

**TERMS OF REFERENCE**  
**Individual Contractor – SWP Trainer**

**1. Assignment Information**

<b>Assignment Title:</b>	Trainer to Local Engineers on Solar Water Pumping Systems (National Consultant)
<b>Cluster/Project:</b>	Programme and Results Cluster
<b>Post Level:</b>	Specialist
<b>Contract Type:</b>	Individual Contractor (IC)
<b>Duty Station:</b>	Phnom Penh, Cambodia
<b>Expected Place of Travel:</b>	Travel to province to conduct training
<b>Contract Duration:</b>	8 working days (in total)

**2. Background**

UNDP has been implementing the project **“Promoting the use of solar technologies for agriculture and rural development in Cambodia”** since November 2020 with a grant from Ministry of Agriculture, Food and Rural Affairs (MAFRA), Republic of Korea. The project objective is to increase the resilience of the agriculture sector in Cambodia and Myanmar to climate change through three-pronged interventions: (i) Supporting the uptake of resilient agricultural practices, (ii) enhancing the agricultural value chain, and (iii) promoting and scaling up the adoption of solar technologies for water pumping and powering market facilities. In Cambodia, the project is being implemented in Siem Reap and Kampong Thom Provinces. The project has two key outputs: (1) Increased smallholder farm productivity through adoption of innovative agricultural technology and an improved value chain; and (2) Enhanced awareness, capacities, adoption, and utilization of solar water pumping (SWP) solutions.

The project conducted field surveys in early 2021 to identify potential types of SWPs. The surveys have identified 6 potential configurations of SWP solutions that can be implemented. Subsequently, the project procured these SWP systems and installed them at 67 sites in early 2022. Although the supplier has provided basic training to local operators on the operation and maintenance of the SWP, it is important to enhance their skills further in addressing unexpected issues and failures while using the SWP systems in the future.

In order to sustainably operate and maintain the implemented solar SWP systems as well as encourage more farmers to shift away from diesel based pumping to SWP, capacity of the user needs to be strengthened including local engineers, and key actors such as already trained staff of provincial and local departments. This training also covers how to repair and replace damaged parts, and how to source quality components from local market.

The training will benefit relevant stakeholders in Kampong Thom and Siem Reap provinces to:

1. Understand solar energy and the concept of SWP application in the agricultural sector.
2. Learn how to select pumps and different designs of the SWP that were implemented.
3. Demonstrate installation, basic operation, maintenance, troubleshooting, repair and replacement of damaged components of SWP.

See Concept note including training topics and agenda (Annex 1).

### 3. Scope of Work

The consultant will perform the following duties:

#### A. Prepare training materials in local language

- Prepare the training note and PowerPoint presentation covering the following topics:
  - Introduction to Solar Water Pumping Systems and Applications
  - Types of Motors and Pumps used in Solar Water Pumping Systems
  - SWP systems implemented and troubleshooting
  - Selection of appropriate SWP system for types of water source and demand
  - Simplified design of SWP system
  - Simplified Cost-Benefit Analysis (CBA) of SWP Systems
- Make available the training notes and PowerPoint presentation in Khmer Language.
- Provide equipment and material available for hands-on training on SWP.

#### B. Delivery training workshop in-person at the venue

- Faceplate the training sessions
- Deliver lecture notes and hand-on training in-person at the venue in local language
- Demonstrate SWP design, installation, basic operation, maintenance, troubleshooting, repair, and replacement of damaged components of SWP.
- Prepare a training report

### 4. Outputs/Deliverables:

The table below list the main deliverables and estimated timeframes:

N	Deliverables/Outputs	Estimated Duration to Complete	Target Due Dates	Review and Approvals Required
1	<b>Pre-training:</b> Training materials developed in Khmer Language including lecture notes and PowerPoint slides	4 days	20-24 June 2022	<ul style="list-style-type: none"> <li>• Technical Advisor on Energy</li> <li>• Programme Analyst</li> <li>• Project Coordinator</li> </ul>
2	<b>During the training:</b> Delivered two-day training at the venue including the required equipment and material available for hands-on training	3 days	6-8 July 2022	
3	<b>After the training:</b> Prepare a training report	1 day	12 July 2022	
<b>Total # of Days:</b>		<b>8 working days</b>		

### 5. Payment Milestone

The consultant will be paid on a lump sum basis under the following installments:

No	Outputs/Deliveries	Payment Schedule	Payment Amount
1	Upon satisfactory completion of deliverable 1, 2 & 3	14 July 2022	100%

## 6. Institutional Arrangement

The consultant's will work under guidance and technical supervision of Technical Advisor on Energy and deliverables will also be reviewed by the Project Coordinator and Programme Analyst, UNDP Cambodia.

