No.

Kathmandu Upatyaka Khanepani Limited
Government of Nepal

Preparatory Survey
on
the Project for Clean Energy Promotion
using
Solar Photovoltaic System
in
Nepal

June 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) conducted the preparatory survey on the Project for Clean Energy Promotion using Solar Photovoltaic System in Nepal.

JICA sent to Nepal a survey team from July 1st to July 9th, July 18th to August 8th, October 1st to October 25th and November 18th to December 27th, 2009.

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

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

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

June 2010

Kazuhiro YONEDA
Director General, Industrial Development Department
Japan International Cooperation Agency

Letter of Transmittal

June, 2010

We are pleased to submit to you the preparatory survey report on the Project for Clean Energy Promotion using Solar Photovoltaic System in Nepal.

This survey was conducted by Nippon Koei Co., Ltd., under a contract to JICA, during the period from June 2009 to June 2010. In conducting the survey, we have examined the feasibility and rationale of the project with due consideration to the present situation of Nepal and formulated the most appropriate outline design for the project under Japan's Grant Aid scheme.

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

Very truly yours,

Tomoyasu FUKUCHI
Project manager
Preparatory Survey team on
the Project for Clean Energy Promotion using Solar Photovoltaic System
Nippon Koei Co., Ltd.

Summery

1. Contents of the Project

Nepal relies mainly on hydropower for its power supply. Even though the power demand increases year by year, the amount of power generation decreases greatly during the dry season due to the rapid decrease of water in the river. This greatly influences the power supply and causes it to fall below the demand, creating a critical situation for the local people. The maximum scheduled power cutoff was executed for 18 hours a day in 2008 and 51.5 hours (maximum of 8 hours per day) during a week in January 2009. Moreover, scheduled cutoff was also executed for a maximum of 16 hours a day during the dry season of 2009.

In Nepal, examples of photovoltaic (PV) systems include the 40 kWp PV water pumping system, which is a field experiment/demonstration project (1992 to 1997) in Bhaktapur District through the joint efforts of The Government of Nepal and New Energy and Industrial Technology Development Organization (NEDO), power supply systems of telecommunications, airport and public facilities, and solar home system in remote areas. All of these installed systems are stand-alone systems and there is no experience yet on grid-connected PV system.

Against this background, this plan was requested to gain extensive knowledge on the PV power generation system, to familiarize and accumulate technical know-how on the grid connected PV system, and to secure power supply for the project site.

The Alternative Energy Promotion Center (AEPC) was established as a government agency in 1996 to promote the renewable energy programs within the country. Then, the Rural Energy Policy was developed in 2006 to cover the promotion of renewable energy resources like PV power generation within the country.

Moreover, the Renewable Energy Subsidy Policy developed in 2000 was also revised for better implementation in 2006. The Renewable Energy Subsidy Policy, which is developed to support the Rural Energy Policy, describes the details of the implementation method/process of subsidy for stand-alone systems mainly targeted to supply power to public water pumps, public facilities like health centers and schools, and remote households.

This project promotes the mitigation of GHG emission, awareness of the PV system and mitigates the electricity cost of the Kathmandu Upatyaka Khanepani Limited (KUKL) facility at Sundarighat in Kathmandu by providing PV system and related equipment on the site. The project also promotes interconnection of the power generation by “clean” renewable energy to the Nepal Electricity Authority (NEA) grid. It also presents countermeasures against air pollution and climate change.

In this assistance plan, from the procurement to the implementation stage, the project implementing agency, its responsible department, and responsible organization of Nepal are as follows.

- Responsible Organization: Kathmandu Valley Water Supply Management Board (KVWSMB)
- Implementing Agency: Kathmandu Upatyaka Khanepani Limited (KUKL)

An open pond space of around 145,966 m^2 is the selected installation site for the PV system. It lies southwest from the center of Kathmandu and toward the north from Chovar Hill near Bagmati riverbank toward Dhobighat.

The PV system will connect to the two incoming 11 kV feeder lines of NEA’s newly-built control room at Sundarighat KUKL facility situated around 250 m away in direct distance from the PV installation site. The 11 kV overhead line from the PV site connects to the NEA feeder and supply power within the Sundarighat KUKL premises. The remaining surplus power will flow towards the grid network of NEA. The feed-in-tariff is based on the power purchase agreement (PPA) contract

between KVWSMB/KUKL and NEA.

2. Result of Survey

The term of the dispatch of the study team was as follows.

- 1st Site Survey: July 1st to July 9th and July 18th to August 8th
- 2nd Site Survey: October 1st to October 25th and November 18th to December 27th
- 3rd Site Survey March 19th to March 28th

From the Nepalese side, installations were requested for six different water pumping and supply facilities of the Kathmandu Upatyaka Khanepani Limited (KUKL). However, the implementation of the design criteria for site selection described as the (1) Realization of long-term demonstration impact (2) Enough space for large capacity installation will not be possibly fulfilled as targeted. Furthermore, considering the fact that there is a scheduled power cut-off and that the planned system does not work during power cut off, fulfilling criteria (3) for maximum utilization of the smooth operation of grid-connected system either as a dedicated line or power supply by multi feeder site is selected. This serves as an alternative to the requested installation site. Thus, as an option for fulfilling the site selection criteria (1) to (4), the open pond rainwater reservoir at Dhobighat site inside Kathmandu Valley is selected.

Design Criteria
Basic Concept (Site Selection)
(1) Realization of Long Term Demonstration Impact
(2) Securing Enough Space for Installation
(3) Existence of Distribution Network for Interconnection
(4) For Smooth O/M near by Existence of Implementing Agency
Basic Concept (Facility Selection)
(1) Anticipation of Demonstration Impact
(2) Anticipation of Surplus Power Sales

The decided installation capacity is 350 kWp while the required installation area is around 4,700 m^2 for crystalline and around 9,200 m^2 for amorphous type modules. The size of the system is good enough for effective demonstration. The recorded annual average power consumption of the Sundarighat KUKL facility from August 2008 to July 2009 is around 560 kW/day and the average calculated power generation is 1,312.5 kWh/day (average solar hour 5 h/day x 350 kWp x system efficiency 75%). which is higher than the consumption. Hence, if the main pump loads are not operational or consumption is low, a reverse power flow towards the existing grid is expected regularly, depending on the solar insolation.

3. Implementation Schedule

The total period from the initial stage of planning, preparation of drawings for inspection, execution of works until the project hand over is planned to be completed within 11 months.

Location Map

Source: Central Intelligence Agency (CIA)

Abbreviations

A/P	Authorization to Pay
B/A	Banking Arrangement
DoED	Department of Electricity Development
E/N	Exchange of Notes
EIA	Environmental Impact Assessment
GHG	Green House Gas
IEC	The International Electrotechnical Commission
IEE	Initial Environmental Evaluation
IEEE	The Institute of Electrical and Electronics Engineers, Inc.
JEC	Japanese Electrotechnical Committee
JIS	Japanese Industrial Standards
JPY	Japanese Yen
KUKL	Kathmandu Upatyaka Khanepani Limited
KVWSMB	Kathmandu Valley Water Supply Management Board
NEA	Nepal Electricity Authority
NPR	Nepalese Rupee
O/M	Operation & Maintenance
PPA	Power Purchase Agreement
PV	Photovoltaic
S/S	Substation
TTS	Telegraphic Transfer Selling
USD	U.S. Dollar

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Chapter 1 Background of the Project

1-1 Present Condition and Needs of the Concerned Sectors

1-1-1 Present Condition and Needs

Nepal relies mainly on hydropower[1] for its power supply. Even though the power demand[2] increases year by year, the amount of power generation decreases greatly during the dry season due to the rapid decrease of water in the river. This greatly influences the power supply and causes it to fall below the demand, creating a critical situation for the local people. The maximum scheduled power cutoff was executed for 18 hours a day in 2008 and 51.5 hours (maximum of 8 hours per day) during a week in January 2009. Moreover, scheduled cutoff was also executed for a maximum of 16 hours a day during the dry season of 2009.

In Nepal, examples of photovoltaic (PV) systems include the 40 kWp PV water pumping system, which is a field experiment/demonstration project (1992 to 1997) in Bhaktapur District through the joint efforts of The Government of Nepal and New Energy and Industrial Technology Development Organization (NEDO), power supply systems of telecommunications, airport and public facilities, and solar home system in remote areas. All of these installed systems are stand-alone systems and there is no experience yet on grid-connected PV system.

Against this background, this plan was requested to gain extensive knowledge on the PV power generation system, to familiarize and accumulate technical know-how on the grid connected PV system, and to secure power supply for the project site.

1-1-2 National and Sector Development Plan

The Alternative Energy Promotion Center (AEPC) was established as a government agency in 1996 to promote the renewable energy programs within the country. Then, the Rural Energy Policy was developed in 2006 to cover the promotion of renewable energy resources like PV power generation within the country.

Moreover, the Renewable Energy Subsidy Policy developed in 2000 was also revised for better implementation in 2006. The Renewable Energy Subsidy Policy, which is developed to support the Rural Energy Policy, describes the details of the implementation method/process of subsidy for stand-alone systems mainly targeted to supply power to public water pumps, public facilities like health centers and schools, and remote households.

1-1-3 Socio-Economic Conditions

In fiscal year 2000/01, the country's economic growth rate was negative due to the deterioration of public peace as a result of political problems. In fiscal year 2003/04, the growth rate has recovered by 3.3% due to the better performance in the agriculture sector. In fiscal year 2004/05, however, there was an agriculture slump due to bad weathers and the slump in the tourism industry due to political disturbances for several months like the general strikes from February 2005 have harmfully influenced the economic growth rate, which remained at 2.0%. The achieved economic growth rate in fiscal year 2006/07 was 3.2%. In fiscal year 2007/8, the rate achieved was 2.7%, which is the lowest in the South Asian region. As for fiscal year 2008/09, 5.3% is expected [3].

The gross domestic product (GDP) shares of the 1st, 2nd and 3rd industries in the country are 33.8%,

[1] The main power generation is by hydropower, which is more than 90% of the total power generated by Nepal Electricity Authority (NEA).
[2] Based on information provided by NEA, the maximum power demand and power consumption respectively increased by 13% and 11% from fiscal year 2007/08 to fiscal year 2008/09.
[3] Source: Asian Development Bank.

17.2% and 48.9%, respectively[4].

1-2 Background of the Grant Aid

(1) Background of the Grant Aid

In January 2008, Japan established the Cool Earth Partnership, which is an activity for developing countries that are aiming to achieve both greenhouse gas (GHG) emission reductions and economic growth and working to contribute to climate stability. Through this, Japan cooperates actively with developing countries to reduce GHG emissions, e.g., by enhancing energy efficiency. A new grant aid scheme named "Program Grant Aid for Environment and Climate Change" has been created in 2008 as a component of this package to support a developing country which is willing to contribute to climate stability but facing shortages in implementing capacity as well as funds.

As a policy of the Japanese Government, JICA decided to promote clean energy including renewable energy to be promoted as a "co-benefit" cooperation case and utilize Japanese advanced technology including technology of the private sectors.

As mentioned in the background, positive utilization of PV technology, in which Japan has high advantage, is required. Moreover, the Ministry of Foreign Affairs conducted surveys about the needs and ideas for the "Program Grant Aid for Environment and Climate Change" using PV power generation and other technology.

The "Program Grant Aid for Environment and Climate Change" aims to address climate change and other environmental challenges. The program intends to combine several components like equipment provision, capacity building and others. Because of this, the program is implemented with the dual aims of equipment provision and installation. However, the soft component is also implemented to establish the operation and maintenance scheme for the smooth operation of the provided equipment.

(2) Purpose of the Grant Aid

This project promotes the mitigation of GHG emission, awareness of the PV system and mitigates the electricity cost of the Kathmandu Upatyaka Khanepani Limited (KUKL) facility at Sundarighat in Kathmandu by providing PV system and related equipment on the site. The project also promotes interconnection of the power generation by "clean" renewable energy to the Nepal Electricity Authority (NEA) grid. It also presents countermeasures against air pollution and climate change.

(3) Over all Plan

1) Responsible Organization

Kathmandu Valley Water Supply Management Board (KVWSMB)

2) Implementing Agency

Kathmandu Upatyaka Khanepani Limited (KUKL)

3) Installation Site of PV System

An open pond space of around 145,966 m^2 is the selected installation site for the PV system. It lies southwest from the center of Kathmandu and toward the north from Chovar Hill near Bagmati riverbank toward Dhobighat.

The PV system will connect to the two incoming 11 kV feeder lines of NEA's newly-built control room at Sundarighat KUKL facility situated around 250 m away in direct distance from the PV installation site. The 11 kV overhead line from the PV site connects to the NEA feeder and supply power within the Sundarighat KUKL premises. The remaining surplus power will flow towards the

[4] Due to rounding, the total is not 100% (World Bank).

grid network of NEA. The feed-in-tariff is based on the power purchase agreement (PPA) contract between KVWSMB/KUKL and NEA.

Chapter 2 Concept of the Project

2-1 Basic Concept of the Project

(1) National Target and Project Target

In Nepal, due to the effects of global warming, melting of glaciers occur rapidly every year than expected. Furthermore, Nepal, being a mountainous country, is also among the countries experiencing the direct effects of global warming created by Green House Gas (GHG) around the world. Energy production and supply is also not sufficient to meet the energy demand. Thus, during the dry season, the people of Nepal experience an average of 16 hours of scheduled power cut per day.

The Government of Nepal is earnestly trying to cope with the extreme situation of power deficits. Hence, as one of the solutions, a long-term plan for utilization of renewable energy resources in the maximum possible extent is introduced.

From this concept, the photovoltaic power generation system (hereinafter called PV system) is being considered to be installed within the Kathmandu Valley, targeting the demonstration and promotion of renewable energy implementation scheme and also to add power to the national grid.

(2) Project Outline

The PV system and its related components are targeted to be installed under this assistance plan. To achieve the mentioned target, the PV system has been decided to be installed at the Dhobighat pond of Kathmandu Valley Water Supply Management Board (KVWSMB) Upatyaka Khanepani Limited (KUKL). The generated power is planned to supply energy to the Sundarighat Water Treatment and Supply Plant of KUKL and to the grid distribution network of Nepal Electricity Authority (NEA). From this, it is expected to reduce the electrical burden of KUKL and promote renewable energy system.

Furthermore, in Nepal, almost 100% of power generation is obtained from hydropower plants. Thus, comparison in terms of reduction of GHG emission is not possible. However, due to the power deficit, there are many cases where personal diesel generators are being used by local people. If this assistance is initiated to eliminate use of personal diesel generators, evaluation of the reduction of GHG emission would be possible.

Procurement and implementation is carried out through the designated agency with the cooperation of responsible organization of Kathmandu Valley Water Supply Management Board (hereinafter KVWSMB) with KUKL of Nepal as the implementing agency.

2-2 Outline Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

Based on the request of the Nepalese government, the basic concepts mentioned below were established and site selection was carried out:

(i) Scope of Assistance Plan: Grid-connected PV system with large capacity is the first of its kind in Nepal. Hence, most of the required components and installation works are included in the scope of assistance plan.

(ii) Site Selection: The basis of site selection are as follows: (1) Longer and wider demonstration impact, (2) Enough installation space for planned large capacity, (3) Nearby

existing grid distribution network for grid connection, and (4) Nearby existence of implementation agency considering smooth support of operation management.

(iii) (iii) Facility Outline: The realization of reverse power sales through grid interconnection is the basic concept. Thus, (1) there is a possibility for grid connection (not too large) and achievement of maximum demonstration impact (2) the generated power is established to supply energy to Sundarighat KUKL facility and reverse flow of surplus power towards grid distribution network is realized.

(2) Natural Conditions

The system is developed to meet the local building standards and will also implement determination of soil bearing capacity at the site meteorological conditions, seismic coefficient and others. For the selection of the materials for construction and to develop the system as well as considering that the PV array will be installed inside rainwater reservoir for dry season use, the following design criteria is established:

(Weather Conditions)

- Maximum ambient temperature : 38 degree Celsius
- Minimum ambient temperature : -5 degree Celsius
- Maximum wind speed : 47 m/s
- Average humidity : 96%
- Average daily Solar insolation : 5.0 kW/m^2/day
- Altitude : 1,350 m

(Design Conditions)

- Design wind speed : 47 m/s
- Soil bearing capacity : 8 ton/m^2
- Depth of concrete foundation : -1.5 m (from pond bottom for PV array)
- AC circuit : 11 kV, 3 Phase 3 Wire to 400 /230 V 3 Phase 4 Wire, 50 Hz
- Earth resistivity : 60.00 Ohm (GL - 2.3 m)

(3) Environmental Condition

Prior to the implementation of the power generation and supply projects, it is required to confirm the requirement of Initial Environment Evaluation (IEE) and Environment Impact Assessment (EIA).

According the regulations, a power generation capacity ranging from 1 MW to 50 MW requires IEE, while above 50 MW (in the case of diesel or thermal power plant above 1 MW) requires EIA. However, since the assistance is intended for a capacity of 350 kWp, IEE or EIA is not required.

(4) Basic Policy for Grid-Connection

In Nepal, experience on grid-connected small hydropower system exists, but grid-connected PV system is the first of its kind. Meanwhile, the licensing, application and procedure for grid-connection for hydropower already exist. Hence, no administrative and technical hindrance is expected for grid connection.

To establish the 350 kWp capacity grid-connected system, (1) application to DoED to obtain permission for power plant generation and supply (2) technical agreement for grid connection together with (3) Power Purchase Agreement (PPA) with NEA, are required.

(5) Social Economic Environment

There are noted cases of robbery. To avoid such situation to the maximum extent, construction of fence is necessary. Construction of a security lookout post should also be considered and included form the planning stage.

(6) Basic Policy for Supply / Construction

The basic design for construction of concrete foundations and buildings are based on Nepalese Standards or Indian Standards, which is the normal practice in Nepal. The designs of equipment are based on international standards like IEC and IEEE. However, considering that the PV system is a product of Japan, the standard of components shall be designed in accordance with JIS and JEC.

(7) Policy for Operation and Maintenance (O/M)

The KUKL has the experience in implementing PV water pumping system and can manage and perform basic O/M. However, grid-connected PV system with large capacity is the first of its kind in Nepal and to operate the system smoothly, technical know-how on initial startup, O/M process and application procedure of grid-connected system shall be covered through soft component activities under the assistance plan.

(8) Policy for Equipments and Facility

To gain long-term demonstration impacts from the installed grid-connected PV system, selection of equipment and related components are based on strongly built and longer durability. Furthermore, the equipment and components are selected to ensure high accuracy and quality, targeting absolute model of grid-connected PV system under the assistance plan.

(9) Policy for Construction Works and Supply

The materials for foundations and other construction items, including the PV structure, 11 kV overhead line and its related components are planned to be procured locally, which should comply with local building standards and technical guidelines. Meanwhile, other materials and components shall be procured from Japan.

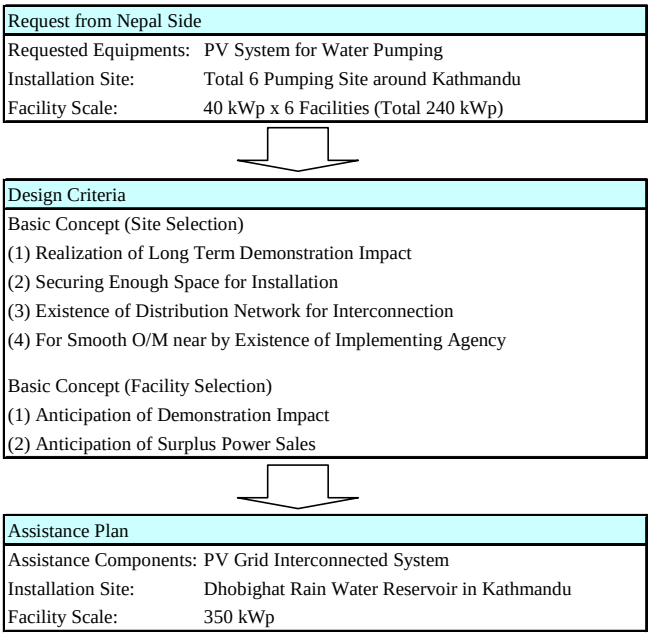
To implement this assistance, an agreement shall be drafted between KVWSMB and procurement agent who will represent the Government of Nepal and handle the contract with consultant and supplier during the implementation. Said agent will also be tasked to control the fund.

(10) Policy for Local Contractor

In Nepal, there is no experience gained on grid-connected PV system until .now. Hence, being the first of its kind, the local contractor for construction and installation need to be supervised and rendered with technical guidance. The construction of concrete foundations, installation of equipment and components under the supervision of a Japanese consultant, is possible. On other hand, local consultants also have the ability to supervise the installation works under the support of a Japanese consultant. Therefore, utilization of local contractors, under the supervision of Japanese technical experts and consultant, is planned.

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

For the requested assistance from Nepal, the basic design policy for deciding the plan and from the results gained, the assistance plan is summarized in Figure 2-2-2-1 below.



Source: JICA Study Team

Figure 2-2-2-1 Contents of Japanese Assistance Plan

From the Nepalese side, installations were requested for six different water pumping and supply facilities of the Kathmandu Upatyaka Khanepani Limited (KUKL). However, the implementation of the design criteria for site selection described as the (1) Realization of long-term demonstration impact (2) Enough space for large capacity installation will not be possibly fulfilled as targeted. Furthermore, considering the fact that there is a scheduled power cut-off and that the planned system does not work during power cut off, fulfilling criteria (3) for maximum utilization of the smooth operation of grid-connected system either as a dedicated line or power supply by multi feeder site is selected. This serves as an alternative to the requested installation site. Thus, as an option for fulfilling the site selection criteria (1) to (4) indicated in Figure 2-2-2-1, the open pond rainwater reservoir at Dhobighat site inside Kathmandu Valley is selected.

The decided installation capacity is 350 kWp while the required installation area is around 4,700 m^2 for crystalline and around 9,200 m^2 for amorphous type modules. The size of the system is good enough for effective demonstration. The recorded annual average power consumption of the Sundarighat KUKL facility from August 2008 to July 2009 is around 560 kW/day and the average calculated power generation is 1,312.5 kWh/day (average solar hour 5 h/day[5] x 350 kWp x system efficiency 75%). which is higher than the consumption. Hence, if the main pump loads are not operational or consumption is low, a reverse power flow towards the existing grid is expected regularly, depending on the solar insolation.

If the default value 0.800 t-CO_2/MWh in Nepal is applied correspondingly, the amount of reduction of carbon dioxide emitted by the accumulated power generated from the PV system during the year becomes 383 t-CO_2/year. (= 1,312.5 kWh/day × 365-day/year × 0.800 t-CO_2/MWh)

(1) Overall Plan

The open pond space area of around 145,966 m^2 is the selected installation site for the PV system. It lies toward south west from the center of Kathmandu and towards the north from Chovar Hill near the Bagmati Riverbank towards Dhobighat. The open space is a level ground suitable for installation of PV system as it is flat and without high storey buildings or obstacles within the surroundings that form shadows. The installed PV system can be possibly viewed from the hilly road passing Chovar Hill connected to the Dachinkali Temple, and hence, is expected to have an effective demonstration

[5] Based on the 22-year NASA data (1983 to 2005)

impact. The installed PV system is considered as one of the components of the KUKL, which will execute regular O/M as it also does to its other equipment/components.

The selected installation is inclined at an angle of 30 degrees[6] at which PV system can generate maximum accumulated power in a year.

The selected land for installation is under the control of Kathmandu Valley Water Supply Management Board (KVWSMB), which is the responsible organization for this assistance. Meanwhile, the implementing agency, KUKL, is the authorized institution of KVWSMB. KVWSMB has already approved the land utilization where the PV system will be installed.

The PV system will connect to the two incoming 11 kV feeder of NEA's newly built control room at the Sundarighat KUKL facility, situated around 250 m away from the PV installation site. The overhead 11 kV line from the PV site connects to the NEA feeder and supply power within the Sundarighat KUKL premises. The remaining surplus power will flow towards the grid network of NEA. The feed-in-tariff shall be based on a Power Purchase Agreement (PPA) contract between KVWSMB/KUKL and NEA. For reference, Figure 2-2-3-1 summarizes the overall layout plan while Figure 2-2-3-2 summarizes the single line diagram of the grid-connected PV system.

There is no burden on the installation and grid-connection to NEA. All the required installation is covered by this assistance. The newly built 11 kV line is the property of KUKL. The responsibility and borderline of high voltage and low voltage is at the primary and secondary side of the transformer, respectively.

The outdoor cubicle and lookout post proposed to be installed and constructed at Dhobighat PV system installation site and at the Sundarighat facility control house, is included in this assistance plan. For reference, the construction plan of the control room and lookout post is summarized in Figure 2-2-3-5 and Figure 2-2-3-6, respectively.

(2) Equipment Plan

The outline of equipment procurement is summarized in Table 2-2-2-1 below.

