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Ministry of Energy, Water Resources and Irrigation
Alternative Energy Promotion Centre (AEPIC)
Making Renewable Energy Mainstream Supply in Nepal

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COURSE INFORMATION



OPERATOR TRAINING FOR SOLAR WATER PUMPING SYSTEMS

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1. COURSE INFORMATION

This course imparts knowledge and skills for the operation and maintenance for solar water pumping systems (SWP) with focus on individual farmers and existing operators with limited technical background. The training builds the skills and understanding to independently operate, manage and troubleshoot SWP systems notwithstanding limited technical expertise.

Title	Operator Training for Solar Water Pumping Systems
Duration	14 hours (2 days)
Language	The training language is Nepali, the Handouts are in Nepali. However, the Course Information for the instructor (this document) is in English.
Class size	Recommended: 15 participants – Maximum size: 20 participants
Target group	<ul style="list-style-type: none"> ▪ Smallholder farmers owning solar water pumps. ▪ People responsible for operation and maintenance of water pump systems. ▪ Local technicians, and individuals possessing foundational understanding in electrical, mechanical, and plumbing sectors. ▪ Agricultural extension professionals.
Enrolment criteria	<ul style="list-style-type: none"> ▪ Minimum school education of 8th grade ▪ Bright and motivated individuals
Training objectives	<p>Upon completion of the training, the participants will possess the skills to:</p> <ul style="list-style-type: none"> ▪ Perform care, maintenance, and basic repair tasks related to electro-mechanical and plumbing components of SWP projects. ▪ Maintain data, keep records and documentation of the SWP system. ▪ Liaise effectively with the community and the installer company should issues arise beyond the operator's capacity to resolve or manage.
Training methodology	<ul style="list-style-type: none"> ▪ Practical, hands-on training on-site an SWP system. Participants have direct access to observe and interact with components and technology. ▪ Encourage active participation and provide immediate feedback (learner-centric, integrating problem/project-based learning strategies). ▪ Case studies centered on typical, solvable SWP issues. ▪ Visual aids, demonstrations, and real-life examples to raise understanding. ▪ Encourage questions and provide detailed explanations to clarify concepts.
Training material	<p>1) Handouts for this training available as separate document in Nepali language</p> <p>2) Course Information for the instructor (this document) in English language</p>
Equipment required	Access to a solar water pumping system site where the training can be conducted.
Certification	The training provider will award a course participation certificate to those participants who have completed the training. For completion, the participant must have full attendance.

Course Structure

Expected Learning Outcomes		Duration in Minutes	Theory	Practice
Opening				
	Opening, ice breaking	60	---	---
1. Components of Solar Water Pumping Systems				
	<ul style="list-style-type: none"> Identify all components of the system. Describe the function of all components of solar water pumping technology. 	30	30	
2. Inspection of Solar Panel and DC Distribution Box				
	<ul style="list-style-type: none"> Interpret specifications provided in the solar panels. Measure the output voltage and current of panels as well as MCB/MCCB using a multimeter. Conduct routine inspections of the DCDB. Execute routine checks of MCCB/MCB and SPD. Perform cleaning of panels and DCDB. 	---	120	
3. Inspection and Maintenance of Pump Controllers				
	<ul style="list-style-type: none"> Measure the output voltage and current of the controller. Conduct a visual inspection to identify issues such as wiring or loose connections and resolve it. Perform cleaning of the controller. 	---	90	
4. Inspection and Cleaning of Pumps				
	<ul style="list-style-type: none"> Verify the output voltage of the controller. Ensure the electrical connection between the pump and the controller. Perform the cleaning procedures for pump filters, impellers for removal of sediments to maintain optimal functionality. 	30	90	
5. Inspection of Protection Devices				
	<ul style="list-style-type: none"> Identify protection devices of the system. Verify and rectify connection issues or damages in the protection devices. Measure earth resistance and apply appropriate measures to reduce it if it exceeds the desired range. 	30	60	
6. Cleaning and Maintenance of Civil Infrastructure				
	<ul style="list-style-type: none"> Inspect the water distribution network connections, identify seepages as well as repair detected seepages in the network. Detect cracks (if any) in civil infrastructure and notify the relevant authorities. Measure the water discharge. Execute schedule cleaning of civil infrastructure. 	---	90	

<i>Expected Learning Outcomes</i>	<i>Duration in Minutes</i>	<i>Theory</i>	<i>Practice</i>
7. Basic Troubleshooting			
<ul style="list-style-type: none"> Identify system problems. Follow troubleshooting checklists to systematically address identified issues. Provide assistance to remote experts in resolving system-related issues. 	30		60
8. Regular Performance Checks			
<ul style="list-style-type: none"> Fill out the log sheet with relevant data and information. Conduct periodic performance checks according to the schedule outlined in the log sheet. 	30		60
Evaluation and Closing			
Post training evaluation, closing and certificate distribution.	30		---
Total in minutes		240	600
Total in hours		4	10

