

Colorado CTE Course – Scope and Sequence

Course Name	Energy Industry Fundamentals (A/B)		Course Details	Level 2 course in the Energy Pathway.
			Course = 0.50 Carnegie Unit Credit	
Course Description	This science CTE course provides a broad understanding of the energy industry with specific focus on the delivery of energy to all users in the United States. It provides a broad understanding of the how and why of generating energy and all the steps necessary to transmit and distribute the energy to businesses and homes across the country. The course provides connection to careers in the energy industry as well as structure of the utility industry, emerging energy technologies and their role as future energy sources.			
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.			
SCED Identification #	18506	Schedule calculation based on 60 calendar days of a 90-day semester. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.		
All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at https://www.cde.state.co.us/standardsandinstruction/essentialskills				
Instructional Unit Topic	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Unit 1: Energy Industry Principles	I. 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 of the customer.		
		B. Discuss the history of the United States energy industry/infrastructure (refer to Energy Information Administration www.eia.doe.gov)		
		C. Identify the role and function of generation, transmission, and distribution organizations.		
		D. Explains the role of regulatory bodies in the energy industry (Federal Energy regulatory commission www.ferc.gov ; Public Service Comission of the State of Floriday www.psc.state.fl.us (highlight “obligation to serve”		
		.E. Discuss environmental laws and regulations that impact the energy		

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		industry (local, state, and federal) and explain the importance of proper documentation to ensure compliance.			
		F. Explain the different structures of energy companies, including investor-owned utilities, municipalities (and associated utility practices such as water/wastewater), electric cooperative, independent power producers and can explain the different lines of energy business, including electric and gas.			
		G. Describe the process of electric metering and billing for energy consumption.			
		H. Discuss the importance and role of unions in the industry.			
Unit 2: Safety Protocol	II. Apply compliance with procedures necessary to ensure a safe and healthy work environment.	A. Identify both potential hazards and accident scenarios in the work environment.			
		B. Follow established safety procedures (OSHA regulation and utility company resources)			
		C. Evaluate changes in the environment with respect to their impact on safety of self and others.			
		D. Promote effective local, state, and national security operations for the protection of people, data, property, and institutions.			

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		E. Comply with energy industry safety procedures and proper ways to perform work.			
		F. Name potential threats created by deviation from safety procedures and improper use of tools and equipment.			
		G. Use safety equipment as specified by use manuals and safety training.			
		H. Use personal protective equipment (PPE) including safety glasses, hearing protection, gloves, work boots, and hard hats.			
		I. Keep personal safety equipment in good working order.	Identify how to maintain safety equipment on a regular basis.		
		J. Use tools and equipment in compliance with user manuals and training.			
		K. Call attention to potential and actual hazardous conditions as they arise.			
		L. alert coworkers and supervisory personnel to hazardous conditions and deviations from safety procedures in a timely manner.			
		M. Maintain appropriate certifications and is knowledgeable in first air or first response procedures.			
		N. Demonstrate understanding and knowledge of lock/tag out practices in the workplace.			
		O. Notify person in charge and/or coworker of unsafe work conditions.			

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		P. Stop the job if there are unsafe working conditions.	Describe various types of unsafe work conditions.		
Unit 3: Electrical Power Generation	III. Describe the electrical power generation.	A. Explain the conventional electric power generation systems and processes.	i. (coal, gas, hydroelectric, and nuclear) ii. Identify electric power generation equipment and systems. Iii. Identify various conventional electric power generation fuel sources and the cost/efficiency/environmental issues associated with: -how oil was created and list its advantages and disadvantages - how coal was created and list its advantages and disadvantages. -how natural gas was created and what are its advantages and disadvantages. - How water is used in hydroelectric power generation and what are its advantages and disadvantages. - how uranium is created and what are its advantages and disadvantages.		
		B. Discuss emerging and alternative electric power generation and technologies and fuel sources.			
		C. Explain how solar energy is used to produce electricity in photovoltaic			

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		systems and what are its advantages and disadvantages.			
		D. Explain how solar energy is used to produce electric energy using steam and what are its advantages and disadvantages.			
		E. Explain how wind energy is used to produce electric energy and what are its advantages and disadvantages.			
		F. Explain how geothermal energy is used to produce electric energy and what are its advantages and disadvantages.			
		G. Explain how biomass energy is used to produce electric energy and what are its advantages and disadvantages.			
		H. Explain how ocean wave energy is used to produce electric energy and what are its advantages and disadvantages.			
		I. Discuss pros and cons of various energy producing technologies and fuels in the electrical infrastructure (including fossil, nuclear, and emerging alternative energy systems.)			
Unit 4: Electrical Power Transmission System	IV. Describe electrical power transmission systems	A. Explain the electrical power transmission process.			

