**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Solar Energy Technology**
**Program Type:** **Career Preparatory**
**Career Cluster:** **Energy**

| | Secondary | PSAV |
|---|---|---|
| Program Number | 8006100 | A600200 |
| CIP Number | 0715050500 | 0715050500 |
| Grade Level | 9-12, 30,31 | 30,31 |
| Standard Length | 3 Credits | 450 Hours |
| Teacher Certification | **All Courses:**<br>ELECTRICAL @7G<br>IND ENGR @7G<br>TEC ED 1@2 | **All Courses:**<br>ELECTRICAL @7G<br>IND ENGR @7G<br>TEC ED 1@2 |
| | **Introduction to Alter. Energy**<br>AGRICULTUR 1@2<br>TEC ED 1@2<br>EARTH SCI @4<br>SCIENCE 4<br>PHYSICS 1,4<br>CHEM 1,4<br>EARTH SCI 4,2<br>**Energy Foundations (Energy Industry Fundamentals)**<br>AGRICULTUR 1@2 | |
| CTSO | SkillsUSA | SkillsUSA |
| SOC Codes (all applicable) | 47-2231 | 47-2231 |
| Facility Code | 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 | N/A | Mathematics: 9<br>Language: 9<br>Reading: 9 |

**Special Note Certification**

When Solar Certifications are codified Instructors will be required to have Solar Certification.

**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 purpose of this program 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 one occupational completion point. When offered at the postsecondary 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 **PSAV** program structure:

| OCP | Course Number | Course Title | Course Length | SOC Code |
|---|---|---|---|---|
| A | EEV 0200 | Solar Energy Technician | 450 Hours | 47-2231 |

The following table illustrates the **Secondary** program structure:

| OCP | Course Number | Course Title | Length | SOC Code | Level |
|---|---|---|---|---|---|
| | 8006110 | Energy Foundations (Energy Industry Fundamentals) | 1 Credit | | 3 |
| | 8006120 | Introduction to Alternative Energy | 1 Credit | | 3 |
| A | 8006130 | Solar Energy Technician | 1 Credit | 47-2231 | 3 |

**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**

## Academic Alignment

Some or all of the courses in this program have been aligned to the Next Generation Sunshine State Standards contained in specific math and science core academic courses. This alignment resulted from a collaborative review by Career and Technical Education (CTE) teachers and core academic teachers. The table below contains the results of the alignment efforts. Data shown in the table includes the number of academic standards in the CTE course, the total number of math and science standards contained in the academic course, and the percentage of alignment to the CTE course. The following academic courses were included in the alignment (see code for use in table).

| Academic Subject Area | Academic Course |
|---|---|
| Math | Algebra 1 (ALG1)<br>Algebra 2 (ALG2)<br>Geometry (GEO) |
| Science | Anatomy/Physiology Honors (APH)<br>Astronomy Solar/Galactic Honors (ASGH)<br>Biology 1 (BIO1)<br>Chemistry 1 (CHM1)<br>Earth-Space Science (ESS)<br>Genetics (GEN)<br>Marine Science 1 Honors (MS1H)<br>Physical Science (PS)<br>Physics 1 (PHY1) |

| Course | Math | | | Science | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ALG1 | ALG2 | GEO | APH | ASGH | BIO1 | CHM1 | ESS | GEN | MS1H | PS | PHY1 |
| Energy Foundations (Energy Industry Fundamentals) | ** | ** | ** | # | 1/52<br>2% | # | 2/55<br>4% | 1/58<br>2% | # | 4/42<br>10% | 6/56<br>11% | 4/53<br>8% |
| Introduction to Alternative Energy | ** | ** | ** | 2/53<br>4% | 5/52<br>10% | 2/56<br>4% | 3/55<br>5% | 3/58<br>5% | 2/35<br>6% | 6/42<br>14% | 7/56<br>13% | 8/53<br>15% |
| Solar Energy Technician | ** | ** | ** | 2/53<br>4% | 5/52<br>10% | 3/56<br>5% | 5/55<br>9% | 4/58<br>7% | 2/35<br>6% | 6/42<br>14% | 8/56<br>14% | 8/53<br>15% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

## Career and Technical Student Organization (CTSO)

SkillsUSA (secondary only) 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

The PSAV component of 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.

## Bright Futures/Gold Seal Scholarship

Course substitutions as defined in the Comprehensive Course Table for this program area may be used to qualify a student for Florida's Gold Seal Vocational Scholarship, providing all other eligibility requirements are met. Eligibility requirements are available online at https://www.osfaffelp.org/bfiehs/fnbpcm02_CCTMain.aspx.

## Fine Arts/Practical Arts Credit

Many courses in CTE programs meet the Fine Arts/Practical Arts credit for high school graduation. For additional information refer to http://www.fldoe.org/schools/pdf/ListPracticalArtsCourses.pdf.

## Standards

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

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry.
02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment.
03.0 Understand electric power generation.
04.0 Understand electric power transmission.
05.0 Understand electric power distribution
06.0 Identify and describe careers and entry requirements.
07.0 Evaluate and analyze energy 'hot topics'.
08.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
09.0 Explain the importance of employability and entrepreneurship skills.
10.0 Use information technology tools.

11.0 Discuss the value of alternative energy.
12.0 Investigate the viability of biomass and biofuel.
13.0 Describe the importance of professional ethics and legal responsibilities.
14.0 Investigate the use of nuclear power.
15.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
16.0 Investigate the viability of solar energy.
17.0 Demonstrate personal money-management concepts, procedures, and strategies.
18.0 Investigate the viability of wind energy.
19.0 Demonstrate knowledge of solar energy.
20.0 Describe safe work practices.
21.0 Conduct a site assessment.
22.0 Design a solar system.
23.0 Install subsystems and components at the site.
24.0 Inspect and troubleshoot solar systems.
25.0 Maintain solar systems.
26.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
27.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
28.0 Demonstrate language arts knowledge and skills.
29.0 Demonstrate science knowledge and skills.
30.0 Demonstrate mathematics knowledge and skills.
31.0 Solve problems using critical thinking skills, creativity and innovation.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Solar Energy Technology**
**PSAV Number:** **A600200**

**Course Number: EEV 0200**
**Occupational Completion Point: A**
**Solar Energy Technician – 450 Hours – SOC Code 47-2231**

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry--The student will be able to:

01.01 Explain the flow of energy from generation through distribution to the customer.
01.02 Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov ).
01.03 Identify the role and function of generation, transmission and distribution organizations.
01.04 Explains the role of regulatory bodies in the energy industry (Federal Energy Regulatory Commission www.ferc.gov; Public Service Commission of the State of Florida www.psc.state.fl.us) (highlight “obligation to serve”).
01.05 Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain importance of proper documentation to ensure compliance.
01.06 Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as water/wastewater), electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.
01.07 Describe the process of electric metering and billing for energy consumption.

02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment--The student will be able to:

02.01 Review the role of the U.S. Department of Labor/ Occupational Safety and Health Administration in work place safety. (http://www.complianceregs.com/29cfr/1910/subR/1910-269.html)
02.02 Identify both potential hazards and accident scenarios in the work environment.
02.03 Follow established safety procedures (OSHA regulations and utility company procedures).
02.04 Evaluate changes in the environment with respect to their impact on safety of self and others.
02.05 Promote effective local, state, and national security operations for the protection of people, data, property and institutions.
02.06 Comply with energy industry safety procedures and proper ways to perform work.
02.07 Name potential threats created by deviation from safety procedures and improper use of tools and equipment.
02.08 Use safety equipment as specified by user manuals and safety training.
02.09 Use Personal Protective Equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.

02.10 Keep personal safety equipment in good working order.
02.11 Use tools and equipment in compliance with user manuals and training.
02.12 Call attention to potential and actual hazardous conditions as they arise.
02.13 Alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.
02.14 Maintain appropriate certification and is knowledgeable in first aid or first response procedures.
02.15 Demonstrate understanding and knowledge of lock/tag out practices in the work place.
02.16 Notify person in charge and/or coworkers of unsafe work conditions.
02.17 Stop the job if there are unsafe working conditions.

03.0 Understand electric power generation--The student will be able to:

03.01 Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).
03.02 Identify electric power generation equipment and systems.
03.03 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental issues associated with each:
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages
03.06 Explain how natural gas was created and what are its advantages and disadvantages.
03.07 Explain how water is used in hydroelectric power generation and what are its advantages and disadvantages.
03.08 Explain how uranium is created and what are its advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources.
03.10 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
03.11 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
03.12 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
03.13 Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
03.14 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
03.15 Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear and emerging alternative energy systems).

04.0 Understand electric power transmission--The student will be able to:

04.01 Explain the electric power transmission process.
04.02 Discuss the application of different electric power transmission principles (including AC vs. DC).
04.03 Name electric power transmission equipment and systems.

04.04 Discuss the emerging technologies in electric power transmission (including Smart Grid).
04.05 Explain ownership/governance of the electric transmission system.

05.0 Understand electric power distribution--The student will be able to:

05.01 Explain the electric power distribution process.
05.02 Discuss the need for electric distribution systems and how they are designed to operate.
05.03 Name electric power distribution system equipment and what the various components do.
05.04 Discuss the emerging technologies in electric power distribution, including distribution automation and SmartGrid systems.

06.0 Identify and describe careers and entry requirements--The student will be able to:

06.01 Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
06.02 Identify entry-level careers available in business and corporate support functions of the energy industry**;** describes the education/experience requirements for entry into those positions, and career advancement opportunities from those positions.
06.03 Describe general wage/salary, benefits, and other advantages of careers in the energy industry.
06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels (Partner to create Energy Education Portal).

07.0 Evaluate and analyze energy 'hot topics'--The student will be able to:

07.01 Discuss the major sources of biomass.
07.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
07.03 Outline the pyramid energy flow including the different trophic levels.
07.04 Describe the major sources, scale, and impacts of biomass energy.
07.05 Draw and label a diagram of biomass plantations.
07.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

09.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

09.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
09.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
09.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
09.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
09.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
09.06 Identify and exhibit traits for retaining employment. ECD7.0
09.07 Identify opportunities and research requirements for career advancement.ECD8.0
09.08 Research the benefits of ongoing professional development. ECD9.0
09.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

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

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

11.0 Discuss the value of alternative energy--The student will be able to:

11.01 Investigate the reasons for seeking alternatives to fossil fuels.
11.02 Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels.
11.03 Discuss the three alternative energy sources that are currently the most developed and widely used (hydroelectric, nuclear, and biomass).

12.0 Investigate the viability of biomass and biofuel--The student will be able to:

12.01 Discuss the major sources of biomass.
12.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
12.03 Outline the pyramid energy flow including the different trophic levels.
12.04 Describe the major sources, scale, and impacts of biomass energy.
12.05 Draw and label a diagram of biomass plantations.
12.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

13.01 Evaluate and justify decisions based on ethical reasoning. ELR1.0
13.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies. ELR1.1

13.03 Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace. ELR1.2
13.04 Interpret and explain written organizational policies and procedures. ELR2.0

14.0 Investigate the use of nuclear power--The student will be able to:

14.01 Explain the process of nuclear fission.
14.02 Define radio-isotopes and half-life.
14.03 Evaluate the advantages and disadvantages of nuclear power.
14.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
14.05 Describe nuclear energy and how it is harnessed.
14.06 Describe the Chernobyl Nuclear Power Plant accident.
14.07 Outline the societal debate over nuclear power.

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

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

16.0 Investigate the viability of solar energy--The student will be able to:

16.01 Describe solar energy and how it is harnessed.
16.02 Explain the significance and historical foundations of solar energy and its pioneers (Horace de Saussure and Clarence Kemp).
16.03 Explain the difference between passive solar and active solar.
16.04 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).
16.05 Describe a central receiver system.
16.06 Draw and label a diagram of a solar thermal plant.
16.07 Evaluate the advantages and disadvantages of using solar energy.

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

17.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
17.02 Describe the effect of money management on personal and career goals. FL3.0
17.03 Develop a personal budget and financial goals. FL3.1
17.04 Complete financial instruments for making deposits and withdrawals. FL3.2
17.05 Maintain financial records. FL3.3
17.06 Read and reconcile financial statements. FL3.4
17.07 Research, compare and contrast investment opportunities.

18.0 Investigate the viability of wind energy--The student will be able to:

18.01 Describe wind energy and the way it is harnessed.
18.02 Explain the significance of wind energy and its pioneers (Charles Brush).
18.03 Define kinetic energy.
18.04 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
18.05 Explain the acronym NIMBY (Not In My Backyard).
18.06 Explain why farmers and ranchers are amenable to wind technology.
18.07 Evaluate the advantages and disadvantages to wind technology.

19.0 Demonstrate knowledge of solar energy--The student will be able to:

19.01 Define basic solar terms (e.g. irradiation, Langley, azimuth).
19.02 Determine true (solar) south from magnetic (compass) south given a declination map.
19.03 Describe basic solar movement and effect of the Earth’s tilt.
19.04 Predict solar position using solar path diagrams.
19.05 Describe angular effects on the irradiance of array.
19.06 Identify factors that reduce/enhance solar irradiation.
19.07 Determine average solar irradiation on various surfaces.
19.08 Describe how a photovoltaic solar cell works.
19.09 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon [p-type], phosphorus-enriched silicon [n-type], and the n-p junction).
19.10 Explain the differences between monocrystalline, polycrystalline, thin-film, and nano-solar cells.
19.11 Convert solar irradiation into a variety of electrical units.
19.12 Determine effect of horizon on solar irradiation (shading).
19.13 Demonstrate use of Solar Pathfinder or sun charts.

20.0 Describe safe work practices--The student will be able to:

20.01 Demonstrate safe and proper use of required tools and equipment.
20.02 Identify personal and environmental safety hazards and accepted practices.
20.03 Explain the importance of basic first aid and CPR in the solar energy work setting.
20.04 Identify and implement Occupational Safety and Health Administration (OSHA) codes and standards concerning installation, operation, public safety and maintenance of solar systems and equipment.

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

21.01 Identify traditional tools and equipment required for conducting site surveys for solar installation and demonstrates proficiency in their use.
21.02 Establish suitable location with proper orientation, area, access and structural integrity for solar systems.
21.03 Diagram possible layouts and locations for array and equipment, including existing building or site features.
21.04 Identify and assess any site-specific safety hazards or other issues associated with the installation of the system.
21.05 Obtain and interpret solar radiation and temperature data for site for purposes of establishing performance expectations.

21.06 Quantify the customer electrical load and energy use through review of utility bills and meter readings.
21.07 Conduct an energy audit.
21.08 Estimate the peak load and average energy use in order to determine the size and amount of solar equipment needed.
21.09 Determine the requirements for installing a solar system for the proper interface with a utility system.

22.0 Design a solar system--The student will be able to:

22.01 Identify appropriate system design and configurations based on the customer's consumption needs based on desired energy, peak power production, autonomy requirements, size, and costs.
22.02 Estimate time, materials and equipment required for installation based on optimizing use of time and materials.
22.03 Identify mechanical design that is consistent with environmental, architectural, structural, code requirements and other conditions of the site.
22.04 Determine the electrical design to be compatible with the existing electrical currents.
22.05 Select appropriate conductor types and rating for each electrical circuit in the open or closed system.
22.06 Determine the derated ampacity of system conductors, and select appropriate sizes based on design currents.
22.07 Determine appropriate size, ratings and locations for all system over-current and disconnect devices.
22.08 Determine appropriate size, ratings and locations for grounding, surge suppression and associated equipment.
22.09 Determine voltage drop for any electrical circuit based on size and length of conductors.
22.10 Select an appropriate utility interconnection point, and determine the size, ratings and locations for over-current and disconnect devices.

23.0 Install subsystems and components at the site--The student will be able to:

23.01 Utilize, draw and label schematics, instructions and recommended procedures in installing equipment while implementing all applicable personal and personnel safety and environmental protections measures.
23.02 Visually inspect and quick test PV modules.
23.03 Assemble modules, panels and support structures as specified by the manufacturer.
23.04 Install module array interconnect wiring; implement measures to disable array during installation.
23.05 Complete final assembly, structural attachment and weather sealing of array to building or other support mechanism(s).
23.06 Install and provide required labels on inverters, controls, disconnects and over-current devices, surge suppression and grounding equipment, junction boxes, batteries and enclosures, conduit and other electrical hardware.
23.07 Label, install and terminate electrical wiring; verify proper connections, voltages and phase/polarity relationships.
23.08 Verify continuity and measure impedance of grounding system.

23.09 Program, adjust and or configure inverters and controls for desired set points and operating modes.

24.0 Inspect and troubleshoot solar systems--The student will be able to:

24.01 Visually inspect the entire installation, identifying and resolving any deficiencies in materials or workmanship.
24.02 Check system mechanical installation for structural integrity and weather sealing.
24.03 Check electrical installation for proper wiring, polarity, grounding and integrity terminations.
24.04 Activate the system and verify overall system functionality and performance based on initial expectations.
24.05 Demonstrate procedures for connecting and disconnecting the system and equipment from all sources.
24.06 Identify and verify all required markings and labels for the system and equipment.
24.07 Identify, provide documentation, and explain all safety issues associated with operations and maintenance of the system.

25.0 Maintain solar systems--The student will be able to:

25.01 Identify the tools and equipment required for maintaining and troubleshooting the system.
25.02 Identify maintenance needs and implement service procedures for modules, arrays, batteries, power conditioning equipment, safety systems, structural and weather sealing systems, and balance of systems equipment.
25.03 Measure system performance and operating parameters, compare with specifications and expectations, and asses operating condition of system and equipment.
25.04 Perform diagnostics and interpret results.
25.05 Identify performance and safety issues, and implement corrective measures.
25.06 Verify and demonstrate complete functionality and performance of system, including start-up, shut-down, normal operation and emergency bypass operations.
25.07 Compile and maintain record of system operation, performance and maintenance.

26.0 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:

26.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
26.02 Explain emergency procedures to follow in response to workplace accidents.
26.03 Create a disaster and/or emergency response plan. SHE2.0

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

27.01 Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace. CM1.0

27.02 Locate, organize and reference written information from various sources. CM3.0
27.03 Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences. CM5.0
27.04 Interpret verbal and nonverbal cues/behaviors that enhance communication. CM6.0
27.05 Apply active listening skills to obtain and clarify information. CM7.0
27.06 Develop and interpret tables and charts to support written and oral communications. CM8.0
27.07 Exhibit public relations skills that aid in achieving customer satisfaction. CM10.0

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

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

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

29.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
29.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings. AF4.3

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

30.01 Demonstrate knowledge of arithmetic operations. AF3.2
30.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
30.03 Construct charts/tables/graphs using functions and data. AF3.5

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

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

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Energy Foundations (Energy Industry Fundamentals)**
**Course Number:** **8006110**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | # | **Anatomy/Physiology Honors** | # | **Astronomy Solar/Galactic Honors** | 1/52 2% |
| **Algebra 2** | ** | **Chemistry 1** | 2/55 4% | **Genetics** | # | **Marine Science 1 Honors** | 4/42 10% |
| **Geometry** | ** | **Physics 1** | 4/53 8% | **Earth-Space Science** | 1/58 2% | **Physical Science** | 6/56 11% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.17.17; SC.912.N.4.2

01.08 Explain the flow of energy from generation through distribution to the customer.
01.09 Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov ).
01.10 Identify the role and function of generation, transmission and distribution organizations.
01.11 Explains the role of regulatory bodies in the energy industry (Federal Energy Regulatory Commission www.ferc.gov; Public Service Commission of the State of Florida www.psc.state.fl.us) (highlight “obligation to serve”).
01.12 Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain importance of proper documentation to ensure compliance.
01.13 Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as

water/wastewater), electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.

01.14 Describe the process of electric metering and billing for energy consumption.

02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment--The student will be able to:

02.01 Review the role of the U.S. Department of Labor/ Occupational Safety and Health Administration in work place safety. (http://www.complianceregs.com/29cfr/1910/subR/1910-269.html)
02.02 Identify both potential hazards and accident scenarios in the work environment.
02.03 Follow established safety procedures (OSHA regulations and utility company procedures).
02.04 Evaluate changes in the environment with respect to their impact on safety of self and others.
02.05 Promote effective local, state, and national security operations for the protection of people, data, property and institutions.
02.06 Comply with energy industry safety procedures and proper ways to perform work.
02.07 Name potential threats created by deviation from safety procedures and improper use of tools and equipment.
02.08 Use safety equipment as specified by user manuals and safety training.
02.09 Use Personal Protective Equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.
02.10 Keep personal safety equipment in good working order.
02.11 Use tools and equipment in compliance with user manuals and training.
02.12 Call attention to potential and actual hazardous conditions as they arise.
02.13 Alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.
02.14 Maintain appropriate certification and is knowledgeable in first aid or first response procedures.
02.15 Demonstrate understanding and knowledge of lock/tag out practices in the work place.
02.16 Notify person in charge and/or coworkers of unsafe work conditions.
02.17 Stop the job if there are unsafe working conditions.

03.0 Understand electric power generation--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.7.2; SC.912.L.17.11, 15, 19; SC.912.P.10.1

03.01 Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).
03.02 Identify electric power generation equipment and systems.
03.03 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental issues associated with each:
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages
03.06 Explain how natural gas was created and what are its advantages and disadvantages.

03.07 Explain how water is used in hydroelectric power generation and what are its advantages and disadvantages.
03.08 Explain how uranium is created and what are its advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources.
03.10 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
03.11 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
03.12 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
03.13 Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
03.14 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
03.15 Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear and emerging alternative energy systems).

04.0 Understand electric power transmission--The student will be able to:

04.01 Explain the electric power transmission process.
04.02 Discuss the application of different electric power transmission principles (including AC vs. DC).
04.03 Name electric power transmission equipment and systems.
04.04 Discuss the emerging technologies in electric power transmission (including Smart Grid).
04.05 Explain ownership/governance of the electric transmission system.

05.0 Understand electric power distribution--The student will be able to:

05.01 Explain the electric power distribution process.
05.02 Discuss the need for electric distribution systems and how they are designed to operate.
05.03 Name electric power distribution system equipment and what the various components do.
05.04 Discuss the emerging technologies in electric power distribution, including distribution automation and SmartGrid systems.

06.0 Identify and describe careers and entry requirements--The student will be able to:

06.01 Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
06.02 Identify entry-level careers available in business and corporate support functions of the energy industry; describes the education/experience requirements for entry into those positions, and career advancement opportunities from those positions.

06.03 Describe general wage/salary, benefits, and other advantages of careers in the energy industry.
06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels (Partner to create Energy Education Portal).

07.0 Evaluate and analyze energy 'hot topics'--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.P.10.2, 8

07.01 Discuss the major sources of biomass.
07.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
07.03 Outline the pyramid energy flow including the different trophic levels.
07.04 Describe the major sources, scale, and impacts of biomass energy.
07.05 Draw and label a diagram of biomass plantations.
07.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

09.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

09.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
09.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
09.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
09.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
09.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
09.06 Identify and exhibit traits for retaining employment. ECD7.0
09.07 Identify opportunities and research requirements for career advancement.ECD8.0
09.08 Research the benefits of ongoing professional development. ECD9.0
09.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

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

10.01 Use Personal Information Management (PIM) applications to increase workplace efficiency. IT1.0
10.02 Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications. IT2.0

10.03 Employ computer operations applications to access, create, manage, integrate, and store information. IT3.0
10.04 Employ collaborative/groupware applications to facilitate group work. IT4.0

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Introduction to Alternative Energy**
**Course Number:** **8006120**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | 2/56<br>4% | **Anatomy/Physiology Honors** | 2/53<br>4% | **Astronomy Solar/Galactic Honors** | 5/52<br>10% |
| **Algebra 2** | ** | **Chemistry 1** | 3/55<br>5% | **Genetics** | 2/35<br>6% | **Marine Science 1 Honors** | 6/42<br>14% |
| **Geometry** | ** | **Physics 1** | 8/53<br>15% | **Earth-Space Science** | 3/58<br>5% | **Physical Science** | 7/56<br>13% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

11.0 Discuss the value of alternative energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.17.11, 17; SC.912.N.1.1; SC.912.P.10.1, 2

11.01 Investigate the reasons for seeking alternatives to fossil fuels.
11.02 Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels.
11.03 Discuss the three alternative energy sources that are currently the most developed and widely used (hydroelectric, nuclear, and biomass).

12.0 Investigate the viability of biomass and biofuel--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.2; SC.912.L.17.19, 20

12.01 Discuss the major sources of biomass.
12.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
12.03 Outline the pyramid energy flow including the different trophic levels.

12.04 Describe the major sources, scale, and impacts of biomass energy.
12.05 Draw and label a diagram of biomass plantations.
12.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

14.0 Investigate the use of nuclear power--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards:
MA.912.S.3.2; SC.912.E.6.6; SC.912.L.17.11; SC.912.N.4.2

14.01 Explain the process of nuclear fission.
14.02 Define radio-isotopes and half-life.
14.03 Evaluate the advantages and disadvantages of nuclear power.
14.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
14.05 Describe nuclear energy and how it is harnessed.
14.06 Describe the Chernobyl Nuclear Power Plant accident.
14.07 Outline the societal debate over nuclear power.

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

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

16.0 Investigate the viability of solar energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards:
MA.912.S.3.2; SC.912.E.6.6; SC.912.L.17.11; SC.912.P.10.1, 13, 18; SC.912.P.12.9

16.01 Describe solar energy and how it is harnessed.
16.02 Explain the significance and historical foundations of solar energy and its pioneers (Horace de Saussure and Clarence Kemp).
16.03 Explain the difference between passive solar and active solar.
16.04 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).

16.05 Describe a central receiver system.
16.06 Draw and label a diagram of a solar thermal plant.
16.07 Evaluate the advantages and disadvantages of using solar energy.

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

17.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
17.02 Describe the effect of money management on personal and career goals. FL3.0
17.03 Develop a personal budget and financial goals. FL3.1
17.04 Complete financial instruments for making deposits and withdrawals. FL3.2
17.05 Maintain financial records. FL3.3
17.06 Read and reconcile financial statements. FL3.4
17.07 Research, compare and contrast investment opportunities.

18.0 Investigate the viability of wind energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.11, 19; SC.912.P.10.1

18.01 Describe wind energy and the way it is harnessed.
18.02 Explain the significance of wind energy and its pioneers (Charles Brush).
18.03 Define kinetic energy.
18.04 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
18.05 Explain the acronym NIMBY (Not In My Backyard).
18.06 Explain why farmers and ranchers are amenable to wind technology.
18.07 Evaluate the advantages and disadvantages to wind technology.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Solar Energy Technician**
**Course Number:** **8006130**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | 3/56<br>5% | **Anatomy/Physiology Honors** | 2/53<br>4% | **Astronomy Solar/Galactic Honors** | 5/52<br>10% |
| **Algebra 2** | ** | **Chemistry 1** | 5/55<br>9% | **Genetics** | 2/35<br>6% | **Marine Science 1 Honors** | 6/42<br>14% |
| **Geometry** | ** | **Physics 1** | 8/53<br>15% | **Earth-Space Science** | 4/58<br>7% | **Physical Science** | 8/56<br>14% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

19.0 Demonstrate knowledge of solar energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.5.4; SC.912.E.6.6; SC.912.L.11, 15, 20; SC.912.N.1.1, 2, 3; SC.912.P.10.1, 2, 3, 9

19.01 Define basic solar terms (e.g. irradiation, Langley, azimuth).
19.02 Determine true (solar) south from magnetic (compass) south given a declination map.
19.03 Describe basic solar movement and effect of the Earth's tilt.
19.04 Predict solar position using solar path diagrams.
19.05 Describe angular effects on the irradiance of array.
19.06 Identify factors that reduce/enhance solar irradiation.
19.07 Determine average solar irradiation on various surfaces.
19.08 Describe how a photovoltaic solar cell works.
19.09 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon [p-type], phosphorus-enriched silicon [n-type], and the n-p junction).
19.10 Explain the differences between monocrystalline, polycrystalline, thin-film, and nano-solar cells.

19.11 Convert solar irradiation into a variety of electrical units.
19.12 Determine effect of horizon on solar irradiation (shading).
19.13 Demonstrate use of Solar Pathfinder or sun charts.

20.0 Describe safe work practices--The student will be able to:

20.01 Demonstrate safe and proper use of required tools and equipment.
20.02 Identify personal and environmental safety hazards and accepted practices.
20.03 Explain the importance of basic first aid and CPR in the solar energy work setting.
20.04 Identify and implement Occupational Safety and Health Administration (OSHA) codes and standards concerning installation, operation, public safety and maintenance of solar systems and equipment.

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

21.01 Identify traditional tools and equipment required for conducting site surveys for solar installation and demonstrates proficiency in their use.
21.02 Establish suitable location with proper orientation, area, access and structural integrity for solar systems.
21.03 Diagram possible layouts and locations for array and equipment, including existing building or site features.
21.04 Identify and assess any site-specific safety hazards or other issues associated with the installation of the system.
21.05 Obtain and interpret solar radiation and temperature data for site for purposes of establishing performance expectations.
21.06 Quantify the customer electrical load and energy use through review of utility bills and meter readings.
21.07 Conduct an energy audit.
21.08 Estimate the peak load and average energy use in order to determine the size and amount of solar equipment needed.
21.09 Determine the requirements for installing a solar system for the proper interface with a utility system.

22.0 Design a solar system--The student will be able to:

22.01 Identify appropriate system design and configurations based on the customer's consumption needs based on desired energy, peak power production, autonomy requirements, size, and costs.
22.02 Estimate time, materials and equipment required for installation based on optimizing use of time and materials.
22.03 Identify mechanical design that is consistent with environmental, architectural, structural, code requirements and other conditions of the site.
22.04 Determine the electrical design to be compatible with the existing electrical currents.
22.05 Select appropriate conductor types and rating for each electrical circuit in the open or closed system.
22.06 Determine the derated ampacity of system conductors, and select appropriate sizes based on design currents.

22.07 Determine appropriate size, ratings and locations for all system over-current and disconnect devices.
22.08 Determine appropriate size, ratings and locations for grounding, surge suppression and associated equipment.
22.09 Determine voltage drop for any electrical circuit based on size and length of conductors.
22.10 Select an appropriate utility interconnection point, and determine the size, ratings and locations for over-current and disconnect devices.

23.0 Install subsystems and components at the site--The student will be able to:

23.01 Utilize, draw and label schematics, instructions and recommended procedures in installing equipment while implementing all applicable personal and personnel safety and environmental protections measures.
23.02 Visually inspect and quick test PV modules.
23.03 Assemble modules, panels and support structures as specified by the manufacturer.
23.04 Install module array interconnect wiring; implement measures to disable array during installation.
23.05 Complete final assembly, structural attachment and weather sealing of array to building or other support mechanism(s).
23.06 Install and provide required labels on inverters, controls, disconnects and over-current devices, surge suppression and grounding equipment, junction boxes, batteries and enclosures, conduit and other electrical hardware.
23.07 Label, install and terminate electrical wiring; verify proper connections, voltages and phase/polarity relationships.
23.08 Verify continuity and measure impedance of grounding system.
23.09 Program, adjust and or configure inverters and controls for desired set points and operating modes.

24.0 Inspect and troubleshoot solar systems--The student will be able to:

24.01 Visually inspect the entire installation, identifying and resolving any deficiencies in materials or workmanship.
24.02 Check system mechanical installation for structural integrity and weather sealing.
24.03 Check electrical installation for proper wiring, polarity, grounding and integrity terminations.
24.04 Activate the system and verify overall system functionality and performance based on initial expectations.
24.05 Demonstrate procedures for connecting and disconnecting the system and equipment from all sources.
24.06 Identify and verify all required markings and labels for the system and equipment.
24.07 Identify, provide documentation, and explain all safety issues associated with operations and maintenance of the system.

25.0 Maintain solar systems--The student will be able to:

25.01 Identify the tools and equipment required for maintaining and troubleshooting the system.

25.02 Identify maintenance needs and implement service procedures for modules, arrays, batteries, power conditioning equipment, safety systems, structural and weather sealing systems, and balance of systems equipment.
25.03 Measure system performance and operating parameters, compare with specifications and expectations, and asses operating condition of system and equipment.
25.04 Perform diagnostics and interpret results.
25.05 Identify performance and safety issues, and implement corrective measures.
25.06 Verify and demonstrate complete functionality and performance of system, including start-up, shut-down, normal operation and emergency bypass operations.
25.07 Compile and maintain record of system operation, performance and maintenance.

26.0 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:

26.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
26.02 Explain emergency procedures to follow in response to workplace accidents.
26.03 Create a disaster and/or emergency response plan. SHE2.0

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

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

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

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

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

29.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
29.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3

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

- 30.01 Demonstrate knowledge of arithmetic operations. AF3.2
- 30.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
- 30.03 Construct charts/tables/graphs using functions and data. AF3.5

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

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

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Power Distribution Technician**
**Program Type:** **Career Preparatory**
**Career Cluster:** **Energy**

| | Secondary | PSAV |
|---|---|---|
| Program Number | 9700100 | X600100 |
| CIP Number | 0715050301 | 0715050301 |
| Grade Level | 9-12, 30,31 | 30,31 |
| Standard Length | 3 Credits | 450 Hours |
| Teacher Certification | **All Courses:**<br>ELECTRICAL @7G<br>IND ENGR @7G<br>TEC ED 1@2<br><br>**Introduction to Alter. Energy**<br>AGRICULTUR 1@2<br>TEC ED 1@2<br>EARTH SCI @4<br>SCIENCE 4<br>PHYSICS 1,4<br>CHEM 1,4<br>EARTH SCI 4,2<br>**Energy Foundations (Energy Industry Fundamentals)**<br>AGRICULTUR 1@2 | **All Courses:**<br>ELECTRICAL @7G<br>IND ENGR @7G<br>TEC ED 1@2 |
| CTSO | SkillsUSA | SkillsUSA |
| SOC Codes (all applicable) | 49-9099 | 49-9099 |
| Facility Code | 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 | N/A | Mathematics: 9<br>Language: 9<br>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 purpose of this program 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 one occupational completion point. When offered at the postsecondary 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 **PSAV** program structure:

| OCP | Course Number | Course Title | Course Length | SOC Code |
|---|---|---|---|---|
| A | EEV0201 | Power Distribution Technician | 450 Hours | 49-9099 |

The following table illustrates the **Secondary** program structure:

| OCP | Course Number | Course Title | Length | SOC Code | Level |
|---|---|---|---|---|---|
| | 8006110 | Energy Foundations (Energy Industry Fundamentals) | 1 Credit | | 3 |
| | 8006120 | Introduction to Alternative Energy | 1 Credit | | 3 |
| A | 9700110 | Power Distribution Technician | 1 Credit | 49-9099 | 3 |

**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**

**Academic Alignment**

Some or all of the courses in this program have been aligned to the Next Generation Sunshine State Standards contained in specific math and science core academic courses. This alignment resulted from a collaborative review by Career and Technical Education (CTE) teachers and

core academic teachers. The table below contains the results of the alignment efforts. Data shown in the table includes the number of academic standards in the CTE course, the total number of math and science standards contained in the academic course, and the percentage of alignment to the CTE course. The following academic courses were included in the alignment (see code for use in table).

| Academic Subject Area | Academic Course |
|---|---|
| Math | Algebra 1 (ALG1)<br>Algebra 2 (ALG2)<br>Geometry (GEO) |
| Science | Anatomy/Physiology Honors (APH)<br>Astronomy Solar/Galactic Honors (ASGH)<br>Biology 1 (BIO1)<br>Chemistry 1 (CHM1)<br>Earth-Space Science (ESS)<br>Genetics (GEN)<br>Marine Science 1 Honors (MS1H)<br>Physical Science (PS)<br>Physics 1 (PHY1) |

| Course | Math | | | Science | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ALG1 | ALG2 | GEO | APH | ASGH | BIO1 | CHM1 | ESS | GEN | MS1H | PS | PHY1 |
| Energy Foundations (Energy Industry Fundamentals) | ** | ** | ** | # | 1/52<br>2% | # | 2/55<br>4% | 1/58<br>2% | # | 4/42<br>10% | 6/56<br>11% | 4/53<br>8% |
| Introduction to Alternative Energy | ** | ** | ** | 2/53<br>4% | 5/52<br>10% | 2/56<br>4% | 3/55<br>5% | 3/58<br>5% | 2/35<br>6% | 6/42<br>14% | 7/56<br>13% | 8/53<br>15% |
| Power Distribution Technician | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

## Career and Technical Student Organization (CTSO)

SkillsUSA (secondary only) 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

The PSAV component of 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.

