
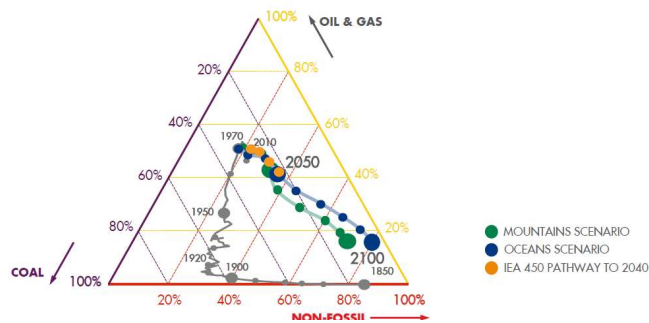


	<h2>Skill Development Programme</h2> <h3>Rooftop Solar Grid Engineers Course</h3> <p>11-23 February, 2019</p>	
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Venue: CSIR-CEERI's Incubation-cum-Innovation Hub, Jaipur Centre,
CFC-1, Malviya Industrial Area, Jaipur-302017

Government of India has set a target of 40 GW installations of Rooftop Systems in the country by 2022. This calls for availability of trained manpower for Installation, Operation & Maintenance of Rooftop Systems. In this regard, National Institute of Solar Energy (NISE) has launched a 10-days Rooftop Grid Engineer Skill Development programme. Three such programmes have already been conducted successfully by NISE. The fourth such skill development course is being conducted during 11-23 February, 2019 in association with CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI) at its Incubation-cum-Innovation Hub, Jaipur Centre, which is first in Rajasthan. This Skill Development programme is approved by Ministry of New and Renewable Energy, Government of India.

An unfolding global energy transition



OBJECTIVE OF THE COURSE:

- Understanding of Basic concepts of Grid-connected rooftop solar power plants.
- Efficient working at every stage of safety, designing, installation, pre- and post commissioning, O&M.
- Understanding of Certification & National level policies of Rooftop SPV plants.

Learning Objectives:

- Understand the basics solar energy and and concept of Rooftop solar , GCRT (Grid connected rooftop solar)
- Survey a rooftop solar PV installation site,
- Understand all equipment related to the rooftop solar PV system,
- Design a rooftop solar PV system as per Customer's requirements as well as appropriate codes and standards,

- Prepare the necessary technical documents related to the design, installation and operation of the rooftop PV system,
- Install a rooftop solar PV system based on the relevant designs and drawings,
- Operate and maintain a rooftop solar PV system including identification and troubleshooting of faults,
- Ensure safety while installation and operation of the rooftop PV system,
- Undertake project management for installation of a rooftop solar PV system,
- Understand necessary formalities with authorities for applications, submissions, approvals, interconnections, inspections, certifications, commissioning, etc.,
- National and State Policies for Grid Integrated SPV Power Plants
- Different Metering mechanisms and Key Implementation Requirements, Standards, Regulations and Procedures for grid integrated solar rooftop development Along with case study
- Pre commissioning inspection of the Grid Connected Rooftop Solar PV Power Plant
- Post commissioning inspection of the Grid Connected Rooftop Solar PV Power Plant

Certification and Assessment:

- This course will be conducted based on Qualification Pack (QP)SGJ/0106 which is approved/certified by National Skill Development Corporation(NSDC). This course QP has been developed based on Industry Requirement in the field of Solar Rooftop Grid Tied system. After completion of this course assessment and certification will be done by Skill Council for Green Jobs.

Tentative Schedule

DAY 1			11/Feb/2019
Time	TOPICS	Learning outcome/in details	Speakers
10:00 -10:30	Welcome inauguration and	Introduction among the participants	Higher authorities
11:30-11:45 Tea Break			
11:45- 1:15	Overview of Renewable Energy Technologies and concept of Rooftop solar , GCRT (Grid connected rooftop solar) ARUN APP, SPIN	Overview of Renewable energy technologies, Brief on National Solar Mission, Conceptualization of Rooftop Solar program in India, Present status for Rooftop program in India Key challenges for Rooftop solar PV sector in India. Types of Rooftop Solar PV Power Plants and their operating principle.	TBD
1:15- 2:00	Lunch		
02:00- 3:30	Solar Resource Assessment	Solar irradiation availability & assessment, Solar irradiation components and its measurement equipment, Importance of solar radiation data in technology selection, Perform simple calculations to derive the power and energy received from solar radiation in a given area	TBD
03:30-3:45 Tea Break			
03:45- 5:30	PV Array Structural Design & Analysis	Introduction to Solid Works & PV Array Structural Design	TBD
DAY-2			12/Feb/2019
10:00- 11:30	Overview and selection criteria for Solar PV Modules, Types of Rooftop Solar PV Power Plants and their operating principle.	Physics of Solar cell, Overview of different technology and types of solar PV modules, Working Principle, Interpretation of Standard test conditions and module watt peak (Wp) notation, Typical Specifications, functioning and operating principle of solar PV modules and associated accessories, Interpretation of I-V curve and its role in module technology selection, Reading and interpretation of data specification sheet Selection criteria for solar PV modules, Introduction to different types of rooftop solar PV power plants including their functional configuration and working principle (Grid tied / Grid connected / Off Grid or Standalone Hybrid)	TBD
11:30-11:45 Tea break			
11:45-	Factors affecting the	Factors affecting the performance of solar	TBD

