



SOLAR ENERGY
INTERNATIONAL

Educate.
Engage.
Empower.

COURSE CATALOG



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Mission & Vision

Solar Energy International (SEI) was founded in 1991 as a nonprofit educational organization. Our mission is to provide industry-leading technical training and expertise in renewable energy to empower people, communities, and businesses worldwide. Why? Because we envision a world powered by renewable energy!

At a Glance

Through the years, trends and technologies come and go, but SEI's mission remains the same today as it was when we began: to empower people around the world through the education of sustainable practices.

Our Philosophy

As we approach our third decade, what inspires us the most is the knowledge that we're helping to make a difference. Renewable energy resources of solar, wind and water can improve the quality of life and promote sustainable development throughout the world. Renewable energy systems are practical, reliable, cost-effective, and healthier for people and the environment.

Our Training Programs

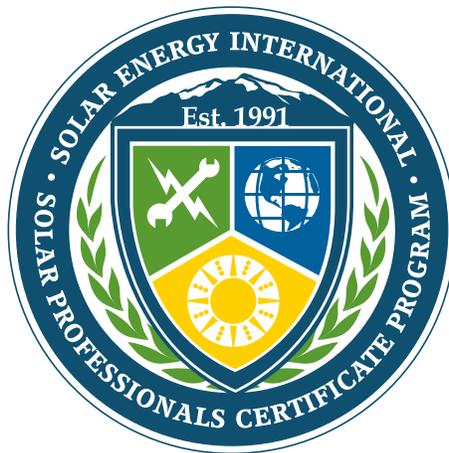
Through our training program, SEI offers hands-on workshops and online courses in solar PV, micro-hydro and solar hot water.

Solar Energy International is a 501(c)(3) Equal Opportunity Institution and Employer, and is not affiliated with any dealer, manufacturer, distributor, or any other renewable energy commercial enterprise.

Our Development Work

SEI works cooperatively with grassroots and development organizations in the Americas, Africa, Micronesia and the Caribbean. SEI staff have delivered services to the Pan American Health Organizations, Non-Governmental development organizations (NGOs), foreign, national and state governments, universities and individuals seeking the benefits of renewable energy.

Certificates and Certification



SEI Solar Professionals Certificate Program

SEI's Solar Professionals Certificate Program (SPCP) is the industry's most rigorous program to prepare for the highly technical clean energy workforce. SPCP is a selective admissions program to help ensure the success of our students and provide a quality workforce for the solar industry.

SPCP is a certificate program, not a certification program. A certificate program is a course of study, similar to a diploma. SEI, which is recognized by many employers as the leading solar training provider, offers a comprehensive certificate program for people wishing to enter the solar industry.

Certification is a credential that you earn to show that you have specific skills or knowledge. They are usually tied to an occupation, technology, or industry. SEI recognizes NABCEP as the leading certifying authority in the solar industry.

SEI requires a certificate program application to be completed by every student candidate. Please visit: <https://www.solarenergy.org/sei-solar-professionals-certificate-program/> for more information.



Residential and Commercial Photovoltaic Systems Certificate

This certificate path covers a comprehensive spectrum of grid-direct residential and commercial photovoltaic design and installation applications. Applying the National Electric Code and job-site safety considerations are strongly emphasized in this certificate program. This program also covers the technical concepts needed as a solar professional, whether you're working on single family homes to commercial projects to utility scale systems.

Required Courses: PV101 or PVOL101 > PV201L > PV202 or PVOL202 > PV203 or PVOL203 > PV303 or PVOL303

*This certificate is recognized for VA funding

Battery-Based Photovoltaic Systems Certificate

Through this certificate program you will be trained on the technical application of solar photovoltaic battery-based systems to serve many different areas such as the telecommunications industry, agricultural applications, off-grid homes and other remote applications, and grid-connected battery back-up systems.

Required Courses: PV101 or PVOL101 > PV203 or PVOL203 > PV201L > PV301L > PV303 or PVOL303 > PV304 or PVOL304

*This certificate is recognized for VA funding

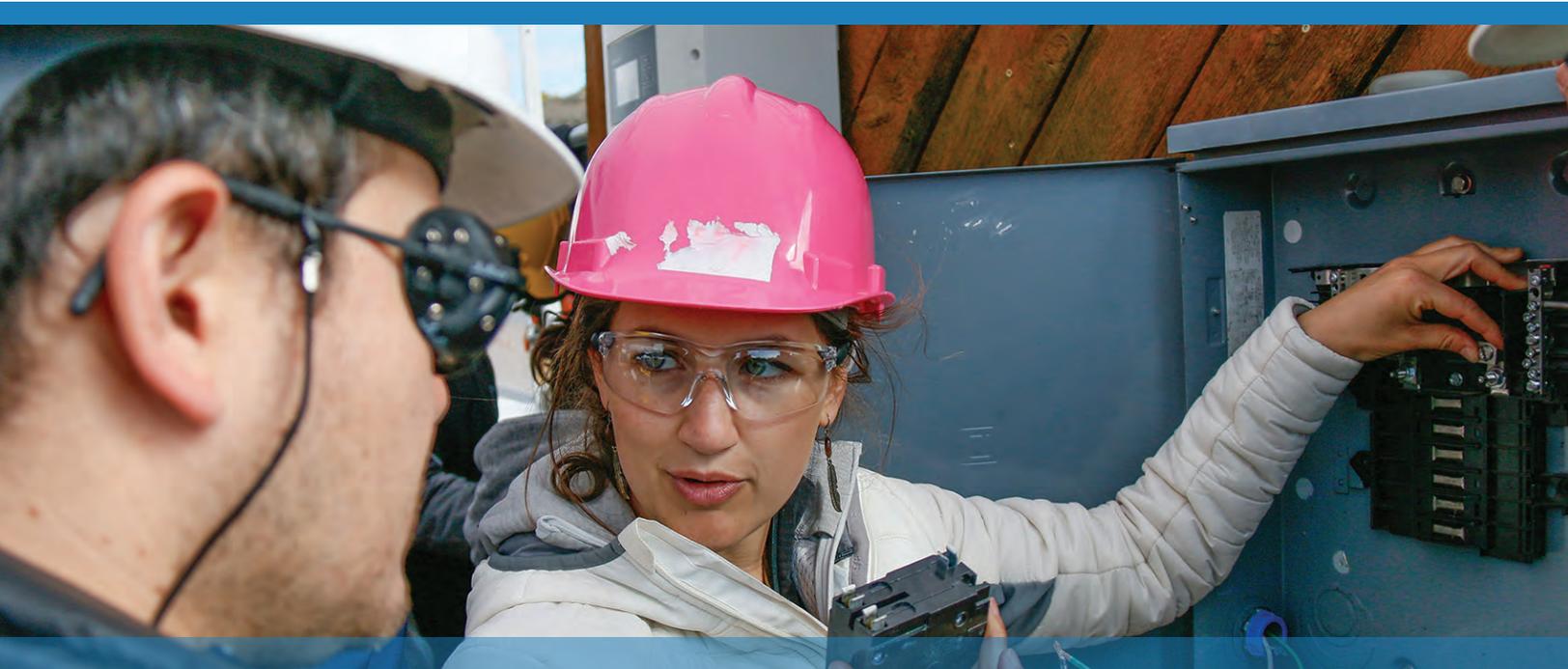
Certificates and Certification

SEI Solar Professionals Certificate Program

Solar Business and Technical Sales Certificate

Not all solar professionals are on the roof installing photovoltaic systems. This certificate path is perfect for an individual who is seeking a sales or product representative position in the industry or is considering starting their own business. A solid focus on the technical, economic, and financial aspects of the solar industry are covered in this path to prepare you for the fast-paced and highly dynamic solar industry.

