DEVELOPING AND DISSEMINATING *PROMISING ENERGY EDUCATION PRACTICES IN WISCONSIN: CREATING A NETWORK OF ENERGY EDUCATORS*

by

Evonne A. Koop

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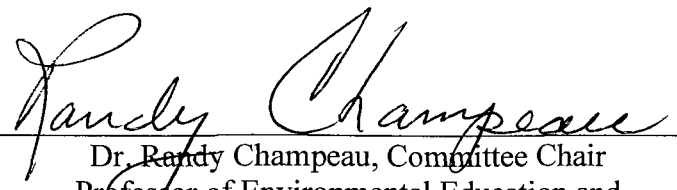
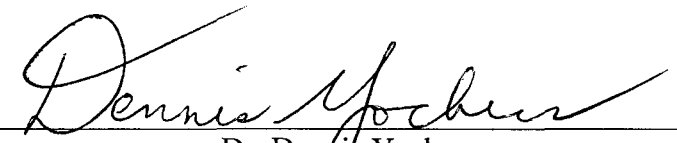
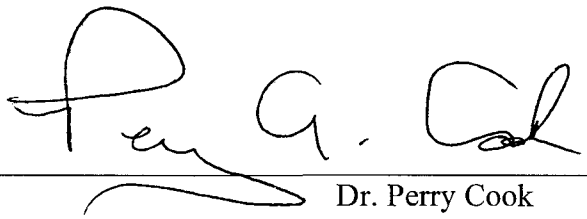
APPROVED BY THE GRADUATE COMMITTEE OF:



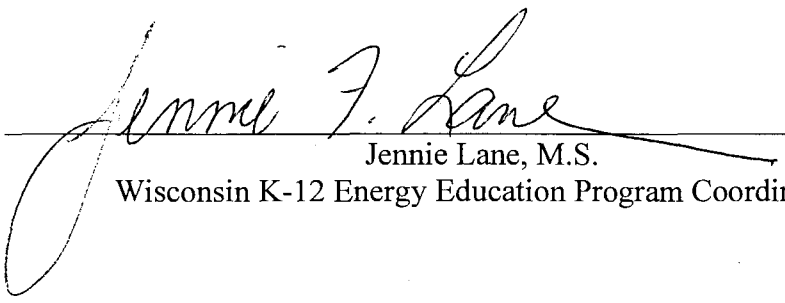
Dr. Randy Champeau, Committee Chair
Professor of Environmental Education and
Director of the Wisconsin Center for Environmental Education



Dr. Dennis Yockers
Associate Professor of Environmental Education



Dr. Perry Cook
Associate Professor of Education



Jennie Lane, M.S.
Wisconsin K-12 Energy Education Program Coordinator

Abstract

The objective of this project was to develop and disseminate an energy education resource, *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators*. "*Promising Practices*" was created to be a networking tool, encouraging educators across the state to share new and creative ways to integrate energy concepts into the curriculum. To date, it is the first energy education resource of its kind in the state.

Promising Practices is a product of the Wisconsin K-12 Energy Education Program (KEEP), a comprehensive statewide energy education initiative. Since 1996, KEEP has provided hands-on energy education training to over 700 teachers in Wisconsin. KEEP continues to search for ways to strengthen energy education in Wisconsin and to support teachers' efforts. In 1998, KEEP was awarded a grant by the Wisconsin Environmental Education Board to fund the development of a project that would provide teachers in Wisconsin with a new energy education resource. This resource would allow teachers to share with others around the state their successes in infusing energy education in their curriculums. *Promising Practices* is the resulting document.

Promising Practices consists of energy-related activities, projects, and lesson plans teachers have created or adapted and found to be successful in the classroom. Additional resources include networking information, energy-related Internet sites, and easy to use cross-reference charts. Beginning in April, 1999 over 1,500 copies of *Promising Practices* will be disseminated to K-12 teachers across Wisconsin and is available on the Internet.

Acknowledgements

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Finally, this project would not have been possible without the participation of many Wisconsin energy educators. Thank you for helping to strengthen energy literacy for our youth and for helping to create a brighter future for Wisconsin. This project "*Promising Practices*" is dedicated to you.

TABLE OF CONTENTS

CHAPTER ONE:
The Problem and Its Setting

The Importance of the Study

Energy is invisible, yet we depend upon it everyday. As teachers prepare their students for life in the 21st century, the need for energy education has become apparent in the face of serious energy-related environmental, social, and political issues. Environmental issues such as global warming, dwindling fossil fuels, solid waste management, and an ever-growing population make the need for energy education a crucial part of every student's education. In response to this challenge, some Wisconsin K-12 educators have been working to increase the energy literacy of their students. Yet because energy lacks tangibility and its concepts are often challenging to verbalize, many teachers agree that energy is one of the hardest and most difficult topics to teach. According to a 1998 study by the Energy Center of Wisconsin, 47 percent of Wisconsin teachers surveyed do not teach about energy.

The focus of this project was to develop and disseminate an energy education resource to assist Wisconsin "energy educators" in teaching about energy and in creating a network for sharing ideas with other energy educators across the state. Up until now, no such effort has been made. K-12 teachers who currently teach about energy volunteered examples of successful ways they have found to teach about the relevance and importance of energy in every subject and at every grade level. These "promising practices" ranged from simple introductory activities to intensive year-long projects. Topics varied from learning about food chain dynamics to learning how energy has shaped our past and current environmental, political, and sociological issues.

The resulting publication, *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators,* will serve as a powerful educational and networking tool for K-12 teachers. Building a network of energy educators throughout Wisconsin is a logical and important step in helping teachers to enhance the energy education they

provide to their students. This resource is a springboard for ideas and a resource for networking with other educators. It is hoped that more teachers will be inspired to teach about energy through its utilization.

The Statement of the Problem

This project will develop and disseminate a document *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators.*

The Subproblems

1. To identify barriers to energy education in K-12 classrooms in Wisconsin.

2. To identify teachers who are currently infusing successful energy education practices into their curriculum.

3. To develop a set of criteria to use in organizing successful energy practices being implemented in K-12 classrooms in Wisconsin.

4. To disseminate *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators.*

The Hypothesis

Wisconsin K-12 educators will find *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators* to be helpful for incorporating energy into their curriculums through program ideas and opportunities for networking.

The Limitations

1. The project will evaluate and include promising energy education practices from selected K-12 educators. It will not include all Wisconsin educators.

2. The promising energy education practices submitted by Wisconsin K-12 educators will have been "tried and true." This means teachers have used these practices and perceived that they increase the energy literacy of their students.

3. The promising energy education practices selected for inclusion will be appropriate for select subject areas and grade levels. Adaptations or modifications may be necessary.

4. Teachers are expected to use *Promising Energy Education Practices* as a teaching reference and networking tool rather than as a curriculum plan; therefore, field-testing for effective implementation is not relevant to this study.

Definitions of Terms

1. Academic Standards- State guidelines that specify what students should know and be able to do in relation to specific subject material by grades four, eight, and twelve.

2. Barriers- The perceived attitudes or beliefs that discourage teachers from implementing energy education into their curriculum.

3. Conceptual Framework- Designed for the Wisconsin K-12 Energy Education Program that identifies important energy concepts that provide the basis of an energy education curriculum.

4. Energy- The ability to organize or change matter or the "ability to do work."

5. Energy Education- The teaching of energy concepts and energy-related environmental issues. Also an important component of Environmental Education.

6. Energy Literacy- An energy literate citizen is one who has knowledge of energy concepts and possesses the skills and motivation to analyze energy-related environmental issues. An energy literate person is one that works individually or collectively to solve energy-related problems and to prevent new ones.

7. Environmental Education- "A lifelong learning process that leads to an informed and involved citizenry having the creative problem-solving skills, scientific and social literacy, ethical awareness and sensitivity for the relationship between humans and the environment, and commitment to engage in responsible individual action and cooperative actions" (WEEB, Oct. 26, 1998 web page).

8. Promising Practices- Student projects, teacher lesson plans and activities that facilitate and inspire students to learn about energy. These may be done independently within the school or in cooperation with state utilities and community groups. May serve as a positive example and guide for other educators to learn from and to incorporate into their curricula.

The Abbreviations

EE: Environmental Education.

KEEP: The Wisconsin K-12 Energy Education Program.

NEED: National Energy Education Development Project.

WEEB: Wisconsin Environmental Education Board.

Wisconsin D.P.I.: Wisconsin Department of Public Instruction.

WCEE: The Wisconsin Center for Environmental Education.

ECW: The Energy Center of Wisconsin.

The Assumptions

1. Educators will use *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Education Educators* to enhance their efforts in teaching about energy.

2. Educators who are currently teaching about energy would benefit from a networking resource such as *Promising Energy Education Practices* to communicate with other energy educators across the state.

CHAPTER TWO:
THE REVIEW OF THE RELATED LITERATURE

Introduction

The purpose of this project was to develop a document "*Promising Energy Education Practices*" to assist and inspire Wisconsin K-12 educators in their efforts to implement energy education into their curriculums and to share ideas with other energy educators across the state. Through providing successful examples of "promising practices" by other K-12 educators, the document is designed to act as a powerful networking tool and as a springboard for ideas and strategies to teach about energy and promote energy literacy.

A review of the related literature resulted in the conclusion that an energy education networking tool is not available for Wisconsin K-12 educators. Therefore, a resource such as *Promising Practices* would be valuable to help teachers overcome barriers they often encounter when teaching about energy. This chapter outlines the reviewed literature that relates to the:

- importance of energy education
- status of energy education in Wisconsin
- barriers that teachers encounter to teaching about energy
- value of providing promising energy education practices in Wisconsin K-12 classrooms.

The Importance of Energy within Environmental Education

Energy is the ability to do work or to change things. Without energy, life as we know it would not be possible. "Energy is the underlying currency that governs everything humans do with each other and with the natural environment that supports them" (KEEP, 1996). However, because energy is so prevalent in our lives, it is easy to take it for granted. We use electricity to power our homes, we use gasoline and oil that come from non-renewable fossil fuels to drive our cars, and we depend upon energy from food to fuel our bodies.

Energy education is essential for an exponentially growing population that is faced with finite resources and serious energy-related environmental issues. Problems such as global warming, air and water quality degradation, and solid waste management all demand that humans are aware of their energy choices and the effects of those choices upon the future. The goals of energy education programs are to increase understanding of how we and other inhabitants of Earth use energy, to learn how energy resources are developed, to analyze issues that arise out of energy resource development and utilization, and to explore resource management practices that address these issues (KEEP 1996). "Energy concepts are important as a set of tools for understanding environmental issues and evaluating potential solutions" (Snyder, 1994). Energy education strives to teach people to apply critical thinking skills in evaluating energy-related environmental issues and to become a knowledgeable, active citizenry that uses energy responsibly.

Making the connection between energy issues and environmental issues is a logical and necessary one. "While the 'Energy Crisis' has faded from the headlines...environmental and economic issues have not" (Snyder, 1994). Energy education teaches students basic energy concepts and the citizen action skills that are necessary to address energy-related environmental issues. Incorporating energy education into the context of environmental education complements the goals of environmental education. "The goal of environmental education is to help students become environmentally aware, knowledgeable, skilled, dedicated citizens who are committed to work, individually and collectively, to defend, improve and sustain the quality of the environment on behalf of present and future generations of all living things" (Wisconsin DPI, 1994).

Almost any environmental issue can be connected to energy use (e.g., global warming, acid rain, and mining issues). "Environmental education...should constitute a comprehensive lifelong education, one responsive to changes in a rapidly changing world." (Tbilisi Declaration, 1977). In order for students to have a full comprehension of environmental issues, they must become both environmentally *and* energy literate. The environmentally literate citizen is one who is able and willing to make environmental decisions which are consistent with both a quality of human life and a quality of the environment. Further, this individual is motivated to act on these decisions either individually or collectively (Hungerford, 1988). Similarly, an energy literate citizen understands energy concepts and possesses the ability to apply critical thinking skills in analyzing energy-related environmental issues and managing their energy use.

The North American Association for Environmental Education (NAAEE) recognizes the importance of energy education to enhancing environmental literacy. The NAAEE *Excellence in Environmental Education – Guidelines for Learning (K-12)* (1999) consistently incorporates energy concepts into environmental learning themes to ensure comprehensive coverage of energy within environmental education lessons. Likewise, it is clear that to strengthen people's understanding of environmental issues it is essential that they have a good understanding of the importance for energy and the pivotal role it plays in those issues.

Learning about energy in formative elementary, middle, and high schools is imperative to producing energy literate students. In 1998, the National Energy Education Development Project (NEED) published a national energy survey titled "What Students and Adults Think About Current Energy Issues and Our Energy Future." The study surveyed 1,743 high school students from 63 high schools nationwide and 552 adults from the surrounding communities. Part of the survey included six basic energy knowledge questions. According to the survey results, "on average only 35.5 percent of the students answered the questions correctly, although 62 percent of the students considered themselves "Very Informed" or "Somewhat Informed" about energy and energy-related issues" (NEED, 1998). This data supports the need to increase the energy literacy of our student population. To provide students with valuable energy-related knowledge and skills we must provide teachers with professional development opportunities and resources to become competent energy educators.

"One of the most pressing issues of our time is the need for civilization to decide how to deal with critical energy-environment problems that affect not only the entire earth but unborn generations as well" (Hollander, 1992). Stein (1998) documents that a national demand for an increase in energy education has resulted in the active development of energy education materials by (a) governmental agencies, (b) public utility companies and utility groups, and (c) environmental organizations (Leon, 1992). "Governmental agencies such as the National Energy Information Center, the National Appropriate Technology Assistance Service, and the Conservation and Renewable Energy Inquiry and Referral Service have all produced general information, curricula, and visual material on energy. The public utilities and industry trade associations such as the American Nuclear Society, the American Coal Foundation, the Renewable Fuels Association and the Solar Energy Industries Association, have also created educational and promotional materials" (Stein, 1998). In response to this challenge the teachers throughout Wisconsin have begun to incorporate energy education and environmental education across school curriculum in an effort to educate students in how to deal with energy-related environmental issues today, and for the future.

Implementation of Energy Education in Wisconsin K-12 Classrooms

An incentive to bring more "energy" in to Wisconsin classrooms has been the dissemination of the *Wisconsin Model Academic Standards for Environmental Education* and the *Wisconsin Model Academic Standards for Science* published in 1998 by the Wisconsin Department of Public Instruction (DPI). The standards for environmental education were established to assist with an interdisciplinary approach to EE and to

provide an umbrella document that describes the integration of disciplinary standards to create curricula that will produce environmentally literate citizens (*Wisconsin's Model Academic Standards*, p.1). Beginning in the fourth grade students are required to meet performance standards on "Energy and Ecosystems" in recognition of the importance of infusing energy education into K-12 curriculum. The goal of this requirement is for students to demonstrate an understanding of the natural environment and the interrelationships among natural systems (*Wisconsin's Model Academic Standards for Environmental Education*, 1998). Energy concepts range from food chain dynamics to understanding and evaluating the effects of energy resource use and management on the environment. Teachers are challenged to incorporate these standards for energy education across the curriculum.

A strong source of support for energy education in Wisconsin has originated from several utilities, municipalities, and cooperatives in Wisconsin. These professional organizations recognize the importance of educating students about energy and the need to support teachers in their efforts to infuse energy across school curricula. These public service organizations have made energy education resources available to teachers as well as providing an impressive and diverse selection of education/outreach programs offered to the schools in their service areas (KEEP, 1997).

The most comprehensive effort in Wisconsin to educate our youth about energy has been the implementation of the Wisconsin K-12 Energy Education Program (KEEP). KEEP was created solely for the purpose of helping to promote energy education within

Wisconsin. In 1993, the Wisconsin Center for Environmental Education (WCEE) proposed that a comprehensive guide to energy education in Wisconsin be developed (KEEP, 1996). In 1996 a framework titled the *Conceptual Guide to K-12 Energy Education in Wisconsin* was developed to guide the production of the subsequent K-12 Activity Guide.

The Conceptual Guide consists of four main themes that build upon each other, and also flow into sub-themes. Theme One, *We Need Energy*, covers the definition of energy, the natural laws that govern energy, and energy transfer within systems. Theme Two, *Developing Energy Resources*, covers the topics of where we locate energy sources for our use and the consumption of these energy resources. Theme Three, *Effects of Energy Resource Development*, covers the effects energy use has on quality of life and on the quality of the environment. Lastly, Theme Four, *Managing Energy Resource Use*, covers the topic of energy resource management and the future management of energy resources (see Appendix A for the full KEEP Conceptual Guide).

The first edition of the KEEP Activity Guide was developed and published in 1997. With funding from the Energy Center of Wisconsin (ECW) and grants awarded by the Wisconsin Environmental Education Board (WEEB) KEEP began to disseminate the Activity Guide through one-credit courses for Wisconsin K-12 educators. Between June 1997 and August 1999 over 700 Wisconsin K-12 teachers participated in the KEEP energy course. The KEEP course provides training and activities that illustrate how every subject and grade level has the opportunity to teach about the relevancy and

importance of energy. For example, science teachers can emphasize energy flow when teaching about food chains. Through energy education, students can explore how energy has shaped past and current environmental, political and sociological issues. Infusing energy education into an existing curriculum can also be utilized as a tool to meet many pre-existing objectives such as critical thinking skills. The KEEP materials are designed so that they can be adapted into any subject area and are adjustable for different grade levels. The KEEP teaching materials also act as a resource in teaching students about environmental issues. It is a strong and positive resource tool for building energy literacy among Wisconsin K-12 teachers and students alike.

Barriers to Energy Education in Wisconsin

In a 1986 study, Sam H. Ham and Daphene R. Sewing researched the question "What are the barriers that inhibit teachers from implementing environmental education programs?". They found that barriers could be categorized into four broad groups:

1. Conceptual – barriers stemming from lack of consensus about the scope and content of EE.
2. Logistical – barriers stemming from a perceived lack of time, funding, instructional resources, suitable class sizes and so forth.
3. Educational - barriers stemming from teachers' misgivings about their own competence to conduct EE programs.
4. Attitudinal - barriers stemming from teachers' attitudes about science and EE instruction.

These four broad categories of barriers were also found in a 1997 study by the Wisconsin Center for Environmental Education (WCEE) titled *Environmental Education in Wisconsin: Are We Walking the Talk?*. A major focus of the study was to "provide implications, conclusions, and strategies relative to improving environmental education in the K-12 schools of Wisconsin" (WCEE, 1997). The results were that teachers who received in-service or pre-service training in environmental education reported that they spent more time infusing it into their classrooms. These teachers also reported that they felt more comfortable with teaching environmental education (WCEE, 1997). A second focus of the study was to investigate what barriers might exist as reasons why teachers do not implement environmental education into their classrooms. In a summary of the 1992 Environmental Education Survey of Response Frequencies and Means of Wisconsin Teachers, the researchers asked the teachers to indicate the main reason why they did not infuse environmental concepts into their teaching. Of the 297 teachers that took the survey, these are the responses with the highest frequencies:

1. Environmental concepts are unrelated to my subject area. (N=75; 25%)
2. I do not have the knowledge or background to teach about the environment effectively. (N=72; 24.2%)
3. I do not have the class time. (N=45; 15.2%)
4. I do not have enough preparation time. (N=22; 7.4%)
5. There are things other than environmental education that are more important to infuse into my teaching. (N=20; 6.7%)

The same four broad categories of barriers to implementing environmental education are also found to be reasons for why many Wisconsin educators do not infuse energy education into their subject areas. According to the 1998 Baseline Study of the K-12 Energy Education Program (KEEP) by Hagler Bailly prepared for the Energy Center of Wisconsin, currently forty-seven percent of Wisconsin teachers surveyed do not teach their students about energy. This study found that "the primary reasons cited by these teachers for not teaching about energy include (1) teachers do not have the knowledge or background to teach this subject area, (2) they do not have enough class time, (3) there are not enough resources or funding available to them, and (4) energy concepts are unrelated to their subject area."

An additional barrier that exists for Wisconsin K-12 teachers is the lack of a consistent, statewide implemented energy education curriculum. How can Wisconsin expect its K-12 teachers to provide adequate instruction related to the standards for energy education but not provide them with the means to prepare them for the task? KEEP has organized a scope and sequence for energy education that meets this need. The key is to ensure that teachers are aware of this resource and understand how to relate it to their teaching situation.

The KEEP courses provide the relevant training and resources to assist teachers across the state with a consistent conceptual guide to teaching about energy. The results of the 1999 KEEP Pre-Course/Post-Course Evaluation Survey Comparison showed that Wisconsin K-12 teachers who attended a KEEP course underwent significant attitude

changes and increased application of energy education in their curriculums (KEEP, 1999). For example, pre-test results showed that prior to participating in the KEEP in-service only 11.6% of teachers strongly agreed that they would be likely to integrate energy education into their curriculum. Yet in the post-test survey, an increase to 36.8% of teachers reported that *as a result* of taking the KEEP course and using the KEEP Education Guide, they would be more likely to integrate energy education into their curriculum" (see Appendix B for the 1999 KEEP Pre-course / Post-course Comparative Data Report).

The Value of Examples of Promising Energy Education Practices in Wisconsin K-12 Classrooms

In addition to providing Wisconsin K-12 teachers with KEEP teacher in-services, what else can be done to overcome perceived barriers to incorporating energy education into the classroom? One suggestion is the dissemination of successful energy education projects, lesson plans, and activities that have been done by other Wisconsin K-12 educators. Up until the completion of this project there has been no published identification of successful energy education practices being implemented by teachers throughout the state. Energy education has remained a fractured effort among educators and has therefore only received inconsistent support. If Wisconsin is to have a successful statewide energy education program it will be necessary to provide a cohesive program of K-12 energy education across the state and also to provide teachers with a supportive network of fellow "energy educators."

Providing examples of peer successes can help to inspire and motivate teachers and learners alike, provide direction in learning about a specific topic, encourage discussion and provide new insights into a problem, and also to provide a model to replicate or expand upon for projects, lesson plans and activities. In Florida, the Office of Environmental Education and the Florida Department of Education recognized the potential for using examples of successful programs being implemented by teachers across the state. *Natural Selections: The 1992 Directory of Sharing Success in Environmental Education* was the final product of their efforts. By describing exemplary school based environmental education programs, the directory was designed to act as a powerful catalyst for other teachers to develop their own successful approaches to environmental education. Additional goals of the book were to inspire teachers to maintain and improve current environmental education programs and develop new ones, even in the face of limited resources (*Natural Selections*, 1992). The document highlighted successful environmental education programs, activities, and projects implemented by Florida K-12 educators and their students. Contact information was provided for each of the programs so that interested teachers could contact them for further information and networking. *Natural Selections* has continued to be an annual publication since its first edition in 1992.

A similar resource of successful case studies is a publication that was jointly produced by the National Association of Conservation Districts (NACD) and NAAEE. *Environmental Education at a Glance: Status, Resources,Success Stories* "summarizes the history of EE and its present status, provides contact information for some of the leading EE

organizations, lists useful resources...[and provides] case studies of successful programs that focus on how EE is being used to meet state outcomes, reach challenged students, teach across the curriculum, and reach multicultural and urban students" (1998, NACD). Provided as an easy-to-use reference book on environmental education that also serves as a networking tool, *EE at a Glance* is a powerful resource for those wishing to teach environmental education.

According to Martha Monroe and Stephen Kaplan in their article "When Words Speak Louder than Actions: Environmental Problem Solving in the Classroom" the use of case studies that spark active and thoughtful discussions on problem solving are just as valuable in studying environmental issues as actual action-oriented learning projects. Some of the benefits of utilizing case studies include "...the variety, as well as the 'experiences' to which students are exposed can be greatly increased, packing into the curriculum framework more opportunities to gain problem solving skills. These case studies themselves are also more likely to be focused on the problem; the search for solutions, and the action taking process and less plagued by distraction and irrelevancy than a classroom experience" (Monroe and Kaplan, 1988). Under this philosophy, the practical classroom application of case studies (examples) provides a positive and manageable alternative to the barriers teachers often encounter for infusing energy education such as lack of funding, lack of materials, and lack of preparation/course time for hands-on special projects.

A New Energy Education Resource in Wisconsin

In an effort to provide continued strong support to teachers who teach about energy, the Wisconsin K-12 Energy Education Program suggested the development of a new resource for teachers that would both inspire and assist them in their efforts to teach energy. Therefore, the goal of this project was to develop and disseminate an energy education resource to assist Wisconsin "energy educators" in teaching about energy and in creating a network for sharing ideas with other energy educators across the state. The resulting publication, *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators,* consists of energy education projects, activities, and lessons that were voluntarily submitted by Wisconsin K-12 teachers. Examples include ways that teachers have found to successfully teach about the relevance and importance of energy in every subject and at every grade level. These "promising practices" range from simple introductory activities to intensive year-long projects. In addition, they help teachers fulfill the academic requirements in the Wisconsin State Standards for Science, Social Studies, and Environmental Education. These promising practices can be used as a springboard for teachers to develop new activities, projects and lesson plans in energy education.

Promising Practices will be disseminated to 1,500 teachers in Wisconsin and will also be available on the Energy Center of Wisconsin' Energy Education website: www.energyed.ecw.org . It is hoped that these examples will serve as a powerful tool to help teachers overcome barriers to teaching about energy and in educating our youth to

become a responsible, critical thinking, pro-active, and "energy smart" citizenry for the future.

Summary

For students to have an adequate understanding of environmental issues it is essential that they have a comprehensive understanding of what energy is and how energy use affects our environment. For K-12 teachers to meet the challenge of implementing *Wisconsin's Model Academic Standards* that address energy, they need to be provided with a comprehensive, consistent K-12 energy curriculum. Implementing the Wisconsin K-12 Energy Education Program (KEEP) statewide and providing educators with a resource of successful peer examples such as *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators* are logical steps in making this possible.

CHAPTER THREE

THE PROJECT METHODOLOGY

Introduction

The purpose of this project was to develop and disseminate a document *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators.* Chapter Three addresses the methodologies used in preliminary development of the document, compiling the materials gathered for the document, and disseminating the document to K-12 teachers throughout Wisconsin. *Promising Practices* was designed for teachers to use as a teaching reference and networking tool rather than as a curriculum plan. Therefore the research design of the study was qualitative in nature and did not contain extensive evaluative data.

Within each area of discussion four topics are addressed: 1) what data was needed, 2) where the data was located, 3) how the data was secured, and 4) how the data was interpreted.

Developing the Document *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators*

To develop a document that is comprised of successful energy education practices being implemented in Wisconsin K-12 classrooms, it was necessary to obtain the names of teachers who taught about energy to contact for information. The second set of data that that was needed were actual "promising energy education practices." These were to be actual examples teachers could provide of innovative energy education lesson plans,

activities, projects, or events they had applied in the classroom and found to be successful.

Obtaining the Names of Teachers

Obtaining the names of educators who taught about energy for contacting purposes was accomplished in five ways:

1. An Advisory Committee to the project was established that consisted of professionals in energy related fields, formal and non-formal educators. Several of the committee members were teachers who also worked as KEEP Adjunct Faculty (see Appendix C for a list of Advisory Committee members). The Advisory Committee was consulted for a list of recommended teachers they viewed as exemplary in infusing energy education into their classrooms. They also gave suggestions for the criteria that would determine what a "promising practice" would be.
2. Articles and announcements were placed in select environmental education related newsletters in Wisconsin (the Midwest Renewable Energy Association newsletter, *KEEP on Going!,* and EE News). This widespread announcement encouraged educators to participate in the development of this document. (see Appendix D for the articles printed in the *KEEP on Going!* newsletter).
3. Twelve professionals in the field of energy in Wisconsin (both utilities and non-utilities) that serve on the Energy Center of Wisconsin Energy Education Board (see Appendix E) were sent a letter requesting them to provide recommendations for teachers they viewed to be promising teachers in energy education.

4. Names of teachers who responded to the KEEP Network Mailing and requested to be contacted about contributing to the project were also compiled.
5. KEEP graduates who took the in-service between the months of June and August were added to the list for contacting. Like the first method of using newsletters to publicize the project, this method of compiling names was an additional effort to encourage a sampling of teachers not through a recommendation process.

Obtaining Teacher's Examples of Promising Energy Education Practices

All of the educators identified in the above sources were sent a letter informing them of the project and were invited to submit a "promising practice" they had implemented and found to be successful in their classroom (see Appendix F for a sample letter). A *Promising Energy Education Practices Questionnaire* (see Appendix G) was included with the letter requesting the name of the activity, project, or lesson title and a summary of the particular practice they were submitting. The survey also requested the following information:

1. What grade level(s) the promising practice was most suitable for.
2. What subject area the promising practice was most suitable for.
3. The amount of preparation time and time needed to complete the project, activity or lesson plan.
4. Any special considerations for necessary materials, preparations or permissions.
5. Any comments they may have had regarding the promising practice or suggestions for future implementation ("next time").

6. If they were willing to be listed as a contact for future networking with other teachers.

One month after sending out these letters and surveys teachers that were recommended and had not responded were called and asked if they wished to participate. Teachers were verbally encouraged to participate in consideration that they may not have felt comfortable "boasting" about their efforts to infuse energy into the classroom curriculum or declined participation as a result of time constraints.

Evaluating Promising Practices

The final step in this first phase of the project was to evaluate the promising practices that were contributed by teachers to determine to what extent they met the established "promising practice" criteria. These criteria will be clarified in the next section of the methods for compiling these promising practices.

Compiling the Information Gathered for the Document *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators*

Establishing Selection Criteria

To establish criteria for the ranking and selection of promising practices for inclusion in the document, the advisory committee to the project was consulted. Suggested parameters included the following:

1. "Promising Practices" would be defined as educational opportunities such as lesson plans, projects, events or professional development opportunities that encouraged energy literacy among students.
2. Promising practices could not be a direct replication of an activity from the KEEP Activity Guide.
3. The promising practices would be appropriate for select subject areas and grade levels.
4. Promising practices would be "tried and true." This means that teachers had used these practices and perceived that they increased the energy literacy of their students.
5. Promising practices should be in agreement with one of the four main themes that constitute the range of concepts covered within energy education as defined by the Wisconsin K-12 Energy Education Program Activity Guide:

- We Need Energy- This theme covers the definition of energy, the natural laws that govern energy, and the energy transfer within systems.
- Developing Energy Resources- This theme covers the topics of energy sources & resources and the consumption of energy resources
- The Effects of Developing Energy Resources- This theme covers the areas of topics of quality of life and the quality of the environment.
- Managing Energy Resources- This theme covers the topics of energy resource management and the future management of resources.

For more extended descriptions of each theme, refer to the *Conceptual Framework for the KEEP Activity Guide* (Appendix A).

Organizing Selected Promising Practices

Once the promising energy education practices were selected they were organized and evaluated into categories thought to be most helpful for teachers. These categories were not pre-determined, as organization was dependent upon what was received. The categories are as follows:

1. *Lesson Enhancement and Integration*- These are promising practices that include a variety of twists and adaptations to energy education infusion activities. Also included are "outside" or additional resources for teachers. Subcategories included:
    A. Comparing Energy Consumption
    B. Energy Efficiency
    C. Energy Issues
    D. Exploring Energy Concepts
    E. Photovoltaics
2. *Projects-* These promising practices included extended projects that involved in-depth, hands-on learning.
3. *Events-* These promising practices included special events to encourage and celebrate energy literacy with students.

4. *Professional Development-* These promising practices included opportunities for teachers seeking ways to increase their skills, knowledge, networks, and ideas for curriculum infusion in energy education.

5. *Additional Resources-* These promising practices included various additional resources that teachers could utilize for providing energy education to their students. These included:

   A. Utilizing the Energy Cycle

   B. Energy Education Internet Sites

   C. Energy Education Bibliography

   D. Energy Education Resources and Programs Offered by Utilities, Municipalities, and Cooperatives in Wisconsin

   E. Conceptual Framework for the KEEP Activity Guide

6. *Cross Reference Charts*- These charts provide a quick reference guide for teachers to best determine how each of the promising practices would work best in their classroom and also meet the Wisconsin State Standards. Cross reference charts include:

   A. Concept Area Chart

   B. Grade Level Chart

   C. Subject Area Chart

   D. Wisconsin Environmental Education Academic Standards

   E. Wisconsin Science Academic Standards

   F. Wisconsin Social Studies Academic Standards

   G. Complementary KEEP Activities Charts

Because the document *Promising Practices* was developed with the potential to be an evolving document, a "*Promising Energy Education Practices Questionnaire*" was included to encourage other teachers to submit their successes in energy education (see Appendix G).

Disseminating the Document *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators*

In April, 1999 1,500 copies of the document were published by the Energy Center of Wisconsin in Madison, WI (see Appendix H). A copy of the published document was disseminated by mail to:

1. Every educator that submitted a promising energy education practice.
2. Past KEEP course participants (N=588).
3. All members of the advisory committee to the project.
4. Teachers who attended the 1999 High School Environmental and Energy Action Conference, hosted by the University of Wisconsin – Stevens Point, April 28, 1999.
5. Future KEEP in-service participants (projected number to be around 400).

Gathering Teacher's Feedback

Accompanying the document *Promising Practices* was a letter sent to all of the above recipients except the teachers who attended the High School Environmental and Energy Action Conference. These teachers were not issued a letter because of its non-formal distribution. Letters to all 700 KEEP Graduates included an invitation for teachers to

share their suggestions and comments about the resource. They were also encouraged to submit a promising practice of their own for future inclusion in the document (see letter, Appendix I).

Promising Practices did not undergo a large scale formal evaluation with the 700 K-12 teachers it was disseminated to. However, qualitative data was gathered from KEEP Adjunct Faculty to compile comments and suggestions for future reference. Twenty Adjunct Faculty received the document *Promising Practices* and a letter (see Appendix J) requesting their assistance in evaluating the resource by filling out a Likert Scale type questionnaire (see questionnaire, Appendix K). Out of the 20 questionnaires that were distributed, 12 were returned. The results, suggestions, and educational implications from this survey will covered in Chapter Four: Results, Summaries and Recommendations.

Future Dissemination

The remaining copies of *Promising Practices* will be disseminated by KEEP Adjunct Faculty in upcoming KEEP courses during 1999 and 2000. *Promising Practices* will also be made available on the Energy Center of Wisconsin's Energy Ed website: www.energyed.ecw.org .

CHAPTER FOUR:

Results, Summaries, and Recommendations

Summary

The purpose of this project was to develop a document *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators.* The goals for the development of this document were:

1. To provide Wisconsin K-12 educators with a new and exciting resource that would both inspire and assist them in their effort to teach about energy.
2. To provide examples of other K-12 teachers who had found successful ways to teach about energy at every grade level and in every subject area.
3. To provide a potentially powerful networking tool for teachers to share ideas with other energy educators across the state.

Results

The result of this project was the final publication *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators* (see Appendix H). In addition, qualitative data was collected in an evaluation of the document by KEEP Adjunct Faculty (see Summary: Step Three: Disseminating the Document *Promising Practices*).

Procedural Summaries

The first step of this project included a literature review to investigate the status of energy education in Wisconsin, what barriers existed for teachers that discouraged them from

teaching about energy more, and what similar projects existed to the one proposed. As a result of the literature review it was determined that:

A. Such a resource as *Promising Practices* did not exist in Wisconsin

B. Such a resource as *Promising Practices* would be beneficial to inspiring and assisting teachers in their efforts to teach about energy.

The second step of this project was a three-fold process that addressed the development, compilation, and dissemination of the document. Following are the summaries and recommendations for each step of this process, should it be continued in the future.

Step One: Developing the Document *Promising Practices*

Summary:

In order to compile a resource of successful energy education practices from K-12 teachers across the state, it was first necessary to determine *whom* to contact. Obtaining the names of teachers who taught about energy was accomplished in several different ways, ranging from soliciting for submittals in select environmental education related newsletters and KEEP mailings to requesting recommendations for specific teachers from professionals in the energy field of Wisconsin (utilities, non-utilities, and energy education).

After a list of teachers for contact had been generated, they were each sent an informational letter describing the goals for the development of *Promising Practices*, with an invitation to participate by submitting their own successful experiences in

teaching about energy. Included with this letter was a *Promising Energy Education Practices Questionnaire* form which they could summarize their "promising practice" and send back in a postage paid envelope.

Soliciting for volunteer submittals through a personalized mailing was not found to be the most successful method of encouraging teachers to contribute. Personal phone calls were made next to each teacher that did not respond to the invitation letter encouraging them to participate. This personal contact generated much more interest in the project, and more teachers submitted a promising practice as a result of this method.

Recommendations:

Should the steps for this project ever be continued in the future, consider the following recommendations to help ensure a smoother process:

- Ask KEEP Adjunct Faculty to continue to recommend teachers they view as exemplary.
- Send these teachers a copy of or an example from the existing document *Promising Practices* in addition to a letter inviting them to participate. This will help clarify what the project consists of and ways in which these teachers can contribute.
- Because teachers are extremely busy and may forget about the invitation to contribute, make personal follow-up phone calls within two weeks of sending out the letters. This will keep the project fresh in their mind and they are more apt to respond if they speak with the project coordinator directly.

Step Two: Compiling the Document *Promising Practices*

Summary:

The second step in the development of *Promising Practices* was to establish criteria for selecting teacher's submittals. The first guiding parameter established was a definition of what would be considered as a "promising practice." A promising practice was defined as "educational opportunities such as lesson plans, projects, events or professional development opportunities that encouraged energy literacy among students." Promising practices were to be appropriate for select subject areas and grade levels; actually "tried and true" by the teacher, and not a direct replication from the KEEP Activity Guide. In addition, a promising practice had to be in agreement with one of the four energy education themes as defined in the KEEP Activity Guide.

After criteria were established the selection of appropriate submittals began. Promising practices were organized into categories thought to be most helpful for teachers. Categories included: lesson enhancement and integration, projects, events, and professional development. A category of "additional resources" was included, that provided helpful information such as energy education Internet sites, an energy education suggested bibliography, and energy education resources and programs offered by different utilities, municipalities, and cooperatives in Wisconsin. Lastly, cross-reference charts were developed to reference each promising practice in the document with energy education concepts, appropriate grade levels and subject areas, Wisconsin Model Academic Standards in the areas of Science, Social Studies, and Environmental Education and complementary activities from the KEEP Activity Guide.

Recommendations:

Should the steps for this project ever be continued in the future, consider the following recommendations to help ensure a smoother process:

- Have KEEP Adjunct Faculty include *Promising Practices* as a resource in the KEEP course. Ask them to gather teacher's impressions of the resource and suggestions for future inclusion.
- Have KEEP Adjunct Faculty encourage new energy educators to contribute their successes in teaching about energy to future editions of *Promising Practices.*
- Have KEEP Adjunct Faculty encourage the teachers in their course to try some of the activities from the book, or to use it to network with other energy educators.
- Try to obtain a diverse sampling of both subject areas and grade levels for inclusion in the document.
- Organize future promising practices into specific grade or topic areas.
- Continue to update the energy education Internet sites and suggested energy education bibliography.

Step Three: Disseminating the Document *Promising Practices*

Summary:

The main audience for the dissemination of *Promising Practices* were 700 Wisconsin K-12 educators who have taken a KEEP teacher in-service course. These teachers were chosen as a target audience because they were already teaching about energy. Because *Promising Practices* was designed for teachers to use as a teaching reference a comparison study between teachers who had a background in energy education training

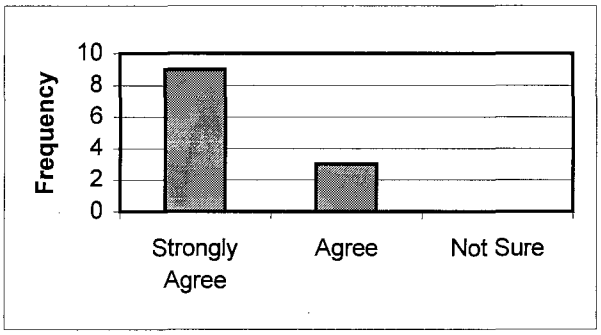
vs. those that had not was not done. Future research in this area might further validate the usefulness of documents like *Promising Practices*.

Questionnaire Results

To compile comments and suggestions for future reference, KEEP Adjunct Faculty received a questionnaire to evaluate *Promising Practices*. The questionnaire consisted of nine questions: eight questions using a Likert Scale format and one open-ended question for general comments. Questions one through eight also included a space for additional comments on the specific topics involved. Out of 20 questionnaires that were distributed, 12 were returned.

Question One:

I believe that Promising Practices is a useful energy education resource for elementary, middle and secondary teachers.



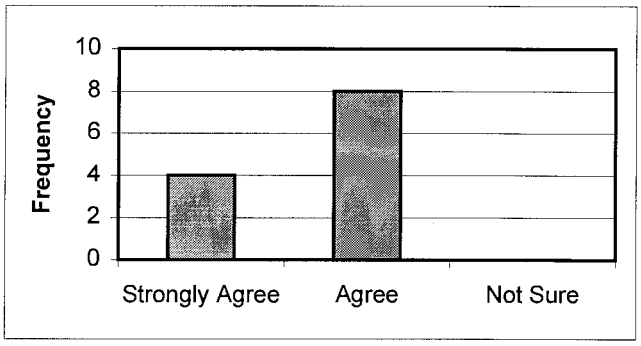
Comments:

- "Teacher suggestions will be very helpful to the classroom teacher in completing 'hands-on' energy activities."
- "Format is easy to use and informative. Contact names add a personal touch."

- "Great to have a document that gives teacher-generated activities."
- "It is a good supplement to KEEP – but may be overkill and teachers don't tend to use materials unless they experience them."

Question Two:

I believe that teachers from a variety of disciplines will find Promising Practices to be a useful tool for teaching about energy.

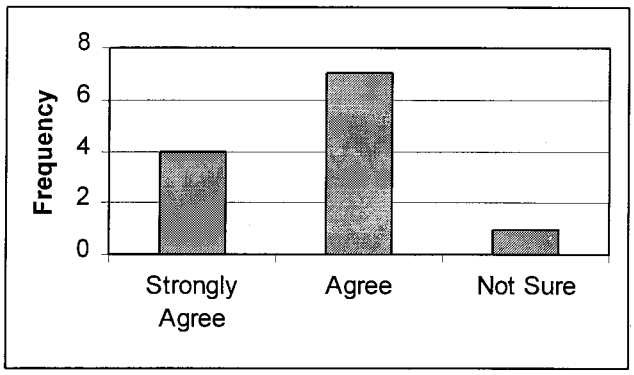


Comments:

- "You have definitely made 'connections' for several academic areas."
- "[I do agree…]if they take the time to review the book and don't shelf it. [Also] if we use it with KEEP training and use activities from this too."
- "Good range of subject areas."
- "There is a good representation of various disciplines."

Question Three:

I believe that by highlighting peer successes Promising Practices will inspire and motivate teachers to teach about energy.

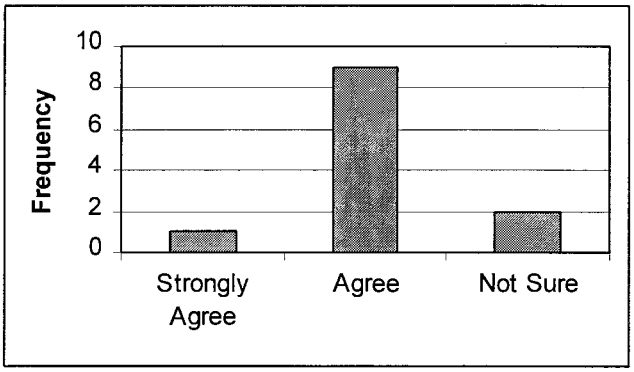


Comments:

- "Very True!"
- "Teachers agree with teachers! They are the experts for each other."
- "Good ideas to share – easy to browse through."

Question Four:

I believe that Promising Practices will serve as a valuable networking tool for energy education teachers in Wisconsin.

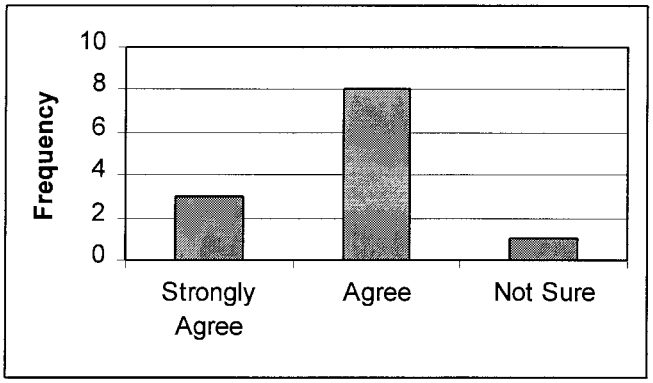


Comments:

- "No excuses accepted now! Teachers have an excellent resource to get the job done – if not, ask for help from the teachers listed."
- "I don't know how much teachers will contact others to network."
- "Distribution and method of sharing this with educators will determine this outcome."
- "I'm just not familiar enough with how much teachers network. I think this report should facilitate this, but I don't know."

Question Five:

I believe that Promising Practices will strengthen energy education Wisconsin.



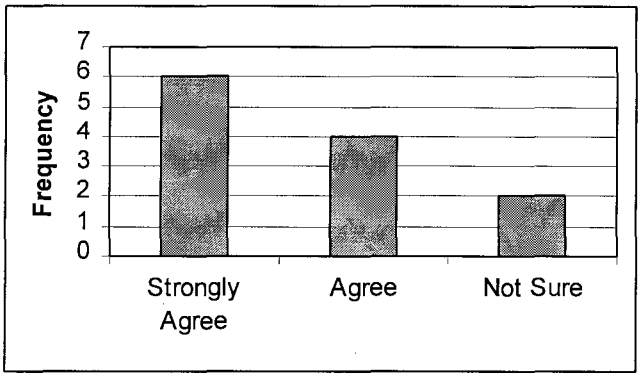
Comments:

- "This is another strong step forward in getting the job done in Wisconsin. Adding the "standards" should make it very inviting to teachers. It may help them in other areas as well!"
- "Every effort that is made will strengthen all forms of effort if the effort is a good one. This product is excellent! KEEP up the great work!"
- "Provides good case studies / examples of energy education in practice."

- "Not too many resources in this format."

Question Six:

I believe that KEEP should continue to build upon and disseminate Promising Practices *in Wisconsin.*

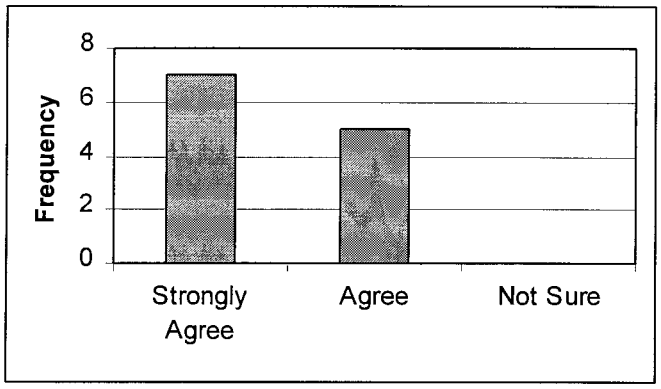


Comments:

- "Some areas will obviously need to be updated. For example, what is the future of nuclear energy as fossil fuel supplies are depleted?"
- "Is there a way to evaluate its use and if teachers are using it?"
- "Get more information out there."
- "May want to include more in-depth activity descriptions in the future."
- "Consider a grade level approach – or a specific topic. One example [topic could be] CO2 – Changes and the Future or Transportation and Fossil Fuels."

Question Seven:

I feel that Promising Practices will be valuable to me as an energy educator.

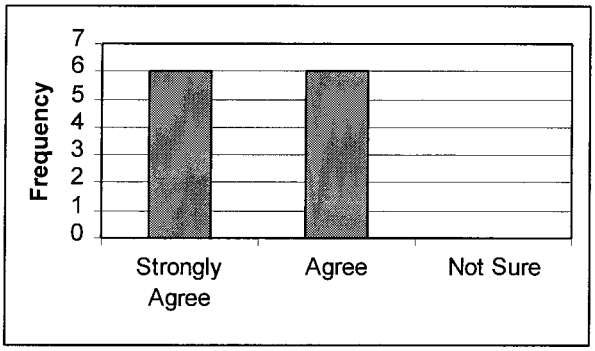


Comments:

- "Teachers always appreciate 'seeing' what another classroom teacher has done with energy at their grade level. Your excellent resource will be most helpful."
- "As a KEEP instructor it is great to have examples of local teachers in a variety of subject areas who are working on energy education."
- "I can use the activities and use them with others."
- "I may try out one or two of the activities (practices) in future upcoming KEEP courses."
- "Will use with KEEP."

Question Eight:

I would recommend Promising Practices to others as an energy education resource.



Comments:

- "No doubt 'cost' is a factor, but it may be helpful for teachers that may want to add it to their curriculum about this important topic."
- "It gives us just enough information and provides a resource person I can contact for more information."

Question Nine:

Please share your suggestions for improving Promising Practices

Comments:

- "WELL DONE! A lot of effort went into *Promising Practices* along with the excellent references. Now it is up to the classroom teachers to get involved. You certainly have done your share of 'providing' for all levels. Thanks for my copy and meeting the needs of classroom teachers. Only suggestion is to update when more helpful energy units are turned in to KEEP."

- "I would like to see more publications of this variety in other content areas. Great for topics like energy that don't have the broad appeal of subjects like wildlife."
- "Activities could be grouped by grade level or subject area etc."
- "A good start overall. May want to tie some of these practices in with the KEEP activity guide in some way. This could perhaps motivate teachers to take the KEEP course, find out what the guide has in it, etc. Perhaps the *Promising Practices* and the KEEP Activity Guide could evolve together in the future."
- Consider listing activities by grade level – sequence to book. Implementation of *Promising Practices* will be key to success. What is your marketing and distribution plan?"
- "My only concern is getting teachers to take the time to look through the book. If we can integrate it into the KEEP courses and have teachers look at it and discuss it, it seems that they would be more likely to use it than if we just send or give it to them. You did a great job."

Recommendations:

- Do a follow up evaluation with the first 700 KEEP graduates who received Promising Practices to find out:
  A. If teachers found "Promising Practices" to be useful in finding ways to teach about energy.
  B. If teachers used "Promising Practices" to network with another energy educator.

- Recommendations that the project be continued in the following ways:
  A. Have KEEP Adjunct Faculty highlight *Promising Practices* in the courses they teach. Use this as a tool to inspire teachers to send in future promising practices.

B. Highlight teacher's Promising Practices in the *KEEP On Going!* newsletter
C. Keep *Promising Practices* updated on the ECW website.
D. Have a KEEP staff person or future graduate student continue this project with future editions of "Promising Practices."

PROJECT CONCLUSION

Energy education is crucial to the development of energy literate citizens. Energy education provides people with an awareness of the energy choices they make and the effects of those choices upon the earth and future generations. Building energy literate students is imperative to solving the serious energy-related environmental, social, and political issues we face today and in the future.

Since 1993 the Wisconsin K-12 Energy Education Program has been working to support and enhance energy education in Wisconsin. With in-service training and energy education resources from KEEP, over 700 Wisconsin teachers have begun to teach about the relevance and importance of energy at every grade level and in every subject area. To continue to support teachers in their efforts to build energy literate students, the document *"Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators"* was developed. This new energy education resource will be disseminated to over 1,000 teachers across the state, and will also be made available nationally on the Internet.

It is the hope of KEEP that *"Promising Practices"* will serve as a powerful teaching tool, providing teachers with new and creative ways of how to teach about the relevance and

importance of energy and networking information to build a support system with other energy educators around the state.

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APPENDICES

APPENDIX A

The KEEP Conceptual Guide to K-12 Energy Education in Wisconsin

K-12 Energy Education Program

A Conceptual Guide to K-12 Energy Education in Wisconsin

Conceptual Framework and Suggested Scope and Sequence

Produced by the Wisconsin K-12 Energy Education Program and The Wisconsin Center for Environmental Education

A Publication of the Energy Center of Wisconsin

Wisconsin K-12 Energy Education Program (KEEP)

WCEE, LRC
University of Wisconsin-Stevens Point
Stevens Point, WI 54481
PH (715) 346-4770
FAX (715) 346-4698
Email: energy@uwsp.edu

KEEP Financial Support

Energy Center of Wisconsin
Wisconsin Center for Environmental Education
Wisconsin Environmental Education Board
University of Wisconsin-Stevens Point

Conceptual Framework Development 1995/1996

KEEP Staff

Ginny Carlton, Energy Education Program Assistant
Steve Knudsen, Coordinator of Research
Jennie Lane, Coordinator of Curriculum Development
Corky McReynolds, Energy Education Team Leader
Randy Champeau, Energy Education Project Director

KEEP Steering Committee

Randy Champeau (Co-chair),
Wisconsin Center for Environmental Education

Carolyn Amegashie,
Wisconsin Department of Transportation

Okho Bohm,
Wisconsin Power & Light Company

Al Hovey,
Longfellow Middle School

Pat Marinac,
Wisconsin Association for Environmental Education

Chuck Mitchell,
Alliance for Clean Energy Systems

Cheryl Parrino,
Public Service Commission of Wisconsin

Susan Stein,
Midwest Renewable Energy Association

Mark Hanson (Co-Chair),
Energy Center of Wisconsin

Tom Bobrofsky,
Wisconsin Elementary Science Teachers

Floyd Henschel,
Wisconsin Society of Science Teachers

James Jenson,
Madison Gas & Electric Company

Corky McReynolds,
Treehaven Environmental Center

Sharon Nelson,
Wisconsin Society of Science Teachers

Barbara Samuel,
Dept. of Administration, Division of Energy and Intergovernmental Relations

Al Stenstrup,
Wisconsin Department of Natural Resources

Jerry Young,
Wisconsin Electric Power Company

KEEP Advisory Review Committee

Randy Champeau, Director,
Wisconsin Center for Environmental Education

Anne Green, Outreach Coordinator,
Wisconsin Center for Environmental Education

Daniel Sivek, Associate Professor,
College of Natural Resources,
University of Wisconsin-Stevens Point

Corky McReynolds, Director,
Treehaven Environmental Center

Phyllis Peri, EE Resource/Network Coordinator,
Wisconsin Center for Environmental Education

Dennis Yockers, Assistant Professor,
College of Natural Resources,
University of Wisconsin-Stevens Point

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Concept Map by **Perry Cook,** Assistant Professor, Department of Education, University of Wisconsin-Stevens Point.

Conceptual framework and Scope and Sequence Reviewed By

Ms. Carolyn Amegashie, Program and Planning Analyst, Wisconsin Department of Transportation, Madison
Mr. Tom Bobrofsky, Wisconsin Elementary Science Teachers Association, Loyal
Mr. Tom Bromley, Science Chairperson, Whitefish Bay High School, Whitefish Bay
Dr. Randy Champeau, Director, wisconsin Center for Environmental Education, Stevens Point
Dr. Perry Cook, Assistant Professor , Department of Education, University of Wisconsin-Stevens Point
Mr. Frank Greb, Manager of Residential and Small Business Marketing Sales, Wisconsin Power and Light, Janesville
Ms. Anne Green, Outreach Coordinator, Wisconsin Center for Environmental Education, Stevens Point
Ms. Sally Ellingboe, K-12 Environmental Education Coordinator, Stevens Point School District, Stevens Point
Mr. Dave Engelson, Environmental Education Consultant, Sun Prairie
Dr. Mark Hanson, Executive Director, Energy Center of Wisconsin, Madison
Mr. Floyd Henschel, Past President, Wisconsin Society of Science Teachers, Beaver Dam
Mr. Al Hovey, Teacher, Longfellow Middle School, Wauwatosa
Mr. Jim Jenson, Community Education Coordinator, Madison Gas and Electric Company, Madison
Mr. Don Lutz, General Science Teacher, Marathon Middle School, Marathon City
Ms. Pat Marinac, Chairperson, Wisconsin Association for Environmental Education, Weyauwega
Ms. Libby McCann, Wisconsin Adopt a Lake/Project WET Coordinator, Stevens Point
Dr. Corky McReynolds, Director, Treehaven Environmental Center, Tomahawk
Mr. Chuck Mitchell, Alliance for Clean Energy Systems, Almond
Mr. Kurt Nelson, C.E.O., SOLutions, Cornucopia
Ms. Sharon Nelson, Past President, Wisconsin Society of Science Teachers, Waunakee
Ms. Cheryl Parrino, Chairman, Public Service Commission of Wisconsin, Madison
Dr. Tehri Parker, Co-Executive Director, Midwest Renewable Energy Association, Amherst
Ms. Hedda Patzke, Science Chairperson, 9th Grade Teacher, Bullen Junior High School, Kenosha
Ms. Phyllis Peri, EE Resource/Network Coordinator, Wisconsin Center for Environmental Education, Stevens Point
Mr. Ken Raneer, Public Service Commission of Wisconsin, Madison
Ms. Barbara Samuel, Public Information Coordinator, Wisconsin Energy Bureau, Department of Administration, Madison
Dr. Daniel Sivek, Associate Professor, College of Natural Resources, University of Wisconsin-Stevens Point
Ms. Susan Stein, Co-Executive Director, Midwest Renewable Energy Association, Amherst
Al Stenstrup, Education Specialist, Wisconsin Department of Natural Resources, Madison
Mr. Dennis Weibel, 2nd Grade Teacher, River Heights Elementary, Menomonie
Julie Willard, Environmental Education Specialist, Wisconsin Center for Environmental Education, Stevens Point
Dennis Yockers, Assistant Professor, College of Natural Resources, University of Wisconsin-Stevens Point
Jerry Young, Community Relations Liaison, Wisconsin Electric Power Company, Milwaukee

Building An Energy Education Curriculum
Workshop Participants

Mr. Michael Anderson, Milwaukee Public Schools, Milwaukee
Mr. Joe Cabibbo, McFarland School District, McFarland
Ms. LeAnn Chase, Port Edwards Public School District, Port Edwards
Ms. Rochelle Cumming, School District of Phillips, Phillips
Mr. Jean Paul Dieme, George Williams College Educational Center, Williams Bay
Ms. Sally Ellingboe, Stevens Point Area School District, Stevens Point
Mr. Mark Elworthy, Eau Claire Area School District, Eau Claire
Mr. David Engelson, Retired, Wisconsin Department of Public Instruction, Sun Prairie
Ms. Kim Fabitz, Student Teacher, Madison Metropolitan School District, Madison
Ms. AnneMarie Flemming, Wisconsin Center for Environmental Education, Stevens Point
Ms. Mary Ford-Washington, Marshfield Schools, Marshfield
Ms. Marlene Furo, St. Vincent De Paul School, Wisconsin Rapids
Ms. Stephen Goding, McFarland School District, McFarland
Mr. Floyd Henschel, Past President, Wisconsin Society of Science Teachers, Beaver Dam
Ms. Jean Hoffmann, Retired Teacher, Whitefish Bay
Mr. Jeff Hyma, South Shore School District, Port Wing
Ms. Ruth Jaeger, School District of Beloit Turner, Beloit
Mr. John Kimmet, Wisconsin Rapids Public Schools, Wisconsin Rapids
Ms. Barb Kobs, School District of Iola-Scandinavia, Iola
Mr. James Korb, Richland School District, Richland Center
Ms. Patricia Krueger, Pittsville Public Schools, Pittsville
Mr. Don Lutz, School District of Marathon, Marathon
Mr. Max Machotka, Madison Metropolitan School District, Madison
Mr. Ken Maciaz, Shawano-Gresham School District, Shawano
Ms. Pat Marinac, Appleton School District, Appleton
Ms. Nola Michalskii, Park Falls School District, Park Falls
Ms. Rhonda Narus, School District of Iola-Scandinavia, Iola
Ms. Tammie Niffennegger, Port Washington-Saukville School District, Port Washington
Ms. Phyllis Peri, Wisconsin Center for Environmental Education, Stevens Point
Ms. Lynn Rinderle, Milwaukee Public Schools, Milwaukee
Mr. Dean Sauers, Retired Teacher, New London
Mr. David Seefeldt, Sheboygan Area School District, Sheboygan
Ms. Barbara Seiter, George Williams College Educational Center, Williams Bay
Mr. James Servais, Green Bay Area Public Schools, Green Bay
Ms. Judy Soles, School District of Platteville, Platteville
Ms. Susan Stein, Midwest Renewable Energy Association, Amherst
Ms. Lynn Swift, Greenfield School District, Greenfield
Mr. Ron Weber, Weyerhauser Schools, Weyerhauser
Ms. Debora Williams, Milwaukee Public Schools, Milwaukee
Ms. Fran Wong, Madison Metropolitan School District, Madison
Ms. Karen Yost, Our Lady of Sorrows School, Milwaukee

Contents

What Is The Wisconsin K-12 Energy Education Program?

The Wisconsin K-12 Energy Education Program (KEEP) was created to help promote energy education in Wisconsin. In 1993, the Wisconsin Center for Environmental Education (WCEE) proposed that a comprehensive guide to K-12 energy education in Wisconsin be developed. In 1995, the Energy Center of Wisconsin, a nonprofit energy-efficiency research organization based in Madison, agreed to fund the project. The Wisconsin Environmental Education Board and the University of Wisconsin-Stevens Point also provided support. With this initial funding secured, WCEE hired a coordinator of curriculum development, a coordinator of research, and a program assistant in the summer of 1995, and the Wisconsin K-12 Energy Education Program was born.

Mission Statement

The mission of KEEP is to initiate and facilitate the development, dissemination, implementation, and evaluation of energy education programs within Wisconsin schools.

Goals

Our goal is to improve and increase energy education in Wisconsin's K-12 schools by developing and disseminating this *Conceptual Guide to K-12 Energy Education in Wisconsin* and an energy education activity guide.

This project consists of three phases:

Phase I: Produce the *Conceptual Guide to K-12 Energy Education in Wisconsin* and an *Energy Education Activity Guide.*

Phase II: Develop and offer college-credit energy education courses for teachers.

Phase III: Continue the energy education initiatives beyond the project funding period.

We completed the first part of Phase I with the 1996 publication of the *Conceptual Guide* which helped direct the development of the *Energy Education Activity Guide.*

This updated *Conceptual Guide* reflects modifications to the framework that evolved during the completion of the *Activity Guide.*

A Rationale For Energy Education

Ask people to talk about energy, and what will they say? Some will describe how they use energy in their lives and at their work places. Some will talk about the cost of energy and mention the price of gasoline or the cost of heating their homes in winter. Others will point out that widespread use of fossil fuels leads to air pollution, acid rain, and global warming; they would say that the market place or the government should promote the use of environmentally-benign energy resources. Still others will recall the energy crisis of the 1970s, when the United States faced an oil embargo by the nations of the Middle East, and later, the subsequent sudden rise in the price of oil. They might add that our nation now imports half the oil it needs, that a disruption in its supply is still possible, and that development of domestic energy resources should be increased. While acknowledging these issues, nearly all of these people will agree that energy is necessary for maintaining their health, their well-being, their lifestyles, and their economy. Many will even say that they often take energy for granted.

Energy is more than an individual economic, environmental, or sociopolitical issue or a passing concern. It is the agent of change for all processes on Earth and throughout the universe. Every interaction among living and nonliving things is accompanied by the transfer and conversion of energy. Energy is the underlying "currency" that is necessary for everything humans do with each other whether in the work place or in their personal lives. Understanding energy in this way enables people to see how issues are interconnected, and how a solution to one issue may even lead to the solution of another. For instance, the person who buys a fuel-efficient car saves money on gasoline, reduces air emissions, and decreases our nation's reliance on imported oil.

Since energy plays an essential role in people's lives, the study of energy and energy issues should be emphasized in education. Some curriculum developers and teachers in Wisconsin include energy-related activities in education curricula. However, many people believe more needs to be done if energy education is to be widely and consistently instituted throughout Wisconsin in a manner that effectively promotes life long learning and links students to the world around them. This *Conceptual Guide to K-12 Energy Education in Wisconsin* helps meet that need, whether you use it to update an existing curriculum or to develop a whole new program for energy education. We have designed this guide so that educators can use it to provide Wisconsin students of every grade level the opportunity to receive a logically sequenced, comprehensive education about energy.

Purpose of this Publication

1. Identify and present concepts that can help people understand energy and make decisions about energy issues.
2. Provide guidance for teachers to incorporate energy education into their curricula.
3. Direct the development of the *Energy Education Activity Guide.*

Conceptual Framework

Introduction

This energy education conceptual framework is not a curriculum in itself, rather, it is a skeleton that provides the foundation for a curriculum. Just as the bones of a skeleton provide strength and structure to a body, the concepts that make up the framework provide the basis for a strong, organized, and comprehensive curriculum. We have endeavored to provide concepts that address a variety of different issues and viewpoints.

These concepts were derived from energy-related frameworks designed by other educational organizations (National Energy Foundation, 1988; North American Association for Environmental Education, 1990) and from physical and environmental science texts. We developed additional concepts to reflect issues specific to Wisconsin. Throughout this process, the KEEP Steering Committee and two focus groups–consisting of energy resource management specialists, curriculum planners, and educators–reviewed and evaluated the framework. Their assistance helps ensure that the concepts in this framework form the basis of a logically sequenced, comprehensive energy education.

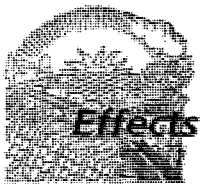
This framework is designed to evolve as energy education evolves. We encourage teachers and curriculum developers to assist with this evolution by modifying and adding to this framework as they build a curriculum that best fits the needs of their educational programs.

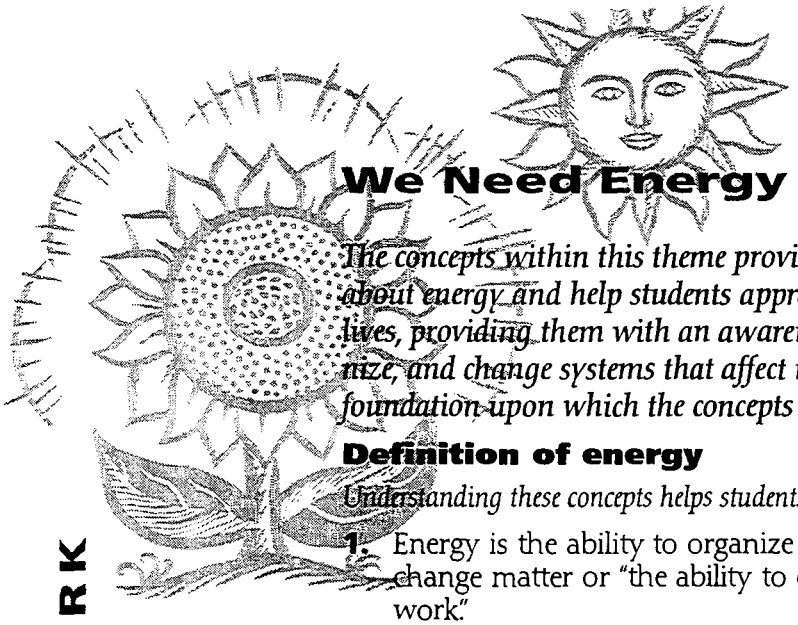
Framework Organization

The concepts within the framework are organized under four themes. Each theme consists of concepts which are further organized into subthemes.

The themes are arranged so that they build upon each other. The information in the first theme lends understanding to concepts in the second theme, and so forth. The first theme, *We Need Energy* defines energy, describes how energy is transferred and converted from one form to another according to the laws of thermodynamics, and explains how energy flows through living and nonliving systems. *Developing Energy Resources* addresses the sources of energy and how humans, through technology, use energy to meet societal wants and needs. It also shows how humans have come to treat energy as a resource. *Effects of Energy Resource Development* covers how using energy resources affects human societies and the environment. Finally, *Managing Energy Resource Use* identifies strategies we can use to help resolve many of the issues presented in the third theme. In addition, this theme discusses how today's energy-related decisions and actions influence the future availability of energy resources.

Themes **Page**





We Need Energy

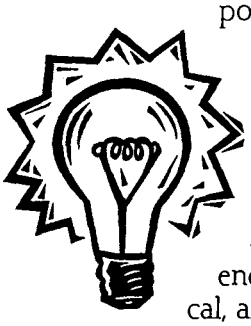
The concepts within this theme provide students with a fundamental knowledge about energy and help students appreciate the nature of energy in their everyday lives, providing them with an awareness of how energy is used to maintain, organize, and change systems that affect their lives. These concepts also provide the foundation upon which the concepts in the following themes are built.

Definition of energy

Understanding these concepts helps students to identify forms of energy.

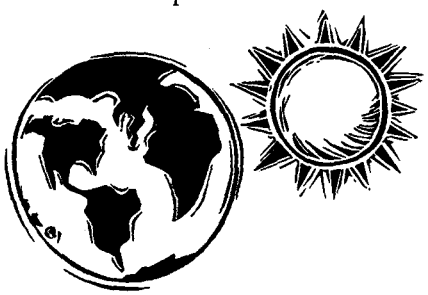
1. Energy is the ability to organize or change matter or "the ability to do work."

2. Energy exists in two main forms: potential energy (energy stored in matter) and kinetic energy (energy of motion). More specific forms of energy include thermal, elastic, electromagnetic (such as light, electrical, and magnetic energy), gravitational, chemical, and nuclear energy.



3. Energy can be measured and quantified. Different units of measure can be used to quantify energy. One unit can be converted to another. Units of measure for energy include calories and kilowatt-hours.

4. Power is the rate at which energy is used. Units of measure for power include horsepower and watts.



Natural laws that govern energy

Mastering these concepts helps students interpret how energy is transferred and converted. It also helps them recognize that there are natural limitations to the amount of energy that anyone or anything can use.

5. Energy can be transferred from one location to another, as in when the sun's energy travels through space to Earth. The two ways that energy can be transferred are by doing work (such as pushing an object) and by transferring heat (conduction, convection, and radiation).

6. Energy can neither be created nor destroyed, it can only be converted from one form to another. This is the first law of thermodynamics. For example, the chemical energy stored in coal can be converted into thermal energy.

7. With each energy conversion from one form to another, some of the energy becomes unavailable for further use. This is the second law of thermodynamics. For example, the thermal energy released by burning coal is eventually dispersed into the environment and cannot be used again. The measure of this dispersal of energy is called "entropy." For example, the entropy of an unburned piece of coal and its surroundings is lower than the entropy of the ashes, cinders, and the warmed surroundings due to burning that piece of coal.

Energy flow in systems

Comprehending these concepts helps students interpret the natural laws that govern energy flow through living and nonliving systems.

8. All systems obey the natural laws that govern energy.

9. Some of the energy converted by systems flows through them. The rest is stored within them for seconds or even millions of years. Some systems convert energy more efficiently than others.

Energy flow in nonliving systems

Understanding these concepts helps students explain how energy creates weather patterns and shapes the Earth's surface.

10. Energy flows through and is stored within a variety of nonliving systems.

- Solar energy absorbed and distributed on Earth's surface gives rise to weather systems and ocean currents.
- The thermal energy stored in Earth's interior shapes and moves Earth's crust as in earthquakes, mountain building, and volcanic activity.

Energy flow in living systems

By mastering these concepts, students should be able to illustrate how humans and other organisms get the energy they need to survive.

11. Living systems use energy to grow, change, maintain health, move, and reproduce. Some of the energy acquired by living systems is stored for later use.

- Plants and other autotrophs convert solar energy to chemical energy via photosynthesis.
- Animals and other heterotrophs convert chemical energy in plants or in other animals to chemical energy they can use via cellular respiration.
- Energy is needed for maintaining the health–nutrition and the quality and quantity of food–of all organisms, including humans.

12. Living systems differ in how fast they use energy. Some living systems–such as birds–use energy quickly for growth and metabolism, and therefore must replace it quickly. Others–such as turtles–use energy more slowly and, therefore, need to replace it less frequently.

Energy flow in ecosystems, including human societies

Fully comprehending these concepts helps students recognize how energy flows through and characterizes ecosystems. It also helps students appreciate that the world around them–including human societies–depends on a continuous supply of energy.

13. Ecosystems use energy to maintain biogeochemical cycles–such as the sedimentary, gaseous, and hydrologic cycles–between living and nonliving systems.

14. Ecosystems are characterized by:

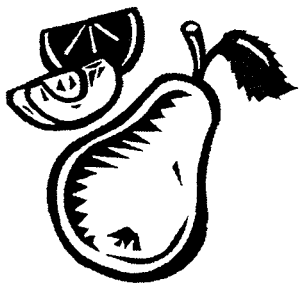
- Types and quantities of available energy sources, such as the chemical energy stored in plants.
- Types and characteristics of energy flows, such as food webs.
- Energy budgets, which are the amount of energy available with respect to the amount of energy used by an ecosystem. The total energy budget of an ecosystem determines its carrying capacity.
- An ability to use energy to maintain a balanced or steady state.

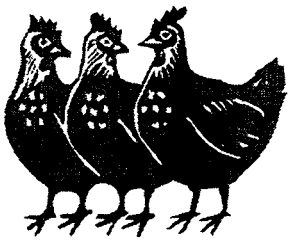
15. Wisconsin has five main biological communities: northern forests, southern forests, prairies, oak savanne and aquatic.

16. Human societies, like natural ecosystems, need energy to organize and maintain themselves. The human use of energy follows the natural laws that govern energy flow in all systems.

17. Human societies range from hunter-gatherer to industrial and can be classified by the amount of energy they use and the rate at which they use it (Miller, 1988).

- Hunter-gatherer societies are adapted to their natural environments. They depend on energy and materials available directly from nature, and their rates of consumption of the energy and materials they use are often in balance with nature.



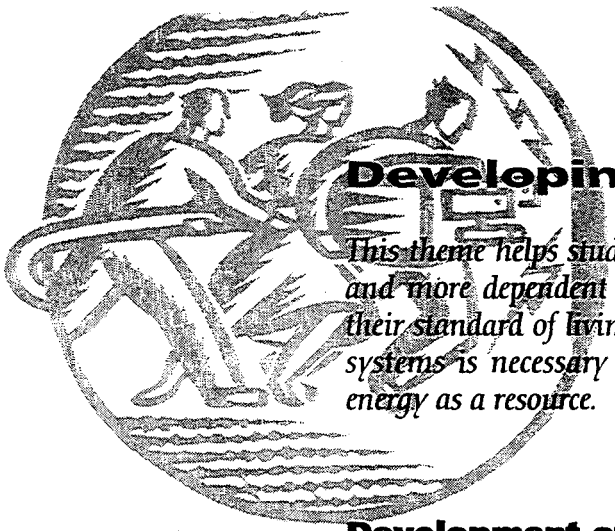


- Nonindustrial agricultural societies modify their natural environments primarily to domesticate food sources. They depend on modest technologies to provide energy and materials.

- Industrial societies attempt to remake and control their natural environment. They have high rates of energy consumption,

depend on sophisticated technologies, and require a substantial energy subsidy to provide energy and materials for residential, commercial, industrial, agricultural, and transportation needs.

18. In general, Wisconsin and the rest of the United States is an industrial, technologically advanced, high-energy-use society.



Developing Energy Resources

This theme helps students realize how they and other humans have become more and more dependent on the development and use of energy resources to satisfy their standard of living. Understanding what energy is and how it flows through systems is necessary to appreciate how humans have come to value and treat energy as a resource.

CONCEPTUAL FRAMEWORK

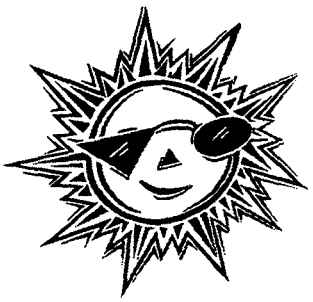
Development of energy resources

Understanding these concepts helps students explain how humans have used technology to further their ability to use energy. It also helps students identify and compare different energy resources–such as renewable and nonrenewable–and appreciate the importance of energy-related technologies.

19. Primary energy sources are those that are either found or stored in nature.

➠ See concept 20 for secondary energy resources.

➠ See concept 25 for renewable and nonrenewable energy resources.

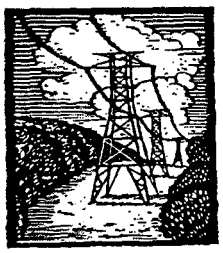


•The sun is a primary energy source and the principal source of Earth's energy. Energy from the sun is stored in other primary energy sources such as coal, oil, natural gas, and biomass (such as wood). Solar energy is also responsible for the energy in the wind and in the water cycle (the hydrologic cycle).

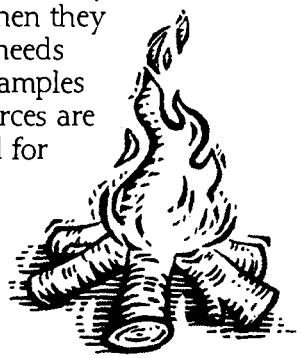
➠ See concept 13 for the hydrologic and other biogeochemical cycles.

•Other primary energy sources found on Earth include nuclear energy from radioactive substances, thermal energy stored in Earth's interior, and potential energy due to Earth's gravity.

20. Secondary energy resources are produced from primary energy resources using technology. For example, we produce electricity–a secondary resource–by burning coal in a power plant or by using photovoltaic cells to harness solar energy. We can also produce alcohol fuel from crops.



21. Energy sources are considered to be energy resources by individuals and society when they serve societal needs and wants. Examples of using resources are burning wood for warmth, and extracting and refining oil to produce fuel for transportation or materials such as plastic.



22. Human societies have obtained energy resources in the following ways:

•Hunter-gatherer societies get their energy from decentralized

KEEP 10

energy systems–as in gathering wood from a forest and burning it to cook food.

- Nonindustrial agricultural societies also get their energy from decentralized energy systems–such as using windmills to grind grain–although these systems are more centralized than those of hunter-gatherer societies.
- Industrial societies get their energy from a mix of centralized energy systems (power plants) and decentralized energy systems (solar panels on rooftops), with centralized energy systems being the dominant energy system. Most of these energy systems were developed by understanding the natural laws that govern energy and applying this knowledge to create sophisticated energy technologies.

23. Some energy sources are concentrated, such as the nuclear energy stored in enriched uranium used in a nuclear power plant, and others are diffuse, such as thermal energy stored in the oceans.

24. Geographically, Earth's energy sources are unevenly distributed.

25. Certain energy resources are renewable because they can be replaced by natural processes quickly. Renewable resources include solar energy, wind, hydropower, and biomass. Even some of these resources can be depleted when their rate of use exceeds their rate of replacement. Other energy resources are nonrenewable because they are either replaced very slowly or are not replaced at all by natural processes. Nonrenewable resources include fossil fuels–coal, oil, and natural gas–and nuclear fuels such as uranium.

26. Wisconsin has primary energy sources.

27. Most of the energy resources currently used in Wisconsin are fossil and nuclear fuels, all of which are imported into the state. Other resources used in Wisconsin include biomass, hydropower, solar energy, and wind, all of which are renewable and can be found within the state.

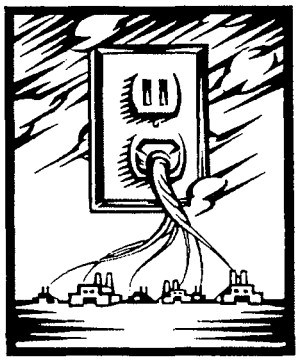
Consumption of energy resources

Mastering these concepts helps students assess modern human societies' dependence on energy and analyze how we have come to value energy as a resource.

28. Supply and demand influence energy resource discovery, development, and use. The supply and demand for an energy resource is determined by resource availability, level of technological development, and societal factors such as lifestyle, health and safety, economics, politics, and culture.

➠ See the next theme, *What Are The Effects Of Energy Resource Use?* for concepts that address the economic and sociopolitical effects of energy consumption.

29. Global demands for energy resources are increasing. This is due to human population growth and increasing worldwide consumption. As certain energy resources are depleted and demand increases, competition for these resources also increases. This is especially true of nonrenewable resources, such as fossil fuels.



Effects of Energy Resource Development

Concepts in this theme help students investigate how energy use has affected their lives. Recognizing these effects increases students' awareness of why and how they use energy and promotes an understanding of why it's important to manage energy resource use.

Quality of life

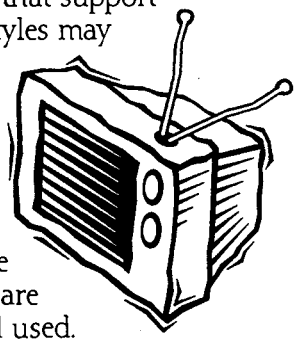
Understanding these concepts helps students analyze current energy-use practices and evaluate how they affect quality of life.

Lifestyles

30. A driving factor in the development of energy-related technology has been people's desire for comfort, convenience, and entertainment.

➡ See concepts 44 - 47 for how comfort, convenience, and entertainment relate to cultural aspects of energy development and use.

31. Technologies that support people's lifestyles may lead to the inefficient use of energy resources, depending on how these technologies are designed and used.



Health and safety

32. There are personal and community health and safety factors associated with the development and use of energy resources. Energy resource development and use may pose direct risks to personal and community health and safety. By affecting the quality of the environment, energy use may pose indirect risks to personal and community health and safety.

➡ See concept 48 for environmental risks to the health and well-being of human and nonhuman life.

33. The health and safety of Wisconsin citizens is related to the development and use of energy resources.

Economic

34. The availability and use of energy resources influence the economic growth and well-being of society.

35. Many occupations, businesses, and public services–such as utilities–result from the development and use of energy resources.

36. The market price of energy includes the cost of energy resource exploration, recovery, refining, pollution control, distribution, and transportation, as well as taxes and other fees.

37. Other costs that are not part of the market price of energy (called externality costs) are due to factors such as environmental damage, property damage, civil unrest, war, and health care.

38. The rate of energy consumption is influenced by energy prices and externality costs.

39. The cost of energy is a factor in Wisconsin's economic development and affects the household budget of Wisconsin citizens.

Sociopolitical

40. Sociopolitical processes result in laws and regulations that govern energy development, availability, and use. Sociopolitical processes have usually governed centralized energy systems such as public utilities.

41. The demand for energy resources influences relationships–alliances and conflicts–among states, regions, and nations.

42. The positive and negative effects of energy resource development and use are not shared equally among states, regions, nations, and individuals, although sociopolitical processes have made some effort to address this.

43. Wisconsin's sociopolitical processes result in laws and regulations that govern energy development, availability, and use.

Cultural

44. The availability of energy resources has shaped cultures, and each culture has value systems that influence how energy resources are used.

45. Energy use by cultures is expressed through art, architecture, urban planning, music, language and literature, theater, dance, other forms of media, sports, and religion.

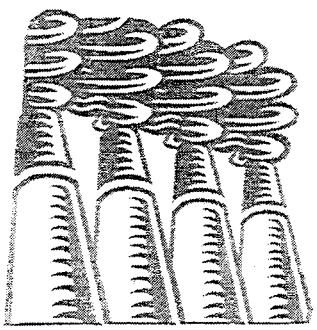
46. Because society's understanding of and relationship with energy changes over time, cultural expressions of energy use change over time as well. For example, ancient Egyptians worshiped the sun, while modern societies associate the sun with a positive mood, recreation, and nature.

47. Wisconsin's culture has been, and will continue to be, shaped in part by available energy resources.

Quality of the environment

By comprehending these concepts, students will be able to explain how current energy use practices affect the quality of the environment and the health of organisms living in the environment.

48. Energy resource development and use can alter environmental conditions leading to, for example, reduced air and water quality, deforestation, and changes in land use due to road building. These altered environmental conditions may pose risks to the health and well-being of human and other life-forms.



49. The faster and more extensively energy resources are developed and used, the more likely that environmental conditions will be altered to a greater degree.

50. It takes less energy and less money to preserve the environment than it does to restore the environment after it has been altered.

51. Wisconsin's environment has been, and continues to be, altered by energy resource development and use.

Managing Energy Resource Use

Concepts in this theme help students identify ways to ensure that energy resources will be available for future users. For students to willingly and effectively take action to manage energy resource use, they must have a thorough understanding and appreciation of what energy is, how it flows through systems, its value as a resource, and the effects its use has on human societies and the environment.

CONCEPTUAL FRAMEWORK

Management of energy resource use

By mastering these concepts, students will recognize their ability to make decisions regarding which resources to use and how those decisions influence the future availability of resources. Students will also identify actions they can take based on these decisions.

52. The choice of energy resource and how it is used influences how energy resources are managed.

53. Energy resources may be managed through conservation, which includes reducing wasteful energy use, using energy for a given purpose more efficiently, or reducing energy use altogether. Energy conservation prolongs the availability of energy resources and contributes to the development of a sustainable society.

54. A citizen, acting individually or as part of a group or organization, may make decisions (such as deciding to ride a bicycle instead of driving a car) and take actions (riding the bicycle) that determine how the energy they use will be managed. Citizens may also affect the actions of other individuals, groups, or organizations to determine how the energy they use will be managed. This can be accomplished by ecomanagement (physical action), education, persuasion, consumer action, political action, or legal action.

55. The decisions and actions taken by societies and their citizens depend on the barriers and incentives associated with energy management choices. Examples of barriers include high energy costs, lack of access to new technologies, and laws that discourage the development or use of certain energy resources. Examples of incentives include rebates, building codes that promote energy conservation, and appliance efficiency standards.

56. Energy management products and programs are available to help Wisconsin citizens use energy resources more efficiently, such as through conservation programs, home heating fuel options, and programs that promote certain lifestyles. These products and programs also help maintain the quality of the environment within and beyond Wisconsin.

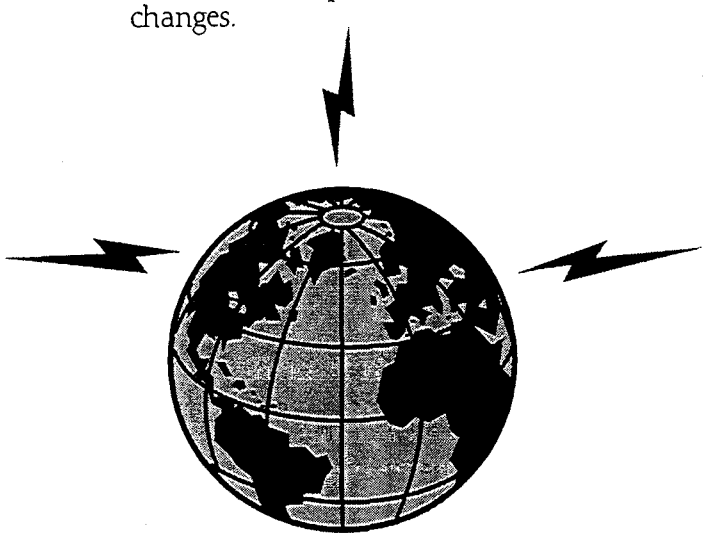
Future outlooks for the development and use of energy resources

By understanding these concepts, students can evaluate how their actions affect the quality of life and the environment of their community, nation, and world. Students will also predict how scientific, technological, and social changes will influence future energy resource availability.

57. New energy resources, new ways of managing energy resources, and new energy technologies will be developed in the future.

58. Choices made today about energy resource management will affect the future quality of life and the environment.

59. New types of societies–such as a sustainable society or a postindustrial society whose economy is based on information and service–may emerge as energy resource development and use changes.



SUGGESTED SCOPE AND SEQUENCE

Suggested Scope And Sequence

Introduction

This section provides guidelines showing when and to what extent energy concepts could be integrated into school curricula. The Wisconsin K-12 Energy Education Program (KEEP) developed this suggested scope and sequence with the help of K-12 teachers who attended the KEEP *Building an Energy Education Curriculum* workshop in October 1995. You can use this section as a guide for when (grade level) and where (subject area) energy concepts can be incorporated into a curriculum.

Note that this scope and sequence is not a one-size-fits-all solution to energy education; educators and curriculum designers in each school system will need to determine the best ways to introduce concepts into their curricula. For example, they may find that after surveying existing curricula, many of these concepts are already being addressed. If a particular concept is not covered, then courses may need to be revised to include them. The companion *Energy Education Activity Guide* will contains interdisciplinary energy-related activities that can be used by educators to bring energy concepts into their lessons.

Scope and Sequence Organization

This scope and sequence is based on the conceptual framework consisting of four main themes presented in the preceding section. The earlier themes in the framework involve lower level thinking skills such as knowledge and comprehension. These should be introduced in the early grades and mastered in middle school. The later themes involve higher level thinking skills such as synthesis and evaluation. These are best suited to middle and high school students.

Proficiency Levels

Each theme will move through three proficiency levels–*introduction, development,* and *mastery*–according to grade level.

- **Introduction**

  The *introduction* level presents basic information related to the concept. Learning usually occurs at the lower cognitive levels (knowledge and comprehension). The objective is to help students become aware of the facts related to the concept and how it is relevant to their lives.

- **Development**

  The *development* level builds on information learned in the introduction level. Students should gain enough knowledge and skills to apply the information to different settings. Analysis of information also begins at this level.

- **Mastery**

  The *mastery* level completes a thorough understanding of the concept. Learning usually occurs at the highest cognitive levels (synthesis and evaluation). The objective is for students to be able to use the information actively in their daily lives.

These proficiency levels are based on the taxonomy of thinking skills within the *cognitive domain* (Bloom, 1956) and on *environmental education subgoals* (Engleson and Yockers, 1994). See the appendix for more information on the cognitive thinking skills taxonomy and environmental education subgoals.

Overview of Suggested Scope and Sequence

The table below is an overview summarizing at what grade levels each theme should be introduced (I), developed (D), and mastered (M). This is a general overview that identifies where most–but not all–of the concepts within each theme should be incorporated. This overview also shows which taxonomic levels of the cognitive domain (CD) are emphasized and what environmental education subgoals (EE) are relevant for each theme. The next section, *Scoped and Sequenced Themes*, provides a more detailed look at each theme.

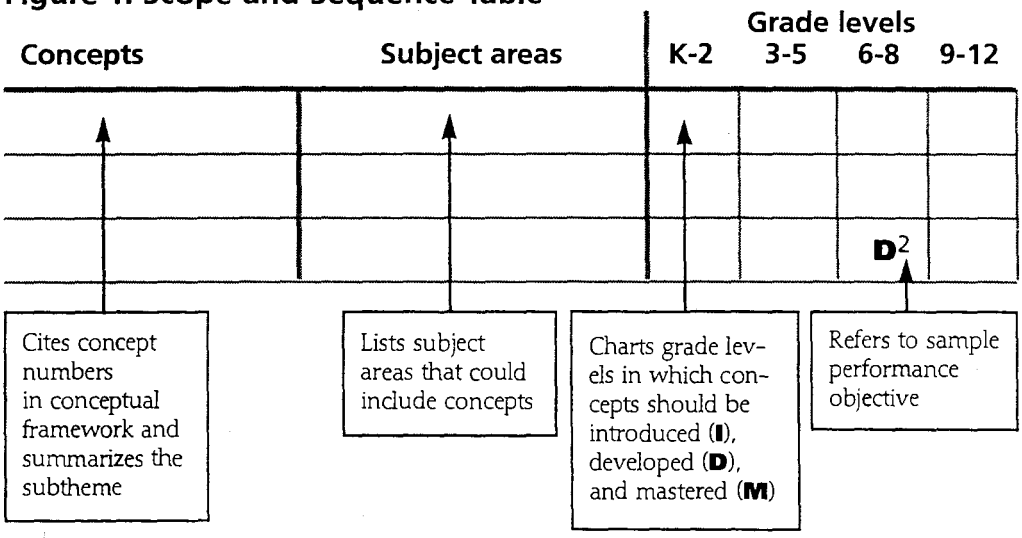
Theme and Comprehensive Performance Objective	Grade levels K-2	3-5	6-8	9-12
We need energy Students will be able to identify forms of energy and simulate or demonstrate how energy is used as it flows through systems (non-living, living, and ecosystems, including human). **CD:** Knowledge, Comprehension and Application **EE:** Perceptual Awareness, Knowledge and Environmental Ethic	I	D	M	
Developing Energy Resources Students will be able to identify energy resources and explain how they are developed and used. **CD:** Analysis **EE:** Environmental Ethic and Citizen Action Skills		I	D	M
Effects of Energy Rescource Development Students will be able to present and defend their views on how current energy-use practices have affected the quality of life and the quality of the environment. **CD:** Analysis **EE:** Knowledge, Environmental Ethic, and Citizen Action Skills		I	D	M
Managing Energy Resource Use Students will be able to make energy choice and use decisions and take action based on their analysis of available energy resources. Students will also demonstrate how use of these resources could affect the quality of life and the quality of the environment. **CD:** Synthesis and Evaluation **EE:** Environmental Ethic, Citizen Action Skills, and Citizen Action Experience		I	D	M

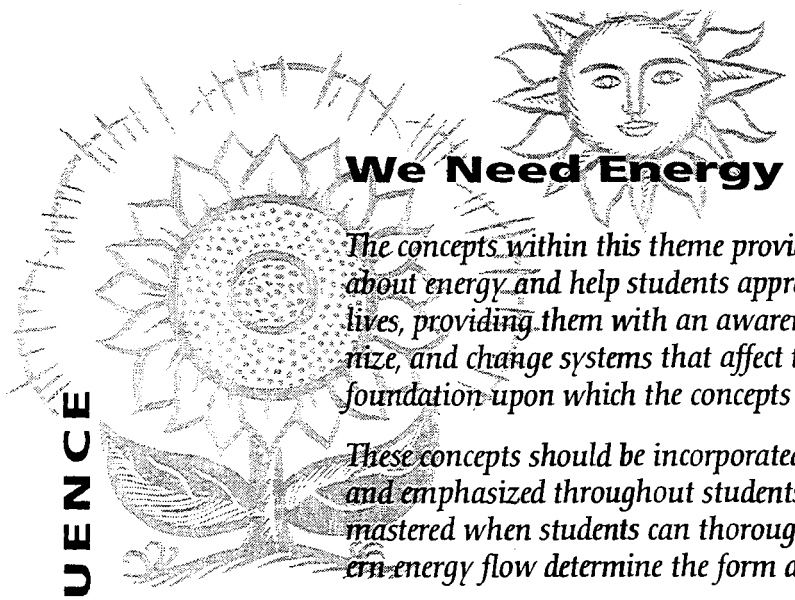
Scoped and Sequenced Themes

For each of the four themes, we use a table to show at what grade level groups of concepts within that theme should be introduced, developed, and mastered (see Figure 1). Concept numbers refer to their locations within the conceptual framework. The tables also indicate the subject areas into which each group of concepts can be integrated.

Following each table are *sample performance objectives* that describe how students should be able to demonstrate they have learned a concept. We use action verbs that reflect the designated proficiency level for the concepts. We considered different learning styles of students, based on the Theory of Multiple Intelligences (see appendix). This theory identifies different ways people best express their knowledge and competencies. For example, some people are musically inclined while others are more analytical, so that instead of students simply stating energy safety rules, they might be encouraged to apply skills within the Musical-Rhythmic Intelligence category by writing and performing a song that communicates these rules. Considering both cognitive thinking skills and multiple intelligences increases the diversity and creativity of the performance objectives, making them more relevant to different subject areas. Superscript numbers within the tables show which subject areas and grade levels are associated with each performance objective.

Figure 1. Scope and Sequence Table





We Need Energy

The concepts within this theme provide students with a fundamental knowledge about energy and help students appreciate the nature of energy in their everyday lives, providing them with an awareness of how energy is used to maintain, organize, and change systems that affect their lives. These concepts also provide the foundation upon which the concepts in the following themes are built.

These concepts should be incorporated early in students' learning experiences and and emphasized throughout students' learning experiences. These concepts are mastered when students can thoroughly explain how the natural laws that govern energy flow determine the form and function of ecosystems.

SUGGESTED SCOPE AND SEQUENCE

Concepts	Subject areas	Grade levels K-2	3-5	6-8	9-12
1-4: Definition of energy Energy is the ability to do work. There are many forms of energy. Power is the rate at which energy is used.	Fine arts[1] Language arts[2] Mathematics Physical education Physical science	**I**[1]	**D**[2]	**M**	**M**
5-7: Natural laws that govern energy Energy cannot be created or destroyed; it can only be converted from one form to another. With each conversion, some energy is always dispersed into a less useful form.	Mathematics Physical science[3] Technology education	**I**	**I**	**D**[3]	**M**
8-12: Energy flow in living systems Living systems' use of energy includes growth, movement, maintenance, and reproduction.	Health education Science[1]*	**I**	**D**[1]	**D**	**M**
13-18: Energy flow in ecosystems, including human societies Ecosystems are characterized by energy availability and patterns of flow. Wisconsin has four ecosystems. Human societies can be classified according to how they use energy.	Family and consumer education Geography[2] Global studies Mathematics Science* Social studies	**I**	**D**	**M**[2]	**M**

*Includes the Earth, life, and physical sciences

Sample Performance Objectives

1. Students will be able to demonstrate that certain actions produce sounds.
Multiple Intelligence: Musical-Rhythmic (introduction to sound energy)
Cognitive Domain: Knowledge
EE Subgoal: Perceptual Awareness, perceiving and discriminating among stimuli

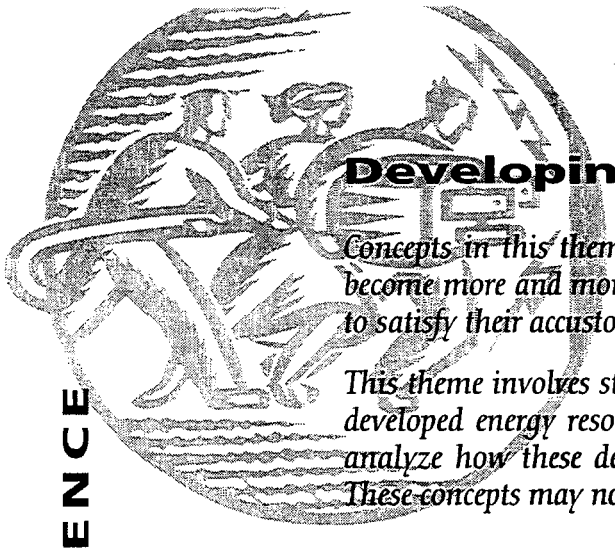
Sample Performance Objectives *Continued*

2. Students will be able to write a story about a hanging drop of water that incorporates the concepts of potential and kinetic energy.
Multiple Intelligence: Verbal-Linguistic
Cognitive Domain: Comprehension
EE Subgoal: Knowledge, translating and interpreting information

3. Students will be able to build a machine that uses the potential energy in water to lift an object.
Multiple Intelligence: Visual-Spatial
Cognitive Domain: Application
EE Subgoals: Perceptual Awareness, processing, refining, and extending perceptions;
Knowledge, knowledge of principles;
Citizen Action Skills, application of principles

4. Students will be able to trace the energy flow of every item in their lunch back to the sun.
Multiple Intelligence: Logical-Mathematical
Cognitive Domain: Comprehension
EE Subgoal: Knowledge, interpreting information

5. Students will be able to design a model village that illustrates how energy flows through a community.
Multiple Intelligence: Visual-Spatial
Cognitive Domain: Application
EE Subgoal: Knowledge, application of principles;
Citizen Action Skills, application of principles.



Developing Energy Resources

Concepts in this theme help students realize how they and other humans have become more and more dependent on the development and use of energy resources to satisfy their accustomed standard of living.

This theme involves students interpreting how humans, through technology, have developed energy resources. Higher-level thinking skills are involved as students analyze how these developments have influenced energy consumption patterns. These concepts may not be thoroughly mastered until students are in high school.

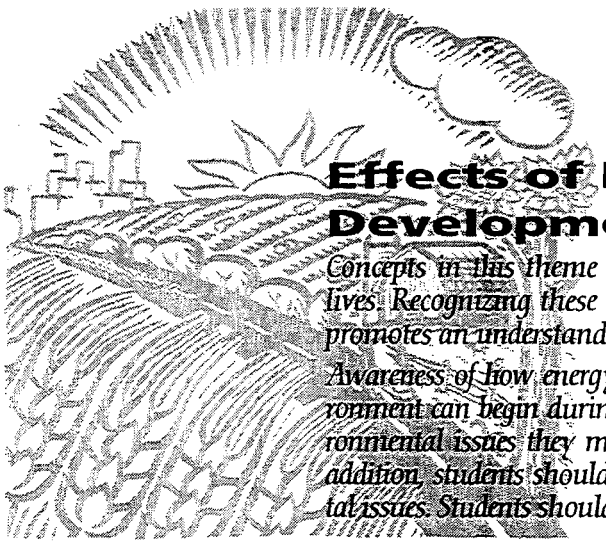
SUGGESTED SCOPE AND SEQUENCE

Concepts	Subject areas	Grade levels K-2	3-5	6-8	9-12
19-27: Development of energy resources Through technology, humans have been able to develop a variety of renewable and nonrenewable energy sources to meet societal needs. Wisconsin imports many of its energy resources.	Geography[1] Mathematics Social studies	I	I	D[1]	M
28-29: Consumption of energy resources Supply and demand influence energy resource development and use. Global demand for energy resources is increasing.	Fine arts[2] Global studies Physical science Social studies	I	I	D	M[2]

Sample Performance Objectives

1. Students will be able to design a chart that compares percentages of energy resources used in Wisconsin and that identifies which of these resources are imported.
   Multiple Intelligences: Visual-Spatial and Logical-Mathematical
   Cognitive Domain: Comprehension
   EE Subgoal: Knowledge, interpreting information

2. Students will be able to write and perform a play that shows how the cost of a resource increases as its availability decreases.
   Multiple Intelligence: Bodily-Kinesthetic
   Cognitive Domain: Analysis
   EE Subgoal: Environmental Ethic, valuing



Effects of Energy Resource Development

Concepts in this theme help students to investigate how energy use has affected their lives. Recognizing these effects increases students' awareness of how they use energy and promotes an understanding of why energy resource use should be managed.

Awareness of how energy use positively and negatively affects quality of life and the environment can begin during the primary grades; however, because of the complexity of environmental issues they may be better introduced at a later stage (e.g., late elementary). In addition, students should develop skills necessary to investigate energy-related environmental issues. Students should master this theme during their high school years.

Concepts	Subject areas	Grade levels K-2	3-5	6-8	9-12
30-47: Quality of life Energy use has affected the quality of human life: life styles; health and safety; economic development; sociopolitical development; and cultural development. Wisconsin's quality of life has been affected by energy use.	Economics[3] Family and consumer education Health education[1] Language arts[2] Science* Social studies[4]	**I**	**I**[1]	**D**[2,3]	**M**[4]
48-51: Quality of the environment Energy use has affected the quality of the environment which in turn affects the health of organisms living in the environment. Wisconsin's environment has been affected by energy resource development and use.	Fine arts[5] Global studies Physical science Social studies	**I**	**I**	**D**	**M**[5]

*Includes the environmental, life, physical sciences

Sample Performance Objectives

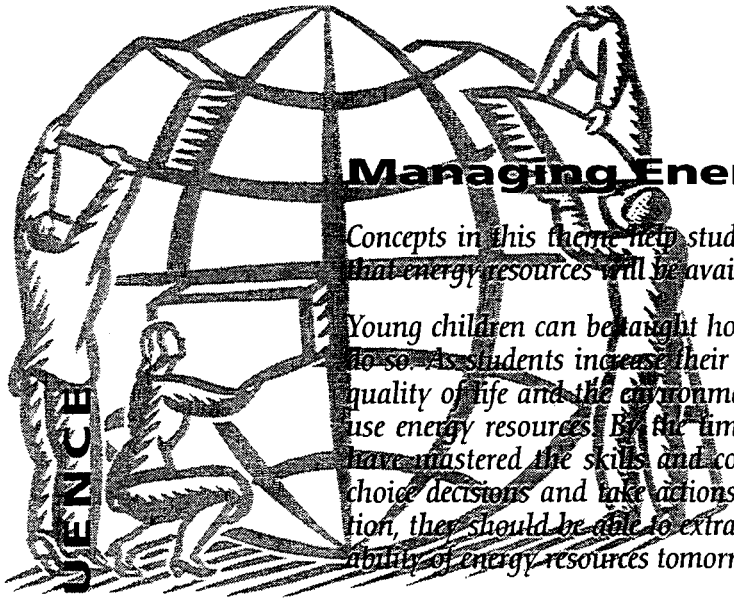
1. Students will be able to perform a rap song that includes safety rules about electricity.
   Multiple Intelligence: Musical-Rhythmic
   Cognitive Domain: Knowledge
   EE Subgoal: Environmental Ethic, responding

2. Students will be able to analyze how energy use and availability have affected the lives of characters in a novel (e.g., *Little House on the Prairie*, by Laura Ingalls Wilder and *Brave New World* by Aldous Huxley).
   Multiple Intelligence: Interpersonal
   Cognitive Domain: Analysis
   EE Subgoal: Environmental ethic, valuing

3. Students will be able to interpret the results of an energy audit to determine how the costs of energy affect the family budget.
   Multiple Intelligence: Interpersonal
   Cognitive Domain: Analysis
   EE Subgoal: Citizen Action Skills, production of a plan or proposed set of options

4. Students will be able to role play a mock rate case hearing that illustrates how the Public Service Commission of Wisconsin regulates the state's electric and gas utilities.
   Multiple Intelligences: Bodily-Kinesthetic and Interpersonal
   Cognitive Domain: Analysis
   EE Subgoal: Environmental Ethic, valuing

5. Students will be able to write a journal article that analyzes the history of an energy-related environmental issue, and presents and interprets the values people affected by the issue hold.
   Multiple Intelligence: Interpersonal
   Cognitive Domain: Analysis
   EE Subgoal: Environmental Ethic, valuing



Managing Energy Resource Use

Concepts in this theme help students to identify ways in which they can help ensure that energy resources will be available for future users.

Young children can be taught how to use energy efficiently and why it's important to do so. As students increase their understanding of how energy-use practices affect the quality of life and the environment, they will begin to determine how they choose to use energy resources. By the time students graduate from high school, they should have mastered the skills and concepts that will enable them to make wise energy choice decisions and take actions that reflect their personal energy use ethic. In addition, they should be able to extrapolate how their actions today could affect the availability of energy resources tomorrow.

SUGGESTED SCOPE AND SEQUENCE

Concepts	Subject areas	Grade levels K-2	3-5	6-8	9-12
52-56: Management of energy resource use Energy resource management involves societies deciding which resources to use and determining how to use them efficiently. Wisconsin has a variety of programs available on energy conservation.	Language arts Environmental science[1] Social studies[3] Technology education[2]	**I**[1]	**I**[2]	**M**	**M**[3]
57-59: Future outlooks for the development and use of energy resources New energy resources, new ways of managing energy resources, and new technologies will be developed in the future. Energy resource management will affect the quality of life and the environment.	Language arts Environmental science Social studies	**I**	**I**	**D**	**M**

Sample Performance Objectives

1. Students will be able to distinguish between a household that is using energy efficiently and one that is not (such as a household that leaves lights on unnecessarily).
   Multiple Intelligence: Logical-Mathematical
   Cognitive Domain: Knowledge
   EE Subgoals: Knowledge, knowledge of terminology;
   Environmental Ethic, responding
2. After they have cooked a meal in a solar oven of their own design, students will be able to explain why they would or would not choose to use a solar oven.
   Multiple Intelligences: Intrapersonal and Visual-Spatial
   Cognitive Domains: Synthesis and Evaluation
   EE Subgoals: Environmental Ethic, organizing a value system;
   Citizen Action Skills, evaluation
3. Students will be able to evaluate the success of promoting and implementing an energy efficiency plan for their school.
   Multiple Intelligence: Intrapersonal
   Cognitive Domain: Evaluation
   EE Subgoals: Citizen Action Skills, analysis and synthesis;
   Citizen Action Experience, education and persuasion

CONCEPT MAP

Concept Map

Introduction

The framework in this document is a list of concepts. Another approach to presenting the concepts is to use a concept map that shows how thoughts and ideas are organized in the mind.

Concept maps are becoming popular instruments in many aspects of learning, including curriculum development. By creating and revising these maps, curriculum developers and teachers illustrate meaningful interconnections among concepts. The map serves as a guide during curriculum development, ensuring that the content is integrated and cohesive.

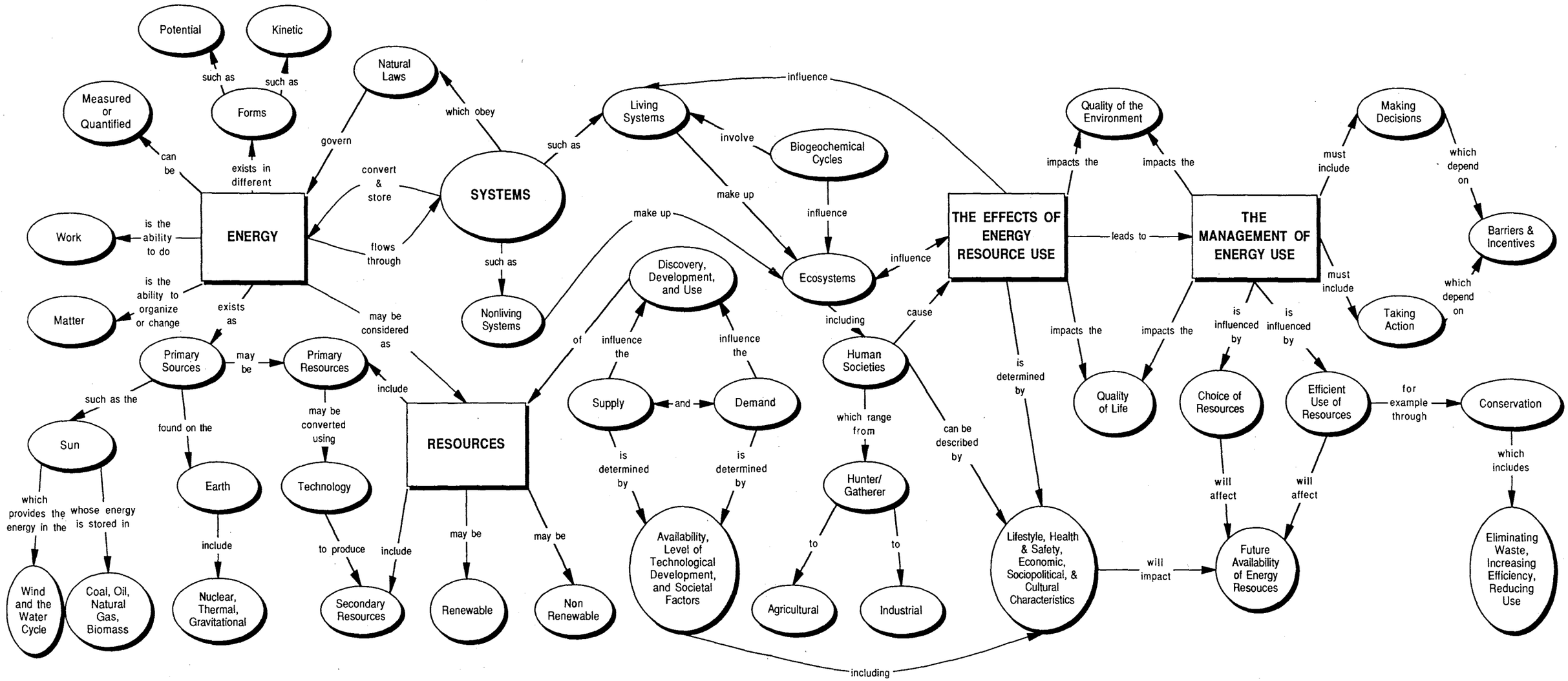
Organization

Our concept map visually represents the themes and selected concepts presented in the framework. It shows that the concepts are not isolated, fragmented ideas. Rather, they are integral components of the framework and are complementary, connected, and interrelated. As we develop the energy education activity guide, we will create more detailed concept maps for each theme.

We encourage educators and curriculum planners to investigate and revise this map or create one of their own as they develop an energy education curriculum or incorporate energy-related concepts into existing curricula.

Explanation of concept map.

The squares are themes; ovals represent subthemes and subordinate concepts. Concepts flow from themes, such as Energy, to subordinate concepts, such as Sun. Arrows with short descriptions connect the concepts and show how they are related (for example, "Energy" flows through "Systems").



Glossary

Autotroph

Organism capable of synthesizing its own food from inorganic substances using light or chemical energy. Examples of autotrophs include plants and some protozoans.

Biogeochemical cycle

Natural processes that cycle nutrients in various chemical forms from the environment, to organisms, and then back to the environment. Examples are the carbon, oxygen, nitrogen, phosphorous, and hydrologic cycles.

Biomass

Plant or animal matter. Biomass can be burned directly as a source of heat or converted to a more convenient gaseous or liquid fuel. Examples include wood and animal waste.

Centralized energy system

Energy system where large amounts of an energy resource are converted from one form to another in a central location. The energy is then distributed to and used by a large number of consumers located within a large area. Electricity generated by a nuclear power plant and distributed by transmission lines to a large number of homes and businesses is an example of a centralized energy system.

Conservation

Wise use and careful management of resources, so as to obtain the maximum possible social benefits from them for present and future generations. Energy resources can be conserved by reducing wasteful energy use, using energy for a given purpose more efficiently, or by reducing energy use altogether.

Decentralized energy system

Energy system where small amounts of an energy resource are converted from one form to another for use by a small number of people. The conversion and consumption of the energy resource usually occurs in the same location. An example is a solar water heater used to provide hot water for a home.

Ecomanagement

Positive physical action taken by an individual or group that improves or maintains some part of the environment. An example would be creating a recycling center in a community.

Ecosystem

Self-regulating natural community of organisms (e.g., plants, animals, bacteria) interacting with one another and with their nonliving environment. Wetlands, forests, and lakes are examples.

Energy forms

Fundamental kinds of energy that are distinct from each other. Two main forms of energy are potential energy (the energy stored in matter) and kinetic energy (the energy of motion). More specific forms of energy include thermal, elastic, electromagnetic (light, electrical, magnetic), gravitational, chemical, and nuclear energy.

Energy resource

Energy source that is used to meet the needs of a human society. For example, oil is an energy resource because it is used to produce fuel for transportation and heating.

Energy source

Matter or system from which one or more forms of energy can be obtained. Natural gas, for example, is a source of thermal energy; sugarcane is a source of chemical energy.

Entropy

(1) A measure of the dispersal or degradation of energy. (2) A measure of the disorder or randomness in a closed system. For example, the entropy of an unburned piece of wood and its surroundings is lower than the entropy of the ashes, burnt remains, and the warmed surroundings due to burning that piece of wood.

Externality cost

Portion of the cost of production and marketing of a product that is borne by society, not by the producer, and thus is not included in the price of the product. For example, the cost of cleaning up a beach after an oil spill is usually not included in the market price of motor oil.

First law of thermodynamics

Energy cannot be created or destroyed; it can only be converted from one form to another. For example, the chemical energy stored in coal can be converted into thermal energy.

Heterotroph

An organism, such as a mammal, that cannot synthesize its own food and is dependent on complex organic substances for nutrition.

Nonrenewable energy resource

Energy resource that is either replenished very slowly or not replenished at all by natural processes. A nonrenewable resource can ultimately be totally depleted or depleted to the point where it is too expensive to extract and process for human use. Fossil fuels are nonrenewable resources.

Photovoltaic cell

Device that converts solar energy directly into electricity. For example, photovoltaic cells provide electricity for hand-held calculators, watches, battery chargers, homes, and satellites.

Primary energy source

Source of energy either found or stored in nature, such as the sun, coal, and oil.

Renewable energy resource

Energy resource that can be quickly replenished. Some renewable resources–such as solar energy–will always be available no matter how they are used. Others–such as wood–can be depleted when their rate of use exceeds their rate of replacement.

Second law of thermodynamics

(1) Each time energy is converted from one form to another, some of the energy is always degraded to a lower-quality, more dispersed, and less useful form. (2) No system can convert energy from one useful form to another with 100 percent efficiency. (3) Energy cannot be spontaneously transferred from a cold body to a hot body. (4) The entropy of a closed system increases over time.

Secondary energy resource

Energy resource that is produced from a primary energy resource using technology, such as electricity produced from solar energy by photovoltaic cells.

Sustainable society

Society based on working with nature by recycling and reusing discarded matter, by conserving matter and energy resources through reducing unnecessary waste and use, and by building things that are easy to recycle, reuse, and repair.

System

(1) A group of interacting, interrelated, or interdependent parts made up of matter and energy that form a complex whole. (2) Anything that uses matter and energy to organize, maintain, or change itself. A system, for example, can be the sun, a glass of water, a frog, or a city.

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Appendix

Taxonomy of Educational Objectives

These tables briefly describe the taxonomy of thinking skills within the cognitive and affective domain. In each table, the descriptions are arranged from lowest level of thinking skills to the highest or most complex.

Cognitive Domain and Selected Illustrative Verbs

Description of Categories Within the Cognitive Domain	Illustrative Verbs
Knowledge Remembering and recalling previously learned information.	define, identify, outline
Comprehension Understanding and interpreting learned information.	paraphrase, predict, rewrite, summarize
Application Demonstrating understanding by using learned information in new or different situations.	change, model, solve, prepare, manipulate
Analysis Identifying parts and components of learned information and investigating relationships among those components.	analyze, diagram, illustrate, relate, perform
Synthesis Arranging components of learned information to create a new product (e.g., a collection of ideas, an invention).	categorize, build, create, plan, organize
Evaluation Judging the value or worth of learned information and products created during synthesis.	evaluate, conclude, critique, justify

Based on Bloom, 1956.

Affective Domain and Selected Illustrative Verbs

Description of Categories Within the Affective Domain	Illustrative Verbs
Receiving Willingness to participate in an experience or new learning situation.	reply, name, follow, identify, recognize
Responding Reacting to and displaying interest in a new learning situation.	report, assist, request, read, seek
Valuing Forming or identifying attitudes and values toward a new learning situation.	complete, describe, explain, demonstrate
Organization Analyzing values related to a learning situation and organizing them into a value system.	modify, organize, prepare, determine
Characterization by a Value or Value Complex Demonstrating behaviors that indicate a value system has been incorporated into one's lifestyle.	illustrate, perform, solve, develop, exhibit

Based on Krathwohl, et al. 1964.

Subgoals of Environmental Education

This table describes the subgoals of environmental education and identifies their associated learning domains.

Subgoal	Definition	Learning Domain
Perceptual Awareness	To help students develop the ability to perceive and discriminate among stimuli; to process, refine, and extend those perceptions; and to concurrently acquire an aesthetic sensitivity to both natural and built environments.	Affective (primarily receiving and responding)
Knowledge	To help students acquire a basic understanding of how the natural environment functions, how its functioning is affected by human activity, and how harmony between human activity and the natural environment can be achieved.	Cognitive
Environmental Ethic	To help students develop a universal ethic on which they may act to defend, improve, and sustain the quality of the environment.	Affective
Citizen Action Skills	To help students develop the skills needed to identify, investigate, and take action toward the prevention and resolution of environmental issues.	Cognitive
Citizen Action Experience	To help students gain experience in applying their acquired perceptual awareness, knowledge, environmental ethic, and citizen action skills in working toward the prevention and resolution of environmental issues at all levels, local through universal.	Cognitive, Affective

Based on Engleson and Yockers, 1994.

Summary of Multiple Intelligences

This table describes the seven types of intelligences.

Type of Intelligence	Definition
Verbal-Linguistic	Using language to express ideas and concepts.
Logical-Mathematical	Skillfully using numbers mathematically and reasoning out problems.
Visual-Spatial	Perceiving elements of the spatial world and representing those expressions efficaciously.
Bodily-Kinesthetic	Creatively using the whole body to illustrate ideas and concepts.
Musical-Rhythmic	Discriminating among musical components and using instruments or the voice to express understandings.
Interpersonal	Demonstrating empathy toward or appreciating the thoughts and feelings of others.
Intrapersonal	Analyzing one's own thoughts and motivations and expressing understandings of those thoughts and feelings through behavior.

Based on Armstrong, 1994.

APPENDIX B

1999 KEEP Pre-course / Post-course Comparative Data Report

1999 KEEP Pre-Course / Post-Course
Comparative Data Report

Congratulations! By attending the KEEP in-service course, you joined a population of teachers who are striving to improve energy education in Wisconsin. Another way you can provide your support is to help us improve this course by completing this survey.

Name (optional): _____
School (optional): _____
Position description/Title: _____
Grade and/or subject areas taught: _____

Number of students reached per year: _____
Number of years teaching this grade/subject: _____ Total number of years teaching: ____
School setting (circle one) Urban Suburban Rural

Course date: _____
Course location: _____
Course instructor: _____

For each of the following items, please circle the word(s) to indicate your response to each statement.

As a result of attending the KEEP course, I believe more strongly that. . .

1. . . . energy education should be considered a priority in our K-12 education system.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	55	174	72	6	1
Pre test %=	17.9%	56.5%	23.4%	1.9%	.3%
Post test count=	83	203	23	1	1
Post test %=	26.7%	65.3%	7.4%	.3%	.3%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	36.74336	4	.00000

2. . . . energy education should be taught by select teachers, such as science teachers, rather than having the majority of teachers in a variety of subject areas teach it.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	2	34	59	174	39
Pre test %=	.6%	11.0%	19.2%	56.5%	12.7%
Post test count=	8	31	41	184	48
Post test %=	2.6%	9.9%	13.1%	59.0%	15.4%

Pre to post test *did not* show significant difference:

Chi Square	Value	DF	Significance
Pearson	8.16336	4	.08577

3. . . . I have adequate training and experience to teach about energy.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	9	66	94	116	23
Pre test %=	2.9%	21.4%	30.5%	37.7%	7.5%
Post test count=	49	204	45	14	0
Post test %=	15.7%	65.4%	14.4%	4.5%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	218.40698	4	.00000

The KEEP course provided opportunities for me to . . .

4. . . . improve my knowledge about energy.

Value Label	Value	Frequency	Percent	Valid Percent	Cum. Percent
Strongly agree	1	155	25.0	49.8	49.8
Agree	2	146	23.5	46.9	96.8
Not sure	3	7	1.1	2.3	99.0
Disagree	4	3	.5	1.0	100.0
Strongly disagree	5				
Missing		309	49.8		
	TOTAL:	620			
Valid Cases	311	Missing Cases	309		

5. . . . gain hands-on experiences in energy education.

Value Label	Value	Frequency	Percent	Valid Percent	Cum. Percent
Strongly agree	1	160	25.8	51.4	51.4
Agree	2	141	22.7	45.3	96.8
Not sure	3	7	1.1	2.3	99.0
Disagree	4	3	.5	1.0	100.0
Strongly disagree	5				
Missing		309	49.8		
	TOTAL:	620			
Valid Cases	311	Missing Cases	309		

6. . . . develop strategies for using KEEP's Education Guide to integrate energy concepts.

Value Label	Value	Frequency	Percent	Valid Percent	Cum. Percent
Strongly agree	1	141	22.7	45.3	45.3
Agree	2	165	26.6	53.1	98.4
Not sure	3	3	.5	1.0	99.4
Disagree	4	2	.3	.6	100.0
Strongly disagree	5				
Missing		309	49.8		
	TOTAL:	620			
Valid Cases	311	Missing Cases	309		

7. . . . explore a variety of energy education support materials.

Value Label	Value	Frequency	Percent	Valid Percent	Cum. Percent
Strongly agree	1	126	20.3	40.5	40.5
Agree	2	173	27.9	55.6	96.1
Not sure	3	10	1.6	3.2	99.4
Disagree	4	2	.3	.6	100.0
Strongly disagree	5				
Missing		309	49.8		
	TOTAL:	620			
Valid Cases	311	Missing Cases	309		

As a result of taking the KEEP course and using the KEEP Education Guide, I am *more* likely to. . .

8. . . . acquire published resources (e.g., teacher guides, videos, trade books) to help me develop energy education lessons and activities.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	59	197	25	16	6
Pre test %=	19.%	65.0%	8.3%	5.3%	2.0%
Post test count=	43	214	44	9	0
Post test %=	13.9%	69.0%	14.2%	2.9%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	16.32705	4	.00261

9. . . . use the Internet to gain access to energy education support materials.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	21	135	64	67	16
Pre test %=	6.9%	44.6%	21.1%	22.1%	5.3%
Post test count=	38	177	78	18	0
Post test %=	12.2%	56.9%	25.1%	5.8%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	56.08478	4	.00000

10. . . . contact local and statewide community resources (e.g., professionals and agencies) to support my efforts to teach about energy.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	18	158	63	56	8
Pre test %=	5.9%	52.1%	20.8%	18.5%	2.6%
Post test count=	30	199	71	11	0
Post test %=	9.6%	64.0%	22.8%	3.5%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	46.31380	4	.00000

11. . . . integrate energy concepts into my curriculum.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	35	198	50	16	3
Pre test %=	11.6%	65.6%	16.6%	5.3%	1.0%
Post test count=	114	184	11	0	1
Post test %=	36.8%	59.4%	3.5%	.0%	.3%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	84.24324	4	.00000

As a result of participating in the KEEP course and using the KEEP Education Guide, my classroom teaching includes *more* activities and lessons that . . .

12. . . . provide students with fundamental knowledge about energy.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	22	151	38	87	8
Pre test %=	7.2%	49.3%	12.4%	28.4%	2.6%
Post test count=	62	223	13	8	0
Post test %=	20.2%	72.6%	4.2%	2.6%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	119.85691	5	.00000

13. . . . promote student understanding of energy resources used in Wisconsin.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	11	104	52	127	10
Pre test %=	3.6%	34.1%	17.0%	41.6%	3.3%
Post test count=	59	202	38	8	0
Post test %=	19.2%	65.8%	12.4%	2.6%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	182.36939	5	.00000

14. . . . involve students in investigating the positive and negative effects of energy resource development and use.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	12	114	47	116	11
Pre test %=	4.0%	38.0%	15.7%	38.7%	3.7%
Post test count=	57	202	32	14	0
Post test %=	18.7%	66.2%	10.5%	4.6%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	147.70179	4	.00000

15. . . . help students gain skills that will allow them to manage their energy use effectively.

	Strongly agree	Agree	Not Sure	Disagree	Strongly Disagree
Pre test count=	15	122	54	103	8
Pre test %=	5.0%	40.4%	17.9%	34.1%	2.6%
Post test count=	66	206	27	7	0
Post test %=	21.6%	67.3%	8.8%	2.3%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	154.38549	4	.00000

16. While planning for the past five months of classroom instruction, about how much time did you spend **preparing** to teach about energy? (NOTE: Classroom instruction means actual time in the classroom; for example, if you are completing this survey in September, the last five months of classroom instruction would most likely be January through May—unless, of course, you taught summer school.)

	<4 hrs.	4-8 hrs.	>8, <40 hrs.	40-80 hr	>80,<160	160hrs+
Pre test count=	189	62	34	5	1	1
Pre test %=	64.7%	21.2%	11.6%	1.7%	.3%	.3%
Post test count=	54	120	120	9	3	0
Post test %=	17.6%	39.2%	39.2%	2.9%	1.0%	.0%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	144.40374	5	.00000

17. My experience with KEEP made me aware of the need to devote a larger proportion of my planning time preparing to teach about energy.

Value Label	Value	Frequency	Percent	Valid Percent	Cum. Percent
Strongly agree	1	110	17.7	24.9	24.9
Agree	2	222	35.8	50.2	75.1
Not sure	3	64	10.3	14.5	89.6
Disagree	4	28	4.5	6.3	95.9
Strongly disagree	5	4	.6	.9	96.8
Missing		178	28.7		
	TOTAL:	620			
Valid Cases	442	Missing Cases	178		

18. During the past five months of classroom instruction, approximately how much time per week did you spend **teaching** about energy? (NOTE: Classroom instruction means actual time in the classroom; for example, if you are completing this survey in September, the last five months of classroom instruction would most likely be January through May—unless, of course, you taught summer school.)

(minutes)	>30	31-60	61-120	121-150	151-180	181-210	211-240	240+
Pre test =	72	33	22	6	5	2	4	11
Pre test %=	46.5%	21.3%	14.2%	3.9%	3.2%	1.3%	2.6%	7.1%
Post test =	74	83	34	29	23	11	9	37
Post test %=	24.7%	27.7%	11.3%	9.7%	7.7%	3.7%	3.0%	12.3%

Pre to post test *did* show significant difference:

Chi Square	Value	DF	Significance
Pearson	29.90137	7	.00010

19. The KEEP Course and Education Guide has influenced me to spend more class time teaching about energy.

Value Label	Value	Frequency	Percent	Valid Percent	Cum. Percent
Strongly agree	1	51	8.2	16.5	16.5
Agree	2	214	34.5	69.0	85.5
Not sure	3	30	4.8	9.7	95.2
Disagree	4	14	2.3	4.5	99.7
Strongly disagree	5				
Missing		310			
	TOTAL:	620			
Valid Cases	310	Missing Cases	310		

20. This course motivated me to use my teaching efforts to promote a comprehensive and cohesive energy education program in Wisconsin.

Value Label	Value	Frequency	Percent	Valid Percent	Cum. Percent
Strongly agree	1	27	4.4	8.9	8.9
Agree	2	155	25.0	51.2	60.1
Not sure	3	95	15.3	31.4	91.4
Disagree	4	26	4.2	8.6	100.0
Strongly disagree	5				
Missing		317			
	TOTAL:	620			
Valid Cases	303	Missing Cases	317		

21. Compared to other in-service courses I have had, I feel the content and methods taught in this course are:

Value Label	Value	Frequency	Percent	Valid Percent	Cum. Percent
Most important	1	25	4.0	8.1	8.1
More important	2	76	12.3	24.8	32.9
As important	3	198	31.9	64.5	97.4
Less important	4	8	1.3	2.6	100.0
Missing		313	50.5		
	TOTAL:	620			
Valid Cases	307	Missing Cases	313		

22. What did you like best about the course?

23. What suggestions do you have for improving the course?

APPENDIX C

List of Advisory Committee Members

Promising Practices Advisory Committee

The following appear in alphabetical order:

- Pat Arndt, Berlin High School, Berlin
- Nick Baumgart, Florence High School. Florence
- Randy Champeau, Director, Wisconsin Center for Environmental Education, Stevens Point
- Terrie Cooper, Riveredge Nature Center, Newberg
- Mary Duritsa-Hemshrot, UWSP Adjunct Faculty, Shell Lake
- Sally Ellingboe, Director, Boston School Forest, Amherst Junction
- David Engleson, Environmental Education Consultant, Sun Prairie
- Steve Knudsen, UWSP Adjunct Faculty, Stevens Point
- Kathy Kuntz, Energy Center of Wisconsin, Madison
- Jennie Lane, KEEP Program Coordinator, Stevens Point
- Pat Marinac, Appleton East High School, Appleton
- Tehri Parker, Midwest Renewable Energy Association, Amherst
- Ann Quale, TJ Walker Middle School, Sturgeon Bay
- Meta Reigel, UWSP Academic Staff, Stevens Point
- Susan Stein, UW-Madison Speakers Bureau Director, Madison
- Al Stenstrup, Wisconsin Department of Natural Resources, Madison
- Dan York, Energy Center of Wisconsin, Madison
- Kelly Zagrzebski-Rodens, Wisconsin Public Service Corporation, Wausau

APPENDIX D

KEEP on Going! Newsletter Articles

In this issue:

Wisconsin K-12 Energy Education Program
A collaboration of
Wisconsin Center for Environmental Education
and
Energy Center of Wisconsin

KEEP On Going

Fall 1998 Vol.1 No. 1

A Promising Connection in 1999

The enthusiasm and creativity displayed by KEEP graduates in the past year has been outstanding. As you know, the main goal of KEEP is to encourage, strengthen, and support Wisconsin's network of energy educators. We want you to stay on top of what other KEEP graduates are doing with energy education.

To help strengthen this connection the Wisconsin Center for Environmental Education, the Energy Center of Wisconsin, and the K-12 Energy Education Program are proud to announce an exciting new energy education resource: *Promising Energy Education Practices in Wisconsin: Creating A Network of Energy Educators.* Thanks to generous support from the Wisconsin Environmental Education Board, *Promising Energy Education Practices* will be published in 1999 and distributed to 1,500 Wisconsin educators. It will consist of exciting energy education projects, activities, and lessons being done by K-12 teachers and students that span across school curriculum and meet Wisconsin state standards.

Now KEEP wants to know what you and your students are doing in energy education—your contribution is essential in bringing this resource to reality!

Up until now teachers in Wisconsin have had no way of exchanging experiences and ideas about energy education. But with this book, hundreds of teachers will be able to announce and share their endeavors and achievements in energy education with others around the state.

Every subject and grade level has the opportunity to teach about the relevancy and importance of energy. From food chain dynamics, to investigating renewable energy sources, to how energy use has shaped our past and current environmental, political, and sociological issues, energy education is there. A promising practice in energy education can range from a ten-minute motivational introductory class activity to a year-long school-wide project (see *KEEP Highlight* on page 3).

So tell us about your promising practices. In the spring of 1999 we'll publish your successful projects completed by students, both in the classroom and in conjunction with the community. New or adapted classroom activities and lesson

Continued on page 3

KEEP HIGHLIGHT

Promising Energy Education Practice

KEEP graduates have dazzled us with their creativity and enthusiasm while taking our courses. And they've found wonderful ways to incorporate energy education into their classrooms. Thanks for your efforts!

KEEP Graduate:
Robert Langton, Library Media Specialist
School:
Middleton High School
Best for Grade(s):
9 – 12
Adaptability:
Very flexible for all age groups
Lesson Plan/Activities:
"Evaluating Resources"
Curricular Overview:
"Evaluating Resources" is a lesson plan developed to be useful with any English, Social Studies, or Science class that wishes to work on research skills. It could be used as a preparation for a debate unit, a persuasive speech unit, a critical reading unit, a unit on environmental issues, and more. Students focus on an energy related issue, learn how and where to find appropriate information about it, and then use the information to defend it. As students conduct their investigation, they gain an awareness of the enormous complexity of issues surrounding energy as well as an appreciation for the importance of energy issues.

You can find out more about this promising practice when *Promising Energy Education Practices* is published in 1999.

Continued from page 1

plans, in formal and non-formal education settings are also needed.

Promising Energy Education Practices is for teachers looking for ideas of how to incorporate energy education into their curriculum. The focus of the book is to provide ideas through basic descriptions of the project or activities, along with teachers' suggestions for "next time" or possible adaptations. Cross-reference charts will interpret:

- where different activities can fit into different subject areas
- where activities and projects meet Wisconsin State Standards
- appropriateness for grade level (K-12)

Contact information, such as mailing address, e-mail, fax, and phone numbers will be provided. This energy education communication link among KEEP graduates will help build a network for energy educators across the state. It will also be made available on the Web in 1999.

To share energy education projects or activities, please fill out the form at the back of this newsletter and mail it back to us or contact Bonnie Koop at (715) 346-4320. It's easy. You give us the basic information and we'll take care of writing it up for the publication.

KEEP Calendar

September 1998
KEEP staff begins collecting promising practices from Wisconsin energy educators. If you have something to share, contact Bonnie Koop at (715) 346-4320.

September 1998
KEEP teacher inservices are ongoing throughout Wisconsin. Visit Energy Ed Online at www.energyed.ecw.org for specific dates and times.

October 1998
National Tour of Solar Homes on Saturday, October 17, 1998.

January 1999
Deadline for teachers and students to apply to present at the Student Environmental and Energy Action Conference.

March 1999
Deadline to register for the Student Environmental and Energy Action Conference in Stevens Point.

April 28, 1999
Student Environmental and Energy Action Conference in Stevens Point. *Promising Energy Education Practices* will be distributed to teachers attending the conference.

May 1999
Wisconsin Public Service will host a Solar Olympics in Green Bay.

May 1999
Promising Energy Education Practices will be available on the internet at Energy Ed Online, www.energyed.ecw.org.

From KEEP

Thank you! With your help, we are nearly done revising the *KEEP Activity Guide.* Your reviews played an instrumental role in letting us know what worked and what didn't. We appreciate your suggestions. Once again, we have included some of your ideas in the *Energy Sparks* section of this newsletter.

The guide has a bright new cover. We also redesigned the activity format. Although a number of you recommended that we divide the guide into two volumes, the expense of buying and mailing two sets of binders prevented us from doing this. We do have binders that are more manageable, we've reduced the size of the guide, and we've removed a couple of activities that you indicated were too difficult or irrelevant to your needs.

We also added a couple of new activities. "Viewpoints" involves students in researching printed and electronic media to analyze perspectives on global climate change. This activity is appropriate for high school students. For elementary school teachers, we developed an activity called "Exploring Heat." Teachers of young children will be pleased to know that we plan to publish a supplement to the guide that contains more activities for elementary students.

On a final note, I'd like to emphasize how much we'd like you to contribute to future editions of *KEEP On Going.* Our next newsletter will be published in the fall of 1999, so if you would like to share energy experiences or upcoming events please let us know by the end of the summer.

Here's wishing you an energetic spring and summer. We look forward to seeing you at the Student Environmental and Energy Action Conference and at the Midwest Renewable Energy Fair!

Jennie Lane

Jennie Lane
Program Coordinator

Continued from page 1

Teams will implement their plans the following school year. KEEP staff will provide consulting and support services to help them.

Community resource professionals, facility managers, and administrative staff are essential to the program's success. Community resource professionals and facility managers will provide technical assistance and model energy-related work skills to students. Administrators ensure school-wide awareness and support of the energy education project.

KEEP is looking for districts to participate in future institutes. If you would like your district to get involved, please share this information with your curriculum coordinator and superintendent. The Energy Center of Wisconsin and the Wisconsin Center for Environmental Education (UW-Stevens Point) are raising funds to provide participating teachers with stipends and university credit and to furnish each district with an energy resource kit. We encourage interested districts to join us in fundraising. ■

A Promising Update on Energy Education

In a few months, you will receive a free copy of *Promising Energy Education Practices: Creating a Network of Energy Educators.* This guide represents the successful efforts of teachers such as yourself to "energize" curriculum. KEEP graduates from around the state volunteered submissions to "Promising Practices" which include creative twists and adaptations to activities or projects dealing with energy. The guide will also be available on the Web at www.energyed.ecw.org.

The guide includes charts that cross-reference the practices to grade level, subject areas, academic standards, and KEEP activities. Each promising activity also includes contact information. We invite you to use these promising practices as creative springboards for designing even more activities, projects, and school-wide events in energy education.

We at KEEP would like to thank all of the teachers that shared their stories of success with energy education in their classrooms. You are an inspiration to us to KEEP on going.

Promising Practices is designed to be an evolving document. So let us hear about *your* promising practices. Write us at the KEEP office and give us the basic information and we'll make sure to include it in our next publication.

APPENDIX E

The Energy Center of Wisconsin Education Committee

Energy Center of Wisconsin - Education Committee

Mr. Jim Jenson
Gas and Electric Company
133 South Blair Street
Madison, WI 53703

Tehri Parker
Midwest Renewable Energy Association
P.O. Box 249
Amherst, WI 54406-0249

Jerry Young
Wisconsin Electric Power Company
231 West Michigan Street, P452
Milwaukee, WI 53203

RoseMarie Topinka
Wisconsin Public Power, Inc.
1425 Corporate Center Drive
Sun Prairie, WI 53590-9109

Okho Bohm
Alliant Gas & Electric – Wisconsin
708 NE 7th Street
Marion, WI 54950

Barbara Samuel
Wisconsin Energy Bureau, Dept. of Administration
P.O. Box 7868
Madison, WI 53707-7868

Liz Was
Xexoxial Endarchy, LTD.
Route 1, Box 131
LaFarge, WI 54639

Oscar Bloch
Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

Ilze Rukis
Wisconsin Public Service Corporation
P.O. Box 19001
Green Bay, WI 54307-9001

John Bachmeier
Northern States Power Company
100 North Barstow Street
Eau Claire, WI 54703

Kathy Kuntz
Energy Center of Wisconsin
595 Science Drive
Madison, WI 53711

Jennie Lane
Wisconsin K-12 Energy Education Program
UW-Stevens Point, LRC
Stevens Point, WI 54481

APPENDIX F

Sample Letter Sent to Teachers Inviting Them to Participate

KEEP

Wisconsin Center for Environmental Education & Energy Center of Wisconsin

Wisconsin K-12 Energy Education Program

Learning Resource Center
University of Wisconsin - Stevens Point

Stevens Point, WI 54481-3897

Phone: (715) 346-4770

Fax: (715) 346-4698

E-mail: energy@uwsp.edu

January 8, 1999

Dear Ms. Mercurio,

As a teacher who cares about energy education, you have actively involved your students in activities that will enhance their energy literacy. Your efforts have not gone unnoticed!

We at the Wisconsin Center for Environmental Education, K-12 Energy Education Program (KEEP) and the Energy Center of Wisconsin (ECW) would like to recognize you for your enthusiasm, creativity, and promise for bringing energy education into your classroom. You have been recognized as doing exceptional work in energy education through a recommendation from Kelly Zagrezebski whose KEEP course you took on February 21, 1998.

In the spring of 1999 an exciting new energy education resource will be published called ***Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators***. It will consist of innovative and adapted projects, activities and lessons being done by K-12 teachers and students that span across school curriculum and meet state standards. (Please refer to the enclosed article from the *KEEP On Going* newsletter to learn more about this exciting new resource).

In order for this publication to become a reality, we need to hear about *your* promising practices! I have included a survey questionnaire for you to share your successes with us in energy education. If you prefer, we can arrange a time to complete the form over the phone. In that case, please call me at (715) 346-4320 and I will call you back to gather the information on your project or activities. If sending in your description, please return it *as soon as possible* as this is a crucial time for compiling these materials.

I look forward to hearing from you! If you have any questions please call me at (715) 346-4320. Thank you for your efforts to help energize Wisconsin!

Sincerely,

Bonnie Koop, Program Assistant
Enclosures:
Questionnaire Form/ Call for Pictures
KEEP on Going! Newsletter Article

APPENDIX G

Promising Energy Education Practices Questionnaire

LET'S *KEEP UP* THE GOOD WORK!

Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators

We want you to share your successes in energy education with us!

The Wisconsin K-12 Energy Education Program (KEEP), the Energy Center of Wisconsin and the Wisconsin Center for Environmental Education are proud to announce an exciting new energy education resource: *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators.* To help strengthen and support the endeavors of K-12 teachers to incorporate energy into their classrooms we have created a networking tool for **YOU** to connect with hundreds of other energy educators across the state. This resource includes energy education projects, activities and lessons straight out of Wisconsin classrooms.

Promising Practices is designed to be an evolving document, so we want to continue to hear about your successes with energy education!

A "promising practice" can range anywhere from a ten-minute motivational introductory class activity to a year-long school-wide project. New or adapted classroom activities and lesson plans, in formal and non-formal educational settings are also needed.

Please share your successes in energy education with us by filling out the following Promising Energy Education Practice Questionnaire

Your Name: _____

Name of School: _____

School Address: _____

School Phone: _____ School Fax: _____

Email: _____

Activity, Project, or Lesson Title:

Please provide a description of the practice (continue on back if necessary):

Extra space for description:

This practice works best for the following grade levels:

____ K-2
____ 3-5
____ 6-8
____ 9-12
____ All grade levels
____ Other:_____

The practice fits into the following subject areas:

____ Science: (Circle those that apply: General, Physical, Earth/Space, Life/Environmental)
____ Environmental Education
____ Social Studies
____ Technology Education
____ Fine Arts
____ Language Arts
____ Mathematics
____ All Subject areas
____ Other:_____

Preparation time:_____ Time needed to complete project:_____

Please list any special considerations for materials, preparation, permissions, etc.:

Please list any suggestions or comments you may have regarding this promising practice or suggestions for next time:

Are you willing to be listed as a contact for networking?

Thank you for taking the time to complete this questionnaire and for helping to improve energy education in Wisconsin.

Please return to:

KEEP – LRC
University of Wisconsin – Stevens Point
Stevens Point WI, 54481
Phone: (715) 346-4320, E mail: ekoop976@uwsp.edu

APPENDIX H

Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators

Promising Energy Education Practices in Wisconsin

Creating a Network of Energy Educators

A Publication of the Energy Center of Wisconsin

Promising Energy Education Practices in Wisconsin

Creating a Network of Energy Educators

ENERGY CENTER OF WISCONSIN
We show you how

Energy Center of Wisconsin
595 Science Drive
Madison, WI 53711

Wisconsin Center for Environmental Education
College of Natural Resources
University of Wisconsin–Stevens Point
Stevens Point, WI 54481

Promising Energy Education Practices in Wisconsin

Produced under a 1998-99 grant from the
Wisconsin Environmental Education Board.

The Wisconsin K–12 Energy Education Program (KEEP)
414 Learning Resources Center
University of Wisconsin–Stevens Point
Stevens Point, WI 54481

Wisconsin K-12 Energy Education (KEEP) Staff

Randy Champeau, Energy Education Project Director
Jennie Lane, Coordinator of Curriculum Development
With contributions by Bonnie Koop, Energy Education Program Specialist, Wisconsin Center for Environmental Education

Promising Energy Education Practices Guide Production

Bonnie Koop, Coordinator of Guide Development
Kathy Kuntz, Project Manager, Energy Center of Wisconsin
Jeremy Kohler, Editor, Energy Center of Wisconsin
Cheryl Roberts-Jackson, Production Design, the fresh design company
Randy Champeau, Energy Education Project Director
Jennie Lane, Coordinator of Curriculum Development

Promising Practices Advisory Council and KEEP Adjunct Faculty

Kathy Kuntz, Energy Center of Wisconsin, Madison
Randy Champeau, Director, Wisconsin Center for Environmental Education, Stevens Point
Jennie Lane, KEEP Program Coordinator, Stevens Point
Sally Ellingboe, Director, Boston School Forest, Amherst Junction
Pat Arndt, Berlin High School, Berlin
Nick Baumgart, Florence High School, Florence
Terrie Cooper, Riveredge Nature Center, Newberg
David Engleson, Environmental Education Consultant, Sun Prairie
Floyd Henschel, UWSP Adjunct Faculty, Beaver Dam
Mary Duritsa-Hemshrot, UWSP Adjunct Faculty, Shell Lake
Jim Jenson, Madison Gas & Electric Company, Madison
Kelly Zagrzebski-Rodens, Wisconsin Public Service Corporation, Wausau
Pat Marinac, Appleton East High School, Appleton
Dennis Weibel, River Heights Elementary, Knapp
Tehri Parker, Midwest Renewable Energy Association, Amherst
Ann Quale, TJ Walker Middle School, Sturgeon Bay
Meta Reigel, UWSP Academic Staff, Stevens Point
Susan Stein, UW-Madison Speakers Bureau Director, Madison
Al Stenstrup, Wisconsin Department of Natural Resources, Madison
Steve Knudsen, UWSP Adjunct Faculty, Stevens Point
Dan York, Energy Center of Wisconsin, Madison
Don Lutz, Marathon Middle School, Marathon
Lynn Rinderle, Scholes Middle School, Milwaukee

About KEEP

To promote energy education in Wisconsin, the Wisconsin Center for Environmental Education (WCEE) proposed that a comprehensive K–12 Energy Education Program (KEEP) be developed and implemented. Key elements of KEEP are a Conceptual Guide with a scope and sequence framework, and an Activity Guide containing specific activities. In 1995, the Energy Center of Wisconsin, a private, nonprofit energy research, development, and demonstration organization agreed to fund this project. The Energy Center's members work collaboratively and include investor-owned electric and gas utilities, municipal utilities, public interest groups, businesses, the Public Service Commission of Wisconsin, and the University of Wisconsin–Madison. WCEE also obtained funding from the Wisconsin Environmental Education Board and the University of Wisconsin–Stevens Point. With initial funding secured, the WCEE hired a coordinator of curriculum development, a coordinator of research, and a program assistant in the summer of 1995, and the Wisconsin K–12 Energy Education Program began.

Mission Statement

KEEP is a statewide capacity building program designed to initiate and to facilitate the development, dissemination, implementation, and evaluation of energy education programs within Wisconsin schools.

Goal

The goal of KEEP is to improve and to increase energy education in Wisconsin K–12 schools by developing and implementing energy education resources and programs.

Table of Contents

Promising Energy Education Practices in Wisconsin
Creating a Network of Energy Educators

Events:
These events include several ways to encourage and celebrate energy literacy with students.

Professional Development:
These opportunities are for teachers seeking ways to increase their skills, knowledge, networks, and ideas for curriculum infusion in energy education.

Additional Resources:

Promising Practices is an evolving document. So let us hear about your promising practices! Simply fill out the Promising Practices form at the end of this book and send it in to us so we can include your ideas in our next issue.

Dedication

Promising Practices is dedicated to all Wisconsin energy educators who are making a brighter future for our youth.

Acknowledgments

The K-12 Energy Education Program (KEEP) would like to thank all of the teachers who shared their stories of success with energy education in their classrooms. You are an inspiration to us to KEEP on going! Your time and enthusiasm for participating in this book is greatly appreciated.

Special thanks to the Promising Practices Advisory Council and additional KEEP In-Service Teachers, whose professional suggestions and teacher recommendations helped guide the creation of this book; to the Energy Center of Wisconsin for their project assistance as well as financial and moral support; and to the Wisconsin Environmental Education Board for grant monies that helped make this document a reality.

Thanks to Jennie Lane, KEEP Program Coordinator, and to Dr. Randy Champeau, director of the Wisconsin Center for Environmental Education, for all of their creative insight, patience, and assistance in developing this book.

Promising Energy Education Practices: For Today and for the Future

Many teachers would agree that in the field of education, energy is a difficult topic to teach. It's invisible, yet we depend upon it everyday! As teachers prepare their students for life in the 21st century, energy-related environmental, social, and political problems make energy education more important than ever. Global warming, exponential population growth, and dwindling fossil fuels demand that students are conscious of the energy choices they make and the effects of those choices upon the future. In response to this challenge, some teachers have been working to increase the energy literacy of their students. Yet according to a 1998 study by the Energy Center of Wisconsin, 47 percent of Wisconsin teachers do not teach energy. By providing examples of teacher successes in energy education, it is our hope that others will be inspired to teach about energy.

This book was created to assist "energy educators." Up until now, no such effort has been made. K-12 teachers from around Wisconsin volunteered the submissions contained here, which give examples of how to teach about the relevance and importance of energy at every grade level in any subject area. These energy educators have successfully brought energy into their classrooms—from food chain dynamics to investigating renewable energy sources to learning how energy use has shaped our past and current environmental, political, and sociological issues. Promising energy education practices range from ten minute motivational activities to year-round projects, and include creative twists and adaptations to already existing activities or projects dealing with energy. These promising practices can be used as springboards for creating even more activities, projects, and lesson plans in energy education.

This book will be distributed to more than 1500 teachers in Wisconsin and will also be available on the Energy Center of Wisconsin's Energy Ed website: www.energyed.ecw.org. Building a network of energy educators throughout Wisconsin is a logical and important step in helping teachers to enhance the energy education they provide their students. It is our hope that these success stories will serve as a powerful tool for teachers.

Promising Practices is designed to be an evolving document. So let us hear about your promising practices! Simply fill out the Promising Practices form at the end of this book and return it to us. You give us the basic information and we'll make sure to include it in our next issue.

Thanks to all of you for helping to strengthen energy education in Wisconsin! Together we are building a brighter future for our students.

Teacher:
JoAnn Emerson
St. Mary's School, Marathon

An Energizing Writers' Workshop

Students get the chance to become historians as they explore the differences of how energy was used in the past and how it is used today. As part of a Writers' Workshop, students take two weeks to interview their grandparents or other senior citizens about the many different energy sources they used to complete different everyday tasks—such as travel, cooking, cleaning, and recreation. The grand finale of the Writers' Workshop is to write a story comparing how energy uses and sources were similar and different for the two generations. A creative extension for this activity is to compile these stories into a booklet to give to students' families.

Grades: 6-8

Preparation:
Prepare students in interview techniques

Activity duration:
Two weeks

Subject areas:
Social studies, Geography, Language arts, General science

Concept areas:
Consumption of energy resources, Quality of life

More information:

JoAnn Emerson
St. Mary's School
716 Market Street
Marathon, WI 54448
School Phone: (715) 443-3430

Energy and Algebra

Often the problems presented in second year algebra seem to have little or no connection to real life. Try spicing up lessons on fitted lines, trend analysis, and forecasts by infusing energy concepts into the unit and using graphic calculators and computer spreadsheets. Your students can research and analyze Wisconsin energy use to forecast energy trends for the future. This way students gain a perspective on energy use in their own back yard.

Divide the class into four groups. Each has the challenge of forecasting Wisconsin energy use in, for example, the year 2000. They develop their forecasts using data from different years:

Group 1—1985, 1986, 1987
Group 2—1994, 1995, 1996
Group 3—1970, 1975, 1980
Group 4—All years

Using both linear and nonlinear computer methods, students graph their predictions and present their findings to the class. Students are also challenged to describe the effects of predicted energy use on the people and environment of Wisconsin.

Resources include:

- *Wisconsin Energy Statistics* (published annually by the Wisconsin Energy Bureau)
- *Algebra 2 and Trigonometry* (Benson, Dodge, et. al., McDougal, Little and Company, 1991)
- TI-82 graphic calculators
- Microsoft Excel spreadsheets
- KEEP Activity, "Energy Futures"

Teacher:
Fred Johnson
Stevens Point Area High School,
Stevens Point

Grades: 9-12

Preparation:
2-5 hours

Activity duration:
Unit lesson of 5 days

Subject areas:
Mathematics

Concept areas:
Consumption of energy resources, Quality of life, Quality of the environment

More information:

Fred Johnson
Stevens Point Area High School
North Point Drive
Stevens Point, WI 54481
School phone: (715) 345-5598
Fax: 345-5408
fjohnson@wisp.k12.wi.us

Teacher:
Mary Forseth
Holy Name School,
Wausau

Grades: 3-5

Preparation:
Daily inclusion where needed

Activity duration:
On-going infusion

Subject areas:
General science, Social studies

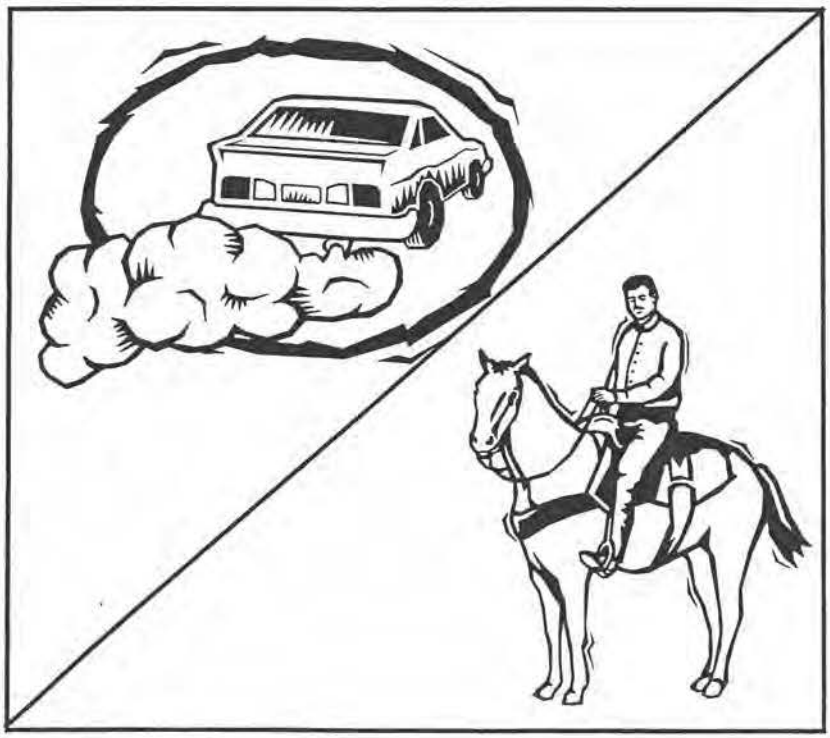
Concept areas:
Consumption of energy resources, Quality of life

More information:

Mary Forseth
Holy Name School
1122 South 9th Ave.
Wausau, WI 54401
School phone:
(715) 848-3281

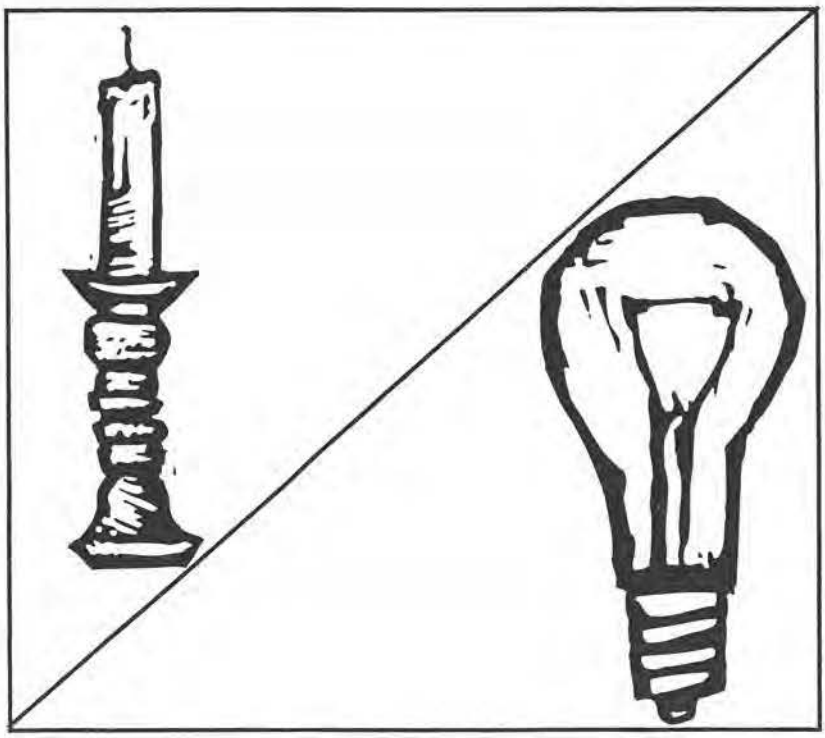
Energy Use Then and Now 1

As fifth graders study U.S. history in their social studies curriculum, they compare how energy was used and valued in the past with more recent times. When studying colonial times, for example, students research how colonists accomplished various tasks, what tools they used, and how they used energy (human power and other sources) to make these tasks possible. When studying the Industrial Revolution, the Great Depression, world wars, and the post-war economic boom, students review and track changes in energy use. While studying the 1970s students discuss the uses of energy and conservation, and compare them to the differences of the past. By studying the differences between energy use "then and now" students are able to have greater insight into the value of energy in our lives and the importance of energy conservation.



Energy Use Then and Now 2

Students compare energy use in the past and present by relating energy use to human population growth and societal changes. As directed by the KEEP activity "Energy Use Then and Now," students select a topic of energy use such as home heating, cooling, household chores, food preparation/preservation, entertainment or travel. Using the school library, they research how the activity or task was accomplished during four different periods in history: pre-agrarian, early agrarian, post-agrarian, and the modern technological era. As an enhancement to this activity, students investigate how past energy use affected the environment. At the end of the unit students present their understanding of energy use through time in various forms such as plays and multimedia video.



Teacher:
Susan Thompson
Riverside Elementary, Ringle

Grades: 6-8

Preparation:
Initially developed – 10 hours

Activity duration:
2 weeks

Subject areas:
Physical science, Earth science, Life science, Environmental science, Environmental education, Social studies, Technology education, Language arts, Mathematics

Concept areas:
Consumption of energy resources, Quality of life

More information:

Susan Thompson
Riverside Elementary
R12231 River Road
Ringle, WI 54471
School phone: (715) 359-2417
mtsllc@dwave.net

Teacher:
Pamela Lucas
Grand Avenue
High School,
Milwaukee

Grades: 9-10

Preparation:
Subject to teacher's timeframe and student cooperation

Activity duration:
15 weeks

Subject areas:
General science, Technology education, Environmental education, Mathematics, Fine arts, Architectural design, Language arts

Concept areas:
Management of energy resource use, Future outlooks for the development and use of energy resources

More information:

Pamela Lucas
Grand Avenue High School
2430 West Wisconsin Ave
Milwaukee, WI 53233
School phone: (414) 933-9900
pjlucas@execpc.com

Design Your Own Energy Efficient Home

Want to "build" your own dream home and design it to be energy efficient? Students are challenged to design an energy efficient home using everything they have learned about energy use, heating, and cooling. Design challenges include:

- Create exterior and interior designs that are energy efficient for the climate in which the home is "built"
- Design each of the rooms to include energy efficient lighting, windows, window decorations, flooring, heating, and cooling appliances
- Landscape the exterior to provide additional energy efficiency
- Estimate the cost of building the home
- Prepare a final report that describes the design and an explanation for why students decided to design the home using the materials they selected
- Give a presentation to peers about the design

Working in groups of up to eight, students choose the roles of architect, carpenter, insulation installer, window installer, heating/cooling contractor, flooring specialist, landscape artist, electrician, and plumber. Home designs are required to fit within a space of 24 x 24 inches. Early models are made of construction and manila paper, with the final model constructed of foam core board. Throughout the course of fifteen weeks, students learn about careers in home building from visiting local professionals who speak on professions such as insulating, window installation, and landscaping. Students take extra steps to research the design of their homes by collecting information from the local home improvement show, contacting building centers and other professionals, and using the Design Your Own Home Suite Programs.

This intensive project requires students to make decisions, work cooperatively in groups, solve problems, use community resources, and use their creativity and knowledge of energy and technology to make their "dream home" as energy efficient as possible.

Energy Awareness in Art Class 1

Don't Throw Energy Away: New Paper from Used

How much paper do students use? Have students track their paper use over the course of a week by carrying a Personal Paper Tally Sheet with them at all times, both at school and at home.

Paper types	SUN	MON	TUE	WED	THU	FRI	SAT	Total weight
Tissues								
Computer paper								
Class handouts and tests								
Toilet paper sheets								
Dinner napkins								
Newspapers/ magazines								
Bathroom paper towels								
Food packaging paper								
Notebook/ drawing paper								
Paper bags/ miscellaneous								

By extrapolating from a week of class data, students estimate how much paper the whole school uses in a year. And by comparing results from students who have different interests (such as math vs. art) students estimate what school activities use the most paper, and where waste can be reduced, reused, or recycled.

For a hands-on experience, students make recycled paper from waste like dryer lint, pine needles, grass cuttings, nettles, newspaper, and paper retrieved from recycling bins—there's plenty of room for creativity in making paper. Other recyclables such as buttons, string, sticks, bones, and food dye can be used to add artistic flair. Slick paints can elaborate the design elements.

Resources include:
Creative Handmade Paper, by Watson, and *Paper Making for Basketry and Crafts*, by L. Stearns.

Teacher:
Paula Wouts-Hanson
Berlin High School, Berlin

Grades: 10-12 (also appropriate for younger grades)

Preparation:
1-2 hours, with art activity add 2 hours

Activity duration:
2.5 to 3 weeks with art project (12-15 hours); two weeks for personal survey only

Subject areas:
Fine arts, Environmental education, Environmental science, Mathematics

Concept areas:
Consumption of energy resources, Quality of the environment

More information:

Paula Wouts-Hanson
Berlin High School
222 Memorial Drive
Berlin, WI 54923
School phone: (920) 361-2000
pollywog@wirural.net

Energy Awareness in Art Class 2

Use Renewable Energy: Pueblo-Style Wood Firing

Teacher:
Paula Wouts-Hanson
Berlin High School,
Berlin

Grades: 9-12

Preparation:
2-3 class periods for discussion of historical background, firing processes plus 6-7 hours for gathering equipment for firing, actual firing and cooling process plus follow-up

Activity duration:
4-6 hours in the classroom and 6 hours outdoors with drying time in between

Subject areas:
Fine arts, History, Environmental science, Mathematics

Concept areas:
Consumption of energy resources, Quality of life

More information:

Paula Wouts-Hanson
Berlin High School
222 Memorial Drive
Berlin, WI 54923
School phone: (920) 361-2000
pollywog@wirural.net

Culture, art, nature, and renewable energy. How can they all be intertwined? Try firing pottery in the traditional methods of the Pueblo Indians. Primitive pottery firing is a two-fold rewarding experience; there is the element of surprise where no one knows exactly what "gifts" the fire may provide, and there is the satisfaction in knowing that the energy used was all renewable.

As an introduction to traditional firing methods, students discover that American Indians such as the Anasazi had developed designs for energy efficient pottery. Coiled pottery was designed to create more surface heat for cooking, and also to remain cool when intended for cooling purposes. Bottoms of the pottery were well rounded for greater exposure to heat when cooking.

Students create their own small cooking pots, experimenting with earthenware clay and mixes of grog with clay and volcanic ash with clay. To fire the clay, students do not use a modern-day kiln, but instead fire their clay using traditional methods: through "ground firing" and "pit firing" in the outdoors, using energy from dead wood and dried horse and cow dung for fuel. Students also experiment with "barrel firing" using wood as the renewable energy source.

After firing, students compare traditional firing to that of an electric kiln in terms of how long firing takes and what temperatures are reached. Students also list pros and cons of traditional and modern methods. Students can learn to respect traditional methods of harnessing energy from nature and see how the rewards of using traditional methods can be well worth the extra effort.

Energy Use Around the World

Take your students on a journey around the world exploring different energy uses.

Solar Cooking—Explore the benefits and challenges of countries that use the sun for cooking. Students map areas in Pakistan, Indonesia, Zimbabwe/Africa and Managua/Nicaragua where they think solar ovens would work best. Students also build solar cookers of their own. Participate in the Cans for Cookers Project (Persons Helping People, St. Paul, Minnesota)—students collect aluminum cans for recycling to help buy solar ovens for people in third world countries.

Wind Power—Students use the Internet to investigate wind turbines used in Europe and California. Study what influences site selection for wind turbines, how turbines use the wind's kinetic energy to produce electricity, and the advantages and disadvantages of using wind to generate electricity.

Geothermal Energy—Students "travel" to Iceland through hands-on projects exploring geothermal dynamics. They learn how energy can be extracted from the Earth's center, how geothermal energy is a possible renewable energy choice, and how Iceland has harnessed volcanism to harness this energy.

Hydro Power—Learn about hydroelectric power plants and the impact they have on indigenous people in China. Investigate how electricity is generated in hydroelectric plants, the advantages and disadvantages of using hydroelectric power, and why certain cultures oppose hydroelectric power.

Nuclear Power—Students discover how a nuclear power plant works, learn about problems of radioactive waste disposal, and investigate case studies of nuclear accidents and their aftermath (in Russia and the United States). At the end of their exploration, students conduct an open debate to question if more nuclear power plants should be built around the world. Students are challenged to come up with evidence both for and against using nuclear power.

Through these explorations, students discover that although cultures around the world are incredibly diverse, our energy needs and issues aren't all that different.

Teacher:
Jeanine Meyer Staab
Medford Area Middle School,
Medford

Grades: 7-8

Preparation:
Each section will vary with amount of preparation for background information, special projects, etc.

Activity duration:
Each section: two to four 50-minute class periods

Subject areas:
Social studies, General science, Environmental science, Technology education, Environmental education, Language art

Concept areas:
Development of energy resources, Consumption of energy resources, Management of energy resource use, Future outlooks for the development and use of energy resources

More information and resource list:

Jeanine Meyer Staab
Medford Area Middle School
509 East Clark Street
Medford, WI 54451
School phone: (715) 748-2516
Fax: 748-1213
jeanine5@hotmail.com

Teacher:
Robert Langdon,
Library Media Specialist
Middleton High School,
Middleton

Grades: 9-12 (very flexible for all age groups)

Preparation:
Varies with organization of your unit. Suggested meeting with Library Media Specialist

Activity duration:
5 to 6 class periods (adaptable)

Subject areas:
Library research skills, Problem solving

Concept areas:
Development of energy resources, Consumption of energy resources, Quality of life, Quality of the environment

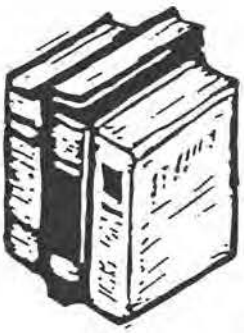
More information:

Robert Langdon
Middleton High School
7400 North Avenue
Middleton, WI 53562
School phone: (608) 828-1620
langdon@danenet.wicip.org

Evaluating Resources

One of the best resources in schools for information on energy is the Library Media Specialist who, at this school, created a lesson plan called Evaluating Resources. Its first goal is to provide students and teachers with a bibliography of energy information resources available in the school library. A second aim is to help students learn how to critically evaluate the information available in their library and elsewhere. For example, you can use the Evaluating Resources lesson plan to help students work on research skills in English, Social Studies, or Science classes. It can also be used to prepare for units on debate, persuasive speech, critical reading, and environmental issues.

Students focus on an energy-related issue, learn how and where to find appropriate information about it, and then use the information to defend it. As students conduct their investigations, they gain an awareness of the enormous complexity of issues surrounding energy as well as an appreciation for the importance of energy issues. Evaluating Resources can not only strengthen students' energy literacy, but also build strong critical-thinking and problem-solving skills.



Generating Less Household Waste—Reduce!

One of the largest contributors to solid waste is overpackaging of items that we buy every day. As part of a lesson on solid waste management, students learn how they can save energy by becoming smarter consumers. By comparing products that are overpackaged with those that are more environmentally friendly, they explore how they can generate less household waste. Students learn to identify packaging material that can be recycled or reused, and how recycling and reuse cuts waste at home and saves money for city trash collectors. Some possible extensions to this activity include having students conduct a personal home inventory of everything that gets thrown away, with the challenge of finding ways to reduce, reuse, or recycle those items. Students could also exercise their consumer voice by writing to a company that overpackages products and asking them to eliminate excess packaging. Students might also make specific suggestions as to how a company can make its products more environmentally friendly.

Teacher:
Ken Mercier
Kewaunee High School, Kewaunee

Grades: 6-12

Preparation:
30 minutes

Activity duration:
1-2 periods

Subject areas:
Physical science, Earth/space science, Environmental education

Concept areas:
Consumption of energy resources, Quality of life, Quality of the environment, Management of energy resource use

More information:

Ken Mercier
Kewaunee High School
911 Third Street
Kewaunee, WI 54216
School phone: (920) 388-2951
lukemercier@yahoo.com

Concept areas:
Consumption of energy Resources, Quality of life, Quality of the environment, Management of energy resource use

Meet the Mad Scientist!
Grades: 3-5
Preparation:
30 minutes (more if creating props)
Activity duration:
45-60 minutes
Subject areas:
Environmental science, Environmental education, Social studies

Electrifying Decisions
Grades: 6-8
Preparation:
Minimal
Activity duration:
45-60 minutes
Subject areas:
Environmental science, Environmental education, Social studies

Energy Alternatives: Looking to the Future
Grades: 6-8
Preparation:
Minimal
Activity duration:
1-2 class periods
Subject areas:
Environmental science, Environmental education, Language arts

Get Mad About Energy!

Would you like to meet the Mad Scientist who has stuck her finger into the socket one too many times, find out why Pleasantville has become an unpleasant place, or explore alternative energy sources for the year 2020? These three interactive lessons from the Cable Natural History Museum can get students "mad" about energy!

Meet the Mad Scientist!
This is a theatrical character activity. Through experiments, students find out how their energy use affects the environment and how they can make positive changes by changing their energy consumption. Topics include global climate change, acid rain, and mercury contamination in Wisconsin's lakes.

Electrifying Decisions
Students help make environmental decisions in a mock court trial, where students explore who has made Pleasantville an unpleasant place to live. Students assume the roles of judge, lawyers, witnesses, bailiff, and jury. ACME Power Company is charged with polluting Pleasantville, but testimonies reveal that residents are also to blame. Students realize that when we point our fingers at possible polluters we often need to point back at ourselves as part of the problem—and the solution. Try providing props such as old suit jackets for the lawyers, a robe and gavel for the judge, and a courtroom setup. Be sure to let the lawyers cross examine their witnesses!

Energy Alternatives: Looking to the Future
In this role-playing activity the year is 2020 and the United States has almost run out of oil. A congressional subcommittee of three students must organize hearings on alternative energy sources to find out how to provide electricity and gasoline. Other students split into groups to represent solar, wind, water, coal, and nuclear energy. After researching the pros and cons of their energy sources, presentations are prepared and given to the subcommittee which then must decide what will be the best energy sources to use for a more sustainable future.

More information and lesson plans:
Sue Benson
Cable Natural History Museum
P.O. Box 416
Cable, WI 54821
(715) 798-3890
cnhmluna@win.bright.net

The Journey of Garbage:

From the Recycling Bin to the Store Shelf

What better way to conserve energy than to recycle the materials we use? The mission of these high school science club members is to spread the good news about recycling. The club performs a series of vignettes for area grade school students in which club members involve the audience in activities that emphasize the importance of energy and resource conservation, and how recycling accomplishes this.

During the show the performers educate students on the materials they can recycle, what happens to these materials, and the new products that are produced from them. They also demonstrate how recycling is creating new businesses and making existing businesses more profitable. One goal is to have audiences learn the value of recycling and become lifelong recyclers. Club members also point out the connection between energy and solid waste. In their vignette show, they explain "how the recycling of one glass bottle results in saving enough electricity to light a 100 watt bulb for four hours. If everyone in your class were to recycle one glass bottle, this would save enough electricity to light that bulb for five days. That's the value of recycling!" It is also their hope that other schools will follow their model and perform recycling shows for grade schools in their community. The show and script won the Governor's 1998 Waste Reduction and Recycling Award. The script can be found at: http://muhs.edu/activities/riverstudies/recycle.html.

To adapt this activity to the classroom, divide your class into groups—each group studies a commonly recycled material and then presents a vignette to the rest of the class.

Teacher:
Gerald Friday
Marquette High School, Milwaukee

Grades: 5-12 is best for presenting. All grades enjoy watching the show.

Preparation:
Enough time for students to learn and practice the script

Activity duration:
30 minutes, longer for older age groups

Subject areas:
Science, Environmental education, Technology education, Fine arts, Language arts

Concept areas:
Consumption of energy resources, Quality of life, Quality of the environment, Management of energy resource use

More information:

Gerald Friday
Marquette High School, Milwaukee
Phone: (414) 933-7220
friday@muhs.edu

Teacher:
Tricia Retzlaff
Lakeview Elementary,
Neenah

Energy Ice Cream

What's a cool way to study human powered energy? Make ice cream the old fashioned way—using people power! Fifth graders got to eat the results of their investigation when they made coffee-can ice cream. Here is their recipe for a "cool" way to study energy:

Mix milk, cream, vanilla, and optional food coloring together. Pour mixture into baby food jars in equal proportions. Tightly screw the lids on the jars and pack them into coffee cans filled with ice and rock salt. Roll the coffee can on the floor between students for 15 to 20 minutes. Stop to check the thickness of the ice cream in the jars. If necessary, dump any excess water and add additional ice and rock salt. Continue to roll the cans for an additional five to ten minutes. When ice cream is ready, eat and enjoy!

Grades: 4-12

Materials:

3 one-pound coffee cans with lids
Baby food jars with lids
Food coloring (optional)
Ice
Rock salt
Spoons

Ingredients: (enough for four students)

1/2 teaspoon vanilla
1 cup cream
1 cup milk
1/2 cup Sugar

Activity duration:
One class period

Subject areas:
General science, History

Concept areas:
Definition and sources of energy

More information:

Tricia Retzlaff
Lakeview Elementary
Neenah, WI 54956
School phone:
(902) 751-6965 ext. 130
tretzlaff@neenah.k12.wi.us

Energy and Agriculture

Wisconsin has a rich cultural and economic history tied to agriculture. Lessons on agriculture under the thematic umbrella of "Appreciating Energy" highlights basic energy concepts and emphasizes an importance for energy conservation. To illustrate that energy is the ability to do work, students focus on how energy from the sun, from different fuel sources, and from humans and other animals is converted to agricultural products. Audio-visual materials about dairy farming, cranberry production, tree farming, and vegetable production in Wisconsin and around the country supplement the lessons. To further enhance learning, students visit a local farm and a local grocery store. By taking these special field trips students gain first-hand experience in seeing the energy that goes into producing food and bringing it to their lunchboxes.

A fun and interactive food chain game can illustrate how energy flows through natural communities, helping students understand the loss of energy through energy transfers. Students also learn how most of the food we eat comes from simple food chains derived from human-controlled agricultural ecosystems.

To help students develop and apply an appreciation for the energy used to produce the food they eat every day, students draw creative cartoons illustrating the differences between a child that wastes energy and a child that conserves energy. They write personal commitment statements of how they can change their own wasteful behavior to more energy-appreciative and energy-conserving behavior.

"Cool" Agriculture Facts

- 180 cows use their energy to make 3,000,000 lbs. of milk every year (8.6 lbs.=1 gallon)
- One farmer feeds 100 people
- 470 acres of arable farm land will use 8000 gallons of diesel fuel per year (eight or nine gallons per hour of use) for start to finish production of crops used to feed dairy cows.

Teacher:
Marilyn Lienke
Jefferson Elementary,
Beaver Dam

Grade: 4

Preparation:
Subject to teacher's timeframe

Activity duration:
Integrated throughout unit

Subject areas:
General science, Technology education, Environmental education, Mathematics, Fine arts, Language arts

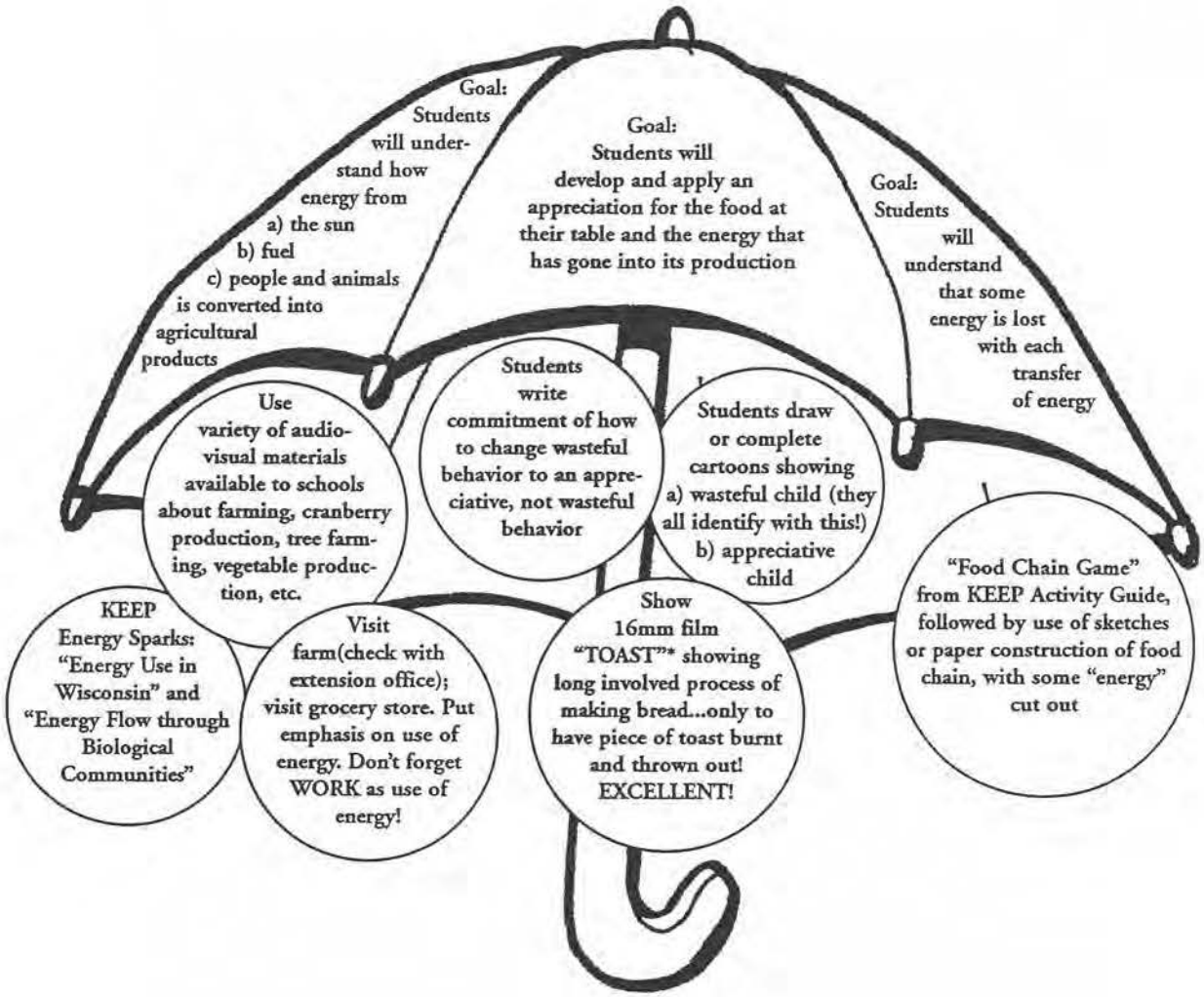
Concept areas:
Energy flow in living systems, Consumption of energy resources, Quality of life

More information:

Marilyn Lienke
Jefferson Elementary
301 Brodke St.
Beaver Dam, WI 53916
School phone: (920) 885-7336
ext 302

Energy and Agriculture, Continued

Activities under the umbrella help students appreciate the energy involved in food production.



*Available from INMS Instructional Media Services, 2170 South 116 Street, West Allis Wisconsin. Tel.: 800-605-8105 or 414-541-8008

Energy Jeopardy

What is a fun and interactive way to review energy concepts, and a great assessment method for the teacher? Play Energy Jeopardy! Divide your students into two or more teams. On the board, write the question categories, and the amount of money allotted to each question as they increase in difficulty:

Energy Terms	Fossil Fuels	Solar Energy Uses	Solar Energy Principles	Pot Luck
$100	$100	$100	$100	$100
$200	$200	$200	$200	$200
$300	$300	$300	$300	$300
$400	$400	$400	$400	$400
$500	$500	$500	$500	$500

One student can keep score. Teams alternate selecting questions ("I'll take Fossil Fuels for $400!"). Either the teacher or another student can be the game show host who reads the questions.

After a question is read, all teams quietly discuss the answer, and write it on a piece of paper. The one who selected question then gives an answer. If the answer incorrect, another team gets a chance to claim the points with a correct answer. Once a question has been answered correctly, its value is erased from the board.

Here are some sample questions:

- Energy Terms—$100: Define energy.
  Answer: Energy is the ability to do work.
- Fossil Fuels—$200: Of all the fossil fuels, which is the cleanest when burned?
  Answer: Natural Gas
- Solar Energy Principles—$300: What do solar cells do?
  Answer: Convert sunlight into energy.
- Pot Luck—$200: Name three sources of biomass energy.
  Answer: (any three) Wood, grasses, fruits, vegetables, dung, sawdust, garbage, sewage.

All players can earn extra points for their efforts, and winning teams get $100,000 Grand candy bars (for energy!), pencils, extra points, or other creative prizes. Students can help prepare for the game by writing the questions. This can also be used as a head-to-head energy concept challenge session. Energy Jeopardy can also be adapted as a review for almost any topic area.

Teacher:
Suzanne Deans
Burlington High School, Burlington

Grades: EEN, 9-12 (adaptable for all age groups)

Preparation:
Minimal

Activity duration:
One class period

Subject areas:
General science, Chemistry, Technology education, Environmental education (can be used in any subject area)

Concept areas:
May cover all energy concept areas

More information:

Suzanne Deans
Burlington High School
225 Robert Street
Burlington, WI 53105
School phone: (414) 763-0200
Fax: 414-763-0216
sdeans@wi.net

Teacher:
Jami Hoekstra Collins
Marshall Early Learning Center,
Marshall

Grades: Pre-kindergarten, Kindergarten

Preparation:
Minimal

Activity duration:
One week

Subject areas:
General science, Fine arts

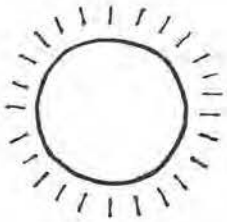
Concept areas:
Definition and sources of energy

More information:

Jami Hoekstra Collins
Marshall Early Learning Center
369 School Street
Marshall, WI 53559
School phone: (608) 655-3466
hoek@marshall.k12.wi.us

These three kid-tested activities are from the book *Mudpies to Magnets*, by Robert A. Williams, Robert E. Rockwell, and Elizabeth A. Sherwood (1987, Gryphon House, Inc.)

Fun in the Sun



As Pre-kindergarten is the beginning of "formal" education for children, so the sun is the first experience of energy to a child. Through different experiments, activities, stories, and songs this pre-kindergarten unit strives to help children understand that the sun is the Earth's primary source of energy upon which all life depends, and to develop an appreciation for its energy.

Sunny Side Up

Give each child a piece colored construction paper (purple usually works best) to be placed in the sun. Provide a collection of various items that children can arrange on their paper. Ask them what they think might happen to their paper with these objects on it when left in the sun, and possible reasons why. Several hours later (or the next day) children remove their objects to find an imprint of the objects on the paper (the sun faded the rest of the paper). Explain that the sun gives off energy to bleach colors wherever its rays can reach, and will not penetrate through some other materials. Have them consider what happens to living things without sunlight.

Children can also cover up an area of grass on the playground with a piece of wood or other heavy object, so that it remains in place for several days. Each day observe the grass underneath and have children note how it loses its green color. Then remove the object and watch the grass become green again. How long did it take for the color to go away, and how long to reappear?

Plant Maze

This experiment investigates how plants react to the stimulus of phototropism, or the ability to seek out sunlight—even if it is hard to find! Give each small group of children a shoebox and a small piece of cardboard paper. Together the group creates a maze within the box with a green vine plant at one end of the box and a small hole at the other. Tape the lid of the box shut. Each day let the children check on the plant and draw a picture of its development. What is happening? Why? Try placing boxes in different locations around the room that receive different amounts of sunlight.

Science Backpack

Each student gets to take home the "science backpack," a tool to attract parental involvement in learning. During a unit on energy, it contains a survey asking families to identify the heat, light, and general energy sources that they used on a particular evening. Children then share the results with the rest of the class. The results are incorporated into a class graph using the children's school photographs under each energy source they listed in the survey. Each day the class totals the new numbers.

Assessing Solar Smarts

Students can get hands-on learning by constructing shoebox solar cookers. An exploration table is set up where students are encouraged to create solar cookers with various materials to improve designs and to make comparisons in cooking times, temperatures, etc. Experimenting with designs and "cooking" in them generates active involvement and enthusiasm, and helps to reinforce energy concepts learned in previous lessons.

To assess student learning and keep students actively involved, students fill out an Energy Learning Log to summarize what they learned, including illustrations of their completed solar cookers. Students are also responsible for completing an individual Shoebox Solar Cooker Assessment Rubric:

Criteria	Excellent (4)	Good (3)	Fair (2)	Poor (1)
Criteria of and explanation of a solar cooker	Followed all of the directions correctly	Followed most of the directions correctly	Followed some of the directions correctly	Most of the solar cooker not complete
	Fully participating member of the group	Usually cooperated with the group	Somewhat cooperative in the group	Did not cooperate with the group
	Clearly explained and demonstrated how the solar cooker works	Showed basic understanding of how the solar cooker works	Showed some understanding of how the solar cooker works	Showed a lack of understanding of how the solar cooker works

Teacher:
Cynthia Theorin
Clear Lake Elementary School,
Clear Lake

Grades: 4-6

Preparation:
30 minutes

Activity duration:
4 hours

Subject areas:
General science, Technology education, Earth science, Environmental education, Mathematics, Fine arts, Language arts

Concept areas:
Development of energy resources, Management of energy resource use, Future outlooks for the development and use of energy resources

More information:

Cynthia Theorin
Clear Lake Elementary School
135 - 8th Street
Clear Lake, WI 54405
School phone: (715) 263-2117
ctheorin@clearlake.k12.wi.us

Teacher:
Allan Clarke
St. Mary Central
High School,
Menasha

Fantastic Photovoltaics

Grades: 9-12, adaptable for younger students

Activity duration:
Two to three class periods

Subject areas:
Environmental science, Environmental education, Chemistry, Physics

Concept areas:
Definition and sources of energy, Natural laws that govern energy

More information:

Allan Clarke
St. Mary Central High School
1050 Zephyr Drive
Neenah, WI 54956
School Phone: (920) 722-7796
arcsmc@aol.com

How can you engage students in learning about the exciting chemistry of photovoltaics? This teacher captures the attention of his students by helping them learn factual "one-liners" that cover the process of creating renewable energy through photovoltaics. He uses twenty steps to explain the science of photovoltaics, and students memorize one-liners as the lesson progresses. At the end of the lesson, students review and reinforce concepts by sharing their one-liners with the rest of the class. Students also perform a fun and interactive skit (adapted from the *KEEP Activity Guide*) where they become photons and electrons in a photovoltaic cell. You can follow this activity with a 15-minute video on solar energy from Channel One. See their website at:
www.k-iii.com/education/channel1/CHANNEL 1.HTML.

Photo courtesy of Allan Clarke, SMC Solar Center

Junior Solar Sprint

Of all the energy education projects I have done with my middle school students, Junior Solar Sprint generates by far the highest level of student interest and creativity.

—Carol Welling

These students look forward to learning about energy—the "hands-on" way! Solar Sprint is a multifaceted problem-solving project in which students design, build, and race model cars that are exclusively powered with solar electric energy. All students begin the project with an identical power source: equal sized electric motors and solar panels. To engineer the fastest car possible students learn about and apply their understanding of photovoltaics, simple machines, motions, forces, and optimum solar angles.

Project criteria include:

- Building a car with only recycled/reused materials such as tape spools, rubber bands, styrofoam packing trays, cardboard, plastic soda bottles, drinking straws, and building insulation foam
- Keeping car design within size parameters of 30 cm wide and 30 cm high
- Working cooperatively with a partner for the six weeks of the project
- Self-grading using a "Solar Sprint Car Self Grading Rubric"

On the day of the big race, winners are selected in these categories:

- Fastest car in your class period
- Fastest car with the body, chassis, and wheels all made from recycled materials
- Most innovative design
- Craftsmanship award

This project requires a fair amount of teacher planning. Initial costs are somewhat high, primarily for the cost of a class set of solar panels, but it can be well worth the effort for the excitement and benefit of this learning experience. The best time to do Junior Solar Sprint is at the end of the school year so that you can take advantage of the higher sun.

Teacher:
Carol Welling
West Junior High,
Wisconsin Rapids

Grades: 6-8

Preparation:
Subject to teacher's timeframe and student cooperation

Activity duration:
6 weeks

Subject areas:
General science, Technology education, Environmental education, Mathematics, Fine arts

Concept areas:
Energy flow in systems, Development of energy resources

More information:

Carol Welling
West Junior High
1921 27th Ave. S.
Wisconsin Rapids, WI 54495
School phone: (715) 422-6200
bjwelling@yahoo.com

For information on purchasing solar panels contact the Pitsco Company, 800-835-0686, www.pitsco.com

SolarWise for Schools Program

The Wisconsin Public Service Community Foundation's SolarWise for Schools Program™ places photovoltaic (PV) systems on high schools in northern Wisconsin that have electrical service from Wisconsin Public Service Corporation. The solar panels generate four kilowatts of power on sunny days, enough to light six classrooms. The PVs reduce the amount of fossil fuel used by the schools and can save up to $400 annually—not to mention 12,458 pounds of carbon dioxide, 58 pounds of sulfur dioxide, 67 pounds of nitrogen oxide, and 2 pounds of particulate emissions! The panels on each school have the potential to produce about 6500 kilowatt hours of energy a year—about the same as one home.

Participating schools also receive a three-week renewable energy curriculum that includes audiovisual materials and laboratory equipment, giving students hands-on experience with solar energy. Students participate in the annual Solar Olympics, a solar energy expo and competition held in May. Each school designs and constructs a solar cooker, a solar water heater, and a solar powered car. Students also create posters and write essays with a solar theme. Solar Jeopardy, an energy quiz game, rounds out the competition.

SolarWise wants to install solar energy systems in all 63 schools in the WPSC service territory. Funding comes from voluntary donations from utility customers and government sources.

More information:

Chip Bircher, Program Manager
Wisconsin Public Service
Office: (920) 433-5518
cbirche@wpsr.com
www.wpsr.com

Shining Light on Photovoltaics: The Sun Chaser

The Sun Chaser is a traveling renewable energy exhibit and photovoltaic power unit provided by the nonprofit Midwest Renewable Energy Association. It can be used to power events, teach about renewable energy, and demonstrate photovoltaic technologies. Equipment on the Sun Chaser includes photovoltaic panels, inverters, a power center, and batteries. Future additions will include educational demonstrations/models and interpretive signs.

MREA instructors can visit middle and high school classes and give lessons demonstrating the Sun Chaser. Alternatively, teachers can get training and keep the Sun Chaser for up to a week to use with their classes as they see fit.

A grant from the National Resources Foundation of Wisconsin has allowed MREA to offer this exciting educational experience to schools for a nominal charge.

You can also use the Sun Chaser to power educational events. It has been used at a several events around Wisconsin and Minnesota such as the Protect the Earth Gathering (Mole Lake, MN), WOJB public radio Off the Grid Day (Hayward, WI) and the Amherst Energy Fair (Amherst, WI).

To bring the Sun Chaser to your school or special event, contact:

MREA
P.O. Box 249
Amherst, WI 54406
Phone: (715) 592-6595
Fax: (715) 592-6596
mreainfo@wi-net.com
www.the-mrea.org

Concept areas:
Energy flow in systems, Development of energy resources, Future outlooks for the development and use of energy resources

More information:

Environmental Science students at Wausau East High School plan to bring the Sun Chaser to elementary schools in Central Wisconsin and give lessons on renewable energy. For more information on having these students come to your school contact:

Steve Hansen
Wausau East High School
Wausau, WI 54403
School phone: (715) 261-3500

Teacher:
James Kraft
Green Bay East High School,
Green Bay

Grades: 9-12

Preparation:
1 to 1.5 years

Activity duration:
1 to 1.5 years

Subject areas:
Technology education, Chemistry, Physics, Conservation, Agriculture, Environmental education, Fine arts

Concept areas:
Development of energy resources, Consumption of energy resources, Management of energy resource use, Future outlooks for the development and use of energy resources

More information:

James Kraft
Green Bay East High School
1415 East Walnut Street
Green Bay, WI 54301
School phone: (920) 448-2090

The Electric Truck—A Solution to Pollution!

As world populations rise, so do the numbers of gas-guzzling, toxic-fume-spewing automobiles that threaten our clean air and protective ozone layer. Looking towards a cleaner future, 11th grade technology education and chemistry students converted a light weight gas powered pick-up truck into an electric vehicle (EV) that runs on renewable fuel. They received technical assistance from a utility, the Wisconsin Public Service Corporation (WPS), as well as funding from the Wisconsin Environmental Education Board.

The batteries on the truck are powered by a solar panel installed on the school roof, making the truck a "solar powered" EV—among the cleanest and most environmentally friendly forms of transportation. EVs fill an important niche in the transportation sector: 90 percent of all trips in the U.S. are under 10 miles and cars average up to 30 miles per day. These short trips, where the car barely warms up, contribute more air pollution per mile than long trips. EVs that have 60 to 70 mile ranges make an excellent second vehicle for the vast majority of drivers.

In the spring of 1999, the students who worked on the project will take the EV as a demonstration vehicle to ten high schools that are up to 30 minutes away. They'll give tours of the truck and discuss the advantages and disadvantages of EVs. In a greater effort for broad community environmental education, they plan to sell the truck to someone in the community at a very affordable price—about $12,000 to $14,000. This lucky local citizen will be able to spread the good news about EVs by driving this traveling billboard.

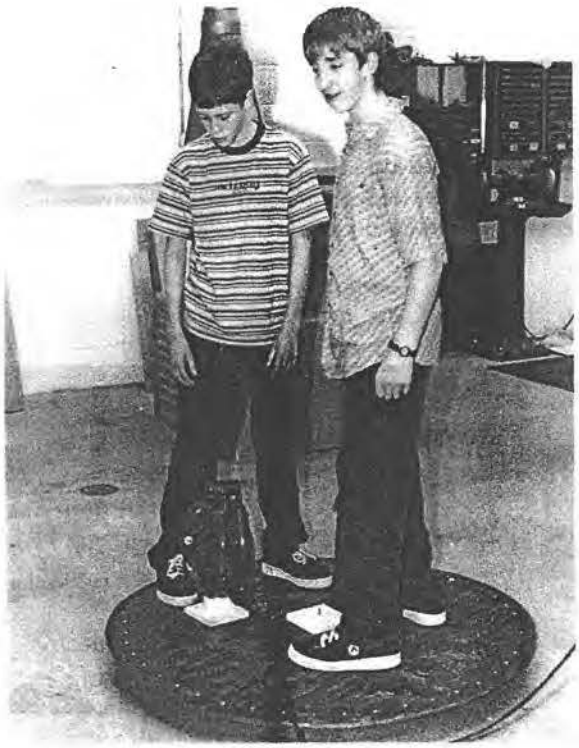
Electric conversion kits make it fairly easy for a high school shop to do a full conversion. The students who performed the conversion say they hope their success will spark similar projects.

Floating on Energy!

Teacher:
Wayne Fish
James Williams Jr. High, Rhinelander

In an activity to learn about the power of electricity and compressed air, students build an impressive, floating "hovercraft." They construct the hovercraft using a circular piece of sturdy plywood five feet in diameter and attaching a 6 mil polyethylene plastic bag underneath. By connecting it to an electric leaf blower, they direct air to blow into the bag—the hovercraft lifts off of the floor and has enough energy to hold the weight of two students.

Students can also rotate through work stations exploring a visible engine that changes chemical energy into electrical energy, nomadics, and alternative energy sources. Students are challenged to design their own energy project and to explain the associated energy concepts and jobs related to it. Some interesting energy projects students have completed in the past include windmills, models of how a power plant works, earth shelter homes, solar collectors, and building robots from electrical kits.



Grade: 8

Preparation:
1-2 hours

Activity duration:
One to two class periods

Subject areas:
General science, Technology education, Mathematics, Architectural design, Language arts

Concept areas:
Natural laws that govern energy, Energy flow in systems

More information:

Wayne Fish
James Williams Jr. High
915 Acacia Lane
Rhinelander, WI 54501
School phone: (715) 369-1314
fishway@rhinelander.k12.wi.us

A Grand New Energy Conference

As students learn about energy efficiency, they can develop an understanding of their own values regarding energy consumption—and they can share their awareness with other members of the community and other students around the state by holding an energy conference. An event like the *Grand New Energy Conference* recently held in Milwaukee—created by students, for students—gives students a chance to develop valuable professional skills.

Students are in charge of all conference planning, and split into teams to get the work done. There can be an Organization Team, a Publishing Team, a Production Team, and a Design Team. Over several months students develop conference presentations and exhibits, design materials from T-shirts to folders, write press releases, and invite other students as well as community leaders to the conference from across the state. Conference attendees spend a day learning about energy issues from their peers.

More information:

Kathy Kuntz
Energy Center of Wisconsin
595 Science Drive
Madison, WI 53711
Office: (608) 238-8276, ext. 42
Fax: (608)238-8733
kkuntz@ecw.org

or

Grand Avenue High School
2430 West Wisconsin Ave
Milwaukee, WI 53233
School Phone: (414) 933-9900

An Energized Earth Day

For Earth Day in 1998 the entire school celebrated in a day of events that focused on energy. Students used fun and exciting hands-on experiences to learn about different forms of energy, energy use, and solid waste problems and management. Highlights included:

- Investigating energy that comes from food by cutting out and drawing pictures of favorite foods and favorite activities
- Exploring how physical energy put their food energy into action by doing a fun 30-minute workout
- Experimenting with solar energy by using it to heat water and cook eggs; and using wind energy to fly kites
- Writing haikus to reflect on energy concepts:
  A Windy Haiku, by Lisa Mercurio-Wroblewski
  The wind blows and blows
  Sending shivers down my spine
  Winter hanging on
- Participating in a creative and educational play, *Trouble at the Fallen R Ranch* by L. Mercurio. This play addressed the problems of solid waste management and the solutions of the "three R's" (recycling, reusing, and reducing). The production included colorful characters such as Sheriff Reese Use, the villains Just Throw Away and Dona Care, the citizens Ima Farmer and Telly Teacher, and the hero: a tall dark stranger named Gotta Recycle.

Teachers and students encourage each other to make every day an energized earth day in their daily lives.

Teacher:
Lisa Mercurio-Wroblewski
St. Aldabert School, Rosholt

Grades: K-8

Preparation:
2-3 hours to gather and organize materials

Activity duration:
One day

Subject areas:
General science, Environmental education, Social studies, Technology education, Fine arts, Problem solving

Concept areas:
Definition and sources of energy, Development of energy resources, Consumption of energy resources, Quality of the environment

More information:

Lisa Mercurio-Wroblewski
St. Aldabert School
3314 St Aldabert Road
Rosholt, WI 54473
School Phone: (715) 677-4517

Teacher:
Kris Shilling
Rice Lake Middle School,
Rice Lake

Recycle Sale!

Grade: 7

Preparation:
One to two weeks for collecting items, publicity and sale preparation

Activity duration:
One day for the sale, integration for remaining recycling project

Subject areas:
Environmental education, Language arts, Math

Concept areas:
Consumption of energy resources, Quality of life, Quality of the environment

More information:

Kris Shilling
Rice Lake Middle School
204 Cameron Road
Rice Lake, WI 54868
School phone: (715) 234-8156
kriss@riasd.ricelake.k12.wi.us

Students hold a Recycle Sale on a Saturday during Earth Week in April. The sale educates both students and the public on saving energy through recycling and reusing goods and materials. The sale also serves as a fundraiser for a future class trip. Students organize the sale by bringing in unwanted items from home that would normally go to waste. Students also send notices to the community to bring in recyclable and reusable items.

Students are in charge of organizing and pricing the objects for sale. They advertise the event by making signs and posters and by announcing it on public radio. Students collect money and assist customers by bagging goods and helping carry purchases to vehicles.

After the sale students divide the leftovers into five different classrooms. Each room is then responsible for finding a way to recycle the objects. Students learn that solid waste problems do not just disappear! Their challenge is to research ways materials can be reused and recycled to save energy and to find a use for everything left over from the sale. For example, students will tear cloth into strips to be woven into rag rugs, some of the objects are turned into works of art, and some items are taken to the recycling center in town so that materials such as plastic and glass can be recovered.

High School Environmental Action Conference—University of Wisconsin-Stevens Point

Each year this conference brings high school teachers, students, and professionals together for presentations and activities. With their teacher's guidance, student presenters have the opportunity to share with peers the exciting and hard work they've done in researching, exploring, and experimenting with environmental issues and topics. At the 1999 conference, which focused on energy issues, student presentations included:

- Investigating Photovoltaic Power with the Sun Chaser
- Rainforest Biodiversity
- Solar Olympics
- Envirothon and Project First
- Living Lightly On the Land: The Reefs and Rainforests of Belize
- Natural Resources and Environmental Education Leadership

Professionals from public utilities, the private sector, and public interest groups also shared their expertise in sessions like:

- Careers in Energy
- Energy 101
- World Energy Issues
- Composting

Hosting a student conference is an exciting and educational experience. Students have the unique opportunity to be recognized by peers, teachers, and professionals in the community for all of their hard work during the school year. Using the community's resource of professionals greatly enriches the conference.

If you have difficulty scheduling time for attending a conference, consider having a smaller in-school conference.

More information:

Dan Sivek
Wisconsin Center for Environmental Education
UW-Stevens Point
Stevens Point, WI 54481
(715) 346-2028
dsivek@uwsp.edu

Energizing Wisconsin's Classrooms: The K-12 Energy Education Program

KEEP's mission is to increase and improve energy education in Wisconsin. To accomplish this, KEEP offers educators several kinds of professional development opportunities.

KEEP offers a free one-credit graduate course through UW-Stevens Point that introduces teachers to KEEP materials. The inservice provides teachers with background information about the four KEEP themes (We Need Energy, Developing Energy Resources, Effects of Energy Resource Development, and Managing Energy Resource Use). The inservice also gives teachers hands-on experience teaching KEEP activities.

The KEEP inservices are offered in various sites around Wisconsin every year. For more information about the inservice, visit Energy Ed Online (www.energyed.ecw.org) or call the KEEP office.

Beginning in 1999 KEEP will also sponsor week-long Education Institutes for teams of teachers from specific school districts. The Institutes offer teachers opportunities to develop and implement school-wide energy programs, typically in conjunction with energy professionals from their communities. To find out how your district can participate in an Education Institute, contact the KEEP office.

More Information:

Jennie Lane
KEEP
Learning Resource Center-WCEE
University of Wisconsin-Stevens Point
Stevens Point, WI 54481-3897
Phone: (715)346-4770
Fax: (715) 346-4698
energy@uwsp.edu

Midwest Renewable Energy Fair

Each June the Midwest Renewable Energy Association hosts the world's largest renewable energy education event. The Energy Fair, a three-day festival held in central Wisconsin, is powered by the wind and sun. Fairgoers attend workshops, purchase renewable energy products and services, view entertainment, and network with others who are interested in renewable energy and sustainable living. There are educational activities for all knowledge and age levels, and concurrent presentations especially for children and teachers.

One of the objectives of the Energy Fair is to educate the general public about practical renewable energy and energy efficient technologies. More than 100 workshops are offered on a wide variety of topics like:

- Solar Water Pumping
- Advanced Photovoltaics
- Renewable Energy for the Developing World
- Methane Gas Production
- Home Sized Wind Systems
- Energy Efficient Appliances

Some workshops for teachers have included:

- Energy and Environmental Education for the 21st Century
- Energy and Air Quality Issues
- Mining and Mineral Awareness
- Energy Education Resources for Teachers
- How to Run and Start a Solar Sprint Program for Students
- Renewables Unit: Brainstorming Session
- How Solar Cells Work

The Energy Fair has working demonstrations of a variety of renewable energy technologies and environmentally friendly actions like photovoltaics, solar thermal systems, wind power, alternative vehicles, composting, energy efficient appliances, and tours of homes in the central Wisconsin area that demonstrate renewable energy technologies and energy efficiency.

The Energy Fair is an unforgettable experience in energy education, and provides excellent opportunities for professional development and to network with other teachers across the state.

More information:

MREA
P.O. Box 249
Amherst, WI 54406
Phone: (715) 592-6595
FAX: (715) 592-6596
mreainfo@wi-net.com
www.the-mrea.org

The Wisconsin Energy Initiative–2 Program: Helping Schools Save Money on Energy

One of the perks of having an energy efficient school is saving money on energy bills—money that can be redirected towards educational needs! The WEI-2 program is dedicated to helping schools in Wisconsin make this a reality. Advisors from the Cooperative Educational Service Agency (CESA) offer schools a full range of service options to identify, select, and implement energy improvements. The utility bill savings that result can be used to make payments on project financing.

WEI-2 allows public schools to make energy related upgrades through operational cost savings while staying within legislated revenue limits. Operational expenses are typically the second largest expense for schools. Services include:

- CESA site survey
- Energy cost benefit study
- Energy cost benefit review
- CESA financing
- Lease purchase financing
- Energy use tracking
- State procurement purchasing
- New construction services
- Operation and maintenance training
- Performance contracting review served by your CESA coordinator

More information:

Rob Everhart
CESAs 1, 2, 3, 5, 6, 7
P.O. Box 564
Portage, WI 53901-0564
(608) 742-8814 ext. 133
Fax (608) 742-2384
everhart@cesa5.k12.wi.us

Pat Bruckhart CESA 10
CESAs 4, 8, 9, 10, 11, 12
725 West Park Ave.
Chippewa Falls, WI 54729
(715) 720-2176
Fax (715) 720-2070
patrick@cesa10.k12.wi.us

www.wei-2.com

Pedal Your Way to Energy Literacy with the Energy Cycle

Do your students start to loose interest when you begin to talk about electricity or energy conservation? Get them up and moving with the Energy Cycle®, a bicycle-powered generator that teaches concepts about energy production, conversion, and conservation. Students pedal the stationary bike and become a "power plant" that generates electricity. They experience and compare the energy—their pedaling effort—needed to power incandescent and compact florescent light bulbs, fans, blow dryers, and radios. This hands-on activity acts as a springboard to discussions about wise energy use and practical tips for saving energy at home and at school, as well as how our energy use affects the environment.

The Energy Cycle can be used for a one or two hour lesson or for several lessons throughout a unit. It can also be a great addition to events like street and county fairs, Earth Day events, 4-H gatherings, and scouts earning their Ecology badges.

One student said, "Man was this fun! Who would have thought I could learn so much about energy by riding a bike? I wish I could learn like this all the time."

Energy Cycles Partners are located at schools and institutions throughout Wisconsin to make the Energy Cycle available to you.

(Continued on next page)

The following Partners will host field trips at their facilities:

Maggie Bishop
Point Beach Energy Center
6600 Nuclear Road
Two Rivers, WI 54241
Phone: (920) 755-6318
FAX: (920) 755-6301
maggie.bishop@wemail.wisenergy.com

Allan Clarke
St. Mary Central High School
1050 Zephyr Drive
Neenah, WI 54956
Phone: (920) 722-7796
FAX: (920) 722-5940
arcsmc@aol.com

Grant Herman
Northland College
1411 Ellis Avenue
Ashland, WI 54806
Phone: (715) 682-1673
FAX: (715) 682-1849
gherman@wheeler.northland.edu

Regina Miller
Riverside Urban
Environmental Center
P.O. Box 11678
Milwaukee, WI 53211
Phone: (414) 964-8505
FAX: (414) 964-1084

Paul Denowski
Edwards YMCA Camp
P.O. Box 16
East Troy, WI 53120
Phone: (414) 642-7466
FAX: (414) 642-5108

The following Partners will arrange to bring the cycle to nearby schools and events:

James Brown
Wisconsin Public Power, Inc.
321 Milwaukee Street
Kaukauna, WI 54130
Phone: (920) 751-5363
FAX: (920) 751-4807
jbrown@wppisys.org

Katy Matthai
Midwest Renewable Energy Association
7558 Deer Road
Custer, WI 54423
Phone: (715) 592-6595
Fax: (715) 592-6596
mreainfo@wi-net.com

Brenda Ramin
CESA 11
225 Osterman Drive
Turtle Lake, WI 54889
Phone: (715) 986-2020
FAX: (715) 986-2040
brendar@cesa11.k12.wi.us

Dan Wesenick
The Einstein Project
3100 Market Street
Green Bay, WI 54304
Phone: (920) 983-1104
FAX: (920) 983-1152
einsteinproject@itol.com

More information:

Dan York
Energy Center of Wisconsin
595 Science Drive
Madison, WI 53711
(608) 238-8276 ext. 42

Energy Education Internet Sites

Would you like to have your students investigate energy policies, energy efficiency, or alternative energy sources? Then tap into the Internet as a resource!

Topic	Address
Energy Ed Online	http://www.energyed.ecw.org
ENERGY: WISCONSIN	
Alliant Energy	http://www.alliantenergy.com
Energy Center of Wisconsin	http://www.ecw.org
Madison Gas and Electric Company	http://www.mge.com
Midwest Renewable Energy Assoc.	http://www.msn.fullfeed.com/~hulet
Northern States Power Company	http://www.nspco.com
RENEW Wisconsin	http.//www.mailbag.com/users/renew-wi
Public Service Commission of Wisconsin	http://badger.state.wi.us/agencies/psc
UW-Madison College of Engineering Solar Energy Lab	http://sel.me.wisc.edu
Wisconsin Electric Power Company	http://www.wisenergy.com/default.html
Wisconsin Energy Bureau	http://www.doa.state.wi.us/deir/boe.htm
Wisconsin Public Power Inc.	http://www.wppisys.org
Wisconsin Public Service Corp.	http://www.wpsr.com
ENERGY: UNITED STATES GOVERNMENT	
U.S. Department of Energy (DOE)	http://www.doe.gov
U.S. DOE - Energy Efficiency and Renewable Office	http://www.eren.doe.gov
U.S. DOE - Energy Information Administration	http://www.eia.doe.gov
U.S. DOE - Office of Fossil Energy	http://www.fe.doe.gov
U.S. DOE - Office of Civilian Radioactive Waste Mgmt.	http://www.rw.doe.gov
U.S. Environmental Protection Agency (EPA)	http://www.epa.gov
U.S. EPA - Energy Star	http://www.epa.gov/energystar
U.S. EPA - Environmental Education Center	http://www.epa.gov/teachers
U.S. EPA - Global Warming	http://www.epa.gov/globalwarming
ENERGY: GENERAL	
Alternative Energy and Fuels	http://www.cais.net/publish/stories/alt.htm
American Gas Association	http://www.aga.com
American Solar Energy Society	http.//www.sni.net/solar
California Energy Commission	http://www.energy.ca.gov/energy/
CREST (Center for Renewable Energy and Sustainable Technology)	http://solstice.crest.org
CREST-GEM (Global Energy Marketplace)	http://solstice.crest.org/renewable/sen
CREST-Sustainable Energy News Newsletter	http://solstice.crest.org/renewables/sen/
Electric Power Research Institute	http://www.epri.com/index.html
Energy Links	http://www.eia.doe.gov/links.html
Energy Net	http://teaparty.terc.edu/energy/energy.html
Energy Online	http://www.energyonline.com
Energy Quest (Calif. Energy Comm.)	http://www.energy.ca.gov/energy/education/
National Energy Foundation	http://www.xmission.com/~nef

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Topic	Address
National Network of Energy and Environmental Education Professional	http://www.leeric.lsu.edu/network/network.htm
School Energy Doctor (CREST)	http://www.crest.org/efficiency/sed
University Oregon - Energy & Environment	http://zebu.uoregon.edu/energy.html
WISCONSIN: STATE AGENCIES	
Wisconsin Department of Natural Resources	gopher://www.dnr.state.wi.us
Wisconsin Department of Public Instruction	http://badger.state.wi.us:70/1/agencies/dpi
Wisconsin Department of Transportation	http://www.dot.state.wi.us/
SCIENCE AND ENVIRONMENT	
Amazing Envir. Organization Web Directory	http://www.webdirectory.com/
Earth Day Event Ideas	http://envirolink.org/envlib/orgs/edn/EDOG/EDOG2.html
Eisenhower Nat'l. Clearinghouse Math/Sci. Ed.	http://www.enc.org
Environmental Education Link	http://www.nceet.snre.umich.edu
Envir. Orgs. On-Line w/Enviro-Link Network	http://envirolink.org/orgs
Exploratorium (San Francisco)	http://www.exploratorium.edu/
National Science Foundation	http://www.nsf.gov
EDUCATION	
Assoc. for Supervision and Curriculum Development (ASCD)	http://www.ascd.org
Classroom Resources (Directories, Databases, Catalog)	http://www.nceet.snre.umich.edu/classres.html
School-to-Work	http://www.stw.ed.gov

Energy Education Bibliography

Wisconsin Center for Environmental Education, June 1998

The following Energy Education resources have been compiled to assist educators in their search for teaching resources on energy. Please help us add to this bibliography by sharing your suggestions. Send suggestions to:

KEEP
Learning Resource Center
UW-Stevens Point
Stevens Point, WI 54481
(715) 346-4770
energy@uwsp.edu

Activity Guides for K-12

KEEP Activity Guide. 1995. Wisconsin K-12 Energy Education Program, Wisconsin Center for Environmental Education, Stevens Point, WI and Energy Center of Wisconsin, Madison, WI.

This guide makes the sometimes intimidating topic of energy understandable to students of all ages. The guide is organized by themes and grade levels to help teachers easily find activities appropriate of their students. Guide available only through inservice course. Contact the KEEP office at (715) 346-4770 or energy@uwsp.edu.

Activity Guides for K-4

Energy: Grade 4. 1991. Nancy Christie. Regional Environmental Education Program, Schuylkill Center for Environmental Education, Philadelphia, PA.
This is the fourth grade unit used in the curriculum for Pennsylvania's Environmental Education Master Plan. This unit focuses on energy and its flow through the food chain. Also appropriate for grades 4-6.

Teach With Energy! Fundamental Energy, Electricity and Science Lessons for Grades K-3. 1990. National Energy Foundation. Salt Lake City, UT.
A resource guide for teachers with activities for teaching energy topics year round. Contains basic energy information and a glossary of terms. User friendly with reproducible pages.

Activity Guides for Grades 4-9

Energy: A Cross-Curricular Approach. 1993. Christine Lalonde. Greenkill Outdoor Environmental Education Center, Huguenot, NY.
This guide provides an interdisciplinary approach to investigating energy concepts. Activities are clearly laid out and easy to understand. The guide is organized by subject areas and by the skills emphasized in those subject areas (e.g., graphing skills in math, poetry skills in Language Arts).

Energy: It's Elementary. 1995. David LaHart. Florida State University, Tallahassee, FL.
This interdisciplinary program includes hands-on investigations and case studies that explore energy issues. The topic areas include energy fundamentals, energy resources, energy conservation, energy efficiency, and building with energy. Also appropriate for grades K-4.

Energy MS/JHS Physical Science. Regional Environmental Education Program. The Schuylkill Center for Environmental Education, Philadelphia, PA.
This guide contains a series of activities that explore several aspects of energy. Students are also encouraged to conduct individual projects such as research and investigation. Many activities are worksheet based.

(Continued on next page)

Evidence of Energy. 1990. Jack E. Gartell, Jr. and Larry E. Schafer. National Science Teachers Association, Washington, DC.
A source book for ideas and projects for taking action to resolve environmental issues. Outlines aspects of scientific research and ways to share results. Also appropriate for grades 9-12.

Hot Water and Warm Homes from Sunlight. 1986. Alan Gould. LHS Gems, Berkley, CA.
A curriculum for teaching concepts about solar energy, the greenhouse effect and home energy use in general. Uses science experiments that incorporate math. This is part of a curriculum series that has been well reviewed and tested by educators. Also appropriate for grades 9-12.

Quick Energy and Beyond. 1991. National Energy Foundation. Colorado and Energy Resource Educators, Estes Park, CO.
This guide contains a variety of activities related to energy. They are organized into "Chargers" (designed to orient students to energy), "Sparks" (quick and simple activities), and "Conductors" (more extensive activities). Most of the activities are "conductors" that investigate energy generation and conversion. Some activities will require some more work by the teachers to make them more thorough. Also appropriate for grades K-4.

Science Alive! 1988. Mark Thomas and Craig Strang. Science Oriented Learning. (1988).
This activity guide presents ecology concepts geared towards low income and minority students. Energy flow, cycles, community and interdependence, and change are all addressed with hands-on, multicultural activities. Contains sections written in Spanish.

Sunlight Works: A Student Centered Activity Guide in Solar Science. 1993. Heather Gurley and Bob Larson. Sunlight Works, Sedona, Arizona.
A workbook that focuses on the sun as Earth's main source of energy. Also appropriate for grades K-4.

Taking Charge: An Introduction to Electricity. 1992. Larry Shafer. National Science Teachers Association, Washington, DC.
This guide presents activities that help students understand electricity. The information is based on simple "everyday" electrical events. Also appropriate for grades 9-12.

Teach With Energy! Fundamental Energy, Electricity and Science Lessons for Grades 4-6. 1992. National Energy Foundation, Salt Lake City, UT.
A resource guide for teachers with activities for teaching energy topics all year round. Activities are organized around the National Energy Foundation's conceptual framework. Activities are straightforward, hands-on, and simple.

Activity Guides for Grades 9-12

Energy Sources for the Future: A Traveling Teaching Unit Teachers' Guide (Second Edition). 1995. The Global Issues Resource Center. Cuyahoga Community College, Cleveland, OH.
A versatile, interdisciplinary unit that can be incorporated into classroom work in several ways. Theme units include A History of Energy Usage, Renewable/Nonrenewable Energy, Future Alternatives, Resource Conservation, and Around the World: An Examination of Global Energy Issues.

Science Projects in Renewable Energy and Energy Efficiency. 1991. American Solar Energy Society. The National Energy Foundation, Salt Lake City, UT.
Contains a variety of projects that can be used to study alternative energy uses and sources. Also provides guidelines for conducting a project.

Wind, Water, Fire and Earth: Energy Lessons for the Physical Sciences. 1986. National Science Teachers Association (NSTA). NSTA, Washington, DC.
A compilation of teaching units on energy produced by the Project for Energy Enriched Curriculum (sponsored by NSTA). Covers topics ranging from "The Basis for Nuclear Power" to "How to get Better Mileage from your Car." Not many activities focusing on alternative energy. Tested by teachers and republished because of a high demand for these activities.

(Continued on next page)

Energy Education Books for Adult/University

Energy: A Conceptual Approach. 1986 Thomas E. VanKoevering and Nancy J. Sell. Prentice Hall, NJ.
Poses questions about energy and attempts to put energy into general concepts that can be understood by the general public. Looks at energy sources, energy use, alternative forms of energy and energy conservation. Contains several appendixes explaining energy relationships, energy conservation techniques and more.

The Energy-Environment Connection. 1992. Jack M. Hollander. Island Press, Washington, DC.
This book is a compendium of essays that address connections between energy and the environment. The book is organized into three themes: 1) the environmental impacts of major energy sources, 2) the environmental and economic benefits of efficient energy use, and 3) policy statements and comprehensive issues, including environmental ethics and economic development.

Renewable Energy: Sources for Fuels and Electricity. 1993. Thomas B. Johansson. Island Press, Washington, DC.
A comprehensive reference guide to alternative energy sources, spotlighting all aspects of each energy source. This guide is for the serious energy researcher.

Homemade Money. 1995. Richard Heede. Rocky Mountain Institute and Brick House Publishing Co., Amherst, NH.
This book gives homeowners and renters suggestions that are cost effective in making the home more energy efficient. Projects suggested are inexpensive.

Community Energy Workbook. 1995 Alice Hubbard and Clay Fung. Rocky Mountain Institute. Amherst, NH.
Provides ideas and strategies to build community level energy policies.

Energy Education Videos

How to Make Great Videos About Saving Energy. 1992. Burlington, Vermont Electric Department.
Developed to help students produce their own video projects. Saving energy is incorporated as a narrative of sample video projects. The focus of the video is on video production, not on saving energy.

The Power of Wind. 1992. American Wind Energy Association.
This video shows how wind is a clean, free alternative to other energy. It suggests using wind as an energy source instead of fossil fuels because it is cleaner, more efficient, and free.

Energy, The Pulse of Life. 1994/95. Jack Micay, MediCinema Ltd., Toronto, Canada.
Three-part series includes The Science of Energy, Energy Choices—A Changing Environment, and Energy Choices—Some Brighter Ideas. This highly entertaining and informative series for teenagers features the Canadian pop group Moxy Früvous, who contribute original songs to reinforce the concepts presented.

Tomorrow's Energy Today: The Energy Efficiency Option. 1993. U.S. dept. of Energy and the Office of Energy Efficiency and Renewable Energy.
Two programs are recorded together to examine the benefits of renewable energy technologies. The first half discusses the different renewable energy methods. The second half highlights ways to reduce energy use in individuals lives.

Energy Education Games

The Energy Resource Game. 1996. Harrison J. Snyder, Jr. Snyder Enterprises, Newburgh, NY.
The object of this game is to educate people in the production of energy while having fun. This is accomplished through the buying and selling of energy in the form of British Thermal Units (BTU). It will be the player who utilizes his/her energy in the most efficient manner that will ultimately become the winner.

Energy Education Resources and Programs Offered by Utilities, Municipalities, and Cooperatives in Wisconsin

Alliant Energy

- Contact Information
  708, NE 7th Street, P.O. Box 298, Marion, WI 54950. Phone: (715) 754-4338
- Resources Available for Educators
  Resources are provided based upon requests
- Education/Outreach Programs Offered to Schools
  Plant tours and nature/environmental projects offered
- To Whom Resources Are Available
  Customers and schools in the Alliant service territory

City Gas Company

- Contact Information
  Customer Service Representative, P.O. Box 370, Antigo, WI 54409. Phone: (715) 623-2099
- Resources Available for Educators
  Distributes teaching materials presented in the American Gas Company Catalog
- Education/Outreach Programs Offered to Schools
  Provide speakers and materials to educators in our service territory to speak on energy-related topics
- To Whom Resources Are Available
  Resources are available to people in their service area

Federation of Cooperatives (Wisconsin Electric Cooperative Association)

- Contact Information
  Director of Membership Services, 30 West Mifflin Street, Suite 401, Madison, WI 53707. Phone: (608) 258-4400
- Resources Available for Educators
  A Film and Video Library and a Catalogue
- Education/Outreach Programs Offered to Schools
  - Mainly focuses on adult groups related to cooperatives (e.g., safety—Adams, Columbia, and Rock County have good safety programs)
  - Works with UW–River Falls to organize a youth leadership congress—a three day program, usually occurring the first week of June
- To Whom Resources Are Available
  Catalog distributed to all public schools in Wisconsin; outreach programs offered in their service area

Madison Gas and Electric Company

- Contact Information
  Community Education Coordinator, P.O. Box 1231, Madison, WI 53701. Phone: (608) 252-7091
- Resources Available for Educators
  - MGE Educational Resource Catalog describes educational services and materials.
  - Power Line, a teacher's newsletter
  - MGE Education services on website: http://www.mge.com
- Education/Outreach Programs Offered to Schools
  - Skill Builders Energy Education Curriculum Class Modules
  - Guest speakers on energy topics
  - Scholarships to teachers and students to Trees for Tomorrow, natural resource center
  - Scholarships for students to Business World
  - Tours of the Blount Generating Station

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Madison Gas and Electric Company (Continued)

- "Switch to Safety" electric safety program for fourth-grade students
- Participation with Madison School Community Partnership Council
- Participation with local job fairs, mock student job interviews

• To Whom Resources Are Available
Primarily to MGE area teachers

Manitowoc Public Utilities (MPU)

• Contact Information
Energy Management Supervisor, 1303 South 8th Street, P.O. Box 1090, Manitowoc, WI 54221-1090.
Phone: (920) 683-4913

• Resources Available for Educators
- About Electric Safety—coloring and activities book
- Let's Explore Electricity—information and activities book
- About Energy—coloring and activities book
- Splash Activities Book
- The Story of Drinking Water
- Other technical publications and materials as required

• Education/Outreach Programs Offered to Schools
- Power Plant tours
- Water Filtration Plant tours
- "Path to Ground" safety demonstration—given by line workers.
- Customized programs on careers, safety, consumer education, energy conservation, and power plant operation

• To Whom Resources Are Available
Only schools located in MPU's service area, which is in the Manitowoc city limits

Marshfield Electric & Water Department

• Contact Information
Administrative Assistant, 2000 S. Roddis Avenue, P.O. Box 670, Marshfield, WI 54449. Phone: (715) 387-1195, ext. 314

• Resources Available for Educators
Books that are normally given out through our "hot line" demonstrations (see below)

• Education/Outreach Programs Offered to Schools
Each spring, our Line Department gives demonstrations to elementary students in grades 4-6. This is a one-hour demonstration that stresses safety around electrical lines and equipment. A "live" display of poles and electrical lines is set up and explained to students. Crew members discuss the dangers of playing near or around electrical equipment, give kite safety tips, and encourage students to be aware of electrical safety and outside of their home.

• To Whom Resources Are Available
"Hot Line" demonstrations available in service area only; a rotating schedule set up with all of the schools for the "hot line" demonstration

Northern States Power Company

• Contact Information
Coordinator of Programs, P.O. Box 8, Eau Claire, WI 54702. Phone: (715) 839-2567

• Resources Available for Educators
Videos, curriculum kits, films, posters, and activity guides

• Education/Outreach Programs Offered to Schools
Safety demonstrations, guest speakers, plant tours

• To Whom Resources Are Available
To educators in their service area only

(Continued on next page)

Rice Lake Utilities

- Contact Information
  320 W. Coleman Street, Rice Lake, WI 54868-2406.
- Resources Available for Educators
  - Walter the Raindrop Coloring Book (provided by the Environmental Protection Agency, Region VII, 911 Walnut, Kansas City, MO 64106)
  - Activity guide given to teachers with the Small Change Theatre. Contact: Wisconsin Public Power Inc., SYSTEM (municipalities), Energy Services Coordinator, 1425 Corporate Drive, Sun Prairie, WI 53590. Phone: (608) 837-2635
- Education/Outreach Programs Offered to Schools
  Small Change Theatre and Utilities booth at the Rice Lake Children's Fair
- To Whom Resources Are Available
  Small Change Theatre and the coloring book are available statewide; the Children's Fair is only in the community

Wisconsin Gas Company

- Contact Information
  626 E. Wisconsin Avenue, Milwaukee, WI 53202. Phone: (414) 291-6673
- Resources Available for Educators
  Gas safety booklets for K-12 distributed at state teacher conventions and to individual schools upon request
- Education/Outreach Programs Offered to Schools
  Small Change Theater Production The Clue that Burned Blue for elementary school assemblies; targeted schools are invited to participate
- To Whom Resources Are Available
  Resources available statewide

Wisconsin Public Power Inc., (municipalities)

- Contact Information
  Energy Services Coordinator, 1425 Corporate Drive, Sun Prairie, WI 53590. Phone: (608) 837-2635
- Resources Available for Educators
  Customer handbooks, specialized flyers/mailers, The Local Circuit Newsletter, videos including: Simple Things You Can Do to Save Energy in Your School; Powering Wisconsin 1994; Electricity: The Things It Could Tell You; How to Make Great Videos about Saving Energy; and Electric Cars: CBS Eye on America

- Education/Outreach Programs Offered to Schools
  - Live theater performance—energy and water education and safety K-6
  - Power Town simulation model on electrical safety
  - Energy Bike demonstrations—bicycle-powered generator providing hands-on experience on how much energy appliances use
  - Utility visits to schools on safety education with utility vehicles/equipment
  - Energy fairs
  - Open house visits/tours at municipal utility any time throughout the year with more emphasis in October during Public Power Week
  - Art contests with students on saving energy
  - Audit and Energy Management programs
- To Whom Resources Are Available
  All resources and education/outreach programs available in service area through local municipal utility, statewide

Wisconsin Public Service Corporation (WPS)

- Contact Information
  Corporate Community Relations Leader, P.O. Box 1166, Wausau, WI 54402. Phone: (800) 236-2270
- Resources Available for Educators
  Resources include videos, teaching kits, and publications; contact WPS for a catalog that details all the resources available to educators
- Education/Outreach Programs Offered to Schools

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Wisconsin Public Service Corporation (WPS) (Continued)

Outreach programs include presentations and facility tours; contact WPS for a catalog that details all the resources available to educators

- To Whom Resources Are Available

  Resources and programs available to primarily educators and community groups in the WPS service area

Wisconsin Electric Power Company

- Contact Information

  Manager Community Relations, 333 West Everett Street, Milwaukee, WI 53203. Phone: (414) 221-2880
- Resources Available for Educators

  Videos
  - Mr. Ouch—electrical safety (pre-school, first grade; six minutes)
  - Safe n' Sound—electrical and natural gas safety (preschool to adult; 14 minutes)
  - Kato's Electrical Safety Video Game Adventure—electrical safety (grades K through 5; 10 minutes)
  - Voltron—electrical safety (grades 4 through 6; 22 minutes)
  - Power Plant Video Tours—a video tour of Wisconsin Electric's Valley Power Plant and Pleasant Prairie Power Plant (grades 6 to adult; 17 minutes)

  Call Wisconsin Electric's Community Relations Office at (414) 221-2887 to reserve a video

  Literature

  Wisconsin Electric offers a variety of electric and natural gas safety brochures for students grades K-12. To obtain a literature request form, call Wisconsin Electric's Educator Request Line at (414) 221-2875

  Internet

  Students can stay power smart by checking the latest information on our web site: http://www.wisenergy.com
- Education Outreach
  - Small Change Theatre—Wisconsin Electric has partnered with Small Change Theatre, a nationally known education theatre troupe, to present The Legend of Mongoose Mountain, a live production demonstrating the importance of electrical and natural gas safety. The play is targeted to children grades K-5 in communities served by Wisconsin Electric. Call Small Change Theatre at (800) 858-3999 for further information. The offering is available 1996-1998.
  - CHOICES—a dynamic decision-making seminar that is geared towards eight and ninth grade and is conducted by volunteer speakers during one class period on two consecutive days. Call Wisconsin Electric at (414) 221-2887 for more information.
  - Electro: A Show of Electricity—a theatrical venture performed by professional actors teaches youngsters on the basic principals of electricity and safe energy practices (Electro: A Show of Electricity is brought to you by Wisconsin Energy in partnership with Discovery World in Milwaukee). Call Discovery World at (414) 765-9966 for a schedule of show times.
  - Point Beach Energy Center—the Point Beach Energy Center is filled with fascinating displays and activities for all ages. Generate your own electricity. See and feel static electricity. Step inside a model nuclear reactor. Programs such as Basic Electricity, Nuclear Power, Renewable Energy Resources, and Radiation among others are available.
    Contact: 6600 Nuclear Road, Two Rivers, WI 54241. Phone: (414) 755-6400
- To Whom Resources Are Available

  Primarily to service area

Wisconsin Fuel & Light Company

- Contact Information

  Public Relations Director, P.O. Box 1627, Wausau, WI 54402. Phone: (715) 847-6219
- Resources Available for Educators

  Offer several printed pieces purchased from several educational publishers on an as-needed basis
- Education/Outreach Programs Offered to Schools:

  Energy management and consulting services (no-charge audits, engineering studies, etc.), guest speakers
- To Whom Resources Are Available

  To schools in service area

Conceptual Framework for the KEEP Activity Guide

KEEP's *A Conceptual Guide to K-12 Energy Education in Wisconsin* (Conceptual Guide) was designed to direct the development of the *Energy Education Activity Guide* (Activity Guide). Below is an abbreviated version of the framework; the charts that follow show how the activities address the concepts identified in the framework.

Theme I: We Need Energy

Definition of Energy

- Energy is the ability to organize or change matter
- Energy exists in two main forms (kinetic and potential)
- Energy can be measured and quantified
- Power is the rate at which energy is used

Natural Laws Govern Energy

- Energy can be transferred from one location to another
- Energy can be neither created nor destroyed; it can only be converted from one form to another (First Law of Thermodynamics)
- With each conversion, some energy becomes unavailable for further use (Second Law of Thermodynamics).

Energy Transfer and Conversion within Systems

- Energy flows through systems; all systems obey the natural laws that govern energy
- Energy flows through a variety of nonliving systems
- Living systems use energy to grow, change, maintain health, move, and reproduce
- Ecosystems use energy to maintain biogeochemical cycles; patterns of energy flow characterize ecosystems; Wisconsin has four natural ecosystems
- Human societies, like natural ecosystems, need energy to organize and maintain themselves
- Human societies range from hunter-gatherer to industrial depending on how they use energy; Wisconsin and the rest of the United States is an industrial, technologically advanced high-energy use society

Theme II: Developing Energy Resources

Energy Sources and Resources

- Primary energy sources are those either found or stored in nature; the sun is Earth's principle energy source
- Secondary energy sources are produced from primary energy sources using technology (e.g., electricity generation)
- Energy sources are considered to be resources by individuals and society when they serve societal needs and wants
- The ways human societies have obtained energy resources have evolved over time
- Some energy sources are concentrated and others are diffuse; geographically Earth's energy sources unevenly distributed
- Certain energy resources are renewable because they can be replaced by natural processes quickly; other energy resources are nonrenewable because they are either replaced very slowly or are not replaced
- Wisconsin imports most of the energy resources it uses (nuclear and fossil fuels); other resources used in Wisconsin include biomass, hydropower, solar energy, and wind, all of which are renewable and can be found within the state

Consumption of Energy Resources

- Supply and demand influence energy resource development and use; global demand for resources is increasing

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Theme III: Effects of Energy Resource Development and Use

Quality of Life

- Energy use has affected the quality of human life, including our lifestyles, health and safety, economy, sociopolitical structure, and culture

Quality of the Environment

- Energy use has affected the quality of the environment which in turn affects the health of organisms living in the environment

Theme IV: Managing Energy Resource Use

Energy Resource Management

- Energy resource management involves societies deciding which resource to use and determining how to use them efficiently; Wisconsin has a variety of energy conservation programs available
- Citizens can make decisions and take actions that determine how the energy they use will be managed; these decisions and actions are influenced by barriers and incentives

Future Management

- New energy resources, new ways of managing energy resources, and new technologies will be developed in the future
- Energy resource management will affect the quality of life and the environment in the future

Concept Area Chart

Promising Practice	Definition of Energy	Natural Laws	Energy Flow	Nonliving Systems	Living Systems	Human Systems	Development	Consumption	Quality of Life	Quality Env.	Management	Future Outlooks
Assessing Solar Smarts							X				X	X
Design Your Own Energy Efficient Home											X	X
Electric Truck			X				X				X	X
Energized Earth Day	X						X	X		X		
Energizing Wisconsin's Classrooms	X	X	X	X	X	X	X	X	X	X	X	X
Energizing Writers' Workshop								X	X			
Energy and Agriculture					X			X	X			
Energy and Algebra								X	X	X		
Energy Awareness in Art Class			X					X	X	X		
Energy Ed Internet Sites	X	X	X	X	X	X	X	X	X	X	X	X
Energy Ice Cream	X											
Energy Jeopardy	X	X	X	X	X	X	X	X	X	X	X	X
Energy Use Around the World							X	X			X	X
Energy Use Then and Now								X	X			
Evaluating Resources							X	X	X	X		
Fantastic Photovoltaics	X											
Floating on Energy!		X	X									
Fun in the Sun	X											
Generating Less Household Waste								X	X	X	X	
Get Mad About Energy!								X	X	X	X	
Grand New Energy Conf.	X	X	X	X	X	X	X	X	X	X	X	X
High School Environmental Action Conference	X	X	X	X	X	X	X	X	X	X	X	X
Journey of Garbage								X	X	X	X	
Junior Solar Sprint			X	X			X					
Midwest Renewable Energy Fair	X	X	X	X	X	X	X	X	X	X	X	X
Pedal Your Way to Energy Literacy	X		X					X	X	X	X	
Recycle Sale!								X	X	X		
Shining Light on PV			X				X					X
SolarWise For Schools	X	X	X	X	X	X	X	X	X	X	X	X
Wisc. Energy Initiative-2								X			X	

Grade Level Chart

Promising Practice	Pre K-2	3-5	6-8	9-12
Assessing Solar Smarts		X	X	
Design Your Own Energy Efficient Home				X
Electric Truck				X
Energized Earth Day	X	X	X	X
Energizing Wisconsin's Classrooms	X	X	X	X
Energizing Writers' Workshop		X	X	
Energy and Agriculture		X	X	
Energy and Algebra				X
Energy Awareness in Art Class			X	X
Energy Ed Internet Sites	X	X	X	X
Energy Ice Cream	X	X	X	X
Energy Jeopardy	X	X	X	X
Energy Use Around the World			X	
Energy Use Now and Then	X	X	X	X
Evaluating Resources	X	X	X	X
Fantastic Photovoltaics		X	X	X
Floating on Energy!			X	X
Fun in the Sun	X			
Generating Less Household Waste		X	X	X
Get Mad About Energy!		X	X	
Grand New Energy Conference				X
High School Environmental Action Conference			X	X
Journey of Garbage		X	X	X
Junior Solar Sprint			X	X
Midwest Renewable Energy Fair	X	X	X	X
Pedal Your Way to Energy Literacy	X	X	X	X
Recycle Sale!			X	
Shining Light on Photovoltaics	X	X	X	X
SolarWise For Schools				X
Wisconsin Energy Initiative-2				X

Subject Area Chart

Promising Practice	General Science	Physical Science	Earth/Space Science	Chemistry	Physics	Environmental Science	Environmental Education	Social Studies	Technology Education	Fine Arts	Language Arts	Mathematics
Assessing Solar Smarts	X		X				X		X	X	X	X
Design Your Own Energy Efficient Home	X						X		X	X	X	X
Electric Truck				X	X		X		X	X		
Energized Earth Day	X						X	X	X	X	X	
Energizing Wisconsin's Classrooms	X	X	X	X	X	X	X	X	X	X	X	X
Energizing Writers' Workshop	X							X			X	
Energy and Agriculture	X			X	X		X		X	X	X	X
Energy and Algebra												X
Energy Awareness in Art Class						X	X	X		X		X
Energy Education Internet Sites	X	X	X	X	X	X	X	X	X	X	X	X
Energy Ice Cream	X							X				
Energy Jeopardy	X			X			X		X			
Energy Use Around the World	X					X	X	X	X		X	
Energy Use Then and Now	X							X				
Evaluating Resources	X	X	X	X	X	X	X	X	X	X	X	X
Fantastic Photovoltaics				X	X	X	X					
Floating on Energy!	X								X		X	X
Fun in the Sun	X									X		
Generating Less Household Waste		X	X				X					
Get Mad About Energy!						X	X	X			X	
Grand New Energy Conference	X	X	X	X	X	X	X	X	X	X	X	X
High School Environmental Action Conference	X	X	X	X	X	X	X	X	X	X	X	X
Journey of Garbage	X						X		X	X	X	
Junior Solar Sprint	X						X		X	X		X
Midwest Renewable Energy Fair	X	X	X	X	X	X	X	X	X	X	X	X
Pedal Your Way to Energy Literacy	X					X	X		X			X
Recycle Sale!							X				X	X
Shining Light on PV	X		X			X	X		X			
SolarWise For Schools	X		X			X	X		X			
Wisc. Energy Initiative-2							X		X			X

Wisconsin Environmental Education Academic Standards

Questioning and Analysis: Students in Wisconsin will use credible research methods to investigate environmental questions, revise their personal understanding to accommodate new knowledge and perspectives, and be able to communicate this understanding to others.
Knowledge of Environmental Processes and Systems: Students in Wisconsin will demonstrate an understanding of the natural environment and the interrelationships among natural systems.
Environmental Issue Investigation Skills: Students in Wisconsin will be able to identify, investigate, and evaluate environmental problems and issues.
Decision and Action Skills: Students in Wisconsin will use findings from environmental issue investigations to develop decision-making skills, and to gain experience in citizen action skills.
Personal and Civic Responsibility: Students in Wisconsin will develop an understanding and commitment to environmental stewardship.

Activity	Question and Analysis	Knowledge	Issue Investigation	Decision and Action	Responsibility
Assessing Solar Smarts	x	x			
Design Your Own Energy Efficient Home	x	x			
Electric Truck				x	x
Energized Earth Day		x	x		
Energizing Wisconsin's Classrooms	x	x	x	x	x
Energizing Writers' Workshop	x				
Energy and Agriculture		x			
Energy and Algebra			x		
Energy Awareness in Art Class			x	x	x
Energy Education Internet Sites	x	x	x		
Energy Ice Cream	x				
Energy Jeopardy	x	x	x		
Energy Use Around the World	x	x	x	x	
Energy Use Then and Now	x				
Evaluating Resources	x	x	x		
Fantastic Photovoltaics	x	x			
Floating on Energy	x	x			
Fun in the Sun		x			
Generating Less Household Waste			x	x	x
Get Mad About Energy!		x	x	x	
Grand New Energy Conference	x	x	x	x	x
High School Environmental Action Conference	x	x	x	x	x
Journey of Garbage	x		x	x	x
Junior Solar Sprint	x	x			
Midwest Renewable Energy Fair	x	x	x		x
Pedal Your Way to Energy Literacy	x		x		
Recycle Sale!			x	x	x
Shining Light on PV		x			
SolarWise For Schools	x	x	x	x	x
Wisconsin Energy Initiative-2					

Wisconsin Science Academic Standards

Science Connections: Students in Wisconsin will understand that there are unifying themes: systems, order, organization, and interactions; evidence, models, and explanation; consistency, change, and measurement; evolution, equilibrium, and energy; and form and function among scientific disciplines. Those themes are to be used to connect the science content standards for Wisconsin to each other.

Nature of Science: Students in Wisconsin will understand that science is ongoing and inventive, and that scientific understandings have changed over time as new evidence is found.

Science Inquiry (Problem Solving): Students in Wisconsin will investigate questions using scientific methods and tools, revise their personal understanding to accommodate new knowledge, and communicate these new understandings to others.

Physical Science: Students in Wisconsin will demonstrate an understanding of the physical and chemical properties of matter, the forms and properties of energy, and how matter and energy are interrelated.

Earth and Space Science: Students in Wisconsin will demonstrate an understanding of the structure and systems of Earth and other bodies in the universe, and their interactions.

Life and Environmental Science: Students in Wisconsin will demonstrate an understanding of the characteristics and structures of living things, the processes of life, and how living things interact with each other and their environment.

Science Applications: Students in Wisconsin will demonstrate an understanding of the relationship of science and technology and how that relationship influences human activities.

Science in Personal and Social Perspectives: Students in Wisconsin will use scientific information and skills to make decisions about themselves, Wisconsin, and the world in which they live.

(Continued on next page)

Activity	Science Connections	Nature of Science	Science Inquiry	Physical Science	Earth & Space Science	Life & Env. Science	Science Applications	Personal & Social Perspectives
Assessing Solar Smarts	x	x	x	x	x		x	
Design Your Own Energy Efficient Home	x	x	x	x			x	x
Electric Truck	x	x	x	x	x			x
Energized Earth Day				x			x	x
Energizing Wisconsin's Classrooms	x	x	x	x	x	x	x	x
Energizing Writers' Workshop				x			x	
Energy and Agriculture				x	x	x		
Energy and Algebra			x					
Energy Awareness in Art Class		x	x	x			x	x
Energy Education Internet Sites	x		x				x	x
Energy Ice Cream				x				
Energy Jeopardy				x				
Energy Use Around the World	x	x		x	x		x	x
Energy Use Then and Now				x			x	
Evaluating Resources	x		x				x	
Fantastic Photovoltaics		x		x			x	
Floating on Energy!	x	x	x	x			x	
Fun in the Sun				x		x		
Generating Less Household Waste	x			x				x
Get Mad About Energy!		x	x	x			x	x
Grand New Energy Conference	x	x	x	x	x	x	x	x
High School Environmental Action Conference	x	x	x	x	x		x	x
Journey of Garbage	x			x	x		x	x
Junior Solar Sprint	x	x	x	x	x			
Midwest Renewable Energy Fair	x	x	x	x	x	x	x	x
Pedal Your Way to Energy Literacy	x		x	x			x	x
Recycle Sale!				x			x	x
Shining Light on PV		x		x	x		x	x
SolarWise For Schools	x	x	x	x	x	x	x	x
Wisconsin Energy Initiative-2							x	x

Wisconsin Social Studies Academic Standards

History: Students in Wisconsin will learn about the history of Wisconsin, the United States, and the world, examining change and continuity over time in order to develop historical perspective, explain historical relationships, and analyze issues that affect the present and the future.

Political Science & Citizenship: Students in Wisconsin will learn about political science and acquire the knowledge of political systems necessary for developing individual civic responsibility by studying the history and contemporary uses of governance, authority, and power.

Geography: Students in Wisconsin will learn about geography through the study of the relationships among places, people, and environments.

Economics: Students in Wisconsin will learn about production, exchange, and consumption so that they can make informed economic decisions.

The Behavioral Sciences: Students in Wisconsin will learn about the behavioral sciences by exploring concepts from the discipline of sociology, the study of the impact of individuals on groups and institutions and vice versa; the discipline of psychology, the study of factors that influence individual identity and learning; and the discipline of anthropology, the study of cultures in various times and settings.

Activity	History Science	Political	Geography	Economics	Behavioral Sciences
Assessing Solar Smarts				x	
Design Your Own Energy Efficient Home			x	x	
Electric Truck				x	
Energized Earth Day				x	
Energizing Wisconsin's Classrooms	x		x	x	x
Energizing Writers' Workshop	x			x	
Energy and Agriculture	x		x	x	
Energy and Algebra				x	
Energy Awareness in Art Class	x		x	x	x
Energy Education Internet Sites					
Energy Ice Cream					
Energy Jeopardy					
Energy Use Around the World	x		x	x	x
Energy Use Then and Now	x			x	
Evaluating Resources	x	x			x
Fantastic Photovoltaics				x	
Floating on Energy!					
Fun in the Sun					
Generating Less Household Waste				x	x
Get Mad About Energy!		x		x	x
Grand New Energy Conference			x	x	x
High School Environmental Action Conference				x	x
Journey of Garbage				x	x
Junior Solar Sprint					
Midwest Renewable Energy Fair			x	x	x
Pedal Your Way to Energy Literacy				x	
Recycle Sale!				x	x
Shining Light on PV				x	
SolarWise For Schools				x	
Wisconsin Energy Initiative-2				x	

Cross Reference for Complementary KEEP Activities—Theme I: We Need Energy

Promising Practice	Complementary KEEP Activities
Assessing Solar Smarts	Station Break, Energy Sparks: Exploring Light Energy
Design Your Own Energy Efficient Home	At Watt Rate, Community Energy Use
Electric Truck	
Energized Earth Day	Energy From Food, Evidence of Energy, Food Chain Game
Energizing Wisconsin's Classrooms	
Energizing Writers Workshop	Station Break, Comprehensive Theme Activity: Energy Story, Energy Sparks: Energy Use at Home
Energy and Agriculture	Energy Use in an Ecosystem, Food Chain Game, Station Break, Energy Sparks: Energy Use in WI
Energy and Algebra	Community Energy Use
Energy Awareness in Art Class	Energy Sparks: Exploring Heat
Energy Education Internet Sites	
Energy Ice Cream	People Power
Energy Jeopardy	Potentially Kinetic, Station Break, Sun Wind Water, Solar Energy and the Carbon Cycle
Energy Use Around the World	At Watt Rate, Diminishing Returns
Energy Use Then and Now	Station Break, Comprehensive Theme Activity: Energy Story, Energy Sparks: Energy Use at Home
Evaluating Resources	
Fantastic Photovoltaics	At Watt Rate, Sun Wind Water, Solar Energy and the Carbon Cycle
Floating on Energy!	Potentially Kinetic, Station Break
Fun in the Sun	Energy From Food, Evidence of Energy, Exploring Heat, Taking Temperatures,Generating Less Household Waste
Get Mad About Energy!	Community Energy Use
Grand New Energy Conference	At Watt Rate, Community Energy Use, Diminishing Returns, Comprehensive Theme Activity: Energy Story
High School Environmental Action Conference	At Watt Rate, Community Energy Use
Journey of Garbage	
Junior Solar Sprint	
Midwest Renewable Energy Fair	Sun Wind Water, Solar Energy and the Carbon Cycle
Pedal Your Way To Energy Literacy	Station Break, At Watt Rate, Community Energy Use, People Power, Energy Sparks: Energy Use at Home
Recycle Sale!	
Shining Light on Photovoltaics	
SolarWise For Schools Program	At Watt Rate, Community Energy Use
Wisconsin Energy Initiative-2	

Cross Reference for Complementary KEEP Activities—Theme II: Developing Energy Resources

Promising Practice	Complementary KEEP Activities
Assessing Solar Smarts	Shoebox Solar Cooker, Energy Sparks: Introducing Renewable and Nonrenewable Resources/Sunvestigation
Design Your Own Energy Efficient Home	So You Want to Heat Your Home, Miracle of Solar Cells, Comprehensive Theme Activity: Energy Debate
Electric Truck	Electric Motors and Generators, Get That Gasoline, Miracle of Solar Cells, Energy Sparks: Energy Conversion in and Automobile Engine
Energized Earth Day	Waterwheels Windmills and Turbines, The Energy Divide
Energizing Wisconsin's Classrooms	
Energizing Writers Workshop	Energy Sparks: Introducing Renewable and Nonrenewable Resources
Energy and Agriculture	Fueling Around, Energy Sparks: Introducing Energy Resources
Energy and Algebra	Comprehensive Theme Activity: Energy Debate, Energy Sparks: Human Population Growth and Energy Use
Energy Awareness in Art Class	The Energy Divide
Energy Education Internet Sites	Fuel That Power Plant, Get That Gasoline, Harnessing Nuclear Energy
Energy Ice Cream	
Energy Jeopardy	The Energy Divide, Get That Gasoline, Miracle of Solar Cells
Energy Use Around the World	Shoebox Solar Cooker, Waterwheels Windmills and Turbines, The Energy Divide, Harnessing Nuclear Energy
Energy Use Then and Now	Energy Sparks: Introducing Renewable and Nonrenewable Resources and Sunvestigation
Evaluating Resources	The Energy Divide, Comprehensive Theme Activity: Energy Debate
Fantastic Photovoltaics	Shoebox Solar Cooker, Miracle of Solar Cells
Floating on Energy!	Shoebox Solar Cooker, Electric Motors and Generators, Miracle of Solar Cells
Fun in the Sun	Where Does it Get Its Energy, Energy Sparks: Windy Wonder
Generating Less Household Waste	
Get Mad About Energy!	Digging for Coal, Fueling Around, Shoebox Solar Cooker, Waterwheels Windmills and Turbines, The Energy Divide
Grand New Energy Conference	Shoebox Solar Cooker, Waterwheels Windmills and Turbines, The Energy Divide, Get That Gasoline, So You Want to Heat Your Home
High School Environmental Action Conference	The Energy Divide, Miracle of Solar Cells, Comprehensive Theme Activity: Energy Debate
Journey of Garbage	
Junior Solar Sprint	Shoebox Solar Cooker, Miracle of Solar Cells
Midwest Renewable Energy Fair	Shoebox Solar Cooker, Waterwheels Windmills and Turbines, Miracle of Solar Cells, Energy Sparks: Introducing Renewable and Nonrenewable Resources and Windy Wonder
Pedal Your Way To Energy Literacy	Circuit Circus, Digging for Coal, The Energy Divide
Recycle Sale!	
Shining Light on Photovoltaics	Shoebox Solar Cooker, Miracle of Solar Cells, Comprehensive Theme Activity: Energy Debate
SolarWise For Schools Program	Shoebox Solar Cooker, Miracle of Solar Cells, Comprehensive Theme Activity: Energy Debate
Wisconsin Energy Initiative-2	

Cross Reference for Complementary KEEP Activities—Theme III: Effects of Energy Resource Development

Promising Practice	Complementary KEEP Activities
Assessing Solar Smarts	
Design Your Own Energy Efficient Home	The Cost of Using Energy, Reading Utility Bills, Reading Utility Meters, Comprehensive Theme Activity: Energy Investigations, Investigation Ideas: Lifestyles
Electric Truck	Driving Reasons, Investigation Ideas: Energy and Transportation
Energized Earth Day	The Dirty Half Dozen, Energy Sparks: Electrical Safety, Investigation Ideas: Lifestyles
Energizing Wisconsin's Classrooms	
Energizing Writers Workshop	Energy Use Then and Now
Energy and Agriculture	Energy Use Then and Now
Energy and Algebra	Energy Prices and the Laws of Supply and Demand, Investigation Ideas: Energy and Economics
Energy Awareness in Art Class	The Cost of Using Energy, Investigation Ideas: Lifestyles
Energy Education Internet Sites	Dealing With Nuclear Waste, The Dirty Half Dozen, Driving Reasons
Energy Ice Cream	
Energy Jeopardy	The Dirty Half Dozen, Driving Reasons, Comprehensive Theme Activity: Energy Investigations
Energy Use Around the World	Dealing With Nuclear Waste, Energy Prices and the Laws of Supply and Demand, Investigation Ideas: Energy and Culture
Energy Use Then and Now	Energy Use Then and Now
Evaluating Resources	
Fantastic Photovoltaics	
Floating on Energy!	
Fun in the Sun	Energy Sparks: Electrical Safety
Generating Less Household Waste	Investigation Ideas: Lifestyles
Get Mad About Energy!	The Dirty Half Dozen, Investigation Ideas: Lifestyles/Energy and the Environment
Grand New Energy Conference	Advertising Energy, Energy Prices and the Laws of Supply and Demand, Comprehensive Theme Activity: Energy Investigations, Investigation Ideas: All
High School Environmental Action Conference	Advertising Energy, Dealing With Nuclear Waste, The Dirty Half Dozen, Investigation Ideas: All
Journey of Garbage	Investigation Ideas: Lifestyles
Junior Solar Sprint	
Midwest Renewable Energy Fair	Investigation Ideas: Lifestyles/Energy and the Environment
Pedal Your Way To Energy Literacy	The Cost of Using Energy, Reading Utility Bills, Reading Utility Meters
Recycle Sale!	Investigation Ideas: Lifestyles
Shining Light on Photovoltaics	
SolarWise For Schools Program	Comprehensive Theme Activity: Energy Investigations
Wisconsin Energy Initiative-2	The Cost of Using Energy, Reading Utility Bills, Reading Utility Meters

Cross Reference for Complementary KEEP Activities—Theme IV: Managing Energy Resource Use

Promising Practice	Complementary KEEP Activities
Assessing Solar Smarts	Why Use Renewable Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Design Your Own Energy Efficient Home	Why Use Renewable Energy, Careers in Energy, Siting for Solar/Wind Energy, Action Ideas, Comprehensive Theme Activity: Energy Action Plan, Energy Sparks: Be an Energy Saver
Electric Truck Saver	Why Use Renewable Energy, Careers in Energy, Energy Futures, Action Ideas, Comprehensive Theme Activity: Energy Action Plan, Energy Sparks: Be an Energy
Energized Earth Day	Don't Throw Away Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Energizing Wisconsin's Classrooms	Action Ideas, Energy Sparks: Be an Energy Saver
Energizing Writers Workshop	Action Ideas, Energy Sparks: Be an Energy Saver
Energy and Agriculture	Don't Throw Away Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Energy and Algebra	Energy Futures, Action Ideas, Energy Sparks: Be an Energy Saver
Energy Awareness in Art Class	Don't Throw Away Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Energy Education Internet Sites	Careers in Energy, Energy Futures, Action Ideas, Energy Sparks: Be an Energy Saver
Energy Ice Cream	Don't Throw Away Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Energy Jeopardy	Don't Throw Away Energy, Why Use Renewable Energy, Siting for Solar/Wind Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Energy Use Around the World	Why Use Renewable Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Energy Use Then and Now	Action Ideas, Energy Sparks: Be an Energy Saver
Evaluating Resources	Don't Throw Away Energy, Why Use Renewable Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Comprehensive Theme Activity: Energy Action Plan, Energy Sparks: Be an Energy Saver
Fantastic Photovoltaics	Why Use Renewable Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Floating on Energy!	Careers in Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Fun in the Sun	Action Ideas, Energy Sparks: Be an Energy Saver
Generating Less Household Waste	Don't Throw Away Energy, Action Ideas, Energy Sparks: Be an Energy Saver Get Mad About Energy! Don't Throw Away Energy, Why Use Renewable Energy, Energy Futures, Action Ideas, Energy Sparks: Be an Energy Saver
Grand New Energy Conference	Don't Throw Away Energy, Why Use Renewable Energy, Careers in Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Comprehensive Theme Activity: Energy Action Plan, Energy Sparks: Be an Energy Saver
High School Environmental Action Conference	Why Use Renewable Energy, Careers in Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Comprehensive Theme Activity: Energy Action Plan, Energy Sparks: Be an Energy Saver
Journey of Garbage	Don't Throw Away Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Junior Solar Sprint	Why Use Renewable Energy, Siting for Solar/Wind Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Midwest Renewable Energy Fair	Why Use Renewable Energy, Careers in Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Pedal Your Way To Energy Literacy	Energy Futures, Action Ideas, Comprehensive Theme Activity: Energy Action Plan, Energy Sparks: Be an Energy Saver

Promising Practice	Complementary KEEP Activities
Recycle Sale!	Don't Throw Away Energy, Action Ideas, Energy Sparks: Be an Energy Saver
Shining Light on Photovoltaics	Why Use Renewable Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Energy Sparks: Be an Energy Saver
SolarWise For Schools Program	Why Use Renewable Energy, Careers in Energy, Energy Futures, Siting for Solar/Wind Energy, Action Ideas, Comprehensive Theme Activity: Energy Action Plan, Energy Sparks: Be an Energy Saver
Wisconsin Energy Initiative-2	Don't Throw Away Energy, Careers in Energy, Action Ideas, Comp. Theme Activity: Energy Action Plan, Energy Sparks: Be an Energy Saver

Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators

We want you to share your successes in energy education with us!

The Wisconsin K-12 Energy Education Program (KEEP), the Energy Center of Wisconsin, and the Wisconsin Center for Environmental Education are proud to announce an exciting new energy education resource: *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators.* To help strengthen and support the endeavors of K-12 teachers to incorporate energy into their classrooms we have created a networking tool for YOU to connect with hundreds of other energy educators across the state. This resource includes energy education projects, activities and lessons straight out of Wisconsin classrooms. If you would like a copy of this document, please contact the KEEP office.

Promising Practices is designed to be an evolving document, so we want to continue to hear about your successes with energy education!

A "promising practice" can range anywhere from a ten-minute motivational introductory class activity to a year-long school-wide project. New or adapted classroom activities and lesson plans, in formal and nonformal educational settings are also needed.

Please share your successes in energy education with us by filling out the following Promising Energy Education Practice Questionnaire.

Your Name: _____

Name of School: _____

School Address: _____

School Phone: _____ School Fax: _____

Email: _____

Activity, Project, or Lesson Title: _____

Please provide a description of the practice (attach additional sheets if necessary):

(Continued on Reverse)

This practice works best for the following grade levels:
____ K-2
____ 3-5
____ 6-8
____ 9-12
____ All grade levels
____ Other: _____

The practice fits into the following subject areas:
____ Science: (Circle those that apply: General, Physical, Earth/Space, Life/Environmental)
____ Environmental Education
____ Social Studies
____ Technology Education
____ Fine Arts
____ Language Arts
____ Mathematics
____ All Subject areas
____ Other: _____

Preparation time: _____ Time needed to complete project: _____

Please list any special considerations for materials, preparation, permissions, etc.:

Please list any suggestions or comments you may have regarding this promising practice or suggestions for next time:

Are you willing to be listed as a contact for networking?

Thank you for taking the time to complete this questionnaire and for helping to improve energy education in Wisconsin.

Please return to:
KEEP - LRC
University of Wisconsin - Stevens Point
Stevens Point WI, 54481
Phone: (715) 346-4320, E mail: ekoop976@uwsp.edu

APPENDIX I

Dissemination Letter to All KEEP Graduates Who Received
A Copy of *Promising Practices*

KEEP

Wisconsin Center for Environmental Education & Energy Center of Wisconsin

To: KEEP Graduates
From: Bonnie Koop, KEEP Program Assistant
Jennie Lane, KEEP Program Coordinator
Re: *Promising Energy Education Practices in Wisconsin*
Date: May 28, 1999

Greetings!

The Energy Center of Wisconsin, the Wisconsin Center for Environmental Education, the Wisconsin Environmental Education Board, and KEEP thank you sincerely for your continued efforts to teach about energy. To express our gratitude we would like to present you with a gift: *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators.*

We designed this energy education resource to provide you with new ideas and inspiration in the areas of lesson enhancement / integration, projects, events, and professional development. Educators across the state volunteered activities and approaches to teaching energy that they found to be successful in application with students. To strengthen energy education in Wisconsin we encourage you to use this resource to network with KEEP graduates across the state and to enhance your own energy education offerings.

Future participants in KEEP courses will receive a copy of *Promising Practices*. Please share the enclosed schedule of upcoming classes with any interested teachers so they can gain access to this resource as well.

Promising Practices is an evolving document. So let us hear about your promising practices! Simply fill out the *Promising Practices* evaluation form at the end of this book and return it to us. Provide us with the appropriate information and we'll make sure to include it in our next issue.

We are also excited to hear if and how you used *Promising Practices.* Please send any suggestions or comments to:

KEEP
Learning Resource Center
UW – Stevens Point
Stevens Point, WI 54481
(715) 346-4770
energy@uwsp.org

Thank you for helping to energize Wisconsin!

Wisconsin K-12 Energy Education Program
•
Learning Resource Center
University of Wisconsin - Stevens Point
•
Stevens Point, WI 54481-3897
•
Phone: (715) 346-4770
•
Fax: (715) 346-4698
•
E-mail: energy@uwsp.edu

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APPENDIX J

Dissemination Letter to All KEEP Adjunct Faculty

KEEP

Wisconsin Center for Environmental Education & Energy Center of Wisconsin

Wisconsin K-12 Energy Education Program

•

Learning Resource Center
University of Wisconsin - Stevens Point

•

Stevens Point, WI 54481-3897

•

Phone: (715) 346-4770

•

Fax: (715) 346-4698

•

E-mail: energy@uwsp.edu

To: KEEP Adjunct Faculty
From: Randy Champeau, Jennie Lane and Bonnie Koop
Re: *Promising Energy Education Practices*
Date: June 8, 1999

Greetings!

With your guidance and suggestions *Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators* has become a reality.

"Promising Practices" has recently been distributed to all 700 KEEP graduates as a resource for new ideas and for inspiration in teaching about energy. In addition, *Promising Practices* will also be distributed in upcoming KEEP courses and made available at the Energy Center of Wisconsin Internet site (www.ecw.org). It is our hope that teachers will utilize *Promising Practices* to network with other energy educators across the state and to strengthen energy education in Wisconsin.

Teachers were invited to voluntarily participate in the publication by submitting their "promising practices." When choosing from these contributions we tried to provide a diversity of subject areas and grade levels that energy education spans. Additional resources for energy education were included such as helpful Internet sites, an energy education bibliography, and cross-reference charts for both Wisconsin State Standards and KEEP activities.

We would greatly appreciate your assistance in reviewing *Promising Practices* and giving us feedback. Enclosed is a short questionnaire and return envelope for your reply. Sharing your expertise in teaching about energy and in working with other teachers will give us helpful insight in to how this book could be improved or utilized in the future.

Thank you again for all of your assistance in the development of this new addition to KEEP's energy education resources. If you have any questions, please contact Bonnie Koop:

KEEP
LRC - UWSP
Stevens Point, WI 54481
(715) 346-4320 or ekoop976@uwsp.edu

Thank you!

APPENDIX K

Evaluation Sent to All KEEP Adjunct Faculty

Promising Energy Education Practices in Wisconsin: Creating a Network of Energy Educators

QUESTIONAIRRE

1. **I believe that *Promising Practices* is a useful energy education resource for elementary, middle, and secondary teachers.**

Strongly Agree Agree Not Sure Disagree Strongly Disagree

Comment:_____

_____

2. **I believe that teachers from a variety of disciplines will find *Promising Practices* to be a useful tool for teaching about energy.**

Strongly Agree Agree Not Sure Disagree Strongly Disagree

*Comment:*_____

_____

3. **I believe that by highlighting peer successes *Promising Practices* will inspire and motivate teachers to teach about energy.**

Strongly Agree Agree Not Sure Disagree Strongly Disagree

*Comment:*_____

_____

4. **I believe that *Promising Practices* will serve as a valuable networking tool for energy education teachers in Wisconsin.**

Strongly Agree Agree Not Sure Disagree Strongly Disagree

*Comment:*_____

_____

5. **I believe that *Promising Practices* will strengthen energy education Wisconsin.**

Strongly Agree Agree Not Sure Disagree Strongly Disagree

*Comment:*_____

_____

6. **I believe that KEEP should continue to build upon and disseminate *Promising Practices* in Wisconsin.**

Strongly Agree Agree Not Sure Disagree Strongly Disagree

*Comment:*_____

7. **I feel that Promising Practices will be valuable to me as an energy educator.**

Strongly Agree Agree Not Sure Disagree Strongly Disagree

*Comment:*_____

8. **I would recommend Promising Practices to others as an energy education resource.**

Strongly Agree Agree Not Sure Disagree Strongly Disagree

*Comment:*_____

9. **Please share your suggestions for improving *Promising Practices*:**

THANK YOU FOR COMPLETING THIS QUESTIONAIRRE

PLEASE RETURN BY FRIDAY JUNE 25th

170