## 7. Duration of the Work and Duty Station

The consultant will work for 8 working days covering the period of 20<sup>th</sup> June 2022 to 12<sup>th</sup> July 2022. The duty station of for this assignment is Phnom Penh with expected 2 working days traveling to provinces for conducting the training and such travel will be covered by UNDP's expense including per diem.

## 8. Minimum Qualifications of the Individual Contractor

<b>Education:</b>	<ul style="list-style-type: none"> <li>Master's degree in energy, economics, applied sciences, public policy, governance, or other relevant areas.</li> </ul>
<b>Experience:</b>	<ul style="list-style-type: none"> <li>At least 5 years of experience in providing training on SWP, with focus on design, installation, basic operation, maintenance, troubleshooting, repair, and replacement of damaged components of SWP.</li> </ul>
<b>Competencies</b>	<p><b>Corporate competencies:</b></p> <ul style="list-style-type: none"> <li>demonstrates integrity by modelling the UN's values and ethical standards.</li> <li>promotes the vision, mission, and strategic goals of UNDP.</li> <li>displays cultural, gender, religion, race, nationality and age sensitivity and adaptability.</li> <li>treats all people fairly without favoritism.</li> <li>fulfils all obligations to gender sensitivity and zero tolerance for sexual harassment.</li> </ul> <p><b>Functional competencies:</b></p> <ul style="list-style-type: none"> <li>excellent analytical and research skills.</li> <li>excellent drafting skills.</li> <li>ability to grasp the development context/challenges in the country.</li> <li>strong interpersonal skills, communication and diplomatic skills.</li> <li>strong facilitation, presentation and public speaking skills.</li> <li>ability to work under pressure and tight deadlines.</li> </ul>
<b>Language Requirement:</b>	Fluency in Khmer and English (spoken and written).

## 9. Criteria for Evaluation

Technical Evaluation Criteria	Obtainable Score
Postgraduate degree in Engineering, economics, applied sciences, public policy, governance or equivalent;	15
A minimum of 5 years of working experience in planning, implementing, and managing programs and/or projects in areas of renewable energy, energy access, and applications of solar PV energy. Work experience in similar projects, solar water pumping solutions, would be an advantage;	40
Experience in planning and delivering trainings is required	20

Good understanding and/or direct work experience with communities, local government institutions, development agencies such as international organization and/or national or international NGOs, with private sector	20
Fluency in Khmer and English (spoken and written)	5
<b>Total Obtainable Score:</b>	<b>100</b>

## Annex 1: Training Concept Note



Ministry of Agriculture,  
Food and Rural Affairs



**Concept Note**  
**Two-days of Training to Local Engineers on the Solar Water Pumping Systems**  
**Venue: Siem Reap (TBD)**  
**Date: TBD**

### 1. Introduction

UNDP has been implementing the project “Promoting the use of solar technologies for agriculture and rural development in Cambodia” since November 2020 with a grant from Ministry of Agriculture, Food and Rural Affairs (MAFRA), Republic of Korea. The project objective is to increase the resilience of the agriculture sector in Cambodia and Myanmar to climate change through three-pronged interventions: (i) Supporting the uptake of resilient agricultural practices, (ii) enhancing the agricultural value chain, and (iii) promoting and scaling up the adoption of solar technologies for water pumping and powering market facilities. In Cambodia, the project is being implemented in Siem Reap and Kampong Thom Provinces. The project has two key outputs: (1) Increased smallholder farm productivity through adoption of innovative agricultural technology and an improved value chain; and (2) Enhanced awareness, capacities, adoption, and utilization of solar water pumping (SWP) solutions.

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### 2. Objective of Training

The training will benefit relevant stakeholders in Kampong Thom and Siem Reap provinces to:

- (i) Understand the solar energy and the concept of SWP application in the agricultural sector;
- (ii) Learn how to select pumps and different designs of the SWP that were implemented;

- (iii) Demonstrate installation, basic operation, maintenance, troubleshooting, repair and replacement of damaged components of SWP.

### 3. Target Participants

The two days training will bring together a total of 35 persons: 25 technical and 10 non-technical. The project team will select the technical participants in close consultation with local authorities and contacts from field missions.

- SWP suppliers in the target districts: 4
- Local engineers: 15
- Technical officials from provinces/districts: 6

The 10 non-technical participants are mainly the project teams of NCDDS, UNDP and the provincial administration.

Project will have a direct contract with trainer(s) selected from local suppliers and individuals who can speak Khmer fluently, have experience in providing SWP training, familiar with SWP systems installation, and understanding the market in Cambodia. The trainer(s) also provide training manual for their session, organize demonstrations, and hand-on training as required.

