NATIONAL GEOGRAPHIC

RESOURCE LIBRARY
ACTIVITY : 2 HRS 30 MINS

Hydroelectric and Geothermal: Benefits and Drawbacks

Students analyze the benefits and drawbacks of hydroelectric and geothermal energy and the environmental impacts on a specific geographic location. They create a multimedia presentation to share what they have learned.

GRADES

6 - 8

SUBJECTS

English Language Arts, Geography, Human Geography

CONTENTS

16 Images, 2 Resources, 3 PDFs, 1 Link

OVERVIEW

Students analyze the benefits and drawbacks of hydroelectric and geothermal energy and the environmental impacts on a specific geographic location. They create a multimedia presentation to share what they have learned.

For the complete activity with media resources, visit:
http://www.nationalgeographic.org/activity/hydroelectric-and-geothermal-benefits-and-drawbacks/

Program

DIRECTIONS

1. Activate students' prior knowledge by asking them to write down two energy resources that are used to generate electricity.

Have students share their responses with the class. Ask: *How diverse were the energy resources you came up with as a class? Are there other resources that can be used to generate electricity?* Have students brainstorm additional energy resources. If necessary, show students the Energy Resources photo gallery to stimulate their thinking. As a class, list benefits and drawbacks of each energy resource on the list. Keep this list for reference in step 8 of the activity. Ask students to propose some benefits of using a variety of energy resources, rather than just relying on one. Encourage them to include reasons that address the benefits and drawbacks of the various resources.

2. Preview reading discussion questions with students.

Explain that students will investigate two energy resources—hydroelectric and geothermal—as examples of the diverse options available for generating electricity. Make sure students understand that energy resources are chosen based on environmental, political, economic, and other factors, but in many cases the environmental or geographic factors may dominate. For example, hydroelectric may be a good option if certain geographic and environmental characteristics, such as a large river, are present. Explain that each student will read one of two articles—one on geothermal and one on hydroelectric—and will then discuss the article with other students who read the same article with the goal of identifying what conditions make it the most favorable solution, keeping in mind that there are always drawbacks. Write the following discussion questions on the board:

- *How is this energy resource used to generate electricity?*
- *Are there specific geographic requirements necessary for this energy resource to be effective? If so, what are they?*
- *What are some environmental benefits and drawbacks of this energy resource?*
- *What are some economic benefits and drawbacks of this energy resource?*
- *What are some societal benefits and drawbacks of this energy resource?*
- *What are other benefits and drawbacks of this energy resource?*

Preview each question with students and make sure they understand what the question is asking. Give examples of environmental, economic, and societal considerations as they relate to energy resources. For example, environmental considerations could include pollution, greenhouse gasses, land conservation issues, the effects of the resource on animal species, or

the effect of the resource on freshwater supplies. Economic considerations could include the initial costs to build the system, costs to run the system, or issues of supply and demand. Societal considerations might include the effects of the system on human health, local or national energy priorities, and ethics considerations. Invite students to brainstorm additional examples.

3. Have students read articles on hydroelectric energy and geothermal energy.

Divide the class in half and assign one half of the class the article Hydroelectric Energy and the other half the article Power Plan. Distribute the Benefits and Drawbacks Chart to all students in both groups. Within each large group, have students pair up with a reading partner. Have each pair preview their article by reading the title and headings and looking at the images. Have them predict what each section of the article will be about. Have students review the discussion questions and predict where answers to these questions might be found within the text. Allow students to ask any questions they might have before reading the article for the first time. Have student pairs read through their article one section at a time. As they read, they should highlight any unfamiliar words. Have students pause after each section of the article and think aloud with their partner to make sure they both understand the content of the section. Then have students write down brief keywords summarizing the section. When students have finished the first read-through, have them look up any unfamiliar words they highlighted and/or determine what the words mean through context clues. Again give students an opportunity to ask any questions before they continue. Have students read their assigned article a second time and use the Benefits and Drawbacks Chart to take notes about the reading.

4. Have groups discuss their reading.

Have students form small groups by partnering with another pair of students who read the same article. Have students within each small group compare charts with one another and discuss what they read, using the provided discussion questions. Have each small group write down the important points of their discussion for each question. Use this discussion to address any errors students might have made on their Benefits and Drawbacks Charts. Have students adjust their individual charts as needed following the discussion.

