

Course Outline

Energy, Environment, and Utilities

REVISED: August/2017

Job Title
PV Technician

72-65-70

Career Pathway:
Energy and Power Technology

Photovoltaics/3

Industry Sector:
Energy, Environment, and
Utilities

Credits: 15

Hours: 180

O*NET-SOC CODE:
47-2231.00

Course Description:

This competency-based course is the last in a sequence of three designed for alternative and renewable energy technology. It provides students with project-based experiences in photovoltaic (PV) installation. Technical instruction includes an introduction and reviews of workplace safety procedures, resource management, and trade mathematics as well as basic entrepreneurship. Emphasis is placed on the electrical design adaptations for PV systems, installation of subsystems and components, maintenance procedures and troubleshooting techniques for PV system malfunctions, and exploration of local, national, and global markets for PV applications. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

CBEDS Title:
Energy and Environmental
Technology

Prerequisites:

Enrollment requires the successful completion of the Photovoltaics/2 (72-65-60) course.

CBEDS No.:
5691

NOTE: For Perkins purposes this course has been designated as a **capstone** course.

Tasks designated by an asterisk (*) meet the North American Board of Certified Energy Practitioners (NABCEP) 10 Learning Objectives for the PV Entry Level exam. The competencies of this course are aligned with the knowledge requirements set by the NABCEP's Entry Level 10 Learning Objectives.

This course cannot be repeated once a student receives a Certificate of Completion.



COURSE OUTLINE COMPETENCY-BASED COMPONENTS

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

COURSE OUTLINE COMPONENTS

LOCATION

GOALS AND PURPOSES

Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

PERFORMANCE OBJECTIVES OR COMPETENCIES

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Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

COURSE OUTLINE COMPETENCY-BASED COMPONENTS
(continued)

COURSE OUTLINE COMPONENTS

LOCATION

INSTRUCTIONAL STRATEGIES

p. 15

Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.

Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.

UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT

Cover

The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.

pp. 7-13

Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.

EVALUATION PROCEDURES

p. 15

The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.

Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.

REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT

Cover

After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.

ACKNOWLEDGMENTS

Thanks to PAUL PIDOUX and MARCELA BAKER for developing and editing this curriculum. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

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CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS

Energy, Environment and Utilities Industry Sector

Knowledge and Performance Anchor Standards

1.0 Academics

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Energy, Environment, and Utilities academic alignment matrix for identification of standards.

2.0 Communications

Acquire, and accurately use Energy, Environment, and Utilities sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Energy, Environment, and Utilities sector workplace environment.

5.0 Problem Solving and Critical Thinking

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Energy, Environment, and Utilities sector using critical and creative thinking; logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Energy, Environment, and Utilities sector workplace environment.

7.0 Responsibility and Flexibility

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Energy, Environment, and Utilities sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization.

10.0 Technical Knowledge and Skills

Apply essential technical knowledge and skills common to all pathways in the Energy, Environment, and Utilities sector.

11.0 Demonstration and Application

Demonstrate and apply the knowledge and skills contained in the Energy, Environment, and Utilities anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

Energy, Environment, and Utilities Sector Pathway Standards

B. Energy and Power Technology Pathway

The Energy and Power Technology pathway provides learning opportunities for students interested in preparing for careers in the energy and power industries.

Sample occupations associated with this pathway:

- ◆ Energy Efficiency Evaluation Specialist
- ◆ Energy Engineer
- ◆ Energy Generation/Power Distribution, Maintenance, Inspection, and Repair Technicians
- ◆ Energy/Building Retrofit Specialist
- ◆ Plant/Field Weatherization Installer

- B1.0 Explore the basic conventional and emerging principles and concepts of the energy industry, including energy production, energy transmission, and alternative energy technologies.
- B2.0 Identify various conventional electric power generation fuel sources and the cost and efficiency issues associated with each.
- B3.0 Investigate emerging and alternative electric power generation technologies and fuel sources.
- B4.0 Understand nonnuclear power generation plant operations (coal, oil, natural gas, solar, wind, geothermal power, hydroelectric, or biofuel).
- B5.0 Understand and apply basic knowledge and skills necessary for nuclear power generation and nuclear power plant personnel.
- B6.0 Research methods of energy procurement, transmission, distribution, and storage.
- B7.0 Understand the interrelationships among components of systems.

