ENERGY IN THE CLASSROOM

Correlation of NEED Materials
to the
Chicago Public Schools
Standards
for
Science

NEED
25th Anniversary 2005
Putting Energy into Education

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To join the ILEED/NEED Network
and receive the materials and training you need to
conduct an energy unit in your classroom
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The NEED Project is a 501(c)(3) nonprofit education association dedicated to providing objective, comprehensive, innovative materials for teachers to use to teach students about energy. Materials are available for students in grades K–12.

KINDERGARTEN

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PROCESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Understand that science involves asking and answering questions and comparing experimental results to what is already known.

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Energy Fair
Primary Energy Flip Book
Trash Flip Book

CFS

1. Conduct simple experiments and observe and explain what was discovered.
2. Read and discuss science-related materials from a variety of sources.

CAS B. Design and conduct simple scientific investigations in which observations are made, data are gathered and organized, and reasonable conclusions are drawn.

CFS

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Energy Fair

1. Ask questions and formulate hypotheses about objects, events, and organisms that can be tested through scientific investigation.
2. Describe and compare objects using the five senses (e.g., for color, shape, texture, size).
3. Select and use instruments to collect, organize, and present data related to a scientific investigation (thermometers, timers, magnifiers, balances).
4. Compare observations of individual and group results.

CAS C. Understand and apply the concepts, principles, and processes of technological design.

CFS

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Energy Fair

1. Construct objects using component parts (e.g., model building, building blocks).
2. Use appropriate vocabulary to describe scientific phenomena and instrumentation.

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

CAS C. Describe and compare the properties and interactions of matter and energy.

CFS

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Energy Fair

1. Compare solids, liquids, and gases and describe how some change from one state to the other.
2. Examine, describe, classify, and compare large-scale physical properties of matter (e.g., size, shape, color, texture, odor, flexibility, state of matter).
3. Discriminate among a variety of natural and man-made sounds.

CAS D. Investigate, explain, and demonstrate characteristics of forces and motion.

NEED MATERIALS

CFS

1. Compare and contrast an action and reaction in the behavior of objects.

Primary Science of Energy

CAS E. Investigate, describe, and compare properties of Earth's basic materials (water, air, rock) and the natural processes that change the earth's surface.

CFS

1. Identify major sources and uses of water.

Primary Stories and More
Primary Energy Flip Book

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS A. Identify and describe major technological changes and their effects on people, tools, and nature.

CFS

1. Identify inventions that assist human senses (e.g., hearing aid, binoculars, eyeglasses).
2. Describe ways that technology is helping to solve the problems of pollution (e.g., water treatment, recycling).

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Primary Energy Flip Book
Trash Flip Book

CAS B. Demonstrate understanding of conservation and the need to protect renewable and non-renewable natural resources.

CFS

1. List causes of pollution.
2. Demonstrate conservation practices such as recycling and reusing containers and paper.

Primary Energy Flip Book
Trash flip Book

CAS D. Follow basic safety rules.

CFS

1. Explain the need for order, cleanliness, and safe practices during an experiment.
2. Describe safety hazards associated with laboratory investigations (e.g., no tasting of any chemicals).

Primary Science of Energy
The Sun and Its Energy

GRADE ONE

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PROCESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Understand that science involves asking and answering questions and comparing experimental results to what is already known.

CFS

1. Conduct simple experiments and observe and explain what was discovered.
2. Demonstrate how repeated observations improve confidence in results.
3. Read and discuss science-related materials from a variety of sources.

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Primary Energy Flip Book
Exploring Magnets

CAS B. Design and conduct simple scientific investigations in which observations are made, date are gathered and organized, and reasonable conclusions are drawn.

CFS

1. Ask questions and formulate hypotheses about objects, events, and organisms that can be tested through scientific investigation.
2. Observe and describe changes in terms of starting conditions, type of change, and ending conditions, using words, diagrams, or graphs (e.g., melting ice cubes, germinating seeds, burning candies).
3. Select and use instruments to collect, organize, and present data related to a scientific investigation (thermometers, timers, magnifiers, balances, microscopes, calculators, and computers).
4. Gather data from investigation by applying a variety of scientific skills (e.g., measurement, reading, recording methods).
5. Organize observations and measurements into charts and graphs and communicate conclusions orally and in writing.
6. Use data based on observations from guided experiments to construct reasonable and accurate explanations.
7. Compare observations of individual and group results.

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Energy Fair
Exploring Magnets
Trash Flip Book

CAS C. Understand and apply the concepts, principles, and processes of technological design.

CFS

1. Use appropriate vocabulary to describe scientific phenomena and instrumentation.
2. Plan and construct simple physical structures to solve specific technological challenges (e.g., blocks to build bridges, towers from drinking straws).

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Energy Fair
Exploring Magnets

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

CAS C. Describe and compare the properties and interactions of matter and energy.

CFS **NEED MATERIALS**

1. Compare solids, liquids, and gases and describe how some change from one state to the other. — Primary Science of Energy
2. Examine, describe, classify and compare large-scale physical properties of matter (e.g., size, shape, color, texture, odor, flexibility, state of matter). — The Sun and Its Energy
3. Discriminate among a variety of natural and man-made sounds. — Exploring Magnets
4. Explain and demonstrate ways that heat and light are produced.

CAS D. Investigate, explain, and demonstrate characteristics of forces and motion.

CFS

1. Compare and contrast an action and reaction in the behavior of objects. — Primary Science of Energy
2. Describe how push or pull may affect the motion of objects. — Exploring Magnets
3. Compare forces using various tools.

CAS E. Investigate, describe and compare properties of earth's basic materials (water, air, rock), and the natural processes that change the earth's surface.

CFS

1. Identify major sources and uses of water. — Primary Energy Flip Book
2. Identify major sources of rock and its uses. — Primary Stories and More
3. Identify ways in which the earth's surface is changed by the weather.

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS A. Identify and describe major technological changes and their effects on people, tools, and nature.

CFS

1. Describe ways that technology is helping to solve the problems of pollution (e.g., water treatment, recycling). — Primary Energy Flip Book
4. Compare the transportation and communications systems of the present to those of the past in terms of factors such as quality, efficiency, and speed. — Primary Stories and More
Trash Flip Book

CAS B. Demonstrate understanding of conservation and the need to protect renewable and non-renewable natural resources.

CFS

1. List causes of pollution and how to prevent them. — Primary Energy Flip Book
2. Demonstrate conservation practices for renewable resources (e.g., reducing, reusing, recycling). — Primary Stories and More
Trash Flip Book

CAS D. Students follow basic safety rules.

CFS

1. Explain the need for order, cleanliness, and safe practices during an experiment. — Primary Science of Energy
2. Describe safety hazards associated with laboratory investigations. (e.g., no tasting of any chemicals). — The Sun and Its Energy

GRADE TWO

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PROCESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Understand that science involves asking and answering questions and comparing experimental results to what is already known.

CFS

1. Conduct simple experiments and observe and explain what was discovered.
2. Demonstrate how repeated observations improve confidence in results.
3. Describe conditions that influence change during an investigation.
4. Explain why similar results are expected when an experiment is repeated under the same conditions.
5. Identify reasons why similar investigations may not always have the same results.
6. Explain why scientists make the processes and results of their investigations public.
7. Describe and compare components and interrelationships of simple systems.
8. Read and discuss science-related materials from a variety of sources.

