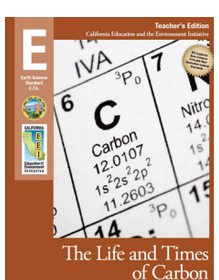
California Education and the Environment Initiative

The EEI Curriculum cohesively integrates science and engineering practices (SEPs), content (disciplinary core ideas/DCIs), and crosscutting concepts (CCs) within its lesson procedures. This preliminary analysis intentionally teases apart the individual SEPs, DCIs, and CCs as a means of correlating the EEI unit with specific performance expectations; however, the EEI lessons weave these components back together to provide three-dimensional learning for students.

High School Earth Science

E.7.b. - The Life and Times of Carbon

"The Life and Times of Carbon" explores the movement of matter and energy among different Earth systems and has them consider how human activities affect the transfer of carbon among ecosystems. Through studies of the global carbon cycle they study how the use of carbon-based fuels releases carbon that then flows between the carbon reservoirs found in different Earth systems and ecosystems. By investigating the use of different fuels and the resulting carbon footprints, they have the opportunity to examine the environmental and socio-economic factors involved in decisions about using carbon-based fuels. Students also consider alternative engineering solutions that might influence the release of carbon that results from the use of carbon-based fuels.



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Next Generation Science Standards* Correlation with the California Education and the Environment Initiative (EEI) Curriculum

The EEI Curriculum is a great choice for transitioning to NGSS and contributes toward achievement of the performance expectations for the disciplinary core ideas reflected in the Summary Chart below: HS-ESS2: Earth's Systems; HS-ESS3: Earth and Human Activity; HS-LS2: Cycles of Matter and Energy Transfer in Ecosystems, and HS-ETS1: Engineering Design. Each EEI unit highlights a small number of performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts. Therefore, the EEI units contribute to students' overall achievement of the performance expectations by the end of a school year, where they will have had multiple opportunities to engage in all appropriate science and engineering practices, disciplinary core ideas, and crosscutting concepts. While EEI was designed to teach the 1998 California science standards to mastery, it reflects the real world interconnections in science and already incorporates many of the paradigm shifts reflected in the NGSS. To learn more about how EEI supports NGSS, visit http://californiaeei.org/NGSSGuides/.

Correlation Chart Key

SEP (Science and Engineering Practices)
DCI (Disciplinary Core Ideas)
CC (Crosscutting Concepts)

	Next Generation Science Standards											
	HS-ESS2			HS-ESS3			HS-ETS1			HS-LS2		
California Connection					✓			✓			✓	
Lesson 1 – Explore the diverse forms of carbon humans depend on and read an article about carbon-based fuels.			✓			✓						
Lesson 2 – Discuss the concepts of carbon flow and carbon reservoirs in the global carbon cycle.	✓					✓				✓	✓	✓
Lesson 3 – Analyze the flow of carbon between different reserves of the global carbon cycle.	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓
Lesson 4 – Investigate the human use of solid fuels and the resulting carbon footprints of different fuels.	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Lesson 5 – Identify the environmental and socio-economic factors involved in decisions about using carbon-based fuels.	✓	✓		✓	✓	✓	✓	✓		✓		✓
Traditional Unit Assessment	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
Alternative Unit Assessment	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	SEP	DCI	CC	SEP	DCI	CC	SEP	DCI	CC	SEP	DCI	CC

EEI E.7.b. The Life and Times of Carbon

Disciplinary Core Ideas Supported by this EEI Unit

HS-ESS2 Earth's Systems
HS-ESS3 Earth and Human Activity
HS-LS2 Cycles of Matter and Energy Transfer in Ecosystems
HS-ETS1 Engineering Design

Performance Expectations	Suggestions for Using the EEI Unit to Support NGSS
HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.	Use the unit to give students multiple opportunities to discuss and analyze the cycling of carbon through biogeochemical models and relevant text that describe how carbon flows between different carbon reservoirs of the global carbon cycle.
HS-ESS3-6: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.	Use the unit to have students evaluate data that correlates the increased use of carbon-based fuels to the rise in carbon dioxide in global carbon reservoirs and the impact biofuel development and use has on Earth systems.
HS-LS2-5: Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.	Use the unit to have students consider how carbon cycles between Earth's systems as plants and ocean phytoplankton take in carbon dioxide and convert it into plant material and how plant and animal respiration releases carbon dioxide back into the oceans and atmosphere.
HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts	Use the unit to have students evaluate examples of alternative biofuels and the impact those decisions may have on social, political, economic, and environmental issues.

