COURSE OVERVIEW NE0003
Solar Energy System Fundamentals: Renewable Energy Essentials

Course Title
Solar Energy System Fundamentals: Renewable Energy Essentials

Course Date/Venue
Please see page 3

Course Reference
NE0003

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Solar for Electrical Engineering. It covers the significance of solar energy including the historical development; the basic principles of photovoltaics, solar radiation and its measurement, solar energy resources and availability; the solar cells and their types, semiconductor physics, P-N junction and its behavior, photovoltaic effect and working principles and efficiency and performance metrics of solar cells; the solar panel technologies, monocrystalline, polycrystalline, thin-film solar panels, manufacturing processes and materials; the pros and cons of different panel types; and the comparison of efficiency, cost and application areas.

Further, the course will also discuss the components, solar modules, inverters, charge controllers and batteries; the sizing and design considerations, load estimation and energy storage requirements of a solar power system; the best practices and safety guidelines, mounting options for solar panels and writing and interconnection methods; the grounding and lightning protection, system maintenance and troubleshooting and grid connection process and requirements; the net metering policies and regulations, grid integration challenges and solutions and power quality issues and mitigation techniques; the monitoring systems for solar energy systems; and the data acquisition and analysis, performance monitoring and fault detection.

During this interactive course, participants will learn the remote monitoring and control and optimization techniques for maximizing system efficiency; the financial analysis, cost estimation, ROI calculation, government incentives and subsidies, project financing options, business models and market trends; the concentrated solar power (CSP) systems, solar thermal technologies and emerging trends in solar research and development; the next generation solar cells, materials and integration of solar other renewable energy sources; the policy frameworks and regulations for solar energy and environmental impacts of solar energy; and the life cycle assessment (LCA) of solar systems and sustainability considerations, eco-design, future prospects and challenges in the solar energy sector.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on solar for electrical engineering
- Discuss the significance of solar energy including the historical development
- Identify the basic principles of photovoltaics, solar radiation and its measurement, solar energy resources and availability
- Recognize solar cells and their types, semiconductor physics, P-N junction and its behavior, photovoltaic effect and working principles and efficiency and performance metrics of solar cells
- Discuss solar panel technologies as well as monocrystalline, polycrystalline, and thin-film solar panels, manufacturing processes and materials
- Explain the pros and cons of different panel types and the comparison of efficiency, cost and application areas
- Recognize the components, solar modules, inverters, charge controllers and batteries, sizing and design considerations, load estimation and energy storage requirements of a solar power system
- Install best practices and safety guidelines, mount options for solar panels and apply writing and interconnection methods
- Carryout grounding and lightning protection, system maintenance and troubleshooting and grid connection process and requirements
- Discuss net metering policies and regulations, grid integration challenges and solutions and power quality issues and mitigation techniques
- Monitor systems for solar energy systems and apply data acquisition and analysis, performance monitoring and fault detection
- Employ remote monitoring and control and optimization techniques for maximizing system efficiency
- Implement financial analysis, cost estimation, ROI calculation, government incentives and subsidies, project financing options, business models and market trends
- Recognize concentrated solar power (CSP) systems, solar thermal technologies and emerging trends in solar research and development

- Discuss next generation solar cells and materials and integration of solar other renewable energy sources
- Explain policy frameworks and regulations for solar energy including environmental impacts
- Illustrate life cycle assessment (LCA) of solar systems as well as discuss sustainability considerations, eco-design, future prospects and challenges in the solar energy sector

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides a basic overview of all significant aspects and considerations of solar for electrical engineering for electrical engineers, energy engineers, renewable energy professionals, system integrators, electric utility professionals, researchers and academics and students.

Course Date/Venue

Session(s)	Date	Venue
1	August 03-07, 2025	Al Buraimi Meeting Room, Sheraton Oman Hotel, Muscat, Oman
2	November 09-13, 2025	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
3	January 25-29, 2026	Al Buraimi Meeting Room, Sheraton Oman Hotel, Muscat, Oman
4	April 05-09, 2026	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Haward's Certificates are accredited by the following international accreditation organizations:

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Mostafa Amin is a **Senior Electrical Engineer** with over **25 years** of extensive Onshore & Offshore experience within the **Oil & Gas**, **Petrochemical and Power** industries. He is an expert in **Renewable Energy**, **Solar Energy**, **Energy Storage Methods**, **Overhead Power Line Maintenance Patrolling & Washing**, **Energy Transmission & Distribution**, **Transmission Line** Structures, Insulators & Accessories, **Transmission Line Construction & Maintenance**, **Insulated Power Cables**, High Voltage Applications, **Transmission Line Parameters**, Sag & Tension of Conductor, Geomagnetic Disturbances, Reactive Power Compensation, **Overhead Line Troubleshooting**, **Electrical Equipments & Control Systems**, **Electric Distribution System Equipment**, **Electrical Power Generation**, **Electric Substation & Distribution, Protection Relays** Maintenance & Application, **Power Transformers** Operation & Maintenance, **Power Transformers** Protection, **Power System** Protection & Coordination, **Power Management** Systems, Protection System Tuning & Configurations, **Distribution System** Operation & Maintenance, **Earthing System**, **HV/LV Motors** Maintenance & Protection, **Circuit Breakers**, Lighting Systems, Underground Cables and Uninterruptible Power Supplies (**UPS**). Further, he is also well-versed in Maintenance & Troubleshooting of UPS Systems & Battery Power Supplies, DC Power Plant, Electric Power System Troubleshooting, Electric Motor Testing, Practical Troubleshooting of Electrical Equipments & Control Circuits, Motors & Variable Speed Drives, Diesel Generators, Analogy/Digital Field Instruments, Direct Current Panels, Gas Turbines, Fire & Gas Detection, Hazardous Area Classification & Intrinsic Safety, Permit to Work & Risk Assessment, Sequence Programming and Programmable Logic Controllers (**PLC)**. He is currently the **General Manager** of **Petrobel** wherein he manages the overall company operation and developing strategic plans.

During his career life, Mr. Mostafa has gained his expertise and thorough practical experience through handling challenging positions such as being the **Assistant General Manager**, **Department Manager**, **Section Head**, **Instructor/Trainer** and **Electrical Engineer**.

Mr. Mostafa has a **Bachelor** degree in **Electrical Power & Machines Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and has delivered numerous trainings, courses, workshops, conferences and seminars internationally.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Solar Energy*** *Solar Energy & Its Significance ● Historical Development of Solar Energy ● Basic Principles of Photovoltaics ● Solar Radiation & Its Measurement ● Solar Energy Resources & Availability*
0930 – 0945	*Break*
0945 – 1100	***Solar Cell Fundamentals*** *Solar Cells & Their Types ● Semiconductor Physics for Solar Cells*
1100 – 1230	***Solar Cell Fundamentals (cont'd)*** *P-N Junction & its Behavior ● Photovoltaic Effect & Working Principles*
1230 - 1245	*Break*
1245 – 1420	***Solar Cell Fundamentals (cont'd)*** *Efficiency & Performance Metrics of Solar Cells*
1420 -1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0930	***Solar Panel Technologies*** *Monocrystalline, Polycrystalline, & Thin-Film Solar Panels ● Manufacturing Processes & Materials*
0930 – 0945	*Break*
0945 – 1100	***Solar Panel Technologies (cont'd)*** *Pros & Cons of Different Panel Types ● Comparison of Efficiency, Cost, & Application Areas*
1100 – 1230	***Solar Power Systems Design*** *Components of a Solar Power System ● Solar Modules, Inverters, Charge Controllers, & Batteries ● Off-Grid vs. Grid-Tied Systems*
1230 – 1245	*Break*
1245 – 1420	***Solar Power Systems Design (cont'd)*** *Sizing & Design Considerations ● Load Estimation & Energy Storage Requirements*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0930	***System Installation & Wiring*** *Installation Best Practices & Safety Guidelines ● Mounting Options for Solar Panels ● Wiring & Interconnection Methods*
0930 – 0945	*Break*
0945 – 1100	***System Installation & Wiring (cont'd)*** *Grounding & Lightning Protection ● System Maintenance & Troubleshooting*
1100 – 1230	***Grid Connection & Net Metering*** *Grid Connection Process & Requirements ● Net Metering Policies & Regulations ● Grid Integration Challenges & Solutions*

1230 – 1245	*Break*
1245 – 1420	***Grid Connection & Net Metering (cont'd)*** *Power Quality Issues & Mitigation Techniques ● Case Studies of Successful Grid-Connected Solar Projects*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