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Energy Fair
Primary Energy Flip Book
Exploring Magnets

CAS B. Design and conduct simple scientific investigations in which observations are made, data are gathered and organized, and reasonable conclusions are drawn.

CFS

1. Ask questions and formulate hypotheses about objects, events, and organisms that can be tested through scientific investigation.
2. Observe and describe changes in terms of starting conditions, types of change, and ending conditions, using words, diagrams, or graphs.
3. Select and use instruments to collect, organize and present data related to a scientific investigation.
4. Gather data from investigations by applying a variety of scientific skills.
5. Organize observations and measurements into charts and graphs and communicate conclusions orally and in writing.
6. Use data based on observations from guided experiments to construct reasonable and accurate explanations.
7. Compare observations of individual and group results.

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Energy Fair
Exploring Magnets

CAS C: Understand and apply the concepts, principles, and processes of technological design.

CFS

1. Use appropriate vocabulary to describe scientific phenomena and instrumentation.
2. Plan and construct simple physical structures to solve specific technological challenges.

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Energy Fair
Exploring Magnets

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

NEED MATERIALS

CAS C. Describe and compare the properties and interactions of matter and energy.

CFS

1. Examine, describe, classify and compare large-scale physical properties of matter.
2. Measure common physical properties of objects.
3. Demonstrate that objects can be made of one or more materials.
4. Describe and demonstrate the construction and operation of electrical circuits.

Primary Science of Energy
The Sun and Its Energy
Building Buddies
Primary Stories and More
Exploring Magnets

CAS D: Investigate, explain, and demonstrate characteristics of forces and motion.

CFS

1. Compare and contrast an action and reaction in the behavior of objects.
2. Describe how push or pull may affect the motion of objects.
3. Compare forces using various tools.
4. Describe how gravity affects motion.
5. Demonstrate that a magnet has a magnetic field and that magnets attract and repel.
6. Demonstrate interactions between positively and negatively charged objects.
7. Distinguish between objects that do and do not interact magnetically; distinguish between objects that do and do not interact electrically.

Primary Science of Energy
The Sun and Its Energy
Primary Energy Flip Book
Exploring Magnets

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS A. Identify and describe major technological changes and their effects on people, tools, and nature.

CFS

1. Describe ways that technology is helping to solve the problems of pollution (e.g., water treatment, recycling).
4. Compare the transportation and communication systems of the present to those of the past in terms of factors such as quality, efficiency, and speed.

Building Buddies
Primary Energy Flip Book
Primary Stories and More

CAS B. Demonstrate understanding of conservation and the need to protect renewable and non-renewable natural resources.

CFS

1. List causes of pollution and how it affects plant and animal life.
2. Investigate, develop, and demonstrate conservation practices for renewable resources.

Primary Energy Infobook
The Sun and Its Energy
Primary Stories and More
Trash Flip Book

CAS D. Follow basic safety rules.

Primary Science of Energy

GRADE THREE

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PROCESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Understand that science involves asking and answering questions and comparing experimental results to what is already known.

CFS

1. Conduct experiments and observe and explain what was discovered.
2. Demonstrate how repeated observations improve confidence in results.
3. Describe conditions that influence change during an investigation (e.g., independent and dependent variables).
4. Explain why similar results are expected when an experiment is repeated under the same conditions.
5. Identify reasons why similar investigations may not always have the same results.
6. Explain why scientists make the processes and results of their investigations public (e.g., so that others can repeat them and review and question their results).
7. Describe and compare components and interrelationships of a simple system (e.g., skeletal system, simple electrical circuit).
8. Read and discuss science-related materials from a variety of sources.

Primary Science of Energy
Energy from the Sun
Building Buddies
Primary Stories and More
Energy Fair
Elementary Energy Infobook
Exploring Magnets

CAS B. Design and conduct simple scientific investigations in which observations are made, data are gathered and organized, and reasonable conclusions are drawn.

CFS

1. Ask questions and formulate hypotheses about objects, events, and organisms that can be tested through scientific investigation.
2. Observe and describe changes in terms of starting conditions, types of changes, and ending conditions, using words, diagrams, or graphs (e.g., melting ice cubes, germinating seeds, burning candles).
3. Select and use instruments to collect, organize and present data related to a scientific investigation (thermometers, timers, magnifiers, balances, microscopes, calculators, and computers).
4. Gather data from investigation by applying a variety of scientific skills (e.g., measurement, manipulation, reading, recording methods).
5. Organize observations and measurements into charts and graphs and communicate conclusions orally and in writing. Use data based on observations from guided experiments to construct reasonable and accurate explanations.
6. Interpret data and evaluate the accuracy of the outcomes or solutions (e.g., repeated trials improve accuracy).
7. Compare observations of individual and group results.

Primary Science of Energy
Energy from the Sun
Building Buddies
Primary Stories and More
Energy Fair
Exploring Magnets
Trash Talk

CAS C. Understand and apply the concepts, principles, and processes of technological design.

CFS

1. Use appropriate vocabulary to describe scientific phenomena and instrumentation.
2. Discuss and design several possible solutions to a given problem.
3. Construct simple models that illustrate concepts and compare those models to what they represent (e.g., compare a balloon rocket to actual rocket, dolls to humans).
4. Create a prototype of a device using materials and tools provided; record and describe the results using appropriate instruments, techniques, and measurement methods.
5. Report the design, test process, and results in solving a given problem.

NEED MATERIALS

Primary Science of Energy
Energy from the Sun
Building Buddies
Primary Stories and More
Energy Fair

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

CAS A. Compare and describe life cycles, basic needs, characteristics, and component parts of organisms.

CFS

1. Describe how plants and animals obtain energy and raw materials.

Elementary Energy Infobook
Primary Science of Energy
Primary Stories and More

CAS C: Describe and compare the properties and interactions of matter and energy.

CFS

1. Describe and compare how energy in different forms affects common objects and is involved in common events (e.g., combustion, electrical conduction).

Primary Science of Energy
Energy from the Sun
Elementary Energy Infobook

CAS D: Investigate, explain, and demonstrate characteristics of forces and motion.

CFS

1. Compare and contrast an action and reaction in the behavior of objects.

Primary Science of Energy
Energy from the Sun

CAS E. Investigate, describe and compare properties of earth's basic materials (water, air, rock), and the natural processes that change the earth's surface.

CFS

1. Describe different types and uses of the earth's rocks, soils, and minerals.
2. Identify the earth's renewable and non-renewable resources around the world (e.g., Mideast oil, Illinois coal, Southeastern U.S. pine lumber, native trees of Hawaii).
7. Illustrate and describe cycles in nature (e.g. water, C02/02)
9. Identify ways that earth's surface influences weather (e.g., evaporation from oceans, condensation due to mountains).

Elementary Energy Infobook
Primary Stories and More
Energy in the Balance

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.
CAS A: Identify and describe major technological changes and

their effects on people, tools, and nature.

NEED MATERIALS

CFS

1. Describe ways that technology is helping to solve the problems of pollution (e.g., water treatment, recycling).
2. Describe effects that technology can have on various environments around the world (e.g., greenhouse effect, replacing CFC's).
3. Identify examples of the disruption of food webs by modem technology and the implications of such interruptions (e.g., draining wetlands, ozone depletion).