CBE
Competency-Based Education

COMPETENCY-BASED COMPONENTS
for the Photovoltaics /3 Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. INTRODUCTION AND SAFETY</p> <p>Review and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations.</p>	<ol style="list-style-type: none"> 1. Review the scope and purpose of the course. 2. Review the overall course content as a part of the Linked Learning Initiative. 3. Review classroom policies and procedures. 4. Review the different occupations in the Energy and Utilities Industry Sector which have an impact on the role of photovoltaic installers. 5. Review the opportunities available for promoting gender equity and the representation of non-traditional populations in computer technology. 6. Review the impact of Environmental Protection Agency (EPA) legislation on Engineering and Design Industry Sector practices in protecting and preserving the environment.* 7. Review and demonstrate the procedures for contacting proper authorities for the removal of hazardous materials based on the EPA standards.* 8. Review the National Electrical Code (NEC) and its role in safeguarding the work conditions of photovoltaic installers/craftsmen.* 9. Review and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the photovoltaic field.* 10. Review the role of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ in increasing the use of clean and renewable technology in California.* 11. Review the City of Los Angeles Building and Safety Codes and their applications to the photovoltaic field.* 12. Review the provisions of the California Title 24 Energy Efficiency Standards (a.k.a. 2008 California Green building Standards Code) as they relate to the Energy and Utilities Industry Sector.* 13. Review classroom and workplace first aid and emergency procedures based on the American Red Cross (ARC) standards. 14. Review the California Occupational Safety and Health Administration (Cal/OSHA) and its electrical safety standards governing photovoltaic installers/craftsmen.* 15. Review how each of the following insures a safe workplace: <ol style="list-style-type: none"> a. employees' rights as they apply to job safety b. employees' obligations as they apply to safety c. employees' training on how to accurately test high voltages* 	<p>Career Ready Practice: 1, 2, 3, 5, 6, 7, 9, 11, 12</p> <p>CTE Anchor: Career Planning and Management: 3.4 Health and Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.11, 6.12, 6.15 Ethics and Legal Responsibility: 8.2</p> <p>CTE Pathway: B1.7</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(4 hours)	<ul style="list-style-type: none"> d. employees' training on how to identify potential electrical/non-electrical hazards* e. employees' training on how to use safety equipment* 16. Pass the safety exam with 100% accuracy.	
B. RESOURCE MANAGEMENT REVIEW Review resource management principles and techniques applied in the photovoltaic field. (1 hour)	<ol style="list-style-type: none"> 1. Review the following definitions: <ul style="list-style-type: none"> a. resources b. management c. sustainability 2. Review the management of the following resources in the photovoltaic field: <ul style="list-style-type: none"> a. time b. materials (including sustainable and green) c. personnel 3. Review specific examples of effective management of the following resources in the photovoltaic field: <ul style="list-style-type: none"> a. time b. materials (including sustainable and green) c. personnel 4. Review the benefits of effective resource management in the photovoltaic field: <ul style="list-style-type: none"> a. profitability b. sustainability c. company growth 5. Review the economic benefits and liabilities of managing resources in an environmentally responsible way. 	Career Ready Practice: 1, 2, 3, 5, 7, 8, 9 CTE Anchor: Career Planning and Management: 3.5 Responsibility and Flexibility: 7.1, 7.2, 7.4, 7.6 CTE Pathway: B2.4
C. TRADE MATHEMATICS REVIEW Review and apply the mathematical requirements in the photovoltaic field.	<ol style="list-style-type: none"> 1. Review the practical applications of math in the photovoltaic field. 2. Review and demonstrate problem-solving techniques involving whole number problems using arithmetic operations (addition, subtraction, multiplication, and division). 3. Review and demonstrate problem-solving techniques involving various fraction problems using arithmetic operations. 4. Review and demonstrate problem-solving techniques involving various decimal problems using addition, subtraction, multiplication, and division. 5. Review and demonstrate techniques for changing fractions to decimals. 6. Review and demonstrate techniques for changing decimals to fractions. 7. Review the English and metric systems of measuring length. 8. Review the English and metric systems of measuring weight. 9. Review the English and metric systems of measuring volume or capacity. 10. Review and demonstrate English and metric problem-solving techniques for various measuring problems using arithmetic operations. 	Career Ready Practice: 1, 3, 5 CTE Anchor: Problem Solving and Critical Thinking: 5.1, 5.2 CTE Pathway: B2.4, B3.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)	<ol style="list-style-type: none"> 11. Review and demonstrate English and metric measuring techniques of objects by using tools common to the trade. 12. Review metric units in ascending and descending powers of ten. 13. Review the conversion of the English numbering system to metric system. 14. Review the conversion of the metric system to English numbering system. 15. Review the calculation of square roots of English numbers. 16. Review and demonstrate problem-solving techniques for geometric problems. 17. Review and demonstrate problem-solving techniques for algebraic problems. 18. Review and demonstrate problem-solving techniques using percentages. 19. Review and demonstrate techniques for reading and interpreting graphs. 20. Review and demonstrate techniques for using a calculator. 	