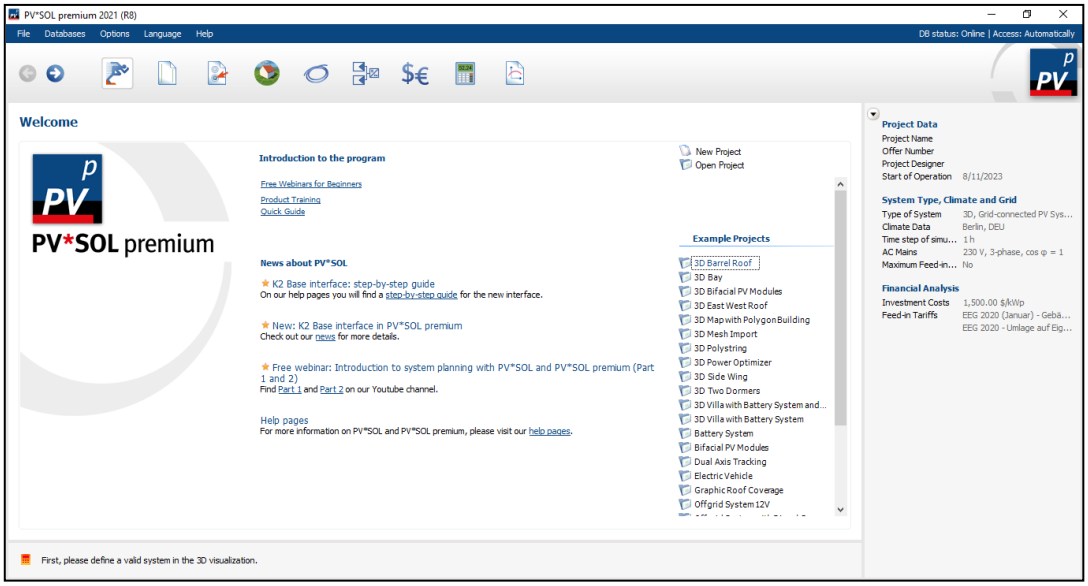
0730 – 0930	***Solar Energy Monitoring & Control*** *Monitoring Systems for Solar Energy Systems ● Data Acquisition & Analysis ● Performance Monitoring & Fault Detection*
0930 – 0945	*Break*
0945 – 1100	***Solar Energy Monitoring & Control (cont'd)*** *Remote Monitoring & Control ● Optimization Techniques for Maximizing System Efficiency*
1100 – 1230	***Solar Project Economics*** *Financial Analysis of Solar Projects ● Cost Estimation & ROI Calculation Government Incentives & Subsidies*
1230 – 1245	*Break*
1245 – 1420	***Solar Project Economics (cont'd)*** *Project Financing Options ● Business Models & Market Trends*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