## Bright Futures/Gold Seal Scholarship

Course substitutions as defined in the Comprehensive Course Table for this program area may be used to qualify a student for Florida's Gold Seal Vocational Scholarship, providing all other eligibility requirements are met. Eligibility requirements are available online at https://www.osfaffelp.org/bfiehs/fnbpcm02_CCTMain.aspx.

## Fine Arts/Practical Arts Credit

Many courses in CTE programs meet the Fine Arts/Practical Arts credit for high school graduation. For additional information refer to http://www.fldoe.org/schools/pdf/ListPracticalArtsCourses.pdf.

## Standards

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

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry.
02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment.
03.0 Understand electric power generation.
04.0 Understand electric power transmission.
05.0 Understand electric power distribution
06.0 Identify and describe careers and entry requirements.
07.0 Evaluate and analyze energy 'hot topics'.
08.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
09.0 Explain the importance of employability and entrepreneurship skills.
10.0 Use information technology tools.
11.0 Discuss the value of alternative energy.
12.0 Investigate the viability of biomass and biofuel.
13.0 Describe the importance of professional ethics and legal responsibilities.
14.0 Investigate the use of nuclear power.

15.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
16.0 Investigate the viability of solar energy.
17.0 Demonstrate personal money-management concepts, procedures, and strategies.
18.0 Investigate the viability of wind energy.
19.0 Understand electrical power transmission and distribution science.
20.0 Understand electric power transmission and distribution systems overview.
21.0 Apply construction, operation, maintenance and repair.
22.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
23.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
24.0 Demonstrate language arts knowledge and skills.
25.0 Demonstrate science knowledge and skills.
26.0 Demonstrate mathematics knowledge and skills.
27.0 Solve problems using critical thinking skills, creativity and innovation.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Power Distribution Technician**
**PSAV Number:** **X600100**

**Course Number: EEV0201**
**Occupational Completion Point: A**
**Power Distribution Technician – 450 Hours – SOC Code 49-9099**

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry--The student will be able to:

- 01.01 Explain the flow of energy from generation through distribution to the customer.
- 01.02 Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov ).
- 01.03 Identify the role and function of generation, transmission and distribution organizations.
- 01.04 Explains the role of regulatory bodies in the energy industry (Federal Energy Regulatory Commission www.ferc.gov; Public Service Commission of the State of Florida www.psc.state.fl.us) (highlight “obligation to serve”).
- 01.05 Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain importance of proper documentation to ensure compliance.
- 01.06 Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as water/wastewater), electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.
- 01.07 Describe the process of electric metering and billing for energy consumption.

02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment--The student will be able to:

- 02.01 Review the role of the U.S. Department of Labor/ Occupational Safety and Health Administration in work place safety. (http://www.complianceregs.com/29cfr/1910/subR/1910-269.html)
- 02.02 Identify both potential hazards and accident scenarios in the work environment.
- 02.03 Follow established safety procedures (OSHA regulations and utility company procedures).
- 02.04 Evaluate changes in the environment with respect to their impact on safety of self and others.
- 02.05 Promote effective local, state, and national security operations for the protection of people, data, property and institutions.
- 02.06 Comply with energy industry safety procedures and proper ways to perform work.
- 02.07 Name potential threats created by deviation from safety procedures and improper use of tools and equipment.
- 02.08 Use safety equipment as specified by user manuals and safety training.

02.09 Use Personal Protective Equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.
02.10 Keep personal safety equipment in good working order.
02.11 Use tools and equipment in compliance with user manuals and training.
02.12 Call attention to potential and actual hazardous conditions as they arise.
02.13 Alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.
02.14 Maintain appropriate certification and is knowledgeable in first aid or first response procedures.
02.15 Demonstrate understanding and knowledge of lock/tag out practices in the work place.
02.16 Notify person in charge and/or coworkers of unsafe work conditions.
02.17 Stop the job if there are unsafe working conditions.

03.0 Understand electric power generation--The student will be able to:

03.01 Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).
03.02 Identify electric power generation equipment and systems.
03.03 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental issues associated with each:
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages
03.06 Explain how natural gas was created and what are its advantages and disadvantages.
03.07 Explain how water is used in hydroelectric power generation and what are its advantages and disadvantages.
03.08 Explain how uranium is created and what are its advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources.
03.10 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
03.11 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
03.12 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
03.13 Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
03.14 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
03.15 Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear and emerging alternative energy systems).

04.0 Understand electric power transmission--The student will be able to:

04.01 Explain the electric power transmission process.
04.02 Discuss the application of different electric power transmission principles (including AC vs. DC).

04.03 Name electric power transmission equipment and systems.
04.04 Discuss the emerging technologies in electric power transmission (including Smart Grid).
04.05 Explain ownership/governance of the electric transmission system.

05.0 Understand electric power distribution--The student will be able to:

05.01 Explain the electric power distribution process.
05.02 Discuss the need for electric distribution systems and how they are designed to operate.
05.03 Name electric power distribution system equipment and what the various components do.
05.04 Discuss the emerging technologies in electric power distribution, including distribution automation and SmartGrid systems.

06.0 Identify and describe careers and entry requirements--The student will be able to:

06.01 Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
06.02 Identify entry-level careers available in business and corporate support functions of the energy industry**;** describes the education/experience requirements for entry into those positions, and career advancement opportunities from those positions.
06.03 Describe general wage/salary, benefits, and other advantages of careers in the energy industry.
06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels (Partner to create Energy Education Portal).

07.0 Evaluate and analyze energy 'hot topics'--The student will be able to:

07.01 Discuss the major sources of biomass.
07.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
07.03 Outline the pyramid energy flow including the different trophic levels.
07.04 Describe the major sources, scale, and impacts of biomass energy.
07.05 Draw and label a diagram of biomass plantations.
07.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

09.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

09.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
09.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
09.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
09.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
09.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
09.06 Identify and exhibit traits for retaining employment. ECD7.0
09.07 Identify opportunities and research requirements for career advancement.ECD8.0
09.08 Research the benefits of ongoing professional development. ECD9.0
09.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

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

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

11.0 Discuss the value of alternative energy--The student will be able to:

11.01 Investigate the reasons for seeking alternatives to fossil fuels.
11.02 Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels.
11.03 Discuss the three alternative energy sources that are currently the most developed and widely used (hydroelectric, nuclear, and biomass).

12.0 Investigate the viability of biomass and biofuel--The student will be able to:

12.01 Discuss the major sources of biomass.
12.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
12.03 Outline the pyramid energy flow including the different trophic levels.
12.04 Describe the major sources, scale, and impacts of biomass energy.
12.05 Draw and label a diagram of biomass plantations.
12.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

13.01 Evaluate and justify decisions based on ethical reasoning. ELR1.0
13.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies. ELR1.1

13.03 Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace. ELR1.2
13.04 Interpret and explain written organizational policies and procedures. ELR2.0

14.0 Investigate the use of nuclear power--The student will be able to:

14.01 Explain the process of nuclear fission.
14.02 Define radio-isotopes and half-life.
14.03 Evaluate the advantages and disadvantages of nuclear power.
14.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
14.05 Describe nuclear energy and how it is harnessed.
14.06 Describe the Chernobyl Nuclear Power Plant accident.
14.07 Outline the societal debate over nuclear power.

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

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

16.0 Investigate the viability of solar energy--The student will be able to:

16.01 Describe solar energy and how it is harnessed.
16.02 Explain the significance and historical foundations of solar energy and its pioneers (Horace de Saussure and Clarence Kemp).
16.03 Explain the difference between passive solar and active solar.
16.04 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).
16.05 Describe a central receiver system.
16.06 Draw and label a diagram of a solar thermal plant.
16.07 Evaluate the advantages and disadvantages of using solar energy.

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

17.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
17.02 Describe the effect of money management on personal and career goals. FL3.0
17.03 Develop a personal budget and financial goals. FL3.1
17.04 Complete financial instruments for making deposits and withdrawals. FL3.2
17.05 Maintain financial records. FL3.3
17.06 Read and reconcile financial statements. FL3.4
17.07 Research, compare and contrast investment opportunities.

18.0 Investigate the viability of wind energy--The student will be able to:

18.01 Describe wind energy and the way it is harnessed.
18.02 Explain the significance of wind energy and its pioneers (Charles Brush).
18.03 Define kinetic energy.
18.04 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
18.05 Explain the acronym NIMBY (Not In My Backyard).
18.06 Explain why farmers and ranchers are amenable to wind technology.
18.07 Evaluate the advantages and disadvantages to wind technology.

19.0 Understand electrical power transmission and distribution science--The student will be able to:

19.01 Explain and use the fundamental laws and principles of electricity & magnetism (e.g., electric charge, electric current, etc.).
19.02 Explain the process involved in the generation of electricity and its transmission from generating plants to substations.
19.03 Explain the process involved in distribution of electricity from substations to residential and commercial users of electric power.
19.04 Identify the components of electrical transmission and distribution systems including but not limited to substations, transformers, regulators, capacitors, reclosers, relays, circuit breakers, motors, transmission facilities, and distribution facilities).
19.05 Explain the purpose and operating characteristic of electric distribution equipment including but not limited to distribution feeder exits from substations, overhead wires and underground cables together with their respective pole lines, trenches and conduit systems.
19.06 Identify the applications of overhead and underground equipment including sectionalizing switches, automatic circuit reclosers, fuses and fuse assemblies, transformers, regulators, capacitors, insulators, surge arresters, and low voltage service equipment.

20.0 Understand electric power transmission and distribution systems overview--The student will be able to:

20.01 Explain how the United States electric power grid system is set up, and its limitations.
20.02 Explain the differences between AC and DC power transmission and distribution.
20.03 Explain how the different grid systems are interconnected and how they are controlled.
20.04 Explain what Smart Grid is and what problems it will solve.
20.05 Discuss the electric power transmission and distribution job functions.
20.06 Explain unique services of the utility business including street and area lighting, energy management, conservation, and matters related to power quality.

21.0 Apply construction, operation, maintenance and repair--The student will be able to:

21.01 Comply with the procedures necessary to ensure a safe and healthy work environment.

21.02 Demonstrate the skills necessary to master safe and secure pole climbing techniques, using appropriate PPE and complementary skills sets in handling ropes and rigging operations.
21.03 Identify proper heavy equipment (trucks & machines) for various transmission and distribution work.
21.04 Explain how new overhead electrical distribution and transmission systems are constructed including setting poles, pulling-in wires, installing wire insulators, hardware, and related equipment such as transformers, circuit breakers, sectionalizing switches and fuses.
21.05 Explain what is involved in underground electrical distribution system construction including digging trenches, installing vaults, conduits, transformers, switchgear, fuses, primary and secondary conductors, splices and connections.
21.06 Discuss the maintenance and repair requirements of electric power distribution and transmission systems, including overhead poles, towers, aerial conductors, and switching equipment, along with similarly purposed devices in underground installations consisting of conduits, cables, connections and related equipment such as transformers, manholes and switching points.
21.07 Explain how to inspect and test power lines and related equipment to locate and identify problems using readings from field instruments and testing procedures.
21.08 Read, interpret, and create basic prints used in the design, operation and maintenance of electrical distribution and transmission systems including engineering drawings, diagrams and schematics, documentation diagrams, and single line diagrams.

22.0 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:

22.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
22.02 Explain emergency procedures to follow in response to workplace accidents.
22.03 Create a disaster and/or emergency response plan. SHE2.0

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

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

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

24.01 Locate, comprehend and evaluate key elements of oral and written information.AF2.4

24.02 Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary. AF2.5
24.03 Present information formally and informally for specific purposes and audiences. AF2.9

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

25.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
25.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings. AF4.3

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

26.01 Demonstrate knowledge of arithmetic operations. AF3.2
26.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
26.03 Construct charts/tables/graphs using functions and data. AF3.5

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

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

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Energy Foundations (Energy Industry Fundamentals)**
**Course Number:** **8006110**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | # | **Anatomy/Physiology Honors** | # | **Astronomy Solar/Galactic Honors** | 1/52 2% |
| **Algebra 2** | ** | **Chemistry 1** | 2/55 4% | **Genetics** | # | **Marine Science 1 Honors** | 4/42 10% |
| **Geometry** | ** | **Physics 1** | 4/53 8% | **Earth-Space Science** | 1/58 2% | **Physical Science** | 6/56 11% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.17.17; SC.912.N.4.2

01.08 Explain the flow of energy from generation through distribution to the customer.
01.09 Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov ).
01.10 Identify the role and function of generation, transmission and distribution organizations.
01.11 Explains the role of regulatory bodies in the energy industry (Federal Energy Regulatory Commission www.ferc.gov; Public Service Commission of the State of Florida www.psc.state.fl.us) (highlight “obligation to serve”).
01.12 Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain importance of proper documentation to ensure compliance.

01.13 Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as water/wastewater), electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.
01.14 Describe the process of electric metering and billing for energy consumption.

02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment--The student will be able to:

02.01 Review the role of the U.S. Department of Labor/ Occupational Safety and Health Administration in work place safety. (http://www.complianceregs.com/29cfr/1910/subR/1910-269.html)
02.02 Identify both potential hazards and accident scenarios in the work environment.
02.03 Follow established safety procedures (OSHA regulations and utility company procedures).
02.04 Evaluate changes in the environment with respect to their impact on safety of self and others.
02.05 Promote effective local, state, and national security operations for the protection of people, data, property and institutions.
02.06 Comply with energy industry safety procedures and proper ways to perform work.
02.07 Name potential threats created by deviation from safety procedures and improper use of tools and equipment.
02.08 Use safety equipment as specified by user manuals and safety training.
02.09 Use Personal Protective Equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.
02.10 Keep personal safety equipment in good working order.
02.11 Use tools and equipment in compliance with user manuals and training.
02.12 Call attention to potential and actual hazardous conditions as they arise.
02.13 Alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.
02.14 Maintain appropriate certification and is knowledgeable in first aid or first response procedures.
02.15 Demonstrate understanding and knowledge of lock/tag out practices in the work place.
02.16 Notify person in charge and/or coworkers of unsafe work conditions.
02.17 Stop the job if there are unsafe working conditions.

03.0 Understand electric power generation--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.7.2; SC.912.L.17.11, 15, 19; SC.912.P.10.1

03.01 Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).
03.02 Identify electric power generation equipment and systems.
03.03 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental issues associated with each:
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages

03.06 Explain how natural gas was created and what are its advantages and disadvantages.
03.07 Explain how water is used in hydroelectric power generation and what are its advantages and disadvantages.
03.08 Explain how uranium is created and what are its advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources.
03.10 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
03.11 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
03.12 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
03.13 Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
03.14 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
03.15 Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear and emerging alternative energy systems).

04.0 Understand electric power transmission--The student will be able to:

04.01 Explain the electric power transmission process.
04.02 Discuss the application of different electric power transmission principles (including AC vs. DC).
04.03 Name electric power transmission equipment and systems.
04.04 Discuss the emerging technologies in electric power transmission (including Smart Grid).
04.05 Explain ownership/governance of the electric transmission system.

05.0 Understand electric power distribution--The student will be able to:

05.01 Explain the electric power distribution process.
05.02 Discuss the need for electric distribution systems and how they are designed to operate.
05.03 Name electric power distribution system equipment and what the various components do.
05.04 Discuss the emerging technologies in electric power distribution, including distribution automation and SmartGrid systems.

06.0 Identify and describe careers and entry requirements--The student will be able to:

06.01 Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
06.02 Identify entry-level careers available in business and corporate support functions of the energy industry**;** describes the education/experience requirements for

entry into those positions, and career advancement opportunities from those positions.

06.03 Describe general wage/salary, benefits, and other advantages of careers in the energy industry.

06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels (Partner to create Energy Education Portal).

07.0 Evaluate and analyze energy 'hot topics'--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.P.10.2, 8

07.01 Discuss the major sources of biomass.

07.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).

07.03 Outline the pyramid energy flow including the different trophic levels.

07.04 Describe the major sources, scale, and impacts of biomass energy.

07.05 Draw and label a diagram of biomass plantations.

07.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

08.01 Describe the nature and types of business organizations. SY1.0

08.02 Explain the effect of key organizational systems on performance and quality.

08.03 List and describe quality control systems and/or practices common to the workplace. SY2.0

08.04 Explain the impact of the global economy on business organizations.

09.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

09.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0

09.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0

09.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0

09.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0

09.05 Evaluate and compare employment opportunities that match career goals.ECD6.0

09.06 Identify and exhibit traits for retaining employment. ECD7.0

09.07 Identify opportunities and research requirements for career advancement.ECD8.0

09.08 Research the benefits of ongoing professional development. ECD9.0

09.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

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

10.01 Use Personal Information Management (PIM) applications to increase workplace efficiency. IT1.0

10.02 Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications. IT2.0

10.03 Employ computer operations applications to access, create, manage, integrate, and store information. IT3.0

10.04 Employ collaborative/groupware applications to facilitate group work. IT4.0

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Introduction to Alternative Energy**
**Course Number:** **8006120**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | 2/56<br>4% | **Anatomy/Physiology Honors** | 2/53<br>4% | **Astronomy Solar/Galactic Honors** | 5/52<br>10% |
| **Algebra 2** | ** | **Chemistry 1** | 3/55<br>5% | **Genetics** | 2/35<br>6% | **Marine Science 1 Honors** | 6/42<br>14% |
| **Geometry** | ** | **Physics 1** | 8/53<br>15% | **Earth-Space Science** | 3/58<br>5% | **Physical Science** | 7/56<br>13% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

11.0 Discuss the value of alternative energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.17.11, 17; SC.912.N.1.1; SC.912.P.10.1, 2

11.01 Investigate the reasons for seeking alternatives to fossil fuels.
11.02 Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels.
11.03 Discuss the three alternative energy sources that are currently the most developed and widely used (hydroelectric, nuclear, and biomass).

12.0 Investigate the viability of biomass and biofuel--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.2; SC.912.L.17.19, 20

12.01 Discuss the major sources of biomass.
12.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
12.03 Outline the pyramid energy flow including the different trophic levels.

12.04 Describe the major sources, scale, and impacts of biomass energy.
12.05 Draw and label a diagram of biomass plantations.
12.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

14.0 Investigate the use of nuclear power--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.2; SC.912.E.6.6; SC.912.L.17.11; SC.912.N.4.2

14.01 Explain the process of nuclear fission.
14.02 Define radio-isotopes and half-life.
14.03 Evaluate the advantages and disadvantages of nuclear power.
14.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
14.05 Describe nuclear energy and how it is harnessed.
14.06 Describe the Chernobyl Nuclear Power Plant accident.
14.07 Outline the societal debate over nuclear power.

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

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

16.0 Investigate the viability of solar energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.2; SC.912.E.6.6; SC.912.L.17.11; SC.912.P.10.1, 13, 18; SC.912.P.12.9

16.01 Describe solar energy and how it is harnessed.
16.02 Explain the significance and historical foundations of solar energy and its pioneers (Horace de Saussure and Clarence Kemp).
16.03 Explain the difference between passive solar and active solar.
16.04 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).

16.05 Describe a central receiver system.
16.06 Draw and label a diagram of a solar thermal plant.
16.07 Evaluate the advantages and disadvantages of using solar energy.

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

17.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
17.02 Describe the effect of money management on personal and career goals. FL3.0
17.03 Develop a personal budget and financial goals. FL3.1
17.04 Complete financial instruments for making deposits and withdrawals. FL3.2
17.05 Maintain financial records. FL3.3
17.06 Read and reconcile financial statements. FL3.4
17.07 Research, compare and contrast investment opportunities.

18.0 Investigate the viability of wind energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.11, 19; SC.912.P.10.1

18.01 Describe wind energy and the way it is harnessed.
18.02 Explain the significance of wind energy and its pioneers (Charles Brush).
18.03 Define kinetic energy.
18.04 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
18.05 Explain the acronym NIMBY (Not In My Backyard).
18.06 Explain why farmers and ranchers are amenable to wind technology.
18.07 Evaluate the advantages and disadvantages to wind technology.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Power Distribution Technician**
**Course Number:** **9700110**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

19.0 Understand electrical power transmission and distribution science--The student will be able to:

- 19.01 Explain and use the fundamental laws and principles of electricity & magnetism (e.g., electric charge, electric current, etc.).
- 19.02 Explain the process involved in the generation of electricity and its transmission from generating plants to substations.
- 19.03 Explain the process involved in distribution of electricity from substations to residential and commercial users of electric power.
- 19.04 Identify the components of electrical transmission and distribution systems including but not limited to substations, transformers, regulators, capacitors, reclosers, relays, circuit breakers, motors, transmission facilities, and distribution facilities).
- 19.05 Explain the purpose and operating characteristic of electric distribution equipment including but not limited to distribution feeder exits from substations, overhead wires and underground cables together with their respective pole lines, trenches and conduit systems.
- 19.06 Identify the applications of overhead and underground equipment including sectionalizing switches, automatic circuit reclosers, fuses and fuse assemblies, transformers, regulators, capacitors, insulators, surge arresters, and low voltage service equipment.

20.0 Understand electric power transmission and distribution systems overview--The student will be able to:

- 20.01 Explain how the United States electric power grid system is set up, and its limitations.
- 20.02 Explain the differences between AC and DC power transmission and distribution.
- 20.03 Explain how the different grid systems are interconnected and how they are controlled.
- 20.04 Explain what Smart Grid is and what problems it will solve.
- 20.05 Discuss the electric power transmission and distribution job functions.
- 20.06 Explain unique services of the utility business including street and area lighting, energy management, conservation, and matters related to power quality.

21.0 Apply construction, operation, maintenance and repair--The student will be able to:

21.01 Comply with the procedures necessary to ensure a safe and healthy work environment.
21.02 Demonstrate the skills necessary to master safe and secure pole climbing techniques, using appropriate PPE and complementary skills sets in handling ropes and rigging operations.
21.03 Identify proper heavy equipment (trucks & machines) for various transmission and distribution work.
21.04 Explain how new overhead electrical distribution and transmission systems are constructed including setting poles, pulling-in wires, installing wire insulators, hardware, and related equipment such as transformers, circuit breakers, sectionalizing switches and fuses.
21.05 Explain what is involved in underground electrical distribution system construction including digging trenches, installing vaults, conduits, transformers, switchgear, fuses, primary and secondary conductors, splices and connections.
21.06 Discuss the maintenance and repair requirements of electric power distribution and transmission systems, including overhead poles, towers, aerial conductors, and switching equipment, along with similarly purposed devices in underground installations consisting of conduits, cables, connections and related equipment such as transformers, manholes and switching points.
21.07 Explain how to inspect and test power lines and related equipment to locate and identify problems using readings from field instruments and testing procedures.
21.08 Read, interpret, and create basic prints used in the design, operation and maintenance of electrical distribution and transmission systems including engineering drawings, diagrams and schematics, documentation diagrams, and single line diagrams.

22.0 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:

22.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
22.02 Explain emergency procedures to follow in response to workplace accidents.
22.03 Create a disaster and/or emergency response plan. SHE2.0

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

23.01 Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace. CM1.0
23.02 Locate, organize and reference written information from various sources. CM3.0
23.03 Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences. CM5.0
23.04 Interpret verbal and nonverbal cues/behaviors that enhance communication. CM6.0
23.05 Apply active listening skills to obtain and clarify information. CM7.0
23.06 Develop and interpret tables and charts to support written and oral communications. CM8.0

23.07 Exhibit public relations skills that aid in achieving customer satisfaction. CM10.0

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

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

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

25.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
25.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3

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

26.01 Demonstrate knowledge of arithmetic operations. AF3.2
26.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
26.03 Construct charts/tables/graphs using functions and data. AF3.5

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

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

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Energy Generation Technician**
**Program Type:** **Career Preparatory**
**Career Cluster:** **Energy**

| | Secondary | PSAV |
|---|---|---|
| Program Number | 9700200 | X600200 |
| CIP Number | 0715050302 | 0715050302 |
| Grade Level | 9-12, 30,31 | 30,31 |
| Standard Length | 3 Credits | 450 Hours |
| Teacher Certification | **All Courses:**<br>ELECTRICAL @7G<br>IND ENGR @7G<br>TEC ED 1@2<br><br>**Introduction to Alter. Energy**<br>AGRICULTUR 1@2<br>TEC ED 1@2<br>EARTH SCI @4<br>SCIENCE 4<br>PHYSICS 1,4<br>CHEM 1,4<br>EARTH SCI 4,2<br>**Energy Foundations (Energy Industry Fundamentals)**<br>AGRICULTUR 1@2 | **All Courses:**<br>ELECTRICAL @7G<br>IND ENGR @7G<br>TEC ED 1@2 |
| CTSO | SkillsUSA | SkillsUSA |
| SOC Codes (all applicable) | 49-9099 | 49-9099 |
| Facility Code | 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 | N/A | Mathematics: 9<br>Language: 9<br>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 purpose of this program 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 one occupational completion point. When offered at the postsecondary 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 **PSAV** program structure:

| OCP | Course Number | Course Title | Course Length | SOC Code |
|---|---|---|---|---|
| A | EEV0202 | Energy Generation Technician | 450 Hours | 49-9099 |

The following table illustrates the **Secondary** program structure:

| OCP | Course Number | Course Title | Length | SOC Code | Level |
|---|---|---|---|---|---|
| | 8006110 | Energy Foundations (Energy Industry Fundamentals) | 1 Credit | | 3 |
| | 8006120 | Introduction to Alternative Energy | 1 Credit | | 3 |
| A | 9700210 | Energy Generation Technician | 1 Credit | 49-9099 | 3 |

## 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

### Academic Alignment

Some or all of the courses in this program have been aligned to the Next Generation Sunshine State Standards contained in specific math and science core academic courses. This alignment

resulted from a collaborative review by Career and Technical Education (CTE) teachers and core academic teachers. The table below contains the results of the alignment efforts. Data shown in the table includes the number of academic standards in the CTE course, the total number of math and science standards contained in the academic course, and the percentage of alignment to the CTE course. The following academic courses were included in the alignment (see code for use in table).

| Academic Subject Area | Academic Course |
|---|---|
| Math | Algebra 1 (ALG1)<br>Algebra 2 (ALG2)<br>Geometry (GEO) |
| Science | Anatomy/Physiology Honors (APH)<br>Astronomy Solar/Galactic Honors (ASGH)<br>Biology 1 (BIO1)<br>Chemistry 1 (CHM1)<br>Earth-Space Science (ESS)<br>Genetics (GEN)<br>Marine Science 1 Honors (MS1H)<br>Physical Science (PS)<br>Physics 1 (PHY1) |

| Course | Math | | | Science | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ALG1 | ALG2 | GEO | APH | ASGH | BIO1 | CHM1 | ESS | GEN | MS1H | PS | PHY1 |
| Energy Foundations (Energy Industry Fundamentals) | ** | ** | ** | # | 1/52<br>2% | # | 2/55<br>4% | 1/58<br>2% | # | 4/42<br>10% | 6/56<br>11% | 4/53<br>8% |
| Introduction to Alternative Energy | ** | ** | ** | 2/53<br>4% | 5/52<br>10% | 2/56<br>4% | 3/55<br>5% | 3/58<br>5% | 2/35<br>6% | 6/42<br>14% | 7/56<br>13% | 8/53<br>15% |
| Energy Generation Technician | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

## Career and Technical Student Organization (CTSO)

SkillsUSA (secondary only) 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

The PSAV component of 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.

## Bright Futures/Gold Seal Scholarship

Course substitutions as defined in the Comprehensive Course Table for this program area may be used to qualify a student for Florida's Gold Seal Vocational Scholarship, providing all other eligibility requirements are met. Eligibility requirements are available online at https://www.osfaffelp.org/bfiehs/fnbpcm02_CCTMain.aspx.

## Fine Arts/Practical Arts Credit

Many courses in CTE programs meet the Fine Arts/Practical Arts credit for high school graduation. For additional information refer to http://www.fldoe.org/schools/pdf/ListPracticalArtsCourses.pdf.

## Standards

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

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry.
02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment.
03.0 Understand electric power generation.
04.0 Understand electric power transmission.
05.0 Understand electric power distribution
06.0 Identify and describe careers and entry requirements.
07.0 Evaluate and analyze energy 'hot topics'.
08.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
09.0 Explain the importance of employability and entrepreneurship skills.
10.0 Use information technology tools.
11.0 Discuss the value of alternative energy.
12.0 Investigate the viability of biomass and biofuel.
13.0 Describe the importance of professional ethics and legal responsibilities.

14.0 Investigate the use of nuclear power.
15.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
16.0 Investigate the viability of solar energy.
17.0 Demonstrate personal money-management concepts, procedures, and strategies.
18.0 Investigate the viability of wind energy.
19.0 Understand generation system overview.
20.0 Apply equipment operation, maintenance and repair.
21.0 Demonstrates the ability to design, analyze and effectively use systems, components and methods with a framework of quality and continuous improvement.
22.0 Diagnoses and corrects abnormalities and malfunctions in equipment and production processes.
23.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
24.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
25.0 Demonstrate language arts knowledge and skills.
26.0 Demonstrate science knowledge and skills.
27.0 Demonstrate mathematics knowledge and skills.
28.0 Solve problems using critical thinking skills, creativity and innovation.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Energy Generation Technician**
**PSAV Number:** **X600200**

**Course Number: EEV0202**
**Occupational Completion Point: A**
**Power Generator Technician – 450 Hours – SOC Code 49-9099**

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry--The student will be able to:

01.01 Explain the flow of energy from generation through distribution to the customer.
01.02 Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov ).
01.03 Identify the role and function of generation, transmission and distribution organizations.
01.04 Explains the role of regulatory bodies in the energy industry (Federal Energy Regulatory Commission www.ferc.gov; Public Service Commission of the State of Florida www.psc.state.fl.us) (highlight "obligation to serve").
01.05 Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain importance of proper documentation to ensure compliance.
01.06 Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as water/wastewater), electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.
01.07 Describe the process of electric metering and billing for energy consumption.

02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment--The student will be able to:

02.01 Review the role of the U.S. Department of Labor/ Occupational Safety and Health Administration in work place safety. (http://www.complianceregs.com/29cfr/1910/subR/1910-269.html)
02.02 Identify both potential hazards and accident scenarios in the work environment.
02.03 Follow established safety procedures (OSHA regulations and utility company procedures).
02.04 Evaluate changes in the environment with respect to their impact on safety of self and others.
02.05 Promote effective local, state, and national security operations for the protection of people, data, property and institutions.
02.06 Comply with energy industry safety procedures and proper ways to perform work.
02.07 Name potential threats created by deviation from safety procedures and improper use of tools and equipment.
02.08 Use safety equipment as specified by user manuals and safety training.
02.09 Use Personal Protective Equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.

02.10 Keep personal safety equipment in good working order.
02.11 Use tools and equipment in compliance with user manuals and training.
02.12 Call attention to potential and actual hazardous conditions as they arise.
02.13 Alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.
02.14 Maintain appropriate certification and is knowledgeable in first aid or first response procedures.
02.15 Demonstrate understanding and knowledge of lock/tag out practices in the work place.
02.16 Notify person in charge and/or coworkers of unsafe work conditions.
02.17 Stop the job if there are unsafe working conditions.

03.0 Understand electric power generation--The student will be able to:

03.01 Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).
03.02 Identify electric power generation equipment and systems.
03.03 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental issues associated with each:
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages
03.06 Explain how natural gas was created and what are its advantages and disadvantages.
03.07 Explain how water is used in hydroelectric power generation and what are its advantages and disadvantages.
03.08 Explain how uranium is created and what are its advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources.
03.10 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
03.11 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
03.12 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
03.13 Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
03.14 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
03.15 Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear and emerging alternative energy systems).

04.0 Understand electric power transmission--The student will be able to:

04.01 Explain the electric power transmission process.
04.02 Discuss the application of different electric power transmission principles (including AC vs. DC).
04.03 Name electric power transmission equipment and systems.

04.04 Discuss the emerging technologies in electric power transmission (including Smart Grid).
04.05 Explain ownership/governance of the electric transmission system.

05.0 Understand electric power distribution--The student will be able to:

05.01 Explain the electric power distribution process.
05.02 Discuss the need for electric distribution systems and how they are designed to operate.
05.03 Name electric power distribution system equipment and what the various components do.
05.04 Discuss the emerging technologies in electric power distribution, including distribution automation and SmartGrid systems.

06.0 Identify and describe careers and entry requirements--The student will be able to:

06.01 Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
06.02 Identify entry-level careers available in business and corporate support functions of the energy industry**;** describes the education/experience requirements for entry into those positions, and career advancement opportunities from those positions.
06.03 Describe general wage/salary, benefits, and other advantages of careers in the energy industry.
06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels (Partner to create Energy Education Portal).

07.0 Evaluate and analyze energy 'hot topics'--The student will be able to:

07.01 Discuss the major sources of biomass.
07.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
07.03 Outline the pyramid energy flow including the different trophic levels.
07.04 Describe the major sources, scale, and impacts of biomass energy.
07.05 Draw and label a diagram of biomass plantations.
07.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

09.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

09.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
09.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
09.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
09.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
09.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
09.06 Identify and exhibit traits for retaining employment. ECD7.0
09.07 Identify opportunities and research requirements for career advancement.ECD8.0
09.08 Research the benefits of ongoing professional development. ECD9.0
09.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

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

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

11.0 Discuss the value of alternative energy--The student will be able to:

11.01 Investigate the reasons for seeking alternatives to fossil fuels.
11.02 Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels.
11.03 Discuss the three alternative energy sources that are currently the most developed and widely used (hydroelectric, nuclear, and biomass).

12.0 Investigate the viability of biomass and biofuel--The student will be able to:

12.01 Discuss the major sources of biomass.
12.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
12.03 Outline the pyramid energy flow including the different trophic levels.
12.04 Describe the major sources, scale, and impacts of biomass energy.
12.05 Draw and label a diagram of biomass plantations.
12.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

13.01 Evaluate and justify decisions based on ethical reasoning. ELR1.0
13.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies. ELR1.1

13.03 Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace. ELR1.2
13.04 Interpret and explain written organizational policies and procedures. ELR2.0

14.0 Investigate the use of nuclear power--The student will be able to:

14.01 Explain the process of nuclear fission.
14.02 Define radio-isotopes and half-life.
14.03 Evaluate the advantages and disadvantages of nuclear power.
14.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
14.05 Describe nuclear energy and how it is harnessed.
14.06 Describe the Chernobyl Nuclear Power Plant accident.
14.07 Outline the societal debate over nuclear power.

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

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

16.0 Investigate the viability of solar energy--The student will be able to:

16.01 Describe solar energy and how it is harnessed.
16.02 Explain the significance and historical foundations of solar energy and its pioneers (Horace de Saussure and Clarence Kemp).
16.03 Explain the difference between passive solar and active solar.
16.04 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).
16.05 Describe a central receiver system.
16.06 Draw and label a diagram of a solar thermal plant.
16.07 Evaluate the advantages and disadvantages of using solar energy.

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

17.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
17.02 Describe the effect of money management on personal and career goals. FL3.0
17.03 Develop a personal budget and financial goals. FL3.1
17.04 Complete financial instruments for making deposits and withdrawals. FL3.2
17.05 Maintain financial records. FL3.3
17.06 Read and reconcile financial statements. FL3.4
17.07 Research, compare and contrast investment opportunities.

18.0 Investigate the viability of wind energy--The student will be able to:

18.01 Describe wind energy and the way it is harnessed.
18.02 Explain the significance of wind energy and its pioneers (Charles Brush).
18.03 Define kinetic energy.
18.04 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
18.05 Explain the acronym NIMBY (Not In My Backyard).
18.06 Explain why farmers and ranchers are amenable to wind technology.
18.07 Evaluate the advantages and disadvantages to wind technology.

