Energy Lights Maine

Lesson Matrix

PowerSleuth
Maine Energy Education Curriculum

Overview	Key Ideas	Lesson Goals Students will:	Connection to Learning Goals from • *Benchmarks for Science Literacy (BSL),* • *National Science Education Standards (NSES),* • and *Maine Learning Results (MLR)*
Lesson 1: **In Search of Light** ***Exploring the Ongoing Role of Light Energy in Human Lives*** *(2 sessions)* In this introduction to the *Energy Lights Maine* module, students consider the ongoing role of light energy in humans' lives. Through a folktale about the Sun, students are reminded that sunlight is the primary source of light energy on Earth. Students investigate a variety of early light emitting devices and consider their benefits and drawbacks.	• Light is a form of energy. • The Sun is the primary source of Earth's light energy. • Human knowledge and skill to create light emitting devices has evolved throughout history.	• Develop a basic understanding that the Sun is the primary source of Earth's energy including light. • Explore light emitting devices of the past and consider their benefits and drawbacks. • Make the connection that natural resources are used to produce (as sources of) light.	• Recognize that the Sun is the source of Earth's surface heat and light energy. MLR D2(3-5) e • Explain that natural resources are limited, and that reusing, recycling, and reducing materials and using renewable resources is important. MLR C3(3-5) e • Science helps people understand their natural world. MLR C4(3-5)
Lesson 2: Circuits and Electric Light *(2 sessions)* Students begin this lesson by examining the components of a portable lighting device- a battery operated flashlight. This initial exploration and the discussion it generates is used to begin a guided exploration of simple circuitry. Students attempt to light a bulb using a battery, a wire, and a light bulb. Students keep a record of each attempt using words and sketches, noting which ones are successful and which are not.	• A complete path to and from a source is needed for an electric current to flow. • The flow of a complete electric current can produce light.	• Determine how to light a bulb with a battery and wire. • Recognize that electric current needs to travel in a complete loop in order to light a bulb. • Identify the essential components of a circuit including a pathway and a source. • Draw a complete circuit needed to light a bulb.	• Electricity in circuits can produce light, heat, sound and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass. NSES B(K-4) • Offer reasons for their findings and consider reasons suggested by others. BSL 12A (3-5) • Keeping records of their investigations and observations and not change the records later. BSL 12A (3-5) • Give examples of how gravity, magnets, and electrically charged materials push and pull objects. MLR D4 (3-5)d

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Lesson 3: A Systematic Look at the Incandescent Light Bulb *(2-3 sessions)* Through first hand observations of an incandescent light bulb, students discover the internal components. Students expand their circuitry knowledge by considering the pathway of electrical energy through a light bulb and by incorporating the bulb into an entire electrical system – a complete circuit. They also explore the concept of a system by considering the implications of a nonworking component of a light bulb.	• Light bulbs are made up of smaller parts, each with its own function. The parts work together to light the bulb. • In a complete circuit, electrical energy not only flows to the light bulb but through the light bulb. • If a part of the bulb or circuit is missing, broken, worn out, mismatched, or misconnected, the circuit will not be complete. • Many circuits incorporate switches. The simplest switch has two metal contacts that, when touching, complete the circuit and allow electricity to flow, and, when separated, break the circuit and not allow the electricity to flow.	• Recognize that light bulbs have parts and that the parts work together as a system. • Describe the flow of electrical energy through a light bulb. • Explain how a simple switch can be used to control the flow of electrical energy.	• Give examples that show how individual parts of organisms, ecosystems, or human-made structures can influence one another. MLR A1(3-5) a • Explain ways that things including organisms, ecosystems, or human-made structures may not work as well (or not at all) if a part is missing, broken, worn out, mismatched, or misconnected. MLR A1(3-5) b • Electricity in circuits can produce light, heat, sound, and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass. NSES B(K-4) 10
Lesson 4: The Case of the Missing Wires *Conductors!* *(2-4 sessions)* After reviewing the essential components of electrical circuits students will be guided through a mystery in which they investigate the conductivity of various materials. Explorations lead to a beginning understanding of uses and safety concerns associated with conductors and insulators.	• While electrical circuits can be connected in different ways, all circuits have three essential parts: a source, a pathway, and a receiver. • A complete path to and from the source (loop) is needed for the electric current to flow. • Current electricity can exist in and move through a conductor. A conductor is a material that allows an electric current to pass through it. • An insulator does not allow an electric current to pass through it.	• Recognize that all materials are not able to provide a pathway for the flow of electricity. • Examine the differences in electrical conductivity of a variety of common materials. • Use knowledge of conductors and insulators to explain why and how certain materials are used simple electrical devices (i.e. light bulbs, extension cords, desk lamps, etc.).	• Electricity in circuits can produce light, heat, sound and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass. NSES B(K-4) • Materials vary in how they respond to electrical currents, magnetic forces, and visible light or other electromagnetic waves. BSL 4D/M9(6-8) • Offer reasons for their findings and consider reasons suggested by others. BSL 12A (3-5) • Scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge). Good explanations are based on evidence from investigations. NSES A (K-4) • Keeping records of their investigations and observations and not change the records later. BSL 12A (3-5)

