Florida Department of Education

Curriculum Frameworks

Energy

Rule 6A-6.0571, F.A.C
Effective May 2022

Florida Department of Education
Curriculum Framework

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

Secondary – Career Preparatory	
Program Number	8006100
CIP Number	0715050500
Grade Level	9-12
Standard Length	3 Credits
Teacher Certification	Refer to the **Program Structure** section.
CTSO	SkillsUSA
SOC Codes (all applicable)	47-2231 - Solar Photovoltaic Installers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction totaling 3 credits.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
8006110	Energy Industry Fundamentals	AGRICULTUR 1@2 ELECTRICAL @7 7G IND ENGR 7G ENG&TEC ED1@2	1 Credit	47-2231	3	
8006120	Introduction to Alternative Energy	AGRICULTUR 1@2 CHEM 1@4 EARTH/SPACE SCI 1 ELECTRICAL @7 7G IND ENGR 7G PHYSICS 1@4 SCIENCE 4 ENG&TEC ED1@2	1 Credit		3	EQ
8006130	Solar Energy Technician	ELECTRICAL @7 7G IND ENGR 7G ENG&TEC ED1@2	1 Credit		3	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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 Explain electric power generation.
04.0 Explain electric power transmission.
05.0 Explain electric power distribution.
06.0 Identify and describe careers and entry requirements.
07.0 Evaluate and analyze emerging technologies in the energy industry.
08.0 Explain the importance of employability and entrepreneurship skills.
09.0 Discuss the value of alternative energy.
10.0 Investigate the viability of biomass and biofuel.
11.0 Investigate the use of nuclear power.
12.0 Investigate the use of solar energy.
13.0 Investigate the use of wind energy.
14.0 Explain solar as a renewable energy.
15.0 Describe safe work practices.
16.0 Conduct a site assessment.
17.0 Design a solar system.
18.0 Understand the permitting process for municipalities, the county and the state.
19.0 Install subsystems and components at the site.
20.0 Understand monitoring systems for solar including utility grade and residential grade monitoring equipment.
21.0 Inspect and troubleshoot solar systems.
22.0 Maintain solar systems.
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 Demonstrate science knowledge and skills.
25.0 Demonstrate mathematics knowledge and skills.

Florida Department of Education
Student Performance Standards

Course Title: **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.

CTE Standards and Benchmarks	
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	Explain 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 current and historical 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 explain the different lines of energy business, including electric and gas.
01.07	Describe the process of electric metering and billing for energy consumption.
01.08	Explain the differences between energy and power components of residential, commercial, industrial and institutional accounts including time of use rate structures.
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 (OSHA) in work place safety. (http://www.osha.gov)
02.02	Identify both potential hazards and accident scenarios in the work environment.

CTE Standards and Benchmarks	
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	Understand the importance of 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 knowledge in first aid or first response procedures.
02.15	Demonstrate understanding and knowledge of lock out/ 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	Explain 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 various conventional electric power generation fuel sources (such as oil, coal, natural gas, hydroelectric power, uranium) and the cost, efficiency and environmental issues associated with each.
03.03	Identify alternative fuel sources (such as solar, wind, ocean wave, tidal, etc.) and alternative and renewable power generation technologies.
03.04	Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear, alternative and renewable).
04.0	Explain electric power transmission--The student will be able to:
04.01	Explain the electric power transmission process.

CTE Standards and Benchmarks	
	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	Explain 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 explain what the various components do.
	05.04 Discuss technologies in electric power distribution, including distribution automation and Smart Grid systems.
06.0	Identify and describe careers and entry requirements--The student will be able to:
	06.01 Compare careers available in the energy industry (e.g., technicians, line workers, plant/field operators, customer service representatives, engineers, IT/ cyber-security) and the educational pathways required.
	06.02 Describe general wage/salary, benefits and other advantages of careers in the energy industry.
07.0	Evaluate and analyze emerging technologies in the energy industry--The student will be able to:
	07.01 Discuss and explore emerging technologies within conventional sources of energy.
	07.02 Discuss and explore wind energy.
	07.03 Discuss and explore solar energy.
	07.04 Discuss and explore biomass energy.
	07.05 Discuss and explore distributed power generation.
	07.06 Identify and discuss current topics in the energy industry such as energy storage and supplemental distribution.
08.0	Explain the importance of employability and entrepreneurship skills--The student will be able to:
	08.01 Identify and demonstrate positive work behaviors needed to be employable. (Refer to 'Common Employability Skills for the Energy Industry'.)
	08.02 Develop personal career plan that includes goals, objectives and strategies.

CTE Standards and Benchmarks
08.03 Examine licensing, certification and industry credentialing requirements.
08.04 Maintain a career portfolio to document knowledge, skills and experience.
08.05 Evaluate and compare employment opportunities that match career goals.
08.06 Identify and exhibit traits for retaining employment.
08.07 Identify opportunities and research requirements for career advancement.
08.08 Research the benefits of ongoing professional development, including internships and externships.
08.09 Examine and describe entrepreneurship opportunities as a career planning option.

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.

CTE Standards and Benchmarks	
09.0	Discuss the value of alternative energy--The student will be able to:
09.01	Investigate the reasons for seeking alternatives to fossil fuels.
09.02	Summarize the contributions to world energy supplies of alternatives to fossil fuels.
09.03	Discuss the alternative energy sources that are currently the most developed and widely used based on geographic location.
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, methanol and algae).
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 a biomass plant.
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 use of nuclear power--The student will be able to:
11.01	Explain the process of nuclear fission.

CTE Standards and Benchmarks	
	11.02 Define radio-isotopes and half-life.
	11.03 Evaluate the advantages and disadvantages of nuclear power.
	11.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
	11.05 Describe nuclear energy and how it is harnessed.
	11.06 Describe the causes of notable failures at nuclear power plants.
	11.07 Outline the societal debate over nuclear power.
12.0	Investigate the use of solar energy--The student will be able to:
	12.01 Describe solar energy and how it is harnessed.
	12.02 Explain the significance and historical foundations of solar energy and pioneers in the fields of solar thermal and solar photovoltaics.
	12.03 Explain the difference between passive solar and active solar.
	12.04 Draw and label a diagram of photovoltaic (PV) cells (e.g. array, panel, module, dopant-enriched silicon).
	12.05 Describe solar thermal and photovoltaic concentrating systems.
	12.06 Draw and label a diagram of a solar thermal plant.
	12.07 Evaluate the advantages and disadvantages of using solar energy.
13.0	Investigate the use of wind energy--The student will be able to:
	13.01 Describe wind energy and the way it is harnessed.
	13.02 List the progression of the use of wind energy through history.
	13.03 Explain the significance of wind energy and pioneers in the field of harnessing wind.
	13.04 Define kinetic energy.
	13.05 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
	13.06 Explain the acronym NIMBY (Not in My Backyard).
	13.07 Explain why farmers and ranchers are amenable to wind technology.

CTE Standards and Benchmarks
13.08 Evaluate the advantages and disadvantages to wind technology.
13.09 Understand the relationship between rotor diameter, wind velocity and wind machine output.

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.

CTE Standards and Benchmarks	
14.0	Explain solar as a renewable energy--The student will be able to:
14.01	Define basic solar related terms (e.g. irradiation, Langley, azimuth).
14.02	Determine true (solar) south from magnetic (compass) south given a declination map; use a magnetic compass and adjust for variation.
14.03	Describe basic solar movement and effect of the Earth's tilt and understand seasonal changes relative to solar movement.
14.04	Describe angular effects on the irradiance of array.
14.05	Identify factors that reduce/enhance solar irradiation.
14.06	Use resources to determine average solar irradiation on a surface at different times of day at different months during a year.
14.07	Describe how the photovoltaic effect uses diffusion across boundary layers to convert light energy to electrical energy.
14.08	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).
14.09	Explain the differences among monocrystalline, polycrystalline and thin-film solar cells.
14.10	Describe the potential application of nano-technology to solar photovoltaic cells.
14.11	Utilize applicable formulas to convert solar irradiation into commonly used electrical units such as kWh per square meter and BTU equivalents.
14.12	Determine the effects of cell temperature versus cell performance/ output.

CTE Standards and Benchmarks	
	14.13 Determine effect of shading on the output power of a photovoltaic solar module.
	14.14 Explain the current-voltage (I-V) curve and how maximum power point tracking (MPPT) is related.
	14.15 Use tools/ diagrams to find solar path.
	14.16 Determine the effect of a partially shaded solar window on collectable radiation over days, months and years.
15.0	Describe safe work practices--The student will be able to:
	15.01 Demonstrate safe and proper use of required tools and equipment.
	15.02 Identify personal and environmental safety hazards, accepted practices, appropriate personal protective equipment and counter measures.
	15.03 Practice battery safety and identify proper personal protective equipment (PPE).
	15.04 Explain the importance of basic first aid and CPR in the solar energy work setting.
	15.05 Practice battery safety and identify proper personal protective equipment (PPE).
	15.06 Identify and implement Occupational Safety and Health Administration (OSHA) codes and standards related to installation, operation, public safety and maintenance of solar systems and equipment.
16.0	Conduct a site assessment--The student will be able to:
	16.01 Identify traditional tools and equipment required for conducting site surveys for solar installation and demonstrate proficiency in their use.
	16.02 Diagram possible layouts and locations for array and equipment, including existing building or site features.
	16.03 Establish suitable location with proper orientation, area, access and structural integrity for solar systems.
	16.04 Identify and assess any site-specific safety hazards or other issues associated with the installation of the system, and establish appropriate safety procedures.
	16.05 Obtain and interpret solar radiation and temperature data for site from various resources for purposes of establishing performance expectations.
	16.06 Quantify the customer electrical load and energy use through review of utility bills and meter readings.
	16.07 Conduct a load analysis.
	16.08 Develop an energy assessment.
	16.09 Estimate the peak load and average energy use in order to determine the size and amount of solar equipment needed.
	16.10 Analyze the commercial rate schedule and compare to energy use in order to determine the most practical size and amount and type

CTE Standards and Benchmarks	
	of solar photovoltaic equipment needed.
16.11	Determine the requirements for installing a solar system for the proper interface with a utility system.
16.12	Explain an electric utility bill.
16.13	Determine the cost for a given amount of electricity based on a utility rate schedule.
17.0	Design a solar system--The student will be able to:
17.01	Identify appropriate system design and configurations based on the customer's consumption needs with consideration for desired energy, peak power production, autonomy requirements, size, cost and available space for system equipment.
17.02	Identify the panel's nameplate specifications, and determine the actual output efficiency based on sited data.
17.03	Estimate time, materials and equipment required for installation based on one-line or three-line system diagram and estimation of system installation times.
17.04	Describe the differences and advantages between a string inverter system and a branch wired micro-inverter system.
17.05	Identify mechanical design that is consistent with environmental, architectural, structural, code requirements and other conditions of the site.
17.06	Understand and verify Underwriters Laboratories (UL) listed equipment (UL1741, UL1703) as well as Institute of Electrical and Electronics Engineers (IEEE) standard 1547.
17.07	Determine the electrical design to be compatible with the existing electrical system at a specified location.
17.08	Identify appropriate conductor types and rating for each electrical circuit in the open or closed system.
17.09	Understand the derated ampacity of system conductors, and select appropriate sizes based on design currents.
17.10	Determine appropriate size, ratings and locations for all system over-current and disconnect devices.
17.11	Determine appropriate size, ratings and locations for grounding, surge suppression and associated equipment.
17.12	Complete mechanical line drawing depicting the array mount structure.
17.13	Read and interpret electrical and mechanical construction drawings.
17.14	Complete an electrical single line diagram.
17.15	Understand the balance of system (BOS) parts.
17.16	Determine voltage drop for any electrical circuit based on size and length of conductors.
17.17	Select an appropriate utility interconnection point, and determine the size, ratings and locations for over-current and disconnect devices.

CTE Standards and Benchmarks	
	17.18 Understand the operation of various types of energy storage grid connected solar systems.
	17.19 Understand the operation of a grid-tied connected solar system and a grid interactive solar system.
	17.20 Understand the operation of an off-grid stand-alone solar system.
	17.21 Understand battery storage system for a stand-alone or grid-interactive solar PV system.
	17.22 Understand the charging characteristics and set points of a battery system.
	17.23 Understand module mismatch and the effect on PV modules, arrays, inverters and charge controllers.
	17.24 Understand the module sun exposure including tilt angle, shading and azimuth angle and the effect on PV modules, arrays, inverters and charge controllers.
	17.25 Understand the issues of voltage in micro inverter branch circuits and how to keep voltage rise less than two percent.
	17.26 Understand the difference between DC, single phase, AC, split phase AC systems and three phase AC systems and the advantages and disadvantages of each.
18.0	Understand the permitting process for municipalities, the county and the state--The student will be able to:
	18.01 Describe documentation necessary to obtain a permit.
	18.02 Understand the job of the authority having jurisdiction.
	18.03 Understand eligibility for specific trades to apply for permits.
	18.04 Generate documentation for a solar system that would allow for permit submittal.
19.0	Install subsystems and components at the site--The student will be able to:
	19.01 Utilize, draw and label schematics, instructions and recommended procedures in installing equipment while implementing all applicable personal and personnel safety and environmental protections measures.
	19.02 Understand general electrical installation principles; e.g. DC versus AC rated equipment; line and load; breaker ratings; conduit types and applications (metal electrical metal tubing (EMT) in structure only when dc wiring present).
	19.03 Visually inspect and quick test PV modules.
	19.04 Assemble modules, panels and support structures as specified by the manufacturer.
	19.05 Install module array interconnect wiring; implement measures to disable or short circuit a module or array during installation.
	19.06 Complete final assembly, structural attachment and weather sealing of array to building or other support mechanism(s).

CTE Standards and Benchmarks	
	19.07 Provide and install 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.
	19.08 Label, install and terminate electrical wiring; verify proper connections, voltages and phase/polarity relationships.
	19.09 Verify continuity and measure impedance of grounding system.
	19.10 Program, adjust and or configure inverters and controls for desired set points and operating modes.
	19.11 Understand the programming of an energy storage grid connected (grid interactive) solar system.
	19.12 Understand the programming of a grid connected solar system.
	19.13 Understand the programming of an off-grid stand-alone solar system.
20.0	Understand monitoring systems for solar including utility grade and residential grade monitoring equipment--The student will be able to:
	20.01 Describe monitoring equipment.
	20.02 Install monitoring equipment.
	20.03 Interpret output of monitoring equipment.
21.0	Inspect and troubleshoot solar systems--The student will be able to:
	21.01 Visually inspect the entire installation, identifying and resolving any evident deficiencies in materials or workmanship.
	21.02 Check system mechanical installation for structural integrity and weather sealing.
	21.03 Check electrical installation for proper wiring, polarity, grounding and integrity terminations.
	21.04 Activate the system and verify overall system functionality and performance based on initial expectations while noting any deficiencies.
	21.05 Demonstrate procedures for connecting and disconnecting the system and equipment from all sources.
	21.06 Identify and verify all required markings and labels for the system and equipment.
	21.07 Identify, provide documentation and explain all safety issues associated with operations and maintenance of the system.
22.0	Maintain solar systems--The student will be able to:
	22.01 Identify the tools and equipment required for maintaining and troubleshooting the system.
	22.02 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.

CTE Standards and Benchmarks	
	22.03 Measure system performance and operating parameters, compare with specifications and expectations, and assess operating condition of system and equipment.
	22.04 Perform diagnostics and interpret results.
	22.05 Identify performance and safety issues, and implement corrective measures.
	22.06 Verify and demonstrate complete functionality and performance of system, including start-up, shut-down, normal operation and emergency bypass operations.
	22.07 Compile and maintain record of system operation, performance and maintenance and explain the system to the client.
23.0	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:
	23.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
	23.02 Explain emergency procedures to follow in response to workplace accidents.
	23.03 Create a disaster and/or emergency response plan for specific incidences.
24.0	Demonstrate science knowledge and skills--The student will be able to:
	24.01 Discuss the role of creativity in constructing scientific questions, methods and explanations.
	24.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.
25.0	Demonstrate mathematics knowledge and skills--The student will be able to:
	25.01 Demonstrate knowledge of arithmetic operations.
	25.02 Analyze and apply data and measurements to solve problems and interpret documents.
	25.03 Construct charts/tables/graphs using functions and data.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Academic Alignment

Secondary Career and Technical Education courses are pending alignment to the B.E.S.T. (Benchmarks for Excellent Student Thinking) Standards for English Language Arts (ELA) and Mathematics that were adopted by the State Board of Education in February 2020. Academic alignment is an ongoing, collaborative effort of professional educators that provide clear expectations for progression year-to-year through course alignment. This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link: http://www.cpalms.org/uploads/docs/standards/eld/SI.pdf.
For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Special Notes

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the postsecondary program with the same Classification of Instructional Programs (CIP) number.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' 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 IEP served in Exceptional Student Education (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 and regulated secondary programs 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 course or a modified course. 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 a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

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

Secondary – Career Preparatory	
Program Number	9700200
CIP Number	0715050302
Grade Level	9-12
Standard Length	3 Credits
Teacher Certification	Refer to the **Program Structure** section.
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9099 - Installation, Maintenance, and Repair Workers, All Other
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction totaling three credits.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
8006110	Energy Industry Fundamentals	AGRICULTUR 1@2 ELECTRICAL @7 7G IND ENGR 7G TEC ED 1@2 ENG&TEC ED1@2	1 Credit	49-9099	3	
8006120	Introduction to Alternative Energy	AGRICULTUR 1@2 CHEM 1@4 EARTH/SPACE SCI 1 ELECTRICAL @7 7G IND ENGR 7G PHYSICS 1@4 SCIENCE 4 TEC ED 1@2 ENG&TEC ED1@2	1 Credit		3	EQ
9700210	Energy Generation Technician	ELECTRICAL @7 7G IND ENGR 7G TEC ED 1@2 ENG&TEC ED1@2	1 Credit		3	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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 Explain electric power generation.
04.0 Explain electric power transmission.
05.0 Explain electric power distribution.
06.0 Identify and describe careers and entry requirements.
07.0 Evaluate and analyze emerging technologies in the energy industry.
08.0 Explain the importance of employability and entrepreneurship skills.
09.0 Discuss the value of alternative energy.
10.0 Investigate the viability of biomass and biofuel.
11.0 Investigate the use of nuclear power.
12.0 Investigate the use of solar energy.
13.0 Investigate the use of wind energy.
14.0 Understand generation system overview.
15.0 Apply equipment operation, maintenance and repair.
16.0 Demonstrate the ability to design, analyze and effectively use systems, components and methods with a framework of quality and continuous improvement.
17.0 Diagnose and corrects abnormalities and malfunctions in equipment and production processes.
18.0 Demonstrate the importance of health, safety and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
19.0 Demonstrate science knowledge and skills.
20.0 Demonstrate mathematics knowledge and skills.

Florida Department of Education
Student Performance Standards

Course Title: **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.

CTE Standards and Benchmarks	
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	Explain 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 current and historical 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 explain the different lines of energy business, including electric and gas.
01.07	Describe the process of electric metering and billing for energy consumption.
01.08	Explain the differences between energy and power components of residential, commercial, industrial and institutional accounts including time of use rate structures.
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 (OSHA) in work place safety. (http://www.osha.gov)
02.02	Identify both potential hazards and accident scenarios in the work environment.

CTE Standards and Benchmarks	
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	Understand the importance of 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 knowledge in first aid or first response procedures.
02.15	Demonstrate understanding and knowledge of lock out/ 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	Explain 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 various conventional electric power generation fuel sources (such as oil, coal, natural gas, hydroelectric power, uranium) and the cost, efficiency and environmental issues associated with each.
03.03	Identify alternative fuel sources (such as solar, wind, ocean wave, tidal, etc.) and alternative and renewable power generation technologies.
03.04	Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear, alternative and renewable).
04.0	Explain electric power transmission--The student will be able to:
04.01	Explain the electric power transmission process.

CTE Standards and Benchmarks	
	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	Explain 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 explain what the various components do.
	05.04 Discuss technologies in electric power distribution, including distribution automation and Smart Grid systems.
06.0	Identify and describe careers and entry requirements--The student will be able to:
	06.01 Compare careers available in the energy industry (e.g., technicians, line workers, plant/field operators, customer service representatives, engineers, IT/ cyber-security) and the educational pathways required.
	06.02 Describe general wage/salary, benefits and other advantages of careers in the energy industry.
07.0	Evaluate and analyze emerging technologies in the energy industry--The student will be able to:
	07.01 Discuss and explore emerging technologies within conventional sources of energy.
	07.02 Discuss and explore wind energy.
	07.03 Discuss and explore solar energy.
	07.04 Discuss and explore biomass energy.
	07.05 Discuss and explore distributed power generation.
	07.06 Identify and discuss current topics in the energy industry such as energy storage and supplemental distribution.
08.0	Explain the importance of employability and entrepreneurship skills--The student will be able to:
	08.01 Identify and demonstrate positive work behaviors needed to be employable. (Refer to 'Common Employability Skills for the Energy Industry'.)
	08.02 Develop personal career plan that includes goals, objectives and strategies.

CTE Standards and Benchmarks
08.03 Examine licensing, certification and industry credentialing requirements.
08.04 Maintain a career portfolio to document knowledge, skills and experience.
08.05 Evaluate and compare employment opportunities that match career goals.
08.06 Identify and exhibit traits for retaining employment.
08.07 Identify opportunities and research requirements for career advancement.
08.08 Research the benefits of ongoing professional development, including internships and externships.
08.09 Examine and describe entrepreneurship opportunities as a career planning option.

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.

CTE Standards and Benchmarks	
09.0	Discuss the value of alternative energy--The student will be able to:
09.01	Investigate the reasons for seeking alternatives to fossil fuels.
09.02	Summarize the contributions to world energy supplies of alternatives to fossil fuels.
09.03	Discuss the alternative energy sources that are currently the most developed and widely used based on geographic location.
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, methanol and algae).
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 a biomass plant.
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 use of nuclear power--The student will be able to:
11.01	Explain the process of nuclear fission.