5. Assign the multimedia presentation.

Explain to the whole class that students who read the same article will collaborate to create a multimedia presentation about the energy resource from their reading. Distribute the Multimedia Presentation Guidelines and the Multimedia Presentation Rubric. Review the guidelines and rubric with students and answer any questions they might have. Assign one of the required sections described in the Presentation Guidelines handout to each small group from step 4. Have students brainstorm a list of tasks that need to be performed; for example, roles might include research, writing text, designing pages, finding/creating graphics or sound, or proofreading. Explain that each small group will be responsible for all elements of the presentation pertaining to their section, but that they will also need to coordinate with the other small groups that read the same article to make sure the overall presentation is cohesive. Stress that students should take on multiple roles if needed and that the workload should be distributed equally.

6. Allow students time to research and create their presentations.

Allow small groups enough time to use computers to conduct further research as necessary and to create their presentations using presentation software available to them. Encourage students to use the MapMaker Interactive to create one or more custom maps to include in their presentations. Establish checkpoints as students prepare their presentations; for example, ask students to check in with you after they create an overall presentation plan, draft text, and draft graphics. Have each group use the Presentation Rubric to review their presentation and revise as needed.

7. Have students present their work.

Review the concept of constructive feedback with students. Specify the kinds of questions you expect to hear following the presentations and the kinds of comments you expect to see in the feedback section of the rubric. Have students present their multimedia presentations to their peers. Allow time for questions following each presentation. After each presentation, have the audience members peer review the presentation using the Multimedia Presentation Rubric.

8. Have students discuss and reflect on their learning.

Allow time for each group to review and discuss the peer reviews of their presentation. Then have each student independently write a reflection of their presentation, including a brief description of what they contributed to the multimedia presentation, what they consider to be the strengths of their presentation, and what they would do differently. As a class, revisit the list from the brainstorming session in step 1. Ask:

- *How does your understanding of the benefits and drawbacks of hydroelectric and geothermal energy compare to the initial list?*
- *What did you learn that surprised you?*
- *Which other resources from the list would you like to explore further? Why?*
- *What are some benefits of using a variety of energy resources?*

TipTeacher Tip

In step 3, review students' charts and listen to their discussions to identify any gaps in knowledge or misconceptions. Address any areas of concern during the discussion. Have students reread sections of the article as necessary.

Modification

Instead of allowing students to define and assign roles within the group, assign specific roles to students based on their individual needs and abilities.

Modification

Make the activity more relevant to your location by replacing the readings in step 2 with reading about two energy resources that are used in your local area.

Informal Assessment

Check students' Benefits and Drawbacks Chart for understanding during the group discussions. Use the provided Multimedia Presentation Rubric and students' written reflections to assess students' presentations.

Extending the Learning

Have students research new or innovative ways to generate electricity or to conserve energy. Examples might include increasing city planning and density, grid modernization, or localized solar energy.

OBJECTIVES

Subjects & Disciplines

- English Language Arts

  Geography
  - Human Geography

Learning Objectives

Students will:

- analyze the benefits and drawbacks of using hydroelectric and geothermal energy as electric energy resources and the corresponding impact on the environment
- research, create, and deliver a multimedia presentation about the benefits, drawbacks, and environmental impacts of using hydroelectric and geothermal energy as electrical energy resources

Teaching Approach

- Learning-for-use

Teaching Methods

- Brainstorming
- Cooperative learning
- Discussions

- Information organization
- Reading
- Reflection
- Research

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Information, Media, and Technology Skills
    - Information Literacy
  - Learning and Innovation Skills
    - Communication and Collaboration
    - Critical Thinking and Problem Solving
- Critical Thinking Skills
  - Analyzing
  - Creating
- Geographic Skills
  - Analyzing Geographic Information
- Science and Engineering Practices
  - Obtaining, evaluating, and communicating information

National Standards, Principles, and Practices

ENERGY LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

• **Fundamental Concept 7.3:**
Environmental quality is impacted by energy choices.

