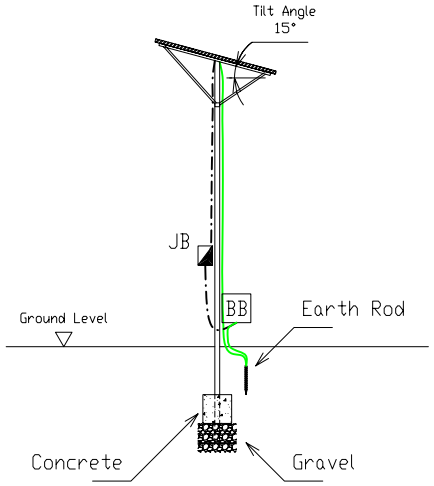




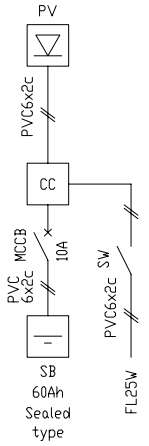
SHS Circuit



Street Lighting



Street Lighting Circuit



Abbreviations

BB	Battery Box	MCCB	Molded Case Circuit Breaker	SB	Storage Battery
CC	Charge Controller	PB	Pull Box	SW	Switch
FL	Fluorescent Light	PV	Photovoltaic		
JB	Joint Box	PVC	Polyvinyl Chloride Cable		

Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference	
Designed by K.SAITO		Checked by T.OGAWA	Approved by - date M.NISHIKAWA -	File name TSJ annex1	Date 09/15/2005	Scale
Japan International Cooperation Agency MASTER PLAN STUDY FOR UTILIZATION OF SOLAR ENERGY IN THE FEDERAL REPUBLIC OF NIGERIA				SOLAR HOME SYSTEM/SOLAR LIGHTING		
				TSJ-003	Edition 001	Sheet 003

Annex 2 Technical Data Sheet

Technical Data Sheet

	Item	Requirement	Proposed	Remarks
1	**BCS**			
1.1	Station Components			
1.1.1	PV Module			
1.1.1.1	Name of manufacture	—		
1.1.1.2	Model number	—		
1.1.1.3	Country of origin	—		
1.1.1.4	Type	Mono-crystalline or poly-crystalline		
1.1.1.5	Maximum power (W)	55 W or more (Not deteriorate by 10% in ten-year operation)		
1.1.1.6	Open circuit voltage (V)	20.5 V or more		
1.1.1.7	Short circuit current (A)	3.4 A or more		
1.1.1.8	Maximum power voltage (V)	16.5 V or more		
1.1.1.9	Maximum power current (A)	3.15 A or more		
1.1.1.10	Accessories	A bypass diode is required.		
1.1.1.11	Characteristics curve	Voltage-current characteristics curve shall be attached.		
1.1.1.12	Catalogue	The catalogue of the product shall be attached.		
1.1.2	Battery Charger			
1.1.2.1	Name of manufacture	—		
1.1.2.2	Model number	—		
1.1.2.3	Country of origin	—		
1.1.2.4	Rated voltage (V)	DC 12 V		
1.1.2.5	Rated current (A)	More than DC 20 A		
1.1.2.6	Low voltage of disconnection	Adjustable between 11.1 V – 11.8 V		
1.1.2.7	Low voltage of reconnection	Adjustable between 12.4 V – 12.8 V		
1.1.2.8	High voltage of disconnection	Adjustable between 13.7 V – 14.5 V		
1.1.2.9	High voltage of reconnection	Adjustable between 13.0 V – 13.8 V		
1.1.2.10	Protection	Protected against short circuit, OV, deep discharge, and inverse connection.		
1.1.2.11	Accessories	A terminal block, display and/or LED are required.		
1.1.2.12	Catalogue	The catalogue of the product shall be attached.		
1.1.3	Charge Controller			
1.1.3.1	Name of manufacture	—		
1.1.3.2	Model number	—		
1.1.3.3	Country of origin	—		
1.1.3.4	Rated voltage (V)	DC 12 V		
1.1.3.5	Rated current (A)	More than DC 4.5 A		
1.1.3.6	Low voltage of disconnection	Adjustable between 11.1 V – 11.8 V		
1.1.3.7	Low voltage of reconnection	Adjustable between 12.4 V – 12.8 V		
1.1.3.8	High voltage of disconnection	Adjustable between 13.7 V – 14.5 V		
1.1.3.9	High voltage of reconnection	Adjustable between 13.0 V – 13.8 V		
1.1.3.10	Protection	Protected against short circuit, OV, deep discharge, and inverse connection.		
1.1.3.11	Accessories	A terminal block, display and/or LED are required.		
1.1.3.12	Catalogue	The catalogue of the product shall be attached.		
1.1.4	Storage Battery			
1.1.4.1	Name of manufacture	—		
1.1.4.2	Model number	—		
1.1.4.3	Country of origin	—		
1.1.4.4	Type	Valve regulated lead-acid, sealed type, and deep cycle use.		
1.1.4.5	Rated voltage (V)	DC 12 V		
1.1.4.6	Rated capacity (Ah)	More than 100 Ah/10hr		
1.1.4.7	Capacity at 1C[*1] discharge (Ah)	For reference, *1 1C is 1-hour rate discharging current.		
1.1.4.8	Capacity at 0.5C[*2] discharge (Ah)	For reference, *2 0.5C is 2-hour rate discharging current.		
1.1.4.9	Capacity at 0.2C[*3] discharge (Ah)	For reference, *3 0.2C is 5-hour rate discharging current.		
1.1.4.10	Capacity at 0.1C[*4] discharge (Ah)	For reference, *4 0.1C is 10-hour rate discharging current.		
1.1.4.11	Capacity at 0.05C[*5] discharge (Ah)	For reference, *5 0.05C is 20-hour rate discharging current.		
1.1.4.12	Allowable DOD	More than 50%		
1.1.4.13	Expected cycle life at DOD of 50% (cycle)	For reference		
1.1.4.14	Expected cycle life at DOD of 100% (cycle)	For reference		
1.1.4.15	Accessories	Polarity identification and terminal covers are required.		
1.1.4.16	Catalogue	The catalogue of the product shall be attached.		
1.1.5	Other Components			
1.1.5.1	Circuit Breaker (CB)			
1.1.5.1.1	Name of manufacture	—		
1.1.5.1.2	Model number	—		
1.1.5.1.3	Country of origin	—		
1.1.5.1.4	Rating for PV input circuit CB	MCCB, bipolar, rated current shall be more than 30 A		
1.1.5.1.5	Rating for battery charging circuit CB	MCCB, bipolar, rated current shall be more than 20 A		
1.1.5.1.6	Rating for lighting circuit CB	MCCB, bipolar, rated current shall be more than 10 A		
1.1.5.1.7	Catalogue	The catalogue of the product shall be attached.		

Name of Bidder

Name of Authorized Signatory, Position

Signature, Date

Technical Data Sheet

	Item	Requirement	Proposed	Remarks
1.1.5.2	Lighting			
1.1.5.2.1	Name of manufacture	—		
1.1.5.2.2	Model number	—		
1.1.5.2.3	Country of origin	—		
1.1.5.2.4	Rating	DC 12 V, fluorescent lamp, more than 13 W		
1.1.5.2.5	Catalogue	The catalogue of the product shall be attached.		
1.1.5.3	Digital Multimeter			
1.1.5.3.1	Name of manufacture	—		
1.1.5.3.2	Model number	—		
1.1.5.3.3	Country of origin	—		
1.1.5.3.4	Function	Measuring ohmic resistance and voltage		
1.1.5.3.5	Catalogue	The catalogue of the product shall be attached.		
1.1.5.4	Radio			
1.1.5.4.1	Name of manufacture	—		
1.1.5.4.2	Model number	—		
1.1.5.4.3	Country of origin	—		
1.1.5.4.4	Output	Approximately 5 W		
1.1.5.4.5	Catalogue	The catalogue of the product shall be attached.		
1.2	Household Components			
1.2.1	Charge Controller			
1.2.2	Name of manufacture	—		
1.2.3	Model number	—		
1.2.4	Country of origin	—		
1.2.5	Rated voltage (V)	DC 12 V		
1.2.6	Rated current (A)	More than DC 4.5 A		
1.2.7	Low voltage of disconnection	Adjustable between 11.1 V – 11.8 V		
1.2.8	Low voltage of reconnection	Adjustable between 12.4 V – 12.8 V		
1.2.9	High voltage of disconnection	Adjustable between 13.7 V – 14.5 V		
1.2.10	High voltage of reconnection	Adjustable between 13.0 V – 13.8 V		
1.2.11	Protection	Protected against short circuit, OV, deep discharge, and inverse connection.		
1.2.12	Accessories	A terminal block, display and/or LED are required.		
1.2.13	Catalogue	The catalogue of the product shall be attached.		
1.2.2	Storage Battery			
1.2.2.1	Name of manufacture	—		
1.2.2.2	Model number	—		
1.2.2.3	Country of origin	—		
1.2.2.4	Type	Lead-acid, vented type, and trickle use.		
1.2.2.5	Rated voltage (V)	DC 12 V		
1.2.2.6	Rated capacity (Ah)	More than 80 Ah/10hr		
1.2.2.7	Capacity at 1C*1 discharge (Ah)	For reference, *1 1C is 1-hour rate discharging current.		
1.2.2.8	Capacity at 0.5C*2 discharge (Ah)	For reference, *2 0.5C is 2-hour rate discharging current.		
1.2.2.9	Capacity at 0.2C*3 discharge (Ah)	For reference, *3 0.2C is 5-hour rate discharging current.		
1.2.2.10	Capacity at 0.1C*4 discharge (Ah)	For reference, *4 0.1C is 10-hour rate discharging current.		
1.2.2.11	Capacity at 0.05C*5 discharge (Ah)	For reference, *5 0.05C is 20-hour rate discharging current.		
1.2.2.12	Expected cycle life at DOD of 50% (cycle)	For reference		
1.2.2.13	Expected cycle life at DOD of 100% (cycle)	For reference		
1.2.2.14	Accessories	Polarity identification and terminal covers are required.		
1.2.2.15	Catalogue	The catalogue of the product shall be attached.		
1.2.3	Other Components			
1.2.3.1	Circuit Breaker (CB)			
1.2.3.1.1	Name of manufacture	—		
1.2.3.1.2	Model number	—		
1.2.3.1.3	Country of origin	—		
1.2.3.1.4	Rating	MCCB, bipolar, rated current shall be more than 10 A		
1.2.3.1.5	Catalogue	The catalogue of the product shall be attached.		
1.2.3.2	Lighting			
1.2.3.2.1	Name of manufacture	—		
1.2.3.2.2	Model number	—		
1.2.3.2.3	Country of origin	—		
1.2.3.2.4	Rating	DC 12 V, fluorescent lamp, more than 9 W		
1.2.3.2.5	Catalogue	The catalogue of the product shall be attached.		

