

## RESPECT Electricity

Electricity enables us to do many things that make our lives better, more convenient and fun. But it also has the capability to seriously injure or even kill us. In this lesson, students will learn how stay safe around electricity and its many applications.

Best for kindergarten through third grade.

### OBJECTIVES

- Understand electricity can be helpful, but also harmful
- Understand safe and proper ways to use electricity
- Identify and distinguish the difference between insulators and conductors
- Identify indoor and outdoor electrical hazards
- Understand proper course of action to take in the event of an electrical hazard or injury

### METHODS

Specific methods used will vary depending on age group and setting and may include:

- **PowerTOWN Electrical Safety Model demonstration—** This 8' tabletop model simulates outdoor electrical hazards such as contacting overhead lines with a kite, ladder and tree, contact with fallen power lines and contact with substation and padmount transformers. A working transformer produces a 10,000 volt, 23 milliamp current, emitting dramatic arcs when contact is made.
- **Is it electric?—**Students will be asked to identify and/or distinguish items that do or do not use electricity.
- **Safe or unsafe?—**Students will be shown a series of images and asked to identify whether the electric application or situation is safe or unsafe.
- **Energy Ball—**It looks like an ordinary ping pong ball, but when both metal connectors are touched, the ball lights up and makes noise. It's a simple and fun way to demonstrate the concepts of circuits, conductors and insulators.
- **Van de Graaff Generator—**Always a crowd pleaser, a variety of experiments can be used with this hair-raising electrostatic generator to demonstrate electric fields and fundamentals of electricity.
- **Hazard Hunt—**Students take a virtual tour to spot the electrical dangers can that lurk inside their homes.

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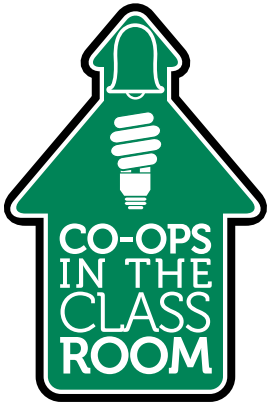
### CONTENT STANDARDS ADDRESSED

#### South Dakota

- 4.P.3.1. Students are able to identify materials as being conductors or insulators of electricity.

#### Minnesota

- 1.1.3.2.1 Know that tools are simple objects that help humans do science and engineering.
- 1.1.3.1.5 Describe how the parts of a system, when put together, can do things that are not possible when the parts are separated.
- 4.2.3.2.3 Demonstrate how the flow of electricity produces heat, light and sound.



## The ENERGY Patrol

With the increasing cost of fossil fuels and declining supply of natural resources, it is now more important than ever to make wise energy decisions. This module enlists students to join the “Energy Patrol” as they identify ways to conserve energy at home and in their schools.

Best for kindergarten through sixth grade.

### OBJECTIVES

- Understand the environmental and economic impact of energy use
- Identify behaviors that are “energy wasters”
- Identify strategies to conserve energy
- Understand that some items/appliances can accomplish the same task more efficiently than others

### METHODS

Specific methods used will vary depending on age group and setting and may include:

- **Smart House Energy Conservation Simulator—**  
This interactive model house turns the concept of energy efficiency into a tangible experience as it demonstrates behaviors that waste or conserve energy.
- **Pedal Power Bicycle Generator—**  
Students can experience firsthand just how much energy it takes to produce electricity when this bicycle generator is used to power a variety of electric devices.
- **Green Earth Clever Catch Game—**  
This fun and interactive ball with energy conservation questions printed on it is used to generate discussion.
- **Watt’s Up? Electricity Consumption Meter—**  
Students learn just how much electricity is consumed by everyday devices when they are plugged into this meter.
- **Stop the Energy Leaks!—**  
It’s a scavenger hunt in their own classroom when students go on the prowl to identify energy-wasting culprits.