<p>D. ELECTRICAL DESIGN ADAPTATION</p> <p>Understand, apply, and evaluate the various PV electrical design criteria and adaptations.</p>	<ol style="list-style-type: none"> 1. Define derated ampacity. 2. Describe and demonstrate the following: <ol style="list-style-type: none"> a. determining the design currents for any part of a PV system electrical circuit* b. selecting appropriate conductor types and ratings for each electrical circuit in the system based on application* c. determining the derated ampacity of system conductors* d. selecting appropriate system conductors based on design currents* e. determining the appropriate size, ratings, and locations for all system overcurrent and disconnect devices* f. determining the appropriate size, ratings, and locations for grounding, surge suppression, and associated equipment* g. determining voltage drop for any electrical circuit based on size and length of conductors* h. verifying that the array operating voltage range is within acceptable operating limits for power conditioning equipment, including inverters and controllers* i. selecting an appropriate utility interconnection point and determining the size, ratings, and locations for overcurrent and disconnect devices* 3. Analyze and document the load demand for the following in residential, commercial, and industrial applications: <ol style="list-style-type: none"> a. PV in simple, stand-alone systems b. PV systems with battery storage c. PV with backup generator power d. PV in hybrid power systems e. PV connected to the utility grid 4. Describe and demonstrate the following: <ol style="list-style-type: none"> a. determining the series/parallel PV array arrangement based on module and inverter specifications for at least three systems 	<p>Career Ready Practice: 1, 3, 4, 5, 9, 10, 12</p> <p>CTE Anchor: Communications: 2.1, 2.5 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.1, 6.6, 6.8, 6.9, 6.11, 6.16 Ethics and Legal Responsibilities: 8.1, 8.2, 8.3 Technical Knowledge and Skills: 10.2, 10.3</p> <p>CTE Pathway: B1.4, B6.4, B7.1, B7.3, B7.4, B7.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(35 hours)	<ul style="list-style-type: none"> b. selecting the BOS components for three specific systems c. determining the voltage drop between major components of at least three systems d. selecting the correct wire size for each different array arrangement in at least three systems e. determining the proper grounding of array and equipment for at least three systems f. designing a grid-tied PV system for the following: <ul style="list-style-type: none"> i. a residence in a rural setting ii. new apartment development with 60 units iii. a three story-commercial building 	
<p>E. SUBSYSTEM AND COMPONENT INSTALLATION</p> <p>Understand and apply the installation techniques used for PV subsystems and components.</p> <p>(40 hours)</p>	<ul style="list-style-type: none"> 1. Define the following: <ul style="list-style-type: none"> a. drawing b. schematics c. impedance 2. Describe and demonstrate the following: <ul style="list-style-type: none"> a. utilizing drawings, schematics, instructions and recommended techniques in installing equipment* b. implementing all applicable personnel safety and environmental protection measures* c. visually inspecting and quick testing PV modules* d. assembling modules, panels and support structures as specified by module manufacturer or design* e. installing module array interconnect wiring* f. implementing measures to disable array during installation* g. completing final assembly, structural attachment, and weather sealing of array to the building or other support mechanism* h. installing and providing required labels on:* <ul style="list-style-type: none"> i. inverters ii. controls iii. disconnects and overcurrent devices iv. surge suppression and grounding equipment v. junction boxes vi. batteries and enclosures vii. conduit and other electrical hardware i. labeling, installing, and terminating electrical wiring* j. verifying proper electrical connections, voltages and phase/polarity relationships* 	<p>Career Ready Practice: 1, 3, 4, 5, 10</p> <p>CTE Anchor: Communications: 2.1, 2.5 Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4 Health and Safety: 6.6, 6.8, 6.9, 6.11, 6.16 Ethics and Legal Responsibilities: 8.1, 8.2, 8.3 Technical Knowledge and Skills: 10.2, 10.3</p> <p>CTE Pathway: B1.4, B6.4, B7.1, B7.3, B7.4, B7.6</p>
