



Renewable Energy and Conservation Curriculum



Table of Contents

	Page
Introduction	...4
Curriculum Overview	... 5
History of Energy	. 6
Renewable vs Non-Renewable Energy Sources	..10
Biofuels	18
Biomass	23
Climate Change (Carbon Emissions)	.. 33
Composting	..38
Earth Day	.43
Electricity	.53
Energy Efficiency	.89
Geothermal Energy	.113
Hydrogen Energy	117
Hydropower	120
Pollution	..140
Recycling	157
Solar Energy	167
Solar Cooking	..178
Water Quality	...186
Wind Energy	.205
Conclusion	216
Web Connections	..217
Evaluation	.218
Mobile Classroom Visit and Camps Info	.219
Suggestions & Ideas	.220





Introduction: Science is a way of understanding nature. Scientific research may begin by generating new scientific questions that can be answered through replicable scientific investigations that are logically developed and conducted systematically. Scientific conclusions and explanations result from careful analysis of empirical evidence and the use of logical reasoning. Some questions in science are addressed through indirect rather than direct observation, evaluating the consistency of new evidence with results predicted by models of natural processes. Results from investigations are communicated in reports that are scrutinized through a peer review process.

The integrity of the scientific process depends on scientists and citizens understanding and respecting the "Nature of Science." Openness to new ideas, skepticism, and honesty are attributes required for good scientific practice. Scientists must use logical reasoning during investigation design, analysis, conclusion, and communication. Science can produce critical insights on societal problems from a personal and local scale to a global scale. Science both aids in the development of technology and provides tools for assessing the costs, risks, and benefits of technological systems. Scientific conclusions and arguments play a role in personal choice and public policy decisions. New technology and scientific discoveries have had a major influence in shaping human history. Science and technology continue to offer diverse and significant career opportunities.

Energy in Earth systems can exist in a number of forms (e.g., thermal energy as heat in the Earth, chemical energy stored as fossil fuels, mechanical energy as delivered by tides) and can be transformed from one state to another and move from one reservoir to another. Movement of matter and its component elements, through and between Earth's systems, is driven by Earth's internal (radioactive decay and gravity) and external (Sun as primary) sources of energy. Thermal energy is transferred by radiation, convection, and conduction. Fossil fuels are derived from plants and animals of the past, are nonrenewable and, therefore, are limited in availability. All sources of energy for human consumption (e.g., solar, wind, nuclear, ethanol, hydrogen, geothermal, hydroelectric) have advantages and disadvantages.

The Earth provides resources (including minerals) that are used to sustain human affairs. The supply of non-renewable natural resources is limited and their extraction and use can release elements and compounds into Earth systems. They affect air and water quality, ecosystems, landscapes, and may have effects on long-term climate. Plans for land use and long-term development must include an understanding of the interactions between Earth systems and human activities.

Great Lakes Energy Service, Inc. is a non-profit education organization. Our mission is to provide education across the Great Lakes region about the relevance of renewable energy use and the importance of conservation of resources. GLES is committed to promoting renewable energy sources and preserving the Earth's natural resources.

We share these lessons with you in this format as we feel they are representative of easy and challenging inquiry based scientific experimentation activities alike, and which are usable across upper elementary, intermediate, and secondary education levels.

If you have questions, concerns, input, or would like more information, please contact us through our website: www.GreatLakesEnergyService.org

Best Regards,

Education Director, GLES



Curriculum Overview

The lessons provided by GLES address renewable energies, pollution and waste, conservation, and human actions that can positively contribute to a cleaner earth such as recycling. The content within is meant to be a supplement to existing curricula that teachers must abide by. They are lessons that have been created by GLES as well as a plethora of other education based organizations. Credit for lessons is included on a lesson by lesson basis.

All lessons contain components of various Michigan Science Grade Level Content Expectations across many all grade levels, and any teacher will easily be able to recognize various forms of Scientific Inquiry, Data Observation, Collection and Reporting, Scientific Reflection and Social Implications, Resources and Human Impacts on Earth Systems, Energy of Earth Systems, and Science and Technology.

Various Standards for Technological Literacy are also addressed with regard to Nature and Technology, Technology and Design, and Technology and Society. Engineering and design plays a role in the formation of wind machines, solar cookers, hydropower turbines, and other construction based lesson plans.

Math Standards that are incorporated into various lesson plans include Measurement; Variability and Change; Collection, Organization and Presentation of Data; Description and Interpretation; and Inference and Prediction.

English Language Arts standards include Meaning and Interpretation via reading and comprehending technical material, and Inquiry and Research as students define and investigate important issues and problems using a variety of resources, including technology.

The use of STEM—short for Science, Technology, Engineering, and Math—is considered crucial subject matter for today's students and critical to their future success in the global economy. GLES helps to deliver these crucial subjects by offering education based programs through GLES programs designed for k-12 schools, learning institutions, youth focused organizations, and community outreach events by delivering a mobile classroom with accompanying environmental stewardship curricula and by hosting Science Camps and Teacher Development Workshops.

Since standards change, we encourage you to align our lessons to fit the particular standards that you must address within the constraints of your curriculum map or district plan.