TERMS OF REFERENCE

For Owner’s Engineer of NEA

Grid-connected SolarPV Power Generation Facilities

1. Background

The World Bank ((Bank) has provided financial support to Nepal Electricity Authority (NEA) through Government of Nepal (GoN) to set up 25MWp grid connected solar PV plantunder the proposed "Grid Solar and Energy Efficiency Project". The Bid for Engineering, Procurement, and Construction (EPC) Contract of a 25MWp Grid-connected Solar Farms Project (the Project), including five years of operation services is expected to be invited by the second week of April 2015. It is anticipated that contract with the successful bidder would be signed in September 2015 and the implementation of project would initiate in October 2015.

NEA (the Employer) now intends to hire an International Consulting Firm as its Owner’s Engineer for supporting NEA in:(i)reviewing the designs and specifications; (ii)contract management, and (iii)construction supervision, commissioning, and acceptance tests. The implementation period for this service contract is expected to be about 14 months in total.

The Consulting Firm also needs to provide recommendations on necessary scope of work and estimated cost for engaging Owner’s Engineer during the Project’s operation service period of 5 years. The scope should include annual tests along with final acceptance inspection and tests to be carried out at the end of 5 year of operation service period.

2. Description of Project

GoN has received Bank financing to develop a 25MWp Solar PV Farms under the Grid-Connected Solar and Energy Efficiency Project.

The following sites, which are in the premise of existing hydropower projects and are owned by NEA, were identified for development of PV solar farms:

1) Devighat
2) Trishuli
3) Kulekhani (will be used only if available areas in the above two sites are not enough)

The Project includes, as associated with the Solar farms, (a) design, planning, engineering, procurement (manufacturing/supply), construction/erection, testing, commissioning, and five years of operation service of 25MWp utility scale Solar Farms as an EPC Contract, to be procured through an ICB process; and (b) consulting services for design review, procurement and contract management, supervision of
construction/installation, testing, and commissioning by an Owner’s Engineer, to be hired through competitive process.

The development of Solar Farms by the EPC Contractor essentially includes:

- **Project planning and design:** Basic project planning, sequencing and scheduling, solar resource assessment, energy yield predictions for project life cycle, basic and detailed designing, project component selection, preparing engineering and construction drawings, facilitating planning permissions, and all other engineering and preparation work as required for planning, design, commissioning, and interconnecting the solar PV plant to utility grid substations.

- **Supply and construction/installation:** Manufacturing, supply, sourcing, procurement, transportation of all solar PV equipment, required insurance, electrical components, structural components, civil engineering material, mechanical engineering components, earth moving equipment, construction machinery, and all other construction equipment as required for development, implementation, construction, testing, commissioning, and interconnection of the Solar Farms to utility grid substations.

- Arranging for power and electricity supply during construction, obtaining permits and approvals from all local stakeholders, government statutory bodies, obtaining permissions from electrical inspectorate, liaison with transmission/grid utility for evacuation infrastructure, relay testing, and charging of transmission lines as required for completion and commission of plant, with assistance of NEA.

- Site preparation (including additional topographic surveys and geotechnical investigations if necessary) and land leveling, providing construction infrastructure like site office, internal roads, stores etc., assembly and construction of the entire solar PV plant, all pre-construction tests, site management and supervision, labor provision, testing and commissioning of all the equipment in steps, and interconnection of the Solar Farms to utility grid substations.

- All the operations not expressly included, that are necessary for proper functioning of the Solar Farms and fulfillment of the guaranteed performance, rules, regulation, and applicable codes, necessarily including all the things that are inherent to the Project and without which the Solar Farms would be unable to start operating commercially.

- Commissioning of the Solar Farms, with provisional acceptance tests, 7 days start-up performance test, monthly and annually performance evaluations, and performance and equipment tests as required by the NEA during the defects liability period. Upon satisfactory commissioning of the plant facilities, provision of all the specified spare parts and documentation necessary for the correct performance, and maintenance for the life cycle time of Solar Farms, the facilities will be officially accepted by and handed to NEA.
- Comprehensively warranting the entire Solar Farms against all defects through a defects liability period (DLP) of five years, transfer all component warranties to the Employer post completing the DLP, and proving guarantees on annual energy output in kWh as agreed on EPC Contract for five (5) years.

