

Energy Career Cluster
Energy Systems Applications
Course Number: 49.53900

COURSE DESCRIPTION:

Energy Systems Applications is the third course in the Energy and Power: Generation, Transmission, and Distribution pathway. In this course, students will continue to learn about energy and power industry fundamentals by furthering their knowledge regarding electric power generation, transmission and distribution. In addition, the students will gain knowledge about business models, regulations, and safety within the energy industry.

Course Standard 1

ENGR-ESA-1

The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. Teachers should incorporate the elements of this standard into lesson plans during the course. The topics listed for each element of the standard may be addressed in differentiated instruction matching the content of each course. These elements may also be addressed with specific lessons from a variety of resources. This content is not to be treated as a unit or separate body of knowledge but rather integrated into class activities as applications of the concept.

Standard: Demonstrate employability skills required by business and industry.

The following elements should be integrated throughout the content of this course.

1.1 Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities.

Person-to-Person Etiquette	Telephone and Email Etiquette	Cell Phone and Internet Etiquette	Communicating At Work	Listening
Interacting with Your Boss	Telephone Conversations	Using Blogs	Improving Communication Skills	Reasons, Benefits, and Barriers
Interacting with Subordinates	Barriers to Phone conversations	Using Social Media	Effective Oral Communication	Listening Strategies
Interacting with Co-workers	Making and Returning Calls		Effective Written Communication	Ways We Filter What We Hear
Interacting with Suppliers	Making Cold Calls		Effective Nonverbal Skills	Developing a Listening Attitude
	Handling Conference Calls		Effective Word Use	Show You Are Listening
	Handling Unsolicited Calls		Giving and Receiving Feedback	Asking Questions
				Obtaining Feedback
				Getting Others to Listen

Nonverbal Communication	Written Communication	Speaking	Applications and Effective Résumés
Communicating Nonverbally	Writing Documents	Using Language Carefully	Completing a Job Application
Reading Body Language and mixed Messages	Constructive Criticism in Writing	One-on-One Conversations	Writing a Cover Letter

Matching Verbal and Nonverbal communication		Small Group Communication	Things to Include in a Résumé
Improving Nonverbal Indicators		Large Group Communication	Selling Yourself in a Résumé
Nonverbal Feedback		Making Speeches	Terms to Use in a Résumé
Showing Confidence Nonverbally		Involving the Audience	Describing Your Job Strengths
Showing Assertiveness		Answering Questions	Organizing Your Résumé
		Visual and Media Aids	Writing an Electronic Résumé
		Errors in Presentation	Dressing Up Your Résumé

1.2 Demonstrate creativity by asking challenging questions and applying innovative procedures and methods.

Teamwork and Problem Solving	Meeting Etiquette
Thinking Creatively	Preparation and Participation in Meetings
Taking Risks	Conducting Two-Person or Large Group Meetings
Building Team Communication	Inviting and Introducing Speakers
	Facilitating Discussions and Closing
	Preparing Visual Aids
	Virtual Meetings

1.3 Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations.

Problem Solving	Customer Service	The Application Process	Interviewing Skills	Finding the Right Job
Transferable Job Skills	Gaining Trust and Interacting with Customers	Providing Information, Accuracy and Double Checking	Preparing for an Interview	Locating Jobs and Networking
Becoming a Problem Solver	Learning and Giving Customers What They Want	Online Application Process	Questions to Ask in an Interview	Job Shopping Online
Identifying a Problem	Keeping Customers Coming Back	Following Up After Submitting an Application	Things to Include in a Career Portfolio	Job Search Websites
Becoming a Critical Thinker	Seeing the Customer's Point	Effective Résumés:	Traits Employers are Seeking	Participation in Job Fairs
Managing	Selling Yourself and the Company	Matching Your Talents to a Job	Considerations Before Taking a Job	Searching the Classified Ads
	Handling Customer Complaints	When a Résumé Should be Used		Using Employment Agencies
	Strategies for Customer Service			Landing an Internship
				Staying Motivated to Search

1.4 Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity.