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		B. Discuss the application of different electrical power transmission principles (including AC vs. DC)			
		C. Name electrical power transmission equipment and systems.			
		D. Discuss the emerging technologies in electric power transmission (including SMART grid).			
		E. Explain ownership/governance of the electrical transmission system.			
Unit 5: Natural Gas	V. Describe electrical power and natural gas distribution.	A. Explain the electric power distribution process.			
		B. Discuss the need for electrical distribution systems and how they are designed to operate.			
		C. Name electrical power distribution system equipment and what the various components do.			
		D. Discuss the emerging technologies in electrical power distribution, including distribution, automation, and SMART grid systems.			
		E. Explain the fundamental concepts of natural gas.			
		F. Identify the components and workings of the gas transmission and distribution network, including metering and regulating stations.			
Unit 6: Energy Careers	VI. Identify and describe careers and entry requirements.	A. Describe entry-level careers available in energy generation, transmission, distribution, and the			

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		education/experience requirements for entry into those positions, along with career development and advancement opportunities for those positions.			
		B. Identify entry-level careers available in business and corporate support functions of the energy industry; describe the education/experience requirements for entry into those positions and career advancement opportunities from those positions.			
		C. Describe general wage/salary, benefits, and other advantages of careers in the energy industry.			
		D. Explain the educational pathways available to gain training necessary for entry into energy careers at the secondary and post-secondary levels (Partner to create Energy Education Portal)			
Unit 7: Hot Topics	VII. Evaluate and analyze energy “hot topics”	A. Describe energy “hot topics”			
		B. Describe energy efficiency/conservation.			
		C. Describe alternative energy (wind, solar, biomass, geothermal).			
		D. Describe emerging technologies (wave, algae, IGCC, clean coal, etc)			
		E. Describe SMART Grid and Time of Use technologies.			

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		F. Describe key energy regulatory topics (cap and trad, etc) efficiency, cost etc)			

Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

[CO CTE Academic Standards Resources \(Rubrics, integration strategies, etc\)](#)

[CDE Colorado Academic Standards Online \(Online standards lookup tool\)](#)

Standard 1: Oral Expression and Listening

- Prepared Graduate 1: Collaborate effectively as group members or leaders who listen actively and respectfully; pose thoughtful questions, acknowledge the ideas of others; and contribute ideas to further the group's attainment of an objective.
 - Students collaborate to analyze energy production and distribution systems, evaluate emerging energy technologies, discuss environmental regulations, and assess solutions to current and future energy challenges.

Standard 2: Reading for All Purposes

- Prepared Graduate 4: Read a wide range of informational texts to build knowledge and to better understand the human experience.
 - Students analyze technical, scientific, regulatory, and industry information related to energy generation, transmission, distribution, safety procedures, environmental regulations, emerging technologies, and energy policy to develop an understanding of the energy industry.
- Prepared Graduate 5: Understand how language functions in different contexts, command a variety of word-learning strategies to assist comprehension, and make effective choices for meaning or style when writing and speaking.
 - Students develop and apply specialized vocabulary related to electrical generation, transmission systems, natural gas distribution, energy regulation, workplace safety, utility operations, and emerging energy technologies.

Standard 3: Writing and Composition

- Prepared Graduate 6: Craft arguments using techniques specific to the genre.
 - Students evaluate and defend positions regarding conventional and alternative energy sources, environmental impacts, energy efficiency, emerging technologies, and energy policy using technical information and evidence-based reasoning.
- Prepared Graduate 7: Craft informational/explanatory texts using techniques specific to the genre.
 - Students develop technical explanations, energy analyses, safety documentation, and reports describing energy generation systems, transmission infrastructure, distribution networks, and emerging technologies.

Standard 4: Research Inquiry and Design

- Prepared Graduate 10: Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.
 - Students investigate conventional and alternative energy sources, analyze energy transmission and distribution systems, evaluate environmental regulations and safety practices, assess emerging technologies, and compare energy production methods to address complex challenges facing the energy industry.

Note: *Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version.*