

Career & Technical Education (CTE) Standards Revision Project

Cluster: Energy

Pathways: Fossil Energy Extraction, Processing & Distribution, Electromechanical Generation & Maintenance, Electrical Energy Transmission & Distribution, Renewable Energy Production, Energy Efficiency & Environmental Technology

The standards for this cluster area a result of a compilation of Energy standards from State CTE Standards developed in Ohio and California and introductory course standards from Colorado community colleges. The attached standards for each of the pathways identify links to Colorado core content standards which have been validated by content specialists in each of the core content areas.

Michael Womochil, Program Director, Agriculture, Natural Resources & Energy

Career Cluster/Cluster Grouping:	Energy
Pathway(s):	Fossil Energy Extraction, Processing & Distribution
Prepared Completer Competencies: ENY 02. Evaluate and analyze the role of fossil fuels in providing the world energy needs	
High School Expectations:	
Concepts and skills students know include: ENY 02.01 Analyze fossil fuels as a principle of energy science	
Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>ENY 02.01 A Identify the main types of fossil fuels (e.g. crude oil, natural gas, coal).</p> <p>SCI2.1e</p> <p>ENY 02.01 B Describe the byproducts of fossil fuels and their effects on the environment.</p> <p>ENY 02.01 C Discuss the formation of fossil fuels and their potential as an energy source in the future.</p> <p>(SCI 3.5a ; SCI 3.5b)</p>	<p>Academic Content Knowledge Alignment:</p> <p>SCI3.5.a-Science, Earth Science, There are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources - Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources</p> <p>SCI3.5.b-Science, Earth Science, - Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere, and biosphere in regards to resource use</p>

ENY 02.01 E Describe the primary process for extracting energy from fossil fuels.

ENY 02.01 F Correlate the positive and negative aspects of fossil fuels as an energy source.

(SCI 3.5a ; SCI 3.5b SCI 3.6a SCI 3.6b SCI 3.6c)

SCI3.6.a-Science, Earth Science, The interaction of Earth's surface with water, air, gravity, and biological activity causes physical and chemical changes - Develop, communicate, and justify an evidence-based scientific explanation addressing questions regarding the interaction of Earth's surface with water, air, gravity, and biological activity

SCI3.6.b-Science, Earth Science, -Analyze and interpret data, maps, and models concerning the direct and indirect evidence produced by physical and chemical changes that water, air, gravity, and biological activity create

SCI3.6.c-Science, Evaluate negative and positive consequences of physical and chemical changes on the geosphere

Learning & Behavioral Skills (Inquiry, Application in Society & Technology & Nature of...):

High School Expectations: .	
Concepts and skills students know include: ENY 02.02 Examine the classifications of fossil fuel technology	
Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>ENY 02.02 A Critique natural gas as a fuel source and its transformation from methane to carbon dioxide and water vapor.</p> <p>(SCI 1.6b; 1.6c)</p> <p>ENY 02.02 B Critique fuel oil as a fuel source and its transformation from carbon and hydrogen to carbon dioxide and water.</p> <p>(SCI1.3b)</p> <p>ENY 02.02 C Critique coal as a fuel source and its transformation from carbon and hydrogen to carbon dioxide and water.(SCI 1.3b)</p>	<p>Academic Content Knowledge Alignment:</p> <p>SCI1.3.b-Science, Physical Science, Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy. - Predict reactants and products for different types of chemical and nuclear reactions</p> <p>SCI1.6.b-Science, Physical Science, When energy changes form, it is neither created not destroyed; however, because some is necessarily lost as heat, the amount of energy available to do work decreases - Evaluate the energy conversion efficiency of a variety of energy transformations</p> <p>SCI1.6.c-Science, Physical Science, - Describe energy transformations both quantitatively and qualitatively</p>

<p>ENY 02.02 D Differentiate among the utilizations of the types of fossil fuels (e.g., transportation, electric generation, heating).</p>	<p>Learning & Behavioral Skills (Inquiry, Application in Society & Technology & Nature of...):</p>
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High School Expectations:	
Concepts and skills students know include: ENY 02.03 Analyze the types of technologies developed to make use of coal.	
Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>ENY 02.03 A Describe the functions and operations of crushers, pulverizers and stokers.</p> <p>ENY 02.03 B Explain the functions and operations of circulating and bubbling fluidized beds.</p> <p>ENY 02.03 C Discuss the functions and operations of integrated gasification combined cycles.</p>	Academic Content Knowledge Alignment:
	Learning & Behavioral Skills (Inquiry, Application in Society & Technology & Nature of...):

