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Certificates: Solar Energy Systems Design, Estimation,
 and Sales
 Solar Energy Technology



<http://www.arc.losrios.edu/~electron>

Solar Energy Systems Design, Estimation, and Sales Certificate

The Solar Energy Systems Design, Estimation, and Sales certificate provides training in all aspects of solar photovoltaic (PV) system design, cost estimation, sales, and installation. It also includes training in oral presentations and management skills. The courses included in the certificate also qualify students to take the North American Board of Certified Energy Practitioners (NABCEP) PV Entry Level Certificate of Knowledge Exam.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- describe the components in a complete grid tie photovoltaic system.
- construct solar photovoltaic battery charging systems.
- analyze test equipment data to determine the location of the “sweet spot” on a solar photovoltaic panel’s Current–Voltage (IV) curves.
- identify tools and test equipment necessary for solar photovoltaic panel installations.
- identify different sizes of wire according to American Wire Gauge (AWG) tables.
- describe the advantages of obtaining the NABCEP Entry Level Certificate of Knowledge Certificate.
- construct a simulated roof system using industry standard building materials.
- calculate the amount of yearly solar radiance in relationship to shading using the Solmetrics SunEye predictor and software.
- inspect and repair malfunctioning components in a functioning grid tie solar photovoltaic system.
- estimate the yearly power output (Wh/year) for a solar photovoltaic system using both the SunEye and the Pathfinder sun angle and shade predictor.
- identify typical locations of electrical/mechanical failures in PV systems.
- maximize communication effectiveness by specifying, planning for, and adapting to the specific audience.
- identify and analyze factors that contribute to effective design, development, and delivery of presentations.
- relate the communication process to public speaking situations.
- assess the ways to start a business and which form of business organization should be used. Describe the financing process and how to access capital.
- explain the importance of a business plan, a financial plan, and a marketing plan. Apply principles of management and marketing relevant to the small business.
- evaluate financial reports.
- analyze the impact of legal requirements and government regulations as related to the operation of the small business.

Career Opportunities

This certificate prepares students for entry level employment in a wide variety of positions in the photovoltaic industry. It is also valuable for people working in the PV industry to upgrade their skills to include the newest advancements in solar technology. Students also meet the requirements to take the North American Board of Certified Energy Practitioners (NABCEP) PV Entry Level Certificate of Knowledge Exam. Career opportunities include PV system designers, PV systems outside sales, PV equipment and associated component sales representatives, and a variety of other emerging careers in this field.

Requirements for Certificate		24 Units
ET 302	Principles of Electricity and Electronics.....	4
ENERGY 140	Electrical Applications for Solar Installers	4
ENERGY 141	Electrical & Mechanical Applications for Solar Installers	4
ENERGY 142	NABCEP (North American Board of Certified Energy Practitioners) Entry Level Test Review	2
ENERGY 143	Solar Photovoltaic Systems Design, Installation, and Troubleshooting	4
BUS 350	Small Business Management/Entrepreneurship	3
SPEECH 301	Public Speaking.....	3

Solar Energy Technology Certificate

The Solar Energy Technology certificate provides training in all aspects of Solar Photovoltaic (PV) System design, installation, troubleshooting and repair. The courses included in the certificate also qualify students to take the North American Board of Certified Energy Practitioners (NABCEP) PV Entry Level Certificate of Knowledge Exam.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- describe the components in a complete grid tie photovoltaic system.
- construct solar photovoltaic battery charging systems.
- analyze test equipment data to determine the location of the “sweet spot” on a solar photovoltaic panel’s Current–Voltage (IV) curves.
- identify tools and test equipment necessary for solar photovoltaic panel installations.
- identify different sizes of wire according to American Wire Gauge (AWG) tables.
- analyze and describe the advantages of obtaining the NABCEP Entry Level Certificate of Knowledge Certificate.
- construct a simulated roof system using industry standard building materials.
- calculate the amount of yearly solar radiance in relationship to shading using the Solmetrics SunEye predictor and software.

- inspect and repair malfunctioning components in a functioning grid tie solar photovoltaic system.
- assess safety hazards in respect to fire, shock, and falls when installing or repairing photovoltaic systems.
- estimate the yearly power output (Wh/year) for a solar photovoltaic system using both the SunEye and the Pathfinder sun angle and shade predictor.
- identify typical locations of electrical/mechanical failures in PV systems
- calculate the correct gauge wire and number of wires in a metal raceway according to National Electrical Code standards
- calculate the battery Amperage required for a stand alone PV system

Career Opportunities

This certificate prepares the student for entry level employment in a wide variety of positions in the Photovoltaic industry. It is also valuable for people working in the PV industry to upgrade their skills to include the newest advancements in solar technology. Students also meet the requirements to take the North American Board of Certified Energy Practitioners (NABCEP) PV Entry Level Certificate of Knowledge Exam. Career opportunities include PV installers, PV service technicians, and other emerging careers in this field.