Science and Engineering Practices (SEPs)	Suggestions for Using EEI to Support SEPs	Disciplinary Core Ideas (DCIs)	Suggestions for Using EEI to Support DCIs	Crosscutting Concepts (CCs)	Suggestions for Using EEI to Support CCs
Developing and using models (HS-LS2-5, HS-ESS2-6)	Use the unit to have students evaluate and complete biogeochemical models of the flow of carbon between various carbon reservoirs (Lessons 2 and 3). Have students develop biogeochemical models to help them explain how carbon flows between reservoirs and the impact that using carbon based fuels adds to the carbon cycle (Lessons 4 and 5).	**ESS2.D: Weather and Climate:** Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6)	Use the unit to have students study how the net increase of carbon dioxide into the atmosphere is dependent upon the ocean and biosphere's capacity to absorb them and that the net increase is a key contributor to global warming (Lessons 3, 4, and 5).	**Energy and Matter (HS-ESS2-6)**	Use the unit to have students explore how carbon is the building block of life (Lesson 1). Have students study that the total amount of carbon on Earth is fixed and that carbon flows through different carbon reservoirs in the global carbon cycle (Lessons 2 and 3). Have students consider how the total amount of carbon released from biomass depends on the type and carbon density of that biomass (Lesson 4).
Using mathematics and computational thinking (HS-ESS3-6)	Use the unit to have students evaluate a variety of articles and text to support claims that the increase in atmospheric	**ESS3.D: Global Climate Change:** Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6)			

Science and Engineering Practices (SEPs)	Suggestions for Using EEI to Support SEPs	Disciplinary Core Ideas (DCIs)	Suggestions for Using EEI to Support DCIs	Crosscutting Concepts (CCs)	Suggestions for Using EEI to Support CCs
	carbon dioxide may have a significant effect on future global carbon reservoirs, and has a measurable effect on living organisms in the atmosphere and the oceans (Lessons 3, 4 and 5). Have students support claims regarding different biofuels and how their use impacts Earth systems and that using biofuels has economic and social consequences to consider (Lesson 5).	**LS2.B: Cycles of Matter and Energy Transfer in Ecosystems:** Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5)	Use the unit to have students explore carbon cycles in different carbon reservoirs in Earth's biosphere, atmosphere, hydrosphere, and geosphere (Lessons 2, 3, and 4).	**Systems and system models (HS-LS2-5, HS-ESS3-6)**	Use the unit to help students examine the inputs and outputs of carbon reservoir systems through the use of biogeochemical models (Lessons 2 and 3). Have students develop biogeochemical models to help them explain how carbon flows between reservoirs and the impact that using carbon-based fuels adds to the carbon cycle (Lessons 4 and 5).
Constructing explanations and designing solutions (HS-ETS1-3)	Use the unit to have students analyze the real-world problem of excess carbon emissions, gather additional sources of evidence, and consider the effects of different solutions as they relate to overall costs, safety, reliability, as well as the potential social, cultural, and environmental impacts (Lessons 3, 4, and 5).	**ETS1.B: Developing Possible Solutions:** When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)	Use the unit to have students evaluate the variety of issues surrounding proposed solutions to increase carbon reservoirs' capacities to absorb carbon, such as "fertilizing" the ocean with nutrients (Lesson 3). Have students evaluate different solutions to reduce the use of fossil fuels, taking into consideration and prioritizing potential impacts on local communities and the environment (Lessons 4 and 5).	**Influence of science, engineering, and technology on society and the natural world (HS-ETS1-3)**	Use the unit to have students evaluate the impacts of new technologies on society and the environment. Encourage students to analyze multiple criteria and help them to recognize that the criteria need to be prioritized when making decisions.