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Lesson 5: Signs of Safety *(1-2 sessions)* After taking a closer look at the materials making up the components of familiar light emitting devices, students extend their understanding of conductors and insulators by identifying potential electrical hazards, discussing what makes them hazardous, and suggesting what can be done to prevent such hazards.	• A complete path to and from the source (loop) is needed for the electric current to flow. • Current electricity can exist in and move through a conductor. A conductor is a material that allows an electric current to pass through it. • An insulator does not allow electric current to pass through it easily. • Electrical energy can be used safely in our homes, businesses, and schools, but it is not without risks. By understanding how electric current travels, people can minimize their chances of being seriously injured or killed from electrical hazards.	• Recognize the applications of conductors and insulators in everyday devices and situations. • Identify electrical hazards in homes, businesses, and schools. • Suggest ways to prevent serious injury and death from electrical hazards.	• Electricity in circuits can produce light, heat, sound and magnetic effects. Electrical circuits require a complete loop through which an electrical current can pass. NSES B(K-4) • Materials vary in how they respond to electrical currents, magnetic forces, and visible light or other electromagnetic waves. BSL 4D/M9(6-8) • The potential for accidents and the existence of hazards imposes the need for personal injury prevention. Safe living involves the recognition of risk in personal decision. NSES F (5-8)
Lesson 6: **People Have the Power!** ***Electricity Generation*** *(1-2 sessions)* Where does electricity that is used to light our homes, schools, and businesses come from? In this lesson, students investigate how electricity is generated on a wide scale basis. The major components of electric production: the turbine, the generator, and energy source are introduced in this lesson.	• Electricity can be generated using a variety of energy sources. • Presently, the majority of electricity generated uses some of the same methods that have been used for over 100 years. • Electricity generation most commonly involves a turbine and generator. • Some energy sources are renewable and some are nonrenewable.	• Explore how electricity is generated. • Investigate several energy sources used in the generation of electricity. • Consider why different energy sources are used in the generation of electricity. • Be introduced to the idea that some energy sources are renewable and some energy sources are nonrenewable.	• The sun is the main source of energy for people and they use it in various ways. The energy in fossil fuels such as natural gas and coal comes from the sun indirectly, because the fuels come from plants that grew long ago. BSL 8C(3-5) b • Electrical energy can be produced from a variety of energy sources... Moreover, electricity is used to distribute energy quickly and conveniently to distant locations. BSL 8C (6-8) d

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Lesson 7: **Around and Around They Go** ***Turbines*** *(2-4 sessions)* Turbines are a common component in most forms of electricity production. During this lesson, students explore turbines by designing and building blades for a simple wind turbine.	• Wind, water, and steam can be used to make things happen. In the context of generating electricity, wind energy can spin a turbine. • Technological design involves using scientific principles to solve problems. • Predicting, observing, designing, testing, analyzing, and redesigning are all part of technological design.	• Describe how wind, water, or steam can be used to make things happen. • Identify different uses of windmills and wind turbines. • Observe and describe how different blade materials and shapes harness wind. • Analyze turbine designs for strengths and weaknesses and implement some of their improvement ideas.	• Propose a solution to a design problem that recognizes constraints including cost, materials, time, space, or safety. MLR B2 (3-5) b • Evaluate their own design results, as well as those of others, using established criteria. MLR B2 (3-5) e • Modify designs based on results of evaluations. MLR B2 (3-5) f • Present the design problem, process, and design or solution using oral, written, and/or pictorial means of communication. MLR B2 (3-5) g • Give examples of changes in the environment caused by natural or man-made influences. MLR C3 (3-5) b • Explain that natural resources are limited, and that reusing, recycling, and reducing materials and using renewable resources is important. MLR C3 (3-5) c • Predict the effect of a given force on the motion of an object. MLR D4 (3-5) a
Lesson 8: : Light Bulbs and Energy Efficiency *(2 sessions)* Students begin to develop an understanding of energy efficiency and the importance of energy conservation by comparing different light bulbs. By comparing the amount of energy, heat, bulb life, and light output each bulb delivers, students learn that some bulbs provide the same light output using less electrical energy. The lesson culminates with a discussion about the broader impact of using energy wisely.	• Not all of the energy that a device uses gets used in the way people intend. As energy moves from place to place, it always produces heat which is often an undesired effect. • Things that are energy-efficient use less energy to do the same task. Energy-efficient devices minimize or redirect unintended energy effects. • Using energy responsibly is something everyone can and should do.	• Develop an understanding of energy-efficiency and the importance of energy conservation. • Discover that some devices do the same job but use less energy to do so. • Recognize that there are many factors to consider when deciding how to use energy responsibly.	• Some people try to reduce the amount of fuels they use in order to conserve resources, reduce pollution, or to save money. BSL 8C/E4 (3-5) • Explain that natural resources are limited, and that reusing, recycling, and reducing materials and using renewable resources is important. MLR C3 (3-5) c • Give examples of changes in the environment caused by natural or man-made influences. C3 (3-5) b • Explain how scientific and technological information can help people make safe and healthy decisions. C3 (3-5) a

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Lesson 9: Bright Schools ***Energy Knowledge in Action!*** *(2-4 sessions)* In this culminating lesson, students examine electric lighting used in their school and determine if there are methods that can reduce the amount of energy being used for the schools' lighting.	• By modifying habits, people can reduce the amount of energy being used for lighting. • By taking action, students can incorporate these simple habits to save energy at school. • These actions are cumulative, important, and have an effect on our environment.	• Conduct a survey to determine how energy is used for lighting in school. • Make recommendations for reducing the amount of energy being used for lighting in school. • Recognize that everyone can contribute to using energy more responsibly by including simple habits like turning off a light when it is not needed.	• Some people try to reduce the amount of fuels they use in order to conserve resources, reduce pollution, or to save money. BSL 8C/E4 (3-5) • Explain that natural resources are limited, and that reusing, recycling, and reducing materials and using renewable resources is important. MLR C3 (3-5) c