- **O&M of the entire Solar Farms for a period of five years**, from the date of official acceptance by and handed over to NEA. The five year O&M includes: (a) daily operation and maintenance services, including supply of spare parts, to ensure the plant facilities operating at guaranteed performance and availability standards; (b) training owner's personnel for operation and maintenance, (c) conducting an Energy Output test annually till five (5) years of O&M to verify acceptable performance of PV plant facilities, (d) official acceptance of the five-year O&M services of EPC Contractor by NEA, and handing over the O&M to NEA; and (e) counter measures to be taken in case of deviations found beyond guaranteed values.

### 3. Scope of Work

#### 3.1 Objective of Services

The objectives of the consulting services shall be to ensure that the Project is implemented with a high standard of workmanship and quality, on schedule, and within the budget, in accordance with the specifications and drawings of the EPC Contract, to acceptable environmental and social standards and in accordance with the NEA's requirements and the Bank’s Safeguard Policies.

The objectives of the services will be achieved through the following major activities:

1) Designs and Documents Review
2) Supporting Contract Management
3) Construction Supervision, Commissioning, and Acceptance Tests

#### 3.2 Brief Description of Services

The Consultant shall assist NEA to provide a comprehensive technical and management services during the construction and O&M stage.

During the procurement stage, the Consultant shall assist the Employer in review of the final designs on the basis of which tender documents have been prepared. The Consultant shall also review Contractor's Equipment drawings as they are received and ensure that they meet the requirements of the specifications. All procurements under the Project (nevertheless executed by the EPC Contractor or others) need to be monitored carefully and informed to the Employer and the Bank immediately the suspicious indications perceived by the Consultant.
During the project implementation stage, the Consultant shall act as the Owner’s Engineer for the Construction and Equipment Contracts. The Consultant will carry out its duties and responsibilities and assume necessary powers, as stipulated in the agreement for consulting services from the Owner’s Engineer. Such agreement may include but not limited to:

1. Review and confirm quality assurance program of the EPC Contractor.
2. Review and confirm the delivery of material to the site.
3. Review and clear construction drawings, schedules and process proposed by the EPC Contractor.
4. Review and confirm quantity and quality of works completed, which would serve as a basis for payment to the contractor according to the EPC Contract terms.
5. Hold regular meetings with the EPC Contractor to review project progress, technical issues, and measure to achieve the targeted cost, quality and schedule control.
6. Manage safety, social, and environmental related issues during the construction cooperating with the Employer.
7. Review and confirm the acceptance test proposals made by the EPC Contractor and support the Employer in completing the acceptance test.
8. Review and confirm the O&M Manual, including training programs for NEA engineers on O&M, prepared by the EPC Contractor.
9. Providing additional technical support to the Employer as needed for successful implementation of the EPC Contract.

3.3 Location of Services

In order to maintain close liaison between project management, design, and construction supervision, the Employer requires that the Consultant’s procurement and contract management, construction supervision, and design staff members are all located near the selected Project sites as specified in the Section 2 Description of Project.

4. Detailed Description of Consulting Services

4.1 Equipment and Electrical System Component

4.1.1 Design, Manufacture, and Installation of Equipment

The Consultant shall perform the duties of the Engineer as defined in the Owner’s Engineer’s contract for the above works and specifically carry out the following duties:

a. review designs and drawings submitted by the EPC Contractor, on the equipment and approve or amend the same in consultation with the Employer.
b. monitor and supervise on site testing of the all the major equipment to ensure that they meet the requirements and specification under the contract in consultation with the Employer in presence of the Employer personnel.