Required Courses: PV101 or PVOL101 > PV201L > PV202 or PVOL202 > PVOL206 > PV203 or PVOL203



International and Developing World Applications Certificate

One billion people in the world do not have access to electricity. This certificate path prepares the solar professional for a career in international solar development. Solar professionals can be found working for government aid agencies and other non-profit organizations who are training local communities to become self sustaining.

Required Courses: PV101 or PVOL101 > PV203 or PVOL203 > PV301L > PV304 or PVOL304 > RDOL101



Renewable Energy Applications Certificate:

This certificate program will expose you to other renewable energy technologies beyond solar photovoltaics. When talking with home or business owners, you may be asked your professional opinion about all the options in the renewable energy sector and which technology will best suit their energy needs and location.

Required Courses: PV101 or PVOL101 > SHOL101 > MH101 > RDOL101

Solar Professionals Trainer Certificate:

Hundreds of solar training programs are sprouting up all over, and gaining the knowledge of how to deliver a world class training program can be difficult and daunting. With decades of hands-on and classroom instruction, the SEI curriculum and overall program is the gold standard for solar training and we want to share that knowledge with you. This certificate program will expose you to SEI's excellent classroom curriculum and renowned lab training facility. This program is reserved only for individuals currently in an instructional role or who's organization is in the process of establishing a renewable energy training program.

Required Courses: PV101 or PVOL101 > PV201L > PV202 or PVOL202 > PV203 or PVOL203 > PVOL206 > PV301L > PV303 or PVOL303 > PV304 or PVOL304 > PV351L

Certificates and Certification

NABCEP Certification

The logo for NABCEP (North American Board of Certified Energy Practitioners) features the word "NABCEP" in a bold, orange, sans-serif font. Below the text is a horizontal line that is blue on the left and orange on the right.

Raising Standards. Promoting Confidence.

The North American Board of Certified Energy Practitioners (NABCEP) offers entry level knowledge assessment, professional certifications, and company accreditation programs to renewable energy professionals throughout North America and the world. Raising industry standards and promoting consumer confidence, NABCEP is known as the “gold standard” for PV Certifications. The NABCEP Certification Handbook is a very helpful resource in understanding the Certification process.

SEI’s online and in-person training program counts towards the training requirements for taking the NABCEP Associate and professional certification exams. NABCEP offers two levels of credentials: 1.) PV Associate Credential, which can be taken after training and 2.) Professional Certifications, which requires both training and field experience. To learn more about NABCEP and the requirements and recommendations for sitting for their exams, visit www.nabcep.org.

PV Associate Credential

The NABCEP Associate Program is intended for many people, including those who are: students in solar training programs, workers at an early stage in their renewable energy career, experienced professionals who have just begun offering solar products or services, or those in renewable energy jobs for which there is no professional certification. The NABCEP Associate Exam requires training or experience in order to sit for the exam.

Training Requirements:

To be eligible to sit for the NABCEP PV Associate Exam with SEI, students must successfully complete:

Required path:

- PV101: Solar Electric Design and Installation (Grid-Direct) – in-person OR PVOL101 Online
- PV203 – PV System Fundamentals (Battery Based) – in person OR PVOL203 Online

Optional:

- PV201L: Solar Electric Lab Week (Grid-Direct) and
- PV301L: Solar Electric Lab (Battery-Based)

The NABCEP PV Associate Exam includes questions on grid-direct and battery-based PV systems.

To learn more about NABCEP, requirements and recommendations for sitting for exams, and study suggestions, visit www.nabcep.org, also refer to the PV Associate Handbook and the NABCEP Certification Handbook.

Recertification

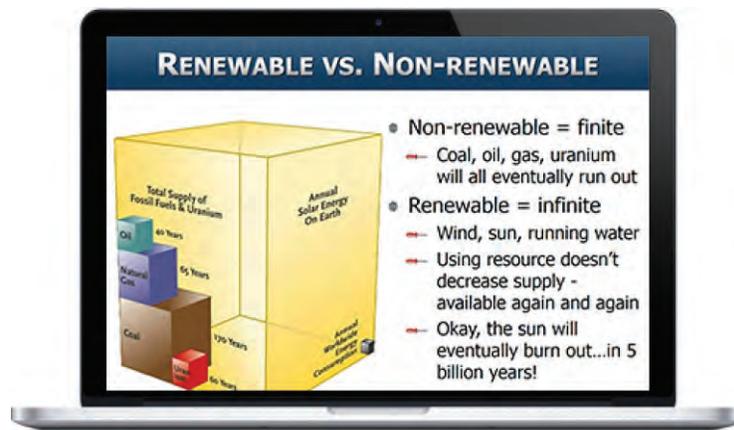
Many of SEI’s trainings will count towards CE hours for Recertification. SEI also offers training bundles for Recertification hours, including both an 18 hour and 30 hour CE training package. Please visit: <https://www.solarenergy.org/on-demand-training/> for details

Course Catalog

RE100: Introduction to Renewable Energy

SEI's Free Online Course

RE100 is a free course that covers the basics of renewable energy. It is a great introduction for those new to the field, those who are looking to make a career change, or those who just want to learn more about renewables and the basics of electricity. Join the tens of thousands of individuals who have gotten their first taste of renewable energy in RE100. In this course, you will learn about the different technologies and trends of renewables, what situations are more appropriate for different types of renewable energy systems, and how to make a difference with your own energy consumption. This course also serves as an introduction to SEI's online campus. To register: <https://www.solarenergy.org/courses/introduction-to-renewable-energy/>



What You Will Learn:

TOPICS INCLUDE

- Why renewable energy?
- Conservation and efficiency
- Basics of electricity
- Solar thermal
- Solar electricity
- Wind power
- Micro-hydro
- Other renewable energy technologies
- Appropriate technology for the developing world
- The economics of renewable energy

Course Catalog

Section 1: Grid-Direct, Solar Electric



ONLINE- PVOL101: Solar Electric Design and Installation (Grid-Direct)

OR

CLASSROOM-BASED- PV101: Solar Electric Design and Installation (Grid-Direct)

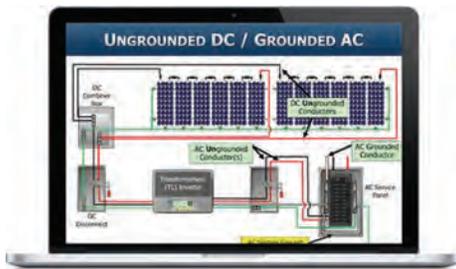
Description:

PV101 is your gateway to a career in the solar industry. It all starts with the fundamentals and a solid understanding of various components, system architectures, and applications for PV systems. Other topics include site analysis, system sizing, array configuration, and performance estimation; electrical design characteristics such as wiring, overcurrent protection, and grounding; a detailed look at module and inverter specifications and characteristics; mounting methods for various roof structures and ground-mounts; and an introduction to safely and effectively commissioning grid-direct PV systems. This course focuses on grid-direct PV systems, but covers material critical to understanding all types of PV systems. These core concepts are expanded on in SEI's upper level PV courses.