Name of Bidder

Name of Authorized Signatory, Position

Signature, Date

Technical Data Sheet

	Item	Requirement	Proposed	Remarks
2	**Public Facility**			
2.1	PV Module			
2.1.1	Name of manufacture	—		
2.1.2	Model number	—		
2.1.3	Country of origin	—		
2.1.4	Type	Mono-crystalline or poly-crystalline		
2.1.5	Maximum power (W)	55 W or more (Not deteriorate by 10% in ten-year operation)		
2.1.6	Open circuit voltage (V)	20.5 V or more		
2.1.7	Short circuit current (A)	3.4 A or more		
2.1.8	Maximum power voltage (V)	16.5 V or more		
2.1.9	Maximum power current (A)	3.15 A or more		
2.1.10	Accessories	A bypass diode is required.		
2.1.11	Characteristics curve	Voltage-current characteristics curve shall be attached.		
2.1.12	Catalogue	The catalogue of the product shall be attached.		
2.2	Charge Controller			
2.2.1	Name of manufacture	—		
2.2.2	Model number	—		
2.2.3	Country of origin	—		
2.2.4	Rated voltage (V)	DC 12 V		
2.2.5	Rated current (A)	More than DC 20 A		
2.2.6	Low voltage of disconnection	Adjustable between 11.1 V – 11.8 V		
2.2.7	Low voltage of reconnection	Adjustable between 12.4 V – 12.8 V		
2.2.8	High voltage of disconnection	Adjustable between 13.7 V – 14.5 V		
2.2.9	High voltage of reconnection	Adjustable between 13.0 V – 13.8 V		
2.2.10	Protection	Protected against short circuit, OV, deep discharge, and inverse connection.		
2.2.11	Accessories	A terminal block, display and/or LED are required.		
2.2.12	Catalogue	The catalogue of the product shall be attached.		
2.3	Storage Battery			
2.3.1	Name of manufacture	—		
2.3.2	Model number	—		
2.3.3	Country of origin	—		
2.3.4	Type	Valve regulated lead-acid, sealed type, and deep cycle use.		
2.3.5	Rated voltage (V)	DC 12 V		
2.3.6	Rated capacity (Ah)	More than 350 Ah/10hr		
2.3.7	Capacity at 1C[*1] discharge (Ah)	For reference, *1 1C is 1-hour rate discharging current.		
2.3.8	Capacity at 0.5C[*2] discharge (Ah)	For reference, *2 0.5C is 2-hour rate discharging current.		
2.3.9	Capacity at 0.2C[*3] discharge (Ah)	For reference, *3 0.2C is 5-hour rate discharging current.		
2.3.10	Capacity at 0.1C[*4] discharge (Ah)	For reference, *4 0.1C is 10-hour rate discharging current.		
2.3.11	Capacity at 0.05C[*5] discharge (Ah)	For reference, *5 0.05C is 20-hour rate discharging current.		
2.3.12	Allowable DOD	More than 50%		
2.3.13	Expected cycle life at DOD of 50% (cycle)	For reference		
2.3.14	Expected cycle life at DOD of 100% (cycle)	For reference		
2.3.15	Accessories	Polarity identification and terminal covers are required.		
2.3.16	Catalogue	The catalogue of the product shall be attached.		
2.4	Other Components			
2.4.1	Circuit Breaker (CB)			
2.4.1.1	Name of manufacture	—		
2.4.1.2	Model number	—		
2.4.1.3	Country of origin	—		
2.4.1.4	Rating	MCCB, bipolar, rated current shall be more than 20 A		
2.4.1.5	Catalogue	The catalogue of the product shall be attached.		
2.4.2	Lighting			
2.4.2.1	Name of manufacture	—		
2.4.2.2	Model number	—		
2.4.2.3	Country of origin	—		
2.4.2.4	Rating	DC 12 V, fluorescent lamp, more than 11 W		
2.4.2.5	Catalogue	The catalogue of the product shall be attached.		

Name of Bidder

Name of Authorized Signatory, Position

Signature, Date

Technical Data Sheet

	Item	Requirement	Proposed	Remarks
3	**SHS**			
3.1	PV Module			
3.1.1	Name of manufacture	—		
3.1.2	Model number	—		
3.1.3	Country of origin	—		
3.1.4	Type	Mono-crystalline or poly-crystalline		
3.1.5	Maximum power (W)	55 W or more (Not deteriorate by 10% in ten-year operation)		
3.1.6	Open circuit voltage (V)	20.5 V or more		
3.1.7	Short circuit current (A)	3.4 A or more		
3.1.8	Maximum power voltage (V)	16.5 V or more		
3.1.9	Maximum power current (A)	3.15 A or more		
3.1.10	Accessories	A bypass diode is required.		
3.1.11	Characteristics curve	Voltage-current characteristics curve shall be attached.		
3.1.12	Catalogue	The catalogue of the product shall be attached.		
3.2	Charge Controller			
3.2.1	Name of manufacture	—		
3.2.2	Model number	—		
3.2.3	Country of origin	—		
3.2.4	Rated voltage (V)	DC 12 V		
3.2.5	Rated current (A)	More than DC 4.5 A		
3.2.6	Low voltage of disconnection	Adjustable between 11.1 V – 11.8 V		
3.2.7	Low voltage of reconnection	Adjustable between 12.4 V – 12.8 V		
3.2.8	High voltage of disconnection	Adjustable between 13.7 V – 14.5 V		
3.2.9	High voltage of reconnection	Adjustable between 13.0 V – 13.8 V		
3.2.10	Protection	Protected against short circuit, OV, deep discharge, and inverse connection.		
3.2.11	Accessories	A terminal block, display and/or LED are required.		
3.2.12	Catalogue	The catalogue of the product shall be attached.		
3.3	Storage Battery			
3.3.1	Name of manufacture	—		
3.3.2	Model number	—		
3.3.3	Country of origin	—		
3.3.4	Type	Valve regulated lead-acid, sealed type, and deep cycle use.		
3.3.5	Rated voltage (V)	DC 12 V		
3.3.6	Rated capacity (Ah)	More than 50 Ah/10hr		
3.3.7	Capacity at 1C[*1] discharge (Ah)	For reference, *1 1C is 1-hour rate discharging current.		
3.3.8	Capacity at 0.5C[*2] discharge (Ah)	For reference, *2 0.5C is 2-hour rate discharging current.		
3.3.9	Capacity at 0.2C[*3] discharge (Ah)	For reference, *3 0.2C is 5-hour rate discharging current.		
3.3.10	Capacity at 0.1C[*4] discharge (Ah)	For reference, *4 0.1C is 10-hour rate discharging current.		
3.3.11	Capacity at 0.05C[*5] discharge (Ah)	For reference, *5 0.05C is 20-hour rate discharging current.		
3.3.12	Allowable DOD	More than 50%		
3.3.13	Expected cycle life at DOD of 50% (cycle)	For reference		
3.3.14	Expected cycle life at DOD of 100% (cycle)	For reference		
3.3.15	Accessories	Polarity identification and terminal covers are required.		
3.3.16	Catalogue	The catalogue of the product shall be attached.		
3.4	Other Components			
3.4.1	Circuit Breaker (CB)			
3.4.1.1	Name of manufacture	—		
3.4.1.2	Model number	—		
3.4.1.3	Country of origin	—		
3.4.1.4	Rating	MCCB, bipolar, rated current shall be more than 10 A		
3.4.1.5	Catalogue	The catalogue of the product shall be attached.		
3.4.2	Lighting			
3.4.2.1	Name of manufacture	—		
3.4.2.2	Model number	—		
3.4.2.3	Country of origin	—		
3.4.2.4	Rating	DC 12 V, fluorescent lamp, more than 9 W		
3.4.2.5	Catalogue	The catalogue of the product shall be attached.		

