ENVI F255: Climate Change and Alaska

3 Credits

Course Syllabus
UAF Bristol Bay Campus - ENVI

Term:	Summer 2023
Course Title:	SEI Solar Electric Installers Training
Dept. & Num:	ENVI F250
Credits:	2
Prerequisites:	None
Dates/Days/Times:	Friday May 8, 8 am – 5:30 pm
	Friday May 15, 8 am – 5:30 pm
Location:	Dillingham
Course Type:	FTF

Instructor:	Eric S. Goddard
Position:	Assistant Professor of Sustainable Energy and Environmental Studies
Phone:	907-843-2233
Fax:	NA
Email:	esgoddard01@alaska.edu
Hours:	By Appointment
Available:	By Appointment

Prerequisites

PVOL101: SOLAR TRAINING – SOLAR ELECTRIC DESIGN AND INSTALLATION (GRID-DIRECT) – ONLINE

Required to be completed by students from the Feb. 20 – April 2, 2023 class enrolled in ENVI F150 – SEI Solar Electric Design.

Course description

This is a practical installation training designed for training instructors to teach SEI PV 101: Solar Electric Design for residential and light commercial purposes. Topics covered include electrical: code, science, equipment, safety and logistic requirements for successful installation of a grid-tied Solar Array with battery based mini labs.

In-depth Course description

Through a formalized course set of Solar Energy International (SEI) Curriculum (https://www.solarenergy.org/sei-solar-professionals-certificate-program/#residential). The SEI courses covered will be PV 101 with a specially integrated portion of PV 303 (DC Battery Lab). Details for the course are:

- 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.

This training will be structured around the Solar PV array installed on the Bristol Bay Campus. Students will be required to work with electricity, utilize hand tools, work from heights (roof, scaffold, scissor lift, bucket truck) and could be necessary to lift items up to 50 lbs. Safety will be paramount and will be addressed as part of the course concerning these factors, including utilization and proper set-up of fall arrest equipment. It is important that student bring clothing and footwear appropriate for this type of setting including any Personal Protective Equipment that they may have (soft rubber shoes/boots, work gloves, safety glasses, hard hat). Hard hat, safety glasses, and work gloves will be provided by the BBC otherwise as part of the class but please bring ones you are comfortable in if you have them. Tools also will be provided but if a student has anything special that applies to this line of work, please feel free to bring it along.

Representative Course Readings/Materials

All materials will be provided by the instructor in either electronic or hardcopy format.

Course Texts:

1. SEI Solar PV Curriculum Handbook ©
    a. Provided upon arrival to class.

Supplemental Course Readings/Materials

1. Other relevant literature and resources provided as needed and subject to change. All web links, photo rights, and literature otherwise are cited or referenced on corresponding lecture slides.
2. Website link to class registration, housing, and further details: https://uaf.edu/bbc/academics/sustainable-energy/solarprofessionalstraining.php

Technology requirements

Zoom is an open source conferencing application that can easily be used for instructor meetings or class sessions (*Canvas pending*). It should be accessed in advance prior to beginning your first session. This will speed up any connection issues and identify compatibility issues prior to the first session. (https://www.alaska.edu/virtual-campus/zoom/)

Google Drive
The instructor will share relevant Google Drives with students and control permissions and access to folders. Please review the academic integrity section of this syllabus regarding items submitted to Google Drive. Reading assignments and other materials may also be accessed through this format as necessary.

Phone Access and Conferencing will be necessary in the event that Zoom or Blackboard utilize too much bandwidth or data requirements to make them feasible for your learning experience. The phone conference number and dial in are as follows:

- **Toll-free dial-in number (U.S. and Canada):**
  - (866) 832-7806
- **Participant conference code:**
  - 1844818

Course Goals

The goals of this course are to provide students with a foundation of practical skills and knowledge concerning the installation of Solar Electric Systems under the design of SEI curriculum.

Student Learning Outcomes and Objectives

Upon successful completion of this course, students will be expected to:
PV101: Students who complete PV101 will be able to:

- Describe global and regional PV demand and growth trends
- Examine solar industry employment trends and options
- Identify and describe basic functions of different components of PV systems
- Introduce the features and applications of the following PV system configurations: PV-direct, stand-alone, grid-direct, multimode
- Diagram systems to understand component interaction and power flow
- Define the two types of electrical current (AC and DC) and explain their differences
- Explain the relationship between: volts, amps, amp-hours, watts, watt-hours, and kilowatt-hours; perform power and energy calculations
- Describe typical electrical service voltages and equipment
- Examine power, energy, and demand / production curves

