

DAY 1

Photovoltaic Systems

1. Solar Radiation

- Solar radiation and components
- Location survey parameters and site assessment

2. Photovoltaic Arrays

- I-V and P-V characteristics and maximal power point
- Influence of solar radiation and cell temperature to PV characteristics
- PV modules and arrays.
- Types of solar cells and manufacturing of cells and modules

3. Photovoltaic Inverters

- Inverters for grid-connected systems
- System topology (central, string, multistring, micro)

4. Photovoltaic System Design

- Photovoltaic mounting structures
- Balance of system components
- Planning and design parameters of grid connected PV systems

DAY 2

Solar Thermal Systems

1. Introduction – Solar Energy and Principles of Harvest

- General characteristics
- Solar radiation at Earth
- Harvesting techniques

2. Application of Solar Thermal Systems

3. Types of Solar Thermal Collectors

- Flat plate
- Evacuated tube collectors
- Comparison of flat plate and evacuated tube solar collector
- Concentrating solar collectors
- Façade solar collectors
- Air solar collectors

4. Solar Thermal Systems

- Types
- Active solar thermal systems
- Combined solar systems
- Solar cooling

5. Components and Specifics

- Connection
- Stagnation
- Accumulation
- Heat exchangers
- Hydraulic characteristics

DAY 3

Photovoltaic Thermal Collectors - PVT

1. Introduction of PVT

- PV-only and solar thermal-only installations
- Temperature characteristics issues of PVs
- Efficiency issues of solar thermal collectors
- PVT systems as a general solution

2. Characteristics of PVT Collectors

- PVT collectors provide both power and thermal energy.
- Application of PVT hybrid collector

3. Testing of PVTs

- Relevant monitoring parameters
- Test results from World verified institutions

4. Dimensioning PVT systems

- PVT only systems
- Combined PVT with Heat Pumps
- Combined PVT with adsorption chillers
- Other practical examples

5. Overview of PVT systems and references

Solar Systems Sustainability and Innovations

1. Sustainability Trends

- Climate target goals (2030/2050) and RES (solar) applications
- Solar energy utilization in the context of the global initiative for carbon neutral world (2050) -Planetary health, climate changes, clean energy (human health issues and biodiversity)
- Environmental – social – economic aspects of clean energy (solar) utilization

2. Innovation Trends in Solar Energy Sector

- Novel types of materials in solar energy devices,
- Progress towards a more sustainable future – recyclability, circular economy,

circularity by design, LCA (Life Cycle Analysis)

- Climate-smart actions and products
- Innovative solutions in solar devices
- Anti-soiling (low soiling) applications
- Thermo-conductive connectors/adhesives

3. Solar energy in NZEB (Nearly Zero Energy Buildings)

- Novel trends in NZEB and construction sector with RES utilization
- Active facades with installed PV modules and PVT collectors

Case studies: EU R&D projects for solar energy utilization in NZEB