<p>F. SYSTEM CHECK-OUT INSPECTION</p> <p>Understand, apply, and evaluate the check-out and inspection techniques for PV systems.</p>	<ul style="list-style-type: none"> 1. Describe and demonstrate the following: <ul style="list-style-type: none"> a. visually inspecting the entire installation* b. determining and resolving deficiencies in materials or workmanship** c. checking system mechanical installation for structural integrity and weather sealing* d. checking electrical installation for:* 	<p>Career Ready Practice: 1, 3, 7, 8</p> <p>CTE Anchor: Communications: 2.1, 2.5</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(30 hours)	<ul style="list-style-type: none"> i. proper wiring practice ii. polarity iii. grounding iv. integrity of terminations e. activating system* f. verifying overall system functionality and performance* g. comparing performance with expectations* h. connecting and disconnecting the system and equipment from all sources* i. locating and verifying all the required system and equipment markings and labels* j. explaining to owner/operator all safety issues associated with system operation and maintenance* k. providing the required documentation to the system owner/operator* 	<p>Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4</p> <p>Health and Safety: 6.6, 6.8, 6.9, 6.11, 6.16</p> <p>Ethics and Legal Responsibilities: 8.1, 8.2, 8.3</p> <p>Technical Knowledge and Skills: 10.2, 10.3</p> <p>CTE Pathway: B1.4, B6.4, B7.1, B7.3, B7.4, B7.6</p>
<p>G. MAINTENANCE AND TROUBLESHOOTING</p> <p>Understand, apply, and evaluate the maintenance and troubleshooting techniques for PV systems.</p>	<ul style="list-style-type: none"> 1. Define the following: <ul style="list-style-type: none"> a. actual system power output b. expected system power output 2. Identify the following: <ul style="list-style-type: none"> a. tools and equipment needed for system performance analysis and repair* b. maintenance needs and service procedures for the following:* <ul style="list-style-type: none"> i. modules ii. arrays iii. batteries iv. power conditioning equipment v. safety systems vi. structural and weather sealing systems vii. balance-of-systems equipment 3. Describe and demonstrate the following: <ul style="list-style-type: none"> a. measuring system performance and operating parameters* b. comparing specifications with expectations* c. assessing operating condition of system and equipment * d. performing diagnostic procedures and interpreting results* e. determining performance and safety issues, and implementing corrective measures* f. verifying complete functionality and performance of system, including:* <ul style="list-style-type: none"> i. start-up ii. shut-down iii. normal operation iv. emergency/bypass operation g. compiling and maintaining record of system operation, performance, and maintenance* 	<p>Career Ready Practice: 1, 3, 4, 5, 10</p> <p>CTE Anchor: Communications: 2.1, 2.5</p> <p>Problem Solving and Critical Thinking: 5.1, 5.2, 5.3, 5.4</p> <p>Health and Safety: 6.1, 6.6, 6.8, 6.9, 6.11, 6.16</p> <p>Ethics and Legal Responsibility: 8.1, 8.2, 8.3</p> <p>Technical Knowledge and Skills: 10.2, 10.3</p> <p>CTE Pathway: B1.4, B6.4, B7.1, B7.3, B7.4, B7.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(50 hours)	<ol style="list-style-type: none"> 4. Research and document the following: <ol style="list-style-type: none"> a. troubleshooting system design problems in: <ol style="list-style-type: none"> i. PV in simple, stand-alone systems ii. PV systems with battery storage iii. PV with backup generator power iv. PV in hybrid power systems v. PV connected to the utility grid b. troubleshooting system performance problems in the following: <ol style="list-style-type: none"> i. a residence in a rural setting ii. new apartment development with 60 units iii. a three story-commercial building 	
<p>H. PV MARKETS AND APPLICATIONS</p> <p>Understand, apply, and evaluate the local, national and global markets and applications for PV systems.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> 1. Research the current economic conditions for the manufacture, distribution and installation of PV systems for the following: <ol style="list-style-type: none"> a. Local markets b. National market c. Global markets 2. Research and analyze the local, national and global demands for the following PV applications: <ol style="list-style-type: none"> a. PV in simple, stand-alone systems b. PV systems with battery storage c. PV with backup generator power d. PV in hybrid power systems e. PV connected to the utility grid 3. Design a marketing strategy to create and/or increase local, national and global demands for residential, commercial and industrial PV applications. 	<p>Career Ready Practice: 1, 2, 3, 11, 12</p> <p>CTE Anchor: Communications: 2.5, 2.6 Technology: 4.1, 4.2, 4.3, 4.6 Problem Solving and Critical Thinking: 5.3, 5.4 Responsibility and Flexibility: 7.1, 7.8 Ethics and Legal Responsibility: 8.2</p> <p>CTE Pathway: B1.1, B1.6, B2.1, B6.3</p>
<p>I. ENTREPRENEURIAL SKILLS</p> <p>Understand, apply, and evaluate the process involved in becoming an entrepreneur in the photovoltaic field.</p>	<ol style="list-style-type: none"> 1. Define entrepreneurship. 2. Identify the necessary characteristics of successful entrepreneurs. 3. Describe the contributions of entrepreneurs to the photovoltaic field. 4. Explain the purpose and components of a business plan. 5. Examine personal goals prior to starting a business. 6. Evaluate sources of monetary investment in a business opportunity. 7. Describe various licensing requirements in the photovoltaic field. 	<p>Career Ready Practice: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12</p> <p>CTE Anchor: Career Planning and Management: 3.7, 3.9</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)	8. Develop a scenario depicting the student as the photovoltaic business owner. 9. Differentiate between LEED business practices and standard business practices.	Technical Knowledge and Skills: 10.2 Demonstration and Application: 11.3, 11.4, 11.5 CTE Pathway: B1.6, B1.7

