

RESOURCE LIBRARY  
ACTIVITY : 3 HRS

## Conserving Energy through Grid Modernization

Students identify a research question related to grid modernization technology, conduct research, write a summary statement, and identify questions for further research.

### GRADES

6 - 8

### SUBJECTS

*English Language Arts*

### CONTENTS

10 Links, 3 PDFs

## OVERVIEW

Students identify a research question related to grid modernization technology, conduct research, write a summary statement, and identify questions for further research.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/conserving-energy-through-grid-modernization/>

## Program



## DIRECTIONS

1. Have students brainstorm what they know about energy conservation.

Divide students into groups of three or four, and ask groups to briefly discuss what energy conservation is. Check in to make sure students understand that energy conservation is all the ways society can reduce use of energy resources and/or make better use of the resources, resulting in a decrease of energy use and thereby making more efficient use of existing energy resources. Ask students to name some energy resources and discuss what role the use of a variety of energy resources has in energy conservation. Then give groups time to brainstorm what they already know about energy conservation from their daily lives, articles they've read, current events such as natural disasters that impact the resiliency of the grid, or television shows they've seen. Ask each group to share a few ideas with the whole class. As students share, check for any misconceptions and address them before moving on.

## 2. Introduce the concept of grid modernization technology.

Write the activity's guiding questions on the board: What are some ways grid modernization technology increases the efficiency of energy distribution? How do the choices we make as a society affect the conservation of energy? Explain that students will explore these questions further. If students did not mention it during the brainstorming, explain that one way to conserve energy is to create a more efficient system for producing energy and for getting electrical energy from its source to its destination. Introduce the concept of grid modernization technology. Make sure students understand that some groups refer to grid modernization as a "smart grid." Go to the provided American Public Media article, "Why we need to build a smart grid—fast." Distribute a copy of the transcript to each student. Play the audio podcast for the class and ask them to follow along with the transcript. Ask students to highlight any parts they don't understand and to record any questions or comments. Answer any questions students might have about the information in the broadcast. Then briefly discuss the podcast. Ask:

- *Why does Maggie Koerth-Baker think that modernizing our electrical grid is so important?*
- *How would a modernized or "smart" grid be different from what we have today?*
- *How would grid modernization technology affect individuals in their homes?*
- *How would it help to conserve energy?*

## 3. Introduce the research activity.

Distribute a copy of the Research Chart and Research Rubric to each student. Explain that students will work in their small groups and use a prewriting process to develop solid research questions about grid modernization technology. They will conduct research, write a summary of their research, and identify questions for further research. Review the worksheet and handout with students and answer any questions they might have. Make sure students understand what information goes into each section of the Research Chart.

#### **4. Model drafting and revising a focused research question.**

Explain that a good research question is very specific and focused, but not something that can be answered just by looking up one or two facts or viewpoints. Model the process of developing a sample research question for students; for example, “What potential energy delivery loss might a modern grid prevent?”:

- Select a general topic for your research.
- Freewrite for one minute on the topic.
- Review your freewriting and circle two or three ideas that most interest you.
- Write a draft research question for each idea you circled. Include one question that is too broad, one that is too narrow, and one that is unclear.
- For each question, point out the problem with the question, and then revise the question to make it a solid research question.

#### **5. Have students draft research questions.**

Have students freewrite individually for five to ten minutes about grid modernization. Then have them share their freewriting with their group and collectively circle five or six ideas they are interested in exploring. Next have them draft one or two research questions based on each idea they circled. Have students discuss these draft questions in their small groups and eliminate any that are not of great interest to the group. Then have them choose two or three research questions and revise them to make them more focused. Finally, have students discuss their revised research questions and select one for further exploration. Some possible topics for research questions include how grid modernization facilitates using a mixture of energy resources, how grid modernization increases the efficiency of energy distribution, reactions to early integration of smart appliances, the costs and financial benefits of grid modernization, and the technology used to modernize the grid.