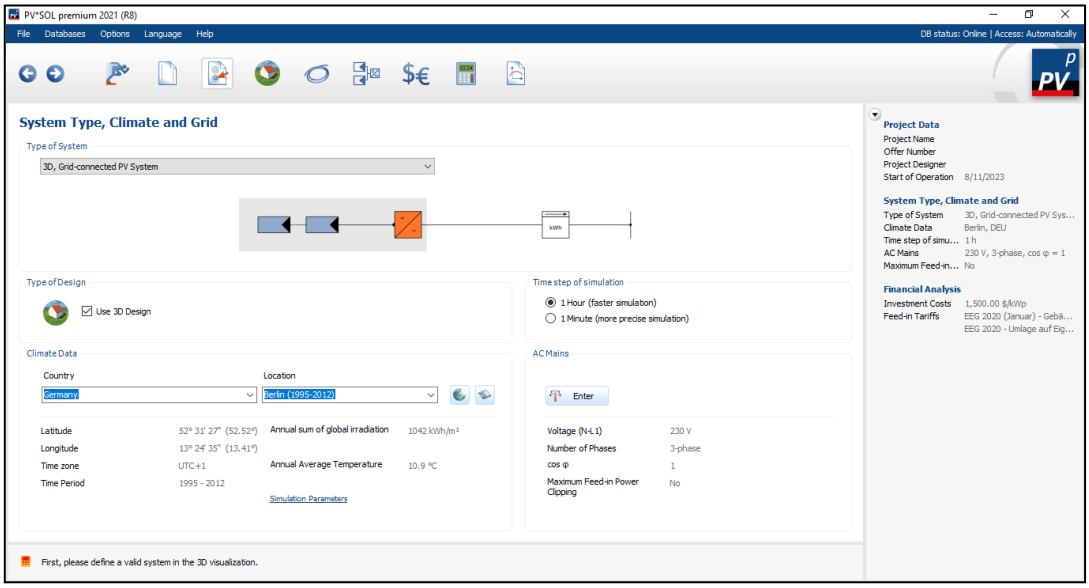
Day 5

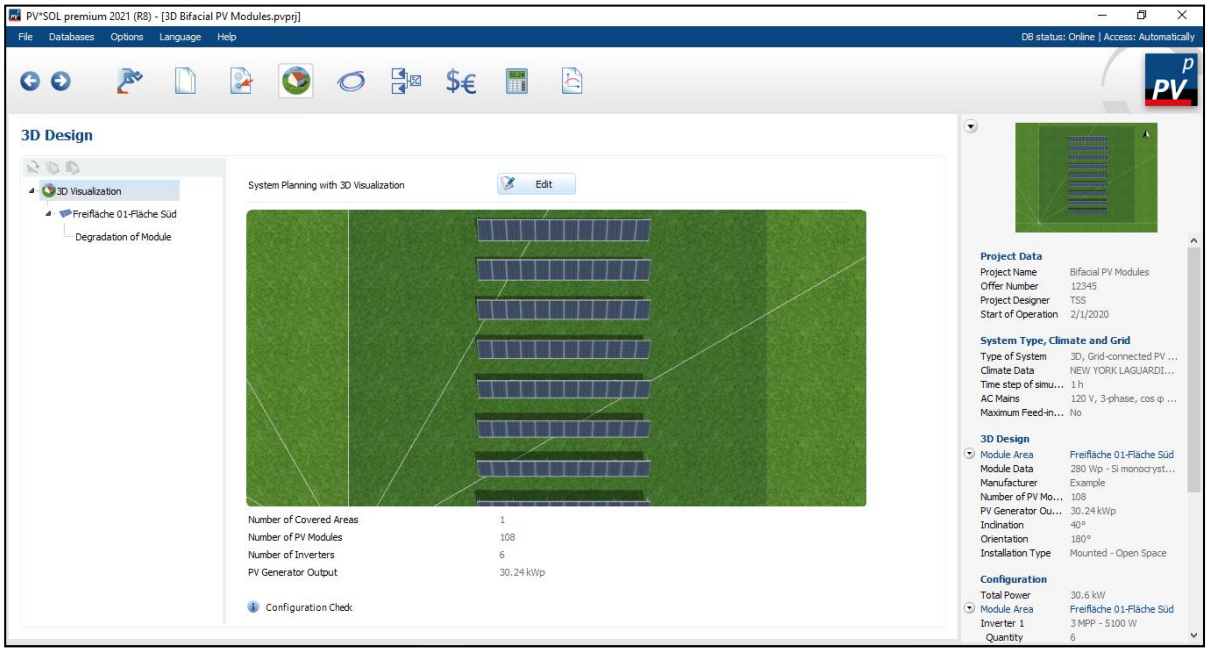
0730 – 0930	***Advanced Solar Technologies*** *Concentrated Solar Power (CSP) Systems ● Solar Thermal Technologies ● Emerging Trends in Solar Research & Development*
0930 – 0945	*Break*
0945 – 1100	***Advanced Solar Technologies (cont'd)*** *Next-Generation Solar Cells & Materials ● Integration of Solar with Other Renewable Energy Sources*
1100 – 1230	***Solar Energy Policy & Environmental Impacts*** *Policy Frameworks & Regulations for Solar Energy ● Environmental Impacts of Solar Energy ● Life Cycle Assessment (LCA) of Solar Systems*
1230 – 1245	*Break*
1245 - 1345	***Solar Energy Policy & Environmental Impacts (cont'd)*** *Sustainability Considerations & Eco-Design ● Future Prospects & Challenges in the Solar Energy Sector*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