Table 2-2-2-1 List of Components (Unit Price above JPY 1,000 Thousand)

Components	Specification	Qty.	Unit	Purpose
PV module	Total capacity 350 kWp and above with number of series and parallels to match the system voltage 3 Phase 400 V to be decided by supplier	1	Set	To generate power by receiving solar insolation
PV structure	Galvanized finishing	1	Set	To support PV module at required height and angle
Junction box	Outdoor use with reverse power flow protection, circuit breaker and surge absorber	1	Set	To collect and arrange the strings of modules at the PV site
Connection box	Outdoor use with reverse power flow protection, circuit breaker and surge absorber	1	Set	To connect and arrange the strings from junction box to match the input of power conditioner
Power Conditioner	Indoor self-standing, 350kW and above in total, output AC 400 V 3 Phase 4 Wire, efficiency 90% and above at rated capacity, with grid-connecting facility and safety protection relays (UVR, OVR, UFR, OFR)	1	Set	To convert the DC power generated by PV array to AC power and to match and supply power to load and grid.

[6] By adjusting the inclination of the PV array at latitude, it is possible to generate the maximum accumulated power in a year. As the site is located at around 27°40 N, the maximum power generation will be inclined at around 27 to 28 degrees and by a few degree adjustment, differences on power generation is negligible. From this, considering the structure manufacturing and installation, 30 degrees inclination is selected.

Components	Specification	Qty.	Unit	Purpose
Step up Transformer	500 kVA, 11 kV/400 V, 50 Hz, 3 Phase 4 Wire, Δ-Y wiring with neutral grounding	1	Unit	To step up 400 V to 11 kV and to connect existing grid and supply power to the existing loads.
Distribution Transformer	315 kVA, 11 kV/400 V, 50 Hz, 3 Phase 4 Wire, Δ-Y wiring with neutral grounding	1	Unit	To supply power to existing loads of Sundarighat, KUKL
11 kV Distribution board	Indoor self-standing, 3 Phase 3 Wire, 50 Hz with protection relays	1	Unit	To connect the 11 kV grid distribution network
11 kV Switchgear panel	Indoor self standing, 11 kV, 3 Phase, 3 Wire, 50 Hz with protection relay and interlock	1	Unit	To connect the existing 11 kV feeder (two feeder) of NEA and 11 kV from PV system with change over interlock switchgear
Outdoor Cubicle	Outdoor self-standing, dust, insects and vermin proof	1	Unit	To install power conditioner, 11 kV distribution board, 400 V distribution panel and so on at PV array installation site
400 V distribution panel	Indoor self-standing with power distribution circuit breaker	1	Unit	To supply power to the equipments at PV Array installation site
400 V distribution board	Indoor self-standing with power distribution circuit breaker	1	Unit	To supply power to existing loads and equipment at control room
Display board	Outdoor display board of size W1,200 x L800 mm	1	Unit	To display PV power generation system information at Sundarighat KUKL facility
Data monitoring, recording and display system	Meteorological data and system data measuring collection units with software for data management.	2	Unit	To collect and manipulate the system information for providing information to general public and for system O/M management.
11 kV power distribution line	11 kV ACSR cables, poles and related materials following NEA's specification	1	Set	To supply power to Sundarighat site from PV system

Source: JICA Study Team

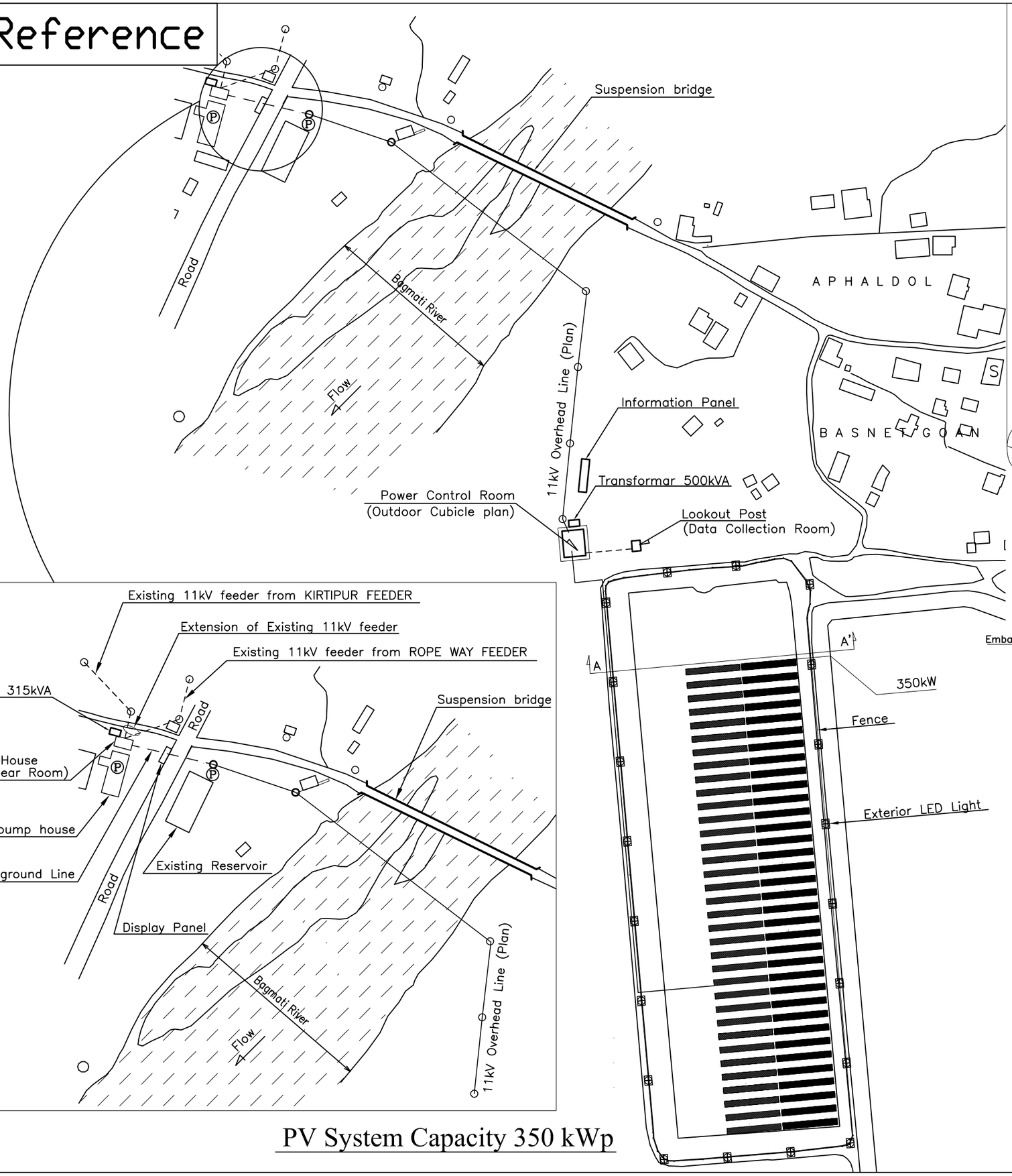
The contents of procurement plan is summarized as follows;

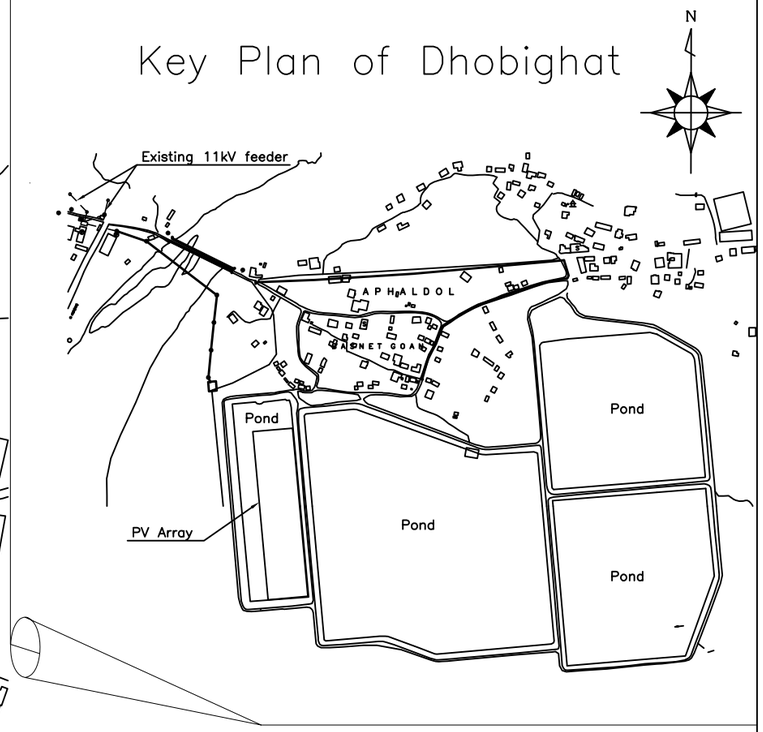
- Demonstration impact: To accelerate the demonstration impact, components are also included in the procurement plan. To view the details of the grid-connected PV system operating status and information, a display panel is included in the equipment procurement plan. On the display panel, five items wil be displayed, i.e., the main related condition for power generation such as the (1) solar insolation (2) ambient temperature, and as power output (3) generated power (kW) (4) accumulated power (kWh) and (5) expected possible amount of reduction of carbon dioxide by the generated power.
- Measurement and Quantification of Assistance Plan: For the continuous measurement, data recording and management device is included in the procurement of equipments to record meteorological and power generation data. From the measured data using precision instruments, the technical impacts of the assistance plan will be possibly measured and quantified.
- Guarantee of Durability: Since storage of battery is not essential in grid-connected system, the electric circuit is the unit most possibly subjected to higher damage probability. The most possible cause of circuit failure is due to the induced spike voltage from lightning and switching action. The countermeasures to prevent this induced spike voltage invading the electric circuit are considered to the possible extent. Such measures involve installation of arrester, earthworks and fence that function as lightning rod.
- Protection against Robbery: Protection against robbery attempts and the lightning protection is part of the function of the fence. The low power consumption LED lamp and fence is considered to install around PV array installation site to prevent robbery. To provide light at night even at the time of power cut storage battery as a backup power for 10 hours of lighting is also planed. Thus, this is also included under the assistance plan.

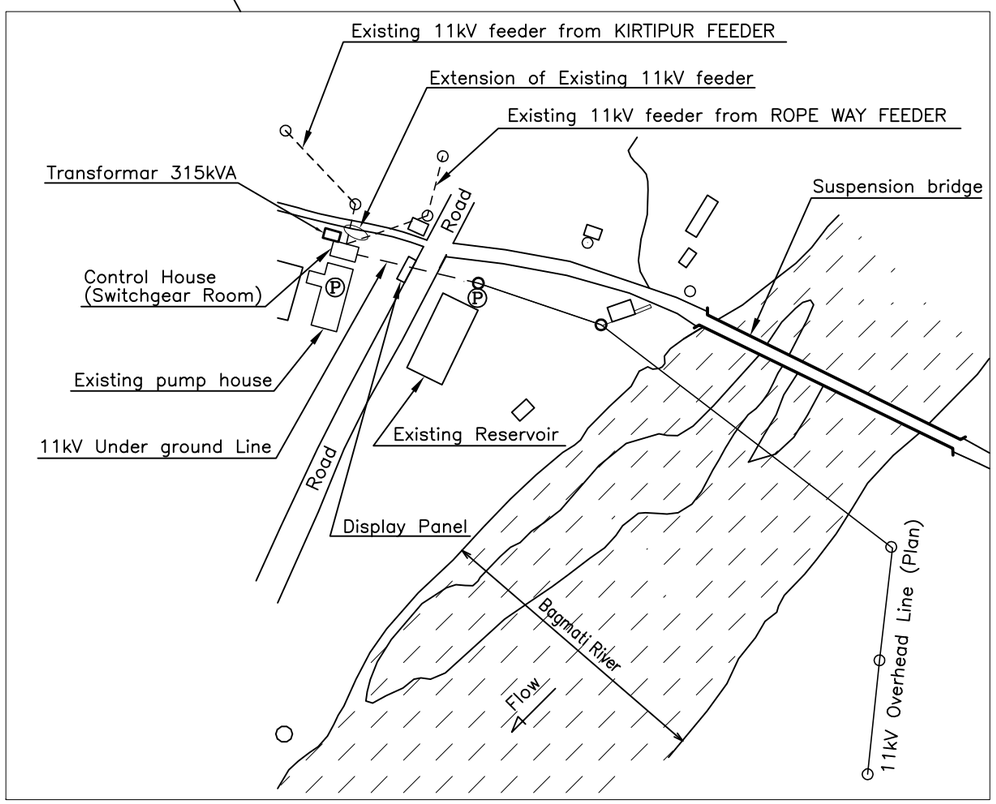
2-2-3 Outline Design Drawing

The overall PV system layout, single line diagram, structure, PV and cubicle foundation plan, control house plan and sections, fence and lookout post plans are shown in Figure 2-2-3-1 to 2-2-3-6.

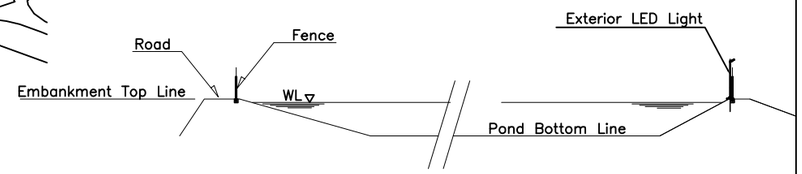
For Reference







PV System Capacity 350 kWp



Section A-A'

Exterior LED Light

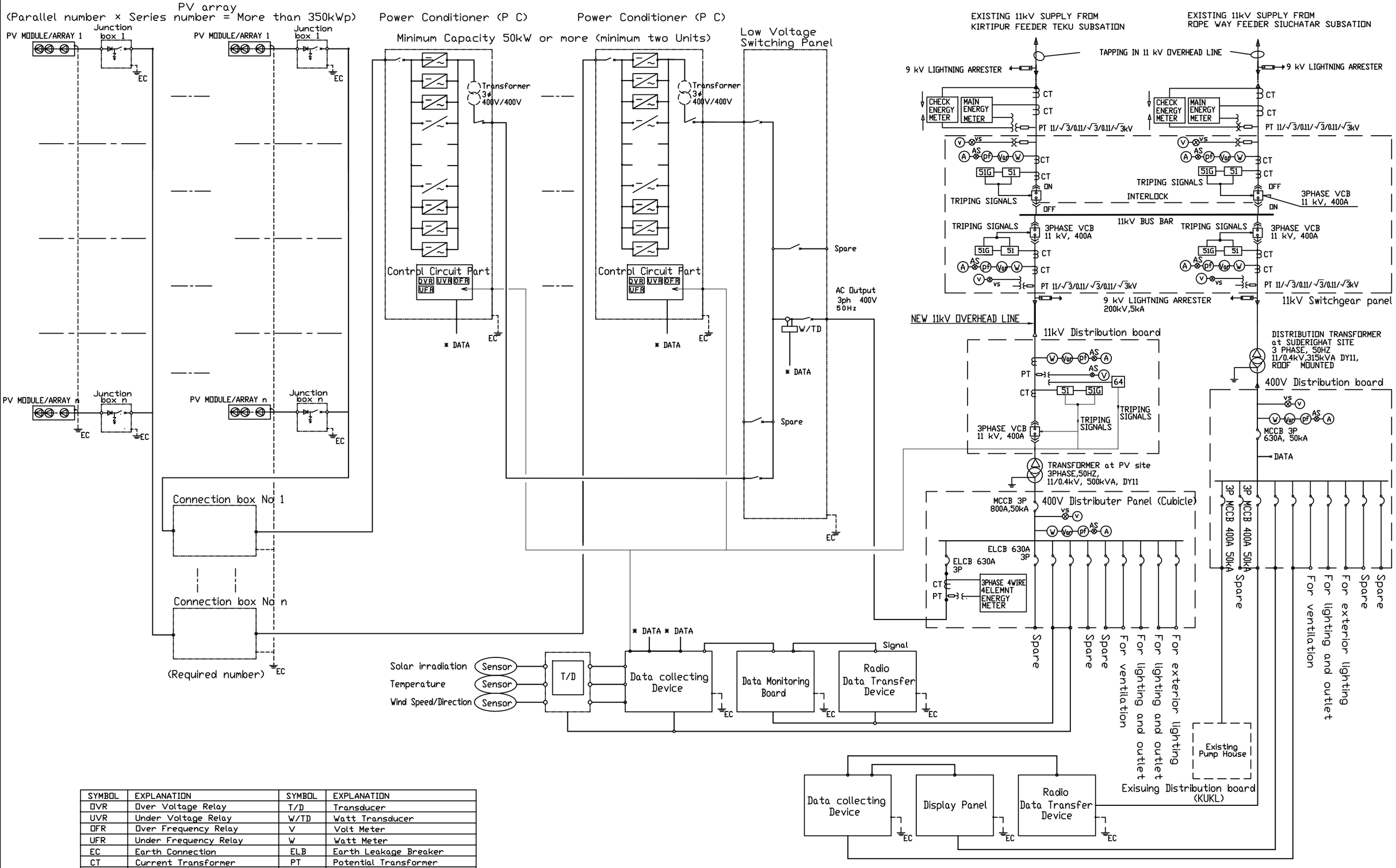
Legend	
	Power Line
	Fence
	Exterior LED Light
	Embankment Top Line
	Pond Bottom Line
	Amorphous Module 350kW
	Polycrystalline Module 350kW
Ⓟ	Existing pump

Preparatory Survey on the Project for Clean Energy Promotion Using Solar Photovoltaic System in Nepal

Figure 2-2-3-1

PV System Layout Drawing

For Reference



SYMBOL	EXPLANATION	SYMBOL	EXPLANATION
OVR	Over Voltage Relay	T/D	Transducer
UVR	Under Voltage Relay	W/TD	Watt Transducer
OFR	Over Frequency Relay	V	Volt Meter
UFR	Under Frequency Relay	W	Watt Meter
EC	Earth Connection	ELB	Earth Leakage Breaker
CT	Current Transformer	PT	Potential Transformer
51	Over Current Relay	64	Ground Fault (Residual Valtage) Relay
51G	Ground Fault Relay	LA	Lightning Arester

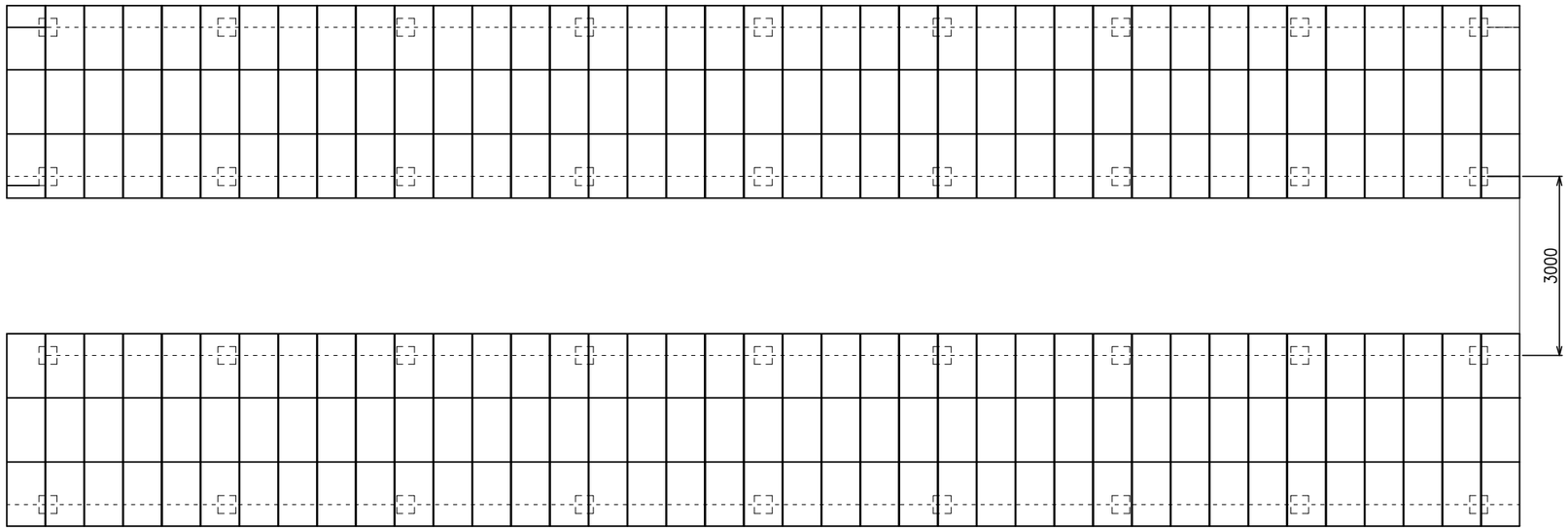
PV System Capacity 350kWp

Preparatory Survey on the Project for Clean Energy Promotion Using Solar Photovoltaic System in Nepal

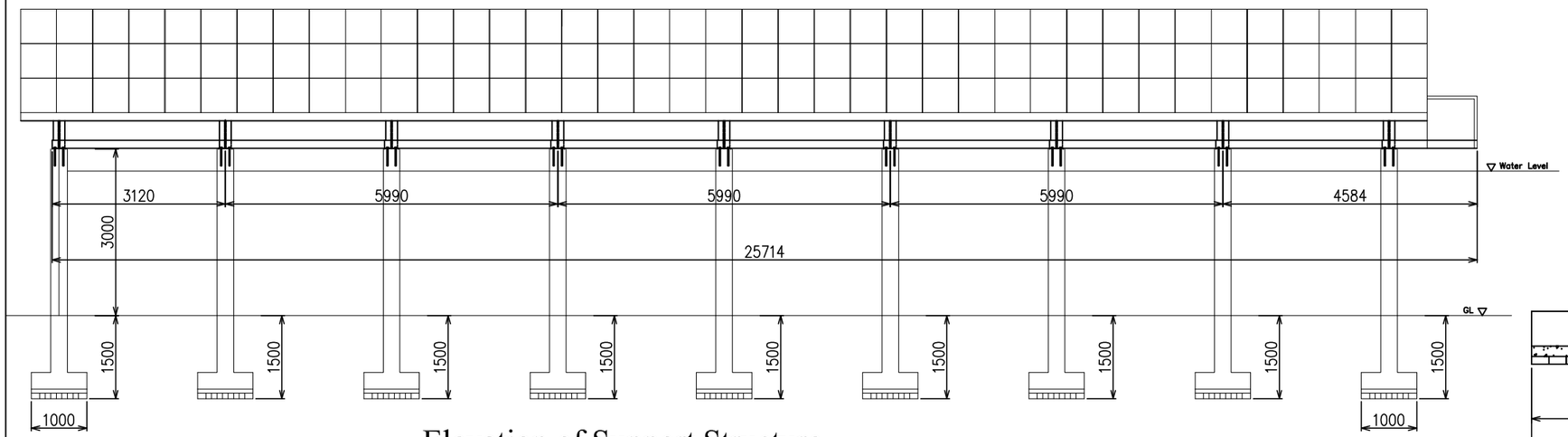
Figure 2-2-3-2

PV System Single Line Diagram

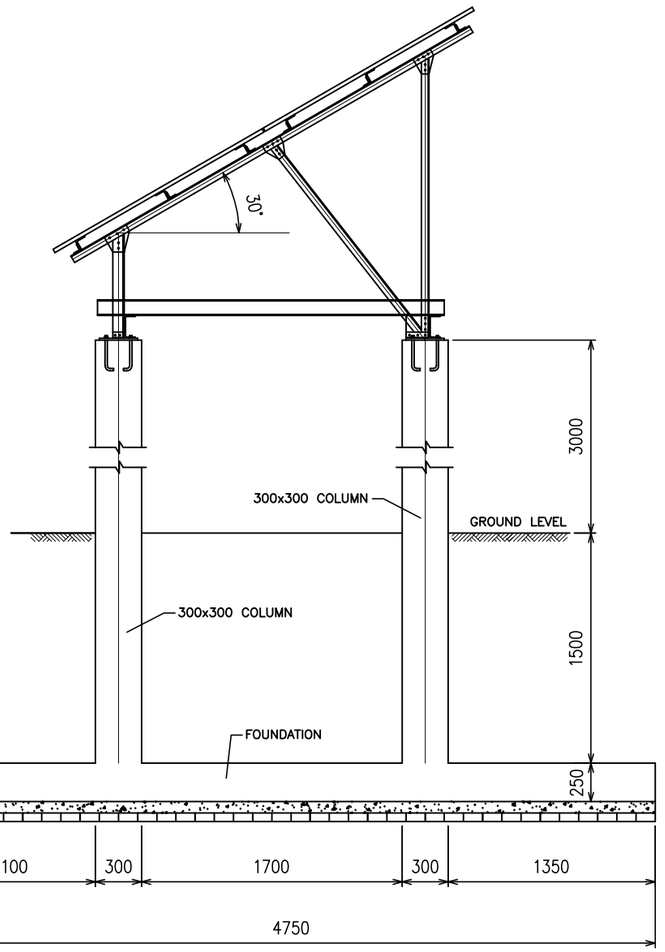
For Reference

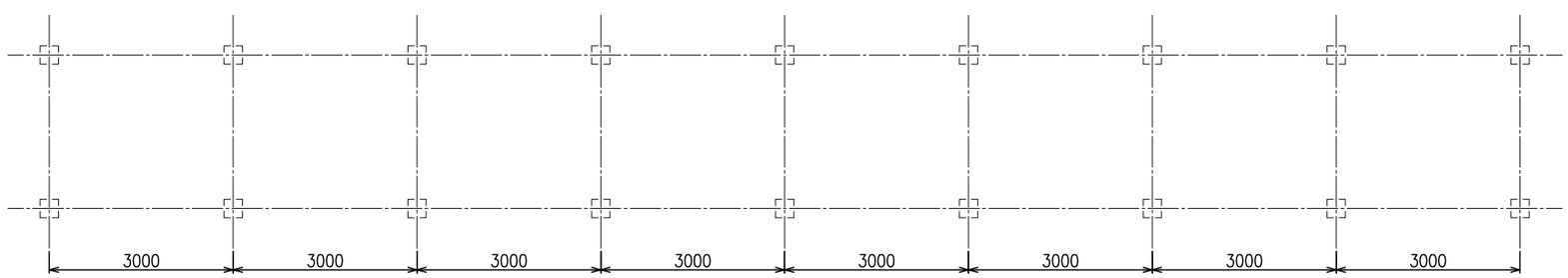


Layout Plan of Dhobighat



Elevation of Support Structure



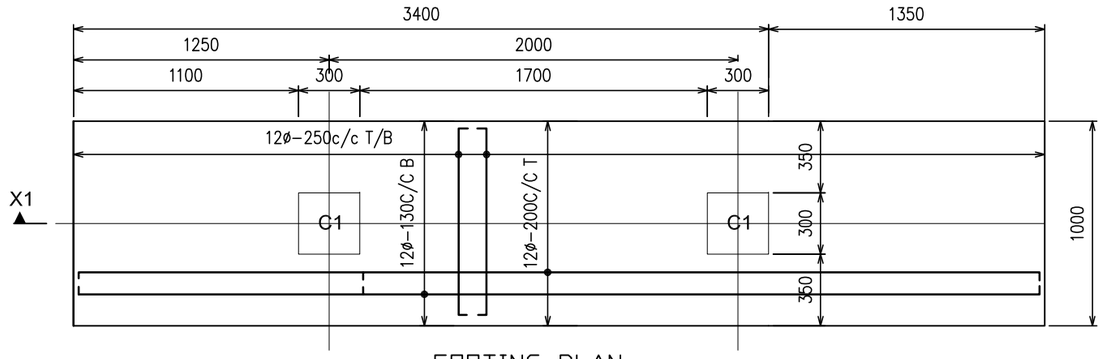


Preparatory Survey on the Project for Clean Energy Promotion Using Solar Photovoltaic System in Nepal

