Lesson Summary

Students will be able to review pros and cons of each energy source as well as interpret graphs to identify which sources are used frequently in the United States. Students will discuss which sources should be used more in the future, using evidence to back their decisions.

(Approx. total time: 45 minutes)

Standards

NGSS Disciplinary Core Ideas

ESS3.A: Natural Resources

Energy and fuels that humans use are derived from natural sources. Some resources are renewable over time, and others are not.

NGSS Science and Engineering Practices

Engaging in Argument from Evidence

Respectfully provide and receive critiques from peers about a proposed explanation by citing relevant evidence and posing specific questions.

Obtaining, Evaluating and Communicating Information

Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts.

Objectives

By the end of the lesson, students will

Know (facts/information):

- Most of the electricity in our country is produced by using non-renewable energy sources.
- Each energy source has pros and cons that must be considered when making a plan for the future.

Understand (concepts, big ideas):

- Limited amounts of natural resources are available on earth. Each decision we make about our use of natural resources can have positive or negative impacts on the environment, the economy, and other people.
The best solutions are found when people with different knowledge and perspectives listen and communicate respectfully and then come to an agreement.

**Be able to do (skills/behaviors/scientific and engineering practices):**
- Analyze and interpret a chart that explains energy sources for electricity production in the United States.
- Respect and value a perspective that is different from their own.

**Vocabulary**
- **coal:** a sedimentary rock formed from plants that lived millions of years ago
- **hydropower:** moving water released from a dam to produce electricity
- **natural gas:** a clean-burning gas formed in between rock layers from plants and animals that lived millions of years ago
- **nonrenewable resource:** a resource that cannot be easily made or replaced naturally in our lifetime
- **perspective:** a person’s point of view or how one person thinks about a situation
- **renewable resource:** a resource that can be replaced or restored naturally
- **solar panel:** a panel designed to absorb the sun’s light as a source of energy for generating electricity or heat
- **wind turbine:** a machine that uses blades to collect energy from the wind

**Materials**
- **Teacher Materials:**
  - Computer and projector
  - Use this video to grab attention at the beginning of the lesson:
    - https://www.youtube.com/watch?v=Fep4CSRoreE
  - Use this website to view and project:
    - https://www.eia.gov/state/
  - More background information for teachers about local energy production:
    - https://www.washingtonpost.com/graphics/national/power-plants/?utm_term=.2e1b9c202129
- **Student Materials:**
  - Energy source cards from Lesson 2.7, 1 per student (students can cut or can be cut ahead of time)
  - Energy for the Future pros and cons chart 2.8 S handout
  - US Energy Consumption by Source 2.8SE handout (optional)
  - Renewable v. Non-Renewable Chart on US Energy handout for each student (or projected on screen)
**2.9 ENERGY FOR THE FUTURE**

### Instructional Strategies

#### Link to Prior Knowledge (5 minutes)

Elicit prior knowledge about energy sources and personal connections to the topic. Share a short video about wind energy.

- What types of energy sources have you learned about? Is there an energy source that you would like to learn more about? Which one?

Allow students to share what they remember about energy sources from the card sort yesterday.

- What do you remember about wind energy? How does that energy system work?

If a review is needed, show video and discuss briefly:

- [https://www.youtube.com/watch?v=Fep4CSRoreE](https://www.youtube.com/watch?v=Fep4CSRoreE)

- Does anyone have a family member who works at a power plant or a company like a coal mine or other place that sells energy materials? Tell us about the work that they do.

If students mention a parent who has a job in the industry, take time to emphasize how important the work that they do is in providing energy/transportation fuel, etc. for people.

#### Instruction (30 minutes)

Pass out pros/cons for each energy source and review it with students.

- No energy source is perfect: each has things that are good about it and problems that come with using it. Here is some information about some of the pros and cons of each energy source. We’ll read through the pros and cons of these energy sources together.