Name of Bidder

Name of Authorized Signatory, Position

Signature, Date

Technical Data Sheet

	Item	Requirement	Proposed	Remarks
4	**Street Lighting**			
4.1	PV Module			
4.1.1	Name of manufacture	—		
4.1.2	Model number	—		
4.1.3	Country of origin	—		
4.1.4	Type	Mono-crystalline or poly-crystalline		
4.1.5	Maximum power (W)	55 W or more (Not deteriorate by 10% in ten-year operation)		
4.1.6	Open circuit voltage (V)	20.5 V or more		
4.1.7	Short circuit current (A)	3.4 A or more		
4.1.8	Maximum power voltage (V)	16.5 V or more		
4.1.9	Maximum power current (A)	3.15 A or more		
4.1.10	Accessories	A bypass diode is required.		
4.1.11	Characteristics curve	Voltage-current characteristics curve shall be attached.		
4.1.12	Catalogue	The catalogue of the product shall be attached.		
4.2	Charge Controller			
4.2.1	Name of manufacture	—		
4.2.2	Model number	—		
4.2.3	Country of origin	—		
4.2.4	Rated voltage (V)	DC 12 V		
4.2.5	Rated current (A)	More than DC 4.5 A		
4.2.6	Low voltage of disconnection	Adjustable between 11.1 V – 11.8 V		
4.2.7	Low voltage of reconnection	Adjustable between 12.4 V – 12.8 V		
4.2.8	High voltage of disconnection	Adjustable between 13.7 V – 14.5 V		
4.2.9	High voltage of reconnection	Adjustable between 13.0 V – 13.8 V		
4.2.10	Protection	Protected against short circuit, OV, deep discharge, and inverse connection.		
4.2.11	Function	The controller shall have a timer-control function.		
4.2.12	Accessories	A terminal block, display and/or LED are required.		
4.2.13	Catalogue	The catalogue of the product shall be attached.		
4.3	Storage Battery			
4.3.1	Name of manufacture	—		
4.3.2	Model number	—		
4.3.3	Country of origin	—		
4.3.4	Type	Valve regulated lead-acid, sealed type, and deep cycle use.		
4.3.5	Rated voltage (V)	DC 12 V		
4.3.6	Rated capacity (Ah)	More than 60 Ah/10hr		
4.3.7	Capacity at 1C[*1] discharge (Ah)	For reference, *1 1C is 1-hour rate discharging current.		
4.3.8	Capacity at 0.5C[*2] discharge (Ah)	For reference, *2 0.5C is 2-hour rate discharging current.		
4.3.9	Capacity at 0.2C[*3] discharge (Ah)	For reference, *3 0.2C is 5-hour rate discharging current.		
4.3.10	Capacity at 0.1C[*4] discharge (Ah)	For reference, *4 0.1C is 10-hour rate discharging current.		
4.3.11	Capacity at 0.05C[*5] discharge (Ah)	For reference, *5 0.05C is 20-hour rate discharging current.		
4.3.12	Allowable DOD	More than 50%		
4.3.13	Expected cycle life at DOD of 50% (cycle)	For reference		
4.3.14	Expected cycle life at DOD of 100% (cycle)	For reference		
4.3.15	Accessories	Polarity identification and terminal covers are required.		
4.3.16	Catalogue	The catalogue of the product shall be attached.		
4.4	Other Components			
4.4.1	Circuit Breaker (CB)			
4.4.1.1	Name of manufacture	—		
4.4.1.2	Model number	—		
4.4.1.3	Country of origin	—		
4.4.1.4	Rating	MCCB, bipolar, rated current shall be more than 10 A		
4.4.1.5	Catalogue	The catalogue of the product shall be attached.		
4.4.2	Lighting			
4.4.2.1	Name of manufacture	—		
4.4.2.2	Model number	—		
4.4.2.3	Country of origin	—		
4.4.2.4	Rating	DC 12 V, fluorescent lamp, outdoor use, more than 25 W		
4.4.2.5	Catalogue	The catalogue of the product shall be attached.		

Name of Bidder

Name of Authorized Signatory, Position

Signature, Date

Annex 3 Price Schedule

Price Schedule

Bid Price Summary

No.	Item	Unit	Quantity	Unit Price (N)	Total Price (N)
1	BCS	set	1		
2	Public Facility	set	1		
3	SHS	set	60		
4	Street Lighting	set	10		
5	Transportation and Maintenance	lot	1		
6	Spare Parts	lot	1		
	Total				

Name of Bidder

Name of Authorized Signatory, Position

Signature, Date

Price Schedule

1 BCS

No.	Item	Specification	Unit	Quantity	Unit Price (N)	Total Price (N)
1.1	Station Components					
1.1.1	PV Module	55 W, silicon crystal	pcs	18		
1.1.2	Battery Charger	12 V, 20 A	pcs	5		
1.1.3	Charge Controller	12 V, 4.5 A	pcs	1		
1.1.4	Storage Battery	100 Ah, sealed type, deep cycle use	pcs	1		
1.1.5	Battery Box	Indoor use for 100 Ah battery	pcs	1		
1.1.6	Circuit Breaker	Bipolar, 30 A	pcs	2		
1.1.7	ditto	Bipolar, 20 A	pcs	5		
1.1.8	ditto	Bipolar, 10 A	pcs	1		
1.1.9	Lighting	12 V, 13 W, fluorescent lamp	pcs	2		
1.1.10	Cable	25 mm^2 x 2 c	lot	1		
1.1.11	ditto	6 mm^2 x 2 c	lot	1		
1.1.12	ditto	2.5 mm^2 x 2 c	lot	1		
1.1.13	Outlet	DC 12 V	pcs	1		
1.1.14	Switch	Bipolar, DC 12 V	pcs	1		
1.1.15	Junction Box	Outdoor use for PV terminal connection	pcs	1		
1.1.16	ditto	Indoor use for charger, controller, and CB	pcs	1		
1.1.17	Pull Box	Outdoor use for wiring	pcs	1		
1.1.18	Digital Multimeter	Measuring ohm resistance and voltage, portable	pcs	1		
1.1.19	Radio	12 V, 5 W with DC plug	pcs	3		
1.1.20	Accessories	Conduit, terminal cover, earth rod, etc.	lot	1		
1.1.21	Electrical Work	PV foundation, wiring and installation	set	1		
1.2	Household Components					
1.2.1	Charge Controller	12 V, 4.5 A	pcs	20		
1.2.2	Storage Battery	80 Ah, vented type, trickle use	pcs	20		
1.2.3	Battery Box	Indoor use for 80 Ah battery	pcs	20		
1.2.4	Circuit Breaker	Bipolar, 10 A	pcs	20		
1.2.5	Junction Box	Indoor use for controller and Fuse	pcs	20		
1.2.6	Lighting	12 V, 9 W, fluorescent lamp	pcs	40		
1.2.7	Cable	6 mm^2 x 2 c	lot	1		
1.2.8	ditto	2.5 mm^2 x 2 c	lot	1		
1.2.9	Outlet	DC 12 V	pcs	20		
1.2.10	Switch	Bipolar, DC 12 V	pcs	40		
1.2.12	Lighting	12 V, 9 W, fluorescent lamp	pcs	40		
1.2.13	Electrical Work	Wiring and installation	set	20		
	Sub-total					

Name of Bidder

Name of Authorized Signatory, Position

Signature, Date

Price Schedule

2 Public Facility

No.	Item	Specification	Unit	Quantity	Unit Price (N)	Total Price (N)
2.1	PV Module	55 W, silicon crystal	pcs	6		
2.2	Charge Controller	12 V, 20 A	pcs	1		
2.3	Storage Battery	350 Ah, sealed type, deep cycle use	pcs	1		
2.4	Battery Box	Indoor use for 350 Ah battery	pcs	1		
2.5	Circuit Breaker	Bipolar, 20 A	pcs	2		
2.6	Lighting	12 V, 11 W, fluorescent lamp	pcs	12		
2.7	Cable	25 mm^2 x 2 c	lot	1		
2.8	ditto	6 mm^2 x 2 c	lot	1		
2.9	ditto	2.5 mm^2 x 2 c	lot	1		
2.10	Outlet	DC 12V	pcs	2		
2.11	Switch	Bipolar, DC 12 V	pcs	3		
2.12	Junction Box	Outdoor use for PV terminal connection	pcs	1		
2.13	ditto	Indoor use for controller and CB	pcs	1		
2.14	Pull Box	Outdoor use for wiring	pcs	1		
2.15	Radio	12 V, 5 W with DC plug	pcs	1		
2.16	Accessories	Conduit, terminal cover, earth rod, etc.	lot	1		
2.17	Electrical Work	PV foundation, wiring, and installation	set	1		
	Sub-total					

3 SHS

No.	Item	Specification	Unit	Quantity	Unit Price (N)	Total Price (N)
3.1	PV Module	55 W, silicon crystal	pcs	1		
3.2	Charge Controller	12 V, 4.5 A	pcs	1		
3.3	Storage Battery	50 Ah, sealed type, deep cycle use	pcs	1		
3.4	Battery Box	Indoor use for 50 Ah battery	pcs	1		
3.5	Circuit Breaker	Bipolar, 10 A	pcs	1		
3.6	Lighting	12 V, 9 W, fluorescent lamp	pcs	2		
3.7	Cable	6 mm^2 x 2 c	lot	1		
3.8	ditto	2.5 mm^2 x 2 c	lot	1		
3.9	Outlet	DC 12V	pcs	1		
3.10	Switch	Bipolar, DC 12 V	pcs	2		
3.11	Junction Box	Indoor use for controller and CB	pcs	1		
3.12	Steel Pole	Galvanized steel, not less than 4 m	pcs	1		
3.13	Accessories	Terminal cover, earth rod, etc.	lot	1		
3.14	Electrical Work	Wiring, installation, and erection	set	1		
	Sub-total					

Name of Bidder

Name of Authorized Signatory, Position

Signature, Date

Price Schedule

4 Street Lighting

No.	Item	Specification	Unit	Quantity	Unit Price (N)	Total Price (N)
4.1	PV Module	55 W, silicon crystal	pcs	1		
4.2	Charge Controller	12 V, 4.5 A	pcs	1		
4.3	Storage Battery	60 Ah, sealed type, deep cycle use	pcs	1		
4.4	Battery Box	Outdoor use for 60 Ah battery	pcs	1		
4.5	Circuit Breaker	Bipolar, 10 A	pcs	1		
4.6	Lighting	12 V, 25 W, fluorescent lamp	pcs	1		
4.7	Cable	6 mm^2 x 2 c	lot	1		
4.8	Switch	Bipolar, DC 12 V	pcs	1		
4.9	Junction Box	Outdoor use for controller and CB	pcs	1		
4.10	Steel Pole	Galvanized steel, not less than 4 m	pcs	1		
4.11	Accessories	Terminal cover, earth rod etc.	lot	1		
4.12	Electrical Work	Wiring, installation, and erection	set	1		
	Sub-total					

5 Transportation and Maintenance

No.	Item	Specification	Unit	Quantity	Unit Price (N)	Total Price (N)
5.1	Transportation	To Garkon-Alli, Kiyawa, Jigawa				
5.1.1	For BCS		lot	1		
5.1.2	For Public Facility		lot	1		
5.1.3	For SHS		lot	1		
5.1.4	For Solar Lighting		lot	1		
5.2	Training	Training at the site				
5.2.1	For BCS		lot	1		
5.2.2	For Public Facility		lot	1		
5.2.3	For SHS		lot	1		
5.2.4	For Solar Lighting		lot	1		
5.3	Maintenance	Periodical maintenance at the site				
5.3.1	For BCS		lot	1		
5.3.2	For Public Facility		lot	1		
5.3.3	For SHS		lot	1		
5.3.4	For Solar Lighting		lot	1		
	Sub-total					