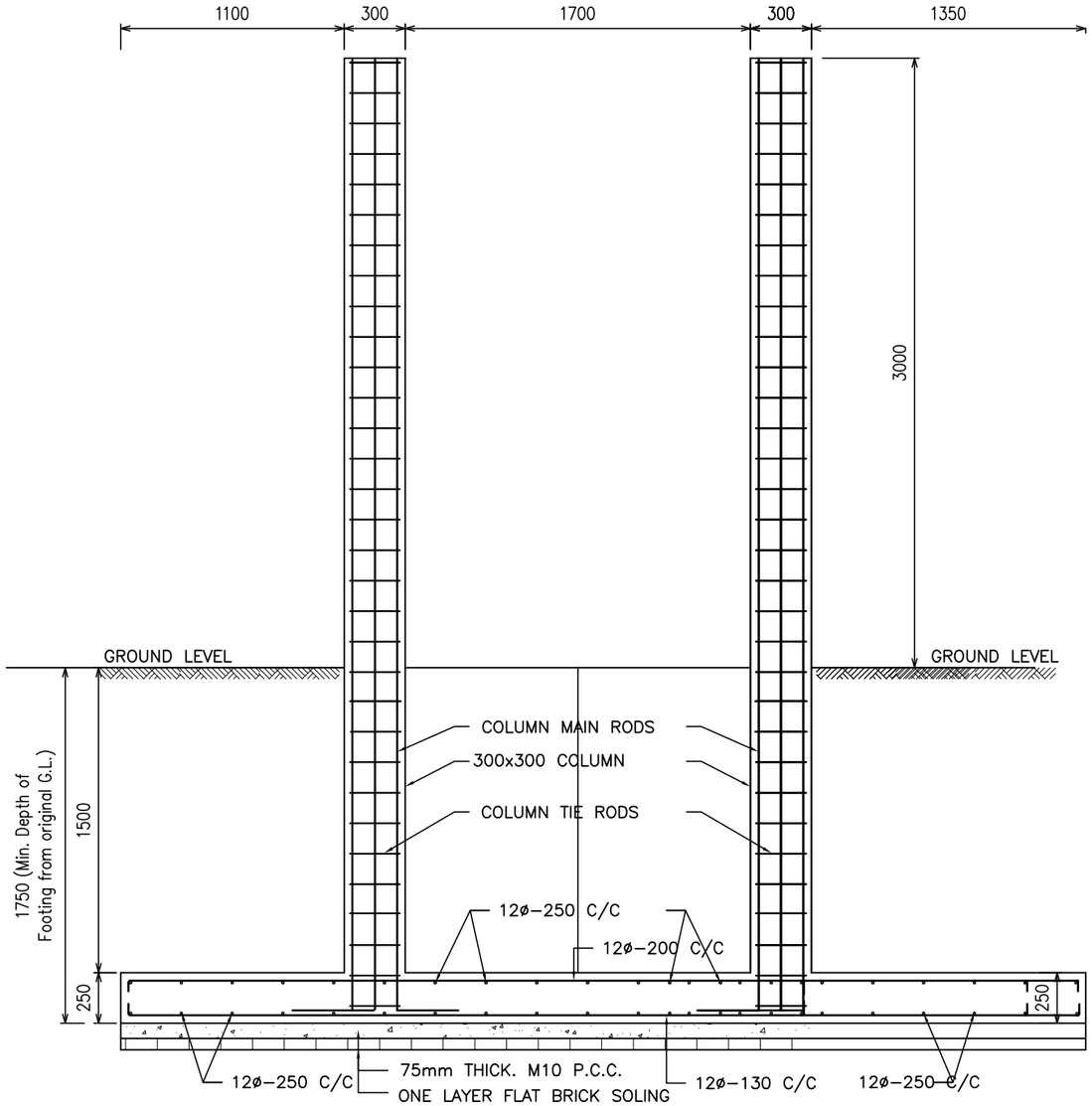
Figure 2-2-3-3

PV Strucure

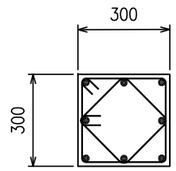
For Reference



FOOTING PLAN

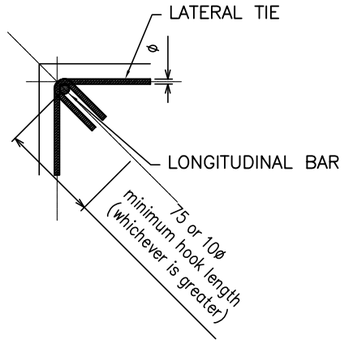


FOOTING SECTION AT X1

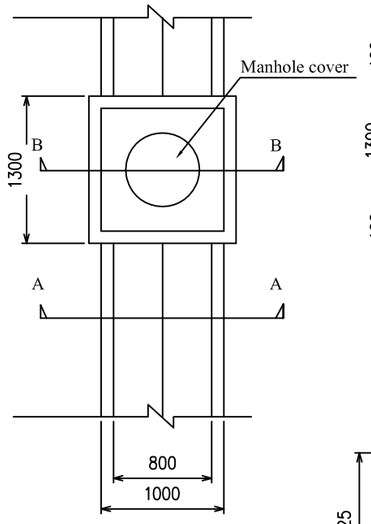


NOTES FOR COLOMN STIRRUPS:–
1. Rectang. Columns with 8 bars: Use 7 mm dia bars with diamond shape ring in the middle @ 4" & 6" near top & bottom and at middle height.

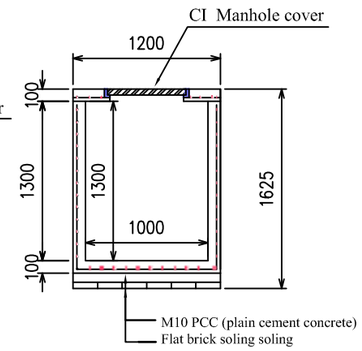
COLUMN DETAILS



DETAIL A–135°HOOK DETAIL FOR STIRRUPS & TIES

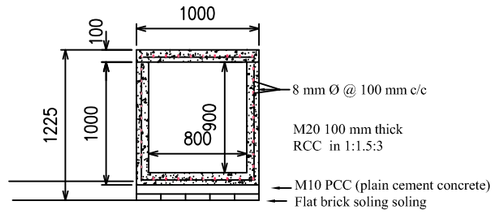


RCC Manhole & RCC cable duct



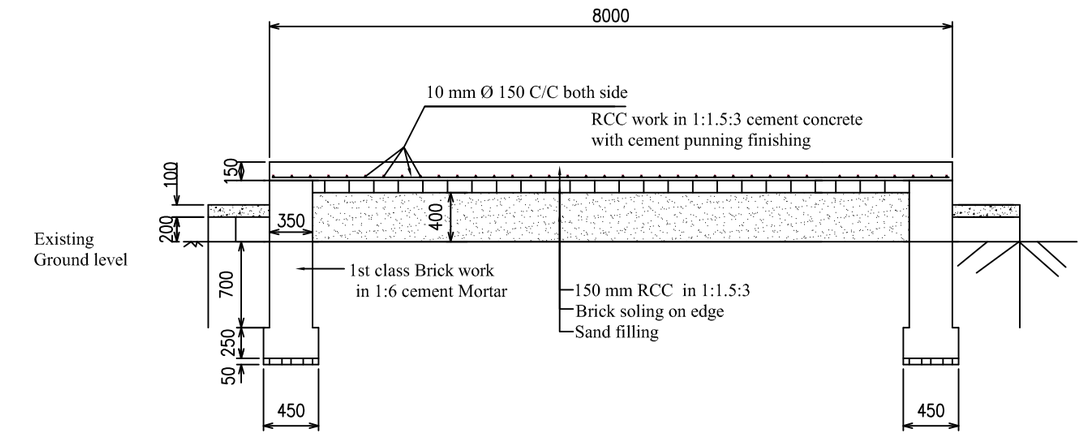
RCC Manhole

Section B–B



RCC cable duct

Section A–A



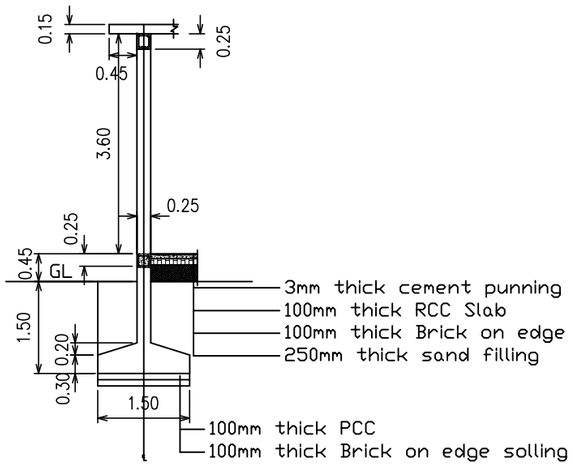
Section A–A of Cubical plateform

Preparatory Survey on the Project for Clean Energy Promotion Using Solar Photovoltaic System in Nepal

Figure 2–2–3–4

PV and Cubicle Foundation Plan

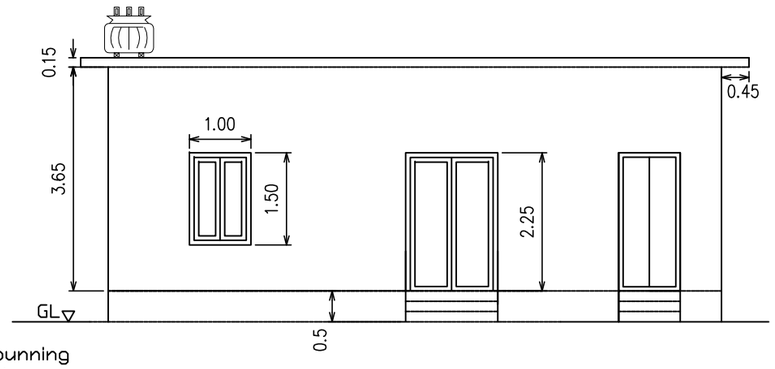
For Reference



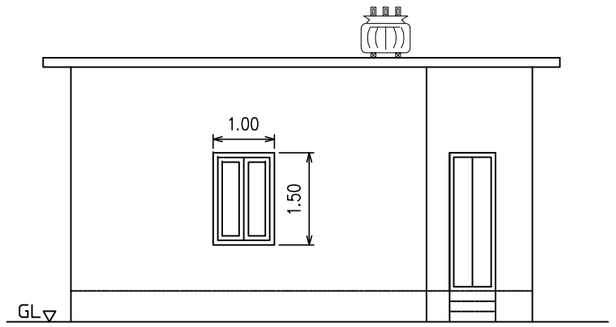
SECTION

FLOOR SECTION

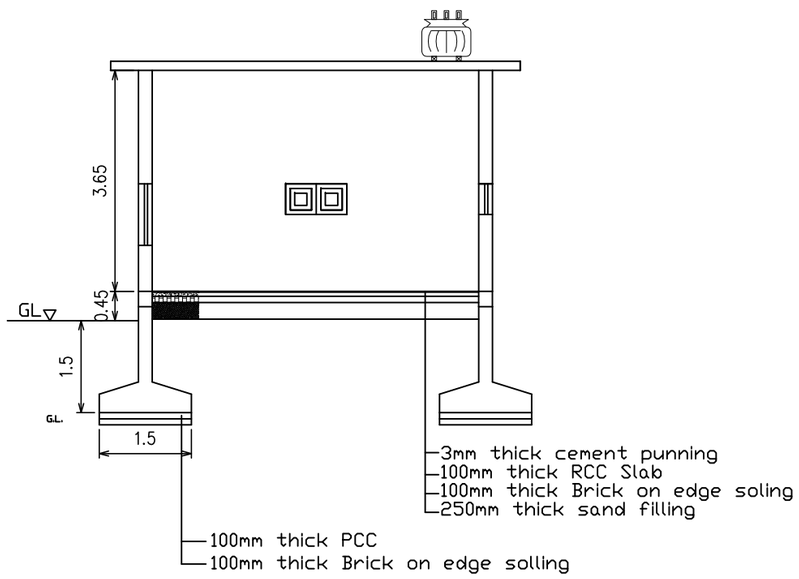
315kVA TRANSFORMER (Outdoor type)



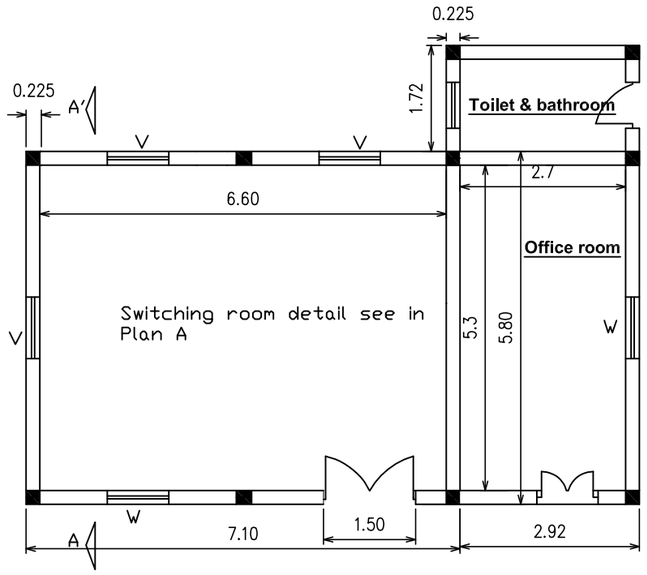
FRONT ELEVATION



SIDE ELEVATION

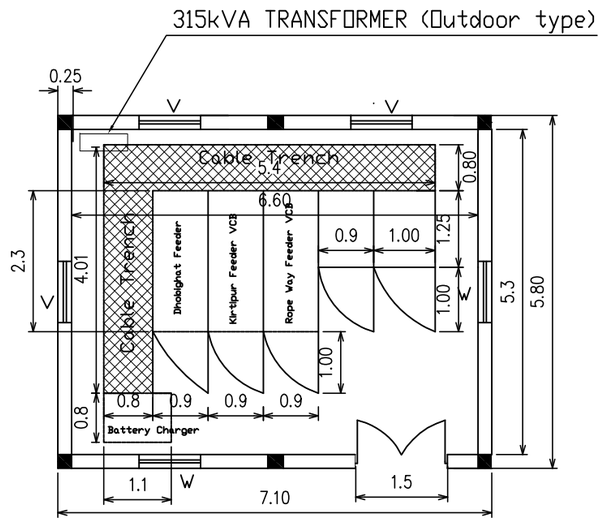


SECTION A-A'



PLAN

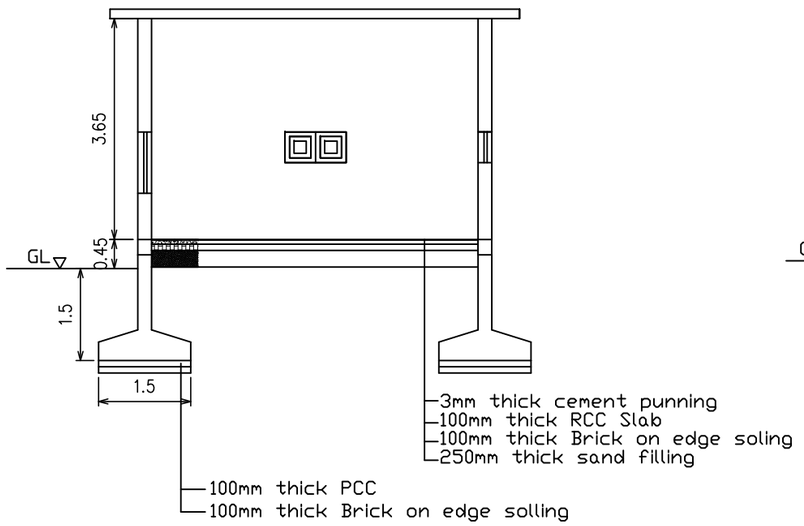
315kVA TRANSFORMER (Outdoor type)



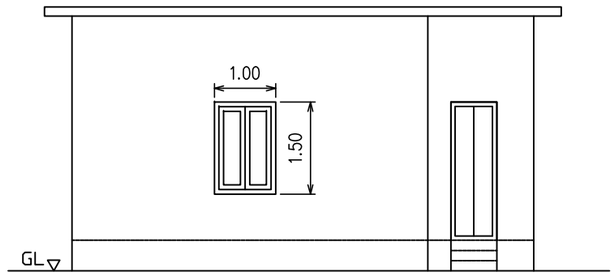
PLAN A

Preparatory Survey on the Project for Clean Energy Promotion Using Solar Photovoltaic System in Nepal	
Figure 2-2-3-5	
Control House , Plane and Sectional Plan	

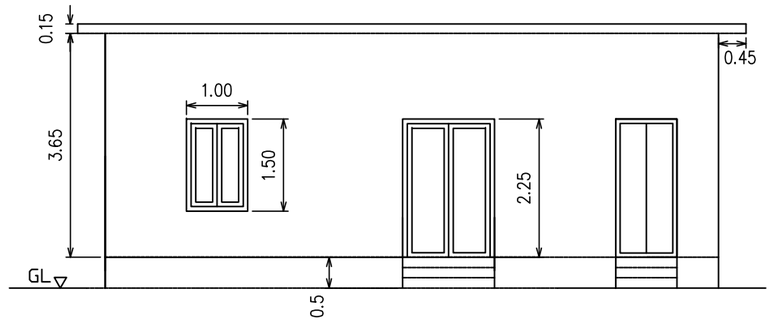
For Reference



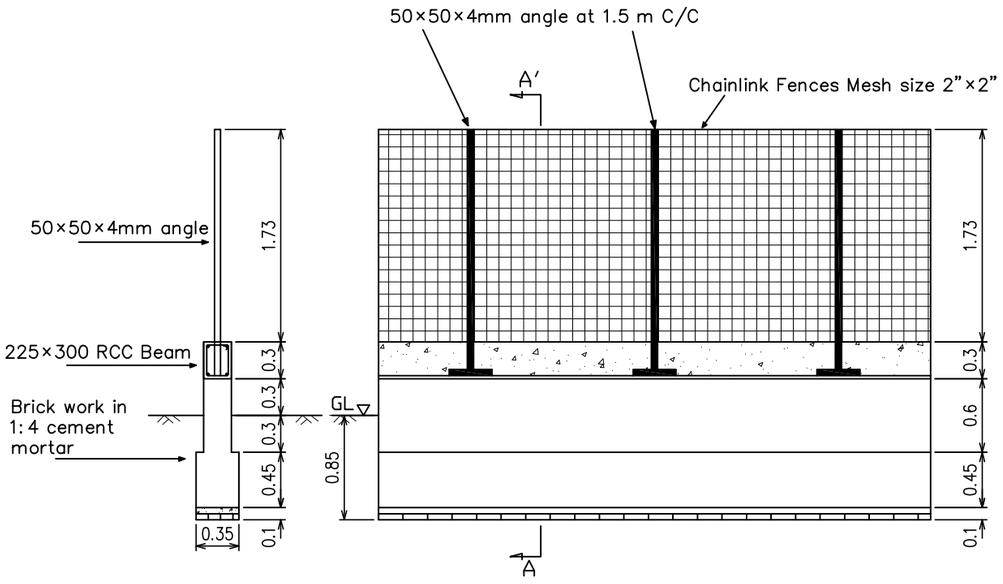
SECTION A-A'



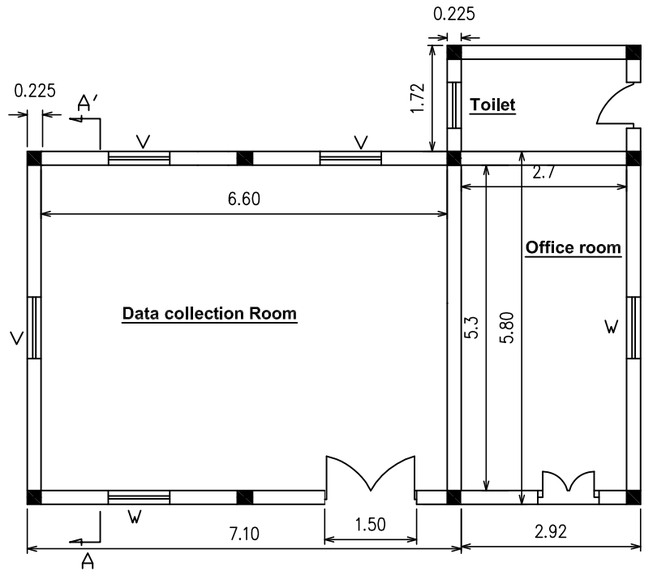
SIDE ELEVATION



FRONT ELEVATION



SECTION A-A'　　Longitudinal section of boundarygabion net (Chainlink fences)



PLAN

Construction of boundary gabion net wall (Chainlink Fences)

Preparatory Survey on the Project for Clean Energy Promotion Using Solar Photovoltaic System in Nepal
Figure 2-2-3-6
Fence and Lookout Post Plan

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The implementation of this assistance is in accordance with the Japanese Grant Aid scheme. For implementation after the exchange of notes (E/N), The Government of Nepal drafts an agent agreement. Consequently, the representing agent selects and handles the contracts with the consultant for system design execution and supervision, and with the contractor for procurement and installation of components.

(1) Responsible Organization and Implementing Agency

In this assistance plan, from the procurement to the implementation stage, the project implementing agency and responsible organization of Nepal are as follows.

- Responsible Organization : Kathmandu Valley Water Supply Management Board (KVWSMB)
- Implementing Agency : Kathmandu Upatyaka Khanepani Limited (KUKL)
  Responsible Department and Section : Operation Department, Electromechanical Section

To execute this assistance plan, KVWSMB and KUKL need to appoint a person responsible for the implementation. The designated person submits the documents and coordinates with institutions like DoED, NEA and so on, for the smooth implementation of the project.