CTE Standards and Benchmarks	
	11.02 Define radio-isotopes and half-life.
	11.03 Evaluate the advantages and disadvantages of nuclear power.
	11.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
	11.05 Describe nuclear energy and how it is harnessed.
	11.06 Describe the causes of notable failures at nuclear power plants.
	11.07 Outline the societal debate over nuclear power.
12.0	Investigate the use of solar energy--The student will be able to:
	12.01 Describe solar energy and how it is harnessed.
	12.02 Explain the significance and historical foundations of solar energy and pioneers in the fields of solar thermal and solar photovoltaics.
	12.03 Explain the difference between passive solar and active solar.
	12.04 Draw and label a diagram of photovoltaic (PV) cells (e.g. array, panel, module, dopant-enriched silicon).
	12.05 Describe solar thermal and photovoltaic concentrating systems.
	12.06 Draw and label a diagram of a solar thermal plant.
	12.07 Evaluate the advantages and disadvantages of using solar energy.
13.0	Investigate the use of wind energy--The student will be able to:
	13.01 Describe wind energy and the way it is harnessed.
	13.02 List the progression of the use of wind energy through history.
	13.03 Explain the significance of wind energy and pioneers in the field of harnessing wind.
	13.04 Define kinetic energy.
	13.05 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
	13.06 Explain the acronym NIMBY (Not in My Backyard).
	13.07 Explain why farmers and ranchers are amenable to wind technology.

CTE Standards and Benchmarks
13.08 Evaluate the advantages and disadvantages to wind technology.
13.09 Understand the relationship between rotor diameter, wind velocity and wind machine output.

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.

CTE Standards and Benchmarks	
14.0	Understand generation system overview--The student will be able to:
14.01	Explain and use the fundamental laws and principles of electricity & magnetism (e.g., electric charge, electric current, etc.)
14.02	Explain the components of electrical generating systems including boilers, generators, alternators, turbines, motors, engines, pumps and switchgear.
14.03	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).
14.04	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.
14.05	Discuss the electric power generation job functions.
15.0	Apply equipment operation, maintenance and repair--The student will be able to:
15.01	Comply with the procedures necessary to ensure a safe and healthy work environment
15.02	Operate, repair and test machines, devices and equipment based on electrical or mechanical standards.
15.03	Exhibit an understanding of equipment principles to be able to diagnose and repair machine malfunctions.
15.04	Operate basic hand and small electric tools and electronic test equipment
15.05	Perform tests and inspections of products, services or processes to evaluate quality or performance.
15.06	Determine the correct kind of tools and equipment needed to do a job

CTE Standards and Benchmarks	
	15.07 Read gauges, dials or other indicators to make sure a machine is working properly
	15.08 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.
16.0	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:
	16.01 Conduct tests and inspections of products, services or processes to evaluate quality or performance.
	16.02 Incorporate new information into both current and future problem solving and decision making.
	16.03 Monitor/assess performance of self and other individuals or organizations to make improvements or take necessary corrective action.
	16.04 Describe how a system should work and how changes in conditions, operations and the environment will affect the performance of that system.
	16.05 Use logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
	16.06 Identify the value of preventative/predictive maintenance versus reactive maintenance.
17.0	Diagnose and correct abnormalities and malfunctions in equipment and production processes--The student will be able to:
	17.01 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.
	17.02 Determine causes of operating errors, and recommend appropriate course of action.
	17.03 Describe when and how to notify supervisory personnel in the event of operational errors or equipment malfunctions.
18.0	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:
	18.01 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
	18.02 Explain emergency procedures to follow in response to workplace accidents.
	18.03 Create a disaster and/or emergency response plan for specific incidences.
19.0	Demonstrate science knowledge and skills--The students will be able to:
	19.01 Discuss the role of creativity in constructing scientific questions, methods and explanations.
	19.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data and develop scientific recommendations based on findings.
20.0	Demonstrate mathematics knowledge and skills--The students will be able to:

CTE Standards and Benchmarks
20.01 Demonstrate knowledge of arithmetic operations.
20.02 Analyze and apply data and measurements to solve problems and interpret documents.
20.03 Construct charts/tables/graphs using functions and data.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Academic Alignment

Secondary Career and Technical Education courses are pending alignment to the B.E.S.T. (Benchmarks for Excellent Student Thinking) Standards for English Language Arts (ELA) and Mathematics that were adopted by the State Board of Education in February 2020. Academic alignment is an ongoing, collaborative effort of professional educators that provide clear expectations for progression year-to-year through course alignment. This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link: http://www.cpalms.org/uploads/docs/standards/eld/SI.pdf.
For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Special Notes

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the postsecondary program with the same Classification of Instructional Programs (CIP) number.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' 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 IEP served in Exceptional Student Education (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 and regulated secondary programs 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 course or a modified course. 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 a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

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

Secondary – Career Preparatory	
Program Number	9700300
CIP Number	0715050320
Grade Level	9-12
Standard Length	4 Credits
Teacher Certification	Refer to the **Program Structure** section.
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9099 - Installation, Maintenance, and Repair Workers, All Other
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction totaling four credits.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	SOC Code	Level	Graduation Requirement
8006110	Energy Industry Fundamentals	AGRICULTUR 1@2 ELECTRICAL @7 7G IND ENGR 7G ENG&TEC ED1@2	1 Credit	49-9099	3	
8727210	Electricity 1	ELECTRICAL @7 7G IND ENGR 7G ENG&TEC ED1@2	1 Credit		2	
8006120	Introduction to Alternative Energy	AGRICULTUR 1@2 CHEM 1@4 EARTH/SPACE SCI 1 ELECTRICAL @7 7G IND ENGR 7G PHYSICS 1@4 SCIENCE 4 ENG&TEC ED1@2	1 Credit		3	EQ
8727220	Electricity 2	ELECTRICAL @7 7G IND ENGR 7G ENG&TEC ED1@2	1 Credit		2	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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 Explain electric power generation.
04.0 Explain electric power transmission.
05.0 Explain electric power distribution.
06.0 Identify and describe careers and entry requirements.
07.0 Evaluate and analyze emerging technologies in the energy industry.
08.0 Explain the importance of employability and entrepreneurship skills.
09.0 Explain the importance of health, safety, environmental stewardship and related regulatory compliance.
10.0 Identify, use and maintain the tools and accessories used in the electrical industry.
11.0 Demonstrate an understanding of basic Direct-Current (DC) electrical-circuit skills.
12.0 Apply mathematics knowledge and skills to electricity.
13.0 Demonstrate an understanding of basic electricity.
14.0 Read and interpret basic electric codes.
15.0 Discuss the value of alternative energy.
16.0 Investigate the viability of biomass and biofuel.
17.0 Investigate the use of nuclear power.
18.0 Investigate the use of solar energy.
19.0 Investigate the use of wind energy.
20.0 Apply mathematics knowledge and skills to electricity.
21.0 Demonstrate further understanding of electricity.
22.0 Demonstrate science knowledge and skills related to electrical principles.

Florida Department of Education
Student Performance Standards

Course Title: **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, innovation, emerging technologies, scientific testing and observation equipment.

CTE Standards and Benchmarks	
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	Explain 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 current and historical 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 explain the different lines of energy business, including electric and gas.
01.07	Describe the process of electric metering and billing for energy consumption.
01.08	Explain the differences between energy and power components of residential, commercial, industrial and institutional accounts including time of use rate structures.
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 (OSHA) in work place safety. (http://www.osha.gov)
02.02	Identify both potential hazards and accident scenarios in the work environment.

CTE Standards and Benchmarks	
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	Understand the importance of 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 knowledge in first aid or first response procedures.
02.15	Demonstrate understanding and knowledge of lock out/ 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	Explain 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 various conventional electric power generation fuel sources (such as oil, coal, natural gas, hydroelectric power, uranium) and the cost, efficiency and environmental issues associated with each.
03.03	Identify alternative fuel sources (such as solar, wind, ocean wave, tidal, etc.) and alternative and renewable power generation technologies.
03.04	Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear, alternative and renewable).
04.0	Explain electric power transmission--The student will be able to:
04.01	Explain the electric power transmission process.

CTE Standards and Benchmarks	
	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 and grid modernization).
	04.05 Explain ownership/governance of the electric transmission system.
05.0	Explain 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 explain what the various components do.
	05.04 Discuss technologies in electric power distribution, including distribution automation, grid modernization and Smart Grid systems.
06.0	Identify and describe careers and entry requirements--The student will be able to:
	06.01 Compare careers available in the energy industry (e.g., technicians, line workers, plant/field operators, customer service representatives, engineers, IT/ cyber-security) and the educational pathways required.
	06.02 Describe general wage/salary, benefits and other advantages of careers in the energy industry.
07.0	Evaluate and analyze emerging technologies in the energy industry--The student will be able to:
	07.01 Discuss and explore emerging technologies within conventional sources of energy.
	07.02 Discuss and explore wind energy.
	07.03 Discuss and explore solar energy.
	07.04 Discuss and explore biomass energy.
	07.05 Discuss and explore distributed power generation.
	07.06 Identify and discuss current topics in the energy industry such as energy storage and supplemental distribution.
08.0	Explain the importance of employability and entrepreneurship skills--The student will be able to:
	08.01 Identify and demonstrate positive work behaviors needed to be employable. (Refer to 'Common Employability Skills for the Energy Industry'.)
	08.02 Develop personal career plan that includes goals, objectives and strategies.

CTE Standards and Benchmarks
08.03 Examine licensing, certification and industry credentialing requirements.
08.04 Maintain a career portfolio to document knowledge, skills and experience.
08.05 Evaluate and compare employment opportunities that match career goals.
08.06 Identify and exhibit traits for retaining employment.
08.07 Identify opportunities and research requirements for career advancement.
08.08 Research the benefits of ongoing professional development, including internships and externships.
08.09 Examine and describe entrepreneurship opportunities as a career planning option.

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.

CTE Standards and Benchmarks	
09.0	Explain the importance of health, safety, environmental stewardship and related regulatory compliance--The student will be able to:
09.01	Clean the work area and maintain it in a safe condition.
09.02	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
09.03	Identify and operate workplace-safety electrical devices.
09.04	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.
09.05	Explain emergency procedures to follow in response to workplace accidents.
09.06	Create a disaster and/or emergency response plan for specific incidences.
09.07	Explain the importance of CPR (cardiopulmonary resuscitation) and first aid.
09.08	Describe "Right-to-Know" Law as recorded in (29 CFR.1910.1200).
10.0	Identify, use and maintain the tools and accessories used in the electrical industry--The student will be able to:
10.01	Identify and select tools, equipment, materials and wires to complete a job.
10.02	Drill holes in metal, wood and concrete for electrical wiring.
10.03	Lay out electrical devices, complying with regulations.

CTE Standards and Benchmarks	
	10.04 Install the following, complying with the appropriate local, state, or national electric codes: a. Conductors and cable b. Standard outlets and switch boxes c. Cord connections on equipment 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
11.0	Demonstrate an understanding of basic Direct-Current (DC) electrical-circuit skills--The student will be able to:
	11.01 Define the following terms: voltage, current, resistance and power.
	11.02 Measure voltage, amperage and resistance using industry standard electrical measuring devices.
	11.03 Analyze and explain a series, series-parallel and parallel circuit.
	11.04 Draw each type of circuit and calculate the circuit values.
	11.05 Explain and apply Ohm's Law.
	11.06 Compute conductance and resistance of conductors and insulators.
12.0	Apply mathematics knowledge and skills to electricity--The student will be able to:
	12.01 Demonstrate knowledge of arithmetic operations.
	12.02 Analyze and apply data and measurements to solve problems and interpret documents.
	12.03 Construct charts/tables/graphs using functions and data.
13.0	Demonstrate an understanding of basic electricity--The student will be able to:
	13.01 Explain the principles of electromagnetism.
	13.02 Explain the magnetic properties of circuits and devices.
	13.03 Relate electricity to the nature of matter.
	13.04 Describe various ways that electricity is produced.
14.0	Read and interpret basic electric codes--The student will be able to:
	14.01 Describe the importance of following the local, state and national electric codes.
	14.02 Read and interpret basic electric codes, wiring plans and specifications.

CTE Standards and Benchmarks
14.03 Identify licensure requirements for electrical occupations.
14.04 Demonstrate knowledge of National Fire Protection Association (NFPA) 70E and how it relates to job safety.

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, innovation, emerging technologies, scientific testing and observation equipment.

CTE Standards and Benchmarks	
15.0	Discuss the value of alternative energy--The student will be able to:
15.01	Investigate the reasons for seeking alternatives to fossil fuels.
15.02	Summarize the contributions to world energy supplies of alternatives to fossil fuels.
15.03	Discuss the alternative energy sources that are currently the most developed and widely used based on geographic location.
16.0	Investigate the viability of biomass and biofuel--The student will be able to:
16.01	Discuss the major sources of biomass.
16.02	Define biofuels (e.g. ethanol, biodiesel, methanol and algae).
16.03	Outline the pyramid energy flow including the different trophic levels.
16.04	Describe the major sources, scale and impacts of biomass energy.
16.05	Draw and label a diagram of a biomass plant.
16.06	List the advantages and disadvantages of using biomass for energy (e.g. CO_2 emissions, photosynthetic efficiency, cost, etc.).
17.0	Investigate the use of nuclear power--The student will be able to:
17.01	Explain the process of nuclear fission.

CTE Standards and Benchmarks	
	17.02 Define radio-isotopes and half-life.
	17.03 Evaluate the advantages and disadvantages of nuclear power.
	17.04 Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
	17.05 Describe nuclear energy and how it is harnessed.
	17.06 Describe the causes of notable failures at nuclear power plants.
	17.07 Outline the societal debate over nuclear power.
18.0	Investigate the use of solar energy--The student will be able to:
	18.01 Describe solar energy and how it is harnessed.
	18.02 Explain the significance and historical foundations of solar energy and pioneers in the fields of solar thermal and solar photovoltaics.
	18.03 Explain the difference between passive solar and active solar.
	18.04 Draw and label a diagram of photovoltaic (PV) cells (e.g. array, panel, module, dopant-enriched silicon).
	18.05 Describe solar thermal and photovoltaic concentrating systems.
	18.06 Draw and label a diagram of a solar thermal plant.
	18.07 Evaluate the advantages and disadvantages of using solar energy.
19.0	Investigate the use of wind energy--The student will be able to:
	19.01 Describe wind energy and the way it is harnessed.
	19.02 List the progression of the use of wind energy through history.
	19.03 Explain the significance of wind energy and pioneers in the field of harnessing wind.
	19.04 Define kinetic energy.
	19.05 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
	19.06 Explain the acronym NIMBY (Not in My Backyard).
	19.07 Explain why farmers and ranchers are amenable to wind technology.

CTE Standards and Benchmarks
19.08 Evaluate the advantages and disadvantages to wind technology.
19.09 Understand the relationship between rotor diameter, wind velocity and wind machine output.

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.

CTE Standards and Benchmarks	
20.0	Apply mathematics knowledge and skills to electricity--The student will be able to:
20.01	Demonstrate and solve basic algebraic formulas related to electricity.
20.02	Solve basic trigonometric functions related to electrical theory.
20.03	Explain basic AC theory and solve related mathematical problems using appropriate test equipment.
20.04	Solve math-related problems from measurements on training aids. (Optional)
21.0	Demonstrate further understanding of electricity--The student will be able to:
21.01	Explain molecular action as a result of temperature extremes, chemical reaction and moisture content.
21.02	Explain how voltage is produced by chemical, mechanical, thermal, photoelectric and piezo electric means.
21.03	Identify electrical symbols in construction documents.
22.0	Demonstrate science knowledge and skills related to electrical principles--The student will be able to:
22.01	Discuss the role of creativity in constructing scientific questions, methods and explanations.
22.02	Formulate scientifically investigable questions, construct investigations, collect and evaluate data and develop scientific recommendations based on findings.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Academic Alignment

Secondary Career and Technical Education courses are pending alignment to the B.E.S.T. (Benchmarks for Excellent Student Thinking) Standards for English Language Arts (ELA) and Mathematics that were adopted by the State Board of Education in February 2020. Academic alignment is an ongoing, collaborative effort of professional educators that provide clear expectations for progression year-to-year through course alignment. This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link: http://www.cpalms.org/uploads/docs/standards/eld/SI.pdf.
For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Special Notes

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the postsecondary program with the same Classification of Instructional Programs (CIP) number.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' 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 IEP served in Exceptional Student Education (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 and regulated secondary programs 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 course or a modified course. 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 a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

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

Secondary – Cooperative Education - OJT	
Course Number	9700420
CIP Number	07150503CP
Grade Level	9-12
Standard Length	Multiple credits
Teacher Certification	Refer to the **Course Structure** section.
CTSO	SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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.

Energy Cooperative Education - 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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Course Structure

The following table illustrates the secondary course structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
9700420	Energy Cooperative Education - OJT	Any Certification appropriate to the students' chosen career field	Multiple Credits	2	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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.

Florida Department of Education
Student Performance Standards

Program Title: Energy Cooperative Education - OJT
Secondary Number: 9700420

Standards and Benchmarks	
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.

Additional Information

Special Notes

The **Cooperative Education Manual** is available on-line and has guidelines for students, teachers, employers, parents and other administrators and includes sample training agreements. It can be accessed on the DOE Website at http://fldoe.org/academics/career-adult-edu/career-tech-edu/additional-cte-programs-courses/diversified-edu.stml.

The occupational standards and benchmarks outlined in this secondary course correlate to the standards and benchmarks of the postsecondary course with the same Classification of Instructional Programs (CIP) number.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' 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.

Note: postsecondary curriculum and regulated secondary programs 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 course or a modified course. 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 a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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
Standard Length	Multiple credits
Teacher Certification	Refer to **Course Structure** section.
CTSO	SkillsUSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

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 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.

The following table illustrates the secondary course structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
9701000	Energy Directed Study	Any Certification appropriate to the students' chosen career field	1 credit – Multiple credits	2	

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics)

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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.

Florida Department of Education
Student Performance Standards

Course Title: **Energy Directed Study**
Course Number: **9701000**
Course Credit: **1**

CTE Standards and Benchmarks	
01.0	Demonstrate expertise in a specific occupation within the career cluster--The student will be able to:
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 & oral communications through the development of presentations, public speaking & 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.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

The occupational standards and benchmarks outlined in this secondary course correlate to the standards and benchmarks of the postsecondary course with the same Classification of Instructional Programs (CIP) number.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' 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 IEP served in Exceptional Student Education (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 and regulated secondary programs 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 course or a modified course. 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 a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Alternative Energy Engineering Technology**
Career Cluster: **Energy**

CCC	
CIP Number	0615170100
Program Type	College Credit Certificate (CCC)
Program Length	18 Credit Hours
CTSO	SkillsUSA
SOC Codes (all applicable)	49-2095 – Electrical and Electronics Repairers, Powerhouse, Substation, and Relay
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This certificate program is part of the Electrical Power Technology AS degree program (1615030318).

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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

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 Direct Current (DC) circuits.
03.0 Demonstrate proficiency in Alternate Current (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.

Florida Department of Education
Student Performance Standards

Program Title: **Alternative Energy Engineering Technology**
CIP Number: **0615170100**
Program Length: **18 Credit Hours**
SOC Code(s): **49-2095**

This certificate program is part of the Electrical Power Technology AS degree program (1615030318). 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 Occupational Safety and Health Administration (OSHA) and National Electrical Safety Code (NESC) standards.
01.02	Make electrical connections to include power conductor connections.
01.03	Identify and use hand tools properly.
02.0	Demonstrate proficiency in Direct Current (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 the Power formula.
02.04	Measure properties of a circuit using Volt-Ohm Meters (VOM) and Digital Volt Meters (DVM) and oscilloscopes.
03.0	Demonstrate proficiency in Alternate Current (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 and apply the principles of transformers to AC.
03.05	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 diodes. (Optional)
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 draw 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 reports and memoranda.
	05.08 Write formal reports of laboratory experiences.
	05.09 Follow 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 Explain the functions of each element in the power generation system.
	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 its advantages and disadvantages are.
	06.05 Explain how solar energy is used to produce electric energy using steam and what its advantages and disadvantages are.
	06.06 Explain how wind energy is used to produce electric energy and what its advantages and disadvantages are.
	06.07 Explain how solar and geothermal energy is used to produce electric energy and what its advantages and disadvantages are.
	06.08 Explain how biomass energy is used to produce electric energy and what its advantages and disadvantages are.
	06.09 Explain how ocean energy is used to produce electric energy and what its advantages and disadvantages are.
	06.10 Explain how fuel cells are used to produce electric energy and what its advantages and disadvantages are.
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 Understand problems associated with transmission lines. (Optional)
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 and Electronics Engineers), NEMA (National Electrical Manufacturers Association) and ANSI (American National Standards Institute) codes.
	09.02 Demonstrate proficiency in interpretation/explanation of the IEEE, NEMA and ANSI codes.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Electrical Utility Lineworker Advanced**
Career Cluster: **Energy**

CCC	
CIP Number	0646030301
Program Type	College Credit Certificate (CCC)
Program Length	45 Credit Hours
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9051 - Electrical Power-Line Installers and Repairers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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 (60) AAS degree program (0646030304).

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 formulas; electrical transmission/ distribution substation operation; installation, maintenance and operation of overhead and underground electrical distribution systems and internship employment.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Standards

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

01.0 Demonstrate proficiencies working with insulating “hot-sticks” tools, protective cover-up materials and insulated rubber gloving techniques.
02.0 Demonstrate proficiencies installing overhead line equipment.
03.0 Demonstrate proficiencies in applying electrical formulas and electric test equipment.
04.0 Demonstrate proficiencies in constructing new underground electrical distribution systems.
05.0 Demonstrate proficiencies in constructing/re-conductoring overhead electrical distribution system.
06.0 Demonstrate techniques for maintenance of overhead facilities.
07.0 Understand electrical metering technology, utility data collection and control technologies.
08.0 Demonstrate safe switching, sectionalizing and isolation of electrical distribution circuits.
09.0 Demonstrate safe work practices in electrical transmission/distribution substations.
10.0 Demonstrate proficiency in applied electrical theory substations.

