2012 – 2013

Florida Department of Education
Curriculum Framework

Program Title: **Solar Photovoltaic System Design, Installation and Maintenance – Entry Level**
Program Type: **Career Preparatory**
Career Cluster: **Energy**

PSAV	
Program Number	X600400
CIP Number	0615050502
Grade Level	30, 31
Standard Length	600 Hours
Teacher Certification	ELECTRICAL @7G AC HEAT ME @7G BLDG MAINT @7G BLDG CONST @7G TEC CONST @7G
CTSO	SkillsUSA
SOC Codes (all applicable)	47-2231, 49-9099
Facility Code	245 - http://www.fldoe.org/edfacil/sref.asp (State Requirements for Educational Facilities)
Targeted Occupation List	http://www.labormarketinfo.com/wec/TargetOccupationList.htm
Perkins Technical Skill Attainment Inventory	http://www.fldoe.org/workforce/perkins/perkins_resources.asp
Industry Certifications	http://www.fldoe.org/workforce/fcpea/default.asp
Statewide Articulation	http://www.fldoe.org/workforce/dwdframe/artic_frame.asp
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the energy career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general

employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the energy career cluster.

The content includes but is not limited to Solar Photovoltaic (PV) System Design, Installation and Maintenance program which is to present information that will assist Florida in increasing the number and skill level of workers who are available to meet the workforce needs of Florida's current and emerging alternative energy industries.

Program Structure

This program is a planned sequence of instruction consisting of two Occupational Completion Points.

When offered at the postsecondary adult career and technical level, this program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

The following table illustrates the program structure:

OCP	Course Number	Course Title	Course Length	SOC Code
A	EEV0205	Solar Photovoltaic Design Installation and Maintenance Helper	150 Hours	49-9099
B	EEV0206	Solar Photovoltaic Design, Installation and Maintenance Technician	450 Hours	47-2231

Laboratory Activities

Laboratory activities are an integral part of this program. These activities include instruction in the use of safety procedures, tools, equipment, materials, and processes related to these occupations. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

Career and Technical Student Organization (CTSO)

SkillsUSA, Inc. is the appropriate career and technical student organization for providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Essential Skills

Essential skills identified by the Division of Career and Adult Education have been integrated into the standards and benchmarks of this program. These skills represent the general knowledge and skills considered by industry to be essential for success in careers across all career clusters. Students preparing for a career served by this program at any level should be able to demonstrate these skills in the context of this program. A complete list of Essential Skills and links to instructional resources in support of these Essential Skills are published on the CTE Essential Skills page of the FL-DOE website (http://www.fldoe.org/workforce/dwdframe/essential_skills.asp).

Basic Skills

In PSAV programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed at http://www.fldoe.org/workforce/dwdframe/rtf/basicskills-License-exempt.rtf.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's IEP or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an Individual Educational Plan (IEP) served in Exceptional Student Education or ESE) will need modifications to meet their needs. Modifications change the outcomes or what the student is

expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note postsecondary curriculum cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number (for eligible students with disabilities).

Articulation

This program has no statewide articulation agreement approved by the Articulation Coordinating Committee. However, this does not preclude the awarding of credits by any college through local agreements.

For details on statewide articulation agreements which correlate to programs and industry certifications, refer to http://www.fldoe.org/workforce/dwdframe/artic_frame.asp.

Standards

After successfully completing this program, the student will be able to perform the following:

01.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
02.0 Identify systems and their components.
03.0 Demonstrate language arts knowledge and skills.
04.0 Identify global environmental impact issues and issues specific to the industry.
05.0 Describe alternative forms of energy and the benefits of environmental awareness.
06.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
07.0 Demonstrate mathematics knowledge and skills.
08.0 Demonstrate science knowledge and skills.
09.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
10.0 Solve problems using critical thinking skills, creativity and innovation.
11.0 Explain the importance of employability and entrepreneurship skills.
12.0 Describe the importance of professional ethics and legal responsibilities.
13.0 Use information technology tools.
14.0 Identify, use and maintain the tools used in the industry.
15.0 Demonstrate personal money-management concepts, procedures, and strategies.
16.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
17.0 Adapt a PV design.
18.0 Conduct a site assessment.