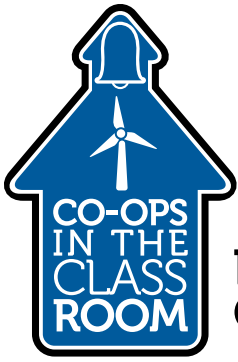
### CONTENT STANDARDS ADDRESSED

#### South Dakota

- 3.L.3.3. Students are able to describe ways humans impact air, water, and habitat quality.
- 3.S.1.1. Students are able to recognize ways to recycle, reuse, and reduce consumption of natural resources.
- 4.S.1.1. Students are able to describe how people continue to invent new ways of doing things, solving problems, and getting work done.
- 4.S.1.2. Students are able to explain how new ideas and inventions often affect people.
- 5.L.3.1. Students are able to describe how natural events and/or human influences may help or harm ecosystems.
- 5.S.2.1. Students are able to explain the interrelationship of populations, resources, and environments.
- 6.N.2.1 Students are able to pose questions that can be explored through scientific investigations.
- 6.S.2.1. Students are able, given a scenario, to identify the problem(s) of human activity on the local, regional, or global environment.
- 6.E.1.2 Students are able to examine the role of water on the Earth.

#### Minnesota

- 1.1.3.2.1 Know that tools are simple objects that help humans do science and engineering.
- 4.1.3.3.1 Describe a technology that is an intrinsic part of human cultures and how the availability of that technology greatly influences human life.
- 4.1.3.3.2 Describe a situation in which one invention led to other inventions.
- 6.1.2.1.1 Identify a common engineered system and evaluate its impact on the daily life of humans, the local environment and wildlife habitat.
- 6.1.2.1.2 Recognize that there is no perfect design and that new technologies have side effects that may increase some risks and decrease others.
- 4.2.3.2.2 Describe how increasing the temperature of a substance requires the addition of energy.
- 4.2.3.2.3 Demonstrate how the flow of electricity produces heat, light and sound.
- 5.3.4.1.1 Categorize energy resources and material resources into renewable and non-renewable.
- 5.3.4.3.1 Compare the impact of different individual decisions on natural systems (for example, choosing paper or plastic bags impacts landfills as well as ocean life cycles)



## ENERGIZING Our Lives

What is energy and where does electricity come from? This module explores the energy sources that fuel our electrical needs, with special emphasis on renewable energy and emerging technologies.

Best for second through sixth grade.

### OBJECTIVES

- Differentiate between renewable and non-renewable energy sources
- Identify the resources we use to generate electricity
- Understand the benefits and challenges of using various energy sources

### METHODS

Specific methods used will vary depending on age group and setting and may include:

- **Energy Model**—This large colorful instructional model provides an overview of primary energy resources, basic fuels, energy conversion processes, and how these resources are consumed in the US.
- **Renewable Energy Classroom Lab**—Students will investigate the output from renewable energy sources of wind, solar and hydro with these generator models.
- **Wind Energy Generator Model**—This functional model is connected to a DC generator and 1.5 volt bulb to indicate electrical output, a great way to showcase the properties of wind energy.
- **Van de Graaff Generator**—Always a crowd pleaser, a variety of experiments can be used with this hair-raising electrostatic generator to demonstrate electric fields and fundamentals of electricity.
- **Alternative Energy Clever Catch**—This fun and interactive ball generates discussion via the alternative energy-related questions printed on it.

### CONTENT STANDARDS ADDRESSED

#### South Dakota

- 3.P.3.1. Students are able to define energy and differentiate between sources of renewable and non-renewable energy.
- 3.L.3.3. Students are able to describe ways humans impact air, water, and habitat quality.
- 3.E.1.2. Describe how humans use Earth's natural resources.
- 3.S.1.1. Students are able to recognize ways to recycle, reuse, and reduce consumption of natural resources.
- 4.S.1.1. Students are able to describe how people continue to invent new ways of doing things, solving problems, and getting work done.
- 4.S.1.2. Students are able to explain how new ideas and inventions often affect people.
- 5.L.3.1. Students are able to describe how natural events and/or human influences may help or harm ecosystems.
- 5.P.3.2. Students are able to describe the Sun's ability to produce energy in the forms of light and heat.
- 5.P.2.1 Students are able to identify forces in specific situations that require objects to interact, change directions, or stop.
- 5.S.1.2. Students are able to describe how designing a solution may have constraints.
- 5.S.2.1. Students are able to explain the interrelationship of populations, resources, and environments.
- 6.P.3.1. Students are able to identify types of energy transformations.
- 6.N.2.1 Students are able to pose questions that can be explored through scientific investigations.
- 6.S.2.1. Students are able, given a scenario, to identify the problem(s) of human activity on the local, regional, or global environment.
- 6.S.1.1. Students are able to describe how science and technology have helped society to solve problems.
- 6.E.1.2 Students are able to examine the role of water on the Earth.
- 6.P.2.1. Students are able to describe how push/pull forces acting on an object produce motion.