### 4. Training Program

#### a. Setting:

This will be in-person training, that requires participants available at the venue for the whole duration of the training for two days, attending lectures and demonstrations. The training will be delivered in Khmer.

The training has four sessions. The morning sessions cover the theoretical sessions, and two afternoon sessions are hands-on training.

#### b. Training material:

The trainers are required to provide training manual including lecture notes and PowerPoint slides. The training manual should be in Khmer language. The trainers should provide required equipment and material available for hands-on training.

### 5. Workshop Agenda

Time & Sessions	Day 1
	Topic/ Description
07h30-08h00	<b>Registration</b>
08h00-08h30	<b>Training kick off – UNDP/NCDDS representatives</b> <ul style="list-style-type: none"> <li>• Training objective and welcome address</li> <li>• Introduction</li> </ul>

08h30-09h30 <b>Session 1 (includes Q&amp;A)</b>	<b>Introduction to Solar Water Pumping Systems and Applications</b> <ul style="list-style-type: none"> <li>• Introduction to solar photovoltaic water pumping systems</li> <li>• Solar pump applications <ul style="list-style-type: none"> <li>○ Village drinking water supply</li> <li>○ Irrigation – water demand for different crops and seasons</li> <li>○ Fish Farms &amp; Aquaculture</li> <li>○ Livestock watering</li> <li>○ Residential needs</li> <li>○ Institutional needs</li> </ul> </li> </ul>
09h30-10h00	<b>Break</b>
10h00-11h00 <b>Session 2</b>	<b>Types of Motors and Pumps used in Solar Water Pumping Systems</b> <ul style="list-style-type: none"> <li>• Types of Motors for Solar PV Pumping Systems</li> <li>• Types of Pump for Solar Water Pumping Applications</li> <li>• Technical models of solar pumping systems <ul style="list-style-type: none"> <li>○ PV array solely used for water pumping</li> <li>○ PV array used for water pump and other applications</li> <li>○ Pump operated from a solar PV mini-grid system</li> <li>○ Solar water pumping system connected to grid</li> </ul> </li> <li>• Different components of solar water pumping system</li> </ul>
11h00-12h15 <b>Session 3</b>	<b>SWP systems implemented and troubleshooting</b> <ul style="list-style-type: none"> <li>• Overview of UNDP implemented SWP Systems types</li> <li>• Typical issues and troubleshooting</li> </ul>
12h15-13h30	<b>Lunch Break</b>
13h30 -16h00 <b>Session 4</b>	<ul style="list-style-type: none"> <li>• Installation, and warranty of different components</li> <li>• How to operate and basic maintenance measures of the SWP systems</li> <li>• Troubleshooting</li> </ul>
<b>Day 2</b>	
08h00-09h00 <b>Session 5</b>	<b>Selection of appropriate SWP system depending on the water source and demand</b> <ul style="list-style-type: none"> <li>• Source of Water – applicable pumps</li> <li>• Water Demand Assessment <ul style="list-style-type: none"> <li>○ Water demand assessment for village water supply</li> <li>○ Water demand assessment for livestock</li> <li>○ Water demand assessment for irrigation</li> </ul> </li> </ul>
09h00-10h30 <b>Session 6</b>	<b>Simplified design of SWP system</b> <ul style="list-style-type: none"> <li>• Step 1: Site and water resource assessment</li> <li>• Step 2: Assessment of water demand and storage and distribution requirement</li> <li>• Step 3: Determine total dynamic head (TDH)</li> <li>• Step 4: Determine peak flow rate and verify safe yield of borehole</li> <li>• Step 5: Selection of suitable motor-pump system</li> <li>• Step 6: Determine the PV array capacity</li> </ul> Recap of the session and discussion
10h30-10h45	<b>Break</b>
10h45-12h00 <b>Session 7</b>	<b>Simplified Cost-Benefit Analysis (CBA) of SWP Systems</b> <ul style="list-style-type: none"> <li>• CAPEX cost and benefit analysis</li> <li>• Payback period/Levelized cost of water delivery</li> <li>• Case example of levelized cost of water delivery</li> </ul>
12h15-13h30	<b>Lunch Break</b>

13h30-16h00 <b>Session 8</b>	<b>Hands-on training</b> <ul style="list-style-type: none"> <li>• How to replace different components of SWP system and their local availability</li> <li>• Health and Safety Guidelines</li> </ul>
16h00-16h30	<b>Break</b>
16h30-17h00	<ul style="list-style-type: none"> <li>• Feedback</li> <li>• Closing remarks</li> <li>• End of the Training</li> </ul>

## 6. Contacts

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