19.0 Read and interpret basic blueprints, job specifications and codes.
20.0 Demonstrate a practical knowledge of basic electricity skills and electrical components.
21.0 Install PV systems.
22.0 Install operation and identification tags and labels.
23.0 Perform a system checkout.
24.0 Maintain and troubleshoot a solar PV system.
25.0 Layout and coordinate a job.
26.0 Install solar collectors.
27.0 Demonstrate knowledge of PV and electrical wiring.
28.0 Install PV and electrical wiring.
29.0 Install PV and electrical equipment and other components.

2012 – 2013

Florida Department of Education
Student Performance Standards

Program Title: **Solar Photovoltaic System Design, Installation and Maintenance – Entry Level**
PSAV Number: **X600400**

Course Number: EEV0205
Occupational Completion Point: A
Solar Photovoltaic Design Installation and Maintenance Helper – 150 Hours –
SOC Code 49-9099

01.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance--The students will be able to:

- 01.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
- 01.01 Demonstrate safe and proper use of required tools and equipment.
- 01.02 Demonstrate safe and accepted practices for personal protection.
- 01.03 Demonstrate awareness of safety hazards and how to avoid them.
- 01.04 Identify and implement appropriate codes and standards concerning installation, operation and maintenance of solar PV systems and equipment.
- 01.05 Identify and implement appropriate codes and standards concerning worker safety and public safety.
- 01.06 Identify personnel safety hazards associated with solar PV installations.
- 01.07 Identify environmental hazards associated with solar PV installations through demonstrated awareness of pertinent Material Safety Data Sheets (MSDS) and other appropriate documents.
- 01.08 Explain emergency procedures to follow in response to workplace accidents.
- 01.09 Create a disaster and/or emergency response plan. SHE 2.0

02.0 Identify systems and their components--The student will be able to:

- 02.01 Identify components specific to an active direct solar system. (For example, this would include: controller, sensors, modules, arrays and inverters. This would apply to the components relevant to each specific type of system.)
- 02.02 Identify components specific to an active indirect solar system.
- 02.03 Identify components specific to a passive direct solar system.
- 02.04 Identify components specific to a passive indirect solar system.

03.0 Demonstrate language arts knowledge and skills--The students will be able to: AF2.0

- 03.01 Locate, comprehend and evaluate key elements of oral and written information.AF2.4
- 03.02 Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary. AF2.5
- 03.03 Present information formally and informally for specific purposes and audiences.AF2.9

04.0 Identify global environmental impact issues and issues specific to the industry--The student will be able to:

04.01 Define climate change and the causes of global warming.
04.02 Discuss greenhouse gas emission and its role in global warming.
04.03 Discuss the ozone layer, the major cause for its depletion and the resulting consequences.
04.04 Define acid rain and its effect on the environment.
04.05 Discuss the negative effects of chemical pollution.
04.06 Discuss the concept of carbon footprint.
04.07 Discuss the major environmental issues specific to your industry.
04.08 Discuss local environmental concerns related to your industry.
04.09 Identify the changes in your business or industry that are considered “green”.
04.10 Identify the new “green collar” jobs that have been created in the industry.

05.0 Describe alternative forms of energy and the benefits of environmental awareness--The student will be able to:

05.01 Describe renewable and non-renewable forms of energy.
05.02 List the various alternative forms of energy to fossil fuels.
05.03 Describe the benefits and challenges of using alternative forms of energy to society and the environment.
05.04 Discuss the benefits of conserving natural resources.
05.05 Discuss the concept and the benefits of preserving biodiversity.
05.06 Describe energy efficiency.
05.07 Define biodegradable materials.
05.08 Describe the benefits of reducing, reusing and recycling materials.
05.09 Identify the incentives being offered for “going green”.

