TERMS OF REFERENCE

Supply and Installation of 105 kW Ground Mounted Array Type Grid Connected Solar Photovoltaic System at the Argyle International Airport

(PACES/002/2016)

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1 BACKGROUND INFORMATION

1.1 Beneficiary Country

St. Vincent and the Grenadines

1.2 Contracting Authority

GEF/UNDP

1.3 Relevant Country Background

The government of St Vincent and the Grenadines has received funding from the Global Environmental Facility (GEF) to support its climate change mitigation thrust. The UNDP is implementing a medium size project entitled "Promoting Access to Clean Energy Services in St. Vincent and the Grenadines (PACES)" on behalf of the government.

The Project will seek to reduce GHG emissions from fossil fuel-based power generation by exploiting the renewable energy resources for electricity generation in St. Vincent and the Grenadines (SVG). It will promote clean energy decentralized electricity solutions in SVG, from unutilised Renewable Energy (RE) resources including inter alia, hydropower, wind, and solar. It is envisaged that through the project activities there will be a greater share of RE in the islands' energy mix by (i) the strengthening of the country's clean energy policy framework including the streamlining of processes for RE investment approvals; (ii) increasing the capacities of appropriate institutions and individuals to support clean energy developments in SVG; and (iii) mobilizing investments for RE demonstration projects utilizing solar resources for electricity generation.

1.4 Current State of Affairs in the Relevant Sector

St. Vincent and the Grenadines (SVG) is a multi-island state comprising the main island of St. Vincent and seven smaller inhabited islands as well as about 30 uninhabited islets constituting the Grenadines. The islands are home to a population of 120,000 people and cover a land area of 389 square kilometres. Aside from the main island of St. Vincent, other Grenadine islands with significant energy demands include, Bequia, Union Island and Canouan. The country is almost completely dependent on imported petroleum products such as diesel (for transport and electricity generation), gasoline (for transport), kerosene (for cooking) and butane/LPG (for cooking and water heating).

The persistent high cost of importing fossil fuels into SVG has led to high electricity generation costs as well as steep electricity tariffs. In December 2004, domestic customers paid on average USD 0.275/kWh (EC$0.74/kWh) in comparison with the 2013 cost of electricity of USD 0.35 per kWh which is among the highest in the region. The average annual household bill in SVG for electricity is more than USD 52 per month (EC$140 per month). The highest price increases for petroleum products were recorded between 2004 and 2008 with the global price of USD 32 per barrel in 2004 to a record price of USD 147 per barrel in 2008. The import value of petroleum and related products into SVG rose to a record high of over USD 59 million (EC$158 million) in 2008, decreasing to USD 41 million (EC$110 million) in 2009. These price spikes have impacted all the major sectors of the Vincentian economy including, transport, electricity generation, manufacturing, agriculture

and tourism. All fuel prices to end-use consumers are government controlled and therefore not reflective of the actual variations of prices on the import market.

SVG has a global horizontal irradiance (GHI) that averages 5.8 kWh/m2/day throughout its low-lying areas. This is sufficient solar resource for flat-panel PV and solar hot water systems. Despite this viable resource, SVG has only developed initiatives utilizing solar energy since 2011. These solar initiatives were designed by the Government of St. Vincent and the Grenadines (GoSVG) using grant funds to demonstrate that solar energy can be used in the country to offset fossil-fuel based electricity generation. The GoSVG, however, has not yet made any substantial efforts to encourage private investment into more solar energy initiatives.

1.5 Progress made in Reducing Barriers

To improve the energy security of SVG, the GoSVG has also issued its National Energy Action Plan (NEAP) in 2010 that identifies specific strategies in Section 4.3 to develop renewable energy as a means to reduce the country's dependence on imported fossil fuels for electricity generation. This includes actions to scale-up development of geothermal, hydropower, wind energy, biomass and waste-to-energy, solar electricity and solar thermal. In addition, NEAP also identifies actions to be taken to deploy de-centralized renewable energy applications for the Grenadine Islands as well as buildings and households that have costly connections to the grid.

