

Sample Energy Lesson Module
Healing Earth

The *Healing Earth* team asks that when you use any aspect of this lesson module that you please send an email sharing: 1) how you used the resource, 2) how your students responded to the resource, activity, or lesson, and 3) what changes you would recommend for future versions. Please email Dr. Michael Schuck (mschuck@luc.edu) and Dr. Nancy Tuchman (ntuchma@luc.edu). The information that you share will help improve these resources for your and others' use. We appreciate your feedback.

Instruction Level	Approx. Time (min)	Activities	Materials Needed	Main Content Area(s)
ENGAGE	30-45 <i>(maybe longer)</i>	<p><i>Relevant sections of the Energy chapter: "Energy Forms and Processes," "The Laws of Thermodynamics," and "History of Energy Use"</i></p> <p>Introduce the topic of this lesson module as the efficiency and power of energy in many different forms. Heating, ventilation, and air-conditioning (HVAC) systems are often the source of the greatest energy costs for large buildings, including schools. Try checking with your school's maintenance staff to set up a brief tour or description of your school's HVAC system including some specifications of the energy usage and costs for your entire school. Alternatively, you could contact a staff member at a large building in your community or a utility company for an indoor tour of their HVAC or other energy related machines.</p> <p>If a tour is not feasible or possible, watch this brief video encouraging Australian companies to reduce the energy usage of their HVAC systems: https://youtu.be/EAlufPJJgs. You can then talk about the fact that your school has a similar system, which your students can research during the energy audit.</p> <p>During the tours or video, have your students write down terms that they think might be related to the science of energy based on their reading of the Energy chapter. Tell them to keep in mind that they will be conducting an energy audit of the school during this module, so they should consider how they would determine the amount of energy and costs that are associated with the school's HVAC system.</p>	Contact with your school maintenance staff or other building staff (or internet access for an alternate activity)	Action, Science

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	10-15	After the tour, compile a list of the science terms that your students wrote down as a class. The terms should help you to see which topics your students recognize already. Guide the students' discussion if they seem to be missing key terms or if some of their terms are not pertinent to this chapter.		
EXPLORE	10	<p><i>Driving question: Is there a relationship among economic indicators, energy use, and pollution?</i></p> <p><i>Relevant sections of the Energy Chapter: "History of Energy Use," "Energy and Ethics"</i></p> <p>In this activity, students will research and map certain economic and environmental statistics for your city, region, or country in order to explore statistical relationships among these data. Have your students pick one statistic from two of following categories to research on their own. Note that some statistics may not be available for all regions or may be difficult to find.</p> <p><i>Economic Indicators:</i></p> <ul style="list-style-type: none"> • Median Household Income • School district testing scores • Per capita income • Unemployment level • Average home prices or property values <p><i>Energy Use Indicators:</i></p> <ul style="list-style-type: none"> • Average electric use per household • Average gas use per household • Average water use by household • Electricity prices (if they vary by region) 	Access to local statistics for your region (or alternative statistics in the attachment), blank posters, markers	Ethics, Global Awareness

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		<p><i>Pollution Indicators:</i></p> <ul style="list-style-type: none"> • Locations of large industries (factories, mills, etc.) • Air quality samples (particulates, etc.) • Soil quality samples (lead levels, etc.) • Water quality samples (hardness, mercury levels, etc.) • Rates of lead poisoning in humans or animals 		
	20	Assign your students to find values for each of their chosen statistics for 5-10 different areas of your city, region, or country. Their values must be in the same geographic areas and use the same units of measurement within each category in order to be comparable. Many government offices or utility companies may keep public records of these data. It may be helpful for groups of 3-4 students to divide up the responsibilities of finding the data.		
	30	Next, students should work in groups of 3-4 to draw a map for these data based on geography or neighborhoods. Ask your students to consider how they will portray the magnitude of each of their statistics, with a legend or other visual cues. Their maps should clearly indicate where the largest and smallest values of their data are located geographically.		
	45	Post your students' maps around your classroom. Allow the students a few minutes to look around at the posters, writing down any patterns that they notice about the locations of the highest and lowest values of certain statistics. As a large group, discuss with your students what relationships they see from their research. Which regions use the most energy? Which use the least? How might income be related to energy use? Is pollution related to energy use or income? If possible, share data from other <i>HE</i> classrooms. How do your class maps compare with other <i>HE</i> classrooms in other countries? (If students have taken a statistics class, they can try graphing some of the data to find a measurement of the relationship between two statistics.)		
	20	Finally, transition your questions to discuss environmental ethics in relation to		