Florida Department of Education
Student Performance Standards

Program Title: **Electrical Utility Lineworker Advanced**
CIP Number: **0646030301**
Program Length: **45 Credit Hours**
SOC Code(s): **49-9051**

This certificate program is part of the Electrical Distribution Technology (60) AAS degree program (0646030304). At the completion of this program, the student will be able to:	
01.0	Demonstrate proficiencies working with insulating “hot-sticks” tools, protective cover-up materials and insulated rubber gloving techniques-- The student will be able to:
01.01	Demonstrate use of a link stick for insulator change out with rubber gloves.
01.02	Demonstrate wire tying with a tie stick.
01.03	Demonstrate operating an energized switch with a switch stick.
01.04	Describe the function of and properly operate a “Load Buster,” load break tool.
01.05	Simulate stick lifting of a hot phase conductor.
01.06	Demonstrate stick installed temporary insulating cover.
01.07	Demonstrate use of load break load pick up tool with rubber gloves.
01.08	Demonstrate use of temporary cutout with rubber gloves.
01.09	Demonstrate installing a jumper with sticks.
01.10	Demonstrate installing a stirrup with sticks.
01.11	Demonstrate gloving a stirrup installation.
01.12	Demonstrate covering energized lines with sticks.
01.13	Demonstrate installing blankets with sticks.
01.14	Demonstrate covering energized lines with gloves.
01.15	Cover a single phase transformer installation using gloving techniques.

	01.16	Demonstrate a dead-end transfer using gloving techniques.
	01.17	Demonstrate phase tying with gloves.
	01.18	Demonstrate installing a jumper using gloving techniques.
	01.19	Demonstrate a dead-end transfer from a baker board using gloving techniques.
	01.20	Discuss safety considerations for gloving of energized conductors.
02.0	Demonstrate proficiencies installing overhead line equipment--The student will be able to:	
	02.01	Use a field work order print/drawing and a standards manual to apply distribution construction standards for installing overhead line equipment.
	02.02	Determine the general voltage class for which a pole line is rated by observation of installed insulator hardware.
	02.03	Apply the correct insulators for a distribution line installation.
	02.04	Apply the correct surge arrestors for a distribution line installation.
	02.05	Discuss the correct use of surge arrestors with respect to their unique operating voltage characteristics.
	02.06	Install and wire surge arrestors in a variety of applications and configurations.
	02.07	Discuss the reasons for various overhead insulator design configurations.
	02.08	Discuss lightning arrestor technologies.
	02.09	Classify distribution class switches and disconnects by current, voltage and style.
	02.10	Install and operate distribution class disconnects in pole, arm and inline installations.
	02.11	Classify a variety of load break rated disconnect switches.
	02.12	Install a variety of distribution class cross arms.
	02.13	Discuss the safety considerations regarding operating and switching aerial circuit breaker and recloser devices.
	02.14	Demonstrate the operating technology for single and three phase reclosers and regulators.
	02.15	Discuss the common failure modes for circuit breakers, reclosers and capacitors.
	02.16	Install and safely operate single and three phase reclosers and regulators.
	02.17	Demonstrate the procedure for removing a regulator from service.

02.18	Install single phase transformers and three phase transformer banks.
02.19	Install and safely operate single and three phase distribution class capacitor banks.
02.20	Remove single and three phase capacitor banks from service.
02.21	Discuss supervisory and standalone control schemes for distribution class field installed capacitor banks.
02.22	Discuss the application and operation of primary and secondary voltage capacitors on alternating current systems.
02.23	Install a single phase and three phase pole mounted recloser.
02.24	Install a pole mounted and platform mounted regulator bank.
02.25	Install single and three phase capacitor banks.
02.26	Install a variety of three phase banked transformers.
03.0	Demonstrate proficiencies in applying electrical formulas and electric test equipment--The student will be able to:
03.01	Demonstrate understanding of alternating current.
03.02	Demonstrate understanding of direct current.
03.03	Demonstrate understanding of measurement of electromotive force.
03.04	Demonstrate understanding of measurement of electrical current.
03.05	Demonstrate measurement techniques to obtain volt-amps, watts and power factor.
03.06	Explain the fundamentals of operation and demonstrate electrical measuring equipment.
03.07	Apply electrical formulas to solve electrical computations.
03.08	Demonstrate a variety of cable location equipment.
03.09	Demonstrate proficiency in cable testing of primary and secondary UG cables.
03.10	Demonstrate understanding of high potential testing procedures.
03.11	Demonstrate proficiency in ground resistance testing.
03.12	Demonstrate proficiency in “ringing” cable connections.
03.13	Demonstrate proficiency of transformer testing.

03.14	Demonstrate understanding of insulating oil test.
03.15	Demonstrate understanding of testing of rubber goods.
03.16	Demonstrate testing of LED lights and components.
03.17	Demonstrate testing of controllers and controller components.
04.0	Demonstrate proficiencies in constructing new underground electrical distribution system--The student will be able to:
04.01	Demonstrate safety considerations regarding trenching and underground installations.
04.02	Identify soil conditions for trenching planning according to OSHA regulations.
04.03	Assemble material and equipment to construct a URD single phase radial installation.
04.04	Read construction drawings for an underground loop system.
04.05	Demonstrate direct burial and conduit installation of URD primary and secondary cable.
04.06	Differentiate between classes and sizes of primary and secondary cables.
04.07	Demonstrate proper storage and handling of primary and secondary cable.
04.08	Demonstrate underground cable installation methods using open excavation and subsurface boring techniques.
04.09	Splice/terminate a variety of types of XLPE and rubber insulated primary cables.
04.10	Install single phase, open-delta and three phase underground transformers.
04.11	Demonstrate safe grounding procedure for1Ø and 3Ø underground cable.
04.12	Discuss the application and wiring of overhead transformers for use in vaults and in enclosures.
04.13	Perform primary cable terminations on a 3 phase loop fed transformer or switch pad.
04.14	Discuss the various types of pre-fabricated and cast-in-place transformer and switchgear pads / foundations / and vaults.
04.15	Install single and three phase riser pole mounted underground cable terminations (potheads) in conjunction with aerial switch or fuse devices.
04.16	Install single phase URD service, conduit riser and meter box connections.
04.17	Discuss old and new technologies associated with underground cable fault finding systems (DC, TDR, VLF-AC, Partial Discharge, etc.).
05.0	Demonstrate proficiencies in constructing/re-conductoring overhead electrical distribution systems--The student will be able to:

05.01	Demonstrate planning a new overhead line construction project.
05.02	Demonstrate planning the re-conductoring of an existing three phase line.
05.03	Identify and plan for safety of the public during wire pulling operations.
05.04	Identify and perform tree trimming to facilitate the installation of conductors.
05.05	Layout the equipment required for a conductor pulling operation.
05.06	Lead the safety planning and grounding aspects of re-conductoring a three phase line.
05.07	Plan and safely execute a variety of hot-line “fanning” operations for pulling conductors.
05.08	Plan and properly position/set poles for re-conductoring change outs and transfers.
05.09	Plan and properly execute covering of existing utilities.
05.10	Install running blocks and equipment for pulling conductors.
05.11	Set up and operate overhead conductor pulling tensioning equipment.
05.12	Demonstrate knowledge of line sagging tools.
05.13	Properly perform phase tensioning, transfer to insulators and tying in of conductors.
05.14	Safely and properly install and remove mechanical jumpers.
05.15	Plan and safely remove abandoned conductors.
06.0	Demonstrate techniques for maintenance of overhead facilities--The student will be able to:
06.01	Demonstrate change out of a variety of distribution class cross arms.
06.02	Demonstrate maintenance of distribution class disconnects in pole, arm and inline installations.
06.03	Demonstrate maintenance of single and three phase reclosers and regulators
06.04	Demonstrate maintenance of single and three phase distribution class capacitor banks.
06.05	Demonstrate maintenance of secondary capacitor installations.
06.06	Demonstrate re-lamping and maintenance of lighting systems.
06.07	Demonstrate proficiency of a variety of insulator change-outs.

	06.08 Demonstrate proficiency of pole change-outs.
	06.09 Demonstrate proficiency in switch and arrestor maintenance and change-outs.
	06.10 Demonstrate proficiency in pole and pole line inspection.
	06.11 Demonstrate proficiency in transformer inspection, maintenance and change-outs.
07.0	Understand electrical metering technology, utility data collection and control technologies--The student will be able to:
	07.01 Demonstrate setting a single phase residential meter.
	07.02 Demonstrate setting a three phase socket-type meter into a meter base.
	07.03 Demonstrate setting a three phase A-base meter and current transformers.
	07.04 Size and apply the correct equipment for a primary metering installation.
	07.05 Install a three phase distribution class metering installation.
	07.06 Wire the line side of a single phase UG meter base.
	07.07 Wire the line side of a three phase open delta UG meter base.
	07.08 Wire the line side of a three phase wye UG meter base.
	07.09 Discuss the technology behind three phase distribution class metering.
08.0	Demonstrate safe switching, sectionalizing and isolation of electrical distribution circuits--The student will be able to:
	08.01 Demonstrate switching/sectionalizing of a three phase overhead line.
	08.02 Demonstrate proper execution of a distribution switching order.
	08.03 Plan a distribution switch order.
	08.04 Demonstrate switching/sectionalizing a three phase line with regulators.
	08.05 Plan and execute a three phase live front loop sectionalizing operation.
	08.06 Demonstrate parking of a UG primary dead-front elbow.
	08.07 Plan and execute a three phase dead front loop sectionalizing operation.
	08.08 Plan and execute a handle operated switching pad sectionalizing operation.

09.0	Demonstrate safe work practices in electrical transmission/distribution substations--The student will be able to:
09.01	Demonstrate a functional knowledge of a substation one line diagram.
09.02	Plan and execute a complete substation switching order.
09.03	Identify all equipment in a typical substation.
09.04	Read and identify the name plate data on substation equipment.
09.05	Describe the function of and components of a recloser relay unit.
09.06	Read and diagnose targets and lockout mode of a substation recloser.
09.07	Change out a recloser relay unit.
09.08	Place a substation recloser in non-automatic operation.
09.09	Safely operate a gang operated air break transmission class switch.
09.10	Describe the component parts of various air/oil/vacuum/gas insulated substation circuit breaker technologies.
09.11	Discuss the procedure to safely execute a buss tie closure and the transfer of individual circuit breaker loads.
09.12	Demonstrate knowledge of a typical SCADA control system.
09.13	Check and service a substation battery bank.
09.14	Demonstrate testing and replacing a distribution class sand fuse.
09.15	Rack out a substation recloser.
09.16	Prepare a procedure to take a substation regulator out of service and then safely return it to service.
09.17	Execute the procedure to reset a tripped off recloser.
09.18	Restore power to an off line substation.
09.19	Discuss how to read and evaluate a remote status recloser controller and switchboard operator.
10.0	Demonstrate proficiency in applied electrical theory substations—The student will be able to:
10.01	Demonstrate an understanding of the history of electricity.
10.02	Demonstrate an understanding of static electricity and lightning.

10.03	Demonstrate an understanding of parallel and series circuits.
10.04	Demonstrate knowledge of the theory of electrical induction.
10.05	Demonstrate knowledge of AC and DC electric theory.
10.06	Demonstrate an understanding of the properties of an electrical arc.
10.07	Demonstrate understanding of the component parts of a transformer.
10.08	Demonstrate understanding of the process of electricity generation.
10.09	Demonstrate an understanding of electric power transmission.
10.10	Demonstrate understanding of the principal of operation of an electric motor.
10.11	Demonstrate an understanding of the theory of capacitance.
10.12	Demonstrate the theory of electrical reactance and resistance.
10.13	Demonstrate an understanding of kW and kVA and the principles of electric energy.
10.14	Identify classes of insulators and conductors.
10.15	Demonstrate basic low voltage control wiring safety and installation.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

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Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Electrical Utility Lineworker Basic**
Career Cluster: **Energy**

CCC	
CIP Number	0646030303
Program Type	College Credit Certificate (CCC)
Program Length	24 Credit Hours
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9051 - Electrical Power-Line Installers and Repairers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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 (60) AAS degree program (0646030304).

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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

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 Demonstrate proficiencies in rigging pole climbing and basic pole framing.
04.0 Demonstrate proficiencies in setting distribution poles.
05.0 Demonstrate techniques for maintenance of underground facilities.
06.0 Demonstrate proficiency in utility construction equipment operation and maintenance.

Florida Department of Education
Student Performance Standards

Program Title: **Electrical Utility Lineworker Basic**
CIP Number: **0646030303**
Program Length: **24 Credit Hours**
SOC Code(s): **49-9051**

This certificate program is part of the Electrical Distribution Technology (60) AAS degree program (0646030304). At the completion of this program, the student will be able to:	
01.0	Demonstrate 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	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	Demonstrate 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	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 a pole top or structure.
02.13	Describe the process and perform a rescue of an injured person from a manhole.
03.0	Demonstrate 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 in setting distribution poles--The student will be able to:

04.01	Discuss and identify different types of and applications of line support structures.
04.02	Identify ratings and manufacturer of structures by reading the pole “brand”.
04.03	Stake and layout a new project for pole setting by reading construction documents.
04.04	Demonstrate proficiencies in setting a variety of pole anchor systems.
04.05	Install a variety of pole guy anchor types.
04.06	Discuss wind loading and pole stresses.
04.07	Discuss and identify pole failure modes.
04.08	Discuss and properly install and test pole/structure grounding installations.
04.09	Lay out the tools and equipment to install a full size utility pole.
04.10	Excavate for and install a wood, fiberglass, concrete or steel pole using a digger-derrick material handler truck.
04.11	Execute a dead-man and push brace installation.
04.12	Demonstrate canting, tamping and raking of distribution structures.
04.13	Identify transmission structure types.
04.14	Identify dead end, close, vertical, cross-arm, alley arm and pole top pin construction.
04.15	Discuss joint-use utility provisions and clearances.
05.0	Demonstrate techniques for maintenance of underground facilities--The student will be able to:
05.01	Demonstrate replacement of a single phase pad mounted transformer.
05.02	Demonstrate both primary and secondary voltage splicing techniques.
05.03	Demonstrate the basic techniques associated with making an insulating tape splice on a primary URD cable.
05.04	Demonstrate the procedure to replace a blown element in a transformer bayonet style fuse holder.
05.05	Demonstrate leakage gradient fault finding equipment on secondary faulted cable.
05.06	Demonstrate leakage gradient fault finding equipment on secondary faulted cable.
05.07	Demonstrate inspection and maintenance on a pad mounted transformer.

	05.08 Demonstrate inspection and maintenance on UG sectionalizer switches.
	05.09 Demonstrate refusing of live front UG transformers.
06.0	Demonstrate proficiency in utility construction equipment operation and maintenance--The student will be able to:
	06.01 Demonstrate safe work practice for operating machinery.
	06.02 Demonstrate routine daily inspection to trucks and mobile equipment.
	06.03 Inspect hydraulic systems for operational integrity.
	06.04 “Fly” a boom for safety inspection.
	06.05 Demonstrate understanding of dielectric testing of an insulated boom section.
	06.06 Clean and maintain dielectric bucket liners and boom insulators.
	06.07 Maintain and install vehicle grounds.
	06.08 Safely jump start a vehicle.
	06.09 Inspect equipment for safe operational conditions.
	06.10 Safely load, secure and unload a variety of equipment from a drive-on trailer.
	06.11 Read a load lifting chart.
	06.12 Plan a lift.
	06.13 Accurately give hand signals to a boom truck operator.
	06.14 Set up an aerial truck for operation.
	06.15 Safely operate an aerial lift truck.
	06.16 Safely operate a boom truck.
	06.17 Safely operate a pole-hole digger truck.
	06.18 Safely operate an operator seated trenching machine.
	06.19 Safely operate a walk behind trencher.
	06.20 Safely operate a backhoe.

06.21 Safely operate a horizontal boring machine (by video).

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Electrical Distribution Technology**
Career Cluster: **Energy**

AAS	
CIP Number	0646030304
Program Type	College Credit
Standard Length	60 Credit Hours
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9051 - Electrical Power-Line Installers and Repairers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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 formulas; 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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

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 Demonstrate 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 formulas 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 Understand electrical metering technology, utility data collection and control technologies.
13.0 Demonstrate safe switching, sectionalizing and isolation of electrical distribution circuits.
14.0 Demonstrate safe work practices in electrical transmission and distribution substations.
15.0 Demonstrate proficiencies in applied electrical theory.
16.0 Demonstrate proficiency in utility construction equipment operation and maintenance.

Florida Department of Education
Student Performance Standards

Program Title: **Electrical Distribution Technology**
CIP Number: **0646030304**
Program Length: **60 Credit Hours**
SOC Code(s) : **49-9051**

At the completion of this program, the student will be able to:	
01.0	Demonstrate 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	Demonstrate 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	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	Demonstrate 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 use of a link stick for insulator change out with rubber gloves.
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 use of load break load pick up tool with rubber gloves.
04.08	Demonstrate use of temporary cutout with rubber gloves.
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	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	Stake and layout a new pole setting project by reading construction documents.
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	Demonstrate 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 standalone 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	Demonstrate proficiencies in applying electrical formulas and electric test equipment—The student will be able to:	
	07.01	Demonstrate understanding of alternating current.
	07.02	Demonstrate understanding of direct current.
	07.03	Demonstrate understanding of measurement of electromotive force.
	07.04	Demonstrate 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 formulas 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 LED lights 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	Read construction drawings for an underground 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	Demonstrate 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	Demonstrate 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 procedure to replace a blown element in a transformer bayonet style fuse holder.
11.05	Demonstrate leakage gradient fault finding equipment on secondary faulted cable.
11.06	Demonstrate inspection and maintenance on a pad mounted transformer.
11.07	Demonstrate inspection and maintenance on UG sectionalizer switches.
11.08	Demonstrate a safe procedure for replacing a fuse element in a live-front pad mounted distribution transformer.
11.09	Demonstrate refusing of live front UG transformers.
12.0	Understands electrical metering technology, utility data collection and control technologies--The student will be able to:

12.01	Demonstrate setting a single phase residential meter.
12.02	Demonstrate setting a three phase socket-type meter into a meter base.
12.03	Demonstrate setting a three phase A-base meter and current transformers.
12.04	Size and apply the correct equipment for a primary metering installation.
12.05	Install a three phase distribution class metering installation.
12.06	Wire the line side of a single phase UG meter base.
12.07	Wire the line side of a three phase open delta UG meter base.
12.08	Wire the line side of a three phase wye UG meter base.
12.09	Discuss the technology behind three phase distribution class metering.
13.0	Demonstrate safe switching, sectionalizing and isolation of electrical distribution circuits--The student will be able to:
13.01	Demonstrate switching/sectionalizing of a three phase overhead line.
13.02	Demonstrate proper execution of a distribution switching order.
13.03	Plan a distribution switch order.
13.04	Demonstrate switching/sectionalizing a three phase line with regulators.
13.05	Plan and execute a three phase live front loop sectionalizing operation.
13.06	Demonstrate parking of a UG primary dead-front elbow.
13.07	Plan and execute a three phase dead front loop sectionalizing operation.
13.08	Plan and execute a handle operated switching pad sectionalizing operation.
14.0	Demonstrate safe work practices in electrical transmission/distribution substations--The student will be able to:
14.01	Demonstrate a functional knowledge of a substation one line diagram.
14.02	Plan and execute a complete substation switching order.
14.03	Identify all equipment in a typical substation.
14.04	Read and identify the name plate data on substation equipment.

14.05	Describe the function of and components of a recloser relay unit.
14.06	Read and diagnose targets and lockout mode of a substation recloser.
14.07	Change out a recloser relay unit.
14.08	Place a substation recloser in non-automatic operation.
14.09	Safely operate a gang operated air break transmission class switch.
14.10	Describe the component parts of various air/oil/vacuum/gas insulated substation circuit breaker technologies.
14.11	Discuss the procedure to safely execute a buss tie closure and the transfer of individual circuit breaker loads.
14.12	Demonstrate knowledge of a typical SCADA control system.
14.13	Check and service a substation battery bank.
14.14	Demonstrate testing and replacing a distribution class sand fuse.
14.15	Rack out a substation recloser.
14.16	Prepare a procedure to take a substation regulator out of service and then safely return it to service.
14.17	Execute the procedure to reset a tripped off recloser.
14.18	Restore power to an off line substation.
14.19	Discuss how to read and evaluate a remote status recloser controller and switchboard operator.
15.0	Demonstrate proficiency in applied electrical theory substations—The student will be able to:
15.01	Demonstrate an understanding of the history of electricity.
15.02	Demonstrate an understanding of static electricity and lightning.
15.03	Demonstrate an understanding of parallel and series circuits.
15.04	Demonstrate knowledge of the theory of electrical induction.
15.05	Demonstrate knowledge of AC and DC electric theory.
15.06	Demonstrate an understanding of the properties of an electrical arc.
15.07	Demonstrate understanding of the component parts of a transformer.

15.08	Demonstrate understanding of the process of electricity generation.
15.09	Demonstrate an understanding of electric power transmission.
15.10	Demonstrate understanding of the principal of operation of an electric motor.
15.11	Demonstrate an understanding of the theory of capacitance.
15.12	Demonstrate the theory of electrical reactance and resistance.
15.13	Demonstrate an understanding of kW and kVA and the principles of electric energy.
15.14	Identify classes of insulators and conductors.
15.15	Demonstrate basic low voltage control wiring safety and installation.
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.
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16.21 Safely operate a horizontal boring machine (by video).

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. 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.

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030 (4) F.A.C. identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science degree and the Associate of Applied Science degree. In addition, Rule 6A-14.0303 FAC implements section 1007.25 Florida Statutes and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

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 AAS degree program includes the following College Credit Certificates:

Electrical Utility Lineworker Advanced (0646030301) – 45 Credit Hours
Electrical Utility Lineworker Basic (0646030103) – 24 Credit Hours
Electrical Utility Lineworker Fundamentals (0646030105) – 12 Credit Hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Electrical Utility Lineworker Fundamentals**
Career Cluster: **Energy**

CCC	
CIP Number	0646030305
Program Type	College Credit Certificate (CCC)
Program Length	12 Credit Hours
CTSO	SkillsUSA
SOC Codes (all applicable)	49-9051 - Electrical Power-Line Installers and Repairers
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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 AAS degree program (0646030304).

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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

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 Demonstrate proficiencies in rigging pole climbing and basic pole framing.
04.0 Demonstrate proficiencies in setting distribution poles.
05.0 Demonstrate basic proficiencies in constructing new underground electrical distribution systems.
06.0 Demonstrate basic techniques for maintenance of underground facilities.
07.0 Demonstrate basic utility construction equipment operation and maintenance procedures.