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTBOOKS

Kemp, William H. The Renewable Energy Handbook Revised Edition, 3rd edition. Aztex Press, 2009.

Schaeffer, John. Real Goods Solar Living Source Book – Special 30th Anniversary Edition. Gaiam Real Goods, 2007.

Strong, Steven J. The Solar Electric House. Sustainability Press, 1994.

Williams, Neville. Chasing the Sun. New Society Publishers, 2005.

RESOURCES

Employer Advisory Board members

CTE Model Curriculum Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/energyutilities.pdf>

Barnett, Dave and Kirk Bjornsgaard. Electrical Power Generation: A Nontechnical Guide. Pennwell Books, 2000.

International Association of Plumbing and Mechanical Officials. Uniform Solar Energy Code. International Association of Plumbing and Mechanical Officials, 2009.

Michael Casey, Douglas Hansen, and Redwood Kardon. Code Check: Electrical: An Illustrated Guide to Wiring a Safe House. 4th edition, Taunton Press, 2006.

National Fire Protection Association. National Electrical Code 2011. National Fire Protection Association, 2011.

www.americangreenjobs.net

www.ases.org

www.careers.pennenergyjobs.com

www.cleantechrecruits.com

www.irecusa.org

www.renewableenergyjobs.com

www.solarenergy.org

www.solarelectricpower.org

www.seia.org

www1.eere.energy.gov

COMPETENCY CHECKLIST

TEACHING STRATEGIES and EVALUATION

METHODS AND PROCEDURES

- A. Lecture and discussion
- B. Multimedia presentations
- C. Demonstrations and participations
- D. Individualized instruction
- E. Peer teaching
- F. Role-playing
- G. Guest speakers
- H. Field trips and field study experiences
- I. Projects

EVALUATION

SECTION A – Introduction and Safety – Pass the safety test with 100% accuracy.

SECTION B – Resource Management Review – Pass all assignments and exams on resource management review with a minimum score of 80% or higher.

SECTION C – Trade Mathematics Review – Pass all assignments and exams on trade mathematics review with a minimum score of 80% or higher.

SECTION D – Electrical Design Adaptation – Pass all assignments and exams on electrical design adaptation with a minimum score of 80% or higher.

SECTION E – Subsystem and Component Installation – Pass all assignments and exams on subsystem and component installation with a minimum score of 80% or higher.

SECTION F – System Check-Out and Inspection – Pass all assignments and exams on system check-out and inspection with a minimum score of 80% or higher.

SECTION G – Maintenance and Troubleshooting – Pass all assignments and exams on maintenance and troubleshooting with a minimum score of 80% or higher.

SECTION H – PV Markets and Applications – Pass all assignments and exams on PV markets and applications with a minimum score of 80% or higher.

SECTION I – Entrepreneurial Skills – Pass all assignments and exams on entrepreneurial skills with a minimum score of 80% or higher.

Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.