Discuss the table as a group. If they read it independently, ask if there were parts that they didn’t understand or things they had questions about. When they are finished reviewing the table, ask:

- What surprised you about different energy sources we use to produce electricity? What new information did you learn?

Ask students to rank the energy sources from highest to lowest use in the future.

Have them set the petroleum card aside, since petroleum is used mostly for transportation and to make other materials, and not electricity production.
People in our country discuss energy sources a lot as they plan for our future. Everyone knows that we need to use more renewable resources in the future, but people don’t always agree on which ones, or how we should start setting up systems that use more renewable resources. Have you heard adults around you talking about the cost of gasoline or electricity? What are they saying?

You guys will be the city planners and problem solvers in the future. Imagine you are planning for the future of our city, thinking about what you want to change about how we produce electricity in 50 years. Now look at your energy source cards again. Put them in order from the ones you think we should be using the most in 50 years, down to the ones that we should using less. The other cards show us energy sources that are used for electricity. Be ready to justify the reasons for your decisions using information about each source from your table. There are no absolutely right or wrong answers to this problem; each state and country chooses different energy sources for different reasons. You may have knowledge about some of these energy sources from other places that will influence your decisions.

The petroleum card from yesterday is not needed for this lesson. Petroleum is used more for transportation and making things like plastic than for generating electricity.

**Ask students to explain their reasoning to partners, using information from the chart to back their claims.**

Remind students to use their Active Listening Skills and Respectful Communication Sentence Stems in their discussion.

Remember to use your active listening and respectful communication skills as you turn and talk with a partner. Share which energy source you each put first on your list and why. Discuss why you agree or disagree. This is a time when there will be a lot of different perspectives about which energy source is best. Remember that we need to be respectful of other perspectives. Often the best ideas are reached after a group of people make decisions based on everyone’s ideas. If you change your mind about which sources should be used more in the future after listening to your partner, move your cards around.

**Ask students to report their final decisions to the group. Create a visual representation of student ideas about energy sources.**

Teacher choice: Summarize student data in a table or chart. One simple strategy is to ask students to put their first choice on a sticky note to put on a chart paper or whiteboard bar chart.

Let’s take a few minutes to summarize what you guys think.

Now that you’ve discussed ideas and listened to each other’s perspectives, write the name of one energy source that you think should be on top of the list (on the board or on a sticky note), to see how much we agree on this important topic.

Give students time to complete this and discuss the data that represents student choices.
Reflect on differences between students. Why do some people prefer one source over another?

Did you agree on which energy sources should be used the most? Why or why not? I noticed a lot of you wrote____. Can someone explain why they picked that? Does anyone have a different perspective to add? Do you think we have to pick only one source, or could we compromise and choose a couple of our favorites? This is what our city planners do when they plan for the future of our city.

If you notice that students are missing some key information that seems to be skewing their perspective, bring their attention to that information in the data. Or ask something like: "I notice that a lot of you picked coal. Are there any important problems with coal that we should keep in mind as we plan for the future?" Or: "Would we have enough electricity if we only use wind turbines? Why or why not?"

Closing (10 minutes)

Briefly discuss which energy sources are used most in your community and state.

Each community decides which energy sources to use based on things like how much it costs and which resources are available nearby. Do you know which energy sources we use in our community? Have you seen a power plant anywhere nearby?

Pull up this website to show students a map or graph and ask them to tell you what they notice and think about energy sources used in their city/state.

Why do you think these sources are used in our state?

- https://www.eia.gov/state/

Assessment

Use formative assessment for this lesson. As you circulate and listen to conversations, reflect on how well students are doing with respecting different perspectives. Pause to listen and provide suggestions for sentence stems when students get stuck or disagree with each other.

Optional Extensions

1. Consider inviting a guest speaker from a local utility or energy company to talk with your students about their energy sources/power plants nearby or planning a field trip to visit a nearby power plant or hydroelectric dam.
2. Have students interpret a chart and reflect on energy use in the United States.

