



6TH GRADE CURRICULUM

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Energy Investigations: Analyzing Your School Energy Use

Lesson 1: 6th Grade

Module Introduction: *Kilowatt Ours* Video

- Watch the video *Kilowatt Ours*
- Discuss electricity production in the United States—trade-offs, consequences, alternatives

Lesson 2: 6th Grade

Analyzing Your School: Memory Drawings

- Review K -5th energy conversion principles (if necessary)
- Discuss the students' views of buildings and their functions
- Create detailed drawings of your school from memory

Lesson 3: 6th Grade

Energy Investigations: Developing an Energy Use Investigation Plan

- Based on the word maps from Lesson 2, students will develop an energy investigation plan.

Lesson 4: 6th Grade

Daily School Energy Use

- Brainstorming exercises about the schools' daily energy use
- Create word maps as tool for organizing and discussing ideas

Lesson 5: 6th Grade

School Building Survey: Getting to Know Your School

- Students discuss and gather information about their schools' general energy use, the building envelope, and lighting

Lesson 6: 6th Grade

Investigations: Creating an Energy Use Inventory Checklist

- Create Energy Use Investigation Plans / Checklists these will provide the templates for the remainder of the module

Lesson 7: 6th Grade

Energy Investigations: Gathering the Data

- Small groups investigate their areas of research around the school

Lesson 8: 6th Grade

Energy Investigations: Writing the Energy Savings Action Plans

- Small group presentations of Energy Savings Action Plans

Lesson 9: 6th Grade

Energy Investigations: Presenting the Energy Saving Action Plans

- Small group presentations on the schools' energy use and energy saving ideas from each investigation site

Lesson 10: 6th Grade

Energy Investigations: Enacting the Energy Savings Action Plans

- Carry out one to three suggestions from the Energy Savings Action Plans

Lesson 1: 6th grade
Module Introduction: Kilowatt Ours Video

Lesson Overview: Learn about real-world, current energy production.

Lesson Concept: Introduce the concept of reducing energy demand and develop understanding of the complex trade-offs associated with electricity generation and use.

Materials:

- Video: *Kilowatt Ours* (www.KilowattOurs.org)

Standards:

- **English:**
 - **VIII.10.MS.3** (Ideas in Action: Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world).
 - **IX.11.MS.1** (Inquiry and Research: Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and, create a thesis or a hypothesis).
- **Science:**
 - **II.1.MS.3** (Reflect on the Nature, Adequacy and Connections Across Scientific Knowledge: Show how common themes of science, mathematics, and technology apply in real-world contexts).
 - **V.1.MS.5** (Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts: Explain how technology changes the surface of the earth).
 - **V.2.MS.3** (Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts: Describe the origins of pollution in the hydrosphere).
 - **V.3.MS.4** (Use Scientific Knowledge from the Earth and Space Sciences in Real-World Contexts: Describe the health effects of polluted air).
- **Social Studies:**
 - **II.5.MS.1** (Geographic Perspective: Describe how social and scientific changes in regions may have global consequences).
 - **IV.2.MS.2** (Economic Perspectives: Compare various methods for the production and distribution of goods and services).
 - **IV.2.MS.4** (Economic Perspective: Examine the historical and contemporary role an industry has played and continues to play in a community).
 - **VI.1.MS.3** (Public Discourse and Decision Making: Explain how culture and experiences shape positions that people take on an issue).
 - **V.2.MS.1** (Inquiry: Pose a social science question about a culture, world region, or international problem).
 - **VI.1.MS.1** (Public Discourse and Decision Making: State public policy issues and their related ethical, definitional, and factual issues as questions).

Timeline: 1 – 2 class periods (38-minute or 56-minute version of film) + discussion

Class Structure: video and whole class discussion

Assessment Strategy: EEK! Daily Assessment, Pre-Module Assessment Questions #1, #2, #3

Lesson 1: 6th grade

Module Introduction: Kilowatt Ours Video

Lesson Overview: Learn about real-world, current energy production.
Lesson Concept: Introduce the concept of reducing energy demand and develop understanding of the complex trade-offs associated with electricity generation and use.

Materials:

- Video: *Kilowatt Ours* (www.KilowattOurs.org)

Background Information

The video *Kilowatt Ours* is a good introduction to how energy is produced in the United States. Focusing primarily on coal mining for electricity production, the video discusses the health, social, and environmental damage of coal mining and pollution.

CLASS EXERCISES:

I. Kilowatt Ours

There are two versions of the film included on the DVD—a 38-minute version and a 56-minute version. Both are recommended. The 56-minute version includes material discussing a successful grass-roots action to not allow a nuclear power plant to be built in a town. Also included in the 60-minute version is discussion of other means of electricity generation and their impacts.

II. Class Discussion

After watching the video, facilitate conversation around open-ended questions such as:

- What did you think about the video?
- What new information did you learn?
- What were you already aware of?
- Were you surprised by anything you learned?

Given that this is the introduction to the module, the class discussion can provide significant information signaling the level of prior knowledge and awareness (of energy issues) the students have—individually and as a class.

III. Discussion Wrap-up

After a minimum of a 20-minute discussion, conclude the discussion by introducing the remainder of the module.

For the next few weeks, we are going to be using our school as a living laboratory conducting experiments. We will be measuring and testing things we use everyday in the school for their energy efficiency. I encourage all of you to take this work seriously, for we have been given the task of not only determining some of the overall energy use of the school, but have been asked to make recommendations based on our findings for how the school can become more energy savvy, more energy efficient.

Lesson 2: 6th grade

Analyzing Your School: Memory Drawings

Lesson Overview: Develop a spatial and structural understanding of the school building.
Lesson Concept: Relying on previous knowledge as one method of guiding the questioning and brainstorming process.

Materials:

- Large white drawing paper
- Pencils
- Erasers
- Colored pencils
- Student Hand-out #1: Ground Rules for Effective Small Group Projects

Standards:

- **English:**
 - **VIII.10.MS.3** (Ideas in Action: Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world).
 - **IX.11.MS.1** (Inquiry and Research: Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and, create a thesis or a hypothesis).
- **Science:**
 - **II.1.MS.3** (Reflect on the Nature, Adequacy and Connections Across Scientific Knowledge: Show how common themes of science, mathematics, and technology apply in real-world contexts).