#### Minnesota

- 0.2.3.1.1 Identify the sun as a source of heat and light.
- 1.2.2.1.3 Demonstrate how push and pull forces can make objects move.
- 1.1.3.1.5 Describe how the parts of a system, when put together, can do things that are not possible when the parts are separated.
- 4.1.3.3.1 Describe a technology that is an intrinsic part of human cultures and how the availability of that technology greatly influences human life.
- 4.1.3.3.2 Describe a situation in which one invention led to other inventions.
- 4.1.3.3.3 Provide an example where science or technology does not provide an acceptable solution to a problem or fulfill every human need.
- 4.2.3.2.3 Demonstrate how the flow of electricity produces heat, light and sound.
- 5.3.4.1.1 Categorize energy resources and material resources into renewable and non-renewable.
- 5.3.4.1.3 Give examples of how mineral and energy resources are obtained and processed to be used by human systems (for example, extraction of iron for steel, oil or coal for energy).
- 5.3.4.1.4 Explain how naturally occurring materials may be processed and changed to modify their properties into more useful products.
- 6.1.2.1.1 Identify a common engineered system and evaluate its impact on the daily life of humans, the local environment and wildlife habitat.
- 6.1.2.1.2 Recognize that there is no perfect design and that new technologies have side effects that may increase some risks and decrease others.
- 6.2.3.2.1 Recognize that objects and substances in motion have kinetic energy.
- 6.2.3.2.3 Differentiate between kinetic and potential energy and identify situations where kinetic energy is converted to potential energy and vice versa.
- 6.2.3.2.4 Trace the changes of energy forms, including thermal, electrical, mechanical, or others as energy is used for transportation, lighting or other purposes.



## What's a KILOWATT?

In this module, students will learn how much energy it takes to produce a kilowatt, what a kilowatt hour is and how many kilowatt hours it takes to power common household appliances.

Best for fourth through sixth grades.

### OBJECTIVES

- Learn how read an electric meter
- Understand the difference and relationship between watts, amps and volts
- Calculate the energy usage and operating cost of various appliances
- Investigate how much energy it takes to produce one kilowatt hour of electricity

### METHODS

Specific methods used will vary depending on age group and setting and may include:

- **Electric Meter Lab—**  
Students can observe electricity consumption in action as they watch the dial spin and learn how to interpret this working electric meter.
- **Watts Up? Electricity Consumption Meter—**  
Students learn just how much electricity is consumed by everyday devices when they are plugged into this meter.
- **Pedal Power Bicycle Generator—**  
Students become their own power plant when they provide the energy for this bicycle generator to run a variety of electric devices.

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### CONTENT STANDARDS ADDRESSED

#### South Dakota

- 4.N.2.1. Students are able to find the products of two-digit factors and quotient of two natural numbers using a one-digit divisor.
- 4.S.1.1. Students are able to interpret data from graphical representations and draw conclusions.
- 5.A.3.2. Students are able to identify information and apply it to a given formula.
- 5.N.2.3. Students are able to multiply and divide decimals by natural numbers (1 – 9).
- 5.S.1.1. Students are able to gather, graph, and interpret data.
- 6.N.2.1. Students are able to add, subtract, multiply, and divide decimals.
- 6.P.3.1. Students are able to identify types of energy transformations.
- 6.N.2.1. Students are able to pose questions that can be explored through scientific investigations.

#### Minnesota

- 4.1.1.5 Solve multi-step real-world and mathematical problems requiring the use of addition, subtraction and multiplication of multi-digit whole numbers. Use various strategies, including the relationship between operations, the use of technology, and the context of the problem to assess the reasonableness of results.
- 5.1.1.4 Solve real-world and mathematical problems requiring addition, subtraction, multiplication and division of multi-digit whole numbers. Use various strategies, including the inverse relationships between operations, the use of technology, and the context of the problem to assess the reasonableness of results.
- 5.1.3.4 Solve real-world and mathematical problems requiring addition and subtraction of decimals, fractions and mixed numbers, including those involving measurement, geometry and data.
- 5.2.1.1 Create and use rules, tables, spreadsheets and graphs to describe patterns of change and solve problems.
- 5.2.3.3 Evaluate expressions and solve equations involving variables when values for the variables are given.
- 6.1.3.4 Solve real-world and mathematical problems requiring arithmetic with decimals, fractions and mixed numbers.