Name of Bidder

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Price Schedule

6 Spare Parts

No.	Item	Specification	Unit	Quantity	Unit Price (N)	Total Price (N)
6.1	Spare Parts for BCS					
6.1.1	Battery Charger	12 V, 20 A	pcs	1		
6.1.2	Charge Controller	12 V, 4.5 A	pcs	1		
6.1.3	Storage Battery	80 Ah, vented type, trickle use	pcs	2		
6.1.4	Circuit Breaker	Bipolar, 30 A	pcs	1		
6.1.5	ditto	Bipolar, 20 A	pcs	1		
6.1.6	ditto	Bipolar, 10 A	pcs	2		
6.1.7	Lighting	12 V, 13 W, fluorescent lamp	pcs	2		
6.1.8	ditto	13 V, 9 W, fluorescent lamp	pcs	20		
6.1.9	Switch	Bipolar, DC 12 V	pcs	10		
6.1.10	Outlet	DC 12V	pcs	5		
6.1.11	Distilled Water	20 liter	pcs	1		
6.2	Spare Parts for Public Facility					
6.2.1	Charge Controller	12 V, 20 A	pcs	1		
6.2.2	Circuit Breaker	Bipolar, 20 A	pcs	1		
6.2.3	Lighting	12 V, 11 W, fluorescent lamp	pcs	6		
6.2.4	Switch	Bipolar, DC 12 V	pcs	1		
6.2.5	Outlet	DC 12V	pcs	1		
6.3	Spare Parts for SHS					
6.3.1	Charge Controller	12 V, 4.5 A	pcs	3		
6.3.2	Circuit Breaker	Bipolar, 10 A	pcs	3		
6.3.3	Lighting	12 V, 9 W, fluorescent lamp	pcs	60		
6.3.4	Switch	Bipolar, DC 12 V	pcs	30		
6.3.5	Outlet	DC 12V	pcs	15		
6.4	Spare Parts for Street Lighting					
6.4.1	Charge Controller	12 V, 4.5 A	pcs	1		
6.4.2	Circuit Breaker	Bipolar, 10 A	pcs	1		
6.4.3	Lighting	12 V, 25 W, fluorescent lamp	pcs	10		
6.4.4	Switch	Bipolar, DC 12 V	pcs	2		
	Sub-total					

Name of Bidder

Name of Authorized Signatory, Position

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パイロットプロジェクト主要機材諸元

表 1 ジガワ州ロット

項 目	要求事項	納入機器
1. BCS		
a. チャージングステーション		
PV モジュール	結晶系、 55W 以上×18 枚	多結晶、60W×18 枚、 Suntech Power 社製（中国）
チャージコントローラー	12V、4.5A 以上×1 台	12V、6A×1 台 MORNINGSTAR 社製（米国）
バッテリーチャージャー	12V、20A 以上×5 台	12V、20A×5 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途、 100Ah 以上×1 台	シール形サイクル用途、 200Ah×1 台 Gaston Battery Industrial 社製 （中国）
照明装置	12V、13W蛍光灯×2 灯	12V、15W蛍光灯×2 灯
b. 需要家（1 軒当たり）		
チャージコントローラー	12V、4.5A 以上×1 台	12V、6A×1 台 MORNINGSTAR 社製（米国）
バッテリー	ベント形トリクル用途、 80Ah 以上×1 台	ベント形トリクル用途、 88Ah×1 台、BUFFALO 社製（日本）
照明装置	12V、9W 蛍光灯×2 灯	12V、15W 蛍光灯×2 灯
2. 公共施設		
PV モジュール	結晶系、55W 以上×6 枚	多結晶、60W×6 枚、 Suntech Power 社製（中国）
チャージコントローラー	12V、20A 以上×1 台	12V、20A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途 350Ah 以上×1 台	シール形サイクル用途 200Ah×2 台 Gaston Battery Industrial 社製 （中国）
照明装置	12V、11W 蛍光灯×12 灯	12V、15W 蛍光灯×12 灯
3. SHS（1 軒当たり）		
PV モジュール	結晶系、55W 以上×1 枚	多結晶、60W×1 枚、 Suntech Power 社製（中国）
チャージコントローラー	12V、4.5A 以上×1 台	12V、6A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途、 50Ah 以上×1 台	シール形サイクル用途、 65Ah×1 台 Gaston Battery Industrial 社製 （中国）
照明装置	12V、9W 蛍光灯×2 灯	12V、15W 蛍光灯×2 灯
4. 街路灯（1 灯当たり）		
PV モジュール	結晶系、55W 以上×1 枚	多結晶、60W×1 枚、 Suntech Power 社製（中国）
チャージコントローラー	タイマー機能付、 12V、4.5A 以上×1 台	タイマー機能付、12V、10A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途 60Ah 以上×1 台	シール形サイクル用途 65Ah×1 台 Gaston Battery Industrial 社製 （中国）
照明装置	12V、25W 蛍光灯×1 灯	12V、18W ナトリウムランプ×1 灯

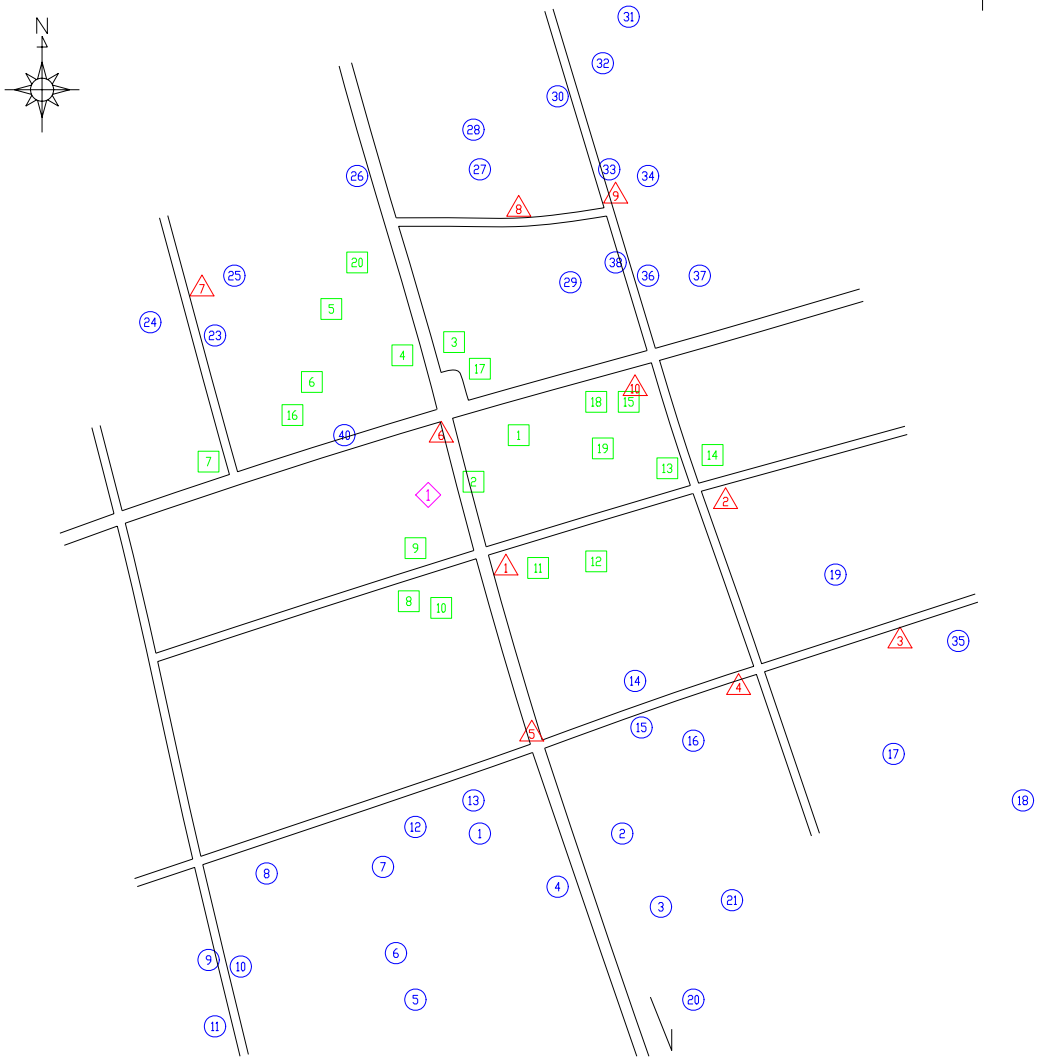
表 2 オンド州ロット

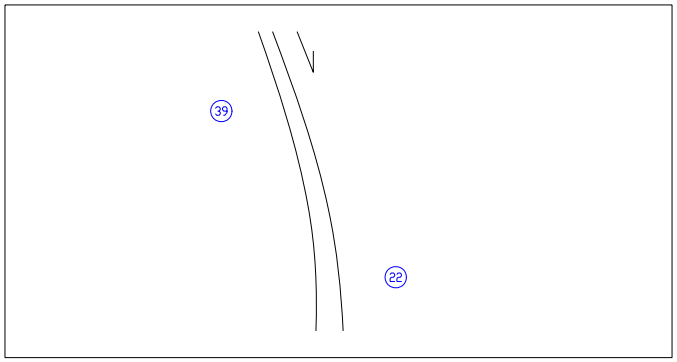
項 目	要求事項	納入機器
1. 公共施設		
a. 照明装置システム		
PV モジュール	結晶系、55W 以上×6 枚	多結晶、60W×6 枚、 Suntech Power 社製（中国）
チャージコントローラー	12V、20A 以上×1 台	12V、20A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途 300Ah 以上×1 台	シール形サイクル用途 200Ah×2 台 Gaston Battery Industrial 社製 （中国）
照明装置	12V、11W 蛍光灯×10 灯	12V、15W 蛍光灯×10 灯
b. PV ワクチン冷蔵庫システム		
PV ワクチン冷蔵庫	12V、1 台 WHO 認証品	12V, 38.7 liter SUN FROST 社製（米国）
PV モジュール	結晶系、55W 以上×4 枚	多結晶、60W×4 枚、 Suntech Power 社製（中国）
チャージコントローラー	12V、1 台	12V、15A×1 台 MORNINGSTAR 社製（米国）
2. SHS（1 軒当たり）		
PV モジュール	結晶系、55W 以上×1 枚	多結晶、60W×1 枚、 Suntech Power 社製（中国）
チャージコントローラー	12V、4.5A 以上×1 台	12V、6A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途、 50Ah 以上×1 台	シール形サイクル用途、 65Ah×1 台 Gaston Battery Industrial 社製 （中国）
照明装置	12V、9W 蛍光灯×2 灯	12V、15W 蛍光灯×2 灯
3. 街路灯（1 灯当たり）		
PV モジュール	結晶系、55W 以上×1 枚	多結晶、60W×1 枚、 Suntech Power 社製（中国）
チャージコントローラー	タイマー機能付、 12V、4.5A 以上×1 台	タイマー機能付、12V、10A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途 50Ah 以上×1 台	シール形サイクル用途 65Ah×1 台 Gaston Battery Industrial 社製 （中国）
照明装置	12V、20W 蛍光灯×1 灯	12V、18W ナトリウムランプ×1 灯