06.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas--The students will be able to:

06.01 Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace. CM1.0
06.02 Locate, organize and reference written information from various sources. CM3.0
06.03 Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences. CM5.0
06.04 Interpret verbal and nonverbal cues/behaviors that enhance communication. CM6.0
06.05 Apply active listening skills to obtain and clarify information. CM7.0
06.06 Develop and interpret tables and charts to support written and oral communications. CM8.0
06.07 Exhibit public relations skills that aid in achieving customer satisfaction. CM10.0

07.0 Demonstrate mathematics knowledge and skills--The students will be able to: AF3.0

07.01 Read and interpret measuring devices.
07.02 Demonstrate knowledge of arithmetic operations. AF3.2
07.03 Operate a calculator.
07.04 Use standard metric units related to the industry.
07.05 Convert inches to millimeters and millimeters to inches.

07.06 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
07.07 Measure size within a specified tolerance.
07.08 Add, subtract, multiply and divide using fractions, decimals, and whole numbers.
07.09 Determine the correct sales price of a job, to include sales tax for a materials list containing a minimum of six items.
07.10 Construct charts/tables/graphs using functions and data. AF3.5

08.0 Demonstrate science knowledge and skills--The students will be able to: AF4.0

08.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
08.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3
08.03 Understand chemical reaction of a battery in use.
08.04 Understand chemical reaction of a battery under charging.
08.05 Identify health related problems which may result from exposure to work related chemicals and hazardous materials, and know the proper precautions required for handling such materials.

09.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives--The students will be able to:

09.01 Employ leadership skills to accomplish organizational goals and objectives. LT1.0
09.02 Establish and maintain effective working relationships with others in order to accomplish objectives and tasks. LT3.0
09.03 Conduct and participate in meetings to accomplish work tasks. LT4.0
09.04 Employ mentoring skills to inspire and teach others. LT5.0

10.0 Solve problems using critical thinking skills, creativity and innovation--The students will be able to:

10.01 Employ critical thinking skills independently and in teams to solve problems and make decisions. PS1.0
10.02 Employ critical thinking and interpersonal skills to resolve conflicts. PS2.0
10.03 Identify and document workplace performance goals and monitor progress toward those goals. PS3.0
10.04 Conduct technical research to gather information necessary for decision-making.PS4.0

11.0 Explain the importance of employability and entrepreneurship skills--The students will be able to:

11.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
11.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
11.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
11.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
11.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
11.06 Identify and exhibit traits for retaining employment. ECD7.0
11.07 Identify opportunities and research requirements for career advancement.ECD8.0
11.08 Research the benefits of ongoing professional development. ECD9.0

11.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0
11.10 Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200)
11.11 Explain the law that describes the Material Safety Data Sheet (MSDS).

12.0 Describe the importance of professional ethics and legal responsibilities--The students will be able to:

12.01 Evaluate and justify decisions based on ethical reasoning. ELR1.0
12.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies. ELR1.1
12.03 Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace. ELR1.2
12.04 Interpret and explain written organizational policies and procedures. ELR2.0

13.0 Use information technology tools--The students will be able to:

13.01 Use Personal Information Management (PIM) applications to increase workplace efficiency. IT1.0
13.02 Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications. IT2.0
13.03 Employ computer operations applications to access, create, manage, integrate, and store information. IT3.0
13.04 Employ collaborative/groupware applications to facilitate group work. IT4.0

14.0 Identify, use and maintain the tools used in the industry--The student will be able to:

14.01 Identify and use:
a. Basic hand tools and tool accessories
b. Power tools (electric, mechanical, and pneumatic, if available)
c. Conduit, Benders, Electrical Metallic Tubing (EMT)
d. Specialized tools of the trade
14.02 Demonstrate the procedures/techniques for the selection, use, care and storage of tools and equipment.
14.03 Identify tools and equipment and the safety hazards associated with them.

15.0 Demonstrate personal money-management concepts, procedures, and strategies--The students will be able to:

15.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
15.02 Describe the effect of money management on personal and career goals. FL3.0
15.03 Develop a personal budget and financial goals. FL3.1
15.04 Complete financial instruments for making deposits and withdrawals. FL3.2
15.05 Maintain financial records. FL3.3
15.06 Read and reconcile financial statements. FL3.4
15.07 Research, compare and contrast investment opportunities.

