

## Thinking About Power Today

Introduction	This activity asks students to compare various sources of energy used in the United States today. It is a suggested follow-up to the Tsongas Industrial History Center's Power to Production program.
Time	2 class periods
Lesson Preparation	<p>Print copies of the Energy Source worksheet for students.</p> <p>Provide sources and/or internet access to research the energy source. There are many places online that discuss various energy sources.</p> <ul style="list-style-type: none"><li>• The National Energy Education Development project has some good info books online on Energy sources broken down by age groups: <a href="http://www.need.org/energysources">http://www.need.org/energysources</a>.</li><li>• Energy4me.org also has some good information: <a href="http://energy4me.org/all-about-energy/">http://energy4me.org/all-about-energy/</a>.</li></ul>
Background Information	<p>Energy refers to the resource used to generate power.</p> <p>“Primary energy sources take many forms, including nuclear energy, fossil energy -- like oil, coal and natural gas -- and renewable sources like wind, solar and hydropower. These primary sources are converted to electricity, a secondary energy source, which flows through power lines and other transmission infrastructure to your home and business.”*</p> <p>“Energy is defined as the capacity to do work. We use energy in almost every aspect of our lives. For many people, it is difficult to think of a part of our day that we do not use mass-produced energy. While the use of energy makes our lives easier, there are negative consequences to the environment associated with it.</p> <p>For fossil fuels, there is the release of carbon dioxide, a greenhouse gas, as well as other pollutants. Others, such as wind and hydropower can disrupt the environment and negatively impact wildlife populations. In general, one downside of more environmentally-friendly sources of energy is a higher production cost. Therefore, there are economic and environmental costs to consider when determining the best sources.</p> <p>The United States contains 5% of the world's population; however, it consumes 26% of the world's energy each year. With increases in population, technological advances, and the desire to provide a reasonable standard of living for the average American, our energy consumption will continue to increase. In fact, it is predicted that our energy consumption will increase by 11% before 2030.</p> <p>Most of our current energy usage comes from non-renewable sources. This means we are quickly depleting our energy sources, and increasing pollution in the process. While there are ways to make the use of fossil fuels cleaner, this does not solve the issue surrounding their limited supply.”^</p>

**Hydropower**

The amount (volume) of water in the Merrimack River, and the distance it drops over the Pawtucket Falls, were essential to power the water wheels, later turbines, which made Lowell’s mills successful. The mill owners and engineers expended effort and money to find the most efficient ways to use the energy produced by the falling water, so that the machines could produce cloth in high volumes.

Today, hydroelectric turbines, the modern version of those early “water power” technologies, along with coal and gas generators, nuclear, solar and other sources of energy, provide the power needed to run the machinery that 21st century life depends upon. Some form of energy is involved in everything we do.

- United States’ residents consume high volumes of energy to support daily life and work.
- All energy sources have advantages and disadvantages.
- Economic and environmental forces help determine the popularity of various types of energy sources.

\* <http://www.energy.gov/science-innovation/energy-sources>

^ <http://www.vcapcd.org/AirTheFilm/pubs/AnalyzingEnergyLessonPlan.pdf>

**Vocabulary**

**Coal:** a combustible black or dark brown rock consisting of carbonized plant matter, found mainly in underground deposits and widely used as fuel. ^

**Energy:** the capacity for doing work; usable power (as heat or electricity); the resources for producing such power.

**Geothermal:** energy produced by the internal heat of the earth. ^

**Hydrogen:** a colorless, odorless, highly flammable gas that can be combined with oxygen to release energy. ^

**Hydropower:** the generation of electricity using flowing water to drive a turbine, that powers a generator. ^

**Natural Gas:** flammable gas consisting largely of methane and other hydrocarbons, occurring naturally underground and used as fuel. ^

**Non-Renewable Energy Sources:** Energy extracted from the ground that has limited supplies, either in the form of gas, liquid or solid. They cannot be replenished, or made again, in a short period of time.