表 3 イモ州ロット

項 目	要求事項	納入機器
1. 公共施設		
PV モジュール	結晶系、55W 以上×8 枚	多結晶、62W×8 枚、 Suntech Power 社製（中国）
チャージコントローラー	12V、30A 以上×1 台	12V、30A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途 350Ah 以上×1 台	シール形サイクル用途 105Ah×4 台 Concord Battery 社製（米国）
照明装置	12V、11W 蛍光灯×12 灯	12V、11W 蛍光灯×12 灯
2. SHS（1 軒当たり）		
PV モジュール	結晶系、55W 以上×1 枚	多結晶、62W×1 枚、 Suntech Power 社製（中国）
チャージコントローラー	12V、4.5A 以上×1 台	12V、6A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途、 50Ah 以上×1 台	シール形サイクル用途、 60Ah×1 台 Delphi Battery 社製（米国）
照明装置	12V、9W 蛍光灯×2 灯	12V、11W 蛍光灯×2 灯
3. 街路灯（1 灯当たり）		
PV モジュール	結晶系、55W 以上×1 枚	多結晶、62W×1 枚、 Suntech Power 社製（中国）
チャージコントローラー	タイマー機能付、 12V、4.5A 以上×1 台	タイマー機能付、12V、10A×1 台 MORNINGSTAR 社製（米国）
バッテリー	シール形サイクル用途 50Ah 以上×1 台	シール形サイクル用途 60Ah×1 台 Delphi Battery 社製（米国）
照明装置	12V、20W 蛍光灯×1 灯	12V、20W 蛍光灯×1 灯

RevNo	Revision note	Date	Signature	Checked
1	Corrected the positions of PV systems	05/31/2006	K.SAITO	





Public Facility
BCS
SHS
Street Lighting

0 50 100 m

No.	Name of Beneficiaries	Remarks	No.	Name of Beneficiaries	Remarks
BCS			SHS		
1	Alhassan Adamu		11	Sa'Adu Ibrahim	
2	Ibrahim Alhassan		12	Usaini Malam	
3	Mati Sabo		13	Alhaji Musa	
4	Sha'Aibu Ubah		14	Adamu Idris	
5	Abdullahi Chibi		15	Ahmed Mohd	
6	Malam Musa Taziri		16	Haruna Yakubu	
7	Hamisu Malam Malam		17	Idris Jibrin	
8	Yusuf Na'Amadu		18	Biyu Dahiru	
9	Ado Sulaiman		19	Shehu Isah	
10	Shehu Danfulani		20	Musa Haruna	
11	Yahaya Tela		21	Yusif Jinjiri	
12	Sha'Aibu Dan'Audu		22	Sama'Ila Sale	
13	Abdu Attahir		23	Ya'U Abdullahi	
14	Sha'Aibu Usman		24	Alhaji Idris	
15	Buba Garko		25	Malam Saleh	
16	Yakubu Tsumba		26	Malam Abdussalamu	
17	Usaini Takya		27	Malam Liman	
18	Mati Darto		28	Kasimuu Daftan	
19	Haruna Dan'Loto		29	Sha'Aibu Umar	
20	Malam Abdulaziz		30	Habu Yunusa	
SHS			31	Idris Tawaru	
1	Salihu Magaji		32	Hashimu Zimbo	
2	Jibrin Narabi		33	Abdul Wahabu Umaru	
3	Sa'Idu Chiko		34	Malam Haruna	
4	Alhaji Ahmed Yakubu		35	Nasalla Musa	
5	Mohd San Mamma		36	Hashimu Santa	
6	Alhaji Yusif Ibrahim		37	Ado Ziko	
7	Sani Mohd		38	Dan Azumi Attahir	
8	Malam Sani Liman		39	Primary School	
9	Malami Jibrin		40	Islamic School	
10	Lawan Salihu				

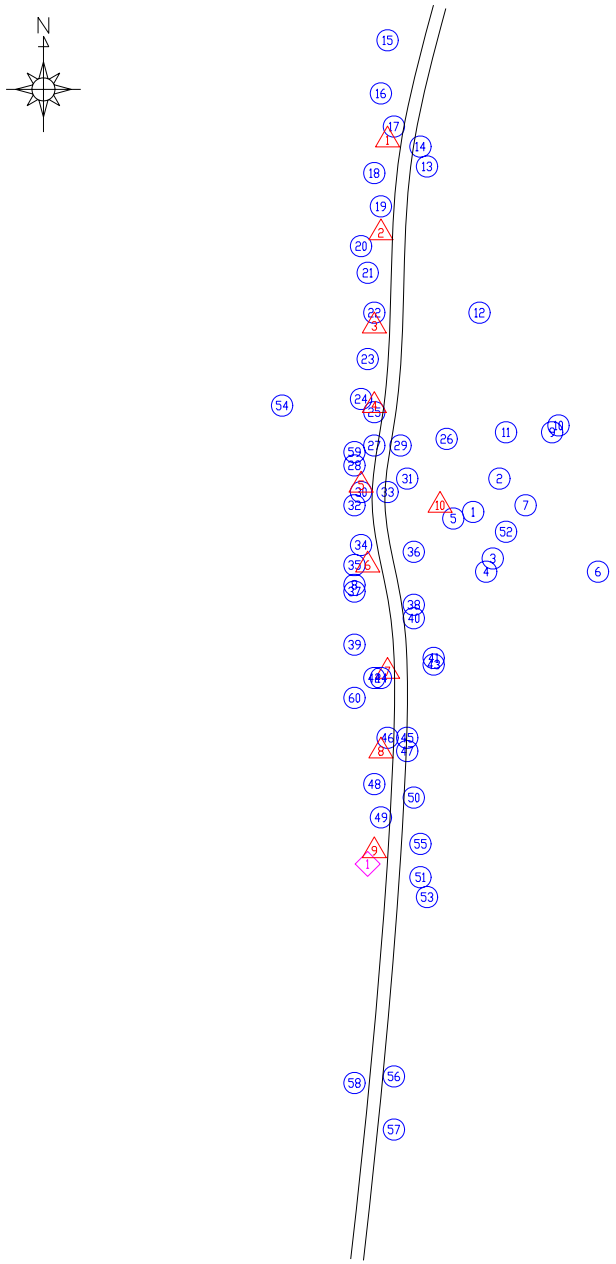
Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference
Designed by K.SAITO		Checked by	Approved by - date	File name JIGAWA Map	Date 05/12/2006	Scale 1:2500

Japan International Cooperation Agency
MASTER PLAN STUDY FOR UTILIZATION OF SOLAR ENERGY IN THE FEDERAL REPUBLIC OF NIGERIA

LAYOUT OF PV SYSTEMS IN JIGAWA STATE

J-002 | Edition 002 | Sheet

RevNo	Revision note	Date	Signature	Checked
1	Corrected the positions of PV systems	06/07/06	K.SAITO	
2	Corrected the positions of PV systems	10/28/06	K.SAITO	



Public Facility
SHS
Street Lighting

0 50 100 m

No.	Name of Beneficiaries	Remarks	No.	Name of Beneficiaries	Remarks
SHS			31	Pa. James Ajayi	
1	Olu of Oke-Agunla		32	Mr. Owolanke	
2	Chief Aliu-Adesoro		33	Oke-Agunla Mosque	
3	Mr. Omotosho		34	Mr. Yusuf George	
4	Mr. J.O. Kikiowo		35	Pa. Yusuf Sule	Same as No.8
5	Mrs. B. Omosebi		36	Chief Asae	
6	Holy Ghost Church		37	Pa. Sunmola Salami	
7	Mr. Adetoye Olalusi		38	Mr. Ojo Fagbemi	
8	Pa. Yusuf Sule		39	Mr. J. Agbona II	
9	Mr. D. Ejemikin		40	Mr. W. Adewunmi	
10	Mr. Omolafe		41	Mr. Ojo Odere	
11	UNDP House	Asst. Oil program	42	Chief Akinropo	
12	L.A. Primary School		43	Pa. Akinlolu	
13	C.A.C. Church, Oke-Agunla		44	Chief Olowokere	
14	Mission House	C.A.C.	45	Chief Oluyi	
15	Chief Odopetu		46	Mrs. Akomolafe	
16	Mr. Akinropo Akinola		47	Pa. Ogunleye	
17	Mrs. Abigeal Olufayo		48	Mrs. Fagbomedo	
18	Mrs. Felicia Fadairo		49	CMS Mission House	
19	Mr. Johnson Oje		50	Mr. Ibitayo	
20	Chief Ajibola II		51	Mr. J. Agbani	
21	Mrs. Easter Ibitoye		52	Olu of Oke-Agunla	Same as No.1
22	Chief Agbona		53	Chief Aiedo Daniel	
23	Mr. Akintoye Abiola		54	Mrs. Adeyanlanu	
24	Mr. Dauda Kikiowo		55	Mr. Adelodi	
25	Mr. Popoola		56	Mr. Adetoye II	
26	Mr. Owoeye Lawrence		57	CMS Church	
27	Mr. J. Fagbamigbe		58	Private N/P School	
28	Mrs. Ayo Ibiye		59	Mrs. Ayo Ibiye	Same as No.28
29	Chief Abidakun		60	Chief Olowokere	Same as No.44
30	Chief Aro-Kolawole				