19.0 Understand generation system overview--The student will be able to:

19.01 Explain and use the fundamental laws and principles of electricity & magnetism (e.g., electric charge, electric current, etc.)
19.02 Explain the components of electrical generating systems including boilers, generators, alternators, turbines, motors, engines, pumps, and switchgear.
19.03 Explain the differences and similarities of power generation, including use of different fuel types, different power plant uses (i.e., base load, peaking, load following, and co-generation).
19.04 Explain the basic operating principles of fossil, hydro-electric, internal combustion and nuclear reactor systems, which supply the bulk of the North American power grid.
19.05 Discuss the electric power generation job functions.

20.0 Apply equipment operation, maintenance and repair--The student will be able to:

20.01 Comply with the procedures necessary to ensure a safe and healthy work environment
20.02 Operate, repair and test machines, devices and equipment based on electrical or mechanical standards.
20.03 Exhibit an understanding of equipment principles to be able to diagnose and repair machine malfunctions.
20.04 Operate basic hand and small electric tools and electronic test equipment
20.05 Perform tests and inspections of products, services or processes to evaluate quality or performance.
20.06 Determine the correct kind of tools and equipment needed to do a job
20.07 Read gauges, dials or other indicators to make sure a machine is working properly
20.08 Read, interpret and create basic prints used in the design, operation and maintenance of electrical and mechanical equipment, including engineering drawings, diagrams and schematics, documentation diagrams, and single line diagrams.

21.0 Demonstrate the ability to design, analyze and effectively use systems, components and methods with a framework of quality and continuous improvement--The student will be able to:

21.01 Conduct tests and inspections of products, services or processes to evaluate quality or performance.
21.02 Incorporate new information into both current and future problem solving and decision making.

21.03 Monitor/assess performance of self and other individuals or organizations to make improvements or take necessary corrective action.
21.04 Describe how a system should work and how changes in conditions, operations and the environment will affect the performance of that system.
21.05 Use logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
21.06 Identify the value of preventative/predictive maintenance versus reactive maintenance.

22.0 Diagnose and correct abnormalities and malfunctions in equipment and production processes--The student will be able to:

22.01 Demonstrate knowledge of normal equipment operation (how individual pieces of equipment relate to each other) in order to anticipate potential equipment problems before they occur
22.02 Determine causes of operating errors, and recommends appropriate course of action.
22.03 Describe when and how to notify supervisory personnel in the event of operational errors or equipment malfunctions.

23.0 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:

23.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
23.02 Explain emergency procedures to follow in response to workplace accidents.
23.03 Create a disaster and/or emergency response plan. SHE2.0

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

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

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

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

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

26.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
26.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3

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

27.01 Demonstrate knowledge of arithmetic operations. AF3.2
27.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
27.03 Construct charts/tables/graphs using functions and data. AF3.5

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

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

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Energy Foundations (Energy Industry Fundamentals)**
**Course Number:** **8006110**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | # | **Anatomy/Physiology Honors** | # | **Astronomy Solar/Galactic Honors** | 1/52 2% |
| **Algebra 2** | ** | **Chemistry 1** | 2/55 4% | **Genetics** | # | **Marine Science 1 Honors** | 4/42 10% |
| **Geometry** | ** | **Physics 1** | 4/53 8% | **Earth-Space Science** | 1/58 2% | **Physical Science** | 6/56 11% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.17.17; SC.912.N.4.2

01.08 Explain the flow of energy from generation through distribution to the customer.
01.09 Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov ).
01.10 Identify the role and function of generation, transmission and distribution organizations.
01.11 Explains the role of regulatory bodies in the energy industry (Federal Energy Regulatory Commission www.ferc.gov; Public Service Commission of the State of Florida www.psc.state.fl.us) (highlight “obligation to serve”).
01.12 Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain importance of proper documentation to ensure compliance.
01.13 Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as

water/wastewater), electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.

01.14 Describe the process of electric metering and billing for energy consumption.

02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment--The student will be able to:

02.01 Review the role of the U.S. Department of Labor/ Occupational Safety and Health Administration in work place safety. (http://www.complianceregs.com/29cfr/1910/subR/1910-269.html)
02.02 Identify both potential hazards and accident scenarios in the work environment.
02.03 Follow established safety procedures (OSHA regulations and utility company procedures).
02.04 Evaluate changes in the environment with respect to their impact on safety of self and others.
02.05 Promote effective local, state, and national security operations for the protection of people, data, property and institutions.
02.06 Comply with energy industry safety procedures and proper ways to perform work.
02.07 Name potential threats created by deviation from safety procedures and improper use of tools and equipment.
02.08 Use safety equipment as specified by user manuals and safety training.
02.09 Use Personal Protective Equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.
02.10 Keep personal safety equipment in good working order.
02.11 Use tools and equipment in compliance with user manuals and training.
02.12 Call attention to potential and actual hazardous conditions as they arise.
02.13 Alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.
02.14 Maintain appropriate certification and is knowledgeable in first aid or first response procedures.
02.15 Demonstrate understanding and knowledge of lock/tag out practices in the work place.
02.16 Notify person in charge and/or coworkers of unsafe work conditions.
02.17 Stop the job if there are unsafe working conditions.

03.0 Understand electric power generation--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.7.2; SC.912.L.17.11, 15, 19; SC.912.P.10.1

03.01 Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).
03.02 Identify electric power generation equipment and systems.
03.03 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental issues associated with each:
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages
03.06 Explain how natural gas was created and what are its advantages and disadvantages.

03.07 Explain how water is used in hydroelectric power generation and what are its advantages and disadvantages.
03.08 Explain how uranium is created and what are its advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources.
03.10 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
03.11 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
03.12 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
03.13 Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
03.14 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
03.15 Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear and emerging alternative energy systems).

04.0 Understand electric power transmission--The student will be able to:

04.01 Explain the electric power transmission process.
04.02 Discuss the application of different electric power transmission principles (including AC vs. DC).
04.03 Name electric power transmission equipment and systems.
04.04 Discuss the emerging technologies in electric power transmission (including Smart Grid).
04.05 Explain ownership/governance of the electric transmission system.

05.0 Understand electric power distribution--The student will be able to:

05.01 Explain the electric power distribution process.
05.02 Discuss the need for electric distribution systems and how they are designed to operate.
05.03 Name electric power distribution system equipment and what the various components do.
05.04 Discuss the emerging technologies in electric power distribution, including distribution automation and SmartGrid systems.

06.0 Identify and describe careers and entry requirements--The student will be able to:

06.01 Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
06.02 Identify entry-level careers available in business and corporate support functions of the energy industry; describes the education/experience requirements for entry into those positions, and career advancement opportunities from those positions.

06.03 Describe general wage/salary, benefits, and other advantages of careers in the energy industry.
06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels (Partner to create Energy Education Portal).

07.0 Evaluate and analyze energy 'hot topics'--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.P.10.2, 8

07.01 Discuss the major sources of biomass.
07.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
07.03 Outline the pyramid energy flow including the different trophic levels.
07.04 Describe the major sources, scale, and impacts of biomass energy.
07.05 Draw and label a diagram of biomass plantations.
07.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

09.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

09.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
09.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
09.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
09.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
09.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
09.06 Identify and exhibit traits for retaining employment. ECD7.0
09.07 Identify opportunities and research requirements for career advancement.ECD8.0
09.08 Research the benefits of ongoing professional development. ECD9.0
09.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

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

10.01 Use Personal Information Management (PIM) applications to increase workplace efficiency. IT1.0
10.02 Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications. IT2.0

10.03 Employ computer operations applications to access, create, manage, integrate, and store information. IT3.0
10.04 Employ collaborative/groupware applications to facilitate group work. IT4.0

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Introduction to Alternative Energy**
**Course Number:** **8006120**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | 2/56<br>4% | **Anatomy/Physiology Honors** | 2/53<br>4% | **Astronomy Solar/Galactic Honors** | 5/52<br>10% |
| **Algebra 2** | ** | **Chemistry 1** | 3/55<br>5% | **Genetics** | 2/35<br>6% | **Marine Science 1 Honors** | 6/42<br>14% |
| **Geometry** | ** | **Physics 1** | 8/53<br>15% | **Earth-Space Science** | 3/58<br>5% | **Physical Science** | 7/56<br>13% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

11.0 Discuss the value of alternative energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.17.11, 17; SC.912.N.1.1; SC.912.P.10.1, 2

11.01 Investigate the reasons for seeking alternatives to fossil fuels.
11.02 Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels.
11.03 Discuss the three alternative energy sources that are currently the most developed and widely used (hydroelectric, nuclear, and biomass).

12.0 Investigate the viability of biomass and biofuel--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.2; SC.912.L.17.19, 20

12.01 Discuss the major sources of biomass.
12.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
12.03 Outline the pyramid energy flow including the different trophic levels.

12.04 Describe the major sources, scale, and impacts of biomass energy.
12.05 Draw and label a diagram of biomass plantations.
12.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

14.0 Investigate the use of nuclear power--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards:
MA.912.S.3.2; SC.912.E.6.6; SC.912.L.17.11; SC.912.N.4.2

14.01 Explain the process of nuclear fission.
14.02 Define radio-isotopes and half-life.
14.03 Evaluate the advantages and disadvantages of nuclear power.
14.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
14.05 Describe nuclear energy and how it is harnessed.
14.06 Describe the Chernobyl Nuclear Power Plant accident.
14.07 Outline the societal debate over nuclear power.

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

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

16.0 Investigate the viability of solar energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards:
MA.912.S.3.2; SC.912.E.6.6; SC.912.L.17.11; SC.912.P.10.1, 13, 18; SC.912.P.12.9

16.01 Describe solar energy and how it is harnessed.
16.02 Explain the significance and historical foundations of solar energy and its pioneers (Horace de Saussure and Clarence Kemp).
16.03 Explain the difference between passive solar and active solar.
16.04 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).

16.05 Describe a central receiver system.
16.06 Draw and label a diagram of a solar thermal plant.
16.07 Evaluate the advantages and disadvantages of using solar energy.

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

17.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
17.02 Describe the effect of money management on personal and career goals. FL3.0
17.03 Develop a personal budget and financial goals. FL3.1
17.04 Complete financial instruments for making deposits and withdrawals. FL3.2
17.05 Maintain financial records. FL3.3
17.06 Read and reconcile financial statements. FL3.4
17.07 Research, compare and contrast investment opportunities.

18.0 Investigate the viability of wind energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.11, 19; SC.912.P.10.1

18.01 Describe wind energy and the way it is harnessed.
18.02 Explain the significance of wind energy and its pioneers (Charles Brush).
18.03 Define kinetic energy.
18.04 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
18.05 Explain the acronym NIMBY (Not In My Backyard).
18.06 Explain why farmers and ranchers are amenable to wind technology.
18.07 Evaluate the advantages and disadvantages to wind technology.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Energy Generation Technician**
**Course Number:** **9700210**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

19.0 Understand generation system overview--The student will be able to:

- 19.01 Explain and use the fundamental laws and principles of electricity & magnetism (e.g., electric charge, electric current, etc.)
- 19.02 Explain the components of electrical generating systems including boilers, generators, alternators, turbines, motors, engines, pumps, and switchgear.
- 19.03 Explain the differences and similarities of power generation, including use of different fuel types, different power plant uses (i.e., base load, peaking, load following, and co-generation).
- 19.04 Explain the basic operating principles of fossil, hydro-electric, internal combustion and nuclear reactor systems, which supply the bulk of the North American power grid.
- 19.05 Discuss the electric power generation job functions.

20.0 Apply equipment operation, maintenance and repair--The student will be able to:

- 20.01 Comply with the procedures necessary to ensure a safe and healthy work environment
- 20.02 Operate, repair and test machines, devices and equipment based on electrical or mechanical standards.
- 20.03 Exhibit an understanding of equipment principles to be able to diagnose and repair machine malfunctions.
- 20.04 Operate basic hand and small electric tools and electronic test equipment
- 20.05 Perform tests and inspections of products, services or processes to evaluate quality or performance.
- 20.06 Determine the correct kind of tools and equipment needed to do a job
- 20.07 Read gauges, dials or other indicators to make sure a machine is working properly
- 20.08 Read, interpret and create basic prints used in the design, operation and maintenance of electrical and mechanical equipment, including engineering drawings, diagrams and schematics, documentation diagrams, and single line diagrams.

21.0 Demonstrate the ability to design, analyze and effectively use systems, components and methods with a framework of quality and continuous improvement--The student will be

able to:

21.01 Conduct tests and inspections of products, services or processes to evaluate quality or performance.
21.02 Incorporate new information into both current and future problem solving and decision making.
21.03 Monitor/assess performance of self and other individuals or organizations to make improvements or take necessary corrective action.
21.04 Describe how a system should work and how changes in conditions, operations and the environment will affect the performance of that system.
21.05 Use logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
21.06 Identify the value of preventative/predictive maintenance versus reactive maintenance.

22.0 Diagnose and correct abnormalities and malfunctions in equipment and production processes--The student will be able to:

22.01 Demonstrate knowledge of normal equipment operation (how individual pieces of equipment relate to each other) in order to anticipate potential equipment problems before they occur
22.02 Determine causes of operating errors, and recommends appropriate course of action.
22.03 Describe when and how to notify supervisory personnel in the event of operational errors or equipment malfunctions.

23.0 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:

23.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
23.02 Explain emergency procedures to follow in response to workplace accidents.
23.03 Create a disaster and/or emergency response plan. SHE2.0

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

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

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

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

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

26.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
26.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3

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

27.01 Demonstrate knowledge of arithmetic operations. AF3.2
27.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
27.03 Construct charts/tables/graphs using functions and data. AF3.5

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

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

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Energy Technician**
**Program Type:** **Career Preparatory**
**Career Cluster:** **Energy**

| | Secondary | PSAV |
|---|---|---|
| Program Number | 9700300 | X600600 |
| CIP Number | 0715050320 | 0715050320 |
| Grade Level | 9-12 | 30, 31 |
| Standard Length | 4 Credits | 600 Hours |
| Teacher Certification | **All Courses:**<br>ELECTRICAL @7G<br>IND ENGR @7G<br>TEC ED 1@2<br><br>**Introduction to Alter. Energy**<br>AGRICULTUR 1@2<br>TEC ED 1@2<br>EARTH SCI @4<br>SCIENCE 4<br>PHYSICS 1,4<br>CHEM 1,4<br>EARTH SCI 4,2<br>**Energy Foundations (Energy Industry Fundamentals)**<br>AGRICULTUR 1@2 | ELECTRICAL @7G<br>IND ENGR @7G<br>TEC ED 1@2 |
| CTSO | SkillsUSA | SkillsUSA |
| SOC Codes (all applicable) | 49-9099 | 49-9099 |
| Facility Code | 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 | N/A | Mathematics: 9<br>Language: 9<br>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 Energy Technician program which consists of two course offering related to energy and two course offering related to electricity which have been incorporated into one program 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 emerging alternative energy needs.

## Program Structure

This program is a planned sequence of instruction consisting of one occupational completion point that focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of energy foundations, alternative energy, and electricity.

When offered at the postsecondary 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 **PSAV** program structure:

| OCP | Course Number | Course Title | Course Length | SOC Code |
|---|---|---|---|---|
| | ETP0090 | Energy Technician 1 | 300 hours | |
| A | ETP0091 | Energy Technician 2 | 300 Hours | 49-9099 |

The following table illustrates the **Secondary** program structure:

| OCP | Course Number | Course Title | Length | SOC Code | Level |
|---|---|---|---|---|---|
| | 8006110 | Energy Foundations (Energy Industry Fundamentals) | 1 Credit | | 3 |
| | 8727210 | Electricity 1 | 1 Credit | | 2 |
| | 8006120 | Introduction to Alternative Energy | 1 Credit | | 3 |
| A | 8727220 | Electricity 2 | 1 Credit | 49-9099 | 2 |

## 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

### Academic Alignment

Some or all of the courses in this program have been aligned to the Next Generation Sunshine State Standards contained in specific math and science core academic courses. This alignment resulted from a collaborative review by Career and Technical Education (CTE) teachers and core academic teachers. The table below contains the results of the alignment efforts. Data shown in the table includes the number of academic standards in the CTE course, the total number of math and science standards contained in the academic course, and the percentage of alignment to the CTE course. The following academic courses were included in the alignment (see code for use in table).

| Academic Subject Area | Academic Course |
|---|---|
| Math | Algebra 1 (ALG1)<br>Algebra 2 (ALG2)<br>Geometry (GEO) |
| Science | Anatomy/Physiology Honors (APH)<br>Astronomy Solar/Galactic Honors (ASGH)<br>Biology 1 (BIO1)<br>Chemistry 1 (CHM1)<br>Earth-Space Science (ESS)<br>Genetics (GEN)<br>Marine Science 1 Honors (MS1H)<br>Physical Science (PS)<br>Physics 1 (PHY1) |

| Course | Math | | | Science | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ALG1 | ALG2 | GEO | APH | ASGH | BIO1 | CHM1 | ESS | GEN | MS1H | PS | PHY1 |
| Energy Foundations (Energy Industry Fundamentals) | ** | ** | ** | # | 1/52<br>2% | # | 2/55<br>4% | 1/58<br>2% | # | 4/42<br>10% | 6/56<br>11% | 4/53<br>8% |
| Electricity 1 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| Introduction to Alternative Energy | ** | ** | ** | 2/53<br>4% | 5/52<br>10% | 2/56<br>4% | 3/55<br>5% | 3/58<br>5% | 2/35<br>6% | 6/42<br>14% | 7/56<br>13% | 8/53<br>15% |
| Electricity 2 | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

### Career and Technical Student Organization (CTSO)

SkillsUSA 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

The PSAV component of 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.

## Bright Futures/Gold Seal Scholarship

Course substitutions as defined in the Comprehensive Course Table for this program area may be used to qualify a student for Florida's Gold Seal Vocational Scholarship, providing all other eligibility requirements are met. Eligibility requirements are available online at https://www.osfaffelp.org/bfiehs/fnbpcm02_CCTMain.aspx.

## Fine Arts/Practical Arts Credit

Many courses in CTE programs meet the Fine Arts/Practical Arts credit for high school graduation. For additional information refer to http://www.fldoe.org/schools/pdf/ListPracticalArtsCourses.pdf.

## Standards

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

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry.
02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment.
03.0 Understand electric power generation.
04.0 Understand electric power transmission.
05.0 Understand electric power distribution
06.0 Identify and describe careers and entry requirements.
07.0 Evaluate and analyze energy 'hot topics'.

08.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
09.0 Explain the importance of employability and entrepreneurship skills.
10.0 Use information technology tools.
11.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
12.0 Identify, use and maintain the tools and accessories used in the electrical industry.
13.0 Demonstrate an understanding of basic Direct-Current (DC) electrical-circuit skills.
14.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
15.0 Demonstrate mathematics knowledge and skills.
16.0 Demonstrate an understanding of basic electricity.
17.0 Read and interpret basic electric codes.
18.0 Discuss the value of alternative energy.
19.0 Investigate the viability of biomass and biofuel.
20.0 Describe the importance of professional ethics and legal responsibilities.
21.0 Investigate the use of nuclear power.
22.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
23.0 Investigate the viability of solar energy.
24.0 Demonstrate personal money-management concepts, procedures, and strategies.
25.0 Investigate the viability of wind energy.
26.0 Apply mathematics knowledge and skills to electricity.
27.0 Demonstrate further understanding of electricity.
28.0 Solve problems using critical thinking skills, creativity and innovation.
29.0 Demonstrate language arts knowledge and skills.
30.0 Demonstrate science knowledge and skills.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Energy Technician**
**PSAV Number:** **X600600**

**Course Number: ETP0090**
**Occupational Completion Point:**
**Energy Technician 1 – 300 Hours – SOC Code 49-9099**

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry--The student will be able to:

00.01 Explain the flow of energy from generation through distribution to the customer.
00.02 Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov ).
00.03 Identify the role and function of generation, transmission and distribution organizations.
00.04 Explains the role of regulatory bodies in the energy industry (Federal Energy Regulatory Commission www.ferc.gov; Public Service Commission of the State of Florida www.psc.state.fl.us) (highlight "obligation to serve").
00.05 Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain importance of proper documentation to ensure compliance.
00.06 Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as water/wastewater), electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.
00.07 Describe the process of electric metering and billing for energy consumption.

02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment--The student will be able to:

02.01 Review the role of the U.S. Department of Labor/Occupational Safety and Health Administration in work place safety. (http://www.complianceregs.com/29cfr/1910/subR/1910-269.html)
02.02 Identify both potential hazards and accident scenarios in the work environment.
02.03 Follow established safety procedures (OSHA regulations and utility company procedures).
02.04 Evaluate changes in the environment with respect to their impact on safety of self and others.
02.05 Promote effective local, state, and national security operations for the protection of people, data, property and institutions.
02.06 Comply with energy industry safety procedures and proper ways to perform work.
02.07 Name potential threats created by deviation from safety procedures and improper use of tools and equipment.
02.08 Use safety equipment as specified by user manuals and safety training.
02.09 Use Personal Protective Equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.

02.10 Keep personal safety equipment in good working order.
02.11 Use tools and equipment in compliance with user manuals and training.
02.12 Call attention to potential and actual hazardous conditions as they arise.
02.13 Alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.
02.14 Maintain appropriate certification and is knowledgeable in first aid or first response procedures.
02.15 Demonstrate understanding and knowledge of lock/tag out practices in the work place.
02.16 Notify person in charge and/or coworkers of unsafe work conditions.
02.17 Stop the job if there are unsafe working conditions.

03.0 Understand electric power generation--The student will be able to:

03.01 Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).
03.02 Identify electric power generation equipment and systems.
03.03 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental issues associated with each:
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages
03.06 Explain how natural gas was created and what are its advantages and disadvantages.
03.07 Explain how water is used in hydroelectric power generation and what are its advantages and disadvantages.
03.08 Explain how uranium is created and what are its advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources.
03.10 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
03.11 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
03.12 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
03.13 Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
03.14 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
03.15 Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear and emerging alternative energy systems).

04.0 Understand electric power transmission--The student will be able to:

04.01 Explain the electric power transmission process.
04.02 Discuss the application of different electric power transmission principles (including AC vs. DC).
04.03 Name electric power transmission equipment and systems.

04.04 Discuss the emerging technologies in electric power transmission (including Smart Grid).
04.05 Explain ownership/governance of the electric transmission system.

05.0 Understand electric power distribution--The student will be able to:

05.01 Explain the electric power distribution process.
05.02 Discuss the need for electric distribution systems and how they are designed to operate.
05.03 Name electric power distribution system equipment and what the various components do.
05.04 Discuss the emerging technologies in electric power distribution, including distribution automation and SmartGrid systems.

06.0 Identify and describe careers and entry requirements--The student will be able to:

06.01 Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
06.02 Identify entry-level careers available in business and corporate support functions of the energy industry**;** describes the education/experience requirements for entry into those positions, and career advancement opportunities from those positions.
06.03 Describe general wage/salary, benefits, and other advantages of careers in the energy industry.
06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels (Partner to create Energy Education Portal).

07.0 Evaluate and analyze energy 'hot topics'--The student will be able to:

07.01 Discuss the major sources of biomass.
07.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
07.03 Outline the pyramid energy flow including the different trophic levels.
07.04 Describe the major sources, scale, and impacts of biomass energy.
07.05 Draw and label a diagram of biomass plantations.
07.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

09.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

09.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
09.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
09.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
09.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
09.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
09.06 Identify and exhibit traits for retaining employment. ECD7.0
09.07 Identify opportunities and research requirements for career advancement.ECD8.0
09.08 Research the benefits of ongoing professional development. ECD9.0
09.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

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

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

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

11.01 Clean the work area and maintain it in a safe condition.
11.02 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
11.03 Identify and operate workplace-safety electrical devices.
11.04 Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
11.05 Explain emergency procedures to follow in response to workplace accidents.
11.06 Create a disaster and/or emergency response plan. SHE2.0
11.07 Demonstrate knowledge of CPR (cardiopulmonary resuscitation) and first aid.
11.08 Describe "Right-to-Know" Law as recorded in (29 CFR.1910.1200)

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

12.01 Identify and select tools, equipment, materials, and wires to complete a job.
12.02 Drill holes in metal, wood, and concrete for electrical wiring.
12.03 Lay out electrical devices, complying with regulations.
12.04 Install the following, complying with the appropriate local, state, or national electric codes:
  a. Conductors and cable
  b. Standard outlets and switch boxes

c. Explain cord connections on major appliances
d. Cords switches, receptacles, and dimmers, including a single-pole switched lighting circuit, a three-way switched lighting circuit, and a four-way combination circuit.

13.0 Demonstrate an understanding of basic Direct-Current (DC) electrical-circuit skills--The student will be able to:

13.01 Define the terms "voltage," "current," "resistance," "power," and "energy."
13.02 Measure voltage, amperage, and resistance, using a Volt-Ohm Meter (VOM) and a Digital Volt-Ohm Meter (DVM).
13.03 Analyze, and explain a series, series-parallel, and parallel circuit.
13.04 Draw each type of circuit and calculate the circuit values.
13.05 Explain and apply Ohm's Law.
13.06 Compute conductance and resistance of conductors and insulators.

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

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

15.0 Demonstrate mathematics knowledge and skills--The student will be able to:

15.01 Demonstrate knowledge of arithmetic operations. AF3.2
15.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
15.03 Construct charts/tables/graphs using functions and data. AF3.5

16.0 Demonstrate an understanding of basic electricity--The student will be able to:

16.01 Explain the principles of electromagnetism.
16.02 Explain the magnetic properties of circuits and devices.
16.03 Relate electricity to the nature of matter.
16.04 Describe various ways that electricity is produced.

17.0 Read and interpret basic electric codes--The student will be able to:

17.01 Describe the importance of following the local, state and national electric codes.
17.02 Read and interpret basic electric codes, wiring plans and specifications.
17.03 Identify licensure requirements for electrical occupations.
17.04 Demonstrate knowledge of National Fire Protection Agency (NFPA) 70E and how it relates to job safety.

**Course Number: ETP0091**
**Occupational Completion Point: A**
**Energy Technician 2 – 300 Hours – SOC Code 49-9099**

18.0 Discuss the value of alternative energy--The student will be able to:

- 18.01 Investigate the reasons for seeking alternatives to fossil fuels.
- 18.02 Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels.
- 18.03 Discuss the three alternative energy sources that are currently the most developed and widely used (hydroelectric, nuclear, and biomass).

19.0 Investigate the viability of biomass and biofuel--The student will be able to:

- 19.01 Discuss the major sources of biomass.
- 19.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
- 19.03 Outline the pyramid energy flow including the different trophic levels.
- 19.04 Describe the major sources, scale, and impacts of biomass energy.
- 19.05 Draw and label a diagram of biomass plantations.
- 19.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

21.0 Investigate the use of nuclear power--The student will be able to:

- 21.01 Explain the process of nuclear fission.
- 21.02 Define radio-isotopes and half-life.
- 21.03 Evaluate the advantages and disadvantages of nuclear power.
- 21.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
- 21.05 Describe nuclear energy and how it is harnessed.
- 21.06 Describe the Chernobyl Nuclear Power Plant accident.
- 21.07 Outline the societal debate over nuclear power.

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

- 22.01 Employ leadership skills to accomplish organizational goals and objectives. LT1.0
- 22.02 Establish and maintain effective working relationships with others in order to accomplish objectives and tasks. LT3.0

22.03 Conduct and participate in meetings to accomplish work tasks. LT4.0
22.04 Employ mentoring skills to inspire and teach others. LT5.0

23.0 Investigate the viability of solar energy--The student will be able to:

23.01 Describe solar energy and how it is harnessed.
23.02 Explain the significance and historical foundations of solar energy and its pioneers (Horace de Saussure and Clarence Kemp).
23.03 Explain the difference between passive solar and active solar.
23.04 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).
23.05 Describe a central receiver system.
23.06 Draw and label a diagram of a solar thermal plant.
23.07 Evaluate the advantages and disadvantages of using solar energy.

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

24.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
24.02 Describe the effect of money management on personal and career goals. FL3.0
24.03 Develop a personal budget and financial goals. FL3.1
24.04 Complete financial instruments for making deposits and withdrawals. FL3.2
24.05 Maintain financial records. FL3.3
24.06 Read and reconcile financial statements. FL3.4
24.07 Research, compare and contrast investment opportunities.

25.0 Investigate the viability of wind energy--The student will be able to:

25.01 Describe wind energy and the way it is harnessed.
25.02 Explain the significance of wind energy and its pioneers (Charles Brush).
25.03 Define kinetic energy.
25.04 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
25.05 Explain the acronym NIMBY (Not In My Backyard).
25.06 Explain why farmers and ranchers are amenable to wind technology.
25.07 Evaluate the advantages and disadvantages to wind technology.

26.0 Apply mathematics knowledge and skills to electricity--The student will be able to:

26.01 Demonstrate Solve basic algebraic formulas related to electricity.
26.02 Solve basic trigonometric functions related to electrical theory.
26.03 Explain basic AC theory and solve related mathematical problems using appropriate test equipment.
26.04 Solve math-related problems from measurements on training aids. (Optional)

27.0 Demonstrate further understanding of electricity--The student will be able to:

27.01 Explain molecular action as a result of temperature extremes, chemical reaction and moisture content.

27.02 Explain how voltage is produced by chemical, mechanical, thermal, photoelectric and piezo electric means.
27.03 Identify electrical symbols in construction documents.

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

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

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

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

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

30.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
30.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Energy Foundations (Energy Industry Fundamentals)**
**Course Number:** **8006110**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | # | **Anatomy/Physiology Honors** | # | **Astronomy Solar/Galactic Honors** | 1/52 2% |
| **Algebra 2** | ** | **Chemistry 1** | 2/55 4% | **Genetics** | # | **Marine Science 1 Honors** | 4/42 10% |
| **Geometry** | ** | **Physics 1** | 4/53 8% | **Earth-Space Science** | 1/58 2% | **Physical Science** | 6/56 11% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

01.0 Demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.17.17; SC.912.N.4.2

01.01 Explain the flow of energy from generation through distribution to the customer.
01.02 Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov ).
01.03 Identify the role and function of generation, transmission and distribution organizations.
01.04 Explains the role of regulatory bodies in the energy industry (Federal Energy Regulatory Commission www.ferc.gov; Public Service Commission of the State of Florida www.psc.state.fl.us) (highlight “obligation to serve”).
01.05 Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain importance of proper documentation to ensure compliance.
01.06 Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as

water/wastewater), electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.

01.07 Describe the process of electric metering and billing for energy consumption.

02.0 Apply compliance with procedures necessary to ensure a safe and healthy work environment--The student will be able to:

02.01 Review the role of the U.S. Department of Labor/Occupational Safety and Health Administration in work place safety. (http://www.complianceregs.com/29cfr/1910/subR/1910-269.html)
02.02 Identify both potential hazards and accident scenarios in the work environment.
02.03 Follow established safety procedures (OSHA regulations and utility company procedures).
02.04 Evaluate changes in the environment with respect to their impact on safety of self and others.
02.05 Promote effective local, state, and national security operations for the protection of people, data, property and institutions.
02.06 Comply with energy industry safety procedures and proper ways to perform work.
02.07 Name potential threats created by deviation from safety procedures and improper use of tools and equipment.
02.08 Use safety equipment as specified by user manuals and safety training.
02.09 Use Personal Protective Equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.
02.10 Keep personal safety equipment in good working order.
02.11 Use tools and equipment in compliance with user manuals and training.
02.12 Call attention to potential and actual hazardous conditions as they arise.
02.13 Alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.
02.14 Maintain appropriate certification and is knowledgeable in first aid or first response procedures.
02.15 Demonstrate understanding and knowledge of lock/tag out practices in the work place.
02.16 Notify person in charge and/or coworkers of unsafe work conditions.
02.17 Stop the job if there are unsafe working conditions.

03.0 Understand electric power generation--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.7.2; SC.912.L.17.11, 15, 19; SC.912.P.10.1

03.01 Explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).
03.02 Identify electric power generation equipment and systems.
03.03 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental issues associated with each:
03.04 Explain how oil was created and list its advantages and disadvantages
03.05 Explain how coal was created and what are its advantages and disadvantages
03.06 Explain how natural gas was created and what are its advantages and disadvantages.

03.07 Explain how water is used in hydroelectric power generation and what are its advantages and disadvantages.
03.08 Explain how uranium is created and what are its advantages and disadvantages
03.09 Discuss emerging and alternative electric power generation technologies and fuel sources.
03.10 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
03.11 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
03.12 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
03.13 Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
03.14 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
03.15 Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.
03.16 Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear and emerging alternative energy systems).

04.0 Understand electric power transmission--The student will be able to:

04.01 Explain the electric power transmission process.
04.02 Discuss the application of different electric power transmission principles (including AC vs. DC).
04.03 Name electric power transmission equipment and systems.
04.04 Discuss the emerging technologies in electric power transmission (including Smart Grid).
04.05 Explain ownership/governance of the electric transmission system.

05.0 Understand electric power distribution--The student will be able to:

05.01 Explain the electric power distribution process.
05.02 Discuss the need for electric distribution systems and how they are designed to operate.
05.03 Name electric power distribution system equipment and what the various components do.
05.04 Discuss the emerging technologies in electric power distribution, including distribution automation and SmartGrid systems.

06.0 Identify and describe careers and entry requirements--The student will be able to:

06.01 Describe entry-level careers available in energy generation, transmission, distribution and the education/experience requirements for entry into those positions, along with career development and advancement opportunities from those positions.
06.02 Identify entry-level careers available in business and corporate support functions of the energy industry; describes the education/experience requirements for entry into those positions, and career advancement opportunities from those positions.

06.03 Describe general wage/salary, benefits, and other advantages of careers in the energy industry.
06.04 Explain the educational pathways available to gain training necessary for entry into energy careers at secondary and post-secondary levels (Partner to create Energy Education Portal).

07.0 Evaluate and analyze energy 'hot topics'--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.P.10.2, 8

07.01 Discuss the major sources of biomass.
07.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
07.03 Outline the pyramid energy flow including the different trophic levels.
07.04 Describe the major sources, scale, and impacts of biomass energy.
07.05 Draw and label a diagram of biomass plantations.
07.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

09.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

09.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
09.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
09.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
09.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
09.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
09.06 Identify and exhibit traits for retaining employment. ECD7.0
09.07 Identify opportunities and research requirements for career advancement.ECD8.0
09.08 Research the benefits of ongoing professional development. ECD9.0
09.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

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

10.01 Use Personal Information Management (PIM) applications to increase workplace efficiency. IT1.0
10.02 Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications. IT2.0

10.03 Employ computer operations applications to access, create, manage, integrate, and store information. IT3.0
10.04 Employ collaborative/groupware applications to facilitate group work. IT4.0

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Electricity 1**
**Course Number:** **8727210**
**Course Credit:** **1**

**Course Description:**

This course enables students to develop the essential competencies for working in the electrical industry. These competencies include safety practices, direct-current electrical-circuit skills, appropriate communication and math skills, basic electricity and electric codes.

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

- 11.01 Clean the work area and maintain it in a safe condition.
- 11.02 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE1.0
- 11.03 Identify and operate workplace-safety electrical devices.
- 11.04 Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.
- 11.05 Explain emergency procedures to follow in response to workplace accidents.
- 11.06 Create a disaster and/or emergency response plan. SHE2.0
- 11.07 Demonstrate knowledge of CPR (cardiopulmonary resuscitation) and first aid.
- 11.08 Describe "Right-to-Know" Law as recorded in (29 CFR.1910.1200)

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

- 12.01 Identify and select tools, equipment, materials, and wires to complete a job.
- 12.02 Drill holes in metal, wood, and concrete for electrical wiring.
- 12.03 Lay out electrical devices, complying with regulations.
- 12.04 Install the following, complying with the appropriate local, state, or national electric codes:
  - a. Conductors and cable
  - b. Standard outlets and switch boxes
  - c. Explain cord connections on major appliances
  - d. Cords switches, receptacles, and dimmers, including a single-pole switched lighting circuit, a three-way switched lighting circuit, and a four-way combination circuit.

13.0 Demonstrate an understanding of basic Direct-Current (DC) electrical-circuit skills--The student will be able to:

- 13.01 Define the terms "voltage," "current," "resistance," "power," and "energy."
- 13.02 Measure voltage, amperage, and resistance, using a Volt-Ohm Meter (VOM) and a Digital Volt-Ohm Meter (DVM).

