



Food and Agriculture  
Organization of the  
United Nations

Online administered training

# RENEWABLE ENERGY FOR IRRIGATION



## THE ROLE OF SOLAR ENERGY IN WATER MANAGEMENT AND IRRIGATION

### Background

In the agricultural sector, energy in the form of electrical and mechanical power is required for a number of activities including land preparation, seeding, irrigation, delivery of pesticides, and harvesting among others. Moreover, the agricultural sector is a large energy consumer for pumping water from wells and thus distributing it through irrigation systems. The use of water and energy in agriculture are interlinked, therefore any increase in demand in any one sector has flow-on effects in the other one. The rising energy demand, driven by social and economic development and by the rapid growth of urban areas, is thus directly affecting the agricultural sector and rural communities that depend on it.

Across the globe, the agricultural sector may face an energy crisis as increasing electricity demand from urban areas is resulting in frequent shortages causing disruption of supply needed for lifting irrigation water. It is, thus, of the utmost importance to reduce the vulnerability of farmers to frequent energy shortages and provide them with reliable, cost-effective and environmentally sustainable energy.

### Training goal and objectives

The online administered training will reflect on the current status of available technologies for the employment of solar energy in agriculture and irrigation and will illustrate the significant impact it can have, from national economies to livelihoods, by reducing exposure to rising electricity and diesel prices and the enhanced reliability of energy supply, with direct benefits in the economy of affected families and resulting into significant savings for rural communities.

In addition, the cases presented will show the generated increased capacities and enhanced knowledge at different levels, from farmers, who acquired technical and operational competences in the management of solar-based irrigation systems, to authorities, who profited of direct implementation cases to enhance their knowledge and develop policies at different institutional levels.

The training aims at enhancing the capacities of participants from a variety of national organizations of Mali, Niger and Libya on several topics:

- Introduction to solar energy;
- Fundamentals and essentials of Solar-Powered Irrigation Systems (SPIs);
- Complexities of farm irrigation systems and their operation through solar energy;
- Introduction to solar PhotoVoltaic (PV) systems;
- Tools and Methodologies for SPIs;
- Tools and Techniques for operation and maintenance;
- Hydraulics of SPIs;
- Economics and financial considerations of SPIs.

### Approach

In accordance with above-mentioned objectives, a 2-day administered e-training has been designed. The main tools used are live and recorded presentations by international experts on several topics related to solar energy for agriculture and irrigation, pool questions and quizzes. Each session begins with a learning module in the form of a virtual class to introduce the subject provided by the trainer, followed by interactive questions and practical sessions to facilitate the interaction and open discussion with trainees.

The theoretical contents presented are further illustrated through video materials and interviews with a range of stakeholders, from practitioners, to developers, to beneficiaries. The training will be carried out in two languages, English and French, with the support of live interpretation.

## SOLAR ENERGY FOR IRRIGATION

10.00-10.10	Welcome note and introduction to the course		Stefania Giusti (FAO)
10.10-10.15	Course introduction	Video	Maher Salman (FAO)
<b>Session 1. Introduction to the farm irrigation systems and their complexities</b>			
10.15-10.35	Farm irrigation systems and their complexities	Presentation	Waqas Ahmad (FAO)
10.35-10.45	Demonstration of an on-farm irrigation systems operated by solar energy	Video tutorial	Muhammad Nasir Jamal, eminent engineer
10.45-11.00	Q&A session		
11.00-11.15	Break		
<b>Session 2. Fundamentals and essentials of SPISS</b>			
11.15-11.35	Introduction to solar energy	Presentation	Prof. Salah Arafa (American University in Cairo, Egypt)
11.35-11.45	Fundamentals of solar energy	Video	
11.45-12.05	Solar-powered water lifting for irrigation	Presentation	Nishant Narayan & Arno Smets (TU Delft University, the Netherlands)
12.05-12.15	Q&A session		
<b>Session 3. Tools and methodology in action for SPISS</b>			
13.30-13.50	Solar-powered water lifting for irrigation	Presentation	Ahmed Abdelfattah (FAO)
13.50-14.00	Types of common uses systems in solar-powered irrigation	Video	
14.00-14.20	Measures of solar energy uses in irrigation: functionality of PV systems and common mistakes	Presentation	Martina Groenemeijer (FuturePump)
14.20-14.30	Solar water pump for smallholder farmers	Video	
14.30-14.45	Break		
<b>Session 4. Tools and techniques for operation and maintenance</b>			
14.45-15.00	Renewable energy for irrigation	Presentation	Vasileios Chatzimpaloglou (Enviromena Power Systems)
15.00-15.10	Q&A session		
15.10-15.30	Day wrap-up		