Florida Department of Education
Student Performance Standards

Program Title: **Electrical Utility Lineworker Fundamentals**
CIP Number: **0646030305**
Program Length: **12 Credit Hours**
SOC Code(s): **49-9051**

This certificate program is part of the Electrical Distribution Technology AAS degree program (0646030304). At the completion of this program, the student will be able to:	
01.0	Demonstrate 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	Research, generally interpret and apply OSHA safe work practices
01.03	Discuss safe trenching, excavation, shoring and confined space practices.
02.0	Demonstrate 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	Evaluate potential hazards for rescue planning in tailboard sessions.
02.03	Identify the standby equipment for job site safety/rescue preparedness.
02.04	Evaluate a first aid kit for completeness.
02.05	Evaluate and administer first aid.
02.06	Describe the processes for organizing a rescue response team.
02.07	Describe the process and perform a rescue of an injured person from an aerial platform.
02.08	Describe the process and perform a rescue of an injured person from a pole top or structure.
02.09	Describe the process and perform a rescue of an injured person from a manhole.
03.0	Demonstrate proficiencies in rigging, pole climbing and basic pole framing--The student will be able to:
03.01	Distinguish between rope types and applications.
03.02	Demonstrate proper care and maintenance of ropes.

03.03	Apply and tie knots for a variety of rigging requirements.
03.04	Discuss and demonstrate the effect of rigging multiple sheave blocks.
03.05	Apply hoist to a variety of lifting situations.
03.06	Demonstrate care, maintenance and operation of cable, chain and strap hoist.
03.07	Demonstrate rigging for pulling/tensioning down guys.
03.08	Demonstrate rigging for lifting equipment and poles.
03.09	Demonstrate inspection, care, maintenance and application of a variety of slings.
03.10	Demonstrate the application and rigging of gins and saddles.
03.11	Discuss the care and maintenance of pole climbing equipment.
04.0	Demonstrate proficiencies in setting distribution poles--The student will be able to:
04.01	Discuss and identify different types of and applications of line support structures.
04.02	Identify ratings and manufacturer of structures by reading the pole “brand”.
04.03	Install a variety of pole guy anchor types.
04.04	Discuss and identify pole failure modes.
04.05	Discuss and properly install and test pole/structure grounding installations.
04.06	Excavate for and install a wood, fiberglass, concrete or steel pole using a digger-derrick material handler truck.
04.07	Excavate for and set a 30/5 wood pole by hand.
04.08	Demonstrate canting, tamping and raking of distribution structures.
04.09	Identify transmission structure types.
04.10	Identify dead end, close, vertical, cross-arm, alley arm and pole top pin construction.
05.0	Demonstrate basic proficiencies in constructing new underground electrical distribution systems.--The student will be able to:
05.01	Use a field work order print/drawing and a standards manual to apply distribution construction standards for installing overhead line equipment.
05.02	Determine the general voltage class for which a pole line is rated by observation of installed insulator hardware.

05.03	Assemble material and equipment to construct a URD single phase redial installation.
05.04	Read construction work drawing of an underground loop system.
05.05	Demonstrate proper storage and handling of primary and secondary cable.
05.06	Splice/terminate a variety of types of XLPE and rubber insulated primary cables.
05.07	Demonstrate safe grounding procedure for1Ø and 3Ø underground cable.
05.08	Discuss the various types of pre-fabricated and cast-in-place transformer and switchgear pads / foundations / and vaults.
05.09	Install single and three phase riser pole mounted underground cable terminations (potheads) in conjunction with aerial switch or fuse devices.
06.0	Demonstrate basic techniques for maintenance of underground facilities --The student will be able to:
06.01	Demonstrate replacement of a single phase pad mounted transformer.
06.02	Demonstrate a secondary triplex and primary splice for direct burial.
06.03	Demonstrate leakage gradient fault finding equipment on secondary faulted cable.
06.04	Demonstrate refusing of live front UG transformers.
07.0	Demonstrate basic utility construction equipment operation and maintenance procedures.--The student will be able to:
07.01	Demonstrate safe work practice for operating machinery.
07.02	Demonstrate routine daily inspection to trucks and mobile equipment.
07.03	“Fly” a boom for safety inspection.
07.04	Maintain and install vehicle grounds.
07.05	Safely jump start a vehicle.
07.06	Inspect equipment for safe operational conditions.
07.07	Read a load lifting chart.
07.08	Plan a lift.
07.09	Accurately give hand signals to a boom truck operator.
07.10	Set up an aerial truck for operation.

07.11	Safely operate an aerial lift truck.
07.12	Safely operate a boom truck.
07.13	Safely operate a pole-hole digger truck.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Electrical Power Technology**
Career Cluster: **Energy**

AS	
CIP Number	1615030318
Program Type	College Credit
Standard Length	68 Credit Hours
CTSO	SkillsUSA
SOC Codes (all applicable)	49-2095 - Electrical and Electronics Repairers, Powerhouse, Substation, and Relay
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The purpose of this program is to prepare students for careers in the energy industry.

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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 68 credit hours.

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 Direct Current (DC) circuits.
03.0 Demonstrate proficiency in Alternate Current (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 Demonstrate proficiency in grounding.
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.
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 Programmable Logic Controller (PLC).
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.
40.0 Demonstrate proficiency in both cyber and physical substation security measures.

Florida Department of Education
Student Performance Standards

Program Title: **Electrical Power Technology**
CIP Number: **1615030318**
Program Length: **68 Credit Hours**
SOC Code(s): **49-2095**

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 Occupational Safety and Health Administration (OSHA) and National Electric Code (NEC) 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 de-soldering techniques.
02.0	Demonstrate proficiency in Direct Current (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 the 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 Volt-Ohm Meters (VOM) and Digital Volt Meters (DVM) 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 Alternate Current (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.

	03.06	Construct and verify the operation of AC capacitive circuits.
	03.07	Analyze and troubleshoot AC capacitive circuits.
	03.08	Define and apply the characteristics of AC inductive circuits.
	03.09	Construct and verify the operation of AC inductive circuits.
	03.10	Analyze and troubleshoot AC inductive circuits.
	03.11	Define and apply the principles of transformers to AC.
	03.12	Construct and verify the operation of AC circuits utilizing transformers.
	03.13	Analyze and troubleshoot AC circuits utilizing transformers.
	03.14	Construct and verify the operation of differentiators and integrators to determine Resistor-Capacitor (RC) and Resistor-Inductor (RL) time constants.
	03.15	Define the characteristics of Resistor-Inductor-Capacitor (RLC) circuits (series, parallel and complex).
	03.16	Construct and verify the operation of RLC circuits (e.g. series, parallel and complex).
	03.17	Define the characteristics of series and parallel resonant circuits.
	03.18	Construct and verify the operation of series and parallel resonant circuits.
	03.19	Analyze and troubleshoot RC, RL and RLC circuits.
	03.20	Define the characteristics of poly phase circuits.
	03.21	Define the basic motor theory and operation.
	03.22	Define the basic generator theory and operation.
	03.23	Set up and operate power supplies for AC circuits.
	03.24	Analyze and measure power in AC circuits (e.g. 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 (zener), varistors (metal-oxide or MOV).

	04.04	Construct diodes circuits.
	04.05	Analyze and troubleshoot diode circuits.
	04.06	Identify and define operating characteristics and application of Bipolar Junction Transistors (BJT).
	04.07	Identify and define operating characteristics and applications of Field Effect Transistors (FET).
	04.08	Identify and define operating characteristics and applications of Metal Oxide Field Effect Transistors (MOSFET), and Insulated Gate Field Effect Transistors (IGFET).
	04.09	Identify and define operating characteristics and application of single stage amplifiers.
	04.10	Construct single-state amplifiers.
	04.11	Analyze and troubleshoot single-state amplifiers.
	04.12	Construct thyristor circuitry.
	04.13	Analyze and troubleshoot thyristor circuitry.
	04.14	Set up and operate a VOM for solid-state devices.
	04.15	Set up and operate a DVM for solid-state devices.
	04.16	Set up and operate power supplies for solid-state devices.
	04.17	Set up and operate oscilloscopes for solid-state devices.
	04.18	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 draw 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 reports and memoranda.

	05.08 Write formal reports of laboratory experiences.
	05.09 Follow installation preventive maintenance and calibration procedures.
06.0	Demonstrate proficiency in DC network analysis--The student will be able to:
	06.01 Analyze multisource circuits using Superimposition Theorem.
	06.02 Analyze multisource circuits using mesh currents.
	06.03 Analyze multisource circuits using branch currents.
	06.04 Analyze multisource circuits using nodal analysis.
	06.05 Analyze multisource circuits using Thevenin’s Theorem.
	06.06 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 poly phase motors.
	08.03 Install 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 Explain the functions of each element in the power generation system.
	09.03 Discuss emerging and alternative electric power generation technologies and fuel sources.
	09.04 Explain how solar energy is used to produce electricity in photovoltaic systems and what its advantages and disadvantages are.
	09.05 Explain how solar energy is used to produce electric energy using steam and what its advantages and disadvantages are.
	09.06 Explain how wind energy is used to produce electric energy and what its advantages and disadvantages are.
	09.07 Explain how geothermal energy is used to produce electric energy and what its advantages and disadvantages are.
	09.08 Explain how biomass energy is used to produce electric energy and what its advantages and disadvantages are.
	09.09 Explain how ocean energy is used to produce electric energy and what its advantages and disadvantages are.
	09.10 Explain how fuel cells are used to produce electric energy and what its advantages and disadvantages are.
	09.11 Explain how nuclear energy is used to produce electric energy and what its advantages and disadvantages are.
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 Institute of Electrical and Electronics Engineers (IEEE), National Electrical Manufacturers Association (NEMA) and American National Standards Institute (ANSI) codes.
	14.02 Demonstrate proficiency in interpretation/explanation of the IEEE, NEMA and ANSI 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 including web-based interviews, phone interviews and in-person interviews.
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 and the global 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 (e.g. 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 (e.g. NEMA standards, IEEE National Electric Code).
19.03	Demonstrate knowledge of insulation test materials and the application of various test equipment (e.g. Megger, hi-pot, Doble).
19.04	Demonstrate knowledge in cable entry and termination. This includes power cable, control cable, shield terminations, current transformer and potential transformer locations and wiring ratings.
19.05	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 device 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 the need for their coordination (i.e. 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 the standard voltage ratings of power cables, control cables and instrumentation cables.
	21.02	Demonstrate proficiency in the standard current ratings of power cables and control cables.
	21.03	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 (e.g. pulling cables, single and multiple groups) and selecting terminating materials and how they are used.
	21.04	Demonstrate proficiency in control cable identification codes of different conductors within a control cable.
	21.05	Demonstrate knowledge in selecting terminating materials and equipment, termination of a control circuit and perform the actual termination and proper installation methods (e.g. pulling cable, single and multiple groups).
	21.06	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, common ratings on the motor nameplate and purpose of mechanical design code.
	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	Demonstrate proficiency in the various methods of motor breaking including friction break, plugging brake and dynamic brake.
	23.07	Demonstrate proficiency in the various methods of starting AC and DC motors, the advantages and disadvantages of each, and the differences between open- and closed-circuit transitions.
	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 (e.g. relays, timers, limit switches, selector switches).

Instrumentation And Control Option	
26.0	Demonstrate proficiency in the plant cycle--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 (e.g. deadweight test, vacuum pump, potentiometer, thermal bath).
27.04	Set up, 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, International Society of Automation-ISA standards).
27.07	Calibrate, configure and troubleshoot analog and digital transmitters.
27.08	Set up and test pneumatic and electronics instrument loops.
28.0	Demonstrate proficiency in final elements--The student will be able to:
28.01	Define construction, operating characteristics, and appropriate applications of control valves (e.g. linear, quick opening, equal percentage) and pressure relieving devices, valve sizing calculations, valve selection, with consideration given to operating issues such as flashing, cavitation, choking and noise.
28.02	Define operating characteristics for dampers; relationship between driver and flow; cams, types (e.g. guillotine, louver).
28.03	Define the operating characteristics and application of valve/damper operator: pneumatic, hydraulic, electric and interface devices (e.g. MOV's, positioners, I/P's).
28.04	Calibrate and troubleshoot final elements and interface devices.
28.05	Set up and test instrument loop with final element.
28.06	Define the fundamental properties and characteristics associated with the flow of fluids and its interaction with the final element.

	28.07	Read, interpret and revise basic Piping & Instrumentation Diagrams (P&ID).
	28.08	Demonstrate proficiency in reading and using steam tables, basic heat rate calculations (e.g. sizing control valves and pressure relieving devices).
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 feed water 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, interpret and revise basic Piping & Instrumentation Diagrams (P&ID).
30.0	Demonstrate proficiency in Programmable Logic Controller (PLC) --The student will be able to:	
	30.01	Identify Central Processing Unit (CPU) architecture building blocks and their uses.
	30.02	Analyze omnibus (BUS) data highway concepts.
	30.03	Analyze various memory schemes.
	30.04	Identify types of input and output devices and peripherals.
	30.05	Interface input and output ports to peripherals.
	30.06	Analyze and troubleshoot input and output ports.
	30.07	Program and troubleshoot programmable logic controllers.
	30.08	Analyze and troubleshoot a communications link.
	30.09	Configure and troubleshoot distributed digital controllers.
	30.10	Analyze and troubleshoot Distributed Control Systems (DCS).
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 competency in using the elements of elementary ladder logic diagrams in PLCs.
	31.04	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 (e.g. 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 Set up 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 (e.g. 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; Potential Transformer (PT) and Current Transformer (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 Convert between physical units (e.g. amperes, volts, OHMS, watts and VARS and per unit parameters).
	37.02 Analyze radial distribution systems (e.g. 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.
40.0	Demonstrate proficiency in both cyber and physical substation security measures--The student will be able to:
	40.01 Demonstrate an understanding of Critical Infrastructure Protection (CIP) standards.
	40.02 Demonstrate an understanding of Federal Energy Regulatory Commission (FERC) bulk electric system requirements.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

General Education Course Requirements for AS and AAS Degrees

State Board of Education Rule 6A-14.030 (4) F.A.C. identifies 15 credit hours as the minimum amount of general education coursework required in the Associate of Science degree and the Associate of Applied Science degree. In addition, Rule 6A-14.0303 FAC implements section 1007.25 Florida Statutes and requires students entering a technical education degree program in the 2022-2023 academic year, and thereafter, to complete at least one identified core course in each subject area as part of the general education course requirements (15 credit hours total) before a degree is awarded) The core subject areas include:

- Communication.
- Humanities.
- Mathematics.
- Natural Sciences.
- Social Sciences.

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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 degree program includes the following College Credit Certificates:

Alternative Energy Engineering Technology (0615170100) – 18 Credit Hours

Standards for the above certificate programs are contained in separate curriculum frameworks.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Energy Management and Controls Technology**
Career Cluster: **Energy**

AS	
CIP Number	1615170100
Program Type	College Credit
Standard Length	60 credit hours
CTSO	SkillsUSA
SOC Codes (all applicable)	17-3023 - Electrical and Electronic Engineering Technicians; 49-2094 - Electronics Repairers, Commercial and Industrial Equipment
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

The Energy Management and Controls Technology 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 focuses on standards and certifications surrounding energy efficiency in industrial or commercial environments, and the methods to evaluate, calculate, implement and troubleshoot components and systems to improve energy efficiency in those environments. Also included are communication skills, leadership skills, human relations and employability skills, technical competency, safe and efficient work practices and a combination of theory and laboratory activities to gain the necessary cognitive and manipulative skills to perform preventive and corrective maintenance and support for energy management systems.
Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of 60 credit hours.

Standards

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

01.0 Formulate energy control strategies to improve efficiency in commercial building systems.
02.0 Initialize Energy Management Systems (EMS) installation.
03.0 Install EMS.
04.0 Evaluate energy management system operational data and components.
05.0 Create EMS control logic to meet building systems sequences of operation.
06.0 Assemble common EMS Direct Current (DC), and Alternating Current (AC) circuits.
07.0 Construct a comprehensive EMS data communication network.
08.0 Construct a secure EMS data communication network.
09.0 Apply technical mathematics.
10.0 Demonstrate proficiency in technical recording and reporting.
11.0 Demonstrate employability skills.
12.0 Demonstrate appropriate communication skills.

Florida Department of Education
Student Performance Standards

Program Title: Energy Management and Controls Technology
CIP Number: 1615170100
Program Length: 60 credit hours
SOC Code(s): 17-3023, 49-2094

At the completion of this program, the student will be able to:	
01.0	Formulate energy control strategies to improve efficiency in commercial building systems--The student will be able to:
01.01	Define an energy audit/assessment process to regulate efficiency standards.
01.02	Describe the sources of energy appropriate to specific operational processes.
01.03	Examine codes, standards, programs and certification requirements related to energy efficiency (i.e. ASHRAE, LEED, CEM, ISO 50001, etc.).
01.04	Identify current programs for energy reduction and the role of smart grid technologies in energy conservation.
01.05	Identify major energy-using systems in commercial facilities.
01.06	Identify the energy consuming components of industrial/commercial systems.
01.07	Discuss energy data reliability in terms of accuracy, precision and repeatability.
01.08	Discuss the energy control strategies of duty cycling, load shedding, air- and water-side economizer, air- and water-side resets, optimum start/stop, setbacks, and scheduling coordination.
01.09	Discuss the role of smart grid technologies in energy conservation.
01.10	Explain and interpret energy use and generation for common group understanding.
01.11	Explain assessment methods for final control elements in commercial systems.
01.12	Explain energy cost control and emission reduction measures to implement energy savings plan.
01.13	Explain the application of cost and energy efficiency in commercial facilities.
01.14	Calculate conversions of energy-related units such as BTUs, Therms, kWH, Watts and others into one standard unit of measure.
01.15	Implement energy management strategies.

	01.16	Analyze a provided energy-consumption trend log.
	01.17	Inspect equipment for real and potential energy losses and optimal performance.
	01.18	Prioritize a list of energy control strategies for given commercial building data.
	01.19	Use appropriate audit techniques for the assessment.
	01.20	Create an air-handling unit discharge set point reset strategy including set points and a sequence of operation.
	01.21	Prepare a load-shedding table from given shed loads including a written sequence of operation.
	01.22	Prepare an air- and water-side economizer control strategy including set points and a sequence of operation.
02.0	Initialize Energy Management Systems (EMS) installation--The student will be able to:	
	02.01	Define factory acceptance testing, commissioning, re/retro/continuous commissioning.
	02.02	Gather data from plant systems including smart meters, totalizators, equipment controls, and Building and Enterprise Systems: Building Automation Systems (BAS) and Distributed Control Systems (DCS).
	02.03	Identify needed data to gather and track for overall project.
	02.04	Measure operating parameters of major industrial equipment, including motors and fans.
	02.05	Participate in on-site orientation (e.g. safety training, security, background check) to regulate site.
	02.06	Review EMS design turnover documentation to assess energy plan.
	02.07	Review existing EMS components to identify the process model of organization.
	02.08	Select actuators (e.g., two-position, modulating, quick response).
	02.09	Manage equipment and materials inventory and report data in an appropriate format and form.
	02.10	Order and verify EMS equipment and EMS installation materials (e.g. conduit, wire).
	02.11	Review design documentation (e.g. mechanical/electrical submittals, drawings, specs).
	02.12	Map points to graphics and set user privileges.
	02.13	Perform project turnover to installation and implement work order procedures.
	02.14	Program operational schedules.
	02.15	Program trend logs.

	02.16	Configure customer dashboards, program custom reports.
	02.17	Turn over project to start-up energy management systems.
	02.18	Coordinate EMS address schema [i.e. Bacnet Broadcast Management Device (BBMD) table, mod bus registry, and Local Operating Network (LON), etc.].
	02.19	Coordinate EMS requirements with other trades (e.g. mechanical, electrical plumbing) to set proposals.
	02.20	Coordinate EMS.
	02.21	Coordinate installation activities with trades and energy audit.
	02.22	Coordinate start-up with other trades to integrate energy policies and regulations into company.
	02.23	Determine operating parameters of major industrial equipment, including motors, fans and pumps.
03.0	Install EMS--The student will be able to:	
	03.01	Determine the power needs and use of commercial systems.
	03.02	Size EMS transformers (e.g. AC voltage, DC voltage).
	03.03	Measure size control valves (e.g. hydronic, steam, isolation) to clarify constraints or requirements that effect process.
	03.04	Create a Graphical User Interface (GUI) and use system commands.
	03.05	Create a project installation schedule to execute activities across different systems.
	03.06	Develop EMS drawings (e.g. schematics, flow diagrams, bill of materials).
	03.07	Develop EMS training outline to implement system requirements.
	03.08	Develop initial redline drawings and interpret sensor data collected from the appropriate instrumentation.
	03.09	Develop points list and sequence of operation.
	03.10	Develop project close-out documents (e.g. as-builts, O&M).
	03.11	Develop system integration plan for the selected EMS equipment (e.g. controllers, field devices, submeters).
	03.12	Layout raceway systems (e.g. underground, ceiling, penetrations).
	03.13	Prepare EMS product submittals including codes, standards, programs and certification.
	03.14	Demonstrate calibration of test equipment and field sensors.

	03.15	Use hand instrumentation, advanced instrumentation with data logging capability, thermal imaging test equipment and data loggers.
	03.16	Configure control systems including open and closed loop control.
	03.17	Configure variable frequency drives.
	03.18	Energize EMS and load controller settings (i.e. memory, firmware, database, etc.).
	03.19	Install EMS devices including; underground conduit, conduit raceway, water side, air side, wall mount ceiling mount, and labels and placards.
	03.20	Install energy management systems site licenses.
	03.21	Install equipment mounted EMS devices, pull wire and terminate EMS panels and end devices.
	03.22	Mount EMS panels and install roof penetrations.
	03.23	Perform pre-functional start-up and QA on factory mounted controls.
	03.24	Set up user interface (e.g., workstation, server, thin client), back up EMS database and prepare point-to-point check out sheet.
04.0	Evaluate EMS operational data and components--The student will be able to:	
	04.01	Describe duct/pipe insulation options and uses.
	04.02	List the steps in problem solving.
	04.03	Monitor commercial systems data communication to troubleshoot.
	04.04	Discuss selection, operation and integration of various lighting systems.
	04.05	Discuss typical performance troubleshooting issues of integrated systems.
	04.06	Interpret common commercial protocols (i.e. BACnet, Modbus, LonWorks, etc.) to troubleshoot equipment and systems.
	04.07	Verify calibration of test equipment and the functionality of alarms & interlocks.
	04.08	Execute a measurement and verification protocol (IPMVP) to measure, verify and validate energy savings.
	04.09	Interpret psychometric charts, fan curves, pump and valve curves, and equipment performance curves.
	04.10	Use the export function in EMS system to archive data in CSV file format for data analysis.
	04.11	Determine energy efficient locations of commercial systems components.
	04.12	Determine optimum operating parameters for equipment and systems (e.g. efficiency curves and part load characteristics).

