



MAINE MUSEUM OF
INNOVATION
LEARNING +
LABOR

Energy Innovation Kit

Teacher's Guide:
Lesson 2

Made possible in part by:

MARGARET E. BURNHAM
CHARITABLE TRUST



Introduction

Maine MILL's Innovation Kit program provides lessons and materials to schools throughout Maine designed to inspire them with stories, experiences, and paths for the future. The Energy Innovation Kit focuses on energy innovation, renewables, and solar energy. Students learn about the history of how power was generated in Maine's mills and factories, and how new forms of energy are captured and deployed. They explore electricity, make circuits, and build solar cars. They learn about jobs in the field, including electrician, solar installer, and electrical engineer, and hear from people in these jobs today. Our Energy Information Kit offers teachers 2 weeks (6-8 class periods) of lessons and activities and all the necessary materials to successfully complete each. Each lesson and activity is linked to Maine State Learning Standards and Next Gen Science Standards, where applicable, to help teachers achieve their curricular goals for the year.

How to Use the Energy Innovation Kit Teacher's Guide

The lessons and activities in this kit are designed for students in upper elementary through middle school. Each lesson contains learning objectives, complete instructions for the lesson from set up to closing, assessment tools, and standards. Teachers have the flexibility to deliver the lessons in sequential order, scaffolding students' knowledge, or they may select individual lessons based on students' past knowledge, experience or ability level. Where appropriate cross-curricular activities, alternate ideas for assessment and lesson alternatives are noted. Materials provided in the kit are only for the lessons provided in this teacher's manual and not for alternate suggested lessons.

Care of the materials in the Energy Innovation Kit

Enough materials have been provided in this kit for 75 students (3 classes of 25 students each). Many activities require students to work in pairs or small groups. All materials in the Energy Innovation Kit are contained in sturdy plastic boxes. Handle the trunk the materials are delivered in with care, it will be heavy. It is recommended that teacher's store materials in a room that can be secured. Each box is labeled with the activity the material is for and a checklist for teachers to use when returning materials to the box. Please note any materials that may have been damaged on the checklist sheet.

Note about Consumable Materials

Lesson 3 contains a selection of consumable materials for students to use in the construction of their model water wheels. Please return any unused materials with the kits to reduce the amount of waste.



Sources of Energy - JigsawActivity

Innovation Kit Lesson 2



Time: 2 - 50-60 min. class periods

Learning Objectives:

- Students will be able to explain the difference between renewable and nonrenewable sources of energy.
- Students will be able to identify multiple sources of renewable and nonrenewable energy.
- Students will examine the drawbacks and benefits of renewable and nonrenewable sources of energy.
- Students will be able to explain how each resource is used to generate electricity.
- Students will examine the social, economic and environmental impact of each type of energy generation.

Materials needed:

- 100 cm of bare copper wire
- 1 bar magnet
- Electric meter
- Cardboard tube
- A copy of [Electricity Generation Class Jigsaw slide deck](#) for students to edit -OR- if you do not have access to technology for each student, or prefer not to use the slide deck, students may create an Electricity Generation Poster with all of the same information. Google Slides is used for this project as multiple students can be working on the slide presentation simultaneously. However, you may choose a different slide presentation application (i.e. Power Point) if you would prefer.
- Copies of Energy Notes Sheet for each student

Class 1

Set Up

1. Have the materials needed to create electricity with a magnet at the front of the room. We have provided the materials for the teacher to demonstrate how this is done. (instructions to follow)
2. Students will work in 6 groups for this activity. **Teacher Tip:** Teachers may wish to assign groups for this project to ensure that groups will work well together and have a balance of abilities.

Introduction

1. Show the materials that you have on the desk at the front of the room - bar magnet, copper wire, cardboard tube and electric meter.
2. Ask students what they already know about each of these items to establish prior knowledge. Questions can include:
 - a. What is a magnet? What does it do? Where do you find magnets in your everyday life?
 - b. What is copper wire used for? Does it conduct electricity?
 - c. Where would you find a meter that reads electricity in your house? What is it used for?
3. Challenge students to think of how you might use the items to create electricity.
4. Explain that magnetism is a form of energy. It can push and pull things. It can even push and pull the tiny particles that make up matter called electrons. When electrons move, you get electricity! A generator works by using a turbine to quickly move magnets over a coil of wire creating electricity.
5. Demonstrate how electricity is generated using these materials. If you have a way to project using a document (or similar type) camera, students can remain in their seats while you demonstrate or you may invite them to the front of the room for a closer look. You may also choose to have students try moving the magnet over the coil.
6. Wind the wire around the tube as many times as you can, leaving a inches of wire at each end.