2 OBJECTIVES, PURPOSE AND EXPECTED RESULT

The main objective of this project is to contribute towards Saint Vincent and the Grenadines' efforts to reduce its reliance on imported fuels by reducing the airport's operational cost on energy through the installation of solar photovoltaic systems

3 PURPOSE OF THE ASSIGNMENT

The purpose of the proposed consultancy is to purchase and install a 105 kW ground mounted array type grid connected solar PV system at the Argyle International Airport.

4 SITE LOCATION

The proposed site is located to the southern end of the runaway at the Argyle International Airport (AIA), outlined in yellow. Exact dimensions are to be finalised. The site consists of a small hill of stock piled earth fill from excavated work. This will be graded in preparation for the 105 PV system.

5 KEY DELIVERABLES

Bidder shall provide a Project Summary Execution Plan for the full scope of services to be provided, including but not limited to the following;

- A detailed description of all the necessary components with related quantities and sizes that comprise the Unit (105 kW PV system) including fixed rack, PV modules, inverters, display screens for monitoring, remote monitoring devices;
- Detailed diagrams outlining the entire installation process including but not limited to;
    - Schematic diagram of the master station
    - Schematic diagram of the wiring system
    - Solar modular specifications (suitable for outdoor applications and grid connectivity) and layout
    - Solar module mounting rack layout
    - Diagram of relevant support structure
- Standard PV module specifications and justification
- Details of payback period and earnings
- Specification on inverter and system maintenance and controls
- System must be designed for a period of 25 years with a 2 year warranty
- Organizational chart with roles and responsibilities of the firm. This chart shall show lines of authority and responsibility. Number of personnel to be utilized on the job shall be indicated in appropriate organizational elements. If significant changes in the organization are expected to occur during the life of the Project or phases of construction, these shall be discussed.
- Key personnel

- Major subcontractors
- Basic construction sequence description
- Overall Project schedule with key design/engineering, procurement, construction and commissioning milestones
- Typical start-up plans
- Conceptual site layout. The conceptual site layout should include consideration for Project requirements.
- Specification sheets for major equipment
- Equipment warranties
- Security plan
- Safety plan
- Environmental compliance plan
- Quality control and assurance plan
- Project management plan
- Details of payback period and earnings
- System warranty

5.1 Schedule of Pricing

An itemized schedule of pricing shall be submitted as part of the proposal and shall include sufficient detail to allow the evaluation panel to fully evaluate The Bidder's proposal in comparison to other Bidders.

The Bidder shall provide labor, time and materials cost schedule.

5.2 Credit Worthiness

In order to evaluate credit worthiness, the Bidder (Company) shall provide an audited annual financial statement for the past two fiscal years and evidence of working capital in the amount of at least the bid value.

5.3 Key Project Risks

The Bidder shall identify key risks that may impact the Project and propose measures to mitigate such risks.

Note: major delays resulting from identified risks will be treated outside of the three (3) months contract period.

6 SCOPE OF WORK

The services of the successful Bidder will be retained for a period of three (3) months for the execution of the Project. The Bidder will work within the framework of the objectives to be achieved, the activities that are established as part of the work programme and the deliverables that must be accomplished.

The Bidder shall be responsible for all aspects of the detailed engineering investigations, design, manufacture, permitting, procurement, supply, shipping and importation, delivery, storage, construction, labour, supervision, proper staffing, all costs related and applicable for the general conditions, erection, installation, commissioning and testing of the complete

project. The Bidder shall also be responsible for the establishment of appropriate operations and maintenance procedures, quality management system documentation and warranties for the project.

6.1 Specific Activities

The Bidder will be required to undertake the following activities to fulfil his/her obligations under this contract:

- Conduct site assessment of proposed site (on a date that would be advised) to inform system design;
- Identify orientation of the system array location;
- Document the solar resource potential at the designated array location through well-known PV design programs (such as Valentin) or international Solar resource databases.
- Procure a 105kW PV grid connected system, most suitable for given conditions
- Successfully install the system within agreed time frame
- Prepare the PV system so that it can be Grid connected (connection done by VINLEC)
- Test and ensure system is fully functional after grid connection by VINLEC
- Train local technicians on system maintenance
- Provide a list of materials for maintenance purposes with names and contact of suppliers

7 RESPONSIBLE BODY

The Bidder shall report to the Project Coordinator of the PACES project within the Energy Unit of the Ministry of National Security, Air and Sea Port Development.

