

## Section II: Schedule of Requirements

### Terms of Reference

#### AR | KHMCO | UNOPS - Cambodia

#### Asia Region (AR) Investment Fund - Energy Secure Health Infrastructure

#### Energy Audit and Clean Energy Plan

### 1. Background:

As with all health systems worldwide, the Covid-19 pandemic in Cambodia has created unforeseen stresses and has forced the reprioritisation of budgets towards mitigating the shocks and providing the services needed to their civilians and dependent populations. Whilst many hospitals, health clinics and health systems have found ways to provide the priority services to those in dire need, it has come at the expense of other health care services and facilities. As the world transitions to dealing with Covid-19 as an endemic disease, health care systems will need to “reset” back to pre-pandemic service levels, whilst managing their inventories, both in capital assets, equipment and physical infrastructure. Many health care providers will face higher operating costs due to increased facilities, equipment and lack of maintenance exacerbated by the pandemic and are increasingly susceptible to volatile energy costs. Cambodia’s Ministry of Health has already indicated its challenges in this regard.

UNOPS, with its mandate in the UN system for Infrastructure implementation and advisory services is well placed to not only assess statewide health systems, but also to provide strategic thinking around the use of these assets and effectiveness in the provision and delivery of these health services as well as the efficiency of the operations and areas for increased sustainability and cost saving. Energy secure health infrastructure foresees looking at how the MoH can optimise its existing infrastructure assets and harness technologies such as clean renewable energies to create savings, radically improve the sustainability of its health services and minimise the shocks and disruption caused by higher (or uncertain) priced energy and to ensure a degree of resilience to energy supply issues, such as load shedding, brownouts or even power grid failures.

UNOPS is seeking the services of consultant expertise to assess two hospital facilities with a view to developing a concept note or project proposal to pilot to demonstrate a “Proof of Concept” in energy secure health infrastructure.

The services shall form two lots. Lot 1 shall consist of an Energy Audit to evaluate the target hospitals energy use, electrical infrastructure design, analysis of the quality of the power supply and a mapping of the electrical requirements. Lot 2 shall take the findings of the Energy Audit and design an intervention using clean energy to increase the security and resilience of the hospitals against future power cost increases, susceptibility to power supply issues etc.

## 2. Locations to cover:

The assessments shall cover two locations. One shall be in a highly urban setting (i.e. Phnom Penh) and the second in a more rural / provincial setting. The sites below are selected from locations where UNOPS has been implementing other health related projects. These sites will form the basis for the activities and services to be performed under the tender.

SN	Hospital Name	Location	GPS coordinates
1	Khmer Soviet Friendship Hospital	Phnom Penh	11°32'35"N;104°54'11"E
2	Kampong Cham Provincial Referral Hospital	Kampong Cham	11°59'28"N;105°27'39"E



Map of Provincial Health facilities

## 3. Requirements:

### a. Lot 1.

The consultant shall perform an **Energy Audit** at each of the target hospital locations. The detailed energy audit involves in-depth investigations into how the energy is currently being consumed, current performance of the existing systems and identification of various potential Energy Conservation

Measures (ECMs). It also gives the estimated cost and simple payback periods for all recommended ECMs.

The detailed energy audit involves the following four (4) main processes:

1. Data collection
2. End-use load apportioning
3. Identification of ECMs
4. Reporting and presentation

#### **Qualification of:**

##### **1. Key Electrical Engineer**

- Bachelor in Electrical Engineering
- 5 year experience in performing energy audits
- 5 years experience in providing Renewable / clean energy solutions tailored to the clients needs / design considerations
- Be able to communicate in English (writing and speaking)

##### **2. Firm Qualifications**

- Legally Registered in Cambodia
- Minimum 03 year experience in relevant field in performing energy audits plus qualified team and necessary skills / equipment
- Have a team of professional engineers who are able to work on each task of the assignment (with the considerations of gender and social inclusion) at the minimum of 20% women engagement plan in the overall activities

Detailed energy audit process:

##### **1. Data Collection:**

One of the key tasks of the Energy Audit is the collection of all energy related data required to apportion the total facility energy consumption into various energy end-uses. The collected data is then used to build a reliable picture of where and how much energy is being consumed and the cost of energy being used at the building. To be able to estimate reliably the building's end-use demand, it is recommended that the Consultant uses the following three steps to identify the building end-use demand:

- I. Desktop data collection
- II. Field data collection
- III. Cross checking of load demand data

These are explained in detail below:

##### **I. Desktop data collection:**

The purpose of desktop data collection is to minimise the field energy related data collection by using all available facility data. The data collected can be used to estimate the time and human effort required for the field data collection activity later. To minimise the time and work required for the field data

collection, the consultant should try to gather energy related data as much as possible using available resources such as:

- A. Architectural drawings (as built drawing)
- B. Mechanical & Electrical drawings for:
  - a. Lighting circuit drawings (as built drawing)
  - b. Air conditioning system drawing and design manual (as built drawing)
  - c. Single line power supply schematic drawings (as built drawing)
- C. Electrical energy bill historical data (for at least one year)
- D. Load control systems such as timers, building automation systems, etc.

## **II. Field data collection:**

The field data collection is a critical step for:

- A. Complementing the missing data, which the Consultant could not find during the Desktop Data Collection process.
- B. Verifying the accuracy of Desktop Data.
- C. Understanding closely the building operations, energy wastages and building maintenance status.
- D. Carrying out the necessary field measurements required to establish main incoming load profile, major energy end-uses such as HVAC, lighting and others. Establishing actual building load apportioning.
- E. Identify any power “quality” issues, such as harmonic distortions, equipment that is “polluting” the power quality, low Power Factor, etc.
- F. The field data forms shown in Appendix 2 can be used to facilitate the field data collection.

## **III. Cross checking of load demand data:**

The accuracy of estimated end-use energy consumption will affect the accuracy of estimated energy savings of various building ECMs. Therefore, for reliable estimate of the building and end-use energy consumption, it is recommended to use the following approach:

- A. Use the field data collected to estimate the building’s total and end-use energy consumptions. Due to a number of assumptions used in this method, in particular the equipment loading and time usage factors, the accuracy in estimating the building total end-use energy consumption may vary depending on the loads measured. For instance, due to the predictable nature of lighting load, this method allows reliable determination of the building lighting load.
- B. Use appropriate data loggers to record the building and end-use load cycles. For example, it is recommended to record typical daily load profiles of main incoming for seven (7) days, one (1) to seven (7) days for HVAC systems and one (1) hour to one (1) day for other equipment.

The logged data can be used to verify the accuracy of the estimated building total and end-use energy consumption generated by the desktop data collection. If there is a large deviation between the end-use loads estimated by desktop data collection and the end use loads estimated by field data collection, the Consultant should alter the assumptions (equipment loading and time usage factors) applied in estimating the building equipment loads used in the desktop data collection to reduce these deviations to an acceptable range. The Consultant

should take into account other factors such as seasonal variations and occupancy changes during the year that may impact on overall energy consumption.

## **2. End-use load apportioning:**

The Consultant can use the above suggested three steps in energy audit data collections to apportion the total building load into its major end-use loads.

## **3. Identification of ECMs:**

The effectiveness of an energy audit is related to the understanding in depth of the nature and operations of the audited building by the Consultant. Knowing the acceptable level of comfort and tolerance for lighting, temperature and humidity level by employees (and other users / patients) are essential to come up with effective and acceptable ECMs.

The ECMs can be classified into the following categories:

Category	Description
No / Low cost measures	Involves practically no/low cost investment and without any disruption to building operations, normally involving general housekeeping measures.
Medium cost measures	Involves medium cost investments with some minor disruption to building operation.
High cost measures	Involves relatively high capital cost investments with much disruption to building operation.

The development of a **Clean Energy Plan** to design and implement these Energy Conservation Measures will be detailed in Lot 2.

## **4. Reporting and presentation:**

Copies of Draft\Interim Report shall be submitted to UNOPS before preparing the Final Report. All deliverables shall be submitted in English.