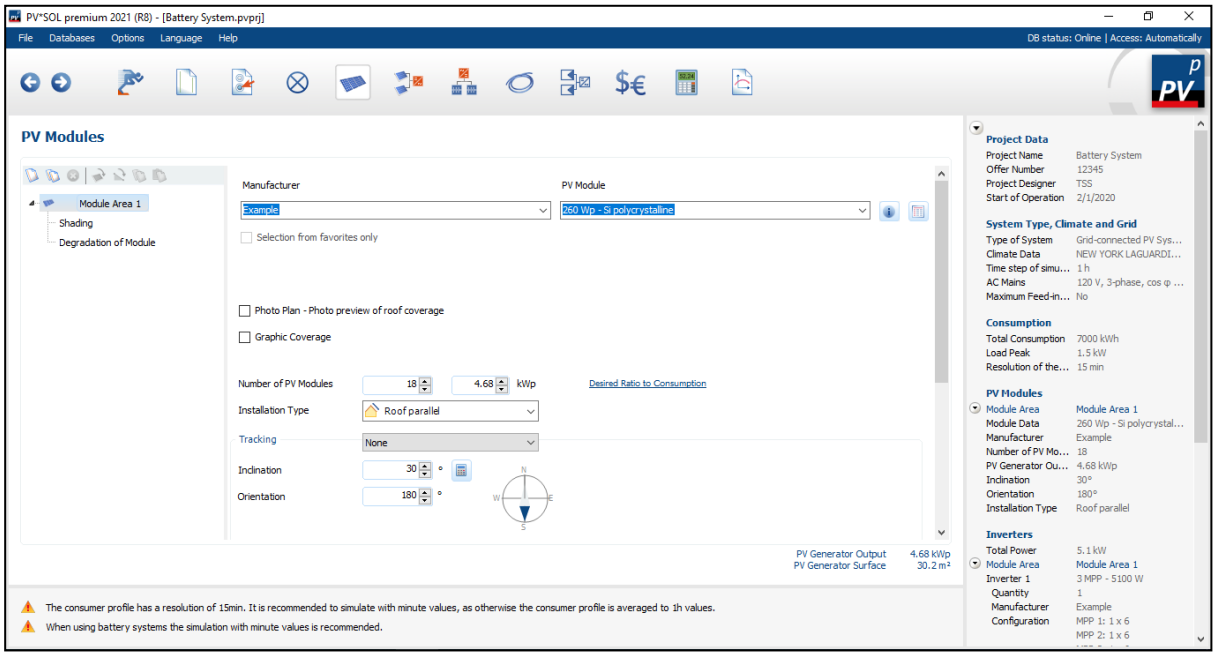
Simulators (Hands-on Practical Sessions)

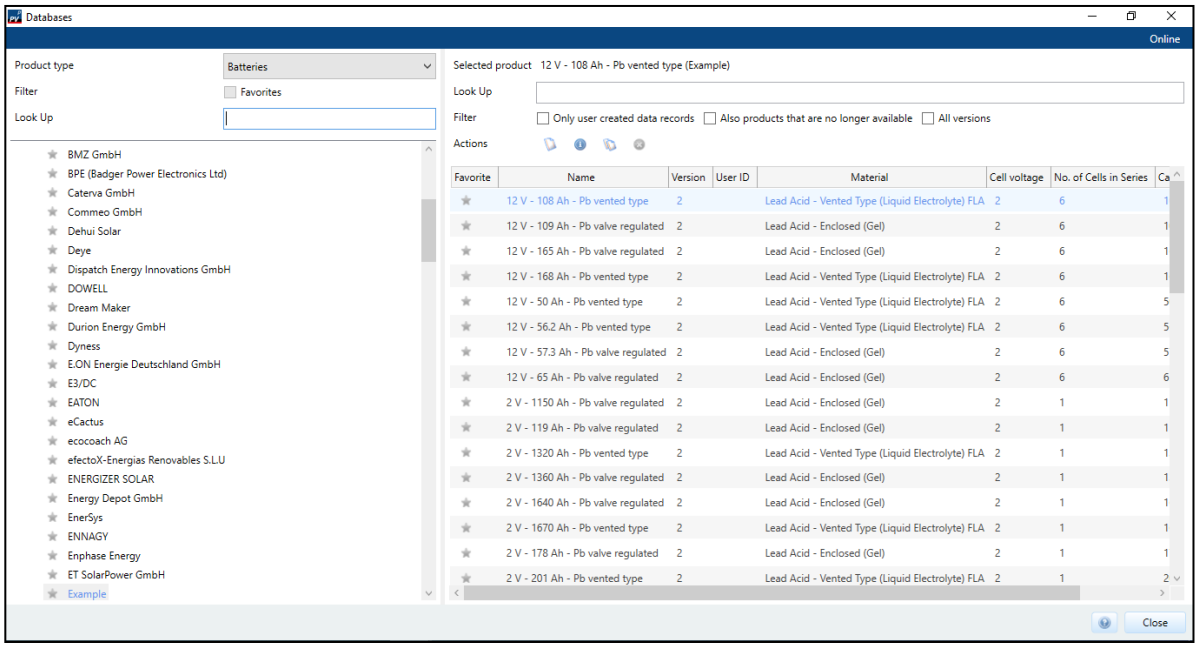
Practical session will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the simulator “PV*SOL Premium”.