- Define utility bill terminology
- Describe PV metering options
- Compare incentive mechanisms for renewable energy installations
- Describe the differences among various PV cell technologies
- Identify key components of a PV module and choose important criteria from module specification sheets
- Locate important points on the I-V curve
- Apply different temperature and irradiance measurements to voltage and current values
- Explain the purpose and basic functioning of bypass diodes
- Identify meters used with PV systems and key points of meter use and safety
- List common functions of digital multimeters (DMM) and clamp-on ammeters
- Describe basic procedures for testing an operating PV system
- Define and list characteristics of series and parallel circuits, and review the application of these connections to ensure system compatibility
- Determine azimuth and altitude angle of the sun using a sun chart
- Define factors that impact the amount of peak sun hours reaching the array
- Apply shading losses to estimated AC energy production
- Identify tilt angle and orientation that provides maximum energy production
- Pre-qualify a customer
- Explain how remote site assessment tools are used
- Identify factors limiting system size
- 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
- Assess PV array layout options
- Identify and define the function of the following on a three-line diagram of a grid-direct PV system: equipment grounding & conductors, ungrounded conductors, functionally grounded conductors, grounding electrode, grounding electrode conductor, electrical system grounding
- Define the primary function of an inverter, and identify the important information used to specify a grid-direct inverter
- Identify the different types of inverter technologies and list their advantages and disadvantages
- Describe some installation tips and techniques for the different types of power electronics
- Calculate PV array size using the online PVWatts tool
- Apply appropriate system loss factors
- Create charts for your location to aid in sizing estimates
- Describe why temperature is an important system design consideration

- Describe DC-to-AC power ratio and how it applies to system design; when to use a higher or lower power ratio
- Describe criteria for different power electronics options in PV systems
- Determine the correct wiring configuration of PV modules and power electronics for a given application
- Identify and describe characteristics of conductor materials and insulations
- Determine color coding of conductors based on wire type and circuit characteristics
- Identify terminology for the various circuits in PV systems
- Determine maximum current for PV system circuits
- Identify and describe considerations for selecting conductors to meet ampacity and voltage drop requirements
- Explain the purpose and correct placement of disconnects and overcurrent protection
- Perform basic overcurrent device sizing for DC and AC PV system circuits
- Identify potential jobsite hazards and opportunities for additional safety training
- Determine proper Personal Protective Equipment (PPE) for PV installation and commissioning tasks
- Describe lockout / tagout procedures
- List 5 basic commissioning tests to be completed after a system is installed

Instructional Methods

The primary instructional method will be lecture through and practical hands-on activities and labs. Classes also will include small group projects and discussions. Reading assignments will require comprehension and ability to write review papers for credit. Be prepared for pop quizzes and exams based on lectures, reading, guest speakers, video media or any other form of teaching presentation.

Explanation of Student Effort

"A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than: 1) one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester, or 2) at least an equivalent amount of work for other academic activities as established by the institute, including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours." (https://www.uaf.edu/uafgov/faculty-senate/curriculum/Academic%20Course%20and%20Degree%20Procedures%20Manual%202020.pdf)

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Course Calendar

Included Separately: See Agenda and Schedule

Course Grading Scale:

All grades use the plus (+) and minus (-) letter grade system and determined on an absolute score (with no curve) according to the following:

- A= 90-100 percent: outstanding work, mastery of topic
- B = 80-89 percent: above average work, all assignments completed
- C = 70-79 percent: average, all assignments completed, satisfactory
- D = 60-69 percent: pass, some unsatisfactory or missing work
- F = less than 60 percent: failure to meet requirements of course

Evaluation and Grading

- 100% - SEI curriculum as assigned. See Agenda.
- Attendance and participation are mandatory. You cannot pass this class if you do not attend.
- Late Policy: Any homework assignment turned in after the due date may be deducted by 10% per day. There will be no makeup projects or assignments unless approved by the instructor.

Course Policies

1.) **Classroom Rules**

- Students are expected to comply with the UAF Student Code of Conduct: https://uaf.edu/deanofstudents/student-code-of-conduct/
- Cellphones are only to be used if necessary. Please do not allow them to distract you or other classmates during class. Do not take them out during class unless asked for instructional purposes or emergency
- Be on time. Late entrances disrupt others.
- Please respect the rights of others to learn. Behaviors that distract attention from lecture or class activities will not be tolerated. Conduct that unreasonably interferes with the learning environment or that violates the rights of others is prohibited by the standards and guidelines collectively described as the UA Student Code of Conduct.
- Do not share the course link(s) with anyone outside of the class.
- If this course is in a virtual meeting format, please do not allow unnecessary distractions from home residents, pets, etc. during sessions.

2.) **Attendance, Tardiness, Class Participation, Make-up Exams**

Regular attendance is necessary for success at the collegiate level. You are expected to actively participate in all classroom sessions. Make sure that you are prompt and that you stay for the scheduled class time. Experience has shown that due to the time constraints of this course your grade will be jeopardized if you are absent from class. Excessive tardiness or absence will not be tolerated and will reflect accordingly on your final grade.