High School Expectations :	
Concepts and skills students know include: ENY 02.03 Explain the issues affecting the transportation and storage of fossil fuels.	
Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>ENY 02.03 A Explore the technical issues affecting the compression and transportation of natural gas.</p> <p>ENY 02.03 B Explore the technical issues affecting the transportation, heating and aboveground storage of fuel oil.</p> <p>ENY 02.03 C Explore the technical issues affecting the transportation, storage and handling of bituminous coal, sub-bituminous coal and lignite.</p> <p>ENY 02.03 D Analyze the economic issues affecting modes of transportation ,handling, storage and distribution of fossil fuels.</p>	Academic Content Knowledge Alignment:
	Learning & Behavioral Skills (Inquiry, Application in Society & Technology & Nature of...):

High School Expectations:	
Concepts and skills students know include: ENY 02.04 Explain how fossil fuels are utilized to produce electrical energy.	
Evidence Outcomes - Students can:	21st Century Skills and Readiness Competencies
<p>ENY 02.04 A Describe the functions of fossil fuel systems (e.g., air and gas flow, water and steam, wastewater, ash and ash byproduct) in generating plants.</p> <p>ENY 02.04 B Describe and diagram the function of the turbine generator in generating plants.</p> <p>ENY 02.04 C Explain and diagram the function of the generator step-up (GSU) transformer and switchyard.</p>	Academic Content Knowledge Alignment:
	Learning & Behavioral Skills (Inquiry, Application in Society & Technology & Nature of...):

High School Expectations	
Concepts and skills students know include: ENY 02.05 Explain the issues and trends affecting the extraction, distribution and storage of fossil fuels.	
Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>ENY 02.05 A Describe the major barriers to extracting fossil fuels from the earth.</p> <p>(SCI 3.5a SCI 3.5b)</p> <p>ENY 02.05 B Contrast current and projected levels of consumption to available resources.</p> <p>(SCI3.5a)</p> <p>ENY 02.05 C Discuss the political complications with obtaining raw resources from foreign sources.</p> <p>(RWC 4.6.a; RWC 4.6.b; RWC 4.6.c; RWC 4.6.d; RWC 4.6.e; RWC 4.7.a; RWC 4.7.b;)</p> <p>ENY 02.05 D Examine the capacity of the U.S. fossil fuel processing industries to meet future consumption.</p>	<p>Academic Content Knowledge Alignment:</p> <p>RWC4.2.a-Reading, Writing and Communicating, Research and Reasoning, Analyze and develop a logical argument that distinguishes facts, opinions, evidence and inferences. - Synthesize information logically: distinguish among facts opinions, evidence, and inferences; identify false premises or assumptions; and detect potential bias and “loaded” language (e.g., sarcasm, personal attack, appeal to pity)</p> <p>RWC4.2.b- Summarize ideas including alternate views, rich detail, well-developed paragraphs, and logical argumentation.</p> <p>RWC4.2.d- If the presentation is or oral a visual product: Prepare notes and visuals for clarity of content and effect, grammatically correct use of language, spelling, and mechanics.</p>

ENY 02.05 E Analyze the current condition of the distribution and storage network (e.g., pipelines, freighters, tankards, distribution centers).

(RWC 4.2.a; RWC 4.2.b RWC 4.2d; RWC 4.11.l; RWC RWC 4.11.a; RWC 4.11.b; RWC 4.11.c; RWC 4.11.d; RWC 4.11.e; RWC 4.11.f; RWC 4.11.g; RWC 4.11.h; RWC 4.11.i; RWC 4.11.j; RWC 4.11.k; RWC 4.11.l; RWC 4.11.m)

ENY 02.05 F Compare consumption in terms of time of day, demand and peak power available.

RWC4.6.a-Reading, Writing and Communicating, Research and Reasoning, Collect, evaluate, and analyze information from multiple sources to answer a question, propose solutions or share findings and conclusions. - Define and narrow a topic for research, developing the central idea or focus.

