

RESOURCE LIBRARY

ACTIVITY : 2 HRS 20 MINS

Energy Sustainability in the Klamath Basin

Students read a case study about the proposed removal of hydroelectric dams along the Klamath River in the western United States. They analyze the problem from the perspective of one of the stakeholders, generate questions, and conduct research. Then they analyze the complexities and balance of power in the case study and vote on a solution.

GRADES

9 - 12+

SUBJECTS*English Language Arts, Geography, Human Geography, Physical Geography***CONTENTS**

4 PDFs, 7 Links

OVERVIEW

Students read a case study about the proposed removal of hydroelectric dams along the Klamath River in the western United States. They analyze the problem from the perspective of one of the stakeholders, generate questions, and conduct research. Then they analyze the complexities and balance of power in the case study and vote on a solution.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/energy-sustainability-klamath-basin/>

Program



DIRECTIONS

1. Activate students' prior knowledge of hydroelectric and geothermal energy resources.

Ask students to name some ways electricity can be generated. Focus on hydroelectric energy and ask:

- *How does a hydroelectric power plant work?*
- *How is electricity produced at a hydroelectric plant?*
- *What are some requirements for a hydroelectric power plant?*
- *What are some advantages and limitations of generating electricity this way?*

Next, draw students' attention to geothermal energy. Explain that geothermal power plants convert heat from inside the Earth into electricity. Ask the same sorts of questions that you asked about hydroelectric power plants to draw out what students know about geothermal power plants and geothermal energy.

2. Introduce the reading to students.

Divide students into small groups. Ask students to think of a time when they had a conflict with other people over something such as sharing a computer with a sibling or deciding with their family how to spend money for a vacation. Have students share stories within their groups. Then ask each group to share their most complex conflict with the whole class. Ask students to describe what made the conflict complex. Ask:

- *How many people were involved in the conflict?*
- *How did you resolve the conflict?*
- *Was the conflict easy to resolve? Why or why not?*
- *Were you satisfied with how the conflict was resolved? Why or why not?*

Distribute a copy of the Case Study: Klamath Basin handout to each student. Have students geo-locate the Klamath River and the Klamath Basin using the MapMaker Interactive. Explain that the case study describes an agreement resolving water use problems among about forty different groups in the Klamath Basin along the Klamath River in California and Oregon. Ask students to keep in mind the personal conflicts they discussed as they read the case study to get a better idea of the complexity of the conflict in the Klamath Basin.

3. Have students independently read and discuss the Klamath Basin Case Study.

Give students time to read the case study. As a class, discuss the reading. Ask students to summarize the problem in the Klamath Basin. Then ask students to identify the major decision-makers in the process and describe the viewpoint of each of the stakeholders. Ask:

- *Who will benefit most from the removal of the dams? Who will not benefit?*
- *Who is holding up the process of dam removal? Why?*
- *How does the identification of new sites for geothermal power in the area affect the situation?*

4. Introduce the stakeholder task to students.

Assign each small group a stakeholder to represent. Explain that students will take on the role of a stakeholder, generate questions the stakeholder might have about the removal of the dams and the investment in geothermal power, and conduct research in order to answer the questions. Explain that students will eventually vote on whether or not they think the hydroelectric dams should be removed and must give a rationale for their vote. Distribute a copy of the Stakeholder Chart and Stakeholder Rubric to each group. Review both handouts with students and answer any questions they might have.

5. Have groups gather information about the problem from their stakeholder's perspective.

Have students work in their groups to re-read the case study and complete the Stakeholder Chart. Have students discuss their stakeholder's perspective within their small groups and develop a list of the stakeholder's priorities. Then ask students to develop a list of questions their stakeholder would likely have about the proposed solution of removing the four dams. Give students time to research the problem in their groups, using the provided webpages. Have them note answers to their questions and any other information that would likely inform their stakeholder's decision-making process. Have them add relevant notes to the Stakeholder Chart as they read additional information.

6. Have students answer the analysis questions and present their ideas to the class.

Discuss the decision-making process with students. Discuss how complex decisions that affect many people are different from personal decisions that mainly affect a single person. Explain that in this case, each stakeholder group has its own needs and wants related to the removal of the dams. These needs and wants affect each stakeholder's decision-making process.

Discuss ways to identify and evaluate important criteria and anticipate the consequences of different choices when making a decision. Have students work within their small groups to discuss and answer the analysis questions at the bottom of the Stakeholder Chart from their stakeholder's perspective. Remind students that their stakeholder's decision-making process would be inherently biased toward that stakeholder's best interests. Invite students to share their completed Stakeholder Chart and their answers to the analysis questions with the class.

Ask:

- *Which stakeholders will be most affected by the decision to remove the dams?*
- *Are those stakeholders the ones who have the power to make the decision? Do you think this is "fair"? Why or why not?*
- *Who do you think should make the decision in situations like this?*

7. Take a vote on the proposed solution.

Have students read the case study a third time, underlining any points or topics that they personally—not as their stakeholder—find important. Take a vote to see how students themselves would vote on the proposed removal of the four dams. Discuss the vote. Ask:

- *Why did you vote the way you did?*
- *If you had no personal stake in the solution, what factors most influenced your decision-making?*
- *Did your feelings about the decision-making process in the case study affect your vote? Why or why not?*

End the discussion by explaining that, in any decision, a person's feelings affect his or her decision-making to some extent.

8. Have students write a rationale explaining their vote.

Distribute the Rationale Rubric and review it with students. Answer any questions they might have. Have students work independently to write one to three paragraphs explaining why they voted the way they did. Encourage them to incorporate factual information and discuss the role their feelings played in their decision-making process. Revisit and discuss the guiding question: How do the various needs and wants of stakeholders affect the complexity of energy decisions? Have students use specific examples from their research in the discussion.