Course Number: EEV0206
Occupational Completion Point: B
Solar Photovoltaic Design, Installation and Maintenance Technician – 450 Hours –
SOC Code 47-2231

16.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment--The students will be able to:

16.01 Describe the nature and types of business organizations. SY1.0
16.02 Explain the effect of key organizational systems on performance and quality.
16.03 List and describe quality control systems and/or practices common to the workplace. SY2.0
16.04 Explain the impact of the global economy on business organizations.

17.0 Adapt a PV design--The student will be able to:

17.01 Determine stand-alone system components' location and system layout and configuration.
17.02 Determine grid tie system components' location and system layout and configuration.
17.03 Determine PV module system components' location and system layout.
17.04 Determine tracking and non-tracking system components' location and system layout and configuration.
17.05 Apply for building permits.
17.06 Estimate time, materials, tools and labor required for installation.
17.07 Determine installation sequence to optimize use of time and materials.
17.08 Inspect all provided system components for damage prior to installation.

18.0 Conduct a site assessment--The student will be able to:

18.01 Determine the required installation area, orientation, and tilt for proposed collector installation.
18.02 Establish whether there is suitable installation area with unobstructed solar access for installing collector.
18.03 Determine the extent of current and future shading for any proposed collector location using typical sun path calculators or similar methods.
18.04 Assure structural integrity and suitability of collector site. Determine soil conditions and integrity for footing design and pipe path. (Local codes or site conditions might then require involving an engineer.)
18.05 Practice all personal safety requirements.
18.06 Identify any other constraints and options for the installation related to local and state code requirements.
18.07 Verify that system to be installed is appropriate for the building and climate.
18.08 Verify with the homeowner the proposed location of the collector and other major components.

19.0 Read and interpret basic blueprints job specifications and codes--The student will be able to:

19.01 Read and interpret measuring devices.
19.02 Draw and interpret basic wiring diagrams.

19.03 Identify the basic symbols used in the electrical trade.
19.04 Read and interpret manufacturers' schematics and specifications.
19.05 Describe the importance of following the local, state, and national codes regarding article 690.
19.06 Read and interpret current standards and codes for PV systems and electrical systems.
19.07 Read and interpret basic building codes in the electrical industry.
19.08 Recognize and identify PV and electrical symbols.
19.09 Identify basic electrical systems from the blueprint.
19.10 From the blueprints and specifications, identify the electrical equipment and materials required for the electrical job.
19.11 Relate the blueprint to all applicable (local, state, and federal) PV and electrical codes.

20.0 Demonstrate a practical knowledge of basic electricity skills and electrical components--The student will be able to:

20.01 Explain the principles of electricity.
20.02 Explain single- and three-phase power distribution.
20.03 Define and explain watts, ohms, volts, and amps.
20.04 Identify and explain electrical measuring tools and devices.
20.05 Explain the standards for and ways to measure watts, resistance, voltage, and amperage, using appropriate instruments or devices.
20.06 Identify and explain appropriate electrical wiring symbols.
20.07 Draw and explain a wiring schematic diagram for a control system.
20.08 Create a wiring schematic for a solar photovoltaic system, using all components and symbols for safe and effective operation and interpretation.
20.09 Explain codes and standards and safety requirements for working with necessary electrical components.
20.10 Troubleshoot protection devices, such as fuses and breakers.
20.11 Interpret tables and charts from the National Electrical Codes (NEC).

21.0 Install PV systems--The student will be able to:

21.01 Determine the location of the PV modules.
21.02 Install different DC voltages, series and parallel.
21.03 Install photovoltaic module.
21.04 Install a PV mounting system.
21.05 Install DC and AC wiring.
21.06 Select ultraviolet radiation protective method for external wiring.
21.07 Protect external wiring from ultraviolet degradation.
21.08 Test operation of DC components.
21.09 Test operation of AC components.
21.10 Determine the area for the electrical equipment and batteries.

22.0 Install operation and identification tags and labels--The student will be able to:

22.01 Determine components that require identification tag and/or label as per National Electric Code (NEC).
22.02 Install identification tags and/or label as per NEC.