The report shall be prepared with due regards to above given requirements in a draft format and submitted for review and comment as soon as field works are completed. The Contractor shall incorporate the comments/ remarks, if any, furnished by UNOPS upon review of the Draft Report and submit the final report. The draft copy of the report shall in general include but not be limited to the following:

1. EXECUTIVE SUMMARY
2. INTRODUCTION
  - 2.1. Audited Building Details
  - 2.2. Objective of the Audit
  - 2.3. Study Scope of the Audit
  - 2.4. Energy Audit Measurement Tools

## 2.5. Brief Description on Electricity Distribution and Background

### 3. DESCRIPTION OF THE EQUIPMENT / SYSTEM AUDIT

#### 3.1. Main Incoming Description

#### 3.2. Lighting System Description

#### 3.3. Air Conditioning System Description

#### 3.4. Other Electrical Equipment Description

### 4. OBSERVATION & FINDINGS

#### 4.1. Load Apportioning

#### 4.2. Main Incoming

#### 4.3. Lighting System

#### 4.4. Air Conditioning System

#### 4.5. Other Building Electrical Equipment

### 5. ANALYSIS AND IDENTIFICATION OF ENERGY CONSERVATION MEASURES (ECMS)

#### 5.1. ECMs at Main Incoming

#### 5.2. ECMs at Lighting System

#### 5.3. ECMs at Air Conditioning System

#### 5.4. ECMs at Other Electrical Equipment

#### 5.5. ECMs Categories

##### 5.5.1. No / Low Cost

##### 5.5.2. Medium Cost

##### 5.5.3. High Cost

### 6. CONCLUSION

#### **b. Lot 2.**

The Consultant shall develop a **Clean Energy Plan** to propose an intervention to implement the Energy Conservation Measures (ECMs) identified in Lot 1. The Plan shall be an integration of the ECMs identified in Lot 1 with the overall objective of reducing purchased energy costs and to increase the resilience of the target hospital to future price escalations and power supply issues.

For each Category of ECM, low cost, medium cost and high cost the Consultant shall prepare the following details in support of the overall **Clean Energy Plan**:

1. Narrative description of the intended ECMs providing an overview of the intervention(s) and expected outcome(s).
2. Detailed design(s) of each ECM package including but not limited to:
  - a. Drawings (to scale, at least A3 and A1 sizes, soft copies in PDF format)
  - b. Specifications
  - c. Design notes including relevant standards and codes and technical design calculations / assumptions
  - d. Bills of Quantities
  - e. Estimated costs
3. Schedule of the activities and overall work plan
4. Details of the expected benefits, such as Return on Investment, anticipated savings, etc.

It is expected that the **Clean Energy Plan** will involve at least one high cost measure that utilises a clean / renewable energy source to provide a mini-grid at the hospital location. The design, sizing and specifications shall be optimised to utilise the hospital facility non-intrusively, i.e by maintaining existing open spaces, not restricting access, parking spaces or building spaces reserved for the provision of medical services. All interventions should be designed to be high-efficiency and low maintenance with low to minimal Operations and Maintenance (O&M) costs.

Additionally the Consultant should be mindful that the **Clean Energy Plan** should serve as a “Proof of Concept” for other projects and the proposed intervention should be scalable based upon the eventual budget of such a project.

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- Have a team of professional engineers who are able to work on each task of the assignment (with the considerations of gender and social inclusion) at the minimum of 20% women engagement plan in the overall activities

#### **4. Bidding.**

Consultants may bid on one or both Lots within the tender. For Consultants who do not bid on both Lots 1 and 2, it shall be noted that Lot 2 shall only commence upon completion of Lot 1 to the satisfaction of UNOPS.

#### **5. Completion of Services.**

For Lot 1, the entire services shall be completed including the final report to the satisfaction of UNOPS within four (4) weeks from the signing of the contract.

For Lot 2, the entire services shall be completed including the final report to the satisfaction of UNOPS within three (3) weeks from the completion of Lot 1.

#### **6. Mode of Payment**

100% Payment shall be made within 30 days of receipt of original invoice. The invoice should be submitted after the completion and acceptance of the final report to UNOPS Cambodia.

The consultant shall state the total cost of the services in United States Dollars (USD)