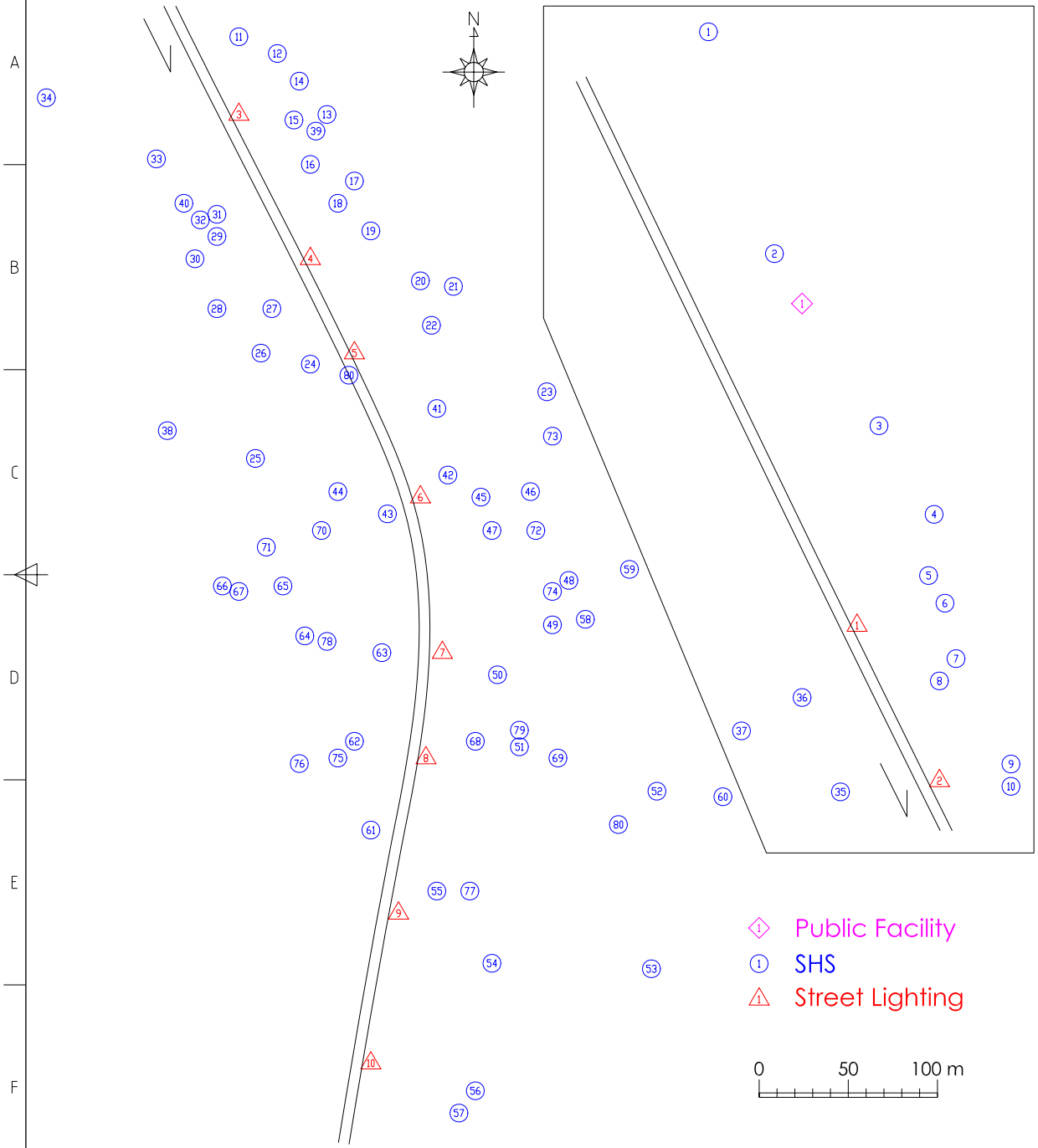
Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference	
Designed by K.SAITO		Checked by	Approved by - date	File name ONDO Map	Date 05/12/2006	Scale 1:2500

Japan International Cooperation Agency
MASTER PLAN STUDY FOR UTILIZATION OF SOLAR ENERGY IN THE FEDERAL REPUBLIC OF NIGERIA

LAYOUT OF PV SYSTEMS IN ONDO STATE

O-001	Edition 003	Sheet

RevNo	Revision note	Date	Signature	Checked
1	Corrected the positions of PV systems	06/11/06	K.SAITO	



No.	Name of Beneficiaries	Remarks	No.	Name of Beneficiaries	Remarks
SHS			41	Mr. Linus Onukwuru	
1	Resident Catchiest of ST. John's Anglican Church		42	Mr. Maurice Okereafor	
2	Mr. Andrew Uzoma		43	Chief Shedrach Nwosu	
3	Mr. Raphael Akujobi		44	Mr. Chima Okoro	
4	Mr. Richard Amadi		45	Mr. Innocent Nworgu	
5	Mr. Anselem Ughaji		46	Mr. Basil Nworgu	
6	Mr. Anthony Nkwocha		47	Mr. Longinus Nworgu	
7	Mr. Cyriacus Nkwocha		48	Mr. Clifford Okere	
8	Mr. Eugene Nweke		49	Mr. Richard Okere	
9	Mr. Patrick Okoroafor		50	Mr. Festus Ibekwe	
10	Mr. Frederick Okoroafor		51	Mr Patrick Amadi	
11	Mr. Micheal Ndukwu		52	Mr. Hillary Ekeh	
12	Mr. Francis Onyekwe		53	Mr. Sabinus Elugwara	
13	Mr. Livinus Okere		54	Mr. Anugustine Elugwara	
14	Mr. Theophilos Onyekwe		55	Nze Theodore Eke	
15	Mr. Samson Okere		56	Nze Sunday Nkwocha	
16	Mr. Emmanuel Nweke		57	Mr. Stanley Nkwocha	
17	Nze Tobias Nweke		58	Mr. Damian Nkwocha	
18	Mr. John Nkwocha		59	Mr. Christian Nkwocha	
19	Mr. Sabastine Onyegbula		60	Rev. Fr. Alex Okoro	
20	Mr. Gilbert Ogbonna		61	Nze Cletus Nkwocha	
21	Mr. Silvanus Okere		62	Mr. Canice Nkwocha	
22	Mr. Maduabu Okere		63	Mr. Hyacinth Nworgu	
23	Mr. Jude Nkwocha		64	Mr. Charles Nkwocha	
24	Mr. Anaele Umunagbu		65	Mr. Linus Egbu	
25	Mr.Ikechi Nwankwala		66	Mr. Cyprian Egbu	
26	Mr. Sabinus Nkwocha		67	Mr. John Egbu	
27	Mr. Sylvester Iroegbu		68	Mr. Celestine Elugwara	
28	Dr. Anaebo Eto		69	Mr. Oliver Ekeh	
29	Mr. Desmond Eke		70	Mr. Eugene Okoro	
30	Mr. Longinus Ekeigwe		71	Mr. Celestine Egbu	
31	Chief Aloyscius Amadi		72	Mr. Gilbert Nworgu	
32	Nze Kelvin Akujobi		73	Mr. Collins Nworgu	
33	Mr. Ernest Nmezi		74	Mr. Marcillinus Okere	
34	Mr. Paul Anaele		75	Mr. Aloyscius Nkwocha	
35	Mr. Alphonscius Eke		76	Mr. Innocent Nkwocha	
36	Mr. Charles Iroegbu		77	Mr. Boniface Onyewe	
37	Mr. Celestine Iroegbu		78	Mr. Athanatus Okereafor	
38	Mr. Godwin Anaele		79	Mr. Desmond Nneji	
39	Mr. Sabinus Nweke		80	Mr. Collins Nkwocha	
40	Mr. Alexander Okere				

Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference	
Designed by K.SAITO		Checked by	Approved by - date	File name IMO Map	Date 05/12/2006	Scale 1:2500
Japan International Cooperation Agency MASTER PLAN STUDY FOR UTILIZATION OF SOLAR ENERGY IN THE FEDERAL REPUBLIC OF NIGERIA		LAYOUT OF PV SYSTEMS IN IMO STATE				
		I-001			Edition 002	Sheet

Agreement

On

The Public Facilities and Individual Facilities

Of

The PV System of the Pilot Project

Under

the Master Plan Study for Utilization of Solar Power Energy

in the Federal Republic of Nigeria

1 Supply of the Pilot Project Equipment

In respect of the Pilot Project Equipment under the Master Plan Study for Utilization of Solar Power Energy in the Federal Republic of Nigeria, the following has been agreed between the Federal Government of Nigeria and the State Government of Imo/Ondo/Jigawa:

1) The Federal Ministry of Power and Steel and the Federal Ministry of Science and Technology of the Federal Republic of Nigeria would entrust the State Government of Imo/Ondo/Jigawa the whole of the Pilot Project extended by JICA Nigeria Office in terms of the receipt of its equipment, operation and maintenance during the monitoring and warranty period and thereafter for the sustainable use of the Pilot Project Equipment:
2) The said Pilot Project consisting of PV System subject to be supplied at free of charge in March 2006 shall be as per Annex I and Annex II;
3) Such equipment of the Pilot Project shall be provided to the following areas:
   a. Umuikoro/Opehi Village, Ngor Okpala Local Government Area, Imo State;
   b. Oke Agunla Village, Akure North Local Government Area, Ondo State; and
   c. Garkon Alli Village, Kiyawa Local Government Area, Jigawa State
4) Such equipment of the Pilot Project shall be exclusively and solely made use of by the above village electrification committee, the name of organization subject to further agreement, and those households selected by the village organization of the said village;
5) PV System as per Annex I and Annex II shall remain as asset of JICA Nigeria Office for indefinite period;
6) During the period after the completion of the installation of the whole of the said Pilot Project Equipment and thereafter, sustainable use of the said Pilot Project Equipment shall be ensured by the individual lessee of the said Pilot Project

Equipment in terms of maintaining in good condition for such sustainable use and repairing any portion of it as a result of natural wear and tear or as a result of vandalism or theft. Sustainable use of the said Pilot Project Equipment shall include accumulation of technical data and organization of a group of people using the said Pilot Project Equipment and recording and maintaining of the conditions of the Pilot Project Equipment as a whole;

7) In the case of the operation and maintenance of the public facilities as per Annex I, the village electrification committee, the name of which is subject to further agreement, shall be responsible for its operation and maintenance, collection of the tariff for the use of such Pilot Project Equipment. In the case the local government in which the said villages located should take responsibility of the payment for the use of the Pilot Project Equipment, the Village Electrification Committee shall record and maintain such record of such payment made in a form of subsidiary or any other form of payment relevant to the prevailing government payment system;
8) In the case of the Battery Charging Station supplied to Garkon Alli Village, Jigawa State, the entire charging station shall be operated and maintained by the village electrification committee of Garkon Alli Village; and
9) Any other difficulties facing in the future should be subject to discussion between the Federal Ministry of Power and Steel and the Federal Ministry of Science and Technology and the State Government of Imo/Ondo/Jigawa.

