

Participant Handbook

Sector
Green Jobs

Sub-Sector
Renewable Energy

Occupation
Installation and Commission

Reference ID: **SGJ/Q0102, Version 1.0**
NSQF Level 4



**Solar PV Installer
(Electrical)**

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Shri Narendra Modi
Prime Minister of India

“ Skilling is building a better India.
If we have to move India towards
development then Skill Development
should be our mission. ”



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SKILL COUNCIL FOR GREEN JOBS

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of
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PowerXP Consultants Pvt Ltd

About this book

Government of India is aiming towards a capacity of about 100,000 MW to come from Solar Energy by the year 2022. This includes a capacity of 40,000 MW to come up on the rooftops of various buildings and houses spread throughout the country. The Ministry of New and Renewable Energy and State Governments are looking for a pool of trained manpower to effectively undertake this work. Alongside, industry operating in the Solar Photovoltaic domain is offering a huge opportunity for the skilled manpower to undertake civil works and electrical works for installing solar rooftop systems.

Considering the huge technically trained manpower requirement to meet this ambitious goal, Skill Council for Green Jobs is targeting a special skilling course for electrical works of Rooftop Solar PV Installations, named Solar PV Installer – Electrical, who specializes in electrical installations and commissioning of Solar Photovoltaic Systems.

This Participant book is designed to enable theoretical and practical training on Rooftop Solar PV Installation as per Solar PV Installer (Electrical) Qualification Pack, SGJ/Q0102 and is available for free download at www.greenskillcouncil.in/NOS

The book is designed considering the minimum education qualification to be ITI/Diploma. However, as part this book, efforts have been made to revise the knowledge of electrical and civil concepts required for this job. The contents of this book are in simple language, without going into too much theoretical details and calculations. It is envisaged that this training manual will provide the participants with the knowledge and skills required for Installing a rooftop Solar Photovoltaic system, complying with all applicable codes, standards, and safety requirements; and enable them to actively participate in the growing solar rooftop market. The Skill Council for Green Jobs is thankful to the valuable contributions made by:

- National Institute of Solar Energy
- USAID PACE-D program
- Clean Access Energy Network
- ADS Global Knowledge Academy
- Smart Brains

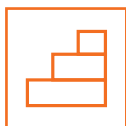
On behalf of Skill Council for Green Jobs, the book has been coordinated, compiled and co-authored by Mr. Tanmay Bishnoi, Head – Standards & Research and Ms Geetika Chauhan, Technical Associate.

Units and symbols used in the book have been listed below.

Symbols Used



Key Learning Outcomes



Steps



Notes



Unit Objectives



Exercise



Tips

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1. Introduction to Solar PV Installer - Electrical

Unit 1.1 – Training Code of Conduct, Job Role and
Career Opportunities



Key Learning Outcomes

At the end of this module, you will be able to:

1. Demonstrate general discipline in the class room and during the training program
2. Explain the role of Solar PV Installer and job opportunities
3. Explain the advantages of doing this course
4. Acquire basic skills of communication

UNIT 1.1: Introduction to the Program

Unit Objectives

At the end of this unit, you will be able to:

1. Demonstrate general discipline in the class room and during the training program
2. Explain the role of Solar PV Installer and job opportunities
3. Explain the advantages of doing this course
4. Acquire basic skills of communication

1.1.1 The Solar PV Installer Classroom – Discipline and Code of Conduct

This course has been designed to introduce you to the concepts of solar photovoltaic power plants from an installation technician's perspective. The delivery of this training is divided into both practical and theoretical components. In order to derive the maximum benefit of undergoing this training program, you are encouraged to adopt a code of conduct during lectures, workshops and industry visits. Imbibing values of discipline, integrity and core professional skills will help you obtain a satisfactory outcome at the end of the program. Moreover it will help you integrate better with your future employers and co-workers.

In the Classroom:

- Be punctual and regular in attending lectures. It will help maintain your pace with the entire class.
- Minimize distractions by keeping mobile phones and music devices turned off during training delivery. Participating in the classroom can be very interesting, and it reflects your commitment to the program.
- Interact with your trainer to find out more about the course and clarify concepts
- Engage in discussions with your batch mates to become a team player and actively participate in group activities to clear concepts and fill knowledge gaps
- Take this opportunity to freely ask your trainer any kind of questions related to the course. Clear understanding of practical and theoretical concepts is very critical to carry out the installation of solar PV plants.
- You must complete assignments and submissions on time with honesty and integrity. This will help you truly assess yourself and develop confidence to independently handle projects.