c. inspect the manufacture of equipment at the Contractor's workshops anywhere in the world, carry out the required tests (if any required), and certify its adequacy and quality before items are packed and shipped to the sites of works, jointly with the Employer. The list of equipment to be inspected is as follows but not limited to:

- PV modules
- Inverters
- Transformers
- Control Systems

d. supervise the installation of the electrical and mechanical equipment in a satisfactory and safe manner in accordance with the specifications and contract requirements.

e. supervise in testing and commissioning of all equipment.

f. supervise in interconnection and synchronization of solar power plant to existing NEA grid substation in safe manner.

g. measurement and verification of work quantities and certification of EPC Contractor's invoices for approval and release of payments.

h. monitor the manufacturing and delivery of equipment to ensure smooth and timely completion of the whole Project.

i. prepare, process and issue variation orders.

j. make recommendations to the Employer regarding settlement of claims by the EPC Contractor.

k. update the cost of contract works every month.

l. Prepare items of work to be completed by the EPC Contractor during Maintenance/Defects Liability Period.

m. Assist the Employer in commissioning the Project upon completion including supervision of resolution of possible defects found during acceptance tests.

n. Review & revise the detailed "O&M Manuals" prepared by the EPC Contractor for use by NEA in the operation of the Project.
prepare a "Completion Report" for the works under the contract, including a summary of final costs, and supply 10 copies of the same to the Employer for future reference.

4.2 Civil Works Component

4.2.1 Design and Construction Drawing

i. Review the Design

The Consultant shall review the design of the civil works, which form the basis of the construction and equipment contract documents. The Consultant shall assume responsibility for the adequacy of such designs, and shall submit in writing to the Employer any changes. The Consultant shall prepare and issue appropriate variation orders of the construction and equipment contracts to incorporate such changes.

ii. Construction Drawings

The Consultant shall review the construction drawings for the civil works of the contracts. He shall also prepare construction drawings for those temporary works, which are identified in the contracts as being prepared by the Engineer or which are necessary for construction of the works, but are not responsibility of the EPC Contractor. The construction drawings shall clearly impart the final design of the works, and shall be revised and supplemented to meet field conditions as the works progress.

iii. Contractor's Drawings

In cases where the EPC Contractor has to prepare construction drawings, the Consultant shall review and approve those drawings in accordance with the contractual conditions. The Consultant shall also approve layouts and details of temporary facilities to be constructed by the EPC Contractor.

4.2.2 Construction Supervision and Management of Contract

The Consultant shall assume full responsibility for the contract management and construction supervision of the civil works. The Consultant shall also perform all the duties and functions required of him as the Owner’s Engineer under the conditions of EPC Contract for the civil works. Some of the important functions are:

a. Approve EPC Contractor’s Programs of Work and any changes made thereto during construction.

b. approve all items of equipment, plant, materials, etc. to be incorporated in the civilworks.
c. check, set out, and provide base line surveys with bench marks for the EPC Contractor to establish their survey control for construction. The Consultant shall be responsible to check surveys and bench marks established by the EPC Contractor at each site of work and ensure accuracy of surveys and bench marks connecting various sites.

d. in consultation with the Employer, prescribe the format for monthly payment certificates of the EPC Contractor.

e. issue stop orders of work with prior approval of the Employer.

f. verify the amount of work done under each item of the Bills of Quantities and check the EPC Contractor's monthly payment requests before submitting to the Employer for approval and release of payments.

g. perform tests on materials as and, when required, to satisfy himself of the suitability of materials for use in the works at the field laboratory already established by the EPC Contractor.

h. Monitor EPC Contractor's progress of work.

i. prepare, process and issue variation orders as required.

j. make recommendations to and draft responses for the Employer to settle claims from the EPC Contractor.

k. update the procurement and cost of contract works every month.

l. Supervise the Employer in taking over the Project and prepare items of work to be completed by the EPC Contractor until the commission of the PV Solar Farms.

m. Review and revise the detailed "O&M Manuals prepared by the EPC Contractor for use by NEA in the operation of the Project.

n. prepare a "Completion Report" for the works under the contract, including a summary of final costs, and supply 10 copies of the same to the Employer for future reference.