1:15	performance of solar PV modules and relevant IEC standards	PV modules, Introduction and understanding of relevant IEC standards for modules or relevant Indian standards.	
1:15-2:00	LUNCH		
2:00-3:30	Design Engineering Centre facility at CSIR-CEERI Jaipur Centre	Demonstration of Solar PV Array Structural Analysis	TBD
3:30-3:45	TEA break		
3:45-5:30	Practical/Hands-on learning: outdoor practical ~ I-V curve tracer, ~ Insulation measurement, ~Thermal imaging etc. ~Module Temperature measurement, ~ Earth resistance test, ~Shading analysis and effect, ~Tilt angle. ~EL Testing demonstration.	Observing the variation in energy generation by changing different parameters like tilt, radiation, shadow, tracking and diode I-V curve verification, Module Temperature measurement, Insulation measurement (Leakage current), IR camera-thermal imaging, EL testing, Earth Resistance Measurement.	TBD
DAY-3		13/Feb/2019	
10:00-11:30	Overview and selection criteria for Solar Inverters	Typical Specifications, functioning and operating principle of inverters and charge controllers, Different types of inverters and protection devices including their relevant regulations for connecting to the grid, (transformer less inverter) Reading and interpretation of data specification sheet, Factors affecting the performance of inverters and charge controllers, Electrical and fire safety for inverters and relevant IEC standard explanation, Introduction and understanding of relevant IEC standards for inverters or relevant Indian standards Selection criteria for inverters and charge controllers.	TBD
11:30-11:45	TEA BREAK		
11:45-1:15	Grid Connectivity challenges, Challenges and its mitigation measures	Understanding the Anti-islanding phenomenon and its importance while grid integration, Interpretation and understating of	MrFiroz Khan

	<p>while integrating solar PV power plant with the grid,</p> <p>Decoding the variation of parameters while integration of the solar PV with the grid</p> <p>Grid Code etc.</p>	<p>relevant IEC standard for anti-islanding, Understand the effect on power factor, harmonics, frequency voltage and other factors while grid integration and their control measures for optimum performance of Rooftop Solar PV power plant</p>	
1:15-2:00	LUNCH		
2:00-5:30	<p>Practical learning - Inverter (CEERI Jaipur Testing Lab)</p>	<p>Working of Different types of inverter and understanding their relevant IEC standard testing process for quality and performance,</p> <p>Demonstration of Anti islanding, change in harmonics, power factor, Phase imbalance etc.</p>	CEERI Jaipur Centre
Day 4		14/Feb/2019	
10:00-11:30	<p>Overview and selection criteria for Battery and balance of system including structure</p>	<p>Typical Specifications, functioning and operating principle for different types of battery, cables, junction Boxes and other accessories;</p> <p>Reading and interpretation of different components data specification sheets;</p> <p>Factors affecting the performance of batteries and other balance of system;</p> <p>Relevant IEC standards explanation, Introduction and understanding of relevant IEC standards or relevant Indian standards for batteries and balance of system</p> <p>Selection criteria for batteries and balance of system</p> <p>IEC 62446</p>	TBD
11:30-11:45	Tea break		
11:45-1:15	<p>Overview of Earthing and lightning protection Junction boxes, MCB, Surge protection and other isolation devices</p>	<p>Overview about Earthing and lightning protection,</p> <p>Different types of earthing and lightning protection</p> <p>Importance of earthing and lightning protection and its safety aspects related to Rooftop Solar PV power plant</p> <p>Verify and assess the safety of earthing and lightning protection of the rooftop solar PV power plant ,</p> <p>Different types protection devices including their relevant regulations for connecting to the grid.</p> <p>Disconnect and isolation devices, Understanding of relevant IEC standards or Indian standards for protection devices.</p>	TBD

		Working principle and operation of the disconnect protections/isolation devices.	
1:15-2:00	Lunch		
2:00-3:00	<p>Visit to 2KW SPV plant for</p> <p>1) components identifications</p> <p>2) Identify the protection devices at site</p> <p>3) Practical on earth-pit Testing using toolkit (earth resistance measurement)</p>	<p>Visit to 2KW SPV plant –</p> <p>Identification and listing of components, Protection devices</p> <p>Earth pit testing,</p>	TBD
3:00-3:15	Tea Break		
3:15-5:30	<p>PRACTICAL /Hands-On Learning for health & safety tool kit and site visit for understanding a solar PV power plant installation. O & Mof Rooftop SPV power plant</p>	<p>Demonstrate safe and proper use of required tools and equipment For Solar PV Installations, Demonstrate the working of safety kit used for Rooftop Solar PV Installations, Demonstrate the use and administration of first aid kit. Visit to a rooftop for understanding a solar PV power plant installation includes operation and maintenance.</p>	TBD
Day-5		15/Feb/2019	
10:00-12:00	<p>Metering arrangements and their relevant regulations ,</p> <p>Key Regulatory Challenges for Solar rooftop development,</p> <p>Key Implementation Requirements, Standards and Procedures for grid integrated solar rooftop development,</p> <p>Different Metering mechanisms and integration with the grid for rooftop SPV Plants,</p>	<p>Types of meters, bidirectional and unidirectional such as import and export, Types of metering arrangement including Net Metering and Gross Metering concepts and layout, Identify the key regulatory parameters for interconnection and metering arrangement including power quality of the grid at the project site, National technical regulations and technical standards such as CEA's 'Technical standards for connectivity of the Distributed Generation Resources' Regulations 2013, CEA's 'Installation and Operations of meters' Regulations 2007 and CEA's 'Measures of Safety and Electricity Supply Regulation,2010</p> <p>Verify the capacity of the rooftop solar PV power plant as per the relevant policy/ regulation,</p> <p>Verification of the operation of the installed Solar metering system including import and export of energy.</p>	TBD