(2) Representative Procurement Agent

The representative procurement agent selects the consultant to perform supervision of implementation and execution and a contractor to execute procurement and installation. The representative procurement agent controls the budget of the project and will represent the Government of Nepal. It authorizes payment based on the work progress of the selected consultant and contractor.

(3) Consultant

The selected consultant enforces the procurement plan, construction schedule, implementation and supervision. The consultant also prepares the technical documents and supports the representative procurement agent in selecting contractor for the supply and implementation. Safety, quality, schedule and construction drawings are also checked and controlled by the consultant. Furthermore, the consultant will provide technical advice and support for document controls related to grid-connection documents and also performs field inspections, commissioning and handover of the project.

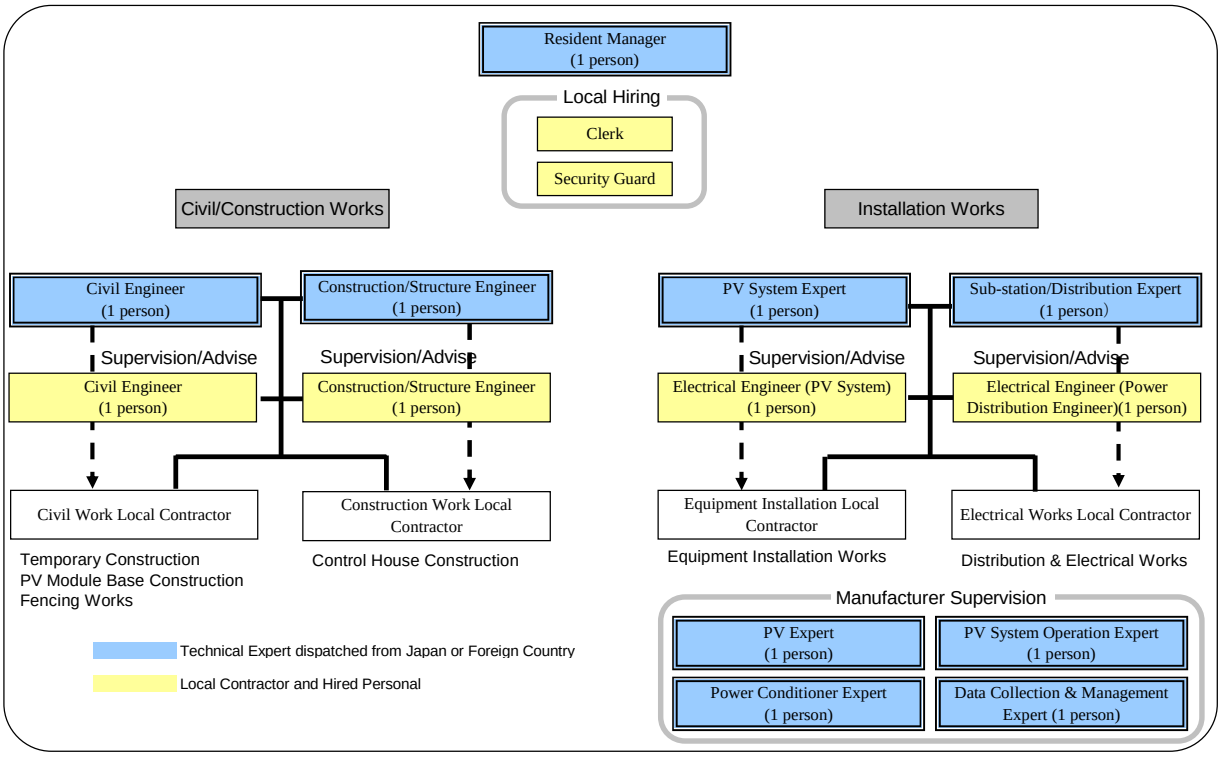
(4) Supplier/Contractor

The supplier/contractor is selected through an open tender method and required related components are procured in accordance with the agreement made.

Furthermore, the selection procedure for local assistance and dispatching of technical expert from Japan for the project is summarized as follows:

- Local Consultant and Construction Company: Both are supposed to be in the field of electricity and civil engineering works, and will work as assistants under the consultant and technical experts from Japan of the project.
- Technical Experts from Japan: The grid-connected PV system is the first case to be introduced in Nepal. Hence, dispatching of technical experts from Japan is essential to cover fields like PV system, sub-station and distribution, civil and construction works.

The administrative structure of procurement contractor is as shown in Figure 2-2-4-1.



Source: JICA Study Team

Figure 2-2-4-1 Structure of Procurement Contractor

The dispatched technical expert from Japan acts as a resident manager involved in the entire field including PV system, sub-station and distribution, civil and construction works. Besides, operation management and initial start up is part of the tasks of the supplier's technical expert.

2-2-4-2 Implementation Conditions

The main points of concern for construction and procurement are as follows:

- Safety Management of Material and Equipment: During the works the procured material and component shall be protected from robbery attempts and accidents by employing a security guard. After completion of the works, KUKL's designated guard shall maintain security against mentioned unwanted incidents.
- Safety Precautions: The PV module structure is installed above 3 m high. Hence, stable scaffolding and working platform is necessary to prevent workers from falling and from accidentally dropping objects.
- Transportation of Equipment/Components: For Nepal, being a mountainous country, smaller size (20 feet) container is selected for smooth transportation of procured equipment and components.

2-2-4-3 Scope of Works

This is the first case of a grid-connected PV system to be implemented in Nepal. Hence, the procurement, construction and installation works are planned to be covered by this assistant plan. The other essential work like securing land for installation and application for power generation and supply permit, application and licensing process for grid interconnection, and finalizing of feed in tariff, and so on are the responsibility of Nepal.

In this plan for the protection against robbery attempts and the lightning protection is part of the function of the fence. Thus, this is also included under the assistance plan.

2-2-4-4 Consultant Supervision

The outline of procurement management and construction plan is as follows:

- Basic Concept: Since the implementation of the grid-connected PV system is Nepal's first experience, procurement management and supervision works are planned for the entire construction period under this assistance plan.
- Notes of Priority: Due to the elevated working place, the necessary workers and reliable supervision is required. Ensuring that the works are progressing properly needs to be studied carefully as this is important for safe project execution.
- Management Structure: The resident management system is adopted to manage the continuous work process from procurement to the end of construction period, as mentioned in the basic policy.
- Contents of Work and Specialty: The fundamental works related to civil works like concrete foundation, fence construction, construction of control house, and so on during the first part is managed by the civil engineer acting as a resident manager. In the succeeding year the installation of PV module, power conditioner and grid-interconnection will also take place. For this, the resident manager needs to be knowledgeable in grid-interconnection and should not just be an electrical engineer. Furthermore, the PV power generation specialist needs to be on site as his presence is indispensable during inspection of concrete foundation for the PV structure, installation of PV module, final inspection of installation and operation test.

2-2-4-5 Quality Control Plan

To manage the quality control of construction works, supply of construction materials and equipment, the following procurement inspection works are planned to be executed under this assistance plan.

(1) Inspection of Drawings

Submission of drawings for the construction equipment under this execution procurement plan is required from the supplier, while verification of the conformity of the materials with the as well as the quality according to the contract is executed by the consultant.

(2) Factory Inspection

The concept is that the inspection of procured components is executed at the factory before shipment packing. The main equipment such as the switch panel and distribution board, PV module, power conditioner and others are subject to acceptance test at the factory before shipment, witnessed by the consultant to confirm compliance with the approved drawings and specifications.

(3) Inspection before Shipment

A third party inspection is executed to confirm if the procured component, packed materials and loads are as per the procurement document for shipment.

(4) Field Inspection

The inspection of construction and installation components is to be performed at the installation site. The inspection of individual equipment and complete system is executed under the presence and responsibility of the procurement contractor. The inspection at the field is witnessed by the consultant's personnel in charge and designated person form the Recipient country.

2-2-4-6 Procurement Plan

(1) Origin of Material

Basically, the procured materials and equipment for the PV system are selected considering durability, ensured high accuracy and quality. The supply of materials and components like construction materials for civil works are locally procured while others are procured from Japan.

The energy meter is required to be specified/procured from NEA[7].

In the case of civil and construction works there are some materials imported from India which is normal practice in the country. Therefore, locally available construction materials are locally procured under this assistance plan.

The countries where the main equipment will be procured are summarized in Table 2-2-4-1.

Table 2-2-4-1 Countries where Main Equipment will be Procured

Material List	Procurement Country (Country of Origin)		
	Local	Japan	Third Country
PV Module		X	
Power Conditioner		X	
Step up Transformer		X	
Insulation Transformer		X	

Source: JICA Study Team

(2) Transportation Route

All required equipment and components for this assistance plan are products of Japan. The transportation routes from Japan to the site, process and shipment duration are summarized in Table 2-2-4-2[8].

Table 2-2-4-2 Shipment Plan

Transportation Route	Shipment Step	Shipment Duration
Port of Japan		
|	Sea Shipment	20 to 30 Days
India / Port of Kolkata		
|	Land Transportation	7 Days
Installation Site (Kathmandu)		

Source: JICA Study Team

(3) Components for Replacement and Tools

The components and parts of PV system are difficult and complicated to repair locally, and it may influence largely the system's operation. In case of damage or break down, the component and accessories for replacement are as mentioned below:

(i) PV Module (3%[9] of Total)
(ii) Power Conditioner (1 unit)

Even though it may not influence the PV system largely, the following items, which might differ depending on the manufacturer and may not be obtained easily, are also subject for replacement to realize a long term smooth operation.

(iii) Fuses
(iv) Display Lamp of Control Panel
(v) Circuit Breakers
(vi) Meteorological Instruments (Thermometer, Pyranometer, Anemometer/Wind Vane)

The following tools for daily O/M are also required.

(i) Insulation Resistance Tester
(ii) Clamp Meter

[7] The procured energy meter by NEA is inspected and supplied to costumer is the process adopted in Nepal.
[8] Required days for custom clearance are not included.
[9] For the replacement of module for accidental break down. The possibility of break down may be whole string. The actual number of module at one string is depends upon the system deigning, normally one strings contains around 10 to 15 module. It will be around 3% of the whole capacity if several strings are considered for replacement.

(iii) Multi-meter

(4) Warranty

A warranty period of one year is required for supplied components, equipment and facility.

2-2-4-7 Operation Guidance Plan

After the finalization of installation, technical transfer to the system operator designated to perform daily O/M is planned. The method of operation adjustment of each individual component, initial start up and O/M are executed by the supplier/manufacturer's expert. The operation and other technical know-how of the complete PV system are executed under the soft component program.

The O/M of the installed PV system also needs to be managed by the O/M team of the technical section of KUKL, or by a separate O/M team to be formed within the section.

Table 2-2-4-3 summarizes the specialty of experts, contents of technology transfer and implementation period.

Table 2-2-4-3 Initial Operation Guide and Management Plan

Specialty of Expert	Contents of Technology Transfer	Implementation Period
PV Technology Expert	Basic know-how of PV technology, daily operation and maintenance	Around 2 Weeks
Power Conditioner Expert	Initial start up, operation producer, emergency management, fault findings and initialization, daily operation and maintenance	Around 2 Weeks
Data Collection and Management Expert	Initial start up, management of data, fault finding, daily operation and maintenance	Around 2 Weeks
PV System Operation Expert	Initial start up, operation method, emergency management, daily operation and maintenance, fault finding and restoring	Around 2 weeks

Source: JICA Study Team

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

Application of the grid-connected PV system in utilizing renewable energy resource under this assistance plan is the first case in Nepal. There is no such experience in Nepal in the past that are related to the smooth operation of grid-connected PV system., Thus, to execute the system installation smoothly and with the aim of sustaining efficient and stable operation, provision of support under the soft components is deemed necessary.

The proposed contents of the soft components are summarized and attached in the soft component plan.

2-2-4-9 Implementation Schedule

The implementation schedule is summarized in Table 2-2-4-4.

Table 2-2-4-4 Implementation Schedule

(Detail Design)

Months	0	1	2	3	4	5	6	7	8	9	10	11	12
1 Domestic Works													
2 Site Survey													

(Procurement & Implementation)

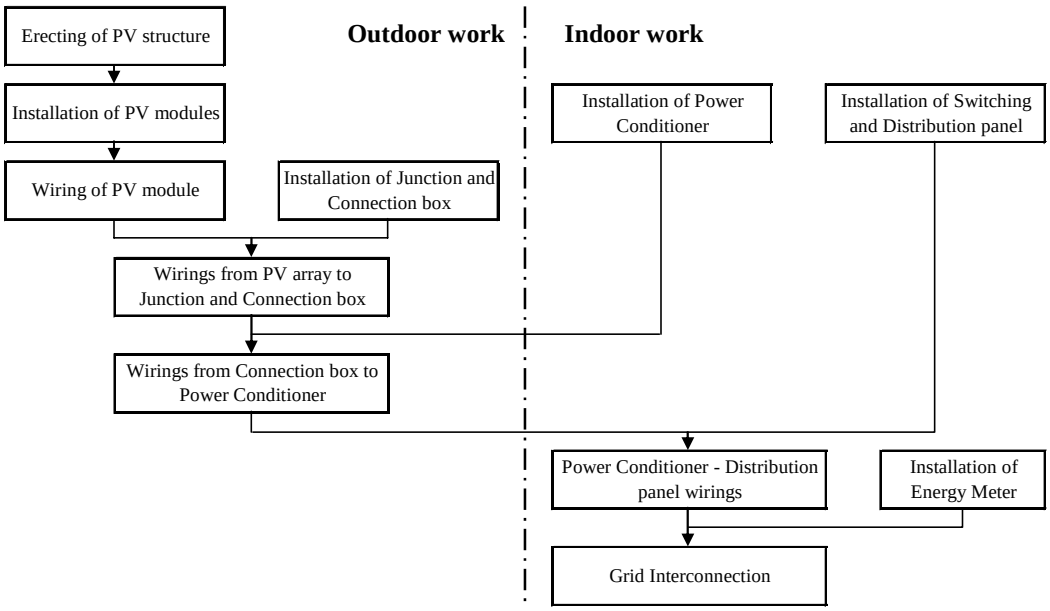
Months	0	1	2	3	4	5	6	7	8	9	10	11	12
1 Designing & Approval													
2 Structure Manufacturing													
3 Equipment Manufacturing													
4 Shipment, Inland Transport & Entry													
5 Civil & Construction Work													
Temporary Works													
Fencing Works													
PV Structure Concrete Base Works													
Construction of Control House													
6 Equipment Installation Works													
PV Structure Erecting Works													
PV Module Installation Work													
Sub-station Equipment Installation													
Other Works													
7 Commissioning													
8 Inspection, Completion and Hand Over													

: Site Works : Domestic Works : Site or (and) Domestic Works

Source: JICA Study Team

The total period from the initial stage of planning, preparation of drawings for inspection, execution of works until the project hand over is planned to be completed within 11 months.

The installation work is divided into outdoor and indoor works; the complete flow is presented in Figure 2-2-4-2 below.



Source: JICA Study Team

Figure 2-2-4-2 Installation Work Flow

2-3 Obligation of Recipient Country

For the execution of this assistance plan, the obligations of the Government of Nepal are as follows:

(i) Acquisition of land for system installation by KUKL
(ii) Acquisition of the electricity sale license from DoED
(iii) The PPA contract with NEA for realization of reverse power sales and grid-connection.

(iv) The procedure for environmental and social consideration
(v) The bank commissioned to establish an account in Japan and procedure for this assistance plan.
(vi) The arrangement of tax exemption for materials supplied, process of entry of materials and domestic transportation.
(vii) The required legal action for entry and sojourn in Nepal, for Japanese and third country experts involved in this assistance plan.
(viii) The exemption on taxes for equipment and service parts and necessary purchases for the Japanese experts engaged in this assistance plan.
(ix) The smooth and appropriate management of supplied equipment.
(x) The necessary expenses, except those from the Grant Aid of Japan.
(xi) The assistance and cooperation to solve any conflicts that may arise between the inhabitants or third person while executing this assistance plan.

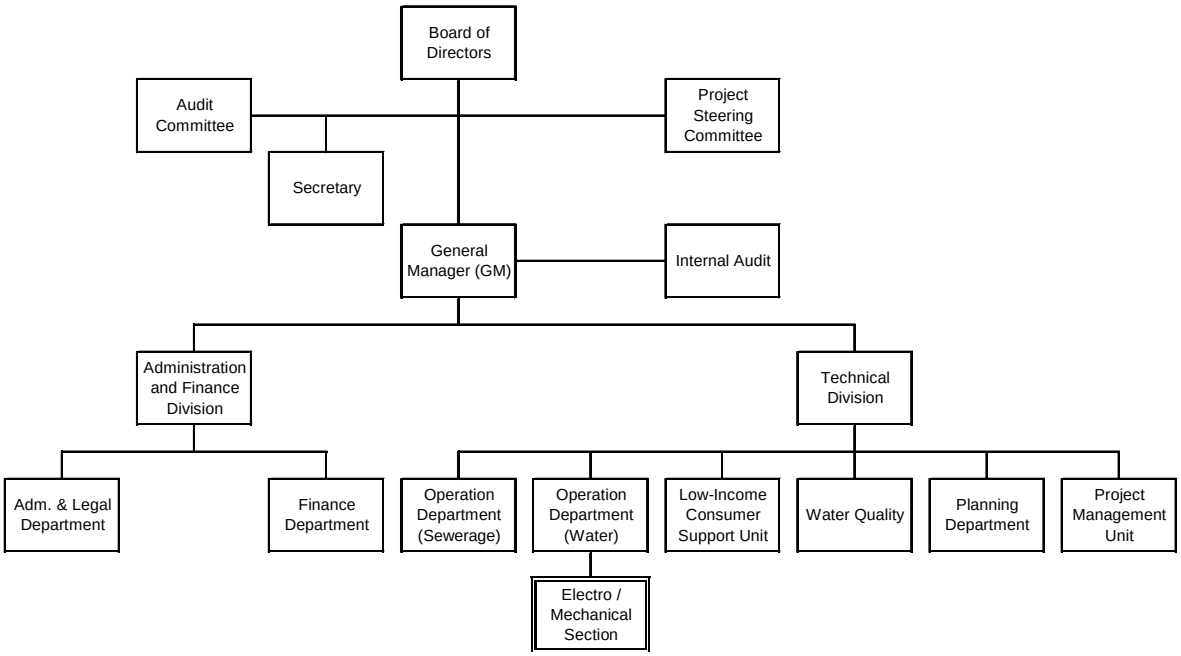
2-4 Project Operation Plan

In this project, administration and maintenance operation is planned to be implemented by KUKL.

KUKL has experience on PV system used for water pumping from deep tube well. The Operation Department, Electromechanical Section of KUKL performs the management of the installed system, and they have gained experience and knowledge in basic management and maintenance.

In this assistance plan, the grid-connected PV system supplies power to KUKL facility. Thus, the Electromechanical Section of the Operation Department will perform the O/M works. Even though the scale of the PV system is large and operates by connecting to the NEA grid, it is judged that they can perform O/M works smoothly with appropriate technology transfer.

The organization chart of KUKL is shown in Figure 2-4-1.



Source: JICA Study Team based on Material from KUKL

Figure 2-4-1 Organization Chart of KUKL

The instruments and the replacement parts related to the O/M management are procured under this assistance plan. A soft component is executed for the technical personnel of KVWSMB/KUKL, to transfer the technical know-how on procured instruments and to respond (troubleshoot) during system break down.

The necessary maintenance management items are summarized in Table 2-4-1.

Table 2-4-1 Main Items of Management and Maintenance

Contents of Inspection	Type of Inspection	Item for Inspection
General inspection (Once in a month)		
PV Array	Visual	- Damage, Corrosion, Lose Connections
Junction and Connection Boxes	Visual	- Damage, Corrosion - Damage of Cable Connections
Power Conditioner	Visual	- Damage and Corrosion - Damage of Cable Connections - Ventilation - Odd Sounds, Odor, Vibration, Overheating - Fault / Error Lamp - Operating Condition
Regular Inspection (Annually, but if any abnormal defect is observed, then inspection and maintenance are carried out)		
PV Array	Visual	- Disorder, Color Change, Cracks of Cables - Tightness of Earth Connection Terminal
Junction and Connection Boxes	Visual	- Disorder, Color Change, Cracks of Cables - Tightness of Earth Connection Terminal
	Measurement and tests	- Insulation Resistance Test - Measurement of Outputs
Power Conditioner	Visual	- Disorder, Color Change, Cracks of Cables - Plugging of Ventilation Filter
	Measurement and Test	- Power generation and display condition - Operation and Error test

Source: JICA Study Team

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The initial costs of procurement, shipment, installation and so on are covered by this assistance plan.

(1) Estimation Condition

(i) Estimate Period: December, 2009
(ii) Exchange Rate: USD 1.00 = JPY 93.97, NPR 1.00 = JPY 1.22
The estimation is based on the average exchange for six months from June 1, 2009 to November 30, 2009. The rate of Nepalese Rupee (NPR) to Japanese Yen (JPY) is based on the announced JPY buying rate of Nepal Rastra Bank, the central bank of Nepal, while the rate of U.S. dollar (USD) is the TTS rate announced by the Bank of Tokyo-Mitsubishi UFJ.
(iii) Construction Period: As mentioned in the execution schedule
(iv) Others: The accumulation of estimation is based on the administrative system of the Japanese Grant Aid.

(2) Cost Sharing of Nepal

Table 2-5-1-1 shows the breakdown of the cost share of Nepal.

Table 2-5-1-1 Estimated Overall Project Cost Share of Nepal

Cost Item	Amount
1. Land Preparation for Control Room (Sundarighat)	NPR 60,000 (JPY 0.07 million)
2. Construction of Transportation Route	NPR 400,000 (JPY 0.49 million)
3. Preparation of Underground Route Crossing Main Road	NPR 100,000 (JPY 0.12 million)

Total	NPR 560,000 (JPY 0.68 million)

Source: JICA Study Team

Besides the above-mentioned costs, expenses like the Banking Arrangement (B/A) procedure, Authorization to Pay (A/P) and import permit shall also be covered by the Nepalese side.

2-5-2 Operation and Maintenance Cost

The yearly maintenance management expenses for grid-connected PV system are calculated as shown on Table 2-5-2-1.

Table 2-5-2-1 Maintenance Management Expenses of PV Grid Interconnected System

Item	Yearly Maintenance/Management Cost
1. Routine Administrative Cost	NPR 1,032,000 (JPY 1,259 thousand)
2. Equipment Operation Maintenance Cost and Expenditure	NPR 600,000 (JPY 732 thousand)
3. Equipment (Reserve Fund)	NPR ***,*** (JPY *** thousand)
Total	NPR *,***,*** (JPY *,*** thousand)

Source: JICA Study Team

Basically, the grid-connected PV system is maintenance free and therefore, the required frequency of daily O/M management is minimal. In actual practice, the requirement of O/M management at the engineering level and technical level is assumed to be 1.0 per month of their salary while the security guard level is assumed to be 6.0 per month (2 person x 3 shift) of their salary. The salary of engineer and technician is around NPR 14,000/month and NPR 12,000/month, respectively while that for security guard is NPR 10,000/month. Considering these, the total salary expense would be NPR 1,032,000/year ((NPR 14,000/month x 1.0 MM + NPR 12,000/month x 1.0 MM + NPR 10,000/ month x 6.0 MM) x 12 month) per year.

The parts or components of the grid-connected PV system that are required for replacement in short-term are not included. Therefore, replacement costs are not calculated by piling the components or parts cost. Instead, the O/M and administrative management expenses are assumed to be covered by the amount saved from the electric bills of KUKL. It is the amount of payment possibly reduced by the generated power from the installed grid-connected PV system and reverse power sales to NEA. If it is not necessary to procure any equipment or parts, the savings are allotted for replacement of components in the future, and as a reserved fund for emergency breakdown of equipment or parts.

2-6 Other Relevant Issues

Since the installation site is located in the planned reservoir pond, the basement should be designed in such a way that it will not be affected by water. The top level of the basement should be higher than that of the bank of the reservoir so that it would not affect the PV arrays and steel structure even in the case of maximum water level.

The PV module structure is installed at a height of above 3 m. Therefore, a stable scaffolding and working platform is necessary to prevent workers from falling and dropping objects during installation. At present, people can freely enter the planned installation site. Thus, access control and 24-hour security are required during the construction period.

After installation works, 24-hour security is also required to prevent people and animals from entering the site. (Generally in Nepal, water supply facilities are under 24-hour security control and KUKL says that the new PV facility installed under the project will also be subject to the same security control.)

There is a possibility that birds gather at the reservoir pond. Therefore, measures should be considered to prevent birds from staying and dropping on the PV module.

The above matters should be described in the tender documents.

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

(1) Direct Impact

Power generation by the PV system will be 479 MWh/year.