4.3 Project Management Component

4.3.1 Contract Procedures

The Consultant shall formulate and establish procedures for the proper management, administration and quality assurance of all contracts for the construction of the Project as well as the Consultant's own services, and shall effect monitoring and control of these procedures.
4.3.2 Reports

The Consultant shall check and approve the following reports, which shall be in a format agreed with the Employer and which shall be submitted in number of copies to be agreed with the Employer.

a. The monthly report shall be coordinated with the requirements set forth in "Project Program" to include submittal of the following:

1) Cumulative expenditure record and estimated cost at completion of each item, Variation Order and claim for the Contracts on construction, equipment, and consulting services;

2) Record of Variation Orders issued and being prepared; and

3) Claims received, under consideration and settled.

b. Quarterly project progress monitoring reports (summary reports on instrumentation monitoring or similar construction performance system) and quarterly financial monitoring reports.

c. Technical reports on instrumentation monitoring or similar construction performance.

d. Completion Reports for all major structures or elements of the contract works, incorporating as-built records and drawings, within 60 days of issue of any Taking-Over Certificate. Completion Reports shall also include details of construction methodology, concrete quality, geological condition etc.

e. Provide any special reports as requested by the Employer.

4.3.3 Project Program

a. Within 60 days of award of the Consulting Contract, the Consultant shall prepare, and submit to the Employer for consent, a detailed program of all of the activities related to the execution of the Project. The Consultant's program shall be based on the reviewed and accepted programs of the Civil and Electrical Works and shall include all activities that interface or otherwise relate to the work being done by the different sub-Contractors or other involved parties.
b. Submission of program data shall include as a minimum:

1) Tabular listings giving:
   - early starts and finishes
   - late starts and finishes
2) Free and total floats;
3) Computer generated bar charts;
4) Information on assumed shutdown periods; and
5) Vacation days, and other non-working time periods.

c. When this program has been approved by the Employer, it shall become the new base-line program for monitoring the execution of the Project (the progress monitoring with milestones) and shall not be modified or revised by the Consultant without the prior consent of the Employer.

d. If updating of the Project program is required, a revised program shall be prepared by the EPC Contractor and reviewed by the Consultant, and resubmitted to the Employer for its consent. When approved, this program will become the new baseline program for all future work. During the performance of the work, the Consultant shall monitor his program and shall provide update reports on a monthly basis together with his monthly report on progress of the works. The monthly updates of the Consultant's program shall be monitored against the approved program and all variations shall be noted. The future impact of major variations shall be determined and analyzed. Necessary corrective measures or re-planning of the Consultant's work shall be established by the Consultant. The Employer shall be notified of corrective measures. When approved, this program will become the new baseline program for the project.

e. Without assuming responsibility, the Consultant shall assist the Employer in the preparation of financing plans for every contract and every component of the Project. These financing plans shall be based on the various financial agreements entered into by GoN and the Employer.

4.3.4 Project Relations

The Consultant shall promote good project relations and in so doing shall monitor project labor relations, living conditions, health and safety programs, and community relations to identify potential problems and resolve them promptly. Problems that cannot be resolved promptly by the Consultant through the construction and equipment contracts shall be reported forthwith to the Employer for action at the earliest possible.

4.3.5 Commissioning of Works

The Consultant shall be responsible for supervising the commissioning of all structures and plant on the Project. The Consultant shall prepare commissioning procedures, involving the Employer's operating staff, coordinate testing and
commissioning programs. During construction, the Consultant shall make himself fully aware of the state of all structures and plant of the civilworks, and ensure that the EPC Contractor or unauthorized personnel do not use or operate the structures and plant prior to or after commissioning except as authorized by the Consultant.

4.3.6 **Review of Operation and Maintenance Manuals provided by the EPC Contractor**

The Consultant shall review and finalize the detailed O&M manuals for the complete plant and all subsystems provided by the EPC Contractor under the construction and equipment contracts.