Timeline: 1 – 2 class periods (40 – 50 minutes)

Class Structure: whole class discussion and small group drawing project

Assessment Strategy: EEK! Daily Assessment
General Assessment Strategy #2

Lesson 2: 6th grade Analyzing Your School: Memory Drawings

At this point, as 6th graders, the students are hopefully well versed in understanding different forms of energy and daily energy uses. The students should have a deep understanding of essential issues concerning:

- forms of energy conversion,
- renewable and non-renewable forms of energy,
- electricity production, distribution, and measurement,
- global energy use, and,
- global energy issues.

If the students cannot discuss and create examples to illustrate the above points, please review appropriate coinciding lessons in the K-5th grade curriculum.

The 6th grade curriculum module focuses on analyzing and assessing energy used within the daily operations of the students' school—exploring how energy is consumed and how energy might be conserved.

Lesson Overview: Develop a spatial and structural understanding of the school building.

Lesson Concept: Relying on previous knowledge as one method of guiding the questioning and brainstorming process.

Materials:

- Large white drawing paper
- Pencils
- Erasers
- Colored pencils
- Student Hand-out #1: Ground Rules for Effective Small Group Project

Background Information:

This lesson explores visual and spatial memory. Collaborating in small groups, the students will draw detailed pictures of specific sections of their school from memory.

We often take for granted—and may not be aware—of the functioning of a building unless we are physically uncomfortable—too hot, too cold, or we are having difficulty seeing due to dim lighting or a glare from a window. The drawings created from this first lesson will be also be used later in the Module. Please mention this to the students.

CLASS EXERCISES:

I. Buildings & Their Functions

Before the students begin the Memory Drawing exercise, ask the students the lead question:
When you think of a building, what comes to mind?

Then, discuss buildings in general by exploring the following questions:

- What are the structural components—what materials might the building be made from?

- How is the temperature regulated?
- What activities occur inside of the building?

II. Memory Drawings: 1st Discussion

Now think of your school. Picture it in your mind. Not just the room you are sitting in, but the entire school building. Now, try to answer the following questions:

- What is the building made out of?
- How do you get in and out of the building—where are all of the doors located?
- How is it lit?
- Are some areas dark?
- Where are windows located?
- Are some rooms always warm?
- Are some rooms always cold?

III. Memory Drawings: A Small Group Project

Depending on the size of the class will greatly determine how large of a section of the school the class will draw during this lesson. The goal is to create a contiguous drawing of the school—or a significant part / area of the school—from memory. Then, after the Memory Drawings are complete, hang them on the wall together and analyze the missing pieces.

The small groups will continue investigating their chosen area for subsequent lessons.

- Determine what areas of the school will be investigated.
- Each small group will decide what part of the school they draw.
- Create one graphic drawing with as much detail as possible in each small group.
- Include such details as: how many doors, windows, and lights are located in your area of the school that your group is drawing.

IV. Memory Drawings: Analysis & Discussion

After each group has completed their drawing, choose one area of the room to tape them together. Analyze the collective drawing (all the pieces together as a whole) searching for gaps between each individual drawing.

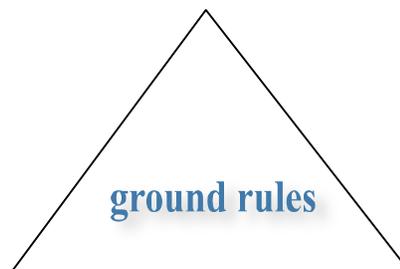
If gaps are found, create connecting pieces to complete the collective drawing. At the end of this lesson, the students have hopefully created a sketch of either the entire building or one contiguous segment of the building.

Teacher's Note: The class will return to this collective drawing throughout the module. Please let the students know this in advance, so they can choose areas of the building that hold particular interest for them.

Student Hand-out #1: Ground Rules for Effective Small Group Projects

Trust

- ‡Respect each others' opinions
- ‡Stay with the group
- ‡Believe in each others' skills
- ‡Keep an open mind



Communication

- ‡Listen to your group members
- ‡Use a 6" voice
- ‡Let all participate
- ‡Encourage others

Responsibility

- ‡Do your part
- ‡Help each other
- ‡Include all group members
- ‡Stay on task

Lesson 3: 6th grade Daily School Energy Use

Lesson Overview: Create word maps to explore ideas about the daily energy consumption of the school and how might energy be conserved.

Lesson Concept: Begin thinking about the school building as an energy system linked to the outside world—using energy resources, and impacting the global community.

Materials:

- Large white drawing paper
- Pencils
- Erasers
- Colored pencils

Standards:

- **English:**
 - **VIII.10.MS.3** (Ideas in Action: Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world).
 - **IX.11.MS.1** (Inquiry and Research: Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and, create a thesis or a hypothesis).
- **Science:**
 - **I.1.MS.1** (Construct New Scientific and Personal Knowledge: Generate scientific questions about the world based on observation).
 - **I.1.MS.6** (Construct New Scientific and Personal Knowledge: Write and follow procedures in the form of step-by-step. . .flow diagrams, and sketches).
- **Social Studies:**
 - **IV.2.MS.2** (Economic Perspectives: Compare various methods for the production and distribution of goods and services).
 - **IV.2.MS.4** (Economic Perspective: Examine the historical and contemporary role an industry has played and continues to play in a community).

Timeline: 1 class periods (40 – 50 minutes)

Class Structure: whole class brainstorming session (create word maps on the board on an overhead) OR small group project (small groups create individual word maps then discuss their completed word maps as a whole class)

Assessment Strategy: EEK! Daily Assessment
General Assessment Strategy #1
General Assessment Strategy #3

Lesson 3: 6th Grade Daily School Energy Use

This lesson is primarily a brainstorming session devoted to exploring the students' ideas and understanding about a building's energy use. As always, it is important to begin from where the students are—begin with their inherent knowledge and work from there. This lesson includes a series of questions as well as background material to facilitate discussions.

Lesson Overview: Create word maps to explore ideas about the daily energy consumption of the school and how might energy be conserved.

