

# Homing in on energy efficiency

## Teacher's guide

### Description

Students evaluate the ways that they utilize energy (particularly electric energy) and develop an “audit” to evaluate energy use at home.

#### Introduction: Connecting power to wattage

Because the focus of the unit is assessing energy use, it is important to establish that different electrical items require different amounts of electric energy to power them. Watts measure the amount of work electricity does, so the unit begins with an animated definition of watt.

#### Part 1: Categorizing energy consumption

Student pairs/small groups categorize similarities and differences among the means of powering different household devices. For example: What is their energy source? Do they constantly draw power, or only when in use? The analysis of energy consumption lays the foundation for the audits that students create at the end of the module.

#### Part 2: Delving deeper into batteries

Rechargeable batteries provide much of the power to the devices that students use daily – some might say constantly! The first activity in this section focuses on phones. Student groups assess their phones' battery lives, considering time and conditions that affect how quickly a phone's battery is drained. This section also includes a video on battery storage, as well as a deeper examination of how batteries work.

#### Part 3: Researching power to the home

This activity centers on an inquiry-driven quest to learn more about how power is delivered to the home. As a class or in small groups, students use the Alliant Energy Kids website to explore the processes of generating and delivering power to the home. The module provides guidance for their inquiry.

#### Part 4: Creating a home energy audit

The unit culminates with students creating energy audits for their homes. The slides provide examples and considerations to guide students as they create their audit templates. Students then conduct their audits at home.

### **Desired outcomes**

The module is designed to:

- Prompt thinking about how we get the energy we need and use (particularly electricity)
- Assess energy use at home
- Connect battery charging with energy consumption
- Identify causes of energy loss and/or lack of efficiency, particularly electric energy
- Extrapolate the effects of efficiency and inefficiency over time and over widespread uses

### **Academic standards addressed**

Wisconsin Science Performance Indicators (Grades 6-8)

SCI.CC5.m

Students understand matter is conserved because atoms are conserved in physical and chemical processes. They also understand that within a natural or designed system the transfer of energy drives the motion and cycling of matter. Energy may take different forms (e.g., energy in fields, thermal energy and energy of motion). The transfer of energy can be tracked as energy flows through a designed or natural system.

SCI.PS3.A.m

Kinetic energy can be distinguished from the various forms of potential energy.

SCI.PS3.B.m

Energy changes to and from each type can be tracked through physical or chemical interactions. The relationship between the temperature and the total energy of a system depends on the types, states and amounts of matter.

SCI.ESS3.D.m

Evidence suggests human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities and social dynamics.

Wisconsin Model Academic Standards for Environmental Education

B.8.1

Describe the flow of energy in a natural and a human-built ecosystem using the laws of thermodynamics (see SC Physical Science).

B.8.15

Analyze how people impact their environment through resource use.

B.8.17

Explain how human resource use can impact the environment, e.g., erosion, burning fossil fuels.

D.8.5

Explain how personal actions can impact an environmental issue; e.g., doing volunteer work in conservation.

Iowa CORE Standards Science

5-ESS3-1

Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

MS-PS3-4

Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

MS-PS3-5

Construct, use and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

MS-PS2-3

Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

MS-PS3-2

Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

MS-PS3-4

Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

MS-PS3-5

Construct, use and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

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Construct, use and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

## **Suggested time to allot**

90 to 120 minutes

## **Materials**

- Interactive white board/computer with display screen
- Internet access
- Students' phones
- Materials to create home audits (computer access if students create them digitally)

## **Cross-curricular extensions**

Want to extend this unit beyond its core focus on science? Here are some suggestions.

### Phone challenge

As a social experiment, challenge students to see how long they can go between charges for their phones and/or tablets. As part of the experiment, have them write a short essay in which they reflect on the experience.

### Home audit expansion

Encourage students to conduct their audits in the home of a family member and/or neighbor – someone with whom it won't be awkward to conduct the audit. Doing this will make it more likely that students will need to share what they've learned, why they're conducting the audit, etc.