	04.13	Perform database maintenance operations.
	04.14	Perform point-to-point check out.
	04.15	Recognize and resolve EMS configuration problems.
	04.16	Evaluate efficiency of major building system loads.
	04.17	Examine equipment operation/controls for real and potential energy losses and optimal performance.
	04.18	Troubleshoot sensors and devices, system faults.
	04.19	Construct multi-trend objects to archive key energy-related system.
	04.20	Establish temporary IT backbone and communication to third party devices.
	04.21	Hypothesize commercial building systems opportunities for energy efficiency improvements from analysis of multi-trend objects.
	04.22	Program EMS and verify addressing with customers (e.g., mac addresses, IP addresses, BBMD) and to confirm safety devices are functional.
	04.23	Program energy management system components for energy efficient.
	04.24	Calibrate EMS sensors.
	04.25	Demonstrate proper maintenance practices for utility systems for energy efficiency.
05.0	Create EMS control logic to meet building systems sequences of operation--The student will be able to:	
	05.01	Describe object-oriented programming and the advantage of using objects in programming.
	05.02	Discuss the purpose and function of standard logic gates (i.e. Or, Nor, Xor, Xnor, And, Nand, etc.).
	05.03	State the key elements of effective modular programming design.
	05.04	Prepare an If-Then-Else conditional statement to meet a provided logic decision action.
	05.05	Use an automated specifications building website for plans and specifications for the most common commercial building mechanical systems.
	05.06	Compare and contrast various building air-delivery system methods (i.e. VAV, constant volume, multizone, dual duct, reheat systems, etc.).
	05.07	Compare and contrast various central plant equipment cooling and heating equipment types (i.e. chiller types, boiler types, water-side economizer, etc.).
	05.08	Debug EMS programming.
	05.09	Construct relay circuit logic representative of Or, Nor, Xor, Xnor, And, and Nand gates.

05.10	Create a programming flow-chart design to meet a given sequence of operation.
05.11	Create programming to meet give logic sequence (i.e. ladder logic diagrams, flow charts, etc.).
05.12	Perform pre-conditioning performance tests.
06.0	Assemble common EMS direct current (DC), and alternating current (AC) circuits--The student will be able to:
06.01	Define and apply the principles of transformers to AC circuits.
06.02	Define the characteristics of AC capacitive and inductive circuits.
06.03	Define the characteristics of series and parallel resonant circuits.
06.04	Define the characteristics of three-phase circuits.
06.05	Describe magnetic properties of circuits and devices.
06.06	Describe the physical laws that govern electricity and magnetism.
06.07	Identify AC sources and properties of an AC signal.
06.08	Define voltage, current, resistance, power and energy.
06.09	Apply maximum power transfer theory to determine the conditions under which maximum power transfer occurs in a circuit.
06.10	Apply Ohm's law and power formulas to electrical/electronic circuits.
06.11	Calculate and measure the conductance and resistance of conductors and insulators.
06.12	Compute the impedance of passive RC, RL, and RLC circuits.
06.13	Analyze and measure AC signals utilizing DMM's, oscilloscope, frequency counter and function generator.
06.14	Analyze and measure power in AC circuits.
06.15	Analyze and troubleshoot AC series, capacitive, inductive, and resonant circuits.
06.16	Analyze and troubleshoot series, parallel, and series-parallel circuits.
06.17	Assemble all standard energy management system input circuits (e.g. 0-5 VDC, 1-5 VDC, 0-10 VDC, 2-10 VDC thermistor, transmitter, 4-20 mamp, contact closures, interlocks).
06.18	Assemble all standard energy management system output circuits (e.g. 0-24 VAC, 0-5 VDC, 0-10 VDC, contact closure, interlocks).
06.19	Construct and verify the operation of AC capacitive and inductive circuits.

06.20	Construct and verify the operation of AC circuits utilizing transformers.
06.21	Construct and verify the operation of DC circuits that demonstrate the maximum power transfer theory.
06.22	Setup and operate power supplies for AC circuits.
07.0	Construct a comprehensive EMS data communication network--The student will be able to:
07.01	Document network settings and develop network training manuals.
07.02	Identify and describe current relevant IEEE network standards.
07.03	Identify network components, media, connectors, applications and protocols.
07.04	Verify cabling installation (i.e. type, fiber, shielding, etc.).
07.05	Explain the functions of wireless components, standards, hardware, software, and infrastructure design.
07.06	Identify major emerging technologies and discuss technical issues related to emerging technologies (e.g., security, bandwidth capability, gigabit transmission rates).
07.07	Back up network settings.
07.08	Configure remote access services, protocols and policies, conditions and settings.
07.09	Configure server settings (e.g. SMTP, web, database, cloud).
07.10	Coordinate IP and wireless network settings (i.e. ports, BBMD, domain, routers, frequency, channels, etc.).
07.11	Analyze network performance.
07.12	Compare and contrast remote access protocols, wireless standards and network authentication methods.
07.13	Compare and contrast the OSI and TCP/IP reference models and their layers.
07.14	Coordinate network device locations (i.e. wireless, hard wire, etc.).
07.15	Determine communications requirements (i.e. gateways, protocols, cabling, etc.).
07.16	Establish server network communications.
07.17	Create an IP addressing scheme using Variable Length Subnet Masks (VLSM) and Classless Inter-Domain Routing (CIDR).
07.18	Plan, configure and test a small network and establish baselines.
07.19	Program secure EMS device addresses.

	07.20 Implement transient voltage surge suppression (i.e. communications, power, grounding, etc.).
	07.21 Incorporate energy management system network topography.
08.0	Construct a secure EMS data communication network--The student will be able to:
	08.01 Describe common security threats to, and vulnerabilities of, computer systems and the corresponding best practices for mitigation.
	08.02 Describe the principles and techniques of securing data storage and transmission.
	08.03 Verify server specifications (i.e. hardware, operating system, database, etc.).
	08.04 Identify and discuss issues related to networked environments, such as security, access control, fair use, privacy and redundancy.
	08.05 Enable access control, identity management and security logging.
	08.06 Perform network security tests.
	08.07 Install and manage the appropriate network security protocols.
	08.08 Implement security policies, including compliance and operational security.
	08.09 Describe effective troubleshooting strategies and techniques to resolve basic hardware, software, and network problems.
	08.10 Describe the functions and characteristics of firewalls.
	08.11 Identify the risks and techniques of data loss and its prevention.
	08.12 Install and update anti-virus software.
	08.13 Monitor and troubleshoot remote access and wireless connections.
	08.14 Troubleshoot network issues.
	08.15 Conduct a network based virus scan.
09.0	Apply technical mathematics--The student will be able to:
	09.01 Measure operating parameters of major industrial equipment, including motors, fans and pumps.
	09.02 Calculate the parameters for basic DC/AC circuits.
	09.03 Calculate the parameters for basic digital circuits.
	09.04 Measure the efficiency of an energy management system.

	09.05 Solve algebra, arithmetic and other related mathematics problems.
10.0	Demonstrate proficiency in technical recording and reporting--The student will be able to:
	10.01 Use computer application programs (i.e. word processor, database, spreadsheet, etc.) to create reports and record and analyze data.
	10.02 Use schematic capture and simulation programs to create figures and gather data for technical reporting.
	10.03 Create an energy and carbon balance accounting report.
	10.04 Maintain a lab notebook documenting procedures, activities, observations, calculations, and results of conducted experiments.
	10.05 Write reports and make oral presentations.
11.0	Demonstrate employability skills--The student will be able to:
	11.01 Conduct a job search.
	11.02 Secure information about a job.
	11.03 Identify documents that may be required when applying for a job interview.
	11.04 Complete a job application form correctly.
	11.05 Demonstrate competence in job interview techniques.
	11.06 Identify or demonstrate appropriate responses to criticism from employer, supervisor, or other employees.
	11.07 Identify acceptable work habits.
	11.08 Demonstrate knowledge of how to make job changes appropriately.
	11.09 Demonstrate acceptable employee health habits.
	11.10 Prepare a work portfolio and resume.
12.0	Demonstrate appropriate communication skills--The student will be able to:
	12.01 Write logical and understandable statements or phrases to accurately fill out forms/invoices commonly used in business and industry.
	12.02 Read and understand graphs, charts, diagrams and tables commonly used in this industry/occupation area.
	12.03 Read and follow written and oral instructions.
	12.04 Answer and ask questions coherently and concisely.

12.05	Read critically by recognizing assumptions and implications and by evaluating ideas.
12.06	Demonstrate appropriate telephone/communication skills.

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http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Electrical Lineworker**
Program Type: **Career Preparatory**
Career Cluster: **Energy**

Career Certificate Program		
Program Number	X100100	
CIP Number	0646030302	
Grade Level	30,31	
Standard Length	1500 Hours	
Teacher Certification	Refer to the **Program Structure** section.	
CTSO	SkillsUSA	
SOC Codes (all applicable)	49-9051 - Electrical Power-Line Installers and Repairers	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading Language Arts): 9

Purpose

The purpose of this program is to prepare students for employment as electrical power-line installers. It is highly recommended that students earn their Commercial Driver's License (CDL).

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 application of electrical/ electronic principles, climbing poles and operating equipment.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

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

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.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	BCV0666	Electrical Lineworker 1	ELECTRICAL @7 7G TEC ELEC @7 7G	540 Hours	49-9051
B	BCV0668	Electrical Lineworker 2	ELECTRICAL @7 7G TEC ELEC @7 7G	540 Hours	49-9051
C	BCV0669	Electrical Lineworker 3	ELECTRICAL @7 7G TEC ELEC @7 7G	420 Hours	49-9051

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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 proficiency in applying basic electrical/electronic principles.
03.0 Demonstrate proficiency in utilizing electrical line service tools and equipment.
04.0 Demonstrate proficiency in troubleshooting and repairing system components.
05.0 Demonstrate science knowledge and skills.
06.0 Demonstrate mathematics knowledge and skills.
07.0 Demonstrate proficiency in installing electrical distribution systems.
08.0 Demonstrate proficiency in street and security lighting activities.
09.0 Demonstrate proficiency in maintenance and inspection duties.
10.0 Demonstrate proficiency in operator functions on high reach trucks.
11.0 Explain the importance of employability and entrepreneurship skills.
12.0 Obtain a Class-A Commercial Driver's License (CDL). (Optional)

Florida Department of Education
Student Performance Standards

Program Title: **Electrical Lineworker**
Career Certificate Program Number: **X100100**

Course Number: BCV0666 **Occupational Completion Point: A** **Electrical Lineworker 1 – 540 Hours – SOC Code 49-9051**	
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.
01.02	Explain emergency procedures to follow in response to workplace accidents.
01.03	Create a disaster and/or emergency response plan.
01.04	Demonstrate knowledge of the "Right-To-Know Law" as recorded in (29 CFR-1910.1200).
02.0	Demonstrate proficiency in applying basic electrical/electronic principles--The student will be able to:
02.01	Interpret electrical terms.
02.02	Identify electrical symbols.
02.03	Construct common electrical circuits.
02.04	Compute for voltage, current, resistance and power.
02.05	Operate meters to measure electrical properties.
02.06	Discuss transformer theory.
02.07	Apply electronic principles where applicable.
02.08	Interpret electronic terms and symbols.
03.0	Demonstrate proficiency in utilizing electrical line service tools and equipment--The student will be able to:
03.01	Utilize hand tools safely.
03.02	Utilize hotline tools safely.

	03.03 Utilize rubber protection as needed.
	03.04 Operate pool trailer.
	03.05 Operate reel jacks.
	03.06 Operate cable pulling guide.
	03.07 Operate shop power tools.
	03.08 Operate hoist.
	03.09 Operate climbing equipment.
	03.10 Operate multimeter.
	03.11 Operate clamp-on ammeter.
	03.12 Operate phase rotation meter.
	03.13 Operate meter.
	03.14 Operate gas detector.
	03.15 Operate hot stick tester.
	03.16 Operate high voltage phase tester.
	03.17 Operate recording ammeter/voltmeter.
	03.18 Discuss a relay tester.
	03.19 Discuss vibro ground.
	03.20 Operate power trencher.
	03.21 Clean facilities and shop.
04.0	Demonstrate proficiency in troubleshooting and repairing system components--The student will be able to:
	04.01 Replace defective conductor.
	04.02 Transfer dead conductor to new pole.
	04.03 Remove foreign objects from conductor.

04.04	Simulate the transfer of hot conductor to new pole.
04.05	Splice dead or hot conductors.
04.06	Convert transformer banks to open delta.
04.07	Replace cross arms.
04.08	Climb through simulated hot equipment using rubber protective devices.
04.09	Trace faulty underground cable.
04.10	Discuss substation breakers, transformers, regulators and relays.

Course Number: BCV0668 **Occupational Completion Point: B** **Electrical Lineworker 2 – 540 Hours – SOC Code 49-9051**	
05.0	Demonstrate science knowledge and skills--The student will be able to:
05.01	Understand molecular action as a result of temperature extremes, chemical reaction and moisture content.
05.02	Discuss the role of creativity in constructing scientific questions, methods and explanations.
05.03	Formulate scientifically investigable questions, construct investigations, collect and evaluate data and develop scientific recommendations based on findings.
05.04	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.
05.05	Understand pressure measurement in terms of PSI, inches of mercury and KPA.
06.0	Demonstrate mathematics knowledge and skills--The students will be able to:
06.01	Demonstrate knowledge of arithmetic operations.
06.02	Analyze and apply data and measurements to solve problems and interpret documents.
06.03	Read and interpret measuring devices (rules and tapes).
06.04	Add 100 addition combinations.
06.05	Add two-digit numbers.
06.06	Add three-digit numbers.
06.07	Subtract 100 subtraction combinations.

06.08 Subtract two-, three- and four-digit numbers.
06.09 Solve one-digit divisor problems.
06.10 Solve two-digit divisor problems.
06.11 Solve two- and three-digit divisor problems.
06.12 Solve multiplication facts.
06.13 Multiply by a one-digit factor.
06.14 Multiply by a two-digit factor.
06.15 Identify the parts of a fraction.
06.16 Solve fractional word problems.
06.17 Classify types of fractions.
06.18 Illustrate equivalent fractions.
06.19 Convert fractions.
06.20 Reduce fractions.
06.21 Solve decimal notations.
06.22 Solve number word problems.
06.23 Round to the nearest whole number.
06.24 Add decimals.
06.25 Subtract decimals.
06.26 Multiply decimals.
06.27 Divide a decimal by a decimal.
06.28 Divide a whole number by a decimal.
06.29 Write fractions as decimals and percents.
06.30 Write percents add fractions and decimals.

	06.31 Solve percent problems.
	06.32 Find the percent of a number.
	06.33 Operate a calculator.
	06.34 Understand and use the metric system.
	06.35 Convert inches to millimeters and millimeters to inches.
	06.36 Construct charts/tables/graphs using functions and data.
	06.37 Solve problems for volume, weight, area, circumference and perimeter measurements for rectangles, squares and cylinders.
	06.38 Measure tolerance(s) on horizontal and vertical surfaces using millimeters, centimeters, feet and inches.
	06.39 Add, subtract, multiply and divide using fractions, decimals and whole numbers.
	06.40 Determine the correct purchase price, to include sales tax for a materials list containing a minimum of six items.
	06.41 Demonstrate an understanding of federal, state and local taxes and their computation.
07.0	Demonstrate proficiency in installing electrical distribution systems--The student will be able to:
	07.01 Set poles manually and using power equipment.
	07.02 Transport, unload and position poles.
	07.03 Frame pole.
	07.04 Install guy anchor and wires.
	07.05 Climb poles using climbing equipment.
	07.06 Hoist materials or equipment to lines.
	07.07 String conductors.
	07.08 Cut or splice conductors.
	07.09 Sag conductors.
	07.10 Install tie wires.
	07.11 Fabricate tie wires.

	07.12 Install pole equipment (cross arms, transformers, fuse cutouts, insulators, air switches, arrestors and pole steps).
	07.13 Install capacitor banks.
	07.14 Install substation equipment.
	07.15 Install utility meters.
	07.16 Install armor rods.
	07.17 Install direct burial cable.
	07.18 Install cable markers.
	07.19 Fabricate underground duct systems.
	07.20 Install underground cable ducts.
	07.21 Rig manholes for cable pulling.
	07.22 Splice high voltage underground cable.
	07.23 Terminate high voltage cable underground and above ground.
	07.24 Install cable racks.
	07.25 Install and test grounding systems.
08.0	Demonstrate proficiency in street and security lighting activities--The student will be able to:
	08.01 Install street light fixtures.
	08.02 Install flood light fixtures.
	08.03 Install lighting control components.
	08.04 Install ballast.
	08.05 Isolate system for test.
	08.06 Adjust timers and controls.
	08.07 Relamp fixtures.
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.

Course Number: BCV0669 **Occupational Completion Point: C** **Electrical Lineworker 3 – 420 Hours – SOC Code 49-9051**	
10.0	Demonstrate proficiency in utility construction equipment operation and maintenance--The student will be able to:
10.01	Demonstrate safe work practice for operating machinery.
10.02	Demonstrate routine daily inspection to trucks and mobile equipment.
10.03	Inspect hydraulic systems for operational integrity.

10.04	“Fly” a boom for safety inspection.
10.05	Demonstrate understanding of dielectric testing of an insulated boom section.
10.06	Clean and maintain dielectric bucket liners and boom insulators.
10.07	Maintain and install vehicle grounds.
10.08	Safely jump-start a vehicle.
10.09	Inspect equipment for safe operational conditions.
10.10	Safely load, secure and unload a variety of equipment from a drive-on trailer.
10.11	Read a load lifting chart.
10.12	Plan a lift.
10.13	Accurately give hand signals to a boom truck operator.
10.14	Set up an aerial truck for operation.
10.15	Safely operate an aerial lift truck.
10.16	Safely operate a boom truck.
10.17	Safely operate a pole-hole digger truck.
10.18	Safely operate an operator seated trenching machine.
10.19	Safely operate a walk behind trencher.
10.20	Safely operate a backhoe.
10.21	Safely operate a horizontal boring machine.
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.
11.02	Develop personal career plan that includes goals, objectives and strategies.
11.03	Examine licensing, certification and industry credentialing requirements.
11.04	Maintain a career portfolio to document knowledge, skills and experience.

	11.05 Evaluate and compare employment opportunities that match career goals.
	11.06 Identify and exhibit traits for retaining employment.
	11.07 Identify opportunities and research requirements for career advancement.
	11.08 Research the benefits of ongoing professional development.
	11.09 Examine and describe entrepreneurship opportunities as a career planning option.
12.0	Obtain a Class-A Commercial Driver's License (CDL). (Optional)

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

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.

Basic Skills

In a Career Certificate Program 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: Computation (Mathematics) and Communications (Language 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, 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, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

Program Title: **Natural Gas Operations and Distribution**
Program Type: **Career Preparatory**
Career Cluster: **Energy**

Career Certificate Program		
Program Number	X500200	
CIP Number	0647000002	
Grade Level	30,31	
Standard Length	1220 Hours	
Teacher Certification	Refer to the **Program Structure** section.	
CTSO	SkillsUSA	
SOC Codes (all applicable)	43-5041 - Meter Readers, Utilities 51-9198 - Helper-Production Workers 47-2073 - Operating Engineers and Other Construction Equipment Operators 53-3032 - Heavy and Tractor-Trailer Truck Drivers	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communication (Reading Language Arts): 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 tasks in field operations support such as deactivation of service, delayed match, corrosion inspections, meter paints, reading meters and assisting with other maintenance activities. The entry-level general technician in the natural gas distribution industry serves as a member of a crew engaged in installing, maintaining and repairing gas mains and service lines. In addition, the technician performs these basic tasks including operating heavy equipment, using hand tools, basic leak investigation, assisting in mechanical joining, landscape maintenance and traffic control, meter reading, Energy Resource Technology (ERT) programming in conjunction with Automated Meter Reading (AMR) duties.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

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

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.

To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	TRA0650 TRA0651	Natural Gas Distribution 1 Natural Gas Distribution 2	NAT GAS TECH 7G	150 hours 150 hours	43-5041 43-5041
B	TRA0652	Natural Gas Distribution 3	NAT GAS TECH 7G	150 hours	43-5041
C	PMT0070 PMT0071	Welder Assistant 1 Welder Assistant 2	METAL WORK 7G WELDING @7 7G	150 hours 150 hours	51-9198 51-9198
D	TRA0086	Tractor Operator	OPER ENGR @7 7G	150 hours	47-2073
E	TRA0080	Tractor Trailer Truck Driver	COMM DRIV @7 7G	320 hours	53-3032

National Standards (NS)

Industry or National Standards corresponding to the standards and/or benchmarks for the Welding Technology program can be found using the following link:

https://www.aws.org/certification/page/certified-welder-program

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

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

01.0 Identify requirements for orientation and safety.
02.0 Operate basic tools/equipment in the natural gas distribution industry.
03.0 Provide assistance with the installation, repair and maintenance of the distribution system.
04.0 Capture documentation in the mobile data terminal (MDT) and recognize abnormal operating conditions such as corrosion, meters under stress, etc.
05.0 Demonstrate basic vehicle control, maintenance, inspection and servicing procedures.
06.0 Complete customer compliance orders.
07.0 Assist in performing regular meter inspections, paint and maintain above and below ground gas systems.
08.0 Apply construction-related mathematics and reading competencies.
09.0 Demonstrate an understanding and apply workplace safety and workplace organization skills.
10.0 Demonstrate basic knowledge of industrial and manufacturing processes.
11.0 Describe and identify metals and their properties accurately.
12.0 Demonstrate basic knowledge of drawing and interpreting welding symbols.
13.0 Apply basic oxyfuel gas cutting principles and practices.
14.0 Create a product using basic oxyfuel gas cutting principles and practices.
15.0 Apply knowledge of drawing and interpreting welding symbols
16.0 Apply intermediate oxyfuel gas cutting principles and practices.
17.0 Demonstrate plasma arc cutting principles and practices.
18.0 Demonstrate a basic understanding of shielded metal arc welding (SMAW).
19.0 Create a product using basic shielded metal arc welding (SMAW) principles and practices.
20.0 Operate pneumatic and crawler-type tractor with attachments.
21.0 Understand vehicle safety and accident prevention procedures.
22.0 Understand and comply with vehicle operating regulations.
23.0 Demonstrate proper cargo handling and documentation procedures.
24.0 Demonstrate trip planning preparation procedures.
25.0 Demonstrate vehicle inspection procedures.
26.0 Perform vehicle maintenance and servicing procedures.
27.0 Demonstrate basic vehicle control procedures.
28.0 Demonstrate backing skills and basic vehicle maneuvers.
29.0 Demonstrate coupling and uncoupling skills.
30.0 Demonstrate road driving skills.
31.0 Demonstrate hazardous driving skills.
32.0 Apply concepts learned for obtaining a Commercial Driver's License (CDL).