What You Will Learn:

Students who complete PVOL101 will be able to:

- Identify and describe basic functions of different components of PV systems
- Explain the relationship between: volts, amps, amp-hours, watts, watt-hours, and kilowatt-hours; perform power and energy calculations
- Define utility bill terminology
- Compare incentive mechanisms for renewable energy installations
- Determine azimuth and altitude angle of the sun using a sun chart
- Identify tilt angle and orientation that provides maximum energy production
- Identify data required to size and design a grid-direct PV system
- Identify common PV mounting options; list advantages and disadvantages of different mounting options
- Calculate PV array size using the online PVWatts tool
- Create charts for your location to aid in sizing estimates
- Identify potential jobsite hazards and opportunities for additional safety training



Course Catalog

Section 1: Grid-Direct, Solar Electric

ONLINE- PVOL202: Advanced PV System Design and the NEC (Grid-Direct)

OR

CLASSROOM-BASED- PV202: Advanced PV System Design and the NEC (Grid-Direct)

Description:

Take a deep dive into National Electrical Code (NEC® 2017) standards as well as other best practices that pertain to designing safe and efficient grid-direct PV systems. PV202 focuses on residential and commercial-scale systems, but the Code requirements, design parameters, and best practices are applicable to all types and sizes of PV installations, including utility-scale. Detailed lessons address requirements for disconnects, overcurrent protection, and wire sizing; interconnection requirements and calculations; grounding, ground-faults, and surge protection; calculations for system sizing, inverter selection, and electrical configuration; ground and roof mount details; and commissioning and performance analysis procedures.

What You Will Learn:

Students who complete PVOL202 will be able to:

- Define the purpose of the National Electrical Code (NEC®) and NEC® terminology for PV equipment
- Determine procedures for proper installation of equipment and conductors, including minimum requirements for working space
- Examine methods for PV wire management and determine where expansion fittings are required
- Describe and identify electrical services, including split-phase and three-phase Wye (Y) and Delta (Δ)
- Evaluate electrical service details to collect and record during solar site evaluation
- Identify options for NEC®-compliant PV system interconnection to the utility grid and determine whether a supply side, load side, or additional service connection is appropriate
- Identify code-compliant methods for connecting an inverter to an existing AC feeder
- Calculate PV module voltage based on temperature to ensure compatibility with system components and NEC® Section 690.7, and explore other options for maximum PV system DC voltage calculations
- Identify NEC® requirements and sizing of disconnects and overcurrent protection devices (OCPDs) in grid-direct PV systems
- Define inverter grounding configurations
- Evaluate inverter choices and system configurations, including string inverters, central inverters, and module level power electronics (MLPE)
- & more!

PV201L: Solar Electric Lab Week (Grid-Direct)

Description:

Put classroom theory into practice with the ultimate hands-on PV experience available! This five-day lab class offers students the opportunity to work closely with experienced PV professionals and get their hands dirty by fully installing and commissioning a wide variety of system types before testing the system, then de-commissioning and breaking down. You will work with modules, inverters, and racking components from a wide range of manufacturers that are all big players in the PV industry. A low student-to-instructor ratio and the world-class lab facility at SEI's lab facilities in Paonia, Colorado (USA), Costa Rica, or Oman combine to make PV201L the perfect environment for your first hands-on PV experience.



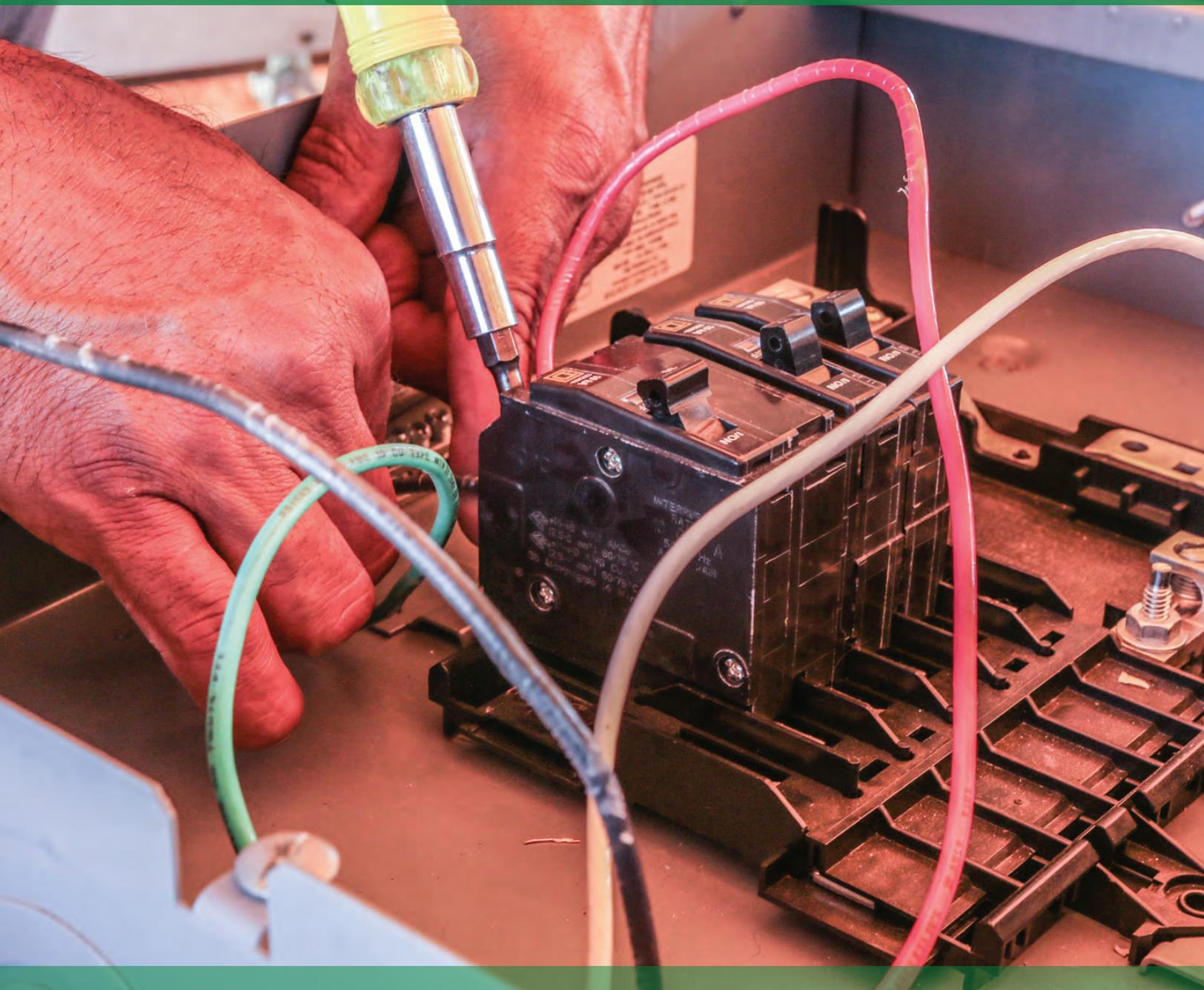
What You Will Learn:

Students who complete the PV201L workshop will be able to:

- Determine safe, best practice installation techniques when working with different inverters, racking hardware, mounting methods including: ballasted roofs, steep asphalt and standing seam metal roofs, ground-mounts, and pole-mounts
- Define fall protection requirements, and properly use different harness set-ups
- Demonstrate lockout/tagout procedures to create a safe working environment
- Properly use an assortment of meters to test equipment

Course Catalog

Section 2: Battery-Based, Solar Electric



ONLINE- PVOL203: PV Systems Fundamentals (Battery-Based)

OR

CLASSROOM-BASED- PV203: PV System Fundamentals (Battery-Based)

Description:

PV systems with energy storage are a rapidly growing segment of the industry. This course builds a foundation for understanding many battery-based applications, in which the complexity far exceeds that of a grid-direct PV system. Load analysis is addressed along with other critical design criteria such as battery bank design, equipment options, and electrical integration of system components. Component options are covered in detail, including batteries, charge controllers, and battery-based inverters. Different battery chemistries, associated pros and cons, and cost comparisons are investigated along with safety and maintenance considerations unique to battery-based PV systems.



What You Will Learn:

Students who complete PVOL203 will be able to:

- Review battery basics and terminology, identify the common types of PV systems and their major components
- Introduce utility-scale storage and microgrids
- Complete a load estimate for different system types and for seasonal loads; evaluate electrical requirements of loads
- Describe the differences when sizing battery-based systems compared to grid-direct systems
- Describe and compare different battery chemistries and technologies
- Find the capacity and voltage of different batteries; determine state of charge
- List safety precautions and hazards to be aware of when working with batteries; list appropriate personal protective equipment (PPE)
- Calculate values for current, voltage, and energy for different battery bank configurations
- Review battery bank design parameters
- Complete a lithium-ion battery bank design example
- List features, options, and metering available for different types of battery chargers
- Explain basics of lithium battery charging
- Compare generator types and duty cycle ratings, including fuel options
- Identify specifications critical for choosing appropriate battery-based inverters
- Identify safe installation procedures

Course Catalog

Section 2: Battery-Based, Solar Electric

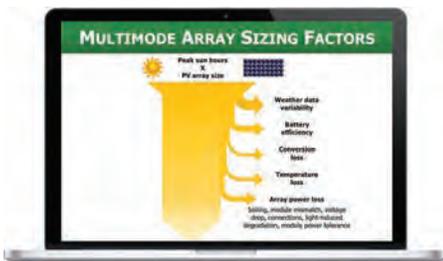
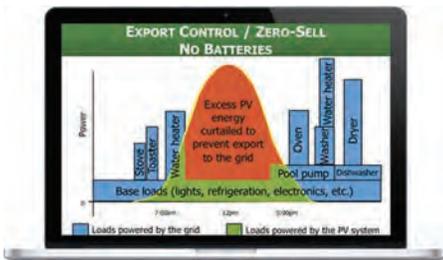
ONLINE- PVOL303: Advanced PV Multimode and Microgrid Design (Battery-Based)

OR

CLASSROOM-BASED- PV303: Advanced PV Multimode and Microgrid Design (Battery-Based)

Description:

Multimode systems are complex energy storage systems that can operate in utility interactive or island mode – and the market for these systems is experiencing exponential growth. Whether providing backup power when the grid is down, operating in self consumption mode, or reducing peak demand charges, there are numerous use cases for PV systems with energy storage that interact with the utility grid. Lessons include detailed design considerations for AC and DC coupled systems, along with analyzing equipment specifications and thorough design examples. National Electrical Code (NEC®) and other code requirements are addressed in detail along with best practice design considerations for battery-based systems.



What You Will Learn:

- Multimode system configurations
- Load analysis and battery bank sizing
- PV array sizing
- Specifying multimode inverters
- Advanced multimode functions
- Code compliance, best practices, and installation considerations
- Charge controllers for multimode systems
- DC coupled multimode battery backup design example
- AC coupled system design considerations
- AC couples multimode batter backup design example
- Energy Storage Systems (ESS) overview
- ESS residential sizing example
- Commercial time of use/peak shaving design example
- Multimode system operating considerations

ONLINE- PVOL304: Advanced PV Stand-Alone System Design (Battery-Based)

OR

CLASSROOM-BASED- PV304: Advanced PV Stand-Alone System Design (Battery-Based)

Description:

Off-grid is where PV got its start – and with so many applications for stand-alone power, new equipment developments, and cost reductions in energy storage technology, this sector of the market is growing like never before. Detailed analysis of load considerations, charge controllers, PV array sizing, and stand-alone inverters is followed by numerous design examples that address the wide-ranging specifics of off-grid applications, from a small DC lighting system to a residential stand-alone system to an island microgrid. Also covered is generator sizing and integration, maintenance for stand-alone systems, and a healthy dose of best practices that have been learned through years of experience. Advance your PV knowledge well beyond where the grid goes with PV304!

What You Will Learn:

- Stand-alone system configurations
- Charge controller and array considerations
- RV system design example
- DC lighting system design example
- Clinic system design example
- Code compliance and best practices for stand-alone systems
- Advanced battery-based inverters
- Generator sizing
- DC coupled stand-alone residential system design example
- AC coupled stand-alone microgrid system design example
- Large-scale microgrid considerations and case studies
- Flooded battery maintenance considerations
- Stand-alone PV system commissioning and maintenance



Course Catalog

Section 2: Battery-Based, Solar Electric

PV301L: Solar Electric Lab Week (Battery-Based)

Description:

This five-day lab class is an amazing opportunity to get hands-on experience with a wide range of battery-based PV system components and architectures at SEI's world-class lab facility in Paonia, Colorado. Working in small groups with instructors who live and breathe battery-based PV, students install, test, and commission numerous PV systems with energy storage that address a wide range of applications. The labs in PV301L consist of stand-alone and multimode PV systems, and include AC and DC coupled equipment. Many experienced solar professionals have never worked with batteries – this is your chance to leap to the front of the pack!