= 5.0 kWh/m^2-day x 350 kWp x 365 days x 0.75 (System Efficiency)
(5.0 kWh/m^2-day: Average Solar Insolation at the Site (NASA data))
(http://eosweb.larc.nasa.gov/cgi-bin/sse/)

1) Reduction of Electricity Cost

The yearly power consumption of the Sundarighat Water Treatment and Supply Plant is 203 MWh from August 2008 to July 2009. The 479 MWh to be generated by the PV system is around 236% of this power consumption. In this estimation, 100% of the required power of the Sundarighat facility can be covered by the PV system with still a surplus of 276 MWh. The estimated income by selling power to NEA is NPR1.32 million (Approximately JPY1.6 million/year = 276 MWh x NRP4.80/kWh, which is NEA's unit price for PPA generated by micro-hydro).

2) Reduction of CO_2 Emission

Most of the power is generated through hydropower; therefore, it is difficult to estimate the CO_2 emission reduction by the PV system. If the default value of 0.800 t-CO_2/MWh in Nepal is applied correspondingly, the amount of CO_2 reduction by the accumulated power generated from the PV system during the year becomes 383 t-CO_2/year (= 479 MWh/year x 0.800 t-CO_2/MWh)

3) Demonstration Impact

In Nepal, the grid-connected PV system under this assistance plan is the first case. Demonstration of the solution to power shortage to executives and technicians of KVWSMB/KUKL and NEA is expected throughout the process such as during installation work, operation and maintenance as well as other matters like grid-connection technology, contracts and procedures.

The number of beneficiaries of the Sundarighat facility is approximately 50,000 households. The facility supplies drinking water of about 2.5 million liters. Big impact is also expected to the beneficiaries.

(2) Indirect Impact

1) Promotion of Renewable Energy

This project is the first case of grid-connected PV system in Nepal. Therefore, familiarization and promotion of power generation through renewable energy and power trade with power grid are expected.

By showing that water, which is necessary for people to survive, can be supplied using renewable energy, this project can provide impact to not only the power sector but also water supply projects.

Additionally, soft component done as part of this project can serve as capacity development for engineers not only on the PV power generation side but also on the grid side since the component contains technology transfer of operation and maintenance of grid-connected PV system and trouble shooting.

2) Awareness

The site can be viewed from the road to the famous temple and Terai plain near the Indian border; therefore, public awareness on the PV system and renewable energy is expected.

Through the soft component implemented as part of this project, the role of the PV system and countermeasures against global warming will be well recognized. Also, the thinking of the people regarding effective energy use will be improved.

3-2 Recommendation

This project is the first case of grid-connected PV system in Nepal. Therefore, there are lots of problems to be solved. The following are the major problems and corresponding recommendations:

Problems

- There is no current technical standard for grid-connected PV system.
- There is no available technician for grid-connected PV system.
- There is no existing scheme to promote renewable energy for grid connections.

Recommendation

- It is necessary to establish technical standard for grid-connected PV system.
- It is necessary to develop training manuals for engineers.
- It is necessary to organize environmental scheme and organization for promoting activities using the installed facilities.

Appendices

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Soft Component (Technical Assistance) Plan

1. Member List of the Study Team

Mr. Tomoyasu FUKUCHI	Consultant Team Leader / Grid-Connection PV System
Mr. Deepak Bista	Deputy Consultant Team Leader / PV System Technology
Mr. Sadatsugu TORIBAMI	Equipment and Facility Planning
Mr. Ryosuke OGAWA	Procurement Planning / Cost Estimation (2)
Mr. J M PRADHAN	Institution and Standards / Grid Operation
Ms. Mika MATSUMURA	Environmental and Social Considerations / Evaluation of Greenhouse Gas Reduction

2. Study Schedule

Mr. Tomoyasu FUKUCHI Consultant Team Leader / Grid-Connection PV System

- 1st Site Survey: July 2 to July 5 and July 18 to July 27, 2009
- 2nd Site Survey: October 12 to October 20, 2009
- 3rd Site Survey: March 22 to March 28, 2010

Mr. Deepak Bista Deputy Consultant Team Leader / PV System Technology

- 1st Site Survey: July 2 to July 5 and July 18 to July 31, 2009
- 2nd Site Survey: October 3 to October 20 and November 21 to December 6, 2009
- 3rd Site Survey: March 19 to March 28, 2010

Mr. Sadatsugu TORIBAMI Equipment and Facility Planning

- 2nd Site Survey: October 17 to October 25, 2009

Mr. Ryosuke OGAWA Procurement Planning / Cost Estimation (2)

- 1st Site Survey: July 18 to August 3, 2009
- 2nd Site Survey: November 28 to December 27, 2009

Mr. J M PRADHAN Institution and Standards / Grid Operation

- 1st Site Survey: July 1 to July 9 and July 18 to August 8, 2009
- 2nd Site Survey: October 1 to October 24 and November 18 to December 11, 2009
- 3rd Site Survey: February 1 to February 9, 2010

Ms. Mika MATSUMURA Environmental and Social Considerations / Evaluation of Greenhouse Gas Reduction

- 2nd Site Survey: October 18 to October 25, 2009

3. List of Parties Concerned in the Recipient Country

Kathmandu Valley Water Supply Management Board (KVWSMB)	Mr.Hari Prasad Dhakal	Executive Director		(977)1-4106182
Kathmandu Upatyaka Khanepani Limited (KUKL)	Mr. Rudra Gautam	Managing Director		(977)1-4262202/3/5
Kathmandu Upatyaka Khanepani Limited (KUKL)	Mr. Gyanesh Nanda Bajracharya	Deputy General Manager		(977)1-4259845
Kathmandu Upatyaka Khanepani Limited (KUKL)	Mr. Chandra Lal Nakarmi	Technical Manager	Technical Division	(977)1-4262203
Kathmandu Upatyaka Khanepani Limited (KUKL)	Mr. Kalyan Singh Thapa	Admin & Finance Manager	Adminstration and Finance Division	(977)1-4262202/5
Kathmandu Upatyaka Khanepani Limited (KUKL)	Mr. Tilak Mohan Bhandari	Acting Manager		(977)1-4262317
Kathmandu Upatyaka Khanepani Limited (KUKL)	Mr. Sanjeev Bikarm Rana	Assistant Manager		
Kathmandu Upatyaka Khanepani Limited (KUKL)	Mr. Indra Kumar Maharjan	Branch Manager	Electro-Mechanical Section, Sundarighat	(977)1-4352115
Alternative Energy Promotion Center (AEPC)	Dr.Narayan Prasad Chulagain	Executive Director		(977)1-5548468/ 5539237/5539390 /1
Alternative Energy Promotion Center (AEPC)	Mr.Surya Kumar Sapkota	Sr. Planning Officer	Policy, Planning and Resource Mobilisation Division	(977)1-5539390/1
Alternative Energy Promotion Center (AEPC)	Ms. Resha Piya	Programme Officer	Energy Sector Assistance Programme (ESAP), Solar Energy Component	(977)1-5539390/2
Alternative Energy Promotion Center (AEPC)	Mr. Niraj Subedi	Programme Officer	Energy Sector Assistance Programme (ESAP), Solar Energy Component	(977)1-5539390/2
Nepal Electricity Auhority (NEA)	Mr. Kul Man Ghising	Manager	Power Trade Department	(977)1-4228128
Nepal Electricity Auhority (NEA)	Mr. Rishi Kesh Sharma	Director	Environmental & Social Studies Department	(977)1-4226730
Nepal Electricity Auhority (NEA)	Mr. Shiv Chandra Jha	Deputy Managing Director	Planning, Monitoring & Information Technology Department	(977)1-4227976
Nepal Electricity Auhority (NEA)	Mr. Yugal Kishor Shah	General Manager	Transmission & Syatem Operation	(977)1-4229455, 4252861 Ext. 3302
Nepal Electricity Auhority (NEA)	Mr. Sher Singh Bhat	Director	System Operation Department, Siuchatar	(977)1-4272176, 4278015
Nepal Electricity Auhority (NEA)	Mr. S.R. Pandey	Chief	Pulchowk Distribution Center	(977)1-5548266, 5523016, 5551422
Ministry of Environment	Mr. Bhai Kaja Manandhar	Senior Divisional Engineeer	EIA Division	(977)1-4211860
Ministry of Environment	Ms. Er-Meena Joshi	Sinior Engineet/ EIA Analist	EIA Division	(977)9741059057 (Mobile)
Ministry of Finance	Mr. Bimal Sapkota	Section Officer	Foreign Aid Coordination Division	(977)1-4211303
Ministry of Finance	Mr. Devi Prasad Sharma	Section Officer	Foreign Aid Coordination Division	(977)1-4211303
Tribuban University Central Library	Mr. Krishna Mani Bhandary	Librarian		(977)1-4330834, 4331317
Tribuban University Central Library	Ms. Bina Vaidya	Associate Librarian		(977)1-4330834, 4331317

4. Minutes of Discussions

"Minutes of Discussions" are attached in following pages.

1st Site Survey / Minutes of Discussion

1st Site Survey / Memorandum of Understanding of Technical Matter

2nd Site Survey / Memorandum of Understanding of Technical Matter

3rd Site Survey / Minutes of Discussion

1st Site Survey / Minutes of Discussion

Minutes of Discussions
on the Preparatory Survey
on the Project for Clean Energy Promotion Using Solar Photovoltaic System

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

JICA sent to Nepal the Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Ryuji MATSUNAGA, Deputy Director General, Office for Climate Change, JICA, and scheduled to stay in the country from July 19 to July 25.

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

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

Kathmandu, July 23, 2009

Ryuji Matsunaga
Leader
Preparatory Survey Team
Japan International Cooperation Agency
JAPAN

Hari Prasad Dhakal
Executive Director
Kathmandu Valley Water Supply Management Board
NEPAL

Rudra Gautam
Managing Director
Kathmandu Upatyaka Khanepani Limited

Witnessed by:

Kul Man Ghising
Manager
Power Trade Department
Nepal Electricity Authority

ATTACHMENT

1. Current Situation

Nepal, one of the countries potentially vulnerable to and significantly affected by climate change, has initiated for the formulation of National Climate Change Policy for Nepal. The government is also tackling with increasing electricity demand in the urban areas, which exceeds its supply at peak time. Therefore, it is highly demanded to reduce greenhouse gas emissions by introducing and promoting clean solar photovoltaic system in the country. Furthermore, the introduction and promotion of the grid-connected solar electricity generation system shall also contribute to the mitigation of the current electricity supply shortage. In response to the situation as well as based on the official request from the Government of Nepal, main items on the project formulation for promoting clean solar photovoltaic system were discussed and confirmed between Nepalese and Japanese sides.

2. Objective of the Project

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

3. Responsible Organization and Implementing Agency

The responsible organization is Kathmandu Valley Water Supply Management Board (hereinafter referred to as "KVWSMB"). (The organization chart of the responsible ministry is shown in Annex-1)

The implementing agency is the Kathmandu Upatyaka Khanepani Limited (hereinafter referred to as "KUKL"). (The organization chart of the implementing organization is shown in Annex-2.)

4. Items Requested by the Government of Nepal

4-1. After discussions with the Team, the installation of the on-grid power generating system using photovoltaic including following equipment was requested by the Nepalese side.
   (1) Photovoltaic (PV) Module (Panel) (total capacity might be around 200kw)
   (2) Junction Box
   (3) Power Conditioner
   (4) Transformer
   (5) Data collecting and display device

4-2. The Dhobi Ghat Reservoir is the first priority while Mharajgunj Reservoir is the second priority for a project site/facility, according to KVWSMB and KUKL, to install the system as shown in Annex-3.

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

4-4. The Nepalese side has understood that the final component and the design of the Project shall be determined (confirmed) at the timing of 2nd phase of the Preparatory Survey.

4-5. The Team will report the findings and items requested by the Nepalese side to JICA Headquarters and the GoJ.

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

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

6. Schedule of the Study

6-1. The Team will proceed to further survey in Nepal until August 8, 2009 as the 1st phase of the Preparatory Survey.

6-1. After the completion of the 1st phase of the Preparatory Survey, the Team will report the results to JICA Headquarters and GoJ.

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

7. Other Relevant Issues

7-1. Major Undertakings to be take by Each Government

The Nepalese side confirmed that major undertakings as shown in Annex-8 should be taken by Nepalese side at its own budget. In addition, the Nepalese side should be responsible for the following issues:

(1) Securing necessary land
-for PV Modules

(2) Tables and PCs, if necessary

7-2 Procurement of Equipment and Materials

The team explained that the major Equipment and Materials for the Program Grand Aid for Environment and Climate Change will be made in Japan, or made by Japanese manufactures wherever, which is under consideration by the Ministry of Foreign Affairs in Japan, in accordance with the policy of G of J, products of Japan shall be procured for major equipment in the Project. The Nepalese side agreed with the policy of Go J and requested that the major Equipment and Materials shall be made in Japan.

7-3 Coordination with Related Organizations

The Implementing Agency of the Project (KUKL) shall be the focal point for the Team, and responsible for the coordination with related organizations.

7-4 Establishment of the Consultative Committee

For the effective implementation of the Programme and utilization of the Grant as shown in Annex 9, the Consultative Committee shall be established and organized. The Committee, coordinated and chaired by KVWSMB, consists of members from both sides, including KUKL, Alternative Energy Promotion Center, Nepal Electricity Authority, the Embassy of Japan, JICA

Nepal Office, and other related bodies as shown in Annex 6.

7-5 Application of the Related Laws and Regulations

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

7-6 Environmental and Social Consideration

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

7-7 Operation and Maintenance

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

7-8 Power Purchase Agreement (PPA) between KUKL and NEA

KUKL will coordinate with NEA to apply for PPA to ensure that the solar system would be properly connected to the national grid and that generated electricity in surplus shall be sold to NEA.

7-9 Customs and Tax exemption

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

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

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

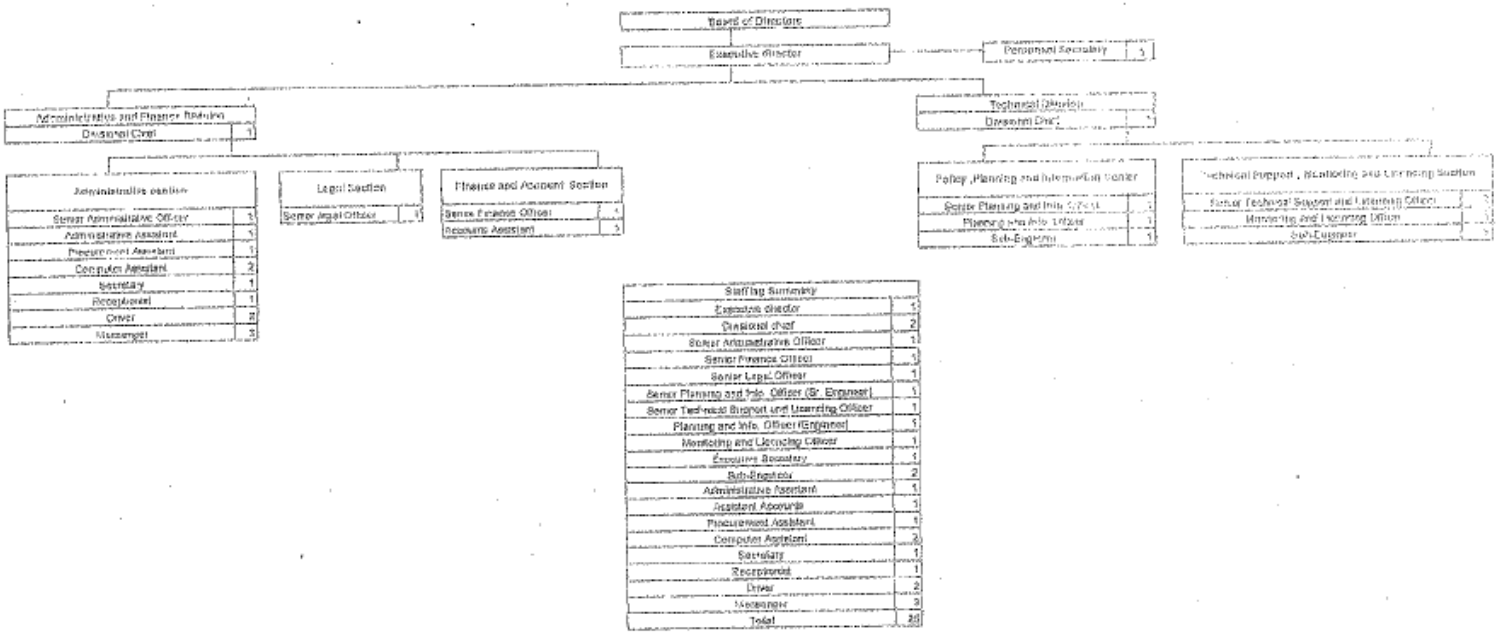
7-12 The Nepalese side shall submit all the answers to the Questionnaire, which the Team handed to the Nepalese side, by August 8, 2009.

<List of Annex>

Annex - 1

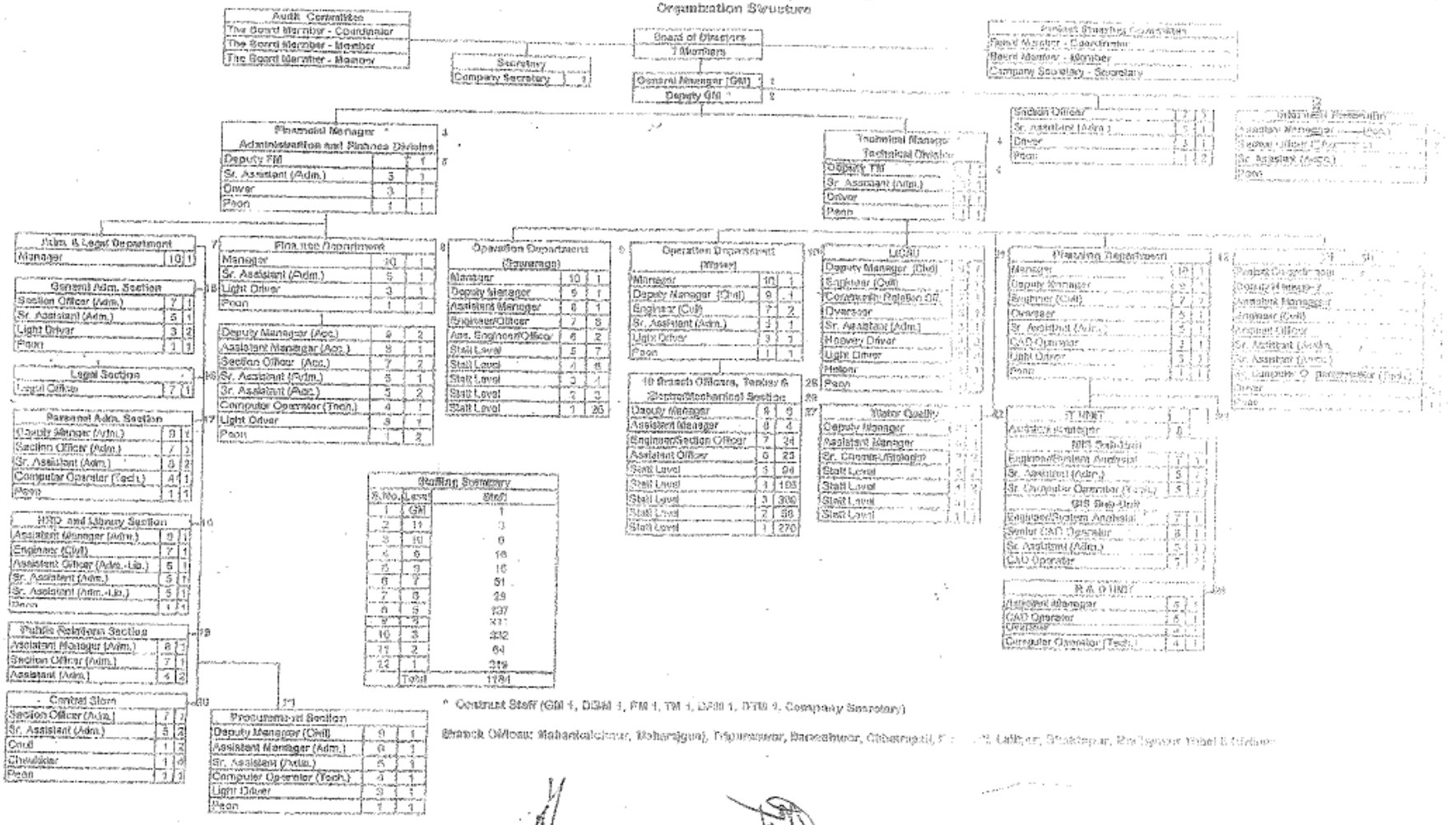
Kathmandu Valley Water Supply Management Board

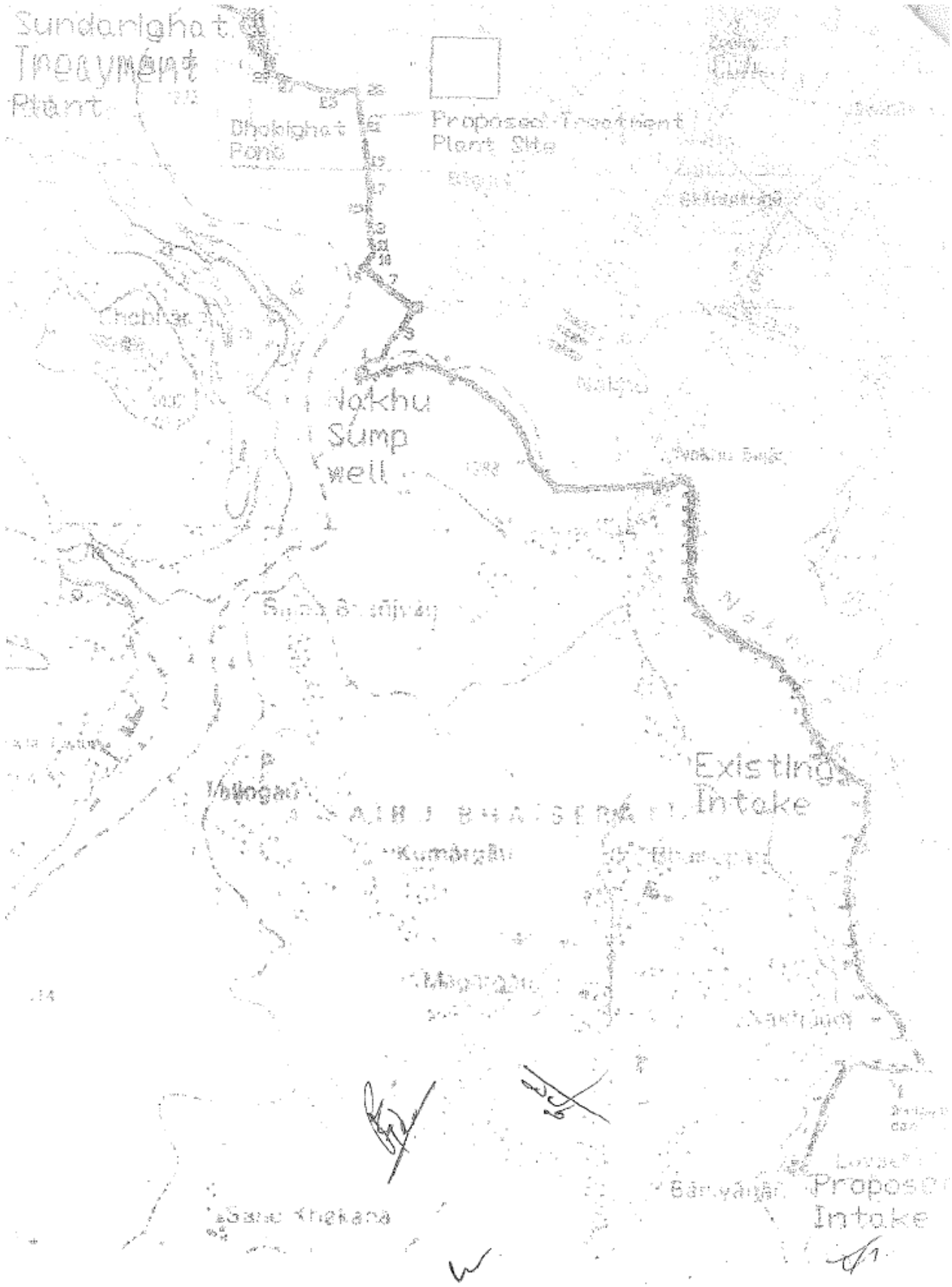
Organizational Structure

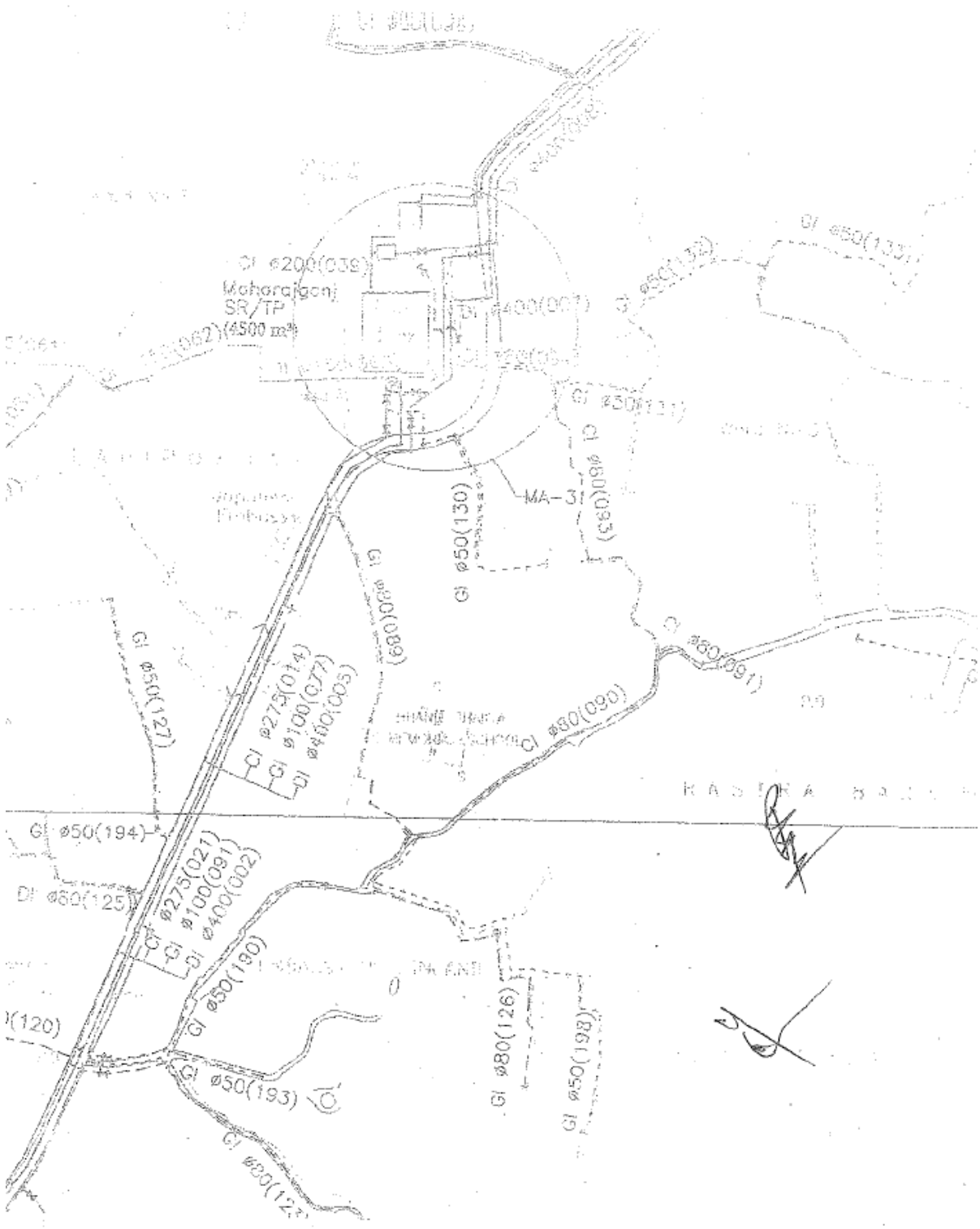


Kathmandu Upatyaka Khanepani Limited

Organization Structure




Sundarighat
Treatment
Plant
Dhakighat
Pond
Proposed Treatment
Plant Site
Nakhu
Sump
well
Existing
Intake
Proposed
Intake


Maharajganj
SR/TP
(4500 m³)
MA-31
KADIRA

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

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

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

1. Procedures for GAEC

GAEC is executed through the following procedures.