Workplace Ethics	Personal Characteristics	Employer Expectations	Business Etiquette	Communicating at Work
Demonstrating Good Work Ethic	Demonstrating a Good Attitude	Behaviors Employers Expect	Language and Behavior	Handling Anger
Behaving Appropriately	Gaining and Showing Respect	Objectionable Behaviors	Keeping Information Confidential	Dealing with Difficult Coworkers

Georgia Department of Education

Maintaining Honesty	Demonstrating Responsibility	Establishing Credibility	Avoiding Gossip	Dealing with a Difficult Boss
Playing Fair	Showing Dependability	Demonstrating Your Skills	Appropriate Work Email	Dealing with Difficult Customers
Using Ethical Language	Being Courteous	Building Work Relationships	Cell Phone Etiquette	Dealing with Conflict
Showing Responsibility	Gaining Coworkers' Trust		Appropriate Work Texting	
Reducing Harassment	Persevering		Understanding Copyright	
Respecting Diversity	Handling Criticism		Social Networking	
Making Truthfulness a Habit	Showing Professionalism			
Leaving a Job Ethically				

1.5 Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills.

Expected Work Traits	Teamwork	Time Management
Demonstrating Responsibility	Teamwork Skills	Managing Time
Dealing with Information Overload	Reasons Companies Use Teams	Putting First Things First
Transferable Job Skills	Decisions Teams Make	Juggling Many Priorities
Managing Change	Team Responsibilities	Overcoming Procrastination
Adopting a New Technology	Problems That Affect Teams	Organizing Workspace and Tasks
	Expressing Yourself on a Team	Staying Organized
	Giving and Receiving Constructive Criticism	Finding More Time
		Managing Projects
		Prioritizing Personal and Work Life

1.6 Present a professional image through appearance, behavior and language.

On-the-Job Etiquette	Person-to-Person Etiquette	Communication Etiquette	Presenting Yourself
Using Professional Manners	Meeting Business Acquaintances	Creating a Good Impression	Looking Professional
Introducing People	Meeting People for the First Time	Keeping Phone Calls Professional	Dressing for Success
Appropriate Dress	Showing Politeness	Proper Use of Work Email	Showing a Professional Attitude
Business Meal Functions		Proper Use of Cell Phone	Using Good Posture
Behavior at Work Parties		Proper Use in Texting	Presenting Yourself to Associates
Behavior at Conventions			Accepting Criticism
International Etiquette			Demonstrating Leadership
Cross-Cultural Etiquette			
Working in a Cubicle			

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence L9-10RST 1-10 and L9-10WHST 1-10:

Georgia Standards of Excellence ELA/Literacy standards have been written specifically for technical subjects and have been adopted as part of the official standards for all CTAE courses.

Course Standard 2

ENGR-ESA-2. Students will identify electric power generation equipment and systems.

- a. Describe the major parts of an electric energy generation and conversion system.
- b. Explain how a furnace operates including the exhaust, ignition, and combustion.
- c. Demonstrate knowledge of how power generation equipment and systems work including: a boiler, superheater, turbine, and a reheater by creating a diagramed image.

Course Standard 3

ENGR-ESA-3. Students will explain the conventional electric power generation systems and process (coal, gas, hydroelectric, and nuclear).

- a. Compare and contrast the process of the formation of oil, coal, and natural gas.
- b. Describe the advantages or disadvantages of using oil, coal, or natural gas in the process of generating electricity
- c. Explain the process of generating hydroelectric electricity and describe its advantages or disadvantages over other forms for generating electricity.

ACADEMIC STANDARDS:

SEV1. Students will investigate the flow of energy and cycling of matter within an ecosystem and relate these phenomena to human society.

SEV4. Students will understand and describe availability, allocation, and conservation of energy and other resources.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SCSh5. Students will demonstrate the computation and estimation skills data and developing reasonable scientific explanations.