23.0 Perform a system checkout--The student will be able to:

23.01 Identify any deficiencies in materials, workmanship, function or appearance by visually inspecting entire installation.
23.02 Determine that the system mechanical installation has structural integrity.
23.03 Determine that the system PV installation is correctly installed.
23.04 Determine that the electrical installation is correctly installed.
23.05 Verify system start-up and shut-down functionality.
23.06 Verify overall system operation and functionality.
23.07 Demonstrate to the owner operation and functionality of system.
23.08 Demonstrate to the owner start-up and shut-down procedures for system.
23.09 Demonstrate to owner simple maintenance and diagnostic procedures.
23.10 Identify for owner all markings and labels for system service and owner interaction.
23.11 Identify for owner safety issues associated with operation and maintenance of system.
23.12 Complete and transfer documentation package to system owner/operators.
23.13 Review system/component warranties and requirements with owner.

24.0 Maintain and troubleshoot a solar PV system--The student will be able to:

24.01 Demonstrate proficiency in using tools and materials required for maintenance and troubleshooting.
24.02 Interpret installation manual, wiring diagrams, drawings, and other specifications to plan maintenance or repair work.
24.03 Determine evaluation points for system monitoring, maintenance and troubleshooting (i.e., batteries, PV modules).
24.04 Identify cause of problems based on evaluation results.
24.05 Determine what repairs or system modifications are needed to restore the system to its baseline operating conditions.
24.06 Perform any identified repairs or modifications to restore system to manufacturer's or operator's satisfaction.

25.0 Layout and coordinate a job--The student will be able to:

25.01 Identify specifications.
25.02 Make a list of materials required to lay out a job.
25.03 Determine the work aids required and the sequence of installations, according to building plans, specifications, and working drawings.

26.0 Install solar collectors--The student will be able to:

26.01 Identify specific manufacturer's mounting design and materials.
26.02 Identify acceptable designed roof mounting.
26.03 Identify different collector mounting methods suitable for roof types or other installation areas.
26.04 Identify different system (due to extra weight and components) mounting methods suitable for roof type.
26.05 Identify locations for roof/wall, foundation penetrations, and structural attachments.

26.06 Evaluate the suitability of selected mounting structural attachments and compliance with applicable local codes.
26.07 Determine multi-modules in different roof locations.
26.08 Install mounting systems.
26.09 Lift PV modules for maximum output.
26.10 Attach mounting bracket and struts (if required) to collector.
26.11 Secure PV modules mounting device.
26.12 Connect PV system to designated electrical equipment.

27.0 Demonstrate knowledge of PV and electrical wiring--The student will be able to:

27.01 Describe and explain the purpose of PV and electrical codes.
27.02 Apply the basic theory and principles of PV and electrical in relation to the codes.
27.03 Read and locate information in the applicable PV and electrical codes.
27.04 Define and explain the terms used in the PV and electrical codes.
27.05 Explain why the code may supersede the manufacturer's specifications.

28.0 Install PV and electrical wiring--The student will be able to:

28.01 Install conduit, types of and fittings.
28.02 Install equipment grounding.
28.03 Install PV mounting variations.
28.04 Install roof mounting hardware.
28.05 Install rail systems.
28.06 Install conductor ampacity.
28.07 Install ampacity correction factors.
28.08 Estimate conductor fill in conduits.
28.09 Estimate a residential load calculation.
28.10 Determine how voltage drop is calculated.
28.11 Determine how to calculate conductor ambient temperature changes.
28.12 Install PV equipment for general use.
28.13 Calculate box fill.
28.14 Install DC over current protection.
28.15 Install AC over current protection.
28.16 Install Transient Volt Surge Suppresser (TVSS) protection.
28.17 Install Series battery connections.
28.18 Install Parallel battery connections.
28.19 Install Series-parallel battery connections.

29.0 Install PV and electrical equipment and other components--The student will be able to:

29.01 Determine PV and electrical components required.
29.02 Determine location of overcurrent devices.
29.03 Install system PV and electrical components as specified in component manufacturer’s or solar manufacturer’s installation manual and schematic.
29.04 Determine the battery rack location.
29.05 Install complete grounding system.
29.06 Determine panel location.