7. Connect both ends of the wire to the meter.
8. Take the magnet and move it near the coil but not through it. Have students share their observations
9. Move the magnet in various directions around the coil. Have students share their observations.
10. Move the magnet through the coil, back and forth. Make more than one trial doing this. Try moving the magnet at different speeds. Move the coil over the magnet, keeping the magnet still. Have students share their observations.
11. You may allow students to try this activity but remind them to handle the materials carefully.

Instructions, Teacher Modeling, Guided Practice

- Explain that students are going to learn about how electricity is generated using this magnet and coil method as well as others and that they will work with a group to become “experts” in their field of energy generation and will be teaching the rest of the class about it.
- Divide students into 6 groups (see teacher tip in Setup) and have students move to sit with their groups. You may assign which energy type each group researches or allow them to choose the one the group would like to learn more about.
- Hand out note taking sheets for each type of energy to the appropriate group. Sheets can also be shared digitally with students so they can click on the live links and take notes directly online.

Independent Work Time

1. Working with their group, students should explore their assigned section of the websites and answer each of the questions on the note taking sheet. These notes will be used later for the creation of their slides.
2. Teacher should check students' notes and answer any questions they may have throughout the period to check for understanding.

Closing and Homework Day 1

1. Students should put their note taking sheet in their science notebook or folder to use in class tomorrow.
2. Homework: Students should complete questions on their note taking sheet if they are unfinished, and each student should find ONE image to illustrate each of the following and make note of the source information for citation*:
 - A drawing, illustration, or chart that shows how their chosen energy source is converted into electricity.
 - A photo of a famous site associated with their energy sources (i.e. the Hoover Dam, Three Mile Island, Alta Wind Energy Center, etc.)

*If you choose to have students create a poster rather than use the slide deck have students print out photos or draw images if they would prefer to.

Class 2

Set up

1. Prior to the start of class, MAKE A COPY of the [Electricity Generation Class Jigsaw](#) slide deck.
2. Share the slide deck with students for editing during this class period.
3. If you choose to have students create a poster rather than use the slide deck, paper/poster board should be set at each table and materials for cutting, pasting and drawing should be available (materials not included in the kit).

Instructions, Teacher Modeling, Guided Practice

- Have students sit with their groups from the last class. Explain that each group will be responsible for teaching the rest of the class about their energy source today. They will be given the first 20 minutes of class to construct their 3 slides or poster. Each group will then have 3 minutes to present their slides/poster with an outline of how each type of energy source creates electricity, the pros and cons of each and share the photos they found from the night before.
- REMIND STUDENTS TO ONLY WORK ON THEIR 3 SLIDES. Students should not edit other groups' slides.
- Project the slide deck onto a screen and demonstrate how students should enter their information.

Independent Work Time and Presentations

1. Students should be given the first 20 minutes to fill in the information needed for their slides and uploading pictures.
2. Each group will then have 3 minutes to present their slides/poster to the class. Questions and answers should be encouraged and can be used to assess student understanding.

Closing and Assessment

1. All students should turn in their note taking sheets for teacher review.
2. See rubric below for assessment.

Standards

Maine Learning Results

4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat and electric currents.

Next Gen Science Standards

4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Rubric for Jigsaw Assessment

Category	4	3	2	1
Coverage of Topic	The slides include all required information plus additional information.	The slides include all required information.	The slides include most of the required information.	The slides include little of the required information.
Images	The image helps the listener/reader to better understand what the energy production facility looks like.	The image mostly helps the listener/reader to understand what the energy production facility looks like.	The image does not generally help the listener/reader to understand what the energy production facility looks like.	The image is missing or unrelated to the topic.
Use of class time	Used time well during the class period. Focused on getting the project done. Never distracted others.	Used time well during each class period. Usually focused on getting the project done and never distracted others.	Used some of the time well during each class period. There was some focus on getting the project done but occasionally distracted others.	Did not use class time to focus on the project AND/OR often distracted others.
Understanding of Topic	Deep understanding of how resource is used to generate electricity and its many pros and cons.	General understanding of how resource is used to generate electricity and its many pros and cons.	Basic understanding of how resource is used to generate electricity and only some pros and cons.	Did not understand how resource is used to generate electricity and only some pros and cons

Fossil Fuels- Coal, Oil and Natural Gas

Notes



What are fossil fuels?