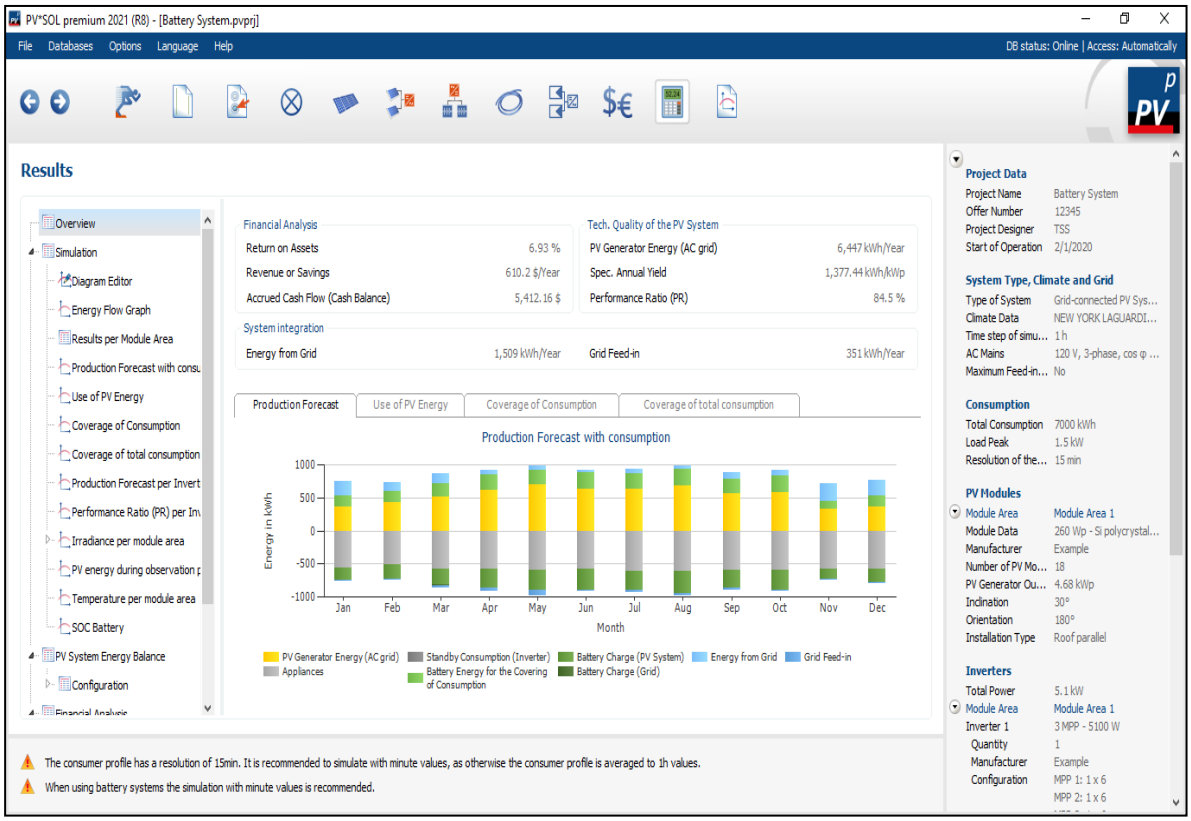





PV*SOL premium 2021 (R8) - [3D Bifacial PV Modules.pvprj]
File Databases Options Language Help
DB status: Online | Access: Automatically
3D Design
3D Visualization
Freifläche 01-Fläche Süd
Degradation of Module
System Planning with 3D Visualization
Edit
Number of Covered Areas 1
Number of PV Modules 108
Number of Inverters 6
PV Generator Output 30.24 kWp
Configuration Check
Project Data
Project Name Bifacial PV Modules
Offer Number 12345
Project Designer TSS
Start of Operation 2/1/2020
System Type, Climate and Grid
Type of System 3D, Grid-connected PV ...
Climate Data NEW YORK LAGUARDI...
Time step of simu... 1 h
AC Mains 120 V, 3-phase, cos φ ...
Maximum Feed-in... No
3D Design
Module Area Freifläche 01-Fläche Süd
Module Data 280 Wp - Si monocryst...
Manufacturer Example
Number of PV Mo... 108
PV Generator Ou... 30.24 kWp
Inclination 40°
Orientation 180°
Installation Type Mounted - Open Space
Configuration
Total Power 30.6 kW
Module Area Freifläche 01-Fläche Süd
Inverter 1 3 MPP - 5100 W
Quantity 6