Building Buddies
Primary Stories and More
Elementary Energy Infobook
Trash Talk

CAS B. Demonstrate understanding of conservation and the need to protect renewable and non-renewable natural resources.

CFS

1. List causes of pollution, its effects on plant and animal life, and possible ways of reducing or preventing it.
2. Investigate, develop, and demonstrate conservation practices for renewable resources (e.g., reducing, reusing, recycling, replanting trees).

Energy from the Sun
Building Buddies
Primary Stories and More
Elementary Energy Infobook
Trash Talk

CAS D: Follow basic safety rules.

CFS

1. Explain the need for order, cleanliness, and safe practices during an experiment.
2. Describe safety hazards associated with laboratory investigation (e.g., fire, poisons, caustic chemicals).

Primary Science of Energy

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PRO-

GRADE FOUR

CESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS, AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A: Identify problems and derive solutions to demonstrate an understanding of the processes of scientific investigation.

CFS

1. Explain why similar investigations may not produce similar results.
2. Illustrate that scientific investigations sometimes result in unexpected findings that lead to new questions and more investigations.
3. Explain why keeping accurate and detailed records is important.
4. Conduct a literature search with appropriate sources on an assigned topic.
5. Synthesize textual resources to solve problems.

EnergyWorks
Elementary Science of Energy
Energy from the Sun
Monitoring and Mentoring
Energy Fair
Elementary Energy Infobook

CAS B. Design and safety conduct scientific investigations to answer questions and test the validity of predictions: making observations, describing procedures, organizing data, drawing reasonable conclusions, and interpreting results.

CFS

1. Formulate appropriate questions to acquire information about objects, organisms, and events in the environment.
2. State a hypothesis, identify the independent and dependent variables, and devise an appropriate experimental design to test the hypothesis.
3. Conduct experiments that require repeated trials using the skills of observation, classification, prediction, and communication of results.
4. Demonstrate skill in using scientific instruments and technology to obtain different levels of precision.
5. Use a variety of techniques to gather and display scientific data derived from individual and collaborative investigations.
6. Use metric units (Standard International Units and conventions) in measuring, calculating, and reporting results.
7. Identify patterns and relationships that suggest cause and effect or support inferences and hypotheses.
8. Differentiate observations from inferences (e.g., failing objects, gravity).
9. Evaluate conflicting data from repeated trials of an investigation and determine sources of error.

EnergyWorks
Elementary Science of Energy
Energy from the Sun
Monitoring and Mentoring
Energy Fair

CAS C. Know and apply the concepts, principles, and processes of technological design.

CFS

1. Use appropriate vocabulary to describe science phenomena and instruments.
2. Build models and describe how they illustrate or fail to illustrate features of the situation they are modeling.
3. Describe examples of how incomplete, inadequate, or inaccurate analysis of a technological problem has led to an unacceptable solution or one with costly unintended consequences.

EnergyWorks
Elementary Science of Energy
Energy from the Sun
Monitoring and Mentoring
Energy Fair

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUN-

DAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTHISPACE SCIENCES AND THEIR CONNECTIONS.

NEED MATERIALS

CAS C. Observe, describe, classify, measure, and compare characteristics of matter and different kinds of energy (mechanical, electrical, magnetic, light, heat chemical).

CFS

1. Demonstrate that light travels in a straight line and can be reflected, refracted, or absorbed.
2. Demonstrate that heat can be produced in a variety of ways by using a variety of techniques (e.g., friction, electricity, metabolism).
3. Explain and demonstrate the use of insulators to prevent energy transfer.

EnergyWorks
Energy from the Sun
Energy House

CAS D. Demonstrate and explain changes in forces and motion.

CFS

1. Describe how the human ear enhances the detection of sound.

EnergyWorks

CAS E. Analyze natural cycles, interactions, and patterns in the earth's land, water, and atmospheric systems.

CFS

1. Describe short- to long-term changes in the earth's climate, suggesting causative factors and outlining effects on biotic communities.
2. Discuss and evaluate evidence that human activities have long-term effects on global climate.

Elementary Energy Infobook
Exploring Energy
Energy in the Balance

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS B. Demonstrate an understanding of the need for protecting, conserving, and efficiently utilizing renewable and nonrenewable natural resources.

CFS

1. Describe changes in physical environments that result from human activity (e.g., irrigation, dams and levees, offshore drilling).
2. Classify materials in terms of their environmental impact (e.g., biodegradability, recyclability
3. Design solutions to selected pollution and environmental problems.
4. Compare energy usage in various regions of the world (e.g., industrial vs. agricultural).
5. Identify opportunities for energy conservation at home, in school and in the community (e.g., automobiles vs. public transportation).

Elementary Energy Infobook
Energy in the Balance
Trash Talk
Monitoring & Mentoring
Energy from the Sun
Today in Energy
Energy Conservation Contract

CAS D. Demonstrate the ability to follow basic safety rules.

CFS

1. Identify and take precautions to minimize safety hazards associated with laboratory investigations.

EnergyWorks
Elementary Science of Energy

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PRO-

GRADE FIVE

CESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS, AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Identify problems and derive solutions to demonstrate an understanding of the processes of scientific investigation

CFS

1. Explain why similar investigations may not produce similar results.
2. Illustrate that scientific investigations sometimes result in unexpected findings that lead to new questions and more investigations.
3. Explain why keeping accurate and detailed records is important.
4. Conduct a literature search with appropriate sources on an assigned topic.
5. Synthesize textual resources to solve problems.

EnergyWorks
ElectroWorks
Exploring Solar Energy
Elementary Science of Energy
Monitoring & Mentoring
Intermediate Energy Infobook
Trash Talk

CAS B. Design and safely conduct scientific investigations to answer questions and test the validity of predictions: making observations, describing procedures, organizing data, drawing reasonable conclusions, and interpreting results.

CFS

1. Formulate appropriate questions to acquire information about objects, organisms, and events in the environment.
2. State a hypothesis, identify the independent and dependent variables, and devise an appropriate experimental design to test the hypothesis.
3. Conduct experiments that require repeated trials utilizing the skills of observation, classification, prediction, and communication of results.
4. Demonstrate skill in using scientific instruments and technology to obtain different levels of precision.
5. Use a variety of techniques to gather and display scientific data derived from individual and collaborative investigations.
6. Use metric units (Standard International Units and conventions) in measuring, calculating, and reporting results.
7. Identify patterns and relationships that suggest cause and effect or support inferences and hypotheses.
8. Differentiate observations from inferences.
9. Evaluate conflicting data from repeated trials of an investigation and determine sources of error.

EnergyWorks
ElectroWorks
Exploring Solar Energy
Elementary Science of Energy
Monitoring & Mentoring
Energy Fair

CAS C. Know and apply the concepts, principles, and processes of technological design.

CFS

1. Use appropriate vocabulary to describe science phenomena and instruments.
2. Design and implement technological solutions to particular problems and describe the entire process, from problem identification to analysis of solution effectiveness.

EnergyWorks
ElectroWorks
Exploring Solar Energy
Elementary Science of Energy
Monitoring & Mentoring
Energy Fair

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

CAS C. Observe, describe, classify, measure, and compare charac-

teristics of matter and different kinds of energy (mechanical, electrical, magnetic, light, heat chemical).

NEED MATERIALS

CFS

1. Demonstrate that light travels in a straight line and can be reflected, refracted, or absorbed (e.g., with mirrors, prisms, color filters).
2. Separate components of a mixture (e.g., solubility, magnetic properties, densities).
3. Demonstrate that electrical energy can be converted to light, heat, sound, and magnetic energy.
4. Compare and demonstrate conduction, convection, and radiation of heat energy.
5. Describe quantitatively the relation between time and distance; mass and force (e.g., velocity, acceleration, momentum, potential energy, and kinetic energy).

EnergyWorks
Exploring Solar Energy

ElectroWorks

EnergyWorks

CAS E. Analyze natural cycles, interactions, and patterns in the earth's land, water, and atmospheric systems.

CFS

1. Distinguish among evaporation, condensation, and precipitation phases of the water cycle.

Intermediate Energy Infobook
Ocean Energy

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS A. Investigate and present ways in which science and technology have changed the tools, careers, resource use, and productivity of society over the centuries.

CFS

2. Describe how science and technology have improved agriculture, transportation, health, and sanitation.

Intermediate Energy Infobook
Yesterday in Energy

CAS B. Demonstrate an understanding of the need for protecting, conserving, and efficiently utilizing renewable and nonrenewable natural resources.

CFS

1. Classify materials in terms of their environmental impact (biodegradability, recyclability).
2. Identify opportunities for energy conservation at home, in school, and in the community (e.g., automobiles vs. public transportation, recycling of aluminum cans).
3. Explain how technology affects perceptions of places and regions (e.g., how television and movies present images to billions of people around the world).

Intermediate Energy Infobook
Energy in the Balance
Trash Talk
Monitoring & Mentoring
Energy Around the World
Today in Energy
Energy Conservation Contract
What Car Will You Drive?

CAS D. Demonstrate the ability to follow basic safety rules.

CFS

1. Identify and take precautions to minimize safety hazards associated with laboratory investigations (e.g., wear safety goggles, gloves, and aprons as needed).

EnergyWorks
Elementary Science of Energy

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PRO-

GRADE SIX

CESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Identify problems and derive solutions to demonstrate an understanding of the processes of scientific investigation.

CFS

1. Explain why similar investigations may not produce similar results.
2. Illustrate that scientific investigations sometimes result in unexpected findings that lead to new questions and more investigations.
3. Explain why keeping accurate and detailed records is important.
4. Conduct a literature search with appropriate sources on an assigned topic.
5. Synthesize textual resources to solve problems.

Monitoring & Mentoring
EnergyWorks
Exploring Solar Energy
ElectroWorks
Intermediate Energy Infobook
Museum of Solid Waste & Energy
Science of Energy

CAS B. Design and safely conduct scientific investigations to answer questions and test the validity of predictions: making observations, describing procedures, organizing data, drawing reasonable conclusions, and interpreting results.

CFS

1. Formulate appropriate questions to acquire information about objects, organisms, and events in the environment.
2. State a hypothesis, identify the independent and dependent variables, and devise an appropriate experimental design to test the hypothesis.
3. Conduct experiments that require repeated trials utilizing the skills of observation, classification, prediction, and communication of results (e.g., collect data from class members and/or have individual students repeat the investigation multiple times).
4. Demonstrate skill in using scientific instruments and technology to obtain different levels of precision (e.g., triple beam and electronic balances, graduated cylinders, sieves, stereoscopes, timers, electric meters, calculators, computers).
5. Use a variety of techniques to gather and display scientific data derived from individual and collaborative investigations (e.g., test, interview, survey).
6. Use metric units (Standard International Units and conventions) in measuring, calculating, and reporting results.
7. Identify patterns and relationships that suggest cause and effect or support inferences and hypotheses.
8. Differentiate observations from inferences (e.g., plant tropisms, growth factors).
9. Evaluate conflicting data from repeated trials of an investigation and determine sources of error.
10. Evaluate the validity of an argument through presentation of data.
11. Contrast relevant and irrelevant information in an investigation.

Monitoring & Mentoring
EnergyWorks
Exploring Solar Energy
ElectroWorks
Intermediate Energy Infobook
Museum of Solid Waste & Energy
Science of Energy

CAS C. Know and apply the concepts, principles, and processes of technological design.

CFS

1. Identify a design problem and propose possible solutions.
2. Identify constraints; develop a plan and procedure to address a design problem.
3. Demonstrate a prototype of a design using available tools and materials.
4. Test the design using suitable materials, techniques, and quantitative measurements to record data.
5. Present the design, the process, and the test results in oral and written forms.
6. Use appropriate vocabulary to describe science phenomena and instruments.

NEED MATERIALS

Monitoring & Mentoring
Energy House

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

CAS C. Observe, describe, classify, measure, and compare characteristics of matter and different kinds of energy (mechanical, electrical, magnetic, light heat chemical).

CFS

1. Describe the major components of atoms and explain how they relate to chemical change.
2. Describe quantitatively the relation between time and distance, and mass and force.
3. Describe, measure, and calculate the times, distances, masses, and forces of moving objects and their interactions within a system.

ElectroWorks
EnergyWorks
Intermediate Energy Infobook

CAS D. Demonstrate and explain changes in forces and motion.

CFS

1. Describe and represent an object's motion graphically according to its position, direction, and speed.
2. Describe the relationship of work to force and distance.
3. Describe (using words, diagrams, or graphs) and predict what changes and what remains unchanged when matter experiences an external influence.

EnergyWorks

CAS E. Analyze natural cycles, interactions, and patterns in the earth's land, water, and atmospheric systems.

CFS

6. Describe the composition and structure of layers of the earth and the atmosphere (e.g., core, mantle, crust).
8. Describe the relationship of solar energy from the sun to phenomena on earth's surface.

Intermediate Energy Infobook
Exploring Solar Energy

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS A. Investigate and present ways in which science and technology have changed the tools, careers, resource use, and productivity of society over the centuries.

CFS

2. Explain how changes in transportation, communication, and other technologies affect the location of economic activities (e.g., shift from trains and boats to trucks has moved population centers).
3. Compare and contrast pure science and applied science (e.g., scientists propose explanations for questions about the natural world and engineers propose solutions relating to human problems, needs, and wants).

NEED MATERIALS

Monitoring & Mentoring
Museum of Solid Waste & Energy
Intermediate Energy Infobook
Yesterday in Energy

CAS B. Demonstrate an understanding of the need for protecting, conserving, and efficiently utilizing renewable and nonrenewable natural resources.

CFS

1. Identify opportunities for energy conservation at home, in school, and in the community (e.g., thermostats, insulation).
2. Describe how technology affects access to resources and their uses (e.g., mining and mineral extraction methods).

Intermediate Energy Infobook
Great Energy Debate Game
Monitoring & Mentoring
Energy Conservation Contract
Energy House
Museum of Solid Waste & Energy

CAS D. Demonstrate the ability to follow basic safety rules.

CFS

1. Identify and take precautions to minimize safety hazards associated with laboratory investigations (e.g., wear safety goggles, wash hands, wear protective clothing).

EnergyWorks
ElectroWorks
Intermediate Science of Energy

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PRO-

GRADE SEVEN

CESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Analyze data, draw conclusions based on evidence, and report results accurately in a variety of formats.

CFS

1. Differentiate between qualitative and quantitative data and understand their appropriate applications to the formation of research questions.
2. Use metric units (Standard International Units and conventions) in measuring, calculating, and reporting results.
3. Use technology such as computers and/or field microscopes, calculators, telescopes, and models to observe and measure objects, organisms, and phenomena directly, indirectly, or remotely.
4. Propose, analyze, and evaluate alternative explanations to phenomena, using scientific principles, models, and theories.
5. Conduct an independent research initiative that includes reading primary sources and present the results in a public forum.

EnergyWorks
ElectroWorks
Exploring Solar Energy
Secondary Science of Energy
Learning & Conserving
What Car Will You Drive?
Ocean Energy

CAS B. Demonstrate understanding of scientific processes and apply them to experiments: stating a purpose, developing a hypothesis, designing procedures, making observations, collecting data, controlling variables, and establishing relationships based on evidence and logical argument.

CFS

1. Explain why it is important and demonstrate how to vary only one experimental factor at a time and control external variables.
2. Explain relationships among theories, hypotheses, experiments, and data.
3. Illustrate how scientific conclusions are open to modification as new data are collected (e.g., ice on the moon).
4. Conduct a variety of scientific investigations.
5. Use conceptual, mathematical, and/or physical models to predict change .
6. Distinguish fact from opinion and science from pseudoscience.

EnergyWorks
ElectroWorks
Exploring Solar Energy
Secondary Science of Energy
Learning & Conserving
What Car Will You Drive?

CAS C. Know and apply the concepts, principles, and processes of technological design.

CFS

1. Use appropriate vocabulary to describe science phenomena and instruments.
2. Identify a real world problem, propose a technological solution, implement the proposed solution, modify it as needed, evaluate, and produce a report of the process.

Learning & Conserving
Energy House
Mission Possible
What Car Will You Drive?

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

CAS C. Analyze qualitatively and quantitatively patterns of

change in matter and energy.

NEED MATERIALS

CFS

1. Describe properties of thermal energy.
2. Describe the interactions of energy with matter.

EnergyWorks
Secondary Science of Energy
Exploring Solar Energy
ThermoDynamics

CAS D. Investigate, analyze, and explain the characteristics of forces and motion, including uniform motions.

CFS

2. Describe the motion of objects by position, direction, and speed.
3. Define work, energy, power, and friction and give real world examples of each.

EnergyWorks

CAS E. Analyze the properties, functions, and formation of the earth's component features.

CFS

2. Explain how earth's atmospheric circulation is driven by solar heating.
4. Collect, record, and analyze weather data, including temperature, cloud types, humidity, air pressure, wind, precipitation, and dew point over a period of time.
5. Investigate and evaluate the biodegradability of renewable and nonrenewable natural resources.

Exploring Solar Energy
Intermediate Energy Infobook
Learning & Conserving
Museum of Solid Waste & Energy

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS A. Evaluate implications of technology for societies, vocations, economies, and the environment, including tradeoffs, intended benefits, unintended consequences, and constraints.

CFS

1. Demonstrate the use of scientific instruments and technology for various purposes and levels of precision.
4. Analyze how the introduction of a new technology has affected or could affect human activity.

EnergyWorks
ElectroWorks
Exploring Solar Energy
Secondary Science of Energy
Learning & Conserving

CAS B. Demonstrate and evaluate civic responsibility by participating in school, home, and community conservation activities.

CFS

1. Develop a personal environmental impact statement and institute a conservation strategy and develop a plan for increased efficiency.
2. Evaluate current conservation practices and their effect on natural resources and the local economy (e.g., solar vs. fossil fuels).

Energy Conservation Contract
Learning & Conserving
Great Energy Debate Game
Mission Possible
What Car Will You Drive?

CAS D. Demonstrate and practice safety techniques to identify and reduce potential hazards.

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PROCESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN

GRADE EIGHT

TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Analyze data, draw conclusions based on evidence, and report results accurately in a variety of formats.

CFS

1. Differentiate between qualitative and quantitative data and understand their appropriate applications to the formation of research questions.
2. Use metric units (Standard International Units and conventions) in measuring, calculating, and reporting results.
3. Use technology such as computers and/or field microscopes, calculators, telescopes, and models to observe and measure objects, organisms, and phenomena directly, indirectly, or remotely.
4. Propose, analyze, and evaluate alternative explanations to phenomena, using scientific principles, models, and theories (e.g., plate tectonics).
5. Present information in a formal laboratory report in a form suited to the purpose and the audience (e.g., scientific method).
6. Conduct an independent research initiative that includes reading primary sources, and present the results in a public forum (e.g., science fair).

Learning & Conserving
ElectroWorks
Exploring Solar Energy
Secondary Science of Energy
ThermoDynamics
Alternative Transportation Fuels
Photovoltaics

CAS B. Demonstrate understanding of scientific processes and apply them to experiments: stating a purpose, developing a hypothesis, designing procedures, making observations, collecting data, controlling variables, and establishing relationships based on evidence and logical argument.

CFS

1. Explain why it is important and demonstrate how to vary only one experimental factor at a time and control external variables.
2. Analyze sources of error in repeated experiments that yield different or variable results.
3. Review experimental procedures, examine evidence, identify faulty reasoning, and point out statements that go beyond the evidence.
4. Explain relationships among theories, hypotheses, experiments, and data.
5. Illustrate how scientific conclusions are open to modification as new data are collected.
6. Conduct a variety of scientific investigations (e.g., experimentation, collecting specimens, observing and describing objects, constructing models, researching scientific literature).
7. Use conceptual, mathematical, and/or physical models to predict change (e.g., computer simulation, solar system model, atomic and molecular models).
8. Distinguish fact from opinion and science from pseudoscience (e.g., astronomy vs. astrology).
9. Manipulate data mathematically to make it applicable to analysis (e.g., derive mathematical functions from tabular data).

ElectroWorks
Exploring Solar Energy
Secondary Science of Energy
Learning & Conserving
ThermoDynamics
Photovoltaics

CAS C. Know and apply the concepts, principles, and processes of technological design.

CFS

1. Form a design team, identify a common design problem, and establish criteria for determining the success of a solution.
2. Compare and contrast solutions to a problem, considering factors such as available materials, tools, cost-effectiveness, and safety.
3. Build, test, and collect data on a prototype model using available materials.
4. Evaluate test results based on established criteria and recommend improvements.
5. Report in a public forum the relative success of a design based on test results and criteria (e.g., science fair).
6. Use appropriate vocabulary to describe science phenomena and instruments.

Learning & Conserving
Energy House
Mission Possible
Alternative Transportation Fuels
Photovoltaics

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

CAS C. Analyze qualitatively and quantitatively patterns of change in matter and energy.

CFS

1. Describe longitudinal and transverse waves and measure frequency and amplitude.
2. Describe the relationship between magnetism and electricity.
3. Construct various electrical circuits and measure their properties (e.g., voltage, current, and resistance).
4. Describe and calculate quantities before and after a chemical or physical change within a system and use that data to support the concept of conservation of mass within a closed system.
5. Apply chemical formulas and balanced equations to explain the conservation of matter.
7. Describe and classify objects and mixtures of substances based on common physical and chemical properties (e.g., states of matter, mass, volume, electrical charge, density, boiling points, pH, magnetism, solubility).
8. Compare and contrast the positions, movements, and relationships of atoms in gases, liquids, and solids.

ElectroWorks
Photovoltaics
Secondary Science of Energy
Learning & Conserving
ThermoDynamics

CAS E. Analyze the properties, functions, and formation of the earth's component features.

CFS

3. Investigate and evaluate the biodegradability of renewable and nonrenewable natural resources.
5. Describe the relationships between the sun and the earth's climate, seasons, weather and time.

Museum of Solid Waste & Energy
Secondary Energy Infobook
Learning & Conserving

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY TEXTS.

CAS A. Evaluate implications of technology for societies, vocations, economies, and the environment including trade-offs,

intended benefits, unintended consequences, and constraints. **NEED MATERIALS**

CFS

1. Demonstrate the use of scientific instruments and technology for various purposes and levels of precision (e.g., balances, graduated cylinders, calculators, computers).
2. Describe how humans have improved agricultural practices through technology and genetic engineering (e.g., disease resistance, crop yields).
3. Analyze how the introduction of new technology has affected or could affect human activity (e.g., gunpowder, engines, modem telecommunications).
4. Describe options in therapies in human medicine made available through advances in technology and pharmacology (e.g., organ transplant, immunosuppressant drugs, bioengineering).
5. Describe relationships between space exploration and technological development (e.g., more sophisticated computers, remote sensing, medical imaging).
6. Debate the issues in scientific controversies (e.g., nuclear energy, genetic engineering, using animals in research).
7. Explain the roles of technology in human modification of the physical environment (e.g., global warming, damming of rivers, irrigation of deserts).
8. Explain the need for laws and policies relating to scientific and technological research (e.g., the safety of workers and consumers).
9. Analyze costs and benefits of using renewable energy and nonrenewable energy sources (e.g., alternative fuels).
10. Examine potential impacts of human genome project (e.g., medical, social, legal, economic).

Learning & Conserving
ElectroWorks
Photovoltaics
Secondary Science of Energy
ThermoDynamics
Secondary Energy Infobook
Great Energy Debate Game
Mission Possible
Alternative Transportation Fuels

CAS B. Demonstrate and evaluate civic responsibility by participating in school, home, and community conservation activities.

CFS

1. Develop a personal environmental impact statement and institute a conservation strategy (e.g., calculate home and school electric, water, and water usage inventories).
2. Evaluate current conservation practices and their effect on natural resources and the local economy (e.g., fuel efficiency, thermostat settings).

Energy Conservation Contract
Learning & Conserving

CAS D. Demonstrate and practice safety techniques to identify and reduce potential hazards.

CFS

1. Demonstrate skill in manipulating laboratory apparatus and identify the safety hazards associated with laboratory investigations (e.g., proper ventilation, protective clothing).

ElectroWorks
Photovoltaics
Secondary Science of Energy
Learning & Conserving
ThermoDynamics

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PROCESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN

PHYSICAL SCIENCE

TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS, AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Propose, consider, analyze, and evaluate alternative explanations to scientific phenomena.

CAS B. Conduct full-scale scientific investigations: formulate the questions to be answered, design approaches that incorporate appropriate variables and controls, implement solutions, collect and record qualitative and quantitative data, and communicate the results.

Learning & Conserving
ElectroWorks
Photovoltaics
Secondary Science of Energy
ThermoDynamics
Secondary Energy Infobook
Great Energy Debate Game
Mission Possible
Alternative Transportation Fuels

CAS C. Know and apply the concepts, principles, and processes of technological design.

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS A. Evaluate the benefits, costs, risks, consequences, social needs, values, and politics inherent in adopting and using evolving technology.

CFS

1. Analyze specific challenges created through international competition for resources, increases in scientific knowledge, and improvements in technical capabilities.
2. Analyze benefits, costs, limitations, and consequences involved in using technologies or resources.
4. Evaluate ways in which technologies have expanded the human capacity to modify the physical environment.

Secondary Energy Infobook
Mission Possible
Energy Around the World
Great Energy Debate Game
Alternative Transportation Fuels

CAS B. Analyze roles of individuals, local governments, nations, economies, and cultures in conserving and preserving natural resources, including wilderness areas.

CFS

1. Analyze global consequences of human modification of Earth's ecosystems.
2. Analyze costs, benefits, and consequences associated with exploration, development, and consumption of natural resources.
3. Identity and explain the environmental factors needed to sustain and enhance the quality of water.
4. Investigate methods for minimizing pollution and procedures for monitoring environmental quality.
5. Describe the overall function of the governmental Environmental Protection Agencies and explain the social, economic, and political implications of the work of these agencies.
6. Compare and contrast renewable and nonrenewable energy resources and formulate hypotheses concerning the social, economic, and environmental implications of using alternative energy sources.

Secondary Energy Infobook
Mission Possible
Energy Around the World
Great Energy Debate Game
Alternative Transportation Fuels

STATE GOAL 11: HAVE A WORKING KNOWLEDGE OF THE PROCESSES OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN TO INVESTIGATE QUESTIONS, CONDUCT EXPERIMENTS, AND SOLVE PROBLEMS.

NEED MATERIALS

CAS A. Propose, consider, analyze, and evaluate alternative explanations to scientific phenomena.

CAS B. Conduct full-scale scientific investigations: formulate the questions to be answered, design approaches that incorporate appropriate variables and controls, implement solutions, collect and record qualitative and quantitative data, and communicate the results.

Learning & Conserving
Secondary Energy Infobook
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Photovoltaics

CAS C. Know and apply the concepts, principles, and processes of technological design.

STATE GOAL 12: HAVE A WORKING KNOWLEDGE OF THE FUNDAMENTAL CONCEPTS AND PRINCIPLES OF THE LIFE, PHYSICAL, AND EARTH/SPACE SCIENCES AND THEIR CONNECTIONS.

CAS C. Demonstrate understanding of the nature of matter and energy.

CFS

1. Apply Laws of Thermodynamics to chemical phenomena and physical phenomena.
2. Explain how conservation of matter and energy is expressed in an environmental context.
3. Apply chemical principles to environmental contexts.
4. Describe the fundamental forces of nature as they apply to environmental sciences.
5. Compare, contrast, and discuss the importance and applications of nuclear fusion, nuclear fission, radioactive decay.

ThermoDynamics
Secondary Science of Energy
Secondary Energy Infobook
Photovoltaics

STATE GOAL 13: HAVE A WORKING KNOWLEDGE OF THE RELATIONSHIPS AMONG SCIENCE, TECHNOLOGY, AND SOCIETY IN HISTORICAL AND CONTEMPORARY CONTEXTS.

CAS A. Evaluate the benefits, costs, risks, consequences, social needs, values, and politics inherent in adopting and using evolving technology.

CFS

1. Analyze specific challenges created through international competition for resources, increases in scientific knowledge, and improvements in technical capabilities.
2. Analyze benefits, costs, limitations, and consequences involved in using technologies or resources (e.g., agricultural pesticides, ground water, nuclear waste disposal, natural gas reserves).
4. Evaluate ways in which technologies have expanded the human capacity to modify the physical environment.
5. Show how beliefs and attitudes influence and have been influenced by new scientific and technological advances (e.g., genetically

Learning & Conserving
Mission Possible
Great Energy Debate Game
Alternative Transportation Fuels

engineered food, alternative energy sources for automobiles, conservation of resources, recycling).

CAS B. Analyze roles of individuals, local governments, nations, economies, and cultures in conserving and preserving natural resources, including wilderness areas.

CFS

1. Analyze global consequences of human modification of the Earth's ecosystems (e.g., global warming, ozone depletion, acid rain, declining biodiversity).
2. Analyze costs, benefits, and consequences associated with exploration, development, and consumption of natural resources.
4. Investigate methods for minimizing pollution and procedures for monitoring environmental quality.
5. Describe the overall function of the governmental Environmental Protection Agencies and explain the social, economic, and political implications of the work of these agencies.
6. Compare and contrast renewable and nonrenewable energy resources and formulate hypotheses concerning the social, economic, and environmental implications of using alternative energy sources.
7. Develop and evaluate a personal environmental impact statement (e.g., calculate electric, water, gasoline, heating fuel, water usage inventories) and recommend improvements.

NEED MATERIALS

Secondary Energy Infobook

Learning & Conserving
Secondary Energy Infobook
Great Energy Debate Game
Mission Possible
Energy Conservation Contract
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Photovoltaics

NEED Project Materials

The NEED Project is a nonprofit organization dedicated to educating students, teachers, and the community about energy. Below is a description of NEED materials available to teachers listed in alphabetical order:

Biodiesel (Grades 4-12)—Students explore biodiesel as a transportation fuel with backgrounders on three reading levels and suggested activities.

Blueprint for Success (Grades K–12)—This booklet is designed to help teachers develop an effective energy education program for their grade level and special needs using NEED materials. Pre- and post surveys at four reading levels and an energy unit exam are also included.

Building Buddies (Grades 1–3)—This primary program introduces students to basic concepts of energy use and conservation, beginning with activities focused on home energy use and extending to school energy use and conservation measures. Students monitor weather conditions, record indoor and outdoor temperatures, and evaluate their energy use behaviors daily. Individual students and classrooms are recognized for energy-saving habits and being good Building Buddies. Teacher and student guides are included. The Building Buddies Kit includes an indoor/outdoor thermometer, immersion thermometer, flicker checker, and Building Buddies pouches, buttons, stickers, and certificates.

Current Energy Affair (Grades 7-12)—Students cat as TV correspondents to report on electric power generation. They explore how electricity is generated and transported, what energy sources are used to make it, the history of electricity, efficiency and conservation, and the future of electricity generation.

ElectroWorks (Grades 4–7)—This hands-on unit introduces students to the mysteries of electricity with five centers—static electricity, batteries, magnets, electromagnetism, and circuits. This unit includes a Teacher Guide and Student Guide with a backgrounder, worksheets, and experiments. An ElectroWorks Kit with the materials needed to conduct the experiments and a class set of Student Guides is also available.

Energy Analysis (Grades 7-12)—Students research and analysis information in graphic formats to discern energy trends.

Energy Around The World (Grades 5-12)—Students work in groups to research and make presentations on energy use in one of 60 countries around the world.

Energy Carnivals (Grades K-12)—NEED's popular carnival games are an excellent way to get students and adults thinking about energy. The Energy Carnival for Grades 4-12 contains complete instructions for ten carnival games including Energy Pictionary, The Wheel of Energy, Top Five, Energy Knockdown, and Energy Taboo. An excellent activity for elementary or middle school energy fair or Earth Day celebration. The Primary Energy Carnival contains nine games appropriate for students in Grades K-3, including games such as Energy Bingo, Energy Math, Memory, Match Game, and Energy Pursuit.

Energy Conservation Contract (Grades 4–12)—Students ask their families and neighbors to sign contracts in which they agree to save energy at home and on the road. Teacher and students guides are included.

Energy Enigma (Grades 7-12)—Students put on their detective hats to uncover the mysteries of the energy sources.

Energy Fair (Grades 2–6)—This unit is a guide to teaching the experimental design model with an emphasis on energy. Classroom projects, suggested energy fair projects, and a student guide are included.

Energy Flows (Grades 5-12)—This hands-on activity explains forms of energy and energy transformations.

Energy From The Sun (Grades 3–4)—This elementary solar energy kit teaches the basics of solar energy and photovoltaics with hands-on explorations.

Energy House (Grades 4–12)—In this activity, students insulate a cardboard-box house with a variety of insulating materials that they purchase with energy bucks, learning about energy conservation and savings. Teacher and student guides are included.

Energy Infobooks (Grades K–12)—NEED's energy infobooks are available in primary (grades K-2), elementary (3-4), intermediate (grades 5-8), and secondary (grades 7-12) versions. The booklets provide information on the sources of energy, electricity, consumption, as well as general energy information. The booklets are revised each year to provide the most complete, up-to-date information. Class sets of infobooks can be ordered.

Energy Infobook Activities (Grades K–12)—NEED's energy infobook activities are companion workbooks to the infobooks and are available in primary (grades K-2), elementary (3-4), intermediate (grades 5-8), and secondary (grades 7-12) versions.

Energy In The Balance (Grades 4–6)—This unit introduces students to the advantages and disadvantages of the major energy sources through a series of critical thinking, charting, and graphing activities.

Energy Jeopardy (Grades 4-12)—Students enjoy learning about energy using this game show format.

Energy Math Challenge (Grades 3–12)—These activities strengthen students' math skills while increasing their knowledge of energy. Students work individually and in teams to solve energy math problems. Elementary, intermediate and secondary skill levels are included.

Energy On Public Lands (Grades 5-8)—Students learn and teach others about how energy on public lands is managed with background information and hands-on activities.

Energy On Stage (Grades 4–12)—NEED's own versions of cartoon characters, classic TV characters, blockbuster movies, and children's stories—all with an energy story to tell.

Energy Source Expo (Grades 3-12)—Students work in groups to develop exhibits and make presentations on the major energy sources as they develop an expo to teach others. Teacher and student instructions and background resources are included.

EnergyWorks—(Grades 4–8) This is a hands-on unit that introduces students to the things energy does—heat, light, motion, sound, growth, and powering technology. This unit includes a Teacher Guide and Student Guide with backgrounders, worksheets, and hands-on experiments. Separate heat, light, motion, and sound units are available. An EnergyWorks Kit with the materials needed to conduct the experiments and a class set of Student Guides is also available.

Ethanol (Grades 4-12)—Students explore ethanol as a transportation fuel with backgrounders on three reading levels and suggested activities.

Exploring Energy (Grades 4–6)—This booklet contains short articles and hands-on explorations on a variety on energy–related topics, such as composting, solar cooking, heat, refrigeration, microwaves, how cars work, and the greenhouse effect.

Exploring Magnets (Grades 1–4)—The Exploring Magnets unit teaches the fundamentals of magnetism using a hands-on kit.

Exploring Solar Energy (Grades 5–8)—The intermediate solar energy kit teaches students the applications of solar energy and photovoltaics using hands-on materials.

Future is Today (Grades 7–12)—Students learn about conventional and alternative fuels with comprehensive background information and suggested activities.

Games & Icebreakers (Grades K–12)—Fun and educational activities and games, including Bumper Stumpers, Energy Bingo, Electric Connections, Energy Chants, and America's Most Wanted Energy Wasters.

Global Trading Game (Grades 4–12)—This activity, developed by the Ohio Energy Project, allows students to become economic advisors, geologists and miners as they work in teams to learn about their assigned country's resources and needs, then trade with other countries.

Great Energy Debate Game (Grades 5–12)—Students work cooperatively to devise strategies for the Great Energy Debate Game. Students represent different energy sources and develop arguments on the merits of their energy source over the others. A good critical thinking game.

Great Energy Rock Performances (Grades 3–12)—Recommended for grades 3-12. Student rock bands sing about their energy sources in this rousing contest. You'll learn more from these energy rock stars as they tell their stories to interviewers out to get the latest energy scoop. Teacher and student instructions included, along with sample songs and interviews.

H_2 Educate (Grades 6-12)—This intermediate/secondary unit introduces students to hydrogen as an important energy carrier for the future, both as a fuel for distributed generation and as a transportation fuel. A hands-on kit explores electrolysis, atomic structure, and hydrogen fuel cells, and includes a hydrogen fuel cell car.

Learning & Conserving (Grades 7–12)––Secondary students learn about energy consumption and conservation by reading utility meters and utility bills, comparing EnergyGuide labels, and exploring electric nameplates. Students conduct comprehensive surveys of the school building and school energy consumption—gathering, recording and analyzing data, and monitoring energy usage. Students develop a comprehensive energy management plan for the school that includes suggestions for retrofits, systems management and conservation practices. The Learning and Conserving Kit includes indoor/outdoor thermometer/ immersion thermometer, hygrometer, light meter, and measuring tape.

Marine Energy (Grades 7–12)––Students construct a topographical map of the United States, including the outer continental shelf and the Exclusive Economic Zone, that shows the major land and underwater formations. Students also conduct a community hearing on the development of energy resources and/or minerals in these areas.

Mission Possible: Energy Trade-offs (Grades 7–12)––This is an activity in which students are challenged to develop an energy plan for a fictitious, growing country. Students consider the advantages and disadvantages of the energy sources available in the country so that they can increase electricity production while maintaining environmental quality.

Monitoring & Mentoring (Grades 4–6)––The elementary program introduces students to methods of measuring energy usage, determining costs, and quantifying environmental effects through a series of activities that include reading electric and natural gas meters, EnergyGuide labels, and electric nameplates. Students conduct surveys of the school building and school energy consumption––gathering, recording and analyzing data, and monitoring energy usage. Students are encouraged to buddy with primary students to learn by teaching others. The Monitoring & Mentoring Kit includes indoor/outdoor thermometer, immersion thermometer, hygrometer, and light meter.

Museum of Solid Waste and Energy (Grades 6–12)—Students create museum stations on eight solid waste and energy topics, such as reusing, recycling paper, metals, and plastics, reducing, and landfilling.

Mystery World Tour (Grades 4–8)––This activity allows students to create 12 murals depicting energy sources and terms, while learning about different countries.

Ocean Energy (Grades 6–8)––Intermediate students learn about all of the energy sources available in, under and over the ocean, with background information and hands-on activities.

Photovoltaics (Grades 8-12)—This secondary solar energy kit provides comprehensive information on solar energy and photovoltaics with hands-on explorations.

Primary Energy Stories & More (Grades K–4)––This booklet contains a series of stories and hands-on activities for primary teachers to use to introduce basic energy concepts and the major energy sources.

Primary Science of Energy (Grades 1–4)—The Primary Science of Energy, for students in Grades K-4, teaches the fundamentals of motion, heat, sound and light through a series of hands-on activities that introduce simple measurement tools such as thermometers, balances, rulers, beakers, and graduated cylinders. Primary students learn to observe, measure, record results, compare and contrast, categorize, make predictions, analyze and graph results, and draw conclusions.

Projects & Activities (Grades K–12) This booklet includes workplan and suggestions for energy outreach activities to other classes, schools, families, and communities, as well as the **Youth Awards Guide** and application form.

Science of Energy—Elementary & Secondary (Grades 4–12)––The Elementary Science of Energy, for students in Grades 4-8, teaches about the forms of energy and how one form is converted into other forms. It is designed to take five class sessions of 45 minutes. The kit includes teacher demonstrations and six experiment stations with complete student instructions and worksheets that incorporate the scientific method. The Secondary Science of Energy (Grades 8-12) teaches the same concepts with more detailed scientific explanations.

Sun and Its Energy (Grades K–2)––This primary solar energy kit teaches the fundamentals of solar energy and photovoltaics with hands-on explorations.

Talking Trash (Grades 4–6)—Students create exhibits of eight trash topics, including reusing, recycling paper, metals, and plastics, reducing, and landfilling.

This Mine Of Mine (Grades 2-6)—Students explore the formation, geology, recovery, and uses of coal, as well as the reclamation of mine sites, by building a plot of land, mining the foal, and reclaiming the land.

Today In Energy (Grades K-4)—Students are introduced to the concepts of energy choice, trade-offs, and costs using math and critical thinking skills to get them through the day with a limited supply of energy bucks.

Transparent Energy (Grades 5–12)—In this activity, students prepare and make presentations on the ten energy sources using transparencies. Included are teacher and student instructions, a sample energy presentation on energy consumption, sample presentation scripts, and transparency masters for the energy sources.

Transportation Fuels Debate Game (Grades 5-12)—Students evaluate the advantages and disadvantages of conventional and alternative transportation fuels.

Transportation Fuels Expo (Grades 5-12)—Students work in groups to develop exhibits and make presentations on conventional and alternative transportation fuels in a debate game format.

Transportation Fuels Rock Performances (Grades 4-12)—Students rock bands write songs and sing about alternative fuels in this entertaining activity. Teacher and student instructions are included, along with sample songs and interviews.

Trash FlipBook (Grades K–2)—Primary students are introduced to trash, recycling, and landfills using a flipbook with simple words and bold graphics, with comprehensive teacher information and suggested hands-on activities.

ThermoDynamics (Grades 7–12)—A guide to hands-on experiments that explore concepts of thermodynamics, including molecular structure, conduction, convection, radiation, specific heat, heat of fusion, and heat of vaporization.

This Mine of Mine (Grades 2–6)—Students build a plot of land with coal deposits in it; mine the coal using tools, then reclaim the land and investigate the uses of coal to produce energy.

Today in Energy (Grades K–4)—This primary activity introduces students to the concepts of choice, trade-offs and economics. Students use math and critical thinking skills to get them through the day with a limited supply of money.

U.S. Energy Geography (Grades 4-12)—This resource includes maps of all ten major energy sources, energy production, energy consumption, and more. The maps can be used as transparency masters.

What Car Will You Drive? (Grades 5–6)—Students are introduced to conventional and alternative fuels with background information and suggested activities.

Yesterday In Energy (Grades 4–12)—The booklet informs students about how life has changed in the United States in the last 100 years, especially in terms of energy sources and usage. Students work in small groups to prepare a museum exhibit and short presentation of one facet of the life of yesterday and today, such as transportation, heating, lighting, and jobs.