

## FOURTH GRADE: ENERGY AND HUMAN IMPACT

### Standards Bundle

*Standards* are listed within the bundle. Bundles are created with potential instructional use in mind, based upon potential for related phenomena that can be used throughout a unit.

4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. (SEP: 8; DCI: ESS3.A; CCC: Cause/Effect, Technology) [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]

4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. (SEP: 6; DCI: ESS3.B, ETS1.B; CCC: Cause/Effect, Technology) [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

### Content Overview

*This section provides a generic overview of the content or disciplinary core ideas as an entry point to the standards.*

Energy and fuels that humans use are derived from natural sources. The use from these natural sources affects the environment. Some of these resources are renewable and can be used over or can be replaced over time, while other resources are non-renewable and are limited and cannot be replaced or reused. When humans use resources they affect the environment in different ways. Just as humans can affect the Earth by using resources, the Earth can affect human life through natural disasters. A variety of hazards result from natural processes; humans cannot eliminate hazards but can reduce their impacts.

### Phenomena

*Phenomena can be used at varying levels of instruction. One could be used to anchor an entire unit, while another might be more supplemental for anchoring just a unit. Please remember that phenomena should allow students to engage in the SEP and use the CCC/DCI to understand and explain the phenomenon.*

- Aftermath of a tornado.
- Air Pollution (smog).
- A building or structure surviving an earthquake.
- Windmills.
- Coal fired furnace.
- Deforestation.

## Storyline

*This section aims to decode not only the DCI connections, but also the SEP and CCC in a detailed account of how they possibly fit together in a progression for student learning, including both rationale and context for the bundle.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b>Obtaining, Evaluating, and Communicating Information</b></p> <ul style="list-style-type: none"> <li>Obtain and combine information from books and other reliable media to explain phenomena.</li> </ul> <p><b>Constructing Explanations and Designing</b></p> <ul style="list-style-type: none"> <li>Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.</li> </ul>	<p><b>ESS3.A: Natural Resources</b></p> <ul style="list-style-type: none"> <li>Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.</li> </ul> <p><b>ESS3.B: Natural Hazards</b></p> <ul style="list-style-type: none"> <li>A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts. (Note: This Disciplinary Core Idea can also be found in 3.WC.)</li> </ul> <p><b>ETS1.B: Designing Solutions to Engineering</b></p> <ul style="list-style-type: none"> <li>Problems Testing a solution involves investigating how well it performs under a range of likely conditions.(secondary)</li> </ul>	<p><b>Cause and Effect</b></p> <ul style="list-style-type: none"> <li>Cause and effect relationships are routinely identified, tested, and used to explain change.</li> </ul>

Earth is composed of many different sources of energy. Wind, water behind dams, and sunlight (solar) are renewable sources. Non-renewable resources are natural gas, coal, and oil. Resources, like trees, are renewable, but can sometimes be used faster than they can be replaced. Using these resources affects the environment in both positive and negative ways. For example, burning fossil fuels pollutes the atmosphere, while using renewable resources can reduce the amount fossil fuels are used and result in less pollutants entering the atmosphere. Students should obtain and evaluate information about different resources available in our areas and how using those resources can affect the environment. Students should create models or diagrams to show the relationships

between the use of resources and the effects on the environment.

Similar to how humans impact the Earth by using resources, the Earth also impacts human life. Natural disasters such as hurricanes, earthquakes, and tornadoes can have a tremendous effect on human life; however, humans can design solutions to reduce the impact these natural disasters have on human life and their societies. Students should research, discuss, and create possible solutions that could minimize the impact of these hazards on human life.

### Formative Assessment

*Formative assessment is crucial because all learners benefit from timely and focused feedback from others. It promotes self-reflection, self-explanation, and social learning. It can also make learning more relevant. Each of the questions below might be used throughout the formative assessment process. Specific prompts may focus on individual practices, core ideas, or crosscutting concepts, but, together, the components need to support inferences about students' three-dimensional science learning as described in a given bundle, standard or lesson-level performance expectation.*

#### **Resources to inform your formative assessment.**

- <http://stemteachingtools.org/brief/30>
- <http://stemteachingtools.org/brief/41>
- <http://stemteachingtools.org/pd/sessionb>

#### **SEP Obtain, Evaluate, and Communicate Information**

- What are the pros and cons to using renewable vs. non-renewable resources?

#### **SEP Construct an Explanation and Designing**

- Design and test a structure that will withstand an earthquake (or other natural disaster).

#### **CCC Cause and Effect**

- How does the use of non-renewable resources affect the environment?
- How does the use of renewable resources affect the environment?
- What steps can humans take to reduce impact from a blizzard, landslide, or hurricane (or other natural disaster)?

### Performance Outcomes

*These are statements of how students use knowledge and are similar to the standards in how they blend DCI, SEP, and CCC, but at a smaller grain-size. These are potential outcomes for instruction as it plays out in lessons and activities in the classroom. It is important to also think of these as smaller outcomes that build toward the larger goal of mastering the standards.*

- **Use a model** to explain that **energy and fuel** are derived from *natural resources*.
- **Use evidence to explain** that some of **Earth's resources** are renewable and some are non-renewable *energy sources*.

- **Construct an explanation** that using natural resources can *affect the environment in different ways*.
- **Explain using evidence** how natural Earth processes, such as natural disasters (tornado, hurricane, earthquake, volcanic eruption, etc.), *impact humans*.
- **Design a solution** by exploring ways to minimize the impact to humans by *natural Earth processes*.
- **Construct an explanation** and *compare the effectiveness* of multiple solutions designed to reduce the impact of natural Earth processes on humans.