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

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

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

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

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

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

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

2 Preparatory Survey

1) Contents of the Survey

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

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

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

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

2) Selection of consulting firms

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

3. Implementation of GAEC after the E/N

1) Exchange of Notes (E/N)

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

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

2) Details of Procedures

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

Essential points to be agreed are outlined as follows:

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

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

a) The Agent

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

b) Agent Agreement

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

c) Approval of the Agent Agreement

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

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

d) Payment Methods

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

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

e) Products and Services Eligible for Procurement

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

f) Selection of firms

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

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

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

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

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

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

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

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

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

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

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

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

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

(2) Other procurements

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

l) Conclusion of the Contracts

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

m) Terms of Payment

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

4) Undertakings required by the Government of the Recipient Country

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

a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.

b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites.

c) To ensure all the expense and prompt unloading and customs clearance at the port of disembarkation and domestic transportation of products purchased under the Grant Aid.

d) To ensure that customs duty, internal taxes and other fiscal levies that may be imposed in the Recipient with respect to the purchase of the Components and the Agent's services will be exempted by the Government of the Recipient.

e) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into the Recipient and stay therein for the performance of their work.

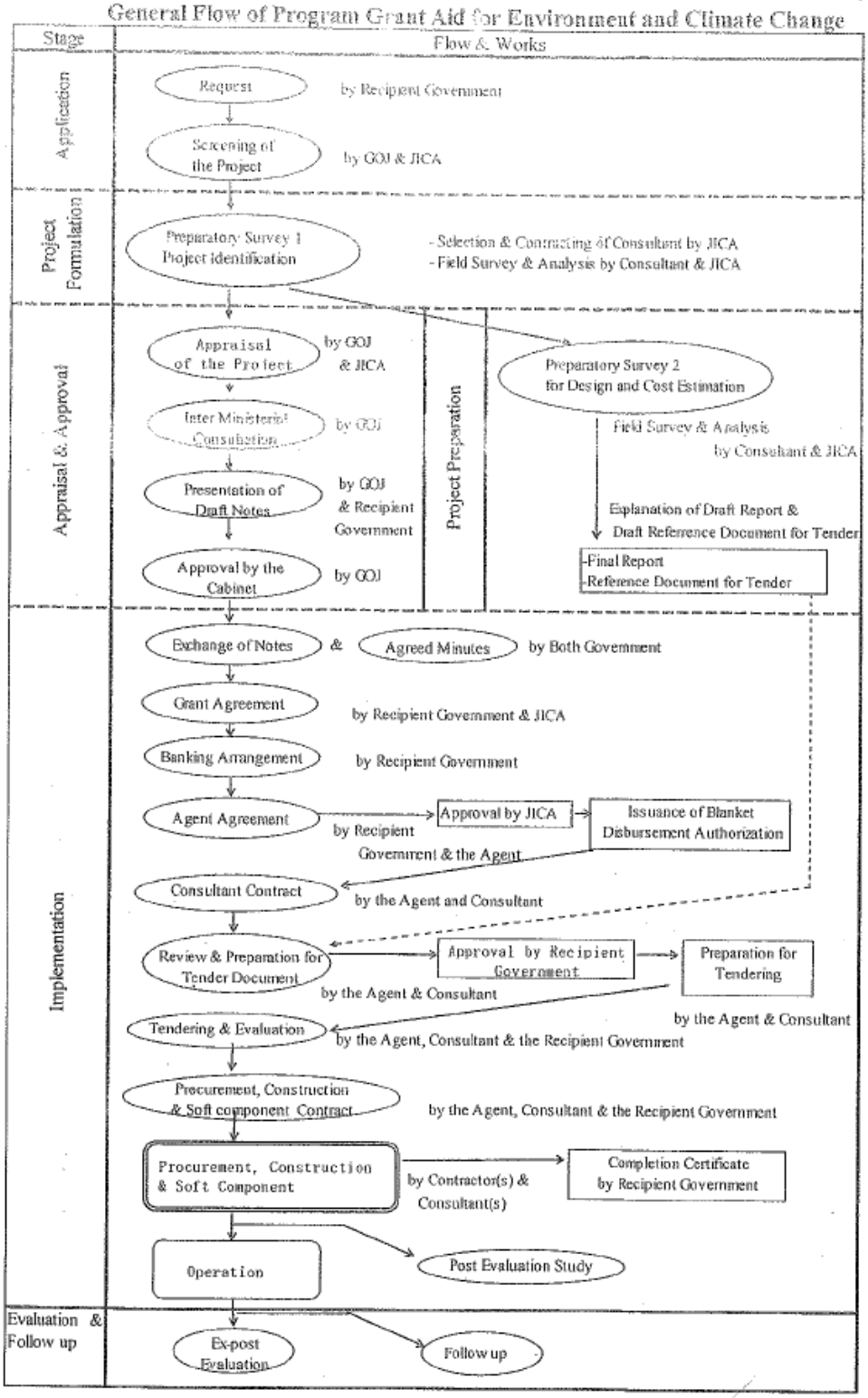
5) "Proper use of funds"

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

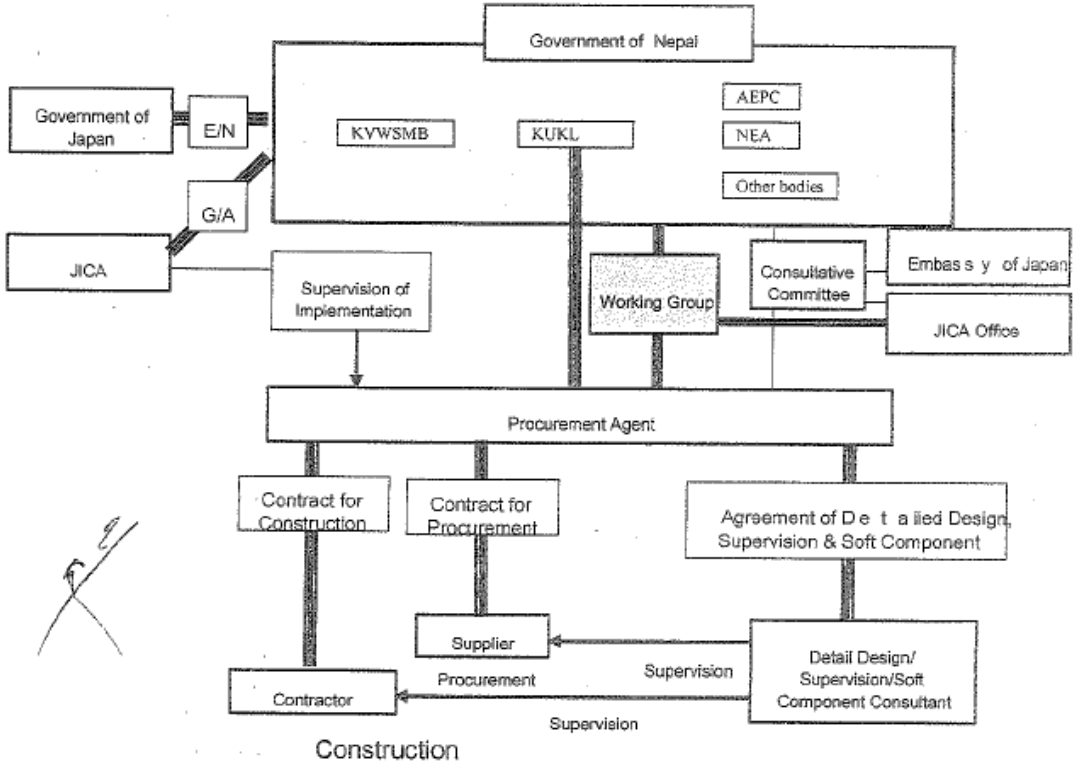
6) "Export and Re-export" of products

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

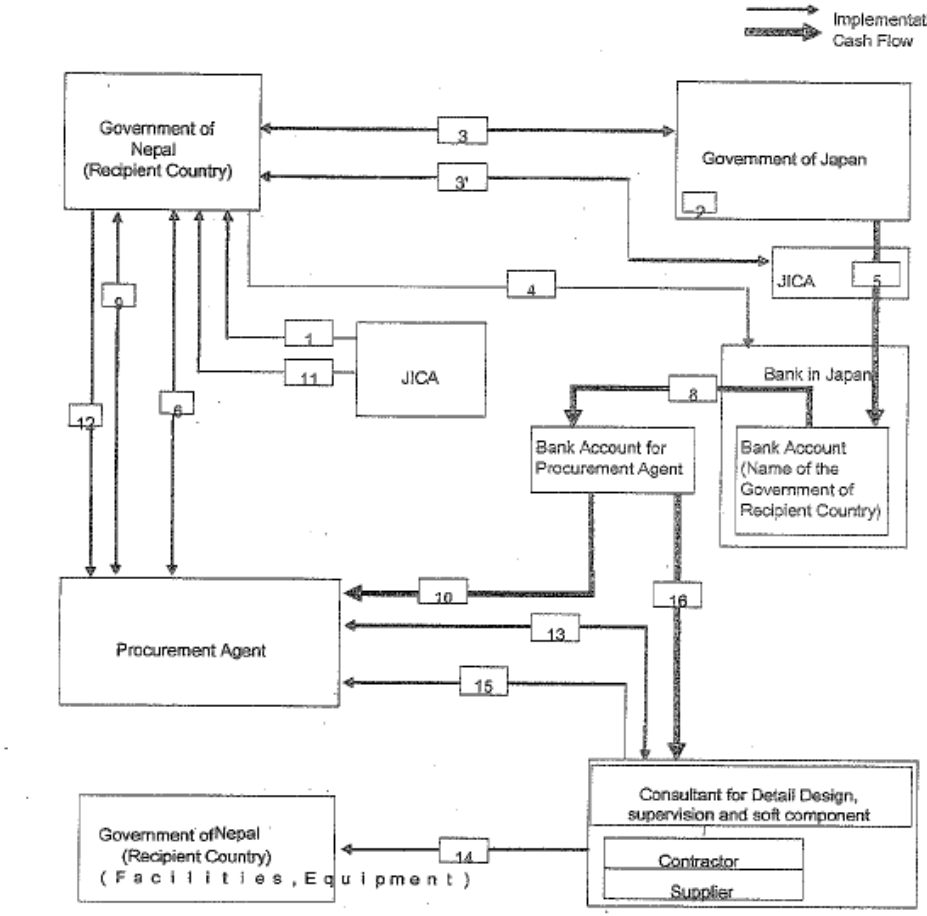
General Flow of Program Grant Aid for Environment and Climate Change



Project Implementation System



Flow of Funds for Project Implementation



1 Preparatory Survey / Reference Document for Tender

2 Approval of Cabinet

3 Signing of Exchange of Notes (E/N)

3' Signing of Grant Agreement (G/A)

4 Banking Arrangement (B/A)

5 Disbursement of Funds from the Government of Japan

6 Signing of Agent Agreement (A/A) + B D A

7 N/A

8 Transfer of Funds

9 Decision of Project Components

10 Payment of Remuneration for Agent

11 Recommendation of Consultant for Detail Design/Supervision (JICA→ Government of Nepal)

12 Recommendation of Consultant for Detail Design / Supervision (Government ofNepal → Procurement Agent)

13 Conclusion of Contract

14 Construction and Procurement

15 Application for Payment

16 Payment

Major undertakings to be taken by each Government

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

Terms of Reference of the Consultative Committee (Provisional)

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

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

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

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

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

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

MEMORANDUM OF UNDERSTANDING ON TECHNICAL MATTER

FOR

PREPARATORY SURVEY ON THE PROJECT FOR CLEAN ENERGY PROMOTION USING SOLAR PHOTOVOLTAIC SYSTEM IN NEPAL

among
JICA Consultant Survey Team
and
Kathmandu Valley Water Supply Management Board
and
Kathmandu Upatyaka Kanepani Limited
and
Nepal Electricity Authority

Kathmandu
July 30, 2009

Mr. Deepak Bahadur Bista
Sub-Team Leader,
JICA Consultant Survey Team
Nippon Koei Co., Ltd.

Mr. Hari Prasad Dhakal
Executive Director,
Kathmandu Valley Water Supply
Management Board (KVWSMB)
NEPAL

Mr. Rudra Gautam
Managing Director,
Kathmandu Upatyaka
Khanepani Limited (KUKL)
NEPAL

Witnessed by :

Mr. Kul Man Ghising
Manager
Power Trade Department
Nepal Electricity Authority (NEA)
NEPAL

The Consultant Survey Team (the Consultant Team) of the Japan International Cooperation Agency (JICA), which is headed by Mr. Tomoyasu FUKUCHI, continuously stayed in Nepal after the official survey team of JICA left Kathmandu on July 24, 2009 for the further survey on technical matter. The Consultant Team and Kathmandu Upatyaka Kanepani Limited (KUKL) jointly conducted the further survey and discussed the technical matter of the Project for Clean Energy Promotion Using Solar Photovoltaic System (the Project). The team confirmed the mutual understanding on the Project as shown below. The Consultant Team will leave Kathmandu on August 3, 2009.

1. **Installation Site** : The first priority for installation of Photovoltaic (PV) system is at Dhobighat water storage pond (KUKL Dhobighat site) and as second priority (as option) is at Panipokhari pumping/supplying plant (KUKL Panipokhari site). To decide Panipokhari site, detail survey of existing water storage tank is essential.

   The Dhobighat water storage pond and Panipokhari site is under control of Kathmandu Valley Water Supply Management Board (KVWSMB). KUKL is the implementing agency of KWSMB and KUKL will obtain the necessary permission and/or take the necessary procedure in due form for installation of PV system if required. The installation site of Dhobighat is shown in Attachment-1 and the installation site of Panipokhari is shown in Attachment-2.

2. **Installation Capacity** : The installation capacity of PV panel is 200 kWp.

   The Consultant Team will prepare the initial design of the Project based on the above installation capacity. The Consultant Team, however, will report the existence of the space in which it is available to install PV panel beyond the capacity of 200 kWp to JICA.

3. **Security for PV power generation project site** : KVWSMB and KUKL has agreed to the JICA official Team in the meeting held with them on July 23, 2009 to arrange good secured 24 hour security at KUKL site.

4. **Grid Connection** : The PV system will be connected to the distribution line of Nepal Electrical Authority (NEA). NEA gave the commitment for the PV system to be able to connect to the distribution line to the JICA official Team in the meeting held with them on July 21, 2009.

5. **Synchronization** : The PV system will synchronize with distribution line at the Sundarighat water treatment plant, will connect with NEA grid. The PV system will be designed to supply electricity only when being synchronized with the grid electricity. The PV system will not be synchronized with any

emergency and/or back-up power sources like the emergency diesel generator of KUKL.

6. **Stockyard** : The place of the stockyard to store the materials and equipment to be installed at the sites will be designated. The stockyard shall be secured good access, security and space enough to work for loading and unloading, and inspection of them. The required space will be informed after finalization of detail deign.

7. **License of Generation** : KUKL will obtain the license of generation from Department of Electricity Development (DoED) immediately after the design of the PV system being finalized (if necessary).

8. **Connection Agreement** : KUKL will have the agreement on connecting PV system to the distribution lines with NEA immediately after the license of generation being obtained.

9. **Focal Point** : Mr. Tilak Mohan Bhandari was designated as the focal point of the Preparatory Survey (the Survey). The focal point will coordinate KVWSMB, NEA, KUKL. KVWSMB and KUKL request to designate focal points of all other organizations concerned at practical working level for the Survey.

10. **Questionnaires** : The questionnaires are shown in Attachment-3. The answer of the questionnaires will be sent to Mr. J. M. Pradhan (cc to Mr. D. B. Bista and Mr. T. Fukuchi) by e-mail by the end of August, 2009. The e-mail addresses of them are shown below.

Mr. J. M. Pradhan:	jmpradhan51@yahoo.com
Mr. D. B. Bista	deepak-bista@island.dti.ne.jp
Mr. T. Fukuchi:	fukuchi-tm@n-koei.jp

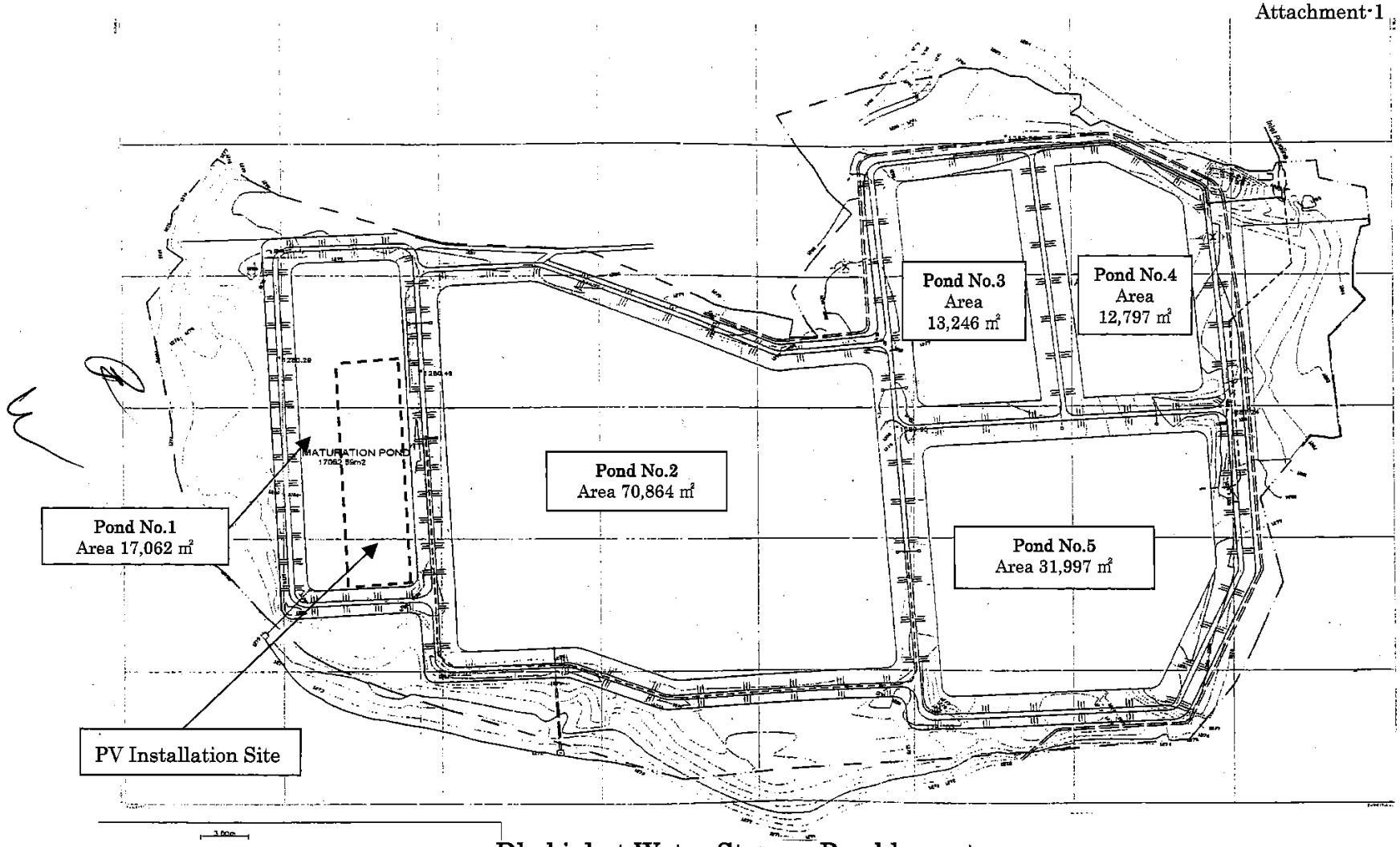
11. **Next Site Survey** : The next site survey is scheduled to be conducted from the beginning October to the beginning of November 2009.