During practical training:

- Keeping in mind your personal safety, always wear Personal Protective Equipment (PPE) while handling electrical and mechanical tools, devices and equipment. This will protect you from electric shocks, physical damage to yourself and your team members. PPE and safety guidelines are extensively covered in later chapters of the book.

1.1.2 Personal Attributes

This job requires the individual to concentrate on the job at hand and complete it without any accidents so diligence and hardworking are desired attributes for individuals performing this role. He must also demonstrate strong work ethics, an ability to communicate courteously with co-workers, and must be good with following instructions of the supervisor.

1.1.3 Role of Solar PV Installer

Brief Job Description

Solar PV Installer - Electrical installs, tests, and commissions' different electrical components of photovoltaic systems, that meet the performance and reliability needs of customers by incorporating quality craftsmanship and complying with all applicable codes, standards, and safety requirements.

The Solar PV Installer - Electrical has the following tasks to be carried out for a successful installation of the electrical components of a Solar PV Power Plant. The first two modules on 'Basics of Solar Energy and Electrical Energy' and 'Basics of Solar Photovoltaic systems) will cover fundamental concepts.

The module on '**Site Survey for Installation of Solar PV System**' is about Solar Photovoltaic Technology and Plant Components. The aim is to understand the customer's requirement for solar PV system. This task covers the following:

- Assess the site condition
- Understand the work requirement
- Engage with customers to understand their requirement
- Visit and evaluate the site for installation
- Identify load to be connected to Solar PV System
- Assess the photovoltaic system required
- Assess the cost of system installation
- Ensure quality, standards and regulatory requirement are adhered

The module on '**Install electrical components of Solar PV system**' is about installation of electrical components of the Photovoltaic system. This task covers the following:

- Prepare for Solar Installation.
- Install Electrical Components.
- Install Conduits and cables.
- Get the Grounding Systems installed
- Install Battery bank (as required)

The module on '**Test and Commission Solar PV System**' is about Testing and Commissioning of electrical components of Photovoltaic System. This task covers the following:

- Test the System.
- Commission the System.

The module on '**Maintain Personal Health & Safety at project site**' is about maintaining Work Safety for the technicians, customers, and site safety at the location of Solar Photovoltaic Power Plants. This task covers the following:

- Establish and follow safe work procedure
- Use and maintain personal protective equipment.
- Identify and mitigate safety hazards.
- Demonstrate safe and proper use of required tools and equipment.
- Identify work safety procedures and instructions for working at height.

1.1.4 Market Demand

The demand of skilled manpower in the Solar Photovoltaics Industry in India and worldwide is a subject under study which has been undertaken by various organizations. As of the time that this Participant Handbook was prepared, several reports have emerged that establish the imperative as well futuristic demand of Solar Photovoltaic Installers in the solar energy market.

As per the 'Human Resource Development Strategies for Indian Renewable Energy Sector', by Ministry of New and Renewable Energy and Confederation of Indian Industry, October 2010, 23 lakh persons were employed in the renewable energy sector globally in 2008. There is a huge job opportunity for solar installers since not many skilled installers are available in the market.

As per this report, the future projections for employment in Solar PV Off-Grid Sub-sector are as follows:

Table 1.1: Future projections for employment in Solar PV Off-Grid Sub-sector

Year	Estimated Employment		
	Direct	Indirect	Total
2010	24,000	48,000	72,000
2017	47,000	93,000	1,40,000
2022	75,000	1,50,000	2,25,000

As per the report on 'Filling The Skill Gap in India's Clean Energy Market: Solar Energy Focus', by Natural Resources Defense Council (NRDC) and the Council on Energy, Environment and Water (CEEW), February, 2016, India would need a large number of skilled manpower to meet the 100 GW target of Solar Installations by 2022. The availability of appropriately skilled manpower has been identified as one of the most prominent challenges in hiring required personnel.