8 FACILITIES TO BE PROVIDED BY THE CONTRACTING AUTHORITY AND/OR OTHER PARTIES

The Project Coordinator of the PACES will be the Manager of the project and will be mandated to provide the Director of the Energy Unit with periodic briefs on the progress of the project. The Coordinator will also brief the UNDP office in Barbados concerning the status of the project.

9 FACILITIES TO BE PROVIDED AGYLE INTERNATIONAL AIRPORT

9.1 Site Preparation Requirements

9.1.1 Groundwork

- Approximately 4,046 m² (1 acre) of land
- Site to be graded and compacted for stability.
- Site treated with a layer of gravel.
- An inner area of approximately 743 m2 (8,000 ft2) within the designated site is to be concreted to prevent vegetation growth

9.1.2 Concrete Foundations

- The concrete mix must have a minimum 28 day compressive strength - 3000 psi

9.1.3 Building

- Structure measuring 2.44 m x 3.05 m x 2.44 m (8 ft x 10 ft x 8 ft) is to be erected at a point nearest to VINLEC's power supply. This structure will house the system's inverters.

10 LOGISTICS AND TIMING

10.1Location

The Bidder will be located at his/her usual place where he/she conducts business. However, he/she will be required to visit the office of the Energy Unit periodically as stipulated by the Project Coordinator.

10.2Commencement Date & Period of Implementation

This exercise shall commence from the date of contract and will operate for a maximum period of three (3) months, consecutive.

A Project Implementation schedule, with specific milestones, must be submitted with the proposal. Requests for extensions must be submitted to the Project Coordinator for approval.

The services of the contractor (Consultant) will be retained for the duration of the project.

11 REQUIREMENTS

11.1Personnel

The head of team shall be a proven professional Expert in Solar PV technology

11.1.1 Qualifications and Experience

- Bachelor Degree in Electrical Engineering or a related field from a recognised University.
- Candidate must have at least seven years of experience in solar PV installation and electrical installation
- Candidate must provide evidence of at least 5 previous PV system installations in the Caribbean that are functioning;
- Candidate must be able to provide PV training and must prove this experience through previously conducted training documentation (summary).
- Experience working with donor and governmental agencies within the Caribbean Region in designing and installing PV systems will be an asset would be an asset

11.2Permitting requirements

- The necessary building permissions will be sought by the Energy Unit.
- The contractor at, its expense, shall obtain and file on a timely basis all documents required to obtain applicable permits and approvals including but not limited to;

a. Import permits and licences
b. Work permits
c. Transportation with appropriate trucking companies
d. Port fees and duties
    - A waiver of import duties and VAT may be granted by the Government upon proper application

Local support in obtaining these permits will be facilitated by the GoSVG through the Energy Unit

12 REQUIRED SYSTEM DESIGN ATTRIBUTES

12.1PV System Design Criteria

- The system shall be designed and constructed for a minimum functional life of 25 years
- The system shall be designed and constructed with the primary objective of maximising energy generation within the lands available with a maximum output of 105kW
- The system shall be designed and constructed in a manner to maximise generation and parasitic loss due to shading, soiling, wire losses, inverter losses and switchgear and transformer losses.
- The systems, facilities and components shall be designed and constructed to withstand without damage all applicable environmental conditions as defined by the local building codes appropriate for the site, including but not limited to wind, corrosion, precipitation, temperature and humidity extremes.
- The generating facilities shall utilise solar PV modules as a means of renewable power generation. The type and technology of the modules shall be specified by the contractor. The contractor shall provide a plan that meets the requirements of this terms of reference.
- The system shall comply with the requirements of IEC and National Electric Safety Codes (NESC), with IEC taking precedence if there are conflicting code requirements
- The system shall be designed and installed in compliance with component manufacturer instructions

12.2 Civil/Structural Requirements

The contractor shall provide a plan specifying specific civil requirement for project implementation. Civil details required include but are not limited to;