Florida Department of Education
Student Performance Standards

Program Title: Natural Gas Operations and Distribution
Career Certificate Program Number: X500200

Course Number: TRA0650 **Occupational Completion Point: A (1 of 2)** **Natural Gas Distribution 1 – 150 Hours – SOC Code 43-5041**	
Course Description: The Natural Gas Distribution 1 course prepares students for work as general technicians in the natural gas distribution industry. Students learn to comply with safety procedures, operate basic tools and equipment and provide customer assistance.	
01.0	Identify requirements for orientation and safety--the student will be able to:
01.01	Comply with school policies and procedures.
01.02	Identify goals of natural gas distribution.
01.03	Describe the safety requirements and regulatory guidelines.
01.04	Describe vehicle safety and accident prevention procedures.
01.05	Apply safety rules and procedures.
01.06	Use tools, materials and processes in an appropriate and safe manner.
01.07	Demonstrate an understanding and apply workplace safety and workplace organization skills.
01.08	Demonstrate basic vehicle control procedures.
01.09	Describe hazardous driving skills.
01.10	Comply with vehicle operating regulations.
01.11	Demonstrate the importance of health, safety and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
01.12	Comply with attendance and tardy policies.
01.13	Comply with directions from field supervisor with a good attitude.
01.14	Perform simple sniff tests to detect gas leaks.
02.0	Operate basic tools/equipment in the natural gas distribution industry--The student will be able to:

02.01	Identify and understand computer hardware.
02.02	Identify information technology tools and proper use.
02.03	Identify components of network systems.
02.04	Describe and use communication features of information technology.
02.05	Apply proper use and care of hand tools.
02.06	Apply proper use and care of power tools.
02.07	Operate pneumatic and crawler-type tractor with attachments.
02.08	Apply proper use and care of ladders and scaffolds.
02.09	Operate a back hoe.
02.10	Operate a crane.
03.0	Provide assistance with the installation, repair and maintenance of the distribution system--The student will be able to:
03.01	Perform vehicle maintenance and servicing procedures.
03.02	Discuss the value of alternative and renewal energy sources.
03.03	Investigate energy consumption and identify ways to use energy wisely.
03.04	Calculate greenhouse gas emissions based on local fuel mixture and energy.
03.05	Demonstrate understanding of operation and maintenance of mechanical systems and engines.
03.06	Understand drawings and detail sheets.
03.07	Identify and explain piping systems.
03.08	Identify and explain butt weld pipe fabrication.
03.09	Read advanced construction documents.
03.10	Read and interpret pipefitting standards and specifications.
03.11	Complete above ground pipe installation.
03.12	Identify and install valves.

03.13	Test piping systems and equipment.
03.14	Apply gas fundamentals.
03.15	Apply electrical fundamentals.
03.16	Work with tubing and fittings.
03.17	Describe and identify metals and their properties.
03.18	Demonstrate basic knowledge of drawing and interpreting welding symbols.
03.19	Apply basic shielded metal arc welding skills.
03.20	Apply basic oxy fuel gas cutting principles and practices.
03.21	Apply visual examination skills.

Course Number: TRA0651 **Occupational Completion Point: A (2 of 2)** **Natural Gas Distribution 2 – 150 Hours – SOC Code 43-5041**	
Course Description: The Natural Gas Distribution 2 course prepares students for work as general technicians in the natural gas distribution industry. Students capture documentation in the mobile data terminal (MDT) to recognize abnormal operating conditions and maintain vehicles.	
04.0	Capture documentation in the mobile data terminal (MDT) and recognize abnormal operating conditions such as corrosion, meters under stress, etc.--The student will be able to:
04.01	Develop and apply keyboarding skills utilizing current technology.
04.02	Develop and apply electronic presentation skills utilizing current technology.
04.03	Develop and apply spreadsheet skills using current technology.
04.04	Perform research using the worldwide web.
04.05	Conduct stress-relieving and aligning.
04.06	Identify and use stream traps.
04.07	Identify and use inline components.
04.08	Use and fabricate special piping.
04.09	Conduct hot taps.
04.10	Maintain valves.

	04.11 Explain the principles of backflow cross and connection control.
	04.12 Explain how liquid propane gas (LPG) system works.
	04.13 Repair, service and maintain plumbing systems.
05.0	Demonstrate basic vehicle control, maintenance, inspection and servicing vehicles--The student will be able to:
	05.01 Demonstrate vehicle inspection procedures.
	05.02 Perform vehicle maintenance and servicing procedures.
	05.03 Demonstrate pre-trip preparation procedures.

Course Number: TRA0652
Occupational Completion Point: B
Natural Gas Distribution 3 – 150 Hours – SOC Code 43-5041

Course Description: The Natural Gas Distribution 3 course prepares students for work as general technicians in the natural gas distribution industry. Students complete customer compliance orders and assist in inspections. Content includes construction mathematics and reading.

06.0	Complete customer compliance orders--The student will be able to:
	06.01 Operate computers and other equipment appropriate to customer service.
	06.02 Describe and demonstrate the human relations skills necessary for successful customer service.
	06.03 Identify and define the terminology applicable to customer service.
	06.04 Identify customer service activities.
	06.05 Demonstrate and understanding of a client's business policies and procedures.
	06.06 Demonstrate the ability to communicate skillfully.
	06.07 Analyze the impact of government regulations and community involvement on customer service.
	06.08 Assist in connecting and disconnecting gas service, manually turning meters on and off.
	06.09 Respond to questions from customers and provide answers directly or by referral.
	06.10 Assist in conducting investigations of high bill complaints, stop meters and special readings by meter reading validation.
07.0	Assist in performing regular meter inspections, paint and maintain above and below ground gas systems--The student will be able to:
	07.01 Identify and explain excavations.

07.02	Identify and explain underground pipe.
07.03	Perform underground pipe installation.
07.04	Accomplish above ground pipe installation.
07.05	Perform non-destructive evaluation (NDE) testing.
07.06	Operate automated dispatch system to complete meter reads and turn-offs service at customer's premise.
07.07	Understand conventional natural gas systems.
07.08	Investigate natural gas transmission and distribution.
08.0	Apply construction-related mathematics and reading competencies--The student will be able to:
08.01	Calculate greenhouse gas emissions based on local fuel mixture and energy.
08.02	Understand drawings and detail sheets.
08.03	Read advanced construction documents.
08.04	Read and interpret pipefitting standards and specifications.
08.05	Calculate mathematic formulas for combustion.

Course Number: PMT0070 **Occupational Completion Point: C (1 of 2)** **Welder Assistant 1 – 150 Hours – SOC Code 51-9198**	**National Standards**
Course Description: The Welder Assistant 1 course prepares students for entry into the welding industry. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study workplace safety and organization, basic manufacturing processes, metals identification, basic interpretation of welding symbols, and oxyfuel gas cutting practices. *Note: This course is pending alignment in the following categories: National Standards*	
09.0 Demonstrate an understanding and apply workplace safety and workplace organization--The student will be able to:	
09.01 Locate and use Safety Data Sheets (SDS).	
09.02 Demonstrate knowledge of first aid or first response procedures.	
09.03 Identify safety procedures in case of smoke or chemical inhalation.	
09.04 Demonstrate knowledge of material handling techniques to safely move materials.	

09.05	Demonstrate the proper techniques for lifting loads.	
09.06	Demonstrate knowledge of safety requirements for material handling equipment such as forklifts, cranes, rigging, and pry trucks.	
09.07	Proactively respond to a safety concern and then document occurrences.	
09.08	Demonstrate knowledge of emergency exits and signage.	
09.09	Demonstrate knowledge of various emergency alarms and procedures.	
09.10	Perform emergency drills and participate in emergency teams.	
09.11	Demonstrate knowledge of clean-up procedures.	
09.12	Explain Lock Out/Tag Out requirements and procedures.	
09.13	Demonstrate knowledge of machinery and equipment safety functions to determine if all safeguards are operational.	
09.14	Identify procedures for handling hazardous material.	
09.15	Develop safety checklists.	
09.16	Identify and report unsafe conditions.	
09.17	Determine the appropriate corrective action after an unsafe condition is identified.	
09.18	Demonstrate knowledge of safety requirements for manual and electrical-powered tools.	
09.19	Demonstrate knowledge of safety requirements for operation of automated machines.	
09.20	Perform safety and environmental inspections.	
09.21	Demonstrate skill in performing leak checks to determine if toxic or hazardous material is escaping from a piece of equipment.	
09.22	Demonstrate knowledge of proper and safe installation techniques as described in manuals, checklists, and regulations.	
09.23	Demonstrate knowledge of equipment shutdown procedures.	
09.24	Identify-safety related maintenance procedures.	
09.25	Selecting and use personal protective equipment (PPE).	
09.26	Explain the safety benefits of 6S work environment.	
09.27	Demonstrate knowledge of ergonomic impact of work techniques.	
09.28	Train other personnel to use equipment safely.	
09.29	Demonstrate knowledge of, and follow applicable safety laws and regulations and the environment (e.g., Occupational Safety and Health Administration (OSHA)).	
09.30	Apply Occupational Safety Health Administration (OSHA) safety standards properly.	

	09.31 Research and identify class A, B, and C type fires.	
	09.32 Demonstrate and apply the proper procedures for extinguishing class A, B, and C type fires.	
	09.33 Demonstrate knowledge of National Institute of Occupational Safety and Health (NIOSH), Environmental Protection Agency (EPA) and other regulatory agencies recommendations, guidelines and best practices.	
	09.34 Describe the Federal Law as recorded in (29 CFR-1910.1200).	
10.0	Demonstrate basic knowledge of industrial and manufacturing processes --The student will be able to:	
	10.01 Demonstrate knowledge of the use of current manufacturing processes as related to the welding industry.	
	10.02 Demonstrate an understanding of the importance and impact of routine maintenance of machines and equipment.	
	10.03 Understand the processes of separating, forming, conditioning, fabricating, and finishing of materials.	
	10.04 Identify and classify manufacturing systems into types, such as customized production, batch production, and continuous production.	
	10.05 Explain the difference between primary and secondary manufacturing processes.	
11.0	Describe and identify metals and their properties accurately --The student will be able to:	
	11.01 Describe and understand the steelmaking process.	
	11.02 Describe and understand the differences between ferrous and nonferrous metals.	
	11.03 Describe and understand casting, alloys and forging.	
	11.04 Identify and understand metallurgical processes related to metals such as galvanized iron and steel, aluminum stainless steel, sheet metal, copper and brass.	
	11.05 Identify, understand, and describe thermal properties of metals.	
	11.06 Identify and describe common gages, shapes and dimensions of metals.	
12.0	Demonstrate basic knowledge of drawing and interpreting welding symbols--The student will be able to:	
	12.01 Interpret and understand basic elements of a drawing or sketch.	
	12.02 Interpret basic welding symbol information.	
	12.03 Design and create a drawing using basic welding symbology.	
	12.04 Identify a specified weld using a welding symbol.	
	12.05 Draw welding symbols using given variables.	
13.0	Apply basic oxyfuel gas cutting principles and practices--The student will be able to:	
	13.01 Perform external inspections of equipment and accessories.	
	13.02 Make minor repairs to equipment and accessories.	

	13.03 Set up manual OFC operations for plain carbon steel.	
	13.04 Operate manual oxyfuel cutting equipment.	
	13.05 Perform straight cutting operations using manual oxyfuel cutting process on plain carbon steel.	
14.0	Create a product using basic oxyfuel gas cutting principles and practices--The student will be able to:	
	14.01 Design and create a basic work of art utilizing material and skills developed.	
	14.02 Produce a custom product.	
	14.03 Create and deliver a presentation to communicate project results to other teams.	

Course Number: PMT0071 **Occupational Completion Point: C (2 of 2)** **Welder Assistant 2 – 150 Hours – SOC Code 51-9198**	**National Standards**
Course Description: The Welder Assistant 2 course is designed to build on the skills and knowledge students learned in Welder Assistant 1 for entry into the welding industry. Students explore career opportunities and requirements of a professional welder. Content emphasizes beginning skills key to the success of working in the welding industry. Students study drawings and welding symbols, intermediate oxyfuel gas cutting practices, plasma arc cutting principles, and basic shielded metal arc welding (SMAW). *Note: This course is pending alignment in the following categories: National Standards*	
15.0 Apply knowledge of drawing and interpreting welding symbols--The student will be able to:	
15.01 Interpret, understand, and apply elements of a drawing or sketch.	
15.02 Interpret, understand, and apply welding symbol information.	
15.03 Design and create a drawing using welding symbology.	
15.04 Identify a specified weld using a welding symbol.	
15.05 Draw welding symbols using given variables.	
15.06 Use and apply appropriate mathematical practices to the design and creation of drawings using welding symbols.	
16.0 Apply intermediate oxyfuel gas cutting principles and practices--The student will be able to:	
16.01 Apply intermediate manual oxyfuel gas cutting skills.	
16.02 Perform shape cutting operations on plain carbon steel.	
16.03 Perform bevel cutting operations on plain carbon steel.	
16.04 Remove weld metal on plain carbon steel using weld washing techniques.	

	16.05 Apply machine oxyfuel gas cutting (track burner) skills.	
	16.06 Perform safety inspections of equipment and accessories.	
	16.07 Make minor external repairs to equipment and accessories.	
	16.08 Set up for plain carbon steel machine OFC (track burner) operations.	
	16.09 Operate machine oxyfuel gas cutting (track burner) equipment.	
	16.10 Perform straight cutting operations on plain carbon steel.	
	16.11 Perform bevel cutting operations on plain carbon steel.	
17.0	Demonstrate plasma arc cutting principles and practices--The student will be able to:	
	17.01 Apply Manual Air (Carbon Arc Gouging) and Cutting (CAC-A) skills.	
	17.02 Perform safety inspections of equipment and accessories.	
	17.03 Make minor external repairs to equipment and accessories.	
	17.04 Set up manual air carbon arc gouging and cutting operations.	
	17.05 Operate manual air carbon arc cutting equipment.	
	17.06 Perform metal removal operations.	
	17.07 Apply manual Arc Gouging and Arc Cutting (AC) skills.	
	17.08 Make minor repairs to equipment and accessories.	
	17.09 Set up for using plasma arc cutting operations.	
	17.10 Operate manual plasma arc cutting equipment.	
	17.11 Perform shape cutting operations using plasma arc cutting process.	
18.0	Demonstrate a basic understanding of shielded metal arc welding (SMAW)--The student will be able to:	
	18.01 Perform external inspections of SMAW equipment and accessories.	
	18.02 Make minor repairs to SMAW equipment and accessories.	
	18.03 Set up shielded metal arc welding operations on plain carbon steel.	
	18.04 Operate shielded metal arc welding equipment.	
	18.05 Make pad welds, all positions, on plain carbon steel.	
19.0	Create a product using oxyfuel gas cutting and introductory shielded metal arc welding (SMAW) principles and practices.--The student will be able to:	
	19.01 Design and create a work of art utilizing material and skills learned.	

19.02	Create a working drawing or blue print using welding symbols learned.	
19.03	Design a custom product from a working drawing or blue print created.	
19.04	Fabricate a custom product using the skills learned related to oxyfuel gas cutting and introductory shielded metal arc welding (SMAW).	
19.05	Create and deliver a presentation to communicate project results.	

Course Number: TRA0086
Occupational Completion Point: D
Tractor Operator – 150 Hours – SOC Code 47-2073

Course Description:
The Tractor Operator course is designed to build on the skills and knowledge students learned in the Heavy Equipment Maintenance Technician course for entry into the Heavy Equipment Operations industry. Content emphasizes beginning skills and concepts as a recommended requisite. Students study pneumatic and crawler-type tractor operations.

20.0	Operate pneumatic and crawler-type tractor with attachments--The student will be able to:
20.01	Move, level, and spread top soil.
20.02	Remove stumps.
20.03	Pile debris for burning.
20.04	Remove and replace dozer blade.
20.05	Remove and replace bucket.
20.06	Attach cutting teeth as needed.
20.07	Safely load dump trucks.

Course Number: TRA0080
Occupational Completion Point: E
Tractor Trailer Truck Driver – 320 Hours – SOC Code 53-3032

Course Description:
The Tractor Trailer Truck Driver course prepares students for entry into the trucking and logistics industry. Students explore career opportunities and requirements of a professional tractor trailer driver. Students study vehicle safety, accident prevention, operating regulations, cargo handling, documentation procedures, pre-trip preparation, vehicle inspection, maintenance, service, control procedures, backing, coupling, uncoupling, maneuvering, road and hazardous driving skills, and licensing requirements.

21.0	Understand vehicle safety and accident prevention procedures--The student will be able to:
21.01	Understand, identify and explain the use of vehicle safety equipment.
21.02	Understand the use of fire extinguishers.
21.03	Utilize seat belts and personal protection gear appropriate to type of operation.

	21.04	Demonstrate safe lifting procedures through use of hands-on labs or through viewing safety video.
	21.05	Describe personal safety equipment and procedures.
	21.06	Describe actions applicable for vehicle accidents.
	21.07	Complete reports in a classroom activity.
	21.08	Understand accident reporting requirements (company, state, federal).
	21.09	Identify all information needed for accident reports to the State, the employer and the insurance company.
	21.10	Complete an accident report.
	21.11	Describe procedures for protecting the scene of an accident.
	21.12	Describe personal liability requirements.
	21.13	Identify hazardous road conditions that are a potential threat to the safety of the truck driver.
	21.14	Describe activities and characteristics of other road users that make them potentially dangerous.
	21.15	Describe the potential consequences of excessive speed.
	21.16	Describe the potential consequences of use of drugs or alcohol.
	21.17	Describe and demonstrate safety procedures for entering and exiting vehicles.
22.0	Understand and comply with vehicle operating regulations--The student will be able to:	
	22.01	Understand and comply with Hours of Service regulations.
	22.02	Maintain a complete, neat and accurate driver's duty status log including discussion of electronic logs.
	22.03	Keep accurate records required by hours of service regulations.
	22.04	Perform mathematical calculations necessary to recap and apply totals to the hours of service regulations.
	22.05	Determine driving hours remaining on a particular day or tour of duty.
	22.06	Understand and comply with applicable United States Department of Transportation regulations including Federal Motor Carrier Safety Administration rules and regulations - Compliance, Safety, and Accountability (CSA) particularly the role of drivers and motor carriers.
	22.07	Understand and comply with Federal, State and local traffic laws including restrictions on vehicle size and weight including permits when required.
23.0	Demonstrate proper cargo handling and documentation procedures--The student will be able to:	
	23.01	Understand how to load and unload cargo safely and efficiently.
	23.02	Understand legal gross weight and axle weight.
	23.03	Describe cargo load to meet legal weight and safety requirements.
	23.04	Understand how to secure cargo using blocking, bracing, packing, rope, cable, chains and strapping.

	23.05	Identify types of hazardous cargoes.
	23.06	Understand the placement of placards when carrying hazardous materials.
	23.07	Understand procedure for use of common cargo handling equipment, including pallets, jacks, dollies, hand trucks, nets, slings, poles and other equipment.
	23.08	Understand categories of hazardous materials and the need for specialized training to handle hazardous materials.
	23.09	Understand hazardous materials documentation requirements.
	23.10	Verify nature, amount and condition of cargo on both pickup and delivery.
	23.11	Verify information on bill of lading and properly record and report discrepancies and damage to the cargo.
	23.12	Verify appropriate signatures on delivery receipts and other required forms.
	23.13	Prepare a bill of lading/manifest.
	23.14	Verify door seal number against shipping document.
	23.15	Describe the handling of C.O.D. shipments.
	23.16	Comply with port of entry or exit and other inspection station procedures.
24.0	Demonstrate trip planning preparation procedures--The student will be able to:	
	24.01	Check vehicle registration and permit.
	24.02	Check accident report packets for proper contents.
	24.03	Plan a route from one point to another that is optimal in terms of travel time, fuel costs, potential hazards and federal, state and local travel restrictions.
	24.04	Describe the use of manual and contemporary GPS navigation systems.
	24.05	Arrange to secure permits required by the nature of the vehicle, its cargo and route to be traveled.
	24.06	Arrange a secure place for vehicle on layovers, especially when transporting hazardous materials.
	24.07	Demonstrate map reading skills.
	24.08	Estimate travel time and plan rest stops and layovers.
	24.09	Estimate fuel consumption and plan fuel stops.
	24.10	Estimate expense money and obtain funds and/or credit cards.
25.0	Demonstrate vehicle inspection procedures--The student will be able to:	
	25.01	Check for previous days DVIR.
	25.02	Check general appearance and condition of vehicle.
	25.03	Check fuel, oil, water levels and automatic transmission fluid level and diesel emissions fluid (DEF).

	25.04	Check signal lights, stop lights and running lights.
	25.05	Check tires, rims and suspension.
	25.06	Check horn, windshield wipers, mirrors and reflectors.
	25.07	Check fifth wheel, trailer hook-up and brake lines.
	25.08	Check emergency bi-directional reflective triangles and fire extinguishers.
	25.09	Check instruments for normal readings.
	25.10	Check steering system, brake action and tractor protection valve.
	25.11	Check cargo-blocking, bracing and tie down.
	25.12	Perform enroute inspections.
	25.13	Perform post-trip inspection of vehicle and all systems.
26.0	Perform vehicle maintenance and servicing procedures--The student will be able to:	
	26.01	Describe function and operation of principle vehicle systems including, engine, engine auxiliary brake, drive train, coupling, suspension and electrical system, DEP engines, and regeneration processes where applicable.
	26.02	Check engine fuel, oil, coolant, battery and filters.
	26.03	Check tire air pressure.
	26.04	Check for proper tire and wheel mounting.
	26.05	Drain moisture from air brake supply reservoirs.
	26.06	Check brakes and related systems.
	26.07	Clean and repair lights.
	26.08	Check fuses and reset circuit breakers.
	26.09	Clean interior and exterior of vehicle.
	26.10	Check mud/rain flaps.
	26.11	Check and adjust tandem and fifth-wheel slides, if so equipped.
27.0	Demonstrate basic vehicle control procedures--The student will:	
	27.01	Place transmission in neutral before starting engine.
	27.02	Start, warm up and shut down the engine, according to the manufacturer's specifications.
	27.03	Build full pressure (90-120 PSI) in air tanks or to governed cut-out.
	27.04	Test parking brake and service brake before moving/driving vehicle.
	27.05	Coordinate use of accelerator and clutch to achieve smooth acceleration and avoid clutch abuse.