13.03 Analyze, and explain a series, series-parallel, and parallel circuit.
13.04 Draw each type of circuit and calculate the circuit values.
13.05 Explain and apply Ohm's Law.
13.06 Compute conductance and resistance of conductors and insulators.

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

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

15.0 Demonstrate mathematics knowledge and skills--The student will be able to:

15.01 Demonstrate knowledge of arithmetic operations. AF3.2
15.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
15.03 Construct charts/tables/graphs using functions and data. AF3.5

16.0 Demonstrate an understanding of basic electricity--The student will be able to:

16.01 Explain the principles of electromagnetism.
16.02 Explain the magnetic properties of circuits and devices.
16.03 Relate electricity to the nature of matter.
16.04 Describe various ways that electricity is produced.

17.0 Read and interpret basic electric codes--The student will be able to:

17.01 Describe the importance of following the local, state and national electric codes.
17.02 Read and interpret basic electric codes, wiring plans and specifications.
17.03 Identify licensure requirements for electrical occupations.
17.04 Demonstrate knowledge of National Fire Protection Agency (NFPA) 70E and how it relates to job safety.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Introduction to Alternative Energy**
**Course Number:** **8006120**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of energy history and the global impact of renewable and non-renewable resources; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; and solar energy safety. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Standards included in this course of instruction have been aligned to the academic courses shown below. This table shows the number of aligned benchmarks, the total number of academic benchmarks, and the percentage of alignment.

| Math | | Science | | | | | |
|---|---|---|---|---|---|---|---|
| **Algebra 1** | ** | **Biology 1** | 2/56<br>4% | **Anatomy/Physiology Honors** | 2/53<br>4% | **Astronomy Solar/Galactic Honors** | 5/52<br>10% |
| **Algebra 2** | ** | **Chemistry 1** | 3/55<br>5% | **Genetics** | 2/35<br>6% | **Marine Science 1 Honors** | 6/42<br>14% |
| **Geometry** | ** | **Physics 1** | 8/53<br>15% | **Earth-Space Science** | 3/58<br>5% | **Physical Science** | 7/56<br>13% |

** *Alignment pending* # *Alignment attempted, but no correlation to academic course.*

18.0 Discuss the value of alternative energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.17.11, 17; SC.912.N.1.1; SC.912.P.10.1, 2

18.01 Investigate the reasons for seeking alternatives to fossil fuels.
18.02 Summarize the contributions to world energy supplies of conventional alternatives to fossil fuels.
18.03 Discuss the three alternative energy sources that are currently the most developed and widely used (hydroelectric, nuclear, and biomass).

19.0 Investigate the viability of biomass and biofuel--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.2; SC.912.L.17.19, 20

19.01 Discuss the major sources of biomass.
19.02 Define biofuels (e. g. ethanol, biodiesel, and methanol).
19.03 Outline the pyramid energy flow including the different trophic levels.

19.04 Describe the major sources, scale, and impacts of biomass energy.
19.05 Draw and label a diagram of biomass plantations.
19.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

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

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

21.0 Investigate the use of nuclear power--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards:
MA.912.S.3.2; SC.912.E.6.6; SC.912.L.17.11; SC.912.N.4.2

21.01 Explain the process of nuclear fission.
21.02 Define radio-isotopes and half-life.
21.03 Evaluate the advantages and disadvantages of nuclear power.
21.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
21.05 Describe nuclear energy and how it is harnessed.
21.06 Describe the Chernobyl Nuclear Power Plant accident.
21.07 Outline the societal debate over nuclear power.

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

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

23.0 Investigate the viability of solar energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards:
MA.912.S.3.2; SC.912.E.6.6; SC.912.L.17.11; SC.912.P.10.1, 13, 18; SC.912.P.12.9

23.01 Describe solar energy and how it is harnessed.
23.02 Explain the significance and historical foundations of solar energy and its pioneers (Horace de Saussure and Clarence Kemp).
23.03 Explain the difference between passive solar and active solar.
23.04 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).

23.05 Describe a central receiver system.
23.06 Draw and label a diagram of a solar thermal plant.
23.07 Evaluate the advantages and disadvantages of using solar energy.

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

| | | |
|---|---|---|
| 24.01 | Identify and describe the services and legal responsibilities of financial institutions. | FL2.0 |
| 24.02 | Describe the effect of money management on personal and career goals. | FL3.0 |
| 24.03 | Develop a personal budget and financial goals. | FL3.1 |
| 24.04 | Complete financial instruments for making deposits and withdrawals. | FL3.2 |
| 24.05 | Maintain financial records. | FL3.3 |
| 24.06 | Read and reconcile financial statements. | FL3.4 |
| 24.07 | Research, compare and contrast investment opportunities. | |

25.0 Investigate the viability of wind energy--The student will be able to:

This standard supports the following Next Generation Sunshine State Standards: SC.912.E.6.6; SC.912.L.11, 19; SC.912.P.10.1

25.01 Describe wind energy and the way it is harnessed.
25.02 Explain the significance of wind energy and its pioneers (Charles Brush).
25.03 Define kinetic energy.
25.04 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
25.05 Explain the acronym NIMBY (Not In My Backyard).
25.06 Explain why farmers and ranchers are amenable to wind technology.
25.07 Evaluate the advantages and disadvantages to wind technology.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Electricity 2**
**Course Number:** **8727220**
**Course Credit:** **1**

**Course Description:**

This course enables students to develop competencies related to math and science applications in electricity.

26.0 Apply mathematics knowledge and skills to electricity--The student will be able to:

- 26.01 Demonstrate Solve basic algebraic formulas related to electricity.
- 26.02 Solve basic trigonometric functions related to electrical theory.
- 26.03 Explain basic AC theory and solve related mathematical problems using appropriate test equipment.
- 26.04 Solve math-related problems from measurements on training aids. (Optional)

27.0 Demonstrate further understanding of electricity--The student will be able to:

- 27.01 Explain molecular action as a result of temperature extremes, chemical reaction and moisture content.
- 27.02 Explain how voltage is produced by chemical, mechanical, thermal, photoelectric and piezo electric means.
- 27.03 Identify electrical symbols in construction documents.

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

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

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

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

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

- 30.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1

30.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3

**2012 - 2013**

**Florida Department of Education**
**Curriculum Framework**

**Course Title:** **Energy Cooperative Education - OJT**
**Course Type:** **Career Preparatory**
**Career Cluster:** **Energy**

| | Secondary | PSAV |
|---|---|---|
| Course Number | 9700420 | X909999 |
| CIP Number | 07150503CP | 07150503CP |
| Grade Level | 9-12, 30, 31 | 30, 31 |
| Standard Length | Multiple credits | Multiple hours |
| Teacher Certification | Any Certification appropriate to the students' chosen career field | Any Certification appropriate to the students' chosen career field |
| CTSO | SkillsUSA | SkillsUSA |

## 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 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 cluster.

**Each student job placement must be related to the job preparatory program in which the student is enrolled or has completed.**

The purpose of this course is to provide the on-the-job training component when the **cooperative method of instruction** is appropriate. Whenever the cooperative method is offered, the following is required for each student: a training agreement; a training plan signed by the student, teacher and employer, including instructional objectives; a list of on-the-job and in-school learning experiences; a workstation which reflects equipment, skills and tasks which are relevant to the occupation which the student has chosen as a career goal; and a site supervisor with a working knowledge of the selected occupation. The workstation may be in an industry setting or in a virtual learning environment. The student **must be compensated** for work performed.

The teacher/coordinator must meet with the site supervisor a minimum of once during each grading period for the purpose of evaluating the student's progress in attaining the competencies listed in the training plan.

The Energy Cooperative OJT may be taken by a student for one or more semesters. A student may earn multiple credits in this course. The specific student performance standards which the student must achieve to earn credit are specified in the Cooperative Education - OJT Training Plan.

## Special Notes

There is a **Cooperative Education Manual** available online that has guidelines for students, teachers, employers, parents and other administrators and sample training agreements. It can be accessed on the DOE website at http://www.fldoe.org/workforce/programs/doc/coopm.doc.

## Career and Technical Student Organization (CTSO)

SkillsUSA, Inc. is the appropriate career and technical student organization(s) 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.

## 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 postsecondary service provider. 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).

## Standards

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

01.0 Perform designated job skills.
02.0 Demonstrate work ethics.

**2012 - 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title: Energy Cooperative Education - OJT**
**Secondary Number: 970040**
**PSAV Number: X90999**

01.0 Perform designated job skills--The student will be able to:

01.01 Perform tasks as outlined in the training plan.
01.02 Demonstrate job performance skills.
01.03 Demonstrate safety procedures on the job.
01.04 Maintain appropriate records.
01.05 Attain an acceptable level of productivity.
01.06 Demonstrate appropriate dress and grooming habits.

02.0 Demonstrate work ethics--The student will be able to:

02.01 Follow directions.
02.02 Demonstrate good human relations skills on the job.
02.03 Demonstrate good work habits.
02.04 Demonstrate acceptable business ethics.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Turbine Generator Maintenance, Inspection and Repair**
**Program Type:** **Career Preparatory**
**Career Cluster:** **Energy**

| | Secondary | PSAV |
|---|---|---|
| Program Number | 9700500 | X600500 |
| CIP Number | 0715050304 | 0715050304 |
| Grade Level | 9-12, 30, 31 | 30, 31 |
| Standard Length | 9 Credits | 1,350 Hours |
| Teacher Certification | TEC CONSTR @7 G<br>MILLWRIGHT @7 G<br>BLDG CONST @7 G<br>IND ENGR @7 G | TEC CONSTR @7 G<br>MILLWRIGHT @7 G<br>BLDG CONST @7 G<br>IND ENGR @7 G |
| CTSO | SkillsUSA | SkillsUSA |
| SOC Codes (all applicable) | 49-9041, 49-9042<br>51-8013 | 49-9041, 49-9042<br>51-8013 |
| 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 | N/A | Mathematics: 9<br>Language: 9<br>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. This program offers a broad foundation of knowledge and skills to prepare students for employment in industrial-machinery maintenance positions.

The content includes but is not limited to understanding all aspects of the industrial-turbine generator equipment maintenance-technology industry, and demonstrates elements of the industry such as planning, management, cost management skills, technical and production skills, underlying principles of technology, labor issues, and health, safety, and environmental issues.

**Program Structure**

This program is a planned sequence of instruction consisting of three occupational completion points.

When offered at the postsecondary 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 **PSAV** program structure:

| OCP | Course Number | Course Title | Course Length | SOC Code |
|---|---|---|---|---|
| A | EEV0140 | Turbine Generator Maintenance Tech I | 450 Hours | 49-9042 |
| B | EEV0141 | Turbine Generator Maintenance Tech II | 450 Hours | 49-9041 |
| C | EEV0142 | Turbine Generator Maintenance Mechanic | 450 Hours | 51-8013 |

The following table illustrates the **Secondary** program structure:

| OCP | Course Number | Course Title | Length | SOC Code | Level |
|---|---|---|---|---|---|
| | 9700510 | Turbine Generator Maintenance Skills 1 | 1 Credit | | 2 |
| | 9700520 | Turbine Generator Maintenance Skills 2 | 1 Credit | | 2 |
| A | 9700530 | Turbine Generator Maintenance Skills 3 | 1 Credit | 49-9042 | 2 |
| | 9700540 | Turbine Generator Maintenance 4 | 1 Credit | | 2 |
| | 9700550 | Turbine Generator Maintenance 5 | 1 Credit | | 2 |
| B | 9700560 | Turbine Generator Maintenance 6 | 1 Credit | 49-9041 | 2 |
| | 9700570 | Turbine Generator Mechanic 7 | 1 Credit | | 2 |
| | 9700580 | Turbine Generator Mechanic 8 | 1 Credit | | 2 |
| C | 9700590 | Turbine Generator Mechanic 9 | 1 Credit | 51-8013 | 2 |

**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 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 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

The PSAV component of 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.

## Bright Futures/Gold Seal Scholarship

Course substitutions as defined in the Comprehensive Course Table for this program area may be used to qualify a student for Florida's Gold Seal Vocational Scholarship, providing all other eligibility requirements are met. Eligibility requirements are available online at https://www.osfaffelp.org/bfiehs/fnbpcm02_CCTMain.aspx.

## Fine Arts/Practical Arts Credit

Many courses in CTE programs meet the Fine Arts/Practical Arts credit for high school graduation. For additional information refer to http://www.fldoe.org/schools/pdf/ListPracticalArtsCourses.pdf.

## 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 Demonstrate science knowledge and skills and explain the basic elements of physics as related to industrial machinery maintenance and repair.
03.0 Explain basic electricity and electronics.
04.0 Demonstrate mathematics knowledge and skills.
05.0 Demonstrate language arts knowledge and skills.
06.0 Read plans and drawings and be able to identify basic turbine generator nomenclature.
07.0 Use information technology tools.
08.0 Solve problems using critical thinking skills, creativity and innovation.
09.0 Demonstrate ability to recognize turbine and generator components and subcomponents and describe their function.
10.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
11.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
12.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
13.0 Demonstrate organizational skills in planning and implementation of a turbine generator component inspection.
14.0 Demonstrate personal money-management concepts, procedures, and strategies.
15.0 Describe the importance of professional ethics and legal responsibilities.
16.0 Explain the importance of employability and entrepreneurship skills.
17.0 Be able to identify and properly use all turbine generator tooling and demonstrate ability to maintain and make repairs to Hy-Torq, impact, and other hydraulic tools.
18.0 Demonstrate application of lubricants and lubricating systems.
19.0 Explain the various fastening mechanisms used on turbine and generator components including the types of materials and why.
20.0 Demonstrate tightening operations on high pressure flanges and cylinders.
21.0 Demonstrate removal techniques of galled bolting and repair of damaged threads.
22.0 Disassembly and reassembly of high speed turbines and generators.
23.0 Perform machine-shop operations.
24.0 Demonstrate piping and tubing systems.
25.0 Understand basic operation of a steam turbine and generator.
26.0 Perform pump maintenance and repair.
27.0 Prepare for machinery startup
28.0 Perform measuring and rotor alignment operations.
29.0 Demonstrate Predictive-Preventive-Maintenance (PPM) technologies.
30.0 Perform failure analysis.
31.0 Generate machine improvements and maintenance management.
32.0 Perform failure analysis.
33.0 Perform bench work skills including breakdown and inspection of control valve components.
34.0 Non-Destructive examination of turbine components.
35.0 Understand principals of generator operation and testing.
36.0 Troubleshoot hydraulic systems.
37.0 Apply vibration-analysis skills.
38.0 Perform machinery balancing.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Turbine Generator Maintenance, Inspection and Repair**
**PSAV Number:** **X600500**

**Course Number: EEV0140**
**Occupational Completion Point: A**
**Turbine Generator Maintenance Tech I – 450 Hours – SOC Code 49-9042**

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. SHE 1.0
- 01.02 Explain emergency procedures to follow in response to workplace accidents.
- 01.03 Create a disaster and/or emergency response plan. SHE 2.0
- 01.04 Perform Lock Out And Tag Out (LOTO) procedures. Understand why a LOTO system is necessary and your responsibilities in utilizing the system.
- 01.05 Identify Occupational Safety and Health Administration (OSHA) and Mine Safety Health Administration (MSHA) requirements and procedures.
- 01.06 Use Materials Safety Data Sheets (MSDS) including knowing how to access the sheets and interpret them.

02.0 Demonstrate science knowledge and skills and explain the basic elements of physics as related to industrial machinery maintenance and repair--The student will be able to:AF4.0

- 02.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
- 02.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3
- 02.03 Explain the standards of measurement and the impact of action and working forces, including tension, compression, torque, and shear.
- 02.04 Identify the principles and laws of motion and explain how they affect acceleration and deceleration.
- 02.05 Explain the relationship of work, power, and energy and the Rankine Cycle.
- 02.06 Explain the operation of simple machines, including the lever, inclined plane, screw, wedge, wheel and axle, pulley, and jacking screws.
- 02.07 Identify the ways of producing power for mechanical efficiency, in terms of gear ratios, work forces, and the types of work done by a crane hook, forklift truck, and screw or bolt.
- 02.08 Understand and demonstrate rigging and lifting principals and perform simple load/lift calculations.
- 02.09 Describe the mechanical and chemical properties of materials commonly used in industry.
- 02.10 Explain the laws and conditions governing static and kinetic friction, the problems caused by friction, and the effects of the angle of repose.
- 02.11 Explain molecular action as a result of temperature extremes, chemical reaction, and moisture content.

02.12 Draw conclusions or make inferences from data.
02.13 Have a basic understanding of the steam turbine.
02.14 Have a basic understanding of the gas turbine.
02.15 Have a basic understanding of a turbo generator.
02.16 Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.

03.0 Explain basic electricity and electronics--The student will be able to:

03.01 Define electrical terms.
03.02 Explain the theory and application of magnetism.
03.03 Explain Ohm's law.
03.04 Describe Direct Current (DC) and Alternating Current (AC) circuits.
03.05 Explain the purpose of a megger test and what a Polarization Index means when determining the acceptability of electrical motor and generator winding acceptability.
03.06 Describe the various components of a generator and motor and their functions.
03.07 Describe the various components of an exciter and their functions.

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

04.01 Demonstrate knowledge of arithmetic operations. AF3.2
04.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
04.03 Construct charts/tables/graphs using functions and data. AF3.5
04.04 Convert measurements from English to metric and from metric to English units.
04.05 Solve job-related problems using proportions.
04.06 Solve job-related problems using statistics.

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

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

06.0 Read plans and drawings and be able to identify basic turbine generator nomenclature--The student will be able to:

06.01 Identify dimensions.
06.02 Identify lists of materials and specifications.
06.03 Identify section and detail views.
06.04 Sketch and dimension a part.
06.05 Disassemble and assemble parts using an exploded-view drawing.
06.06 Identify dimensioning of radii, round holes, fillets, and chamfers.
06.07 Identify screw threads and bolt types.
06.08 Apply dimensional tolerances.

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

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

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

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

09.0 Demonstrate ability to recognize turbine and generator components and subcomponents and describe their function--The student will be able to:

09.01 Understand and explain a turbine generator outline drawing.
09.02 Be able to identify each major component of a turbine and generator from the outline drawing and explain its function, e.g.: cylinders, rotor, bearings, valves.
09.03 Be able to identify and explain the function of subcomponents, e.g.: diaphragms, buckets/blades, bearing seals, valve seats, plugs, stems.

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

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

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

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

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

12.01 Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace. CM1.0

12.02 Locate, organize and reference written information from various sources. CM3.0
12.03 Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences. CM5.0
12.04 Interpret verbal and nonverbal cues/behaviors that enhance communication. CM6.0
12.05 Apply active listening skills to obtain and clarify information. CM7.0
12.06 Develop and interpret tables and charts to support written and oral communications. CM8.0
12.07 Exhibit public relations skills that aid in achieving customer satisfaction. CM10.0

13.0 Demonstrate organizational skills in planning and implementation of a turbine generator component inspection--The student will be able to:

13.01 Develop and explain an equipment laydown plan/drawing.
13.02 Develop and explain a plan (work package) for disassembly, inspection, and reassembly of a turbine component, including:
  a. Inspection hold points
  b. Tagging plan
  c. Estimated man-hours
  d. Inspection data sheets
13.03 Develop a simple critical path schedule for the inspection of a turbine generator component.

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

14.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
14.02 Describe the effect of money management on personal and career goals. FL3.0
14.03 Develop a personal budget and financial goals. FL3.1
14.04 Complete financial instruments for making deposits and withdrawals. FL3.2
14.05 Maintain financial records. FL3.3
14.06 Read and reconcile financial statements. FL3.4
14.07 Research, compare and contrast investment opportunities.

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

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

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

16.01 Identify and demonstrate positive work behaviors needed to be employable. ECD1.0
16.02 Develop personal career plan that includes goals, objectives, and strategies. ECD2.0
16.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
16.04 Maintain a career portfolio to document knowledge, skills, and experience. ECD5.0

16.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
16.06 Identify and exhibit traits for retaining employment. ECD7.0
16.07 Identify opportunities and research requirements for career advancement.ECD8.0
16.08 Research the benefits of ongoing professional development. ECD9.0
16.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

**Course Number: EEV0141**
**Occupational Completion Point: B**
**Turbine Generator Maintenance Tech II – 450 Hours – SOC Code: 49-9041**

17.0 Be able to identify and properly use all turbine generator tooling and demonstrate ability to maintain and make repairs to Hy-Torq, impact, and other hydraulic tools--The student will be able to:

17.01 Describe, explain and demonstrate use of all turbine generator tooling including:
a. Gas bolt heaters
b. Tensioners
c. Slugging wrenches
d. Torque wrenches including multipliers
e. Hydraulic jacks
f. Rotor skid pan and rotor blocks
17.02 Demonstrate common maintenance and service repairs on:
a. Impact wrenches
b. Hy-Torq heads
c. Hydraulic pumps

18.0 Demonstrate application of lubricants and lubricating systems--The student will be able to:

18.01 Explain the functions of lubrication.
18.02 Explain the properties of oil lubricants and the factors determining the selection of lubricants.
18.03 Identify the types, advantages, and functions of lubricant additives.
18.04 Explain a typical turbine generator lube oil system and the various components associated with it.
18.05 Identify areas of the turbine where grease would be applied and why.
18.06 Explain the types of oil filtration used in turbine generator systems including strainers.
18.07 Understand principals of a lube oil flush and how to set up various types of turbine generator maintenance lube oil flushes.
18.08 Explain oil sampling and demonstrate how to take an oil sample and perform cleanliness analysis.

19.0 Explain the various fastening mechanisms used on turbine and generator components including the types of materials and why--The student will be able to:

19.01 Demonstrate understanding of the types of materials used to properly clamp steam and oil cylinders and flanges.
19.02 Have basic understanding of and be able to explain torque, stress, stretch, corrosion, galling, and thread types.

20.0 Demonstrate tightening operations on high pressure flanges and cylinders--The student will be able to:

20.01 Explain the various types of tightening mechanisms that are used on turbine generators and auxiliary components.
20.02 Have an understanding of the materials used for different flange tightening applications based on pressure and temperatures.
20.03 Explain and demonstrate the tools used for tightening and measuring tightening mechanisms.
20.04 Explain the types of gaskets used in turbine generator applications and the advantage and disadvantage of each.
20.05 Understand gasket compression and demonstrate proper assembly of various types of gaskets including neoprene, Garlock, corrugated metal, serrated, and spiral wound.
20.06 Demonstrate ability to measure and cut a gasket from a sheet of gasket material.
20.07 Understand and explain the different types of lubricants utilized on high temperature bolting including advantages and disadvantages.
20.08 Understand and demonstrate tightening principals including torque and bolt stretch and outside influences on each.
20.09 Demonstrate proper use of various tightening tools.

21.0 Demonstrate removal techniques of galled bolting and repair of damaged threads--The student will be able to:

21.01 Understand alternative methods of removing galled bolting and how to determine best alternative based on type of material and location of fastener.
21.02 Understand safety requirements before initiating grinding or burning operations.
21.03 Demonstrate proper setup of cutting torch and demonstrate ability to cut bolting from a cylinder case.
21.04 Demonstrate proper use of grinding burrs to remove galled bolting.

22.0 Disassembly and reassembly of high speed turbines and generators--The student will be able to:

22.01 Develop a component and parts laydown plan and explain logic for it.
22.02 Understand all of the various lifting tools and devices used when disassembling a turbine generator.
22.03 Understand and demonstrate the use of a rigging and lifting plan.
22.04 Understand and demonstrate ability to inspect and identify problems with lifting devices including slings (wire rope, nylon, Kevlar) and hoists/come-a-longs.
22.05 Demonstrate proper use of a sling for lifting turbine generator components of various geometries.
22.06 Understand lifting capabilities of slings and the relationship between angles and stress.
22.07 Understand the function of a lifting beam and how to set up a load for proper lifting.
22.08 Understand and demonstrate ability to remove a generator rotor from the stator.
22.09 Understand necessity and the process for parts tagging and bagging.
22.10 Understand storage requirements including protection of flange surfaces during outage duration.

22.11 Understand process for protecting ingress of foreign objects into lubrication and steam systems.
22.12 Understanding of rigging and lifting principals.
22.13 Demonstrate ability to rig and lift a non symmetrical turbine component.
22.14 Demonstrate ability to disassemble and reassemble a steam piping flange.
22.15 Understand crane signals and demonstrate ability to communicate with team during a lift.

23.0 Perform machine-shop operations--The student will be able to:

23.01 Demonstrate safety in performing machine-shop operations.
23.02 Identify the types of cutting tools.
23.03 Bore a hole to a specified size.
23.04 Chase an external V-thread.
23.05 Identify the different types of work-holding devices.
23.06 Prepare metal for finishing.
23.07 Set up, use, and adjust an arbor press.
23.08 Set up, use, and adjust a hydraulic press.
23.09 Set up, use, and adjust broaching tools.
23.10 Cut keyways with an end mill.

24.0 Demonstrate piping and tubing systems--The student will be able to:

24.01 Identify the components of a piping system.
24.02 Explain the maintenance considerations of metallic and nonmetallic piping systems.
24.03 Describe the safety requirements for working with piping and tubing systems.
24.04 Join copper tubing.
24.05 Join common fittings.
24.06 Join metallic piping
24.07 Bend back-to-back, stub-ups, and doglegs in Electrical Metallic Tubing (EMT)

25.0 Understand basic operation of a steam turbine and generator--The student will be able to:

25.01 Understand transforming work from high pressure steam
25.02 Understand the difference between a reaction and impulse turbine
25.03 Understand means of controlling the turbine.
25.04 Understand the difference between speed control and load control.
25.05 Understand extraction in a cogeneration facility.

26.0 Perform pump maintenance and repair--The student will be able to:

26.01 Demonstrate the safety procedures for performing pump maintenance.
26.02 Determine pump capacity and system requirements.
26.03 Perform pump maintenance.
26.04 Identify packing and seal requirements.
26.05 Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating, diaphragm, positive placement, and vacuum pumps.
26.06 Disassemble and reassemble a pump.

27.0 Prepare for machinery startup--The student will be able to:

27.01 Describe the requirements and precautions for machinery startup.
27.02 Align machinery using wire line, transit, dial indicators, a computer, and laser-alignment devices.
27.03 Position and secure machinery on a foundation.
27.04 Level machinery and install balance-vibration dampeners.
27.05 Identify pipe-stress standards for machine-maintenance applications.
27.06 Perform finish alignment and check for pipe stresses in machinery- maintenance applications.

**Course Number: EEV0142**
**Occupational Completion Point: C**
**Turbine Generator Maintenance Mechanic – 450 Hours – SOC Code: 51-8013**

28.0 Perform measuring and rotor alignment operations--The student will be able to:

28.01 Demonstrate the safe use of hand tools such as wrenches, files, scrapers, taps, dies, torque wrenches, grinders, and cutoff wheels.
28.02 Demonstrate the proper use of precision measuring devices such as inside and outside micrometers, depth gauges, and dial indicators.
28.03 Select correct tools for metric and standard fasteners.
28.04 Explain the types of misalignment and how to calculate the moves necessary to correct the misalignment.
28.05 Demonstrate how to set up dial indicators to perform a turbine generator coupling alignment check.
28.06 Demonstrate how to perform a Swing Check to align a three bearing unit.
28.07 Explain the purpose of a tight wire and how it is set up in a turbine.
28.08 Demonstrate how to take measurements from the wire to check alignment of the internal components

29.0 Demonstrate Predictive-Preventive-Maintenance (PPM) technologies--The student will be able to:

29.01 Explain the use of infrared thermography.
29.02 Explain the use of ultrasound technology.
29.03 Explain the use of advanced alignment techniques
29.04 Explain the use of oil ferrography and the types of oil sampling
29.05 Describe the safety requirements for PPM technologies.
29.06 Demonstrate the use of one of the above predictive-maintenance procedures
29.07 Plan an advanced PPM schedule.

30.0 Perform failure analysis--The student will be able to:

30.01 Conduct/lead a failure analysis meeting to determine the root cause of a failure.
30.02 Create a failure-analysis form and write a minimum of two different types of failure-analysis reports.
30.03 Explain the types of bearing failures.
30.04 Explain the types of shaft fatigues and failures.
30.05 Explain the types of lubrication breakdowns.
30.06 Estimate the cost and the impact on production of a specific failure.

31.0 Generate machine improvements and maintenance management--The student will be able to:

31.01 Review and critique machinery and base design for improvement, before the equipment is placed on order.
31.02 Identify the essential elements of effective maintenance management:
a. Reward system
b. Predictive-preventive maintenance
c. Planning
d. Work-order systems
e. Organizations
f. Goals and tracking
g. Facilities
h. Storerooms
i. Contractors
j. Shutdowns
31.03 Write a report on the design and effective use of at least two of the essential elements of management.

32.0 Perform failure analysis--The student will be able to:

32.01 Conduct/lead a failure analysis meeting to determine the root cause of a failure.
32.02 Create a failure-analysis form and write a minimum of two different types of failure-analysis reports.
32.03 Explain the types of bearing failures.
32.04 Explain the types of shaft fatigues and failures.
32.05 Explain the types of lubrication breakdowns.
32.06 Estimate the cost and the impact on production of a specific failure.

33.0 Perform bench work skills including breakdown and inspection of control valve components--The student will be able to:

33.01 Identify and explain the various components of a turbine generator control system including hydraulic, and electro hydraulic.
33.02 Understand the importance and various types of material used for sealing control systems.
33.03 Understand and demonstrate proper preparation for disassembling and inspecting a control mechanism.
33.04 Understand the importance of cleanliness during the disassembly of a control mechanism.
33.05 Explain how a control mechanism works and the critical measurement required to assure proper operation.
33.06 Demonstrate proper removal and installation of hydraulic lines.

34.0 Non-Destructive examination of turbine components–The student will be able to:

34.01 Understand the various materials in a steam and gas turbine.
34.02 Understand the relevant turbine non destructive examination techniques and how each one is used, including:
a. Ultrasonic Testing

b. Penetrant Testing
c. Magnetic Particle Testing
d. Radiographic Testing

34.03 Indentify the proper non destructive testing technique for various turbine components.
34.04 Understand the cleanliness standards and cleaning methods required on turbine components.

35.0 Understand principals of generator operation and testing--The student will be able to:

35.01 Understand basic principal of electrical energy production.
35.02 Basic understanding of excitation.
35.03 Understand function of each major generator component:
a. Core
b. Rotor/Field
c. Stator/Armature
d. Exciter
35.04 Understand the difference in megawatts and KVA.
35.05 Understand electrical testing.

36.0 Troubleshoot hydraulic systems--The student will be able to:

36.01 Explain the safety procedures for troubleshooting hydraulic systems.
36.02 Read a hydraulic schematic.
36.03 Install hydraulic components.
36.04 Connect electrically controlled valves.
36.05 Explain hydraulic-system troubleshooting techniques.
36.06 Repair and replace valves.
36.07 Repair and replace cylinders.
36.08 Repair and replace pumps and motors.

37.0 Apply vibration-analysis skills--The student will be able to:

37.01 Collect vibration data.
37.02 Interpret vibration data.
37.03 Determine velocity, acceleration, spike energy, frequency, amplitude, and other vibration sources.
37.04 Describe the safety requirements and precautions for vibration analysis.
37.05 Operate and use vibration software.
37.06 Predict and verify the condition of machinery in an industrial setting using vibration tools.
37.07 Explain the approximately 25 sources of vibration.
37.08 Explain the Bearing Frequency (BIFO) Formulas.
37.09 Demonstrate proficiency in vibration detection.

38.0 Perform machinery balancing--The student will be able to:

38.01 Describe the safety requirements and precautions for balancing procedures and equipment.
38.02 Identify the principles of static balancing.
38.03 Perform a vector balance in the classroom.

38.04 Identify balancing standards, ISO 1940 or equal.
38.05 Perform a stand balance in a shop.
38.06 Perform a field balance in an industrial setting.
38.07 Use portable or stationary balancing equipment.

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**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Maintenance Skills 1**
**Course Number:** **9700510**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include a safe working environment, science and math skills, electricity and electronics skills along with basic turbine generator nomenclature.

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
- 01.02 Explain emergency procedures to follow in response to workplace accidents.
- 01.03 Create a disaster and/or emergency response plan. SHE2.0
- 01.04 Perform Lock Out And Tag Out (LOTO) procedures. Understand why a LOTO system is necessary and your responsibilities in utilizing the system.
- 01.05 Identify Occupational Safety and Health Administration (OSHA) and Mine Safety Health Administration (MSHA) requirements and procedures.
- 01.06 Use Materials Safety Data Sheets (MSDS) including knowing how to access the sheets and interpret them.

02.0 Demonstrate science knowledge and skills and explain the basic elements of physics as related to industrial machinery maintenance and repair--The student will be able to:AF4.0

- 02.01 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF4.1
- 02.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF4.3
- 02.03 Explain the standards of measurement and the impact of action and working forces, including tension, compression, torque, and shear.
- 02.04 Identify the principles and laws of motion and explain how they affect acceleration and deceleration.
- 02.05 Explain the relationship of work, power, and energy and the Rankine Cycle.
- 02.06 Explain the operation of simple machines, including the lever, inclined plane, screw, wedge, wheel and axle, pulley, and jacking screws.
- 02.07 Identify the ways of producing power for mechanical efficiency, in terms of gear ratios, work forces, and the types of work done by a crane hook, forklift truck, and screw or bolt.
- 02.08 Understand and demonstrate rigging and lifting principals and perform simple load/lift calculations.
- 02.09 Describe the mechanical and chemical properties of materials commonly used in industry.

02.10 Explain the laws and conditions governing static and kinetic friction, the problems caused by friction, and the effects of the angle of repose.
02.11 Explain molecular action as a result of temperature extremes, chemical reaction, and moisture content.
02.12 Draw conclusions or make inferences from data.
02.13 Have a basic understanding of the steam turbine.
02.14 Have a basic understanding of the gas turbine.
02.15 Have a basic understanding of a turbo generator.
02.16 Identify health-related problems that may result from exposure to work-related chemicals and hazardous materials, and know the proper precautions required for handling such materials.

03.0 Explain basic electricity and electronics--The student will be able to:

03.01 Define electrical terms.
03.02 Explain the theory and application of magnetism.
03.03 Explain Ohm's law.
03.04 Describe Direct Current (DC) and Alternating Current (AC) circuits.
03.05 Explain the purpose of a megger test and what a Polarization Index means when determining the acceptability of electrical motor and generator winding acceptability.
03.06 Describe the various components of a generator and motor and their functions.
03.07 Describe the various components of an exciter and their functions.

04.0 Demonstrate mathematics knowledge and skills--The student will be able to: AF3.0

04.01 Demonstrate knowledge of arithmetic operations. AF3.2
04.02 Analyze and apply data and measurements to solve problems and interpret documents. AF3.4
04.03 Construct charts/tables/graphs using functions and data. AF3.5
04.04 Convert measurements from English to metric and from metric to English units.
04.05 Solve job-related problems using proportions.
04.06 Solve job-related problems using statistics.

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

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

06.0 Read plans and drawings and be able to identify basic turbine generator nomenclature--The student will be able to:

06.01 Identify dimensions.
06.02 Identify lists of materials and specifications.
06.03 Identify section and detail views.
06.04 Sketch and dimension a part.
06.05 Disassemble and assemble parts using an exploded-view drawing.
06.06 Identify dimensioning of radii, round holes, fillets, and chamfers.
06.07 Identify screw threads and bolt types.

06.08 Apply dimensional tolerances.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Maintenance Skills 2**
**Course Number:** **9700520**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include using technology, solving problems; recognize turbine generator components along with leadership and teamwork skills.

07.0 Use information technology tools--The student will be able to:

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

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

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

09.0 Demonstrate ability to recognize turbine and generator components and subcomponents and describe their function--The student will be able to:

- 09.01 Understand and explain a turbine generator outline drawing.
- 09.02 Be able to identify each major component of a turbine and generator from the outline drawing and explain its function, e.g.: cylinders, rotor, bearings, valves.
- 09.03 Be able to identify and explain the function of subcomponents, e.g.: diaphragms, buckets/blades, bearing seals, valve seats, plugs, stems.