TipTeacher Tip

If students are unable to find the answers to some of their questions during the research phase, have them mark those as pending and draft new questions.

TipTeacher Tip

In step 2, monitor student discussions to make sure students do not share inappropriate personal stories.

Informal Assessment

Use the provided Stakeholder Rubric and Rationale Rubric to assess students' research and written rationales.

Extending the Learning

Have students research a conflict about another hydroelectric dam, such as the Three Gorges Dam in China, the Aswan Dam in Egypt, the Belo Monte Dam in Brazil, or the Elwha Dam in the United States. Have them write a case study describing the geographic background, the conflict, the stakeholders, and any proposed or implemented solutions. Alternatively, students could research and report on a conflict with another energy resource.

OBJECTIVES

Subjects & Disciplines

- English Language Arts

Geography

- Human Geography
- Physical Geography

Learning Objectives

Students will:

- research the Klamath Basin hydroelectric dam removal and geothermal energy proposals
- analyze the effects of replacing the hydroelectric dam with geothermal power from the perspectives of various stakeholders
- take a personal stance for or against the proposed solution and formulate a rationale for their position
- explain the complexities of the decision-making process

Teaching Approach

- Learning-for-use

Teaching Methods

- Cooperative learning
- Discussions
- Reading
- Research
- Writing

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Information, Media, and Technology Skills
 - Information Literacy
 - Media Literacy

- Learning and Innovation Skills
 - Communication and Collaboration
 - Critical Thinking and Problem Solving
- Critical Thinking Skills
 - Analyzing
 - Evaluating
- Geographic Skills
 - Acquiring Geographic Information
- Science and Engineering Practices
 - Asking questions (for science) and defining problems (for engineering)
 - Engaging in argument from evidence
 - 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.

- **Fundamental Concept 7.6:**

Some populations are more vulnerable to impacts of energy choices than others.

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 GEOGRAPHY STANDARDS

- **Standard 13:**

How the forces of cooperation and conflict among people influence the division and control of Earth's surface

- **Standard 14:**

How human actions modify the physical environment

NATIONAL SCIENCE EDUCATION STANDARDS

- **(9-12) Standard F-3:**

Natural resources

- **(9-12) Standard F-4:**

Environmental quality

- **(9-12) Standard F-6:**

Science and technology in local, national, and global challenges

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- **Writing Standards 6-12:**

Research to Build and Present Knowledge, W.11-12.7

- **Writing Standards 6-12:**

Research to Build and Present Knowledge, W.9-10.7

ISTE STANDARDS FOR STUDENTS (ISTE STANDARDS*S)

- **Standard 2:**

Communication and Collaboration

- **Standard 4:**

Critical Thinking, Problem Solving, and Decision Making

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Paper
- Pencils

REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per small group, Projector

PHYSICAL SPACE

- Classroom
- Computer lab

GROUPING

- Large-group instruction

OTHER NOTES

This activity can be conducted in either one or two sessions.

BACKGROUND & VOCABULARY

Background Information

The decision-making process surrounding adding or removing power plants can be extremely complex. Because these decisions have environmental, social, and economic impacts, a variety of stakeholders with conflicting wants and needs are often involved. In addition, local, state, and federal governments have roles in approving permits, roads, infrastructure, and other aspects of any such project. Depending on the location of the proposed plant, the Department of the Interior and/or Environmental Protection Agency (EPA) might need to do environmental and economic impact studies. In many cases, funding from these projects comes from a variety of sources and usually needs to be approved through state and federal legislatures.

The 2010 Klamath Basin water agreements provided a number of provisions for restoring the Klamath Basin, including the removal of four dams that have blocked water and access for salmon to their spawning grounds. One reason the Klamath Basin water agreements are unique is the cooperation shown from so many on opposing sides of the problem. However,

the agreements are “Agreements in Principal” and are non-binding. Approval from the Department of the Interior and funding from California, Oregon, and the federal government are needed before the dams can be removed.

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
case study	noun	form of problem-based learning, where the teacher presents a situation that needs a resolution. The learner is given details about the situation, often in a historical context. The stakeholders are introduced. Objectives and challenges are outlined. This is followed by specific examples and data, which the learner then uses to analyze the situation, determine what happened, and make recommendations.
conflict	noun	a disagreement or fight, usually over ideas or procedures.
dam	noun	structure built across a river or other waterway to control the flow of water.
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	<i>noun</i>	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	<i>noun</i>	location in which the energy resource (oil, coal, gas, wind, etc.) is converted into electrical energy.
geothermal energy	<i>noun</i>	heat energy generated within the Earth.
hydroelectric power	<i>noun</i>	usable energy generated by moving water converted to electricity.
non-renewable energy	<i>noun</i>	energy resources that are exhaustible relative to the human life span, such as gas, coal, or petroleum.
renewable energy	<i>noun</i>	energy obtained from sources that are virtually inexhaustible and replenish naturally over small time scales relative to the human life span.
stakeholder	<i>noun</i>	person or organization that has an interest or investment in a place, situation, or company.

For Further Exploration

Articles & Profiles

- [National Geographic Magazine: Klamath River](#)
- [National Geographic Education: Learning to Make Systematic Decisions](#)
- [National Geographic Education: Geo-Education—Preparation for 21st-Century Decisions](#)

Maps

- [National Geographic Maps: Energy Realities](#)

Websites

- [U.S. Department of Energy: Geothermal Technologies Program—Energy Basics](#)

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