MM3P1. Students will solve problems (using appropriate technology).

MM3P2. Students will reason and evaluate mathematical arguments.

MM3P3. Students will communicate mathematically.

MM3P4. Students will make connections among mathematical ideas and to other disciplines.

MM3P5. Students will represent mathematics in multiple ways.

ELAALRC2. The student participates in discussions related to curricular learning in all subject areas.

ELAALRC3. The student acquires new vocabulary in each content area and uses it correctly.

Course Standard 4

ENGR-ESA-4. Students will define nuclear power and discuss in terms of positive and negative impacts, as well as relevance to various situations in today's society.

- a. Define terms relating to nuclear energy, including but not limited to, the following: fission, fusion, breeder reacting, boiling water reactors, pressurized water reactors, plutonium and plutonium 239, proliferation, isotope, electron, plasma, Nuclear Waste Policy Act, Kyoto Protocol, control rod, half-life, uranium 235 and uranium 238, Nucleus, Proton, Neutron, plasma, radioactivity, and shipping cask.
- b. Discuss supply and demand for nuclear power.
- c. Create a technical report that includes international use, restrictions, and regulations of nuclear power including inequities of regulations and policies throughout the world.
- d. Develop an outline that provides information regarding present and future uses of nuclear power in the world.

Course Standard 5

ENGR-ESA-5. Students will explain how nuclear power is generated.

- a. Explain how nuclear power is created and how the atom uranium is utilized.
- b. Create a flow chart that details the Nuclear Fuel Cycle.
- c. Compare and contrast the two types of nuclear power reactors used in the United States including Boiling Water Reactors and Pressurized Water Reactors.
- d. Explain the U.S. Nuclear Regulatory Commission (NRC) safeguards and regulations including inspection, performance assessment and enforcement, and operational experience evaluation.

Course Standard 6

ENGR-ESA-6. Students will identify alternative sources for generation of electric power (i.e., solar, wind, geothermal, biomass, and ocean/tidal motion) and describe the advantages and disadvantages of their use for the consumer, industry, and the environment.

- a. Explain how solar, wind, biomass, and wave energy are used to produce electricity and steam.
- b. Compare and contrast the advantages and disadvantages of solar, wind, biomass, and wave energy.

Course Standard 7

ENGR-ESA-7. Students will explain the conditions necessary to build a functional electric power distribution and transmission grid.

- a. Compare and contrast the electric power transmission and distribution.
- b. Discuss the application of different electric power transmission principles (including AC vs. DC).
- c. Describe electric power transmission equipment and systems and how each element functions together to transfer power.
- d. Discuss the implications (economical, environmental, and social) of emerging technologies in electric power transmission and distribution (including the Smart Grid).
- e. Discuss the need for electric distribution systems and how they are designed to operate.
- f. Describe different electric power distribution systems and compare their advantages as it relates to implementation (i.e. substations, distribution feeder circuits, switches, primary circuits, secondary circuits, and services).

Course Standard 8

ENGR-ESA-8. Students will explain the transmission and distribution of natural gas.

- a. Explain the natural gas transmission and distribution process.
- b. Describe how the parts of a natural gas distribution system relate to each other and to the operation of the system as a whole.
- c. Discuss the emerging technologies in natural gas distribution; compare the advantages and disadvantages respect to each other and their (economical, environmental, and social) impact.

Course Standard 9

ENGR-ESA-9. Students will explain the different processes used to conserve energy resources and increase efficient distribution and use.

- a. Define energy efficiency.
- b. Explain how to reduce the carbon footprint by identifying energy conservation techniques.
- c. Examine different systems of energy distribution relating to its implication in energy conservation with both residential and commercial settings energy use.

Course Standard 10

ENGR-ESA-10. Students will explain the ownership of the transmission and distribution systems.