## **6. Form jigsaw groups and have the new groups peer review the research questions.**

Form new groups of three or four students. Each new group should have no more than one member from each original research group. Review the research question portion of the Research Rubric with students. In their new groups, have students take turns reading and discussing their research questions. Have each student take notes on their peers' suggestions and comments to take back to their research group. Return students to their research groups and have them share and discuss the peer reviewers' comments. Have them make any necessary revisions to their research question before writing the final version of the question in the appropriate place on the Research Chart.

## **7. Have students research to gather information about their question.**

Have students note information they already have related to their research question in the appropriate box on the Research Chart. Then have students research their question using the provided websites and complete the middle section of the Research Chart as they work.

## **8. Have students draft a summary statement and questions for additional research.**

After students have finished their research, have each small group draft a brief summary statement to summarize what they learned about their research question. Then have them draft a list of additional questions they have on the topic. Have each group share their summary statement and list of questions with the class.

## **9. Revisit the topic of energy conservation.**

Ask students to revisit the guiding questions: What are some ways grid modernization technology increases the efficiency of energy distribution? How do the choices we make as a society affect the conservation of energy? Briefly discuss these questions using new information students have gathered over the course of the activity. Distribute the Paragraph

Rubric and review it with students. Have each student work independently to write three to five paragraphs answering these questions from their own perspective. Have students include evidence from their research to support their ideas.

## TipTeacher Tip

In step 5, if students need more practice with research questions before they begin drafting their own, show them three versions of the same research question, have them identify which is the best version for research, and discuss why the identified question is better than the others.

## TipTeacher Tip

See the links in the Resources for Further Understanding section for support with modeling a research question.

## TipTeacher Tip

This activity is a good opportunity for collaboration between science and language arts teachers.

## TipTeacher Tip

To help keep small groups organized and on task, assign each group member a role. Roles could include leader/facilitator, note-taker, timekeeper, and “ambassador” (whose job is to ask the teacher any questions from the group).

## Modification

Students may need an introduction to grid modernization before you begin this activity. Use the "[Toilets and the SMART GRID](#)" video clip from the film *Earth: The Operator's Manual* to introduce the concept.

## Informal Assessment

Use the provided Research Rubric to assess groups' Research Chart and questions. Use the Paragraph Rubric to evaluate students' written responses to the guiding questions.

## Extending the Learning

Have each student select one of the questions for further research generated by their research group and revise it into a focused research question. Then have students research the question, again using the Research Chart worksheet. Have each student share his or her research summary with the original research group.

## OBJECTIVES

## Subjects & Disciplines

- English Language Arts

## Learning Objectives

Students will:

- summarize their research in a summary statement
- identify and categorize additional questions related to energy conservation for further research
- formulate a written response to the guiding questions, supported by evidence from research
- define a research question related to energy conservation and grid modernization technology and conduct research on the question

## Teaching Approach

- Learning-for-use

# Teaching Methods

- Brainstorming
- Cooperative learning
- Discussions
- Jigsaw
- Modeling
- Research
- Writing

## 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 Skills
  - Analyzing
- Science and Engineering Practices
  - Asking questions (for science) and defining problems (for engineering)
  - Obtaining, evaluating, and communicating information

## National Standards, Principles, and Practices

### ENERGY LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

- Fundamental Concept 6.1:

Conservation of energy has two very different meanings.

- Fundamental Concept 6.2:

One way to manage energy resources is through conservation.

## 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.

## NATIONAL SCIENCE EDUCATION STANDARDS

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

Science and technology in society

## COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- **Writing Standards 6-12:**

Text Types and Purposes, W.8.1

- **Writing Standards 6-12:**

Research to Build and Present Knowledge, W.8.7

- **Writing Standards 6-12:**

Research to Build and Present Knowledge, W.6.7

- **Writing Standards 6-12:**

Text Types and Purposes, W.6.1

- **Writing Standards 6-12:**

Text Types and Purposes, W.7.1

- **Writing Standards 6-12:**

Research to Build and Present Knowledge, W.7.7

## ISTE STANDARDS FOR STUDENTS (ISTE STANDARDS\*S)

- **Standard 3:**

Research and Information Fluency

### **Preparation**

### **What You'll Need**

### **MATERIALS YOU PROVIDE**

- Paper
- Pencils

## REQUIRED TECHNOLOGY

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

## PHYSICAL SPACE

- Classroom
- Computer lab

## GROUPING

- Large-group instruction

## OTHER NOTES

This activity should be conducted in two or three sessions. Before starting the activity, download and copy the transcript of the American Public Media article from the provided link.