What You Will Learn:

- Determine safe procedures for installing battery-based PV systems, including: wiring combiner boxes, disconnects, power centers, controllers, battery banks, and inverters
- Understand fundamental procedures for commissioning and maintaining battery-based PV systems
- Perform basic programming and testing of components for specific battery-based applications



Course Catalog

Section 3: Other Renewable Energy Applications



ONLINE:

RDOL101: Appropriate Technology for the Developing World

Description: Are you interested in international development, humanitarian work, or helping others with renewable energy projects internationally? If you answered yes- this course is for you! The first part of this course surveys technologies that aim to improve people's access to basic human needs: water and sanitation, food processing and cooking technologies, biomass, rural electrification, and appropriate building techniques. The second part of the course focuses on project development and successful implementation. Throughout the course, the focus is on the community-their needs, how to guide decision makers to understand the benefits of different technologies, and how to learn from community members. Working with a community is essential to the success of an appropriate technology project.

What You Will Learn:

- Describe current situation for people living around the world regarding access to water and sanitation, clean cooking technologies, electricity, and adequate housing
- Define appropriate technology and provide examples of applications in the developing world
- Explain the basic components for photovoltaic (PV), wind, and micro-hydro systems
- Explain how quality, comfortable homes can be constructed with limited resources and the use of natural, local materials readily found in rural communities around the world
- Assess a site for locally available natural building materials that can be utilized to provide safe, adequate shelter
- Review the role of NGOs
- Describe some possible negative consequences of bringing technology to a community
- Justify the common principles to create a successful international development project

SHOL101: Solar Thermal Training- Solar Hot Water Design and Installation

Description: Students in this course will learn the theory, design considerations and installation strategies necessary to install and maintain a solar domestic hot water system. Passive solar water heaters, drainback systems, antifreeze systems, and photovoltaic powered systems are all addressed, as well as an introduction to pool and space heating systems.

What You Will Learn:

The course will familiarize students with industry history, the distribution chain, jobs in the industry, safe practices, and national codes and standards. Students will explore the different types of collectors, systems, components, and materials used in solar heating systems and determine their appropriate applications.

The course will also examine the techniques and tools used for installing solar heating equipment. Finally, students will learn how to conduct site assessments, analyze hot water loads, develop accurate system sizing and project cost estimates, and identify the economic and non-economic benefits of a solar heating system.

Course Catalog

Section 3: Other Renewable Energy Application

LAB-BASED LEARNING:

MH101: Micro-Hydro Training- Micro-Hydro Design & Installation

Description: This workshop will cover design considerations as they apply to both low and high head micro-hydro systems. The focus will be on core concepts that may be applied to a wide range of hydro applications, including irrigation ditches that are commonly found throughout the Western U.S. Course instruction will include how to measure elevation differences and water flow rates. Several turbines will be installed and tested as part of the course participation. Check out our YouTube video about the course.

What you will learn:

Participants perform preliminary system sizing for mechanical and electrical power generation of 50-watt to 100-kilowatt capacities. This workshop combines class lectures with site tours and lab exercises. Hands-on exercises include: methods of flow measurement, determining head, analyzing and assembling small functioning systems. The class is taught by two highly experienced Micro-hydro installers/instructors.

What You Will Learn:

- Safety Procedures
- System Components
- Turbine Types
- AC and DC Systems
- Site Analysis
- System Design
- Battery Storage
- Maintenance & Troubleshooting
- Case Studies
- Legal requirements

PV110: Solar Water Pumping

Description: There is almost something magical about using energy from the sun to pump water – and often the sunnier it is the more water is needed! This three day course combines presentations with hands-on experience and tours of local, operating systems. There are many different types of pumps - some of which are more appropriate than others depending on the amount of water needed and the specifics of the site. Selecting the proper pump for the job, sizing the PV array, selecting equipment such as controllers and linear current boosters, and installation methods are all covered in detail in PV110.

What You Will Learn:

- Pressure
- Storage
- Drip and spray irrigation systems





Course Catalog

Section 4: O&M and Continuing Education



ONLINE:

PVOL350: PV Systems – Tools and Techniques for Operations and Maintenance

As more and more PV systems come online, the operations and maintenance (O&M) field is rapidly expanding. This course trains PV technicians to safely and effectively perform O&M tasks, including inspections, commissioning, performance verification, and troubleshooting. Students will become familiar with a wide range of advanced analytical tools, meters, and techniques – such as insulation resistance testers, I-V curve tracers, and infrared cameras. Learn the theory and practical applications from instructors with real-world experience, using curriculum developed by an industry-leading team of experts. This course is applicable to all sizes of grid-direct PV systems including residential, commercial, and large-scale; it does not cover battery maintenance or medium voltage-specific O&M. Fleet operations and system data managers will also find this course challenging and valuable.

What You Will Learn:

- Introduction to O&M and preventative and reactive maintenance plans and activities
- Risks, costs, and benefits of a well-structured O&M plan
- Safety procedures and PPE requirements for O&M technicians
- Importance of OSHA and NFPA 70E training
- How to create electrically safe work environments and appropriate lock-out/tag-out (LOTO) procedures
- Field procedures and tests required during installation, start up, and for system performance evaluation

IN THE LAB:

PV351L: PV Systems - Tools and Techniques for Operations and Maintenance Lab Week (Grid-Direct)

PV351L is an intensive, advanced training designed for solar professionals already working in the PV industry who want to take their technical skills to the next level and gain hands-on experience with a wide range of advanced analytical tools and meters. Through a mix of classroom and lab time, theory is immediately applied in the field, with a focus on commissioning, operations and maintenance, troubleshooting, and performance evaluation. Students gain experience using a wide variety of the latest and greatest tools the industry has to offer, including various multimeters, insulation resistance testers, IV curve tracers, and infrared cameras. Learn the advanced skills required to ensure PV systems operate safely and reliably!

What You Will Learn:

Students who complete the PV351 workshop will be able to:

- Determine use and analyze results from various test tools used during commissioning, performance evaluation, operations and maintenance, and troubleshooting.
- Define the theory, procedures, and processes behind insulation resistance testing, IV curve tracing, infrared cameras and thermal imaging, performance evaluation, and troubleshooting
- Demonstrate proper set-up, use, and function of PV test tools including: IV curve tracers, insulation resistance testers, and thermal cameras
- Evaluate the performance of working systems using correct and complete field procedures
- Troubleshoot and locate common PV array and system faults using appropriate methodologies and testing tools

Course Catalog

Section 4: O&M and Continuing Education

On-Demand Continuing Education Training

SEI's Continuing Education program is aligned with the North American Board of Certified Energy Practitioners (NABCEP) approved topic list for re-certification. These sessions are offered as on-demand recorded presentations to provide flexibility for the busy professional.

