

# Introduction

The KEEP *Energy Education Activity Guide* provides K–12 teachers in a variety of subject areas with easy-to-use, hands-on, minds-on activities designed to promote energy literacy in Wisconsin students.

The Wisconsin Department of Public Instruction's Academic Standards were referenced during the development of this activity guide. See the Cross-Reference Charts to learn how activities in this guide relate to different subject areas, utilize a variety of teaching methods, and connect to lifelong learning opportunities such as School-to-Career.

## **Thematic Organization for the KEEP Energy Education Activity Guide**

KEEP's *Conceptual Guide to K–12 Energy Education in Wisconsin* directed the development of the *Energy Education Activity Guide*.

The activities are divided into four themes. Within the themes, the activities are subdivided by grade levels (K–4, 5–8, and 9–12).

Activities within this guide are organized by the following themes:

### **Theme I: We Need Energy**

**Goal:** To help students appreciate the nature of energy and to provide them with an awareness of how energy is used to maintain, organize, and change systems that affect their everyday lives. Through participation in activities from this theme, students gain a fundamental knowledge about energy, including what it is, where it comes from, and what forms it takes. In addition, they become familiar with energy conversions and limitations of energy use.

### **Theme II: Developing Energy Resources**

**Goal:** To help students identify different energy resources and analyze the processes involved in making those resources available to meet our needs. Understanding what energy is and how it flows through systems is necessary to appreciate how humans have come to harness, value, and treat energy resources.

### **Theme III: Effects of Energy Resource Development**

**Goal:** To encourage students to investigate how energy use affects their lives. Recognizing these effects increases students' awareness of why and how they use energy and promotes an understanding of why societies and individuals manage their energy resource use.

### **Theme IV: Managing Energy Resource Use**

**Goal:** To provide students with knowledge and skills they can use to help ensure that energy resources are effectively used on a sustainable basis. 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.

## **Grade Levels and Theme Emphasis**

Concepts within all the themes are relevant to teachers at any grade level and in a variety of subject areas (see Cross-Reference Charts: Grade Levels and Subject Areas). However, when building a K–12 energy education program, certain themes can be stressed at different grade levels. The chart on the next page shows a schematic organization of the themes by grade level. Participating in activities from **Theme I: We Need Energy** provides students with a fundamental knowledge about energy. The concepts within this theme are the foundation upon which concepts in the other three themes are built. Therefore, We Need Energy should be emphasized in grades K–5. Elementary teachers will find a variety of activities and teaching ideas intended to introduce students to basic energy concepts.

Activities and teaching ideas from **Theme II: Developing Energy Resources** have students identify and look at different sources of energy. These concepts are appropriate for the upper elementary grades, especially grades 3–5. However, other concepts within this theme require higher level thinking skills because students must interpret and examine the process of energy

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resource development. Therefore, many of the activities from this theme pertain to students in middle school.

Awareness of how energy use positively and negatively affects quality of life, economic activity, and the environment can begin during the primary grades; however, because of the complexity of many issues, these concepts may be better introduced at a later stage. The majority of the activities within **Theme III: Effects of Energy Resource Development** are appropriate for the middle school years. High school students can take what they have learned earlier and use the knowledge and skills to conduct independent investigations (see Investigation Ideas in Theme III). Educators can teach younger students the importance of efficient energy use. However, younger students may not comprehend the reasoning behind these efforts until they learn to think more abstractly. The higher level thinking skills (such as linking economic activity and energy flows, linking environmental impacts and energy flows, and extrapolating how today's actions could affect the availability of energy resources tomorrow) are best suited for more mature students.

Consequently, most of the activities from **Theme IV: Managing Energy Resource Use** are

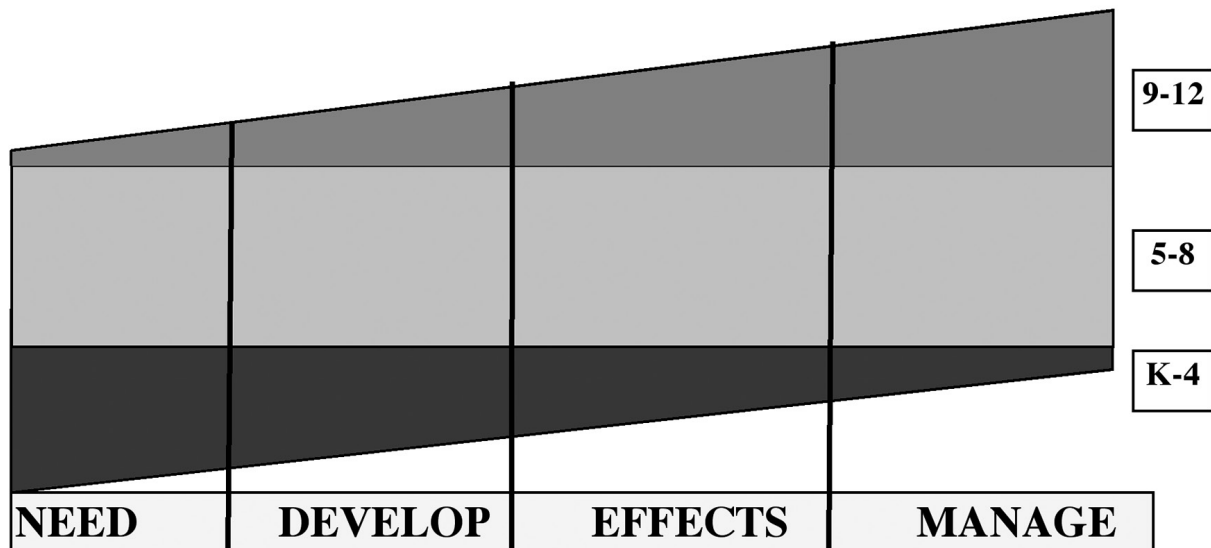
designed for middle and high school students. By the time students graduate from high school, they should have mastered the concepts and learned lessons from the world around them. These competencies will enable them to make wise decisions regarding energy choices, to understand the workplace and career opportunities derived from activities within the *KEEP Energy Education Activity Guide* and associated school-to-career elements, and to take actions that reflect their personal ethic and knowledge of energy.

## Types of Activities

There are three types of activities within this guide:

- **Theme Activities**
- **Energy Sparks** (NOTE: For grades 6–12 these are called Investigation Ideas in Theme III and Action Ideas in Theme IV.)
- **Comprehensive Theme Activities**

**Theme Activities** are fully developed activities that provide educators with background information, explicit objectives, a detailed procedure, and assessment strategies. They are designed to be self-contained lessons. Background information is usually found within the activity; occasionally other sections of the guide may be referenced. Most activities require some preparation time to locate



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and set up materials. However, this time should decrease with successive uses. For the most part, the materials should be available in local stores, online or within the school. Many activities are accompanied by *Student Activity Sheets*.

**Energy Sparks** are for teachers who simply want ideas for teaching students about energy. Teachers may use some of these ideas as targeted time-fillers, while other ideas can be developed into in-depth investigations. The Investigation Ideas complement the Comprehensive Theme Activity for the theme Effects of Energy Resource Development. Students can read these ideas and select a topic or issue for their investigation. Likewise, Action Ideas support the Comprehensive Theme Activity for the last theme, Managing Energy Resource Use. Students can use this list of suggestions to help them identify their action project.

**Comprehensive Theme Activities** (CTAs) provide teachers with the means to assess students' comprehension of most or all of the concepts within a theme. CTAs have students communicate what they know through creative projects. These projects require that students compile, organize, and present their knowledge in a manner that satisfies specific criteria.

NOTE: The CTAs in the *Energy Education Activity Guide* are group projects that could require several weeks to complete. However, there are limitless approaches for conducting CTAs. For example, simple experiments conducted by all the students in the class within a few minutes can in some cases be used as a CTA. Many of the formative and summative assessments in each of the theme activities may serve as CTAs.

Following is a brief description of the **Comprehensive Theme Activity** for each theme.

**Theme I: "Energy Story":** Students will be able to create a thorough and comprehensive story of how energy is used around the home, school, and community. Students will use their story to define

energy, categorize end uses of energy, and identify sources of energy.

**Theme II: "Energy Debate":** Students will debate the advantages and disadvantages of developing and using various energy resources. The debate should summarize the costs and benefits of energy resource development, consumption, and disposal, and then conclude with future outlooks for resource availability.

**Theme III: "Energy Investigations":** Students will investigate and analyze the effects of energy development and use on human societies and the environment. For example, they may survey peers to learn their views about conserving energy or willingness to car pool.

**Theme IV: "Energy Action Plan":** Students will develop an action plan that promotes positive behavior regarding energy use, helps resolve an energy-related issue, or both. Students will choose the best action based on careful analysis, research and implement the plan, and evaluate the results. Examples of action plans include developing and implementing an energy conservation plan for their home or school.

## Coordination of Activities

Educators may use each type of activity within the guide independently, or they can organize the activities into a unit (for example, a series of activities that build upon each other to address the goals of an overarching theme). The Theme activities include a section called **Related KEEP Activities**. This section identifies other theme activities and teaching ideas (from **Energy Sparks**) that can be used before or after, or as a supplement to, a particular activity. The Cross-Reference Charts organize activities by grade level, subject area, and assessment strategies and are another way educators can quickly identify activities that meet their teaching needs.

The **Comprehensive Theme Activities** can be conducted independently or they can be used in conjunction with theme activities, acting as

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a culminating learning event that ties together concepts within theme activities. The CTA would most likely be assigned at the beginning of a unit on energy, and as students participated in theme activities and other learning experiences, they would apply the information they gained toward completing the CTA. For students to successfully complete the CTA, they should have mastered the concepts within an entire theme.

## **Integrating Energy Concepts**

Concepts in the *Energy Education Activity Guide* are applicable to teachers of Science, Mathematics, Social Studies, English Language Arts, Technology Education, Family and Consumer Science, or to anyone who wants to promote energy as part of their environmental education curriculum.

KEEP activities can be used to address the Academic Standards developed by the Wisconsin Department of Public Instruction as well as the Next Generation Science Standards and Common Core Standards for English Language Arts and Mathematics. These standards identify what students should understand and how they should demonstrate achieved learning.

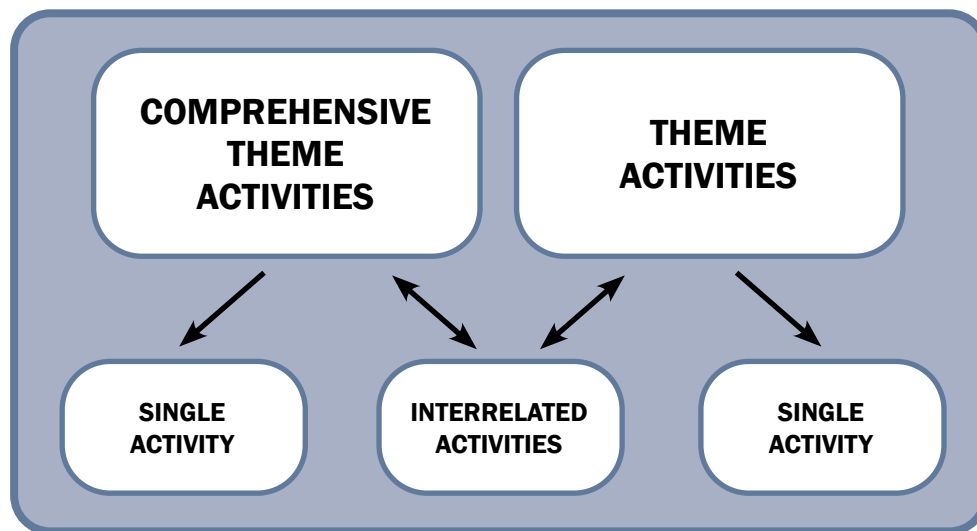
In addition to the various Cross-Reference Charts, educators and curriculum developers can refer to the [Conceptual Guide](#) to learn where energy

concepts apply to curricula and standards. This publication includes a “Suggested Scope and Sequence” that provides guidelines showing when and to what extent energy concepts could be integrated into school curricula. For example, teachers can use the scope and sequence to identify the concepts appropriate for their subject and grade level. The next step for educators is to determine which of these concepts are already included in and which are lacking from their curricula. **Theme Activities** and **Energy Sparks** found within the *KEEP Energy Education Activity Guide* provide teachers with opportunities to bring these energy concepts into curricula.

According to state mandate, environmental education objectives and activities are to be integrated into district kindergarten through grade 12 sequential curriculum plans, with greatest emphasis in art, health, science, and social studies. The Conceptual Guide was designed with the goals for environmental education in mind. KEEP developed activities based on this document. Therefore, educators and curriculum planners can use KEEP materials in their efforts to develop and implement environmental education curriculum.

## **Conducting an Energy End Use Survey and Management Plan**

Students can be involved in inventorying and



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assessing how they use energy. Through end use surveys and management plans, students (1) comprehensively investigate energy use in their home, school, and community; (2) analyze the cost of using energy; and (3) identify actions they can take to use energy more efficiently. For more information about how to organize this plan, see **Introduction to the Energy End Use Survey and Management Plan**.

## School-to-Career Features

KEEP Theme Activities and Comprehensive Theme Activities provide an excellent opportunity to link and develop school-to-career learning opportunities. KEEP activities are based on real-world situations and experiences. Thus, they provide a pathway to private and public institutions in the community that can provide professional knowledge, assistance, examples, and learning experiences. Investor-owned, municipal, and cooperative utilities have traditionally provided energy education and are potential school-to-career partners, as are a variety of firms, nonprofit groups, community organizations, and government agencies.

Examples of school-to-career skills include using resources and technology effectively, interpersonal proficiency, and understanding systems. These skills are critical for all students, regardless of the career path they choose.

## Enrichment

Many theme activities have an **Extensions** section or direct teachers to relevant teaching ideas in **Energy Sparks**. These referrals suggest techniques for students to further investigate concepts introduced in the activity.

## Assessing Student Learning

This *Energy Education Activity Guide* provides several approaches for assessing student learning. It is helpful to assess students' current understandings and misconceptions about energy. Use the introductory lesson "Energy Ideas" to gain insight into what students currently think and feel about energy. Furthermore, the **Orientation** of each activity procedure provides suggestions for ascertaining what students know about the upcoming lesson.

**Formative and Summative Assessment** ideas are located within each theme activity. The **Formative Assessment** points out events during the activity when educators can check their students' achievement of the objectives. **Summative Assessment** takes place near the end of the activity or after the activity's completion. The aim of **Summative Assessment** is to determine if students can take what they have learned and apply it to a different experience.

Students' comprehension of concepts within an entire theme can be assessed through the **Comprehensive Theme Activities**. These comprehensive projects provide teachers with the means to make objective evaluations of which concepts students have mastered and which areas students need further instruction.

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The Wisconsin K-12 Energy Education Program is supported through funding from



Wisconsin K-12 Energy Education Program (KEEP)  
College of Natural Resources  
University of Wisconsin - Stevens Point



# Introduction to the Energy End Use Survey and Management Plan

You can organize a series of KEEP activities to lead your students from awareness of their energy use to actively managing their energy use. The following list identifies activities that focus on students' assessing their energy use. (See **Related KEEP Activities** within each activity for additional planning ideas.)

## Theme I: We Need Energy

"At Watt Rate?" involves students in identifying and calculating how much energy they use.

Alternative idea: To analyze energy use and transportation, see the activity "Driving Reasons" in Theme III. Use "Community Energy Use" in Theme I if you would like your students to broaden their research to include the community.

## Theme II: Developing Energy Resources

"Fuel That Power Plant" and "Electric Motors and Generators" have students investigating where their electricity comes from and how it is generated.

Alternative idea: If the focus of their energy use assessment is on transportation, have students participate in the activity "Get That Gasoline."

## Theme III: Effects of Energy Resource Development

"The Cost of Using Energy" involves students in identifying some of the economic effects of energy development and use. "The Dirty Half Dozen" helps students identify some environmental effects of their energy use.

Alternative idea: Students can also investigate other effects by applying what they learned in "At Watt Rate?" or "Driving Reasons" to complete the Comprehensive Theme Activity: "Energy Investigations."

## Theme IV: Managing Energy Resource Use

Use the Comprehensive Theme Activity: "Energy Action Plan" to have students design an energy efficiency action plan. Encourage students to select relevant actions (from Action Ideas: Energy Efficiency Measures) based on their findings from the activities "At Watt Rate?," and "The Cost of Using Energy."



# Activity Format

Brief description of student learning and activity procedure.

**Grade Level:** Suggested grade levels: K-4, 5-8, 9-12

**Subject Areas:** Relevant subject areas.

**Setting:** Recommended location.

**Time:**

**Preparation:** Approximate time needed to review background information and set up materials.

**Activity:** Average class time needed to conduct the activity.

**Vocabulary:** Key terms introduced or used in the activity.

**Major Concept Area(s):**

- Lists the major concepts covered in this activity.

**Getting Ready:** Directions for preparing materials or setting up demonstrations prior to conducting the activity with students.

**Objectives**

Knowledge and skills students will acquire as a result of doing the activity.

**Rationale**

Importance of students learning the concepts or skills in this activity.

**Materials**

Items needed for the activity. Any necessary preparation of materials is described in **Getting Ready**. **Teacher Pages** are noted in bold, black italics. **Student Activity Sheets** are noted in bold, blue, italics.

**Background**

Description of energy topics and concepts addressed in the **Procedure**.

**Procedure**

**Orientation**

Discussion topics that can be used to relate forthcoming concepts to students' lives and to assess what students currently know about the concepts in the activity.

**Steps**

Suggested strategy for completing the activity.

**Closure**

Discussion topics that can be used to conclude the activity and to assess what students have gained from participating in the activity.

**Assessment**

**Formative**

Questions about student actions that occurred during the activity.

**Summative**

Suggested activities that have students applying learned information or skills to new situations.

**Extensions**

Variations and additions to the activity. Enrichment activities and relevant teaching ideas can be found in the "Energy Sparks" sections.

**Related KEEP Activities**

Theme activities and teaching ideas from "Energy Sparks" that can precede, supplement, or follow this activity.

**Credit(s)**

Citations for lesson components.