Lesson Concept: Begin thinking about the school building as an energy system linked to the outside world—using energy resources, and impacting the global community.

Materials:

- Large white drawing paper
- Pencils
- Erasers
- Colored pencils

Background Information:

This lesson is also, as Lesson 1, based solely on the students' previous knowledge. This lesson is a brainstorming session—encourage the students to 'free-associate' ideas about energy use in their school.

Hopefully, by the end of the lesson, the students will have created and agreed upon a list of energy investigations they will explore during the last three lessons of the unit. This lesson is crucial in that it provides an opportunity for the students to develop and explore specific questions that pique their interest.

CLASS EXERCISES:

I. Daily School Energy Word Map

Word mapping is a fun way to quickly share many ideas about a given topic. Once the word map is created, look for connections across subject areas.

Begin this brainstorming session by creating a whole class word map and use 'school energy use' as the starting point.

Step 1: Hang a large piece of white butcher paper on the board or wall.

Step 2: Write the words 'school energy use' in the middle of the paper.

Step 3: Ask the students to brainstorm about every different energy use in the school that they can think of. Write down all of their responses.

Hint: Use different colors for each tier to avoid confusion.

Teacher's Note: Please remember there is no 'right' or 'wrong' way to create a word map—this is a brainstorming exercise. The intent is to gather as many ideas as possible about what the students perceive as different energy uses around the school.

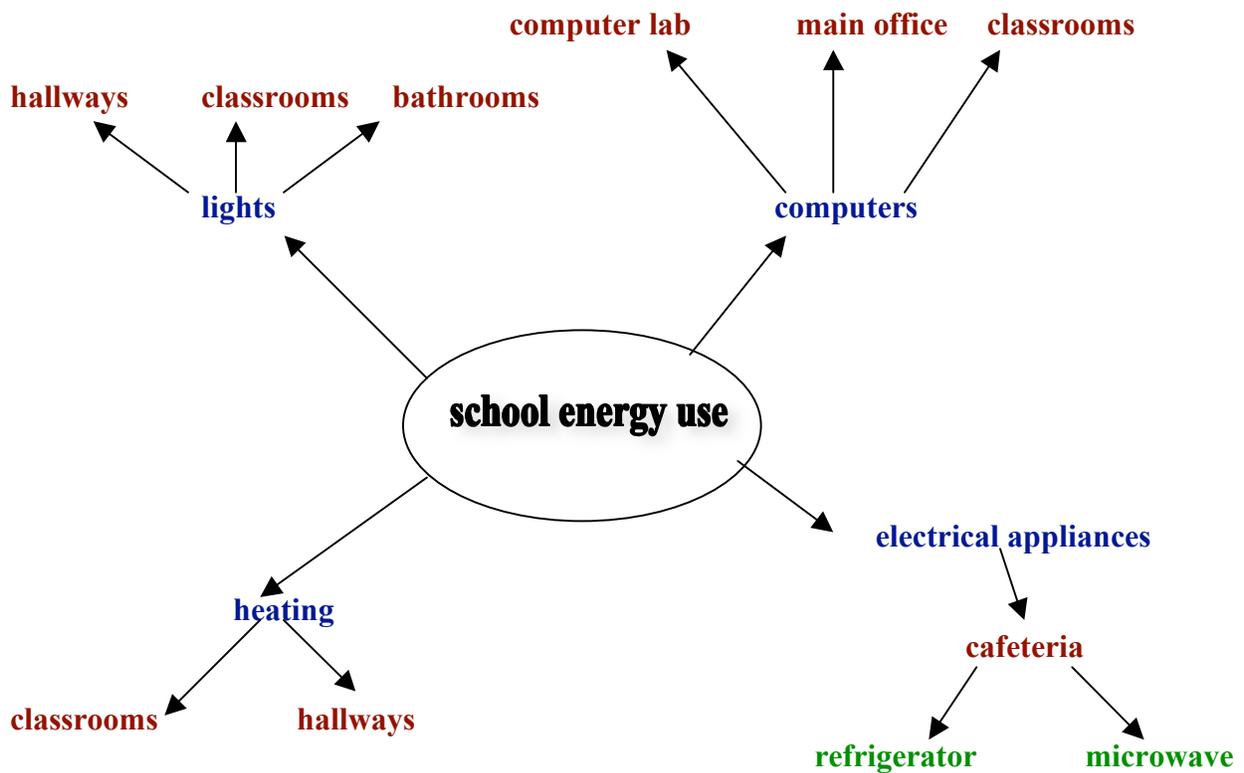
Below is an example of an initial word map and a brief explanation of the tiers of investigation.

Understanding the example word map: Tiers of Investigation

The 1st tier of investigation = objects that use energy in the school (lights, computers, etc.)

The 2nd tier of investigation = physical placement of objects in the school (hallways, classrooms, bathrooms, etc.)

The 3rd tier of investigation = brainstorming the 2nd tier (refrigerator, microwave)



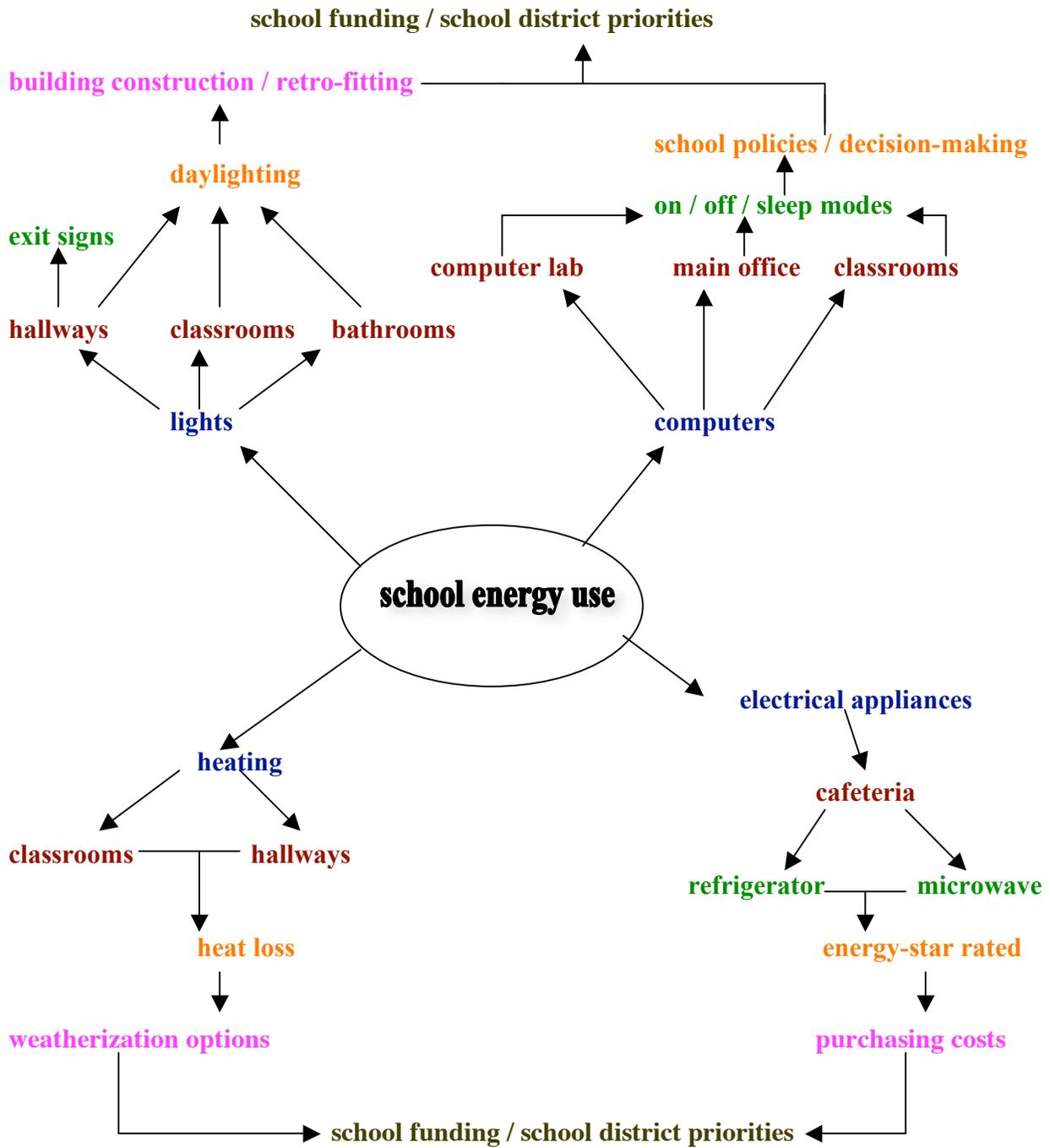
II. Discussion & Small Group Investigations

After the word map is complete, discuss who is most interested in pursuing which topics. Then, ask the students to form small investigation groups.

- Small Group Investigations—begin compiling answers to the following questions:
 - How, where, and with what devices might energy be consumed in the school every day?
 - What do you think consumes the greatest amount of energy in the school?
 - Is there a particular room or area in the school that you think uses the most energy? Refer to the Memory Drawings created in Lesson 1.
 - If you were to develop a plan to investigate the energy used in the school, what would be the steps taken (in order)?
 - What do you think could be done to conserve energy in your school? Be specific and try to think of ideas that could be easily accomplished.
 - Why might it be important to conserve energy resources?
 - Can you imagine three examples of how you school energy use might adversely affect the environment—social environment and physical environment?

III. Taking it Further: More Detailed energy Use Word Mapping

After the students have discussed their ideas to the above questions, ask the small groups to create another word map reflecting their ideas. As each tier of investigation investigates the possible scenarios, impacts, causes, and potential solutions for the preceding tier, the word map becomes more complex. Remember to use different colors for each tier of investigation to avoid confusion. Below is an example of a more detailed word map discussing School Energy Use:



Lesson 4: 6th Grade

School Building Survey: Getting to Know Your School

Lesson Overview: Explore, measure, and assess the school from an energy savings point of view.

Lesson Concept: Actively consider the school building as an energy system linked to the outside world—using energy resources, and impacting the global community.

Materials:

- Clipboards
- Pencils
- Erasers
- School Building Survey form
- Note-taking journals

Standards:

- **English:**
 - **IX.11.MS.1** (Inquiry and Research: Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and, create a thesis or a hypothesis).
- **Science:**
 - **I.1.MS.1** (Construct New Scientific and Personal Knowledge: Generate scientific questions about the world based on observation).
 - **I.1.MS.2** (Construct New Scientific and Personal Knowledge: Design and construct simple investigations).
- **Mathematics:**
 - **III.1.MS.4** (Data Analysis and Statistics: Identify what data are needed to answer a particular question or solve a given problem, and design and implement strategies to obtain, organize, and present those data).

Timeline: 1 class periods (40 – 50 minutes)

Class Structure: whole class brainstorming session (create word maps on the board on an overhead) OR small group project (small groups create individual word maps then discuss their completed word maps as a whole class)

Assessment Strategy: EEK! Daily Assessment
General Assessment Strategy #1
General Assessment Strategy #2
General Assessment Strategy #3

Lesson 4: 6th Grade

School Building Survey: Getting to Know Your School

Based on the word maps from Lesson 2, students develop an energy investigation plan that will provide the framework for gathering energy use data in Lesson 5.

Lesson Overview: Explore, measure, and assess the school from an energy savings point of view.

Lesson Concept: Actively consider the school building as an energy system linked to the outside world—using energy resources, and impacting the global community.

Materials:

- Clipboards
- Pencils
- Erasers
- School Building Survey form
- Note-taking journals

CLASS EXERCISES:

I. Assessing the School

Now, that the students have brainstormed their ideas about the school's potential daily energy use, it is time for the students to begin analyzing the school from an energy savings point of view.

Remaining in their small groups, divide the tasks into three groups

- General information
- Building envelope
- Lighting

II. School Building Survey Forms

Below is a basic school building survey form template. The students may want to explore additional questions. This form is inspired by the School Building Survey created by the NEED Project in the Learning & Conserving Student Guide. Please contact the NEED Project (www.need.org) for a detailed version of this lesson.

SCHOOL BUILDING SURVEY FORM

GENERAL INFORMATION

1. In what year was the school built?
2. Have any additions been made to the original school building? When were they made?
3. Have any renovations been made to the original school building? When were they made?
4. How many hours is the school in use during the week?
5. Compute the average amount of hours the school is in use during 12 months (one full year).
6. What are the total annual energy costs for the school—including electricity, heating, water heating?
7. Does the school have any means of generating energy other than purchasing energy from the electric or gas company? If yes, what and how much energy is generated?

BUILDING ENVELOPE

1. What is the building made of? In what condition is it?
2. What is the roofing material? What is the condition of the roof?
3. Are there any leaks in the building during a heavy rain or snowfall?
4. Is the building designed for using passive solar or light?
5. How many windows are there on each side of the building?
6. Are any windows cracked or broken?
7. Do windows seal tightly?
8. Are the windows single or double-glazed?
9. Do the windows have adjustable blinds?
10. Are trees planted around the building to provide shade in warm months?
11. Is the building insulated? Are the walls and ceiling insulated?
12. Do the doors (to the outside) seal tightly?

LIGHTING

1. What kinds of lighting are used in the school?
2. Are lights and fixtures kept clean?
3. Can lights be controlled with dimmer switches? In which areas or rooms?
4. Do the rooms have passive lighting available?
5. Are there automatic timers for any of the lights?
6. Are there any skylights or naturally-lit areas in the school?

This list is compiled from the NEED Project's Learning & Conserving Student Guide
(www.need.org)

Lesson 5: 6th grade

Energy Investigations: Developing an Energy Investigation Plan

Lesson Overview: In small groups, determine the what, where, and how of the Energy Investigation Plan.

Lesson Concept: Actively consider the school building as an energy system linked to the outside world—using energy resources, and impacting the global community by asking the question: How might energy be conserved?

Materials:

- Note-taking journals / folders
- Pencils
- Erasers

Standards:

- **English:**
 - **VIII.10.MS.3** (Ideas in Action: Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world).
 - **IX.11.MS.1** (Inquiry and Research: Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and, create a thesis or a hypothesis).
- **Science:**
 - **I.1.MS.1** (Construct New Scientific and Personal Knowledge: Generate scientific questions about the world based on observation).
 - **I.1.MS.2** (Construct New Scientific and Personal Knowledge: Design and construct simple investigations).
 - **I.i.MS.6** (Construct New Scientific and Personal Knowledge: Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches).
- **Social Studies:**
 - **V.2.MS.1** (Inquiry: Pose a social science question about a culture, world region, or international problem).
- **Mathematics:**
 - **III.1.MS.4** (Data Analysis and Statistics: Identify what data are needed to answer a particular question or solve a given problem, and design and implement strategies to obtain, organize, and present those data).

Timeline: 1 class periods (40 – 50 minutes)

Class Structure: whole class brainstorming session (create word maps on the board on an overhead) OR small group project (small groups create individual word maps then discuss their completed word maps as a whole class)

Assessment Strategy: EEK! Daily Assessment, General Assessment Strategy #3

Lesson 5: 6th Grade

Energy Investigations: Developing an Energy Investigation Plan

Based on the Memory Drawings from Lesson 1, the word maps from Lesson 2, and the information from the School Building Survey forms from Lesson 3, students, in small groups, will now develop personal energy investigation plans that will provide the framework for the remainder of the module.

Lesson Overview: In small groups, determine the what, where, and how of the Energy Investigation Plan.

Lesson Concept: Actively consider the school building as an energy system linked to the outside world—using energy resources, and impacting the global community by asking the question: How might energy be conserved?

Materials:

- Note-taking journals / folders
- Pencils
- Erasers

CLASS EXERCISES:

I. Developing the Plan

At this point, the students can begin directly combining the information created from the school building Memory Drawings (lesson 2), the word maps (lesson 3), and the School Building Survey forms (lesson 4).

Ask each group to develop a plan for investigating 3 items in their chosen room / area of the school. Use the previous ideas generated to provide a starting point for the small group discussions.

Encourage the students to investigate energy uses that affect the school directly and indirectly.

- **Step #1:** Have the students first determine if they feel physically uncomfortable in the room—too hot, too cold, too dark, too bright, bad smell (ventilation), etc.
- **Step #2:** If they have physical comfort issues when in the room, develop a set of hypotheses of what might be causing the issue(s).
- **Step #3:** Develop an Action Plan for research that could support their hypotheses.
- **Step #4:** If the students believe the room is physically comfortable, encourage them to develop a plan of what they would like to investigate.
- **Step #5:** A few examples of energy issues to investigate might be:
 - **Lighting:** # of lights in the room, type of lighting, wattage, # of hours of lighting / day, compute energy use per day, per week, per school year, compute approximate energy costs for lighting the room for a school year.
 - **Heat loss:** measure surface window temperature, measure surface wall temperature, calculate temperature differences, calculate potential energy savings costs for window insulation.
 - **Electrical appliances:** using a watt meter, measure the energy used over time of different appliances in the room—computers, lights, clocks, etc.

II. Organizing the Group

Once the group has determined what they will investigate. They need to develop a plan for how they will conduct their research—the tools needed— and who will do what part of the research. Given that this is a cursory look at energy use in the school, the following basic tools are suggested:

- Clipboards
- Note-taking journals
- Tape measure
- Watt meters (measures electrical energy use)
- IR thermometers (measure surface temperature)
- Pieces of tracing paper (identify poorly sealed window / doors)

Lesson 6: 6th grade

Investigations: Creating an Energy Use Inventory Checklist

Lesson Overview: In small groups, create an Action Plan that can be used to carry-out the Energy Investigation Plan.

Lesson Concept: Actively consider the school building as an energy system linked to the outside world—using energy resources, and impacting the global community by asking the question: How might energy be conserved?

Materials:

- Note-taking journals / folders
- Pencils
- Erasers
- Inventory Checklist

Standards:

- **English:**
 - **VIII.10.MS.3** (Ideas in Action: Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world).
 - **IX.11.MS.1** (Inquiry and Research: Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and, create a thesis or a hypothesis).
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- **Mathematics:**
 - **III.1.MS.4** (Data Analysis and Statistics: Identify what data are needed to answer a particular question or solve a given problem, and design and implement strategies to obtain, organize, and present those data).

Timeline: 1 – 2 class periods (40 – 50 minutes)

Class Structure: small group project

Assessment Strategy: EEK! Daily Assessment, General Assessment Strategies #3 & #4

Lesson 6: 6th Grade

Investigations: Creating an Energy Use Inventory Checklist

Lesson Overview: In small groups, determine the what, where, and how of the Energy Investigation Plan.

Lesson Concept: Actively consider the school building as an energy system linked to the outside world—using energy resources, and impacting the global community by asking the question: How might energy be conserved?

Materials:

- Note-taking journals / folders
- Pencils
- Erasers
- Inventory Checklist

Background Information:

Once the small groups have developed a plan for what part of the school building they will analyze, they are now prepared to create a check-list to help organize their ideas. The following are a list of questions with potential answers in brackets, (). You may want to present these questions to the class in order to facilitate the students' focus:

- What part of the school are you analyzing? (the library)
- What potential energy loss are you analyzing? (heat loss)
- Where do you believe this energy loss is taking place? (through the windows)
- What tools are you using to analyze the energy loss? (IR thermometers, pieces of tracing paper)
- How will you record your findings? (create check-list)

CLASS EXERCISES:

I. Creating an Energy Assessment Checklist

Either create a checklist of your own or use the one provided. The checklist provided is generic. If you begin with the provided checklist, the students may discover ways of improving or fine-tuning

Questions List: room by room assessment (compile all answers to create whole school assessment)

- # of windows: drafty? surface temperature, size
- surface temperature of walls 6" from window—N,S,E,W and **1' from window—N,S,E,W??**
- # of doors: drafty?
- Surface temperature surface temperature of walls 6" from doors—N,S,E,W and 1' from doors—N,S,E,W
- # of lights
- type of lighting: fluorescent, incandescent, compact fluorescent
- # of exit signs

Explanations of each category:

- Compare surface temperature of windows & walls: idea: to see if there is a significant difference in surface temperature between the window and the wall, demonstrate there is often significant heat loss through windows, especially if they are not double-paned or covered in IR film (discuss IR film)
- Drafty window test: hold a piece of plastic wrap close 4” away from the window edges. If the plastic wrap flutters or moves at all there is air coming through.

Room / Hallway Location:	Total #	Drafty (y or n)	Size of each	Surface Temperature
Window Analysis (total # in room)				
Window #1				
Window #2				
Window #3				
Window #4				
Window #5				
Window #6				
Window #7				
Window #8				
Wall Analysis (surface temperature: °F)	North	East	South	West
Window #1: 6" around window				
Window #2: 6" around window				
Window #3: 6" around window				
Window #4: 6" around window				
Window #5: 6" around window				
Window #6: 6" around window				
Window #7: 6" around window				
Window #8: 6" around window				
Lighting Analysis (type & wattage)		CFL	Fluorescent	Incandescent
Light #1				
Light #2				
Light #3				
Light #4				
Exit Signs (location in room / hallway)	Total #			

Lesson 7: 6th Grade

Energy Investigation: Gathering the Data

Lesson Overview: In small groups, students investigate the areas of research for the Energy Investigation Plans.

Lesson Concept: Actively consider the school building as an energy system linked to the outside world—using energy resources, and impacting the global community by asking the question: Where are energy losses occurring? How might energy be conserved?

Materials:

- Note-taking journals / folders
- Clipboards
- Pencils
- Eraser
- IR Thermometers?
- Watt meters?

Standards:

- **English:**
 - **VIII.10.MS.3** (Ideas in Action: Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world).
 - **IX.11.MS.1** (Inquiry and Research: Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and, create a thesis or a hypothesis).
- **Science:**
 - **I.1.MS.1** (Construct New Scientific and Personal Knowledge: Generate scientific questions about the world based on observation).
 - **I.1.MS.2** (Construct New Scientific and Personal Knowledge: Design and construct simple investigations).
 - **I.1.MS.4** (Construct New Scientific and Personal Knowledge: Use measurement devices to provide consistency in an investigation).
 - **I.1.MS.6** (Construct New Scientific and Personal Knowledge: Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches).
- **Social Studies:**
 - **V.2.MS.1** (Inquiry: Pose a social science question about a culture, world region, or international problem).
 - **VII.1.MS.2** (Citizen Involvement: Engage in activities intended to contribute to solving a national or international problem they have studied).
- **Mathematics:**
 - **III.1.MS.1** (Data Analysis and Statistics: Collect and explore data through observation, measurement, surveys, sampling techniques and simulations).

Timeline: 1 – 2 class periods (40 – 50 minutes)

Class Structure: small groups investigations throughout the school building

Assessment Strategy: EEK! Daily Assessment, General Assessment Strategy #3

Lesson 7: 6th Grade

Energy Investigation: Gathering the Data

Lesson Overview: In small groups, being investigating the areas of research for the Energy Investigation Plans.

Lesson Concept: Actively consider the school building as an energy system linked to the outside world—using energy resources, and impacting the global community by asking the questions: Where are energy losses occurring? How might energy be conserved?

Materials:

- Note-taking journals / folders
- Clipboards
- Pencils
- Erasers
- IR Thermometers?
- Watt meters?

Background Information:

In this lesson, the students leave the classroom and begin investigating other areas of the school. We recognize this may be difficult in certain school climates given the students will need supervision when in other areas of the school as well as require access to the areas they are investigating.

CLASS EXERCISE:

I. Gathering the Information

With clipboards, check-lists, and note-taking journals in hand, the students go to their chosen areas of investigation and begin gathering data.

II. Returning with Information

Hopefully, the students will return with the desired information. If not, ask the group(s) to write about their roadblocks to gathering the data and determine what steps need to be taken in order to assist them *or* decide their original idea needs to be shifted to accommodate the given reality of the school atmosphere.

III. Making Sense of the Information

Now, that the groups have their data, they need to begin interpreting the data to determine what might be done to begin saving energy in the school. This information will be ultimately written as part of the final Energy Savings Action Plan created by the class.

IV. Sharing the Information

After all the groups have gathered their data, have each group share their findings with the class. If multiple groups researched one topic, such as lighting, but researched different parts of the building, ask them to work together to create the Energy Saving Action Plan for that topic.

Lesson 8: 6th Grade

Energy Investigations: Writing the Energy Savings Action Plans

Lesson Overview: Synthesize the data gathered to create viable Energy Savings Action Plans.
Lesson Concept: Where are energy losses occurring? How might energy be conserved?

Materials:

- Note-taking journals / folders
- Pencils
- Erasers
- ****optional**** Video: *Simple Things Your School Can Do To Save Energy*

Standards:

- **English:**
 - **VIII.10.MS.3** (Ideas in Action: Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world).
 - **IX.11.MS.1** (Inquiry and Research: Generate questions about important issues that affect them or topics about which they are curious; narrow the questions to a clear focus; and, create a thesis or a hypothesis).
- **Science:**
 - **I.1.MS.6** (Construct New Scientific and Personal Knowledge: Write and follow procedures in the form of step-by-step instructions, recipes, formulas, flow diagrams, and sketches).
- **Social Studies:**
 - **II.5.MS.1** (Geographic Perspective: Describe how social and scientific changes in regions may have global consequences).
 - **V.2.MS.1** (Inquiry: Pose a social science question about a culture, world region, or international problem).
 - **VII.1.MS.2** (Citizen Involvement: Engage in activities intended to contribute to solving a national or international problem they have studied).
- **Mathematics:**
 - **III.1.MS.1** (Data Analysis and Statistics: Collect and explore data through observation, measurement, surveys, sampling techniques and simulations).

Timeline: 1 – 2 class periods (40 – 50 minutes)

Class Structure: small group writing project

Assessment Strategy: EEK! Daily Assessment
General Assessment Strategy #3
General Assessment Strategy #4

Lesson 8: 6th Grade

Energy Investigations: Writing the Energy Savings Action Plans

Lesson Overview: Synthesize the data gathered to create viable Energy Savings Action Plans.
Lesson Concept: Where are energy losses occurring? How might energy be conserved?

Materials:

- Note-taking journals / folders
- Pencils
- Erasers
- ****optional**** Video: *Simple Things Your School Can Do To Save Energy*

Background Information:

This video may or may not be helpful to your students depending on two factors: the amount of time you have to complete the project, and, the level of self-direction of your class. This video was created by a group of students at a school and is an introduction to developing a plan to help the school save energy.

CLASS EXERCISE:

I. (*optional*) Watch the video: *Simple Things Your School Can Do To Save Energy*
Though some of the suggestions may not be applicable for your class, the video provides a general overview of how to create energy savings in a school.

II. Writing the Energy Savings Action Plans

With the compiled data from Lesson 7, the groups can now begin to write their personal suggestions for how the school could save energy. Once again, if multiple groups researched one topic, such as lighting, but researched different parts of the building, ask them to work together to create the Energy Saving Action Plan for that topic.

III. Energy Savings Action Plan Goals

- A. 1st Step: Writing a Synopsis of the Problem
- B. 2nd Step: Writing a Synopsis of the Method(s) Used for Analyzing the Problem
- C. 3rd Step: Writing a Synopsis of the Findings (Data Compilation)
- D. 4th Step: Writing Suggestions for Enacting a Realistic Energy Savings Plan that Addresses the Initial Problem: goal 1 – 3 proposals (actions)
- E. 5th Step: Writing a Clear & Concise Strategy for Making the Changes (what to do, cost / labor involved, where to purchase materials if necessary, can it be student supported from start to finish, etc.)

Lesson 9: 6th Grade

Energy Investigations: Presenting the Energy Saving Action Plans

Lesson Overview: Present the Energy Savings Action Plans.

Lesson Concept: How might energy be conserved?

Materials:

- Note-taking journals / folders
- Student Hand-out: Presentation Ground Rules

Standards:

- **English:**
 - **VIII.10.MS.3** (Ideas in Action: Use oral, written, and visual texts to identify and research issues of importance that confront adolescents, their community, their nation, and the world).
- **Science:**
 - **IV.2.MS.4** (Use Scientific Knowledge from the Physical Sciences in Real-World Contexts: Describe how waste products accumulating from natural and technological activity create pollution).
- **Social Studies:**
 - **II.2.MS.5** (Geographic Perspective: Describe the consequences of human/environment interactions in several different types of environment).
 - **II.5.MS.1** (Geographic Perspective: Describe how social and scientific changes in regions may have global consequences).
 - **VI.1.MS.1** (Public Discourse and Decision Making: Compose essays expressing decisions on national and international policy issues).

Timeline: 1 – 2 class periods (40 – 50 minutes)

Class Structure: group presentations

Assessment Strategy: EEK! Daily Assessment
General Assessment Strategy #2
General Assessment Strategy #3
General Assessment Strategy #4

Lesson 9: 6th Grade

Energy Investigations: Presenting the Energy Saving Action Plans

Lesson Overview: Present the Energy Savings Action Plans.
Lesson Concept: How might energy be conserved?

Materials:

- Note-taking journals / folders
- Student Hand-out: Presentation Ground Rules

CLASS EXERCISES:

I. Presenting the Energy Savings Action Plans

The day has arrived for the presenting of the group created Energy Savings Action Plans! Even if students have become deeply engaged in the research project, have developed positive, reflective, trusting relationships within their small group, and have created an insightful project, the public presentation may still be very difficult for many students.

In order to help facilitate a continued trusting environment where the students feel comfortable standing in front of the class and discussing their Action Plan, there are two specific issues we have found important to discuss with the class prior to the presentations: presentation organization and class ground rules.

II. Presentation Organization

Presentation organization is specifically how the group arrives at who will do what during the small group presentation. In order for their hard work to be understood and acknowledged, the group needs to be clear about what each member will be discussing. Below is a general outline of one way to help the groups organize their presentation materials.

A. **Timed Presentations:** Provide the groups with the presentation time maximum and minimum—for example, all group presentations need to be between 3 – 5 minutes.

B. **Taking Turns:** Even if one group member may feel inherently more comfortable speaking in front of the class than another group member, it is important to encourage all group members to directly participate in the presentation.

C. **Get to the Point:** Given that the presentations will have time limits, the groups need to develop a clear plan of how they will answer the target questions and present visuals (if applicable).

D. **Stay on Track:** Oftentimes, when 6th grade students become nervous, they begin laughing. Laughter, no matter the cause, can become infectious. Let students know ahead of time that the clock is ticking—if they waste their time they won't have an effective presentation.

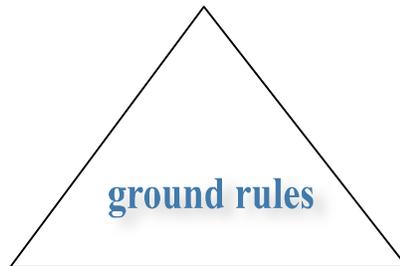
E. **Be Respectful:** As an audience member, it is important to treat the presenters as you hope to be treated. Listen attentively, ask informed questions, do not interrupt, and be mindful of time constraints.

III. Presentation Ground Rules

These ground rules apply for the whole class during presentations—the presenters and the audience.

Trust

- ‡Respect each others' personal style
- ‡Don't make fun of anyone
- ‡Keep an open mind



Communication

- ‡Speak clearly
- ‡Stay focused
- ‡Answer questions at the end of the presentation
- ‡Wait your turn

Responsibility

- ‡Pay close attention
- ‡Ask informed questions
- ‡Include all group members

IV. Compiling the Energy Savings Action Plans

Once each group presents their Energy Savings Action Plan, write down their 1-3 suggestions of how to effectively carry-out their Plan. After all of the groups have presented their Plans, discuss, as a class, which Action Plans should be presented to the principal.

Student Hand-out: Presentation Ground Rules

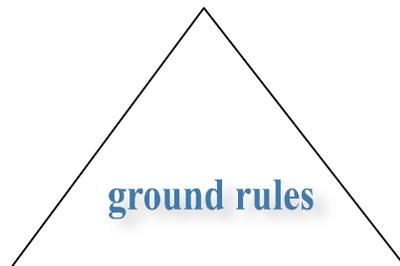
Small Group Organization

- A. **Timed Presentations:** Provide the groups with the presentation time maximum and minimum—for example, all group presentations need to be between 3 – 5 minutes.
- B. **Taking Turns:** Even if one group member may feel inherently more comfortable speaking in front of the class than another group member, it is important to encourage all group members to directly participate in the presentation.
- C. **Get to the Point:** Given that the presentations will have time limits, the groups need to develop a clear plan of how they will answer the target questions and present the visuals.
- D. **Stay on Track:** Oftentimes, when 6th grade students become nervous, they begin laughing. Laughter, no matter the cause, can become infectious. Let students know ahead of time the clock is ticking—if they waste their time they won't have an effective presentation.
- E. **Be Respectful:** As an audience member, it is important to treat the presenters as you hope to be treated. Listen attentively, ask informed questions, do not interrupt, and be mindful of time constraints.

Small Group Presentation Ground Rules

Trust

- ‡Respect each others' personal style
- ‡Don't make fun of anyone
- ‡Keep an open mind



Communication

- ‡Speak clearly
- ‡Stay focused
- ‡Answer questions at the end of the presentation
- ‡Wait your turn

Responsibility

- ‡Pay close attention
- ‡Ask informed questions
- ‡Include all group members

Lesson 10: 6th Grade
Energy Investigations: Enacting the Energy Savings Action Plans

Lesson Overview: Present and gain approval for the Energy Savings Action Plans to be endorsed by the principal. Enact the Energy Savings Action Plans.

Lesson Concept: We live in a global society where our energy demands and reductions can affect others living around the world. How might energy be conserved?

Materials:

- Note-taking journals / folders

Standards:

- Science:
 - II.1.MS.3 (Reflect on the Nature, Adequacy and Connections Across Scientific Knowledge: Show how common themes of science, mathematics, and technology apply in real-world contexts).
- Social Studies:
 - VII.1.MS.2 (Citizen Involvement: Engage in activities intended to contribute to solving a national or international problem they have studied).

Timeline: 1 – 2 class periods (40 – 50 minutes)

Class Structure: group / class action

Assessment Strategy: EEK! Daily Assessment
Post-Module Assessment Questions #1, #2, #3

Lesson 10: 6th Grade

Energy Investigations: Enacting the Energy Savings Action Plans

Lesson Overview: Present and gain approval for the Energy Savings Action Plans to be endorsed by the principal. Enact the Energy Savings Action Plans.

Lesson Concept: We live in a global society where our energy demands and reductions can affect others living around the world. How might energy be conserved?

Materials:

- Note-taking journals / folders

CLASS EXERCISES:

I. Gaining Approval

After the class has decided how to prioritize the Energy Savings Plans and which ones to act on, these proposals, most likely, should be presented to the principal for approval (and to be commended!).

II. Setting up the System to Maintain Energy Savings

A. Computers

If one of the outcomes is to reduce energy by turning off the computers at the end of school instead of leaving them on or in sleep mode, then a system needs to be set-up so that someone, or a group of individuals, is responsible for turning off the computers. Perhaps a check-list could be made, signs, etc.

B. Weatherization

If one of the outcomes is to reduce energy by repairing weather stripping or caulking around window / doors, then a plan needs to be approved for raising the money to purchase materials, purchasing the materials, and carrying-out the work.

C. Lighting

If one of the outcomes is to reduce energy by making use of daylighting when possible, turning off lights when not in use, replacing incandescent light bulbs with compact fluorescent light bulbs, or proposing other strategies (replacing the exit signs with LED exit signs), then create the necessary plans for making signs, and purchasing and installing materials.

D. Spread the Word

No matter what energy savings plans are carried out, make an effort to let the rest of the school know what your class has been doing to investigate and develop plans to help save energy. Remember the best work in society is done in an open, transparent, non-dogmatic, and honest manner.