- Pads and foundations for mounting panels which can withstand category V hurricane wind speeds (157 mph or higher).
- All structures must be designed in accordance with local building codes and treated for saline conditions.
- The complete generating system, support structure, and ancillary structures shall comply with Category V hurricane. The structure must resist both static and dynamic wind loading without damage to resonance or fatigue. The structures must be designed to withstand gravitational loads and combined loads as required by the applicable codes. The structures must take into account expected thermal expansion and contraction and thermal cycling

- The selected Company will be required to provide details in engineering drawings approved by VINLEC as part of the design and permitting process. Structural details should include but are not limited to the PV mounting fasteners, support structures, material specifications, grades and finishes, inverter pads, metering sections, monitoring and disconnect facilities and array layout drawings.

12.3 Mechanical Requirements

- All generating facility components, support structures, hardware, conduits, wire management, enclosures, shade structures and the like shall be protected from corrosion due to known or expected atmospheric conditions local to the project site. Consideration shall be given to humidity, salinity, acidity, condensation, air particulates, or other conditions likely to cause accelerated corrosion of materials
- Contact of dissimilar metals and finishes shall be avoided or managed to prevent premature galvanic corrosion.
- Aluminium shall not be in direct contact with concrete or copper
- Areas of exposed ferrous metals (i.e. cuts, field wields, butt ends and similar) shall be aggressively treated with multiple applications of an appropriate corrosion protection coating.
- Support structure components in contact with soil shall be protected from detrimental subsurface corrosion for the design life of the project. Particular site specific evaluations including local soil conditions shall be conducted to assure long-term structural integrity of all support structures.
- Fastener quantity, diameter, material grade and finish shall be selected appropriate to each joint to assure sufficient initial clamping preload, prevention of loss preload, and maintainability of the joint for the design life of the project.
- Mechanical wire and cable management shall be provided to prevent all opportunities for strain, abrasion, disconnection, accidental grounding and similar avoidable hazards. Mechanical wire management components shall be rated for long-term sunlight exposure.

13 TECHNICAL SPECIFICATIONS

13.1 General Electrical Requirements

Voltage insulation levels, grounding, equipment interrupting and continuous current capacities, circuit protection, and mechanical strengths shall be selected and coordinated in accordance with calculations and the recommendations of the National Electrical Safety Code (NESC), International Electrotechnical Commission (IEC) or other applicable codes and standards as noted (with IEC taking precedence if conflicting code requirements). Any variation from code shall be noted. Electrical systems shall be designed for the expected environmental conditions at the site, including temperature, humidity, elevation, and corrosion.

Conductor colour codes shall be in compliance with the existing St. Vincent and the Grenadines regulations based on IEE BS7671 – British Standard.

Direct current (DC) and alternating current (AC) conductors shall be labelled to match wiring diagrams at all combiner boxes, pull boxes, electrical enclosures, inverters, etc.

13.2 PV Modules

- Modules installed shall conform to the manufacturer's published data sheet(s).
- Manufacturer shall provide test data that quantify initial light-induced degradation (LID).
- The average power ratings of all modules shipped, based on the manufacturer's flash test data, shall be greater than or equal to the nominal rating of the module as specified in the published data sheet.
- Modules shall be listed to Underwriters Laboratories (UL) 1703 and/or IEC and individually marked as such.
- Modules shall be independently certified to qualification standard IEC 61216 (crystalline silicon flat plate modules) or to IEC 61646 (thin film flat plate modules), as appropriate.
- Module string configuration must be compatible with the proposed inverter (provide name of inverter or list of possible inverters).
- PV module connectors must be designed for environmental exposure, be polarized, not interchangeable, and have an ampacity rating not less than the maximum series fuse rating of the module.

13.3 Module interconnection cables

- Conductor size is to be determined in accordance with the IEC, including conditions of use with particular consideration of temperature rise due to solar exposure, terminal ratings, and consideration of over-current protection and all possible current sources.
- Module interconnect wiring should be identified and marked for "Sunlight Resistant" when exposed, "Cable Tray" when in cable tray, and "Direct Burial" when directly buried.
- Solid wire that could break when modules are serviced or moved should be avoided.

