



**Workshop
on
Sand to PV Systems: Materials Devices,
Measurements and Testing
during
14/01/2019 - 08/02/2019**

**sponsored by
Ministry of New and Renewable Energy
Govt. of India**



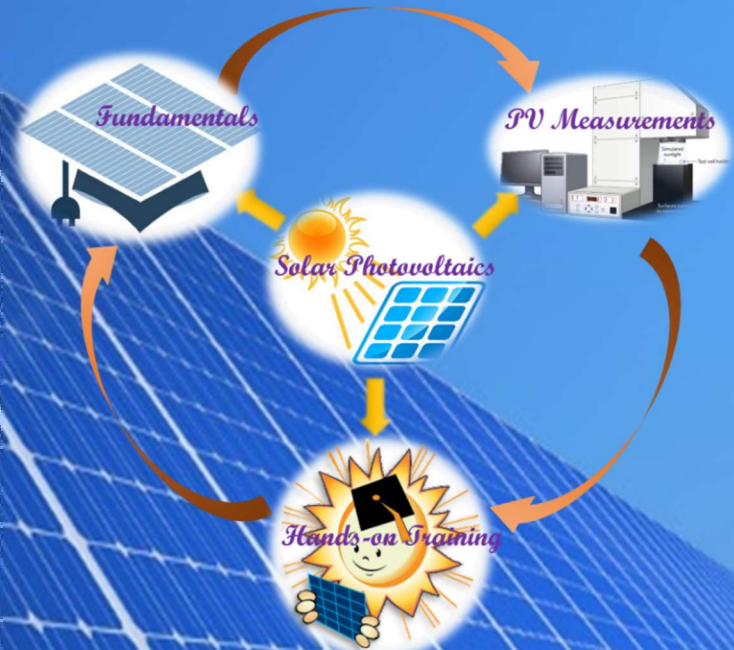
Course Modules:

- Basics of ingot to solar module design and integration
- Measurement and traceability of solar cell parameters
- Hands-on training on cell fabrication and measurements and field deployment issues
- Basics of PV power generation, storage and maintenance of PV systems along with other BoS components

Targeted beneficiaries:

- Undergraduate and post-graduate students in Renewable Energy programmes
- Personnel aspiring exciting career in solar PV industries,
- Personnel working with solar PV systems, particularly technician, trainers and engineers

The training provides an excellent opportunity to learn several aspects of Solar PV technology and get hands-on experience in designing and developing the solar PV systems.



CSIR - NATIONAL PHYSICAL LABORATORY

Dr. K. S. Krishnan Marg

New Delhi - 110 012

www.nplindia.org

PV metrology at CSIR-National Physical Laboratory

The National Physical Laboratory is the National Metrology Institute of India and a Premier Research Laboratory in the field of Physical Sciences. Over the years, the Laboratory has more than realized its primary mandate as the custodian of Measurement Standards for the nation while substantially expanding its research activities to emerge as a leading national institution for research in a whole gamut of Physical Sciences.

CSIR-NPL has been involved in solar energy related research activities for more than four decades and has produced more than 100 PhDs who are occupying senior positions in R&D and teaching institutions, scientific management and in PV industry both in India and abroad. The group has established state-of-art facilities for fabrication and characterisation of PV Cells. Each year, a large number of students from IITs, NITS and other institutes join NPL for their thesis/dissertation and summer training.

Accurate measurement of key PV parameters is of fundamental importance for PV devices manufacturers and customers. These measurements should be traceable to national standards in order to have accurate power rating of photovoltaic (PV) cells and modules. In order to achieve the national solar power target of 100 GW by 2022, the deployment of solar modules is increasing at a rapid pace. Due to the high volume of solar PV installations of 20 GW per year, an uncertainty of 1% in power measurement can lead to an uncertainty of 200 MW per year in the product value.

Objective

To empower the young generation workforce in the field of PV technology to meet the requirement of industry by disseminating the information about PV systems, measurements & related metrology. This leads to the considerable improvement of efficiency, PV module reliability, which reduces the cost of solar electricity, promotes investor confidence in the technology. Further, hands-on training on different aspects of PV systems may serve the growth of the PV industry effectively and hence the nation.

Key Benefits

- In-depth knowledge of basics, fabrication of solar cells, various components of a photovoltaic power plant such as photovoltaic modules, inverters, charge controllers, batteries, switchyard, structures, integration, testing and evaluation and so on.
- Photovoltaic system types, design principles & examples, quality management system, etc
- Hands-On: Fabrication of cells and modules, PV measurements & metrology, Standards of PV cells, traceability and uncertainty, troubleshooting, safety, etc.

Certificate

Certificate will be issued to the participants by CSIR-NPL on the successful completion of the training program. It is mandatory to attend the entire period of the workshop.

Course contents

The workshop consist of 3 parallel modules ranging from solar PV fundamentals of sand to module fabrication, measurements and hands-on training related to fabrication, measurements and standardization. The conference will be augmented by industry/lab visits.

1

Fundamentals of Solar Cells

Basic Principles of Solar Radiation
Silicon Growth methods, Wafer slicing and quality estimation
Solar Cell Design and output parameters
Evolution of Si Cell Technology

2

PV Measurements & Metrology

Components of solar cell measurements and socio-economic impact
Measurements on PV modules and Module testing & Reliability
Components of PV systems (Balance of Systems - BoS)
Traceability for cells/modules and Quality Management system
IEC standards for PV modules & Product certification

3

Hands-on training

Solar energy measurements
Silicon growth and wafering, and quality assessment of wafers
Cell fabrication methods, and process diagnostics
PV measurements and its intricacies
Evaluation of PV modules, BoS components
PV system design, integration, installation, troubleshooting and safety

Important dates

Particulars	Date
Last date for submission of application	28/12/2018
Intimation of confirmation of participation	04/01/2019

Fees: There is no fee for the participation as the workshop is sponsored by MNRE, Govt. of India. The participants will be provided free lodging and boarding during the workshop. However, no to-and-fro travel assistance will be provided.

Note:

- The number of seats are limited and are to be distributed among different categories as per the targeted aim of the programme.
- Submission of application does not guarantee the confirmation of participation. Selection will be made by expert committee and its decision will be final.
- Accommodation will not be provided for local participants.