Are fossil fuels a renewable or nonrenewable energy source? Explain.

How are fossil fuels used to create electricity?

How does using fossil fuels for electricity production impact global temperatures? Explain.

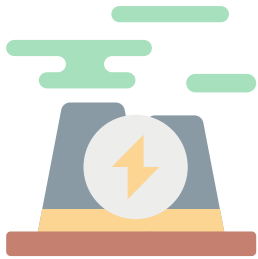
Some of the pros of fossil fuels:

Some of the cons of fossil fuels:

Websites you may use for this information:

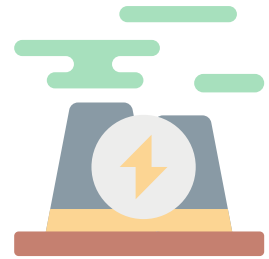
<https://www.eia.gov/kids/energy-sources/>

<https://www.energy.gov/fossil>



Nuclear Energy

Notes



What is nuclear energy?

Is nuclear power a renewable or nonrenewable energy source? Explain.

How is nuclear energy used to create electricity?

How does nuclear energy production impact the environment?

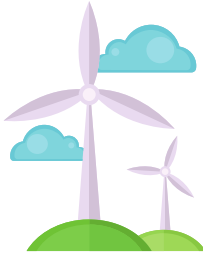
Some of the pros of nuclear power:

Some of the cons of nuclear power:

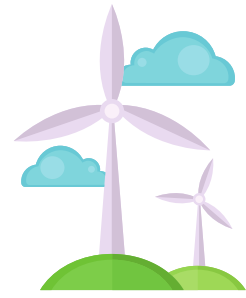
Websites you may use for this information:

<https://www.eia.gov/kids/energy-sources/uranium/>

<https://www.nei.org/fundamentals/what-is-nuclear-energy>



Wind Energy Notes



What is wind energy?

Is wind energy a renewable or nonrenewable energy source? Explain.

How is wind used to create electricity?

How do wind turbines impact the environment?

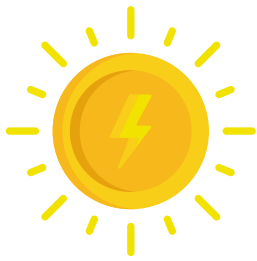
Some of the pros of wind power:

Some of the cons of wind power:

Websites you may use for this information:

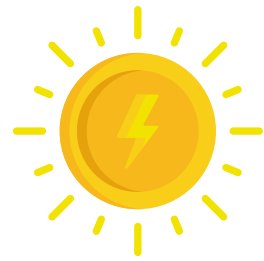
<https://www.energy.gov/wind>

<https://www.eia.gov/kids/energy-sources/wind/>



Solar Energy

Notes



What is solar energy?

Is solar energy a renewable or nonrenewable energy source? Explain.

How is the sun used to create electricity?

What are some ways solar energy production impacts in the environment?

Some of the pros of solar power:

Some of the cons of solar power:

Websites you may use for this information:

<https://www.eia.gov/kids/energy-sources/solar/>

<https://www.energy.gov/solar>



Hydropower

Notes



What is hydropower?

Is hydropower a renewable or nonrenewable energy source? Explain.

How is water used to create electricity?

What are some of the ways hydroelectric power impacts the environment?

Some of the pros of hydropower:

Some of the cons of hydropower:

Websites you may use for this information:

<https://www.energy.gov/eere/water/water>

<https://www.eia.gov/kids/energy-sources/hydropower/>



Geothermal Energy

Notes



What is geothermal energy?

Is geothermal energy a renewable or nonrenewable energy source? Explain.

How is geothermal energy used to create electricity?

What are some ways geothermal energy impacts the environment?

Some of the pros of geothermal:

Some of the cons of geothermal:

Websites you may use for this information:

<https://www.energy.gov/eere/geothermal/geothermal-technologies-office>

<https://www.eia.gov/kids/energy-sources/geothermal/>