Project the U.S. energy consumption chart using a document camera or projector, or make copies for students to use.
Now I’d like to show you a chart that shows the energy sources we use in our country right now. What do you notice about this chart?

Students may notice that petroleum is used a lot. Point out that oil and gas are used for transportation, and this is why there are so many oil barrels in the chart.

Explain what the numbers on the chart mean if students are having a hard time interpreting the chart. Allow students to count and write down the number of each energy source if needed.

Take time to be sure all students can understand this representation of data before proceeding.

How well does your order match our current energy uses?

Is the U.S. using your first choice of an energy source? Why or why not? What are some important reasons why a state or city would choose one type of energy source over another? (Examples include cost, environmental impacts, human impacts, animal impacts, etc.)

3. Students need to be ready to agree, disagree, and ask questions of each other in ways that show respect. You may want to practice the sentence stems before science class and show how these stems can be used to help students engage in arguments from evidence. For instance, if one student is proposing a solar energy plan for the future, another student can use the sentence stem and say, “I agree with your solar energy plan and I think that solar is a great idea for this area because it’s so sunny.” Alternatively, a student can say, “I thought about it in a different way and I think we’ll have problems using solar power because the sun doesn’t always shine, and it costs a lot to make batteries to store solar energy.” Students can practice asking questions by asking, “Can you say more about your plan to store the solar energy?” Or “What did you mean when you said that you will find a new kind of battery that uses materials that are easy to find?”

References


Planning Page

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Instruction (30 minutes)

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Ask students to rank the energy sources from highest to lowest use in the future.

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2.9 ENERGY FOR THE FUTURE

Reflect on differences between students. Why do some people prefer one source over another?

Closing (10 minutes)

Briefly discuss which energy sources are used most in your community and state.
## ENERGY FOR THE FUTURE

<table>
<thead>
<tr>
<th></th>
<th><strong>PROS</strong></th>
<th><strong>CONS</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>COAL</strong></td>
<td>• Inexpensive</td>
<td>• Non-renewable</td>
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<tr>
<td></td>
<td>• There is a lot of coal underground in the United States</td>
<td>• Releases carbon dioxide when burned</td>
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<tr>
<td></td>
<td>• Many coal power plants are already built</td>
<td>• Leftover ash after burning needs to be treated carefully so that it does not pollute water</td>
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<td><strong>HYDROPOWER</strong></td>
<td>• Renewable</td>
<td>• Dams flood large areas of land and change river ecosystems</td>
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<tr>
<td></td>
<td>• No air pollution or carbon dioxide emissions</td>
<td>• Fish cannot migrate unless fish ladders are built</td>
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<tr>
<td><strong>NATURAL GAS</strong></td>
<td>• Inexpensive</td>
<td>• Non-renewable</td>
</tr>
<tr>
<td></td>
<td>• Pollutes the air less than coal</td>
<td>• Releases carbon dioxide when burned</td>
</tr>
<tr>
<td></td>
<td>• There is a lot of natural gas underground in the United States</td>
<td>• Releases another gas called methane into the air when it leaks from wells and pipelines</td>
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<tr>
<td><strong>SOLAR PANELS</strong></td>
<td>• Solar panels do not pollute air or water</td>
<td>• Sometimes the sun does not shine</td>
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<tr>
<td></td>
<td>• The sun is free and shines everywhere</td>
<td>• Batteries to store solar power are expensive and use minerals that are hard to find</td>
</tr>
<tr>
<td><strong>WIND TURBINE</strong></td>
<td>• Renewable</td>
<td>• When wind is not blowing, other energy sources must be used, or electricity must be stored in expensive batteries</td>
</tr>
<tr>
<td></td>
<td>• No air pollution or carbon dioxide emissions</td>
<td>• Birds or bats may be injured by blades</td>
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<thead>
<tr>
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