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

- 10.01 Employ leadership skills to accomplish organizational goals and objectives. LT1.0
- 10.02 Establish and maintain effective working relationships with others in order to accomplish objectives and tasks. LT3.0
- 10.03 Conduct and participate in meetings to accomplish work tasks. LT4.0

10.04 Employ mentoring skills to inspire and teach others. LT5.0

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

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

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Maintenance Skills 3**
**Course Number:** **9700530**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include communication skills, implementation of turbine generator skills, along with personal money management and professional responsibilities.

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

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

13.0 Demonstrate organizational skills in planning and implementation of a turbine generator component inspection--The student will be able to:

- 13.01 Develop and explain an equipment laydown plan/drawing.
- 13.02 Develop and explain a plan (work package) for disassembly, inspection, and reassembly of a turbine component, including;
  - a. Inspection hold points
  - b. Tagging plan
  - c. Estimated man-hours
  - d. Inspection data sheets
- 13.03 Develop a simple critical path schedule for the inspection of a turbine generator component.

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

- 14.01 Identify and describe the services and legal responsibilities of financial institutions. FL2.0
- 14.02 Describe the effect of money management on personal and career goals. FL3.0
- 14.03 Develop a personal budget and financial goals. FL3.1
- 14.04 Complete financial instruments for making deposits and withdrawals. FL3.2
- 14.05 Maintain financial records. FL3.3

14.06 Read and reconcile financial statements. FL3.4
14.07 Research, compare and contrast investment opportunities.

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

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

16.0 Explain the importance of employability and entrepreneurship skills--The student will be able to:

16.01 Identify and demonstrate positive work behaviors needed to be employable.ECD1.0
16.02 Develop personal career plan that includes goals, objectives, and strategies.ECD2.0
16.03 Examine licensing, certification, and industry credentialing requirements. ECD3.0
16.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD5.0
16.05 Evaluate and compare employment opportunities that match career goals.ECD6.0
16.06 Identify and exhibit traits for retaining employment. ECD7.0
16.07 Identify opportunities and research requirements for career advancement.ECD8.0
16.08 Research the benefits of ongoing professional development. ECD9.0
16.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD10.0

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Maintenance 4**
**Course Number:** **9700540**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include identifying and using generator specific tools. Explain how lubricants and the lubricating system functions along with various mechanical fastening systems.

17.0 Be able to identify and properly use all turbine generator tooling and demonstrate ability to maintain and make repairs to Hy-Torq, impact, and other hydraulic tools--The student will be able to:

17.01 Describe, explain and demonstrate use of all turbine generator tooling including:
a. Gas bolt heaters
b. Tensioners
c. Slugging wrenches
d. Torque wrenches including multipliers
e. Hydraulic jacks
f. Rotor skid pan and rotor blocks

17.02 Demonstrate common maintenance and service repairs on:
a. Impact wrenches
b. Hy-Torq heads
c. Hydraulic pumps

18.0 Demonstrate application of lubricants and lubricating systems--The student will be able to:

18.01 Explain the functions of lubrication.
18.02 Explain the properties of oil lubricants and the factors determining the selection of lubricants.
18.03 Identify the types, advantages, and functions of lubricant additives.
18.04 Explain a typical turbine generator lube oil system and the various components associated with it.
18.05 Identify areas of the turbine where grease would be applied and why.
18.06 Explain the types of oil filtration used in turbine generator systems including strainers.
18.07 Understand principals of a lube oil flush and how to set up various types of turbine generator maintenance lube oil flushes.
18.08 Explain oil sampling and demonstrate how to take an oil sample and perform cleanliness analysis.

19.0 Explain the various fastening mechanisms used on turbine and generator components including the types of materials and why--The student will be able to:

19.01 Demonstrate understanding of the types of materials used to properly clamp steam and oil cylinders and flanges.
19.02 Have basic understanding of and be able to explain torque, stress, stretch, corrosion, galling, and thread types.

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**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Maintenance 5**
**Course Number:** **9700550**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include tightening operations, removal techniques. Disassembly and reassembly of high speed turbines and generators along with machine-shop related operations.

20.0 Demonstrate tightening operations on high pressure flanges and cylinders--The student will be able to:

- 20.01 Explain the various types of tightening mechanisms that are used on turbine generators and auxiliary components.
- 20.02 Have an understanding of the materials used for different flange tightening applications based on pressure and temperatures.
- 20.03 Explain and demonstrate the tools used for tightening and measuring tightening mechanisms.
- 20.04 Explain the types of gaskets used in turbine generator applications and the advantage and disadvantage of each.
- 20.05 Understand gasket compression and demonstrate proper assembly of various types of gaskets including neoprene, Garlock, corrugated metal, serrated, and spiral wound.
- 20.06 Demonstrate ability to measure and cut a gasket from a sheet of gasket material.
- 20.07 Understand and explain the different types of lubricants utilized on high temperature bolting including advantages and disadvantages.
- 20.08 Understand and demonstrate tightening principals including torque and bolt stretch and outside influences on each.
- 20.09 Demonstrate proper use of various tightening tools.

21.0 Demonstrate removal techniques of galled bolting and repair of damaged threads--The student will be able to:

- 21.01 Understand alternative methods of removing galled bolting and how to determine best alternative based on type of material and location of fastener.
- 21.02 Understand safety requirements before initiating grinding or burning operations.
- 21.03 Demonstrate proper setup of cutting torch and demonstrate ability to cut bolting from a cylinder case.
- 21.04 Demonstrate proper use of grinding burrs to remove galled bolting.

22.0 Disassembly and reassembly of high speed turbines and generators--The student will be able to:

- 22.01 Develop a component and parts laydown plan and explain logic for it.

22.02 Understand all of the various lifting tools and devices used when disassembling a turbine generator.
22.03 Understand and demonstrate the use of a rigging and lifting plan.
22.04 Understand and demonstrate ability to inspect and identify problems with lifting devices including slings (wire rope, nylon, Kevlar) and hoists/come-a-longs.
22.05 Demonstrate proper use of a sling for lifting turbine generator components of various geometries.
22.06 Understand lifting capabilities of slings and the relationship between angles and stress.
22.07 Understand the function of a lifting beam and how to set up a load for proper lifting.
22.08 Understand and demonstrate ability to remove a generator rotor from the stator.
22.09 Understand necessity and the process for parts tagging and bagging.
22.10 Understand storage requirements including protection of flange surfaces during outage duration.
22.11 Understand process for protecting ingress of foreign objects into lubrication and steam systems.
22.12 Understanding of rigging and lifting principals.
22.13 Demonstrate ability to rig and lift a non symmetrical turbine component.
22.14 Demonstrate ability to disassemble and reassemble a steam piping flange.
22.15 Understand crane signals and demonstrate ability to communicate with team during a lift.

23.0 Perform machine-shop operations--The student will be able to:

23.01 Demonstrate safety in performing machine-shop operations.
23.02 Identify the types of cutting tools.
23.03 Bore a hole to a specified size.
23.04 Chase an external V-thread.
23.05 Identify the different types of work-holding devices.
23.06 Prepare metal for finishing.
23.07 Set up, use, and adjust an arbor press.
23.08 Set up, use, and adjust a hydraulic press.
23.09 Set up, use, and adjust broaching tools.
23.10 Cut keyways with an end mill.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Maintenance 6**
**Course Number:** **9700560**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include the piping and tubing system and the basic operation of a steam turbine and generator. Perform pump maintenance and repair activities along with preparing for machinery startup operations.

24.0 Demonstrate piping and tubing systems--The student will be able to:

- 24.01 Identify the components of a piping system.
- 24.02 Explain the maintenance considerations of metallic and nonmetallic piping systems.
- 24.03 Describe the safety requirements for working with piping and tubing systems.
- 24.04 Join copper tubing.
- 24.05 Join common fittings.
- 24.06 Join metallic piping
- 24.07 Bend back-to-back, stub-ups, and doglegs in Electrical Metallic Tubing (EMT)

25.0 Understand basic operation of a steam turbine and generator--The student will be able to:

- 25.01 Understand transforming work from high pressure steam
- 25.02 Understand the difference between a reaction and impulse turbine
- 25.03 Understand means of controlling the turbine.
- 25.04 Understand the difference between speed control and load control.
- 25.05 Understand extraction in a cogeneration facility.

26.0 Perform pump maintenance and repair--The student will be able to:

- 26.01 Demonstrate the safety procedures for performing pump maintenance.
- 26.02 Determine pump capacity and system requirements.
- 26.03 Perform pump maintenance.
- 26.04 Identify packing and seal requirements.
- 26.05 Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating, diaphragm, positive placement, and vacuum pumps.
- 26.06 Disassemble and reassemble a pump.

27.0 Prepare for machinery startup--The student will be able to:

- 27.01 Describe the requirements and precautions for machinery startup.
- 27.02 Align machinery using wire line, transit, dial indicators, a computer, and laser-alignment devices.
- 27.03 Position and secure machinery on a foundation.

27.04 Level machinery and install balance-vibration dampeners.
27.05 Identify pipe-stress standards for machine-maintenance applications.
27.06 Perform finish alignment and check for pipe stresses in machinery-maintenance applications.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Mechanic 7**
**Course Number:** **9700570**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include performing alignment operations and Predictive-Preventive-Maintenance (PPM) technology and how to generate machine improvement and maintenance activities.

28.0 Perform measuring and rotor alignment operations--The student will be able to:

- 28.01 Demonstrate the safe use of hand tools such as wrenches, files, scrapers, taps, dies, torque wrenches, grinders, and cutoff wheels.
- 28.02 Demonstrate the proper use of precision measuring devices such as inside and outside micrometers, depth gauges, and dial indicators.
- 28.03 Select correct tools for metric and standard fasteners.
- 28.04 Explain the types of misalignment and how to calculate the moves necessary to correct the misalignment.
- 28.05 Demonstrate how to set up dial indicators to perform a turbine generator coupling alignment check.
- 28.06 Demonstrate how to perform a Swing Check to align a three bearing unit.
- 28.07 Explain the purpose of a tight wire and how it is set up in a turbine.
- 28.08 Demonstrate how to take measurements from the wire to check alignment of the internal components

29.0 Demonstrate Predictive-Preventive-Maintenance (PPM) technologies--The student will be able to:

- 29.01 Explain the use of infrared thermography.
- 29.02 Explain the use of ultrasound technology.
- 29.03 Explain the use of advanced alignment techniques
- 29.04 Explain the use of oil ferrography and the types of oil sampling
- 29.05 Describe the safety requirements for PPM technologies.
- 29.06 Demonstrate the use of one of the above predictive-maintenance procedures
- 29.07 Plan an advanced PPM schedule.

30.0 Perform failure analysis--The student will be able to:

- 30.01 Conduct/lead a failure analysis meeting to determine the root cause of a failure.
- 30.02 Create a failure-analysis form and write a minimum of two different types of failure-analysis reports.
- 30.03 Explain the types of bearing failures.
- 30.04 Explain the types of shaft fatigues and failures.
- 30.05 Explain the types of lubrication breakdowns.
- 30.06 Estimate the cost and the impact on production of a specific failure.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Mechanic 8**
**Course Number:** **9700580**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include how to generate machine improvements and maintenance activities along with performing failure analysis. Perform bench work skills along with the non-destructive examination of turbine components.

31.0 Generate machine improvements and maintenance management--The student will be able to:

31.01 Review and critique machinery and base design for improvement, before the equipment is placed on order.
31.02 Identify the essential elements of effective maintenance management:
a. Reward system
b. Predictive-preventive maintenance
c. Planning
d. Work-order systems
e. Organizations
f. Goals and tracking
g. Facilities
h. Storerooms
i. Contractors
j. Shutdowns
31.03 Write a report on the design and effective use of at least two of the essential elements of management.

32.0 Perform failure analysis--The student will be able to:

32.01 Conduct/lead a failure analysis meeting to determine the root cause of a failure.
32.02 Create a failure-analysis form and write a minimum of two different types of failure-analysis reports.
32.03 Explain the types of bearing failures.
32.04 Explain the types of shaft fatigues and failures.
32.05 Explain the types of lubrication breakdowns.
32.06 Estimate the cost and the impact on production of a specific failure.

33.0 Perform bench work skills including breakdown and inspection of control valve components--The student will be able to:

33.01 Identify and explain the various components of a turbine generator control system including hydraulic, and electro hydraulic.
33.02 Understand the importance and various types of material used for sealing control systems.

33.03 Understand and demonstrate proper preparation for disassembling and inspecting a control mechanism.
33.04 Understand the importance of cleanliness during the disassembly of a control mechanism.
33.05 Explain how a control mechanism works and the critical measurement required to assure proper operation.
33.06 Demonstrate proper removal and installation of hydraulic lines.

34.0 Non-Destructive examination of turbine components--The student will be able to:

34.01 Understand the various materials in a steam and gas turbine.
34.02 Understand the relevant turbine non-destructive examination techniques and how each one is used, including:
a. Ultrasonic Testing
b. Penetrant Testing
c. Magnetic Particle Testing
d. Radiographic Testing
34.03 Indentify the proper non destructive testing technique for various turbine components.
34.04 Understand the cleanliness standards and cleaning methods required on turbine components.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Turbine Generator Mechanic 9**
**Course Number:** **9700590**
**Course Credit:** **1**

**Course Description:**

This course is designed to develop competencies in the areas of turbine generator maintenance, inspection and repair. These competencies include understanding principles of generator operation and testing, how to troubleshoot hydraulic systems. Apply vibration-analysis skills and how to perform machinery balancing.

35.0 Understand principals of generator operation and testing--The student will be able to:

- 35.01 Understand basic principal of electrical energy production.
- 35.02 Basic understanding of excitation.
- 35.03 Understand function of each major generator component:
  - a. Core
  - b. Rotor/Field
  - c. Stator/Armature
  - d. Exciter
- 35.04 Understand the difference in megawatts and KVA.
- 35.05 Understand electrical testing.

36.0 Troubleshoot hydraulic systems--The student will be able to:

- 36.01 Explain the safety procedures for troubleshooting hydraulic systems.
- 36.02 Read a hydraulic schematic.
- 36.03 Install hydraulic components.
- 36.04 Connect electrically controlled valves.
- 36.05 Explain hydraulic-system troubleshooting techniques.
- 36.06 Repair and replace valves.
- 36.07 Repair and replace cylinders.
- 36.08 Repair and replace pumps and motors.

37.0 Apply vibration-analysis skills--The student will be able to:

- 37.01 Collect vibration data.
- 37.02 Interpret vibration data.
- 37.03 Determine velocity, acceleration, spike energy, frequency, amplitude, and other vibration sources.
- 37.04 Describe the safety requirements and precautions for vibration analysis.
- 37.05 Operate and use vibration software.
- 37.06 Predict and verify the condition of machinery in an industrial setting using vibration tools.
- 37.07 Explain the approximately 25 sources of vibration.
- 37.08 Explain the Bearing Frequency (BIFO) Formulas.
- 37.09 Demonstrate proficiency in vibration detection.

38.0 Perform machinery balancing--The student will be able to:

38.01 Describe the safety requirements and precautions for balancing procedures and equipment.
38.02 Identify the principles of static balancing.
38.03 Perform a vector balance in the classroom.
38.04 Identify balancing standards, ISO 1940 or equal.
38.05 Perform a stand balance in a shop.
38.06 Perform a field balance in an industrial setting.
38.07 Use portable or stationary balancing equipment.

**2012 - 2013**

**Florida Department of Education**
**Curriculum Framework**

**Course Title:** **Energy Directed Study**
**Career Cluster:** **Energy**

| Secondary – Career Preparatory | |
|---|---|
| Course Number | 9701000 |
| CIP Number | 0715050350 |
| Grade Level | 11-12, 30, 31 |
| Standard Length | Multiple credits |
| Teacher Certification | Any Certification appropriate to the students' chosen career field |
| CTSO | SkillsUSA |

## Purpose

The purpose of this course is to provide students with learning opportunities in a prescribed program of study within the Energy cluster that will enhance opportunities for employment in the career field chosen by the student.

## Course Structure

The content is prescribed by the instructor based upon the individual student's assessed needs for directed study.

This course may be taken only by a student who has completed or is currently completing a specific secondary job preparatory program or occupational completion point for additional study in this career cluster. A student may earn multiple credits in this course.

The selected standards and benchmarks, which the student must master to earn credit, must be outlined in an instructional plan developed by the instructor.

## Laboratory Activities

A learning laboratory is provided as required to support the educational activities of the student. This laboratory may be in the traditional classroom, in an industry setting, or a virtual learning environment.

## 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.

## 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 postsecondary service provider. 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).

## Standards

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

01.0 Demonstrate expertise in a specific occupation contained within the career cluster.
02.0 Conduct investigative research on a selected topic related to the career cluster using approved research methodology, interpret findings, and prepare presentation to defend results.
03.0 Apply enhanced leadership and professional career skills.
04.0 Demonstrate higher order critical thinking and reasoning skills appropriate for the selected program of study.

**2012 - 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Energy Directed Study**
**Course Number:** **9701000**
**Course Credit:** **1**

01.0 Demonstrate expertise in a specific occupation within the career cluster.

01.01 The benchmarks will be selected from the appropriate curriculum frameworks and determined by the instructor based upon the individual students assessed needs.

02.0 Conduct investigative research on a selected topic related to the career cluster using approved research methodology, interpret findings, and prepare presentation to defend results--The student will be able to:

02.01 Select investigative study referencing prior research and knowledge.
02.02 Collect, organize and analyze data accurately and precisely.
02.03 Design procedures to test the research.
02.04 Report, display and defend the results of investigations to audiences that may include professionals and technical experts.

03.0 Apply enhanced leadership and professional career skills--The student will be able to:

03.01 Develop and present a professional presentation offering potential solutions to a current issue.
03.02 Enhance leadership and career skills through work-based learning including job placement, job shadowing, entrepreneurship, internship, or a virtual experience.
03.03 Participate in leadership development opportunities available through the appropriate student organization and/or other professional organizations.
03.04 Enhance written and oral communications through the development of presentations, public speaking, and live and/or virtual interviews.

04.0 Demonstrate higher order critical thinking and reasoning skills appropriate for the selected program of study--The student will be able to:

04.01 Use mathematical and/or scientific skills to solve problems encountered in the chosen occupation.
04.02 Read and interpret information relative to the chosen occupation.
04.03 Locate and evaluate key elements of oral and written information.
04.04 Analyze and apply data and/or measurements to solve problems and interpret documents.
04.05 Construct charts/tables/graphs using functions and data.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Course Title:** **Introduction to Energy**
**Course Type:** **Orientation/Exploratory**
**Career Cluster:** **Energy**

| Secondary - Middle School | |
|---|---|
| Program Number | 9709350 |
| CIP Number | 149709350M |
| Grade Level | 6-8 |
| Standard Length | Semester |
| Teacher Certification | TEC ED 1@2<br>ELECTRICAL @7G<br>IND ENGR @7G |
| CTSO | SkillsUSA |
| Facility Code | 245 http://www.fldoe.org/edfacil/sref.asp (State Requirements for Educational Facilities) |

## Purpose

The purpose of this course is to assist students in making informed decisions regarding their future academic and occupational goals and to provide information regarding careers in the Energy career cluster. The content includes but is not limited to planning, managing and providing support and technical services related to the generation, transmission and distribution of various types of energy along with the design engineering, construction, maintenance, and repair of these systems. Reinforcement of academic skills occurs through classroom instruction and applied laboratory procedures.

Instruction and learning activities are provided in a laboratory setting using hands-on experiences with the equipment, materials and technology appropriate to the course content and in accordance with current practices.

## 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

The length of this course is one semester. It may be offered for two semesters when appropriate. When offered for one semester, it is recommended that it be at the exploratory level and more in-depth when offered for two semesters.

## 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.

## 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 to meet individual needs and ensure equal access. 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.

## Standards

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

01.0 Demonstrate an understanding of careers in Energy Generation.
02.0 Demonstrate an understanding of careers in Energy Transmission/Distribution.
03.0 Apply leadership and communication skills.
04.0 Describe how information technology is used in the Energy career cluster.
05.0 Use information technology tools.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Introduction to Energy**
**Course Number:** **9709350**
**Course Credit:** **Semester**

**Course Description:**

Beginning with a broad overview of the Energy career cluster, students are introduced to the terminology, careers, history, required skills, and technologies associated with each pathway in the Energy career cluster. Additionally, they will be provided with opportunities to acquire and demonstrate beginning leadership skills.

01.0 Demonstrate an understanding of careers in Energy Generation --The student will be able to:

- 01.01 Define and use proper terminology associated with the Energy Generation.
- 01.02 Describe some of the careers available in Energy Generation.
- 01.03 Identify common characteristics of the careers in Energy Generation.
- 01.04 Research the history of Energy Generation careers and describe how the associated careers have evolved and impacted society.
- 01.05 Identify skills and education required to successfully enter any career in the Energy Generation.
- 01.06 Describe common career ladders in Energy Generation.
- 01.07 Describe technologies associated in careers within Energy Generation.

02.0 Demonstrate an understanding of careers in Energy Transmission/Distribution --The student will be able to:

- 02.01 Define and use proper terminology associated with Energy Transmission/Distribution.
- 02.02 Describe some of the careers available in Energy Transmission/Distribution.
- 02.03 Identify common characteristics of the careers in Energy Transmission/Distribution.
- 02.04 Research the history of Energy Transmission/Distribution and describe how the careers have evolved and impacted society.
- 02.05 Identify skills and education required to successfully enter any career in Energy Transmission/Distribution.
- 02.06 Describe common career ladders in Energy Transmission/Distribution.
- 02.07 Describe technologies associated in careers within Energy Transmission/Distribution.

03.0 Apply leadership and communication skills--The student will be able to:

- 03.01 Discuss the establishment and history of the SkillsUSA organization.
- 03.02 Identify the characteristics and responsibilities of organizational leaders.
- 03.03 Demonstrate parliamentary procedure skills during a meeting.
- 03.04 Participate on a committee which has an assigned task and report to the class.

03.05 Demonstrate effective communication skills through delivery of a speech, a slide presentation, or conducting a demonstration.
03.06 Use a computer to assist in the completion of a project related to the Energy career cluster.

04.0 Describe how information technology is used in the Energy career cluster. – The student will be able to:

04.01 Identify information technology (IT) careers in the Energy career cluster, including the responsibilities, tasks and skills they require.
04.02 Relate information technology project management concepts and terms to careers in the Energy career cluster.
04.03 Manage information technology components typically used in professions of the Energy career cluster.
04.04 Identify security-related ethical and legal IT issues faced by professionals in the Energy career cluster.

05.0 Use information technology tools. – The student will be able to:

05.01 Identify the functions of web browsers, and use them to access the World Wide Web and other computer resources typically used in the Energy career cluster.
05.02 Use e-mail clients to send simple messages and files to other Internet users.
05.03 Demonstrate ways to communicate effectively using Internet technology.
05.04 Use different types of web search engines effectively to locate information relevant to the Energy career cluster.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Course Title:** **Introduction to Energy and Career Planning**
**Course Type:** **Orientation/Exploratory**
**Career Cluster:** **Energy**

| Secondary - Middle School | |
|---|---|
| Program Number | 9709360 |
| CIP Number | 149709360M |
| Grade Level | 6-8 |
| Standard Length | Semester |
| Teacher Certification | TEC ED 1@2<br>ELECTRICAL @7G<br>IND ENGR @7G |
| CTSO | SkillsUSA |
| Facility Code | 245 http://www.fldoe.org/edfacil/sref.asp (State Requirements for Educational Facilities) |

## Purpose

The purpose of this course is to assist students in making informed decisions regarding their future academic and occupational goals and to provide information regarding careers in the Energy career cluster. The content includes but is not limited to planning, managing and providing support and technical services related to the generation, transmission and distribution of various types of energy along with the design engineering, construction, maintenance, and repair of these systems. Reinforcement of academic skills occurs through classroom instruction and applied laboratory procedures.

Instruction and learning activities are provided in a laboratory setting using hands-on experiences with the equipment, materials and technology appropriate to the course content and in accordance with current practices.

## 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

The length of this course is one semester. It may be offered for two semesters when appropriate. When offered for one semester, it is recommended that it be at the exploratory level and more in-depth when offered for two semesters.

## 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.

## 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 to meet individual needs and ensure equal access. 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.

## Career Planning

The career and education planning course required by Section 1003.4156, Florida Statutes, has been integrated into this course. This course must include career exploration using CHOICES or a comparable cost-effective program and educational planning using the online student advising system known as Florida Academic Counseling and Tracking for Students at the Internet website FACTS.org; and shall result in the completion of a personalized academic and career plan.

## Standards

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

01.0 Demonstrate an understanding of careers in Energy Generation.
02.0 Demonstrate an understanding of careers in Energy Transmission/Distribution.
03.0 Apply leadership and communication skills.
04.0 Describe how information technology is used in the Energy career cluster.
05.0 Use information technology tools.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Introduction to Energy and Career Planning**
**Course Number:** **9709360**
**Course Credit:** **Semester**

**Course Description:**

Beginning with a broad overview of the Energy career cluster, students are introduced to the terminology, careers, history, required skills, and technologies associated with each pathway in the Energy career cluster. Additionally, they will be provided with opportunities to acquire and demonstrate beginning leadership skills.

01.0 Demonstrate an understanding of careers in Energy Generation --The student will be able to:

- 01.01 Define and use proper terminology associated with the Energy Generation.
- 01.02 Describe some of the careers available in Energy Generation.
- 01.03 Identify common characteristics of the careers in Energy Generation.
- 01.04 Research the history of Energy Generation careers and describe how the associated careers have evolved and impacted society.
- 01.05 Identify skills and education required to successfully enter any career in the Energy Generation.
- 01.06 Describe common career ladders in Energy Generation.
- 01.07 Describe technologies associated in careers within Energy Generation.

02.0 Demonstrate an understanding of careers in Energy Transmission/Distribution --The student will be able to:

- 02.01 Define and use proper terminology associated with Energy Transmission/Distribution.
- 02.02 Describe some of the careers available in Energy Transmission/Distribution.
- 02.03 Identify common characteristics of the careers in Energy Transmission/Distribution.
- 02.04 Research the history of Energy Transmission/Distribution and describe how the careers have evolved and impacted society.
- 02.05 Identify skills and education required to successfully enter any career in Energy Transmission/Distribution.
- 02.06 Describe common career ladders in Energy Transmission/Distribution.
- 02.07 Describe technologies associated in careers within Energy Transmission/Distribution.

03.0 Apply leadership and communication skills--The student will be able to:

- 03.01 Discuss the establishment and history of the SkillsUSA organization.
- 03.02 Identify the characteristics and responsibilities of organizational leaders.
- 03.03 Demonstrate parliamentary procedure skills during a meeting.
- 03.04 Participate on a committee which has an assigned task and report to the class.

03.05 Demonstrate effective communication skills through delivery of a speech, a slide presentation, or conducting a demonstration.
03.06 Use a computer to assist in the completion of a project related to the Energy career cluster.

04.0 Describe how information technology is used in the Energy career cluster. – The student will be able to:

04.01 Identify information technology (IT) careers in the Energy career cluster, including the responsibilities, tasks and skills they require.
04.02 Relate information technology project management concepts and terms to careers in the Energy career cluster.
04.03 Manage information technology components typically used in professions of the Energy career cluster.
04.04 Identify security-related ethical and legal IT issues faced by professionals in the Energy career cluster.

05.0 Use information technology tools. – The student will be able to:

05.01 Identify the functions of web browsers, and use them to access the World Wide Web and other computer resources typically used in the Energy career cluster.
05.02 Use e-mail clients to send simple messages and files to other Internet users.
05.03 Demonstrate ways to communicate effectively using Internet technology.
05.04 Use different types of web search engines effectively to locate information relevant to the Energy career cluster.

**Listed below are the standards that must be met to satisfy the requirements of Section 1003.4156, Florida Statutes.**

**Understanding the Workplace**

06.0 Describe how work relates to the needs and functions of the economy, society, and personal fulfillment.
07.0 Describe the influences that societal, economic, and technological changes have on employment trends and future training.
08.0 Describe the need for career planning, changing careers, and the concept of lifelong learning and how they relate to personal fulfillment.
09.0 Describe how legislation such as the Americans with Disabilities Act and Child Labor Laws regulates employee rights.

**Self- Awareness**

10.0 Use results of an interest assessment to describe their top interest areas and relate to careers/career clusters.
11.0 Identify five values that they consider important in making a career choice.
12.0 Identify skills needed for career choices and match to personal abilities.
13.0 Demonstrate the ability to apply skills of self-advocacy and self-determination throughout the career planning process.
14.0 Identify strengths and areas in which assistance is needed at school.
15.0 Apply results of all assessments to personal abilities in order to make realistic career choices.

**Exploring Careers**

16.0 Demonstrate the ability to locate, understand, and use career information.
17.0 Use the Internet to access career and education planning information.
18.0 Identify skills that are transferable from one occupation to another.
19.0 Demonstrate use of career resources to identify occupational clusters, career opportunities within each cluster, employment outlook, and education/ training requirements.
20.0 Explain the relationship between educational achievement and career success.

**Goal Setting and Decision-Making**

21.0 Identify and demonstrate use of steps to make career decisions.
22.0 Identify and demonstrate processes for making short and long term goals.

**Workplace Skills**

23.0 Demonstrate personal qualities (e.g. dependability, punctuality, responsibility, integrity, getting along with others) that are needed to be successful in the workplace.
24.0 Demonstrate skills to interact positively with others.
25.0 Demonstrate employability skills such as working on a team, problem-solving and organizational skills.

**Career and Education Planning**

26.0 Identify secondary and postsecondary school courses that meet tentative career plans.
27.0 Identify advantages and disadvantages of entering various secondary and postsecondary programs for the attainment of career goals.
28.0 Demonstrate knowledge of varied types and sources of financial aid to obtain assistance for postsecondary education.
29.0 Identify inappropriate discriminatory behaviors that may limit opportunities in the workplace.
30.0 Develop a career and education plan that includes short and long-term goals, high school program of study, and postsecondary/work goals.
31.0 Describe how extracurricular programs can be incorporated in career and education planning.
32.0 Demonstrate knowledge of high school exit options (e.g., standard diploma, certificate of completion, special diploma, GED, etc.) and impact on post-school opportunities.
33.0 Describe high school credits and explain how GPAs are calculated.

**Job Search**

34.0 Demonstrate skills to complete a job application.
35.0 Demonstrate skills essential for a job interview.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Fundamentals of Energy**
**Program Type:** **Orientation/Exploratory**
**Career Cluster:** **Energy**

| Secondary - Middle School | |
|---|---|
| Program Number | 9790300 |
| CIP Number | 149790300M |
| Grade Level | 6-8 |
| Standard Length | One Year |
| Teacher Certification | TEC ED 1@2<br>ELECTRICAL @7G<br>IND ENGR @7G |
| CTSO | SkillsUSA |
| Facility Code | 245 http://www.fldoe.org/edfacil/sref.asp (State Requirements for Educational Facilities) |

## Purpose

The purpose of this course is to assist students in making informed decisions regarding their future academic and occupational goals and to provide information regarding careers in the Energy career cluster. The content includes but is not limited to careers in the energy industry, various energy sources, and electrical power generation, transmission and distribution. Instruction and learning activities are provided in a laboratory setting using hands-on experiences with the equipment, materials and technology appropriate to the course content and in accordance with current practices.

## 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.

## 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 to meet individual needs and ensure equal access. 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.

## Standards

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

01.0 Identify careers and entry requirements in the energy industry.
02.0 Locate power plants in Florida.
03.0 Understand conventional electric power generation.
04.0 Discuss the value of alternative and renewable energy sources.
05.0 Understand electric power transmission and distribution.
06.0 Investigate the viability of wind energy.
07.0 Investigate the viability of solar energy.
08.0 Investigate the use of hydroelectricity.
09.0 Investigate the use of nuclear power.
10.0 Investigate the viability of biomass and biofuel.
11.0 Investigate the viability of geothermal energy.
12.0 Calculate greenhouse gas emissions based on local fuel mixture and energy consumption.
13.0 Identify components of network systems.
14.0 Describe and use communication features of information technology.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Course Title:** **Fundamentals of Energy**
**Course Number:** **9790300**
**Course Length:** **One Year**

**Course Description:**

The purpose of this course is to assist students in making informed decisions regarding their future academic and occupational goals and to provide information regarding careers in the Energy career cluster. The content includes but is not limited to careers in the energy industry, various energy sources, and electrical power generation, transmission and distribution.

01.0 Identify careers and entry requirements in the energy industry--The student will be able to:

- 01.01 Describe careers in the energy industry.
- 01.02 Explain educational pathways available to gain training to begin a career in the energy industry.
- 01.03 Classify careers from entry-level to professional level.
- 01.04 Explain the importance of employability skills and how destructive decisions can affect future employment.
- 01.05 Research and present information on an energy career including roles and responsibilities, opportunities for employment and the requirements for education and training.

02.0 Locate power plants in Florida--The student will be able to:

- 02.01 Describe the energy source(s) the power plants use.
- 02.02 Map the areas that are served by particular power plants.

03.0 Understand conventional electric power generation--The student will be able to:

- 03.01 Explain the conventional electric power generation systems and process (coal, petroleum, hydroelectric, and nuclear).
- 03.02 Identify various conventional electric power generation fuel sources and the cost/ efficiency/ environmental advantages and disadvantages of each.
- 03.03 Draw and label diagrams of conventional electrical power generation systems.

04.0 Discuss the value of alternative and renewable energy sources--The student will be able to:

- 04.01 Investigate the reasons for seeking alternatives to fossil fuels.
- 04.02 Explain the difference between alternative energy and renewable energy.

05.0 Understand electric power transmission and distribution--The student will be able to:

05.01 Explain the electric power transmission process.
05.02 Discuss the application of different electric power transmission principles (including AC vs. DC).
05.03 Explain the electric power distribution process.
05.04 Discuss the need for electric distribution systems and how they are designed to operate.
05.05 Discuss the emerging technologies in electric power transmission and distribution, including distribution automation and SmartGrid systems.

06.0 Investigate the viability of wind energy--The student will be able to:

06.01 Describe wind energy and the way it is harnessed.
06.02 Evaluate the advantages and disadvantages to wind technology.
06.03 Draw and label a diagram of a windmill.

07.0 Investigate the viability of solar energy--The student will be able to:

07.01 Describe solar energy and how it is harnessed.
07.02 Explain the difference between passive solar and active solar.
07.03 Draw and label a diagram of PV cells (e.g. array, panel, module, boron-enriched silicon).
07.04 Describe a central receiver system.
07.05 Draw and label a diagram of a solar thermal plant.
07.06 Evaluate the advantages and disadvantages of using solar energy.

08.0 Investigate the use of hydroelectricity--The student will be able to:

08.01 Describe hydroelectric energy and how it is produced.
08.02 Draw and label a diagram of a hydroelectric plant.
08.03 Evaluate the advantages and disadvantages of using hydroelectricity energy

09.0 Investigate the use of nuclear power--The student will be able to:

09.01 Explain the process of nuclear fission.
09.02 Define radio-isotopes and half-life.
09.03 Evaluate the advantages and disadvantages of nuclear power.
09.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
09.05 Describe nuclear energy and how it is harnessed.

10.0 Investigate the viability of biomass and biofuel--The student will be able to:

10.01 Discuss the major sources of biomass.
10.02 Define biofuels (e.g. ethanol, biodiesel and methanol).
10.03 Outline the pyramid energy flow including the different trophic levels.
10.04 Describe the major sources, scale, and impacts of biomass energy.
10.05 Draw and label a diagram of biomass plantations.

10.06 List the advantages and disadvantages of using biomass for energy (e.g. $CO_2$ emissions, photosynthetic efficiency, cost, etc.).

11.0 Investigate the viability of geothermal energy--The student will be able to:

11.01 Describe geothermal energy and the way it is harnessed.
11.02 Evaluate the advantages and disadvantages of using geothermal energy.
11.03 Draw and label a diagram of a geothermal power plant.

12.0 Investigate energy consumption and identify ways to use energy wisely --The student will be able to:

12.01 Describe energy efficiency and conservation
12.02 Read and interpret residential utility bill.
12.03 Learn how to measure energy use of various equipment
12.04 Learn how to measure light output
12.05 Graph temperature and humidity levels in classrooms

13.0 Calculate greenhouse gas emissions based on local fuel mixture and energy consumption—The student will be able to:

13.01 Research local fuel mixture.
13.02 Read and interpret residential utility bill.
13.03 Determine greenhouse gas emissions (carbon dioxide, methane, nitrous oxide, etc.) for various types of fuel (e.g. coal, petroleum, natural gas).
13.04 Plan ways to conserve energy at home and at school.
13.05 Plan ways to improve energy efficiency at home and at school.
13.06 Explain the importance of fuel mix diversity.

14.0 Identify components of network systems--The student will be able to:

14.01 Identify structure to access internet, including hardware and software components.
14.02 Identify and configure user customization features in web browsers, including preferences, caching, and cookies.
14.03 Recognize essential database concepts.
14.04 Define and use additional networking and internet services.

15.0 Describe and use communication features of information technology--The student will be able to:

15.01 Define important internet communications protocols and their roles in delivering basic Internet services.
15.02 Identify basic principles of the Domain Name System (DNS).
15.03 Identify security issues related to Internet clients.
15.04 Identify and use principles of Personal Information Management (PIM), including common applications.
15.05 Efficiently transmit text and binary files using popular Internet services.
15.06 Conduct a webcast and related services.

15.07 Represent technical issues to a non technical audience.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Electrical Power Technology**
**Career Cluster:** **Energy**

| | AS | AAS |
|---|---|---|
| CIP Number | 1615030304 | 0615030304 |
| Program Type | College Credit | College Credit |
| Standard Length | 68 Credit Hours | 68 Credit Hours |
| CTSO | SkillsUSA | SkillsUSA |
| SOC Codes (all applicable) | 49-2095 | 49-2095 |
| Targeted Occupation List | http://www.labormarketinfo.com/wec/TargetOccupationList.htm | |
| Perkins Technical Skill Attainment Inventory | http://www.fldoe.org/workforce/perkins/perkins_resources.asp | |
| Statewide Articulation | http://www.fldoe.org/workforce/dwdframe/artic_frame.asp | |

## 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 DC/AC circuits, power generation, instrumentation and electrical network analysis, design, theory, solid state devices, and analog circuits. Integrated into this content will be communications skills, safe and efficient workplace practices, and technical recording and reporting. This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Electrical Power industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

## Program Structure

This program is a planned sequence of instruction consisting of sixty-eight credit hours.

## 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 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.

**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 postsecondary service provider. 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.

**Articulation**

To be transferable statewide between institutions, this program must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

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

**Program Length**

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The AAS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS. The standard length of this program is sixty-eight credit hours according to Rule 6A-14.030, F.A.C.

**Certificate Programs**

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for

entry into employment (Rule 6A-14.030, F.A.C.). This AS/AAS degree program includes the following College Credit Certificates:

Alternative Energy Engineering Technology (0615050304) – 18 Credit Hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

**Standards**

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

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in DC circuits.
03.0 Demonstrate proficiency in AC circuits.
04.0 Demonstrate proficiency in solid state devices.
05.0 Demonstrate proficiency in technical recording and reporting.
06.0 Demonstrate proficiency in DC network analysis.
07.0 Demonstrate proficiency in AC network and coupled circuit analysis.
08.0 Demonstrate proficiency in principles of rotating machinery.
09.0 Demonstrate proficiency in principles of power generation systems.
10.0 Demonstrate proficiency in principles of power transformers.
11.0 Demonstrate proficiency in principles of power transmission systems.
12.0 Demonstrate proficiency in principles of power distribution systems.
13.0 Demonstrate proficiency in principles of switchgear, motor control centers, and ac breaker panels.
14.0 Demonstrate proficiency in interpretation of electric codes.
15.0 Demonstrate proficiency in employability skills.
16.0 Demonstrate an understanding of the energy industry.
17.0 Demonstrate proficiency in generators, exciters, and voltage regulators**.**

**Generation Option**

18.0 Demonstrate proficiency in transformers.
19.0 Demonstrate proficiency in switchgear, motor control centers, breaker panels, and AC and DC plant power distribution.
20.0 Demonstrate proficiency in protective devices.
21.0 Demonstrate proficiency in power cable, control cable, instrumentation cable and raceways.
22.0
23.0 Demonstrate proficiency in motors.
24.0 Demonstrate proficiency in the plant cycle (both I & C and Electric).
25.0 Demonstrate proficiency in electric motors.

**Instrumentation and Control Option**

26.0 Demonstrate proficiency in the plant cycle (both I and Electric).
27.0 Demonstrate proficiency in primary elements and transmitters.
28.0 Demonstrate proficiency in final elements.
29.0 Demonstrate proficiency in process control.
30.0 Demonstrate proficiency in mircroprocessor systems.
31.0 Demonstrate proficiency in combustion control.

32.0 Demonstrate proficiency in electric motor control.
33.0 Demonstrate proficiency in digital circuits.

**Distribution Option**

34.0 Demonstrate proficiency in the application of power transformers.
35.0 Demonstrate proficiency in the use of electrical equipment.
36.0 Demonstrate proficiency in the principles of system protection.
37.0 Demonstrate proficiency in 3 phase power system analysis.
38.0 Demonstrate proficiency in basic surveying skills.
39.0 Demonstrate proficiency in distribution circuit design.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Electrical Power Technology**
**CIP Numbers:** **A.S. 1615030300, A.A.S. 0615030300**
**Program Length:** **60 Credit Hours**
**SOC Code(s):** **49-2095**

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The AAS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS. At the completion of this program, the student will be able to:

01.0 Demonstrate proficiency in laboratory practices–The student will be able to:

- 01.01 Apply proper OSHA safety standards.
- 01.02 Make electrical connections to include power conductor connections.
- 01.03 Identify and use hand tools properly.
- 01.04 Identify and use power tools properly.
- 01.05 Demonstrate acceptable soldering and desoldering techniques.

02.0 Demonstrate proficiency in DC circuits–The student will be able to:

- 02.01 Solve algebraic problems to include exponentials (prerequisite to DC content).
- 02.02 Solve problems in electronic units utilizing metric prefixes.
- 02.03 Relate electricity to the nature of the matter.
- 02.04 Identify sources of electricity.
- 02.05 Define voltage, current, resistance, power and energy.
- 02.06 Apply Ohm's Law and Power formula.
- 02.07 Read and interpret color codes and symbols to identify electrical components and values.
- 02.08 Measure properties of a circuit using VOM and DVM meters and oscilloscopes.
- 02.09 Compute conductance and measure resistance of conductors and insulators.
- 02.10 Apply Ohm's Law to series circuits.
- 02.11 Construct and verify the operation of series circuits.
- 02.12 Analyze and troubleshoot parallel circuits.
- 02.13 Apply Ohm's Law to parallel circuits.
- 02.14 Construct and verify the operation of a parallel circuit.
- 02.15 Analyze and troubleshoot parallel circuits.
- 02.16 Apply Ohm's Law to series-parallel/parallel-series circuits.
- 02.17 Construct and verify the operation of series-parallel/parallel-series and bridge circuits.
- 02.18 Troubleshoot series-parallel/parallel-series and bridge circuits.
- 02.19 Identify and define voltage divider circuits (loaded and unloaded).
- 02.20 Construct and verify the operation of voltage divider circuits (loaded and unloaded).
- 02.21 Analyze and troubleshoot voltage divider circuits (loaded and unloaded).
- 02.22 Apply maximum power transfer theory.
- 02.23 Construct and verify operation of circuits that demonstrate maximum power transfer theory.

02.24 Describe magnetic properties of circuits and devices.
02.25 Determine the physical and electrical characteristics of capacitors and inductors.
02.26 Define RC and RL time constants and classify the output differentiators and integrators.
02.27 Set up and operate power supplies for DC circuits.

03.0 Demonstrate proficiency in AC circuits–The student will be able to:

03.01 Solve basic trigonometric problems applicable to electrical technology (prerequisite to AC).
03.02 Identify properties of an AC signal.
03.03 Identify AC sources.
03.04 Analyze and measure AC signals utilizing VOM, DVM, oscilloscope, frequency counter and function generator.
03.05 Define the characteristics of AC capacitive circuits.
03.07 Construct and verify the operation of AC capacitive circuits.
03.08 Analyze and troubleshoot AC capacitive circuits.
03.09 Define and apply the characteristics of AC inductive circuits.
03.10 Construct and verify the operation of AC inductive circuits.
03.11 Analyze and troubleshoot AC inductive circuits.
03.12 Define and apply the principles of transformers to AC.
03.13 Construct and verify the operation of AC circuits utilizing transformers.
03.14 Analyze and troubleshoot AC circuits utilizing transformers.
03.15 Construct and verify the operation of differentiators and integrators to determine RC and RL time constants.
03.16 Analyze and troubleshoot differentiator and integrator circuits.
03.17 Define the characteristics of RLC circuits (series, parallel, and complex).
03.18 Construct and verify the operation of RLC circuits (series, parallel, and complex).
03.19 Define the characteristics of series and parallel resonant circuits.
03.20 Construct and verify the operation of series and parallel resonant circuits.
03.21 Analyze and troubleshoot RC, RL, and RLC circuits.
03.22 Define the characteristics of polyphase circuits.
03.23 Define the basic motor theory and operation.
03.24 Define the basic generator theory and operation.
03.25 Set up and operate power supplies for AC circuits.
03.26 Analyze and measure power in AC circuits (real, reactive and apparent power).

04.0 Demonstrate proficiency in solid state devices–The student will be able to:

04.01 Identify and define properties of semiconductor materials.
04.02 Identify and define operating characteristics and applications of junction diodes.
04.03 Identify and define operating characteristics and applications of special diodes (xener, MOV for example metal oxide).
04.04 Construct diodes circuits.
04.05 Analyze and troubleshoot diode circuits.
04.06 Identify and define operating characteristics and application of bipolar transistors.
04.07 Identify and define operating characteristics and applications of Field Effect Transistors (FET's).
04.08 Identify and define operating characteristics and application of single stage amplifiers.
04.09 Construct single-state amplifiers.

04.10 Analyze and troubleshoot single-state amplifiers.
04.11 Construct thyristor circuitry.
04.12 Analyze and troubleshoot thyristor circuitry.
04.13 Set up and operate a VOM for solid-state devices.
04.14 Set up and operate a DVM for solid-state devices.
04.15 Set up and operate power supplies for solid-state devices.
04.16 Set up and operate oscilloscopes for solid-state devices.
04.17 Set up and operate function generators for solid-state devices.

05.0 Demonstrate proficiency in technical recording and reporting–The student will be able to:

05.01 Draw engineering electrical sketches, interpret electrical schematics, writing diagrams, charts, graphs and geographical sketches.
05.02 Record data and design curves and graphs.
05.03 Write reports and make oral presentations.
05.04 Maintain test logs.
05.05 Make equipment failure reports.
05.06 Specify and requisition simple electrical components.
05.07 Compose technical letters and memoranda.
05.08 Write formal reports of laboratory experiences.

06.0 Demonstrate proficiency in DC network analysis--The student will be able to:

06.01 Analyze multisource circuits using Millman's Theorem.
06.02 Analyze multisource circuits using Superimposition Theorem.
06.03 Analyze multisource circuits using Mesh Currents.
06.04 Analyze multisource circuits using Branch Currents or similar method.
06.05 Analyze multisource circuits using Nodal Analysis.
06.06 Analyze multisource circuits using Thevenin's Theorem.
06.07 Analyze DC circuits using computer programs.

07.0 Demonstrate proficiency in AC network and coupled circuit analysis–The student will be able to:

07.01 Analyze magnetic circuits.
07.02 Apply Faraday's Law of induced voltages.
07.03 Solve for mutual inductance in a coupled circuit.
07.04 Analyze AC circuits using network theorems.
07.05 Solve problems in transient analysis in RC and RL circuits.
07.06 Demonstrate and analyze the effects of loading on transformers.
07.07 Analyze RLC circuits using complex numbers.
07.08 Analyze RC/RCL filters.
07.09 Analyze AC circuits using computer programs.

08.0 Demonstrate proficiency in principles of rotating machinery--The student will be able to:

08.01 Identify and define the characteristics of DC, series, shunt, compound motors, and generators.
08.02 Identify and define the characteristics of AC, single phase, and polyphase motors.
08.03 Set up and operate DC and AC motors.

09.0 Demonstrate proficiency in principles of power generation systems--The student will be able to:

09.01 Identify the elements of a power generation system.
09.02 Solve problems involving alternators.

10.0 Demonstrate proficiency in principles of power transformers—The student will be able to:

10.01 Identify the characteristics of power transformers.
10.02 Solve problems involving the application of power transformers.

11.0 Demonstrate proficiency in principles of power transmission systems--The student will be able to:

11.01 Identify power transmission lines.
11.02 Solve problems involving transmission lines.

12.0 Demonstrate proficiency in principles of power distribution systems--The student will be able to:

12.01 Identify power distribution systems.
12.02 Solve problems involving distribution systems.

13.0 Demonstrate proficiency in principles of switchgear, motor control centers, and ac breaker panels--The student will be able to:

13.01 Identify the properties of switchgears.
13.02 Describe the operation of switchgear, motor control centers, and AC breaker panels.

14.0 Demonstrate proficiency in interpretation of electric codes—The student will be able to:

14.01 Understand the need for IEEE (Institute of Electrical, Electronics and Engineers), NEMA (National Electrical Manufacturers Association) and ANSI (American National Standards Institute) codes.
14.02 Demonstrate proficiency in interpretation/explanation of the IEEE (Institute of Electrical, Electronics and Engineers), NEMA (National Electrical Manufacturers Association) and ANSI (American National Standards Institute) codes.

15.0 Demonstrate proficiency in employability skills--The student will be able to:

15.01 Conduct a job search.
15.02 Secure information about a job.
15.03 Identify documents that may be required when applying for a job.
15.04 Complete a job application form correctly.
15.05 Demonstrate competence in job interview techniques.

16.0 Demonstrate an understanding of the energy industry--The student will be able to:

16.01 Describe the importance of the power industry to the American economy.

16.02 Define the differences between energy production, energy transmission, and energy distribution.
16.03 Describe the importance of a reliable power grid to the American economy.
16.04 Describe the role of the power grid in energy distribution.
16.05 Identify and discuss the regulatory characteristics associated with the energy industry.
16.06 Identify the necessary personal characteristics of a successful energy professional.

17.0 Demonstrate proficiency in generators, exciters, and voltage regulators**--**The student will be able to:

17.01 Demonstrate proficiency in the principles of generators.
17.02 Identify the magnetic field associated with a generator.
17.03 Identify positive and negative rotation.
17.04 Identify the purpose and function of a generator or field ground circuit.
17.05 Identify the different methods of excitation.
17.06 Identify the most common parameters of a generator.
17.07 Identify each component of the generator, how they interrelate and their individual function.

**Generation Option**

18.0 Demonstrate proficiency in transformers–The student will be able to:

18.01 Demonstrate proficiency in the principles of transformers including the autotransformer.
18.02 Identify the magnetic fields associated with a transformer.
18.03 Identify the characteristics of a power transformer.
18.04 Identify and make proper single phase transformer connections.
18.05 Identify and make proper three phase (delta, WYE) transformer connections.
18.06 Make proper tap changes.
18.07 Analyze the ideal circuit model of a transformer.
18.08 Identify and analyze transformer nomenclature, polarity, name plate data and ratings.
18.09 Identify and analyze transformer losses and efficiency.
18.10 Perform basic maintenance procedures and testing including oil testing and ratio test phasing.
18.11 Locate and correct fault currents.

19.0 Demonstrate proficiency in switchgear, motor control centers, breaker panels, and AC and DC plant power distribution—The student will be able to:

19.01 Demonstrate proficiency in the various classifications and components of switchgear, motor control centers, and distribution breaker panels.
19.02 Demonstrate knowledge in the standards that govern the application of switchgear, motor control centers, and breaker panel (NEMA standards, IEEE National Electric Code).
19.03 Demonstrate knowledge in fault current calculations equipment rational (continuous, interrupt, and with standard capabilities).

19.04 Demonstrate knowledge of insulation test materials and the application of various test equipment (Megger, hi-pot, Doble).
19.05 Demonstrate knowledge in cable entry and termination. This includes power cable, control cable, shield terminations, current transformer, and potential transformer locations and wiring ratings.
19.06 Demonstrate knowledge in plant one line electrical diagram configurations and various distribution systems to include auxiliary power systems, reserve power systems, DC power systems, automatic power systems and automatic transfer systems.
   a. Demonstrate the application of plant one line electrical diagram configurations and various distribution systems to include auxiliary power systems, reserve power systems, DC power systems, automatic power systems and automatic transfer systems.
   b. Identify the characteristics of fused panels and breaker panels.
   c. Demonstrate knowledge and use (application) of ground bus, neutral bus, and grounded neutral bus.
   d. Demonstrate proficiency in plant DC power distribution systems to include batteries (inverters and troubleshooting techniques).

20.0 Demonstrate proficiency in protective devices--The student will be able to:

20.01 Demonstrate knowledge of what a protective devise is for motors, generators, transformers and switchgear and why they are necessary.
20.02 Demonstrate proficiency in understanding the IEEE standard device numbering system.
20.03 Demonstrate knowledge in various categories of protective devices and their coordination (overcurrent, differential, etc.).
20.04 Perform an acceptance test on a breaker, fuse, and overcurrent relay.
20.05 Demonstrate proficiency in selecting the correct protective device and its rating for a motor, cable and lighting load.
20.06 Know of potential transformer, current transformers and their application in metering and protection circuits.

21.0 Demonstrate proficiency in power cable, control cable, instrumentation cable and raceways--The student will be able to:

21.01 Demonstrate proficiency in how power cables, control cables and instrumentation cables are constructed.
21.02 Demonstrate proficiency in the standard voltage ratings of power cables, control cables and instrumentation cables.
21.03 Demonstrate proficiency in the standard current ratings of power cables and control cables.
21.04 Demonstrate proficiency in power cable effects of heat (internal and external) on the ampere rating of a cable, magnetic effects of conductors, knowledge of when the ground shields are necessary and how to terminate them, methods of installing power cables in conduits, trays, and duct banks (pulling cables, single and multiple groups) and selecting terminating materials and how they are used.
21.05 Demonstrate proficiency in control cable identification codes of different conductors within a control cable.

21.06 Demonstrate knowledge in selecting terminating materials and equipment, termination of a control circuit and perform the actual termination, and proper installation methods (pulling cable, single and multiple groups).
21.07 Demonstrate proficiency in instrumentation cable, the different metals used to make conductors for instrumentation cables, the effects of large power circuits in close proximity to instrumentation cables, how and why shields are included in instrumentation cables, proper methods of installing instrumentation cables, knowledge on when to extend ground shield, terminate a ground shield, and the methods used, how to terminate a thermocouple cable and make actual installation, knowledge of the standard conductor identification methods, and 802 differences between thermocouple extension cable.

22.0 Demonstrate proficiency in grounding--The student will be able to:

22.01 Explain why grounding is necessary.
22.02 Demonstrate knowledge in how ground circuits are necessary for the interruptions of protective devices.
22.03 Demonstrate knowledge in how ground systems protect individuals from shocks.
22.04 Demonstrate proficiency in layout, installing, and sizing ground conductors.
22.05 Demonstrate proficiency in the magnetic effects of phase conductors and ground conductors.
22.06 Demonstrate proficiency in the identification of grounding conductors.
22.07 Demonstrate the principles of point source grounding and maintaining it.
22.08 Demonstrate proficiency in ground systems effectiveness.

23.0 Demonstrate proficiency in motors--The student will be able to:

23.01 Identify the characteristics needed to properly select a motor for replacement or a new application.
23.02 Demonstrate knowledge of the NEMA Standards MG1 and MG2.
23.03 Identify and test a DC motor for receiving criteria.
23.04 Identify and test an AC motor for receiving criteria.
23.05 Demonstrate proficiency in establishing a motor direction of rotation and changing it.
23.06 Applicable to AC single phase, AC three phase, DC motors.
23.07 Demonstrate proficiency in the various methods of starting AC and DC motors.
23.08 Demonstrate proficiency in motor control circuits by developing the logic and wiring a control circuit.
23.09 Demonstrate proficiency in control and application of 3 phase synchronize motors.

24.0 Demonstrate proficiency in the plant cycle (both I & C and Electric)--The student will be able to:

24.01 Identify and define the basic elements of the basic steam cycle.
24.02 Describe major plant components, such as: boilers, turbine, generators, pollution control equipment, heat exchangers, pumps, etc.
24.03 Demonstrate proficiency in reading and using steam tables, basic heat rate calculations (feed water heater performance).

25.0 Demonstrate proficiency in electric motors**--**The student will be able to:

25.01 Read, interpret and troubleshoot from elementary diagrams.
25.02 Demonstrate competency in the elements of the elementary diagrams (relays, timers, limit switches, selector switches).

**Instrumentation And Control Option**

26.0 Demonstrate proficiency in the plant cycle (both I and Electric)--The student will be able to:

26.01 Identify and define the basic elements of the basic steam cycle.
26.02 To describe major plant components, such as: boilers, turbine, generators, pollution control equipment, heat exchangers, pumps, etc.
26.03 Demonstrate proficiency in reading and using steam tables, basic heat rate calculations (feed water heater performance).

27.0 Demonstrate proficiency in primary elements and transmitters--The student will be able to:

27.01 Define physical properties relating to pressure, level, temperature, ph, conductivity, vibration, and flow.
27.02 Identify the types and appropriate application of primary elements used in measuring those physical properties.
27.03 Operate basic test equipment (deadweight test, vacuum pump, potentiometer, thermal bath).
27.04 Setup, calculate and measure the output of primary elements and transmitters under varying conditions.
27.05 Identify and define the operating characteristics of electric and pneumatic transmitters.
27.06 Specify appropriate primary elements and transmitters for basic process measurements (e.g., case ratings, ranges accuracy, basic data sheets, ISA standards).
27.07 Calibrate, configure and troubleshoot analog and digital transmitters.
27.08 Design, setup and test pneumatic and electronics instrument loops.

28.0 Demonstrate proficiency in final elements--The student will be able to:

28.01 Define operating characteristics and appropriate applications for control valves (valve sizing calculations, flashing, cavitation, types (plug, globe, ball, butterfly) action (linear, quick opening, equal percentage).
28.02 Define operating characteristics for dampers (relationship between driver and flow; cams, types (e.g. guillotine, louver).
28.03 Define the operating characteristics of valve/damper operator: pneumatic, hydraulic, electric and interface devices: SOV's, positioners, I/P's.
28.04 Calibrate and troubleshoot final elements and interface devices.
28.05 Design, setup and test instrument loop with final element.

29.0 Demonstrate proficiency in process control--The student will be able to:

29.01 Identify and define the elements of automatic control integral, derivative, proportional, direct acting, feed forward, ration, cascade, three element feedwater control, etc.)
29.02 Analyze and test tuning constant relationships (example: Define the output of a process with a set or ramp change using a proportional plus derivative action controller).
29.03 Read and interpret basic functional diagrams.

30.0 Demonstrate proficiency in mircroprocessor systems--The student will be able to:

30.01 Identify CPU (Architecture) building blocks and their uses.
30.02 Analyze BUS concepts.
30.03 Analyze various memory schemes.
30.04 Set up and operate oscilloscopes for microprocessor systems.
30.05 Set up and operate logic/data analyzers for troubleshooting microprocessor systems.
30.06 Identify types of input and output devices and peripherals.
30.07 Interface input and output ports to peripherals.
30.08 Analyze and troubleshoot input and output ports.
30.09 Specify, program and troubleshoot programmable logic controllers.
30.10 Analyze and troubleshoot a communications link.
30.11 Configure and troubleshoot distributed digital controllers.
30.12 Analyze and troubleshoot Distributed Control Systems (DCS's).

31.0 Demonstrate proficiency in combustion control--The student will be able to:

31.01 Demonstrate competence in the following: steam flow – air flow relationship steam flow – fuel flow relationship fuel flow – air flow relationship excess oxygen steam flow – air flow – fuel flow relationship.
31.02 Demonstrate competencies in the simple cycle and combine cycle combustion turbines.
31.03 Demonstrate competence in drum level control and in heat recovery steam generator control.
31.04 32.03 Demonstrate competency in using the elements of elementary ladder logic diagrams in PLCs.
31.05 Define critical protection systems such as implosion protection systems such as implosion protection, burner management systems.
31.06 Read, interpret, and troubleshoot from functional diagrams.

32.0 Demonstrate proficiency in electric motor control–The student will be able to:

32.01 Read, interpret and troubleshoot from elementary diagrams.
32.02 Demonstrate competency in the elements of the elementary diagrams (relays, timers, limit switches, selector switches).

33.0 Demonstrate proficiency in digital circuits–The student will be able to:

33.01 Define and apply numbering systems to codes and arithmetic operations.
33.02 Analyze, minimize logic circuits using Boolean operations.
33.03 Setup and operate power supplies for digital circuits and solve power distribution and noise problems.

33.04 Set up and operate oscilloscopes for digital circuits.
33.05 Identify types of logic gates and their truth tables.
33.06 Troubleshoot logic circuits.
33.07 Analyze types of flip-flops and their truth tables.
33.08 Identify, define and measure characteristics if Integrated Circuit (IC) logic families.
33.09 Identify types of registers and counters.
33.10 Analyze clock and timing circuits.
33.11 Relate the uses of digital-to-analog and analog-to-digital circuits.
33.12 Identify types of digital displays.
33.13 Construct digital display circuits.
33.14 Troubleshoot digital display circuits.

**Distribution Option**

34.0 Demonstrate proficiency in the application of power transformers--The student will be able to:

34.01 Demonstrate proficiency in the principles of transformers including the autotransformer.
34.02 Identify the magnetic fields associated with a transformer.
34.03 Identify the characteristics of a power transformer.
34.04 Identify and make proper single phase transformer connections.
34.05 Identify and make proper three phase (delta, WYE) transformer connections.
34.06 Make proper load tap changes.
34.07 Analyze the ideal circuit model of a transformer.
34.08 Identify and analyze transformer nomenclature, polarity, name plate data and ratings.
34.09 Identify and analyze transformer losses and efficiency.
34.10 Perform basic maintenance procedures and testing including oil testing and ratio test phasing.
34.11 Locate and correct fault currents.

35.0 Demonstrate proficiency in the use of electrical equipment–The student will be able to:

35.01 Identify and troubleshoot circuit breakers and reclosers in transmission and distribution systems.
35.02 Identify and analyze the use of conductors (overhead and underground) in transmission and distribution systems.
35.03 Identify the characteristics and uses of poles, wood, concrete and aluminum.
35.04 Identify the types of wood treatments for poles.
35.05 Identify and analyze the use of capacitors, insulators, regulators and arresters.
35.06 Design and analyze guying and anchor systems.
35.07 Make high voltage connection.
35.08 Identify load management devices.
35.09 Identify and analyze the use of switches and switchgear.
35.10 Identify and analyze the use of conduit and panel guards.
35.11 Set up and operate instrument transformers PT and CT.
35.12 Identify and analyze, metering systems.
35.13 Identify and analyze lighting systems.

36.0 Demonstrate proficiency in the principles of system protection--The student will be able to:

36.01 Identify and analyze the use of feeder breaker recloser and fuses.
36.02 Identify and define the characteristics of a substation.
36.03 Design, identify and analyze motor projection devices.
36.04 Analyze the loading, voltage drops, balance and circuit balance of a 3 phase system.

37.0 Demonstrate proficiency in 3 phase power system analysis—The student will be able to:

37.01 Covert between physical units (amperes, volts, OHMS, watts, and VARS and per unit parameters).
37.02 Analyze radial distribution systems (complete line and phase, voltages, currents and power flows).
37.03 Analyze 3 phase systems on a single phase basis (assume balanced systems).
37.04 Analyze the loading, voltage drops, balance and circuit balance of a 3 phase system.

38.0 Demonstrate proficiency in basic surveying skills—The student will be able to:

38.01 Define and apply the general principles of surveying.
38.02 Be proficient in the use of and application of survey equipment.
38.03 Identify easements and analyze legal descriptions.

39.0 Demonstrate proficiency in distribution circuit design --The student will be able to:

39.01 Design basic overhead and underground single and 3 phase line extensions.
39.02 Demonstrate an understanding of fuse and breaker coordination.
39.03 Demonstrate an understanding of the “per unit” system of calculations.
39.04 Demonstrate an understanding of grounded and ungrounded systems.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Alternative Energy Engineering Technology**
**Career Cluster:** **Energy**

| CCC | |
|---|---|
| CIP Number | 0615050304 |
| Program Type | College Credit Certificate (CCC) |
| Program Length | 18 Credit Hours |
| CTSO | SkillsUSA |
| SOC Codes (all applicable) | 49-2095 |
| Targeted Occupation List | http://www.labormarketinfo.com/wec/TargetOccupationList.htm |
| Perkins Technical Skill Attainment Inventory | http://www.fldoe.org/workforce/perkins/perkins_resources.asp |
| Statewide Articulation | http://www.fldoe.org/workforce/dwdframe/artic_frame.asp |

**Purpose**

This certificate program is part of the Electrical Power Technology AS/AAS degree program (1615030300/0615030300).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

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 DC/AC circuits, power generation, instrumentation and electrical network analysis, design, theory, solid state devices, and analog circuits. Integrated into this content will be communications skills, safe and efficient workplace practices, and technical recording and reporting. This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Energy and Power industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

## 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 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.

### 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 postsecondary service provider. 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.

### Articulation

For details on 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 course the student will be able to perform the following:

01.0 Demonstrate proficiency in laboratory practices.
02.0 Demonstrate proficiency in DC circuits.
03.0 Demonstrate proficiency in AC circuits.
04.0 Demonstrate proficiency in solid state devices.
05.0 Demonstrate proficiency in technical recording and reporting.
06.0 Demonstrate proficiency in principles of power generation systems such as solar, wind, geothermal, Biofuels/biomass, hydroelectric and ocean energy.
07.0 Demonstrate proficiency in principles of transformers.
08.0 Demonstrate proficiency in principles of power transmission systems.
09.0 Demonstrate proficiency in interpretation of electric codes.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Alternative Energy Engineering Technology**
**CIP Number:** **0615050304**
**Program Length:** **18 Credit Hours**
**SOC Code(s):** **49-2095**

This certificate program is part of the Electrical Power Technology AS/AAS degree program (1615030300/0615030200). At the completion of this program, the student will be able to:

01.0 Demonstrate proficiency in laboratory practices --The student will be able to:

- 01.01 Apply proper OSHA safety standards.
- 01.02 Make electrical connections to include power conductor connections.
- 01.03 Identify and use hand tools properly.
- 01.04 Identify and use power tools properly.

02.0 Demonstrate proficiency in DC circuits --The student will be able to:

- 02.01 Identify sources of electricity.
- 02.02 Define voltage, current, resistance, power and energy.
- 02.03 Apply Ohm's Law and Power formula.
- 02.04 Measure properties of a circuit using VOM and DVM meters and oscilloscopes.
- 02.05 Describe magnetic properties of circuits and devices.
- 02.06 Determine the physical and electrical characteristics of capacitors and inductors.

03.0 Demonstrate proficiency in AC circuits -- The student will be able to:

- 03.01 Identify properties of an AC signal.
- 03.02 Identify AC sources.
- 03.03 Analyze and measure AC signals utilizing VOM, DVM, oscilloscope, frequency counter, and function generator.
- 03.04 Define the characteristics of AC capacitive circuits.
- 03.08 Define and apply the characteristics of AC inductive circuits.
- 03.09 Define and apply the principles of transformers to AC.
- 03.10 Define the characteristics of polyphase circuits.
- 03.11 Define the basic motor theory and operation.
- 03.12 Define the basic generator theory and operation.

04.0 Demonstrate proficiency in solid state devices --The student will be able to:

- 04.01 Identify and define properties of semiconductor materials.
- 04.02 Identify and define operating characteristics and applications of junction diodes.
- 04.03 Identify and define operating characteristics and applications of special diodes (xener, MOV for example metal oxide).
- 04.04 Analyze and troubleshoot diode circuits.
- 04.05 Set up and operate a DVM for solid-state devices.

05.0 Demonstrate proficiency in technical recording and reporting --The student will be able to:

- 05.01 Draw engineering electrical sketches, interpret electrical schematics, writing diagrams, charts, graphs and geographical sketches.
- 05.02 Record data and design curves and graphs.
- 05.03 Write reports and make oral presentations.
- 05.04 Maintain test logs.
- 05.05 Make equipment failure reports.
- 05.06 Specify and requisition simple electrical components.
- 05.07 Compose technical letters and memoranda.
- 05.08 Write formal reports of laboratory experiences.
- 05.09 Draft installation preventive maintenance and calibration procedures.

06.0 Demonstrate proficiency in principles of power generation systems --The student will be able to:

- 06.01 Identify the elements of a power generation system.
- 06.02 Solve problems involving alternators.
- 06.03 Discuss emerging and alternative electric power generation technologies and fuel sources.
- 06.04 Explain how solar energy is used to produce electricity in photovoltaic systems and what are its advantages and disadvantages.
- 06.05 Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.
- 06.06 Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.
- 06.07 Explain how solar and geothermal energy is used to produce electric energy and what are its advantages and disadvantages.
- 06.08 Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.
- 06.09 Explain how ocean energy is used to produce electric energy and what are its advantages and disadvantages.
- 06.10 Explain how fuel cells are used to produce electric energy and what are its advantages and disadvantages.

07.0 Demonstrate proficiency in principles of power transformers --The student will be able to:

- 07.01 Identify the characteristics of power transformers.
- 07.02 Solve problems involving the application of power transformers.

08.0 Demonstrate proficiency in principles of power transmission systems --The student will be able to:

- 08.01 Identify power transmission lines.
- 08.02 Solve problems involving transmission lines.

09.0 Demonstrate proficiency in interpretation of electric codes --The student will be able to:

09.01 Understand the need for IEEE (Institute of Electrical, Electronics and Engineers), NEMA (National Electrical Manufacturers Association) and ANSI (American National Standards Institute) codes.

09.02 Demonstrate proficiency in interpretation/explanation of the IEEE (Institute of Electrical, Electronics and Engineers), NEMA (National Electrical Manufacturers Association) and ANSI (American National Standards Institute) codes.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Electrical Distribution Technology**
**Career Cluster:** **Energy**

| | AS | AAS |
|---|---|---|
| CIP Number | 16646030101 | 0646030101 |
| Program Type | College Credit | College Credit |
| Standard Length | 65 Credit Hours | 65 Credit Hours |
| CTSO | SkillsUSA | SkillsUSA |
| SOC Codes (all applicable) | 49-9051 | 49-9051 |
| Targeted Occupation List | http://www.labormarketinfo.com/wec/TargetOccupationList.htm | |
| Perkins Technical Skill Attainment Inventory | http://www.fldoe.org/workforce/perkins/perkins_resources.asp | |
| Statewide Articulation | http://www.fldoe.org/workforce/dwdframe/artic_frame.asp | |

**Purpose**

The purpose of this program is to prepare students for employment as utility electrical line workers, or in related work on private industry owned and operated electrical distribution systems. Workers in this industry are employed by public power, cooperative or municipal utilities, privately owned systems such as the mining industry and electrical distribution system contractors.

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 safety and safe work practices; fundamentals of electricity and electrical formulae; study of utility practices and basic utility business models; leadership, communications and interpersonal skills; electrical transmission/distribution substation operation; installation, maintenance and operation of overhead and underground electrical distribution systems; electrical service metering and the application of electrical test instrumentation used in the industry. The program is broad in its scope employing industry recognized levels of training progression and performance objectives. The introduction of basic technology in each learning component and progressive employment of the program content will bring the student from novice ground man to the proficiency level of journeyman line worker.

## Program Structure

This program is a planned sequence of instruction consisting of 65 credit hours.

## 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

This program includes 21 semester hours of college level general education courses. The general education components include oral and written communications skills, basic computer skills, college algebra computation skills, problem solving, critical thinking and interpersonal skills. These general education skills are included to insure the graduate is capable of succeeding in an industry that is rapidly and consistently employing new and advanced technologies. In addition, the advanced thinking and problem solving skills are not only valuable to the graduate's future learning opportunities but an employer desired skill set as well. The general education components of the program are statewide transferable credits toward other college level programs.

## 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.

## 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 postsecondary service provider. 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.

## Articulation

To be transferable statewide between institutions, this program must have been reviewed, and a "transfer value" assigned the curriculum content by the appropriate Statewide Course

Numbering System discipline committee. This does not preclude institutions from developing specific articulation agreements with each other.

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

## Program Length

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The AAS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS. The standard length of this program is 65 credit hours according to Rule 6A-14.030, F.A.C.

## Certificate Programs

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.). This AS/AAS degree program includes the following College Credit Certificates:

Electrical Distribution Technology Advanced (0646030102) – 50 Credit Hours
Electrical Distribution Technology Basic (0646030103) – 24 Credit Hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

## Standards

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

01.0 Demonstrate general safe work practices promulgated under Federal, State and industry regulation.
02.0 Demonstrate rescue, CPR and lifesaving strategies particularly related to the industry.
03.0 Demonstrates proficiencies in rigging pole climbing and basic pole framing.
04.0 Demonstrate proficiencies working with insulating “hot-sticks” tools, protective cover-up materials, and insulated rubber gloving techniques.
05.0 Demonstrate proficiencies in setting distribution poles.
06.0 Demonstrate proficiencies installing overhead line equipment.
07.0 Demonstrate proficiencies in applying electrical formulae and electric test equipment.
08.0 Demonstrate proficiencies in constructing new underground electrical distribution systems.
09.0 Demonstrate proficiencies in constructing/re-conductoring overhead electrical distribution systems.
10.0 Demonstrate techniques for maintenance of overhead facilities.
11.0 Demonstrate techniques for maintenance of underground facilities.
12.0 Demonstrate an understanding of a variety of utility business models representing the industry.
13.0 Understand electrical metering technology, utility data collection and control technologies.
14.0 Demonstrate safe switching, sectionalizing and isolation of electrical distribution circuits.
15.0 Demonstrate safe work practices in electrical transmission and distribution substations.

16.0 Demonstrate proficiencies in applied electrical theory.
17.0 Demonstrate proficiency in utility construction equipment operation and maintenance.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Electrical Distribution Technology**
**CIP Numbers:** **A.S. 1646030101, A.A.S. 0646030101**
**Program Length:** **65 Credit Hours**
**SOC Code(s) :** **49-9051**

The AS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS, and it must be transferable according to Rule 6A-14.030 (2), F.A.C. The AAS degree requires the inclusion of a minimum of 15 credits of general education coursework according to SACS. At the completion of this program, the student will be able to:

01.0 Demonstrates general safe work practices promulgated under federal, state and industry regulation--The student will be able to:

- 01.01 Discuss and describe function and mission of OSHA and an employer's Safety Organization.
- 01.02 Research, generally interpret and apply sections of a "Safe Work" practice manual.
- 01.03 Research, generally interpret and apply OSHA safe work practices.
- 01.04 Discuss safe trenching, excavation, shoring and confined space practices.
- 01.05 Discuss the applied safe work practices when given a scenario.
- 01.06 Discuss safe truck driving and pole and equipment trailer practices.
- 01.07 Understand the process of obtaining the State of Florida CDL-A Permit License.

02.0 Demonstrates rescue, CPR and lifesaving strategies particularly related to the industry--The student will be able to:

- 02.01 Describe the rescue and life saving requirement training for line workers as promulgated under OSHA.
- 02.02 Evaluate potential hazards for rescue planning in tailboard sessions.
- 02.03 Identify the standby equipment for job site safety/rescue preparedness.
- 02.04 Evaluate safety/rescue equipment for worthiness.
- 02.05 Evaluate a first aid kit for completeness.
- 02.06 Evaluate and administer first aid.
- 02.07 Effectively initiate professional lifesaving 911 response in an emergency situation.
- 02.08 Describe the processes for organizing a rescue response team.
- 02.09 Perform as the incident commander in a rescue response.
- 02.10 Perform CPR alone and as a team on adults, children and infants.
- 02.11 Describe the process and perform a rescue of an injured person from an aerial platform.
- 02.12 Describe the process and perform a rescue of an injured person from pole top or structure.
- 02.13 Describe the process and perform a rescue of an injured person from a manhole.

03.0 Demonstrates proficiencies in rigging, pole climbing and basic pole framing--The student will be able to:

03.01 Discuss and explain how ropes are manufactured.
03.02 Discuss the construction of and application of rope.
03.03 Distinguish between rope types and applications.
03.04 Demonstrate proper care and maintenance of ropes.
03.05 Apply and tie knots for a variety of rigging requirements.
03.06 Discuss and demonstrate the effect of rigging multiple sheave blocks.
03.07 Rig a variety of sheaved blocks.
03.08 Demonstrate proper rope splicing techniques.
03.09 Apply hoist to a variety of lifting situations.
03.10 Demonstrate care, maintenance and operation of cable, chain and strap hoist.
03.11 Demonstrate rigging for pulling/tensioning down guys.
03.12 Demonstrate rigging for lifting equipment and poles.
03.13 Demonstrate inspection, care, maintenance and application of a variety of slings.
03.14 Demonstrate the application and rigging of gins and saddles.
03.15 Discuss and demonstrate the dynamics of compound rigging.
03.16 Discuss the care and maintenance of pole climbing equipment.

04.0 Demonstrate proficiencies working with insulating “hot-sticks” tools, protective cover-up materials, and insulated rubber gloving techniques--The student will be able to:

04.01 Demonstrate hot line rigging of strap hoist with sticks.
04.02 Demonstrate wire tying with a tie stick.
04.03 Demonstrate operating an energized switch with a switch stick.
04.04 Describe the function of and properly operate a “Load Buster,” load break tool.
04.05 Simulate stick lifting of a hot phase conductor.
04.06 Demonstrate stick installed temporary insulating cover.
04.07 Demonstrate transferring a dead-end with sticks.
04.08 Perform hotline stick insulator and arrestor change-outs.
04.09 Demonstrate installing a jumper with sticks.
04.10 Demonstrate installing a stirrup with sticks.
04.11 Demonstrate gloving a stirrup installation.
04.12 Demonstrate covering energized lines with sticks.
04.13 Demonstrate installing blankets with sticks.
04.14 Demonstrate covering energized lines with gloves.
04.15 Cover a single phase transformer installation using gloving techniques.
04.16 Demonstrate a dead-end transfer using gloving techniques.
04.17 Demonstrate phase tying with gloves.
04.18 Demonstrate installing a jumper using gloving techniques.
04.19 Demonstrate a dead-end transfer from a baker board using gloving techniques.
04.20 Discuss safety considerations for gloving of energized conductors.

05.0 Demonstrates proficiencies in setting distribution poles—The student will be able to:

05.01 Discuss and identify different types of and applications of line support structures.
05.02 Identify ratings and manufacturer of structures by reading the pole “brand”.
05.03 Stake and layout a new project for pole setting by reading a construction blueprint.
05.04 Demonstrate proficiencies in setting a variety of pole anchor systems.
05.05 Install a variety of pole guy anchor types.
05.06 Discuss wind loading and pole stresses.

05.07 Discuss and identify pole failure modes.
05.08 Discuss and properly install and test pole/structure grounding installations.
05.09 Layout the tools and equipment needed to install a full size utility pole.
05.10 Excavate for and install a wood, fiberglass, concrete, or steel pole using a digger-derrick material handler truck.
05.11 Execute a dead-man and push brace installation.
05.12 Demonstrate canting, tamping and raking of distribution structures.
05.13 Identify transmission structure types.
05.14 Identify cross arm, alley arm, arm less, and vertical pole head construction using pole top pin-and-insulators and post-type-insulators.
05.15 Discuss joint-use utility provisions and clearances.

06.0 Demonstrates proficiencies installing overhead line equipment--The student will be able to:

06.01 Use a field work order print/drawing and a standards manual to apply distribution construction standards for installing overhead line equipment.
06.02 Determine the general voltage class for which a pole line is rated by observation of installed insulator hardware.
06.03 Apply the correct insulators for a distribution line installation.
06.04 Apply the correct surge arrestors for a distribution line installation.
06.05 Discuss the correct use of surge arrestors with respect to their unique operating voltage characteristics.
06.06 Install and wire surge arrestors in a variety of applications and configurations.
06.07 Discuss the reasons for various overhead insulator design configurations.
06.08 Discuss lightning arrestor technologies.
06.09 Classify distribution class switches and disconnects by current, voltage and style.
06.10 Install and operate distribution class disconnects in pole, arm and inline installations.
06.11 Classify a variety of load break rated disconnect switches.
06.12 Install a variety of distribution class cross arms.
06.13 Discuss the safety considerations regarding operating and switching aerial circuit breaker and recloser devices.
06.14 Demonstrate the operating technology for single and three phase reclosers and regulators.
06.15 Discuss the common failure modes for circuit breakers, reclosers, and capacitors.
06.16 Install and safely operate single and three phase reclosers and regulators.
06.17 Demonstrate the procedure for removing a regulator from service.
06.18 Install single phase transformers and three phase transformer banks.
06.19 Install and safely operate single and three phase distribution class capacitor banks.
06.20 Remove single and three phase capacitor banks from service.
06.21 Discuss supervisory and stand alone control schemes for distribution class field installed capacitor banks.
06.22 Discuss the application and operation of primary and secondary voltage capacitors on alternating current systems.
06.23 Install a single phase and three phase pole mounted recloser.
06.24 Install a pole mounted and platform mounted regulator bank.
06.25 Install single and three phase capacitor banks.

06.26 Install a variety of three phase banked transformers.

07.0 Demonstrates proficiencies in applying electrical formulae and electric test equipment—The student will be able to:

07.01 Demonstrates understanding of alternating current theory.
07.02 Demonstrates understanding of direct current theory.
07.03 Demonstrates understanding of measurement of electromotive force.
07.04 Demonstrates understanding of measurement of electrical current.
07.05 Demonstrate measurement techniques to obtain volt-amps, watts, and power factor.
07.06 Explain the fundamentals of operation and demonstrate electrical measuring equipment.
07.07 Apply electrical formulae to solve electrical computations.
07.08 Demonstrate a variety of cable location equipment.
07.09 Demonstrate proficiency in cable testing of primary and secondary UG cables.
07.10 Demonstrate understanding of high potential testing procedures.
07.11 Demonstrate proficiency in ground resistance testing.
07.12 Demonstrate proficiency in “ringing” cable connections.
07.13 Demonstrate proficiency of transformer testing.
07.14 Demonstrate understanding of insulating oil test.
07.15 Demonstrate understanding of testing of rubber goods.
07.16 Demonstrate testing of streetlight ballast and components.
07.17 Demonstrate testing of controllers and controller components.

08.0 Demonstrate proficiencies in constructing new underground electrical distribution systems--The student will be able to:

08.01 Demonstrate safety considerations regarding trenching and underground installations.
08.02 Identify soil conditions for trenching planning according to OSHA regulations.
08.03 Assemble material and equipment to construct a URD single phase radial installation.
08.04 Demonstrate knowledge of reading construction work order drawing (blueprint reading) for an underground URD loop system.
08.05 Demonstrate direct burial and conduit installation of URD primary and secondary cable.
08.06 Differentiate between classes and sizes of primary and secondary cables.
08.07 Demonstrate proper storage and handling of primary and secondary cable.
08.08 Demonstrate underground cable installation methods using open excavation and subsurface boring techniques.
08.09 Splice/terminate a variety of types of XLPE and rubber insulated primary cables.
08.10 Install single phase, open-delta, and three phase underground transformers.
08.11 Demonstrate safe grounding procedure for1Ø and 3Ø underground cable.
08.12 Discuss the application and wiring of overhead transformers for use in vaults and in enclosures.
08.13 Perform primary cable terminations on a 3 phase loop fed transformer or switch pad.
08.14 Discuss the various types of pre-fabricated and cast-in-place transformer and switchgear pads / foundations / and vaults.

08.15 Install single and three phase riser pole mounted underground cable terminations (potheads) in conjunction with aerial switch or fuse devices.
08.16 Install single phase URD service, conduit riser and meter box connections.
08.17 Discuss old and new technologies associated with underground cable fault finding systems (DC, TDR, VLF-AC, Partial Discharge, etc.).

09.0 Demonstrate proficiencies in constructing/re-conductoring overhead electrical distribution systems--The student will be able to:

09.01 Demonstrate planning a new overhead line construction project.
09.02 Demonstrate planning the re-conductoring of an existing three phase line.
09.03 Identify and plan for safety of the public during wire pulling operations.
09.04 Identify and perform tree trimming to facilitate the installation of conductors.
09.05 Layout the equipment required for a conductor pulling operation.
09.06 Lead the safety planning and grounding aspects of re-conductoring a three phase line.
09.07 Plan and safely execute a variety of hot-line “fanning” operations for pulling conductors.
09.08 Plan and properly position/set poles for re-conductoring change outs and transfers.
09.09 Plan and properly execute covering of existing utilities.
09.10 Install running blocks and equipment for pulling conductors.
09.11 Set up and operate overhead conductor pulling tensioning equipment.
09.12 Demonstrate knowledge of line sagging tools.
09.13 Properly perform phase tensioning, transfer to insulators and tying in of conductors.
09.14 Safely and properly install and remove mechanical jumpers.
09.15 Plan and safely remove abandoned conductors.

10.0 Demonstrates techniques for maintenance of overhead facilities--The student will be able to:

10.01 Demonstrate change out of a variety of distribution class cross-arms.
10.02 Demonstrate maintenance of distribution class disconnects in pole, arm, and inline installations.
10.03 Demonstrate maintenance of single and three phase reclosers and regulators.
10.04 Demonstrate maintenance of single and three phase distribution class capacitor banks.
10.05 Demonstrate maintenance to system grounding conductors and connections.
10.06 Demonstrate re-lamping and maintenance of lighting systems.
10.07 Demonstrate proficiency of a variety of insulator change-outs.
10.08 Demonstrate proficiency of pole change-outs.
10.09 Demonstrate proficiency in switch and arrestor maintenance and change-outs.
10.10 Demonstrate proficiency in pole and pole line inspection.
10.11 Demonstrate proficiency in transformer inspection, maintenance and change-outs.

11.0 Demonstrates techniques for maintenance of underground facilities--The student will be able to:

11.01 Demonstrate replacement of a single phase pad mounted transformer.

11.02 Demonstrate both primary and secondary voltage splicing techniques.
11.03 Demonstrate the basic techniques associated with making an insulating tape splice on a primary URD cable.
11.04 Demonstrate the basic techniques necessary to make a lead-to-solid dielectric primary cable transition splice.
11.05 Demonstrate the procedure to replace a blown element in a transformer bayonet style fuse holder.
11.06 Demonstrate leakage gradient fault finding equipment on secondary faulted cable.
11.07 Demonstrate inspection and maintenance on a pad mounted transformer.
11.08 Demonstrate inspection and maintenance on UG sectionalizer switches.
11.09 Demonstrate a safe procedure for replacing a fuse element in a live-front pad mounted distribution transformer.

12.0 Demonstrates an understanding of a variety of utility business models representing the industry--The student will be able to:

12.01 Demonstrate understanding of basic utility management elements.
12.02 Demonstrate an understanding of cooperative, municipal, and investor owned power provider models.
12.03 Demonstrate an understanding of role of associations such as the Electric Cooperative Associations, the American Public Power Association, and investor owned power providers.
12.04 Demonstrate an understanding of the role of associations such as the Electric Cooperative Association, the American Public Power Association, and the Edison Electric Institute.
12.05 Demonstrate understanding of history of power company development, regulation and legislation.
12.06 Demonstrate an understanding of deregulation of the electric power provider industry.
12.07 Demonstrate an understanding of regulatory agencies that govern utility operations, such as FERC, EPA, USDA, and State PSC.
12.08 Demonstrate an understanding of differences in the economics of operation between cooperative, municipal, and investor owned power providers.
12.09 Demonstrate an understanding of cost of delivered goods and common pricing structures for residential, commercial and industrial service.
12.10 Demonstrate understanding of inter and intrastate mutual aid agreements.
12.11 Demonstrate an understanding of “wheeling”, purchase power and leased system agreements.
12.12 Demonstrate an understanding of pole line management.
12.13 Demonstrate an understanding of GPS and GIS technologies.

13.0 Understands electrical metering technology, utility data collection and control technologies--The student will be able to:

13.01 Demonstrate setting a single phase residential meter.
13.02 Demonstrate setting a three phase socket-type meter into a meter base.
13.03 Demonstrate setting a three phase A-base meter and current transformers.
13.04 Size and apply the correct equipment for a primary metering installation.
13.05 Install a three phase distribution class metering installation.
13.06 Wire the line side of a single phase UG meter base.

13.07 Wire the line side of a three phase open delta UG meter base.
13.08 Wire the line side of a three phase wye UG meter base.
13.09 Discuss the technology behind three phase distribution class metering.

14.0 Demonstrates safe switching, sectionalizing and isolation of electrical distribution circuits--The student will be able to:

14.01 Demonstrate switching/sectionalizing of a three phase overhead line.
14.02 Demonstrate proper execution of a distribution switching order.
14.03 Plan a distribution switch order.
14.04 Demonstrate switching/sectionalizing a three phase line with regulators.
14.05 Plan and execute a three phase live front loop sectionalizing operation.
14.06 Demonstrate parking of a UG primary dead-front elbow.
14.07 Plan and execute a three phase dead front loop sectionalizing operation.
14.08 Plan and execute a handle operated switching pad sectionalizing operation.

15.0 Demonstrate safe work practices in electrical transmission/distribution substations--The student will be able to:

15.01 Demonstrate a functional knowledge of a substation one line diagram.
15.02 Plan and execute a complete substation switching order.
15.03 Identify all equipment in a typical substation.
15.04 Read and identify the name plate data on substation equipment.
15.05 Describe the function of and components of a recloser relay unit.
15.06 Read and diagnose targets and lockout mode of a substation recloser.
15.07 Change out a recloser relay unit.
15.08 Place a substation recloser in non-automatic operation.
15.09 Safely operate a gang operated air break transmission class switch.
15.10 Describe the component parts of various air/oil/vacuum/gas insulated substation circuit breaker technologies.
15.11 Discuss the procedure to safely execute a buss tie closure and the transfer of individual circuit breaker loads.
15.12 Demonstrate knowledge of a typical SCADA control system.
15.13 Check and service a substation battery bank.
15.14 Demonstrate testing and replacing a distribution class sand fuse.
15.15 Rack out a substation recloser.
15.16 Prepare a procedure to take a substation regulator out of service and then safely return it to service.
15.17 Execute the procedure to reset a tripped off recloser.
15.18 Restore power to an off line substation.
15.19 Discuss how to read and evaluate a remote status recloser controller and switchboard operator.

16.0 Demonstrate proficiency in applied electrical theory substations—The student will be able to:

16.01 Demonstrate an understanding of the history of electricity.
16.02 Demonstrate an understanding of static electricity and lightning.
16.03 Demonstrate an understanding of parallel and series circuits.
16.04 Demonstrate knowledge of the theory of electrical induction.
16.05 Demonstrate knowledge of AC and DC electric theory.

16.06 Demonstrate an understanding of the properties of an electrical arc.
16.07 Demonstrate understanding of the component parts of a transformer.
16.08 Demonstrate understanding of the process of electricity generation.
16.09 Demonstrate an understanding of the concept of transmitting electric power.
16.10 Demonstrate understanding of the principal of operation of an electric motor.
16.11 Demonstrate an understanding of the theory of capacitance.
16.12 Demonstrate the theory of electrical reactance and resistance.
16.13 Demonstrate an understanding of kW and kVA and the fundamental principles of electric energy.
16.14 Identify classes of insulators and conductors.
16.15 Demonstrate basic low voltage control wiring safety and installation.

17.0 Demonstrate proficiency in utility construction equipment operation and maintenance— The student will be able to:

17.01 Demonstrate safe work practice for operating machinery.
17.02 Demonstrate routine daily inspection to trucks and mobile equipment.
17.03 Inspect hydraulic systems for operational integrity.
17.04 “Fly” a boom for safety inspection.
17.05 Demonstrate understanding of dielectric testing of an insulated boom section.
17.06 Clean and maintain dielectric bucket liners and boom insulators.
17.07 Maintain and install vehicle grounds.
17.08 Safely jump start a vehicle.
17.09 Inspect equipment for safe operational conditions.
17.10 Safely load, secure and unload a variety of equipment from a drive-on trailer.
17.11 Read a load lifting chart.
17.12 Plan a lift.
17.13 Accurately give hand signals to a boom truck operator.
17.14 Set up an aerial truck for operation.
17.15 Safely operate an aerial lift truck.
17.16 Safely operate a boom truck.
17.17 Safely operate a pole-hole digger truck.
17.18 Safely operate an operator seated trenching machine.
17.19 Safely operate a walk behind trencher.
17.20 Safely operate a backhoe.
17.21 Safely operate a horizontal boring machine.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Electrical Distribution Technology Advanced**
**Career Cluster:** **Energy**

| CCC | |
|---|---|
| CIP Number | 0646030102 |
| Program Type | College Credit Certificate (CCC) |
| Program Length | 50 Credit Hours |
| CTSO | SkillsUSA |
| SOC Codes (all applicable) | 49-9051 |
| Targeted Occupation List | http://www.labormarketinfo.com/wec/TargetOccupationList.htm |
| Perkins Technical Skill Attainment Inventory | http://www.fldoe.org/workforce/perkins/perkins_resources.asp |
| Statewide Articulation | http://www.fldoe.org/workforce/dwdframe/artic_frame.asp |

**Purpose**

The purpose of this program is to prepare students for advanced entry-level employment as utility electrical line workers, or in related work on private industry owned and operated electrical distribution systems.

This certificate program is part of the Electrical Distribution Technology AS/AAS degree program (1646030101/0646030101).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

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 safety and safe work practices; fundamentals of electricity and electrical formulae; electrical transmission/distribution substation operation; installation, maintenance and operation of overhead and underground electrical distribution systems and internship employment.

## 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.

### 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 postsecondary service provider. 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.

### Articulation

For details on 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 course the student will be able to perform the following:

01.0 Demonstrate general safe work practices promulgated under Federal, State and industry regulation.
02.0 Demonstrates rescue, CPR and lifesaving strategies particularly related to the industry.
03.0 Demonstrates proficiencies in rigging pole climbing and basic pole framing.
05.0 Demonstrates proficiencies in setting distribution poles.
06.0 Demonstrates proficiencies installing overhead line equipment.
07.0 Demonstrates proficiencies in applying electrical formulae and electric test equipment.
08.0 Demonstrates proficiencies in constructing new underground electrical distribution systems.
10.0 Demonstrates techniques for maintenance of overhead facilities.

11.0 Demonstrates techniques for maintenance of underground facilities.
16.0 Demonstrates proficiencies in applied electrical theory.
17.0 Demonstrate proficiency in utility construction equipment operation and maintenance.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Electrical Distribution Technology Advanced**
**CIP Number:** **0646030102**
**Program Length:** **50 Credit Hours**
**SOC Code(s):** **49-9051**

This certificate program is part of the Electrical Distribution Technology AS/AAS degree program (1646030101/0615.030201). At the completion of this program, the student will be able to:

01.0 Demonstrates general safe work practices promulgated under Federal, State and industry regulation--The student will be able to:

- 01.01 Discuss and describe the function and mission of OSHA and an employer's Safety Organization.
- 01.02 Be able to research, generally interpret and apply sections of a Safe Work practice manual.
- 01.03 Be able to research, generally interpret and apply OSHA safe work practices
- 01.04 Discuss safe trenching, excavation and shoring practices.
- 01.05 When given a scenario the student will be able to discuss the applied safe work practices.
- 01.06 Discuss safe truck driving and pole and equipment trailer practices.
- 01.07 Understand the process of obtaining the State of Florida CDL-A Permit License.

02.0 Demonstrates rescue, CPR and lifesaving strategies particularly related to the industry--The student will be able to:

- 02.01 Describe the rescue and life saving requirement training for line workers under OSHA.
- 02.02 Correctly evaluate potential hazards for rescue planning in tailboard sessions.
- 02.03 Correctly identify the standby equipment for job site safety/rescue preparedness.
- 02.04 Evaluate safety/rescue equipment for worthiness.
- 02.05 Evaluate a first aid kit for completeness.
- 02.06 Correctly evaluate and administer first aid.
- 02.07 Effectively initiate professional lifesaving 911 response in an emergency situation.
- 02.08 Describe the processes for organizing a rescue response team.
- 02.09 Perform as the incident commander in a rescue response.
- 02.10 Perform CPR alone and as a team on adults, children and infants.
- 02.11 Describe the process and perform a rescue of an injured person from an aerial platform.
- 02.12 Describe the process and perform a rescue of an injured person from a pole top or structure.
- 02.13 Describe the process and perform a rescue of an injured person from a manhole.

03.0 Demonstrates proficiencies in rigging, pole climbing and basic pole framing--The student will be able to:

03.01 Discuss and explain how ropes are manufactured.
03.02 Discuss the construction of and application of rope.
03.03 Distinguish between rope types and applications.
03.04 Demonstrate proper care and maintenance of ropes.
03.05 Correctly apply and tie knots for a variety of rigging requirement.
03.06 Discuss and demonstrate the effect of rigging multiple sheave blocks.
03.07 Properly rig a variety of sheaved blocks.
03.08 Demonstrate proper rope splicing techniques.
03.09 Properly apply hoist to a variety of lifting situations.
03.10 Demonstrate care, maintenance and operation of cable, chain and strap hoist.
03.11 Demonstrate rigging for pulling/tensioning down guys.
03.12 Demonstrate rigging for lifting equipment and poles.
03.13 Demonstrate inspection, care, maintenance and application of a variety of slings.
03.14 Demonstrate the application and rigging of gins and saddles.
03.15 Discuss and demonstrate the dynamics of compound rigging.
03.16 Discuss the care and maintenance of pole climbing equipment.

05.0 Demonstrate proficiencies in setting distribution poles--The student will be able to:

05.01 Discuss and identify different types of and applications of line support structures.
05.02 Identify ratings and manufacturer of structures by reading the pole “brand.”
05.03 Correctly stake and layout for pole setting by reading a construction blueprint.
05.04 Install a variety of pole guy anchor types.
05.05 Discuss wind loading and pole stresses.
05.06 Discuss and identify pole failure modes.
05.07 Discuss and properly install and test pole/structure grounding installations.
05.08 Properly layout the tools and equipment to set a wood or concrete pole.
05.09 Properly excavate for and install a wood or concrete pole using a pole truck and capstan.
05.10 Properly excavate for and set a 30/5 wood pole by hand.
05.11 Properly execute a dead-man and push brace installation.
05.12 Demonstrate canting, tamping and raking of distribution structures.
05.13 Demonstrate proficiencies in setting a variety of pole anchor systems.
05.14 Identify transmission structure types.
05.15 Correctly identify dead end, close, vertical, cross-arm, alley arm and pole top pin construction.
05.16 Intelligently discuss joint-use utility provisions and clearances.

06.0 Demonstrates proficiencies installing overhead line equipment--The student will be able to:

06.01 Using a blueprint and standards manual properly apply distribution construction standards for Pole Line Equipment installations.
06.02 Correctly determine the application and voltage of a distribution class insulator by observation of a pole line.
06.03 Properly apply the correct insulators for a distribution line installation.
06.04 Properly apply the correct surge arrestors for a distribution line installation
06.05 Properly install and wire surge arrestors in a variety of applications and configurations.
06.06 Discuss stress cone and insulator technology.
06.07 Discuss lightning arrestor technologies.

06.08 Classify distribution class switches and disconnects by current, voltage and style.
06.09 Properly classify a variety of load break rated disconnect switches.
06.10 Install a variety of distribution class cross arms.
06.11 Discuss the safety considerations regarding operating and switching OCB's and reclosers.
06.12 Demonstrate the operating technology for single and three phase reclosers and regulators.
06.13 Correctly install three phase transformer banks and distribution class line boost transformers.
06.14 Install and safely operate single and three phase distribution class capacitor banks.
06.15 Properly remove single and three phase capacitor banks from service.
06.16 Install and operate secondary capacitor installations.
06.17 Correctly install a variety of three phase banked transformers.

07.0 Demonstrates proficiencies in applying electrical formulae and electric test equipment--The student will be able to:

07.01 Demonstrates understanding of Alternating Current mathematical models.
07.02 Demonstrates understanding of Direct Current mathematical models.
07.03 Demonstrates understanding of measurement of electromotive force.
07.04 Demonstrates understanding of measurement of electrical current.
07.05 Demonstrate measuring Volt Amps and Watts.
07.06 Explain the fundamentals of operation and demonstrate electrical measuring equipment.
07.07 Correctly apply electrical formulae to solve electrical computations.
07.08 Demonstrates a variety of cable location equipment.
07.09 Demonstrates proficiency in cable testing of primary and secondary UG cables.
07.10 Demonstrate understanding of high potential testing procedures.
07.11 Demonstrates proficiency in ground testing.
07.12 Demonstrates proficiency in "ringing" cable connections.
07.13 Demonstrates understanding of testing of rubber goods.
07.14 Demonstrates testing of streetlight ballast and components.
07.15 Demonstrates testing of controllers and controller components.

08.0 Demonstrates proficiencies in constructing new underground electrical distribution system--The student will be able to:

08.01 Demonstrates safety considerations regarding trenching and underground installations.
08.02 Correctly identify soil conditions for trenching planning according to OSHA regulations.
08.03 Correctly assemble material and equipment to construct a URD single phase redial installation.
08.04 Demonstrate knowledge of blueprint reading for an underground loop system.
08.05 Demonstrate direct burial and conduit installation of URD primary and secondary cable.
08.06 Correctly differentiate between classes and sizes of primary and secondary cables.
08.07 Demonstrate proper storage and handling of primary and secondary cable.
08.08 Demonstrate excavation, punching and cutting of buried primary cable.

08.09 Correctly splice/terminate a variety of types of XLPE and rubber insulated primary Iabels.
08.10 Install and ground a single phase URD transformer.
08.11 Install, ground and tie two single phase pad mount transformers into an open-delta bank.
08.12 Demonstrate understanding of the process of cast in place concrete transformer/switch pad foundations.
08.13 Correctly install a pole mounted 3 phase pot head termination with grounding and dropouts.
08.14 Correctly install a single phase residential service pole and meter riser.
08.15 Demonstrate “thumping” fault location on primary cable.

10.0 Demonstrate techniques for maintenance of overhead facilities--The student will be able to:

10.01 Demonstrates change out of a variety of distribution class cross arms.
10.02 Demonstrates maintenance of distribution class disconnects in pole, arm and inline installations.
10.03 Demonstrates maintenance of single and three phase reclosers and regulators
10.04 Demonstrates maintenance of single and three phase distribution class capacitor banks.
10.05 Demonstrates maintenance of secondary capacitor installations.
10.06 Demonstrates re-lamping and maintenance of lighting systems.
10.07 Demonstrates proficiency of a variety of insulator change-outs.
10.08 Demonstrates proficiency of pole change-outs.
10.09 Demonstrates proficiency in switch and arrestor maintenance and change-outs.
10.10 Demonstrates proficiency in pole and pole line inspection.
10.11 Demonstrates proficiency in transformer inspection, maintenance and change-outs.

11.0 Demonstrates techniques for maintenance of underground facilities--The student will be able to:

11.01 Demonstrates replacement of a single phase pad mounted transformer.
11.02 Demonstrates a secondary triplex and primary splice for direct burial.
11.03 Perform a tape splice of primary URD cable.
11.04 Demonstrate a conversion splice of lead to XLPE primary cable.
11.05 Refuse a three phase bayonet fusing system.
11.06 Demonstrate leakage gradient fault finding equipment on secondary faulted cable.
11.07 Demonstrate inspection and maintenance on a pad mounted transformer.
11.08 Demonstrate inspection and maintenance on UG sectionalizer switches.
11.09 Demonstrate refusing of live front UG transformers.

16.0 Demonstrates proficiencies in applied electrical theory--The student will be able to:

16.1 Demonstrates an understanding of the history of electricity.
16.2 Demonstrates an understanding of static electricity and lightning.
16.3 Demonstrates an understanding of parallel and series circuits.
16.4 Demonstrates knowledge of the theory of electrical induction.
16.5 Demonstrates knowledge of AC and DC electric theory.

16.6 Demonstrates an understanding of the properties of an electrical arc.
16.7 Demonstrates understanding of the component parts of a transformer.
16.8 Demonstrates understanding of the process of electricity generation.
16.9 Demonstrate an understanding of properties of transmitting electrical current.
16.10 Demonstrates understanding of the principal of operation of an electric motor.
16.11 Demonstrate the theory of capacitance.
16.12 Demonstrate the theory of electrical reactance and resistance.
16.13 Demonstrate understanding of KW, KVA and the principals of electric power.
16.14 Identify classes of insulators and conductors.
16.15 Demonstrate basic low voltage control wiring safety and installation.

17.0 Demonstrate proficiency in utility construction equipment operation and maintenance--
The student will be able to:

17.1 Demonstrate safe work practice for operating machinery.
17.2 Demonstrate routine daily inspection to trucks and mobile equipment.
17.3 Inspect hydraulic systems for operational integrity.
17.4 Properly “fly” a boom for safety inspection.
17.5 Demonstrate understanding of dielectric testing of an insulated boom section.
17.6 Clean and maintain dielectric bucket liners and boom insulators.
17.7 Maintain and install vehicle grounds.
17.8 Safely jump start a vehicle.
17.9 Inspect equipment for safe operational conditions.
17.10 Safely load, secure and unload a variety of equipment from a drive-on trailer.
17.11 Read a load lifting chart.
17.12 Plan a lift.
17.13 Accurately give hand signals to a boom truck operator.
17.14 Set up an aerial truck for operation.
17.15 Safely operate an aerial lift truck
17.16 Safely operate a boom truck.
17.17 Safely operate a pole-hole digger truck.
17.18 Safely operate an operator seated trenching machine.
17.19 Safely operate a walk behind trencher.
17.20 Safely operate a backhoe.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Electrical Distribution Technology Basic**
**Career Cluster:** **Energy**

| CCC | |
|---|---|
| CIP Number | 0646030103 |
| Program Type | College Credit Certificate (CCC) |
| Program Length | 24 Credit Hours |
| CTSO | SkillsUSA |
| SOC Codes (all applicable) | 49-9051 |
| Targeted Occupation List | http://www.labormarketinfo.com/wec/TargetOccupationList.htm |
| Perkins Technical Skill Attainment Inventory | http://www.fldoe.org/workforce/perkins/perkins_resources.asp |
| Statewide Articulation | http://www.fldoe.org/workforce/dwdframe/artic_frame.asp |

**Purpose**

The purpose of this program is to prepare students for entry-level employment as assistant to utility electrical line workers or in related work on private industry owned and operated electrical distribution systems.

This certificate program is part of the Electrical Distribution Technology AS/AAS degree program (1646030101/0646030101).

A College Credit Certificate consists of a program of instruction of less than sixty (60) credits of college-level courses, which is part of an AS or AAS degree program and prepares students for entry into employment (Rule 6A-14.030, F.A.C.).

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 safety and safe work practices; fundamentals of electricity, and basic installation of overhead and underground electrical distribution systems.

## 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.

### 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 postsecondary service provider. 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.

### Articulation

For details on 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 course the student will be able to perform the following:

01.0 Demonstrates general safe work practices promulgated under Federal, State and industry regulation.
02.0 Demonstrates rescue, CPR and lifesaving strategies particularly related to the industry.
03.0 Demonstrates proficiencies in rigging pole climbing and basic pole framing.
05.0 Demonstrates proficiencies in setting distribution poles.
08.0 Demonstrates proficiencies in constructing new underground electrical distribution systems.
11.0 Demonstrates techniques for maintenance of underground facilities.
17.0 Demonstrate proficiency in utility construction equipment operation and maintenance.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Electrical Distribution Technology Basic**
**CIP Number:** **0646030103**
**Program Length:** **24 Credit Hours**
**SOC Code(s):** **49-9051**

This certificate program is part of the Electrical Distribution Technology AS/AAS degree program (1646030101/0615.030201). At the completion of this program, the student will be able to:

01.0 Demonstrates general safe work practices promulgated under federal, state and industry regulation--The student will be able to:

- 01.01 Discuss and describe the function and mission of OSHA and an employer's Safety Organization.
- 01.02 Be able to research, generally interpret and apply sections of a Safe Work practice manual.
- 01.03 Be able to research, generally interpret and apply OSHA safe work practices
- 01.04 Discuss safe trenching, excavation and shoring practices.
- 01.05 When given a scenario the student will be able to discuss the applied safe work practices.
- 01.06 Discuss safe truck driving and pole and equipment trailer practices.
- 01.07 Understand the process of obtaining the State of Florida CDL-A Permit License.

