

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 Commission of the State of Florida www.psc.state.fl.us (highlight “obligation to serve”		
		E. Discuss environmental laws and regulations that impact the energy industry (local, state, and federal) and explain the importance of proper documentation to ensure compliance.		

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		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.			
		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.			

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		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.			
		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		

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			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 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			

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		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.			
		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.			

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		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 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.		

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

Energy Standards:

CTE Standards and Competency alignment for this course comes from the Common Course Numbering System;

https://erpdnssb.cccs.edu/PRODCCCS/ccns_pub_controller.p_command_processor?pi_search_type=SB COURSE&pi_subj_code=ENY&pi_crse_num=161&pi_archive_date=&pi_course_status=A&pi_term_code=202230

CAS Academic Standards Alignment: Online Version: <https://www.cde.state.co.us/apps/standards/>; Download version:

<https://www.cde.state.co.us/apps/standards/>

Reading, Writing, and Communicating:

Math:

Science:

Essential Skills:

Problem Solver:

- **Critical Thinking and Analysis:** The ability to apply a deliberate process of identifying problems, gathering information, and weighing possible solutions, including: making choices rooted in understanding patterns, cause-and-effect relationships, and the impacts that a decision can have on the individual and others.

Community Member:

- **Social Awareness:** the ability to understand the perspectives of, empathize with, feel compassion for, and recognize strengths in others, including those from diverse backgrounds, cultures, and contexts and how they affect social interactions.
- **Civic Engagement:** The ability to develop and apply knowledge, skills, and habits gained from experiences – within communities of diverse perspectives – to address issues, affect change, and/or solve problems.

Communicator:

- **Interpersonal communication:** the ability to establish and maintain healthy and supportive relationships, including: the capacity to communicate clearly by successfully conveying information and feelings, listening actively, setting boundaries, negotiating conflict constructively, and seeking or offering support and help when needed.

Empowered Individual:

- **Self-Awareness:** the ability to understand one's own emotions, thoughts, and values, and how personal actions and emotions influence behavior across contexts, including: the capacity to recognize one's strength and limitations with a well-grounded sense of confidence and purpose.
- **Career Awareness:** The ability to apply the knowledge and understanding of how one's dreams, experiences, and interests translate into career fulfillment and lifelong pursuits in local, regional, national, and global career pathways and opportunities.