Students can select individual training webinars, or choose a discounted training package consisting of multiple CE webinars.

SEI'S Continuing Education Training Packages for NABCEP Recertification consist of 18 or 30 credit hours chosen from our Continuing Education (CE) Webinar Offerings. Students can choose webinars to meet the Code Based, JTA and Other/ NonTech hours required by NABCEP for Recertification.

The following are just a few of our dozens of CE offerings. Check out more online at: <https://www.solarenergy.org/on-demand-training/>





CE524: PVsyst for PV System Production Modeling

PVsyst is the primary software the PV industry turns to for production guarantees, system design optimization, and system performance verification. Learn how to get started creating accurate production estimates for any size PV system, from residential to large-scale.

CE522: 2017 National Electrical Code[®] and PV Systems

This course walks through the 2017 National Electrical Code, focusing on critical updates, changes, and relevant details that impact PV system design and installation for small residential to large-scale projects.

CE520: Introduction to SketchUp PV System Modeling

Establish fundamental SketchUp modeling methods and techniques for creating a realistic 3D residential roof and designing PV module layouts.

CE517: Performance Modeling of PV Systems

Estimating the production of PV systems is critical for project success. Take an in-depth look at PV system performance modeling, required for financial calculations as well as back-testing system performance.

Course Catalog

Section 4: O&M and Continuing Education

CE514: Building and Fire Codes- Rooftop PV Considerations

This course covers the building and fire codes that are specifically relevant to both residential and commercial PV installations on rooftops, including the International Building Code (IBC); the International Residential Code (IRC); and the International Fire Code (IFC).

CE513: Rooftop PV- What You Need to Know About Roof Systems

This course provides the basics on how roofs function, and explains in detail specific considerations for roof systems when PV arrays are installed.

CE505: Code-Compliant Roof Mounting and Waterproof Flashing

Roof penetrations can be a tremendous liability for solar installation contractors. This presentation covers important roofing codes and methods consistent with roofing best practices





Industry-Leading Lab Training Facilities

CARPORT GRID-DIRECT SYSTEM



- SMA Inverter
- Schletter Racking
- Panasonic PV Modules



SCHNEIDER BATTERY-BASED SYSTEM



- Schneider Multimode Inverter/Charger
- Schneider Charge Controller
- Canadian Solar PV Modules



GROUND MOUNTED GRID-DIRECT SYSTEM



- Fronius Inverter
- RBI Racking
- Mission Solar PV Modules



POLE MOUNTED GRID-DIRECT SYSTEM



- ABB Inverter
- General Specialties Racking
- Hanwha Solar PV Modules



BALLASTED GRID-DIRECT SYSTEM



- Solectria Inverter
- Tigo TSR-F MLPE
- Panel Claw Racking
- Jinko Solar PV Modules



SEI Solar Training Center in Paonia, Colorado

MICROINVERTER GRID-DIRECT SYSTEM



- Enphase Microinverters
- Mission Solar PV Modules
- Everest Racking



MAGNUM BATTERY-BASED SYSTEM



- Iron Edison Nickel-Iron Battery Bank
- Magnum Multimode Inverter/Charger
- Magnum Charge Controller
- Midnite Charge Controller
- Tigo MLPE
- Trina Solar PV Modules



OUTBACK BATTERY-BASED SYSTEM



- Deka Solar Flooded Lead Acid Batteries
- Outback Multimode Inverter/Charger
- Outback Charge Controller
- Sanyo PV Modules



STEP ROOF GRID-DIRECT SYSTEM



- SolarEdge Inverter with SolarEdge DC to DC Converters
- Snap-n-Rack Racking
- REC PV Modules



SUNNY ISLAND BATTERY-BASED SYSTEM



- Blue Planet Energy Lithium Ferrous Phosphate Battery
- SMA Sunny Island Multimode Inverter/Charger
- SMA Grid-Direct Inverter
- CertainTeed BIPV Solar Shingle



SOLAR ENERGY
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Educate.
Engage.
Empower.

Industry-Leading Lab Training Facilities

SEI-CFIA Solar Training Center in Costa Rica



GROUND MOUNTED GRID-DIRECT SYSTEM WITH STRING INVERTER



- Fronius String Inverter
- Trina Solar PV Modules
- Schletter Ground Mount Racking
- Midnite Solar MNPV6 Combiner Box



ROOF MOUNTED GRID-DIRECT SYSTEM WITH DC-DC CONVERTERS



- SolarEdge String Inverter + DC to DC converters
- Snap-N-Rack Racking
- Trina Solar PV Modules



ROOF MOUNTED GRID-DIRECT SYSTEM WITH MICROINVERTERS



- Enphase Microinverters
- Yingli Solar PV Modules
- Snap-n-Rack Racking



Solar Training Center in Halban, Oman

GROUND MOUNT GRID-DIRECT SYSTEM



- Huawei String Inverter
- Trina Solar PV Modules



METAL ROOF MOUNT GRID-DIRECT SYSTEM



- SMA Inverter
- Trina Solar PV Modules
- K2 Racking



EAST / WEST BALLAST MOUNT GRID-DIRECT SYSTEM



- Fronius String Inverter
- Trina Solar PV Modules
- East/West K2 Racking



SOUTH BALLAST MOUNT GRID-DIRECT SYSTEM



- Fronius String Inverter
- Trina Solar PV Modules
- K2 Racking



INTERFACE PROTECTION AND MONITORING



- Interface Protection System
- AC Combiner Panel
- Site Data Monitoring and Weather Station



SOLAR ENERGY
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Educate.
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Financial Assistance, Travel & Lodging



Financial Assistance

SCHOLARSHIPS:

Walt Ratterman Scholarship

If you are from a developing country and would like take SEI training in order to bring renewable energy technologies to your community, you may qualify for the Walt Ratterman Scholarship.

Heather Andrews/Womens' Scholarship Fund

For women looking to start or advance their career in the solar industry, SEI established the Heather Andrews Scholarship Fund to support women's solar training. Heather was a SEI alumna and solar champion who passed away February 8, 2012, and this scholarship honors her life.

Johnny Weiss Scholarship Fund

In 2013, SEI established the Johnny Weiss Scholarship Fund in honor of our Co-Founder, Johnny Weiss. This scholarship is for one person per year, chosen personally by Johnny Weiss, who demonstrates Johnny's commitment to making the world a better place through service. A preference is given to Native Americans or people from the developing world. This scholarship is for a full tuition course.

Live It Like Austin Scholarship Fund

The Webster Family and the National Independent Service Association created the Live It Like Austin Scholarship Fund to honor our SEI student, supporter, and friend Austin Dale Webster.

The Levi Heinold/Mountain Power Scholarship

Scott Ely and Sunsense Solar created this scholarship to honor Levi Heinold, an SEI alum who passed away in February 2018, by empowering aspiring solar professionals to complete SEI's entry-level solar training and certification.

General Scholarship Fund

SEI also has a General Scholarship Fund from which we award tuition assistance to those in financial need, from any country, and who are often underemployed or unemployed and in search of a new and meaningful career.