	27.06	Maintain proper engine RPM while driving.
	27.07	Properly modulate air brakes to bring vehicle to a smooth stop.
	27.08	Properly shift up and down through all gears using clutch.
	27.09	Double clutch non-synchronized transmissions and time shift for smooth and fuel efficient performance.
	27.10	Select proper gear for speed and highway conditions.
	27.11	Operate manual, automatic and semiautomatic transmissions as available training equipment allows.
	27.12	Coordinate steering, braking and acceleration to take the vehicle through a desired path forward and backward in a straight line.
	27.13	Adequately judge the path trailer will take (off tracking) as vehicle negotiates left or right curves and turns.
	27.14	Use clutch and gears to maintain proper operating range/power/RPM of the motor while slowing the vehicle.
	27.15	Park the vehicle, set brakes and shut off the engine.
	27.16	Properly chock/block wheels where and when required.
28.0	Demonstrate backing skills and basic vehicle maneuvers--The student will:	
	28.01	Check area before and during backing.
	28.02	Properly utilize guides and mirrors.
	28.03	Properly back in straight line and curved paths.
	28.04	Properly back into an alley dock.
	28.05	Back 100 feet through an alley.
	28.06	Make proper straight in approach during offset backing maneuvers.
	28.07	Properly position unit for backing into a loading dock.
	28.08	Properly back to a dock. (actual or simulated)
	28.09	Properly stop unit within 36 inches of the dock without contacting dock. (actual or simulated)
	28.10	Properly Parallel Park.
	28.11	Judge side, rear and overhead clearances and path of the trailer.
	28.12	Make a straight-in approach to an alley.
	28.13	Drive forward through an alley for 100 feet.
29.0	Demonstrate coupling and uncoupling skills—The student will be able to:	
	29.01	Reverse-steer and articulate a vehicle.
	29.02	Align the tractor properly to connect with trailer.

	29.03	Back and secure the tractor properly into the trailer kingpin without damage.
	29.04	Perform tug test against the locking mechanisms and visual checks to make sure coupling is secure.
	29.05	Connect electrical and air lines properly.
	29.06	Set in-cab air brake controls properly.
	29.07	Retract and secure landing gear after coupling is secure.
	29.08	Properly uncouple and secure the trailer.
30.0	Demonstrate road driving skills--The student will be able to:	
	30.01	Carefully enter traffic from parked position.
	30.02	Use clutch and gears properly.
	30.03	Proceed from a stopped position without rolling backward.
	30.04	Use mirrors properly.
	30.05	Signal intention to turn well in advance of turn.
	30.06	Get into proper lane to turn well in advance of turn.
	30.07	Check traffic conditions and turn only when intersection is clear.
	30.08	Restrict traffic from passing on right when preparing to complete a right hand turn. Maintain 3 feet or less on right side of vehicle.
	30.09	Execute a right hand turn maintaining 3 feet or less on right side of vehicle.
	30.10	Complete a turn promptly and safely and not impede other traffic.
	30.11	Select and shift to proper gear prior to beginning any turn.
	30.12	Obey all traffic signals.
	30.13	Plan stop in advance and adjust speed correctly.
	30.14	Use brakes properly on grades.
	30.15	Plan stops far enough in advance to avoid hard braking.
	30.16	Stop clear of crosswalks.
	30.17	Come to a complete stop at all stop signs.
	30.18	Yield right of way at intersections having yield signs.
	30.19	Check for cross traffic regardless of traffic signals.
	30.20	Approach all intersections prepared to stop if necessary.
	30.21	Stop a minimum of 15 feet but not more than 50 feet before railroad grade crossing if stop is necessary.

30.22	Select proper gear to avoid shifting gears on railroad grade crossing.
30.23	Determine sufficient space required for passing.
30.24	Pass only in safe locations.
30.25	Pass on two-lane highway.
30.26	Pass on four or more lane highway.
30.27	Signal lane changes before and after passing.
30.28	Pass only when appropriate to avoid impeding other traffic.
30.29	Return to right lane promptly, but only when safe to do so.
30.30	Observe speed limits.
30.31	Adjust speed properly to road, weather and traffic conditions.
30.32	Slow down in advance of curves, danger zones and intersections.
30.33	Maintain consistent speed where possible.
30.34	Yield right of way.
30.35	Allow faster traffic to pass.
30.36	Understand or demonstrate the proper procedures for navigating a weigh station.
30.37	Use horn only when necessary.
30.38	Park only in legally permissible parking areas.
30.39	Check instruments at regular intervals.
30.40	Maintain proper engine RPM while driving.
30.41	Determine minimum front-to-rear distances when following other vehicles using industry recognized standards.
31.0	Demonstrate hazardous driving skills--The student will be able to:
31.01	Understand preparation for operation in cold weather.
31.02	Demonstrate proper procedure for expelling moisture from the air tanks after each trip.
31.03	Understand proper procedure for checking ice accumulation on brakes, slack adjuster, air hoses, electrical wiring and radiator shutters during operation.
31.04	Perform operational adjustments necessary to maintain control in all weather conditions, including speed selection, braking and following distance.
31.05	Describe procedures to check safe operation of brakes after driving through deep water.
31.06	Perform proper use of windshield wipers, washers and defrosters to maintain visibility.

	31.07	Observe and evaluate changing road surface conditions.
	31.08	Demonstrate or understand ability for recognizing conditions that produce low traction, including initial rainfall, ice, snow and mud.
	31.09	Describe and understand procedures to avoid skidding and jackknifing.
	31.10	Understand procedures to avoid hydroplaning and describe the road and vehicle conditions that produce it.
	31.11	Understand procedures for mounting and dismounting tire chains.
	31.12	Understand procedures for extricating the vehicle from snow, sand and mud by maneuvering or towing.
	31.13	Demonstrate ability to adjust rate of change in speed and direction to accommodate road conditions to avoid skidding.
	31.14	Describe procedures required to coordinate acceleration and shifting to overcome the resistance of snow, sand and mud.
	31.15	Demonstrate ability to perform brake checks on equipment prior to mountain driving.
	31.16	Understand procedures required to use right lane or special truck lane going up grades.
	31.17	Understand procedures required to place transmission in appropriate gear for engine braking before starting downgrade.
	31.18	Understand procedures required to use proper braking techniques and maintain proper engine braking before starting downgrades.
	31.19	Understand proper use of truck escape ramp when brakes fail on a downgrade.
	31.20	Understand procedure required for observing temperature gauge frequently when pulling heavy loads up long grades.
	31.21	Understand the effect of vehicle weight and speed upon braking and shifting ability on long downgrades.
	31.22	Identify the meaning and use of percent of grade signs.
	31.23	Understand bringing the truck to a stop in the shortest possible distance while maintaining directional control on a dry surface.
	31.24	Understand procedures to make an evasive turn off the roadway and return to the roadway while maintaining directional control.
	31.25	Understand procedures to bring the vehicle to a stop in the event of a brake failure.
	31.26	Understand procedures to maintain control of the vehicle in the event of a blowout.
	31.27	Understand procedures to bring truck to a stop in the shortest possible distance while maintaining directional control when operating on a slippery surface.
	31.28	Understand procedures to recover from vehicle skids induced by snow, ice, water, oil, sand, wet leaves or other slippery surfaces.
	31.29	Understand procedures to counter steer out of a skid in a way that will regain directional control and not produce another skid.
	31.30	Understand procedure to operate brakes properly to provide maximum braking without loss of control.
32.0	Apply concepts learned for obtaining a Commercial Driver's License (CDL)--The student will be able to:	
	32.01	Demonstrate competence in performing basic Commercial Vehicle Driving skills utilizing the CDL testing criteria.
	32.02	Demonstrate understanding and knowledge of Commercial Vehicle Driving Laws as required, to safely and legally operate a commercial vehicle.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

Florida SkillsUSA is the intercurricular career and technical student organization(s) 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.

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.

Basic Skills

In a Career Certificate Program 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: Computation (Mathematics) and Communications (Language 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, 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, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

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

Career Certificate Program		
Program Number	X600400	
CIP Number	0615170300	
Grade Level	30, 31	
Standard Length	600 Hours	
Teacher Certification	Refer to the **Program Structure** section.	
CTSO	SkillsUSA	
SOC Codes (all applicable)	47-2231 - Solar Photovoltaic Installers 49-9099 - Installation, Maintenance and Repair Workers, All Other	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communication (Reading Language Arts): 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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

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

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.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	EEV0205	Solar Photovoltaic Design Installation and Maintenance Helper	ELECTRICAL @7 7G AC HEAT ME @7 7G	150 Hours	49-9099
B	EEV0206	Solar Photovoltaic Design, Installation and Maintenance Technician	BLDG MAINT @7 7G BLDG CONST @7 7G TEC CONST @7 7G	450 Hours	47-2231

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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 Demonstrate mathematics knowledge and skills.
06.0 Demonstrate science knowledge and skills.
07.0 Explain the importance of employability and entrepreneurship skills.
08.0 Identify, use and maintain the tools used in the industry.
09.0 Adapt a PV design.
10.0 Conduct a site assessment.
11.0 Read and interpret basic blueprints, job specifications and codes.
12.0 Demonstrate a practical knowledge of basic electricity skills and electrical components.
13.0 Install PV systems.
14.0 Install operation and identification tags and labels.
15.0 Perform a system checkout.
16.0 Maintain and troubleshoot a solar PV system.
17.0 Layout and coordinate a job.
18.0 Install solar collectors.
19.0 Demonstrate knowledge of PV and electrical wiring.
20.0 Install PV and electrical wiring.

Florida Department of Education
Student Performance Standards

Program Title: Solar Photovoltaic System Design, Installation and Maintenance – Entry Level
Career Certificate Program 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.
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	Describe "Right-to-Know" Law as recorded in (29 CFR-1910.1200).
01.10	Explain the law that describes the Material Safety Data Sheet (MSDS).
02.0	Identify systems and their components--The student will be able to:
02.01	Identify and compare active and passive solar systems and their components.
02.02	Understand the concept of solar domestic hot water and pool systems.
02.03	Identify components for solar domestic hot water and pool systems.
02.04	Compare open loop, closed loop and drain back solar thermal systems.

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 changes in business or industry that are considered to be “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 Describe and calculate energy efficiency.
	04.06 Define biodegradable materials.
	04.07 Describe the benefits of reducing, reusing and recycling materials.
	04.08 Identify the incentives being offered for “going green”.
05.0	Demonstrate mathematics knowledge and skills--The students will be able to:
	05.01 Read and interpret measuring devices.
	05.02 Demonstrate knowledge of arithmetic operations.

	05.03	Operate a calculator.
	05.04	Use standard metric units related to the industry.
	05.05	Convert inches to millimeters and millimeters to inches.
	05.06	Analyze and apply data and measurements to solve problems and interpret documents.
	05.07	Measure size within a specified tolerance.
	05.08	Add, subtract, multiply and divide using fractions, decimals and whole numbers.
	05.09	Determine the correct sales price of a job, to include sales tax for a materials list containing a minimum of six items.
	05.10	Construct charts/tables/graphs using functions and data.
06.0	Demonstrate science knowledge and skills--The students will be able to:	
	06.01	Discuss the role of creativity in constructing scientific questions, methods and explanations.
	06.02	Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.
	06.03	Understand chemical reaction of a battery in use.
	06.04	Understand chemical reaction of a battery under charging.
	06.05	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.
07.0	Explain the importance of employability and entrepreneurship skills--The students will be able to:	
	07.01	Identify and demonstrate positive work behaviors needed to be employable.
	07.02	Develop personal career plan that includes goals, objectives and strategies.
	07.03	Examine licensing, certification and industry credentialing requirements.
	07.04	Maintain a career portfolio to document knowledge, skills and experience.
	07.05	Evaluate and compare employment opportunities that match career goals.
	07.06	Identify and exhibit traits for retaining employment.
	07.07	Identify opportunities and research requirements for career advancement.
	07.08	Research the benefits of ongoing professional development.

	07.09 Examine and describe entrepreneurship opportunities as a career planning option.
08.0	Identify, use and maintain the tools used in the industry--The student will be able to:
	08.01 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
	08.02 Demonstrate the procedures/techniques for the selection, use, care and storage of tools and equipment.
	08.03 Identify tools and equipment and the safety hazards associated with them.

Course Number: EEV0206 **Occupational Completion Point: B** **Solar Photovoltaic Design, Installation and Maintenance Technician – 450 Hours – SOC Code 47-2231**	
09.0	Adapt a PV design--The student will be able to:
	09.01 Determine stand-alone system components' location and system layout and configuration.
	09.02 Determine grid tie system components' location and system layout and configuration.
	09.03 Determine PV system components' location and system layout.
	09.04 Determine tracking and non-tracking system components' location and system layout and configuration.
	09.05 Apply for building permits.
	09.06 Estimate time, materials, tools and labor required for installation.
	09.07 Determine installation sequence to optimize use of time and materials.
	09.08 Inspect all provided system components for damage prior to installation.
10.0	Conduct a site assessment--The student will be able to:
	10.01 Determine the required installation area, orientation and tilt for proposed collector installation.
	10.02 Establish whether there is suitable installation area with unobstructed solar access for installing collector.
	10.03 Determine the extent of current and future shading for any proposed collector location using typical sun path calculators or similar methods.
	10.04 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.)

10.05	Practice all personal safety requirements.
10.06	Identify any other constraints and options for the installation related to local and state code requirements.
10.07	Verify that system to be installed is appropriate for the building and climate.
10.08	Verify with the homeowner the proposed location of the collector and other major components.
11.0	Read and interpret basic blueprints job specifications and codes--The student will be able to:
11.01	Read and interpret measuring devices.
11.02	Draw and interpret basic wiring diagrams.
11.03	Identify the basic symbols used in the electrical trade.
11.04	Read and interpret manufacturers' schematics and specifications.
11.05	Describe the importance of following the local, state and national codes regarding article 690.
11.06	Read and interpret current standards and codes for PV systems and electrical systems.
11.07	Read and interpret basic building codes in the electrical industry.
11.08	Recognize and identify PV and electrical symbols.
11.09	Identify basic electrical systems from the blueprint.
11.10	From the blueprints and specifications, identify the electrical equipment and materials required for the electrical job.
11.11	Relate the blueprint to all applicable (local, state and federal) PV and electrical codes.
12.0	Demonstrate a practical knowledge of basic electricity skills and electrical components--The student will be able to:
12.01	Explain the principles of electricity.
12.02	Explain single- and three-phase power distribution.
12.03	Define and explain watts, ohms, volts and amps.
12.04	Identify and explain electrical measuring tools and devices.
12.05	Explain the standards for and ways to measure watts, resistance, voltage and amperage, using appropriate instruments or devices.
12.06	Identify and explain appropriate electrical wiring symbols.

	12.07 Draw and explain a wiring schematic diagram for a control system.
	12.08 Create a wiring schematic for a solar photovoltaic system, using all components and symbols for safe and effective operation and interpretation.
	12.09 Explain codes and standards and safety requirements for working with necessary electrical components.
	12.10 Troubleshoot protection devices, such as fuses and breakers.
	12.11 Interpret tables and charts from the National Electrical Codes (NEC).
13.0	Install PV systems--The student will be able to:
	13.01 Determine the location of the PV modules.
	13.02 Design and install series and parallel circuits.
	13.03 Install photovoltaic modules.
	13.04 Install a PV mounting system.
	13.05 Install DC and AC wiring.
	13.06 Select ultraviolet radiation protective method for external wiring.
	13.07 Protect external wiring from ultraviolet degradation.
	13.08 Test operation of DC components.
	13.09 Test operation of AC components.
	13.10 Determine the area for the electrical equipment and batteries.
14.0	Install operation and identification tags and labels--The student will be able to:
	14.01 Determine components that require identification tag and/or label as per National Electric Code (NEC).
	14.02 Install identification tags and/or label as per NEC.
15.0	Perform a system checkout--The student will be able to:
	15.01 Identify any deficiencies in materials, workmanship, function or appearance by visually inspecting entire installation.
	15.02 Determine that the system mechanical installation has structural integrity.
	15.03 Determine that the system PV installation is correctly installed.

	15.04 Determine that the electrical installation is correctly installed.
	15.05 Verify system start-up and shut-down functionality.
	15.06 Verify overall system operation and functionality.
	15.07 Demonstrate to the owner operation and functionality of system.
	15.08 Demonstrate to the owner start-up and shut-down procedures for system.
	15.09 Demonstrate to owner simple maintenance and diagnostic procedures.
	15.10 Identify for owner all markings and labels for system service and owner interaction.
	15.11 Identify for owner safety issues associated with operation and maintenance of system.
	15.12 Complete and transfer documentation package to system owner/operators.
	15.13 Review system/component warranties and requirements with owner.
16.0	Maintain and troubleshoot a solar PV system--The student will be able to:
	16.01 Demonstrate proficiency in using tools and materials required for maintenance and troubleshooting.
	16.02 Interpret installation manual, wiring diagrams, drawings and other specifications to plan maintenance or repair work.
	16.03 Determine evaluation points for system monitoring, maintenance and troubleshooting (i.e., batteries, PV modules).
	16.04 Identify cause of problems based on evaluation results.
	16.05 Determine what repairs or system modifications are needed to restore the system to its baseline operating conditions.
	16.06 Perform any identified repairs or modifications to restore system to manufacturer’s or operator’s satisfaction.
17.0	Layout and coordinate a job--The student will be able to:
	17.01 Identify specifications.
	17.02 Make a list of materials required to lay out a job.
	17.03 Determine the work aids required and the sequence of installations, according to building plans, specifications and working drawings.
18.0	Install solar collectors--The student will be able to:
	18.01 Identify manufacturer mounting product specifications and materials.

	18.02 Identify typical roof attachment details (designs).
	18.03 Identify different collector mounting methods suitable for roof types or other installation areas.
	18.04 Identify different system (due to extra weight and components) mounting methods suitable for roof type.
	18.05 Identify locations for roof/wall, foundation penetrations and structural attachments.
	18.06 Evaluate the suitability of selected mounting structural attachments and compliance with applicable local codes.
	18.07 Determine array layout for roofs with multiple installation locations.
	18.08 Install racking systems.
	18.09 Tilt PV modules for maximum output.
	18.10 Attach mounting bracket and struts (if required) to collector.
	18.11 Connect PV system at point of interconnection.
19.0	Demonstrate knowledge of PV and electrical wiring--The student will be able to:
	19.01 Describe and explain the purpose of PV and electrical codes.
	19.02 Apply electrical PV theory and principles to corresponding sections of the codes.
	19.03 Read and locate information in the applicable PV and electrical codes.
	19.04 Define and explain the terms used in the PV and electrical codes.
	19.05 Explain why the code may supersede the manufacturer's specifications.
20.0	Install PV and electrical wiring--The student will be able to:
	20.01 Install conduit, types of and fittings.
	20.02 Install equipment grounding.
	20.03 Select PV mounting solutions for various applications.
	20.04 Install roof mounting hardware.
	20.05 Install rail systems.
	20.06 Determine conductor ampacity.

20.07	Determine ampacity correction factors.
20.08	Calculate conductor fill in conduits.
20.09	Estimate residential loads.
20.10	Determine how voltage drop is calculated.
20.11	Determine how to calculate conductor ambient temperature changes.
20.12	Calculate box fill.
20.13	Install DC over current protection.
20.14	Install AC over current protection.
20.15	Install Transient Volt Surge Suppresser (TVSS) protection.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

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.

Basic Skills (if applicable)

In a Career Certificate Program 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: Computation (Mathematics) and Communications (Language 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, 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, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

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

Career Certificate Program		
Program Number	Pending	
CIP Number	Pending	
Grade Level	30, 31	
Standard Length	1,200	
Teacher Certification	Refer to the **Program Structure** section.	
CTSO	SkillsUSA	
SOC Codes (all applicable)	49-9041 - Industrial Machinery Mechanics 49-9071 - Maintenance and Repair Workers 51-8013 - Power Plant Operators	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communication (Reading Language Arts): 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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

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

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.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	EEV0140	Turbine Generator Maintenance Tech I	TEC CONSTR @7 7G MILLWRIGHT 7 G BLDG CONST @7 7G IND ENGR 7 G	400 Hours	49-9071
B	EEV0141	Turbine Generator Maintenance Tech II		400 Hours	49-9041
C	EEV0142	Turbine Generator Maintenance Mechanic		400 Hours	51-8013

Common Career Technical Core – Career Ready Practices

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2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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 Read plans and drawings and identify basic turbine generator nomenclature.
06.0 Recognize turbine and generator components and subcomponents and describe their function.
07.0 Plan a turbine generator component inspection.
08.0 Use turbine generator tooling to maintain and make repairs to Hy-Torq, impact and other hydraulic tools.
09.0 Demonstrate application of lubricants and lubricating systems.
10.0 Explain the various fastening mechanisms used on turbine and generator components.
11.0 Demonstrate tightening operations on high pressure flanges and cylinders.
12.0 Remove galled bolting and repair of damaged threads.
13.0 Disassemble and reassemble high speed turbines and generators.
14.0 Perform machine-shop operations.
15.0 Demonstrate piping and tubing systems.
16.0 Understand basic operation of a steam turbine and generator.
17.0 Perform pump maintenance and repair.
18.0 Prepare for machinery startup.
19.0 Perform measuring and rotor alignment operations.
20.0 Demonstrate Predictive-Preventive-Maintenance (PPM) technologies using a borescope.
21.0 Perform failure analysis.
22.0 Generate machine improvements and maintenance management.
23.0 Perform bench work skills including breakdown and inspection of control valve components.
24.0 Perform non-destructive examination of turbine components.
25.0 Understand principals of generator operation and testing.
26.0 Troubleshoot hydraulic systems.
27.0 Apply vibration-analysis skills.
28.0 Perform machinery balancing.