2. Administration of the Pilot Project

1) Purposes of the Use of Pilot Project Equipment

The PV System of the Pilot Project as above should be made available as follows:

a. Those equipment as per Annex I shall be made use of for the public purposes and administered by the organization of the above villages; and
b. For the individual use of the above villages as per Annex II.

2) Administration of the Pilot Project Equipment

a. Public facilities such as lighting system for the meeting place, clinics etc. as per Annex I are subject to direct administration of the village organization.
b. Individual facilities as per Annex II. should be leased to individuals of the above villages upon agreement made between the village organization termed as “Village Electrification Committee” and individual household.

3) Administration of the Pilot Project Organization

State government shall be responsible for the administration of village organization termed as “Village Electrification Committee” in terms of technical assistance and administrative manner of the village organization, which should play an important role for the operation and maintenance of the Pilot Project under the guidance of JICA Nigeria Office and its entrusted consultant as follows:

a. Village Electrification Committee shall prepare “Lease Agreement on the PV System for Individual Lessee” and enter into lease contract with selected

individual household that would make use of the Pilot Project equipment;

b. Determine the amount of payment for the use of Pilot Project equipment;
c. Collect and save the payment made by the individual lessees and maintain account for the purpose of operation and maintenance of the Pilot Project;
d. Maintain accountant for the payment of the use of Pilot Project equipment;
e. Maintain technicians for repairing Pilot Project Equipment, log book on the repairing works and liaise with the state government for any difficulties beyond the capacity of the village organization.

3. Duration of Lease

The term of lease of PV System under the lease agreement shall be indefinite period.

4. Ownership of PV System

The ownership of the PV System shall be JICA Nigeria Office and the PV System shall be made use of for the public and individual purposes.

5. Use of PV System

a. Ownership of PV System

The ownership of the above (tick marked) PV System shall remain indefinite period with JICA Nigeria Office. The lessee shall not be allowed to sell any part or whole of the above (tick marked) PV System to other individuals or private or public organizations at all.

b. Relocation of the PV System Within the Same Village

In the event that the lessee shall move to other place within the village, the above (tick marked) PV system shall be relocated to the lessee's new place of resident and the cost of relocation shall be born by the lessee.

c. Relocation of the PV System to Other Village

In the event that the lessee shall move to other place than the village in which the lessee reside, the lease agreement of the above (tick marked) PV System shall be terminated as expressed in "d. Termination of Lease".

d. Termination of Lease

In case the lessee should wish to terminate the lease, the lessee shall notify Village Electrification Committee one month in advance and the lessee shall dismantle at the cost of lessee whole of the above (tick marked) PV System and return it to Village Electrification Committee in which the lessee resides.

e. Transfer of Lease

The lessee shall be able to transfer the lease of the whole of the above (tick marked) PV System the resident residing within same village in which the lessee resides. The lessee shall notify the Village Electrification Committee for his/her intention of the transfer of the above (tick marked) PV System one month in advance. Any cost incurred for the transfer of the above (tick marked) PV System shall be born by the lessee while technical assistance on the installation of the above (tick marked) PV System shall be provided by the Village Electrification Committee.

6. Payment for the PV System

Amount of payment made directly to the village organization for the use of PV System of the Pilot Project shall be agreed upon between the village organization and all the

community because they all benefit from the use of public facilities.
The amount of payment should include the future replacement cost of batteries and other consumables.

7. Warranty of the PV System
Natural wear and tear of the battery, fluorescent lamp, indoor wiring, switches, and wall outlet of the PV System shall not be covered by the warranty of the supplier of the PV System for one year from the date of completion of installation for both public facilities and individual facilities.

Date:_____, 2006

_____
JICA Nigeria Office (JICA)

_____	_____
Federal Ministry of Power and Steel	Federal Ministry of Science and Technology

_____	_____	_____
Jigawa State Government	Ondo State Government	Imo State Government
_____	_____	_____
Kiyawa Local Government	Akure North Local Government	Ngor Okpala Local Government
_____	_____	_____
Garkon Alli Village Organization	Oke Agunla Village Organization	Umuikoro/Opehi Village Organization

Annex I (1) Pilot Project Equipment for Public Facilities

1. Pilot Project Equipment: Public Facilities for Garkon Alli Village, Jigawa State

Items of Equipment	Quantities	Notes
(1) Public Facilities	1 Mosque	
1) PV module 60W	6 pcs	
2) Charge controller (12V, 20A)	1 set	
3) Battery (Sealed type, 400Ah)	1 set	
4) Circuit breaker (2p-20A)	1 set	
5) Stand/cable	1 lot	
6) Fluorescent lamp (DC12V-15W)	12 sets	
(2) Battery Charging Station	1 lot	
1) PV module 60W	18 pcs	
2) Charge controller (12V, 10A)	1 set	
3) Battery charger (12V, 20A)	5 sets	including one (1) spare
4) Battery (Sealed type, 100Ah)	1 set	
5) Circuit breaker (2p-30A)	2 sets	
Circuit breaker (2p-20A)	1 set	
Circuit breaker (2p-10A)	1 set	
6) Stand/Cable	1 lot	
7) Fluorescent lamp (DC12V-15W)	2 sets	
(3) Street lighting	10 sets	
1) PV module 60W	1 pc /set	
2) Charge controller (12V, 10A)	1 set/set	
3) Battery (Sealed type, 65Ah)	1 set/set	
4) Circuit breaker (2p-10A)	1 set/set	
5) Stand/cable	1 lot/set	
6) Sodium lamp (DC12V-18W)	1 sets/set	

Annex I (2) Pilot Project Equipment for Public Facilities

2. Pilot Project Equipment: Public Facilities for Oke Agunla Village, Ondo State

Items of Equipment	Quantities	Notes
(1) Lighting for Health Care Center	1 HCC	
1) PV module 60W	6 pcs	
2) Charge controller (12V, 20A)	1 set	
3) Battery (Sealed type, 400Ah)	1 set	
4) Circuit breaker (2p-20A)	1 set	
5) Stand/cable	1 lot	
6) Fluorescent lamp (DC12V-11W)	10 sets	
(2) PV Refrigerator for Health Care Center		
1) PV Refrigerator	1 set	Certified by WHO
2) PV module 60W	4 pcs	
3) Charge controller (12V)	1 set	
4) Battery (Sealed type, 200Ah)	1 set	
5) Circuit breaker (2p-20A)	1 lot	
6) Stand/cable	1 lot	
(3) Street lighting	10 sets	
1) PV module 60W	1 pc /set	
2) Charge controller (12V, 10A)	1 set/set	
3) Battery (Sealed type, 65Ah)	1 set/set	
4) Circuit breaker (2p-10A)	1 set/set	
5) Stand/cable	1 lot/set	
6) Sodium lamp (DC12V-18W)	1 sets/set	

Annex I (3) Pilot Project Equipment for Public Facilities

3. Pilot Project Equipment: Public Facilities for Umuikoro/Opehi Village, Imo State

Items of Equipment	Quantities	Notes
(1) Lighting for Public Meeting Place	1 PMP	
1) PV module 62W	8 pcs	
2) Charge controller (12V, 30A)	1 set	
3) Battery (Sealed type, 420Ah)	1 set	
4) Circuit breaker (2p-32A)	1 set	
5) Stand/cable	1 lot	
6) Fluorescent lamp (DC12V-11W)	12 sets	
(2) Street lighting	10 sets	
1) PV module 55W	1 pc /set	
2) Charge controller (12V, 10A)	1 set/set	
3) Battery (Sealed type, 60Ah)	1 set/set	
4) Circuit breaker (2p-10A)	1 set/set	
5) Stand/cable	1 lot/set	
6) Fluorescent lamp (DC12V-20W)	1 sets/set	

Annex II (1) Pilot Project Equipment for Individual Facilities

1. Pilot Project Equipment: Individual Facilities for Garkon Alli Village, Jigawa State

Items of Equipment	Quantities	Notes
(1) Solar Home System (SHS)	40 houses	
1) PV module 60W	1 pc /house	
2) Charge controller (12V, 6A)	1 set/house	
3) Battery (Sealed type, 65Ah)	1 set/house	
4) Circuit breaker (2p-10A)	1 set/house	
5) Stand/cable	1 lot/house	
6) Fluorescent lamp (DC12V-11W)	2 sets/house	
(2) Battery and house wiring for BCS	20 houses	
1) Charge controller (12V, 6A)	1 set/house	
2) Battery (Vent type, 80Ah)	1 set/house	
3) Circuit breaker (2p-10A)	1 set/house	
4) Stand/cable	1 set/house	
5) Fluorescent lamp (DC12V-9W)	2 sets/set	

