SCHOOL OF SUSTAINABLE ENERGY
AAETI

RESIDENTIAL TRAINING

DECENTRALISED RENEWABLE ENERGY (DRE) SYSTEMS

DESIGN, INSTALLATION AND MAINTENANCE OF SOLAR MINI-GRID SYSTEMS

DATES: July 26-28, 2023 | LANGUAGE: English

VENUE: Anil Agarwal Environment Training Institute (AAETI), Nimli, Rajasthan

TRAINING MODULE

DAY 1 – JULY 26, 2023	
Session 1 30 minutes 10:00 Hours – 10:30 Hours	**Introduction** ■ Introduction to the Course ■ Workplace Health & Safety in Solar PV plants ■ Common hazards and controls ■ General safety measures **Introduction to Mini-grids, Electrical Basics and Circuits** ■ Introduction to electrical circuits - series circuits, parallel circuits, combining series and parallel circuits ■ Characteristics of DC and AC electricity
Session 2 & 3 40 minutes 10:30 Hours – 11:10 Hours	**Solar Energy (Solar Resources)** ■ Solar resource and radiation ■ Measuring solar radiation ■ Solar radiation data ■ Solar window ■ Peak Sun Hours ■ Optimum positioning for off-Grid PV system – Azimuth, tilt angle **Solar Energy (PV Cells and Modules)** ■ Working principle of PV cell ■ PV Cell Electrical Characteristics ■ Quantifying PV Module Performance ■ Types of PV Modules technology and specification ■ Evolution of PV technology – Types, size, eff. ■ PV Module Protection ■ Overall demand and manufacturing capacity in India and globally
Tea Break: 11:10 Hours – 11:30 Hours	
Session 4 40 minutes 11:30 Hours – 12:10 Hours	**Solar Energy (PV Array Efficiency and Output)** ■ Losses in PV system ■ Output of a PV Array **Energy Storage** ■ Electricity storage ■ Purpose of batteries in PV systems ■ Battery technologies, characteristics, and comparison ■ Combining batteries ■ Battery control systems ■ Safe handling & disposal of batteries
Session 5 30 minutes 12:10 Hours – 12:40 Hours	**Power Conversion Equipment** ■ DC to DC Conversion – System controllers and regulators ■ DC to AC Conversion – Inverters ■ Types of Inverters ■ Inverter power ■ Matching of solar PV array, inverter, and MPPT
12:40 Hours – 13:00 Hours	**Group task assignment**
Lunch Break: 13:00 Hours – 14:00 Hours	

Session 6 50 minutes 14:00 Hours – 14:50 Hours	**Mini-grid Site Selection and Demand Assessment** ■ Overview of mini-grids ■ Clustering mini-grid sites ■ Population density vs. mini-grid size ■ Load assessment ■ Identifying Base Loads ■ Metering for mini-grids
Session 7 40 minutes 14:50 Hours – 15:30 Hours	**General Mini-Grid Design Principles** ■ System design principles ■ Sizing of the PV array for mini-grid ■ Establish design criteria ■ Design Process ■ Determine system configuration ■ Design iteration and optimization ■ Drawings and balance-of-system ■ Overview of mini-grids PV system design
Tea Break: 15:30 Hours – 15:50 Hours	
Session 8 45 minutes 15:50 Hours – 16:35 Hours	**Sizing System Equipment** ■ Calculate total daily energy demand ■ Qualification criteria for battery inverter selection ■ Select battery inverter ■ Qualification criteria for battery selection ■ Effect of operating temperature on battery sizing ■ Depth of discharge vs cycle life of batteries ■ Selection of battery
Session 9 25 minutes 16:35 Hours – 17:00 Hours	**Mini-grid Community Engagement** ■ Introduction to Community Engagement ■ Community Engagement Process ■ Community Engagement Tools
End of Day 1	
DAY 2 – JULY 27, 2023	
Session 10 60 minutes 09:30 Hours – 10:30 Hours	**Key considerations/ Best practices in operation of Mini-grids catering to various communities across various geographies.** Mr. Sharad Tiwari/ Mr. Sugata Mukherjee – Tata Power Renewable Microgrid Ltd.
Session 11 60 minutes 10:30 Hours – 11:30 Hours	**Design and Optimization of Mini-Grid Systems** Mr. Vivek Solanki - Solextron AG India
Tea Break: 11:30 Hours – 11:50 Hours	
Session 12 60 minutes 11:50 Hours – 12:50 Hours	**Economics and Business Opportunities for Mini-Grids** ■ Source of funding ■ Initial system cost ■ Ongoing or recurring cost ■ Life cycle cost analysis

	■ Levelized cost of electricity ■ Business model and implementation strategy
Lunch Break: 12:50 Hours – 13:50 Hours	
Session 13 60 minutes 13:50 Hours – 14:50 Hours	**Mini-grids for empowering entrepreneurship** Mr. Nitin Akhade, Customized Energy Solutions India Pvt. Ltd.
Session 14 60 minutes 14:50 Hours – 15:50 Hours	**Sustainable operation and development of Mini-Grid systems** ■ Challenges for developers Mr. Satya Prakash Choubey, Global Energy Alliance for People and Planet, India
Tea Break: 15:50 Hours – 16:10 Hours	
Session 15 60 minutes 16:10 Hours – 17:10 Hours	**Identifying and addressing community challenges** Mr. Gaurav Pandey, Independent Consultant, DRE. Ex- Mlinda Sustainable Environment Pvt. Ltd.
Session 16 & 17 40 minutes 17:10 Hours – 17:50 Hours	**Mini-grid Energy Generation Performance Monitoring** ■ Data Collection ■ Analysis ■ Performance indicators **Mini-Grid Installation, Maintenance and Troubleshooting** ■ Installation of PV array ■ PV mounting system ■ Commissioning ■ Maintenance of components ■ Shutdown procedure ■ Troubleshooting of plant
End of Day 2	
DAY 3 – JULY 28, 2023	
Session 18 60 minutes 09:30 Hours – 10:30 Hours	**The Mini-grid case studies** Based on field visits and documentation by CSE
60 minutes 10:30 Hours – 11:30 Hours	**Group activity assessment**
Tea Break: 11:30 Hours - 11:50 Hours	
20 minutes 11:50 Hours – 12:10 Hours	**Feedback**
60 minutes 12:10 Hours – 13:10 Hours	**Certifications and Vote of Thanks** **Mr. Jay C. Shiv,** Programme Director, Centre for Science and Environment
Lunch Break: 13:10 Hours – 14:00 Hours	
14:00 Hours onwards	**Dispersal from AATI Campus**