End

Attachment

1. Installation Site of PV System in Dhobighat water pond.
2. Installation Site of PV System in Panipokhari pumping/supplying plant.
3. Questionnaires

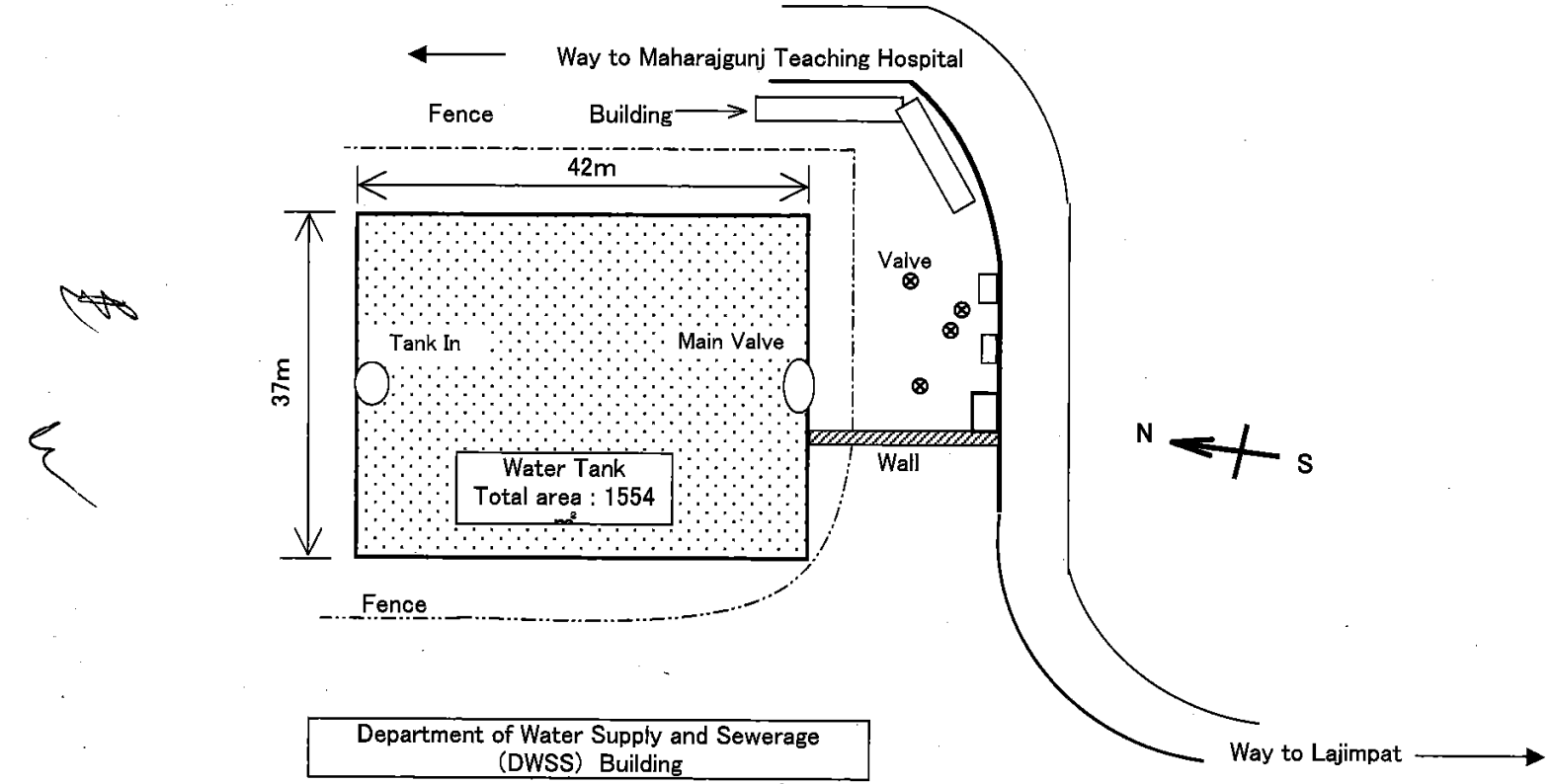
Attachment-1



Dhobighat Water Storage Pond lay out

Attachment -2

Panipokhari pumping/supplying plant lay out



Note : Not in scale

Attachment-3

INFORMATION REQUIRED FROM NEPAL

July 30, 2009

A. ACTS, REGULATIONS, RULES:

Request to Line Ministry MOWR/ DoED

1. Policy and Strategies of Power sector
2. Legislative and Regulatory frame work related to Power Sector like: Electricity act, Regulations etc
3. Institutional arrangement for electric industry

Request to NEA

1. Single line diagram of Patan and Kirtipur Area
2. 11kV system diagram shown in map of Patan and Kirtipur Area
3. NEA Grid Code document
4. Grid operation Standards
5. Transmission and Distribution Planning Criteria
6. Transmission Construction Standard
7. Distribution Construction Standard

B. INFORMATION RELATED TO POWER PURCHASE AGREEMENT:

Request to NEA

1. NEA Guide line for PPA application.
2. Typical PPA document (preferably for PV cell if exists or Wind power or BIOMAS or Small Hydro Power Project less than $\leq$500 kW)
3. Typical connection arrangement (schematic diagram with equipments, protection, metering scheme) required for the PPA for reference
4. Type of meters, specification of meters, accuracy class, specification etc required at connection point.
5. Type of instrument transformer, specification of transformer, accuracy class, specification etc required at connection point.
6. Any other mandatory and specific requirement for the connection agreement switching, protection etc at connecting point with NEA.
7. If there is any IPP connected to distribution system (embedded generator) i.e. at 11kV, or 400V, please provide the typical connection diagram for reference.
8. Electricity Tariff for IPP $\leq$ 25MW
9. Typical Operation code for embedded generator (IPP) for reference
10. Type of PPA agreement for embedded generator : a) take or pay b) give or pay c) net metering

C. STANDARDS:

1. Design Standard of construction (Civil) in English if it is required for the project.
2. Quantity Survey Standard of electricity works, mechanical works, labors and other engineering works in English if it is required for the project.

D. RENEWABLE ENERGY (PV System)

1. Record of past projects of PV systems within the country carried out by Nepal Government with detail break downs i.e. detail of installation site, year of installation, capacity, purpose, present status, budgets, implementing agency and so on.
2. Record of past projects supported by international donor agencies with detail break down i.e. detail of installation site, year of installation, name of donor agency, capacity, purpose, present status, system cost, implementing agency and so on.
3. List of future plan, proposed site detail, budgets, purpose and so on.
4. Detail of guideline, policy, standards to establish PV systems (if any).

MINUTES OF UNDERSTANDING
ON TECHNICAL MATTER
FOR
PREPARATORY SURVEY ON THE PROJECT FOR CLEAN ENERGY PROMOTION USING SOLAR PHOTOVOLTAIC SYSTEM
IN
NEPAL

among
JICA Consultant Survey Team
and
Kathmandu Valley Water Supply Management Board
(Responsible Organization)
and
Kathmandu Upatyaka Kanepani Limited
(Implementing Agency)
and
Nepal Electricity Authority
and
Alternative Energy Promotion Center

Kathmandu
December 4, 2009

Mr. Deepak BISTA
Sub-Team Leader,
JICA Consultant Survey Team
Nippon Koei Co., Ltd.

Mr. Hari Prasad Dhakal
Executive Director,
Kathmandu Valley Water Supply
Management Board (KVWSMB)

Mr. Rudra Gautam
Managing Director,
Kathmandu Upatyaka Khanepani Limited (KUKL)

Witnessed by:

Mr. Kul Man Ghising
Manger,
Nepal Electricity Authority (NEA)

Mr. Surya Kumar Sapkota
Sr. Planning Officer,
Alternative Energy Promotion Center (AEPC)

The Consultant Survey Team (JICA survey team) of the Japan International Cooperation Agency (JICA), which is headed by Mr. Tomoyasu FUKUCHI, conducted the 2nd site survey from October 1 to today and continues the survey till October 26 and again will conduct the survey from November 17 to December 27, 2009. The understanding among Kathmandu Valley Water Supply Management Board (KVWSMB), Kathmandu Upatyaka Khanepani Limited (KUKL), Nepal Electricity Authority (NEA) and Alternate Energy Promotion Center (AEPC), on the 2nd site survey, the parties confirmed the following matters.

1. **Installation Site and Interconnection** : The Photovoltaic (PV) power generation interconnected with NEA grid is decided to install at Dhobighat water storage pond (KUKL Dhobighat site), synchronizing with NEA grid at Sundarighat Water Treatment Plant site with to separate feeder namely Kirtipur Feeder from Take substation and Ropeway Feeder from Siuchatar Substation.

2. **Installation Capacity** : The installation capacities of PV panel is planned to be 200 kWp at Dhobighat site.
   The Consultant team, however, will report the strong request of KUKL/KVWSMB that even thought the Paniphokhari site is dropped out, the decided total budget should be used for Dhobighat site increasing installation capacity.

3. **Process of Licensing** : From the Electricity Act 1992, Provided that no license shall be required to be obtained by national or a corporate body for the generation, transmission or distribution of electricity up to 1,000 kW and for conducting necessary survey thereof. Before generating transmitting or distributing hydroelectricity of the capacity ranging from 100 kW to 1000 kW, information to that effect shall be given to the prescribed officer in a manner as prescribed. From this, KVWSMB submitted information letter to Department of Electricity Development Board (DoED) for proposed ON grid PV power generation system interconnecting with NEA grid, through and the line ministry on 12th October 2009 for prior notice. KUKL/KVWSMB will inform and provide copy of approval letter from DoED to JICA survey team as soon as possible. For this, if incase KUKL/KVWSMB needs to submit technical information related to PV power generation system interconnecting with NEA grid, JICA survey team will assist.

4. **Process of Interconnection and Power Purchase Agreement (PPA) with NEA** : After getting License or Permission to install PV power generation system interconnecting with NEA grid, KUKL/KVWSMB will submit required documents to NEA for PPA and connection agreement after signing E/N. For this, JICA survey team will provide the related technical support on PV power generation and interconnection to NEA grid.

5. **Environment Protection** : The KUKL/KVWSMB submitted the information letter of PV power generation interconnecting with NEA grid to the Ministry of Environment (MoE) through line ministry for their study to verify the requirement of EIA or IEE. The MoE forwarded the letter to Alternate Energy Promotion Center (AEPC) for their record and information on 13th October 2009.

   From the meeting held on 29th November 2009, at KUKL, it is understood that for renewable energy projects, EIA or IEE has not been carried out up to date. For further detail KUKL/KVWSMB is enquiring to MoE.

6. **Energy Meter (WHM)** : From the meeting held on 29th November 2009 at KUKL, confirmed that should install one bidirectional energy meter to record import and export of power and one check meter at each NEA feeder. For this, KUKL/KVWSMB shall write a letter to get required specifications of Energy Meter (WHM) and its component/instrument from NEA and provide information to JICA survey team until 21st December 2009.

7. **Tax procedures** : The KUKL/KVWSMB need to apply for tax exemptions to Ministry of Finance after E/N through their line Ministry. If in case tax is required than KUKL/KVWSMB and line Ministry will take responsibility and will arrange as per rule of Federal Government of NEPAL.

8. **Stockyard** : The place of the stockyard to store the materials and equipment to be installed at the sites will be designated. The stockyard shall be secured good access, security and space enough to work for loading and unloading, and inspection of them. The required space will be informed after finalization of detailed deign.

9. **3rd Site Survey** : The 3rd site survey is scheduled to be conducted in February 2010.

End

ATTACHMENT

1. **Components of the Draft Final Report**

Kathmandu Valley Water Supply Management Board (hereinafter referred to as "KVWSMB") and Kathmandu Upatyaka Khanepani Limited (hereinafter referred to as "KUKL") agreed and accepted in principle the components of the Draft Final Report explained by the Team.

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

The Nepalese side understood components of the Minutes of Discussion signed by both sides on 23rd July, 2009 (hereinafter referred to as "the previous M/D"), and would take the necessary measures confirmed on the previous M/D for smooth implementation of the Program following procedures of the Program Grant Aid for Environment and Climate Change of the Government of Japan as shown in **Annex-1**.

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

3.1. Project site and capacity of PV module

Both sides confirmed that project site is Dhobi Ghat Reservoir. The Team explained that the capacity of PV module can be increased up to 350 kW by the result of outline design and cost estimation. Nepalese side accepts the change.

3.2. Official permission to set the PV system on the site for the Program

Both sides confirmed completion of necessary procedures for official permission from related organizations to set the PV system in the project site.

4. **Items of Equipment to be procured**

The Team explained that the items of equipment to be procured as shown in **Annex-2** based on the result of the Preparatory Survey conducted in August 2009. After discussion, both side confirmed to procure the major equipment such as PV module, Power Conditioner and Transformer should be products of Japan, and products of third country are acceptable for other equipment.

5. **Procurement Process of the Program**

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

(1) The Agent renders the services stipulated in the provisions of the G/A as well as the E/N for the Program;

(2) The Agent will undertake the procurement procedure necessary for the Program according to the provisions of the G/A and E/N and any other concerned guidelines
(3) JICA will provide the draft Final Report and Final Report to the Agent; and
(4) The Agent will commence the procurement according to the contents of the Final Report of the Outline Design.

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

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

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

6. Project Cost

The Nepalese side agreed that the cost for the Program should not exceed the upper limit of amount agreed on in E/N. Both sides also confirmed that the cost for the Program contains procurement cost of equipment, the cost for transportation up to the site for the Program, installation cost, the Agent fee, and the cost for soft component for the technical support of operation and maintenance of equipment.

7. Confidentiality of the Program

(1) Detailed specifications of the Facilities

Both sides confirmed that all the information related to the Program including detailed drawings and specifications of the facilities and equipment and other technical information shall not be released to any outside parties (i.e. outside of JICA, Nepalese side and the Agent) before conclusion of all the contract(s) for the Program.

(2) Confidentiality of the Cost Estimation

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

8. The Consultative Committee

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

The members of the Committee are as follows:

(1) Representative(s) of KVWSMB (Chair)
(2) Representative(s) of KUKL
(3) Representative(s) of Ministry of Finance
(4) Representative(s) of Ministry of Physical Planning and Works
(5) Representative(s) of JICA Nepal Office

The first meeting of the Committee shall be held after the signing of the contract between the Agent and the consultant. Further meetings shall be held upon request of either the Nepalese side or the Japanese side. The Procurement Agent may advise both sides on the necessity to call a meeting of the Committee.

9. Other Relevant Issues

9.1. Undertakings required by the Nepal Country

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

(1) Land usage for PV system

The owner of the land for the following equipment and materials for PV system is KVWSMB and the implementation organization is KUKL. Therefore, the Nepalese side has reconfirmed that there is no objection for the implementation of the Program.

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

(2) Generated Energy by PV system

The purchased tariff of power generated by PV system shall be determined by the end of March, 2011 by Nepalese side. The Japanese side shall assist the Nepalese side through soft component during the implementation of the Program.

(3) Environmental and Social Considerations

The Nepalese side shall finalize about the issue related with IEE/EIA as soon as possible (by the end of April 2010 at the latest) and shall apply for IEE/EIA after the final report is submitted if required. Nepalese side will inform JICA Nepal Office about outcome of the process.

(4) Application of the Related Laws and Regulations

The Nepalese side agreed the structural design for the installation of PV system shall comply with the Architectural Regulation in Japan and Nepal.

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

The Nepalese side agreed that the KUKL shall be responsible for the application of related

laws and regulations for the operation of the PV system for interconnection with the distribution lines before commissioning of the Program. The Japanese side shall assist the Nepalese side to introduce necessary procedures through soft component during the implementation of the Program.

(5) Customs and Tax Exemption

The Nepalese side agreed that the KVWSMB shall be responsible for the exemption and/or reimbursement of all customs, tax, levies and duties incurred in Nepal for the implementation of the Program.

(6) Assignment of Counterpart Personnel

1) Overall project management

The Nepalese side assigned following personnel for overall project management and coordination in each organization.

KVWSMB	:Mr. Hari Prasad Dhakal, Executive Director
KUKL	:Mr. Tilak Mohan Bhandari, Acting Manager

2) Soft Component

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

The Nepalese side assigned the focal Counterpart Personnel for the soft component.

- KVWSMB: Mr. Pushkar Koirala, Engineer
- KUKL: Mr. Tilak Mohan Bhandari, Acting Manager
  Mr. Indra Kumar Maharjan, Electrical Engineer
- NEA: Mr. Kul Man Ghising, Manager
- AEPC: Mr. Surya Prasad Sapkota, Planning Officer

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

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

The Nepalese side has reconfirmed that the KVWSMB is the owner of Equipment and responsible for securing necessary budget and personnel for Operation and Maintenance (O&M) of Grid-connected PV system procured and installed under the Program. The Nepalese side confirmed that the Equipments procured under the Program shall be operated and maintained by KUKL and KVWSMB will guarantee it.

<List of Annex>

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

Annex-2 List of Equipments

Annex-3 Project Cost Estimation (Confidential)

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

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

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

1. Procedures for GAEC

GAEC is executed through the following procedures.

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

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

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

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

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

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

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

2. Preparatory Survey

1) Contents of the Survey

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

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

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

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

2) Selection of consulting firms

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

prepare a report, based on the terms of reference set by JICA.

3. Implementation of GAEC after the E/N

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

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

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

3) Focal points of "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change"
a) The Agent
The Agent is the organization, which provides procurement of products and services on behalf of the Recipient according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the A/M.

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

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

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

d) Payment Methods
The Agent Agreement will stipulate that "Regarding all transfers of the fund to the Agent, the Recipient will designate the Agent to act on behalf of the Recipient and issue a Blanket Disbursement Authorization ("the BDA")to conduct the transfer of the fund (hereinafter

referred to as "the Advances") to the Procurement Account from the Recipient Account.

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

e) Products and Services Eligible for Procurement
Products and services to be procured will be selected from those defined in the G/A.

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

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

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

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

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

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

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

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

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

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

k) Additional procurement

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

(1) Procurement of same products and services

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

(2) Other procurements

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

l) Conclusion of the Contracts

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

m) Terms of Payment

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

4) Undertakings required by the Government of the Recipient Country

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

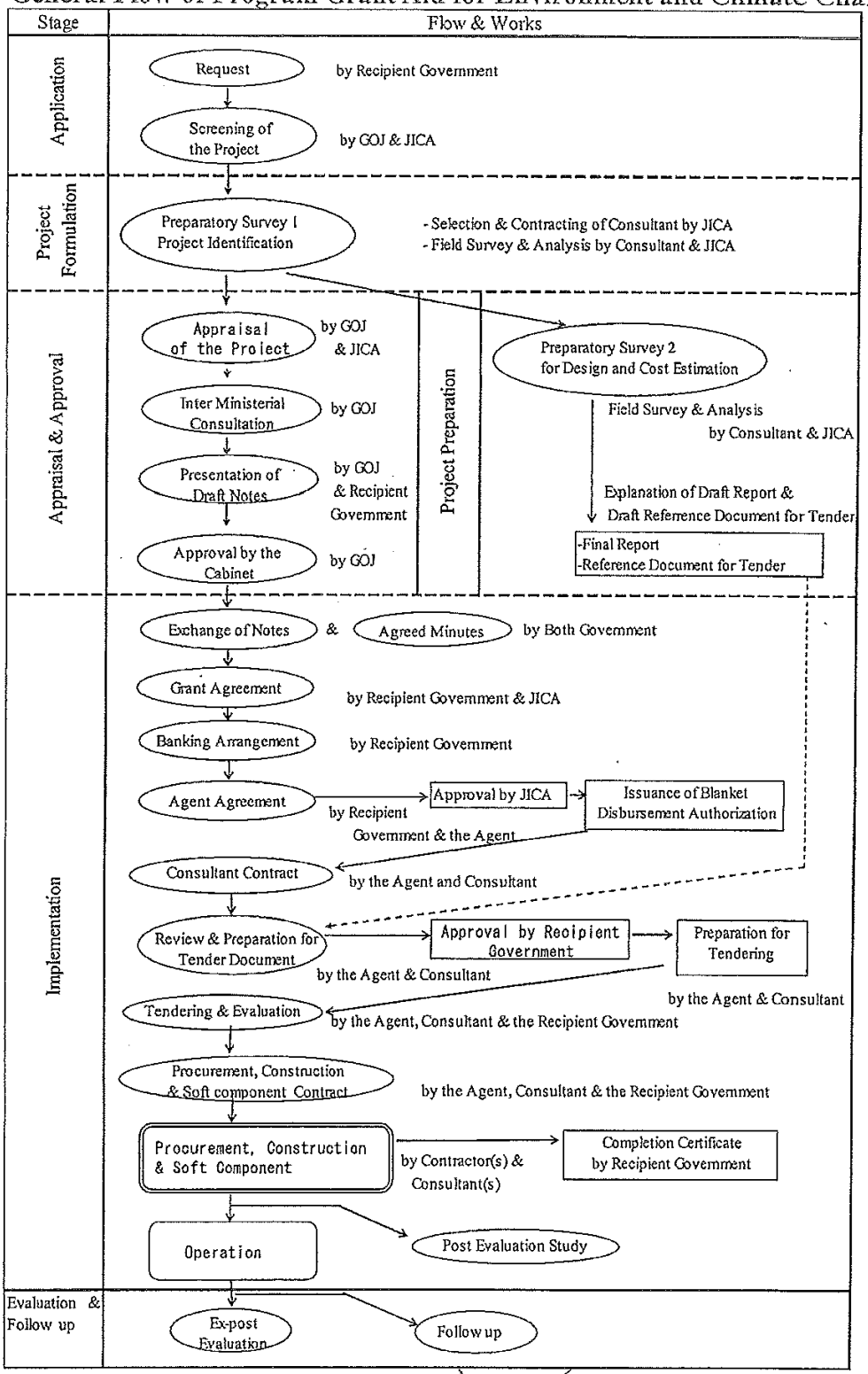
a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.
b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites.
c) To ensure all the expense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

5) "Proper use of funds"

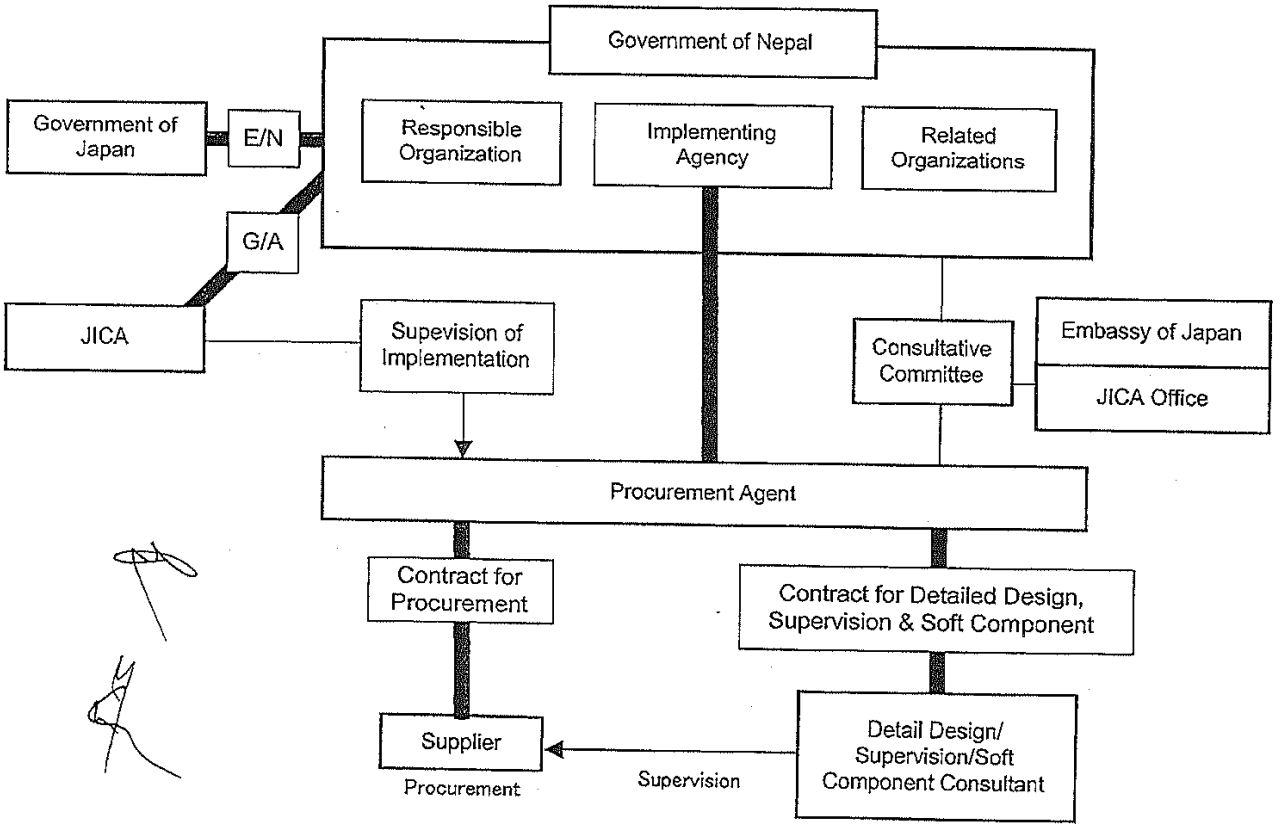
The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