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		<p>these maps and relationships. Ask your students if they are aware of any historical reasons that these relationships might exist. Do they think that communities which pollute more or use more energy should be somehow responsible for the effects of the pollution? How might environmental justice be related to energy use in the region your students examined?</p> <p>If data are unavailable or too difficult to find for your region, a sample data set is included in the attachments for the city of St. Louis, Missouri, USA. Students can work individually or as small groups to map these data instead.</p> <p><i>Activity adapted from Bill Anderson from St. Louis University High School.</i></p>		
EXPLAIN	45-50	<p><i>Relevant sections of the Energy Chapter: “Energy Forms and Processes,” “Photosynthesis and the Flow of Solar Energy to Living Organisms,” and “Trophic Levels and Trophic Efficiency”</i></p> <p>Present your own lecture material for the science topics, focusing on the First and Second Laws of Thermodynamics, different forms of energy, and trophic levels. Important connections to draw in this section include the idea that energy transfers in nature or in man-made systems follow the same laws. The first two activities examined energy in artificial systems, but this section can help to reveal the parallels in the natural world.</p>	Lecture material	Science
EVALUATE	20	<p><i>Relevant sections of the Energy Chapter: “Case Study: El Hierro,” “Renewable and Nonrenewable Energy,” “Nonrenewable Energy Sources,” “Renewable Energy,” and “Energy and Action.”</i></p> <p>In this section, your students will conduct an energy audit of your school and evaluate ways to reduce your school’s energy use. To begin, try to make a list as a class of all of the ways that your school uses energy each day. How could you measure exactly how much energy your school uses for each item on your list?</p>		Action, Science

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		Which items do your students predict would use the most energy per year?		
	30	Split your students into groups of 2-3. Assign or let your students pick one of the items from their list of highest energy uses. Alternatively, you could also assign student groups to audit different areas of your school. Explain that they will be conducting an energy audit to find out how much energy your school actually uses and identifying ways for your school to reduce that energy use. Allow your students time to research and discuss how they might find out the actual energy usage of their assigned item or place. One helpful website is http://energy.gov/energysaver/energy-saver , with information about estimating energy costs and other tips for energy savings. After they have discussed for about 15 minutes, have them write out an action plan about how they will conduct the audit. When will they visit their space(s)? Do they need to contact someone at the school or another company? How much information do they need to complete the assignment? Allow time inside or outside of class for your students to conduct their audit.		
	30	After your students have had time to complete their audits, have them work on a 1-page summary report of their findings, including suggestions for how your school could use energy more efficiently in the areas that they audited. It is important to emphasize for your students that reducing certain uses of energy can save more energy than others. As a class, discuss the findings of each of the groups and evaluate their suggestions for improvements. Consider these questions: Which improvements or actions would have the biggest impact? Why should your school make these changes?		
	20	Share the story of Beth Rickard who worked as a high school student to drastically change the energy usage of her school. Read about her story at http://myhero.com/hero.asp?hero=Beth_Rickard_06 . Choose one or two actions as a class to pursue further at your own school. What next steps would your class need to take to complete these actions?		

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		<p>Activity adapted from: https://learning.blogs.nytimes.com/2011/02/16/how-green-is-my-school-conducting-an-energy-audit/?_r=1.</p>		
<p>ELABORATE</p>	<p>10-15</p> <p>30</p> <p>20</p>	<p><i>Relevant sections of the Energy Chapter: “Energy and Spirituality,” and “Chapter Reflection Questions and Explorations”</i></p> <p>Natural disasters can be powerful signs of the energy of nature. Similarly, some man-made machines can be astonishingly beautiful or terrifying. In Ray Bradbury’s short story “Powerhouse,” a woman who is on her way to see her dying mother has a spiritual experience while taking shelter from a storm in a power plant. Find a copy of this short story in your school or local library for your students to read for homework.</p> <p>After reading the story, have your students write in their journals about the following questions: Have you ever been amazed or frightened by an experience of the energy of the natural world or of a machine? Have you ever had an experience of feeling spiritually energized? Describe these experiences in comparison to the experience of the woman in “Powerhouse.”</p> <p>Ask some of your students to share their experiences with the class. Then discuss how your students’ experiences are similar to and different from each other. Ask them to share how their experiences connect with the science they learned in this chapter.</p> <p><i>This activity can easily be switched with the opening Engage activity depending on the scheduling of a tour.</i></p>	<p>A copy of the short story “Powerhouse” by Ray Bradbury in <i>A Sound of Thunder and Other Stories</i>, online copy can be found here, student notebooks</p>	<p>Spirituality</p>