13.4 Combiner boxes (if applicable)

- Combiner boxes must have IP67 standard.

13.5 Disconnects

- Disconnects must be listed to the appropriate UL and/or IEC standard for the application.
- Disconnects must be provided at locations required by the IEC.

13.6 Inverters

- PV inverter systems shall be commercial grade, pure sign wave, and specifically designed for PV installations.
- Minimum inverter warranty shall be 10 years, design life shall be 25 years (inverter exchange every 10 years shall be included in the bid).
- Inverter systems shall be designed for the expected environmental conditions at the site, including temperature, humidity, elevation, and corrosion.
- The PV inverter system shall be designed and materials shall be furnished in accordance with the latest revisions of applicable sections of UL, IEC and IEE.

- Inverter voltage, current, and frequency capability are to be selected in accordance with the PV technology used and conditions local to the generating facility

13.7 Warranties and Guaranties

The contractor shall include a plan for comprehensive Project Warranty including but not limited to;

- PV modules , workmanship, and long-term performance
- Inverter materials, workmanship, and long-term performance
- Balance of System (BoS) materials, workmanship, and long-term performance
- Energy performance guarantee at point of interconnection

14 FACILITIES TO BE PROVIDED BY THE BIDDER

The Bidder shall provide all the facilities that he requires to discharge his work (e.g. laptops/desktops, software, tools and equipment, etc.).

15 EQUIPMENT

- No equipment is to be purchased on behalf of the Contracting Authority/beneficiary country as part of this service contract or transferred to the Contracting Authority/beneficiary country at the end of this contract.

16 REPORTS

16.1Reporting Requirements

The Bidder shall submit to the Project Coordinator, three hard copies along with an electronic file copy of the Draft and Final Report of the project. The report should outline system's operation and maintenance; performance, etc. The Project Coordinator will be responsible for the approval of these documents.

17 MONITORING

The progress of the installation will be monitored by a Site Engineer who will be appointed by the Project Coordinator to act on his behalf. The Site Engineer will be responsible for conducting technical due diligence on the installation of the 105 kW PV system at the Argyle International Airport, and to make intervention where necessary to ensure system compliance. The Site Engineer will be authorised to bring to the attention on the contractor any concerns regarding the installation and work with the contractor to resolving any issues.

18 EVALUATION CRITERIA AND SELECTION PROCESS

18.1 Proposal Selection Process

<u>Criteria for responsivity</u>

- Company Profile

- Project Team

- Project Proposal

All proposals will be reviewed to determine whether they are responsive or non-responsive to the requirements of this **ToRs**. Proposals that are determined to be non- responsive will be rejected. The remaining proposals will be evaluated and rated based on the evaluation criteria prescribed below. The Evaluation Panel reserve the right to conduct site visits and/or interviews and/or to request that Bidders make presentations and/or demonstrations, as appropriate.

18.2 Bid Clarification and Contract Negotiation Meetings

In the process of evaluating the responses, bid clarification meetings may be required of selected Company. Following detailed evaluations, the Evaluation Panel will select the winning bid and provide notification for final contract negotiations.

18.3Notice of Award

Upon conclusion of the evaluation process and any subsequent negotiations, all Bidders will be notified of the outcome.

18.4 Evaluation Criteria

Proposals will be evaluated based on the criteria noted below (weighting of 70% technical and 30% financial):

a) Company

1. Relevant experience & references (Caribbean experience is required to bid)
2. Accreditations
3. Financial stability & credit worthiness
4. Organizational effectiveness
5. Familiarity with relevant permitting and regulatory processes

b) Project Team

1. Depth and breadth of team experience
2. Key staff qualifications
3. Technical expertise
4. Evidence of successful project management

c) Project Proposal

1. Bid quality and completeness
2. Energy generation and quality of energy estimate
3. Project Execution Plan
4. Demonstration of understanding of scope based on submitted documents
5. Level of detail provided
6. Equipment selection
7. Bid price (Schedule of Pricing)
8. Overall Project capital cost
9. Levelized cost of energy/Project returns
10. Cost risk assessment and contingency planning