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

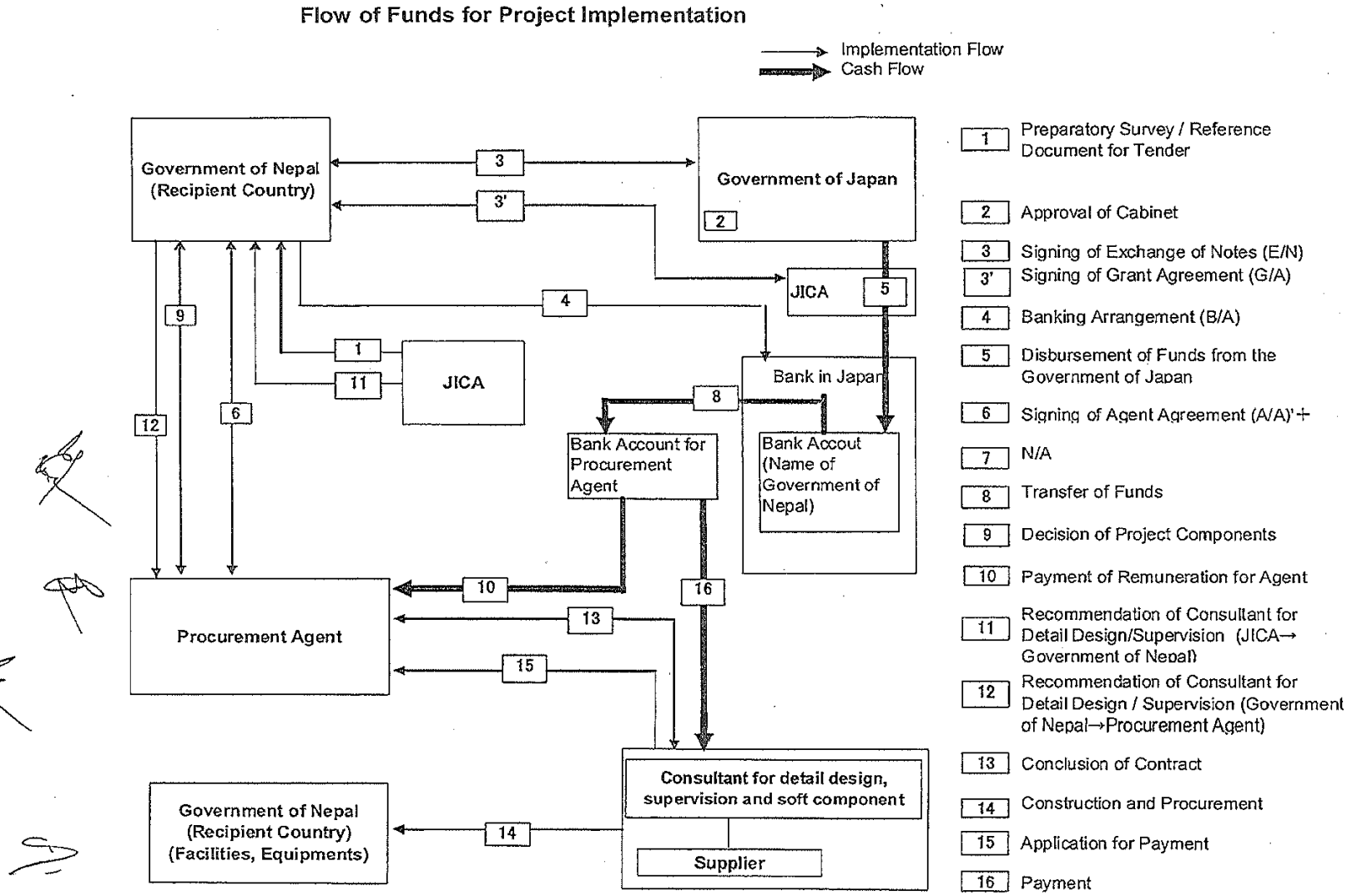
General Flow of Program Grant Aid for Environment and Climate Change



Project Implementation System



Flow of Funds for Project Implementation



List of Major Equipments

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

Components	Specification	Qty.	Unit	Purpose
PV module	Total capacity 350 kWp and above with no. of series and parallels to match the system voltage 3 Phase 400 V to be decided by supplier	1	Set	To generate power by receiving solar insolation
PV structure	Galvanized finishing	1	Set	To support PV module at required height and angle
Junction box	Outdoor use with reverse power flow protection, circuit breaker and surge absorber	1	Set	To collect and arrange the strings of modules at PV site
Connection box	Outdoor use with reverse power flow protection, circuit breaker and surge absorber	1	Set	To connects and arrange the strings from Junction box to match the input of power conditioner
Power Conditioner	Indoor self standing, 350kW and above in total, output AC 400 V 3 Phase 4 Wire, efficiency 90% and above at rated capacity, with grid-connecting facility and safety protection relays (OCR, UVR, OVR, UFR, OFR)	1	Set	To convert the DC power generated by PV array to AC power and to match and supply power to load and grid.
Step up Transformer	315 kVA and 500 kVA 11 kV/400 V、50 Hz、3 Phase 4 Wire, Δ-Y wiring with neutral grounding	2	Unit	To step up 400 V to 11 kV and to connect existing grid and supply power to the existing loads.
11 kV Distribution board	Indoor self standing, 3 Phase 3 Wire, 50 Hz with protection relays	1	Unit	To connect 11 kV grid distribution network
11 kV Switchgear panel	Indoor self standing, 11 kV, 3 Phase, 3 Wire, 50 Hz with protection relay and interlock	1	Unit	To connect existing 11 kV feeder (two feeder) of NEA and 11 kV from PV system with change over interlock switchgear
Outdoor Cubicle	Outdoor self standing, dust, insects and vermin proof	1	Unit	To install power conditioner, 11 kV distribution board, 400 V distribution panel and so on at PV array installation site
400 V distribution panel	Indoor self standing with power distribution circuit breaker	1	Unit	To supply power to the equipments at PV Array installation site
400 V distribution board	Indoor self standing with power distribution circuit breaker	1	Unit	To supply power to existing loads and equipment at control room
Display board	Outdoor display board of size W1,200 x L800 mm	1	Unit	To display PV power generation system information at Sundarighat KUKL facility
Data monitoring, recording and display system	Meteorological data and system data measuring collection units with software for data management.	1	Unit	To collect and manipulate the system information to provide information to general public and for system operation and maintenance management.

Source: JICA Study Team

5. Soft Component (Technical Assistance) Plan

“Soft Component (Technical Assistance) Plan” is attached in following pages.

Soft Component Plan
(Nepal)

1. Background of the Soft Component Plan

This project promotes awareness of the PV system, builds technical experience on PV system and grid-connection, securement of electricity, and promotes mitigation of GHG emission by providing PV system and related equipment to Kathmandu Upatyaka Khanepani Limited (KUKL) in Kathmandu, the capital of Nepal. The project also promotes/disseminates renewable energy through actual demonstration.

In Nepal, the government institution, Alternative Energy Promotion Centre (AEPC), was established in 1996 to promote renewable energy.

The established renewable energy subsidy policy of 2000 for rural areas was revised in 2006 for better promotion and implementation, under which, programs like small solar home systems, solar water pumping, solar lighting for schools and health centers/posts, mini-micro hydro, bio-gas are covered. From this it can be understood that the Government of Nepal is implementing the programs enthusiastically through AEPC to promote renewable energy programs in the rural areas of the country.

However, until now, the grid-connected power generation utilizing renewable energy has not yet been realized under this law. If the photovoltaic power generation system (PV system) planned under this assistance from Japan is put into practice, then this will be the first actual example of a grid-connected power generation system utilizing renewable energy resource.

Considering the above circumstance, there is no accumulated experience in the proper operation of grid-connected PV system in Nepal. Therefore, it is necessary to conduct a soft component for the project aiming to support the smooth start up and ensuring its sustainability.

In particular, technical supports for (1) Existing Grid and PV System, (2) Grid Connection and Power Purchase Agreement (PPA), (3) Data Analysis of Data Logger, (4) Power Restoration and Failure Recovery Technique and (5) Awareness Campaign are required.

2. Target of Soft Component

There are several standalone PV systems which have capacity of few kWp, however there is no grid-connected PV system and the PV system by this project will be first case in Nepal. Therefore there is not enough accumulated technical/practical experience including PPA at present.

A certain amount of accumulated technical/practical experience is necessary for the smooth start up of the project. Accumulated technical/practical experience for trouble shooting, evaluation of generation performance and operational efficiency, starting up of same kind of grid-connected facility are also necessary.

The targets of the soft component, defined as those that should be achieved after a certain period from the completion of the project, are as follows:

(1) The implementing agency, Kathmandu Upatyaka Khanepani Limited (KUKL), is expected to operate the grid-connected PV system[1] smoothly while Nepal Electricity Authority (NEA) operates their distribution network together with the grid-connected PV system without any hindrance.
(2) Generated power from the PV system shall be utilized at Sundarighat Water Treatment Plant and the supply center of KUKL (Sundarighat Center), while the surplus power flows into the grid of NEA, which is called reverse power flow. The Power Purchase Agreement (PPA) between KUKL and NEA is made for the trading of the reverse power.
(3) The impact of this assistance of Japan to the project is quantified and measured effectively through the accumulated data. Based on the accumulated data and corresponding analysis results, the efficiency of PV system operation is improved and the planning of other grid-connected PV system is effectively conducted.
(4) When there is a system failure, KUKL performs the necessary restoration works smoothly.
(5) The project becomes the model case for the introduction and promotion of the renewable energy source as grid-connected renewable energy system.

3. Outcomes of the Soft Component

The outcomes of the soft component, defined as those that should be achieved upon its completion, are as follows:

(1) Existing Grid and PV System

The KVWSMB/KUKL and NEA should both understand the following points.

(i) The composition of the existing distribution grid that is connected with PV system
(ii) The protection system of the existing distribution grid
(iii) The actual situation of power supply from the existing distribution grid
(iv) The quality of power supply of existing distribution grid that connects to Sundarighat Center (fluctuation of voltage, frequency and so on)
(v) Basic knowledge on PV system
(vi) Protection and operating method of grid connected PV system

This soft component is executed at the introductory phase of the cluster of the five soft components to understand the composition of the existing grid and obtain basic knowledge on the PV system.

(2) Grid Connection and Power Purchases Agreement

In Nepal, power plants generating below 1,000 kW essentially do not need to apply for license but are required to provide detailed information of the project before installation. Meanwhile, power generation and transmission of above 100 kW requires application to secure permit. Therefore, the detailed information of the system and power transmission to the NEA grid network needs to follow the same procedure. The application for power transmission permit is

[1] Grid-connected PV system means the PV system that is connected to the power grid and is operated with the power grid. The electricity of the grid is Alternative Current (AC) and the electricity generated by PV system is Direct Current (DC). Thus, DC electricity has to be inverted to AC and this inverted AC needs to be synchronized with AC of the grid in order to connect PV system to the grid. Furthermore, whenever there is a failure of PV system, that failure should not be influence to the grid. For this, the grid-connected PV system requires protection devices. In this manner, the grid-connected PV system needs more advance technology comparing the standalone PV system with battery.

under the jurisdiction of the Department of Electricity Development (DoED).

To realize the reverse power sales of surplus power, KUKL submits the application to DoED for the power transmission license. Based on the application, DoED issues the licenses to KVWSMB/KUKL for power transmission. KVWSMB/KUKL and NEA will finalize the PPA between them for the reverse power sales and feed-in tariff.

Even though a feed-in tariff system exists and it is mandatory, for entrepreneurs to follow rules and regulations before feeding surplus power to the distribution network, the power generated from renewable energy resources like PV system is not yet realized in actual practice. If an introductory example can be made, it will definitely help to promote the planning of future projects as well as those in the pipeline. As a result, the realization of the reverse power sales with the support of the soft component can be realized as one of the most important outcomes.

(3) Data Analysis

The data logger is one of the components of the PV system that records data on solar insolation, generated power, generated energy, and so on. With the recorded data, the staff of KVWSMB/KUKL will understand the (1) analysis method, (2) system management method from the analysis results, (3) methodology of utilizing data for further expansion of the project or applying the data for planning other PV systems.

(4) Power Restoration and Failure Recovery Technique

When the interconnected grid experiences black out due to some reasons, the PV system also stops supplying power to the grid automatically. When the system is restored, the PV system reconnects from the KVWSMB/KUKL side without any problem. Moreover, the failure of the PV system is handled appropriately.

If soft component - (1) is assumed to be a chapter of the basic theory, this shall also be put into practice. The training proceeds with the equipment installed and the trainees learning how to properly operate the system.

(5) Awareness Campaign

From the inspection tour with concerned personnel like ministers, policymakers, civil servants, technical experts and advisers, the knowledge and information of PV system in actual practice is disseminated. The inspection tour to sites with PV system is held targeting students of surrounding schools, and local inhabitants who are willing to visit and desire to gather some information on the PV system.

4. Confirmation of Achievement

The method of confirming the achievement level is as follows:

(1) Existing Grid and PV System

The achievement level of the soft component is confirmed with the understanding level of the staff of the KVWSMB/KUKL and the staff of NEA on the items listed in "3. Outcomes of the Soft Component" above. At the end of the soft component, the level of understanding is determined through a written examination.

(2) Grid Connection and Power Purchase Agreement

The achievement level of the soft component is confirmed with the fulfillment of the (i) tariff of reverse power sales being finalized, (ii) power sales license being issued to KVWSMB/KUKL (iii) PPA being signed between KVWSMB/KUKL and NEA, and finally, (iv) grid-connected renewable energy sources being utilized following the above PPA as a good example.

(3) Data Analysis

The achievement level of the soft component is confirmed with the facts that the staff of KVWSMB/KUKL is able to (i) analyze the collected data from the data logger, (ii) use the analysis results for maintenance purposes, and (iii) put the data and analysis results to practical use for the expansion plan of the project or for promotion of new grid-connected PV systems. At the end of the soft component, the achievement level is confirmed through practical work test.

(4) Power Restoration and Failure Recovery Technique

The achievement level of the soft component is confirmed with the facts that the staff of KUKL are able to (i) restore the PV system appropriately during the training operation which involves simulated situation of power failure in distribution network and (ii) fix the failures appropriately during the training where occurrence of failure of the PV system is siumlated. At the end of the soft component, the achievement level is confirmed through a practical work test.

(5) Awareness Campaign

The achievement level of the soft component is confirmed through a questionnaire survey executed at the time of inspection tour and querying the personnel of the concerned organization about their awareness.

5. Activities of the Soft Component (Input Plan)

(1) Existing Grid and PV System

(Japanese Side)

(a) Necessary Technology and Type of Profession: Power facilities and PV power generation, Consultant.

(b) Required Expertise Level: The expert is required to be knowledgeable in overall electricity power management engineering, has general knowledge on distribution network and should be able to conduct lectures on grid-connected PV power generation systems.

(c) Execution Method: Preparation of handouts and operations manual, and consequently conduct training and initiate actual practice. The training and practice described in items (i) to (vi) of "3. Outcomes of the Soft Component" should be executed. Especially, for item (iv), i.e., the quality of power supply of the existing grid that connects to Sundarighat Center (fluctuation of voltage, frequency and so on), the actual data recorded during the survey period should be used.

(d) Input from Resource Person (Number of experts and duration): Electrical and PV System Expert: 1 expert for 2.0 man-months (M/M), estimated based on the following tasks:

- Preparation of training and handouts: 0.5 M/M
- The training and lecture will be executed on the following contents.

(i) The composition of the existing grid network that connects with grid-connected PV system: 0.1 M/M
(ii) Protection system of the grid: 0.1 M/M
(iii) Power supplying situation of the grid: 0.1 M/M
(iv) Quality of the electricity in Sundarighat Center supplied by the existing grid: 0.2 M/M
(v) Basic knowledge on PV system: 0.1 M/M
(vi) Operation of grid-connected PV system and its protection system: 0.3 M/M

- Execution of evaluation test: 0.1 M/M
- Preparation of maintenance manual: 0.2 M/M
- Execution of appropriate maintenance practice: 0.3 M/M

(Nepalese Side)

(e) Necessary Technology and Type of Profession: Electrical engineering, Consultant
(f) Required Technical Level: Senior Engineer or equivalent professional (with technical background)
(g) Execution Method: Preparation of handouts, carry out training and practice
(h) Input from Resource (Number of person and duration): Consultant (1 person for 1.5 M/M)
(i) Targeted Personnel: Staff of KVWSMB/KUKL, NEA and AEPC

(2) Grid Connection and Power Purchase Agreement

(Japanese Side)

(a) Necessary Technology and Type of Profession: Grid operation/power management, Consultant
(b) Required Expertise: The expert should be able to guide the management and institution of distribution grid network
(c) Execution Method: Preparation of procedure manual on PPA and provide related practical support
(d) Input from Resource Person (Number of experts and duration): Grid operation/Power management expert: 1 person for 1.5 M/M, estimated based on the following tasks

- Preparation of procedure manual: 0.5 M/M
- Planned support for PPA is as follows.

(i) Consultation with DoED: 0.1 M/M
(ii) Support on submitting application for power transmission licenses: 0.1 M/M
(iii) Support on preparation of buyback tariff: 0.2 M/M
(iv) Support on the negotiation for PPA with NEA: 0.3 M/M
(v) Support on preparing PPA document: 0.3 M/M

(Nepalese Side)

(e) Necessary Technology and Type of Profession: Power management engineering, Consultant
(f) Required Technical Level: Senior Engineer or equivalent professional (with technical background)
(g) Execution Method: Preparation of procedure manual and execution of related support

(h) Input from Resource Person (Number of person and duration): Consultant (1 person for 1.0 M/M)

(i) Targeted Personnel: Staff of KVWSMB/KUKL, NEA and AEPC

(3) Data Analysis

(Japanese Side)

(a) Necessary Technology and Type of Profession: Data analysis/PV power generation, Consultant

(b) Required Expertise: In addition to the knowledge on data analysis, familiarity with PV system is necessary

(c) Execution Method: Preparation of data logger operation manual, conduct of training and initiation of actual practice.

(d) Input from Resource Person (Number of expert and duration): Data analysis expert: 1 person for 1.5 M/M, estimated based on the following tasks:

- Preparation of users' manual on data logger: 0.5 M/M
- The target and input of the training on data logger operation is as follows.

(i) Understanding function and composition of data logger system: 0.1 M/M

(ii) Understanding applied software: 0.1 M/M

(iii) Understanding appropriate technique on data sampling and raw data processing: 0.1 M/M

(iv) Learning management process of recorded daily, weekly, monthly and annual data: 0.1 M/M

(v) Finding out the cause of fault that occurred based on the recorded data: 0.2 M/M

(vi) Selecting appropriate preset values of power conditioner and other equipment for effective operation based on the recorded data: 0.2 M/M

(vii) Utilizing recorded data for future promotion: 0.2 M/M

(Nepalese Side)

(e) Necessary Technology and Type of Profession: Data analysis/computer literacy

(f) Required Technical Level: Senior Engineer or equivalent professional (with technical background)

(g) Execution Method: Training and practice

(h) Input from Resource Person (Number of person and duration): Consultant (1 person for 1.0 M/M)

(i) Targeted Personnel: Staff of KVWSMB/KUKL and AEPC

(4) Power Restoration and Failure Recovery Technique

(Japanese Side)

(a) Necessary technology and type of profession: PV power generation, Consultant

(b) Required Expertise Adequate knowledge on management, operation and maintenance of grid-connected PV system.

(c) Execution method: Preparation of manual, conduct training and practice.
The manual will be prepared for the restoration of operation of grid-connected PV system when the existing grid experiences power breakdown. Practical training on restoration

will be conducted using this procedure manual.

The manual will be prepared for the trouble shooting of PV system. The manual includes (i) method of specifying breakdown point of occurrence, (ii) method of replacement of component, and (iii) the information that should be passed on accurately to the manufacturers in Japan, in order to fix the defects.

(d) Input from Resource Person (Number of expert and duration): PV power generation Expert: 1 person for 1.5 M/M, estimated based on the following tasks:

- Preparation of restoration process manual: 0.5 M/M
- Training for restoration of operation: 0.4 M/M
- Training for finding faulty components and their replacement: 0.6 M/M

(Nepalese Side)

(e) Necessary Technology and Type of Profession: Electrical engineering, Consultant
(f) Required Technical Level: Senior Engineer or equivalent professional (with technical background)
(g) Execution Method: Manual preparation, conduct training, and practice
(h) Input from Resource Person (Number of person and duration): Consultant (1 person for 1.2 M/M)
(i) Targeted Personnel: Staff of KUKL

(5) Awareness Campaign

(Japanese Side)

(a) Necessary Technology and Type of Profession: Dissemination of renewable energy, Consultant
(b) Required Expertise: Knowledgeable in awareness campaign of renewable energy
(c) Execution method: Preparation of awareness campaign pamphlet and execution of inspection tour
(d) Input from Resource Person (Number of expert and duration): Renewable Energy Promotion Management Expert: 1 person for 0.5 M/M, estimated based on the following tasks:

- Preparation of pamphlet: 0.1 M/M
- Execution of inspection tour: 0.1 M/M
- Preparation of draft awareness promotion plan: 0.2 M/M
- Consultation and coordination for execution of awareness promotion plan with the related organizations: 0.1 M/M

(Nepalese Side)

(e) Necessary Technology and Type of Profession: PV power generation, Consultant
(f) Required Technical Level: Senior Engineer or equivalent professional (with technical background)
(g) Execution Method: Preparation of awareness pamphlet for dissemination and execution of inspection tour
(h) Input from Resource Person (Number of person and duration): Consultant (1 person for 0.4 M/M)

(i) Targeted Personnel: Staff of KVWSMB/KUKL and AEPC

6. Procurement of Input Resource of Soft Component

It is planned that Japanese consultant will be directly procured as resource person for providing input and conducting the soft component.

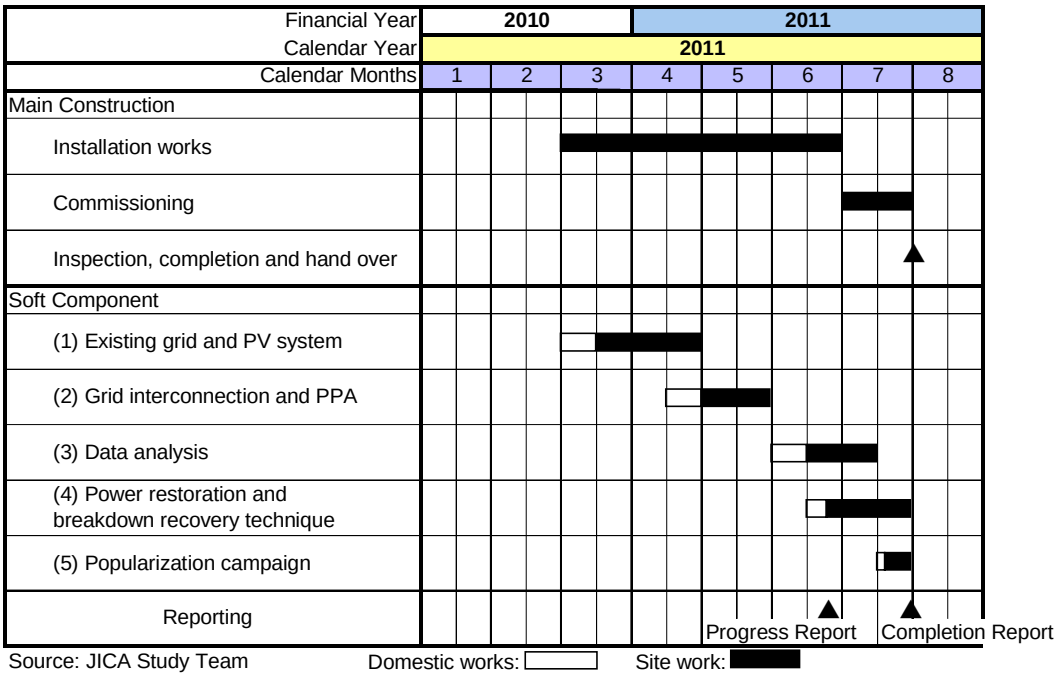
It is difficult to find local human resources who are able to conduct the soft component program in Nepal because installation of the grid-connected PV system is the first case in the country. Therefore, local consultants shall only be employed to provide support to Japanese consultant.

7. Implementation Schedule of Soft Component

The implementation schedule is shown in the following chart.

Execution of the soft components during the actual PV system installation will be much effective through witnessing and actual application of PV system. Therefore, it is planned to perform all the soft components during the period of actual installation of the PV system.

Implementation Schedule of Soft Component



Source: JICA Study Team Domestic works: Site work:

8. Reports and Documents

The reports and documents to be submitted are as follows:

(i) Text for Existing Grid and PV System (English):	10 sets
(ii) Manual for the Daily Operation and Maintenance of PV System (English):	10 sets
(iii) Manufacturer's Manual on Grid Connection for PV System (English):	10 sets
(iv) Application Manual on Data Logger (English):	10 sets
(v) Manual for Power Restoration and Breakdown Recovery (English):	10 sets
(vi) Promotion and Awareness Campaign Pamphlet (Nepali/English):	200 sets each
(vii) Progress Report (English/Japanese):	4 sets each
(viii) Completion Report (English/Japanese):	5 sets each

Due to the short implementation period of the soft component (5), the progress report for said component will not be submitted.

9. Obligation of Implementing Agency of Recipient Country

In order to achieve the target of the soft component, it is essential for KUKL and other related organizations to continue the activities based on the technology and knowledge learned during its implementation. Moreover, the technology and knowledge need to be transferred or taken over continuously in the organizations.

One of the foreseen obstructions in the efficient execution of the above is the transfer of the staff who already learned the soft component, to other organizations. In such case, it is highly possible that related activities and transfer of technology and knowledge will be discontinued. In order to avoid such situation, KVWSMB/KUKL needs to (i) determine the number of staff who will participate in the execution of each soft component, (ii) properly maintain the manuals and documents prepared during the implementation of the soft component, and (iii) carefully manage the technology and knowledge transfer in the organization.