Apply Online

<https://www.solarenergy.org/scholarship-funds/> or ask our Student Services Team about our scholarship opportunities (970-527-7657 option 1 or email sei@solarenergy.org).

Financial Assistance, Travel & Lodging

ACTIVE DUTY MILITARY & VETERANS CAREER TRANSITION PROGRAM:

Solar Energy International's Solar Professionals Certificate Program (SPCP) is authorized to accept Veterans Education Benefits for qualified candidates and offer outreach programs for veterans and active duty military personnel. We proudly offer educational opportunities to military members, their families, and veterans. Approved for Veterans Benefits by the Colorado State Approving Agency, SEI is authorized to offer eligible veterans the ability to use their education benefits towards our in-person classroom and hands-on lab training through SEI's Solar Professionals Certificate Program (SPCP). Online courses do not qualify at this time.



In 2015, SEI was selected as the lead training provider during the pilot program for the Department of Energy's Sunshot Initiative Solar Ready Vets program. SEI continues to support Solar Ready Vets as an advising and training partner to the program.

As an organization, SEI believes in the opportunities that renewable energy can afford our country, such as energy independence and sustainable use of our country's natural resources. With that in mind, we also honor those who have served our country and who are choosing to follow up their military service with a new kind of service in the renewable energy sector.

Learn more at: <https://www.solarenergy.org/active-duty-military-veterans-career-transition/> or ask our Student Services Team about the Active Duty Military & Veterans Career Transition Program.

Travel & Lodging

YOUR STAY IN PAONIA, COLORADO:

Paonia is located on the Western Slope of the Rocky Mountains, at 5,645 ft. in elevation. Along with Hotchkiss and Crawford, Paonia is one of the small towns that make up the North Fork Valley. The North Fork of the Gunnison River flows through Paonia and the valley. On both sides of the valley are higher mesas offering panoramic views of the West Elk Mountains, Ragged Mountains, Black Canyon of the Gunnison, and San Juan Mountains.

Travel:

We recommend students fly into one of the two regional airports in either Montrose or Grand Junction, an hour to 1.5 hours from Paonia respectively. Upon registration, SEI provides students with discount codes to rental car companies and a list of area shuttle drivers who can pick you up and drop you off at the airport.

Lodging:

There many quaint, local lodging options available, including bed and breakfasts (B&B), farmhouses, motels, and camping options.

Several establishments offer local deals for SEI students. When students register for classes, you will receive a lodging list to help you find affordable housing with local community members.

Check out more information on our website.



Financing, Travel & Lodging

YOUR SOLAR TRAINING VACATION:



Outdoor Adventures

Whether you're looking for a quick adventure after class or a longer adventure on the weekends, Paonia is surrounded by BLM land, National Forests, and the West Elk Wilderness. Rent a mountain bike at The Cirque and enjoy trails on Jumbo Mountain, which is just minutes from downtown. Head to Lost Lakes for a picturesque hike followed by a swim in snowmelt lakes, or visit Erickson Springs for a perfect end-of-day hike.



Black Canyon of the Gunnison National Park

Big enough to be overwhelming, still intimate enough to feel the pulse of time, Black Canyon of the Gunnison exposes you to some of the steepest cliffs, oldest rock, and craggiest spires in North America. With two million years to work, the Gunnison River, along with the forces of weather, has sculpted this vertical wilderness of rock, water, and sky. Less than an hour from SEI's campus, this relatively undiscovered National Park makes for a perfect end-of-class adventure.



Nationally Award-Winning Wineries

Paonia is home to highest altitude commercial wineries and vineyards in the world. After class, we suggest visiting Azura Cellars for wine tasting while enjoying an epic view from their incredible winery. Walk the vineyards at Stone Cottage Cellars while sipping on their perfectly not-too-sweet Gewurtzraminer, enjoy a glass next to the North Fork of the Gunnison River at Black Bridge Winery, or tour their red wines which are fermented in open vats and aged in French oak.



The Farms

On your way to SEI, you'll pass by acres and acres of orchards. Paonia is known for its organic fruit: cherries, apricots, peaches, nectarines, pears, apples. Delicious Orchards and Orchard Valley Farms are the places to go for fruit picking. From Desert Wyer with their numerous PV systems and heritage-bred sheep, to the Living Farm with their four season growing operations, to Zephyros Farm and their fields of flowers- enjoy all of the produce and products the valley has to offer.

Partnerships and Support



CONTRACT TRAINING

Custom Training with Solar Energy International

Solar Energy International offers custom in-person courses, practical hands-on trainings and instructor-led online trainings to PV designers, installers, and solar business professionals. SEI's contract training programs are designed to meet the needs of EPCs, manufacturers, wholesale distributors, government, and other businesses involved in the rapidly growing renewable energy and PV markets. SEI's experienced instructors lead practical, hands-on trainings at your PV facilities or at SEI's Lab Facilities in Colorado, Costa Rica and Oman. SEI's curriculum and contract training services are also available in Spanish.

Tuition Discount for Employees/Members

If your company is looking to provide training to ten or more employees or members, SEI can provide a special pricing program to meet your training needs. SEI's range of introductory and advanced courses can serve as foundational training for employees new to the solar industry or as advancement and continuing education for existing employee. Once your special pricing program is complete, your employee can simply use your company discount enroll in an online or in-person training that works with their schedule and meets your training goals.

To request contract training please complete our contract training questionnaire:
<https://www.solarenergy.org/curriculum-licensing/>

CURRICULUM LICENSING

Solar Energy International's Curriculum Licensing Program is a key way for training institutions to avoid reinventing the wheel when developing their own programs. We provide a fully-developed, fully-packaged training curriculum. Interested parties can complete a questionnaire on SEI's website to determine eligibility:
<https://www.solarenergy.org/curriculum-licensing/>

Partnerships and Support

BECOME AN INDUSTRY SPONSOR

Promoting a world powered by renewable energy

As a sponsor of Solar Energy International you're a transformative leader.

We're forming 3-year sponsorship commitments so you can access SEI's network to increase your company's brand visibility and product recognition while generating future customers via SEI's audience. As a sponsor you are increasing your reach while demonstrating a commitment to our vision of a world powered by renewable energy. Be the first in SEI's 28-year history to strategically sponsor organizational growth and industry expertise.

SEI's Industry Sponsor Program recognizes our highly-valued industry sponsors who show a commitment to advancing SEI's vision of a world powered by renewable energy. Join us to be part of the growth of SEI; we're building physical infrastructure capacity and programmatic reach so that we can make a real impact training a skilled, safe renewable energy workforce. With our sponsors' support, we aim to train 110,000 solar professionals worldwide by 2022.