## BACKGROUND & VOCABULARY

### Background Information

Energy conservation is a way of decreasing our use of energy resources. There are many ways to conserve energy. One way is to simply use less energy, such as turning down the thermostat in the winter. Another way to conserve energy is to use it more efficiently. Grid modernization technology increases the efficiency of the electrical grid, allowing us to use fewer energy resources to supply the same energy for use.

The basic technology behind the U.S. electrical grid has remained largely unchanged for over a century. During that time, the amount of energy traveling along the grid has increased exponentially. Grid modernization includes changes to the grid infrastructure and a variety of

technologies that allow for better, more automated communication between the places where electricity is generated and the places where it is used. For example, during times of peak electrical usage, additional power plants often have to be brought on line to meet an increased demand. A more modern grid would allow consumers to briefly cycle off individual appliances, such as hot water heaters or air conditioners, in their homes during peak times to help the system run more efficiently. Participating customers would pay lower electric bills. The cost/benefit of cycling off appliances at this level is still open to debate. The costs of implementation may outweigh the benefits when compared to other peak control or efficiency technologies. Grid modernization technology would update and automate the electrical grid, increasing efficiency and conserving energy resources.

## Prior Knowledge

[<a href="http://energy.gov/eere/education/energy-literacy-essential-principles-and-fundamental-concepts-energy-education">Energy Literacy Principle 1</a>: Energy is a physical quantity that follows precise natural laws.",<a href="http://energy.gov/eere/education/energy-literacy-essential-principles-and-fundamental-concepts-energy-education">Energy Literacy Principle 2</a>: Physical processes on Earth are the result of energy flow through the Earth system.",<a href="http://energy.gov/eere/education/energy-literacy-essential-principles-and-fundamental-concepts-energy-education">Energy Literacy Principle 3</a>: Biological processes depend on energy flow through the Earth system.]

## Recommended Prior Activities

- None

## Vocabulary

Term	Part of Speech	Definition
conserve	<i>verb</i>	to save or use wisely.
electrical energy	<i>noun</i>	energy associated with the changes between atomic particles (electrons).
electrical grid	<i>noun</i>	network of cables or other devices through which electricity is delivered to consumers. Also called a power grid.
electricity	<i>noun</i>	set of physical phenomena associated with the presence and flow of electric charge.

<b>Term</b>	<b>Part of Speech</b>	<b>Definition</b>
<b>energy</b>	<i>noun</i>	capacity to do work.
<b>energy conservation</b>	<i>noun</i>	process of using less energy, or using it more efficiently and sustainably.
<b>energy efficiency</b>	<i>noun</i>	use of a relatively small amount of energy for a given task, purpose, or service; achieving a specific output with less energy input.
<b>energy resource</b>	<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.
<b>energy source</b>	<i>noun</i>	location in which the energy resource (oil, coal, gas, wind, etc.) is converted into electrical energy.
<b>freewriting</b>	<i>noun</i>	a prewriting technique in which students write continuously about a specific topic for a set period of time without regard to grammar or spelling.
<b>grid modernization</b>	<i>noun</i>	improving an electricity grid system by using digital technologies to monitor and control electricity flow, coordinate between electricity producers and users, maximize efficiency and reliability, and minimize cost.
<b>jigsaw</b>	<i>adjective, noun</i>	cooperative learning technique in which individuals within the group each study different aspects, or pieces of a topic, then come together to teach one another about what they have learned, ultimately resulting in the entire group learning about all of the studied aspects of the topic.

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## For Further Exploration

### Websites

- [Colorado State University: The Bedford Research Room—Developing a Research Question](#)
- [George Mason University: The Writing Center—How to Write a Research Question](#)

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