	Case study	Case study of Solar PV plant and their functioning including performance, challenges and solutions for net metering and gross metering arrangements respectively	
11:30-11:45	Tea Break		
12:00-01:15	Case study	Continued	
01:15-2:00	Lunch		
2:00-5:30	Sizing of SPV power plant manually -Basic concept of off Grid SPV Plant and Grid Connected Rooftop SPV power plant Understanding of Single Line Diagram	Understand the principles of sizing for different types of Rooftop Solar PV power plants; Understanding the integration of existing home UPS system with Solar PV Read and Interpret Single Line Diagram for different types of Rooftop Solar PV Power plants, Ensuring that the single line diagram of a rooftop solar PV power plant is as per the regulatory specifications.	TBD
Day 6		18/Feb/2019	
10:00-05:30	Industry Visit		
Day 7		19/Feb/2019	
10:00-11:30	Sizing of SPV power plant manually , And with the help of PV Syst and PV sol	Understand the principles of sizing for different types of Rooftop Solar PV power plants; Understanding the integration of existing home UPS system with Solar PV	TBD
11:30-11:45	Tea Break		
11:45-01:15	Site survey for Solar rooftop power plant -Location analysis -Load analysis Along with toolkit	Assess the load to be run on Solar Power Plant, Prepare a load profile, Understand the location of installations and optimize the route plan, Assess the site level pre-requisites for solar panel installation, Document the site survey variables ad prepare a layout diagram Along with challenges. Structure.	TBD
1:15-2:00	Lunch		
02:00-03:30	Overview of Pre-commissioning inspection parameters Checklist.	Identify and verify the documents required for connecting the rooftop solar PV power plant to the grid, Identify the key regulatory parameters for	TBD

	Interconnection requirement and documents required as per regulations, (CEA and CERC regulations)	interconnection and metering arrangement including power quality of the grid at the project site, Understanding the importance and completion of the checklist for the following- Test, record and verify the power quality of rooftop PV power plant at time of interconnection including harmonics, current, voltage etc. Test and verify the power factor Verify that the inverters, panels, protection devices, etc. Are conforming to IEC standards or relevant Indian standards	
03:30-03:45	Tea Break		
03:45-05:30	Practical Hands on learning	Site visit to verify the Pre commissioning parameters w.r.t checklist (Solar Power Plant visit)	TBD
DAY-8		20/Feb/2019	
10:00-5:30	Practical / hands-on Installation of grid connected SPV power plant	Practical and hands-on learning on installation, inspection and testing of solar PV power plant connecting to grid and test string voltage, and other relevant parameters for commissioning of plant (Industry Visit)	
DAY-9		21/Feb/2019	
10:00-11:30	Govt scheme, subsidy, National and State level policies for Grid integrated solar PV Plant	Govt scheme, subsidy, National and State level policies for Grid integrated solar PV Plant,	TBD
11:30-11:45	Tea Break		
11:45-01:00	Best practice for Rooftop Solar PV Installations , Business models for Rooftop Solar PV deployment	Best practice for Rooftop Solar PV Installations , Business models for Rooftop Solar PV deployment	TBD
01:00-02:00	Lunch		
2:00-3:30	Financial Calculation	Cost Analysis of Rooftop Plant	TBD
3:30-3:45	Tea Break		
3:45-5:30	Post commissioning checklist, Practical / Hands-On learning for Challenges and its mitigation measures while integrating solar PV power plant with the grid	Discussion on Post commissioning checklist, Verify the operation of the disconnect protections/isolation devices. Test, record and verify the power quality of rooftop PV power plant at time of interconnection including harmonics, current, voltage etc. Test and verify the power factor Test and verify the Rooftop Solar PV power plant for any phase imbalance	TBD

	Post commissioning checklist with Power Analyzer		
DAY 10		22/Feb/2018	
10:00-1:00	Assessment by NISE	Assessment	NISE
1:00-2:00	Lunch		
2:00-4:00 p.m.	Assessment by NISE	Assessment	NISE

	DAY 11	23/Feb/2019	
9:30-11:00	Closing Ceremony		

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