Requirements for Certificate		18 Units
ET 302	Principles of Electricity and Electronics	4
ENERGY 140	Electrical Applications for Solar Installers	4
ENERGY 141	Electrical & Mechanical Applications for Solar Installers	4
ENERGY 142	NABCEP (North American Board of Certified Energy Practitioners) Entry Level Test Review	2
ENERGY 143	Solar Photovoltaic Systems Design, Installation, and Troubleshooting	4

ENERGY 140 Electrical Applications for Solar Installers 4 Units

Prerequisite: ET 302 with a grade of "C" or better
Hours: 54 hours LEC; 54 hours LAB

This is an introductory course in Solar Photovoltaic (PV) energy. It covers how solar photovoltaic energy works and how to assess if PV is feasible in a variety of situations. Topics include calculating and measuring PV power outputs for different conditions, using software tools and hardware for calculating and sizing PV systems, and measuring and analyzing shading conditions. Additionally, it addresses how to install and connect necessary components. This is the first course in a series leading to the solar photovoltaic energy installers certification. Field trips are required.

ENERGY 141 Electrical & Mechanical Applications for Solar Installers 4 Units

Prerequisite: ENERGY 140 or 299 with a grade of "C" or better
Hours: 54 hours LEC; 54 hours LAB

This is an advanced course in Solar Photovoltaic (PV) energy. Topics include using hardware and software tools for shading and correctly orientating solar panels, the effect PV panel orientation has on system power output and efficiency, what effect optimum PV panel loading has on power produced, and how to perform load analysis on a specific residence. Additionally, it covers various manufacturers' software to calculate PV panel string sizing for optimum efficiency when working with grid tie inverters. National Electrical Code (NEC) and fire code wire sizing, fusing, and other safety instructions and procedures are stressed. The successful completion of this course and ENERGY 142 qualify students to take the NABCEP (North American Certified Energy Practitioner) certified solar photovoltaic installers and service technicians entry level certificate of knowledge of PV systems test. Field trips are required. This course may be taken two times for credit using different test equipment.

ENERGY 142 NABCEP (North American Board of Certified Energy Practitioners) Entry Level Test Review 2 Units

Prerequisite: ENERGY 140 with a grade of "C" or better
Corequisite: ENERGY 141
Hours: 36 hours LEC

This advanced course in solar photovoltaic (PV) energy offers preparation for the North American Board of Certified Energy Practitioners (NABCEP) PV Entry Level Certificate of Knowledge Exam. Topics include hardware and software tools used for determining percent of shade and orienting solar panels, the effect of PV panel orientation on system power and efficiency, and the load analysis. Additionally, it covers calculating PV panel string sizing when working with grid tie inverters as related to the NABCEP test. National Electrical Code (NEC) and fire code wire sizing, fusing, and other safety instructions and procedures are reviewed. The successful completion of this course and ENERGY 141 qualifies students to take the NABCEP certified solar photovoltaic installers and service technicians entry level certificate of knowledge of PV systems test. Field trips are required. This course may be taken two times for credit using different software.

ENERGY 143 Solar Photovoltaic Systems Design, Installation, and Troubleshooting **4 Units**

Prerequisite: ENERGY 141 and 142 with grades of "C" or better

Hours: 54 hours LEC; 54 hours LAB

This advanced course in solar photovoltaic (PV) energy offers the opportunity for hands-on experience designing, installing, and troubleshooting grid-tie and stand alone PV systems. Topics include hardware and software tools used in the solar PV industry, blueprint reading, calculating component size and capacity, and personal safety. Additionally, it covers calculating PV panel string sizing when working with grid tie inverters and battery sizing when designing stand alone PV systems. National Electrical Code (NEC) and fire code wire sizing, fusing, and other safety instructions and procedures are reviewed. Field trips are required. This course may be taken two times for credit using different hardware.

ENERGY 148 NABCEP (North American Board of Certified Energy Practitioners) Review for Electricians **3 Units**

Enrollment Limitation: NABCEP requires students to be a State of California licensed electrician

Hours: 54 hours LEC

This course in solar photovoltaic (PV) energy offers preparation for the North American Board of Certified Energy Practitioners (NABCEP) PV Entry Level Certificate of Knowledge Exam for state of California certified electricians. Topics include hardware and software tools, shade and orienting solar panels, the effect of PV panel orientation on system power and efficiency, and load analysis. Additionally, it covers calculating PV panel string sizing when working with grid tie inverters as related to the NABCEP test. National Electrical Code (NEC) and fire code wire sizing, fusing, and other safety instructions and procedures are reviewed. The successful completion of this course qualifies students to take the NABCEP Certified Solar Photovoltaic Installers and Service Technicians Entry Level Certificate Of Knowledge Of PV Systems Exam. Field trips are required. This course may be taken two times for credit using different software.

ENERGY 303 Energy and Sustainability **3 Units**

Same As: ET 303 and NATR 303

General Education: AA/AS Area IV

Course Transferable to CSU

Hours: 54 hours LEC

Fundamentals of energy and its impact on society and the environment are covered in this course. The mechanics, advantages and disadvantages of current and future renewable, green and nonrenewable energy sources are investigated. Residential energy audits are covered. Field trips are required. This course is not open to students who have completed ET 303 or NATR 303.