02.0 Demonstrates rescue, CPR and lifesaving strategies particularly related to the industry--The student will be able to:

- 02.01 Describe the rescue and life saving requirement training for line workers under OSHA.
- 02.02 Correctly evaluate potential hazards for rescue planning in tailboard sessions.
- 02.03 Correctly identify the standby equipment for job site safety/rescue preparedness.
- 02.04 Evaluate safety/rescue equipment for worthiness.
- 02.05 Evaluate a first aid kit for completeness.
- 02.06 Correctly evaluate and administer first aid.
- 02.07 Effectively initiate professional lifesaving 911 response in an emergency situation.
- 02.08 Describe the processes for organizing a rescue response team.
- 02.09 Perform as the incident commander in a rescue response.
- 02.10 Perform CPR alone and as a team on adults, children and infants.
- 02.11 Describe the process and perform a rescue of an injured person from an aerial platform.
- 02.12 Describe the process and perform a rescue of an injured person from a pole top or structure.
- 02.13 Describe the process and perform a rescue of an injured person from a manhole.

03.0 Demonstrates proficiencies in rigging, pole climbing and basic pole framing--The student will be able to:

03.01 Discuss and explain how ropes are manufactured.
03.02 Discuss the construction of and application of rope.
03.03 Distinguish between rope types and applications.
03.04 Demonstrate proper care and maintenance of ropes.
03.05 Correctly apply and tie knots for a variety of rigging requirements.
03.06 Discuss and demonstrate the effect of rigging multiple sheave blocks.
03.07 Properly rig a variety of sheaved blocks.
03.08 Demonstrate proper rope splicing techniques.
03.09 Properly apply hoist to a variety of lifting situations.
03.10 Demonstrate care, maintenance and operation of cable, chain and strap hoist.
03.11 Demonstrate rigging for pulling/tensioning down guys.
03.12 Demonstrate rigging for lifting equipment and poles.
03.13 Demonstrate inspection, care, maintenance and application of a variety of slings.
03.14 Demonstrate the application and rigging of gins and saddles.
03.15 Discuss and demonstrate the dynamics of compound rigging.
03.16 Discuss the care and maintenance of pole climbing equipment.

05.0 Demonstrates proficiencies in setting distribution poles--The student will be able to:

05.01 Be able to discuss and identify different types of and applications of line support structures.
05.02 Be able to identify ratings and manufacturer of structures by reading the pole "brand."
05.03 Be able to correctly stake and layout for pole setting by reading a construction blueprint.
05.04 Install a variety of pole guy anchor types.
05.05 Discuss wind loading and pole stresses.
05.06 Discuss and identify pole failure modes.
05.07 Discuss and properly install and test pole/structure grounding installations.
05.08 Properly layout the tools and equipment to set a wood or concrete pole.
05.09 Properly excavate for and install a wood or concrete pole using a pole truck and capstan.
05.10 Properly excavate for and set a 30/5 wood pole by hand.
05.11 Properly execute a dead-man and push brace installation.
05.12 Demonstrate canting, tamping and raking of distribution structures.
05.13 Demonstrate proficiencies in setting a variety of pole anchor systems.
05.14 Identify transmission structure types.
05.15 Correctly identify, dead end, close, vertical, cross-arm, alley arm and pole top pin construction.
05.16 Intelligently discuss joint-use utility provisions and clearances.

08.0 Demonstrates proficiencies in constructing new underground electrical distribution system--The student will be able to:

08.01 Demonstrate safety considerations regarding trenching and underground installations
08.02 Correctly identify soil conditions for trenching planning according to OSHA regulations
08.03 Correctly assemble material and equipment to construct a URD single phase redial installation.
08.04 Demonstrate knowledge of blueprint reading for an underground loop system.

08.05 Demonstrate direct burial and conduit installation of URD primary and secondary cable.
08.06 Correctly differentiate between classes and sizes of primary and secondary cables.
08.07 Demonstrate proper storage and handling of primary and secondary cable.
08.08 Demonstrate excavation, punching and cutting of buried primary cable.
08.09 Correctly splice/terminate a variety of types of XLPE and rubber insulated primary cables.
08.10 Install and ground a single phase URD transformer.
08.11 Install, ground and tie two single phase pad mount transformers into an open-delta bank.
08.12 Demonstrate understanding of the process of cast in place concrete transformer/switch pad foundations.
08.13 Correctly install a pole mounted three phase pot head termination with grounding and dropouts.
08.14 Correctly install a single phase residential service pole and meter riser.
08.15 Demonstrate “thumping” fault location on primary cable.

11.0 Demonstrates techniques for maintenance of underground facilities--The student will be able to:

11.01 Demonstrates replacement of a single phase pad mounted transformer.
11.02 Demonstrates a secondary triplex and primary splice for direct burial.
11.03 Perform a tape splice of primary URD cable.
11.04 Demonstrate a conversion splice of lead to XLPE primary cable.
11.05 Refuse a three phase bayonet fusing system.
11.06 Demonstrate leakage gradient fault finding equipment on secondary faulted cable.
11.07 Demonstrate inspection and maintenance on a pad mounted transformer.
11.08 Demonstrate inspection and maintenance on UG sectionalizer switches.
11.09 Demonstrate refusing of live front UG transformers.

17.0 Demonstrate proficiency in utility construction equipment operation and maintenance--The student will be able to:

17.01 Demonstrate safe work practice for operating machinery.
17.02 Demonstrate routine daily inspection to trucks and mobile equipment.
17.03 Inspect hydraulic systems for operational integrity.
17.04 Properly “fly” a boom for safety inspection.
17.05 Demonstrate understanding of dielectric testing of an insulated boom section.
17.06 Clean and maintain dielectric bucket liners and boom insulators.
17.07 Maintain and install vehicle grounds.
17.08 Safely jump start a vehicle.
17.09 Inspect equipment for safe operational conditions.
17.10 Safely load, secure and unload a variety of equipment from a drive-on trailer.
17.11 Read a load lifting chart.
17.12 Plan a lift.
17.13 Accurately give hand signals to a boom truck operator.
17.14 Set up an aerial truck for operation.
17.15 Safely operate an aerial lift truck.
17.16 Safely operate a boom truck.

17.17 Safely operate a pole-hole digger truck.
17.18 Safely operate an operator seated trenching machine.
17.19 Safely operate a walk behind trencher.
17.20 Safely operate a backhoe.
17.21 Safely operate a horizontal boring machine.

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

**Program Title:** **Electrical Line Service and Repair**
**Program Type:** **Career Preparatory**
**Career Cluster:** **Energy**

| | PSAV |
|---|---|
| Program Number | I460303 |
| CIP Number | 0646030300 |
| Grade Level | 30,31 |
| Standard Length | 1500 Hours |
| Teacher Certification | ELECTRICAL @7G<br>TEC ELEC @7G |
| CTSO | SkillsUSA |
| SOC Codes (all applicable) | 49-9051 |
| 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<br>Language: 9<br>Reading: 9 |

**Purpose**

The purpose of this program is to prepare students for employment as Electrical Powerline Installer.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Electric Line Service and Repair industry; planning, management, finance, technical and product skills, underlying principles of technology, labor issues, community issues and health, safety, and environmental issues.

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.

**Program Structure**

This program is a planned sequence of instruction consisting of one 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 | EEV0151 | Electrical Powerline Installer 1 | 1500 Hours | 49-9051 |

**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 proficiency in applying basic electrical/electronic principles.
02.0 Demonstrate science knowledge and skills.
03.0 Demonstrate mathematics knowledge and skills.
04.0 Demonstrate proficiency in installing electrical distribution systems.
05.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
06.0 Demonstrate proficiency in street and security lighting activities.
07.0 Demonstrate language arts knowledge and skills.
08.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
09.0 Demonstrate proficiency in maintenance and inspection duties.
10.0 Use information technology tools.
11.0 Demonstrate personal money-management concepts, procedures, and strategies.
12.0 Demonstrate proficiency in troubleshooting and repairing system components.
13.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
14.0 Demonstrate proficiency in utilizing electrical line service tools and equipment.
15.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
16.0 Demonstrate proficiency in operator functions on high reach trucks.
17.0 Solve problems using critical thinking skills, creativity and innovation.
18.0 Describe the importance of professional ethics and legal responsibilities.
19.0 Explain the importance of employability and entrepreneurship skills.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Electric Line Service and Repair**
**PSAV Number:** **I460303**

**Course Number: EEV0151**
**Occupational Completion Point: A**
**Electrical Powerline Installer – 1500 Hours – SOC Code 49-9051**

01.0 Demonstrate proficiency in applying basic electrical/electronic principles--The student will be able to:

- 01.01 Interpret electrical terms.
- 01.02 Identify electrical symbols.
- 01.03 Construct common electrical circuits.
- 01.04 Compute for voltage, current, resistance and power.
- 01.05 Operate meters to measure electrical properties.
- 01.06 Discuss transformer theory.
- 01.07 Apply electronic principles where applicable.
- 01.08 Interpret electronic terms and symbols.

02.0 Demonstrate science knowledge and skills--The student will be able to: AF 4.0

- 02.01 Understand molecular action as a result of temperature extremes, chemical reaction, and moisture content.
- 02.02 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF 4.1
- 02.03 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF 4.3
- 02.04 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.
- 02.05 Understand pressure measurement in terms of PSI, inches of mercury, and KPA.

03.0 Demonstrate mathematics knowledge and skills--The students will be able to: AF 3.0

- 03.01 Demonstrate knowledge of arithmetic operations. AF 3.2
- 03.02 Analyze and apply data and measurements to solve problems and interpret documents. AF 3.4
- 03.03 Read and interpret measuring devices (rules and tapes).
- 03.04 Add 100 addition combinations.
- 03.05 Add two-digit numbers.
- 03.06 Add three-digit numbers.
- 03.07 Subtract 100 subtraction combinations.
- 03.08 Subtract two-, three- and four-digit numbers.
- 03.09 Solve one-digit divisor problems.
- 03.10 Solve two-digit divisor problems.
- 03.11 Solve two- and three-digit divisor problems.
- 03.12 Solve multiplication facts.

03.13 Multiply by a one-digit factor.
03.14 Multiply by a two-digit factor.
03.15 Identify the parts of a fraction.
03.16 Solve fractional word problems.
03.17 Classify types of fractions.
03.18 Illustrate equivalent fractions.
03.19 Convert fractions.
03.20 Reduce fractions.
03.21 Solve decimal notations.
03.22 Solve number word problems.
03.23 Round to the nearest whole number.
03.24 Add decimals.
03.25 Subtract decimals.
03.26 Multiply decimals.
03.27 Divide a decimal by a decimal.
03.28 Divide a whole number by a decimal.
03.29 Write fractions as decimals and percents.
03.30 Write percents add fractions and decimals.
03.31 Solve percent problems.
03.32 Find the percent of a number.
03.33 Operate a calculator.
03.34 Understand and use the metric system.
03.35 Convert inches to millimeters and millimeters to inches.
03.36 Construct charts/tables/graphs using functions and data. AF 3.5
03.37 Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares, and cylinders.
03.38 Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
03.39 Add, subtract, multiply and divide using fractions, decimals, and whole numbers.
03.40 Determine the correct purchase price, to include sales tax for a materials list containing a minimum of six items.
03.41 Demonstrate an understanding of federal, state and local taxes and their computation.

04.0 Demonstrate proficiency in installing electrical distribution systems--The student will be able to:

04.01 Set poles manually and using power equipment.
04.02 Transport, unload and position poles.
04.03 Frame pole.
04.04 Install guy anchor and wires.
04.05 Climb poles using climbing equipment.
04.06 Hoist materials or equipment to lines.
04.07 String conductors.
04.08 Cut or splice conductors.
04.09 Sag conductors.
04.10 Install tie wires.
04.11 Fabricate tie wires.
04.12 Install pole equipment (cross arms, transformers, fuse cutouts, insulators, air switches, arrestors and pole steps).
04.13 Install capacitor banks.

04.14 Install substation equipment.
04.15 Install utility meters.
04.16 Install armor rods.
04.17 Install direct burial cable.
04.18 Install cable markers.
04.19 Fabricate underground duct systems.
04.20 Install underground cable ducts.
04.21 Rig manholes for cable pulling.
04.22 Splice high voltage underground cable.
04.23 Terminate high voltage cable underground and above ground.
04.24 Install cable racks.
04.25 Install and test grounding systems.

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

05.01 Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace. CM 1.0
05.02 Locate, organize and reference written information from various sources. CM 3.0
05.03 Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences. CM 5.0
05.04 Interpret verbal and nonverbal cues/behaviors that enhance communication. CM 6.0
05.05 Apply active listening skills to obtain and clarify information. CM 7.0
05.06 Develop and interpret tables and charts to support written and oral communications. CM 8.0
05.07 Exhibit public relations skills that aid in achieving customer satisfaction. CM 10.0

06.0 Demonstrate proficiency in street and security lighting activities--The student will be able to:

06.01 Install street light fixtures.
06.02 Install flood light fixtures.
06.03 Install lighting control components.
06.04 Install ballast.
06.05 Isolate system for test.
06.06 Adjust timers and controls.
06.07 Relamp fixtures.

07.0 Demonstrate language arts knowledge and skills--The students will be able to: AF 2.0

07.01 Locate, comprehend and evaluate key elements of oral and written information. AF 2.4
07.02 Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary. AF 2.5
07.03 Present information formally and informally for specific purposes and audiences. AF 2.9

08.0 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:

08.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE 1.0

08.02 Explain emergency procedures to follow in response to workplace accidents.
08.03 Create a disaster and/or emergency response plan. SHE 2.0
08.04 Demonstrate knowledge of the "Right-To-Know Law" as recorded in (29 CFR-1910.1200).

09.0 Demonstrate proficiency in maintenance and inspection duties--The student will be able to:

09.01 Control vegetation in powerline right-of-way.
09.02 Control vegetation in substations.
09.03 Inspect conductors for uniform sag.
09.04 Inspect poles and cross arms.
09.05 Check for corroded hardware.
09.06 Check fuse cutouts.
09.07 Check high voltage switches.
09.08 Check circuit breakers and regulators.
09.09 Inspect fences and warning signs.
09.10 Perform di-electric tests.
09.11 Perform load test.
09.12 Maintain all electrical components.
09.13 Recover equipment.
09.14 Read service meters.
09.15 Realign existing poles.
09.16 Pump water from manholes.
09.17 Check for deterioration of cable, connectors, and poles.

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

10.01 Use Personal Information Management (PIM) applications to increase workplace efficiency. IT 1.0
10.02 Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications. IT 2.0
10.03 Employ computer operations applications to access, create, manage, integrate, and store information. IT 3.0
10.04 Employ collaborative/groupware applications to facilitate group work. IT 4.0

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

11.01 Identify and describe the services and legal responsibilities of financial institutions. FL 2.0
11.02 Describe the effect of money management on personal and career goals. FL 3.0
11.03 Develop a personal budget and financial goals. FL 3.1
11.04 Complete financial instruments for making deposits and withdrawals. FL 3.2
11.05 Maintain financial records. FL 3.3
11.06 Read and reconcile financial statements. FL 3.4
11.07 Research, compare and contrast investment opportunities.

12.0 Demonstrate proficiency in troubleshooting and repairing system components--The student will be able to:

12.01 Replace defective conductor.
12.02 Transfer dead conductor to new pole.
12.03 Remove foreign objects from conductor.
12.04 Simulate the transfer of hot conductor to new pole.
12.05 Splice dead or hot conductors.
12.06 Convert transformer banks to open delta.
12.07 Replace cross arms.
12.08 Climb through simulated hot equipment using rubber protective devices.
12.09 Trace faulty underground cable.
12.10 Discuss substation breakers, transformers, regulators, and relays.

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

13.01 Employ leadership skills to accomplish organizational goals and objectives. LT 1.0
13.02 Establish and maintain effective working relationships with others in order to accomplish objectives and tasks. LT 3.0
13.03 Conduct and participate in meetings to accomplish work tasks. LT 4.0
13.04 Employ mentoring skills to inspire and teach others. LT 5.0

14.0 Demonstrate proficiency in utilizing electrical line service tools and equipment--The student will be able to:

14.01 Utilize hand tools safely.
14.02 Utilize hotline tools safely.
14.03 Utilize rubber protection as needed.
14.04 Operate pool trailer.
14.05 Operate reel jacks.
14.06 Operate cable pulling guide.
14.07 Operate shop power tools.
14.08 Operate hoist.
14.09 Operate climbing equipment.
14.10 Operate multimeter.
14.11 Operate clamp-on ammeter.
14.12 Operate phase rotation meter.
14.13 Operate meter.
14.14 Operate gas detector.
14.15 Operate hot stick tester.
14.16 Operate high voltage phase tester.
14.17 Operate recording ammeter/voltmeter.
14.18 Discuss a relay tester.
14.19 Discuss vibro ground
14.20 Operate power trencher.
14.21 Clean facilities and shop.

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

15.01 Describe the nature and types of business organizations. SY 1.0
15.02 Explain the effect of key organizational systems on performance and quality.

15.03 List and describe quality control systems and/or practices common to the workplace. SY 2.0
15.04 Explain the impact of the global economy on business organizations.

16.0 Demonstrate proficiency in utility construction equipment operation and maintenance--The student will be able to:

16.01 Demonstrate safe work practice for operating machinery.
16.02 Demonstrate routine daily inspection to trucks and mobile equipment.
16.03 Inspect hydraulic systems for operational integrity.
16.04 "Fly" a boom for safety inspection.
16.05 Demonstrate understanding of dielectric testing of an insulated boom section.
16.06 Clean and maintain dielectric bucket liners and boom insulators.
16.07 Maintain and install vehicle grounds.
16.08 Safely jump-start a vehicle.
16.09 Inspect equipment for safe operational conditions.
16.10 Safely load, secure and unload a variety of equipment from a drive-on trailer.
16.11 Read a load lifting chart.
16.12 Plan a lift.
16.13 Accurately give hand signals to a boom truck operator.
16.14 Set up an aerial truck for operation.
16.15 Safely operate an aerial lift truck.
16.16 Safely operate a boom truck.
16.17 Safely operate a pole-hole digger truck.
16.18 Safely operate an operator seated trenching machine.
16.19 Safely operate a walk behind trencher.
16.20 Safely operate a backhoe.
16.21 Safely operate a horizontal boring machine.

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

17.01 Employ critical thinking skills independently and in teams to solve problems and make decisions. PS 1.0
17.02 Employ critical thinking and interpersonal skills to resolve conflicts. PS 2.0
17.03 Identify and document workplace performance goals and monitor progress toward those goals. PS 3.0
17.04 Conduct technical research to gather information necessary for decision-making.PS 4.0

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

18.01 Evaluate and justify decisions based on ethical reasoning. ELR 1.0
18.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies. ELR 1.1
18.03 Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace. ELR 1.2
18.04 Interpret and explain written organizational policies and procedures. ELR 2.0

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

19.01 Identify and demonstrate positive work behaviors needed to be employable.ECD 1.0
19.02 Develop personal career plan that includes goals, objectives, and strategies.ECD 2.0
19.03 Examine licensing, certification, and industry credentialing requirements. ECD 3.0
19.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD 5.0
19.05 Evaluate and compare employment opportunities that match career goals.ECD 6.0
19.06 Identify and exhibit traits for retaining employment. ECD 7.0
19.07 Identify opportunities and research requirements for career advancement.ECD 8.0
19.08 Research the benefits of ongoing professional development. ECD 9.0
19.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD 10.0

**2012 – 2013**

**Florida Department of Education**
**Curriculum Framework**

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

| PSAV | |
|---|---|
| Program Number | X600300 |
| CIP Number | 0715050303 |
| Grade Level | 30, 31 |
| Standard Length | 600 Hours |
| Teacher Certification | PLUMBIN @7G<br>ELECTRICAL @7G<br>AC HEAT ME @7G<br>BLDG MAINT @7G<br>BLDG CONST @7G<br>TEC CONST @7G |
| CTSO | SkillsUSA |
| SOC Codes (all applicable) | 49-9099<br>47-4099.02 |
| 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<br>Language: 9<br>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 Thermal 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 | EEV0203 | Solar Thermal system Design, Installation And Maintenance Helper | 300 Hours | 49-9099 |
| B | EEV0204 | Solar Thermal System Design, Installation And Maintenance Technician | 300 Hours | 47-4099.02 |

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

17.0 Adapting a system 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 Installing electrical control systems.
22.0 Installing operation and identification tags and labels.
23.0 Performing a system checkout.
24.0 Maintaining and troubleshooting a solar thermal system.
25.0 Layout and coordinate a job.
26.0 Installing solar collectors.
27.0 Demonstrate knowledge of plumbing codes.
28.0 Installing piping, pipe insulation and connecting system piping.
29.0 Installing mechanical/plumbing equipment and other components.
30.0 Installing water heater and storage tanks.

**2012 – 2013**

**Florida Department of Education**
**Student Performance Standards**

**Program Title:** **Solar Thermal System Design, Installation and Maintenance, Entry Level**
**PSAV Number:** **X600300**

**Course Number: EEV0203**
**Occupational Completion Point: A**
**Solar Thermal System Design, Installation and Maintenance Helper – 300 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 student will be able to:

- 01.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments. SHE 1.0
- 01.02 Explain emergency procedures to follow in response to workplace accidents
- 01.03 Demonstrate safe and proper use of required tools and equipment
- 01.04 Demonstrate safe and accepted practices for personal protection
- 01.05 Demonstrate awareness of safety hazards and how to avoid them
- 01.06 Identify and implement appropriate codes and standards concerning installation, operation and maintenance of solar thermal systems and equipment
- 01.07 Identify and implement appropriate codes and standards concerning worker safety and public safety
- 01.08 Identify personnel safety hazards associated with solar thermal installations.
- 01.09 Create a disaster and/or emergency response plan. SHE 2.0
- 01.10 Identify environmental hazards associated with solar thermal installations through demonstrated awareness of pertinent Material Safety Data Sheets and other appropriate documents

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: collector, tank, pump, controller, sensors, isolation and drain valves, pressure and temperature relief valves, air vent, piping, insulation, flashing, etc. 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
- 02.05 Identify components specific to a swimming pool heating solar system

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

- 03.01 Define climate change and the causes of global warming.
- 03.02 Discuss greenhouse gas emission and its role in global warming.

03.03 Discuss the ozone layer, the major cause for its depletion and the resulting consequences.
03.04 Define acid rain and its effect on the environment.
03.05 Discuss the negative effects of chemical pollution.
03.06 Discuss the concept of carbon footprint.
03.07 Discuss the major environmental issues specific to your industry.
03.08 Discuss local environmental concerns related to your industry.
03.09 Identify the changes in your business or industry that are considered “green”.
03.10 Identify the new “green collar” jobs that have been created in the industry.

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

04.01 Describe renewable and non-renewable forms of energy.
04.02 List the various alternative forms of energy to fossil fuels.
04.03 Describe the benefits and challenges of using alternative forms of energy to society and the environment.
04.04 Discuss the benefits of conserving natural resources.
04.05 Discuss the concept and the benefits of preserving biodiversity.
04.06 Describe energy efficiency.
04.07 Define biodegradable materials.
04.08 Describe the benefits of reducing, reusing and recycling materials.
04.09 Identify the incentives being offered for “going green”.

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

05.01 Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace. CM 1.0
05.02 Locate, organize and reference written information from various sources. CM 3.0
05.03 Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences. CM 5.0
05.04 Interpret verbal and nonverbal cues/behaviors that enhance communication. CM 6.0
05.05 Apply active listening skills to obtain and clarify information. CM 7.0
05.06 Prepare a job ticket or estimate.
05.07 Read and interpret industry-related materials.
05.08 Find information in technical literature, such as a manufacturer's manual.
05.09 Develop and interpret tables and charts to support written and oral communications. CM 8.0
05.10 Write logical and understandable statements or phrases, and accurately fill out the forms/invoices commonly used in the industry.
05.11 Exhibit public relations skills that aid in achieving customer satisfaction. CM 10.0
05.12 Communicate job-related information and coordinate with other trades.
05.13 Use industry-related computer software.

06.0 Demonstrate language arts knowledge and skills--The students will be able to: AF 2.0

06.01 Locate, comprehend and evaluate key elements of oral and written information. AF 2.4
06.02 Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary. AF 2.5
06.03 Present information formally and informally for specific purposes and audiences. AF 2.9

07.0 Demonstrate mathematics knowledge and skills--The students will be able to: AF 3.0

- 07.01 Demonstrate knowledge of arithmetic operations. AF 3.2
- 07.02 Analyze and apply data and measurements to solve problems and interpret documents. AF 3.4
- 07.03 Construct charts/tables/graphs using functions and data. AF 3.5
- 07.04 Operate a calculator.
- 07.05 Use standard metric units related to the industry.
- 07.06 Convert inches to millimeters and millimeters to inches.
- 07.07 Solve problems of length, area, volume and weight to include the circumference of a circle, the area of a rectangle, and the volume of a cylinder.
- 07.08 Measure size within a specified tolerance.
- 07.09 Add, subtract, multiply and divide using fractions, decimals, and whole numbers.
- 07.10 Determine the correct sales price of a job, to include sales tax for a materials list containing a minimum of six items.

08.0 Demonstrate science knowledge and skills--The student will be able to: AF 4.0

- 08.01 Understand molecular action as a result of temperature extremes, chemical reaction, and moisture content.
- 08.02 Discuss the role of creativity in constructing scientific questions, methods and explanations. AF 4.1
- 08.03 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.AF 4.3
- 08.04 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.
- 08.05 Understand pressure measurement in terms of PSI.

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

- 09.01 Use Personal Information Management (PIM) applications to increase workplace efficiency. IT 1.0
- 09.02 Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications. IT 2.0
- 09.03 Employ computer operations applications to access, create, manage, integrate, and store information. IT 3.0
- 09.04 Employ collaborative/groupware applications to facilitate group work. IT 4.0

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

- 10.01 Evaluate and justify decisions based on ethical reasoning. ELR 1.0
- 10.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies. ELR 1.1
- 10.03 Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace. ELR 1.2
- 10.04 Interpret and explain written organizational policies and procedures. ELR 2.0

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

11.01 Identify and describe the services and legal responsibilities of financial institutions. FL 2.0
11.02 Describe the effect of money management on personal and career goals. FL 3.0
11.03 Develop a personal budget and financial goals. FL 3.1
11.04 Complete financial instruments for making deposits and withdrawals. FL 3.2
11.05 Maintain financial records. FL 3.3
11.06 Read and reconcile financial statements. FL 3.4
11.07 Research, compare and contrast investment opportunities.

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

12.01 Employ critical thinking skills independently and in teams to solve problems and make decisions. PS 1.0
12.02 Employ critical thinking and interpersonal skills to resolve conflicts. PS 2.0
12.03 Identify and document workplace performance goals and monitor progress toward those goals. PS 3.0
12.04 Conduct technical research to gather information necessary for decision-making.PS 4.0

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

13.01 Describe the nature and types of business organizations. SY 1.0
13.02 Explain the effect of key organizational systems on performance and quality.
13.03 List and describe quality control systems and/or practices common to the workplace. SY 2.0
13.04 Explain the impact of the global economy on business organizations.

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

14.01 Employ leadership skills to accomplish organizational goals and objectives.LT 1.0
14.02 Establish and maintain effective working relationships with others in order to accomplish objectives and tasks. LT 3.0
14.03 Conduct and participate in meetings to accomplish work tasks. LT 4.0
14.04 Employ mentoring skills to inspire and teach others. LT 5.0

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

15.01 Identify and demonstrate positive work behaviors needed to be employable.ECD 1.0
15.02 Develop personal career plan that includes goals, objectives, and strategies.ECD 2.0
15.03 Examine licensing, certification, and industry credentialing requirements. ECD 3.0
15.04 Maintain a career portfolio to document knowledge, skills, and experience.ECD 5.0
15.05 Evaluate and compare employment opportunities that match career goals.ECD 6.0
15.06 Identify and exhibit traits for retaining employment. ECD 7.0
15.07 Identify opportunities and research requirements for career advancement.ECD 8.0
15.08 Research the benefits of ongoing professional development. ECD 9.0

15.09 Examine and describe entrepreneurship opportunities as a career planning option. ECD 10.0
15.10 Explain the law that describes the Material Safety Data Sheet (MSDS).
15.11 Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200)

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

16.01 Identify and use
a. Basic hand tools and tool accessories
b. Power tools (electric, mechanical, and pneumatic, if available)
c. Pipe and tube-working tools of the trade
d. Specialized tools of the trade
16.02 Demonstrate the procedures/techniques for the selection, use, care and storage of tools and equipment.
16.03 Identify tools and equipment and the safety hazards associated with them.

**Course Number: EEV0204**
**Occupational Completion Point: B**
**Solar Thermal System Design, Installation and Maintenance Technician – 300 Hours**
**SOC Code 47-4099.02**

17.0 Adapting a system design--The student will be able to:

17.01 Determine active direct system components' location and system layout and configuration
17.02 Determine active indirect system components' location and system layout and configuration
17.03 Determine passive direct system components' location and system layout
17.04 Determine passive indirect system components' location and system layout and configuration
17.05 Determine solar pool system components' location and system layout and configuration
17.06 Apply for building permits
17.07 Estimate time, materials, tools and labor required for installation
17.08 Determine installation sequence to optimize use of time and materials
17.09 Inspect all provided system components for damage prior to installation

18.0 Conducting 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.
18.05 Determine soil conditions and integrity for footing design and pipe path. (Local codes or site conditions might then require involving an engineer).
18.06 Determine suitable location for installing all subsystem components (all valves and ancillary equipment required for complete system installation.)

18.07 Practice all personal safety requirements.
18.08 Identify any other constraints and options for the installation related to local and state code requirements.
18.09 Verify that system to be installed is appropriate for the building and climate
18.10 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 isometric sketches.
19.03 Identify the basic symbols used in the pipe trades.
19.04 Read and interpret manufacturers' schematics and specifications.
19.05 Describe the importance of following the local, state, and national codes for plumbing and/or pipe fitting.
19.06 Read and interpret current standards and codes for plumbing and/or pipe fitting.
19.07 Read and interpret basic building codes in the pipe-trade industry.
19.08 Recognize and identify plumbing symbols.
19.09 Identify basic plumbing systems from the blueprint.
19.10 From the blueprints and specifications, identify the plumbing fixtures and materials required for the plumbing job.
19.11 Relate the blueprint to all applicable (local, state, and federal) plumbing codes.
19.12 Cross-reference all working drawings to determine the location and elevation of the piping system and duct work.

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 solar thermal or 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 Installing electrical control systems--The student will be able to:

21.01 Determine the location of the controller.
21.02 Install differential controller and sensors.
21.03 Install photovoltaic module controller and pump.
21.04 Install a timer controller.
21.05 Install control wiring.

21.06 Select ultraviolet radiation protective method for external wiring.
21.07 Protect external wiring from ultraviolet degradation.
21.08 Test operation of controller.
21.09 Determine type of flashing to use for specific roof type.
21.10 Determine the area where wire flashing will be installed.
21.11 Make roof penetrations.
21.12 Install wire flashing and sealant.
21.13 Install control wiring.

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

22.01 Determine components that require identification tag and/or label
22.02 Install identification tags and/or label

23.0 Performing 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 and is weather sealed
23.03 Determine that the system plumbing 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 Maintaining and troubleshooting a solar thermal 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., sensor calibration, heat exchanger fluid integrity, pump operation)
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 Lay out 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 Installing solar collectors--The student will be able to:

26.01 Identify specific manufacturer's mounting design and materials
26.02 Identify acceptable National Roofing Contractor's Association roof mounting and penetration methods
26.03 Identify different collector mounting methods suitable for roof types or other installation areas
26.04 Identify different system (in the case of ICS and thermosiphon systems, 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-collector piping strategy.
26.08 Install collector mounting device to installation area.
26.09 Weather seal roof penetrations and other structural devices with flashings and sealants.
26.10 Lift collectors to installation area Psychomotor.
26.11 Attach mounting bracket and struts (if required) to collector.
26.12 Secure collector to collector mounting device.
26.13 Connect collector to piping.

27.0 Demonstrate knowledge of plumbing codes--The student will be able to:

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

28.0 Installing piping, pipe insulation and connecting piping--The student will be able to:

28.01 Identify and explain the purpose of the piping, tubing, and fittings.
28.02 Determine the extent of, and make allowances for expansion of pipe and its effect on hangers and the integrity of the pipe.
28.03 Attach pipe hangers and supports.
28.04 Determine type, length, and diameter of copper piping required.
28.05 Slope piping to avoid traps in horizontal pipe runs.
28.06 Install pipe flashing and sealant.
28.07 Install stand-off hangers beneath piping on roof if needed.
28.08 Determine under-ground piping method.
28.09 Install under-ground piping.
28.10 Cut copper pipe to desired length.
28.11 Solder copper piping connections.
28.12 Test soldering fittings for leaks.
28.13 Determine type, length, and diameter of plastic piping required.

28.14 Cut plastic pipe to desired length.
28.15 Glue plastic piping connections.
28.16 Test glued fittings for leaks.
28.17 Determine type, diameter, and length of insulation required.
28.18 Cut insulation and install over piping and plumbing fittings.
28.19 Miter insulation ends, where appropriate.
28.20 Glue and seal insulation joints, as required.
28.21 Select ultraviolet radiation protective method.
28.22 Protect insulation from ultraviolet degradation.
28.23 Determine type of pipe flashing to use for specific roof type.
28.24 Determine the area where pipe flashing will be installed.
28.25 Make roof penetrations.
28.26 Identify and use pipe joining methods.
28.27 Identify and use various types of torches.
28.28 Explain the purposes and procedures for protecting piping materials and fabrication, such as valves, fittings, and products, from heat.
28.29 Fabricate and leak-test the piping, tubing, and fittings used in the industry.
28.30 Maintain project time and materials lists.

29.0 Installing mechanical/plumbing equipment and other components--The student will be able to:

29.01 Determine system plumbing, valves and other components required
29.02 (This includes the following: valves, air vent, check, drain, auto drain down, expansion tanks, flow control, isolation, diverting, solenoid, mixing, anti-scald, pressure relief, temperature pressure relief, vacuum relief, balancing, freeze, etc. as well as the following monitoring components; flow meter, temperature gauge pressure gauge, etc.)
29.03 Determine location of plumbing valves and other components.
29.04 Install system plumbing valves and monitoring system components as specified in component manufacturers or solar manufacturer's installation manual and schematic.
29.05 Determine the heat exchanger location.
29.06 Install heat exchanger and heat exchanger fluids as specified in manufacturer's installation manuals and schematics.
29.07 Determine pump location.
29.08 Install the pump according to the manufacturer's installation manual.

30.0 Installing water heater and storage tanks--The student will be able to:

30.01 Prepare the environment for tank installation (water and power source).
30.02 Determine by inspection that the new water heater and/or storage tank and required subcomponents are damage free.
30.03 Determine tank ports to be used for plumbing lines.
30.04 Determine dip tube strategy.
30.05 Determine plumbing retrofit method to be used if conventional water heater tank (electric or gas) is used.
30.06 Install drain pan per local codes.
30.07 Remove the old conventional water heater tank, if required.
30.08 Install dip tubes.
30.09 Install port fittings if required.

30.10 Install tank valves (drain, pressure temperature relief, etc.).
30.11 Connect plumbing and valves between solar tank and conventional auxiliary tank (if required).
30.12 Connect water heater and/or storage tank to water source.
30.13 Fill tank with water.
30.14 Connect the water heater and/or storage tank to power source.
30.15 Determine that water heater and storage tanks are installed per manufacturers' recommendations and code.
30.16 Determine that installed tank and fittings have no leaks
30.17 Install exterior tank insulation blanket if required
30.18 Install thermosiphon solar tank

**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<br>AC HEAT ME @7G<br>BLDG MAINT @7G<br>BLDG CONST @7G<br>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<br>Language: 9<br>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.