**Nuclear:** energy released in fission or fusion. ^

**Oil:** a viscous liquid derived from petroleum, especially for use as a fuel. ^

	<p><b>Power:</b> a source or means of supplying energy; especially electricity</p> <p><b>Renewable Energy Sources:</b> Energy that comes from a source that’s constantly renewed, such as the sun and wind, and can be replenished naturally in a short period of time.</p> <p><b>Solar:</b> energy produced by the sun. ^</p> <p><b>Wind:</b> energy produced by the movement of air. ^</p> <p>^ <a href="http://www.vcapcd.org/AirTheFilm/pubs/AnalyzingEnergyLessonPlan.pdf">http://www.vcapcd.org/AirTheFilm/pubs/AnalyzingEnergyLessonPlan.pdf</a></p>
<p>Anticipated Student Preconceptions/ Misconceptions</p>	<p>This lesson is research on sources that produce energy for use. This is not examining the sources of energy in scientific terms.</p>
<p>Frameworks</p>	<p><b>Massachusetts Science Frameworks</b></p> <p><b>Grade 5</b>  <b>Earth and Space: 5-ESS3-1:</b> Obtain and combine information about ways communities reduce the impact on the Earth’s resources and environment by changing an agricultural, industrial, or community practice or process.</p> <p><b>High School</b>  <b>Technology/Engineering: HS-ETS4-1(MA):</b> Research and describe various ways that humans use energy and power systems to harness resources to accomplish tasks effectively and efficiently.</p> <p><b>New Hampshire Science Frameworks</b></p> <p><b>Grade 3-4</b>  <b>S:ESS4:4:3.4:</b> Recognize there are pros and cons to using different types of energy, such as solar energy and fossil fuels, and compare the differences.</p> <p><b>S:ESS4:11:3.1:</b> Differentiate between and provide examples of renewable and nonrenewable sources of energy; and explain the advantages and limitations of each.</p> <p><b>Common Core Frameworks</b>  <b>CCSS.ELA-Literacy.RI.5.2:</b> Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.</p> <p><b>CCSS.ELA-Literacy.RST.6-8.2:</b> Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.</p>

Guiding Question	What sources of energy do people around the world use today? What are the advantages and disadvantages using these types of energy to produce power?
Objectives	<p>Student will be able to:</p> <ul style="list-style-type: none"> <li>List advantages and disadvantages of an energy source.</li> </ul>
Activity	<p>Day One</p> <ol style="list-style-type: none"> <li>As a class, discuss the various sources of energy available around the world. Create a list of energy resources by source (e.g. coal, oil, solar, etc.)</li> <li>Break class into smaller groups. Each group will choose/be given one of the energy sources to research. Give each group (or each student in the group) a copy of the Energy Source worksheet to use as guide for their research. Students should use online and book sources to research their energy source.</li> </ol> <p>Day Two</p> <ol style="list-style-type: none"> <li>Have each small group presents its findings to the class. Groups should share the pros and cons of each source.</li> </ol> <p>Option for Day Two: Jigsaw one member of each small group to form new groups, each with one person representing each of the types of energy. Have students share with the new group about the type of energy they researched. Groups should discuss the various sources of energy and a possible plan for the future based on the advantages and disadvantages of each and needs of society.</p>
Assessment	<p>Have students write a short assessment, three-four paragraphs, sharing their thoughts on an energy plan for the future. They should highlight the advantages and disadvantages of each energy source, and discuss how much of the various energy sources should be used.</p> <p>See rubric.</p>
Differentiated Suggestions	<p>If you prefer not to do group work, this activity also works as an independent exercise, with each student doing his/her own research.</p> <p>In addition, you may ask students to create and present a poster or power point about their energy source.</p>
Adapting the Activity for Other Grades	<p>For younger grades, breaking the research into individual tasks. KidsZone has a simple description of some sources.  <a href="http://www.enwin.com/kids/electricity/power_sources.cfm">http://www.enwin.com/kids/electricity/power_sources.cfm</a></p> <p>For older/more advanced classes, students can develop charts listing multiple power sources and assess the advantages/disadvantages of each.</p>
Bibliography	<p>Websites:  National Energy Education Development Project, <a href="http://www.need.org">www.need.org</a>.  Essential Energy Information, <a href="http://energy4me.org">energy4me.org</a>.  Department of Energy, <a href="http://energy.gov/science-innovation/energy-sources">http://energy.gov/science-innovation/energy-sources</a>.  The National Academy of Science. <a href="http://needtoknow.nas.edu/energy/">http://needtoknow.nas.edu/energy/</a>  KidsZone, <a href="http://www.enwin.com/kids/electricity/power_sources.cfm">http://www.enwin.com/kids/electricity/power_sources.cfm</a>.</p>

Books :

Haugen, David M., Susan Musser, and Vickey Kalambakal. *Energy alternatives: opposing viewpoints*. Detroit, MI: Greenhaven Press, 2010.

Bowden, Rob. *Energy Sources: the impact of science and technology*. Pleasantville, NY: Gareth Stevens Pub, 2010.

Sandall, Barbara R. *Using STEM to investigate issues in alternative energy*. Greensboro, NC: Mark Twain Media, 2011.

CATEGORY	Exceeds expectations	Meets expectations	Does not meet expectations
<b>Amount of Information</b>	All topics are addressed with 2-3 sentences about each.	All topics are addressed with at least 2 sentences about each.	One or more topics were not addressed.
<b>Quality of Information</b>	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information has little or nothing to do with the main topic.
<b>Plan for future energy use</b>	Students' assessment included additional information about what they would propose	Students' assessment included what they would propose.	Students' assessment included insufficient information about what they would propose.

# Energy Source Worksheet

**Type of Energy:**

**Uses/Importance:**

**Advantages:**

**Disadvantages/Problems/Concerns:**