## SPIS DESIGN AND OPERATION CONSIDERATIONS

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### Session 1. Checklist and requirements for SPIS

10.00-10.20	<b>Introduction to ITB Operation Manual</b>	<i>Presentation</i>	Ahmed Abdelfattah (FAO)
10.20-10.30	<b>Q&amp;A session</b>		

### Session 2. Designing consideration of irrigation system hydraulics

10.30-11.00	<b>Designing consideration of irrigation system hydraulics</b>	<i>Presentation</i>	Muhammad Nasir Jamal (Rabail Technologies)
11.00-11.10	<b>Q&amp;A session</b>		
11.10-11.20	<b>Break</b>		

### Session 3. Designing a SPIS: Using solar power technology to run irrigation systems

11.20-11.40	<b>Designing a SPIS</b>	<i>Presentation</i>	Adrian Honey (Lorentz GmbH)
11.40-11.50	<b>Q&amp;A session</b>		
11.50-12.00	<b>Morning wrap-up</b>		

### Session 4. Case studies: solar-powered irrigation

13.00-13.15	<b>Solar powered water in the el-Behera governate, Egypt</b>	<i>Presentation</i>	Ahmed Abdelfattah (FAO)
13.15-13.20	<b>Egypt project overview</b>	<i>Video</i>	
13:20-13:25	<b>The voices of the beneficiaires: farmers of el-Behera</b>	<i>Video interviews</i>	
13:25-13:30	<b>The role of partners: SPIS operators in el-Behera</b>	<i>Video interviews</i>	
13.30-13.40	<b>Water harvesting, conjunctive use of groundwater and solar powered water lifting for irrigation – Mafraq, Jordan</b>	<i>Presentation</i>	Ahmed Abdelfattah (FAO)
13.40-13.50	<b>Case study: water harvesting reservoir pilot in Kinoni, Uganda</b>	<i>Presentation</i>	Ahmed Abdelfattah (FAO)
13.50-14.00	<b>Break</b>		

# SCHEDULE

## Session 5. Economics and Financial of SPIs – The way forward

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14.00-14.20	<b>Solar-powered water lifting for irrigation – Economic considerations of a cleaner production system</b>	<i>Presentation</i>	Juan Carlos Intriago Zambrano (TU Delft University, the Netherlands)
14.40-14.50	<b>Q&amp;A session</b>		
14.50-15.15	<b>Day wrap-up</b>		

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## The Building Forward Better Initiative

Conflict and fragility are at the core of some of the biggest challenges today – they are able to hinder development progress and reverse any development gains. Environmental factors are rarely, if ever, the sole cause of conflicts and vulnerability. However, the exploitation of natural resources and related environmental stresses can be implicated in all phases of the conflict cycle from contributing to the outbreak and perpetuation of violence to undermining prospects for peace.

A fundamental problem in fragile contexts is the loss of human capital. Without the contribution of knowledgeable professionals, the re-building process becomes even more complicated. Local capacities should be at the base of any re-building planning and investments, as they provide access to local knowledge and information and can guarantee the sustainability of the program in the long-term.

Indeed, effective institutions are central to address both the “capacity deficit” and “legitimacy deficit” faced in fragile contexts. Recognizing the importance to invest in human capital, the “Building Forward Better” Initiative of FAO promotes a blended training methodology, composed of administered and self-administered online and face-to-face training, addressing a series of topics in the domain of natural resources management.

The Initiative aims to reduce the knowledge gap and strengthen national institutions to enhance agricultural productivity, improve food security and, ultimately, contribute to peaceful societies for sustainable development

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