3.) **Plagiarism and Academic Integrity**

Academic dishonesty applies to examinations, assignments, laboratory reports, fieldwork, practicums, creative projects, or other academic activities. Examples include, but are not limited to:

a) presenting as their own the ideas or works of others without proper citation of sources;
b) utilizing devices not authorized by the faculty member;
c) using sources (including but not limited to text, images, computer code, and audio/video files) not authorized by the faculty member;
d) providing assistance without the faculty member's permission to another student, or receiving assistance not authorized by the faculty member from anyone (with or without their knowledge);
e) submitting work done for academic credit in previous classes, without the knowledge and advance permission of the current faculty member;
f) acting as a substitute or utilizing a substitute;
g) deceiving faculty members or other representatives of the university to affect a grade or to gain admission to a program or course;
h) fabricating or misrepresenting data;
i) possessing, buying, selling, obtaining, or using a copy of any material intended to be used as an instrument of assessment in advance of its administration;
j) altering grade records of their own or another student's work;
k) offering a monetary payment or other remuneration in exchange for a grade; or
l) violating the ethical guidelines or professional standards of a given program.

For more, see Students Rights and Responsibilities.

4.) **Extended Absence Policy**

Extended absences are defined as missed classes or course work by students beyond what is permissible by the instructor's written course policies. Students may need to miss class and/or course work for a variety of reasons, including, but not limited to:

- bereavement
- personal illness or injury
- serious illness of a friend, family member or loved one
- military obligations

- jury service
- other emergency or obligatory situations

For more information, go to the student handbook or the Center for Students Rights and Responsibilities.

5.) **UAF Incomplete Grade Policy:**

Your instructor follows the University of Alaska Fairbanks Incomplete Grade Policy:

> "The letter "I" (Incomplete) is a temporary grade used to indicate that the student has satisfactorily completed (C- or better) the majority of work in a course but for personal reasons beyond the student's control, such as sickness, has not been able to complete the course during the regular semester. Negligence or indifference are not acceptable reasons for an "I" grade."

For more information, see the UAF regulations regarding grades.

COVID-19 statement: Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website: https://sites.google.com/alaska.edu/coronavirus/uaf?authuser=0
Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Student protections statement: UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/.

Disability services statement: I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities.

ASUAF advocacy statement: The Associated Students of the University of Alaska Fairbanks, the student government of UAF, offers advocacy services to students who feel they are facing issues with staff, faculty, and/or other students specifically if these issues are hindering the ability of the student to succeed in their academics or go about their lives at the university. Students who wish to utilize these services can contact the Student Advocacy Director by visiting the ASUAF office or emailing asuaf.office@alaska.edu.

Student Academic Support:

- Speaking Center (907-474-5470, uaf-speakingcenter@alaska.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor)

- UAF Math Services, uafmathstatlab@gmail.com, Chapman Building (for math fee paying students only)
- Developmental Math Lab, Gruening 406
- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, https://www.ctc.uaf.edu/student-services/student-success-center/)
- For more information and resources, please see the Academic Advising Resource List (https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf)

Student Resources:

- Disability Services (907-474-5655, uaf-disability-services@alaska.edu, Whitaker 208)
- Student Health & Counseling **[6 free counseling sessions]** (907-474-7043, https://www.uaf.edu/chc/appointments.php, Whitaker 203)
- Center for Student Rights and Responsibilities (907-474-7317, uaf-studentrights@alaska.edu, Eielson 110)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, asuaf.office@alaska.edu, Wood Center 119)

Nondiscrimination statement: The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discriminate on the basis of race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marital status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender identity, political affiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint procedures are included on UA's statement of nondiscrimination available at www.alaska.edu/nondiscrimination. For more information, contact:
UAF Department of Equity and Compliance
1692 Tok Lane, 3rd floor, Constitution Hall, Fairbanks, AK 99775
907-474-7300
uaf-deo@alaska.edu

Additional syllabi statement for courses including off-campus programs and research activities:

University Sponsored Off-Campus Programs and Research Activities

We want you to know that:

1. UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination.
2. Incidents can be reported to your university's Equity and Compliance office (listed below) or online reporting portal. University of Alaska takes immediate, effective, and appropriate action to respond to reported acts of discrimination and harassment.
3. There are supportive measures available to individuals that may have experienced discrimination.

4. University of Alaska's Board of Regents' Policy & University Regulations (UA BoR P&R) 01.02.020 Nondiscrimination and 01.04 Sex and Gender-Based Discrimination Under Title IX, go to: http://alaska.edu/bor/policy-regulations/.
5. UA BoR P&R apply at all university owned or operated sites, university sanctioned events, clinical sites and during all academic or research related travel that are university sponsored.

For further information on your rights and resources click here.