Transformative Leaders:

Terawatt Sponsor

\$500,000 by 2022 • \$166,667/year

Leader Benefits:

- Exclusive Presenting Sponsor of SEI Classroom for 3 years
- Co-host 3 educational webinars featuring SEI technical expert
- Full-page Ad in SEI student notebooks for 3 years
- Full integration into SEI's social media plan
 - 30 posts over 3 years
- \$50,000 training credit
 - Equivalent to approximately 60 employees trained online, 30 in-person

Sponsor Benefits:

- Press release with partnership announcement
- Recognition on SEI's website for 3 years
- Logo recognition at major solar conferences for 3 years

Gigawatt Sponsor

\$250,000 by 2022 • \$83,333/year

Leader Benefits:

- Presenting Sponsor of SEI Student Lounge for 3 years
 - Up to 2 Gigawatt Sponsors co-sponsor SEI Student Lounge
- Co-host 2 educational webinars featuring SEI technical expert
- Half-page Ad in SEI student notebooks for 3 years
- Integration into SEI's social media plan
 - 21 posts over 3 years
- \$25,000 training credit
 - Equivalent to approximately 30 employees trained online, 15 in-person

Sponsor Benefits:

- Press release with partnership announcement
- Recognition on SEI's website for 3 years
- Logo recognition at major solar conferences for 3 years

Megawatt Sponsor

\$100,000 by 2022 • \$33,333/year

Leader Benefits:

- Presenting Sponsor of SEI Equipment Center for 3 years
 - Up to 6 Megawatt Sponsors co-sponsor SEI Equipment Center
- Co-host 1 educational webinar featuring SEI technical expert
- Integration into SEI's social media plan
 - 15 posts over 3 years
- \$10,000 training credit
 - Equivalent to approximately 12 employees trained online, 6 in-person

Sponsor Benefits:

- Press release with partnership announcement
- Recognition on SEI's website for 3 years
- Logo recognition at major solar conferences for 3 years

BECOME AN INDUSTRY SPONSOR

Promoting a world powered by renewable energy

SPONSORS:

Kilowatt Sponsor

\$30,000 by 2022 • \$10,000/year

Sponsor Benefits:

- Large Sponsorship Plaque recognition at SEI Water Center for 3 years
- \$3,000 training credit
- Integration into SEI's social media plan – 6 posts over 3 years
- Press release with partnership announcement
- Recognition on SEI's website for 3 years
- Logo recognition at major solar conferences for 3 years

Watt Sponsor

\$10,000 by 2022 • \$3,333/year

Sponsor Benefits:

- Small Sponsorship Plaque recognition at SEI Water Center for 3 years
- \$1,000 training credit
- Integration into SEI's social media plan – 3 posts over 3 years
- Press release with partnership announcement
- Logo recognition at major solar conferences for 3 years

INDUSTRY SPONSORSHIP	TRANSFORMATIVE LEADERS			SPONSORS	
	Terawatt	Gigawatt	Megawatt	Kilowatt	Watt
	\$500,000 \$166,667/year	\$250,000 \$83,333/year	\$100,000 \$33,333/year	\$30,000 \$10,000/year	\$10,000 \$3,333/year
Presenting Sponsor on Paonia Campus	Exclusive Sponsor @ Student Classroom	2 Sponsors @ Student Lounge	6 Sponsors @ Equipment Center	Sponsor Plaque, Large @ Water Center	Sponsor Plaque, Small @ Water Center
Co-Host Educational Webinar	3	2	1	–	–
Ad in SEI Student Notebooks	Full Page	Half Page	–	–	–
Social Media Posts	30	21	15	6	3
Training Credit	\$50,000	\$25,000	\$10,000	\$3,000	\$1,000
Partnership Announcement Press Release	X	X	X	X	X
Website Recognition	X	X	X	X	X
Conference Recognition	X	X	X	X	X
Level of Logo Placement	Top	Second	Third	Fourth	Fifth

Partnerships and Support

CHECK OUT OUR INDUSTRY PARTNERS AND SUPPORTERS
IN SEI'S INDUSTRY-LEADING LAB YARD:





SEI Professional Services

Engineering a World Powered by Solar Energy

LEADERS IN THE PV INDUSTRY

OUR MISSION



SEI Professional Services (SEIPS) provides the foremost technical expertise in solar PV and energy storage to empower people, grow businesses, ensure successful projects, and influence the global industry through implementation of best practices and quality engineering.

OUR ADVANTAGE



A PV system, large or small, is a long term investment. SEIPS provides world-class services no matter the scope or complexity of your project. We stay a step ahead of the rapidly changing industry because our team is comprised of solar professionals who are also educating our industry's workforce.

THE TEAM



SEIPS is comprised of a core team of highly skilled PV system designers, engineers, and NABCEP Certified PV Installation Professionals™, in addition to a world-wide network of experienced industry professionals.

- Over 500 years of combined experience in the PV industry
- Experts in PV systems from residential to utility-scale, including energy storage

DESIGN AND ENGINEERING SERVICES

OUR SERVICES

SEI Professional Services provides electrical, structural, and civil engineering. We take great pride in our detailed approach to ensure quality design services. We use a unique process of team-based design, and internal and external review to ensure a quality, vetted product for our clients. This integrated approach provides you with a comprehensive set of construction plans and installation specifications, the quality of which is rarely matched in the industry.

CONSTRUCTION PLAN SETS

- Full construction documents for residential to utility-scale PV systems
- Partial – working together with your team to provide specific pieces of the overall design
- Production estimates using PVsyst, Helioscope, Homer, and other software

ELECTRICAL ENGINEERING

- Photovoltaic systems
- Utility interconnection
- Medium voltage design
- Energy storage systems

CIVIL ENGINEERING

- Project development - base map preparation/creation
- Access and zoning permits
- Geotechnical analysis and reporting
- Erosion control plans

STRUCTURAL ENGINEERING

- Equipment pad design
- Racking system design
- PV system capacity analysis of existing structures

INDEPENDENT ENGINEER (IE) SERVICES

- Quality assessment and quality control (QA/QC)
- Design reviews

WE HAVE DESIGNED OVER 200 MW OF SOLAR PV AND THIS NUMBER IS GROWING FAST!

Licensed Professional Engineers available in most states. Todos nuestros servicios se ofrecen también en español.
SEI Engineering LLC does business as SEI Professional Services and provides services under both entity names.

CONSULTING AND FIELD SERVICES

OUR SERVICES

SEIPS has the expertise and the versatility to tailor our services to meet the needs of your project. From project planning to quality assurance – on the project site or consulting remotely – the SEIPS team provides leading-edge knowledge of equipment, codes and standards, and best practices to ensure a safe and successful PV installation. A consulting discount is available for SEI alumni (discounted rate for up to 10 hours).



TECHNICAL ANALYSIS

- Feasibility – analysis of key factors for the success of your prospective project
- Standards – documentation and procedures to improve your in-house processes, or to use as standards for your partners
- Operations and Maintenance planning-for long-term performance of your PV system

ON SITE QA/QC

- Inspections - verify installation progress and final completion to ensure quality
- Performance Verification – testing and analysis to validate predicted, measured and expected energy production (may also be performed remotely)