IRA/NCTE STANDARDS FOR THE ENGLISH LANGUAGE ARTS

• **Standard 7:**
Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g.,

print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

- **Standard 8:**

Students use a variety of technological and informational resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

NATIONAL COUNCIL FOR SOCIAL STUDIES CURRICULUM STANDARDS

- **Theme 7:**

Production, Distribution, and Consumption

NATIONAL GEOGRAPHY STANDARDS

- **Standard 14:**

How human actions modify the physical environment

- **Standard 16:**

The changes that occur in the meaning, use, distribution, and importance of resources

NATIONAL SCIENCE EDUCATION STANDARDS

- **(5-8) Standard F-2:**

Populations, resources, and environments

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- **Speaking and Listening Standards 6-12:**

Presentation of Knowledge and Ideas, SL.8.4

- **Speaking and Listening Standards 6-12:**

Presentation of Knowledge and Ideas, SL.7.4

- **Speaking and Listening Standards 6-12:**

Presentation of Knowledge and Ideas, SL.6.4

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Pencils

REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per learner, Audio recording device, Media production software, Microphone, Presentation software, Projector

PHYSICAL SPACE

- Classroom
- Computer lab

GROUPING

- Large-group instruction

OTHER NOTES

This activity should be conducted over three sessions.

BACKGROUND & VOCABULARY

Background Information

All of the energy that people use to generate electricity originates from an energy resource. Renewable energy resources are used at a rate that is slower or equal to the rate at which they can be resupplied by nature. Non-renewable energy resources are finite, or limited. Once they have been used, they are gone. Examples of renewable energy resources include hydroelectric, solar, geothermal, wind, and biomass. Examples of non-renewable resources include coal, petroleum, and natural gas. Many renewable resources are specific to certain climates or geographical locations. For example, large-scale hydroelectric energy requires a large river that can be dammed to control the water flow. Geothermal energy is specific to areas where the underground heat and water are relatively close to the surface, such as along plate boundaries. In general, renewable energy resources produce less pollution than non-renewable resources. However, renewable energy resources do have environmental impacts.

Hydroelectric dams flood large areas, displacing people and wildlife. They can present problems for fish that migrate upstream. Water around hydroelectric dams is at a higher temperature than normal, which can cause problems for aquatic species in the area. Geothermal plants can release greenhouse gases and chemicals associated with acid rain, albeit in much smaller quantities than those released from a coal-fired power plant. In some geothermal systems, water pollution or overuse of water is a concern. Conservation is also an issue with geothermal energy. Since a geothermal plant must be located near the resource, developing resources in pristine areas or wilderness areas could negatively affect the area.

Prior Knowledge

["Energy Literacy Principle 1: Energy is a physical quantity that follows precise natural laws.","Energy Literacy Principle 2: Physical processes on Earth are the result of energy flow through the Earth system.","Energy Literacy Principle 3: Biological processes depend on energy flow through the Earth system."]

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
constructive feedback	*noun*	tool to enhance the teaching and learning process; highlighting strengths and achievements as well as areas for improvement.
diversified energy portfolio	*noun*	scenario in which a utility is acquiring electricity from multiple different sources.
electricity	*noun*	set of physical phenomena associated with the presence and flow of electric charge.
energy	*noun*	capacity to do work.

Term	Part of Speech	Definition
energy resource	*noun*	source of energy found in nature that has not been subject to any human-induced energy transfers or transformations; for example, oil, coal, gas, wind, or sunlight.
energy source	*noun*	location in which the energy resource (oil, coal, gas, wind, etc.) is converted into electrical energy.
geothermal energy	*noun*	heat energy generated within the Earth.
hydroelectric energy	*noun*	energy generated by moving water converted to electricity. Also known as hydroelectricity.
non-renewable energy	*noun*	energy resources that are exhaustible relative to the human life span, such as gas, coal, or petroleum.
peer review	*noun*	the many ways in which students can share their creative work with peers for constructive feedback and then use this feedback to revise and improve their work.
renewable energy	*noun*	energy obtained from sources that are virtually inexhaustible and replenish naturally over small time scales relative to the human life span.

For Further Exploration

Articles & Profiles

- National Geographic Environment: Hydropower

Maps

- National Geographic Maps: Energy Realities

Websites

- Energy.gov: Geothermal
- Energy.gov: Water
- National Geographic Environment: Geothermal Energy

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