Table 1.2: Scale of skilled workers needed to achieve Solar targets

Function	Key Skills	Trained Manpower to achieve 40 GW of Rooftop Solar by 2022	Trained Manpower to achieve 60 GW of Utility Scale Solar by 2022
Business development	Tracking the market, Drafting Bids, land selection, project finance	15,200	2,400
Design and Pre-Construction	Plant Design engineering	18,400	10,200
Construction and Commissioning	Site engineering	1,54,000	28,200
	Electricals training and PV installation	3,38,400	2,86,200
Operations and maintenance	Performance data monitoring and troubleshooting	1,40,400	1,23,000

1.1.5 Career Progression

Apart from existing reports and analysis carried out, Skill Council for Green Jobs, through collaboration industry interactions, has conducted an Occupational Mapping and Skill Gap Analysis to identify the employment patterns in the Solar Industry. As part of this exercise, an Occupational Map has been prepared to show the career progression for the installers.

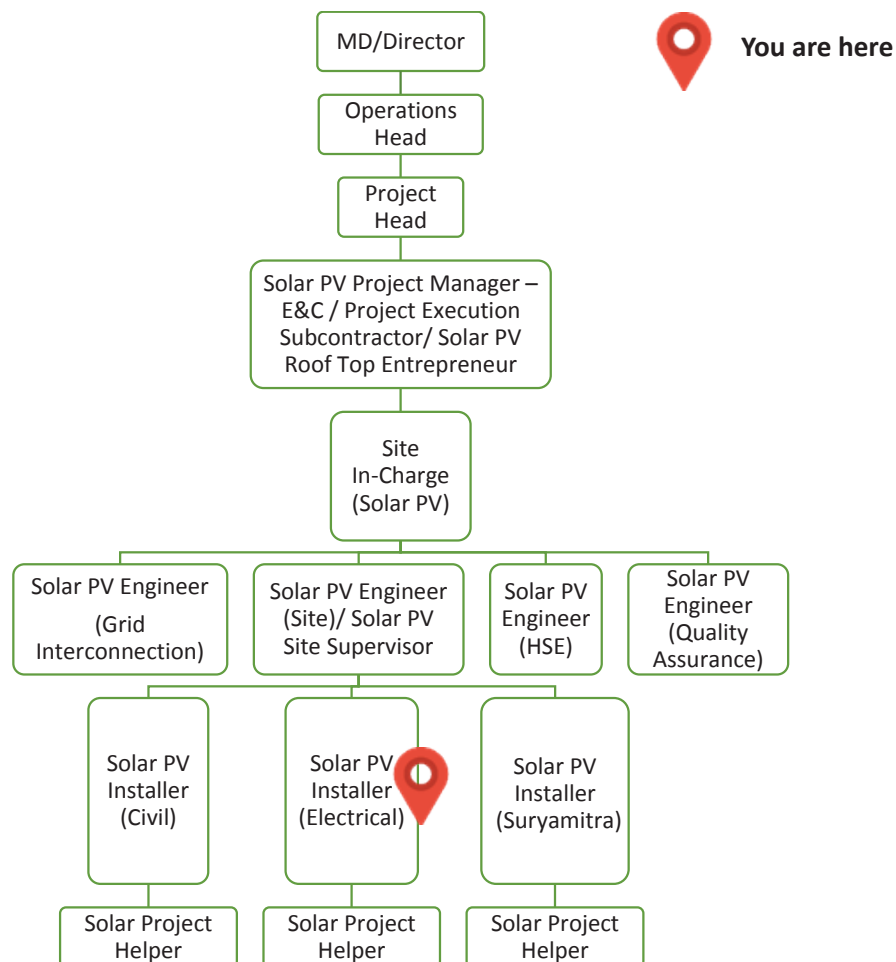


Fig 1.1.1 Career progression of a Solar PV Installer (Electrical)

Exercise

1. Briefly introduce yourself to your classmates telling them your name, age, address, educational background and any previous experience. Write down the purpose and expectations that you may have from this course and read it out to the class. You may like to frame this introduction in complete sentences.



2. Basics of Solar Energy and Electrical Energy



Unit 2.1 – An Introduction: Energy from the Sun

Unit 2.2 – Ohm's Law: Electric Current, Voltage and Resistance

Unit 2.3 – Connection in Series and Parallel

Unit 2.4 – Measuring Instruments

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