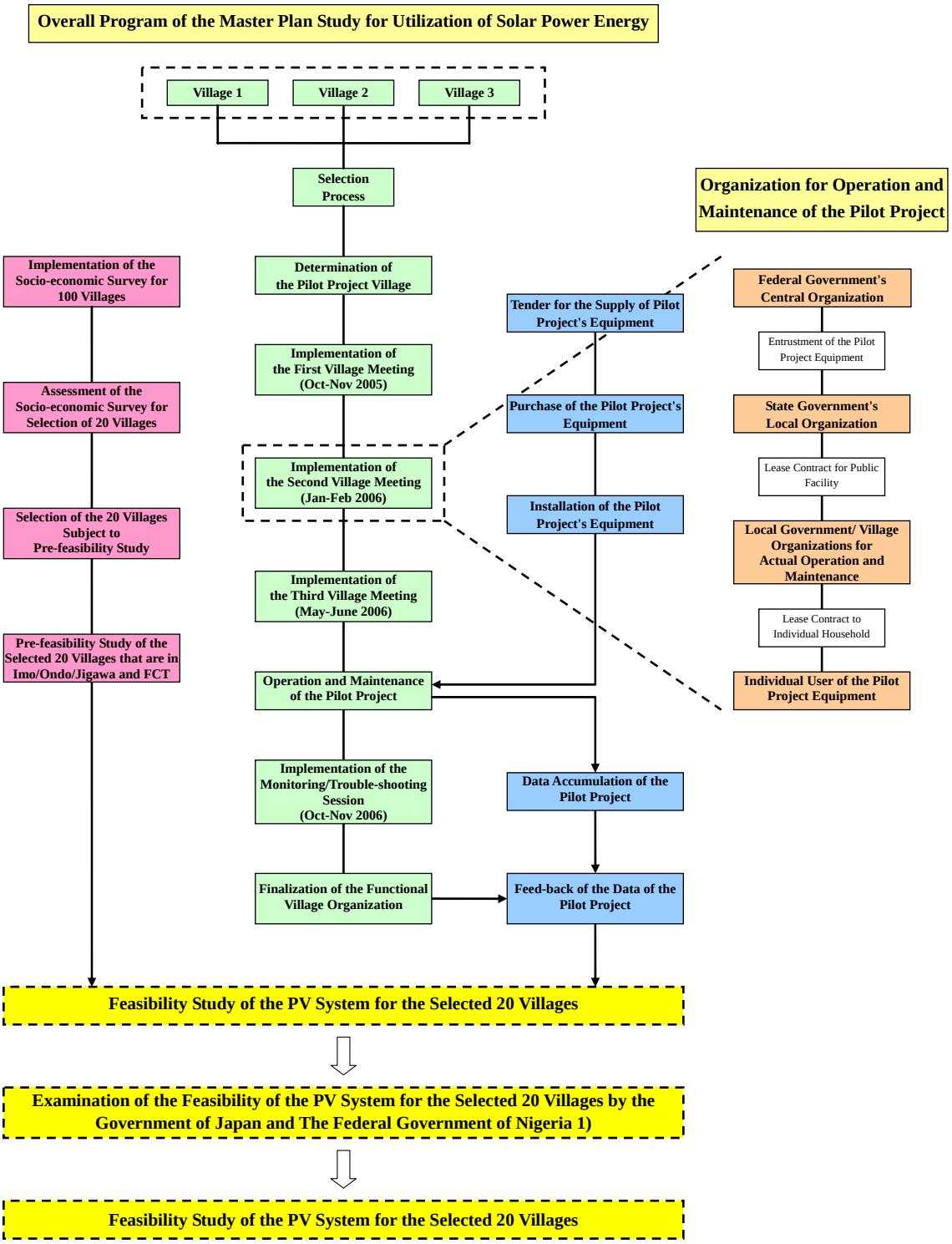
2. Pilot Project Equipment: individual Facilities for Oke Agunla Village, Ondo State

Items of Equipment	Quantities	Notes
(1) Solar Home System (SHS)	60 houses	
1) PV module 60W	1 pc /house	
2) Charge controller (12V, 6A)	1 set/house	
3) Battery (Sealed type, 65Ah)	1 set/house	
4) Circuit breaker (2p-10A)	1 set/house	
5) Stand/cable	1 lot/house	
6) Fluorescent lamp (DC12V-9W)	2 sets/house	

3. Pilot Project Equipment: Individual Facilities for Umuikoro/Opehi Village, Imo State

Items of Equipment	Quantities	Notes
(1) Solar Home System (SHS)	80 houses	
1) PV module 62W	1 pc /house	
2) Charge controller (12V, 6A)	1 set/house	
3) Battery (Sealed type, 60Ah)	1 set/house	
4) Circuit breaker (2p-10A)	1 set/house	
5) Stand/cable	1 lot/house	
6) Fluorescent lamp (DC12V-11W)	2 sets/house	

Figure 1 Implementation of the Pilot Project



Note: 1) Implementation of the Solar PV System for the Selected 20 Villages is subject to further application made by the Government of Nigeria to the Government of Japan.

Lease Agreement

On

The PV System

For

Individual Lessee

1. We, the Name of Leaser: _____
   Address: _____, _____ State, would like to make PV System available for the use of individuals to lease as follows:

   ☐ a. Solar Home System (PV module for 60-62W, Charge controller: 12V, 6A, Battery: Sealed Type, 60-65Ah, Circuit Breaker: 2pieces, 10A each, Stand/cable and Fluorescent Lamp: DC12V, 9-11W, 2 sets)

   ☐ b. Battery Charging System (Charge controller: 12V, 6A, Battery: Vent Type, 80Ah, Circuit breaker: 2pieces, 10A each, Stand/cable and Fluorescent Lamp: DC12V, 9W, 2 sets)

2. I, Name of the Lessee: _____
   Address: _____Village, _____
   Local Government Area, _____ State,
   ID No.: _____

   would like to apply for the above (tick marked) PV System for individual use and would agree conditions as per this Lease Agreement.

3. Duration of Lease
   The term of lease of PV System under the lease agreement shall be indefinite period.

4. Ownership of PV System
   a. Ownership of PV System
   The ownership of the above (tick marked) PV System shall remain indefinite period with JICA Nigeria Office. The lessee shall not be allowed to sell any part or whole of the above (tick marked) PV System to other individuals or private or public organizations at all.

   b. Relocation of the PV System within the Same Village
   In the event that the lessee shall move to other place within the village, the above (tick

marked) PV System shall be relocated to the lessee's new place of resident and the cost of relocation shall be born by the lessee.

c. Relocation of the PV System to Other Village

In the event that the lessee shall move to other place than the village in which the lessee reside, the lease agreement of the above (tick marked) PV System shall be terminated as expressed in "d. Termination of Lease".

d. Termination of Lease

In case the lessee should wish to terminate the lease, the lessee shall notify Village Electrification Committee (the name subject to agreement) one month in advance and the lessee shall dismantle at the cost of lessee whole of the above (tick marked) PV System and return it to Village Electrification Committee in which the lessee resides.

e. Transfer of Lease

The lessee will be able to transfer the lease of the whole of the above (tick marked) PV System to the resident residing within same village in which the lessee resides. The lessee shall notify the Village Electrification Committee his/her intention of the transfer of the above (tick marked) PV System one month in advance. Any cost incurred for the transfer of the above (tick marked) PV System shall be born by the lessee while technical assistance on the installation of the above (tick marked) PV system shall be provided by the Village Electrification Committee.

5. Payment for the PV System

a. Initial Payment

The following amount shall be paid to the Village Electrification Committee in which the lessee resides as initial charge for the lease of above (tick marked) PV System:

1) Solar Home System: _____ Naira
2) Battery Charging System: _____Naira

b. Monthly Payment

The following amount shall be paid to the Village Electrification Committee in which the lessee resides as monthly charge for the lease of above (tick marked) PV System:

1) Solar Home System: _____ Naira
2) Battery Charging System: _____Naira

The above monthly charge will be made in cash and paid to the person designated by the Village Electrification Committee of _____Village, _____ Local Government Area, _____ State on the designated date of payment.

c. Default of Payment

Should the lessee fail to make the above monthly payment for three consecutive months, this Lease Agreement shall be terminated upon decision made by the Village Electrification Committee in which the lessee resides.

d. Removal of PV System upon Default of Payment

Upon decision made by the Village Electrification Committee for the termination of this Lease Agreement due to the default of monthly payment for three consecutive months by the lessee, the Village Electrification Committee shall take action as necessary but not limited to as follows:

i. Notify and request for assistance on the default of such payment of such individual lessee to the local government and the state government responsible to the Pilot Project;
ii. Consider the above (tick marked) PV System shall be removed at the expenses of the Village Electrification Committee upon decision made for removal and transfer of the said PV System in question to other potential lessee within the village;
iii. The entire system is so transferred and installed to other individual as the Village Electrification Committee should make such decision for new lease agreement and that it would be subject to the agreement of such nominated individual; and
iv. Village Electrification Committee shall maintain inventory of such removal and transfer of PV system in the log book maintained at the office of Village Electrification Committee.

e. Non-refundable Policy of the Payment for Lease

All of the payment made under this contract shall not be refunded.

6. Warranty of the PV System

Natural wear and tear of the battery, fluorescent lamp, indoor wiring, switches, and wall outlet of the above (tick marked) PV System shall not be covered by the warranty of the supplier of the above (tick marked) PV System for one year from the date of completion of installation.

7. Liability of the Lessee and Leaser

a. Liability of Lessee

The lessee shall repair and/or replace at the his/her expenses, the battery, fluorescent lamp, indoor and outdoor wiring, switches and wall outlet of the above (tick marked) PV System.

In the event that the above (tick marked) PV System malfunctioned, the lessee shall notify the Village Electrification Committee for checking, technical assistance for repairing and execution of such repairing works and any replaced portion of the above (tick marked) PV System shall be so recorded in the log book maintained at the Village Electrification Committee.

b. Liability of Leaser

The Leaser shall be responsible at the expenses of the Leaser the installation of the whole of the above (tick marked) PV System and its maintenance works during the lease period.

The Leaser shall also be responsible for providing technical assistance on repairing and replacing of any parts of the above (tick marked) PV System upon request made by the lessee.

Replacement of the battery, charge controller and solar panels as they become malfunction or upon reaching their own life period, which varies from __ years to __ years subject to frequency and running hours of its use, shall be made at the cost of the Leaser. Such replacement should be clearly recorded and notified to JICA Nigeria Office through the state government responsible to oversee the above (tick marked) PV System and that it shall notify to the Federal Government of Nigeria

I HAVE READ AND UNDERSTOOD THE ABOVE LEASE AGREEMENT AS STATED AND I CERTIFY THAT THE INFORMATION PROVIDED BY THE VILLAGE ELECTRIFICATION COMMITTEE IS COMPLETE AND ACCURATE. I WOULD THEREFORE AGREE TO BE BOUND BY THE TERMS AND CONDITIONS CONTAINED HEREWITH.

Date:_____

Primary Lease

Lessee: _____ Leaser:_____

Secondary Lease (In the case of transfer is made):

Date:_____

Lessee: _____ Leaser:_____