PV*SOL premium 2021 (R8) - [Battery System.pvprj]
File Databases Options Language Help
DB status: Online | Access: Automatically
PV Modules
Module Area 1
Shading
Degradation of Module
Manufacturer
Example
PV Module
260 Wp - Si polycrystalline
Selection from favorites only
Photo Plan - Photo preview of roof coverage
Graphic Coverage
Number of PV Modules 18 4.68 kWp
Desired Ratio to Consumption
Installation Type Roof parallel
Tracking None
Inclination 30 °
Orientation 180 °
PV Generator Output 4.68 kWp
PV Generator Surface 30.2 m²
The consumer profile has a resolution of 15min. It is recommended to simulate with minute values, as otherwise the consumer profile is averaged to 1h values.
When using battery systems the simulation with minute values is recommended.
Project Data
Project Name Battery System
Offer Number 12345
Project Designer TSS
Start of Operation 2/1/2020
System Type, Climate and Grid
Type of System Grid-connected PV Sys...
Climate Data NEW YORK LAGUARDI...
Time step of simu... 1 h
AC Mains 120 V, 3-phase, cos φ ...
Maximum Feed-in... No
Consumption
Total Consumption 7000 kWh
Load Peak 1.5 kW
Resolution of the... 15 min
PV Modules
Module Area Module Area 1
Module Data 260 Wp - Si polycrystal...
Manufacturer Example
Number of PV Mo... 18
PV Generator Ou... 4.68 kWp
Inclination 30°
Orientation 180°
Installation Type Roof parallel
Inverters
Total Power 5.1 kW
Module Area Module Area 1
Inverter 1 3 MPP - 5100 W
Quantity 1
Manufacturer Example
Configuration MPP 1: 1 x 6
MPP 2: 1 x 6


Databases
Online
Product type
Batteries
Filter
Favorites
Look Up
Selected product 12 V - 108 Ah - Pb vented type (Example)
Look Up
Filter
Only user created data records
Also products that are no longer available
All versions
Actions
BMZ GmbH
BPE (Badger Power Electronics Ltd)
Caterva GmbH
Commeo GmbH
Dehui Solar
Deye
Dispatch Energy Innovations GmbH
DOWELL
Dream Maker
Durion Energy GmbH
Dyness
E.ON Energie Deutschland GmbH
E3/DC
EATON
eCactus
ecocoach AG
efectoX-Energias Renovables S.L.U
ENERGIZER SOLAR
Energy Depot GmbH
EnerSys
ENNAGY
Enphase Energy
ET SolarPower GmbH
Example
Favorite
Name
Version
User ID
Material
Cell voltage
No. of Cells in Series
12 V - 108 Ah - Pb vented type 2 Lead Acid - Vented Type (Liquid Electrolyte) FLA 2 6
12 V - 109 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 6
12 V - 165 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 6
12 V - 168 Ah - Pb vented type 2 Lead Acid - Vented Type (Liquid Electrolyte) FLA 2 6
12 V - 50 Ah - Pb vented type 2 Lead Acid - Vented Type (Liquid Electrolyte) FLA 2 6
12 V - 56.2 Ah - Pb vented type 2 Lead Acid - Vented Type (Liquid Electrolyte) FLA 2 6
12 V - 57.3 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 6
12 V - 65 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 6
2 V - 1150 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 1
2 V - 119 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 1
2 V - 1320 Ah - Pb vented type 2 Lead Acid - Vented Type (Liquid Electrolyte) FLA 2 1
2 V - 1360 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 1
2 V - 1640 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 1
2 V - 1670 Ah - Pb vented type 2 Lead Acid - Vented Type (Liquid Electrolyte) FLA 2 1
2 V - 178 Ah - Pb valve regulated 2 Lead Acid - Enclosed (Gel) 2 1
2 V - 201 Ah - Pb vented type 2 Lead Acid - Vented Type (Liquid Electrolyte) FLA 2 1
Close