RWC4.6.b- Formulate open-ended research questions

RWC4.6.c- Identify and evaluate potential sources of information

RWC4.6.d- Use a variety of strategies (e.g., technical reading, search engines, direct observation, interview) to collect and organize relevant information.

RWC4.6.e- Evaluate quality, accuracy, and completeness of information and the credibility of the sources.

RWC4.7.a-Reading, Writing and Communicating, Research and Reasoning, Analyze and evaluate text for validity and accuracy. - Compare and contrast the logic (assumptions and beliefs) and use of evidence (existing and missing information; primary sources and secondary sources) used by two authors presenting similar or opposing arguments (e.g., articles by two political columnists that address the same issue).

RWC4.7.b- Judge the accuracy of the information in a text, citing text-based evidence, author's use of expert authority, author's credibility to defend the evaluation.

RWC4.11.a-Reading, Writing and Communicating, Research and Reasoning, Use quality reasoning and effective problem solving strategies. - Analyze the purpose, question at issue, information, points of view, implications and consequences, inferences, assumptions and concepts inherent in thinking.

RWC4.11.b- Assess strengths and weaknesses of their thinking and thinking of others by using criteria including: relevance, clarity, accuracy, fairness, significance, depth, breadth, logic and precision.

RWC4.11.c- Articulate goal and purpose

RWC4.11.d- State the problem clearly and precisely.

RWC4.11.e- Identify the type of problem at hand.

RWC4.11.f- Determine what parts of the problem are solvable.

RWC4.11.g- Determine the information needed to solve the problem.

RWC4.11.h- Analyze and interpret information.

	<p>RWC4.11.i- Make inferences after considering information.</p> <p>RWC4.11.j- Identify and evaluate options for advantages and disadvantages.</p> <p>RWC4.11.k- Determine appropriate forms of action.</p> <p>RWC4.11.l- Monitor the implications of actions.</p> <p>RWC4.11.m- Be prepared to revise strategy if situation requires it.</p> <p>SCI3.5.a-Science, Earth Science, There are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources - Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources</p> <p>SCI3.5.b-Science, Earth Science, - Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere, and biosphere in regards to resource use</p>
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	Learning & Behavioral Skills (Inquiry, Application in Society & Technology & Nature of...):
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High School Expectations	
Concepts and skills students know include: ENY 02.06 Explain the process and techniques used in fossil fuel exploration and extraction	
Evidence Outcomes Students can:	21st Century Skills and Readiness Competencies
<p>ENY 02.06 A Differentiate between common rocks and minerals associated with petroleum</p> <p>ENY 02.06 B Understand sedimentary rocks deformation and basic oil traps (SCI 3.1b)</p> <p>ENY 02.06 C Explore fundamental mapping methods</p> <p>ENY 02.06 D Understand mapping layers using geographic information systems (SCI3.6b)</p> <p>ENY 02.06 E Perform simple global positioning maneuvers using a handheld GPS device</p> <p>ENY 02.06 F Recognize source rocks and the generation, migration, and accumulation of petroleum (SCI 3.1b)</p>	<p>Academic Content Knowledge Alignment:</p> <p>SCI3.1.b-Science, Earth Science, The history of the universe, solar system and Earth can be inferred from evidence left from past events - Analyze and interpret data regarding Earth’s history using direct and indirect evidence</p> <p>SCI3.6.b-Science, Earth Science, The interaction of Earth’s surface with water, air, gravity, and biological activity causes physical and chemical changes-Analyze and interpret data, maps, and models concerning the direct and indirect evidence produced by physical and chemical changes that water, air, gravity, and biological activity create</p> <hr/> <p>Learning & Behavioral Skills (Inquiry, Application in Society & Technology & Nature of...):</p>

<p>ENY 02.06 G Differentiate between the various types of petroleum exploration techniques</p> <p>ENY 02.06 H Explore the mechanics of drilling a well</p> <p>ENY 02.06 I Examine various artificial lift methods</p> <p>ENY 02.06 J Understand fluid surface treatments and storage</p> <p>ENY 02.06 K Recognize the similarities and differences between onshore and offshore drilling and production methods</p>	
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