- a. Compare and contrast the types of ownership including: fully-integrated investor-owned utilities, transmission/distribution owners, transmission owners, distribution owners, and miscellaneous owners.
- b. Discuss the application of current state, city, or local community regulations that guide energy usage.

Course Standard 11

ENGR-ESA-11. Students will understand and be able to implement safety practices and procedures within the energy industry.

- a. Describe the roles of federal, state, and local agencies in workplace safety and health.
- b. Explain the importance of compliance with standards, regulations, and established procedures to ensure safe and healthful work environment.
- c. Create an OSHA job safety plan that demonstrates knowledge of basic regulatory requirements that promote safe and effective operations for protection of people, data, property, and institutions.
- d. Demonstrate through lab activities basic procedural guidelines that promote safe and effective operations for the protection of people, data, property, and institutions.
- e. Explain the roles and responsibilities of employers, employees, and the general public in creating and maintaining workplace, personal, and community safety cultures.

Course Standard 12

ENGR-ESA-12. Students will demonstrate the importance of following safety practices for utility workers.

- a. Identify potential threats and consequences from deviation of safety procedures and improper use of tools.
- b. Explain the importance of using personal protective equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats and the potential dangers of failing to do so.
- c. Describe the processes and policies of companies to maintain personal safety equipment (PPE) to ensure working order.

- d. Demonstrate through lab activities the use tools and equipment in compliance with user manuals and safety training.
- e. Describe the appropriate first aid practices and first response procedures for electrical and nonelectrical emergencies including: cuts, insect stings, dog bites, broken bones, spinal injury, thermal burns, electrical burns, chemical burns, electric shock, shock, heart attack, stroke, and unconsciousness.

Course Standard 13

ENGR-ESA-13

Students will demonstrate knowledge of the basic and emerging principles and concepts that impact the energy industry.

- a. Explain the flow of energy from generation through distribution to the customer.
- b. Identify the role and function of generation, transmission and distribution organizations.
- c. Explain the role of regulatory bodies in the energy industry.
- d. Discuss environmental laws and regulations that impact the energy industry and explain importance of proper documentation to ensure compliance.
- e. Explain the different structures of energy companies, including investor-owned utilities, municipalities, electric cooperatives, independent power producers and can explain the different lines of energy business, including electric and gas.
- f. Describe the process of electric metering and billing for energy consumption.
- g. Discuss the importance and role of unions in the industry.

Course Standard 14

ENGR-ESA-14

Students explore how related career and technology student organizations are integral parts of career and technology education courses. Students will develop leadership, interpersonal, and problem-solving skills through participation in co-curricular activities associated with the Technology Student Association.

- a. Explain the goals, mission and objectives of CTSO organizations.
- b. Explore the impact and opportunities a student organization (TSA) can develop to bring business and education together in a positive working relationship through innovative leadership and career development programs.
- c. Explore the local, state, and national opportunities available to students through participation in related student organization (TSA) including but not limited to conferences, competitions, community service, philanthropy, and other (TSA) activities.
- d. Explain how participation in career and technology education student organizations can promote lifelong responsibility for community service and professional development.
- e. Demonstrate teamwork, leadership, interpersonal relations, and project management.

- f. Through teamwork, apply the skills and abilities in requirements analysis and configuration control while working with plans, processes, and projects as assigned.
- g. Through teamwork, use the skills required in project management to track and assess the progress of a plan, process, or project as assigned.
- h. Through teamwork, apply the skills in quality assurance as well as those in process management and development for appropriate applications of systems integration techniques to an assigned project
- i. Effectively use project management techniques (e.g., teamwork, appropriate time management practices, effective organizational skills, conduct analysis of cost, resources, and production capacity, and quality practices with continuous improvement).
- j. Understand and demonstrate proper work ethics when working with plans, processes, and projects as assigned.

Support of CTAE Foundation Course Standards and Georgia Standards of Excellence

ELACC9-10SL1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

ELACC9-10SL4: Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.