PV*SOL premium 2021 (R8) - [Battery System.pvprj]
File
Databases
Options
Language
Help
DB status: Online | Access: Automatically
Results
Overview
Simulation
Diagram Editor
Energy Flow Graph
Results per Module Area
Production Forecast with consu
Use of PV Energy
Coverage of Consumption
Coverage of total consumption
Production Forecast per Invert
Performance Ratio (PR) per In
Irradiance per module area
PV energy during observation p
Temperature per module area
SOC Battery
PV System Energy Balance
Configuration
Financial Analysis
Return on Assets 6.93 %
Revenue or Savings 610.2 $/Year
Accrued Cash Flow (Cash Balance) 5,412.16 $
Tech. Quality of the PV System
PV Generator Energy (AC grid) 6,447 kWh/Year
Spec. Annual Yield 1,377.44 kWh/kWp
Performance Ratio (PR) 84.5 %
System integration
Energy from Grid 1,509 kWh/Year
Grid Feed-in 351 kWh/Year
Production Forecast
Use of PV Energy
Coverage of Consumption
Coverage of total consumption
Production Forecast with consumption
Energy in kWh
1000
500
0
-500
-1000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
PV Generator Energy (AC grid)
Standby Consumption (Inverter)
Battery Charge (PV System)
Energy from Grid
Grid Feed-in
Appliances
Battery Energy for the Covering of Consumption
Battery Charge (Grid)
The consumer profile has a resolution of 15min. It is recommended to simulate with minute values, as otherwise the consumer profile is averaged to 1h values.
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Consumption
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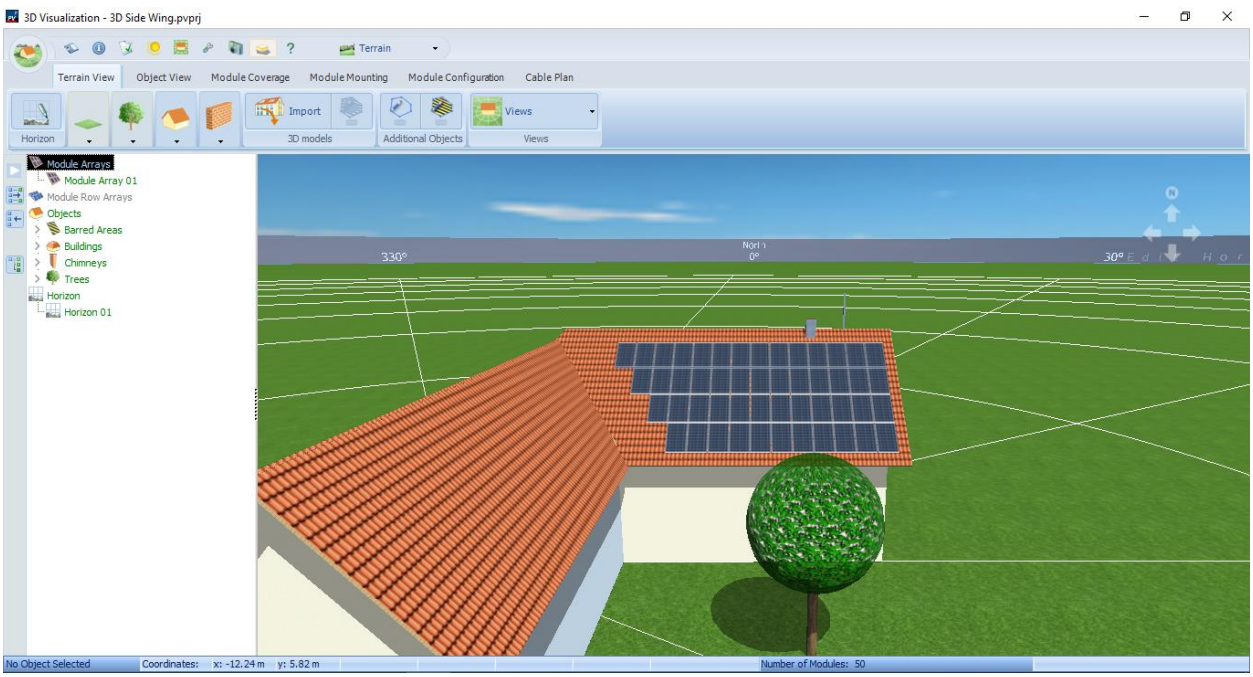

PV*SOL Premium

Course Coordinator

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