2. LEARNING ACTIVITIES

Trainer Activities	Learner Activities	Teaching Aids	Time (hours)
Opening			
The inaugural session will be graced by the esteemed presence of the ward chairperson from the local government where the system is deployed and training facilitators. In the opening session the training objectives and methods will be highlighted.			0.5
Ice-breaking			
<ul style="list-style-type: none"> Establish ground rules for the training. Conduct an introduction of the participants followed by guided questions. <ul style="list-style-type: none"> How many years of experience working as an operator? What are the expectations from the training? What are the key factors for ensuring long-term sustainability of SWP systems? 	<ul style="list-style-type: none"> Individual introductions: <ul style="list-style-type: none"> Name, address, and installed capacity of the system. Individual shares his/her understanding of SWP and highlights the importance of SWP. Share expectations from the training. 	Meta cards and markers	0.5
1. Components of Solar Water Pumping Systems			
<ul style="list-style-type: none"> Explain the function and role of system components. Guide tour of the installed SWP system to familiarize with the components and layout. 	<ul style="list-style-type: none"> Observe and take notes of the installed system during the tour. Participate in discussion and share observations about the system components. 	Meta cards and markers	1
2. Inspection of Solar Panels and DC Distribution Box (DCDB)			
<ul style="list-style-type: none"> Give an illustrative talk on solar panels showing real panels. Emphasize the significance of safety protocols. Explain the purpose of the DCDB. Demonstrate voltage and current measurement on panels. Divide participants into 3 groups and assign each to review the panel datasheet and measure current and voltage of the panels and DCDB. 	<ul style="list-style-type: none"> Listen to the information shared by the trainers. Work in a group for the given assignment. Ask the trainers for the information and steps that are unclear. 	Solar panels, mobile phone, notebook and pen	2

<i>Trainer Activities</i>	<i>Learner Activities</i>	<i>Teaching Aids</i>	<i>Time (hours)</i>
<ul style="list-style-type: none"> ▪ Guide learners to measure the voltage and current. ▪ Demonstrate how to conduct routine inspections of the DCDB. ▪ Demonstrate cleaning of panels and DCDB. ▪ Assign groups to clean the panels and DCDB the next day morning. 	<ul style="list-style-type: none"> ▪ Clean the panels and DCDB, the next day morning as assigned to the group. Training re-commences after that. 	Mop, cloth, brush and clean water	
3. Inspection and Maintenance of Pump Controllers			
<ul style="list-style-type: none"> ▪ Give an illustrative talk on a pump controller. ▪ Highlight the importance of safety protocols. ▪ Demonstrate measuring voltage and current on the controller. ▪ Assign each participant to measure output current and voltage. ▪ Perform cleaning of the controller. 	<ul style="list-style-type: none"> ▪ Measure output current and voltage as assigned. ▪ Inspect the electrical connection and discuss possible measures to resolve it. 	Multimeter, notebook and pen	1.5
4. Inspection and Cleaning of Pumps			
<ul style="list-style-type: none"> ▪ Give an illustrative talk on pumps. ▪ Highlight the importance of safety. ▪ Ask learners to take out the pump and clean the intake. ▪ Demonstrate pump servicing. ▪ Highlight the importance of cable insulation. 	<ul style="list-style-type: none"> ▪ Support the trainer to take out the pump. ▪ Take a photo prior to commencing pump servicing. ▪ Check the status of the pump, examine the filtration, and remove the sediment buildup. ▪ Inspect and check the electrical connection between the pump and controller. 	Camera, screwdriver set, flip chart, marker, notebook and pen	2
5. Inspection of Protection Devices			
<ul style="list-style-type: none"> ▪ Explain the equipment used for protecting the SWP system. ▪ Guide participants in identifying and rectifying connection problems, emphasizing safety protocols and best practices. ▪ Provide instruction on how to measure earth resistance. 	<ul style="list-style-type: none"> ▪ Examine actual protection devices for any connection issues or damages. ▪ Work in groups to conduct measurements of earth resistance. 	Earth tester, flip chart, marker, notebook and pen	1.5

<i>Trainer Activities</i>	<i>Learner Activities</i>	<i>Teaching Aids</i>	<i>Time (hours)</i>
6. Cleaning and Maintenance of Civil Infrastructure			
<ul style="list-style-type: none"> ▪ Give Illustrative talks on the civil structure and its importance. ▪ Assign learners to measure the water output of the pump. ▪ Conduct visual inspection of key components including intake, collection tank, RVT and pipeline. ▪ Highlight common signs for any leakages, seepage or cracks that learners should be attentive to during inspections. ▪ Demonstrate ways to resolve leakages in the piping system. ▪ Ask learners to connect HDPE. 	<ul style="list-style-type: none"> ▪ Measure water output using the bucket method. ▪ Work in groups for the defined length of the pipeline and identify the leakage, seepage or cracks in the structure. ▪ Conduct a visual inspection of the civil structure components such as intake, collection, tank, RVT and pipeline. ▪ Connect HDPE using hot plates. 	Bucket, stopwatch, hot plate, HDPE pipe (2.5"), notebook, pen, flipchart and markers	1.5
7. Basic Troubleshooting			
<ul style="list-style-type: none"> ▪ Provide an overview of common system problems that may arise and their potential causes. ▪ Explain the troubleshooting checklist to systematically address identified issues. ▪ Inform participants about their responsibilities in operating and maintaining such a system. 	<ul style="list-style-type: none"> ▪ Engage in discussion regarding common operational system problems. ▪ Apply troubleshooting checklists to tackle the identified issues systematically. ▪ Identify system issues from the list which are beyond the responsibility of learners. 	Handouts	1.5
8. Regular Performance Checks			
<ul style="list-style-type: none"> ▪ Provide instructions on how to fill out the log sheet with relevant data. ▪ Discuss the significance of adhering to the schedule to ensure proper function of the system over time. 	<ul style="list-style-type: none"> ▪ Fill out the log sheet under the guidance of a trainer. 	Log sheet, notebook and pen	1.5
Evaluation and Closing			
<ul style="list-style-type: none"> ▪ Explain the evaluation and distribute the forms. Collect the filled forms. ▪ Distribute the certificates. 	<ul style="list-style-type: none"> ▪ Participants complete the evaluation form. ▪ Participants are awarded a certificate. 	Evaluation forms, certificates	0.5