The Consultant shall liaise with the Employer and the EPC Contractor to ensure that uniform, complete, high quality O&M manuals are prepared for the Project.

4.3.7 **Additional Assistance to NEA**

As directed by the Employer, the Consultant shall assist the Employer in carrying out specific tasks directly or indirectly related to the Project, such as, but not necessarily limited to, the following:

a. In the event that the Consultant is required to deal with any dispute pursuant to the EPC contract, the services required and the remuneration for such services shall be deemed to be additional to the scope of the Consulting Services Agreement, provided that such dispute does not arise from any failure of the Consultant to properly perform his duties under the Agreement and provided further that the Consultant shall assign senior staff other than the field staff responsible for the supervision work to deal with such dispute. If required, the Foreign Expert can be assigned for short time, with prior approval of the Employer.

b. Supervising in initiating work on future phases of the Project, if required.

c. Technology transfer to enhance the Employer’s technical knowledge on solar power development and project management capacity through on-the-job-training.

4.3.8 **Experts**

The Consultant will assign adequately qualified key personnel to carry out the Consulting Services. In particular, the key personnel should possess the qualification and experience as indicated in the following.
1. International Staff (Key Staff)

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>1</td>
<td>Project Manager/Solar Expert</td>
</tr>
<tr>
<td>2</td>
<td>Civil Engineer (foundations, structures, and supporting procurement)</td>
</tr>
<tr>
<td>3</td>
<td>Electrical Engineer (having expertise in grid interconnection and procurement)</td>
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</tbody>
</table>

2. Local Expert including Local Support Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Civil Engineer (foundations and structures)</td>
</tr>
</tbody>
</table>
| 2    | Electrical Engineer (Transmission)  
  • At least 10 years’ experience |
| 3    | Safeguard Specialist (environmental but also with social experience) |

5. Requirement for Owner’s Engineer

5.1 General

To provide the consulting services for the duration of the Project (until the PV Solar Farms’ commissioning), the Consultant team of engineers and other specialists, shall be experienced in the design and supervision of construction of solar projects including power stations, civil structures, transmission lines, grid substations, and other appurtenant works.

Emphasis is placed on the need for relevant design and construction supervision engineers to have knowledge and previous experience of similar works to those at the Project site. It is particularly important that the engineers shall have substantial previous experience in dealing with contractual matters and contract claims under FIDIC conditions for several large engineering projects.

The benchmarks for owners engineering company are as follows:

- Must have valid registration, and must have been established for not less than 5 years from the date of the EOI.
- Must have at least 5 years’ experience in utility scale solar PV.
- Must have experience as owners engineer in at least 3 PV projects in Asia.
- Must have worked as independent consulting engineer in at least 5 solar projects larger than 10 MWp and total track record more than 100 MWp.
- Track record in grid interconnection at 11 kV or more for at least 2 projects.
- Track record in civilworks for at least 2 solar PV projects.
Responsibility for management of all services shall be with the Consultant's Project Manager. The Project Manager shall provide overall technical direction and coordination of the Services. He shall liaise with the Employer's Project Chief on various issues, technical, financial, or otherwise. He shall also manage and coordinate the assignment of special experts (foreign/local), with prior approval of the Employer, as required.

The Consultant’s Project Manager shall maintain a team of design engineers and CAD operator (draftsmen) at the site, obtained from this particular recruitment process or staff deputed by the Employer who shall perform design modification and adjustments arising from the actual encountered site conditions. The design team shall work under the leadership of the Project Manager. The design team will be required to coordinate the entire design effort with the EPC Contractor's engineers assigned to the Project.

The Local Experts shall assist the Project Manager to direct and supervise the contract. The Local Experts, assisted by the Employer staff shall be responsible for coordination and administration of all activities at the project site relevant to the EPC Contractor. The Local Experts or their assistants shall be available at all times during execution of the contract.

5.2 Expatriate and local Staff

The estimated person-months required for the assignment is specified below:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Total Man Month</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>International Staff (Key Staff)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Project Manager/Solar Expert</td>
<td>14 (full time on sites)</td>
</tr>
<tr>
<td></td>
<td>2 Civil Engineer (foundations, structures, and supporting procurement)</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>3 Electrical Engineer (having expertise in grid interconnection and procurement)</td>
<td>4</td>
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<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description</th>
<th>Total Man Month</th>
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<tbody>
<tr>
<td>B</td>
<td><strong>Local Expert including Local Support – full time on sites</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Civil engineer (foundations and structures)</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>• At least 10 years’ experience</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Electrical Engineer (Transmission)</td>
<td>12</td>
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<tr>
<td></td>
<td>3 Safeguard Specialist</td>
<td>6</td>
</tr>
</tbody>
</table>
6. Consultant's Facilities

6.1 Housing and Office for Consultant
The Consultant shall arrange its own accommodation and office.

6.2 Consultant's Transportation
The Consultants shall arrange the rental vehicles including all necessary costs, such as drivers, fuels, maintenance fees, and insurances.

6.3 Equipment and Miscellaneous
The Consultant shall arrange the office equipment including computers with necessary software at their own.

6.4 International Trips and Hotel Accommodation in Kathmandu
The cost of all travel and accommodation shall be included and arranged by the Consultant.

7. Remuneration and Payment

7.1 Terms of Payment for Consulting Services
Payment shall be made on a monthly basis as approved by the Employer.

7.2 Reimbursement
The Consulting team shall get the reimbursements "all in" agreement basis except for pickup trucks.

8. Equipment Inspection
Equipment Inspection shall be done in co-ordination with NEA staffs assigned to the project. For each inspection there will be one expatriate staff accompanying NEA engineers to facilitate the inspection process. The entire cost of inspection will be borne by Consulting Firm.

9. Organization and Staffing

9.1 Site Supervision and Supporting Team
For effective implementation, the work shall be carried out by a fully integrated team of staff consisting of the Project Manager, expatriate staff/experts, locally hired manpower, and exclusively assigned staff from NEA to the Project.
This team shall operate as an independent and self-sufficient entity with the Project Manager entrusted with full responsibility and authority to act on behalf of the Consultant.

Members of the project team shall be assigned for the full duration of their involvement and shall be stationed at the site office. During this time, they shall report to the Project Manager directly, or to assigned supervisors within the project team.

The services shall be fully based at the site with a site office. The construction management and construction supervision shall be carried out from this site office. The design changes, project monitoring, certification of monthly bills etc. shall all be carried out from this site office.

9.2 Project Manager

The focal point of the project organization is the Project Manager, the principal contact and communication channel with the Employer. He shall be an international staff and a solar expert. The Project Manager shall have total project responsibility for the work and for providing the requisite leadership, direction, and supervision. He shall be accountable to the Employer for day-to-day performance of the project team and shall be vested with sufficient authority to act. He shall exercise all standard management functions including planning, scheduling, directing, organizing, and controlling; and shall be involved in key technical activities; and assigned to specific technical tasks to achieve maximum efficiency and benefit to the Project.

The Project Manager shall be a Solar Engineer with 10 years of general experience and 5 years of experience in solar power construction projects. He shall have an experience as a team leader with experience of at least one solar project of installed capacity of 5 MW or above. He should be able to communicate fluently in English Language and shall not be more than 65 years old at the date of submission of proposal.

9.3 Other Expatriate Staff

The Civil & Electrical Engineers shall possess 10 years of general experience and 3 years of experience in photovoltaic projects.

They will work in close coordination with the Project Manager and shall be responsible for the design and supervision works as required, and shall be responsible for their related fields individually.

9.4 Local Staff (Local Expert including Local Support)

The local staff members shall be directly responsible to the Project Manager for all technical activities and functional management tasks including coordinating
activities within their divisions, assigning work to specialist staff in their team, and maintaining quality and progress control.

The assignment of the staff shall be shown on a Staff Time Schedule and will become part of Consultant Contract.