Florida Department of Education
Student Performance Standards

Program Title: Turbine Generator Maintenance, Inspection and Repair
Career Certificate Program Number: X600500

Course Number: EEV0140 **Occupational Completion Point: A** **Turbine Generator Maintenance Tech I – 400 Hours – SOC Code 49-9071**	
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.
01.02	Explain emergency procedures to follow in response to workplace accidents.
01.03	Perform Lock-Out-and-Tag-Out (LOTO) procedures. Understand why a LOTO system is necessary and your responsibilities in utilizing the system.
01.04	Identify Occupational Safety and Health Administration (OSHA) and Mine Safety Health Administration (MSHA) requirements and procedures.
01.05	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:
02.01	Explain the standards of measurement and the impact of action and working forces, including tension, compression, torque and shear.
02.02	Identify the principles and laws of motion and explain how they affect acceleration and deceleration.
02.03	Explain the relationship of work, power and energy and the Rankine Cycle.
02.04	Explain the operation of simple machines, including the lever, inclined plane, screw, wedge, wheel and axle, pulley and jacking screws.
02.05	Demonstrate rigging and lifting principals and perform simple load/lift calculations.
02.06	Describe the mechanical and chemical properties of materials commonly used in industry.
02.07	Explain the laws and conditions governing static and kinetic friction, the problems caused by friction and the effects of the angle of repose.
02.08	Explain molecular action as a result of temperature extremes, chemical reaction and moisture content.
02.09	Draw conclusions or make inferences from data.

	02.10 Develop a basic understanding of the steam turbine.
	02.11 Develop a basic understanding of the gas turbine.
	02.12 Develop a basic understanding of a turbo generator.
	02.13 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:
	04.01 Demonstrate knowledge of arithmetic operations.
	04.02 Analyze and apply data and measurements to solve problems and interpret documents.
	04.03 Convert measurements from English to metric and from metric to English units.
05.0	Read plans and drawings and identify basic turbine generator nomenclature--The student will be able to:
	05.01 Identify dimensions.
	05.02 Identify lists of materials and specifications.
	05.03 Identify section and detail views.
	05.04 Sketch and dimension a part.
	05.05 Disassemble and assemble parts using an exploded-view drawing.
	05.06 Identify dimensioning of radii, round holes, fillets and chamfers.

	05.07 Identify screw threads and bolt types.
	05.08 Apply dimensional tolerances.
06.0	Recognize turbine and generator components and subcomponents and describe their function--The student will be able to:
	06.01 Understand and explain a turbine generator outline drawing.
	06.02 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 and valves.
	06.03 Be able to identify and explain the function of subcomponents, e.g.: diaphragms, buckets/blades, bearing seals, valve seats, plugs, stems.
07.0	Plan the implementation of a turbine generator component inspection--The student will be able to:
	07.01 Develop and explain a plan (work package) for disassembly, inspection and reassembly of a turbine component, including;
	a. Tagging plan
	b. Inspection data sheets
	07.02 Develop a simple critical path schedule for the inspection of a turbine generator component.

Course Number: EEV0141 Occupational Completion Point: B Turbine Generator Maintenance Tech II – 400 Hours – SOC Code: 49-9041	
08.0	Use turbine generator tooling to maintain and make repairs to Hy-Torq, impact and other hydraulic tools--The student will be able to:
	08.01 Use turbine generator tooling for the following:
	a. Gas bolt heaters and induction heaters (explain)
	b. Tensioners (explain)
	c. Slugging wrenches
	d. Torque wrenches including multipliers
	e. Hydraulic jacks
	f. Rotor skid pan and rotor blocks
	08.02 Repair and maintain the following:

		a. Impact wrenches
		b. Hy-Torq heads (explain)
		c. Hydraulic pumps
09.0	Demonstrate application of lubricants and lubricating systems--The student will be able to:	
	09.01	Explain the functions of lubrication.
	09.02	Explain the properties of oil lubricants and the factors determining the selection of lubricants.
	09.03	Identify the types, advantages and functions of lubricant additives.
	09.04	Explain a typical turbine generator lube oil system and the various components associated with it.
	09.05	Identify areas of the turbine where grease would be applied and explain why.
	09.06	Explain the types of oil filtration used in turbine generator systems including strainers.
	09.07	Explain a cleanliness analysis of an oil sample.
10.0	Explain the various fastening mechanisms used on turbine and generator components--The student will be able to:	
	10.01	Explain the types of materials used to properly clamp steam and oil cylinders and flanges.
	10.02	Explain torque, stress, stretch, corrosion, galling and thread types.
11.0	Demonstrate tightening operations on high pressure flanges and cylinders--The student will be able to:	
	11.01	Explain the various types of tightening mechanisms that are used on turbine generators and auxiliary components.
	11.02	Explain the materials used for different flange tightening applications based on pressure and temperatures.
	11.03	Use appropriate tools for tightening and measuring tightening mechanisms.
	11.04	Explain the types of gaskets used in turbine generator applications and the advantage and disadvantage of each.
	11.05	Understand gasket compression and demonstrate proper assembly of various types of gaskets including neoprene, Garlock, corrugated metal, serrated and spiral wound.
	11.06	Measure and cut a gasket from a sheet of gasket material.
	11.07	Explain the different types of lubricants utilized on high temperature bolting including advantages and disadvantages.
	11.08	Demonstrate tightening principals including torque and bolt stretch and outside influences on each.

	11.09 Use various tightening tools.
12.0	Remove galled bolting and repair of damaged threads--The student will be able to:
	12.01 Determine the best alternative method of removing galled bolting based on the type of material and the location of the fastener.
	12.02 Understand safety requirements before initiating grinding or burning operations.
	12.03 Demonstrate proper setup of cutting torch and demonstrate ability to cut bolting from a cylinder case.
	12.04 Use grinding burrs to remove galled bolting.
13.0	Disassemble and reassemble high speed turbines and generators--The student will be able to:
	13.01 Understand all of the various lifting tools and devices used when disassembling a turbine generator.
	13.02 Interpret a rigging and lifting plan.
	13.03 Inspect and identify problems with lifting devices including slings (wire rope, nylon, Kevlar) and hoists/come-a-longs.
	13.04 Use a sling for lifting turbine generator components of various geometries.
	13.05 Understand lifting capabilities of slings and the relationship between angles and stress.
	13.06 Understand the function of a lifting beam and how to set up a load for proper lifting.
	13.07 Understand and demonstrate ability to remove a generator rotor from the stator.
	13.08 Understand necessity and the process for parts tagging and bagging.
	13.09 Understand storage requirements including protection of flange surfaces during outage duration.
	13.10 Understand process for protecting ingress of foreign objects into lubrication and steam systems.
	13.11 Explain rigging and lifting principals.
	13.12 Rig and lift a non-symmetrical turbine component.
	13.13 Disassemble and reassemble a steam piping flange.
	13.14 Use crane signals and demonstrate ability to communicate with team during a lift.
14.0	Perform machine-shop operations--The student will be able to:
	14.01 Demonstrate safety in performing machine-shop operations.

	14.02 Identify the types of cutting tools.
	14.03 Bore a hole to a specified size.
	14.04 Chase an external V-thread.
	14.05 Identify the different types of work-holding devices.
	14.06 Prepare metal for finishing.
	14.07 Set up, use and adjust an arbor press.
	14.08 Cut keyways with an end mill.
15.0	Demonstrate piping and tubing systems--The student will be able to:
	15.01 Identify the components of a piping system.
	15.02 Explain the maintenance considerations of metallic and nonmetallic piping systems.
	15.03 Describe the safety requirements for working with piping and tubing systems.
	15.04 Join copper tubing.
	15.05 Join common fittings.
	15.06 Join metallic piping.
16.0	Understand basic operation of a steam turbine and generator--The student will be able to:
	16.01 Understand transforming work from high pressure steam.
	16.02 Understand the difference between a reaction and impulse turbine.
	16.03 Understand means of controlling the turbine.
	16.04 Understand the difference between speed control and load control.
	16.05 Understand extraction in a cogeneration facility.
	16.06 Understand the use of overspeed devices.
17.0	Perform pump maintenance and repair--The student will be able to:
	17.01 Demonstrate the safety procedures for performing pump maintenance.

	17.02 Perform pump maintenance.
	17.03 Identify packing and seal requirements.
	17.04 Explain the operating principles of centrifugal, propeller and turbine rotary, reciprocating, diaphragm, positive placement and vacuum pumps.
	17.05 Disassemble and reassemble a pump.
18.0	Prepare for machinery startup--The student will be able to:
	18.01 Describe the requirements and precautions for machinery startup.
	18.02 Align machinery using wire line, transit, dial indicators, a computer and laser-alignment devices.
	18.03 Position and secure machinery on a foundation.
	18.04 Perform finish alignment and check for pipe stresses in machinery-maintenance applications.

Course Number: EEV0142
Occupational Completion Point: C
Turbine Generator Maintenance Mechanic – 400 Hours – SOC Code: 51-8013

19.0	Perform measuring and rotor alignment operations--The student will be able to:
	19.01 Demonstrate the safe use of hand tools such as wrenches, files, scrapers, taps, dies, torque wrenches, grinders and cutoff wheels.
	19.02 Use precision measuring devices such as inside and outside micrometers, depth gauges and dial indicators.
	19.03 Read micrometers.
	19.04 Select correct tools for metric and standard fasteners.
	19.05 Explain the types of misalignment and calculate the moves necessary to correct the misalignment.
	19.06 Set up dial indicators to perform a turbine generator coupling alignment check.
	19.07 Explain the purpose of a tight wire and how it is set up in a turbine.
	19.08 Take measurements from the wire to check alignment of the internal components.
20.0	Demonstrate Predictive-Preventive-Maintenance (PPM) technologies using a borescope--The student will be able to:
	20.01 Explain the use of infrared thermography.
	20.02 Explain the use of ultrasound technology.

	20.03 Explain the use of advanced alignment techniques.
	20.04 Demonstrate the use of one of the above predictive-maintenance procedures.
21.0	Perform failure analysis--The student will be able to:
	21.01 Explain the types of bearing failures.
	21.02 Explain the types of shaft fatigues and failures.
	21.03 Explain the types of lubrication breakdowns.
22.0	Generate machine improvements and maintenance management--The student will be able to:
	22.01 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
23.0	Perform bench work skills including breakdown and inspection of control valve components--The student will be able to:
	23.01 Identify and explain the various components of a turbine generator control system including hydraulic and electro hydraulic.
	23.02 Understand the importance and various types of material used for sealing control systems.
	23.03 Prepare for disassembling and inspecting a control mechanism.
	23.04 Understand the importance of cleanliness during the disassembly of a control mechanism.

	23.05 Explain how a control mechanism works and the critical measurement required to assure proper operation.
	23.06 Demonstrate proper removal and installation of hydraulic lines.
	23.07 Demonstrate proper installation and removal of thermocouples.
24.0	Perform non-destructive examination of turbine components--The student will be able to:
	24.01 Understand the various materials in a steam and gas turbine.
	24.02 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
	24.03 Identify the proper nondestructive testing technique for various turbine components.
	24.04 Understand the cleanliness standards and cleaning methods required on turbine components.
25.0	Understand principals of generator operation and testing--The student will be able to:
	25.01 Understand basic principal of electrical energy production.
	25.02 Basic understanding of excitation.
	25.03 Understand function of each major generator component:
	a. Core
	b. Rotor/Field
	c. Stator/Armature
	d. Exciter
	25.04 Understand the difference in megawatts and KVA.
	25.05 Understand electrical testing.
26.0	Troubleshoot hydraulic systems--The student will be able to:

	26.01 Explain the safety procedures for troubleshooting hydraulic systems.
	26.02 Read a hydraulic schematic.
	26.03 Explain hydraulic-system troubleshooting techniques.
	26.04 Repair and replace pumps and motors.
27.0	Apply vibration-analysis skills--The student will be able to:
	27.01 Explain the approximately 25 sources of vibration.
28.0	Perform machinery balancing--The student will be able to:
	28.01 Describe the safety requirements and precautions for balancing procedures and equipment.
	28.02 Identify the principles of static balancing.
	28.03 Perform a vector balance in the classroom.
	28.04 Identify balancing standards, ISO 1940 or equal.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Career and Technical Student Organization (CTSO)

SkillsUSA is the intercurricular 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.

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.

Basic Skills

In a Career Certificate Program 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: Computation (Mathematics) and Communications (Language 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, 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, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Florida Department of Education
Curriculum Framework

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

Career Certificate Program		
Program Number	X600600	
CIP Number	0715170101	
Grade Level	30, 31	
Standard Length	600 Hours	
Teacher Certification	Refer to the **Program Structure** section.	
CTSO	SkillsUSA	
SOC Codes (all applicable)	49-9099 - Installation, Maintenance, and Repair Workers, All Other	
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml	
Basic Skills Level	Computation (Mathematics): 9	Communications (Reading Language Arts): 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.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

This program is a planned sequence of instruction consisting of one occupational completion point.

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.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	ETP0090	Energy Technician 1	ELECTRICAL @7 7G IND ENGR 7G	300 hours	49-9099
	ETP0091	Energy Technician 2		300 hours	49-9099

Common Career Technical Core – Career Ready Practices

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

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 Explain electric power generation.
04.0 Explain electric power transmission.
05.0 Explain electric power distribution.
06.0 Identify and describe careers and entry requirements.
07.0 Evaluate and analyze emerging technologies in the energy industry.
08.0 Explain the importance of employability and entrepreneurship skills.
09.0 Explain the importance of health, safety, environmental stewardship and related regulatory compliance.
10.0 Identify, use and maintain the tools and accessories used in the electrical industry.
11.0 Demonstrate an understanding of basic Direct-Current (DC) electrical-circuit skills.
12.0 Apply mathematics knowledge and skills to electricity.
13.0 Demonstrate an understanding of basic electricity.
14.0 Read and interpret basic electric codes.
15.0 Discuss the value of alternative energy.
16.0 Investigate the viability of biomass and biofuel.
17.0 Investigate the use of nuclear power.
18.0 Investigate the use of solar energy.
19.0 Investigate the use of wind energy.
20.0 Apply further mathematics knowledge and skills to electricity.
21.0 Demonstrate further understanding of electricity.
22.0 Demonstrate science knowledge and skills related to electrical principles.

Florida Department of Education
Student Performance Standards

Program Title: **Energy Technician**
Career Certificate Program 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:
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	Explain 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 current and historical 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 explain the different lines of energy business, including electric and gas.
01.07	Describe the process of electric metering and billing for energy consumption.
01.08	Explain the differences between energy and power components of residential, commercial, industrial and institutional accounts including time of use rate structures.
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.osha.gov)
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	Understand the importance of 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 knowledge in first aid or first response procedures.
02.15	Demonstrate understanding and knowledge of lock out/ 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	Explain 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 various conventional electric power generation fuel sources (such as oil, coal, natural gas, hydroelectric power, uranium) and the cost, efficiency and environmental issues associated with each.
03.03	Identify alternative fuel sources (such as solar, wind, ocean wave, tidal, etc.) and alternative and renewable power generation technologies.
03.04	Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear, alternative and renewable).
04.0	Explain 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	Explain 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 explain what the various components do.
	05.04 Discuss 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 Compare careers available in the energy industry (e.g., technicians, line workers, plant/field operators, customer service representatives, engineers, IT/ cyber-security) and the educational pathways required.
	06.02 Describe general wage/salary, benefits and other advantages of careers in the energy industry.
07.0	Evaluate and analyze emerging technologies in the energy industry--The student will be able to:
	07.01 Discuss and explore emerging technologies within conventional sources of energy.
	07.02 Discuss and explore wind energy.
	07.03 Discuss and explore solar energy.
	07.04 Discuss and explore biomass energy.
	07.05 Discuss and explore distributed power generation.
	07.06 Identify and discuss current topics in the energy industry such as energy storage and supplemental distribution.
08.0	Explain the importance of employability and entrepreneurship skills--The student will be able to:
	08.01 Identify and demonstrate positive work behaviors needed to be employable. (Refer to 'Common Employability Skills for the Energy Industry'.)
	08.02 Develop personal career plan that includes goals, objectives and strategies.
	08.03 Examine licensing, certification and industry credentialing requirements.
	08.04 Maintain a career portfolio to document knowledge, skills and experience.
	08.05 Evaluate and compare employment opportunities that match career goals.
	08.06 Identify and exhibit traits for retaining employment.
	08.07 Identify opportunities and research requirements for career advancement.
	08.08 Research the benefits of ongoing professional development, including internships and externships.

	08.09 Examine and describe entrepreneurship opportunities as a career planning option.
09.0	Explain the importance of health, safety, environmental stewardship and related regulatory compliance--The student will be able to:
	09.01 Clean the work area and maintain it in a safe condition.
	09.02 Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
	09.03 Identify and operate workplace-safety electrical devices.
	09.04 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.
	09.05 Explain emergency procedures to follow in response to workplace accidents.
	09.06 Create a disaster and/or emergency response plan for specific incidences.
	09.07 Explain the importance of CPR (cardiopulmonary resuscitation) and first aid.
	09.08 Describe "Right-to-Know" Law as recorded in (29 CFR.1910.1200).
10.0	Identify, use and maintain the tools and accessories used in the electrical industry--The student will be able to:
	10.01 Identify and select tools, equipment, materials and wires to complete a job.
	10.02 Drill holes in metal, wood and concrete for electrical wiring.
	10.03 Lay out electrical devices, complying with regulations.
	10.04 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 equipment.
	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.
11.0	Demonstrate an understanding of basic Direct-Current (DC) electrical-circuit skills--The student will be able to:
	11.01 Define the following terms: voltage, current, resistance and power.
	11.02 Measure voltage, amperage and resistance using industry standard electrical measuring devices.
	11.03 Analyze and explain a series, series-parallel and parallel circuit.

11.04	Draw each type of circuit and calculate the circuit values.
11.05	Explain and apply Ohm's Law.
11.06	Compute conductance and resistance of conductors and insulators.
12.0	Apply mathematics knowledge and skills to electricity--The student will be able to:
12.01	Demonstrate knowledge of arithmetic operations.
12.02	Analyze and apply data and measurements to solve problems and interpret documents.
12.03	Construct charts/tables/graphs using functions and data.
13.0	Demonstrate an understanding of basic electricity--The student will be able to:
13.01	Explain the principles of electromagnetism.
13.02	Explain the magnetic properties of circuits and devices.
13.03	Relate electricity to the nature of matter.
13.04	Describe various ways that electricity is produced.
14.0	Read and interpret basic electric codes--The student will be able to:
14.01	Describe the importance of following the local, state and national electric codes.
14.02	Read and interpret basic electric codes, wiring plans and specifications.
14.03	Identify licensure requirements for electrical occupations.
14.04	Demonstrate knowledge of National Fire Protection Association (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**	
15.0	Discuss the value of alternative energy--The student will be able to:
15.01	Investigate the reasons for seeking alternatives to fossil fuels.
15.02	Summarize the contributions to world energy supplies of alternatives to fossil fuels.
15.03	Discuss the alternative energy sources that are currently the most developed and widely used based on geographic location.

16.0	Investigate the viability of biomass and biofuel--The student will be able to:
16.01	Discuss the major sources of biomass.
16.02	Define biofuels (e.g. ethanol, biodiesel, methanol and algae).
16.03	Outline the pyramid energy flow including the different trophic levels.
16.04	Describe the major sources, scale and impacts of biomass energy.
16.05	Draw and label a diagram of a biomass plant.
16.06	List the advantages and disadvantages of using biomass for energy (e.g. CO_2 emissions, photosynthetic efficiency, cost, etc.).
17.0	Investigate the use of nuclear power--The student will be able to:
17.01	Explain the process of nuclear fission.
17.02	Define radio-isotopes and half-life.
17.03	Evaluate the advantages and disadvantages of nuclear power.
17.04	Draw and label a diagram of a Light-Water Reactor (LWR) (e.g. control rods, coolant, containment vessel, dry casks, turbine, etc.).
17.05	Describe nuclear energy and how it is harnessed.
17.06	Describe the causes of notable failures at nuclear power plants.
17.07	Outline the societal debate over nuclear power.
18.0	Investigate the use of solar energy--The student will be able to:
18.01	Describe solar energy and how it is harnessed.
18.02	Explain the significance and historical foundations of solar energy and pioneers in the fields of solar thermal and solar photovoltaics.
18.03	Explain the difference between passive solar and active solar.
18.04	Draw and label a diagram of photovoltaic (PV) cells (e.g. array, panel, module, dopant-enriched silicon).
18.05	Describe solar thermal and photovoltaic concentrating systems.
18.06	Draw and label a diagram of a solar thermal plant.
18.07	Evaluate the advantages and disadvantages of using solar energy.

19.0	Investigate the use of wind energy--The student will be able to:
	19.01 Describe wind energy and the way it is harnessed.
	19.02 List the progression of the use of wind energy through history.
	19.03 Explain the significance of wind energy and pioneers in the field of harnessing wind.
	19.04 Define kinetic energy.
	19.05 List and describe the topography and weather patterns of the states that are considered the “Saudi Arabia of wind power.”
	19.06 Explain the acronym NIMBY (Not in My Backyard).
	19.07 Explain why farmers and ranchers are amenable to wind technology.
	19.08 Evaluate the advantages and disadvantages to wind technology.
	19.09 Understand the relationship between rotor diameter, wind velocity and wind machine output.
20.0	Apply further mathematics knowledge and skills to electricity--The student will be able to:
	20.01 Demonstrate and solve basic algebraic formulas related to electricity.
	20.02 Solve basic trigonometric functions related to electrical theory.
	20.03 Explain basic AC theory and solve related mathematical problems using appropriate test equipment.
	20.04 Solve math-related problems from measurements on training aids. (Optional)
21.0	Demonstrate further understanding of electricity--The student will be able to:
	21.01 Explain molecular action as a result of temperature extremes, chemical reaction and moisture content.
	21.02 Explain how voltage is produced by chemical, mechanical, thermal, photoelectric and piezo electric means.
	21.03 Identify electrical symbols in construction documents.
22.0	Demonstrate science knowledge and skills related to electrical principles--The student will be able to:
	22.01 Discuss the role of creativity in constructing scientific questions, methods and explanations.
	22.02 Formulate scientifically investigable questions, construct investigations, collect and evaluate data and develop scientific recommendations based on findings.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

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Adult students with disabilities, as defined in Section 1004.02, 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, F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College System Institution must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities 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.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml