



# Organisation of Eastern Caribbean States



## **REQUEST FOR EXPRESSIONS OF INTEREST**

**Organisation of the Eastern Caribbean States Commission (OECSC)**

**Caribbean Efficient and Green-Energy Buildings Project**

**Grant No.:** TF0C2148-60

**Assignment Title:** Consulting Services for the Preparation of Detailed Designs and Technical Specifications for Energy Efficiency Measures and Distributed Solar PV Systems for Public Buildings in Grenada, Saint Lucia & Guyana.

**Reference No.:** LC-OECS COMMISSION-414663-CS-QCBS

**Number and Title of LOTS:**

**LOT 1:** Grenada

**LOT 2:** Saint Lucia

**LOT 3:** Guyana

The Organisation of the Eastern Caribbean States Commission (OECSC) has received financing from the World Bank, acting as administrator of grant funds provided by donors under the Support for Small Island Developing States (SIDS) DOCK Support Program Multi Donor Trust Fund, toward the cost of the Caribbean Efficient and Green-Energy Buildings Project. The OECSC intends to apply part of the proceeds for Consulting Services for the Preparation of Detailed Designs and Technical Specifications for Energy Efficiency Measures and Distributed Solar PV Systems for Public Buildings in Grenada, Saint Lucia, and Guyana.

The consulting services (the Services) include the defining of EE measures (EEMs) and distributed solar PVs systems (DPVs) to be implemented in selected public buildings in Grenada, Saint Lucia and Guyana and preparation of the detailed design, technical specifications, and bill of quantities (BOQ) for the bidding documents for implementing the proposed EEMs and DPVs investments. In addition, the assignment will include identification of environmental and social risks associated with the planned implementation and preparation of Environmental and Social Management Plans (ESMPs) by the

Environmental and Social Management Frameworks (ESMFs) and other instruments for the project which have been prepared by each participating government.

The implementation period will be six (6) months, i.e., from August 2024 to January 2025.

The OECS Commission now invites eligible consulting firms (“Consultants”) to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience to perform the Services. In the assessment of submissions, consideration will be given to technical competence, qualifications and experience, and local and regional experience on similar assignments.

**Key Experts will not be evaluated at the shortlisting stage.**

**The shortlisting criteria are:**

1. Relevant international (especially experience outside the country where the firm is based) project experience within the last ten (10) years, in consulting services related to both Energy Efficiency (EE) measures and Distributed Photovoltaic (DPV) systems respectively in public/commercial buildings, similar in nature and complexity. This should include conducting energy audits, identifying and assessing opportunities and feasibility for EE and DPVs, preparing detailed designs, technical specifications, and Bills of Quantities (BOQ) for buildings, conducting or supervising the implementation of EE and DPV projects etc. **(60%)** including:
  - Core Business & field of expertise, corporate capacity, and number of years in business;
  - Experience in EE services;
  - Experience in DPV services.
2. Availability of a team of skilled staff with in-depth international experience and local/regional experience in executing similar assignments in PV and EE respectively, capacity to provide the requested key personnel for project implementation and with EE and Solar PV expertise to complete the project activities within the allocated time and inclusion of Caribbean Nationals amongst proposed personnel/experts. **(30%)** including:
  - Team with relevant experience in EE;
  - Team with relevant experience in DPVs;
  - Team with experience in Caribbean, regional/local experts.
3. Experience in providing the relevant services in the Caribbean region or in countries with similar conditions. **(10%)**

To obtain the maximum degree of comparison among Expressions of Interests (EOIs) and facilitate the evaluation process, the EOI should be a **MAXIMUM of Forty (40) pages** and include the following information mentioned below:

- Title page with name of firm submitting the EOI: should contain name of firm (or joint venture and/or a sub-consultancy, if applicable), address, email, telephone, name of contact person and date of submission.
- Expression of Interest: including the firm's general and specific experience.

The attention of interested Consultants is drawn to Section III, paragraphs, 3.14, 3.16, and 3.17 of the World Bank's Procurement Regulations for IPF Borrowers, Fifth Edition, September 2023 ('Procurement Regulations') setting forth the World Bank's policy on conflict of interest.

Consulting Firms wishing to signify their interest in undertaking the prescribed services are to submit an Expression of Interest (EOI) providing information demonstrating that they have the required qualifications and relevant experience to perform the services. **Consultants can indicate their interest in providing services in up to two (2) countries (LOTS) of their choice.**

Consultants must clearly indicate whether they intend to associate with other firms in the form of a joint venture or a sub-consultancy to enhance their qualifications. In the case of a joint venture, all the partners in the joint venture shall be jointly and severally liable for the entire contract, if selected.

Expressions of interest can be submitted via email to the first address and copied to the second address by **May 09, 2024, at 16:00 hours Eastern Caribbean Time (EST)**. Email submissions should include the name and address of the Consultant and shall be clearly marked in the subject line as **"Expression of Interest- Consulting Services for the Preparation of Detailed Designs and Technical Specifications for Energy Efficiency Measures and Distributed Solar PV Systems for Public Buildings in [insert LOT Number and Title]."**

Further information can be obtained at the address below between 09:00 and 16:00 hours (Atlantic Standard Time) Monday to Friday.

**Tehillah Bannis**  
**Procurement Officer**  
**Organisation of the Eastern Caribbean States Commission**  
**P.O. Box 179**  
**Morne Fortune**  
**Castries**  
**St. Lucia**  
**Tel: 1-758-455-6418**  
**E-mail: [procurementbids@oecs.int](mailto:procurementbids@oecs.int) Copied to: [judith.ephraim@oecs.int](mailto:judith.ephraim@oecs.int)**

A Consultant will be selected in accordance with the Quality and Cost Based Selection (QCBS) based selection method set out in the World Bank's Procurement Regulations for IPF Borrowers, Fifth Edition, September 2023.

The Terms of Reference (TOR) for this consultancy is provided below.

## **LOT 1: Grenada**

### **Organisation of Eastern Caribbean States Commission Caribbean Efficient and Green Energy Buildings Project (CEGEB)**

#### ***Preparation of Detailed Designs and Technical Specifications for Energy Efficiency Measures and Distributed Solar PVs Systems for Public Buildings in Grenada***

### **Terms of Reference**

#### **Introduction and Context**

Despite the availability of indigenous renewable energy resources, many Caribbean nations continue to have a heavy dependence on imported fossil fuels which has threatened energy security and led to high electricity prices. The vast majority of power generation capacity in countries such as Grenada, Saint Lucia and Guyana, consists of diesel-fired power plants. The reliance on expensive imported diesel fuel, together with the inability to take advantage of economies of scale due to the small market sizes of individual island states has resulted in extremely high electricity tariffs in these countries.

The Government of Grenada has established policies and goals for transition to a low carbon economy and transformation of the power sector supply mix to make use of its indigenous renewable energy resources. Grenada submitted its second NDC in November 2020, targeting a reduction of greenhouse gas emissions (GHG) at 30% of the 2010 level by 2025, of which 20% will come from implementing energy efficiency (EE) measures and 10% from adding renewable energy (RE) into the production mix. Grenada has updated the National Energy Policy and Implementation Action Plans. However, despite the renewable energy potential and national commitments, the expectation is that more progress should have been realized to date.

Recent energy audit projects of 24 public buildings<sup>1</sup> in Grenada, conducted in 2022, have indicated major benefits from investments in EE and distributed solar photovoltaic (PV) systems. These interventions can reduce dependency on imported fuel, lower electricity costs, decrease GHG emissions, and enhance resilience of critical public services. Given the limited land availability for large-scale, centralized, solar-powered electricity generation, due to mountainous terrain and small size of these countries EE and RE interventions are highly attractive in the short-to-medium term. The results from these energy audits indicate that EE and RE investments are economically viable. The payback periods of EE and RE measures identified in these audits have been estimated to be less than three years.

The Government of Grenada has requested support from the World Bank (WB) in the design and implementation of the multi-country Caribbean Efficient and Green Energy

---

<sup>1</sup> These public buildings include government buildings and facilities such as central and municipal administrative buildings, universities and schools, hospitals and clinics, stadiums, orphanages, museums, and other publicly owned facilities.

Buildings Project (CEGEB)<sup>2</sup> with estimated total financing of US\$ 98 million. This five-year investment Project is being prepared aiming at obtaining approval by the World Bank in July 2024 and will be implemented by the Grenada Ministry of Climate Resilience, the Environment and Renewable Energy (Grenada MCRERE) and the Organisation of Eastern Caribbean States (OECS) Commission.

The CEGEB is designed to address common challenges in the energy sector that countries in the region face and will support investment on EE measures and RE systems, such as distributed solar PV systems installed on rooftops or in public spaces, and solar water-heating systems. The EE retrofits will include passive and active EE measures along with improvements in building-control systems. Passive EE measures will include energy-efficient windows, shading, wall and roof insulation, cool surfaces, etc. Active EE measures will include the replacement of existing inefficient building equipment and appliances, or installation of new energy efficient equipment and appliances, such as lighting systems, air-conditioning equipment, ceiling fans, and refrigerators or freezers using refrigerants with low or no global-warming potential (GWP), where possible. Improvements in control systems will include smart controls, sensors, and energy-management systems to meet EE objectives. CEGEB will also support safe disposal of used equipment and materials.

The OECS Commission has received a Project Preparation Grant from the WB and plans to use the proceeds from the PPG to hire a consulting firm (hereafter referred to as the Consultant) to prepare detailed designs, technical specifications, and bidding documents for EE measures (EEMs) and solar PV systems (DPV) in 10 public buildings in Grenada these buildings.

### **Objective of the assignment**

The objective of this assignment is to define the EEMs and DPVs to be implemented in 10 public buildings in Grenada and prepare the detailed design, technical specifications, and bill of quantities (BOQ) for the bidding documents for implementing the proposed EEMs and DPVs investments. The assignment will also include identification of environmental and social risks associated with the planned implementation and preparation of Environmental and Social Management Plans (ESMPs) in accordance with the Environmental and Social Management Frameworks (ESMFs) and other instruments for the project which have been prepared by the Government of Grenada. **The list of the buildings is provided in Annex 1A.**

The assignment will include a detailed review of the EEMs and DPVs identified in the audits already conducted,<sup>3</sup> identification of any additional EEMs, DPVs or other measures that may be appropriate,<sup>4</sup> assessment of the current technical energy performance of the buildings, detailed analysis of the EEMs and DPVs, and analysis of the implementation

---

<sup>2</sup> The CEGEB Project also includes Saint Lucia and Guyana, in addition to Grenada.

<sup>3</sup> The completed audit reports and all collected data of the buildings will be provided to the consultant.

<sup>4</sup> Such as structural or infrastructure upgrades/replacement (electric systems, piping for HVAC, hot water, etc. that may be deemed necessary to ensure sustainability/longevity of the proposed EE improvements and DPVs.

costs, energy and cost savings, paybacks, IRR and NPV and co-benefits such as improved comfort levels, reduced local pollution, decreased GHG emissions and increased resilience. It will also include the preparation of any needed drawings, detailed costing, and technical specifications, and key implementation steps that will be translated into bidding documents. The assignment will also include the confirmation of compliance with relevant energy norms and standards.

### **Scope of Work**

The Consultant shall develop a list of EEMs and DPVs for each of the public buildings and prepare the detailed design (including drawings), technical specifications, bills of quantities (BoQs), necessary for preparation of the bidding documents to implement the investment (which will be carried out by another consultant). The Grenada MCRERE will facilitate and support coordination with the building administrations to ensure full and timely access to the facilities for the assessments to be conducted and facilitate sharing of available and relevant documentation of the facilities, including energy bills, with the Consultant. The Consultant is expected to use available documentation and drawings as reference, (where drawings are unavailable, the consultant can use or create as-built drawings) but shall confirm completeness and accuracy during site visits, and, to the extent needed, the Consultant should make drawings of current systems.

The Consultant shall report to OECS, and through OECS to MCRERE and WB.

The Consultant shall perform the following tasks:

#### **Task 1: Review of existing energy audits & surveys, and inception report**

All public buildings selected for the implementation of EEMs and DPVs have existing energy audits & surveys based on walk-through assessments, preliminary analysis of energy consumption and cost, and economic and financial analyses of the investment. These energy audit reports will be shared with the Consultant and will serve as an information basis. In this Task, the Consultant shall review and assess the audit reports and the EEMs and DPVs defined and analyzed in these reports, and define the detailed methodology and approach to be used to check, verify, and complement these audit reports as necessary in order to (i) identify any field work for measurements to collect additional data not reported in the audits and develop a measurement plan; (ii) identify any additional EEMs and DPVs to be implemented; (iii) develop the appropriate designs and drawings; (iv) prepare technical specifications and BOQs; (v) develop bidding documents; and (vi) identify E&S risks and prepare ESMPs.

The Consultant shall prepare and submit an Inception Report to OECS, MCRERE and WB describing the review and assessment and the methodology and approach to be utilized.

The inception report shall: (i) summarize the results of the review and assessment of the energy audits; (ii) identify additional information to be collected for the buildings during site visits; (iii) define the methodology and approach for site visits and for identifying additional EEMs and DPVs; (iv) present the plan for site visits, data collection, and field work; (v) provide a detailed work program for the rest of the project, (vi) identify potential

issues and problems and approach for addressing these; (vii) list any assistance or action items needed from OECS, MCRERE and/or WB.

The Consultant shall also document in the Inception Report the key parameters and methodology for updating the financial calculations under the existing audits such as payback and IRR following the WB guidelines for economic and financial analyses for similar investments.

## **Deliverable**

Inception Report

Task 2: Site visits, data collection for EEMs and DPVs; Identification and assessment of EEMs

### ***Site visits and data collection***

The Consultant shall conduct site visits to the public buildings and interviews with building users, officials and/or energy managers to verify and update the information available in the existing energy audits,<sup>5</sup> and collect additional data as needed. If necessary, measurements will be taken to obtain additional data in accordance with the measurement plan defined in Task 1.

The following information will be documented for each building:

- General building information: square meters and age (including date of any major retrofits), typology and general use of the building,
- Building layout, floorplan, and site plan with the orientation of the building and the surroundings.
- Structural assessment: inspection by a qualified Engineer of structural integrity of roof, ceiling, physical condition of building, and any defects that could affect longevity, utility, safety, or feasibility of EEM installation,
- Environmental inspection: presence of water damage or mold, evidence of wood-destroying insects or other vermin or pest infestation, or presence of asbestos, but not limited to these only,
- Operations: Occupancy rate, occupancy schedules, descriptions of current energy management activities,
- Utility information: Data available about energy consumption and costs for energy services. Review and analysis of the energy bills and data on electric (and fossil fuels if any) energy consumption and water bills (if any) for at least 36 months. The analysis of historical data will consider disruption derived from COVID lockdowns,
- Building envelope: Collect data and information about actual condition of building envelope: e.g., area and composition of external walls, floors, roofs and windows, building geometry, thermal transmittance and u-values of building elements,

---

<sup>5</sup> The beneficiaries and administrations are responsible for providing necessary inputs, like copies of invoices and bills of energy consumption, technical design documentation, copies of walk-through audit reports, and any other data. Some of the information may be available from the walk-through audits already carried out.



- Energy systems: energy sources, technical characteristics of equipment comprising cooling controls, ventilation, sanitary hot water, air conditioning and lighting systems, among others,
- Inventory of existing systems and electrical equipment: HVAC systems, automatic control systems, lighting, motors, etc.,
- Assessment of the energy performance levels of the existing systems and equipment from equipment ratings and specifications or measurements,
- Other relevant information impacting energy consumption levels, such as operating hours of the institution and energy services, number of users, indoor comfort measurements and occupant surveys (temperatures, humidity), energy consumption related to behavior of the users, thermostat settings etc.,
- Total building's electrical load measurement for at least one week to identify electricity consumption during weekdays and weekends,
- Energy consumption of air conditioning systems and indoor temperatures, at least for 24 hours,
- Output values like airflow, water flow, air and water temperatures of cooling production and distribution central systems,
- Electrical consumption of lighting systems for sample circuits, and lighting level (lux) in sample representative locations.
- Carry out a survey of the status of all electrical and electro-mechanical installations, against national wiring regulation, in consultation with the relevant governing Electrical authority. This should include:
  - Analyze the capacity of electrical boards,
  - Analyze the status of the main wiring,
  - Analyze the load demands on the mains of power equipment,
  - Verify the existence of protective earth connection and lightning protection where required,
  - Diagnose the state of the buildings' electrical installations, proposing necessary improvement measures, including estimated costs,
  - Discuss the location for the inverters, DC and AC cables.

### ***Identification and Assessment of EEMs***

Based on the analysis of the above information, the Consultant shall develop the energy consumption baseline. The baseline will consider indoor temperatures measured and current equipment installed (consistent with the energy bills). If comfort level in the building is not met and/or active systems do not comply regulations in place, the Consultant will also calculate a normative baseline, considering that indoor temperatures meet comfort levels and equipment installed in compliance with regulations.<sup>6</sup> The energy model should be calibrated with data determined by calculation or measurement, and should provide estimates on the baseline consumption (actual and normative) disaggregated by energy use

---

<sup>6</sup> Compare the comfort level/electricity consumption of a building of similar type which meet national/international standard in order to set up baseline.

for cooling, preparation of sanitary hot water, indoor lighting, ventilation, etc.

The Consultant shall then identify the EEMs – including the EEMs that were recommended in the audit reports and any additional EEMs identified by the Consultant. EEMs should include both active and passive measures. All EEMs should be in compliance with local and regional regulations and guidelines such as, for example, the CARICOM Energy Efficiency Building Code, and EE Standards and Labeling, etc.

For each EEM in each building, the Consultant shall update the electricity savings, fuel savings, greenhouse gas emission reductions; cost savings, O&M costs, investment costs, payback, IRR and NPV. The investment costs of EEMs should be determined based, to the best extent possible, on preliminary quotes from contractors, vendors and installers, or ESCOs. Costs should include breakdown of labor, installation and construction costs, materials and equipment, all indirect costs needed for implementation (pipe accessories, civil construction works, electrical connections, changes in electrical boards, remediation of mold or asbestos, replacement of ceiling or roof elements (if required), etc.). It should also include O&M costs, commissioning costs, and costs of waste management and safe disposal of used equipment and materials.

The consultant shall provide a complete list of all EEMs considered and a list of the recommended EEMs based on the prioritization methodology developed in Task 1 and approved by OECS and MCRERE.

The Consultant shall also prepare a measurement and verification (M&V) plan based on international best practice<sup>7</sup> and develop the related M&V protocols and operational procedures to verify the achieved savings. The M&V Plan shall specify for each EEM the parameters to be measured, the pre-implementation baseline values for these parameters, the post-implementation measurements, and the methodology for calculation of the achieved energy savings and making any needed adjustments for changes in any baseline parameters.

## **Deliverables**

**Detailed Task 2 Report**, consisting of an Executive Summary and a separate section for each building, including all data collected in this Task, complete list of EEMs, list of recommended EEMs for implementation, and M&V plan.

---

<sup>7</sup> Such as, for example, the International Performance Measurement and Verification Protocol (IPMVP).

### Task 3 – Develop Indicative model, design of the DPVs systems for each building and support preparation of the bidding documents for proposed DPVs investment

Based on the results of Task 2, the consultant will:

- ✓ Assess the roof, its capacity, age, technical drawings, access, and safety. The consultant shall justify with a FEA (finite element analysis)<sup>8</sup> as necessary the bearing capacity of the roofs, but it may also use the technical specifications of the roof, if available. Technical requirement for an FEA is provided in Annex 3.
- ✓ Provide the area available for solar PV modules in m<sup>2</sup> and consider a high efficiency PV module (not less than 21,5%) (consideration for a lower % possible 19) for the conversion to kWp. ***The consultant shall explain the area considered versus the available area for the PV modules and refrain from providing only kWp.***
- ✓ Model each solar DG system, using PVsyst and provide P50 and P90 yield values. The consultant shall analyze the solar resource and make sure that the source used is of good quality. All solar systems, including those for grid connections, must be designed to use most of the available area for energy generation considering not less than 25% of DC/AC oversizing; Among the technical requirements, ensure that the proposed solar systems are designed to withstand winds associated with Category 5 hurricanes systems.<sup>9</sup>
- ✓ The AC capacity should be sized based on i) the load, which should be analyzed for 1 year based on the bills (except for the COVID affected periods (2020-2021)) and measured for at least a full week for each building, if possible, and ii) the contracted AC capacity or available AC capacity as provided by the utility (the rating of the breakers shall be reported). The consultant shall also report the maximum AC and DC capacities that can be deployed in each building (respecting the minimum of 25% DC/AC oversizing).
- ✓ Identify in each building and discuss with the owner/responsible the location for the PV modules, the inverters, the DC cables, the AC cables, the main switch board or similar for grid connection. The location of the meter(s) should also be included. The accesses to the roofs must be reported.
- ✓ Carports should also be considered, characterized and described.
- ✓ Provide for the solar PV systems: indicative layout, single line diagrams and configuration of each solar DG system including the main equipment.
- ✓ Provide cost estimates for the solar PV systems assuming local prices and also international ones. For each building, the Consultant shall define the electricity savings, fuel savings, GHG savings, cost savings, O&M costs, investment needs, payback, IRR and NPV.
- ✓ Prepare a draft report on the proposed DPVs, including results of economic and financial analyses to the OECS for approval.
- ✓ After the approval of the proposed DPV investments, prepare technical documentation (design, technical specifications and bill of quantities (BOQs) for the bidding documents for the procurement of goods, services and works required to implement the proposed DPVs investments. Refrain from over specifying as the contracts will be EPC, so consider minimums to be generated and delivered.

## Deliverables

- Task 3.1: Draft report specifying the proposed DPVs.
- Task 3.2: Detailed design (including the appropriate architectural, mechanical and electrical drawings (in DWG and PDF formats) technical specifications, bills of quantities needed for preparation of the bidding documents for each EEM.

### **Task 4. Detailed design of EEMs, technical specifications, and bills of quantities**

Following approval by MCRERE of the proposed EEMs in Task 2, the Consultant shall prepare the detailed designs (including the appropriate architectural, mechanical, and electrical drawings) technical specifications, bills of quantities and bidding documents for each EEM in each building.

Specifically, this task includes (but is not limited to) the following activities:

For each of the selected EEMs, prepare the technical design documentation, including technical descriptions, design calculations, lay-outs and drawings, detailed technical specifications and priced bill of quantities (BoQs). For technical requirements and specifications that will be linked to new materials or equipment not included in country-specific norms or standards, the Consultant shall follow relevant recognized international norms and codes. The technical design shall also take into account relevant regulations in Grenada on health, environmental protection and safety, any existing environmental management plans for public buildings and facilities, and the environmental and social management framework for the project (ESMF) provided by the OECS. The technical design documentation shall be certified by the Consultant according to relevant provisions in the Law on Construction of Grenada.

Discuss and agree the draft design documentation with the OECS, MCRERE, WB and other stakeholders and revise as needed. The detailed design documentation should at least include:

- ✓ Architectural drawings (plans, sections, facades, technical details).
- ✓ Remediation or structural correction plans (mold, pests, roof elements) if required; Installation drawings (schemes, details, units, specifications)
- ✓ Structural drawings (when needed).
- ✓ Technical specifications.
- ✓ Bills of quantities for work to be implemented,
- ✓ Calculations.

In case approval from local authorities/state expertise for the reconstruction/building retrofits in accordance with local legislation is needed, provide technical support in the approval process if required.

## Deliverables

Task Report specifying the EEMs and related detailed design (including the appropriate

---

<sup>8</sup> See the TOR of the FEA to be respected in a separate document. The FEA shall only be done, if clearly required based on a visual inspection or analysis of technical drawings.

<sup>9</sup> The FEA analysis should be done to confirm the capacity of the roof to resist such wind speeds.

architectural, mechanical, and electrical drawings (in DWG and PDF formats) technical specifications, bills of quantities as needed for preparation of the bidding documents for each EEM.

**Task 5: Identify environmental and social risks and prepare Environmental and Social Management Plans (ESMPs)**

In this Task, the Consultant shall:

- ✓ **Identify environmental and social risks associated with the implementation of the EEMs:** Identify environmental and social risks associated with each of the EEMs, including presence and quantity of any hazardous materials (such as, but not limited to, asbestos and mercury containing light bulbs) that would have to be removed as part of the implementation.
- ✓ **Prepare site specific Environmental and Social Management Plans (ESMPs):** Prepare site-specific environmental and social management plans (ESMPs)/ any other guidance as per the ESMF and submit them to OECS and MCRERE. The ESMPs shall include specifications and bills of quantities for removal, packaging, transport and disposal/interim storage of any relevant hazardous materials, personal safety equipment and monitoring requirements and estimate of costs for the measures. This will also include the locations where the hazardous materials can be disposed and the interim storage location for the mercury containing light bulbs as per the ESMF and country legislation.
- ✓ **Provide support to the MCRERE to carry out public consultations on audit and ESMPs.** MCRERE in coordination with the OECS Commission will organize site-specific public consultations to describe the mitigation, monitoring, and institutional measures to be taken during sub-project implementation and operation to eliminate adverse environmental and social risks and impacts. The consultations will also present on the specific actions and resources needed to implement these measures and the grievance system in place to stakeholders. The consultant will provide materials and support needed for the consultation and update the ESMP considering the inputs from the consultation.

**Deliverables**

- Report on environmental and social risks covering each building site.
- ESMP for each building site.
- Reporting on consultations undertaken during subproject preparation and implementation.

**Services to be provided to the Consultant**

The OECS Commission in coordination with Grenada MCRERE will provide the Consultant with the energy audit reports conducted in the countries and introductions to the respective building administrators.

The Consultant will be responsible for all other arrangements to ensure coordination with the respective buildings' administrations and all relevant entities.

It will be the responsibility of the consultant, when site visits are carried out, to ensure that all safety precautions are taken.

### **Qualifications**

The Consultant should be a firm with relevant international (experience outside where the firm is based) project experience. Relevant technical experience would include programs related to EE measures and DPVs in buildings (especially public buildings), such as conducting of energy audits in buildings, development of detailed designs, technical specifications and BOQs, implementation of building EE programs, etc.

The Consultant must propose a team capable of successfully carrying out all aspects of the TORs with local/international in-depth experience in executing similar assignments. The Consultant shall demonstrate the capability to mobilize enough skilled staff for carrying out the project activities within the allocated time. The exact composition of the non-key expert team will be left to each firm to propose but key skills and credentials are expected to include (see specifications in Annex 2):

### **Timeframe and implementation arrangements**

The estimated time frame is expected to be 6 months from the day of the contract signing. Expenditure on logistics, including international travel, is to be included in the proposed costs.

The Consultant will provide all necessary equipment or resources for the activities.

### **Deliverables and timeline**

The proposed timeline is outlined below and will be agreed with the OECS, MCRERE, and WB.

	<b>Deliverables</b>	<b>Delivery Date</b>
1	Inception Report	1 month from signing the contract
2	Task 2- Draft report on Site visits, data collection for EEMs and DPVs; Identification and assessment of EEMs	2 months after signing the contract
3	Task 3.1- Draft report on Develop Indicative model, design of DPVs systems	3 months after signing the contract
4	Task 3.2 - Report on detailed design, technical specification & BOQ of DPVs systems	5 months after signing the contract
5	Task 4. Detailed design of EEMs, technical specifications, and bills of quantities	5 months after signing the contract
6	Task 5. Report on environmental and social risks and ESMPs	5 months after signing the contract
7	Approval of all Reports	6 months after signing the contract
8	Update Reports from Consultant (identifying challenges, risks and progress)	Bi-weekly

## **LOT 2: Saint Lucia**

### **Caribbean Efficient and Green Energy Buildings Project (CEGEB)**

#### ***Preparation of Detailed Designs and Technical Specifications for Energy Efficiency Measures and Distributed Solar PVs Systems for Public Buildings in Saint Lucia***

### **Terms of Reference**

#### **Introduction and Context**

Despite the availability of indigenous renewable energy resources, many Caribbean nations continue to have a heavy dependence on imported fossil fuels which has threatened energy security and led to high electricity prices. The vast majority of power generation capacity in countries such as Saint Lucia, Grenada, and Guyana, consists of diesel-fired power plants. The reliance on expensive imported diesel fuel, together with the inability to take advantage of economies of scale due to the small market sizes of individual island states has resulted in extremely high electricity tariffs in these countries.

In January 2021, the Government of Saint Lucia published its updated NDC, targeting a seven percent reduction of GHG relative to 2010, in the energy sector, by 2030. This level is far above the two percent targeted in Saint Lucia's first NDC submission. In addition, Saint Lucia has updated the National Energy Policy and Implementation Action Plans. However, despite the renewable energy potential and national commitments, there has been relatively little progress to date.

Recent energy audit projects of 33 public buildings<sup>10</sup> in Saint Lucia, conducted in 2022, have indicated major benefits from investments in EE and distributed solar photovoltaic (PV) systems. These interventions can reduce dependency on imported fuel, lower electricity costs, decrease GHG emissions, and enhance resilience of critical public services. Given the limited land availability for large-scale, centralized, solar-powered electricity generation, due to mountainous terrain and small size of these countries EE and RE interventions are highly attractive in the short-to-medium term. The results from these energy audits indicate that EE and RE investments are economically viable. The payback periods of EE and RE measures identified in these audits have been estimated to be less than three years.

The Government of Saint Lucia has requested support from the World Bank (WB) in the design and implementation of the multi-country Caribbean Efficient and Green Energy Buildings Project (CEGEB)<sup>11</sup> with estimated total financing of US\$ 98 million. This five-year investment Project is being prepared aiming at obtaining approval by the World Bank in July 2024 and will be implemented by The Ministry of Infrastructure, Port, Transport,

---

<sup>10</sup> These public buildings include government buildings and facilities such as central and municipal administrative buildings, universities and schools, hospitals and clinics, stadiums, orphanages, museums, and other publicly owned facilities.

<sup>11</sup> The CEGEB Project also includes Grenada and Guyana, in addition to Saint Lucia

Physical Development and Urban Renewable (MIPTPDUR) in Saint Lucia and the Organisation of Eastern Caribbean States (OECS) Commission.

The CEGEB is designed to address common challenges in the energy sector that countries in the region face and will support investment on EE measures and RE systems, such as distributed solar PV systems installed on rooftops or in public spaces, and solar water-heating systems. The EE retrofits will include passive and active EE measures along with improvements in building-control systems. Passive EE measures will include energy-efficient windows, shading, wall and roof insulation, cool surfaces, etc. Active EE measures will include the replacement of existing inefficient building equipment and appliances, or installation of new energy efficient equipment and appliances, such as lighting systems, air-conditioning equipment, ceiling fans, and refrigerators or freezers using refrigerants with low or no global-warming potential (GWP), where possible. Improvements in control systems will include smart controls, sensors, and energy-management systems to meet EE objectives. CEGEB will also support safe disposal of used equipment and materials.

The OECS Commission has received a Project Preparation Grant from the WB and plans to use the proceeds from the PPG to hire a consulting firm (hereafter referred to as the Consultant) to prepare detailed designs, technical specifications, and bidding documents for EE measures (EEMs) and solar PV systems (DPV) in 10 public buildings in Saint Lucia.

### **Objective of the assignment**

The objective of this assignment is to define the EEMs and DPVs to be implemented in 10 public buildings in Saint Lucia and prepare the detailed design, technical specifications, and bill of quantities (BOQ) for the bidding documents for implementing the proposed EEMs and DPVs investments. The assignment will also include identification of environmental and social risks associated with the planned implementation and preparation of Environmental and Social Management Plans (ESMPs) in accordance with the Environmental and Social Management Frameworks (ESMFs) and other instruments for the project which have been prepared by the Government of Saint Lucia. **The list of the buildings is provided in Annex 1B.**

The assignment will include a detailed review of the EEMs and DPVs identified in the audits already conducted,<sup>12</sup> identification of any additional EEMs, DPVs or other measures that may be appropriate,<sup>13</sup> assessment of the current technical energy performance of the buildings, detailed analysis of the EEMs and DPVs, and analysis of the implementation costs, energy and cost savings, paybacks, IRR and NPV and co-benefits such as improved comfort levels, reduced local pollution, decreased GHG emissions and increased resilience. It will also include the preparation of any needed drawings, detailed costing, and technical specifications, and key implementation steps that will be translated into bidding documents. The assignment will also include the confirmation of compliance with relevant

---

<sup>12</sup> The completed audit reports and all collected data of the buildings will be provided to the consultant.

<sup>13</sup> Such as structural or infrastructure upgrades/replacement (electric systems, piping for HVAC, hot water, etc. that may be deemed necessary to ensure sustainability/longevity of the proposed EE improvements and DPVs.



energy norms and standards.

### **Scope of Work**

The Consultant shall develop a list of EEMs and DPVs for each of the public buildings and prepare the detailed design (including drawings), technical specifications, bills of quantities (BoQs), necessary for preparation of the bidding documents to implement the investment (which will be carried out by another consultant). The Saint Lucia MIPTPDUR will facilitate and support coordination with the building administrations to ensure full and timely access to the facilities for the assessments to be conducted and facilitate sharing of available and relevant documentation of the facilities, including energy bills, with the Consultant. The Consultant is expected to use available documentation and drawings as reference, (where drawings are unavailable, the consultant can use or create as-built drawings) but shall confirm completeness and accuracy during site visits, and, to the extent needed, the Consultant should make drawings of current systems.

The Consultant shall report to OECS, and through OECS to MIPTPDUR and WB.

The Consultant shall perform the following tasks:

#### **Task 1: Review of existing energy audits & surveys, and inception report**

All public buildings selected for the implementation of EEMs and DPVs have existing energy audits & surveys based on walk-through assessments, preliminary analysis of energy consumption and cost, and economic and financial analyses of the investment. These energy audit reports will be shared with the Consultant and will serve as an information basis. In this Task, the Consultant shall review and assess the audit reports and the EEMs and DPVs defined and analyzed in these reports, and define the detailed methodology and approach to be used to check, verify, and complement these audit reports as necessary in order to (i) identify any field work for measurements to collect additional data not reported in the audits and develop a measurement plan; (ii) identify any additional EEMs and DPVs to be implemented; (iii) develop the appropriate designs and drawings; (iv) prepare technical specifications and BOQs; (v) develop bidding documents; and (vi) identify E&S risks and prepare ESMPs.

The Consultant shall prepare and submit an Inception Report to OECS, MIPTPDUR and WB describing the review and assessment and the methodology and approach to be utilized.

The inception report shall: (i) summarize the results of the review and assessment of the energy audits; (ii) identify additional information to be collected for the buildings during site visits; (iii) define the methodology and approach for site visits and for identifying additional EEMs and DPVs; (iv) present the plan for site visits, data collection, and field work; (v) provide a detailed work program for the rest of the project, (vi) identify potential issues and problems and approach for addressing these; (vii) list any assistance or action items needed from OECS, MIPTPDUR and/or WB.

The Consultant shall also document in the Inception Report the key parameters and methodology for updating the financial calculations under the existing audits such as payback and IRR following the WB guidelines for economic and financial analyses for similar investments.

## **Deliverable**

### Inception Report

Task 2: Site visits, data collection for EEMs and DPVs; Identification and assessment of EEMs

#### ***Site visits and data collection***

The Consultant shall conduct site visits to the public buildings and interviews with building users, officials and/or energy managers to verify and update the information available in the existing energy audits,<sup>14</sup> and collect additional data as needed. If necessary, measurements will be taken to obtain additional data in accordance with the measurement plan defined in Task 1.

The following information will be documented for each building:

- General building information: square meters and age (including date of any major retrofits), typology and general use of the building,
- Building layout, floorplan, and site plan with the orientation of the building and the surroundings,
- Structural assessment: inspection by a qualified Engineer of structural integrity of roof, ceiling, physical condition of building, and any defects that could affect longevity, utility, safety, or feasibility of EEM installation,
- Environmental inspection: presence of water damage or mold, evidence of wood-destroying insects or other vermin or pest infestation, or presence of asbestos, but not limited to these only,
- Operations: Occupancy rate, occupancy schedules, descriptions of current energy management activities,
- Utility information: Data available about energy consumption and costs for energy services. Review and analysis of the energy bills and data on electric (and fossil fuels if any) energy consumption and water bills (if any) for at least 36 months. The analysis of historical data will consider disruption derived from COVID lockdowns,
- Building envelope: Collect data and information about actual condition of building envelope: e.g., area and composition of external walls, floors, roofs and windows, building geometry, thermal transmittance and u-values of building elements,
- Energy systems: energy sources, technical characteristics of equipment comprising cooling controls, ventilation, sanitary hot water, air conditioning and lighting systems, among others,
- Inventory of existing systems and electrical equipment: HVAC systems, automatic control systems, lighting, motors, etc.,

---

<sup>14</sup> The beneficiaries and administrations are responsible for providing necessary inputs, like copies of invoices and bills of energy consumption, technical design documentation, copies of walk-through audit reports, and any other data. Some of the information may be available from the walk-through audits already carried out.

- Assessment of the energy performance levels of the existing systems and equipment from equipment ratings and specifications or measurements,
- Other relevant information impacting energy consumption levels, such as operating hours of the institution and energy services, number of users, indoor comfort measurements and occupant surveys (temperatures, humidity), energy consumption related to behavior of the users, thermostat settings etc.,
- Total building's electrical load measurement for at least one week to identify electricity consumption during weekdays and weekends,
- Energy consumption of air conditioning systems and indoor temperatures, at least for 24 hours,
- Output values like airflow, water flow, air and water temperatures of cooling production and distribution central systems,
- Electrical consumption of lighting systems for sample circuits, and lighting level (lux) in sample representative locations.
- Carry out a survey of the status of all electrical and electro-mechanical installations against national wiring regulations in consultation with the relevant governing Electrical authority. This should include:
  - Analyze the capacity of electrical boards,
  - Analyze the status of the main wiring,
  - Analyze the load demands on the mains of power equipment,
  - Verify the existence of protective earth connection and lightning protection where required,
  - Diagnose the state of the buildings' electrical installations, proposing necessary improvement measures, including estimated costs,
  - Discuss the location for the inverters, DC and AC cables.

### ***Identification and Assessment of EEMs***

Based on the analysis of the above information, the Consultant shall develop the energy consumption baseline. The baseline will consider indoor temperatures measured and current equipment installed (consistent with the energy bills). If comfort level in the building is not met and/or active systems do not comply regulations in place, the Consultant will also calculate a normative baseline, considering that indoor temperatures meet comfort levels and equipment installed in compliance with regulations.<sup>15</sup> The energy model should be calibrated with data determined by calculation or measurement, and should provide estimates on the baseline consumption (actual and normative) disaggregated by energy use for cooling, preparation of sanitary hot water, indoor lighting, ventilation, etc.

The Consultant shall then identify the EEMs – including the EEMs that were recommended in the audit reports and any additional EEMs identified by the Consultant. EEMs should include both active and passive measures. All EEMs should be in compliance with local and regional regulations and guidelines such as, for example, the CARICOM Energy

---

<sup>15</sup> Compare the comfort level/electricity consumption of a building of similar type which meet national/international standard in order to set up baseline.

Efficiency Building Code, and EE Standards and Labeling, etc.

For each EEM in each building, the Consultant shall update the electricity savings, fuel savings, greenhouse gas emission reductions; cost savings, O&M costs, investment costs, payback, IRR and NPV. The investment costs of EEMs should be determined based, to the best extent possible, on preliminary quotes from contractors, vendors and installers, or ESCOs. Costs should include breakdown of labor, installation and construction costs, materials and equipment, all indirect costs needed for implementation (pipe accessories, civil construction works, electrical connections, changes in electrical boards, remediation of mold or asbestos, replacement of ceiling or roof elements (if required), etc.). It should also include O&M costs, commissioning costs, and costs of waste management and safe disposal of used equipment and materials.

The consultant shall provide a complete list of all EEMs considered and a list of the recommended EEMs based on the prioritization methodology developed in Task 1 and approved by OECS and MIPTPDUR.

The Consultant shall also prepare a measurement and verification (M&V) plan based on international best practice<sup>16</sup> and develop the related M&V protocols and operational procedures to verify the achieved savings. The M&V Plan shall specify for each EEM the parameters to be measured, the pre-implementation baseline values for these parameters, the post-implementation measurements, and the methodology for calculation of the achieved energy savings and making any needed adjustments for changes in any baseline parameters.

## **Deliverables**

**Detailed Task 2 Report**, consisting of an Executive Summary and a separate section for each building, including all data collected in this Task, complete list of EEMs, list of recommended EEMs for implementation, and M&V plan.

**Task 3 – Develop Indicative model, design of the DPVs systems for each building and support preparation of the bidding documents for proposed DPVs investment**

Based on the results of Task 2, the consultant will:

---

<sup>16</sup> Such as, for example, the International Performance Measurement and Verification Protocol (IPMVP).

- ✓ Assess the roof, its capacity, age, technical drawings, access, and safety. The consultant shall justify with a FEA (finite element analysis)<sup>17</sup> as necessary the bearing capacity of the roofs, but it may also use the technical specifications of the roof, if available. Technical requirement for an FEA is provided in Annex 3.
- ✓ Provide the area available for solar PV modules in m<sup>2</sup> and consider a high efficiency PV module (not less than 21,5%) consideration for a lower % possible 19) for the conversion to kWp. ***The consultant shall explain the area considered versus the available area for the PV modules and refrain from providing only kWp***
- ✓ Model each solar DG system, using PVsyst and provide P50 and P90 yield values. The consultant shall analyze the solar resource and make sure that the source used is of good quality. All solar systems, including those for grid connections, must be designed to use most of the available area for energy generation considering not less than 25% of DC/AC oversizing; Among the technical requirements, ensure that the proposed solar systems are designed to withstand winds associated with Category 5 hurricanes systems.<sup>18</sup>
- ✓ The AC capacity should be sized based on i) the load, which should be analyzed for 1 year based on the bills (except for the COVID affected periods (2020-2021)) and measured for at least a full week for each building, if possible, and ii) the contracted AC capacity or available AC capacity as provided by the utility (the rating of the breakers shall be reported). The consultant shall also report the maximum AC and DC capacities that can be deployed in each building (respecting the minimum of 25% DC/AC oversizing).
- ✓ Identify in each building and discuss with the owner/responsible the location for the PV modules, the inverters, the DC cables, the AC cables, the main switch board or similar for grid connection. The location of the meter(s) should also be included. The accesses to the roofs must be reported.
- ✓ Carports<sup>19</sup> should also be considered, characterized and described.
- ✓ Provide for the solar PV systems: indicative layout, single line diagrams and configuration of each solar DG system including the main equipment.
- ✓ Provide cost estimates for the solar PV systems assuming local prices and also international ones. For each building, the Consultant shall define the electricity savings, fuel savings, GHG savings, cost savings, O&M costs, investment needs, payback, IRR and NPV.
- ✓ Prepare a draft report on the proposed DPVs, including results of economic and financial analyses to the OECS for approval.
- ✓ After the approval of the proposed DPV investments, prepare technical documentation (design, technical specifications, and bill of quantities (BOQs) for the bidding documents for the procurement of goods, services and works required to implement the proposed DPVs investments. Refrain from over specifying as the contracts will be EPC, so consider minimums to be generated and delivered.

---

<sup>17</sup> See the TOR of the FEA to be respected in a separate document. The FEA shall only be done, if clearly required based on a visual inspection or analysis of technical drawings.

<sup>18</sup> The FEA analysis should be done to confirm the capacity of the roof to resist such wind speeds.

<sup>19</sup> Carports are preferable for Waterfront Buildings.

## **Deliverables**

- Task 3.1: Draft report specifying the proposed DPVs.
- Task 3.2: Detailed design (including the appropriate architectural, mechanical and electrical drawings (in DWG and PDF formats) technical specifications, bills of quantities needed for preparation of the bidding documents for each EEM.

### **Task 4. Detailed design of EEMs, technical specifications, and bills of quantities**

Following approval by the MITPDUR of the proposed EEMs, the Consultant shall prepare the detailed designs (including the appropriate architectural, mechanical, and electrical drawings) technical specifications, bills of quantities and bidding documents for each EEM in each building.

Specifically, this task includes (but is not limited to) the following activities:

For each of the selected EEMs, prepare the technical design documentation, including technical descriptions, design calculations, lay-outs and drawings, detailed technical specifications and priced bill of quantities (BoQs). For technical requirements and specifications that will be linked to new materials or equipment not included in country-specific norms or standards, the Consultant shall follow relevant recognized international norms and codes. The technical design shall also take into account relevant regulations in Saint Lucia on health, environmental protection and safety, any existing environmental management plans for public buildings and facilities, and the environmental and social management framework for the project (ESMF) provided by the OECS. The technical design documentation shall be certified by the Consultant according to relevant provisions in the Law on Construction of Saint Lucia.

Discuss and agree the draft design documentation with the OECS, MIPTPDUR, WB and other stakeholders and revise as needed. The detailed design documentation should at least include:

- ✓ Architectural drawings (plans, sections, facades, technical details).
- ✓ Remediation or structural correction plans (mold, pests, roof elements) if required; Installation drawings (schemes, details, units, specifications)
- ✓ Structural drawings (when needed).
- ✓ Technical specifications.
- ✓ Bills of quantities for work to be implemented,
- ✓ Calculations.

In case approval from local authorities/state expertise for the reconstruction/building retrofits in accordance with local legislation is needed, provide technical support in the approval process if required.

## **Deliverables**

Task Report specifying the EEMs and related detailed design (including the appropriate

---

architectural, mechanical, and electrical drawings (in DWG and PDF formats) technical specifications, bills of quantities as needed for preparation of the bidding documents for each EEM.

**Task 5:** Identify environmental and social risks and prepare Environmental and Social Management Plans (ESMPs)

In this Task, the Consultant shall:

- ✓ **Identify environmental and social risks associated with the implementation of the EEMs:** Identify environmental and social risks associated with each of the EEMs, including presence and quantity of any hazardous materials (such as, but not limited to, asbestos and mercury containing light bulbs) that would have to be removed as part of the implementation.
- ✓ **Prepare site specific Environmental and Social Management Plans (ESMPs):** Prepare site-specific environmental and social management plans (ESMPs)/ any other guidance as per the ESMF and submit them to OECS and MIPTPDUR. The ESMPs shall include specifications and bills of quantities for removal, packaging, transport and disposal/interim storage of any relevant hazardous materials, personal safety equipment and monitoring requirements and estimate of costs for the measures. This will also include the locations where the hazardous materials can be disposed and the interim storage location for the mercury containing light bulbs as per the ESMF and country legislation.
- ✓ **Provide support to the MIPTPDUR to carry out public consultations on audit and ESMPs.** MIPTPDUR in coordination with the OECS Commission will organize site-specific public consultations to describe the mitigation, monitoring, and institutional measures to be taken during sub-project implementation and operation to eliminate adverse environmental and social risks and impacts. The consultations will also present on the specific actions and resources needed to implement these measures and the grievance system in place to stakeholders. The consultant will provide materials and support needed for the consultation and update the ESMP considering the inputs from the consultation.

#### **Deliverables**

- Report on environmental and social risks covering each building site.
- ESMP for each building site.
- Reporting on consultations undertaken during subproject preparation and implementation.

#### **Services to be provided to the Consultant**

The OECS Commission in coordination with Saint Lucia MIPTPDUR will provide the Consultant with the energy audit reports conducted in the countries and introductions to the respective building administrators.

The Consultant will be responsible for all other arrangements to ensure coordination with the respective buildings' administrations and all relevant entities. It will be the responsibility of the consultant, when site visits are carried out, to ensure that all safety precautions are taken.

**Qualifications**

The Consultant should be a firm with relevant international (experience outside the country where the firm is based) project experience. Relevant technical experience would include programs related to EE measures and DPVs in buildings (especially public buildings), such as conducting of energy audits in buildings, development of detailed designs, technical specifications and BOQs, implementation of building EE programs, etc.

The Consultant must propose a team capable of successfully carrying out all aspects of the TOR with local/international in-depth experience in executing similar assignments. The Consultant shall demonstrate the capability to mobilize enough skilled staff for carrying out the project activities within the allocated time. The exact composition of the team will be left to each firm to propose (see specifications in Annex 2) but key skills and credentials are expected to include:

**Timeframe and implementation arrangements**

The estimated time frame is expected to be 6 months from the day of the contract signing. Expenditure on logistics, including international travel, is to be included in the proposed costs.

The Consultant will provide all necessary equipment or resources for the activities.

**Deliverables and timeline**

The proposed timeline is outlined below and will be agreed with the OECS, MIPTPDUR, and WB.

	<b>Deliverables</b>	<b>Delivery Date</b>
1	Inception Report	1 month from signing the contract
2	Task 2- Draft report on Site visits, data collection for EEMs and DPVs; Identification and assessment of EEMs	2 months after signing the contract
3	Task 3.1- Draft report on Develop Indicative model, design of DPVs systems	3 months after signing the contract
4	Task 3.2 - Report on detailed design, technical specification & BOQ of DPVs systems	5 months after signing the contract
5	Task 4. Detailed design of EEMs, technical specifications, and bills of quantities	5 months after signing the contract
6	Task 5. Report on environmental and social risks and ESMPs	5 months after signing the contract
7	Approval of all Reports	6 months after signing the contract
8	Update Reports from Consultant (identifying challenges, risks and progress)	Bi-weekly



## **LOT 3: Guyana**

### **Organisation of Eastern Caribbean States Commission Caribbean Efficient and Green Energy Buildings Project (CEGEB)**

#### ***Preparation of Detailed Designs and Technical Specifications for Energy Efficiency Measures and Distributed Solar PVs Systems for Public Buildings in Guyana***

### **Terms of Reference**

#### **Introduction and Context**

Despite the availability of indigenous renewable energy resources, many Caribbean nations continue to have a heavy dependence on imported fossil fuels which has threatened energy security and led to high electricity prices. The vast majority of power generation capacity in countries such as Guyana, Saint Lucia, and Grenada, consists of heavy fuel oil and diesel-fired power plants. The reliance on expensive imported heavy fuel oil and diesel fuel, together with the inability to take advantage of economies of scale due to the small market sizes of individual island states has resulted in extremely high electricity tariffs in these countries. With the discovery and exploration of natural gas resources in Guyana the development of a gas fired power plant, hydropower and solar power are under way and is expected to reduce the dependency on expensive fossil fuel imports and reduce the electricity prices.

Guyana aims to reduce its carbon emissions by 70% by 2030. Guyana's Low Carbon Development Strategy (LCDS) highlighted three strategic priorities to achieve this emission target: (i) investing in transformational energy infrastructure across the generation and transmission systems; (ii) implementing fiscal incentives and government policies to support the use of renewable energy at the level of households and businesses; and (iii) investing in EE.

Energy surveys of selected buildings conducted by the Guyana Energy Agency (GEA) have indicated major benefits from investments in EE and distributed solar photovoltaic (PV) systems. These interventions can reduce dependency on fossil fuel, lower electricity costs, decrease GHG emissions, and enhance resilience of critical public services. The results from these energy surveys indicate that EE and RE investments are economically viable.

The Government of Guyana has requested support from the World Bank (WB) in the design and implementation of the multi-country Caribbean Efficient and Green Energy Buildings Project (CEGEB Project)<sup>20</sup> with estimated total financing of US\$ 98 million. This five-year investment Project is being prepared with the aim of obtaining approval by the World Bank in July 2024 and will be implemented by the Guyana Energy Agency (GEA) and the Organisation of Eastern Caribbean States (OECS) Commission.

---

<sup>20</sup> The CEGEB Project also includes St. Lucia and Grenada, in addition to Guyana.

The CEGEB Project is designed to address common challenges in the energy sector that countries in the region face and will support investment in EE measures and RE systems, such as distributed solar PV systems installed on rooftops or in public spaces. The EE retrofits will include passive and active EE measures along with improvements in building-control systems. Passive EE measures will include energy-efficient windows, shading, wall and roof insulation, cool surfaces, etc. Active EE measures will include the replacement of existing inefficient building equipment and appliances, or installation of new energy efficient equipment and appliances, such as lighting systems, air-conditioning equipment, ceiling fans, and refrigerators or freezers using refrigerants with low or no global-warming potential (GWP), where appropriate. Improvements in control systems will include smart controls, sensors, and energy-management systems to meet EE objectives. The Project will also support safe disposal of used equipment and materials.

The OECS Commission has received a Project Preparation Grant (PPG) from the WB and plans to use the proceeds from the PPG to hire a consulting firm (hereafter referred to as the Consultant) to undertake the investment grade audits in 13 public buildings in Guyana and prepare detailed designs, technical specifications, and bidding documents for EE measures (EEMs) and solar PV systems (DPVs) in these buildings.

### **Objective of the assignment**

The objective of this assignment is to define the EEMs and DPVs to be implemented in 13 public buildings in Guyana and prepare the detailed design, technical specifications, and bill of quantities (BOQ) for the bidding documents for implementing the proposed EEMs and DPVs investments. The assignment will also include identification of environmental and social risks associated with the planned implementation and preparation of Environmental and Social Management Plans (ESMPs) in accordance with the Environmental and Social Management Frameworks (ESMFs) and other instruments for the project which have been prepared by the Government of Guyana. **The list of the buildings is provided in Annex 1C.**

The assignment will include a detailed review of the EEMs and DPVs identified in the preliminary surveys already conducted,<sup>21</sup> identification of any additional EEMs, DPVs or other measures that may be appropriate,<sup>22</sup> assessment of the current technical energy performance of the buildings, detailed analysis of the EEMs and DPVs, and analysis of the implementation costs, energy and cost savings, paybacks, IRR and NPV and co-benefits such as improved comfort levels, reduced local pollution, decreased GHG emissions and increased resilience. It will also include the preparation of any needed drawings, detailed costing, and technical specifications, and key implementation steps that will be translated into bidding documents. The assignment will also include the confirmation of compliance with relevant energy norms and standards.

---

<sup>21</sup> GEA has completed surveys and collected inventory and energy consumption data for the buildings and done preliminary analysis of EE measures and PV capacity and feasibility. This will be provided to the consultant.

<sup>22</sup> Such as structural or infrastructure upgrades/replacement (electric systems, piping for HVAC, hot water, etc. that may be deemed necessary to ensure sustainability/longevity of the proposed EE improvements and DPVs.

## **Scope of Work**

The Consultant shall develop a list of EEMs and DPVs for each of the public buildings and prepare the detailed design (including drawings), technical specifications, bills of quantities (BOQs), necessary for preparation of the bidding documents to implement the investment (which will be carried out by another consultant). The GEA will facilitate and support coordination with the building administrations to ensure full and timely access to the facilities for the assessments to be conducted and facilitate sharing of available and relevant documentation of the facilities, including energy bills, with the Consultant. The Consultant is expected to use available documentation and drawings as reference (where drawings are unavailable, the consultant can use or create as-built drawings), but shall confirm completeness and accuracy during site visits, and, to the extent needed, the Consultant should make drawings of current systems.

The Consultant shall report to OECS Commission, and through the Commission to GEA and WB.

The Consultant shall perform the following tasks:

### **Task 1: Review of existing energy audits & surveys, and inception report**

All public buildings selected for the implementation of EEMs and DPVs have existing energy surveys based on walk-through assessments, preliminary analysis of energy consumption and cost, and economic and financial analyses of the investment. These energy surveys will be shared with the Consultant and will serve as an information basis. In this Task, the Consultant shall review and assess the surveys and the EEMs and DPVs defined and analyzed in these reports, and define the detailed methodology and approach to prepare the investment grade audit reports as necessary to (i) identify any field work for measurements to collect data and develop a measurement plan; (ii) identify EEMs and DPVs to be implemented; (iii) develop the appropriate designs and drawings; (iv) prepare technical specifications and BOQs; (v) develop bidding documents; and (vi) identify E&S risks and prepare ESMPs.

The Consultant shall prepare and submit an Inception Report to OECS Commission, GEA and WB describing the review and assessment and the methodology and approach to be utilized.

The inception report shall: (i) summarize the results of the review and assessment of the energy surveys; (ii) identify information to be collected for the buildings during site visits; (iii) define the methodology and approach for site visits and for identifying EEMs and DPVs; (iv) present the plan for site visits, data collection, and field work; (v) provide a detailed work program for the rest of the project, (vi) identify potential issues and problems and approach for addressing these; (vii) list any assistance or action items needed from OECS Commission, GEA and/or WB.

The Consultant shall also document in the Inception Report the key parameters and methodology for conducting financial calculations such as payback and IRR following the WB guidelines for economic and financial analyses for similar investments.

## **Deliverable**

### Inception Report

Task 2: Site visits, investment grade audits, data collection for EEMs and DPVs; Identification and assessment of EEMs

#### ***Site visits and data collection***

The Consultant shall conduct site visits to the public buildings and interviews with building users, officials and/or energy managers to collect information and data. The existing surveys can be used as basis for the data collection,<sup>23</sup> and collect additional data as needed. If necessary, measurements will be taken to obtain additional data in accordance with the measurement plan defined in Task 1.

The following information will be documented for each building:

- General building information: square meters and age (including date of any major retrofits), typology and general use of the building,
- Building layout, floorplan, and site plan with the orientation of the building and the surroundings.
- Structural assessment: inspection by a qualified Engineer of structural integrity of roof, ceiling, physical condition of building, and any defects that could affect longevity, utility, safety, or feasibility of EEM installation,
- Environmental inspection: presence of water damage or mold, evidence of wood-destroying insects or other vermin or pest infestation, or presence of asbestos, but not limited to these only,
- Operations: Occupancy rate, occupancy schedules, descriptions of current energy management activities,
- Utility information: Data available about energy consumption and costs for energy services. Review and analysis of the energy bills and data on electric (and fossil fuels if any) energy consumption and water bills (if any) for at least 36 months. The analysis of historical data will consider disruption derived from COVID lockdowns,
- Building envelope: Collect data and information about actual condition of building envelope: e.g., area and composition of external walls, floors, roofs, and windows, building geometry, thermal transmittance and u-values of building elements,
- Energy systems: energy sources, technical characteristics of equipment comprising cooling controls, ventilation, sanitary hot water, air conditioning and lighting systems, among others,
- Inventory of existing systems and electrical equipment: HVAC systems, automatic control systems, lighting, motors, etc.,
- Assessment of the energy performance levels of the existing systems and equipment from equipment ratings and specifications or measurements,

---

<sup>23</sup> The beneficiaries and administrations are responsible for providing necessary inputs, like copies of invoices and bills of energy consumption, technical design documentation, copies of walk-through surveys, and any other data. Some of the information may be available from the surveys already carried out.

- Other relevant information impacting energy consumption levels, such as operating hours of the institution and energy services, number of users, indoor comfort measurements and occupant surveys (temperatures, humidity), energy consumption related to behavior of the users, thermostat settings etc.,
- Total building's electrical load measurement for at least one week to identify electricity consumption during weekdays and weekends,
- Energy consumption of air conditioning systems and indoor temperatures, at least for 24 hours,
- Output values like airflow, water flow, air and water temperatures of cooling production and distribution central systems,
- Electrical consumption of lighting systems for sample circuits, and lighting level (lux) in sample representative locations.
- Carry out a survey of the status of all electrical and electro-mechanical installations against national wiring regulations in consultation with the relevant governing Electrical Authority: This should include:
  - Analyze the capacity of electrical boards,
  - Analyze the status of the main wiring,
  - Analyze the load demands on the mains of power equipment,
  - Verify the existence of protective earth connection and lightning protection where required,
  - Diagnose the state of the buildings' electrical installations, proposing necessary improvement measures, including estimated costs,
  - Discuss the location for the inverters, DC and AC cables.

### ***Identification and Assessment of EEMs***

Based on the analysis of the above information, the Consultant shall develop the energy consumption baseline. The baseline will consider indoor temperatures measured and current equipment installed (consistent with the energy bills). If comfort level in the building is not met and/or active systems do not comply regulations in place, the Consultant will also calculate a normative baseline, considering that indoor temperatures meet comfort levels and equipment installed in compliance with regulations.<sup>24</sup> The energy model should be calibrated with data determined by calculation or measurement, and should provide estimates on the baseline consumption (actual and normative) disaggregated by energy use for cooling, preparation of sanitary hot water, indoor lighting, ventilation, etc.

The Consultant shall then identify the EEMs – including the EEMs that were recommended in the audit reports and any additional EEMs identified by the Consultant. EEMs should include both active and passive measures. All EEMs should be in compliance with local and regional regulations and guidelines such as, for example, the CARICOM Energy Efficiency Building Code, and EE Standards and Labeling, etc.

---

<sup>24</sup> Compare the comfort level/electricity consumption of a building of similar type which meet national/international standard in order to set up baseline.

For each EEM in each building, the Consultant shall update the electricity savings, fuel savings, greenhouse gas emission reductions; cost savings, O&M costs, investment costs, payback, IRR and NPV. The investment costs of EEMs should be determined based, to the best extent possible, on preliminary quotes from contractors, vendors, and installers, or ESCOs. Costs should include breakdown of labor, installation and construction costs, materials and equipment, all indirect costs needed for implementation (pipe accessories, civil construction works, electrical connections, changes in electrical boards, remediation of mold or asbestos, replacement of ceiling or roof elements (if required), etc.). It should also include O&M costs, commissioning costs, and costs of waste management and safe disposal of used equipment and materials.

The consultant shall provide a complete list of all EEMs considered and a list of the recommended EEMs based on the prioritization methodology developed in Task 1 and approved by OECS Commission and GEA.

The Consultant shall also prepare a measurement and verification (M&V) plan based on international best practice<sup>25</sup> and develop the related M&V protocols and operational procedures to verify the achieved savings. The M&V Plan shall specify for each EEM the parameters to be measured, the pre-implementation baseline values for these parameters, the post-implementation measurements, and the methodology for calculation of the achieved energy savings and making any needed adjustments for changes in any baseline parameters.

### **Deliverables**

**Detailed Task 2 Report**, consisting of an Executive Summary and a separate section for each building, including all data collected in this Task, complete list of EEMs, list of recommended EEMs for implementation, and M&V plan.

**Task 3 – Develop Indicative model, design of the DPVs systems for each building and support preparation of the bidding documents for proposed DPVs investment**

Based on the results of Task 2, the consultant will:

---

<sup>25</sup> Such as, for example, the International Performance Measurement and Verification Protocol (IPMVP).

- ✓ Assess the roof, its capacity, age, technical drawings, access, and safety. The consultant shall justify with a FEA (finite element analysis)<sup>26</sup> as necessary the bearing capacity of the roofs, but it may also use the technical specifications of the roof, if available. Technical requirement for an FEA is provided in Annex 3.
- ✓ Provide the area available for solar PV modules in m<sup>2</sup> and consider a high efficiency PV module (not less than 21.5%) for the conversion to kWp. The consultant shall explain the area considered versus the available for the PV modules and refrain from providing only kWp.
- ✓ Model each solar DG system, using PVsyst and provide P50 and P90 yield values. The consultant shall analyze the solar resource and make sure that the source used is of good quality. All solar systems, including those for grid connections, must be designed to use most of the available area for energy generation considering not less than 25% of DC/AC oversizing.
- ✓ The AC capacity should be sized based on i) the load, which should be analyzed for 1 year based on the bills (except for the COVID affected periods (2020-2021) and measured for at least a full week for each building, if possible, and ii) the contracted AC capacity or available AC capacity as provided by the utility (the rating of the breakers shall be reported). The consultant shall also report the maximum AC and DC capacities that can be deployed in each building (respecting the minimum of 25% DC/AC oversizing).
- ✓ Identify in each building and discuss with the owner/responsible the location for the PV modules, the inverters, the DC cables, the AC cables, the main switch board or similar for grid connection. The location of the meter(s) should also be included. The accesses to the roofs must be reported.
- ✓ Carports should also be considered, characterized and described.
- ✓ Provide for the solar PV systems: indicative layout, single line diagrams and configuration of each solar DG system including the main equipment.
- ✓ Provide cost estimates for the solar PV systems assuming local prices and also international ones. For each building, the Consultant shall define the electricity savings, fuel savings, GHG savings, cost savings, O&M costs, investment needs, payback, IRR and NPV.
- ✓ Prepare a draft report on the proposed DPVs, including results of economic and financial analyses to the OECS Commission for approval.
- ✓ After the approval of the proposed DPV investments, prepare technical documentation (design, technical specifications and bill of quantities (BOQs) for the bidding documents for the procurement of goods, services and works required to implement the proposed DPVs investments. Refrain from over specifying as the contracts will be EPC, so consider minimums to be generated and delivered.

## **Deliverables**

- Task 3.1: Draft report specifying the proposed DPVs.

---

<sup>26</sup> See the TOR of the FEA to be respected in a separate document. The FEA shall only be done, if clearly required based on a visual inspection or analysis of technical drawings.

- Task 3.2: Detailed design (including the appropriate architectural, mechanical, and electrical drawings (in DWG and PDF formats) technical specifications, bills of quantities needed for preparation of the bidding documents for each EEM.

#### Task 4. Detailed design of EEMs, technical specifications, and bills of quantities

Following approval by the GEA of the proposed EEMs in Task 2, the Consultant shall prepare the detailed designs (including the appropriate architectural, mechanical, and electrical drawings) technical specifications, bills of quantities and bidding documents for each EEM in each building.

Specifically, this task includes (but is not limited to) the following activities:

For each of the selected EEMs, prepare the technical design documentation, including technical descriptions, design calculations, lay-outs and drawings, detailed technical specifications and priced bill of quantities (BoQs). For technical requirements and specifications that will be linked to new materials or equipment not included in country-specific norms or standards, the Consultant shall follow relevant recognized international norms and codes. The technical design shall also take into account relevant regulations in Guyana on health, environmental protection and safety, any existing environmental management plans for public buildings and facilities, and the environmental and social management framework for the project (ESMF) provided by the OECS Commission. The technical design documentation shall be certified by the Consultant according to relevant provisions in the Law on Construction of Guyana.

Discuss and agree the draft design documentation with the OECS Commission, GEA, WB and other stakeholders and revise as needed. The detailed design documentation should at least include:

- ✓ Architectural drawings (plans, sections, facades, technical details).
- ✓ Remediation or structural correction plans (mold, pests, roof elements) if required; Installation drawings (schemes, details, units, specifications)
- ✓ Structural drawings (when needed).
- ✓ Technical specifications.
- ✓ Bills of quantities for work to be implemented,
- ✓ Calculations.

In case approval from local authorities/state expertise for the reconstruction/building retrofits in accordance with local legislation is needed, provide technical support in the approval process if required.

#### **Deliverables**

Task Report specifying the EEMs and related detailed design (including the appropriate architectural, mechanical, and electrical drawings (in DWG and PDF formats) technical specifications, bills of quantities as needed for preparation of the bidding documents for each EEM.



## Task 5: Identify environmental and social risks and prepare Environmental and Social Management Plans (ESMPs)

In this Task, the Consultant shall:

- ✓ **Identify environmental and social risks associated with the implementation of the EEMs:** Identify environmental and social risks associated with each of the EEMs, including presence and quantity of any hazardous materials (such as, but not limited to, asbestos and mercury containing light bulbs) that would have to be removed as part of the implementation.
- ✓ **Prepare site specific Environmental and Social Management Plans (ESMPs):** Prepare site-specific environmental and social management plans (ESMPs)/ any other guidance as per the ESMF and submit them to OECS Commission and GEA. The ESMPs shall include specifications and bills of quantities for removal, packaging, transport and disposal/interim storage of any relevant hazardous materials, personal safety equipment and monitoring requirements and estimate of costs for the measures. This will also include the locations where the hazardous materials can be disposed and the interim storage location for the mercury containing light bulbs as per the ESMF and country legislation.
- ✓ **Provide support to the GEA to carry out public consultations on audit and ESMPs.** GEA in coordination with the OECS Commission will organize site-specific public consultations to describe the mitigation, monitoring, and institutional measures to be taken during sub-project implementation and operation to eliminate adverse environmental and social risks and impacts. The consultations will also present on the specific actions and resources needed to implement these measures and the grievance system in place to stakeholders. The consultant will provide materials and support needed for the consultation and update the ESMP considering the inputs from the consultation.

### **Deliverables**

- Report on environmental and social risks covering each building site.
- ESMP for each building site.
- Reporting on consultations undertaken during subproject preparation and implementation.

### **Services to be provided to the Consultant**

The OECS Commission in coordination with GEA will provide the Consultant with the preliminary energy surveys already conducted and introductions to the respective building administrators.

The Consultant will be responsible for all other arrangements to ensure coordination with the respective buildings' administrations and all relevant entities.

It will be the responsibility of the consultant, when site visits are carried out, to ensure that

all safety precautions are taken.

### **Qualifications**

The Consultant should be a firm with relevant international (experience outside the country where the firm is based) project experience. Relevant technical experience would include programs related to EE measures and DPVs in buildings (especially public buildings), such as conducting of energy audits in buildings, development of detailed designs, technical specifications and BOQs, implementation of building EE programs, etc.

The Consultant must propose a team capable of successfully carrying out all aspects of the TOR with local/international in-depth experience in executing similar assignments. The Consultant shall demonstrate the capability to mobilize enough skilled staff for carrying out the project activities within the allocated time. The exact composition of the team will be left to each firm to propose (see specifications in Annex 2) but key skills and credentials are expected to include:

### **Timeframe and implementation arrangements**

The estimated time frame is expected to be 6 months from the day of the contract signing. Expenditure on logistics, including international travel, is to be included in the proposed costs.

The Consultant will provide all necessary equipment or resources for the activities.

### **Deliverables and timeline**

The proposed timeline is outlined below and will be agreed with the OECS Commission, GEA, and WB.

	<b>Deliverables</b>	<b>Delivery Date</b>
1	Inception Report	1 month from signing the contract
2	Task 2- Draft report on Site visits, data collection for EEMs and DPVs; Identification and assessment of EEMs	2 months after signing the contract
3	Task 3.1- Draft report on Develop Indicative model, design of DPVs systems	3 months after signing the contract
4	Task 3.2 - Report on detailed design, technical specification & BOQ of DPVs systems	5 months after signing the contract
5	Task 4. Detailed design of EEMs, technical specifications, and bills of quantities	5 months after signing the contract
6	Task 5. Report on environmental and social risks and ESMPs	5 months after signing the contract
7	Approval of all Reports	6 months after signing the contract
8	Update Reports from Consultant (identifying challenges, risks and progress)	Bi-weekly

**Annex 1A: List of Public Buildings for LOT 1-Grenada**

**Grenada List of Buildings**

#	Building Name	Electricity Consumption (kWh/year) <sup>27</sup>
	<i>Proposed for First Batch:</i>	
1	General Hospital	1,476,311
2	Financial Complex	936,666
3	National Stadium	606,486
4	Ministerial Complex	474,624
5	TAMCC Tanteen (St George)	374,451
6	Ministry education	338,311
7	HM Prison	309,546
8	Grenville Fish Market	282,384
9	Police Training School	244,638
10	Grenada Boys Secondary School	105,187
	<i>Other Candidate Buildings</i>	
11	Gouyave Fish Market	241,770
12	Marketing National & Importing Board (MNIB)	140,882
13	Court Building (Ministry of Legal Affairs)	132,286
14	Carriacou Fish Market	108,471
15	Mc Donald College	53,553

---

<sup>27</sup> Indicative annual electricity consumption from the energy audits average calculation.

**Annex 1B: List of Public Buildings for LOT 2-Saint Lucia**

**Saint Lucia List of buildings**

#	Building Name	Electricity Consumption (kWh/year) <sup>28</sup>
	<i>Proposed Buildings for the First Batch</i>	
1	Owen King Hospital	5,564,746
2	Victoria Hospital	1,276,388
3	Financial Adm. Center	1,187,816
4	Francis Compton Bldg	1,179,460
5	Sir Stanislaus James Bldg	667,767
6	Heraldine Rock Bldg	562,086
7	Sir Arthur Lewis College	470,137
8	Bordelais Correctional Facility	345,509
9	Tissue Culture	257,807
10	Soufriere Hospital	141,059

---

<sup>28</sup> Indicative annual electricity consumption from the energy audits average calculation.

## **Annex 1C: List of Public Buildings for LOT 3-Guyana**

### **Guyana List of Public Buildings**

<b>#</b>	<b>Building Name</b>	<b>Electricity Consumption (kWh/year)<sup>29</sup></b>
<b>1</b>	GECOM	205,398.68
<b>2</b>	Regional Democratic Council Region 3	101,584.25
<b>3</b>	Kingston Drugs Bond	88,511.00
<b>4</b>	Diamond Drugs Bond	81,331.90
<b>5</b>	National Ophthalmology Hospital	73,418.10
<b>6</b>	Zeeburg Secondary School	41,804.96
<b>7</b>	Parika GRA	38,928.91
<b>8</b>	Rosignal Health Center	27,504.87
<b>9</b>	West Ruimveldt Primary School	27,133.92
<b>10</b>	Port Mourant District Hospital	24,213.92
<b>11</b>	Parika Health Center	11,199.22
<b>12</b>	Good Hope Secondary School	To be provided
<b>13</b>	Yarrowkabra Secondary School	To be provided

---

<sup>29</sup> Indicative annual electricity consumption from the energy audits average calculation.

## **Annex 2: Expected qualifications and expertise**

The following key expertise and specialists are expected to be included in the team (to be evaluated as part of the technical proposal):

### **Key Expert 1: Energy Efficiency Specialist/Project Manager**

The expert has specific experience of 10+ years in similar international EE assessments, energy audits, and EE in buildings. He/she has been project manager of similar international projects involving EE assessments and/or conducting energy audits, developing energy baselines, assessing EEMs in buildings, project commissioning etc. The expert has a university degree in engineering in the relevant field, energy economics, energy management, or similar field, and solid experience in the identification and assessment of EEMs in buildings and performance of energy audits. Experience in similar countries is an advantage. Fluency in English required.

### **Key Expert 2: Solar PV specialist**

Solar PVs engineer with 10 years of experience in similar international investment activities for solar PVs system. University degree in civil/electrical engineering, energy management, or equivalent. Prior experience in preparation of design, construction and bidding documents. Strong knowledge of international and national standards and norms on renewable energy efficiency and building codes. Fluency in English required.

### **Key Expert 3: Energy Economist.**

The expert has a university degree in energy or environmental economics or similar and at least 5 years of experience in preparation of feasibility study analysis, cash flow analysis, IRR/NPV/payback calculations of a variety of EE measures in building environments and with experience in economic or financial analysis for WB projects. Fluency in English required.

### **Key Expert 4: Environmental and Social Expert.**

University degree in environmental engineering or equivalent with at least 5 years of experience in hazardous material inventories in buildings, in particular asbestos, and experience with international requirements for proper asbestos and mercury containing CFLs removal, handling and possible treatment options, including costs. Some expertise in social issues, social risk management and stakeholder consultations will be a plus. Knowledge of international best practices, and development of simplified, low-cost options. Fluency in English required.

### **ANNEX 3: Terms of Reference for the Finite Elements Analysis (FEA)**

#### **Scope of work**

Rooftops at the XXX building are being considered to be used to install PV rooftops, namely the (name of the building-to be provided):

One of the concerns that need to be addressed is the structural capacity of the rooftops to withstand the PV modules plus structures as well as during installation for safety reasons. The finite element analysis (FEA) for the roof shall include:

- a) The design criteria for the roofs.
- b) Specifications for the roof materials used.
- c) The design criteria for the PV systems: the roof shall be simulated full of PV modules along the longest dimension. The nodes for the FEA should not be spaced more than 1 meter.
- d) A list of live loads: environmental loads such as worst-case wind conditions perpendicular to the roof and 50 and 100 years data to be used. In addition, seismic criteria, and any other special loads should be considered in the analysis:
  1. PV modules plus supporting structures of around 30 kg/m<sup>2</sup>.
  2. Humans during installation at 150 kg/m<sup>2</sup>.
- e) Deflection values of structural elements and the PV systems under several live loads and wind directions as defined above. A graph with the deflection of the roof should be presented with a resolution not more than 1 meter.
- f) Vertical and lateral load analysis for:
  1. PV modules plus supporting structures of around 30 kg/m<sup>2</sup>.
  2. Humans during installation at 150 kg/m<sup>2</sup>.
- g) Dynamic and vibration analyses with and without the PV system.
- h) Computer analysis and design results with reports for all the cases mentioned above and a set of recommendations if applicable.
- i) For the case that an analysis proves a roof being incapable for solar usage a solution may be given to re-enforce the roof.
- j) Please specify the software to be used for the finite elements analysis (FEA) on the proposal.